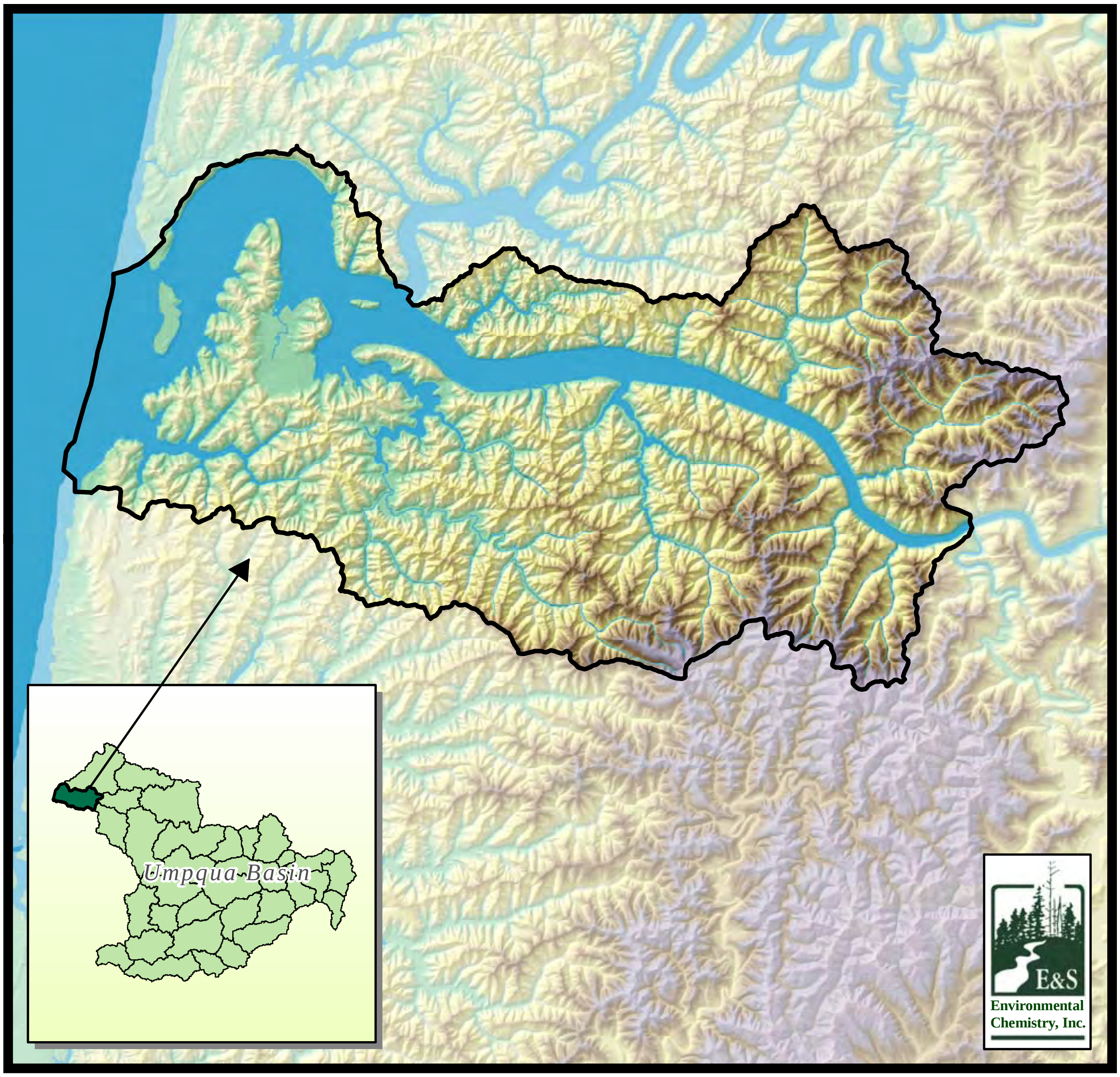
Lower Umpqua River Watershed Assessment



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

May, 2006

Umpqua Basin Watershed Council
1758 NE Airport Road
Roseburg, Oregon 97470
(541) 673-5756
www.ubwc.org

Lower Umpqua River Watershed Assessment

Final Report

May, 2006

Prepared by

E&S Environmental Chemistry, Inc.
P.O. Box 609
Corvallis, OR 97339

Kai Snyder
Tim Sullivan
Deian Moore
Richard Raymond

This document should be cited as:
Snyder, K., T. Sullivan, D. Moore, and R. Raymond. 2006. Lower Umpqua River Watershed Assessment. Prepared by E&S Environmental Chemistry, Inc. for the Umpqua Basin Watershed Council, Roseburg, OR.

This project has been funded in part by the United States Environmental Protection Agency under assistance agreement CO-000451-02 to the Oregon Department of Environmental Quality. The contents of this document do not necessarily reflect the views and policies of the Environmental Protection Agency, nor does mention of trade names or commercial products constitute endorsement or recommendation for use.

Table of Contents

List of Figures

List of Tables

List of Maps

Acknowledgements:

This document would not have been possible without the generous assistance of many people. Nancy Geyer provided steady and meticulous editorial oversight, and greatly helped to ensure consistency between this document and previous assessments. Janice Green also provided detailed review of earlier drafts. Jan Tetreault helped immensely by organizing meetings and providing careful review. Bob Kinyon, Sandy Lyon, Debbie Thornton, and Terry Luecker all went out of their way to assist us, and even made room for us in their office from time to time. In addition, the following people provided essential assistance to this watershed assessment effort:

Walt Barton
Jim Brick
Laura Brophy
Bill Canaday
Dan Couch
Robin Fears
Otto Freienmuth
Jake Gibbs
John Guetterman
Glen Harkleroad
Dave Harris
Paul Heberling
Linda Higgins
Lew Howe
Brian Kasper
Rich Kilbane
Heidi Kincaid
Bobbi Lindberg
Sam Moyers
Mark Nauman
Don Ollivant
Pat Olmstead
Frank Price
Eric Riley
Leonard Schussel
Kent Smith
Cathy Solley
Jerry Solley
Bruce Williams
Jake Winn
Lisa Winn

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 Lower 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 Lower 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 Lower 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 outlined 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, Inc. (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.

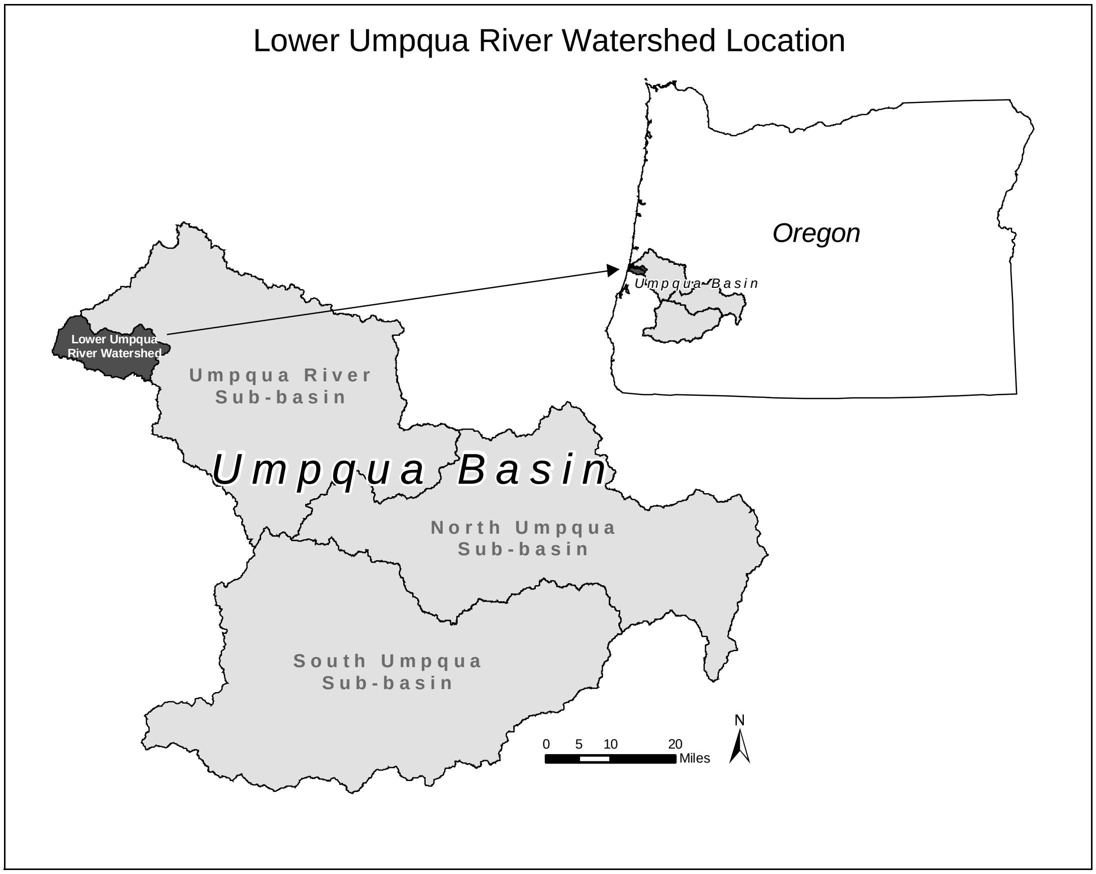
Lower Umpqua River Watershed assessment meetings were held in conjunction with the preparation of this assessment. Landowners and residents met for three meetings in 2005. A total of 18 people attended one or more meetings and the field trip, with an average of 6 participants per meeting. Meeting participants 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 Lower Umpqua River Watershed, a 67,930-acre area in the Umpqua River sub-basin that extends from the mouth of the Umpqua River upstream to the confluence of Mill Creek, just below Scottsburg, and all tributary streams that drain into the Umpqua River in between. The watershed stretches a maximum of 7 miles north to south and 18 miles east to west (Map 1.1). Reedsport, Gardiner, and Winchester Bay, all located in the lower portion of the watershed, are the only population centers within the watershed. Reedsport is the only incorporated city. Highway 38 runs east-west, paralleling the Umpqua River. Highway 101 runs north-south, crossing the Umpqua River at Reedsport.



Map 1.1. Location of the Lower 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 Lower Umpqua River Watershed, the Umpqua River collects water from tributaries as far eastward as the crest of the Cascade Mountains.

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 (EPA) system of ecoregion classification, the Lower Umpqua River Watershed includes three ecoregions: Mid-Coastal Sedimentary, Coastal Uplands, and Coastal Lowlands (Table 1.1, Map 1.2).

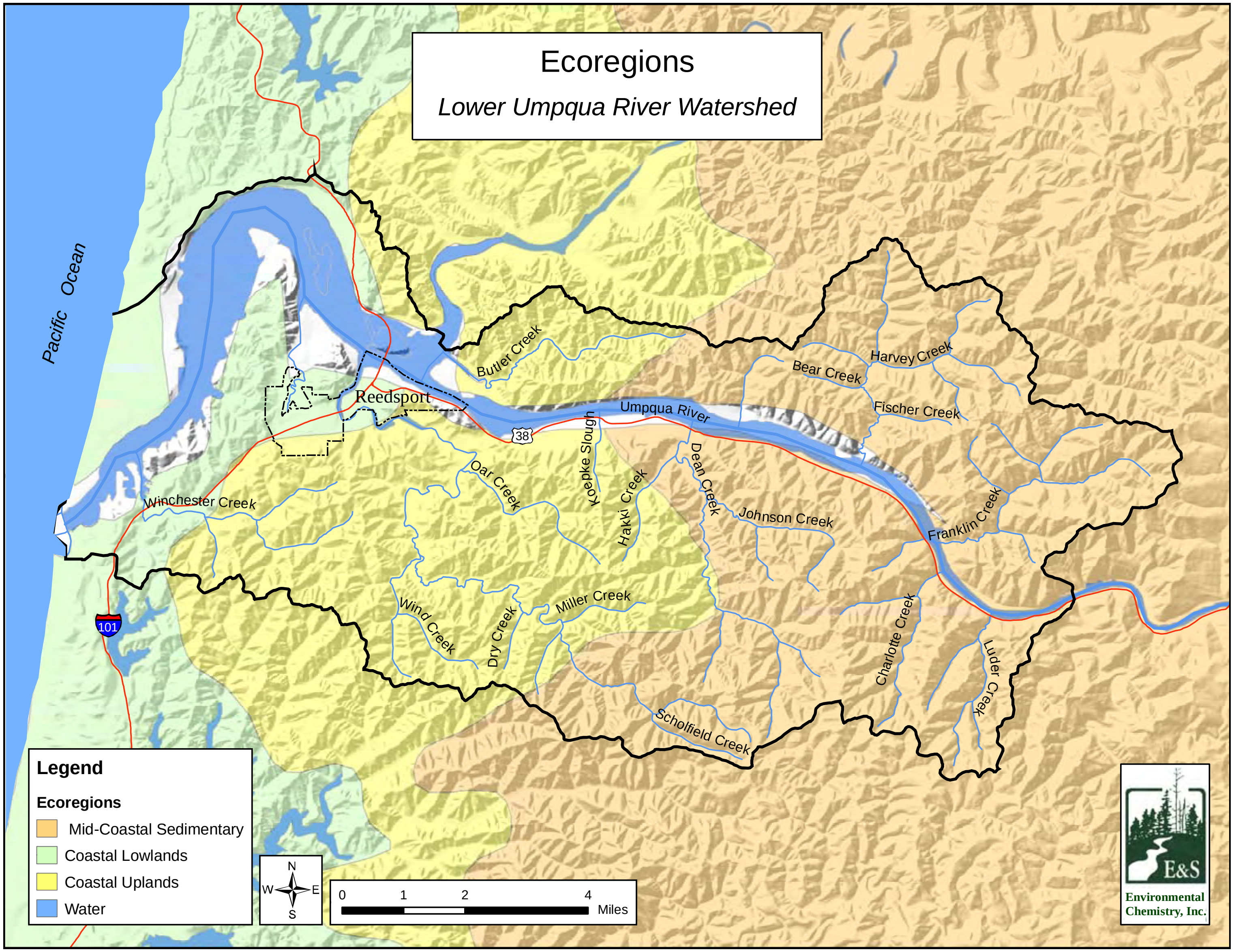
The largest portion of the watershed (53%) lies within the Mid-Coastal Sedimentary Ecoregion. This ecoregion is characterized by moderately-sloping, dissected mountains with medium- to high-gradient streams. Its Douglas-fir forests are intensively managed for timber.

Table 1.1. Description of US EPA level IV ecoregion classifications in the Lower Umpqua River Watershed.

Geology*	Topography	Soils	Erosion	Climate	Land Use	Potential Natural Vegetation
1a. Coastal Lowlands						
Alluvial deposits on low terraces or dunes (spits) of wind-blown sand.	Low-gradient streams that often meander widely. Tidal influence. Tidal marshes flow through flat floodplains.	Deep silty clay loams to sand. Peat soil associated with tidal marshes.	Erosion rate low due to the low gradient. Mostly depositional areas.	Wet winters, relatively dry summers and mild temperatures throughout the year. Heavy precipitation during winter months. Mean annual precipitation 60 to 85 inches.	Dairy farms, urban/rural residential development, recreation, pastureland.	Douglas-fir, western hemlock, Sitka spruce, western red cedar, wetland plants, pasture grasses.
1b. Coastal Uplands						
Weak Sandstone.	Low-gradient medium and large streams; few waterfalls exist. Headwater small streams often steep and usually bordered by steep slopes. High stream density.	Mostly deep silt loam.	High erosion rate. Landslides include deep-seated earthflows in lower gradient areas and shallow landslides (often triggering debris slides) in steep headwater channels.	Wet winters, relatively dry summers and mild temperatures. Heavy precipitation. Mean annual precipitation 70 to 125 inches; up to 200 inches in higher elevations.	Forestry, rural residential development, recreation.	Douglas-fir, western hemlock, Sitka spruce, western red cedar, red alder, salmonberry, stink currant.
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 to 130 inches. Mean temps: Jan. min/max – 32°F/48°F; July min/max 48°F/78°F	Mostly forest; some pastureland in valleys. timber production, 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.

* 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 Lower Umpqua River Watershed.

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

Ecoregion	Total Acres	Percent of Total
Coastal Lowlands	6,643	11
Coastal Uplands	20,741	36
Mid-Coastal Sedimentary	30,701	53

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. Stream sedimentation is higher than in the Volcanics Ecoregion, located to the east. The central portion of the watershed, including much of the land along Highway 101 and the land along Highway 38 east to just beyond Koepke Slough, is part of the Coastal Uplands Ecoregion. It occupies 36% of the watershed (Table 1.2). This ecoregion is characterized by low-gradient, medium to large streams bordered by flat to steep slopes. Steep-gradient small streams in narrow steep-sided valleys are also present. Erosion rates are high and landslides may be either deep-seated in low-gradient areas or shallow in steep headwater channels. The climate of the Coastal Uplands Ecoregion is marine influenced with an extended winter rainy season and minimal seasonal temperature extremes. Abundant fog during the summer dry season reduces vegetation moisture stress. The Coastal Uplands Ecoregion includes much of the historical distribution of Sitka spruce. Today, its Douglas-fir forests are managed for timber production.

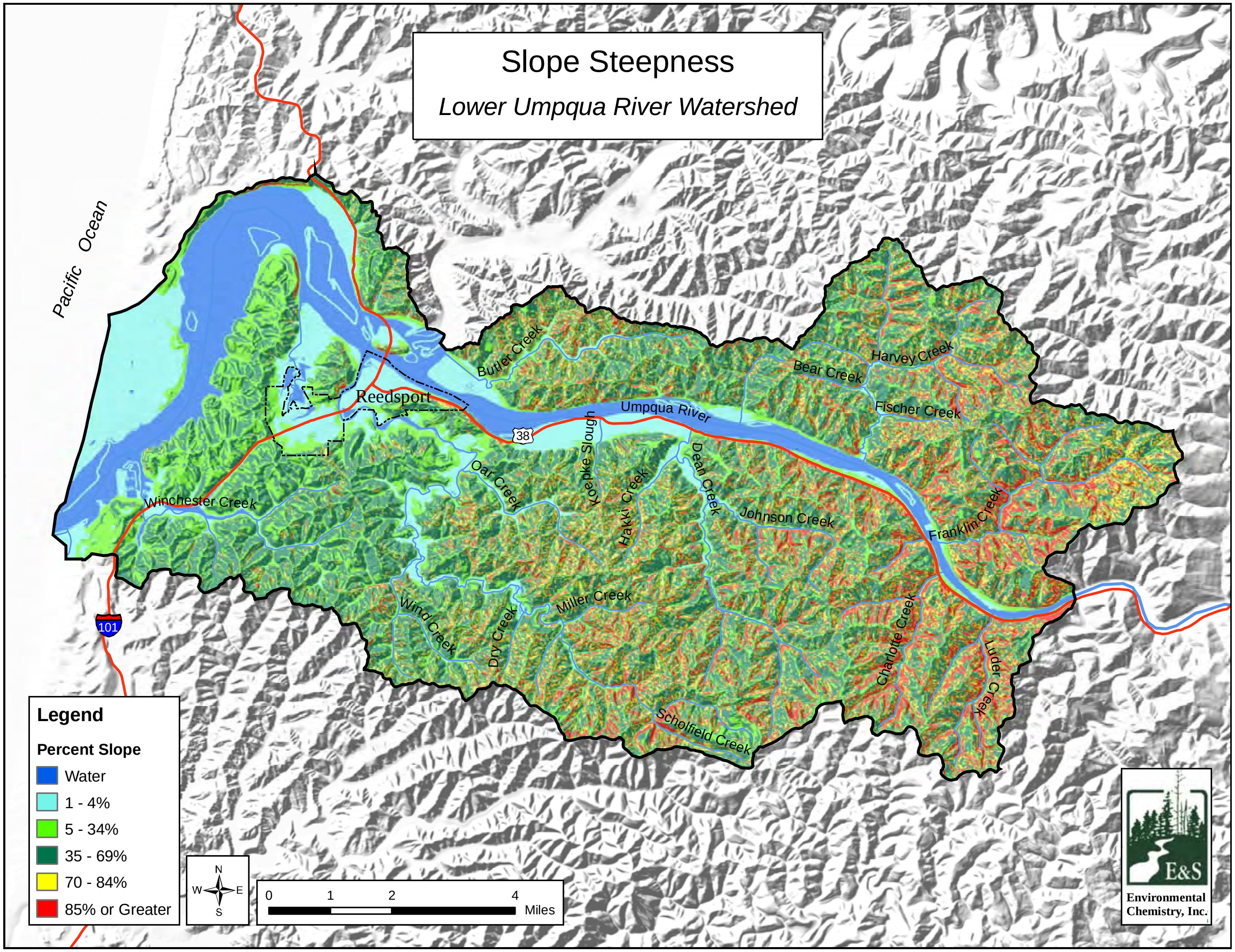
The Coastal Lowlands Ecoregion is found at the base of the Umpqua Basin Watershed, and comprises the remaining 11% of the watershed area. This ecoregion is characterized by very low-gradient, meandering streams, at times under tidal influence, and bordered by mostly flat floodplains. Erosion rates are low and sediment deposition is high due to the low gradient. The Coastal Lowlands Ecoregion contains beaches, dunes, and marine terraces below 400 feet elevation. Wet forests, lakes, estuarine marshes, and tea-colored (tannic) streams are characteristic features of the landscape. Wetlands have been widely drained and converted to agriculture and livestock uses. Residential, commercial, and recreational developments are expanding in the coastal corridor.

1.2.3. Topography

In the Lower Umpqua River Watershed, slopes range from 0% to 4% in the floodplains around the estuary and along the mainstem Umpqua River. The western third of the watershed is dominated by land that is less than 34% slope. The steepest lands (greater than 85% slope) are found mainly in the eastern portions of the watershed. Upland area slopes are generally from 35% to 70% (Map 1.3). The lowest points in the watershed lie at sea level. The highest point is 1,939 feet in the eastern portion of the watershed. In the Lower Umpqua River Watershed, none 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. 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



Map 1.3. Percent slope for the Lower Umpqua River Watershed.

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 Lower 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).

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 Lower Umpqua River Watershed occurs in the Coast Range Province.

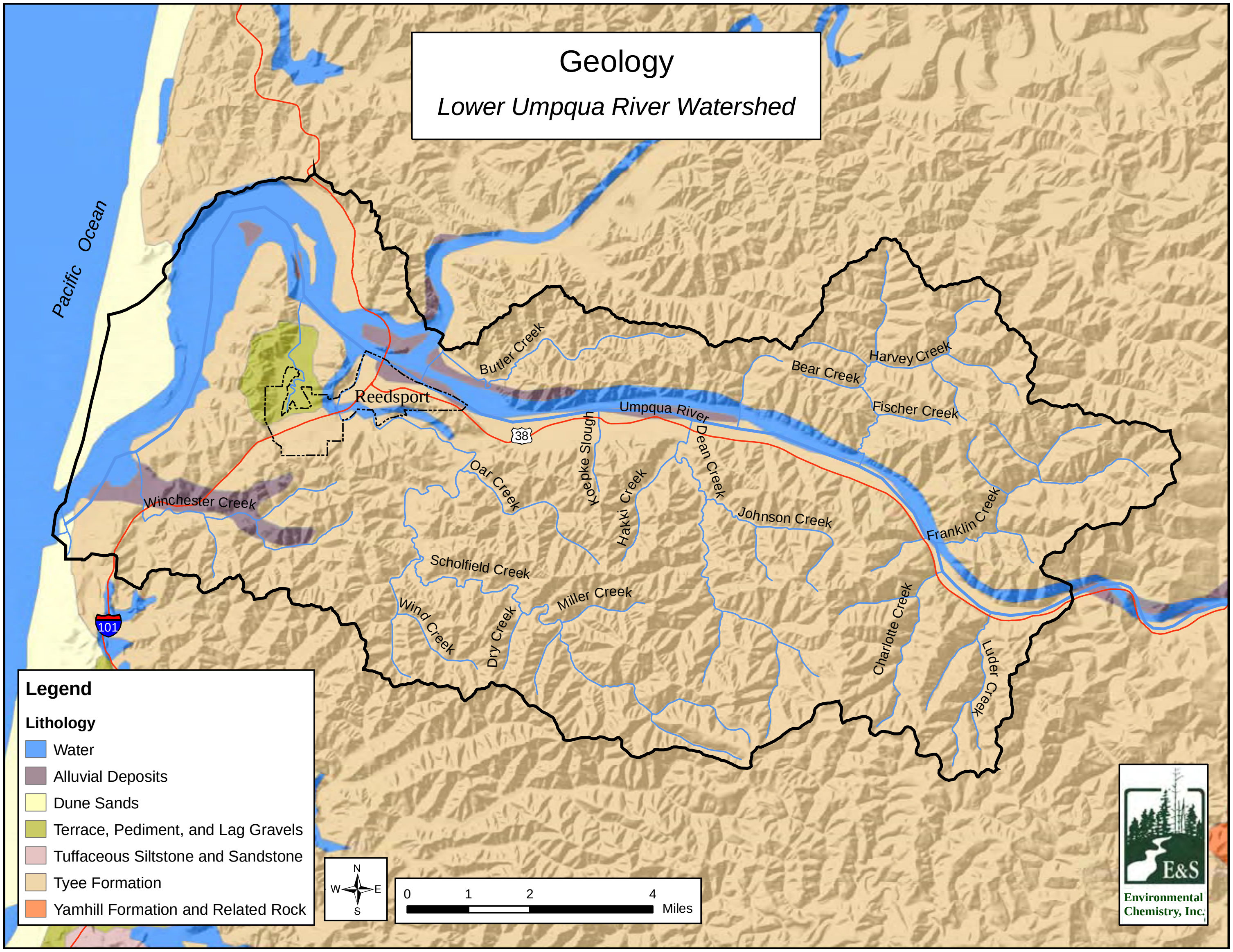
The Lower Umpqua River Watershed exhibits varied relief. Most of the eastern portion of the watershed is fairly steep with stream channels that dissect the landscape. The western portion of the watershed contains little steep ground. The mainstem Umpqua River and the lower reaches of Winchester Creek, Scholfield Creek, and Dean Creek have fairly extensive floodplains. The largest low relief features in the watershed are the Umpqua River estuary and the floodplains along the mainstem Umpqua River up to near the confluence with Luder Creek.

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

Lithology	Area (acres)	Percent of Watershed
Water	6,651	9.8
Alluvial Deposits	1,963	2.9
Dune Sands	1,524	2.2
Terrace, Pediment, and Lag Gravels	1,084	1.6
Tyee Formation	56,709	83.5

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 to the Tyee geological unit, 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). Alluvial deposits occur in narrow bands along the mainstem river and along Winchester Creek. Terrace, Pediment, and Lag Gravels are deposited in the area to the west of Reedsport. Dune Sands are found on the spit that separates the estuary from the Pacific Ocean.

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 influence stream water quality. Generally, groundwater is more consistently of high quality than surface water. However, many streams in mountainous areas, such as the Lower Umpqua River Watershed, are naturally surface-water dominated, with groundwater playing a relatively minor role.



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

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. 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 near the estuary and 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 Dean Creek and Scholfield 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.

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 Lower Umpqua River Watershed Stream Network

The Lower Umpqua River Watershed begins approximately where the Umpqua River estuary meets the Pacific Ocean and includes 23 stream miles of the Umpqua River.[1] Map 1.2 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 121.3 stream miles in the Lower Umpqua River Watershed. The longest tributary to this section of the Umpqua River is Scholfield Creek (approximately 15 stream miles).

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.

Streamflow is not measured within the watershed. However, 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).

The Umpqua estuary is classified as a shallow draft development estuary by the Oregon Department of Land Conservation and Development. As such, the Umpqua estuary is managed for navigation and other public needs.

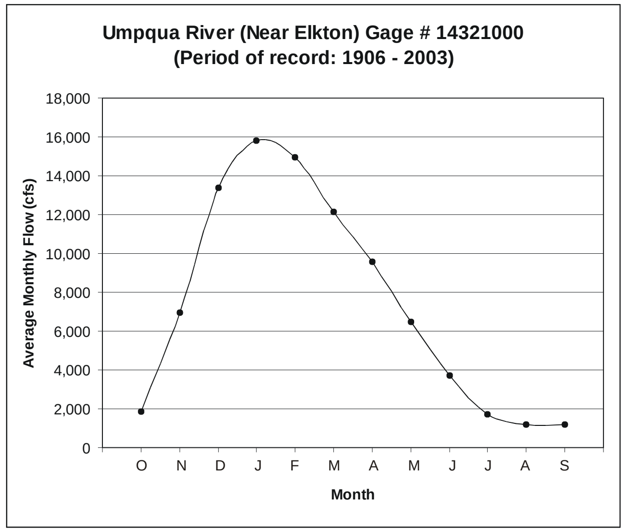


Figure 1.1. Average monthly Umpqua River discharge near Elkton.

1.2.6. Climate

The watershed is exposed to a marine 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. Annual precipitation is high and occurs mostly during the winter months (Figure 1.2). The upper reaches of the watershed generally receive over 80 inches of precipitation per year. The lower reaches closer to Reedsport receive about 75 inches, with rainfall averaging over 9.5 inches for each of the months of November through March and less than 2 inches per month for June through August. Slightly higher values occur at the higher elevations in Elliott State Forest. Fog in western areas is common during summer. A rain shadow is caused by the high ridges of the Coast Range, and precipitation is less than 60 inches 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.

High-intensity rainfall is associated with the initiation of shallow landslides on steep slopes in the region. For example, intense rainstorms during the winters of 1981/1982 and 1996/1997 initiated many shallow landslides region-wide. Nearly seven inches of rain was recorded at North Bend within a 24-hour period in November, 1996, causing extensive landslide activity.

There is a climate station within the Lower Umpqua River Watershed at Reedsport.[2] Air temperatures in the watershed are mild throughout the year with cooler temperatures at higher elevations. Due to the moderating effect of the Pacific Ocean, summer air temperatures in the lower reaches of the watershed may increase significantly only a few miles inland, relative to areas near the ocean. Figure 1.2 shows the average monthly minimum and maximum

[2] The National Oceanographic and Atmospheric Administration (NOAA) administers this station. Data are available from the Oregon Climate Station website http://ocs.oce.orst.edu/.

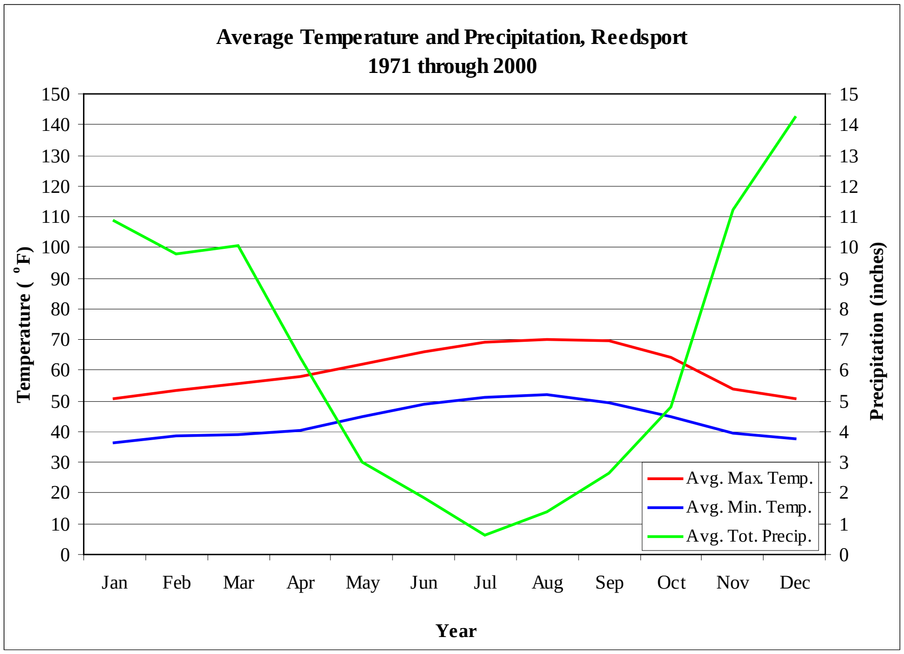


Figure 1.2. Thirty-year average monthly temperature (°F) and precipitation (inches) at Reedsport (1971 to 2000).[3]

temperatures for Reedsport. Maximum temperatures in the summer are generally near 70°F. Maximum temperatures can exceed 90°F, but marine air generally keeps summer temperatures much cooler. Minimum winter temperatures are usually above freezing, generally near 40°F. Few days in winter have temperatures below freezing.

