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1. Introduction

Seasonal water shortages occur in nearly all sub-basins. Water supplies of a number of communities and industries are curtailed during late summer and early fall. New water rights are unavailable during these low flow seasons on most streams in the basin, jeopardizing continued growth and economic diversification. Several smaller South Umpqua River tributary sub-basins cannot meet instream water requirements 80 percent of the time throughout the year. This does not allow for new water rights at any time of the year in those sub-basins.[1] Agricultural endeavors cannot intensify nor diversify without more dependable water supplies.

Flooding is also a frequent occurrence in many areas within the County, with significant events occurring about 2 to 3 times per decade in most sub-basins. Years with significant flooding since 1950 occurred in 1950, 1953, 1955, 1961, 1964, 1971, 1974, 1981, 1983, 1996, and 2005. Although some flooding is expected in floodplain areas, and is important for overall stream function, extreme flooding particularly into municipal areas may cause significant damage by destroying community infrastructure and causing excessive eroding of streambanks.

In addition, water quality conditions deteriorate during the low streamflow period, exemplified by high water temperatures, excessive algae growth, high pH and low dissolved oxygen. Section 303(d) of the Clean Water Act requires states to list waters for which technology-based limits alone do not ensure attainment of applicable water quality standards. The Umpqua Basin Total Maximum Daily Load (TMDL) assessment was completed by the Oregon Department of Environmental Quality (ODEQ) in October 2006. The Water Quality Management Plan for that assessment lists the Umpqua Basin streams on the 303(d) list addressed by the 2006 TMDL (Table 1-1). There are also approximately 142 miles of stream listed for various toxics and 84 miles listed for sedimentation that are not addressed by the current TMDL. Specifics of all the listings by stream are discussed in the water quality sections of each sub-basin.

[1] Storage rights may be obtained when flows meet the current needs 50 percent of the time, therefore some streams may still allow storage water rights while no new consumptive use rights are permitted.

Parameter	South Umpqua sub-basin	North Umpqua sub-basin	Mainstem Umpqua sub-basin
Temperature – *rearing*	603.4 (68)	247.3 (27)	514.5 (39)
Temperature – *spawning*	65.3 (12)	70.6 (11)	4.2 (2)
pH	163.7 (7)	38.6 (7)	25.3 (3)
Dissolved oxygen	78.4 (2)	16.7 (3)	81.7 (2)
Bacteria – *summer*	76.4 (5)	0	0
Bacteria – *fall, winter, spring*	16.3 (3)	0	162.6 (9)
Bacteria – *all-year - shellfish*	0	0	123.1 (8)
Biological criteria	101.2 (5)	0	12.7 (1)
Aquatic weeds/algae	57.7 (2)	3.7 (1)	0
Chlorophyll a	41.8 (1)	0	0
Phosphorus	15.9 (1)	0	0
Total stream miles with one or more listings[1]	**728.0 (106)**	**291.6 (49)**	**649.5 (64)**

[1] Streams with more than one listing were counted only once in the total stream miles.
Source: Umpqua Basin TMDL, Water Quality Management Plan (ODEQ 2006).

Table 1- 1: Umpqua Basin stream miles (and number of listed segments) on the 303(d) list addressed by the 2006 TMDL.

1.A. Program Goal and Objectives

Douglas County has made substantial progress in addressing water resources issues throughout the Umpqua Basin. These efforts (described in Section 1.C) reflect the following overall water management program goal:

> ***Provide year-round, high quality surface water supplies sufficient to meet current and future needs for all beneficial uses in Douglas County.***

Beneficial uses have been designated by the State and are outlined in the Oregon Administrative Rules (OAR 340-041-0320) on all streams and lakes in the Umpqua Basin. Although beneficial uses vary somewhat by river, stream or lake, they include the following uses in the basin:

- Domestic water supply
- Fishing
- Industrial water supply
- Irrigation
- Water contact recreation
- Livestock watering
- Aesthetic quality
- Fish and aquatic life
- Hydropower
- Wildlife and hunting
- Commercial navigation and transportation

This program goal is more specifically stated in the following program objectives:

1. Achieve water quantity and quality conditions in all streams and lakes to protect the relevant beneficial uses listed above (OAR 340-041-0320).

2. Insure available municipal and/or industrial water supplies to fully meet existing needs, and to support further population growth and industrial diversification.

3. Insure available irrigation water supplies to fully meet current shortages, and to provide for further agricultural intensification and diversification.

Douglas County has alleviated many water resources issues within the basin. However, additional concerns described in the Sub-basin Assessments Section (Section 2) and shown in Table 1-1, illustrate the need for continued efforts by the Water Resources Management Program.

The activities necessary to meet the program goal and objectives are described in the sections that follow. In addition, the Findings and Implementation Chapter in Volume I includes a discussion of proposed actions which the Douglas County Natural Resources Division staff believe may be accomplished in the next several decades to address many of the issues.

1.B. Natural Resources Division Activities

Douglas County Natural Resources Division activities and responsibilities are arranged into the following three categories:

- Resources Management
- Storage
- Stewardship

Resources Management includes the work assigned to, and carried out by the Natural Resources Division, such as flow data collection, water quality monitoring, flood warning, operation and maintenance of Ben Irving and Galesville reservoirs, and adaptive management studies to improve the effectiveness of management decisions.

Accomplishment of these activities demands coordination with local agencies at all levels. Implementation of County programs must proceed in concert with Federal and State agency authorities and policies, and strive to resolve any conflicts between County objectives and State policy. New activities of County agencies, suggested in subsequent paragraphs, will need to be inaugurated and coordinated to assist in achieving the goal and objectives.

The Storage element includes not only management of the existing Ben Irving and Galesville reservoirs, but analyzing new potential storage projects and developing those that are feasible and necessary. As new storage projects are completed, they will be operated to meet downstream needs, and maintained in safe and efficient operating conditions. County criteria and specific concerns with development of storage facilities are discussed under Storage Element (Section 2.C.) in Volume I.

Since storage facilities are not appropriate on some streams in the County, and may not always provide complete solutions to problems, a Stewardship category has been designed to assist in achieving the program goal and objectives. While water resources are being used, they must also be cared for and conserved. All Douglas County residents use the water and have the opportunity to improve water quality in the Umpqua Basin. For example, steps may be taken by owners of riparian lands to reduce water quality degradation. Better management of toxic chemicals can reduce runoff contamination. Water conservation may be improved through education of County water users.

1.C. Background

1.C.1. Douglas County

Douglas County has become increasingly active in water resources management since it established the Water Resources Survey in 1956. The primary focus of the Survey at its inception was collection of hydrologic data. In the last fifty years, the County program of water resources management has evolved into one of the most active in Oregon and is among the leading counties in the nation. The Water Resources Survey was renamed the Natural Resources Division (NRD) in 1996.

The NRD water resources responsibilities have expanded to include the operation of Ben Irving and Galesville reservoirs, and planning of additional storage facilities. The NRD partners with the United States Geological Survey, the United States Forest Service, Oregon Department of Fish and Wildlife, Oregon Department of Environmental Quality, Oregon Water Resources Department, the Bureau of Land Management, and other agencies in various water-related projects.

In 1956, the County developed the Water Resources Advisory Committee, referred to today as the Water Resources Advisory Board. The current board is composed of nine members that include local citizens from throughout the County familiar with water issues that provide guidance and input to County officials on water issues and needs specific to different regions of the County.

In 1992, the Umpqua Basin Fisheries Restoration Initiative was developed as a subcommittee to the Water Resources Advisory Board. The initial focus of the group was to complete 2,000 miles of aquatic habitat surveys on basin streams. The group was later changed to become an official watershed council and an advisory group to the Douglas County commissioners in 1997. The name was then changed to the Umpqua Basin Watershed Council (UBWC).

The official connection of the watershed council as a subcommittee to the Water Resources Advisory Board was terminated in 2000 when the council was registered as an Oregon non-profit organization. The UBWC received provisional 501(c)(3) status the following year and a final status ruling in 2006. The council changed its name in 2005 and is now known as the Partnership for the Umpqua Rivers. The council now serves as a non-profit watershed council for most of the Umpqua River basin. There are also two other watershed councils operating in the basin, Smith River and Elk Creek watershed councils. The primary focus of the watershed councils is to improve water quality and fish habitat in the basin streams.

In the western region of the country, major water resources projects have been constructed by federal agencies such as the U.S. Bureau of Reclamation and U.S. Army Corps of Engineers in response to local requests to alleviate the kinds of issues identified in this assessment. These agencies have prepared or contracted studies of potential storage projects in the Umpqua Basin since the early 1950's.

Construction of the Galesville Reservoir is the only County project to date that has received federal funding. The Galesville project was partially funded by the U.S. Bureau of Reclamation Small Reclamation Projects Program. Although other projects have been identified that met the economic and environmental criteria of the program, no other major federal storage projects have received federal funding in Douglas County.

The County, in recognition of issues and limitations related to water use, first prepared their Water Resources Management Program in 1979. The program was later updated in a 1989 revision. This 2008 revision is the first update authorized by the County since 1989.

In 1979 the County completed the Berry Creek Project. This $7.5 million (1978 dollars) earth-fill dam serves in-lieu of the United States Bureau of Reclamation's proposed Olalla Project, one of the authorized but not constructed projects in the County. The impoundment, Ben Irving Reservoir, has the storage capacity of 11,250 acre-feet for irrigation, municipal use, streamflow augmentation and reservoir recreation purposes. The project was constructed entirely with County funds on a "pay-as-you-go" basis.

A second storage project, jointly sponsored by Douglas County and the City of Canyonville, was completed in 1981. Win Walker Reservoir is a 300 acre-foot impoundment that provides essential storage for the City's water supply. Construction of the $2.8 million project (1980 dollars) was funded by the City of Canyonville, the County, and a Farmers Home Administration grant.

In 1982, after detailed engineering and environmental studies of four alternative sites, construction began on the 41,870 acre-foot Galesville Project located on Cow Creek near Azalea. Prior to construction, Douglas County citizens passed a ballot measure by over 75 percent approving construction of the project. The project was completed in 1986. Primary project benefits include flood control, irrigation, municipal and industrial water supply, and anadromous fish habitat enhancement. Hydroelectric power is a secondary use that is generated as releases are made for the primary benefits listed above.

Total project costs were $36 million in 1986 dollars. The project was funded in part, by the Small Reclamation Projects Program (PL 84-984) administered by the U.S. Bureau of Reclamation. About $15 million in grant funds for flood control, anadromous fish, and recreation costs of the project were received. The County expended about $10 million during the construction period. The remaining project costs of about $11 million were to be repaid as a loan over a 40-year term. In early 1988, the U.S. Bureau of Reclamation offered to discount the loan for a payment of about $7 million. The County accepted the offer and no further financial obligations exist.

In 1985 Douglas County funded engineering costs for a 100 acre-foot reservoir for the City of Yoncalla. The completed structure is considered an interim measure until a more reliable water supply becomes available.

Douglas County has spent approximately $12 million between 1997 and 2008 on pre-construction work for the Milltown Hill Project located in the Northern portion of the County. The project was shelved in 1997 when cutthroat trout were listed as threatened on the endangered species list, and the State would not grant a fish passage waiver. Subsequent waivers were allowed with the requirement of substantial fish habitat mitigation work that proved too costly for the County to endure.

Cutthroat trout were later de-listed in 2000, and the County began an update of environmental reports in 2005 in the hope of securing construction funding. The most recent cost estimate update was prepared in 2006, which presented the total cost of the project at $80 million (2006 dollars). Fish passage and mitigation, and water quality have been major issues in the approval of this project. The County suspended the environmental update work in 2008 due to the escalating costs and lack of funding sources.

Douglas County Commissioners inaugurated the Stream Habitat Improvement Program (SHIP) by ordinance in September, 1984. This program provides financial assistance to eligible applicants for projects that will increase anadromous fish populations; preserve, enhance, or restore aquatic and riparian habitat; and/or provide educational activities pertaining to fisheries. These projects make a significant contribution to the stream improvement program under the direction of the NRD.

Annual funding levels for the SHIP program are approved by the Douglas County Board of Commissioners. The program is administered by a five-member Salmon Habitat Advisory Committee, with the advice of representatives from the Oregon Department of Fish & Wildlife (ODFW), Oregon Department of Forestry, U.S. Forest Service, and Bureau of Land Management. The committee is authorized to develop intergovernmental agreements as necessary for implementation of appropriate projects, and to develop priorities.

Applications for projects are reviewed by the NRD and ODFW staff. Action recommendations are made to the advisory committee with regard to specific applications. Project costs are shared by landowners, the County, and other entities.

In 1993, a Southern Pacific freight train derailed near Yoncalla. In 1995, the Yoncalla Creek Diesel Spill fund was established as mitigation for the associated spill. The fund is administered by the SHIP Committee. Since the creation of the SHIP program in 1984, at least 45 projects have been completed with approximately $422,339 invested between both the SHIP and Yoncalla Diesel Spill funds. There is currently $8,999 in the SHIP fund and $269,538 (as of September 2007) in the Yoncalla Diesel Spill fund.

1.C.2. State of Oregon

The waters of the Umpqua Basin belong to the public and their use is regulated by the Oregon Water Resources Department (OWRD). Oregon water laws are based on the principal of prior appropriation. This means the first person to obtain a water right on a stream is the last to be shut off in times of low streamflows. In water-short times, the water right holder with the oldest date of priority can demand the water specified in their water right regardless of the needs of junior users. If there is a surplus beyond the needs of the senior right holder, the water right holder with the next oldest priority date can take as much as necessary to satisfy needs under their right and so on down the line until there is no surplus or until all rights are satisfied.

In Oregon, the appropriation doctrine has been law since February 24, 1909, when passage of the first unified water code introduced state control over the right to use water. In recent years, OWRD, while supportive, has not taken a direct role in development of water resources projects, but has confined itself to establishing water use policies and administration of water law.

The Water Resources Commission, the policy setting body of the OWRD, has prepared a program of water use for the Umpqua Basin (OR Administrative Rules, Chapter 690, Division 516, Umpqua Basin Program). The program identifies beneficial uses, withdraws some streams from further appropriation, and establishes minimum perennial stream flows for instream uses or instream water rights at strategic locations throughout the basin.

In 2007, the Oregon Legislature approved the Oregon Water Supply and Conservation Initiative (OWSCI). The initiative provides $750,000 for the State to take a broad look at water needs and water availability throughout the State, and to strategically develop the tools, methodologies, and budgets required to ensure that those who need water – both in-stream and out-of-stream – will have access to the resource for generations to come. The initiative has the following five main components:

1. A compilation of already-existing information regarding water demands and needs in Oregon
2. A statewide inventory of already-identified, potential conservation projects
3. A statewide inventory of potential water storage sites
4. Match funding for community-based and regional water supply planning
5. Completion of a state investigation of basin yield estimates.

In the short-term, OWSCI will collect much of the baseline data that policymakers need to better understand the status of Oregon's water resources. In the longer term, OWSCI will house the databases that allow the state to update and add information as it becomes available. As this information is ever-changing, the Water Resources Department intends to deposit it into an online system that can be updated and managed to accommodate new data.