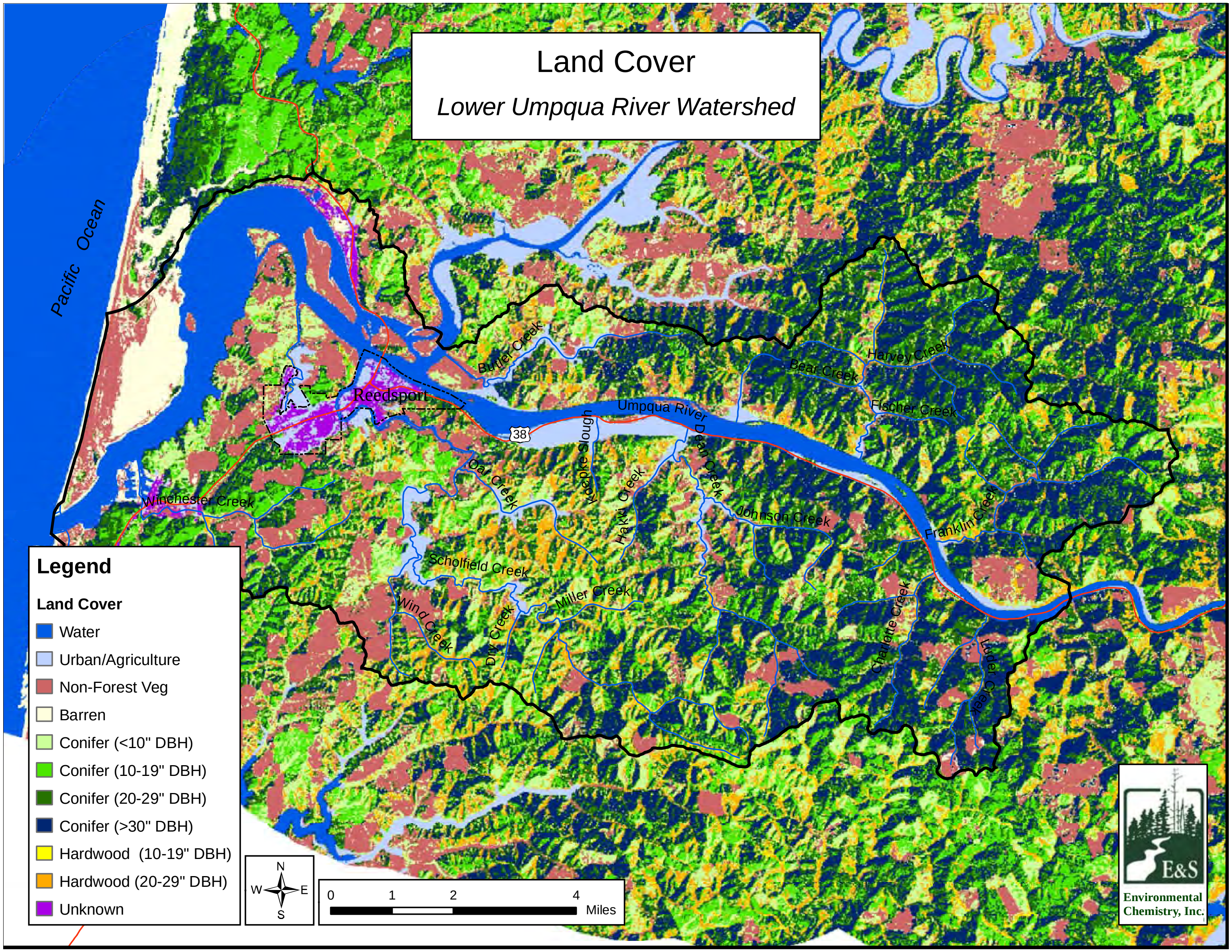
1.2.7. Vegetation

The upland portions of the watershed are mainly forested with coniferous forest stands, especially Douglas-fir. Coniferous forests cover 62.3% of the watershed, with a good distribution of size classes (Table 1.4). Almost two-thirds of the coniferous forests within the watershed are comprised of trees larger than 20 inches diameter at breast height (DBH),[4] and most of those are found on federal and state lands. Hardwood forests comprise 6.8% of the watershed, and are more common along stream corridors and in some of the lower-elevation areas. Non-forested areas, including agricultural lands, tidal areas, and dunes, predominate in the lower portions of the watershed (Map 1.5).

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

Type	Percent	Acres
Barren	2.6	1,686
Conifer (<10" DBH)	14.0	9,512
Conifer (10-19" DBH)	9.1	6,186
Conifer (20-29" DBH)	19.1	12,981
Conifer (>30" DBH)	20.1	13,655
Hardwood (10-19" DBH)	0.9	601
Hardwood (20-29" DBH)	5.9	4,029
Non-Forest	13.9	9,468
Urban	2.1	1,450
Agriculture	3.0	2,031
Water	9.3	6,330
Grand Total	100.0	67,930

[3] Source: http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?orreed
[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 Lower Umpqua River Watershed.

Based on aerial photo interpretation, field measurements of individual trees, and timber harvest records for young stands, trees currently growing in the portion of Elliott State Forest that drains to the Umpqua Basin are an even mix of stands over 100 years old and younger plantations (Biosystems 2003).

All of the major types of tidal wetlands occur within the Umpqua estuary, including low marsh, bulrush and sedge marsh, immature high marsh, mature high marsh, and tidal swamp (Jefferson 1975, Brophy and So 2004). The large volume of fresh water carried by the Umpqua River has a strong influence on the estuary. In fact, with a drainage area of 4,500 square miles, the Umpqua Basin is the largest in coastal Oregon south of the Columbia River watershed. Because of the strong freshwater influence on the estuary, bulrush marsh, which is tolerant of both fresh and brackish conditions, is prevalent.

Conifer revegetation in riparian areas is generally sparse subsequent to forest clearing disturbance. This is likely due to competition from rapidly-growing brush and high soil moisture. In many areas, regeneration has resulted in hardwood stands. For example, in an analysis of riparian forests in Elliott State Forest, Biosystems (2003) found that hardwoods were the most dominant stand type within 100 feet of the stream for all stream size classes. Conifer stands occupied only 10.5% of the area within 50 feet of the stream centerline for medium and large streams (that is, streams having average flows 2 to 10 cfs and greater than 10 cfs, respectively) and only 18.2% of the areas within 50 feet of the stream centerline for small streams (less than 2 cfs, on average). Hardwood dominance generally decreases with increasing distance from the stream. However, Biosystems (2003) found that hardwoods still occupied 31% of the land within 150 and 200 feet of large streams. The prevalence of conifers in the riparian zone and the age class distribution of riparian trees generally correspond with past forest management in Elliott State Forest.

1.3. Land Use, Ownership, and Population

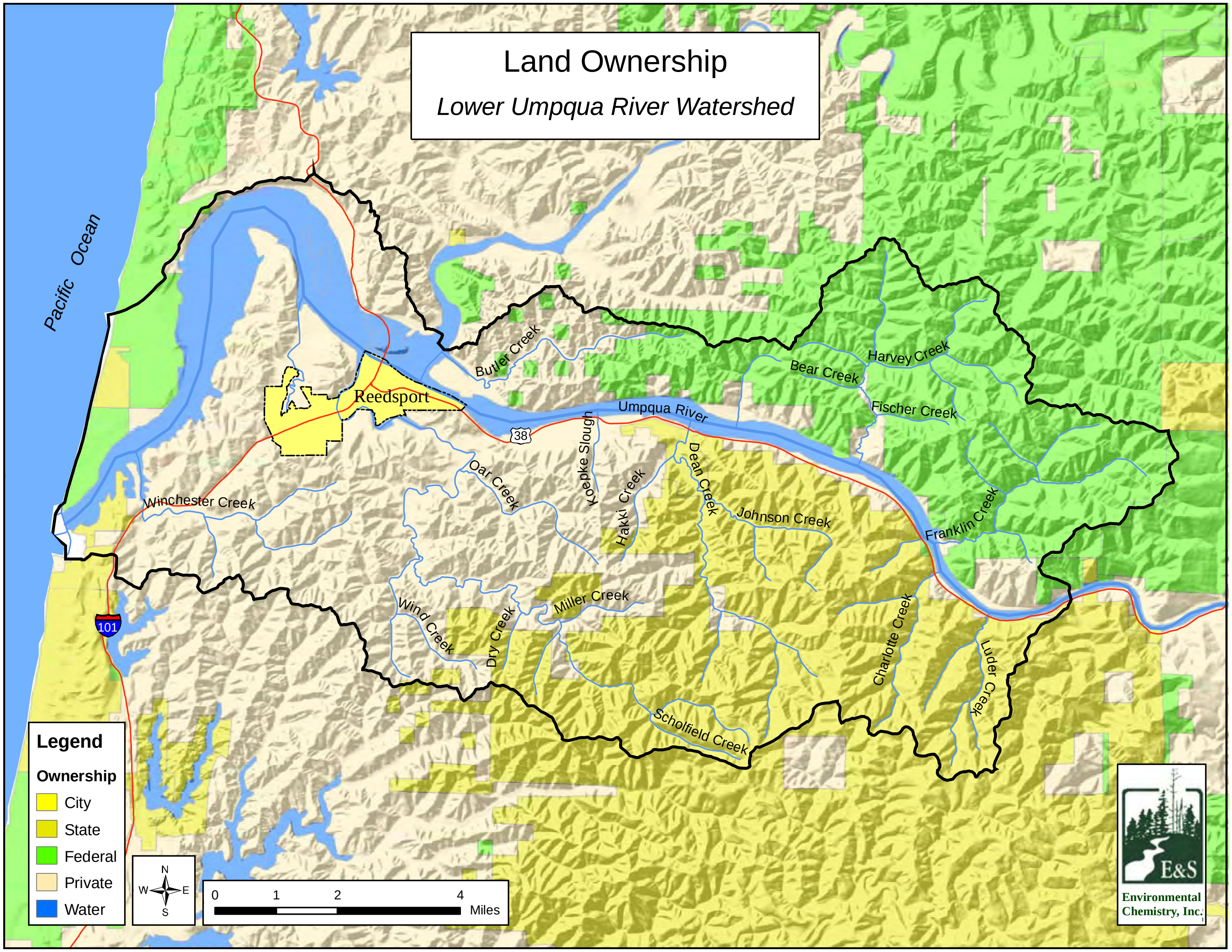
1.3.1. Land Use and Ownership

Table 1.5. Land ownership in the Lower Umpqua River Watershed.

Ownership	Area (acres)	Percent of Watershed
Federal	15,132	22.3
Private	26,914	39.8
State	18,824	27.8
Water	6,845	10.1

The most common land use in the Lower Umpqua River Watershed is forestry, with about 69% of the land base being forested. Much of the forested land is used for public or private forestry. Agriculture constitutes about 3% of the land use, and mostly occurs in the floodplains of the lower Umpqua River and its major tributary streams. As shown on Map 1.6 and in Table 1.5, land ownership is rather uniformly distributed among private (39.8%), state-owned (27.8%), and federally-owned (22.3%) land, with over 10% of the land covered by water. Public ownership is mostly administered by the Oregon Department of Forestry (ODF) and the Bureau of Land Management (BLM). Private lands are mostly concentrated in the western half of the watershed, and public lands in the east.

Because Elliott State Forest comprises 28% of the watershed, management of this land by ODF is very important to the watershed as a whole. Management priorities in Elliott State Forest



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

have changed in recent years. The forest has adopted, on an interim basis, the stream protection criteria implemented by northwestern Oregon State Forest Districts. Stream protection measures are intended to match the conditions within individual timber harvest units, but are established within the general framework of the Forest Practices Act and the Elliott State Forest Management Plan. Based on conversations with ODF foresters, Biosystems (2003) judged that the following measures, among others, generally apply to the current management of Elliott State Forest:

- Surveys for marbled murrelets within proposed harvest units occur each of two years prior to finalizing timber sales.
- All streams within a harvest unit that could be fish-bearing (using criteria outlined in the Forest Practices Rules) are treated as fish-bearing, even if a field survey has not been conducted to confirm the presence of fish.
- All trees growing within 100 feet of a fish-bearing stream are retained. Buffers are expanded to include areas of slope instability, wetlands, and other special features. In-unit trees (green trees and a certain number of snags per acre of clearcut harvest) are often retained as extensions of streamside buffers.
- All trees growing within 50 feet of perennial streams (not considered fish-bearing) are retained. These buffers also may be extended laterally to include areas of slope instability, wetlands, and other special features. These buffers are often expanded to satisfy in-unit tree requirements for clearcut harvest units.
- The Southwest Region geotechnical specialists review proposed harvest units to determine if unusual slope instability problems exist. If so, higher risk areas may be excluded from the harvest unit or trees may be retained on those portions of the harvest unit where slope instability is high.
- Opportunities to improve fish habitat and slope stability within nearby streams are often incorporated into timber sales. This can include adding large trees from the harvest unit to fish-bearing streams deficient in large wood or decommissioning old roads.

The annual acreage of clearcut harvest in Elliott State Forest is now about 510 acres annually. Thinning of stands, mostly in the 30- to 70-year-old age class also occurs. An average of 535 acres per year was thinned from late 1997 to early 2001. Under the 1995 Habitat Conservation Plan for northern spotted owls, the forest is segregated into short (80 to 135 years) and long (160 to 240 years) rotation basins. Most of the Umpqua region (75%) of the forest is designated as long rotation. Past timber harvest now curtails additional harvest in the long rotation basins, putting more pressure for near-term future harvest in the adjacent Coos Region.

The Lighthouse tract of Elliott State Forest occurs on a hilltop near the Umpqua River lighthouse. It is occupied by 50- to 65-year-old Sitka spruce stands that comprise important landmarks overlooking Winchester Bay.

Elliott State Forest is bordered to the west mostly by privately-owned lands, with state and US Forest Service lands along the coast to the west of the estuary. Along the northern side of the Umpqua River lies an extensive tract of Siuslaw National Forest land, with a minor amount of BLM land.

Human land uses have caused many changes to the Umpqua estuary. Many former tidal wetlands have been filled and/or excavated to develop port facilities, mills, marinas. and other industrial, commercial, and residential sites. The "old town" section of Reedsport is built almost entirely on former tidal marsh. Other major areas of filled tidal wetlands include Bolon Island Industrial Park, the Gardiner Mill, and Winchester Bay. Many former tidal marshes and swamps are now diked and ditched and used as agricultural lands; one of the largest of these is the Dean Creek Elk Viewing Area (Brophy and So 2004).

Dredging of the Umpqua River is periodically conducted to deepen the navigational channel. In the past, some of the dredged material has been placed on current or former tidal wetlands. Some examples include the north end of Steamboat Island, Leeds Island, and the Dean Creek Elk Viewing Area. The Dean Creek Elk Viewing Area is a popular wildlife attraction, located along the south side of Highway 38 a few miles east of Reedsport.

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 Lower Umpqua River Watershed boundary. The only population centers with census data within the Lower Umpqua River Watershed are Reedsport and Winchester Bay. In 2000, the population of Reedsport was 4,378 and Winchester Bay was 488. The population of the Lower Umpqua River Watershed is probably less than 5,000 people, or an average of fewer than 47 people per square mile.[5]

Part of the Reedsport Census County Division (CCD) is also within the watershed (Map 1.7).[6] Data from these areas are included in this section to provide an overview of the human population that lives within the Lower Umpqua River Watershed.

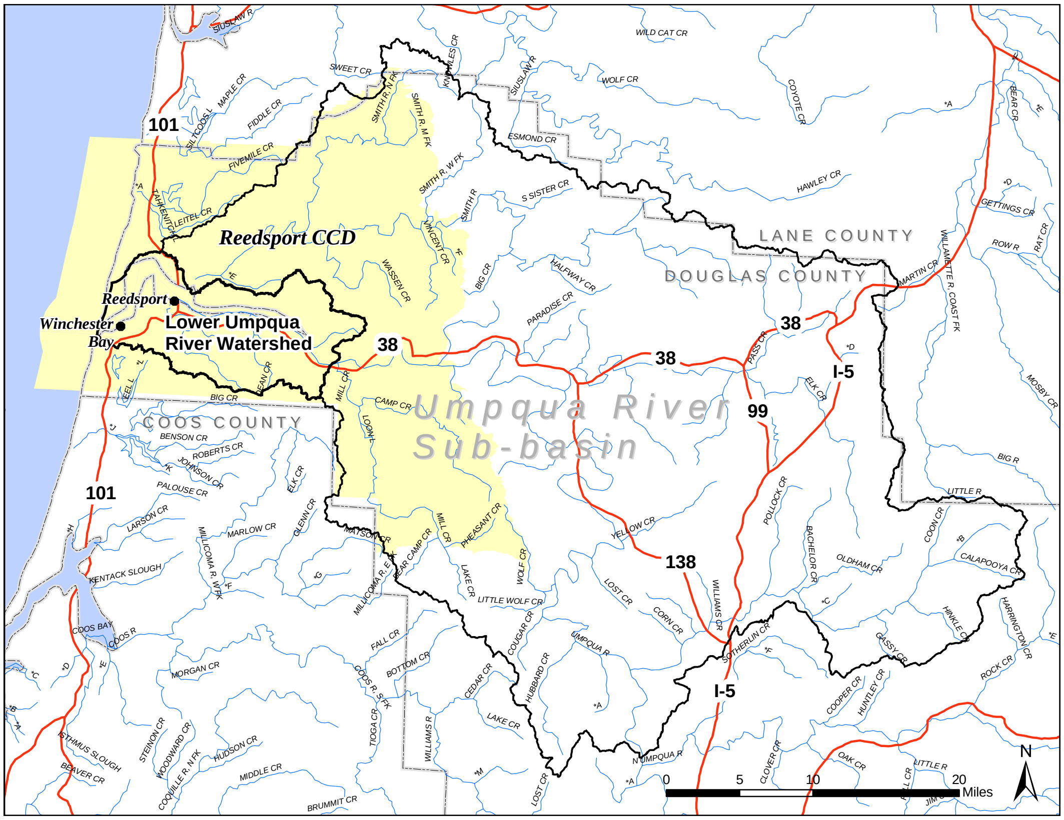
1.3.2.2. General Demographic Characteristics and Housing

Table 1.6 provides Census 2000 information about general demographic characteristics and housing for Reedsport, Winchester Bay, and the Reedsport CCD; Douglas County data are provided for comparison. The median ages for Winchester Bay, Reedsport, and the Reedsport CCD are all higher than the county's median age by six years or more. The largest racial group for all areas is white, with the next largest group being Hispanic or Latino. Average household size and family size are comparable for all three areas. The percents of owner-occupied housing in both Reedsport and Winchester Bay are less than the percents for the Reedsport CCD and the county. Winchester Bay has a much higher housing vacancy rate than the Reedsport CCD, the county, or the City of Reedsport.

---

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

[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."



Map 1.7. Location of the Reedsport CCD.[7]

Table 1.6. 2000 Census general demographic characteristics and housing information for Reedsport, Winchester Bay, the Reedsport CCD, and Douglas County.

Parameter	Reedsport	Winchester Bay	Reedsport CCD	Douglas County*
Median age (years)	47.1	49.5	47.1	41.2
Race				
White	93.9%	96.1%	94.1%	93.9%
Hispanic or Latino	4.7%	1.4%	3.9%	3.3%
Asian	0.4%	0.4%	0.4%	0.6%
American Indian or Alaskan Native	1.2%	1.4%	1.3%	1.5
African American	0%	0%	0%	0.2%
Native Hawaiian or Pacific Islander	0%	0%	0%	0.1%
Households				
Avg. household size (#)	2.19	2.01	2.21	2.48
Avg. family size (#)	2.71	2.57	2.69	2.90
Owner-occupied housing	66.9%	65.5%	68.3%	71.7%
Vacant housing units	9.2%	34.3%	14.9%	8.0%

* In 2000, the population of Douglas County was 100,399 people

[7] Source: US Census Bureau's American FactFinder website: http://factfinder.census.gov

1.3.2.3. Social Characteristics

Table 1.7 provides information from the 2000 Census for education, employment, and income for the Cities of Reedsport and Winchester Bay and the Reedsport CCD; Douglas County data are included for comparison. In all Census areas, slightly more than 80% of the adult population over age 25 has at least a high school graduate level of education, and 13 to 15% have a bachelor's degree or higher. The percent of unemployed persons in the labor force is higher in Winchester Bay than in Reedsport, the county or the Reedsport CCD. The top three occupations in Table 1.7 account for around 70% of the labor force in all four areas, and the top three industries employ about half of the workers. Median family income ranges from about $33,000 to $39,000 in the four areas considered. Nevertheless, 17.9% of the families in Winchester Bay are below the poverty level, as compared with fewer than 12% in Reedsport, the Reedsport CCD, and Douglas County.

Table 1.7. 2000 Census information for education, employment, and income for Reedsport and Winchester Bay, the Reedsport CCD, and Douglas County.

Parameter	Reedsport	Winchester Bay	Reedsport CCD	Douglas County
Education – age 25+				
High school graduate or higher	80.9%	86.4%	80.8%	81.0%
Bachelor's degree or higher	14.1%	15.2%	13.5%	13.3%
Employment- age 16+				
In labor force	46.3%	43.0%	46.9%	56.9%
Unemployed in labor force	4.6%	6.7%	5.6%	4.3%
Top three occupations	Service occupations; Management, professional, and related occupations; Sales and office occupations	Sales and office occupations; Management, professional, and related occupations; Construction, extraction, and maintenance occupations	Management, professional, and related occupations; Sales and office occupations; Service occupations	Management, professional and related occupations; Sales and office; Production, transportation, and material moving.
Top three industries	Educational, health, and social services; Arts, entertainment, recreation, accommodation and food services; Retail trade	Construction; Arts, entertainment, recreation, accommodation and food services; Educational, health, and social services	Educational, health, and social services; Arts, entertainment, recreation, accommodation and food services; Retail trade	Educational, health, and social services; Manufacturing; Retail trade
Income				
Per capita income	$16,093	$17,307	$16,178	$16,581
Median family income	$33,689	$37,292	$33,056	$39,364
Families below poverty	11.7%	17.9%	11.8%	9.6%

2. Past Conditions[8]

The past conditions chapter provides an overview of events since the early 1800s that have impacted land use, land management, population growth, and fish habitat in Douglas County and in the Lower 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,* the *Elliott State Forest Watershed Analysis* (Biosystems 2003), 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

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

found in the valleys were reported to grow both in groups and as single trees in the open. The oaks were described as reaching two to three foot diameters and to have a low and spreading form. Many early visitors 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 Lower Umpqua 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). 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

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).

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

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.

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.

2.2.1. 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.

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.

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). During these log drives, the stream channels were gouged, spawning gravels were removed or muddied, and fish passage may have been affected (Markers 2000).

> <u>Splash Dams</u>
>
> 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.

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 region 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).

1900s to the 1960s Timeline	
1900	Fish hatchery established near Glide
1903	Prunes major agricultural crop
1909	Flood
1923	Pacific Highway (Highway 99) completed
1927	Flood
1929	Northwest Turkey Show in Oakland (Douglas County ranked 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).

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. Both kinds of stream cleaning often involved driving bulldozers up and down the stream channel.

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

---

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

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

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 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 1995).

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

<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.

of federal timber from both the US Forest Service and the Bureau of Land Management. A housing slump in the early 1980s and a decline in federal timber in the 1990s resulted in the closure or 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]

Because Elliott State Forest comprises a sizeable component of the watershed, its management history is important. Past management of the forest can be described in four phases, as outlined by Biosystems (2003). The forest was established in 1929 and its management was mainly custodial until the 1940s. During that custodial period, initial timber inventories were conducted and fire towers and some roads were built. Forest management procedures developed during the second phase, from World War II to the Columbus Day Storm of 1962. The timber sale program was developed and road construction accelerated. The Columbus Day storm triggered the third phase of Elliott State Forest management. The timber sale program was accelerated to salvage blowdown from the storm and the road building program was completed. The fourth, and current, phase began with the listing in1990 of the northern spotted owl as threatened under the federal Endangered Species Act and the development of the 1995 Habitat Conservation Plan.

2.4.2. Dam Construction

By the 1870s, there were a number of dams on the Umpqua River and concerns were raised about fish passage. Oregon residents began demanding the enforcement of fishways for salmon and steelhead over dams. A leading citizen of Roseburg was prosecuted in 1894 for failing to install a fishway in a dam that he owned. The Fish and Game Protector reported that "this individual was arrested, and under the influence of local sentiment and some of the most remarkable evidence ever given in court as to the gymnastic ability of the Umpqua salmon, he was acquitted" (Markers 2000).

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

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 the Umpqua Valley's excellent tourist areas. Tourist destination 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.

---

[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.

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

2.5. 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 through 1940. Subsequently, growth accelerated, slowing in the 1980s to a pace equivalent to that of pre-war years.

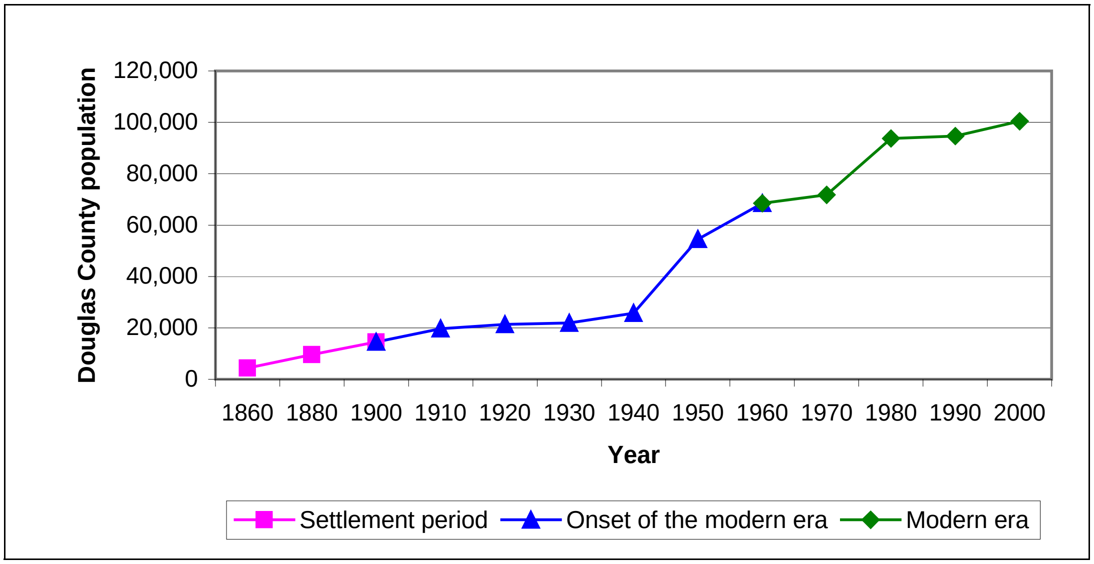


Figure 2.1. Population growth in Douglas County from 1860 through 2000.

2.6. Historical Changes in Vegetation

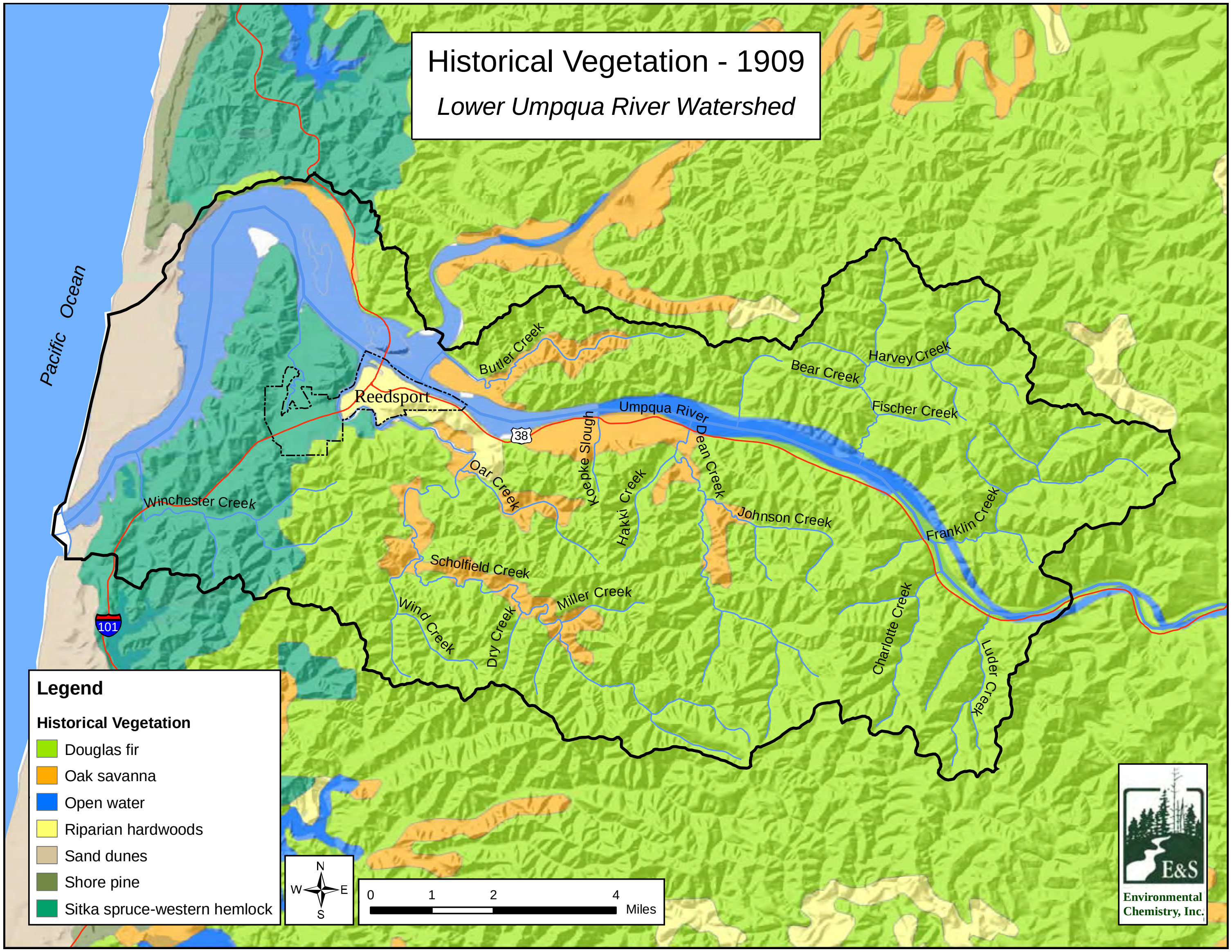
Forest vegetation was somewhat different in pre-settlement times than it is today. Much of the forest vegetation in Elliott State Forest was initiated following a large fire in 1868 (Morris 1934). Historically, fire has played an important role in the watershed. Large stand-replacement fires caused by 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 Basin commonly used fire to improve browse.

Data are available with which to evaluate vegetation patterns in 1909 within the watershed (Map 2.1). Sitka spruce dominated the forest landscape along the southern shore of Winchester Bay. Most upland areas were covered with coniferous forests dominated by Douglas-fir. Riparian hardwoods occurred east of Reedsport and oak savanna vegetation occurred in some areas along the lower mainstem Umpqua River and several of its tributary streams (Map 2.1).

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, 1955/1956, and 1964 (Weyerhaeuser 1998, Taylor and Hatten 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). 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 Lower Umpqua River Watershed in 1909.

3. Current Conditions

This chapter explores the current conditions of the Lower 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), the *Elliott State Forest Watershed Analysis* (Biosystems 2003), the *South Umpqua River Watershed Assessment and Action Plan* (Geyer 2003), 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 (OWRD).

<u>Key Questions</u>

- In general, how are the streams, riparian areas, and wetlands within the Lower Umpqua River Watershed functioning?
- How is water quality in terms of temperature, bacteria, 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 Lower 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.

[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.

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 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

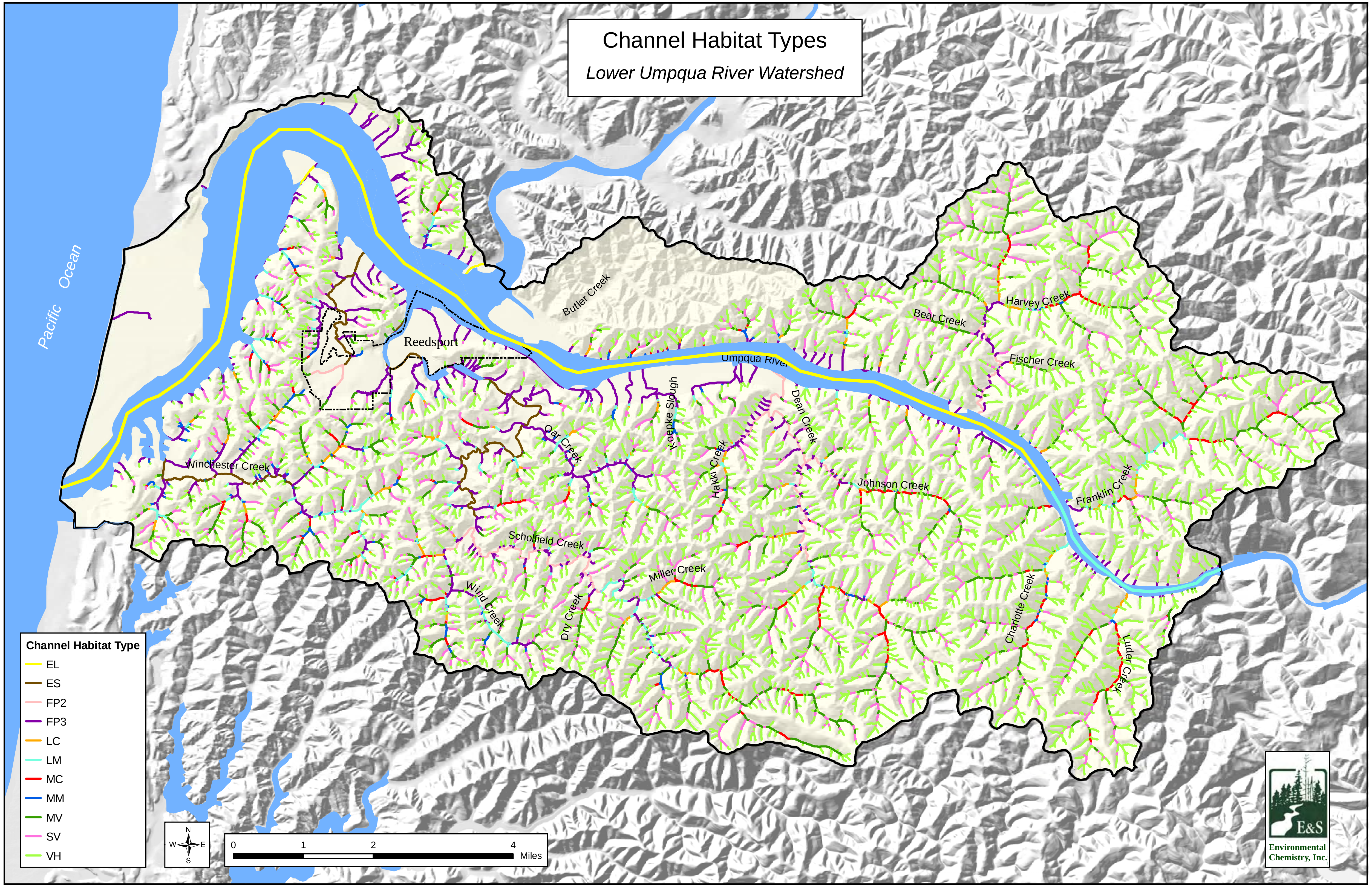
This section discusses the channel morphology of the Lower Umpqua River Watershed. Information in this section has been summarized from the following documents: *Going with the Flow: Understanding Effects of Land Management on Rivers, Floods, and Floodplains* (Ellis-Sugai and Godwin 2002), *South Umpqua 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 Lower Umpqua River Watershed, specific stream examples, and possible restoration opportunities as described by OWEB. Locations are shown in Map 3.1.

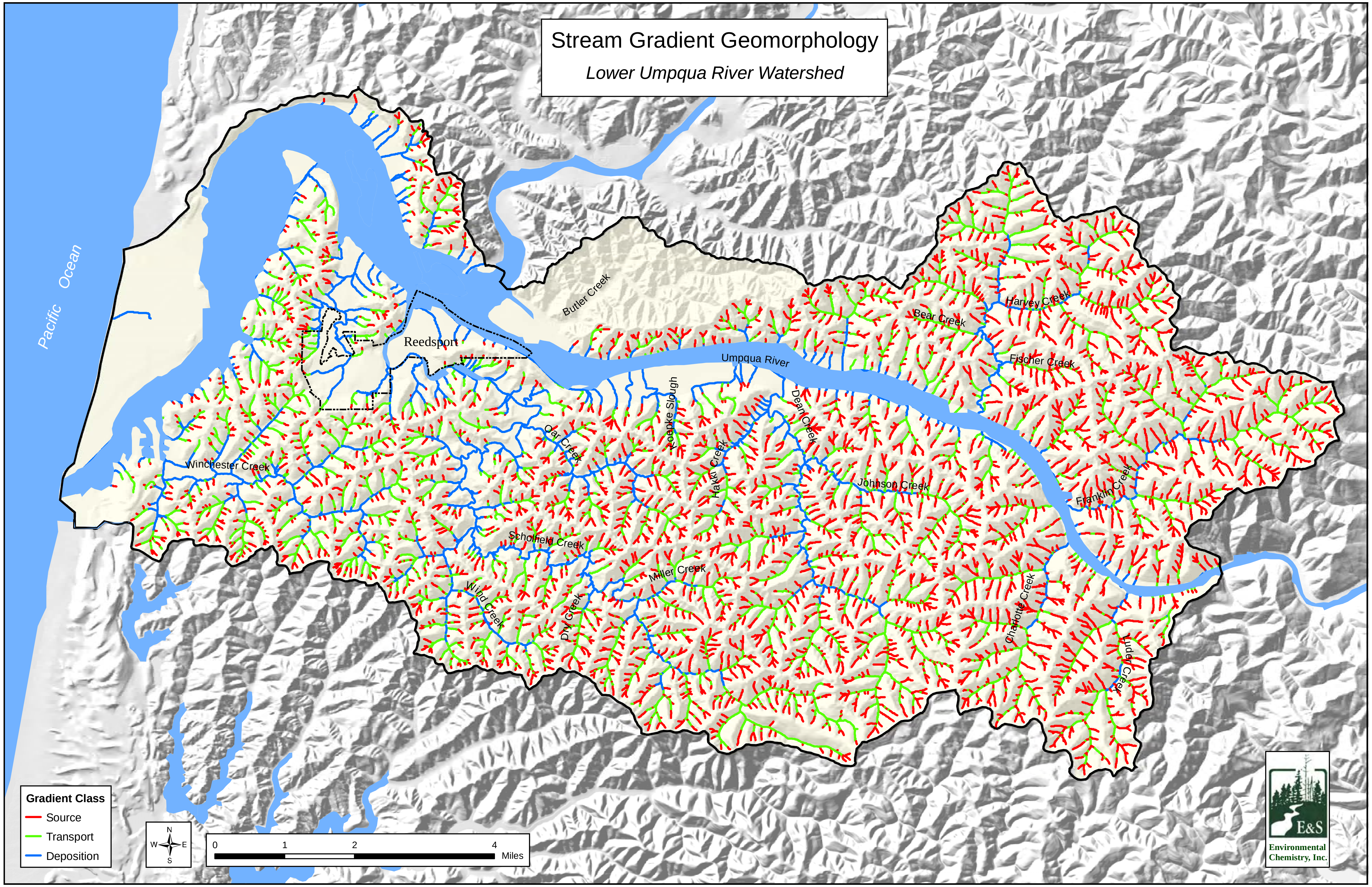
Streams in steep headwaters (often 20% slope or greater) are “source” streams, adding sediment and wood to the stream system. They have high-energy flows and no floodplain, and are prone to landslides. “Transport” streams have medium gradients, with slopes often between 3% and 20%. They have small meanders 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 and allow sediment and wood to settle out and be stored in these reaches of the streams for long periods. Depositional streams are often the most sensitive to changes in the watershed. Table 3.2 and Map 3.2 show the distribution and percent of streams within each gradient class.

Many of the tributary streams of the Lower 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



Map 3.1. Channel habitat type (CHT) distributions within the Lower Umpqua River Watershed. See Table 3.1 for CHT code descriptions. No data exist for the Butler Creek subwatershed.



Map 3.2. Stream gradient classes in the Lower Umpqua River Watershed. No data exist for the Butler Creek subwatershed.

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

Channel Habitat Type	Stream Miles (%)	Example within Watershed	Restoration Opportunities[1]
Large estuary (EL)	21.3 (2.8%)	Umpqua River	Unique biological communities in estuaries make them desirable sites for restoration. Restoration strategies include reconnection of wetlands, sloughs, and off-channel areas, and removal or breaching of dikes. Limiting development is also a common strategy.
Small estuary (ES)	17.1 (2.2%)	Scholfield Creek near mouth	Strategies for enhancing small estuaries are similar to large estuaries, including restricting development, reconnection off-channel areas, breaching dikes, and restoring wetlands.
Low gradient medium floodplain (FP2)	12.7 (1.6%)	Dean Creek near mouth	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)	127.9 (16.6%)	Oar Creek at mouth	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)	11.4 (1.5%)	Luder Creek middle reaches	Though these channels are not often responsive, riparian planting projects may improve water temperature and erosion issues.
Low gradient moderately confined (LM)	22.1 (2.9%)	Wind Creek middle reaches	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)	18.4 (2.4%)	Johnson Creek upper reaches	Though these channels are not often responsive, riparian planting projects may improve water temperature and erosion issues.
Moderate gradient moderately confined (MM)	10.2 (1.3%)	Wind Creek upper reaches	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)	72.6 (9.4%)	Dry Creek upper reaches	Though these channels are not often responsive, riparian planting projects may improve water temperature and erosion issues.
Steep narrow valley (SV)	102.2 (13.3%)	Oar Creek uppermost reaches	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)	354.4 (46.0%)	Oar Creek uppermost reaches	Though these channels are not often highly responsive, the establishment of riparian vegetation along stable banks may address water temperature problems.
TOTAL	770.3 (100.0%)		

[1] From WPN 1999

Table 3.2. Lower Umpqua River Watershed stream miles within each gradient class.		
Gradient Class	**Stream Miles in the Watershed**	**Percent of Total**
Source	326.4	42.4
Transport	228.3	29.6
Deposition	216.0	28.0
Total	770.7	100.0

and wood downstream. These streams also are located in areas where the overall landscape is 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 Lower Umpqua River and lower reaches of Winchester, Scholfield, and Dean Creeks all have wide floodplains. The floodplain of the Lower Umpqua River broadens considerably downstream of the confluence with Dean Creek. These broad, low-gradient reaches lend themselves to complex aquatic habitat with large wood, coarse sediment, pools, bars, and side channels. However, due to the meandering nature of these reaches, off-channel and wetland restoration projects are likely to be more successful than in-stream or bank stabilization projects.

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 refuge areas. The riparian forest is the most important source of large wood. Large trees in headwall areas[14] may also provide an important source of large wood transport to the stream through natural landslides.

3.1.2.2. Stream Habitat Surveys

Since 1992, 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, 36.2 stream miles were surveyed in the Lower Umpqua River Watershed. Each stream was divided into reaches based on channel and riparian habitat characteristics for a total of 25 reaches averaging 1.4 miles in length.

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

[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.

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 had few 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.

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 and help determine issues that might be of greatest concern.

Of the 25 surveyed stream reaches, only one rated as fair or good in all four categories. Twenty-one stream reaches (84%) have at least two categories rated as poor. Looking at Table 3.4, it is noteworthy that 68% of all reaches rated as poor for both riffle condition and large woody material. Nearly three-quarters (72%) of the reaches rated as poor or fair for pool conditions, and none of the reaches rated as good for riffle conditions. Finally, only 12% of riparian areas rated as good.

Overall pool ratings were highest in the lower reaches of the tributary stream systems and generally worse closer to the headwaters. More than half of the surveyed reaches in Dean Creek were rated as good for pool conditions. None of the survey reaches in Franklin Creek or Charlotte Creek was rated as good for pool conditions (Map 3.3).

Riffle conditions were poor in at least some portion of all surveyed streams. None of the surveyed reaches was rated as good. Riffle conditions were uniformly poor in Winchester Creek and Charlotte Creek (Map 3.4). In some locations, often in the upper reaches of the surveyed

Table 3.3. Stream habitat survey benchmarks.

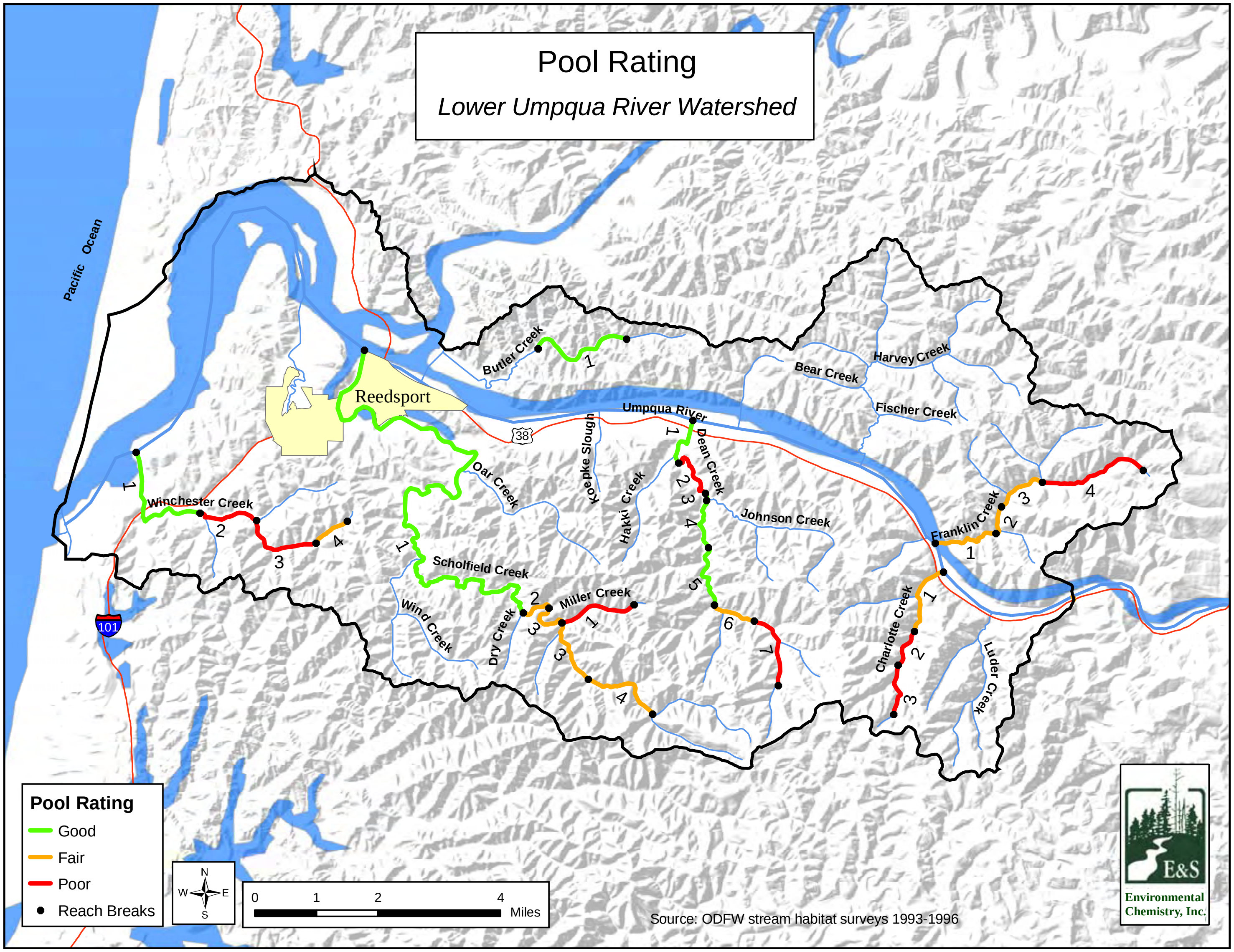
Habitat Characteristic	Measurements Used for Rating Habitat Quality	Benchmark Values		
		Good	**Fair**	**Poor**
Pools	1. **Percent area in pools:** percentage of the creek area that has pools	1. > 30	1. 16-30	1. <16
	2. **Residual pool depth:** depth of the pool (m), from the bottom of the pool to the bottom of the streambed below the pool a) small streams b) large streams	2a. > 0.5 2b. > 0.8	2a. 0.5 - 0.3 2b. 0.8 - 0.5	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	1. ≤ 20.4	1. 20.5-29.4	1. ≥ 29.5
	2. **Percent gravel in the riffles:** percentage of creek substrate in the riffle sections of the stream that are gravel	2. ≥ 30	2. 16-29	2. ≤ 15
	3. **Percent sediments** (silt, sand, and organics) **in the riffles:** percentage of creek substrate in the riffle sections of the stream that are sediments	3. ≤ 7	3. 8-14	3. ≥ 15
Riparian	1. **Dominant riparian species:** hardwoods or conifers	1. large diameter conifers	1. medium diameter conifers & hardwoods	1. small diameter hardwoods
	2. **Percent of the creek that is shaded** a) For a stream with width < 12m (39 ft) b) For a stream with width > 12m	2a. > 70 2b. > 60	2a. 60 – 70 2b. 50 – 60	2a. < 60 2b. < 50
Large Woody Material in the Creek	1. **Number of wood pieces**[1] per 100m (328 ft) of stream length	1. > 19.5	1. 10.5-19.5	1. < 10.5
	2. **Volume of wood** (cubic meters) per 100m of stream length	2. > 29.5	2. 20.5-29.5	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.

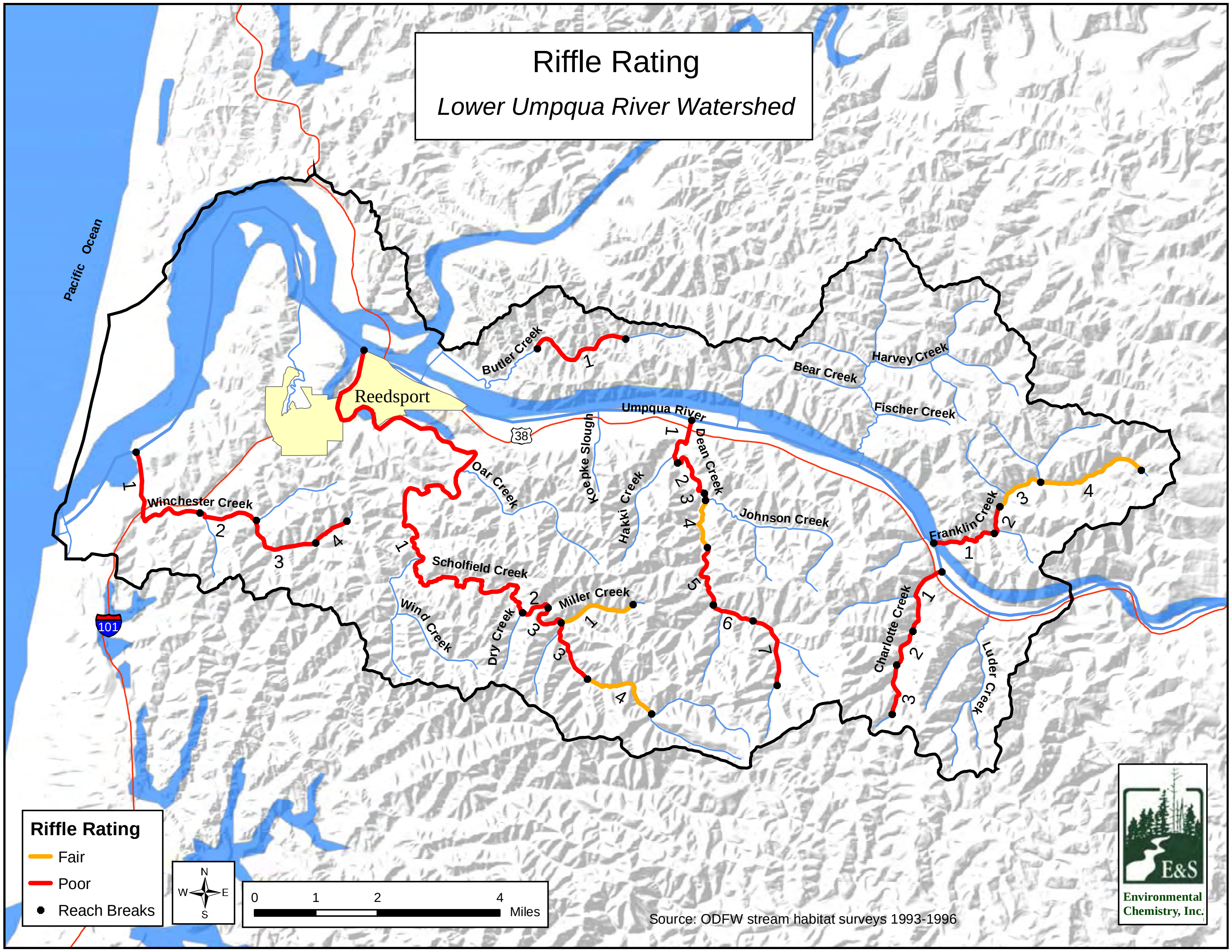
Table 3.4. Lower Umpqua River Watershed stream habitat conditions (see Map 3.3 for stream locations).

Stream	Reach	Pools	Riffles	Riparian Area	Large Wood
Butler Creek	1	•••	•	•	•
Charlotte Creek	1	••	•	••	•••
Charlotte Creek	2	•	•	••	•••
Charlotte Creek	3	•	•	••	•••
Dean Creek	1	•••	•	•	•
Dean Creek	2	•	•	•	•
Dean Creek	3	•••	•	•	•
Dean Creek	4	•••	••	•	•
Dean Creek	5	•••	•	•	•
Dean Creek	6	••	•	••	•
Dean Creek	7	•	•	•••	•
Franklin Creek	1	••	•	••	•
Franklin Creek	2	••	•	••	•
Franklin Creek	3	••	••	•••	•
Franklin Creek	4	•	••	•••	•••
Mill Creek	1	••	•	••	•
Miller Creek	1	•	••	••	•
Scholfield Creek	1	•••	•	•	•
Scholfield Creek	2	••	•	•	•
Scholfield Creek	3	••	•	••	•
Scholfield Creek	4	••	••	••	••
Winchester Creek	1	•••	•	•	•
Winchester Creek	2	•	•	•	•
Winchester Creek	3	•	•	•	•
Winchester Creek	4	••	•	••	•

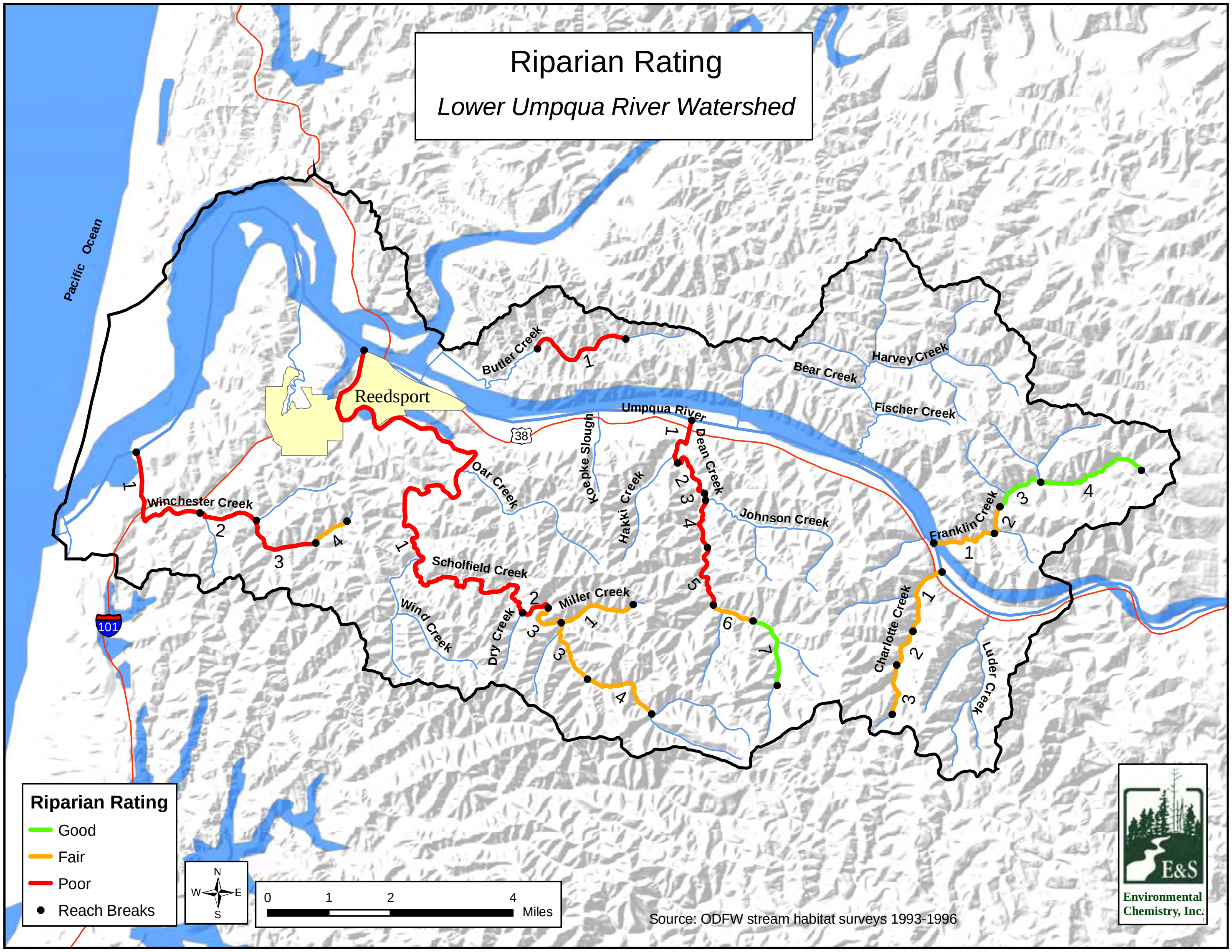
• Poor •• Fair ••• Good



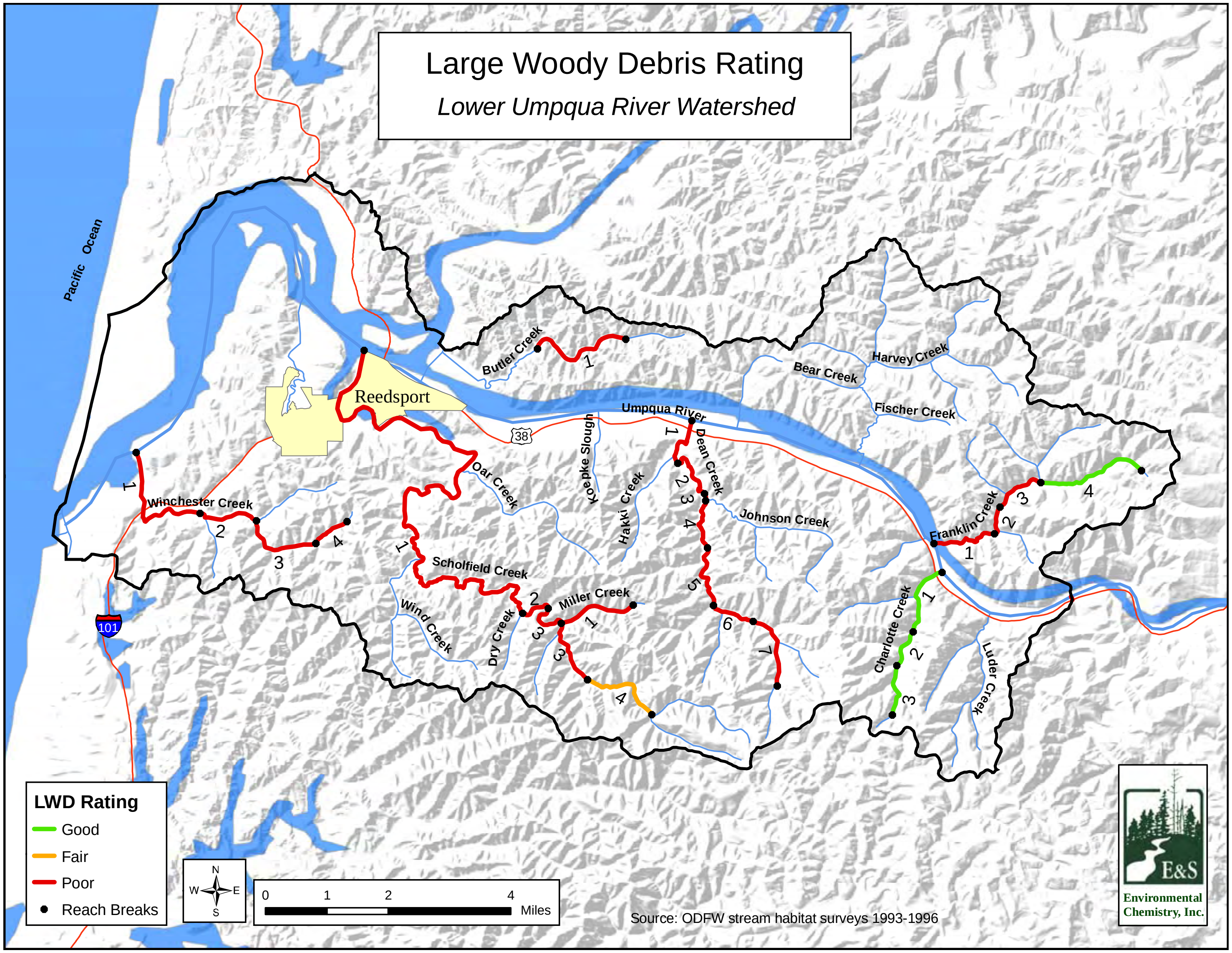
Map 3.3. Overall pool rating of Lower Umpqua River Watershed stream reaches surveyed by ODFW, based on results for percent area in pools and residual pool depth. Numbers correspond to the reach numbers in Table 3.4. Some reaches are intersected by tributary junctions. In such cases, the reach number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



Map 3.4. Overall riffle rating of Lower 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 Lower 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 Lower 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.

streams, the poor riffle conditions rating was due largely to an inadequate supply of gravel. In other locations, often in the lower reaches of the surveyed streams, the poor riffle condition rating was due largely to excess fine sediments.