The Oregon Department of Environmental Quality (ODEQ) has adopted water quality standards for the basin, which regulate the discharge of wastes into basin streams. ODEQ identified Douglas County as a Designated Management Agency in its Umpqua Basin TMDL Water Quality Management Plan, approved by EPA in April, 2007 (ODEQ 2006). The County's designation is due to its legal ability to enforce regulations that effect water quality (see Section 1.D.1).[2]

1.D. Water Quality

The ODEQ has adopted an extensive system of general and specific water quality standards for Oregon streams. Standards for the Umpqua Basin may be found in Oregon Administrative Rules, Chapter 340; specifically OAR 340-041-0320 through 0326. The ODEQ standards are adopted to protect beneficial uses specific to a stream, river, or lake. The standards reference many water quality parameters such as those mentioned in Table 1-1. Comparing water quality data to state standards can help focus attention on areas that may have pollution problems. Changes in the concentration of many of these constituents result from specific point discharges and are therefore subject to regulation through ODEQ's discharge permit process, while others are considered the result of non-point source pollution resulting from an accumulation of effects over a broader area.

1.D.1. Total Maximum Daily Load (TMDL) Assessments

ODEQ has prepared several Total Maximum Daily Load (TMDL) assessments with specific location, degree and intensity of point and non-point source problems in the rivers, streams, and lakes of the Umpqua Basin and the Tenmile Watershed in the coastal area.[3] Table 1-1 is a result of the Umpqua Basin TMDL assessment approved in April, 2007. A TMDL was approved for the Little River Watershed in the North Umpqua sub-basin in 2002. Stream segments that were listed in the Little River Watershed are expected to meet water quality standards based on limits to pollution allocated in the TMDL. A TMDL assessment for the Coquille Watershed which includes streams and rivers in the Camas Valley sub-basin is currently in progress.

The goal of the assessments is to allocate pollution levels between different point-sources and non-point sources so that the total pollution discharge to an area is at or below the level a water body can tolerate without exceeding the State standard. The allocation formula is illustrated in the following:

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[2] State water quality standards and the Umpqua Basin TMDL Water Quality Management Plan can be found on the ODEQ website.
[3] The Tenmile Watershed TMDL is mostly in Coos County. However it includes Clear Lake and Eel Lake in Douglas County.

Point-source (wasteload allocation)	+	**Non-point-source** (load allocation)	+	*Margin of safety & Future reserve capacity*	=	**TMDL** (loading capacity)

Douglas County, along with numerous other entities is identified as a "designated management agency" in the TMDL assessments.[4] Designated management agencies are recognized by the State of Oregon as having legal authority to ensure that targets identified in the TMDL are met. Douglas County has authority for regulating the TMDL on rural and urban/non-resource land in the County. Land uses on these areas include the following:

- All non-agricultural, non-forestry-related land uses including transportation uses (road, bridge, and ditch maintenance and construction practices)
- Designing and siting of housing/home, commercial, and industrial sites in urban and rural areas
- Golf courses and parks
- Operation of Galesville Dam/Reservoir and Berry Creek Dam/Ben Irving Reservoir
- Riparian protection
- Other land uses as applicable to the TMDL

An implementation plan for the TMDL will be created. The information from the implementation plan will assist in review of corrective work being funded by the County and various agencies, as well as with activities under the Stream Habitat Improvement Program, the Salmon and Trout Enhancement Program, and other related programs.

Monitoring and Review

ODEQ will review progress of the TMDL on a five-year basis. The review will evaluate the progress toward achieving the TMDL and water quality standards and the success of implementing the water quality management plan. Each Designated Management Agency (DMA), including Douglas County will also monitor and document its progress in implementing the provisions of its implementation plan and provide that information to ODEQ. DMAs are also expected to develop benchmarks for attainment of TMDL surrogates, which can then be used to measure progress. Where implementation or effectiveness is found inadequate, ODEQ expects DMAs to revise the components of their implementation plans to address the deficiencies. For more information on implementing the TMDL and the role of each DMA, refer to Chapter 7 of the Umpqua Basin TMDL (ODEQ 2006).

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[4] Six other designated management agencies identified in the Umpqua Basin TMDL include: Oregon Department of Agriculture; Oregon Department of Forestry; Bureau of Land Management and the Forest Service; Oregon Department of Transportation; National Pollution Discharge Elimination System; and the nine incorporated cities in Douglas County. Refer to the Umpqua Basin TMDL for specific information on each agency's responsibilities.

2. Sub-basin Assessments

The Umpqua Basin is divided into five primary areas in this document for assessment purposes. Each area assessment contains a comprehensive inventory of water resources issues and concerns for the sub-basins within that area. Together they provide a summary of the current status of water resources and potential future water use issues for the entire Umpqua Basin.

2.A. Umpqua River / Coastal Lakes Sub-basins

2.A.1. Area Description

This section of the Douglas County Water Resources Management Plan covers the Umpqua River and the watersheds that drain into the River from its mouth at Winchester Bay to the upstream extent of tidal influence at river mile 28 near Scottsburg. It includes the drainages of Smith River and Mill Creek. The area also includes the coastal lakes in Douglas County to the north and south of the Umpqua River (Figure 2.A.1).

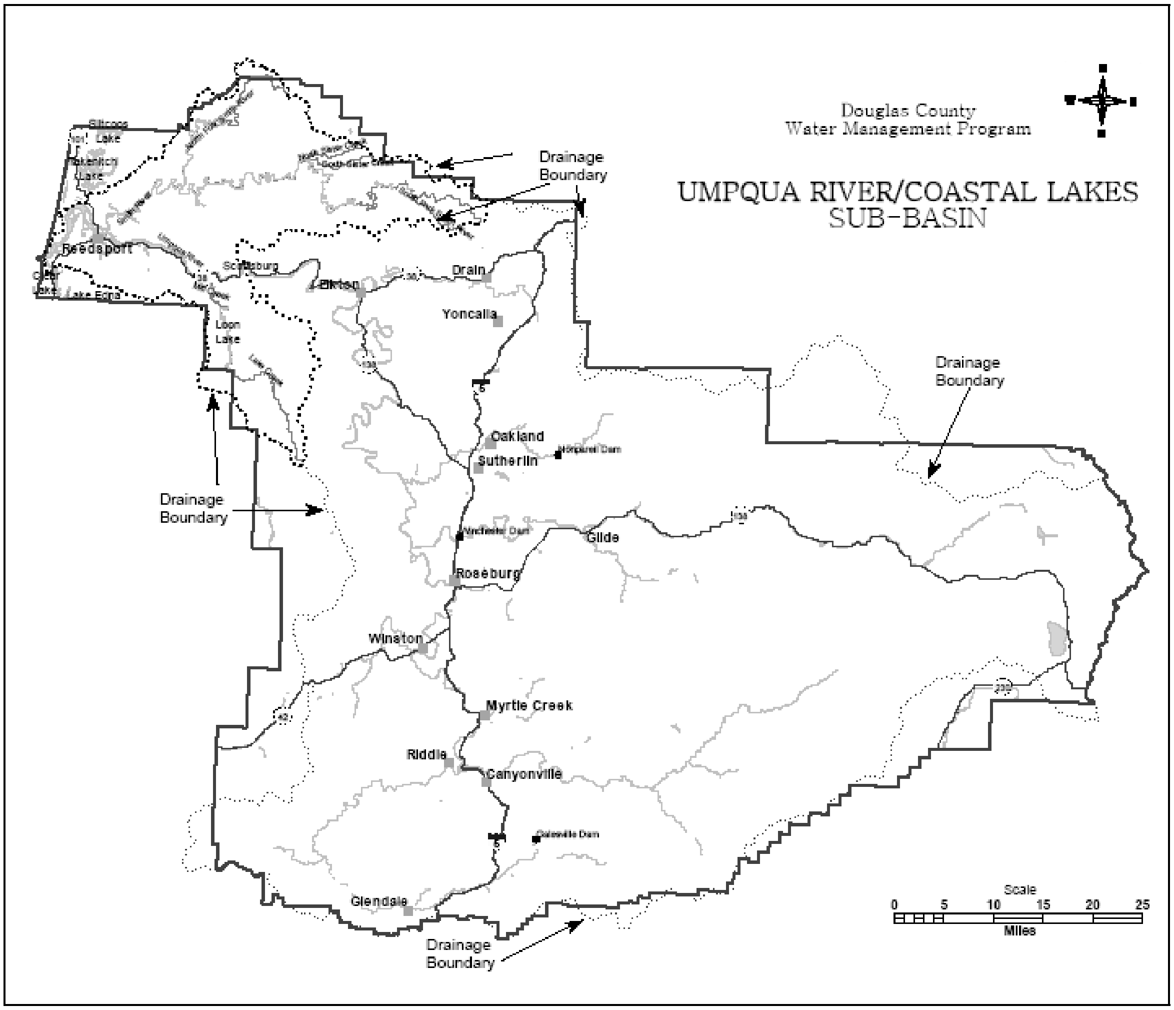

Figure 2.A.1: Umpqua River / Coastal Lakes sub-basins within Douglas County.

Reedsport is the only incorporated community within this area of Douglas County. The unincorporated communities include Winchester Bay, Gardiner, and Scottsburg. Major economic activities include commercial and sport fishing, industrial manufacturing, tourism, and timber production.

The Central Oregon and Pacific Railroad, and US Highway 101 traverse the western portion of the sub-basin. Oregon Highway 38 follows the course of the Umpqua River upstream to Elkton. West of Highway 101, littoral zone lands in the County are within the Oregon Dunes National Recreation Area. Major portions of sub-basin lands north of the Umpqua River and bordering the river between river miles 15 and 23 are included in the Siuslaw National Forest. Forest lands to the south along the Umpqua River between river miles 17 and 25 are part of the Elliot State Forest.

Climate

The climate in this sub-basin is characteristic of Coastal Oregon. Winter temperatures generally are mild with freezing temperatures rarely occurring except in the higher elevations of the coastal mountains. Summer temperatures are mild. Reedsport average temperatures are approximately 60°F in August and 45°F in December and January.

Precipitation

Precipitation records have been maintained in the area since 1893. The weather stations have been located at Gardiner (1893-1914 and 1983-present), the Umpqua River Lighthouse (1915-1937), and Reedsport (1938-2005). Average annual precipitation in recent years is about 67 inches at Gardiner. The maximum recorded annual amount is 103.56 inches in 1904, while the minimum, occurring in 1936, was 42.75 inches. Although precipitation at Gardiner is higher than much of the interior portions of Douglas County, there is a significant dry period in July and August where less than 1.5 inches total occurs on average. To illustrate rainfall variation, the maximum, mean, and minimum monthly amounts are tabulated for the Gardiner station in Table 2.A-1.

Period	Monthly and annual precipitation (inches)					
	Gardiner 1893-1914			Gardiner 1983-March 2006		
	max	mean	min	max	mean	min
October	9.74	5.44	0.07	11.81	4.96	0.25
November	21.37	13.09	4.94	22.33	10.95	2.59
December	20.99	11.15	6.08	21.84	11.36	3.66
January	21.33	12.96	4.23	22.48	10.68	0.76
February	20.15	10.23	2.30	18.41	7.85	1.56
March	24.21	9.26	3.29	17.85	8.13	2.23
April	14.70	5.68	0.00	11.10	5.27	2.19
May	10.27	4.93	1.29	9.22	4.07	0.20
June	6.13	2.48	0.71	4.57	2.40	0.18
July	2.29	0.48	0.00	3.17	0.72	0.00
August	4.22	0.81	0.00	2.91	0.78	0.03
September	6.33	2.81	0.44	5.09	1.63	0.02
Annual[1]	103.56	78.55	58.35	95.18	66.66	46.45

[1] Values are maximum annual, mean annual, and minimum annual; not total of column entries.
Source: Douglas County Natural Resource Division.

Table 2.A-1: Monthly and annual maximum, mean, and minimum precipitation measured at Gardiner for two time periods.

Surface Water – Rivers and Streams

Quantity

The Oregon Water Resources Department has estimated the average annual discharge of the Umpqua River into the Pacific Ocean to be about 7.9 million acre-feet, the largest flow into the Pacific Ocean of streams located entirely in Oregon. The Natural Resources Division (NRD), the National Weather Service, and the City of Reedsport operate and maintain a stream gage and precipitation gage in the sub-basin at the Reedsport Discovery Center. The gage is considerably influenced by tidal fluctuations and flow from the Smith River, a major tributary to the Umpqua River that empties into its estuary; therefore it is not used to determine accurate Umpqua River discharge. Instead, gages monitored by the USGS located on the Smith River and on the Umpqua River near Elkton are used to estimate discharges in both of these rivers.[5] Mean, maximum, and minimum discharges from these gages are listed in Table 2.A-2.

Stream gage	Period of record (water year)	Discharge (cfs)			Runoff average (ac-ft/year)
		max	min	mean	
Umpqua River near Elkton	1906-2005	265,000	640	7,343	5,320,000
Smith River near Gardiner	1966-1973	20,500	5	756	547,700

Table 2.A-2: Discharge maximum, minimum, and mean levels, and runoff for the Umpqua River near Elkton and the Smith River near Gardiner.

Mean monthly streamflow distribution for the Umpqua River near Elkton for water years 1906 through 2005 is represented in Table 2.A-3. Although this station is located upriver of the Umpqua River/Coastal Lakes sub-basins, it illustrates the seasonal variation in flow of the Umpqua River. The Umpqua River below Scottsburg and the lower reaches of the Smith River below North Fork are subject to Pacific Ocean tidal influences. About 83 percent of the annual discharge occurs between the months of November through April. Discharge in each month of August and September average about one percent of the annual amount.

[5] The Smith River gage no longer operates. Data are based on water years 1966 to 1973.

Month	Umpqua River near Elkton	
	mean discharge (cfs)	percent of annual
October	1,852	2
November	6,872	8
December	13,380	15
January	15,750	18
February	14,810	17
March	12,040	14
April	9,511	11
May	6,512	7
June	3,710	4
July	1,711	2
August	1,173	1
September	1,194	1
Total	**88,515**	**100**
Source: USGS water resource data for water years 1906-2005		

Table 2.A-3: Mean monthly discharge and the percent of annual discharge from 1906 to 2005 for the Umpqua River near Elkton.

<u>Flooding</u>
Periodic flooding has occurred in Reedsport and Gardiner during periods of large flows in the Umpqua River coupled with high tides. Major flooding in the City of Reedsport has been alleviated by construction of a dike by the Corps of Engineers and pumps used by the City to remove water. At times when high flows in Scholfield Creek coincide with high tides and flood stages in the Umpqua River, minor flooding occurs within Reedsport. Flooding of the business district of Gardiner occurs frequently, as that community is unprotected. For example, high tides and peak flows in 2005 produced flood water in Reedsport and Gardiner. However, Reedsport was able to prevent water from entering the town by use of the dike and pumps while Gardiner was flooded.