Riparian conditions were best in the upper reaches of Franklin Creek and Dean Creek. In general, riparian conditions deteriorated in a downstream direction (Map 3.5). A similar pattern was found for large woody debris conditions, which were best in the upper reaches of Franklin Creek and throughout Charlotte Creek. Large woody debris conditions were uniformly poor in Winchester, Dean, and Butler Creeks, and nearly so in Scholfield Creek (Map 3.6).

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 and overwintering 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, off-channel refuge during high flow, 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.

3.1.3.1. Irrigation ditches

Irrigation ditches without fish wheel screens are a problem primarily 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, the extent to which unscreened irrigation ditches are impacting juvenile fish populations is unknown, because no comprehensive surveys of fish screens have been conducted in the Lower Umpqua River Watershed.

3.1.3.2. Dams

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

[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.

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. According to the ODFW database, there are no dams that are barriers or obstacles to adult or juvenile fish passage in the Lower Umpqua River Watershed.

3.1.3.3. Culverts

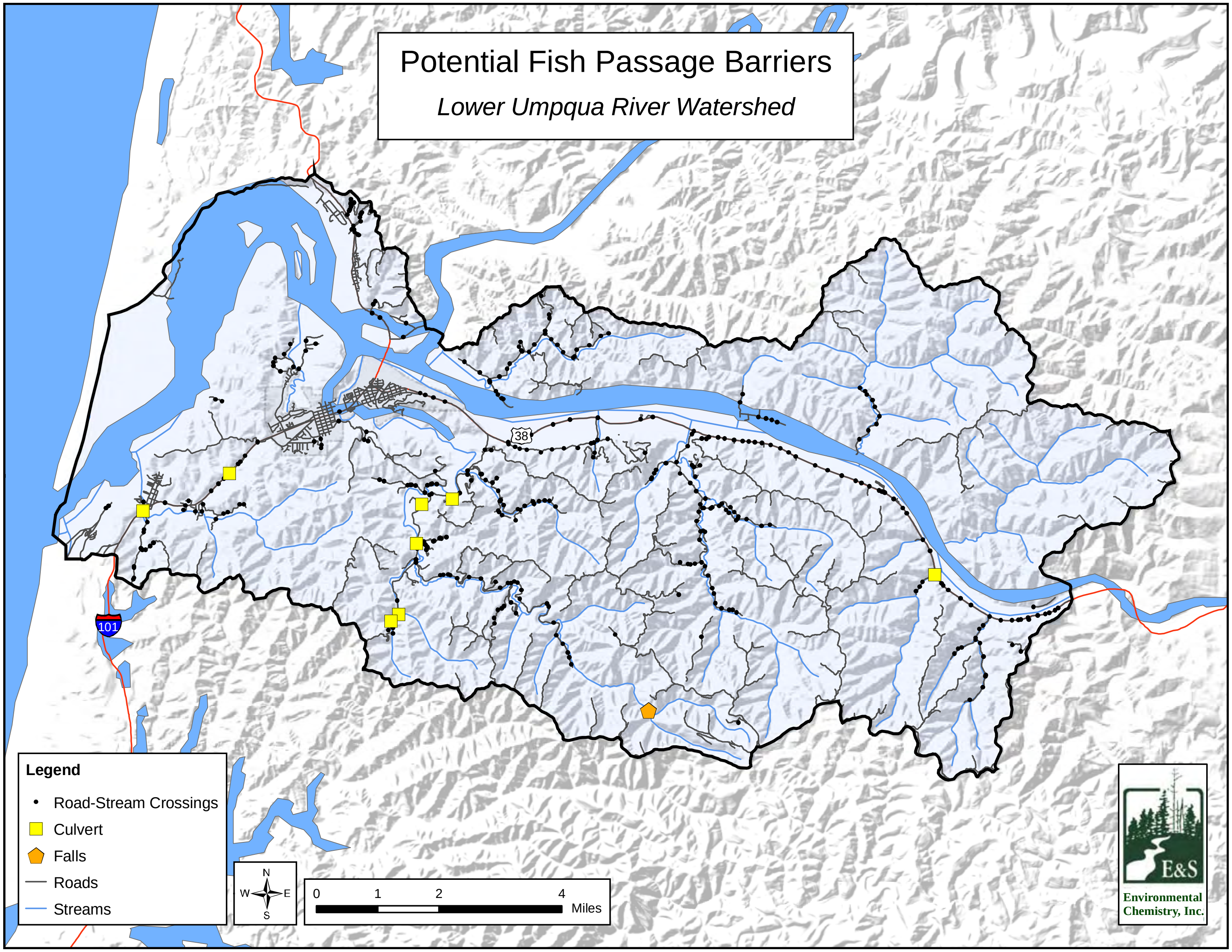
Culverts can be either barriers or obstacles to fish passage, especially if the distance from the downstream water surface to the culvert outfall is too far for fish to jump. Culverts can also block fish access by creating high velocity in the pipe. A drop of two feet can cause problems for adult cutthroat 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.

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 3.7 shows potential fish passage barriers, including road-stream crossings, within the Lower Umpqua River Watershed. Most of these crossings contain culverts. A culvert is the most common method of passing a road over a stream, although bridges and hardened crossings are used as well. The ODFW fish passage barrier database identifies eight culverts within the watershed that are known barriers to salmonids.

Currently, the Umpqua Basin Fish Access Team (UBFAT) is working on identifying and prioritizing fish passage-limiting culverts, as well as other fish passage barriers and obstacles, on public and private land throughout the Umpqua Basin. At the time of writing, however, the Lower Umpqua River Watershed had not been analyzed by UBFAT. 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.



Map 3.7. Potential fish passage barriers, including road-stream crossings, in the Lower Umpqua River Watershed.

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 necessarily intended to alter the stream's path. Therefore, 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.

Removal of wood from streams in the past 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. Although anecdotal evidence suggests that such stream "cleaning" activities may have occurred in the Lower Umpqua River Watershed, we did not find specific information regarding the locations of such activities. Nevertheless, recent surveys of the stream system by ODFW indicate a lack of large woody debris and related physical complexity throughout most of the watershed.

In the lower watershed, outside of Oregon Department of Forestry (ODF) and BLM lands, additional human alterations of stream morphology have included channelization, straightening, bank armoring, diking, and dredging. The specific locations of these activities are not well documented.

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.

---

[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.

During salvage logging in the 1960s following the 1962 Columbus Day storm, 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 within the watershed. Nevertheless, 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 potential 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, to a somewhat lesser extent, poor or fair pools and riparian areas 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 Lower Umpqua River Watershed.

---

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

3.1.5.3. Channel Modification Key Findings

- There are few examples of permitted channel modification projects in the Lower 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. Stream Function 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.
- Very little information exists regarding the distribution of unscreened ditches or the condition of existing fish screens and fish wheels. An inventory of ditches and fish screens is recommended.

---

[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 vegetation immediately adjacent to a stream is the riparian zone. Riparian zones influence stream conditions in many ways. Above-ground vegetation can provide shade, reduce flood velocities, and add nutrients to the stream. Roots help prevent bank erosion and 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.

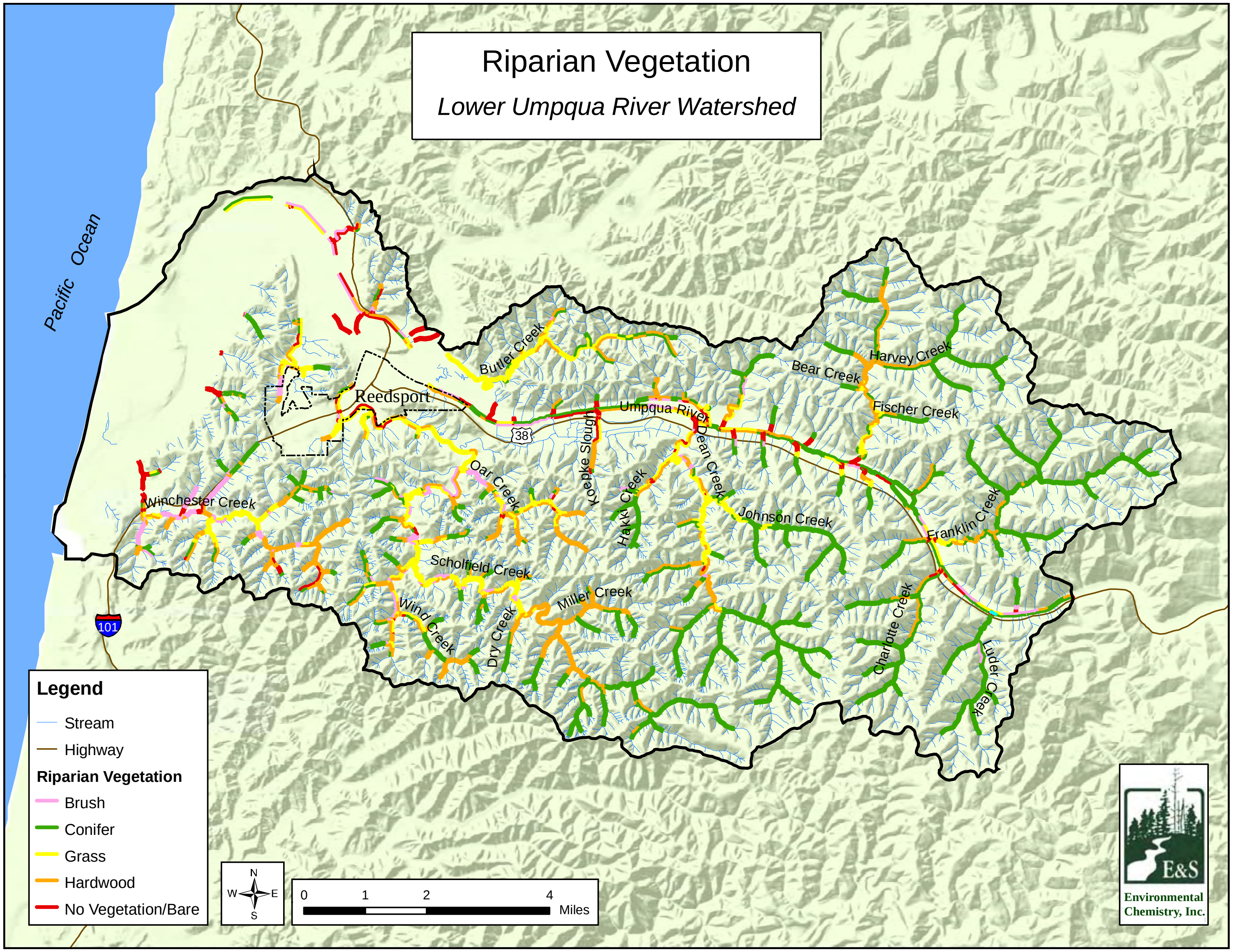
Riparian vegetation in the watershed was primarily conifer (47.8%), followed by hardwood forest (21.6%) and grass (17.5%; Table 3.5). This suggests only moderate potential to develop future large wood sources to the stream system. Riparian conifers were found mostly in the upper tributary stream systems in the eastern half of the watershed (Map 3.8).

Table 3.5. Lower Umpqua River Watershed aerial photo interpretation of riparian vegetation.

Vegetation Type	Left Bank (Miles)	Right Bank (Miles)	Left Bank (Acres)	Right Bank (Acres)	Total (Acres)	Total (Percent)
Brush	11.0	9.8	199.1	178.3	377.4	6.4
Conifer	77.5	77.7	1,410.9	1,411.1	2,822	47.8
Grass	27.6	29.2	501.0	531.2	1,032.2	17.5
Hardwood	34.1	36.1	619.7	656.0	1,275.7	21.6
No Vegetation/Bare	12.2	9.6	221.2	175.3	396.5	6.7
Total*	162.4	162.4	2952.0	2,952.0	5,904.0	100.0

* Columns may not sum to totals due to rounding.

Riparian vegetation along the mainstem river was comprised of a mixture of cover types. Areas of the tributary streams that were dominated by hardwood forest or grasses were generally found in the lower reaches of the tributaries, especially in the western portion of the watershed (Map 3.8). Overall, riparian vegetation in the watershed provides only a moderate degree of shade-producing cover. Only half of the riparian areas were classified as having high cover (Figure 3.1). 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.



Map 3.8. Distribution of riparian vegetation classes throughout the watershed.

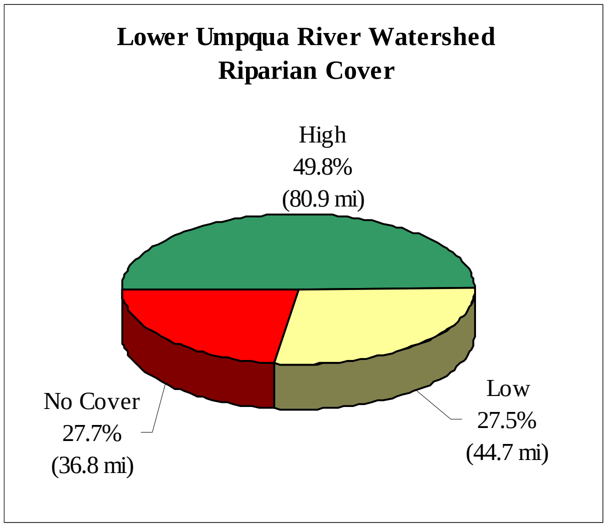


Figure 3.1. Results of aerial photo interpretation of riparian cover.

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 recent tidal wetland restoration assessment, *Tidal Wetland Prioritization for the Umpqua River 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?

In general, 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; and

---

[20] Jeanine Lum of Barnes and Associates, Inc., contributed material for section 3.2.2.
[21] The growing season in Douglas County is approximately from March 1 through October 31.

1. 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 the cause of malaria and "malignant fever". 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.

Background on the Clean Water Act and National Wetlands Inventory

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.

Types of wetlands

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 use 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. Three subsystems of riverine wetlands occur in this watershed. "Tidal" riverine wetlands are found on rivers or streams that have tidal influence. "Upper perennial" riverine wetlands occur on high gradient streams that typically have a gravel, rock or cobble bottom, with occasional sandy patches. "Lower perennial" riparian wetlands occur on low gradient rivers and streams characterized by a sandy or muddy bottom. The "estuarine" classification includes wetland areas in estuaries where there is a mixing of freshwater and saltwater. It includes "subtidal", which remain submerged during low tides, and "intertidal", which may be exposed during low tides. Finally, there are "marine intertidal" wetlands, which are influenced directly by the open ocean and may be exposed during low tides. The "lacustrine" classification refers to wetlands associated with lakes that are dominated by trees, shrubs, persistent emergents, emergent mosses, or lichens. It may include freshwater marshes and aquatic beds. The littoral habitats of the lacustrine category extend to a depth of 6.6 feet below low water or to the maximum extent of nonpersistent emergents. NWI data are displayed in Map 3.9 and Table 3.6.

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

Based on the current NWI wetlands data, the majority of the wetlands in the Lower Umpqua River Watershed consist of estuarine systems (61.9%; Table 3.6, Figure 3.2). This includes both subtidal and intertidal estuarine systems. The estuarine wetlands are found in the lower portion of the watershed, along the mainstem of the Umpqua River, where there is a tidal influence (Map 3.9). Palustrine systems comprise 27.3% of the watershed. These wetland types can be found along the middle portions of the Umpqua River, and also alongside most of the tributaries such as Winchester Creek, Scholfield Creek, Butler Creek, Dean Creek, and Fischer Creek. Riverine systems cover just 10% of the watershed, and include tidal, lower perennial, and upper perennial wetlands. These are restricted to the upper portion of the Lower Umpqua River, where there is no tidal influence. Only 0.8% of the Lower Umpqua River Watershed contains lacustrine systems. These wetlands are only found in the bay area, near the ocean.

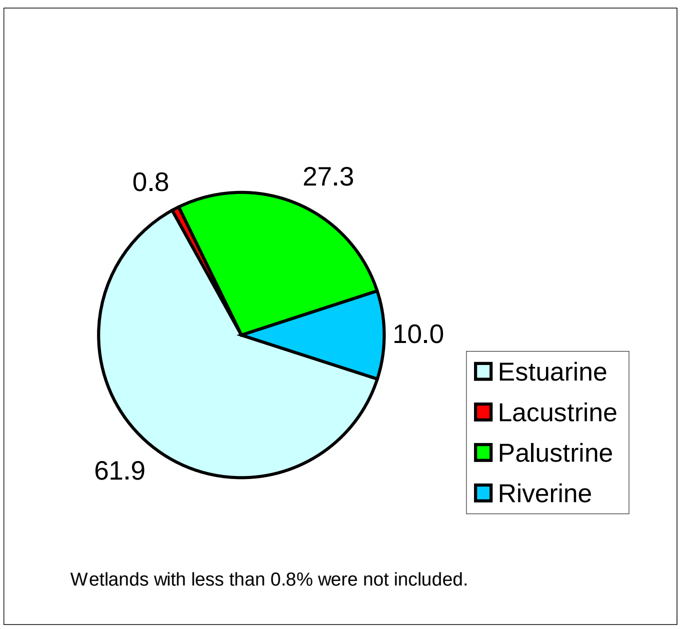
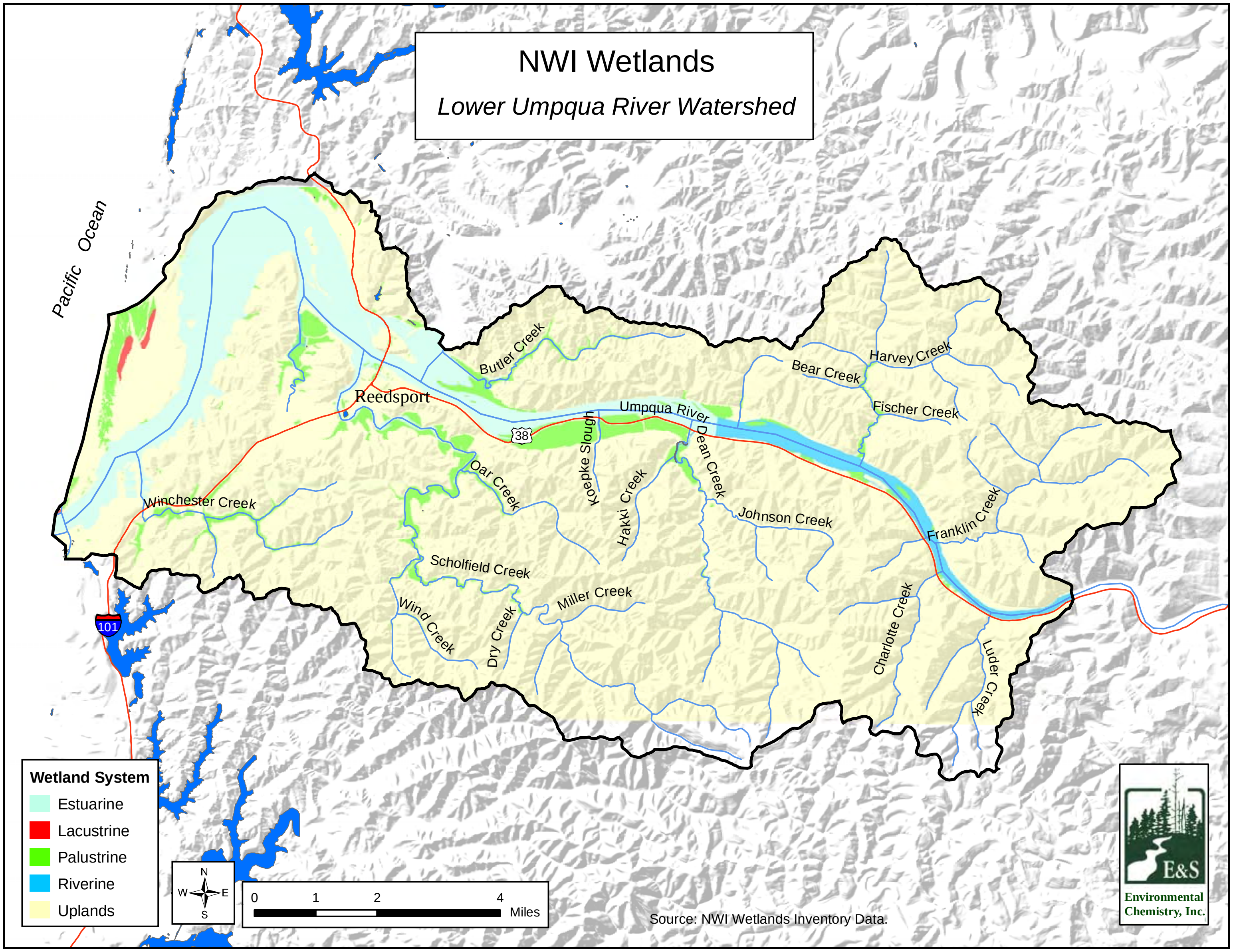


Figure 3.2. Percent of wetland types in the Lower Umpqua River Watershed.



Map 3.9. Lower Umpqua River Watershed wetlands.

Table 3.6. Lower Umpqua River Watershed wetlands and deepwater habitat classification.

Wetland Type	Wetland Area	
	Acres*	**Percent***
Estuarine		
Subtidal - Unconsolidated Bottom	4,097.1	41.6
Intertidal - Aquatic Bed	14.9	0.2
Intertidal - Emergent	670.7	6.8
Intertidal - Rocky Shore	0.4	0.0
Intertidal - Unconsolidated Shore	1,312.0	13.3
Total	**6,095.1**	**61.9**
Lacustrine		
Littoral - Unconsolidated Shore		
Total	**79.6**	**0.8**
Marine		
Intertidal - Unconsolidated Shore		
Total	**4.5**	**0.0**
Palustrine		
Aquatic Bed - Permanently Flooded	13.5	0.1
Emergent - Temporarily Flooded	423.8	4.3
Emergent - Saturated	9.6	0.1
Emergent - Seasonally Flooded	941.2	9.5
Emergent – Semi-permanently Flooded	17.1	0.2
Emergent – Seasonally Tidal	230.0	2.3
Emergent – Semi-permanently Tidal	190.0	1.9
Forested - Temporarily Flooded	59.5	0.6
Forested - Seasonally Flooded	144.6	1.5
Forested – Seasonally Tidal	111.6	1.1
Forested – Temporary Tidal	75.2	0.8
Scrub/Shrub - Temporarily Flooded	43.2	0.4
Scrub/Shrub - Saturated	1.1	0.0
Scrub/Shrub - Seasonally Flooded	305.8	3.1
Scrub/Shrub – Semi-permanently Flooded	11.7	0.1
Scrub/Shrub - Seasonally Tidal	40.7	0.4
Unconsolidated Bottom - Permanently Flooded	9.6	0.1
Unconsolidated Bottom - Artificially Flooded	20.8	0.2
Unconsolidated Bottom - Temporarily Flooded	11.2	0.1
Unconsolidated Bottom - Seasonally Flooded	28.0	0.3
Total	**2,688.3**	**27.3**
Riverine		
Tidal - Unconsolidated Bottom	980.0	9.9
Lower Perennial - Aquatic Bed	3.0	0.0
Upper Perennial - Unconsolidated Shore	6.5	0.1
Total	**989.5**	**10.0**
Grand Total	**9,856.9**	**100.0**

* Numbers may not sum due to rounding

Tidal wetlands in the Lower Umpqua River Watershed provide important habitat for many marine and anadromous fish and migratory birds, as well as a variety of ecological functions. Human activities, primarily filling, diking, and drainage, have caused the loss of the majority of the tidal wetlands in Oregon. Losses in Oregon's 17 largest estuaries ranged from 2% to 91% between 1870 and 1970; the average loss was 68% (Good 2000). To restore functions and health to the coastal ecosystem, many organizations are looking for opportunities to reverse this loss by restoring tidal wetlands. Strategic planning is essential for identifying potential restoration or conservation opportunities and for coordinating an estuary-wide approach to restoration.

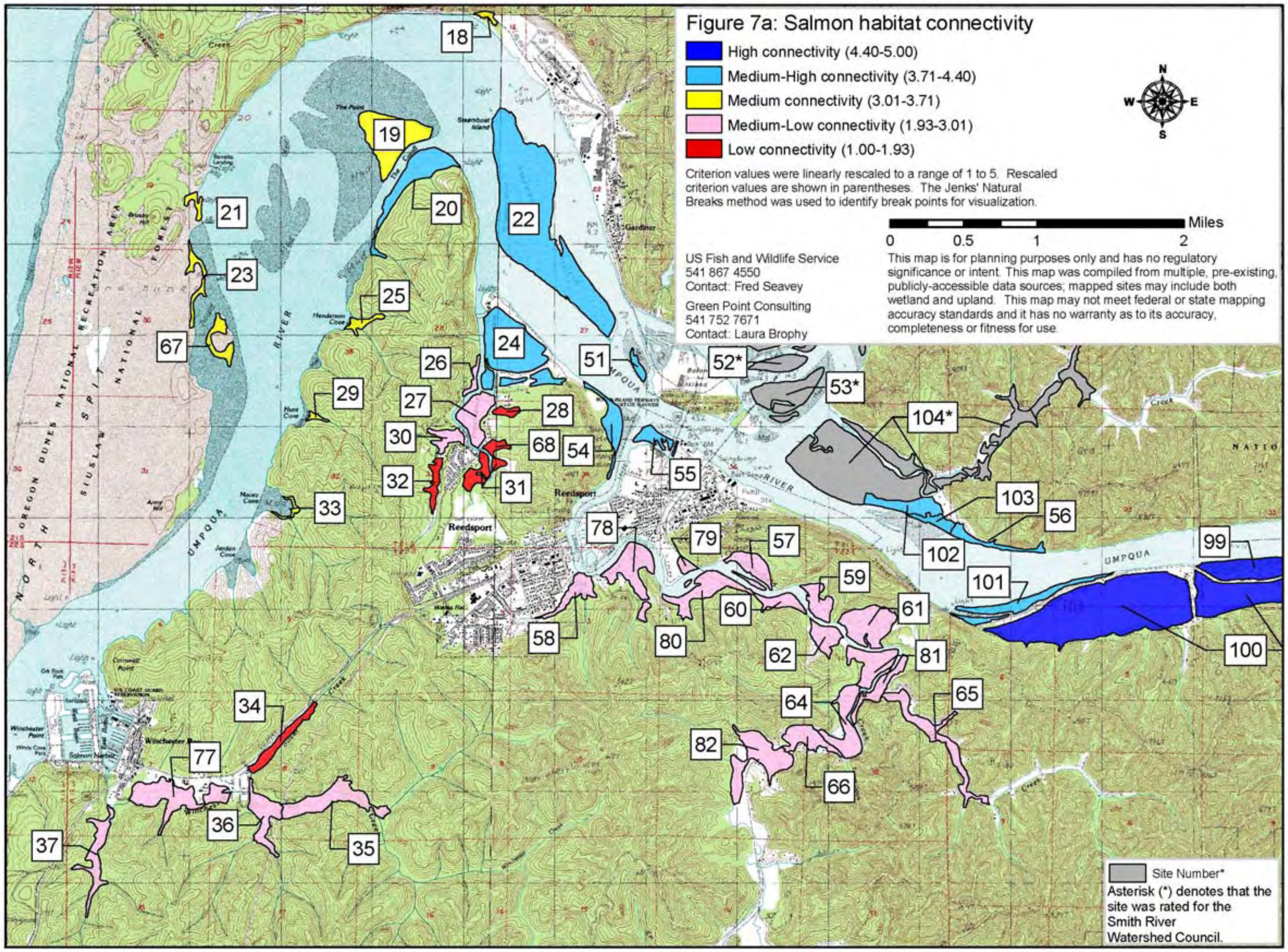
Highly productive tidal wetlands provide essential food chain support and wildlife habitat. For example, it is very clear that tidal wetlands provide a variety of functions that are vital to salmon. The mixing of salt water from the ocean and fresh water from streams and rivers provides "osmotic transition zones" that allow juvenile salmon to adapt gradually to salt water. Deeply incised tidal channels provide shelter from predators, and tidal flushing keeps water temperatures cool and dissolved oxygen concentrations high. Rich wetland soils and plant communities support a wide range of invertebrates that are prey for salmon. Such benefits to salmon are dependent to a large degree on the extent to which tidal wetlands are connected to the freshwater system. Brophy et al. (2004) recently classified wetlands in and adjacent to the Umpqua River estuary on the basis of salmon habitat connectivity. The results of that classification are shown in Map 3.10. There are many wetland areas near Reedsport and Winchester Bay that could benefit from enhanced connectivity. In addition to supporting salmon, tidal wetlands provide important habitat for visiting marine fish, resident fish, shorebirds, waterfowl such as ducks and geese, native landbirds, small mammals and their predators, and large mammals such as elk and bear.

Human-related alterations and non-native species introductions have changed the area, type, and function of tidal wetlands. Wetland areas have been greatly altered by extensive filling and drainage. Wetland types have been changed by physical site alterations that modify hydrology, tidal regimes, and salinities, resulting in shifts in dominant vegetation and other wetland characteristics. These shifts have greatly altered wetland functions. Major and minor alterations in tidal wetlands in the Lower Umpqua River Watershed are summarized in Table 3.7. The most common disturbances have been diking, ditching, and filling of wetland areas.

Table 3.7. Tidal wetland areas and alterations in the Umpqua Estuary, excluding Smith River Watershed.

Alteration Type	Area (ha)	Percent of Total Area
None	288.0	32.5
Major alterations		
Diking	255.2	28.7
Ditching	140.8	15.9
Total major alterations	396.0	44.6
Minor alterations		
Culvert	10.4	1.2
DMD/Fill on Part of Site	136.5	15.4
Grazed	0.0	0.0
Road/Railroad	56.1	6.3
Total minor alterations	203.0	22.9
TOTAL	887.0	100.0

Alterations such as diking, ditching, tidegates, restrictive culverts, dams, roads, and bridges affect tidal wetlands



Map 3.10. Salmon habitat connectivity of tidal wetlands in the Lower Umpqua River Watershed. The numbers in boxes refer to site location codes in Brophy and So's report. (Source: Brophy and So 2004)

primarily by impeding or preventing tidal flow. Changes in wetland structure due to altered tidal flow greatly affect tidal wetland functions. Such structural changes can include a decrease in tidal channel complexity, shift in the composition and distribution of vegetation communities, changes in soil biology and chemistry, decreases in salinity, and altered patterns of sediment erosion and deposition.

All of the major types of tidal wetlands in Oregon are found in the Umpqua estuary. These include low marsh, bulrush and sedge marsh, immature high marsh, and mature high marsh, as well as tidal swamp. The estuary is strongly influenced by the large volume of fresh water carried by the Umpqua River. The strong freshwater influence contributes to the predominance of bulrush marsh in the estuary, since bulrush is tolerant of both fresh and brackish water.

Human land uses have resulted in many changes to the Umpqua estuary. Many former tidal wetlands have been filled and/or excavated to develop port facilities, mills, marinas, and other industrial, commercial, and residential sites. The City of Reedsport north of Providence Creek is built almost entirely on former tidal marsh. Other major areas of filled tidal wetlands include Bolon Island Industrial Park, the Gardiner Mill, and the City of Winchester Bay. Many former tidal marshes and swamps are now diked and ditched agricultural lands; one of the largest of these is the Dean Creek Elk Viewing Area.

Dredging of the Lower Umpqua River is periodically conducted to deepen the navigational channel. In the past, some of the dredged material has been placed on current or former tidal wetlands. Some examples include the north end of Steamboat Island, Leeds Island, and the Dean Creek Elk Viewing Area.

3.2.2.3. Restoration Opportunities in the Lower Umpqua River Watershed

There is little specific reference in historical records to wetlands in the Lower 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 Lower 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 stream-associated wetlands and other 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.

3.2.3. Riparian Zones and Wetlands Key Findings and Action Recommendations

3.2.3.1. Riparian Zones Key Findings

- Conifers dominate only half of the riparian zones within the watershed, mainly along tributary streams in the eastern half of the watershed.
- Riparian cover is rated as high along only half of the stream length. Thus, there are good opportunities to enhance stream shading.

3.2.3.2. Wetlands Key Findings

- Historical settlement, development, and long-term agricultural use of the Lower Umpqua River Watershed have probably affected the original wetland hydrology and resulted in loss of wetland areas.
- Most of the remaining wetlands in the Lower Umpqua River Watershed are found on private land.
- 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 extensive estuarine wetlands and palustrine wetlands along the lower reaches of many tributary streams, and riverine wetlands along the mainstem Umpqua River above the confluence with Dean Creek.

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, and 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 discusses the condition of water quality in the Lower Umpqua River Watershed, with a focus on six important water quality parameters. Background information for this section was compiled from the following sources: the *Oregon Watershed Assessment Manual* (Watershed Professionals Network 1999), *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 Umpqua Soil and Water Conservation District (SWCD), 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 lower watershed, 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 within the Umpqua Basin.

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

Beneficial Uses	Umpqua River Estuary to Head of Tidewater and Adjacent Marine Waters	Umpqua River Main Stem from Head of Tidewater to Confluence of North and South Umpqua Rivers
Public Domestic Water Supply*		X
Private Domestic Water Supply*		X
Industrial Water Supply	X	X
Irrigation		X
Livestock Watering		X
Anadromous Fish Passage	X	X
Salmonid Fish Rearing	X	X
Salmonid Fish Spawning		X
Resident Fish and Aquatic Life	X	X
Wildlife and Hunting	X	X
Fishing	X	X
Boating	X	X
Water Contact Recreation	X	X
Aesthetic Quality	X	X
Hydropower	X	X
Commercial Navigation and Transportation	X	

***With adequate pretreatment (filtration and disinfection) 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."[22] 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."[23] A TMDL document is currently being completed for

[22] ODEQ can also use data collected by other agencies and organizations to evaluate water quality.
[23] 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.

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 Lower Umpqua River Watershed, six water quality parameters are reviewed in this section: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. In this assessment, we evaluate available data in the Lower 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).

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

Water Quality Attribute	Evaluation Criteria
Temperature	Daily maximum of 64E F (17.8E C) 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	8.75 Fg/L
Total Nitrogen	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
Organic Contaminants	Any detectable amount

[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

Table 3.11 and Map 3.11 show the streams identified for inclusion on the 303(d) list that require TMDL plans. The entire length of the mainstem Umpqua River, divided into three segments in this watershed, was placed on the Oregon 303(d) list due to documented violations of water quality standards. In addition, Scholfield Creek is listed from the mouth to river mile five for bacteria. 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 Lower 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.

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

Stream	River Mile	Parameter	303(d) Stream Miles	Percent of Streams in Watershed
Scholfield Creek	0 to 5	Fecal Coliform	5.0	4.1
Umpqua River	1 to 6.7	Fecal Coliform	5.7	4.7
	7.7 to 11.8	Fecal Coliform	4.1	3.4
	11.8 to 25	Temperature	11.1	9.1
Total			25.9	21.3

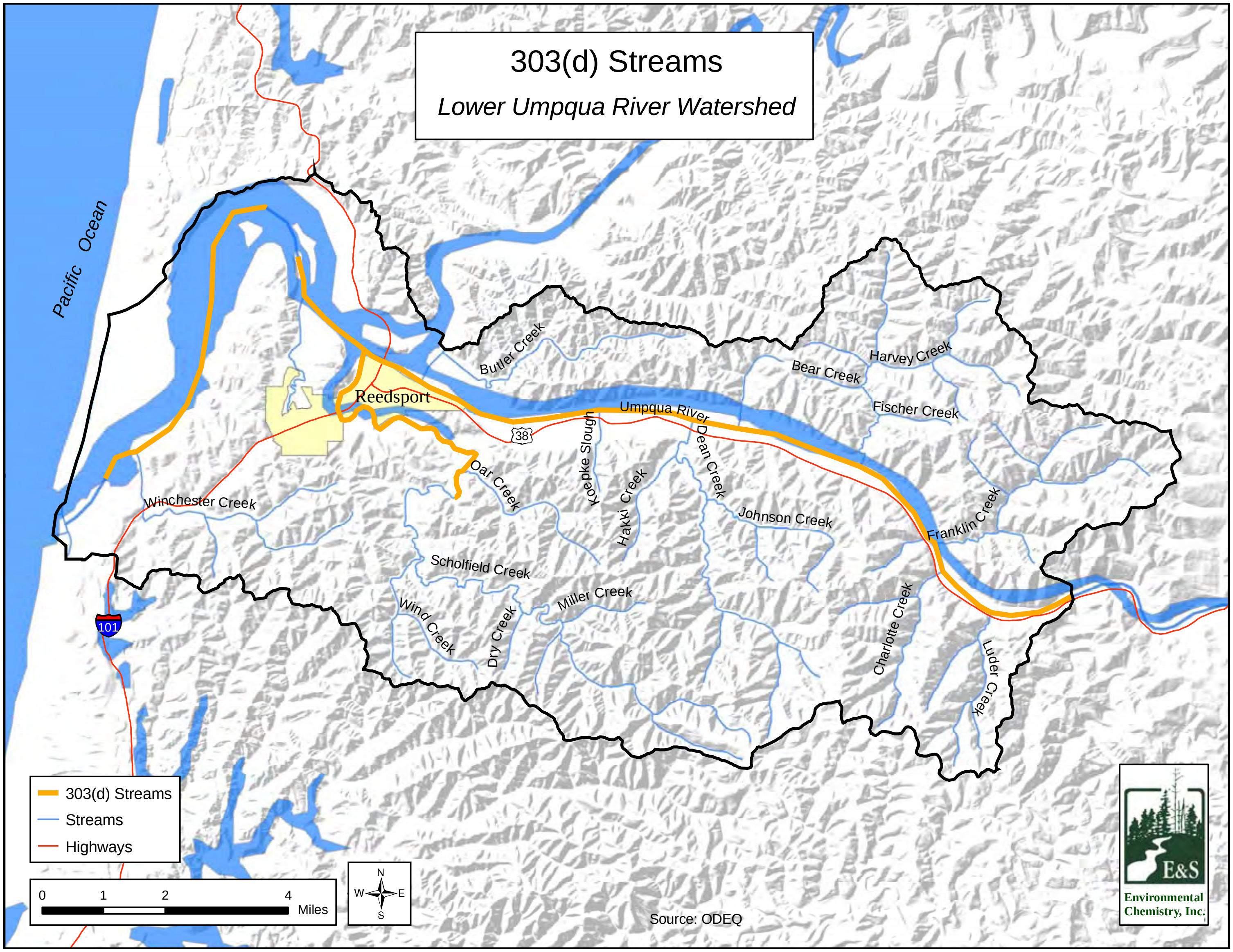
3.3.4. Temperature

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.[24] 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

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



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

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 (21.1°C). 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. Twice a day, the tide creates a reverse flow of cooler water in the mainstem Umpqua River and lower tributary reaches for relatively short periods of time, even during the warmest months. In the summer and fall months, water temperature can exceed the 64°F standard and cause streams to be water quality limited. In the Lower Umpqua River Watershed, the mainstem river was 303(d) listed for temperature from river mile 11.8 to 25.

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 Lower Umpqua River Watershed (Smith 1999).[25] 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.

Available stream temperature data are summarized in Table 3-12 and Map 3-12 for four monitoring sites within the watershed. Results are highly variable depending on location. Wind Creek and Franklin Creek exhibited no temperature exceedences above the 64°F standard, whereas Scholfield Creek exceeded the standard nearly half of the time and Lake Creek 100% of the time 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.

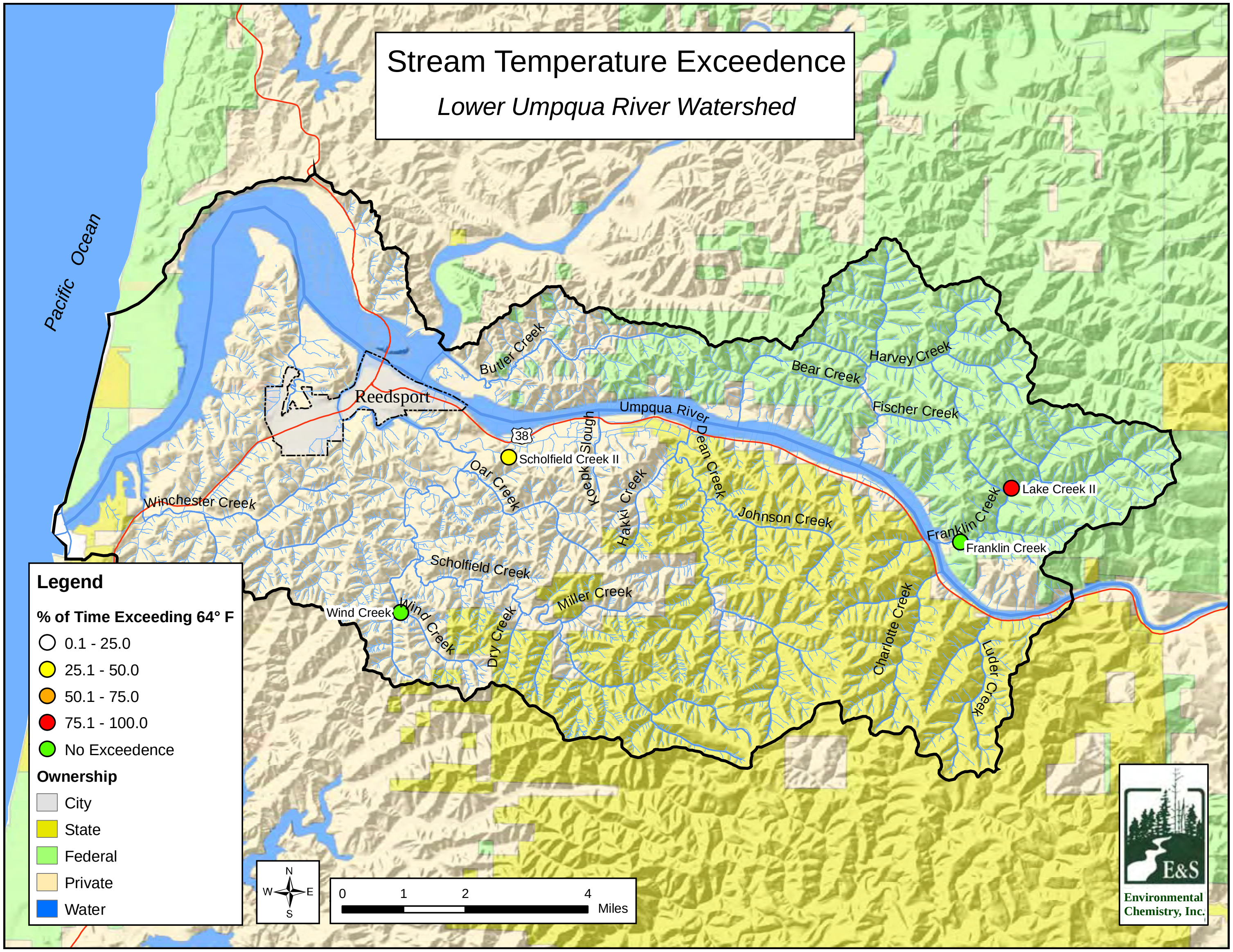
Site Name	Station ID	Percent Exceeded
Franklin Creek	28038	0.0
Wind Creek	25390	0.0
Lake Creek II*	27809	100.0
Scholfield Creek II*	27815	48.2

* Stream temperature monitoring did not begin until 7/31/01 for Lake Creek II and 7/30/01for Scholfield Creek II.

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.[26] 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

[25] Copies of this study, "Lower Umpqua Watershed Temperature Study, 1999" by Kent Smith, are available at the UBWC office.
[26] 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.

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 (1999) 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.

Data reported by Biosystems (2003) indicate that streams in the Elliot State Forest within the Lower Umpqua River and Mill Creek watersheds had existing shade conditions averaging 78% to 89%. Shade values greater than 80% generally maintain-stream temperatures below 70^{o}F, even at distances of 20 miles from the drainage divide (Biosystems 2003). Even with full shading, however, it is highly likely that stream temperatures will warm to above the 64^{o}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^{o}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^{o}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^{o}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^{o}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 (1999) 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 (1999) 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 Lower Umpqua River Watershed would have any appreciable impacts on the temperature of the mainstem Umpqua River.

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 to 14 measures pH. On this scale, a pH of 7 is neutral, more than 7 is alkaline, and less than 7 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 are outside of 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 suggest that Scholfield Creek often has pH that ranges between 6.4 and 6.7 (Table 3.13). There is no reason to believe that these values, although often slightly below the ODEQ acceptable range, are impacted by human activities. This is because the kinds of human activities that lower streamwater pH (i.e., mining in areas with geological sources of sulfur and/or air pollution in the form of acid rain) are not prevalent in the watershed.

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 will 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 Lower Umpqua River Watershed. For the rest of the year, the standard is 8.0 mg/L. For estuarine waters, which include most of the mainstem Umpqua River within the watershed and the lower sections of many tributary streams, the standard is 6.5 mg/L. Table 3.13 shows DO sampling results for 2002 through 2004 within the watershed, available from the SWCD. At the sites sampled, DO levels were consistently below water quality standards in the lower section of Scholfield Creek. No streams are 303(d) listed for DO in the Lower Umpqua River Watershed. However, the SWCD data suggest DO might be an important water quality concern in Scholfield Creek. DO data available from EPA include about 250 samples, mostly from the Umpqua River. Median values of DO were generally well above the 6.5 mg/L standard for estuarine waters (Table 3.14). Again, however, the data for Scholfield Creek suggested the possibility of a DO problem, with the one available sample showing DO below the standard of 6.5 mg/L.

Table 3.13. Lower Umpqua River Watershed water quality data. (Source: Umpqua Soil and Water Conservation District)

Stream	Site	Date	PH	Dissolved Oxygen (mg/L)	Turbidity (NTU)
Harvey Creek	High	7/16/2002	6.44	N/A	0.58
	Low	7/16/2002	6.81	7.29	0.46
		10/11/2002	6.75	7.81	0.50
Scholfield Creek	High	7/17/2002	6.77	7.02	0.37
		9/10/2002	6.43	4.74	N/A
		7/16/2003	6.74	6.86	1.28
		8/19/2003	6.68	5.43	0.99
	Low	7/17/2002	6.65	5.18	1.74
		9/27/2002	6.41	3.26	9.45
		7/16/2003	6.54	3.23	3.32
		8/19/2003	6.54	2.45	8.02
		9/25/2003	6.52	1.64	8.27
		7/26/2004	6.42	4.74	3.26
		8/20/2004	6.41	4.08	5.80
		9/15/2004	6.59	6.18	1.79

Table 3.14. Lower Umpqua River 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
Dissolved Oxygen (mg/L)	Franklin Creek at River Mile 1.0	1993	1	10.4	0
	Harvey Creek at River Mile 0.5	1993	1	7.5	0
	Reedsport L.F. Creek near B-4 *	1999	1	13.0	0
	Reedsport Landfill Scholfield Creek, upstream from landfill *	1999	1	10.3	0
	Reedsport Landfill Scholfield Creek, downstream from landfill *	1999	1	10.0	0
	Scholfield Creek in Reedsport off Umpqua River *	2001	1	5.0	100
	Smith River at mouth *	1957-1982	31	8.2	0
	Umpqua River 1 mile upstream of Reedsport *	1957-1982	31	8.4	0
	Umpqua River at Hwy 101 *	1957-1983	31	8.5	0
	Umpqua River at Marker #12 (Double Cove Point) *	1957-1982	29	8.7	0
	Umpqua River at Marker #17 *	1957-1983	29	8.8	0
	Umpqua River at Marker #24 *	1957-1980	26	8.5	0
	Umpqua River at Marker #6 *	1957-1983	34	8.5	6
	Umpqua River at River Mile 23.9, 0.6 nautical miles downstream of Mill Creek	2004	20	7.8	0
	Umpqua River at River Mile 3.9, in Hunt Cove *	2004	4	8.5	0
	Umpqua River at River Mile 5.4, near Barretts Landing *	2001	3	6.7	33
	Umpqua River at River Mile 6, south of The Point *	2001	1	6.6	0
	Umpqua River at River Mile 6.6, north of The Point *	2004	4	7.5	0
	Umpqua River at River Mile 8.5, east shore near sawmill *	2001	3	6.1	67
Nitrate as N (mg/L)	Franklin Creek at River Mile 1.0	1993	1	0.6	NA**
	Harvey Creek at River Mile 0.5	1993	1	0.3	NA
	Reedsport L.F. Creek near B-4	1995-1999	3	3.3	NA
	Scholfield Creek	1999	2	0.0	NA
	Scholfield Creek in Reedsport off Umpqua River	2001	1	0.1	NA
	Umpqua River	1999	7	0.0	NA
	Umpqua River at River Mile 23.9, 0.6 nautical miles downstream of Mill Creek	2004	3	0.0	NA
	Umpqua River at River Mile 3.9, in Hunt Cove	2004	1	0.1	NA
	Umpqua River at River Mile 5.4, near Barretts Landing	2001	3	0.1	NA
	Umpqua River at River Mile 6, south of The Point	2001	1	0.2	NA
	Umpqua River at River Mile 6.6, north of The Point	2004	1	0.0	NA
	Umpqua River at River Mile 8.5, east shore near sawmill	2001	3	0.1	NA

Table 3.14. Continued.

Parameter Name	Station Description	Year	Number of Samples	Median	Percent Exceeding Criterion
Phosphorus (: g/L)	Franklin Creek at River Mile 1.0	1993	1	10.0	NA
	Harvey Creek at River Mile 0.5	2003	1	8.0	NA
Turbidity (NTU)	Franklin Creek at River Mile 1.0	1993-2001	1	1.0	0
	Harvey Creek at River Mile 0.5	1993-2001	5	1.0	0
	Scholfield Creek at River Mile 3 (Umpqua)	2001	3	4.0	0
	Scholfield Creek at Thorton Oar Lane	2001	6	3.0	0
	Scholfield Creek downstream of Dry Creek	2001	4	3.0	0
	Scholfield Creek downstream of Miller Creek	2001	3	1.0	0
	Scholfield Creek in Reedsport off Umpqua River	2001	1	10.4	0
	Scholfield Slough at mouth	1986-2001	16	6.0	0
	Umpqua River 1 mile upstream of Reedsport	1973-1987	16	3.5	0
	Umpqua River at Big Bend (inside)	1986-1987	10	3.0	0
	Umpqua River at Dean Creek Elk Viewing Area	2001	6	17.0	0
	Umpqua River at Gardiner Boat Ramp	2001	6	11.0	0
	Umpqua River at Half Moon Bay	1986-1987	7	3.0	0
	Umpqua River at Hwy 101	1973-2001	20	6.0	0
	Umpqua River at IP Mill Site (Gardiner)	1986-1987	10	4.0	0
	Umpqua River at Jerden Cove	1986-1987	9	2.0	0
	Umpqua River at Leeds Island	1986-1987	8	3.5	0
	Umpqua River at Macey Cove	1986-1987	8	2.0	0
	Umpqua River at Marker #12 (Double Cove Point)	1973-1987	16	2.0	0
	Umpqua River at Marker #17	1973-1983	6	2.0	0
	Umpqua River at Marker #19	1986-1987	11	3.0	0
	Umpqua River at Marker #24	1974-1983	5	2.0	0
	Umpqua River at Marker #6	1973-1987	15	2.0	0
	Umpqua River at Marker #6A	1986-1987	8	2.0	0
	Umpqua River at Marker #8 (entrance to Winchester Bay)	1986-1987	8	2.0	0
	Umpqua River at River Mile 8.5, east shore near sawmill	2001	3	5.7	0
	Umpqua River at Umpqua Wayside State Park	2001	7	17.0	0

* indicates estuarine quality conditions (6.5 mg/L instead of 8.0)
** NA - Not enough samples were gathered to represent conformity to the nutrient criteria with certainty

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, geological phosphorus, 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.[27]

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 Lower Umpqua River Watershed. Therefore, this assessment used the OWEB recommended standards for evaluating nutrient levels in the watershed. OWEB recommends using 0.05 mg/L for total phosphorus, and 0.3 mg/L for total nitrate (including nitrites and nitrates). Table 3.14 shows total nitrate and phosphorus sampling locations and results available from EPA for monitoring sites within the Lower Umpqua River Watershed since 1993. There are not sufficient data available with which to make a determination regarding the nutrient status of streams within the watershed. At the present time, there is no reason to suspect that nutrients limit water quality in the Lower Umpqua River 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 8 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

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

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 Lower Umpqua River Watershed are only required to meet the freshwater standard for contact recreation, the stricter shellfish standard applies throughout the estuary.

The Umpqua River is included on the 303(d) list for bacteria for all seasons from river miles 1.0 to 11.8, in two separate segments in the estuary. Scholfield Creek is also listed from the mouth to river mile five. The Umpqua estuary supports commercial and recreational shellfish harvest and therefore must meet the stricter shellfish standard. Table 3.15 lists the Umpqua Basin streams on the 303(d) list for bacteria. Shellfish harvesting areas, and monitoring of water quality associated with them, are under the jurisdiction of the Oregon Department of Agriculture (ODA).

Table 3.15. Fecal coliform bacteria water quality limited streams in the Lower Umpqua River Watershed.

Record ID	Waterbody Name	River Mile	Season	Beneficial Use
5652	Scholfield Creek	0 to 5	Year Around	Shellfish
5650	Umpqua River	1 to 6.7	Year Around	Shellfish
5649	Umpqua River	7.7 to 11.8	Year Around	Shellfish

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 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 (14 cfu/100 ml) 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 Lower 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 wildlife and livestock waste, failing residential septic systems, and rural residential and urban runoff. Point source pollution, on the other hand, is discharged by individual facilities through a pipe into a waterbody. There are several locations in the Lower Umpqua River Watershed that are known point sources of bacteria contribution to the river. The Reedsport landfill has a National Pollutant Discharge Elimination System

(NPDES)[28] permit to discharge into Scholfield Creek. In addition, there are facilities that treat domestic sewage and discharge effluent to the Umpqua River. The Reedsport wastewater treatment plant has been operating beyond its designed capacity and occasionally releasing partially treated or diluted sewage into the Umpqua River. It is currently being renovated and will not only meet current needs and requirements, but also have the capability to provide services for potential future growth. ODEQ determined that most of these facilities do not cause or contribute to violations of the bacteria water quality standard.

3.3.9. Sedimentation and Turbidity

Information for this section was taken from a variety of sources, including Oregon Department of Forestry (ODF) 2000, Skaugset et al. 2002, Chesney 1982, Spies et al. 2002, Reeves et al. 1995, Istanbulluoglu et al. 2004, WPN 1999, Naiman and Bilby 1998, Robison et al. 1999, and Biosystems 2003.

3.3.9.1. Overview of Sedimentation and Turbidity

Natural resource scientists refer to sediment as any organic or inorganic material that enters a stream and settles to the bottom. 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. Both issues are addressed in this section, but the emphasis is on the role of fine sediments in the streamwater.

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, thrive in streams having large amounts of fine sediment.

Turbidity is a measurement of water clarity, which provides an indication of the amount of fine sediment suspended in the water. 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

[28] The National Pollutant Discharge Elimination System is the name of the Clean Water Act permit program which applies to wastewater treatment plants and other facilities which discharge directly to state waters. It also applies to certain stormwater permits.

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 Lower Umpqua River Watershed that are 303(d) listed for sedimentation. Available data are limited but generally do not suggest that sedimentation is a problem in the watershed**.**

Turbidity is measured by passing a light beam through a water sample. As suspended sediment increases, less light penetrates the water. Turbidity is recorded in NTUs (nephelometric turbidity units), and high NTU values reflect high turbidity. According to 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 Lower Umpqua River Watershed that are 303(d) listed for turbidity.

The Oregon water quality standard for turbidity does not specify a numerical value. OWEB recommends using 50 NTUs as the turbidity evaluation criteria for watershed assessments. At this level, turbidity may interfere with sight-feeding aquatic organisms. None of 218 Lower Umpqua River Watershed turbidity samples exceeded 50 NTUs (Table 3.14). Median values at most sampling sites were less than about 20% of the evaluation criterion value. There is no reason to suspect that turbidity is an important water quality concern in the mainstem river. Additional monitoring is necessary to determine if turbidity levels are of concern in tributaries.

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 Lower 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

---

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

include streambank erosion and erosion associated with agricultural practices and/or urban development.

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 dissolved oxygen levels, and increased siltation of spawning gravels.

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 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.

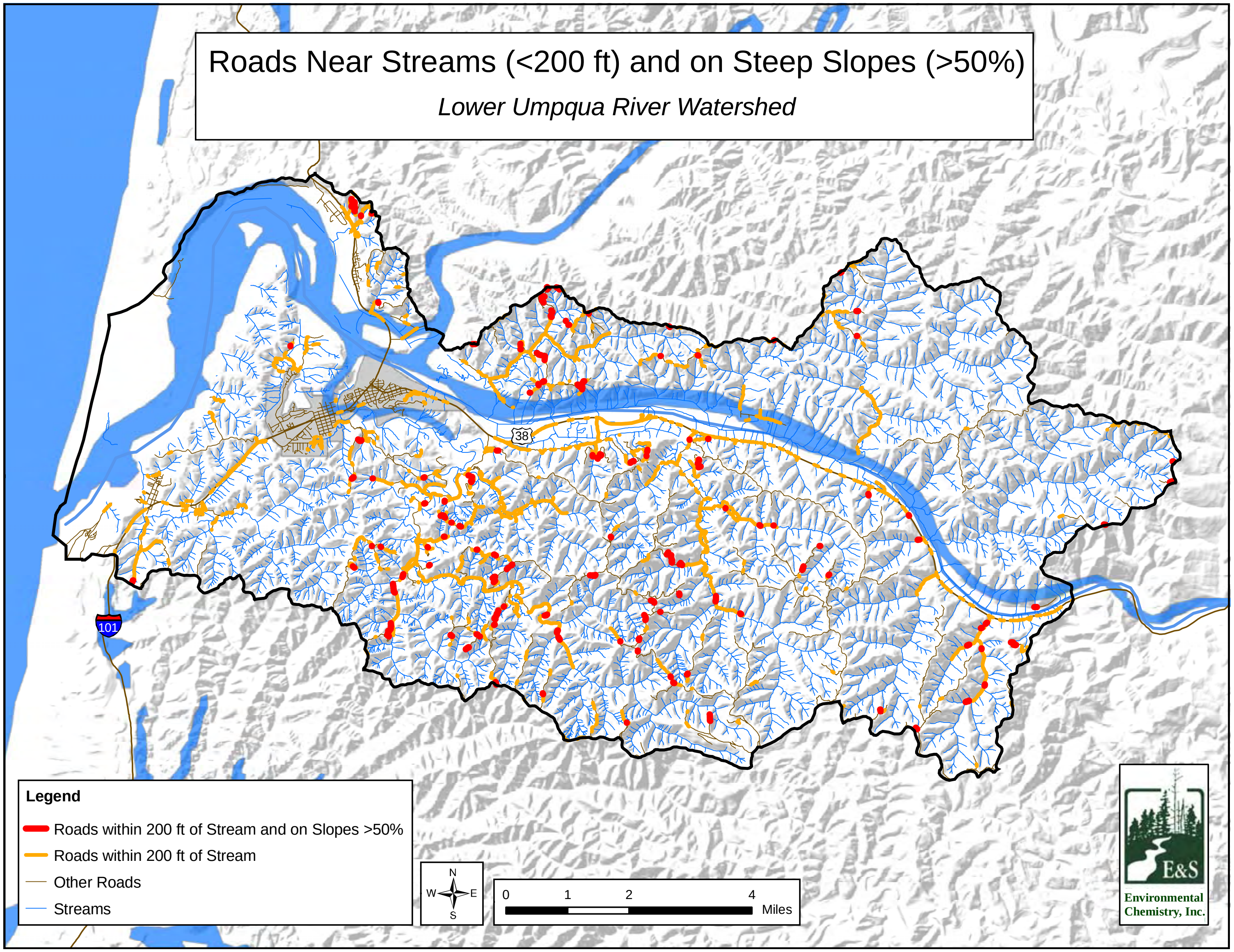
The closer a road is to a stream, the greater the likelihood that road-related runoff contributes to sedimentation. In the Lower Umpqua River Watershed, there are 72 miles of roads (31% of 234 total miles) within 200 feet of streams (see Map 3.13). Data from the ODF road inventory conducted in 1997 through 1998 within portions of Elliott State Forest that lie within the Lower Umpqua River Watershed suggested a density of past landslides along roads of 1.5 landslides per square mile. No impending landslide sites were identified during the Elliott State Forest Assessment.

Roads on steep slopes have a greater potential for erosion and/or failure than roads on level ground. There are only approximately 4 miles of roads (2% of 234 total miles) located on a 50% or greater slope and within 200 feet of a stream within the Lower Umpqua River Watershed (see Map 3.13). An analysis of road conditions near streams is necessary to determine how much stream sedimentation is potentially attributable to road conditions. Information on road surface types and conditions is lacking from most areas of the Lower Umpqua River Watershed. Data are available for the 78 miles of road that lie within Elliott State Forest. Of those road miles, 25% are dirt and 75% are gravel. Nearly two-thirds (65%) are located on ridges where erosion risk is minimal, 30% in mid-slope position, and 4% in riparian areas or valley bottoms (Biosystems 2003).

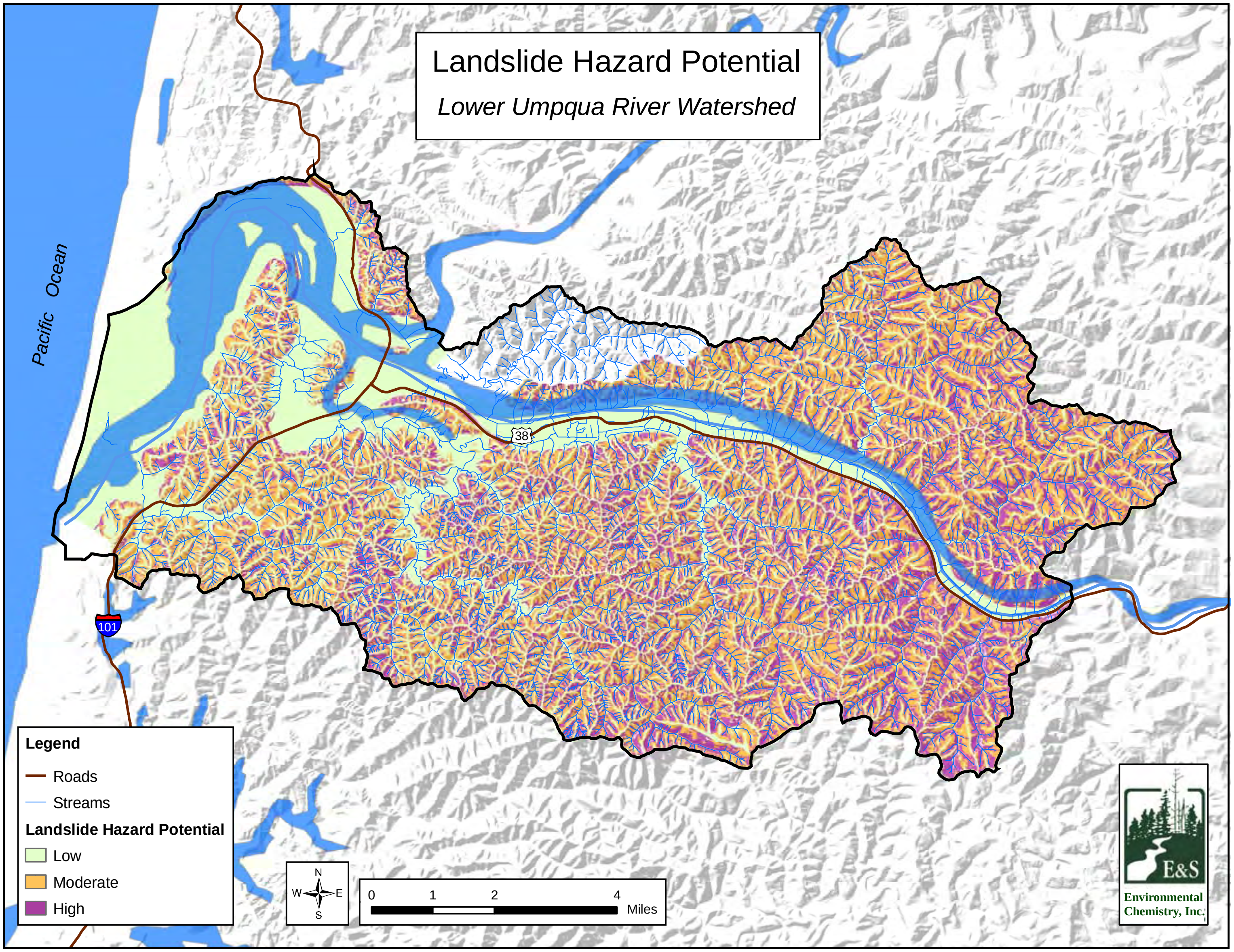
Like roads, culverts can contribute to stream sedimentation when they are failing. Culverts often fail when the pipe is too narrow to accommodate high streamflows, or when the pipe is placed too high or too low in relation to the stream surface. In the latter cases, the amount of flow overwhelms the 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 is currently evaluating culverts throughout the Umpqua Basin, but results were unavailable at the time of writing. See Section 3.1.3.3 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. The eastern portion of the watershed generally has steeper slopes. Slope steepness will clearly 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. 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 Lower 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



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



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

landslides per square mile), and low landslide potential less than 0.1 landslides per square kilometer (0.26 landslides per square mile). Twenty-four percent of the land area within the Lower Umpqua River Watershed was classified as having high debris flow hazard.