Table 2.A-4 shows recorded North Umpqua River flood levels since 1906 measured at the Umpqua River near Elkton station where flood stage is reached at a height of 33 feet. Most of the flood history shows peak events in November through February. Two exceptions were a large flood at the end of October in 1950 and another smaller flood in early March. Recorded floods were generally higher before 1975 with the largest event occurring in December 1964 when the river was nearly 19 feet above flood level. This storm event brought high rainfall that fell on deep accumulated snow in the Cascades causing rapid snowmelt and large-scale, widespread flooding throughout much of the Umpqua Basin. Data show floods occurred 22 times (in 20 different years) in nearly 100 years of data. There were also two occurrences in December of 1956 and 1957 where the river flood gage was even with the flood level of 33 feet.[6]

[6] The measurement in December 1956 is based on estimated data.

Umpqua River near Elkton gage			
Date	**Height above flood stage (ft)**	**Date**	**Height above flood stage (ft)**
Nov 23, 1909	6.48	Jan 17-18, 1971	10.63
Feb 21, 1927	7.96	Mar 3, 1972	4.35
Dec 31, 1942	8.10	Jan 15, 1974	11.20
Jan 7, 1948	4.80	Jan 8, 1976	0.24
Oct 29-30, 1950	11.20	Dec 6, 1981	6.18
Jan 19, 1953	10.00	Feb 17-18, 1983	4.53
Nov 23, 1953	9.40	Feb 13,1984	2.90
Dec 22, 1955	12.60	Feb 23, 1986	3.07
Nov 23, 1961	7.10	Nov 18-19, 1996	5.41
Dec 22-23, 1964	*18.95*	Dec 7-8, 1996	6.42
Jan 4, 1966	0.40	Dec 30-31, 2005	6.59
Source: USGS National Water Information System and Douglas County Flood Crest History from the Douglas County website last updated March 15, 2006.			

Table 2.A-4: Flood history measured at the Umpqua River near Elkton stream gage. Gage floods at 33 feet.

Quality

Water quality and quantity affect the use of water. The quality of water in the mainstem Umpqua River and many of its tributaries does not always meet state standards for all parameters (see **Error! Reference source not found.**). Failure to meet a standard may vary by season due to changes in quantity of flow, as well as other seasonal changes.

Oregon Water Quality Index[7]

"The purpose of the Oregon Water Quality Index (OWQI) is to improve understanding of water quality issues by integrating complex data and generating a score that describes water quality status and evaluates water quality trends," (Cude 2001). While it is not a comprehensive assessment of water quality for any specific use, the index aids in the assessment of water quality for recreational uses (i.e. fishing and swimming), and the goal of the index is to assess water quality as it relates to fish. For a complete description of the index and how it was developed and used, refer to *Oregon Water Quality Index: A Tool for Evaluating Water Quality Management Effectiveness* (Cude 2001).

The Oregon Water Quality Index is a single number that expresses water quality by integrating measurements of the following eight water quality variables collected at ODEQ monitoring stations:

[7] Discussion in this section is based largely on the Oregon Water Quality Index Report for the Umpqua Basin Water Years 1986-1995 (Cude). However, current index values and updates to the discussion are from the most current Oregon Water Quality Index Summary Report Water Years 1996-2005.

- temperature
- dissolved oxygen (percent saturation and concentration)
- biochemical oxygen demand
- pH
- total solids
- ammonia and nitrate nitrogen
- total phosphorus
- bacteria

Index values are then used to determine trends in water quality for each site. However, the index does not consider changes in toxic concentrations, habitat, or biology of the streams.

Average Oregon Water Quality Index results for the summer, and for the rest of the year, as well as the minimum for the season for the Umpqua River near Elkton (WY 1996 - 2005) are listed in Table 2.A-5. Although this site is upriver from the Umpqua River/Coastal Lakes sub-basin, it gives an indication of the overall water quality in the lower portion of the main Umpqua River. The most current index values at this site are the same for all seasons, which is considered "good" in the ODEQ rating scale, and there is no significant trend in water quality at this site.

Site	River mile	Summer average (June – Sept)	Fall, winter, and spring average (Oct – May)	Minimum seasonal average	Rating[1]
Umpqua River at Elkton	48.4	87	87	87	good

[1] Based on minimum seasonal average.
Scores: very poor 0-59; poor 60-79; fair 80-84; good 85-89; excellent 90-100.
Source: Oregon Water Quality Index Summary Report Water Years 1996-2005.

Table 2.A-5: Oregon Water Quality Index rating for the Umpqua River near Elkton for water years 1996-2005.

<u>Point and Non-point Source Pollution</u>
Point-source pollution comes from an identifiable point of discharge into the water. Non-point source pollution includes where the primary sources of pollution cannot be identified as coming from a specific site. These factors may include water temperature, erosion and sedimentation, bacteria, and other items. Point source and non-point source pollution problems identified in the Umpqua Basin and Tenmile Watershed TMDL assessments and other monitoring data from the area are summarized below.

Bacteria
The lower portions of the Umpqua River, Scholfield Creek, Smith River, and Winchester Creek failed to meet the State standard for bacteria (fecal coliform). All of these streams empty into the estuary at the mouth of the Umpqua River. The estuary is important for commercial and sport shellfish harvest. Since shellfish filter large volumes of water and accumulate high levels of bacteria that can be a health concern to humans, the State standard in these areas is more restrictive than in other areas further upstream that lack shellfish. The Umpqua River also exceeded the State standard for fecal coliform and *E. coli* bacteria further upriver between miles 25 and 109 during high flows for water

contact recreation use, and throughout the year for shellfish growing. Bacteria levels tend to increase further upriver compared to the estuary.

Although there are several point-sources of bacteria from wastewater treatment plants in the Umpqua River and the estuary, ODEQ determined that these usually meet standards for discharge, thus not contributing significantly to the higher bacteria levels measured. However, the Reedsport wastewater treatment plant releases partially treated or diluted sewage when its capacity is exceeded during heavy rainfall. There is a significant increase in median concentrations of fecal coliform from upstream to downstream of the plant. ODEQ concluded in the Umpqua Basin TMDL that "based on the discharge monitoring reports from the Reedsport treatment plant, it seems likely that a large portion of this load increase is due to the release of partially treated or diluted sewage."

There are no point sources of discharge in the Smith River and thus exceedence of the standards is from non-point sources. Most of the sources in the Umpqua River and estuary are also primarily attributed to accumulated non-point sources. Potential non-point fecal bacteria sources include wildlife, livestock waste, failing residential septic systems, pets, and illegal discharges. Fecal bacteria can be deposited directly into a water body or transported into water bodies by runoff or subsurface flow. Refer to the Wastewater permits section for more on bacteria related to wastewater treatment plants.

Identification of specific non-point sources for all of these streams has not been done at this time. However, in 2004 the Smith River Watershed Council commissioned a study in Smith River and the lower Umpqua River to identify bacteria sources using DNA analysis. Over the course of the study, the overall bacteria levels were generally lower than the State standard. The findings showed the largest proportions of contamination averaged over all sites and flow conditions were from wildlife (70-80 percent) and domesticated animals (15 percent). The contribution from humans was less than one percent.

Most of the sampling occurred during a period with an absence of larger storm events that typically occur more infrequently, but that likely contribute to the highest runoff. Bacteria levels upriver are highest during peak flows.[8] It is unclear whether the relative inputs of bacteria from different sources would change during peak flow events, or whether all sources would increase proportionately. The ODEQ would like to see additional information to definitively identify the predominant sources of bacteria during peak flows when the overall bacteria levels are beyond the standard for water contact recreation.

The lower Smith River and Scholfield Slough show bacteria concentrations similar to those further downstream on the Umpqua River indicating there is probably mixing with

[8] According to the Umpqua Basin TMDL, bacteria concentrations on the Umpqua River at Elkton correspond well with flows, while the Gardiner site seems to mimic rainfall, and the Douglas County Pier site showed consistent results throughout the flow or rainfall period. The lack of discernable pattern is attributed to many factors including the preceding and following storms, variability of rainfall, tidal influence, and a reported sewage overflow at the Reedsport wastewater treatment plant.

Umpqua River waters at these sites. However, higher concentrations upstream show that both tributaries discharge into the estuary at concentrations above the shellfish standard. Although some of the sampling for the Smith River study occurred in the lower Umpqua River, no DNA sampling further upriver or in other tributaries of concern has been done.

Samples from the upper portions of Smith River (RM 77.5 to 88.7) failed to meet State biological criteria standards; however the number of samples was insufficient for listing. Additional monitoring is needed to determine if the biological criteria is impaired in Smith River.

The Umpqua Basin TMDL has assigned load allocations to point and non-point sources of bacteria. The sources of bacteria addressed in the TMDL were summarized in the following way:

> Studies by DEQ during storms indicated that forested lands do not contribute any significant bacteria load to streams in the Umpqua Basin, but agricultural, rural residential, and urban lands, as well as possible turbulence releasing bacteria from stream sediments were the sources of bacteria. Since relative contributions could not be determined from the data, the load allocations for non-point sources were allocated to all non-point sources in the basin.

The Umpqua Basin TMDL includes a loading capacity calculation for each of the listed streams in the sub-basins. The calculation determines the percent of fecal coliform reduction in each stream necessary to meet the State water quality standard for shellfish. Table 2.A-6 lists the streams and their necessary reductions during the wet season only.

Stream	Percent fecal coliform reduction
Umpqua River	54
Smith River	50
Scholfield Slough	80
Winchester Creek	86
Source: Umpqua Basin TMDL	

Table 2.A-6: Percent fecal coliform reduction necessary on each stream to meet the State fecal coliform water quality standard for shellfish.

Temperature

Water temperature is a major factor affecting water quality. It effects concentrations of other constituents, as well as the chemical and biological interaction of these constituents. Thus, it is a primary factor in determining the types of organisms able to inhabit a body of water. Salmonids are among the most sensitive fish, therefore ODEQ standards have been set based on salmonid temperature tolerance levels.

The temperature standard varies throughout the Umpqua Basin according to the habitat area and the species that use that area. The standard is based on a seven-day average maximum (7DAM) temperature to avoid short-duration spikes in temperature that likely have minimal impacts on salmonids. Throughout the Umpqua River/Coastal Lakes sub-basins, the maximum desirable water temperature is approximately 55°F during spawning periods (Oct 15 through May 15), and 64°F during migrating and rearing periods in the summer months (May 15 through Oct 15).[9] Although these are desirable temperatures based on healthy salmonid populations, there is no evidence that all of these streams ever met these standards.

There are 25 streams (or stream portions) that do not currently meet the State standards for temperature within the Umpqua River/Coastal Lakes sub-basins. These listings are shown in Table 2.A-7 with the time of year that they exceed the standard.

[9]Spawning use in parts of the main Umpqua River and its tributaries in the sub-basin is from October to May; however, most of the main Umpqua River is not used for spawning. In these areas, the higher temperature of 64°F would be the standard throughout the year.

Stream	Listed segment (river mile)	Season
Buck Creek	0 to 0.7	summer
Bum Creek	0 to 2.3	summer
Camp Creek	0 to 20.5	non-spawning
Carpenter Creek	0 to 1.3	non-spawning
Cedar Creek	0 to 3.0	non-spawning
Cleghorn Creek	0 to 2.8	Sept 15 to May 31
Fiddle Creek[1]	0 to 13.4	non-spawning
Franklin Creek	0 to 4.5	non-spawning
Halfway Creek	0 to 1.2	non-spawning
Herb Creek	0 to 2.7	summer
Johnson Creek	0 to 4.3	non-spawning
Little Mill Creek	0 to 4.1	non-spawning
Middle Fork North Fork of Smith River	0 to 4.6	non-spawning
N Branch of Middle Fork of North Fork Smith	0 to 1.0	summer
North Fork Smith River	0 to 31.8	non-spawning
Russell Creek	0 to 2.2	summer
Smith River	0 to 88.5	non-spawning
Soup Creek	0 to 1.4	summer
South Fork Smith River	0 to 7.0	non-spawning
South Sister Creek	0 to 8.6	summer
Umpqua River	0 to 109.2	non-spawning
Unnamed (tributary to Little South Fork Smith River)	0 to 1.4	Sept 15 – May 31
Unnamed (tributary to Middle Fork North Fork Smith R.)	0 to 1.6	non-spawning
West Branch North Fork Smith River	0 to 3.4	non-spawning
West Fork Smith River	0 to 15.4	non-spawning

[1] These streams are outside the Umpqua Basin; thus are not addressed by the Umpqua Basin TMDL. Only the first mile of Fiddle Creek is in Douglas County; the rest is in Lane County.
Source: Oregon DEQ 2004/2006 Integrated Report.

Table 2.A-7: Stream segments that exceed State water temperature standards (Umpqua River/Coastal Lakes sub-basins).

The entire Umpqua River and the Smith River up to river mile 88 exceed the temperature standard of 64°F throughout the non-spawning portion of the year, predominantly the summer months when salmonids are rearing and migrating in these systems. Most of the remaining tributaries also exceed the standard in the non-spawning or summer season. Two tributaries in the Smith River drainage, Cleghorn Creek and an unnamed creek, exceed the standard of 55°F during the winter spawning period only (from Oct 15 to May 15). Although Soup Creek is listed as exceeding the temperature standard, residents are discussing this listing with ODEQ since they have observed it dries up in the summer during some years.

Data from temperature monitoring stations managed by Douglas County and U.S. Geological Survey (USGS) gages, and sampling by the ODEQ and the Partnership for the Umpqua Rivers Watershed Council, and other agency sources are the basis for the following discussions of water temperature conditions.

The Partnership for the Umpqua Rivers commissioned a temperature study (Smith 2001) in the Umpqua River sub-basin in 2000. Results of temperature monitoring from that study showed that Lake Creek above Loon Lake exceeded the State standard continuously from the end of July to the middle of September. Scholfield Creek exceeded over 48 percent of the time for the same period, although it is not listed as water quality impaired for temperature. Four different sites monitored on Mill Creek exceeded the standards over 90 percent of the time.

Figure 2.A.2 illustrates representative bulk water temperature conditions in the summer of 2000 from the Umpqua River above Little Mill Creek, located downriver of Scottsburg at approximately river mile 27. For comparison, Figure 2.A.3 shows the same information from the Umpqua River below Paradise Creek, located approximately thirteen miles further upriver between Scottsburg and Elkton at approximately river mile 40. The reference line is the ODEQ standard (64°F) for the summer months.

Water temperatures vary with local ambient conditions, amount of direct solar radiation, and proportion of ground water flowing into the stream. The effect of ambient air temperature on stream temperature is reflected in Figure 2.A.2 and Figure 2.A.3 where maximum and minimum 7DAM temperatures occur on the same days at each location. In addition, most of the Umpqua River within this sub-basin is influenced by tidal fluctuations twice per day; when cooler water flows upriver for relatively short periods of time even during the warmest months.