In cities and towns, sediment enters streams from storm water systems. Urban development results in high amounts of impervious surfaces concentrated in a small area.[30] As a result, less rainfall is absorbed by the soil, leading to heightened peak streamflows and shortened lag times from rainfall to peak streamflow following rain events. To prevent flooding, cities have extensive storm water systems that convey runoff from streets and other paved areas to nearby rivers and streams.

Different types of land within an urban setting produce different amounts of sediment in runoff. Residential neighborhoods produce the least amount of sediment per unit area, commercial areas produce moderate loads of sediment, and heavy industrial areas produce the highest amounts. The highest amounts occur in areas that are under construction. Earth disturbances and bare surfaces often cause substantial sediment production, but the sediment production usually decreases after the construction is complete. Sediment production, especially of fine sediments, can be high in some urban and suburban areas. However, there is little urban land use (about 2%) within the watershed. Therefore, the overall influence of urban development on sediment dynamics within the watershed is expected to be minor.

Burned areas erode more easily than unburned areas because of the temporary lack of vegetative cover, loss of soil cohesion provided by roots, and abundance of fine material, such as ash. It is well known that large fires and subsequent debris flows can result in the accumulation of very large quantities of sediment in the stream, and the effects can persist for decades. There are no data suggesting that fires have contributed excessive amounts of sediment to streams in the watershed in recent years.

3.3.9.4. Role of Soils in Sedimentation Processes[31]

Certain characteristics of soils within the watershed play important roles in erosion and storm runoff, both of which impact the streams. 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 indicate areas prone to erosion that may negatively impact stream characteristics. Information in this section has been summarized from the following documents: *Oregon Watershed Assessment Manual* (WPN 1999), *South Umpqua River Watershed Assessment and Action Plan* (Geyer 2003), *Soil Resource Inventory* (Umpqua National Forest 1976), and *Technical Release 55* (USDA 1986).

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 (USDA Agriculture Research Service National

---

[30] Impervious surfaces are ones that do not permit water infiltration, such as roads, roofs, and compacted soil.
[31] Kristin Anderson and John Runyon of BioSystems, Inc. contributed some of the material for this section.

Sedimentation Laboratory 2003). K-factor values typically range from 0 to 0.6 (Pacific Northwest National Laboratory 2003). K-factor values for soils are determined in the NRCS soil survey process.

Map 3.15 depicts the K-Factor within the Lower Umpqua River Watershed. A large portion of the watershed has moderate erosion potential, with the most erosive areas located in and around Elliot State Forest (Map 3.15). The least erosive areas are generally located in the eastern portions of the watershed (Map 3.15). Nearly half of the watershed has been assigned a K-Factor of 0, whereas only about 6% of the watershed has been assigned a K-factor greater than 0.3 (Table 3.16).

Table 3.16. Soil erodibility in the Lower Umpqua River Watershed.

K-Factor	Area (acres)	Percent*
0.00	52,796	48.7
0.10	10,308	9.5
0.15	6,673	6.2
0.17	506	0.5
0.20	7,210	6.6
0.24	28	<0.1
0.28	24,006	22.1
0.32	1,634	1.5
0.37	4,392	4.0
0.43	418	0.4
0.49	519	0.5

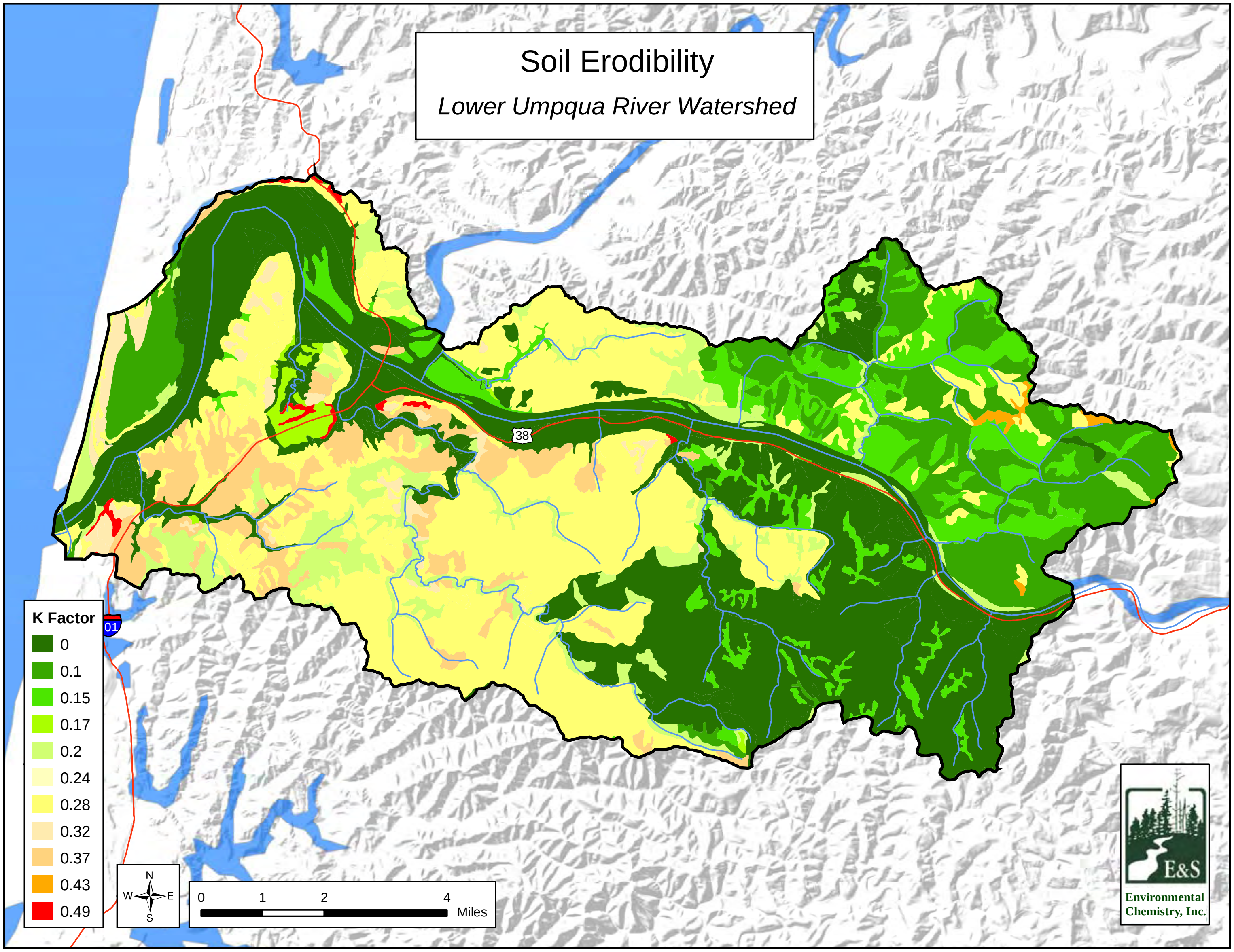
*Percents may not equal 100 due to rounding.

Hydrologic soil groupings (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 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.

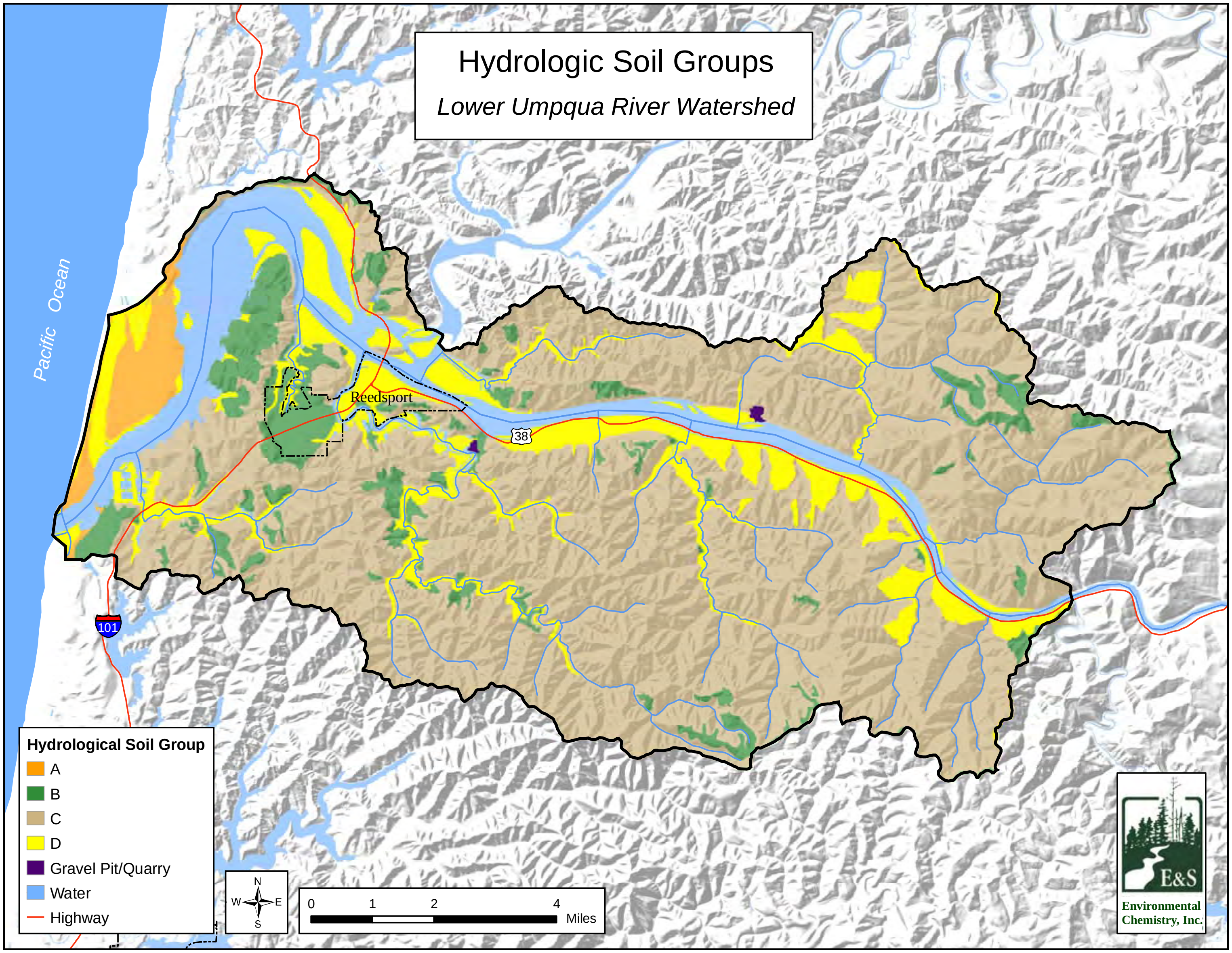
Table 3.17 provides descriptions of the hydrologic soil groups. Map 3.16 and Table 3.18 show the distribution of hydrologic soils in the Lower Umpqua River Watershed. The majority of the Lower Umpqua River Watershed has soils in the C hydrologic soils group (see Map 3.16), which has moderate infiltration rates. Soils with lower infiltration rates and higher runoff potential are found along the south bank of the mainstem river and most of the tributary streams. These areas may be more prone to delivering sediment and faster runoff than other areas.

Table 3.17. 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 3.15. Soil erosion potential and K-factor for the Lower Umpqua River Watershed.



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

Table 3.18. Summary of hydrologic soil group statistics for the Lower Umpqua River Watershed.		
Hydrologic Soil Group (HSG)	**Amount in Watershed**	
	Square Miles	**Percent**
A	2.3	2.4
B	8.2	8.5
C	72.9	75.6
D	12.9	13.4
Gravel Pit/Quarry	0.1	0.1
Grand Total	96.4	100.0

3.3.10. Water Quality Key Findings and Action Recommendations

3.3.10.1. Temperature Key Findings

- The mainstem of the Umpqua River and the lower reaches of Scholfield Creek were 303(d) listed for temperature.
- Temperatures in Franklin and Wind creeks did not exceed the 64^{o}F temperature standard furing the UBWC temperature study.
- Tributary streams tend to be about 10^{o}F cooler than the mainstem river.

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

- Bacteria concentrations within the Lower Umpqua River Watershed exceed water quality standards. ODEQ has conducted a TMDL analysis to assist in the process of reducing bacterial contamination of stream and estuarine waters within the watershed.
- High bacteria concentrations in the mainstem Umpqua River, the estuary, and Scholfield Creek are due mainly to diffuse nonpoint sources of pollution, such as livestock, wildlife, and residential septic systems.
- The levels of pH, nutrients, and DO can be interrelated. In the Lower Umpqua River, it is unlikely that nutrient and DO levels limit water quality in most locations. However, DO levels have been found to be low in Scholfield Creek.
- We found no data regarding toxics in this watershed. However, activities associated with the use of toxics are uncommon in the watershed, so it is unlikely that toxics are an issue in this watershed.

3.3.10.3. Sedimentation and Turbidity Key Findings

- Turbidity data indicate that usual turbidity levels in the Lower Umpqua River Watershed should not affect sight-feeding fish like salmonids.
- Areas of moderate soil erodibility and runoff potential occur along several tributary streams in the western portions of the Lower Umpqua River Watershed.
- Steep to moderately steep slopes are found throughout 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, agriculture, and residential development 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 Lower Umpqua River Watershed for water quality conditions. 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 Lower Umpqua River Watershed’s bacteria levels:
    - Limit livestock access to streams 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.
- Evaluate DO conditions in Scholfield Creek to determine if there is a chronic DO problem.

3.4. Water Quantity

This section analyzes hydrology and water use and availability in the Lower Umpqua River Watershed. Background information for this section was compiled from the following sources: 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 Lower 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.

The Lower 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 soils in higher, well-drained areas. Existing flood control features used to protect floodplain land uses have simplified natural streamflow processes in some places and reduced the complexity of in-stream habitats that support fish and aquatic organisms. 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[32] capacity, increased peak flows, downcutting of channels, and increased flow velocities in the lower watershed.

[32] 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 Lower 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 Lower 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

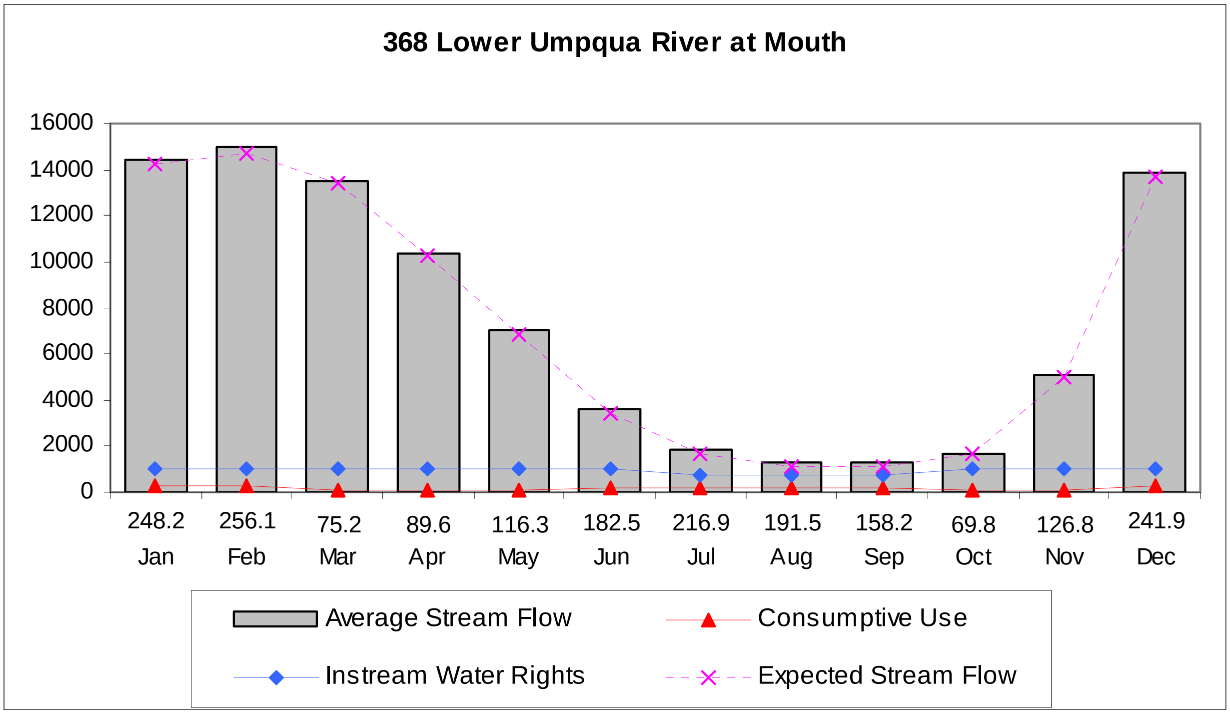
Data from the OWRD have been used to determine water availability in the Lower Umpqua River Watershed. Availability is based on streamflow, consumptive use, and in-stream water rights. The amount of water available for issuance of new water rights is determined by subtracting consumptive use and the in-stream water rights from streamflow. In most of the Umpqua Basin, there is no water available for new water rights from "natural" streamflow during the summer.[33]

To analyze water availability, OWRD has divided the Umpqua Basin into water availability basins, or WABs. The Lower Umpqua River Watershed consists of three WABs: Dean Creek (#305), Scholfield Creek (#355), and the Lower Umpqua River at mouth (#368). Figure 3.3 shows surface water availability for each of them.

The shaded bars on Figure 3.3 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 this WAB, in-stream water rights are consistently below average streamflow during all months, indicating that the available water is not over-allocated based on average flow conditions. Expected streamflow is close to average streamflow all year.

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

[33] 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.



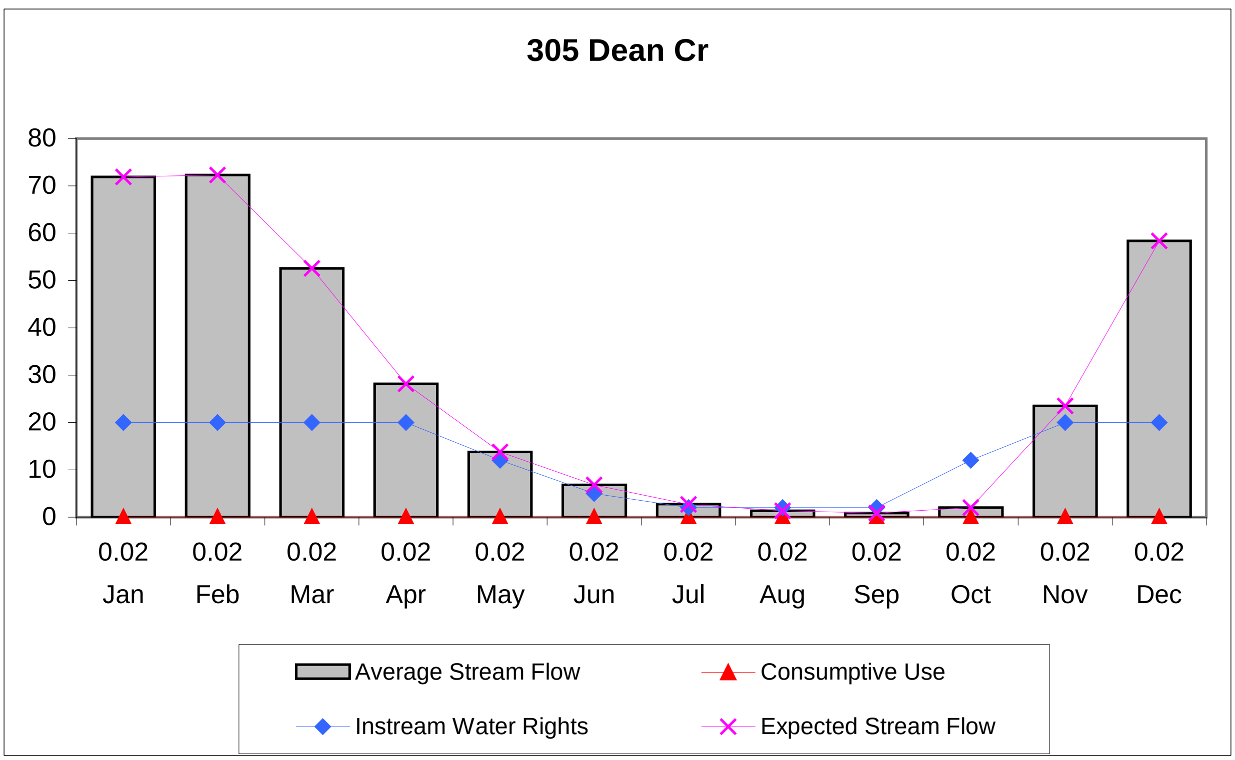


Figure 3.3. Water availability in the Lower Umpqua River WABs.

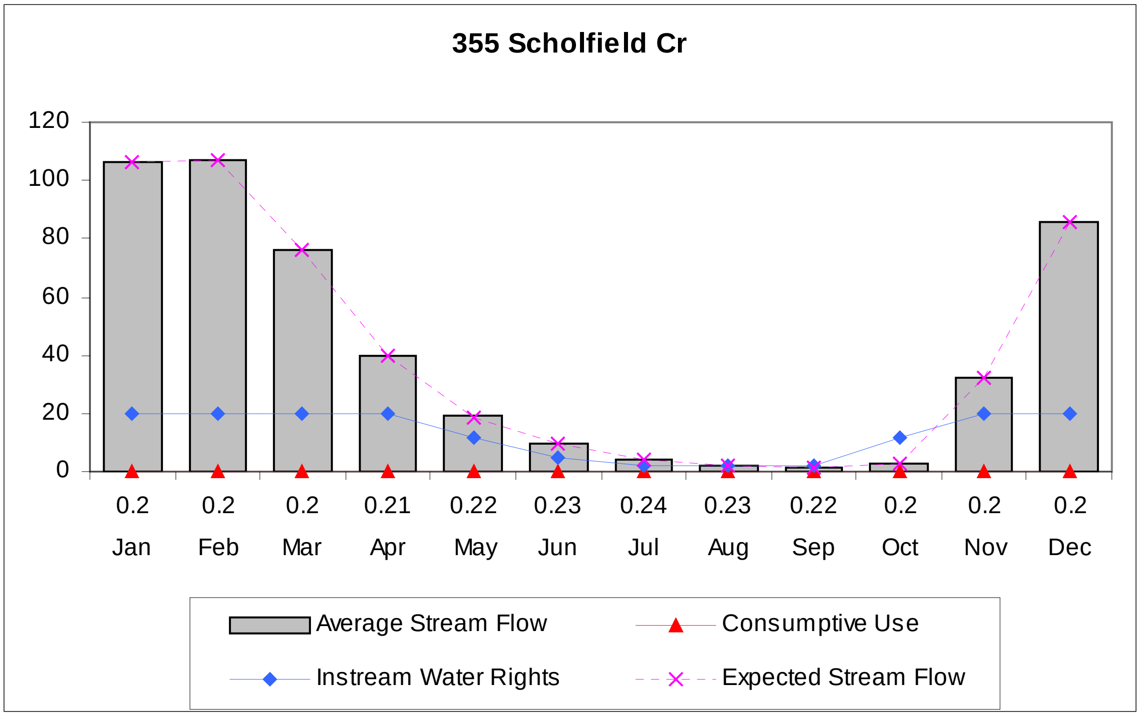


Figure 3.3. Continued.

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 3.4 shows consumptive use by category for the Lower Umpqua River Watershed. Included in the figure are all uncanceled water rights. Therefore these data do not indicate exact water consumption.[34]

Domestic water use is the largest (42.8% of total) use of water for the watershed, followed by commercial (19.6%) and irrigation (18.6%) use. There are no rights secured for recreation, fish, or wildlife uses in the Lower Umpqua River Watershed.

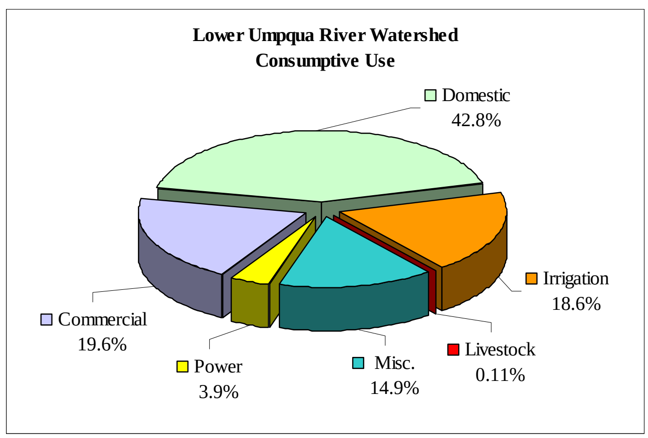


Figure 3.4. Lower Umpqua River Watershed consumptive use.

[34] 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 5 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.

3.4.4. Streamflow and Flood Potential

A county gaging station was installed in the Umpqua River at Reedsport in 1998. Because of the short period of record available from this station (with no substantial high-flow events) and the tidal influence on stream height at Reedsport, data from the Reedsport gaging station are not presented here. Rather, mainstem Umpqua River discharge is evaluated using data from the USGS gaging station at Elkton, which is about 20 miles upstream from the upper reaches of the Lower Umpqua River Watershed.

Figure 3.5 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 3.6**.** 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 seasonal flow patterns in the vicinity of the Lower 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 zero 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%,

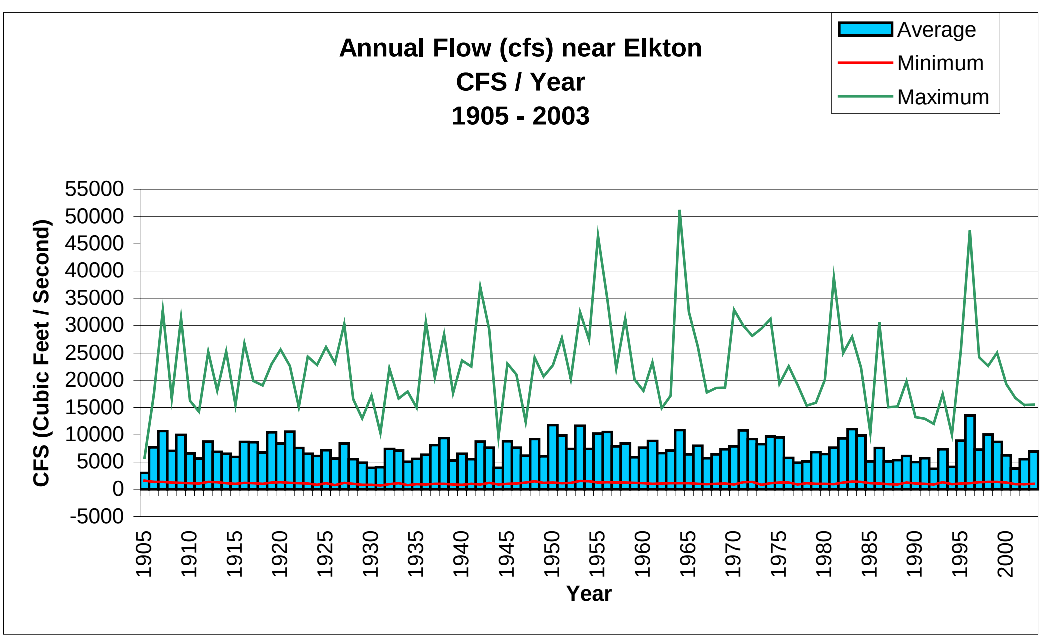


Figure 3.5. Annual flow of the Umpqua River at Elton between 1905 and 2003, depicted as average, minimum, and maximum monthly flow values.

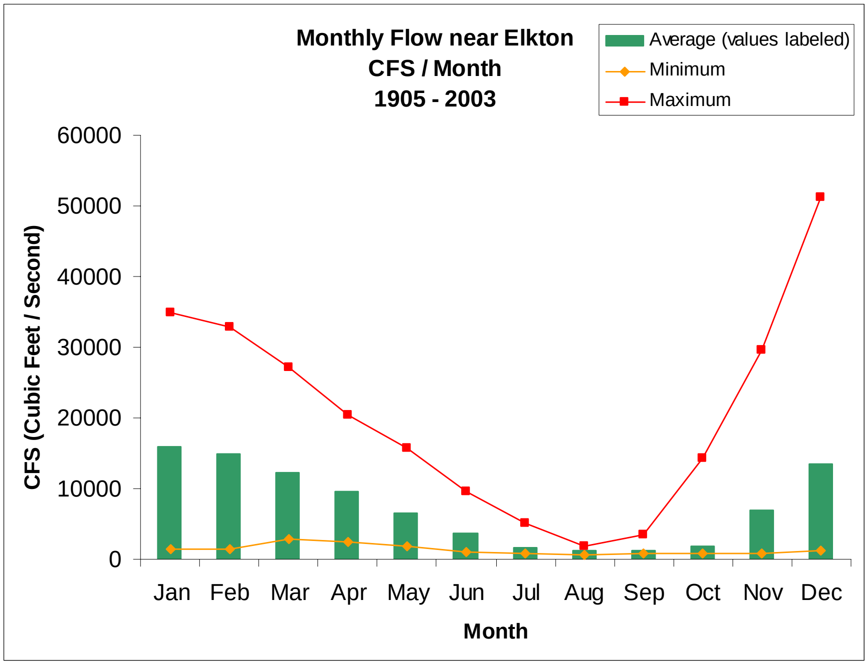


Figure 3.6. Distribution of monthly streamflow values for the Umpqua River at Elkton across the year.

respectively, of the annual runoff occurring in the months of December, January, and February (Figure 3.7). May through September contribute 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.

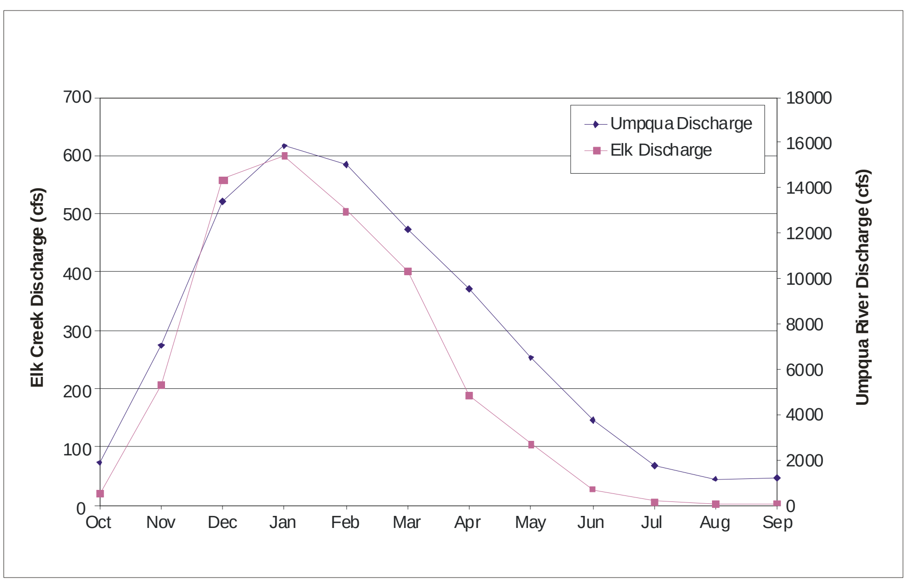


Figure 3.7. Mean monthly streamflow of Elk Creek near Drain, OR and Umpqua River near Elkton, OR. (Source: BLM 2004)

3.4.5. Minimum Flow

Because rain is infrequent in the summer, streamflows become low in late summer along the Umpqua River and tributary streams inside the Lower 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 3.19 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 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.

Table 3.19. 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.

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 maximum winter rainfall. Frequent peak flows (those flows that occur several times each winter, but are less than the annual maximum 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 3.20 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 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.

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

Table 3.20. 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.

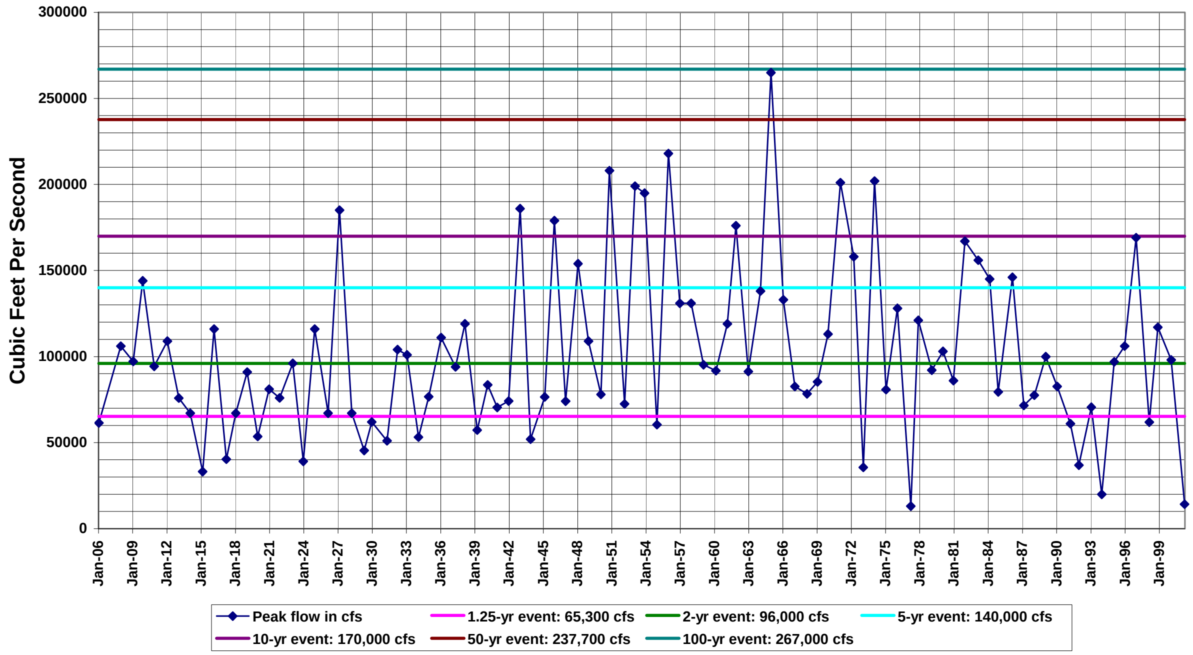


Figure 3.8. Peak discharge of the Umpqua River at Elkton for water years 1906 through 2001. (Source: BLM 2004)[35]

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 3.21.

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.

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.

[35] 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.

Table 3.21. Major historical (through 1964) rainstorms affecting the Oregon Coast that likely resulted in high rainfall and possible flooding in the Lower 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.

3.4.7. Water Quantity Key Findings and Action Recommendations

3.4.7.1. Water Availability and Water Rights by Use Key Findings

- In all three Lower Umpqua River Watershed WABs, in-stream water rights are less than average streamflow during all months of the year.
- During the summer, there is minimal "natural" streamflow available for new water rights, although water near the river mouth may be too saline for human uses.
- Domestic use is the largest use of water in the watershed. Commercial and irrigation are the second and third largest water uses in the watershed, respectively.

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 Lower Umpqua River Watershed is unknown at this time, but is not expected to be substantial.

3.4.7.3. Water Quantity Action Recommendations

- In general, water use is not a significant issue of concern in this watershed.

3.5. Fish

This section examines the presence, distribution, and abundance of fish species in the Lower Umpqua River Watershed. Background information for this section 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 (NOAA) Fisheries Service, the US Fish and Wildlife Service (USFWS), and the Bureau of Land Management (BLM).

3.5.1. Fish Presence

The Lower Umpqua River Watershed is home to many fish species. Table 3.22 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 Lower Umpqua River system.

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 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.[36] The USFWS and NOAA Fisheries Service 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 ESA listing of Oregon Coast steelhead trout is warranted. In January, 2003, various groups petitioned to protect the Pacific lamprey

[36] 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 3.22. Fish with established populations or runs within the Lower 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*

(*Lampetra tridentata*) and western 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 listing was determined to be unwarranted in 1993. Currently, there are no other ESA-listed threatened or endangered aquatic species in the Lower 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 Lower 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 along the Oregon Coast has declined significantly over the past 150 years. This decline is attributed to many factors, including degradation of habitat quality and availability, ocean conditions, impacts associated with 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.[37]

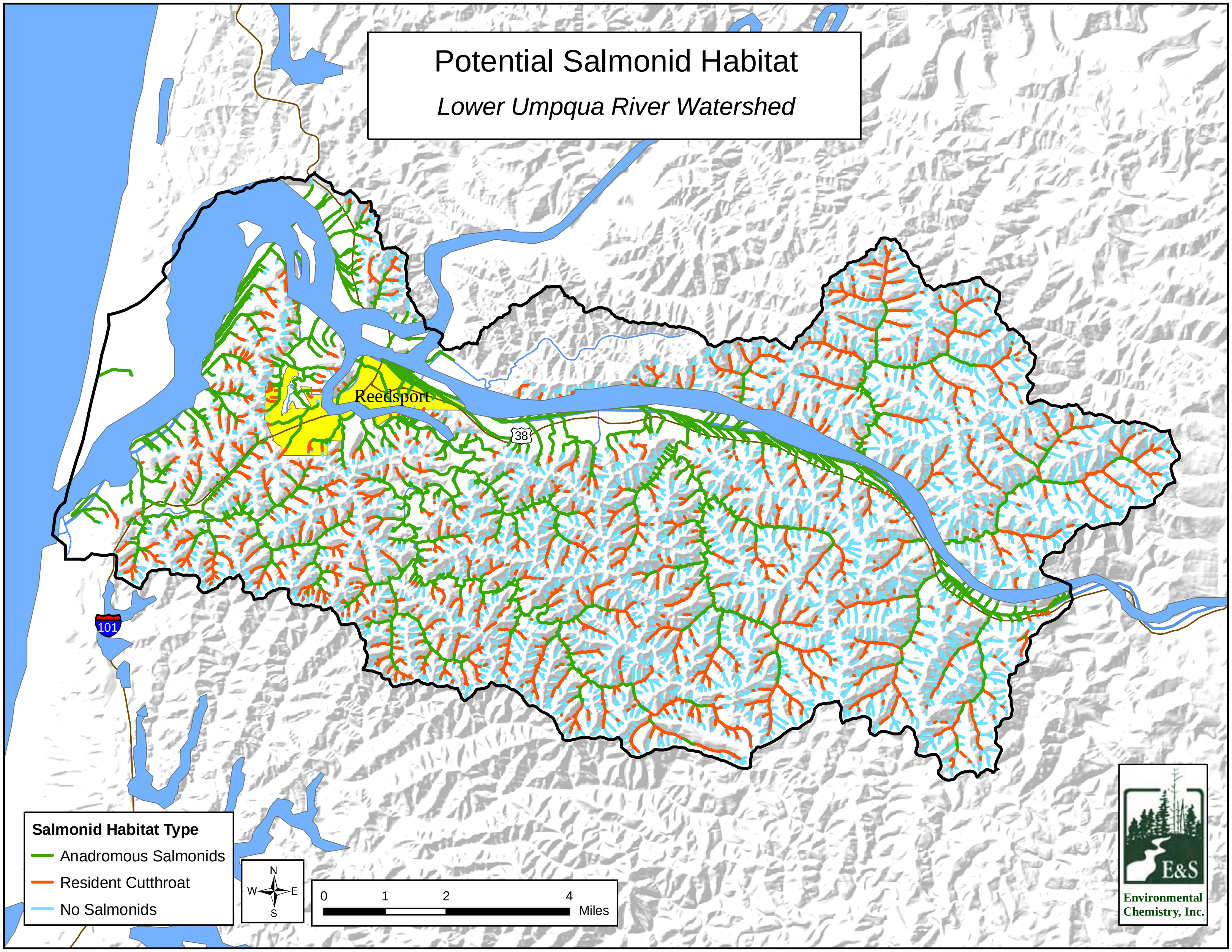
ODFW has developed anadromous salmonid distribution maps based on fish observations, assumed fish presence, and habitat conditions. Fish observations are the most accurate because agency biologists have recorded fish presence in the stream. With “assumed fish presence,” stream reaches are included in 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

---

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



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

anadromous salmonids and resident cutthroat trout within the watershed. There are about 241 stream miles of potential anadromous salmonid habitat within the Lower Umpqua River Watershed. Winter steelhead and coho use about 39% and 35%, respectively, of the potential available habitat.[38] Summer steelhead, spring chinook, and fall chinook each use 11% or less (Table 3.23). The total of all stream miles with anadromous salmonids given in Table 3.21 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 3.23. Miles of stream potentially supporting anadromous salmonids in the Lower Umpqua River Watershed, based on mapping at a scale of 1:100,000 by ODFW.

Species	Fish Utilization (miles)	Potential Habitat Utilized (percent)
Coho	83	35
Fall Chinook	26	11
Spring Chinook	23	9
Summer Steelhead	23	9
Winter Steelhead	93	39

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 anadromous cutthroat.

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

Less is known about the present status of sea-run cutthroat trout than the other anadromous salmonid species in the Lower 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 about 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

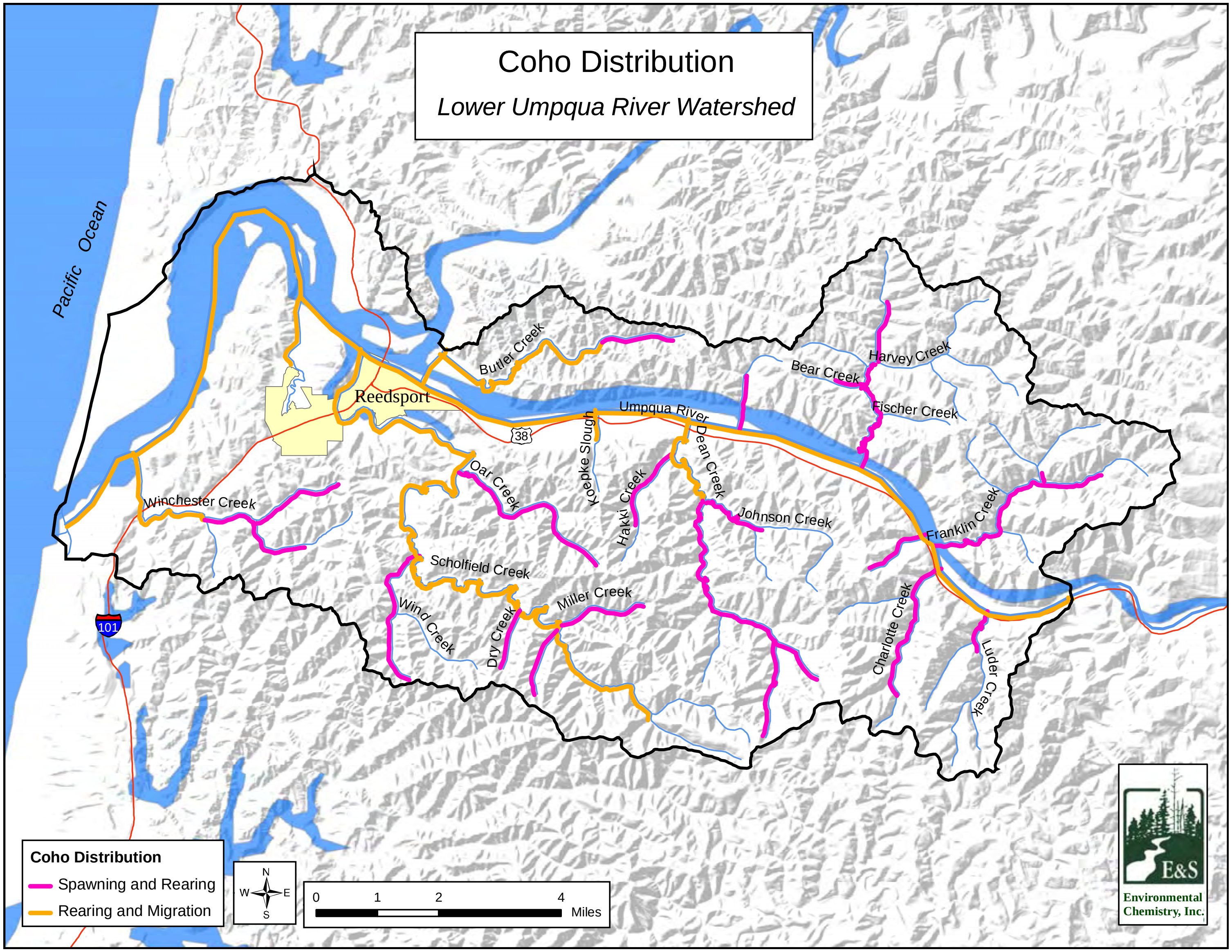
Coho distribution within the watershed is shown in Map 3.18. Many of the tributary streams within the watershed provide spawning habitat for coho. The mainstem Umpqua River, the lower portions of Winchester, Butler, Dean, and Luder creeks, and most of Scholfield Creek also provide important coho rearing and migration habitat. ODFW conducts coho spawning surveys throughout the Umpqua Basin.[39] 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 3.9). 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.

Estimates of the coho population specific to the Lower Umpqua River Watershed are not available. However, counts of live fish (spawners) were conducted from 1990 through 2000. Available data from ODFW are shown in Table 3.24 for Dean Creek; two tributaries to Scholfield Creek; aggregated data for the Smith River, Dean Creek, and Scholfield Creek; and the Umpqua River sub-basin. Dean Creek, Scholfield Creek, and the Smith River are important components of the overall coho habitat, accounting for roughly four times as many coho spawners as the mainstem Umpqua River (Table 3.24).

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 3.25, including estimates of total and wild coho and 95% confidence intervals associated with those estimates.[40] It is important to note that the Umpqua River system accounted for more

[39] Coho spawning survey data can be requested from the ODFW Corvallis Research Laboratory.
[40] 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 3.25).



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

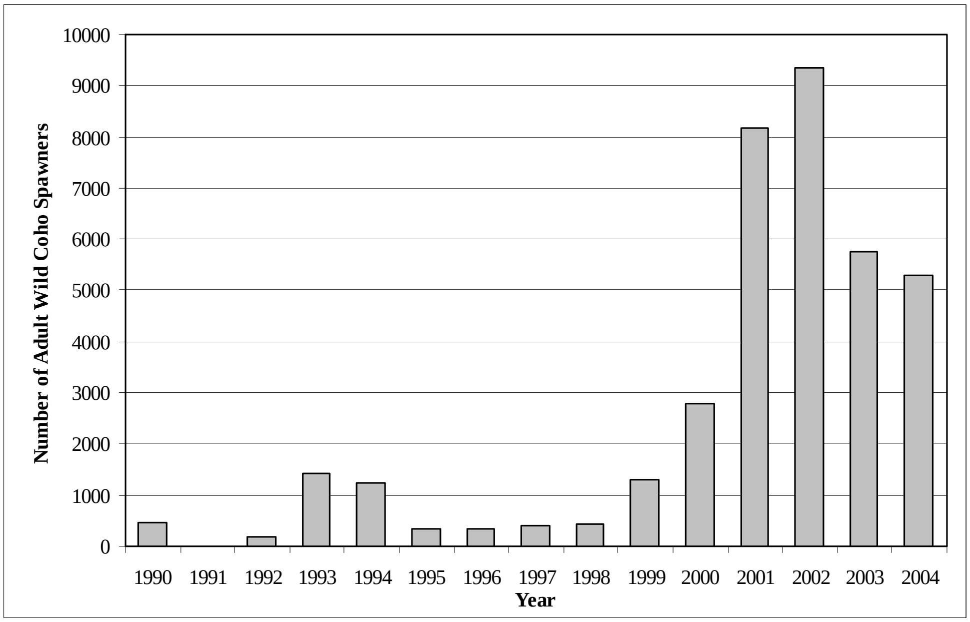


Figure 3.9. Estimates of annual adult wild coho spawner abundance in the mainstem Umpqua River for the period 1990 through 2004. No coho were observed in 1991. Estimates were prepared by ODFW, based on results from randomly-selected spawning surveys.

Table 3.24. Coho spawning counts (live fish) within and near the Lower Umpqua River Watershed. (Source: ODFW)

Year	Dean Creek	Dry Creek, Tributary to Scholfield Creek	Oar Creek, Tributary to Scholfield Creek	Umpqua River Excluding Major Tributaries	Smith River, Dean Creek, Scholfield Creek & Tributaries
1990				455	589
1991				0	1,316
1992				192	1,759
1993				1,431	4,804
1994				1,240	1,689
1995				352	6,803
1996				339	4,904
1997	1		86	397	935
1998	2	8	5	444	5,118
1999		3	3	1,289	2,323
2000				2,774	3,706
Total	3	11	94	8,913	33,946

Table 3.25. Estimated coho spawner abundance during the 2004 spawning season, based on statistical protocols of EPA's Environmental Monitoring and Assessment Program (EMAP).

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

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.

Peak count data are less precise than estimates of spawner abundance, but do provide some valuable information regarding long-term changes. Peak count data reflect the maximum number of live and dead coho seen per mile by an observer. Such data are available for Dean Creek back to 1981 and for Scholfield Creek back to 1950 (Figure 3.10). Peak counts in Dean Creek were higher in 2001 and 2002 than in any previous years over the past two decades. However, the longer data record for Scholfield Creek suggests that coho abundance may have been several times higher in the 1960s as compared with more recent years.

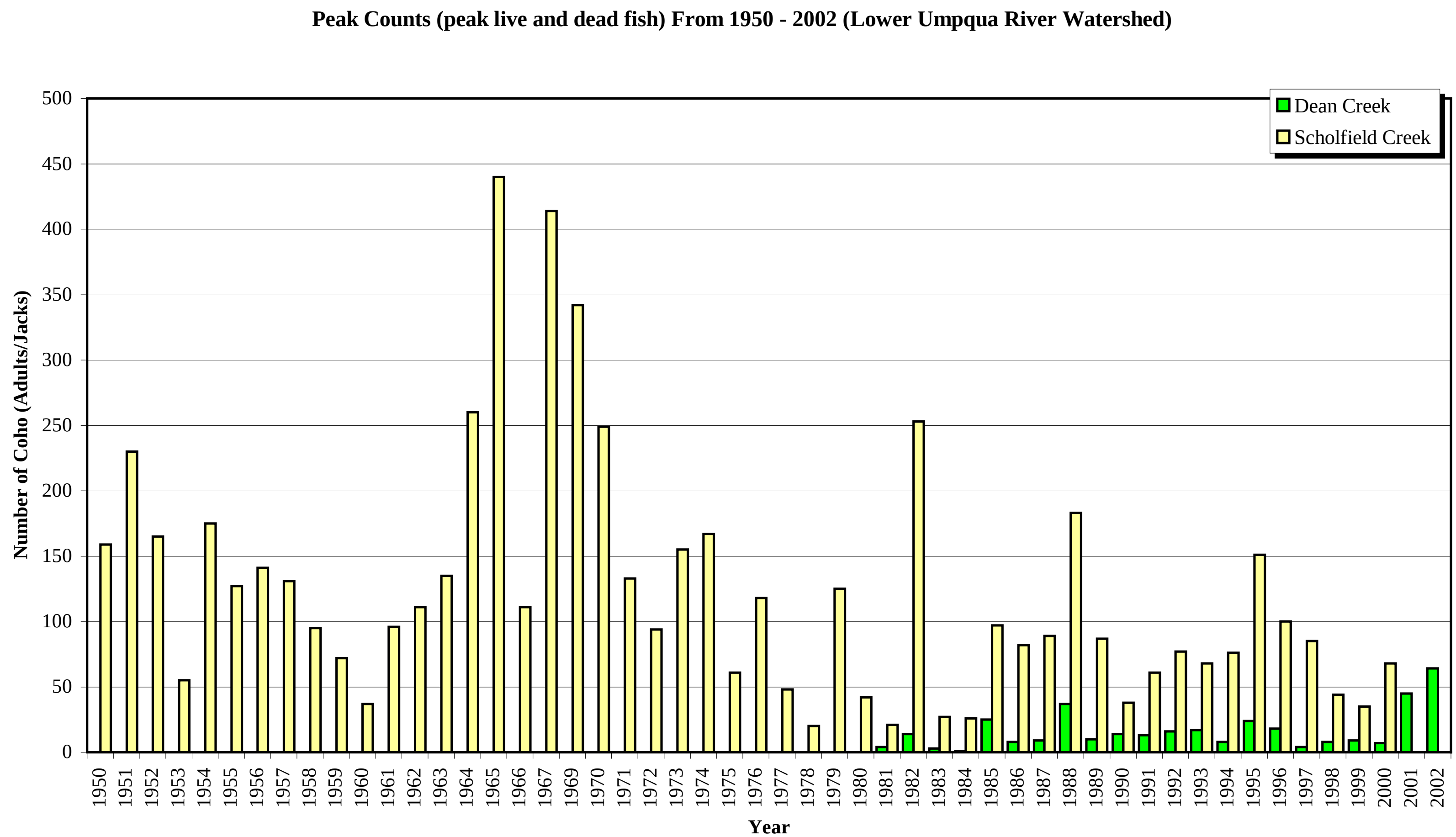
Recently, the Oregon Watershed Enhancement Board (OWEB) and ODFW synthesized available information on the status of coho relative to viability criteria and conservation efforts to address factors responsible for decline in Oregon coho populations. ODFW (2005) concluded that the most important limiting 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 Lower Umpqua River Watershed, the only known spawning and rearing habitat for chinook salmon is found along the lower reaches of Franklin Creek, where fall chinook are known to spawn. Rearing and migration habitat for both fall and spring chinook occurs along the length of the mainstem Umpqua River across the watershed (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 cataracts. 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 bay, based on angler catch cards and limited creel surveys. The annual catch has been relatively stable since 1991, at 1,000 to 3,000 fish per year (Figure 3.11).

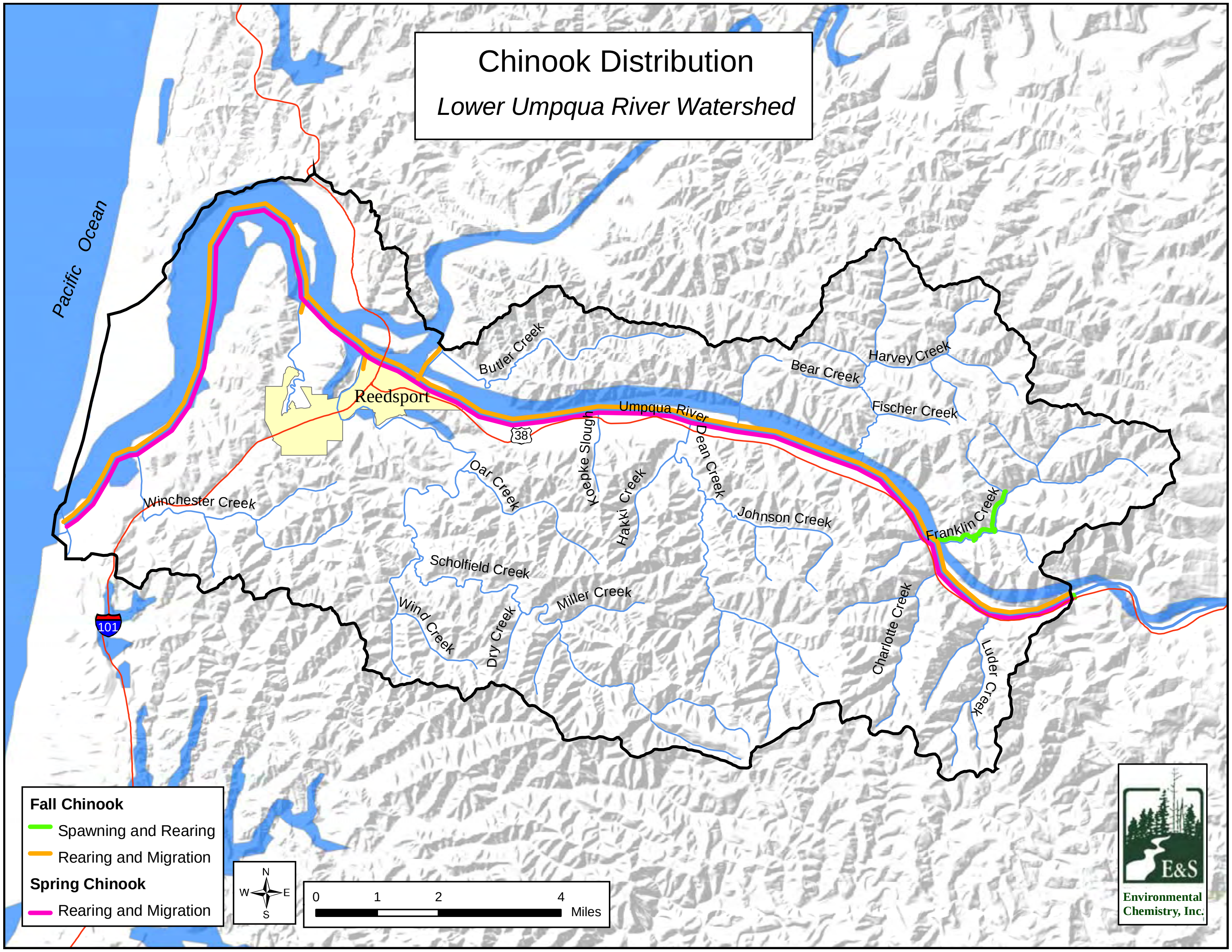
3.5.3.4. Steelhead Trout

Steelhead trout include a resident phenotype (rainbow trout) and an anadromous phenotype (steelhead). Steelhead express a further array of life histories, including various fresh water 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 residency may last one to three years. Adult steelhead may enter fresh water on



This report category (Adult Return-Peak/Other Spawning Counts) contains primarily peak spawning ground counts. These counts usually represent the highest daily count of live fish in the given spawning area. Also included in this category are carcass counts, fish-days (the total number of fish days over an entire spawning season where a fish-day equals one fish present for one day), and fish per mile counts, which are simply peak counts divided by the miles surveyed in the index area.

Figure 3.10. Peak spawning ground counts of live and dead coho in Dean and Scholfield creeks. (Source: ODFW)



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

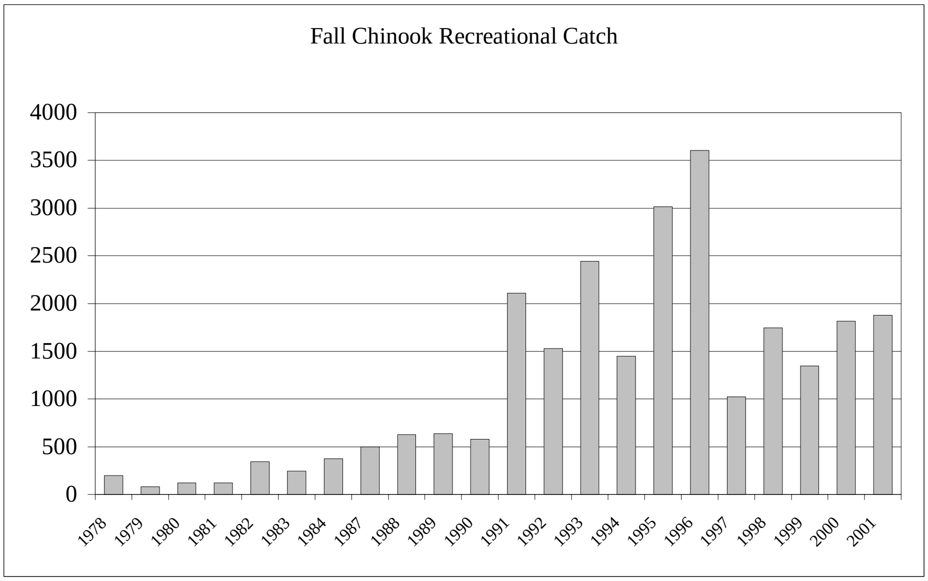


Figure 3.11. Estimated recreational catch of fall chinook salmon in the Umpqua River and Winchester Bay. Data were not collected in 1985 and 1986. (Source: Moyers et al. 2003)

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 Lower Umpqua River Watershed, but migrate along the length of the mainstem Umpqua River to spawning areas further upstream. Winter steelhead are widely distributed throughout the Lower Umpqua River Watershed. Winter steelhead generally enter streams from November through March and spawn soon after entering fresh water. 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 the main tributary streams within the watershed are used for winter steelhead spawning (Map 3.20). The Umpqua River sub-basin is used as a winter steelhead migration corridor.