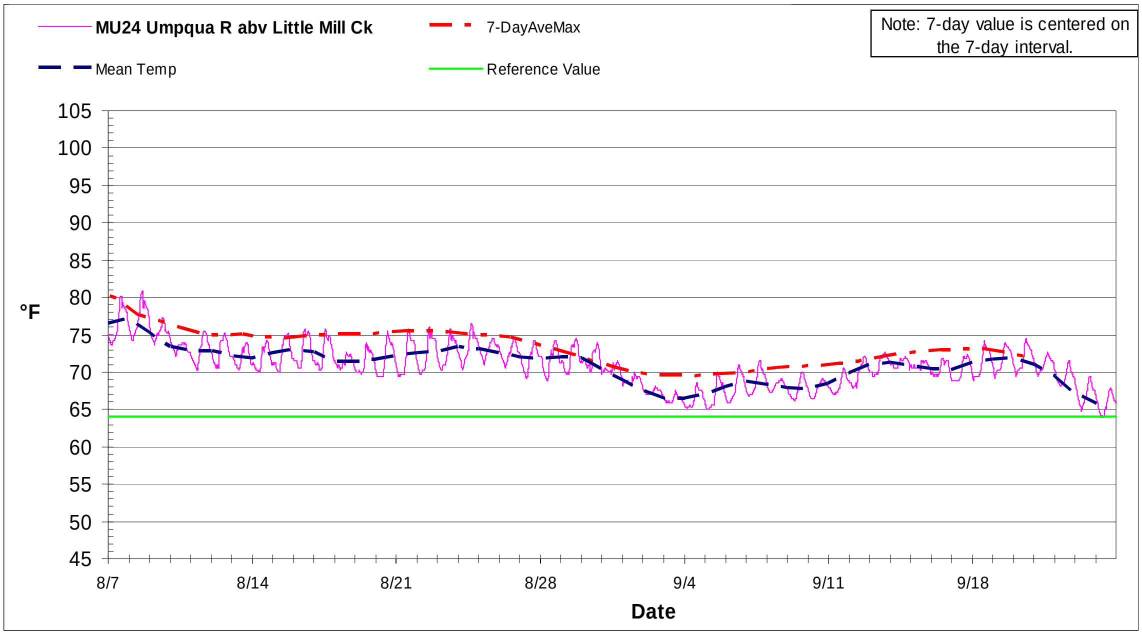

Figure 2.A.2: Summer 2000 temperature data for the Umpqua River above Little Mill Creek (RM 27) relative to the State standard of 64°F (provided by K. Smith, InSight Consultants).

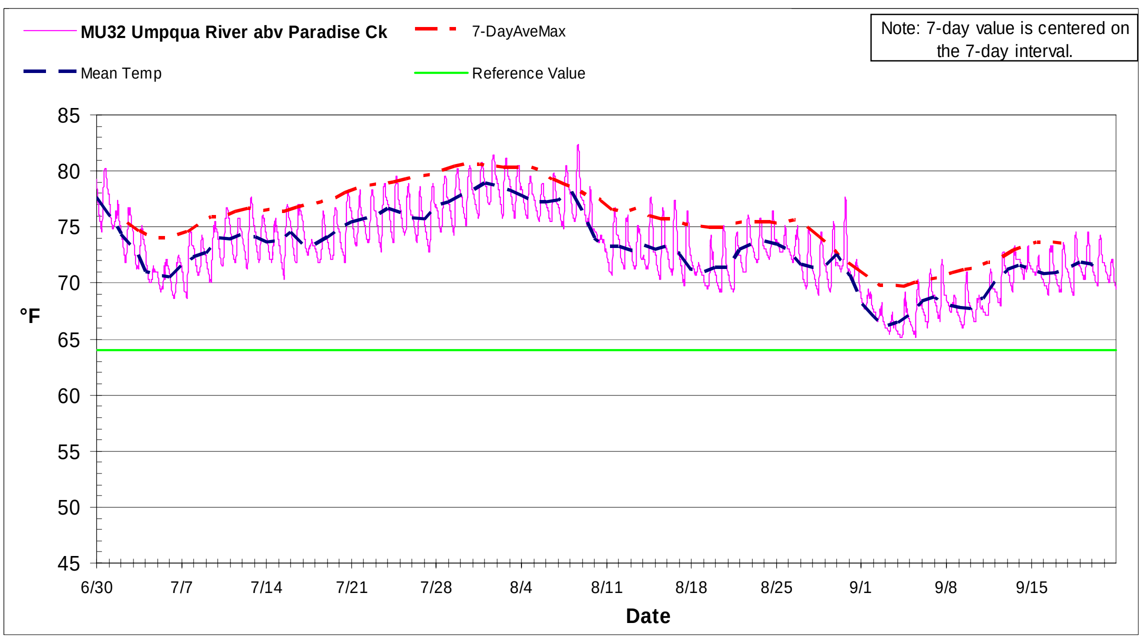

Figure 2.A.3: Summer 2000 temperature data for the Umpqua River above Paradise Creek (RM 40) relative to the State standard of 64°F (provided by K. Smith, InSight Consultants).

Stream temperature at a particular point is a function of many local factors that include exposure to solar radiation, longwave heating from the local environment and groundwater interaction. Water's susceptibility to change temperature is a function of both the volume and velocity of flow. Stream temperatures usually follow a warming trend as the distance from the headwaters (and the corresponding stream volume) increases. Stream temperatures typically increase from about 52°F at the headwater source, to the ambient air temperature of downstream locations. Temperature data from within the Umpqua Basin indicates that most streams longer than seven miles will exceed the State standard of 64°F. Streams that are exposed to direct sunlight can exceed the standard in a shorter distance. Temperatures may also vary within a given area on the river with cooler temperatures in the deeper water. Isolated points of upwelling ground water may provide some thermal refuge for aquatic life.

In most tributary streams, water quality is generally good except for water temperature. Removal of riparian vegetation that provides shade, and channel modification can cause local elevated temperatures. The Umpqua River sub-basin temperature study found that tributary streams tended to be in the order of 10°F cooler than the lower Umpqua River with smaller streams typically cooler than larger streams. Figure 2.A.4 illustrates temperature data during the summer of 2000 for Mill Creek, one of the larger tributaries to the Umpqua River. Mill Creek temperatures were about 3°F cooler than stream temperatures measured at the Umpqua River above Little Mill Creek.[10] Actual measured temperatures represented by the pink line on the graph exceeded the State standard (64°F) for most of the summer, and 7DAM temperatures did not cool down to meet the standard until the end of the measured period in late September.

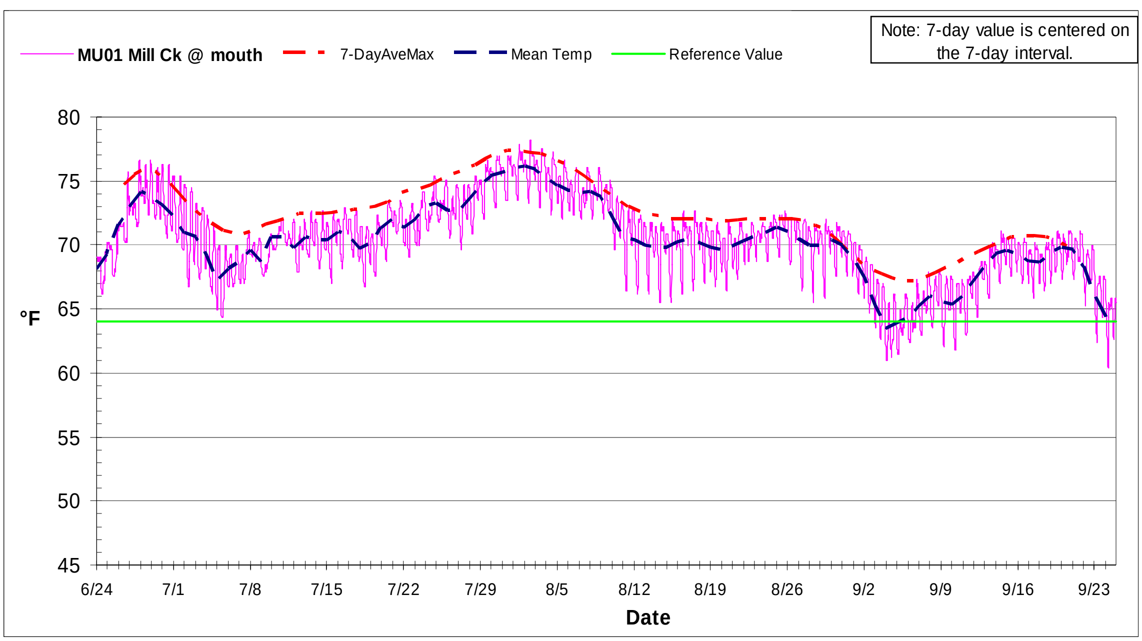

Figure 2.A.4: Summer 2000 temperature data from the mouth of Mill Creek compared to the State standard of 64°F (Smith 2001).

[10] The temperature measuring site at the Umpqua River above Little Mill Creek is approximately three miles upriver from the mouth of Mill Creek; thus the actual temperature of the Umpqua River at Mill Creek may be slightly higher.

The Umpqua Basin TMDL requires that human-induced sources of heat to streams not cumulatively increase a stream's temperature by more than 0.3°C (0.5°F). This allocation is distributed evenly between point sources, non-point sources, and a margin of safety; thus each type of pollution is not allowed to increase the stream's temperature by more than 0.1°C (0.17°F).

Riparian vegetation, stream morphology, hydrology, climate, and geographic location influence stream temperature. Of these influences, riparian condition, channel morphology and hydrology are affected by human activities (ODEQ 2006). The TMDL uses riparian condition as the measurable characteristic to determine human non-point source impacts on temperature since changes in channel morphology and hydrology are more difficult to quantify and restore.

The TMDL analyzed a range of stream types throughout the basin. The current total solar heat load and the portion of the load attributed to non-point source human-activities were modeled on each stream. The results show that there is generally little impact from riparian losses on the largest streams but smaller streams can be severely impacted. The results of the modeling found only 0.5 percent of the current solar heat load to the main Umpqua River is from anthropogenic non-point sources, while the North Fork Smith River is attributed with 60 percent. The West Fork Smith River and the Smith River each resulted in over 50 percent of their heat load induced by non-point source human activity as well. Smith River and its two tributaries mentioned here showed the highest proportions of solar heat attributed to non-point source human activities in the basin.

To insure that non-point heat sources do not elevate stream temperature beyond the allocation, shade loss on streams from removal of riparian vegetation will be limited. Each stream is given an optimal shade amount based on the stream width and vegetation. Activities that remove shade will be monitored to meet the streams shade potential. Refer to the Umpqua Basin TMDL for more detailed information.

Point sources were found to have little effect (<1 percent) on the overall heat loading of streams in the Umpqua Basin. One exception was the North Umpqua Hydroelectric Project that has greatly reduced streamflow in the North Umpqua River. The lower flows are believed to be the primary cause of high temperatures in not only the North Umpqua River but downstream throughout the Umpqua River to tidal influenced areas. The recent FERC relicensing of the hydroelectric project now requires higher minimum streamflow that should alleviate the elevated temperatures downstream (ODEQ 2006). Other point sources have also been allocated a cumulative 0.1°C increase on any given stream. Refer to the wastewater permits section for details of this allocation.

Dissolved Oxygen

Salmonid eggs and smolts are sensitive to dissolved oxygen levels. When levels drop too low for even short periods of time, eggs, smolts, and other aquatic organisms will die. The amount of oxygen that is dissolved in water will vary depending upon temperature, barometric pressure, flow, and time of day. Both cold water and higher barometric pressure dissolve more oxygen than warm water, and low pressure. In addition, flowing water contains more dissolved oxygen than still water. Aquatic organisms produce oxygen through photosynthesis and use oxygen during respiration. As a result, dissolved oxygen levels tend to be highest in the afternoon when algal photosynthesis is at its peak, and lowest before dawn after organisms have used oxygen for respiration during the night.

There are no streams listed as water quality impaired for dissolved oxygen in the sub-basin. However, results from the Soil and Water Conservation District of samples taken in 2002 to 2004 indicate consistently low dissolved oxygen levels in the lower portion of Scholfield Creek indicating a potential problem. Although Scholfield Creek is not listed as water quality impaired for temperature, the results from monitoring during the 2000 summer and early fall season showed elevated temperatures nearly half the time. This may be contributing to lower dissolved oxygen levels. According to the ODEQ records, the sample site was determined to be within estuarine waters where these temperature standards are not applicable.

Toxics

A number of streams in the sub-basin are a “potential concern” for toxics. These streams have been sampled and results have not met State water quality standards but the number of samples is insufficient to determine if they are water quality impaired. They are not currently on the 303(D) list, but warrant additional monitoring. Table 2.A-8 shows the streams that are of “potential concern with insufficient data” where toxic levels may affect aquatic life or human health throughout the year.

Stream	River miles	Toxic	Concern
Halfway Creek tributary	0 to 1.2	alkalinity	aquatic life
Middle Fork North Fork Smith R	0 to 4.6	alkalinity	aquatic life
Mill Creek	0 to 8.8	alkalinity	aquatic life
North Fork Smith River	0 to 31.8	alkalinity	aquatic life
Scholfield Creek	0 to 16.3	alkalinity	aquatic life
	0 to 16.3	iron	aquatic life & human health
	0 to 16.3	manganese	human health
Smith River	0 to 88.8	alkalinity	aquatic life
	0 to 88.8	iron	aquatic life & human health
South Fork Smith River	0 to 7.0	alkalinity	aquatic life
Umpqua River	0 to 109.3	alkalinity	aquatic life

Table 2.A-8: Streams with potential concern where samples failed to meet State standards but sample sizes were insufficient for listing.

Streams that potentially do not meet alkalinity standards may be high in $CaCO_3$, creating health problems for aquatic life. Toxic levels that may have effects on human health are of particular concern where residents use the stream as a primary water source as well as regularly consume fish from the stream. These streams potentially include Scholfield

Creek where high iron and manganese levels were found; and Smith River where elevated iron levels were sampled. Further samples are needed to definitively determine the water quality in these streams.

Other Water Quality Concerns

The maximum upstream tidal effect in the Umpqua River appears to be about river mile 24, at the point where Mill Creek discharges into the river. From July to October, water in the Umpqua River downstream of Dean Creek at river mile 16.5, has been noted by the US Geological Survey as being "too salty for domestic or most agricultural uses."

Dissolved solid concentrations are typically low and sediment concentrations high during winter storm events in streams of western Douglas County. This is also typical of western Oregon coastal streams.[11]

Wastewater Permits

ODEQ manages a wastewater permit program that identifies point-sources of wastewater with potential serious water quality or public health impacts. It requires that those facilities obtain and comply with a wastewater discharge permit. Permit conditions generally include effluent limits; monitoring standards; compliance conditions to improve operation; special operating conditions; and other administrative requirements such as prompt reporting of spills.

Since 1973, permits for discharges to surface waters are issued under the National Pollutant Discharge Elimination System (NPDES). The primary purpose of these permits is to insure that wastewater discharges do not cause harm to the receiving waters or endanger public health. Wastewater discharges that affect land quality and/or ground water are regulated under Water Pollution Control Facilities (WPCF) permits. Their primary purpose is to protect public health and ground water.

General permits are issued when an individual permit is not necessary to adequately protect water quality, and there are several minor sources or activities involved in similar operations that are discharging similar types of waste. These general permits can be to surface water discharges or ground water/land discharges. Individual and general wastewater permits to surface water issued in the sub-basins are discussed in this section. Table 2.A-9 is an inventory of waste discharges in the Umpqua River/Coastal Lakes sub-basins derived from the ODEQ Wastewater Permit database. Permits for discharges that may affect ground water are discussed in the ground water quality section.

[11]D.A. Curtiss, Collins, C.A., Oster, E.A. 1984. Water-Resources of Western Douglas County, Oregon. U.S. Geological Survey Water-Resources Investigations Report 83-4017.

Source	Receiving stream	Class	Waste type
American Bridge Company	Umpqua River	minor	stormwater
Brandy Bar Landing, Inc.	Umpqua River	minor	sewage
Fred Wahl Marine Construction, Inc.	Umpqua River	minor	stormwater
International Paper Company	Umpqua River	minor	stormwater
Douglas County Public Works (Reedsport Landfill)	Scholfield Creek	minor	wastewater/ stormwater
H.G.E. Inc. Architects, Engineers, Surveyors & Planners	Scholfield Creek	minor	stormwater
LTM, Incorporated	Umpqua River	minor	stormwater
Nelson, Leslie C.O. DBA	Winchester Creek	minor	stormwater
Reedsport , City of	Umpqua River	minor	stormwater
Reedsport, City of	Umpqua River	minor	wastewater/sewage
Scholfield Development LLC	Scholfield Creek	minor	stormwater
Scholfield Properities, Inc.	Providence Creek	minor	stormwater
Westwood Lumber Co., Inc.	Smith River	minor	stormwater
Westwood Lumber Co., Inc.	Frantz Creek	minor	wastewater
Westwood Lumber Co., Inc.	Butler Creek	minor	stormwater
Winchester Bay Sanitary District	Umpqua River	minor	sewage
Source: ODEQ Wastewater Permits database accessed 10/20/06.			

Table 2.A-9: Waste discharge permits in the Umpqua River/Coastal Lakes sub-basins.

Point-source waste discharges are concentrated near Reedsport and include minor industrial sources such as stormwater and wastewater discharge. There is no longer a major industrial source since International Paper's Gardiner plant discontinued operation, although a permit is still held in its name for discharge into the Pacific Ocean. Minor domestic discharges include sewage treatment facilities at Winchester Bay and Reedsport and from Brandy Bar Landing, Inc. Several other small sewage permits are held on Scholfield Creek, Mill Creek, and Smith River, but are considered to have minimal impacts due to the season or amount of discharge.

Brandy Bar Landing discharges effluent into the Umpqua River at about 7.5 miles upstream of shellfish growing waters. According to ODEQ, it's loading accounts for much less than one percent of the total load and would not cause or contribute to water quality standard violations in the Umpqua estuary.

The Reedsport wastewater treatment plant releases partially treated or diluted sewage when its capacity is exceeded due to inflow and infiltration caused by heavy rainfall. There is a statistically significant increase in fecal coliform concentrations measured upstream and downstream of the plant. The Umpqua Basin TMDL states that based on the discharge monitoring reports from the Reedsport treatment plant, it is likely that much of this increase is due to the release of partially treated or diluted sewage. The Umpqua Basin TMDL will require bacteria concentrations of the water immediately surrounding the outfall of the Reedsport wastewater treatment plant to meet the shellfish water quality standard for bacteria.

The Umpqua Basin TMDL states that the Winchester Bay wastewater treatment plant releases partially treated sewage during the summer months because of increased use. The outfall is on the Douglas County Pier and is approximately one mile from the jetty triangle commercial oyster beds. Despite these releases, the surrounding monitoring sites did not violate the shellfish standard during the summer months. The Umpqua Basin TMDL will also require bacteria concentrations of the water immediately surrounding the outfall of the Winchester Bay wastewater treatment plant to meet the shellfish water quality standard for bacteria.

The Reedsport Landfill operated by Douglas County does not discharge directly into shellfish growing waters. The dilution in Scholfield Creek is considered sufficient to insure that effluent concentrations at the recreation contact standard do no cause or contribute to violation of the shellfish standard in the estuary. The facility is not expected to contribute to exceedence of the bacteria standard when in compliance with its permit since it only discharges during significant rainfall events.

Effluent discharges from eleven wastewater treatment plants throughout the Umpqua Basin will be required to meet temperature limits during the non-spawning season (typically summer months). These limits are established in the Umpqua Basin TMDL and are incorporated with permit renewals. Limits are based on streamflow, stream temperature, and amount of discharge. The intent is to maintain the cumulative temperature increase from point sources to less than 0.1°C during the non-spawning months to help meet the temperature standards on streams throughout the basin. Although none of the restrictions apply to plants located within the Umpqua River or Coastal Lakes sub-basins, restrictions on plants located upriver are expected to improve stream temperatures downstream including within the Umpqua River and Coastal Lakes sub-basins.

Surface Water – Lakes and Reservoirs

Quantity

Several lakes lie along the coast within Douglas County; Tahkenitch, Elbow, Threemile, Edna, and Clear lakes. Portions of Siltcoos and Eel lakes also are included within County boundaries. The primary uses of these lakes are for recreation, aesthetics, and water supply for lakeshore residences. Most of the lakes are natural, although Siltcoos, Clear, and Tahkenitch lakes have been altered by construction of small dams at their outlets for dedicated storage and control of the lake water surface elevation. The storage in Siltcoos Lake (15,070 acre-feet) and in Tahkenitch Lake (11,000 acre-feet), is dedicated to the former paper mill at Gardiner. Siltcoos and Tahkenitch lakes have been identified as containing “potentially independent” populations of coho salmon (*Oncorhynchus kisutch)*.

Potentially independent populations were historically self-sustaining, but were probably also demographically influenced by neighboring independent populations.[12]

The waters of Clear Lake and Lake Edna have been set aside for the exclusive use of the City of Reedsport by a State Engineer's Order dated October 4, 1940. No use of the water from Lake Edna has occurred to date, nor have any facilities been constructed.

Water Resource District policy limits use of water from other lakes within this portion of the County for the following: domestic purposes, irrigation of small gardens, recreation, and aquatic life needs. Loon Lake is the only other large lake located in the sub-basin. It is located within the Mill Creek drainage, a tributary of the Umpqua River converging at approximately river mile 24. Surface area and volume of larger lakes in the sub-basin are listed in Table 2.A-10.

Name	Surface area (acres)	Volume (acre-ft)
Clear Lake	310	16,700
Eel Lake	350	12,500
Siltcoos Lake	(summer) 2,500	(summer) 37,000
Tahkenitch Lake	1,500	20,000
Threemile Lakes (North & South)	65	770
North Tenmile Lake	1,000	13,000
Loon Lake	270	16,000
Lake Edna	40	1,100

Table 2.A-10: Surface area and volume of larger lakes in the Umpqua River/Coastal Lakes sub-basin.

In 1980, the USGS, in cooperation with the City of Reedsport, published the report "Evaluation of water-supply sources in the Reedsport area, Oregon" (Rinella et al. 1980). The following material is taken from that report:

> “The water supply for the Reedsport area is obtained from Clear Lake, a 310 acre coastal lake that contains 16,600 acre-feet of water at full pool level. The lake receives about 6,000 acre-feet of water annually from runoff and direct precipitation, and it loses about 600 acre-feet by evaporation. The 2,100 acre-feet diverted annually for public supply is about two-thirds of the 'usable storage capacity' of the lake volume above the water-supply outlet pipe."

[12] Coho Assessment Synthesis: Part 1, Draft, Jay Nicholas, Bruce McIntosh and Ed Bowles, Oregon Watershed Enhancement Board and Oregon Department of Fish and Wildlife, Salem, Oregon., January 31, 2005

Quality

A number of water quality investigations have been conducted in the sub-basin, most by the USGS. The 1984 USGS report "Water Resources of Western Douglas County, Oregon" summarizes water resource conditions as follows:

> "Water in the lakes in western Douglas County is soft and contains small concentrations of dissolved solids. Loon Lake, unlike other lakes in the area, has an abnormal oxygen demand in the metalimnion, and does not seem to be dependent entirely on the phosphorus nutrient to increase its algal production. Because of the fairly abundant algal growth during the summer months and the abundance of aquatic weeds, Tahkenitch Lake is the most active in terms of biological productivity. Elbow Lake is considered to be similar to Tahkenitch Lake based on the one spring sampling and the reported abundance of aquatic weeds."

Tahkenitch and Siltcoos lakes have eutrophication problems and are listed as water quality impaired for aquatic weeds or algae. According to ODEQ, the Atlas of Oregon Lakes documents extensive growth of Elodea densa, a non-native aquatic plant and a “B” designated weed with the Oregon Department of Agriculture. The plant dominates the macrophyte community and interferes with fishing, water contact recreation and the aesthetics in the lakes. Since the 1940's, repeated studies have been made by public agencies and academic groups of the problem, but no definitive solutions have yet been presented. Several techniques have been suggested such as deepening the lakes, bottom sterilization, and biological control. Small areas near resorts and private homes can be cleared by the use of weed harvesters and herbicides. Although the weeds present a nuisance to fishermen, residents, and resort owners, the water quality is not materially affected.

Tahkenitch and Siltcoos lakes are outside of the Umpqua Basin; thus water quality concerns in these lakes are not addressed in the Umpqua Basin TMDL. A draft TMDL assessment for the Siltcoos area that includes both lakes is expected in 2008.

Water quality in Clear Lake is especially important since it is the supply for the City of Reedsport and adjacent communities. The 1980 USGS report “Evaluation of Water Resources in the Reedsport Area, Oregon” concludes:

> "The water of Clear Lake is of the sodium chloride type and is low in dissolved solids and nutrients. The water is considered to be of good quality for public supply on the basis of biological and chemical constituents analyzed, which include trace elements, pesticides, and organic material."

According to ODEQ, Clear Lake is currently listed as impaired in the summer for chlorophyll a, dissolved oxygen, and pH based on a 1994 Clear Lake Limnological Survey. However, the current status lists that some of the pollutant criteria for these categories have been met. The effects from impaired dissolved oxygen and pH levels primarily impact fish and aquatic life, although pH levels can also impact water contact recreation. Impaired chlorophyll a levels can also affect the water supply, as well as fishing, aesthetics, and livestock watering.

The City of Reedsport commissioned a study approved in December, 2006 to amend the City's Water Facilities Plan (Kennedy/Jenks Consultants 2006). According to the amendment "rising turbidity levels due to algae and nutrient loading may eventually force the City to add filtration to the treatment plant." To address these concerns the City is considering several strategies to better protect the watershed for Clear Lake. These include the following:

- Preserving water rights for Clear Lake;
- Preparing a watershed management plan;
- Protecting Clear Lake from soil erosion that may cause accelerated nutrient loading;
- Improving control of watershed access; and
- Preparing an emergency response plan to address drought conditions or accidental contamination of Clear Lake.

Eel Lake is listed as water quality impaired for pH in the summer and turbidity throughout the year based on a 1994 Limnological Survey.[13] Similar to the effects of pH in Clear Lake, fish and aquatic life and water recreation are the likely uses that may be affected. Eel Lake meets some of the pollutant criteria for turbidity, which at high levels may impact both the water supply and fish. Eel Lake is also designated a "potential concern" for biological criteria based on samples in 1994 and 1995 that showed only 61 percent of the expected aquatic communities present (mostly macro invertebrates).

ODEQ has prepared a draft TMDL for the Tenmile Watershed that incorporates both Eel and Clear lakes (refer to Water Quality in the Introduction for more on TMDLs). The TMDL proposes to remove Eel Lake from the 303(d) list for pH based on continued pH monitoring from 1995 to 2004, but retain it as a "potential concern." According to the TMDL a detailed review of the additional data "...reveals that although elevated pH values were episodically recorded, they did not occur at durations long enough to meet the water quality limited listing criteria." The TMDL goes on to note that:

> "…in years where historic pH standard exceedences did occur during the summer months, elevated turbidity levels were documented during the previous winter period. This link between upland sediment (nutrient) delivery and subsequent pH response indicates that algae cycles may be occurring in response to sediment delivery. This algae response is likely an influencing factor on [the] lake pH. It is recommended that, because of the episodic occurrence of elevated pH, that Eel Lake be identified as a water body of Potential Concern."

[13] The northern extent of Eel Lake is within Douglas County. The rest is located in Coos County.

Ground Water

Ground water makes up approximately 95 percent of available freshwater resources statewide. According to the 2002 Oregon Water Quality Assessment (ODEQ 2003), 90 percent of all rural residents and a large portion of all Oregon residents rely on ground water for drinking water.[14] Industry and irrigation of agriculture and livestock are also dependent on ground water supplies. Ground water supplies base flow for most of the state's rivers, lakes, streams, and wetlands. Cool groundwater inflow effectively cools streams during the summer months, often providing critical thermal refuge areas for sensitive freshwater species. The magnitude of this effect depends upon the ratio of the groundwater inflow to the amount of surface flow.

The dominant use of ground water in Douglas County is as a primary and supplemental source or drinking water for rural residents. As surface water sources are used to capacity, residents are becoming more dependent on ground water resources. These demands are expected to increase as the population of the County increases especially in rural areas. In the Coastal Lakes / Umpqua River sub-basins, approximately 374 wells are identified as domestic use wells, while 5 are for community use and 2 for irrigation use.

Quantity

Assessment of ground water conditions is based on the USGS report "Evaluation of water-supply sources for the Reedsport area, Oregon", (Rinella, et al. 1980) and on current well data from the Oregon Department of Water Resources.

Within the sub-basin there are three major hydrogeologic units, or aquifers. Apart from a narrow band of coastal deposits and fluvial deposits along the valleys of major streams, the sub-basins are underlain by a thick layer of marine sedimentary formations. For example, an oil and gas test well drilled in the Spencer Creek vicinity in the Smith River drainage penetrated about 9,000 feet of marine sandstone, siltstone, and shale.

According to the USGS report, yields of water wells drilled in these marine sedimentary formations prior to 1980 ranged from a few gallons per minute (gpm) to about 20 gpm. Well depths ranged from 32 to 560 feet. Between 1955 and 1980, 22 of 479 wells drilled in these formations were reported to be dry or to provide insufficient quantities for domestic use. Most rural domestic users derive adequate ground water supplies for domestic use including lawn and garden watering. However, due to low well yields in some areas, it is not uncommon for domestic users to install storage tanks as part of their supply system.

The 1980 USGS report states the following in regard to the coastal deposits:

> "The only ground water source with potential to supply the needs of the Reedsport area is the dune sand-marine aquifer between U.S. Highway 101 and the coast. The aquifer is estimated to contain at least 12 billion gallons of water and to receive annual recharge from precipitation equivalent to 10

[14] Over 90 percent (2,459) of Oregon's public water supply systems get their water exclusively from ground water. Over 400,000 residents get their drinking water from individual home water supply wells.

million gallons per day. Wells in the most productive part of the aquifer could be expected to yield a few hundred gallons per minute."

Wells developed in the fluvial aquifers are located in gravel deposits along stream channels, and are generally shallow. Well yields are generally good, since most of these wells are hydraulically connected to the associated stream.

Table 2.A-11 lists the number of wells by water yield in three different areas of the sub-basins. The majority of the wells in all three areas produce over ten gallons per minute indicating an abundance of ground water in most of these areas, although all three areas have a large proportion of wells with one to five gallons per minute as well.