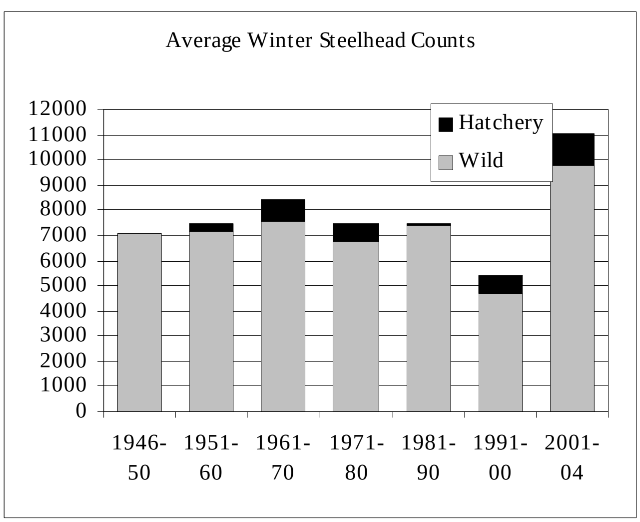
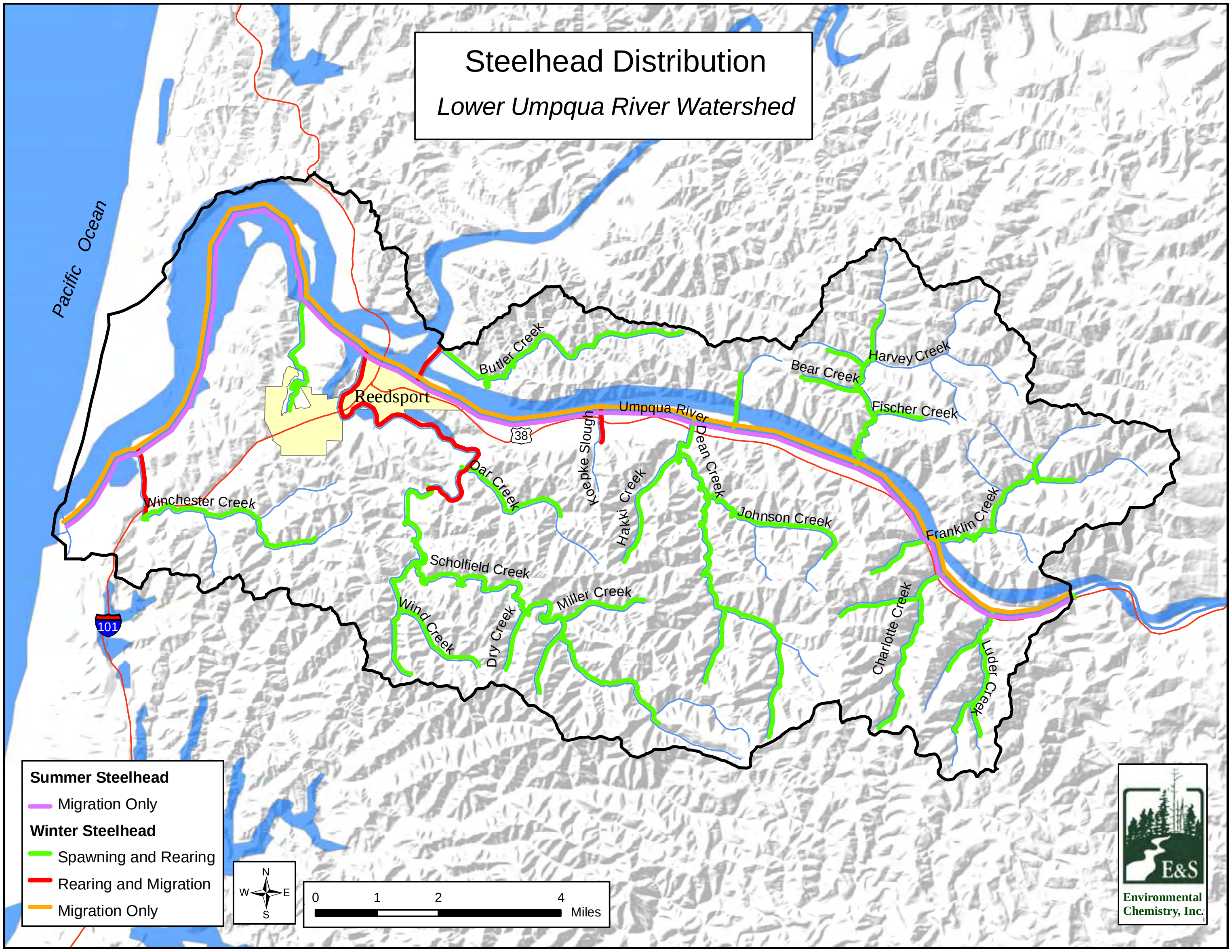


Figure 3.12. Average winter steelhead counts at Winchester Dam Fishway on the North Umpqua River. (Source: ODFW 2005)

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 (Hart and Reynolds 2002).

ODFW has maintained a long-term fish counting station at Winchester Dam since 1946 (Figure 3.12). Winchester Dam is located on the North Umpqua River at

1946 (Figure 3.12). Winchester Dam is located on the North Umpqua River at



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

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.

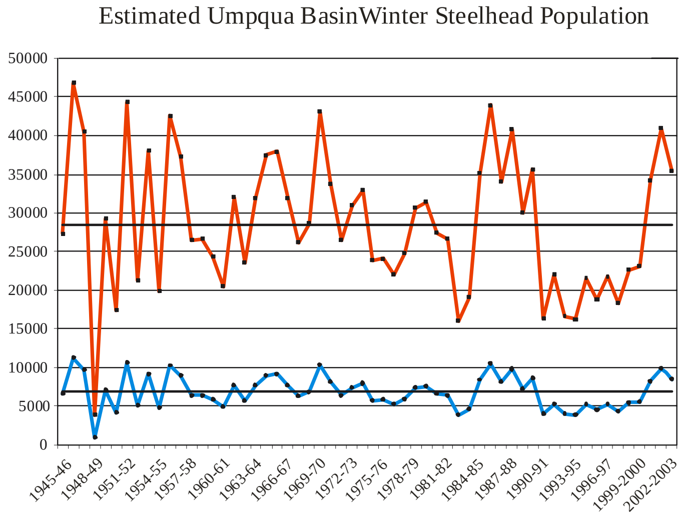


Figure 3.13. Umpqua Basin (red) and North Umpqua River sub-basin (blue) winter steelhead population estimates (excluding Smith River). Source: ODFW 2005.

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 3.13). The population estimate for the Umpqua Basin in 2002/2003 was 35,313 (pre-harvest).

Table 3.26 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 similar. The sample sizes for the telemetry and Peterson mark/recapture studies were limited due to 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.

Table 3.26. 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

Steelhead population data specific to individual tributaries within the Lower Umpqua River Watershed are not as readily available as population estimates for the entire Umpqua Basin. Nevertheless, some tributary steelhead data are available. Charlotte Creek was surveyed in 2003 by ODFW for winter steelhead spawning. Just over one mile of stream was surveyed on 13 occasions. Seven live fish were counted and the surveyors recorded an average of 16.7 steelhead redds per mile.

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 3.14). However, the elusive behavior of adult steelhead pose difficulties in conducting spawning surveys for this species. Therefore, these numbers are only rough estimates.

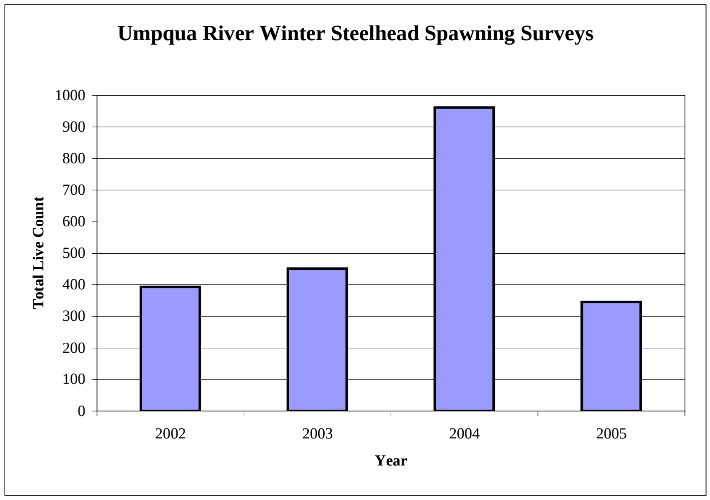


Figure 3.14. Winter steelhead spawning surveys for the Umpqua River.

3.5.3.5. Other Selected Native Fish Species

Both green sturgeon and white sturgeon (*Acipenser transmontanus)* reside in the Umpqua River, although very little is known about their population sizes or distributions. 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 fresh water, 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.

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 the watershed. 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 3.15). 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.

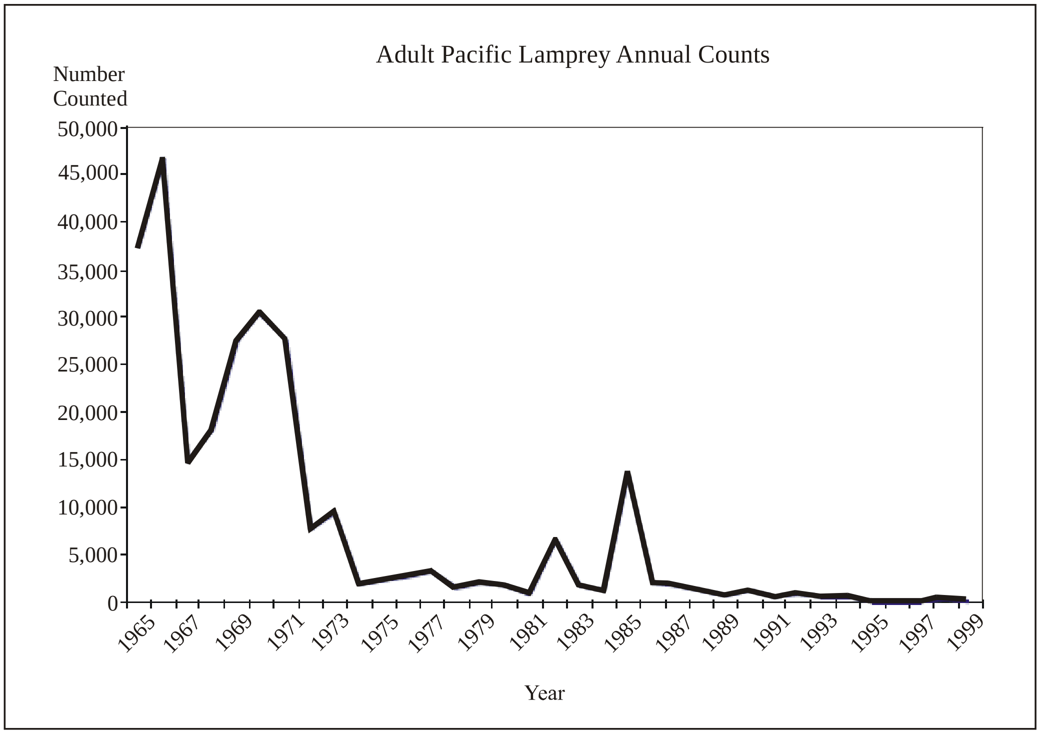


Figure 3.15. Annual counts of Pacific lamprey at Winchester Dam on the North Umpqua River, 1965 through 1999.

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 Lower 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 have 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 be 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 3.15). 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 Lower Umpqua River Watershed with annual runs are coho, winter and summer steelhead, spring and fall chinook, sea run cutthroat, and Pacific lamprey. Cutthroat trout is the only resident salmonid species.
- Although many medium and large tributaries within the Lower Umpqua River Watershed are within the distribution of 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 Lower 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 Lower 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[41]

4.2.1. Reedsport and Winchester Bay[42]

4.2.1.1. Population and Economic Growth

Reedsport is the only incorporated city in the Lower Umpqua River Watershed. Winchester Bay is unincorporated, but is a well-established population center. Over the past five years, the populations of Reedsport and Winchester Bay have declined. In 1999, International Paper, the largest employer of the region, closed a mill in Gardiner resulting in a loss of approximately 400 jobs. The population of Reedsport and the surrounding region is not expected to grow in the near future.

The demographics of the Lower Umpqua River Watershed are shifting, with an increase in the proportion of retirees. Oregon coastal towns have been the focus of several national news reports identifying them as a desirable retirement locations, drawing in recent retirees from outside the state. In addition, opportunities in the watershed are limited for young people, and many leave the area for employment or further education. These factors are contributing to a shift in the age distribution of the population toward a higher median age.

---

[41] 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.

[42] This information is from Rick Hohnbaum, City Manager, City of Reedsport.

4.2.1.2. Business and Industry

Tourism is the primary source of revenue for the local economy of the Lower Umpqua River Watershed. The scenic beaches, dunes, rivers, and forests draw in tourists for a variety of recreational activities. Beach combing, hiking, fishing, and exploring the dunes on off-highway recreational vehicles (OHRV) are some of the most popular activities. Tourism is increasing throughout the Oregon Coast, largely due to population growth in inland urban areas.

One of the largest industrial employers in the region is American Bridge, which manufactures steel highway bridges. American Bridge opened a manufacturing plant in Reedsport in 2002, and produces bridges throughout the western United States for public and private clients. American Bridge currently employs 65 workers in the Lower Umpqua River Watershed and foresees continuing growth in the future.

4.2.1.3. Utilities

Reedsport's wastewater treatment plant is currently being renovated in order to increase capacity and the quality of wastewater treatment. The sewer lines are adequate for the city's needs, and no renovations are planned in the near future. In 2002, Canyonville completed upgrades to its water intake facility. The facility is equipped with a computerized monitoring system and will sound an alarm in the event of a problem. Since there is very little population growth in Canyonville, the city is confident that water from Oshea Creek and Canyon Creek, the current wastewater treatment plant, and the new water intake facility will continue to meet the city's needs into the future.

4.2.2. Agricultural Landowners[43]

Beef cattle is the primary agricultural product provided by the Lower Umpqua River Watershed.[44] Almost all agricultural lands are privately held and most 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

---

[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.

[45] Many farmers and ranchers are also forestland owners (see section 4.2.3).

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 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 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 predator control programs in the 1960s through 1999. Now, the USDA once again handles 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

---

[46] Tansy ragwort is less common today than 10 years ago, the result of the introduction of successful biological control methods.

[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.

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, bear, 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 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 67,930 acres in the Lower Umpqua River Watershed, approximately 40% are private, most of which are forestlands. Family forestlands are a minority of privately-owned forestland.

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 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 wood products certified as derived from sustainably managed forests. Many family forestland owners follow the Oregon Forest Practices

[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).

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.

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

[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.

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]

In the Lower Umpqua River Watershed, 40% of the land base is privately owned, the majority of which belongs to industrial timber companies. These lands are intensively managed for timber production. Most industrial timberlands are located in areas that favor Douglas-fir, tending to be hillsides and higher elevations.[52] 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.

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.

---

[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.

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 people who transfer incomes into the watershed from elsewhere. 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 Coos Bay District Office of the Bureau of Land Management (BLM) administers approximately 600 acres of land in the Lower 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 Coos Bay 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]

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.

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 as determined 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 result in 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

---

[54] For more information, contact the Bureau of Land Management Coos Bay District Office at 1300 Airport Lane North Bend, OR 97459.

[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.

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 individuals 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.

Other potential hindrances to ODEQ's work are budget cuts and staff reductions. There are only two Healthy Stream Partnership positions assigned to the Umpqua Basin, which is approximately 2.7 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 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. These data have been summarized for water years 1995 through 2004. Trend analysis was conducted 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.

The OWQI station nearest to the Lower Umpqua Watershed is near the town of Elkton. No OWQI monitoring stations are located in the Lower Umpqua Watershed. Prior to 1993, the Elkton station had been located on Elk Creek at Hayhurst Road, just downstream of the Drain wastewater treatment facility. Since establishment in 1993, the Elkton station has shown generally good water quality throughout the year. However, the effects of non-point source pollution are evident, and in the wet season the river is impacted by high fecal coliform bacteria, total phosphates, total solids, and biochemical oxygen demand, and by high pH, total solids, and temperature in the summer. The trend has been stable, with neither improvements nor declines in water quality (ODEQ 2005).

In the lower Umpqua River, there has been concern regarding the effects of wastewater discharge from the Reedsport treatment facility. The treatment facility was in need of upgrades and repairs. According to the city manager, funding to update the treatment facility has been secured, and an engineering firm has been hired to complete the work, so water quality is expected to improve.

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. Lower 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, to a somewhat lesser extent, poor or fair pools and riparian areas 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 Lower Umpqua River Watershed.

5.2.1.3. Channel Modification Key Findings

- There are few examples of permitted channel modification projects in the Lower 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. Stream Function 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.[56]
- 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.
- Very little information exists regarding the distribution of unscreened ditches or the condition of existing fish screens and fish wheels. An inventory of ditches and fish screens is recommended.

5.2.2. Riparian Zones and Wetlands

5.2.2.1. Riparian Zones Key Findings

- Conifers dominate only half of the riparian zones within the watershed, mainly along tributary streams in the eastern half of the watershed.
- Riparian cover is rated as high along only half of the stream length. Thus, there are good opportunities to enhance stream shading.

5.2.2.2. Wetlands Key Findings

- Historical settlement, development, and long-term agricultural use of the Lower Umpqua River Watershed have probably affected the original wetland hydrology and resulted in loss of wetland areas.
- Most of the remaining wetlands in the Lower Umpqua River Watershed are found on private land.
- Landowner "buy-in" and voluntary participation must be fostered if wetland conservation is to be successful in the watershed.

---

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

- There are opportunities for enhancement and protection of wetlands, including extensive estuarine wetlands and palustrine wetlands along the lower reaches of many tributary streams, and riverine wetlands along the mainstem Umpqua River above the confluence with Dean Creek.

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, and 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

- The mainstem of the Umpqua River and the lower reaches of Scholfield Creek were 303(d) listed for temperature.
- Temperatures in Franklin and Wind creeks did not exceed the 64^{o}F temperature standard during the UBWC temperature study.
- 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 Lower Umpqua River Watershed exceed water quality standards. ODEQ has conducted a TMDL analysis to assist in the process of reducing bacterial contamination of stream and estuarine waters within the watershed.
- High bacteria concentrations in the mainstem Umpqua River, the estuary, and Scholfield Creek are due mainly to diffuse nonpoint sources of pollution, such as livestock, wildlife, and residential septic systems.
- The levels of pH, nutrients, and DO can be interrelated. In the Lower Umpqua River, it is unlikely that nutrient and DO levels limit water quality in most locations. However, DO levels have been found to be low in Scholfield Creek.
- We found no data regarding toxics in this watershed. However, activities associated with the use of toxics are uncommon in the watershed, so it is unlikely that toxics are an issue in this watershed.

5.2.3.3. Sedimentation and Turbidity Key Findings

- Turbidity data indicate that usual turbidity levels in the Lower Umpqua River Watershed should not affect sight-feeding fish like salmonids.
- Areas of moderate soil erodibility and runoff potential occur along several tributary streams in the western portions of the Lower Umpqua River Watershed.
- Steep to moderately steep slopes are found throughout 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, agriculture, and residential development 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 Lower Umpqua River Watershed for water quality conditions. 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 Lower Umpqua River Watershed’s bacteria levels:
    - Limit livestock access to streams 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.
- Evaluate DO conditions in Scholfield Creek to determine if there is a chronic DO problem.

5.2.4. Water Quantity

5.2.4.1. Water Availability and Water Rights by Use Key Findings

- In all three Lower Umpqua River Watershed WABs, in-stream water rights are less than average streamflow during all months of the year.
- During the summer, there is minimal “natural” streamflow available for new water rights, although water near the river mouth may be too saline for human uses.
- Domestic use is the largest use of water in the watershed. Commercial and irrigation are the second and third largest water uses in the watershed, respectively.

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 Lower Umpqua River Watershed is unknown at this time, but is not expected to be substantial.

5.2.4.3. Water Quantity Action Recommendations

- In general, water use is not a significant issue of concern in this watershed.

5.2.5. Fish

5.2.5.1. Fish Populations Key Findings

- The anadromous fish species in the Lower Umpqua River Watershed with annual runs are coho, winter and summer steelhead, spring and fall chinook, sea run cutthroat, and Pacific lamprey. Cutthroat trout is the only resident salmonid species.
- Although many medium and large tributaries within the Lower Umpqua River Watershed are within the distribution of 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.
- Based on a coast-wide EPA study in 2004, 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 Lower 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 Lower 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.

6. References Cited

Alt, D. and D.W. Hyndman. 2001. Northwest Exposures: A Geologic History of the Northwest . Mountain Press Publishing Company.

Bakken, L.J. 1970. Lone Rock Free State. The Mail Printers, Myrtle Creek, Oregon.

Beckham, D. 1990. Swift Flows the River: Log Driving in Oregon. Arago Books, Coos Bay, OR.

Beckham, S.D. 1986. Land of the Umpqua: A History of Douglas County, Oregon. Douglas County Commissioners, Roseburg, Oregon.

Bilby, R.E. and P.A. Bisson. 1998. Function and distribution of large woody debris. *In* Naiman, R.J. and R.E. Bilby (Eds.). River Ecology and Management: Lessons from the Pacific Coastal Ecoregion. Spring-Verlag, NY.

Biosystems. 2003. Elliott State Forest Watershed Analysis. Corvallis, OR.

Bureau of Land Management (BLM). 2002. Upper Umpqua Watershed Analysis. Roseburg and Coos Bay Districts.

Bureau of Land Management (BLM). 2004. Middle Umpqua River Watershed Analysis. Version 2.1. Umpqua Resource Area, Coos Bay District. North Bend, OR.

Brophy, L.S. and K. So. 2004. Tidal wetland prioritization for the Umpqua Estuary. Prepared for USFWS Coastal Program, Newport Field Office. Green Point Consulting, Corvallis, OR. www.GreenPointConsulting.com

Cantwell, R. 1981. Cow Creek Valley. The Drain Enterprise, Drain, Oregon.

Chesney, C. 1982. Mass erosion occurrence and debris torrent impacts on some streams in the Willamette National Forest. M.S. thesis, Oregon State University. Corvallis, OR.

Committee for Family Forestlands. 2002. Sustaining Oregon's Family Forestlands. Oregon Department of Forestry.

Cowardin, L.M., V. Carter, F. Goblet, and E.T. LaRoe. 1979. Classification of Wetlands and Deepwater Habitats of the United States. FWS/OBS-79/31. U.S. Fish and Wildlife Service, Washington, D.C.

Ellis-Sugai, B.and D.C. Godwin. 2002. Going With the Flow: Understanding Effects of Land Management on Rivers, Floods, and Floodplains. Oregon Sea Grant/Oregon State University, Corvallis, OR.

Emmett, R.L., S.A. Hinton, S.L. Stone, and M.E. Monaco. 1991. Distribution and abundance of fishes and invertebrates in West Coast estuaries. Volume II: Species life history summaries. ELMR Rep. No. 8. NOAA/NOS Strategic Environmental Assessments Division, Rockville, MD. 329 pp.

Farnell, J. E. 1980. Tillamook Bay Rivers navigability study. Division of State Lands, Salem, OR.

Geyer, N.A. 2003. South Umpqua River Watershed Assessment and Action Plan. Prepared for the Umpqua Basin Watershed Council, Roseburg, Oregon.

Good, J.W. 2000. Summary and current status of Oregon's estuarine ecosystems. Section 3.3 in Oregon State of the Environment: Full Report. Oregon Progress Board, Salem, OR. Available online at http://egov.oregon.gov/DAS/OPB/soer2000index.shtml

Guard, B.J. 1995. Wetland Plants of Oregon and Washington. Lone Pine Publishing, Redmond, WA.

Hart, P.J.B. and J.D. Reynolds (eds.). 2002. Handbook of Fish Biology and Fisheries Volume I. Fish Biology, Volume II. Fisheries. Blackwell Publishers.

Hulsing, H., and N.A. Kallio. 1964. Magnitude and frequency of floods in the United States, Part 14: Pacific slope basins in Oregon and lower Columbia River Basin, U.S. Geol. Surv. Water Supply Pap., 1689, 320 pp.

Istanbulluoglu, E., D.G. Tarboton, R.T. Pack and C.H. Luce. 2004. Modeling of the interactions between forest vegetation, disturbances and sediment yields. J. Geophys. Res. - Earth Surface 109(F1): F01009, doi: 10.1029/2003JF000041.

Jacobs, S., J. Firman, G. Susac, D. Stewart, and J. Weybright. 2002. Status of Oregon coastal stocks of anadromous salmonids, 2000-2001 and 2001-2002. Oregon Plan for Salmon and Watersheds, Monitoring Program Report, No. OPS-ODFW-2002-3. Oregon Department of Fish and Wildlife, Portland.

Jefferson, C.A. 1975. Plant communities and succession in Oregon coastal salt marshes. PhD thesis, Department of Botany and Plant Pathology, Oregon State University, Corvallis, OR. 192 pp.

Kostow, K. 2002. Oregon lampreys: natural history status and analysis of management issues. Oregon Department of Fish and Wildlife, Corvallis, OR.

Leedy, J.C. 1929. 1928 Annual Report - Douglas County. Oregon State Agricultural College, Corvallis, OR.

Levesque, P. 1985. A chronicle of the Tillamook County Forest Trust Lands. Vol. 1. Published for Tillamook County, Tillamook, OR.

Loy, W.G., S. Allan, A.R. Buckley, and J.E. Meacham. 2001. Atlas of Oregon, 2nd edition. University of Oregon Press, Eugene, OR.

Markers, A.G. 2000. Footsteps on the Umpqua. Dalton Press, Lebanon, OR.

Meteorology Committee Pacific Northwest River Basins Commission. 1969. Climatological Handbook Columbia Basin States: Temperature Volume I Part A.

Minter, H.A. 1967. Umpqua Valley Oregon and Its Pioneers: The History of a River and Its People. Binfords & Mort, Publishers, Portland, OR.

Morris, W.G. 1934. Forest fires in western Oregon and western Washington. Oregon Historical Quarterly 35:313-319.

Moyers, S, J. White, B. Riggers, M. Williams, C. Sheely, and H. Weeks. 2003. Umpqua River Fall Chinook Salmon Escapement Indicator Project: 1998 - 2002. Cumulative Progress Report. Oregon Department of Fish and Wildlife, Marine Resources Program, Newport, OR. 41 pp

Naiman, R.J. and R.E. Bilby (eds.). 1998. River Ecology and Management: Lessons from the Pacific Coastal Ecoregion. Springer-Verlag, New York. 696 pp.

Nickelson, T.E, J.W. Nicholas, A.M. McGie, R.B. Lindsay, and D.L. Bottom. 1992. Status of anadromous salmonids in Oregon coastal basins. Oregon Department of Fish and Wildlife.

Oregon Climate Service. 2003. Weather data from the web site: http://www.ocs.orst.edu.

Oregon Department of Environmental Quality. 2005. Oregon Water Quality Index summary report: water years 1995-2004. Oregon Department of Water Quality, Portland, OR. 13 pp.

Oregon Department of Environmental Quality. 1998. Oregon's Approved 1998 Section 303(d) Decision Matrix.

Oregon Department of Fish and Wildlife (ODFW). 2005. Coastal Coho Assessment. http://nrimp.dfw.state.or.us/oregonplan. Accessed February, 2006.

Oregon Department of Fish and Wildlife (ODFW). 2004. Electronic fish distribution for Oregon. Available on the internet http://rainbow.dfw.state.or.us/nrimp/information/index.htm

Oregon Department of Fish and Wildlife. 2000. Development of Methods to Estimate Escapement of Chinook Salmon in the South Umpqua River: Pacific Salmon Commission Semi Annual Progress Report – Oregon.

Oregon Department of Fish and Wildlife. 1995 Biennial Report in the Status of Wild Fish in Oregon. Accessed November 7, 2002. Available at: http://www.dfw.state.or.us.

Oregon Department of Fish and Wildlife (ODFW). 1993. Review of threatened and endangered, sensitive and stocks of concern. Southwest Regional Fish Management Meeting, Charleston.

Oregon Department of Forestry (ODF). 1993. Elliott State Forest management plan. Coos Bay.

Oregon Labor Market Information System. The Lumber and Wood Products Industry: Recent trends. Accessed November 13, 2002. Available at: http://www.qualityinfo.org/olmisj/OlmisZine.

Orr, E.L., W.N. Orr, and E.M. Baldwin. 1992. Geology of Oregon. Fourth Edition. Dendall/Hunt Publishing Co., Dubuque, Iowa.

Oregon State University Extension Service. 2002. Watershed Stewardship: A Learning Guide. Oregon State University;

Oregon State University Extension Service. 2000. Fish Passage Short Course. Oregon State University.

Parker, J.R. 1936. 1935 Annual Report - Douglas County. Oregon State Agricultural College, Corvallis, OR.

Patton, C.P. 1976. Atlas of Oregon. University of Oregon, Eugene, OR.

Pacific Northwest National Laboratory. Soil Erodibility Factor [Web Page]. Accessed 2003 Apr. Available at: http://mepas.pnl.gov/earth/formulations/source_term/5_0/5_32/5_32.html

Press, F. and R. Siever. 1986. Earth. 4[TH] edition. W.H. Freeman and Company, San Francisco.

Reeves, G. H., K. M. Burnett, and S. V. Gregory. 2002. Fish and aquatic ecosystems of the Oregon Coast Range. In: Hobbs, et al. (eds.). Forest and Stream Management in the Oregon Coast Range. Oregon State University Press, Corvallis, OR. pp. 68-98.

Reeves, G.H., L.E. Benda, K. Burnett, P.A. Bisson, and J.R. Sedell. 1995. A disturbance-based ecosystem approach to maintaining and restoring freshwater habitats of evolutionarily significant units of anadromous salmonids in the Pacific Northwest. Amer. Fish. Soc. Symp. 17:334-349.

Robison E.G., K. Mills, J. Paul, L. Dent, and A. Skauget. 1999. Storm impacts and landslides of 1996. Forest Practices Technical Report #4, Forest Practices Monitoring Program. Oregon Department of Forestry, Salem.

Ruth, R.H. and R.A. Yoder. 1953. Reducing wind damage in the forests of the Oregon Coast Range. Research Paper 7. USDA Pacific Northwest Forest and Range Experiment Station.

Ryu, I.C., A.R. Niem, and W.A. Niem. 1996. Oil and gas potential of the southern Tyee basin, southern Oregon Coast Range. Oregon Department of Geology and Mineral Industries, Salem.

Schlesser, H.D. 1973. Fort Umpqua: Bastion of Empire. Oakland Printing Company, Oakland, OR.

Skaugset, A.E., G.H. Reeves, and R.F. Kleim. 2002. Ecology and management of wildlife and their habitats in the Oregon Coast Range, In: Hobbs et al. (eds.). Forest and Stream Management in the Oregon Coast Range, Oregon State University Press, Corvallis, OR. pp. 213-241.

Smith, K 2000. South Umpqua Watershed Temperature Study 1999: Procedure, Results, and Preliminary Analysis. Umpqua Basin Watershed Council, Yoncalla, OR.

Spies, T.A., D.E. Hibbs, J.L. Ohmann, G.H. Reeves, R.J. Pabst, F.J. Swanson, C.A. Whitlock, J. A. Jones, B.C. Wemple, L.A. Parendes, and B.A. Schrader. 2002. Ecology and management of wildlife and their habitats in the Oregon Coast Range. In: Hobbs et al. (eds.). Forest and Stream Management in the Oregon Coast Range. Oregon State University Press, Corvallis, OR. pp. 31-67.

Taylor, G.H. and R.R. Hatton. 1999. The Oregon weather book: A state of extremes. Oregon State University Press, Corvallis, OR.

Umpqua National Forest. 1976. Soil Resource Inventory, Umpqua National Forest. US Department of Agriculture, Pacific Northwest Region Forest Service.

USDA Agriculture Research Service National Sedimentation Laboratory. Revised Universal Soil Loss Equation [Web Page]. Accessed 2003 Apr. Available at: http://www.sedlab.olemiss.edu/rusle/description.html.

USDA Natural Resources Conservation Service. 1986. Technical Release 55. Conservation Engineering Division.

Walker, G.W. and N.S. MacCleod. 1991. Geologic Map of Oregon. US Geological Survey.

Watershed Professionals Network (WPN). 1999. Oregon Watershed Assessment Manual. Prepared for the Governor's Watershed Enhancement Board. Salem, OR.

Wellman, R.E., J.M. Gordon, and R.L. Moffatt. 1993. Statistical Summaries of Streamflow Data in Oregon: Volume 2 – Annual Low and High Flow, and Instantaneous Peak Flow. U.S. Geological Survey Open-File Report 93-63.

Wetlands Conservancy. Conserving Oregon's Wetlands [Website]. Accessed March 16, 2003. Available at: http://www.wetlandsconservancy.org/oregons_greatest.html.

Weyerhaeuser. 1998. South Fork Coos River watershed analysis. Weyerhaeuser Corp. Coos Bay, OR.

Winterbotham , J. 1994. Umpqua: The Lost County of Oregon. Creative Images Printing. Brownsville, OR.