Area	Depth range (feet)	Number of wells by water yield (gpm)			
		<1	1 to 5	> 5 to 10	>10
Coastal	31 to 500	3	17	9	32
Umpqua River	10 to 540	5	51	44	87
Smith River	33 to 575	7	50	31	59
Source: Oregon Water Resources Department (well data from 1955 to 2007).					

Table 2.A-11: Number of wells by water yield in different areas of the Umpqua River/Coastal Lakes sub-basins.

A comparison of well data from before and after 1980 shows there were generally fewer or an equal percentage of new wells abandoned in all three areas (Table 2.A-12). The data also show a higher percentage of wells with water yields less than 1 gpm in all three areas. This may be a reflection of an acceptance of lower water yields that are sufficient to supply domestic water for a household. However, in both the Coastal and Smith River areas there are also lower percentages of new wells with yields greater than 10 gpm.

Category	Coastal dunes area		Umpqua River area		Smith River area	
	1956-1980	1981-2007	1956-1980	1981-2007	1955-1980	1981-2007
Total new wells	35	24	121	83	66	45
new wells abandoned	3 %	0 %	4 %	5 %	8 %	2 %
Yield (gpm)						
< 1	3 %	8 %	1 %	5 %	0 %	14 %
1 to 5	26 %	31 %	28 %	26 %	34 %	41 %
> 5 to 10	11 %	19 %	25 %	22 %	23 %	20 %
> 10	60 %	42 %	46 %	47 %	43 %	25 %
Depth drilled (feet)						
median depth	80	155	85	135	115	195
average depth	112	163	114	162	149	200
Source: Oregon Water Resources Department						

Table 2.A-12: Comparison of well data before and after 1980 for three areas within the sub-basins.

All three areas show wells with deeper completed drill depths and deeper levels at which first water was encountered. Although this may indicate a lower ground water table, it may also be an indication of well drilling expanding into less optimal areas for accessing water.

Quality

Ground water is vulnerable to contamination from both point and non-point source activities. The Oregon Groundwater Quality Protection Act of 1989 (ORS 468B. 150-190) sets a goal of preventing ground water contamination while striving to restore and maintain the high quality of Oregon's ground water resources. The Oregon Department of Human Services working with ODEQ, monitors public drinking water sources to ensure they meet Oregon drinking water quality standards. Assessment of ground water quality in this section is based on reviews of data from these ground water sources as well as the USGS report "Water-Resources of Western Douglas County, Oregon" (Curtis et al. 1984).

The USGS data indicate that water from the dune sand aquifer would probably be of good quality for municipal water supplies, except for excessive dissolved iron concentrations. Samples from 9 wells in the Coastal Dunes area, 26 in the Umpqua River area, and 4 from the Smith River area were chemically analyzed. The number of samples from each area that exceeded representative standards is listed in Table 2.A-13. Standard values are also included to provide a measure of suitability of the water sampled. It should be noted that the standards apply to public water supplies, and concentrations exceeding the standards may be acceptable to many users.

Constituent	Standard (mg/l)	Number of wells exceeding standards		
		Coastal Dunes	Umpqua River	Smith River
Iron (Fe)	0.3	1	3	0
Manganese (Mn)	0.05	2	5	0
Sulfate (SO4)	250	0	0	0
Chloride (Cl)	250	0	0	0
Fluoride (F)	1.8[1]	0	0	0
Boron (B)	0.75[2]	0	0	1
Total wells sampled		9	26	4

[1] The standard for fluoride is currently 2.0 mg/l for children under 9 years and 4 mg/l for all other individuals.
[2] There is currently no recommended standard for boron by the EPA or the State of Oregon. However the World Health Organization currently recommends an upper limit of 0.5 mg/l in drinking water.

Source: Water Resources of Western Douglas County, Oregon; USGS, 83-4017

Table 2.A-13: Number of wells exceeding water quality standards for public water supplies in the Umpqua River/Coastal Lakes sub-basins in 1984.

Of the constituents listed in Table 2.A-13, only fluoride is considered to have a standard that when exceeded, is not suitable for human health. Fluoride is beneficial in moderate a-mounts because it retards dental decay, but in concentrations of more than several milligrams per liter can eventually cause darkening or mottling of children's teeth. In excess of 4 mg/l it may lead to bone disease including pain and tenderness of the bones.

Exceeding the standards for iron, manganese, sulfate, and chloride affect the aesthetic quality of water and may not meet public acceptance of the source for drinking; however exceedence of these parameters does not adversely affect human health. Excessive iron or manganese causes staining of plumbing fixtures and laundry and can give a peculiar taste to the water. Sulfate in excessive concentrations can have a laxative effect on people not accustomed to the water. Chloride in excess of about 500 mg/l may give a salty or mineral taste to the water. Neither the EPA nor ODEQ have a current standard set for boron. Although a boron concentration of 1 mg/l can be unsuitable for irrigating sensitive plants. The World Health Organization recommends an upper limit of Boron of 0.5 mg/l in drinking water.

Many well owners in the sub-basin report "sulfur water". However, samples analyzed show that concentrations of hydrogen sulfide, the cause of the rotten-egg odor, are not toxic and other water quality constituents are within acceptable ranges. Excessive hardness is undesirable but seldom is cause for rejection of a water supply. The USGS rating for hardness is shown in Table 2.A-14, along with the number of samples from all three areas in each category.

Hardness range ($CaCO_3$ mg/l)	Rating	Coastal dunes	Umpqua River	Smith River
0 to 60	soft	6	9	3
61 to 120	moderately hard	1	2	0
121 to 180	hard	0	2	0
More than 180	very hard	0	0	0
Source: Water Resources of Western Douglas County, Oregon; USGS, 83-4017				

Table 2.A-14: Number of samples by range of hardness for each area in the Umpqua River/Coastal Lakes sub-basins.

The only ground water public water sources in the sub-basins that registered any chemical detection in the Oregon Department of Human Services database include wells at Brandy Bar Landing and at the BLM Loon Lake recreation site. The Brandy Bar Landing well tested somewhat high for sodium levels measured in 1993 (108 mg/l) and in 2002 (430 mg/l) and a thallium level at the current maximum standard of 0.002 mg/l in 1993. There is no standard level for sodium although a recommended level for aesthetic quality has been set at 20 mg/l by EPA. A second well site at the BLM Loon Lake recreation site registered trace amounts of seven chemicals although none exceeded standards.

2.A.2. Water Use

The following section summarizes current and future water use in this portion of Douglas County. Water use types considered include municipal, rural domestic, industrial, irrigation, aquatic life, recreation and hydroelectric power. Analysis and more detailed discussion of municipal, rural domestic and industrial water use are included in Appendix M. Irrigation water use is analyzed in Appendix I, and water use needs for aquatic life are discussed in Appendix F.

Current

For purposes of this report, the measure of current water use is derived from water use reports showing raw water diversion by each water district and by water rights information provided by the Oregon Water Resources Department. Some water use report information was also obtained from individual water service providers.

Regulation and use of surface water in Oregon is based on the 1909 water code. The basic principles of the code are listed below.

1. All water within the state, from all sources of supply, except for private springs which do not naturally flow off the property of origin in a well defined channel, belongs to the public; and

2. Subject to existing rights, all waters in the State, except those withdrawn by legislative action or by an administrative order of the Water Resources Commission, may be appropriated for beneficial use by complying with requirements of the Surface Water Code, and by means of permits issued by the Water Resources Department.

Prominent highlights in Oregon's water law system provide that:

- "Beneficial use shall be the basis, the measure, and the limit of all rights to the use of water in this state;"

- A water right is appurtenant to the place of use for which it was established; and

- During times of shortage, water is distributed among the various water rights of record according to the prior appropriation doctrine. Under this doctrine, the oldest water right receives their full legal entitlement before the next oldest right receives any water. Essentially this doctrine states that “first in time is first in right.”

To obtain a water right under the 1909 Water Code an application must be filed with the Oregon Water Resources Department. The application must include a complete description of the proposed use with a map showing the location of the point of diversion and place of use. If the proposed use is not prohibited by statute, administrative rule, or policies of the State, and water is available, a permit to appropriate water is issued. The application date becomes the priority date of the right. The permit specifies a time limit within which the applicant must demonstrate that water has actually been put to the proposed beneficial use as described in the application. Once beneficial use has been established to the satisfaction of the State, a Certificate of Water Right is issued.

Pre-1909 water rights are determined through a legal proceeding known as adjudication. The Oregon Water Resources Department first collects claims from appropriators who started using water before 1909. Once all claims are received and any protests resolved, a judge issues a decree setting forth the rights of the various claimants.

Inchoate water rights, which are those uses occurring prior to 1909 and continuing since, can be made a "water right of record" through a legal proceeding known as an adjudication. The proceeding usually involves a geographic area in which water rights of record exist and is concluded by a decree of the District Court specifying priority dates and amounts for the rights involved.

The priority date of a water right of record is the governing factor during times of water shortage. If priority dates are the same, then domestic use has preference over all other uses, agricultural purposes are next in line and all other uses follow.

Municipal

The City of Reedsport is the only municipal water purveyor in this sub-basin. The City's water system serves the incorporated area, as well as the unincorporated urban areas of Gardiner and Winchester Bay. The primary water source is from Clear Lake, which as noted earlier has been set aside by State Engineer's Order of October 4, 1940 for exclusive use by the City. The waters of Lake Edna also were included in that order. The City holds surface water rights allowing maximum diversion rates of 7,090 gallons per minute with a 1912 priority and 4,488 gallons per minute with a 1935 priority. In 1980, the City acquired another 300 gallons per minute distributed evenly among three wells. Two wells are associated with Clear Lake and a third is located on a tributary to Bushnell Creek. Total current water rights for the City are 11,879 gallons per minute.

The 2006 population served by the water system is estimated to be 5,543 people. The City's Water Use Report lists monthly raw water diversion amounts by water year. Based on years 2002 through 2006, the average annual use is 415.4 million gallons per year equating to a daily average of 205 gallons per capita per day. This daily per capita rate includes an estimated 20 percent increase due to loss of water from leakage in the system.[15] The per capita use would be reduced to 164 gallons per capita per day after reducing the demand by the 20 percent estimate.

Peak daily use for years 2005 and 2006 is estimated at 369 gallons per capita per day, resulting in a peak diversion requirement of 1,432 gallons per minute during the month of July, well within the maximum allowed under the City's rights.[16]

Reedsport's estimated peak per capita use is similar to the county-wide average of 372 gallons per capita per day. In the past, Reedsport exceeded the County average. This was in part due to the gravity fed system that filled the reservoir. The system allowed a fairly

[15] Reedsport does not meter individual residences so the average per capita per day includes water drawn from Clear Lake for other uses as well. The 2006 Water Facilities Plan Amendment estimates loss of 20 percent of the water drawn from Clear Lake to leakage in the system (Kennedy/Jenks 2006).
[16] This includes the extra water required due the estimated 20% leakage in the system.

constant overflow creating an inflated demand for water. In 2002, the system was improved. Although some overflow still occurs, it is substantially lower than previous years. In addition, the peak calculations for the City of Reedsport include the estimated 20 percent increase in water demand due to leakage in the system. Reducing the demand by the estimated 20 percent would result in a peak per capita rate is 295 gallons per capita per day, lower than the county-wide average. More detailed discussion and calculations are included in Appendix M.

Rural Domestic

The majority of the population in Sub-basin A occurs within, and immediately surrounding Reedsport. In total, about 22 percent of the population (1,385 people) is not on water service. About 403 of those people (29 percent) access water via domestic surface water rights, while the remaining 982 people (71 percent) are presumed to primarily use ground water wells.[17]

Approximately 261 people reside in the coastal area outside the Umpqua Basin, where there is no water service. The remaining over 1,124 people are within the Umpqua Basin with no service. The rural population is located in some concentrations near Scottsburg and outside Reedsport. The rest is spread out along the lower Umpqua River, Smith River including the lower portions of North and South Fork Smith River, around Loon Lake, and around Clear Lake and other coastal lakes.

Industrial

Industrial water use from the 2004 Reedsport Facilities Plan was determined to be 30 gallons per acre-day and was based on the industrial land use area of 386.5 acres. Since that estimate, approximately 19.7 acres have been rezoned to residential use. However, the net effect on industrial water use is expected to be insignificant (Kennedy/Jenks 2006). At the estimated 30 gallons per acre-day on 366.8 acres, the current industrial use is 11,004 gallons per day (7.6 gallons per minute).

Commercial use is assessed separately in the City’s Facilities Plan at 976 gallons per acre-day on 100.7 acres. The total equates to 98,283 gallons per day (68.3 gallons per minute).

Privately held industrial water rights are minimal in the sub-basins. They include 233 gallons per minute for small business manufacturing from a spring and an unnamed stream that are tributaries to Scholfield Creek and for 22 gallons per minute from the North Fork Smith River. The City of Reedsport has water rights of 7,091 gallons per minute with a priority date of 1912 that are designated for both municipal and industrial use. Current industrial water rights are adequate to meet current needs.

Irrigation

Approximately 81 cfs for irrigation is currently held in irrigation water rights from the mainstem Umpqua River and its tributaries excluding the North Umpqua and South Umpqua river systems. The majority of these diversions come from areas upstream of

[17] Some rural domestic users may pay to have water trucked in during some periods of the year.

Scottsburg. Irrigation is a relatively minor use in the Coastal Lakes / Umpqua River sub-basins since the Umpqua River is affected by tides to approximately river mile 24 near the confluence with Mill Creek. The majority of irrigation is thus from tributary water sources.

Irrigation from surface water sources occurs on relatively small parcels along stream channels, mostly in the Smith River and Mill Creek watersheds. In the lower Umpqua River sub-basin, 9.3 cfs is held in irrigation rights from either the main river or its tributaries. The majority comes from Lake Creek and its tributaries above Loon Lake where 4.15 cfs in water rights is used to irrigate 378 acres; and from Smith River and its tributaries where 4.18 cfs are used to irrigate 409 acres. Most rights on Smith River are senior to 1974 minimum instream flow rights for aquatic life.

Aquatic Life

<u>Instream Flow</u>
Water use by aquatic life is expressed by State of Oregon minimum flows. Minimum flows vary through the year to meet the needs of aquatic life. Minimum flows at selected locations within the Umpqua River sub-basin are listed in Table 2.A-15 with their priority dates of right.

Time of year	**Umpqua River from the confluence to the mouth (cfs)**			**Smith River from North Fork to the mouth (cfs)**		**Mill Creek from Camp Creek to the mouth (cfs)**
	10/24/58	**3/26/74**	**4/12/93**	**10/24/58**	**3/26/74**	**3/26/74**
October						
1 to 15	525	900	1560	20	30	40
16 to 31	525	1000	1560	20	100	70
November	525	1000	1700	20	180	130
December	525	1000	1700	20	180	100
January	525	1000	1700	20	180	100
February	525	1000	1700	20	180	100
March	525	1000	1700	20	180	100
April	525	1000	1700	20	180	100
May	525	1000	1700	20	150	70
June						
1 to 16	525	1000	1700	20	100	40
17 to 31	525	750	1700	20	100	40
July	525	750	1000	20	50	20
August	525	750	1000	20	30	20
September	525	750	1000	20	30	20
Source: State of Oregon Water Resources Department database located at http://apps.wrd.state.or.us.						

Table 2.A-15: Minimum instream flows to support aquatic life in selected areas of the Umpqua River sub-basin with priority dates of right.

The Instream Water Rights Act was passed in 1987, allowing agencies to apply for instream water rights to protect recreation, water quality, and fish and wildlife habitat. Prior to establishment of this act, the Oregon Water Resources Department established minimum flows through the administrative rule making process. Minimum flow values specified in a rule, or “basin program,” were not water rights but were administered as such by the Department. These established flows became instream water rights subsequent to passage of the 1987 Act. Thus water rights allowing direct diversion that have been obtained after the date of establishment of a minimum flow are subject to curtailment as stream flow amounts decrease below that specified minimum flow rate. However, when the junior right includes a "household use" component as with domestic or municipal rights, that amount of use has preference over the minimum flows.

In the case of a reservoir constructed after establishment of a minimum flow, the minimum flow must be released at all times, unless inflow to the reservoir is less than the specified minimum, in which case the amount of inflow must be released. Either type of water right senior to the date of establishment of a minimum flow is not subject to curtailment to meet minimum flows.

Fish Abundance and Distribution

The Umpqua River below Scottsburg is the passageway to the entire Umpqua Basin for anadromous species. Nearly all tributaries host some spawning. The resulting juvenile salmonids spend their rearing period, ranging from a few months to three years depending upon species, in the tributaries. Other species found in the Umpqua River/Coastal Lakes sub-basins include striped bass, sturgeon (both white and green), shad, and sea-run cutthroat trout. Cutthroat trout are also resident throughout the sub-basin. Small-mouth bass, which were introduced illegally into the South Umpqua River some 20 years ago, have since spread downstream and have established a thriving population. Appendix F contains detailed data and discussion of salmonids in the sub-basins.

Abundance data from 2002 show about 2,400 fall chinook in the North Fork Smith River. Above Smith River Falls, the estimates included 9,800 coho salmon and 1,700 winter steelhead. All winter steelhead above the falls were wild stock. Presently, 62,500 fall chinook fry are released into the Winchester Bay to promote a bay fishery.

Adult coho population estimates for Tahkenitch and Siltcoos lakes are based on traditional spawning ground surveys. Coho populations are somewhat variable by year but have generally stayed at the same relative abundance levels over the last 10 years. The 10-year average stocking level from 1995 through 2005 is 4,657 fish in Siltcoos Lake and 2,540 fish in Tahkenitch Lake. Both lakes show an increased population average in the last 10 years compared to the 46-year average.

The anadromous spawning population in the sub-basin is comprised of winter and summer steelhead, coho salmon, and fall and spring chinook salmon. Based on 1976 estimates, about 9,643 fish spawned in the lower Umpqua River sub-basin, representing about 21 percent of the fish spawning in the entire Umpqua Basin. Although there is little or no spawning shown in the mainstem Umpqua River, tributary streams were heavily used. Smith River contributed about 76 percent of the spawning population in the sub-basin. Mill

Creek and Scholfield Creek hosted about 8 percent each with Mill Creek home to all of the summer steelhead spawning in the sub-basin. Spawners have also been noted in Dean, Harvey, Charlotte, Franklin, Luder and Little Mill creeks. See Appendix F for detailed information.

Few anadromous fish rear in the lower mainstem Umpqua River primarily because of seasonal high water temperatures. Rearing generally occurs in tributary streams where the juveniles were spawned, or juveniles may relocate to cooler streams. In addition, rearing of fall chinook and some spring chinook occur in the estuary. Anadromous species are passing through the sub-basin in all months of the year. Thus, it is important for water quality conditions to remain within limits tolerable to anadromous species during the entire year.

In addition to salmonids, striped bass and shad spawn in the lower 23 miles of Smith River, while sturgeon use the lower 8 miles. Sturgeon also spawn in the Umpqua River between river miles 13 and 25. The Umpqua River is also host to spawning striped bass upstream of river mile 13, and shad above river mile 19. Spawning population estimates are not available for cutthroat trout, resident trout, shad, striped bass, sturgeon, and warm-water game fish.

<u>Fishery Concerns</u>

There are a number of factors limiting anadromous fish productivity in the sub-basins. Primary factors include loss of instream and estuarine rearing habitat, water quality issues, and fish passage barriers. Juvenile production is relatively low because of high temperature, low streamflow, and large amounts of bedrock. Loss of riparian areas on smaller tributary streams influences both water quality and instream habitat. Decreased shade cover may result in increased stream temperatures on small streams. Removal of large trees in these areas results in fewer sources for stream input. These large wood pieces are vital for creating instream habitat on small and medium sized tributaries.

The Coho Viability Assessment Final Report (Nicholas et al. 2005) identified stream complexity as the primary life cycle bottleneck and water quality as the secondary bottleneck in the Lower Umpqua coho population.[18] The Lower Umpqua population area has 535 miles available to juvenile coho, of which only 61 miles (11 percent) is considered high quality habitat.

Tahkenitch Lake is assessed as a separate population in the report with a primary bottleneck of exotic fish species and secondary bottlenecks including both stream complexity and water quality. The lake has an estimated 48 miles available to juvenile coho, of which 33 miles (69 percent) is high quality.

Fish passage is also a significant known limiting factor in the Umpqua River sub-basin. While there are no barriers to passage of anadromous fish on the mainstem Umpqua River, there are locations elsewhere in the sub-basin where obstructions to passage limit use of additional suitable habitat. Fish passage barriers identified in the Umpqua Basin Action

[18] The Lower Umpqua population in the Coho Viability Assessment includes the Umpqua River from the mouth to Elkton.

Plan in the Lower Umpqua River Watershed include tide gate issues on Dean and Scholfield creeks, and culvert problems on Butler Creek, Charlotte Creek, Luder Creek, and potentially Dean Creek (Barnes & Assoc. 2007).

UBFAT is conducting surveys on all fish passage structures in the basin to determine those that are barriers to fish and rating the significance of each barrier. Surveys have not yet been done in the Coastal Lakes / Umpqua River sub-basins. Contact the Douglas Soil and Water Conservation District in the future to determine where fish passage barriers occur on county-maintained structures, as well as the Smith River Watershed Council for information in the Smith River Watershed.

In the Smith River drainage an eighty-foot high barrier exists in the upper drainage. Smith River Falls is a fifteen foot high waterfall located at river mile 30 where passage was provided by construction of a fish ladder. In the Mill Creek drainage, a 150-foot barrier prevents anadromous fish access to Loon Lake. Camp Creek, a tributary to Mill Creek, is blocked by a 25-foot high falls.

Enhancement Opportunities

Douglas County owns a 651 acre parcel of land south of Reedsport along two unnamed tributaries to Winchester Creek; 884 acres along Joyce, West Fork Joyce, and Pretty Gulch creeks in the Smith River watershed; and 120 acres along Camp Seven Gulch Creek. These areas may have opportunities for riparian and/or in-stream habitat improvement. The County also owns 19 acres along Smith River and Otter Slough and along the Umpqua River across from Little Mill Creek, both of which may have opportunities for enhancement of estuary habitat. See Appendix F for more information on enhancement opportunities.

Recreation

Water-based recreation facilities are prevalent in this sub-basin. There are a number of privately developed and operated recreation sites on the major lakes, as well as 25 public agency recreation facilities throughout the sub-basin. Table 2.A-16 lists only those public agency sites with boat launching facilities.

Area	Site name	Agency[1]
Coastal	East Carter	USFS
	Tahkenitch Boat Ramp	USFS
	Tahkenitch Landing	USFS
	William E. Tugman	OSP
	Bolon Island	DCP
	Gardiner County Dock	DCP
	Salmon Harbor	DCP
	Umpqua Lighthouse	OSP
Smith River	Noel Ranch	USFS
	Riverside Wayside	DCP
Umpqua River	Umpqua State Scenic Corridor	OSP
	Loon Lake	BLM
	Scottsburg	DCP

[1] BLM = Bureau of Land Management; DCP = Douglas County Parks Department; OSP = Oregon State Parks; USFS = US Forest Service.

Table 2.A-16: Public boating sites with launching facilities in the Umpqua River/Coastal Lakes sub-basins.

The Umpqua River Basin is one of the largest producers of anadromous fish in Oregon, exclusive of the Columbia River Basin. During 1997-98 (the last season tag surveys were conducted) an estimated 6,898 salmon and steelhead were caught. Approximately 30 percent of the basin total harvest, and nearly all of the fall chinook harvest was from the Smith and mainstem Umpqua rivers (Table 2.A-17).

Sub-basin	Chinook		Coho	Steelhead		Total
	Spring	Fall		Summer	Winter	
Smith River	0	287	0	0	13	300
Mainstem Umpqua[1]	0	934	352	194	319	1,799
Total sub-basins	0	1,221	352	194	332	2,099
Total Umpqua Basin	634	1,230	569	3,955	510	6,898
Percent of Basin	0	99	62	5	65	30

[1] Mainstem Umpqua includes the entire Umpqua River from the mouth to the confluence of the North and South rivers.
Source: ODFW most recent catch data from 1997.

Table 2.A-17: Numbers of fish caught during the 1997-98 season in the Umpqua River sub-basin relative to the entire Umpqua Basin.

Recreation fish catch in the sub-basin includes fall chinook, winter steelhead, cutthroat trout, striped bass, and warm-water game fish. In 2001-2002 an estimated 1,876 fall chinook were harvested recreationally in the Umpqua River and Winchester Bay. The ten-year average fall chinook catch from 1992-93 to 2001-02 for this area was 1,984 fish (Moyers et al 2003).

Largemouth bass are considered the most popular warm-water game fish in Oregon based on ODFW angler surveys. The most important largemouth bass fisheries in the state are located in the coastal lakes including Siltcoos, and Tahkenitch, as well as other western Oregon lakes and reservoirs.

Hydroelectric Power

There are no public or private utility-owned large-scale hydroelectric generation plants in the Coastal Lakes/Umpqua River sub-basins. There are sites with small capacity potential on tributaries to both the Smith and Umpqua rivers. Due to their small scale, development of these sites is expected to occur through individual efforts, rather than in conjunction with large-scale multiple purpose water storage projects.

Future

Municipal

Future municipal use is based on information from the 2006 City of Reedsport Water Facilities Plan Amendment (Kennedy/Jenks Consultants 2006), the Douglas County Comprehensive Plan Population Assessment (Douglas County 2004), and reported water use by the City of Reedsport water district. The data include the current population receiving water service and projections of the future population in 2050. The projections to 2050 reflect the long-term financial conditions normally encountered with large-scale water resource developments.

Appendix M contains the derivation of water needs for future municipal water use in the sub-basin. The 2006 sub-basin population served by municipal water service is 5,543 people. Based on projected growth in the Reedsport area, the population needing water service in 2050 is expected to be 9,689 people. The peak demand for water in 2050 will require water diversion of 2,482 gallons per minute in July to meet the needs of the population. If the City can improve the efficiency of the system to reduce an estimated 20 percent increase in water demand due to leakage, the need could be reduced to 1,986 gallons per minute.

The City has water rights for 4,788 gallons per minute exclusively for municipal use and another 7,091 gallons per minute designated for municipal and industrial use, for a total of 11,879 gallons per minute. The water supply appears adequate to meet future demand. If the 7,091 gallons per minute were split equally between municipal and industrial use, the total municipal water rights would be 8,334 gallons per minute, which is still adequate to meet future municipal demand.

Based on the 2006 City of Reedsport Water Facilities Plan Amendment, the projected future needs for the City during the peak month are 1,389 gallons per minute (2.0 million gallons per day) in 2025. This correlates to the projection in Appendix M for year 2030 where the peak water need is estimated at 1,999 gallons per minute including the 20 percent loss of water due to system leakage. If the system is improved, the need would fall to 1,599 gallons per minute in the year 2030. The City Plan outlines the recommendations to fix leakage problems in the system over the next 25 years. This would make the lower peak month projections (1,599 gallons per minute in 2030 and 1,986 gallons per minute in 2050) feasible. In either case, the existing water rights (11,879 gallons per minute) are adequate to meet future demand.

The City's 2006 Amendment also estimates residential water use needs to the year 2077. Based on an expected total population of 11,040 people for Reedsport, Gardiner, and Winchester Bay, the expected average residential water consumption will be 1.6 million gallons per day. The City's current rights of 8,334 gallons per minute equate to 12 million gallons per day and are more than adequate to meet this projected need.[19]

Rural Domestic

The allocated rural population of these sub-basins is expected to increase from 1,385 to 2,424 people. Using a peak per capita need of 290 gallons per capita per day to allow for rural domestic needs, the future rural domestic need is estimated to be 471 acre-feet per year. The Coastal area is expected to have a rural population of at least 457 people of the 2,424; requiring 89 acre-feet per year compared to 382 acre-feet per year within the Umpqua Basin including Smith River. Population increases are relatively small and densities are expected to remain low. Currently used sources are expected to remain adequate to meet these future needs. See Appendix M for further details.

Industrial

Estimates of future water use for the City of Reedsport are based on extension of current water use. Current water use in the urban area of the sub-basin includes some industrial use in the water system service area. Thus, limited expansion of incidental industrial growth within the water system is accounted for.

According to the City of Reedsport Water Facilities Plan Amendment the current average industrial water use of 30 gallons per acre-day is expected to increase to 350 gallons per acre-day at build-out of full industrial potential on lands zoned industrial. There are a total of 508 acres that would be used for industry at build-out. At 350 gallons per acre-day and 508 acres, the total water need will be 177,800 gallons per day (123 gallons per minute).

The Water Facilities Plan estimates the commercial rate of use will remain similar to current use rates at 1,000 gallons per acre-day at build-out. The expected acres of commercial use are 211 acres for a total use of 211,000 gallons per day (147 gallons per minute).

Review of the 1989 Water Management Program report indicates that future industrial needs in the sub-basin should recognize the needs of expanded sand and gravel industry. These needs were estimated to be 1,600 acre-feet per year from the mainstem Umpqua River (See Appendix M). Although there is still need for the material, sand and gravel mining from rivers is becoming more restrictive and is unlikely to expand. This may cause more

[19] The 8,334 gpm water rights assume that 3,545 gpm of the total 11,879 gpm would be used for industrial use.

expansion of mining into rock pits around the County. Barging material from Canada where restrictions on dredging are less significant may be considered.[20]

A pellet mill is being considered for establishment on Bolon Island. Water needs for pellet production are expected to be minimal and the projections for industrial use by the City should meet the needs of these industries.

Irrigation

Significant development of new lands for irrigation is not expected in these sub-basins. There are currently 416 acres with existing irrigation water rights in the Smith River system and along the Umpqua River. There is an estimated 460 acres of total potential irrigation land based on aerial photo mapping in these same areas (see Appendix I). Therefore only 44 acres are available for future irrigation. These acres are in the Smith River Watershed.

Future water needs for irrigation are estimated at an average use of 2.44 acre-feet per acre per season. Based on this average, the future irrigation potential use in the sub-basins would be 107 acre-feet per season.

Not all land within the sub-basins has been mapped for possible irrigation land.[21] Although it is not expected to be extensive, it is likely that some additional land along tributaries to the Umpqua River could be developed for irrigation.

Hydroelectric Power

The County has secured a Preliminary Permit and filed a Notice of Intent with the Federal Energy Regulatory Commission (Docket # P-12743-000) to place a wave energy generating facility on the south jetty of Winchester Bay. The Reedsport OPT Wave Park Project would be located 3 miles off shore near Reedsport, and occupy about 2.5 miles of land in the Oregon Dunes Recreation Area. According to the permit, the project would generate between 0.7 and 2.2 gigawatt-hours of energy annually that would be sold to a local utility company.

2.A.3. Sub-basin Concerns

The following section contains a discussion of water quantity and water quality concerns, as well as other issues related to water resources and their use in the sub-basin.

Quantity

The quantity of water resources in major streams and from identified aquifers in the sub-basin appears adequate for meeting all future out-of-stream needs. However, there probably will be shortages for increased irrigation use in August and September on smaller tributary streams. There also will be continued risk of water shortages with development of

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[20] Helga Conrad, Umpqua Economic Development Program, personal communication (4/23/07).
[21] The Lake Creek area above Loon Lake is not included in the potential irrigation mapping even though it has almost as much of the current irrigated acreage as the Smith River area.

wells to supply water for individual rural residences. Development of facilities to meet specific needs, such as for municipal/industrial uses, may be accomplished on a local scale.

For anadromous fish, seasonal low streamflows generally are tolerable. However, low streamflows facilitate higher stream temperature that can exceed healthy limits for salmonids on smaller tributaries. Low flows can also cause impairment of fish passage at some locations on tributaries. One example located at river mile 29 in Smith River; a "bedrock apron" exists where flows are too shallow in late summer. Exposed bedrock also prevents spawning.

Quality

Water quality conditions in the sub-basin are adequate for all perceived present and future out-of-stream uses. However, a concern exists for the potential loss of water quality in Clear Lake from pollution hazards. US Highway 101 borders the western shore of Clear Lake providing opportunity for accidental spills of hazardous cargo that may be contained in vehicles traveling this route.

Several instream water quality issues exist in the sub-basins. Tahkenitch and Siltcoos Lakes have eutrophication problems that can limit fishing, water-contact recreation, and aesthetic value.

High water temperatures in the Umpqua River and many tributaries in late summer limit its use for rearing by adult anadromous salmonids. Warm stream temperatures can increase diseases and health problems for salmonids. When temperatures exceed 68°F, they can also cause mortality of salmonids. However, warm water temperatures are optimal for the small-mouth bass population.

Fecal coliform levels in the estuary and portions of Smith River, Umpqua River, Winchester Creek, and Scholfield Creek pose a problem for shellfish harvest. Further up the Umpqua River, both fecal coliform and *E. coli* bacteria levels also pose a problem for water-contact recreation. These levels tend to increase with peak flows in the winter.

Flooding and Urban Drainage

Flooding has occurred in Reedsport and Gardiner during periods of peak flows in the Umpqua River coupled with high tides. Major flooding in the City of Reedsport has been alleviated by construction of a dike by the Corps of Engineers and pumps used by the City to remove water. At times when high flows in Scholfield Creek coincide with high tides and flood stages in the Umpqua River, minor flooding occurs within Reedsport. Flooding of the business district of Gardiner occurs frequently, as that community is unprotected. For example, high tides and peak flows in 2005 produced flood water in Reedsport and Gardiner. However, Reedsport was able to prevent water from entering the town by use of the dike and pumps while Gardiner was flooded.

2.B. Umpqua River / North Umpqua River Sub-basins

2.B.1. Area Description

The Umpqua River and North Umpqua River sub-basins shown in Figure 2.B-1 include the watersheds that drain into the following rivers or sections of river within the Umpqua Basin:

1. the Umpqua River from Scottsburg (RM 19) upstream to the confluence of the North and South Umpqua rivers at about river mile 112 (with the exception of the Elk Creek and Calapooya Creek watersheds[22]); and

2. the entire drainage of the North Umpqua River, from its confluence with the South Umpqua, upstream over 106 river miles to its origin at Maidu Lake on the crest of the Cascade Range.

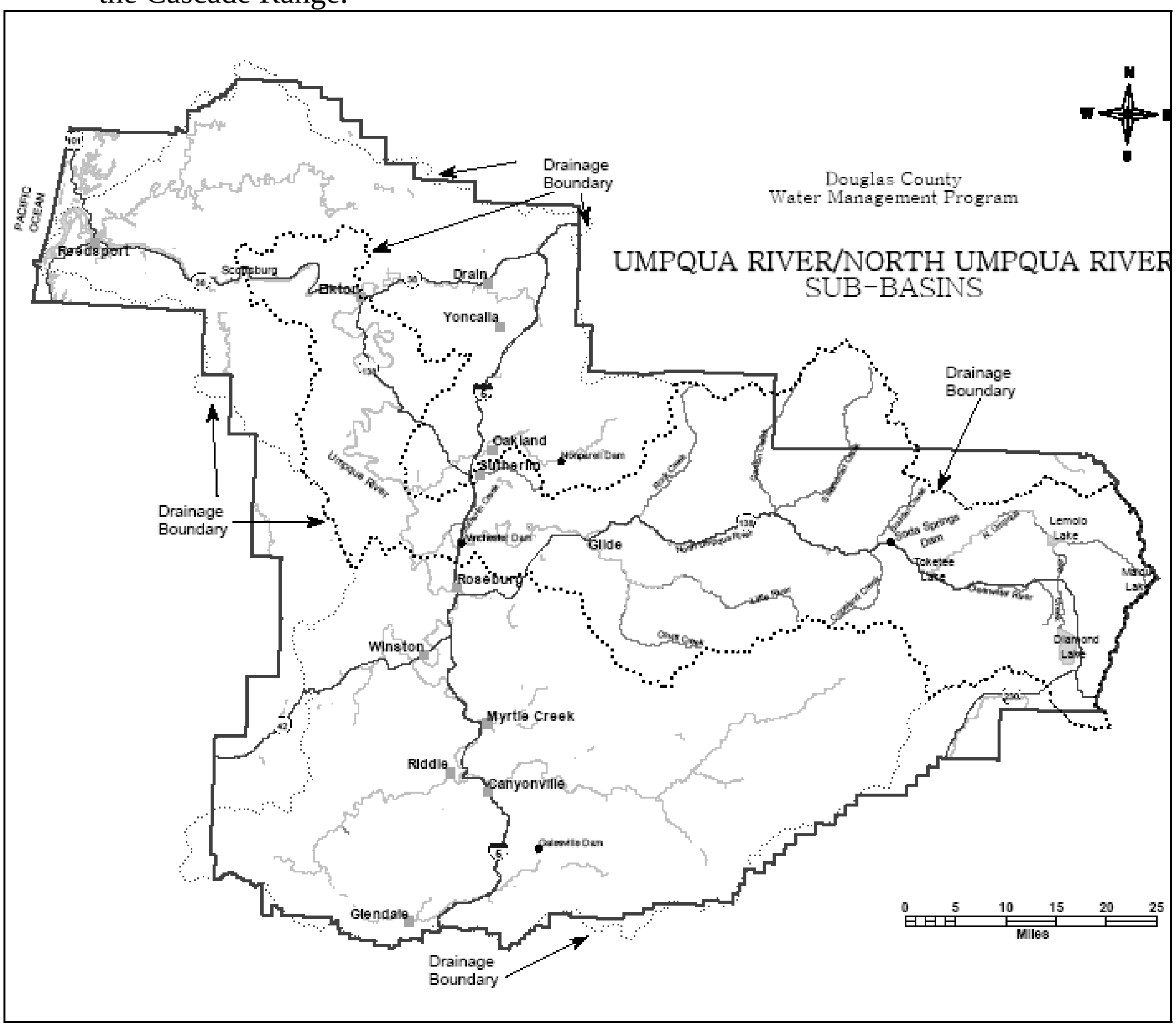

Figure 2.B.1: Umpqua River/North Umpqua River sub-basins within Douglas County.

[22] The drainages of Elk and Calapooya creeks are each reviewed separately in Section 2.C.

Communities along the Umpqua River upstream of Scottsburg include Wells Creek, Elkton, Tyee, and Umpqua. The terrain in this area between Scottsburg and the confluence of the North and South Umpqua rivers is steeply rolling. The land is predominantly in private ownership along the course of the Umpqua River, with most of the abundant, narrow valley lands used for irrigated pasture. Oregon Highway 38 follows the Umpqua River from Scottsburg to Elkton. Upstream of Elkton, the course of the Umpqua River is sinuous with large bends. Highway 138 starting at Elkton, intermittently follows the course of the Umpqua River en route to Roseburg.

The confluence of the North and South Umpqua Rivers occurs at Garden Valley, Umpqua River mile 112. This valley contains one of the larger blocks of high quality irrigable lands in the basin. It is intensively farmed for row crops and orchards.

Sutherlin Creek discharges into the North Umpqua River five miles upstream of the confluence of the North and South Umpqua rivers. Low-density, rural-residential development exists along both banks of the North Umpqua River upstream through the Riversdale area to Winchester Dam and the community of Winchester at river mile 7. Highway 99, Interstate 5, and railroad bridges cross the North Umpqua River just downstream of the dam,

Upstream of Winchester, development is mostly rural-residential along the north bank to the vicinity of Whistlers Bend at about river mile 22. Secondary roads, with rural-residential development on both banks, extend upstream to the mouth of Little River at river mile 29 and the community of Glide.

Oregon Highway 138 crosses the North Umpqua River east of Glide at about river mile 38 and follows the north bank upstream to the North Umpqua River's confluence with Clearwater River at about river mile 75, where it continues along Clearwater River to Clearwater Falls.

Communities upstream of Glide include Idleyld Park, Steamboat, Dry Creek, and Toketee Falls. The western boundary of the Umpqua National Forest crosses the river at about river mile 45, and all riparian lands above that point are federally administered.

The Rock Creek Fish Hatchery is located near the mouth of Rock Creek, a North Umpqua tributary entering at about river mile 35. Species produced at the ODFW facility include fall and spring chinook, summer and winter steelhead, coho, and rainbow trout.

The North Umpqua is internationally known for its anadromous fishery and drift boating. Above Glide, the river fishery is restricted to the use of flies only. Steamboat Creek, a tributary entering the North Umpqua River at about river mile 53, is intensively managed for production of anadromous fish.

Climate

From Scottsburg upstream to about Elkton, the climate is influenced by Oregon coastal conditions. Winters are generally mild and damp with mild to warm summer temperatures. Upstream of Elkton to the vicinity of Glide on the North Umpqua, the area is within the rain shadow of the Coastal Range providing a Mediterranean type climate. Winters are generally mild, with some precipitation occurring as snow in most years, followed by warm, dry summers. Upstream of Idleyld Park, climatic conditions are influenced by the Cascade Range. Winter temperatures are related to elevation, and significant winter precipitation occurs as snow, while summer conditions are dry and cool relative to the central portions of the County.

Precipitation

Douglas County operates several precipitation-measuring stations in the sub-basins. The station with the longest record is in Roseburg initially located at the Roseburg airport with records from 1877 to 1965. It was subsequently moved to the KQEN station where it continues to operate today. To illustrate the variability of precipitation within the sub-basin, Table 2.B-1 lists maximum, minimum, and mean precipitation by month and the mean annual precipitation for four locations distributed throughout the sub-basin. They include: Elkton 3SW; Roseburg Airport; Roseburg KQEN; and Toketee Falls located in the higher elevation area of the North Umpqua River.

Table 2.B-1 shows lower precipitation levels measured in Roseburg (about 33 inches) than either Elkton (52 inches) or Toketee Falls (48 inches). The maximum recorded annual amount in Roseburg was about 60 inches in 1996, while the minimum, occurring in 1976, was almost 22 inches. On average, about 87 percent of the precipitation in Roseburg occurs from October through April.

The stations at Elkton and Toketee Falls have similar periods of record and show similar annual minimum precipitation levels of just under 35 inches. Maximum and mean precipitation levels average about five inches more at Elkton than Toketee Falls. Mean precipitation is lower in the late fall through early spring months (November through March) but higher in the summer (May through September) at Toketee Falls compared to Elkton; indicative of the higher elevation of Toketee Falls where much of the winter precipitation occurs as snow.

Period	Roseburg (Airport) 1877 to 1965			Roseburg (KQEN) 1965 to April 2006			Elkton 3SW 1955 to April 2006			Toketee Falls 1953 to 2006		
	max	mean	min	max	mean	min	max	mean	min	max	mean	min
October	12.53	2.69	0.00	4.66	2.20	0.06	12.58	3.63	0.00	8.57	3.67	0.10
November	10.68	4.68	0.19	15.91	5.23	1.09	21.38	8.23	1.55	19.12	7.25	1.13
December	15.74	5.47	1.46	15.77	5.92	0.84	26.99	9.96	1.51	24.35	7.95	1.06
January	12.23	5.27	1.35	11.33	5.45	0.58	17.58	8.67	0.59	13.48	7.07	0.46
February	12.19	4.25	0.17	9.75	3.60	1.02	16.10	6.61	0.74	12.53	5.05	1.27
March	8.61	3.37	0.06	6.99	3.51	1.01	12.48	6.12	0.88	11.31	5.23	0.76
April	5.28	2.18	0.15	7.05	2.54	0.59	8.59	3.73	0.97	8.16	3.83	0.97
May	4.63	1.82	0.01	6.33	1.80	0.27	5.94	2.34	0.00	7.86	3.02	0.47
June	5.94	1.22	0.00	2.67	0.86	0.00	3.83	1.06	0.00	5.49	1.75	0.02
July	2.79	0.28	0.00	2.98	0.40	0.00	1.46	0.27	0.00	4.46	0.64	0.00
August	2.41	0.34	0.00	3.30	0.58	0.00	3.32	0.54	0.00	5.58	0.96	0.00
September	4.11	1.13	0.00	3.70	1.05	0.00	5.04	1.33	0.00	6.00	1.56	0.00
Annual[1]	46.44	32.76	23.24	60.19	32.84	21.71	85.16	51.74	34.94	79.94	47.82	34.24

[1] Values are maximum annual, mean annual, and minimum annual; not total of column entries.
Source: Douglas County Natural Resource Division.

Table 2.B-1: Monthly and annual precipitation for four locations across the Umpqua River/North Umpqua River sub-basin.

Surface Water – Rivers and Streams

Quantity

There are twenty-two stream gages that have USGS published records in the Umpqua River/North Umpqua River sub-basins. Of these, one station remains active on the Umpqua River, and nineteen stations are active in the North Umpqua drainage. Surface water flow within the sub-basins is characterized in Table 2.B-2 by the following three stream gages: Umpqua River near Elkton, North Umpqua at Winchester, and Little River near Peel. Detailed streamflow records are available from the Douglas County Natural Resources Division. Mean monthly discharges for these same stations are shown in Table 2.B-3.

Stream gage	Period of record (water year)	Discharge (cfs)			Runoff average (ac-ft/year)
		max	min	mean	
Umpqua River near Elkton	1906-2005	265,000	640	7,343	5,320,000
North Umpqua at Winchester	1908-2004[1]	150,000	235	3,687	2,671,000
Sutherlin Creek at Sutherlin	1955-1967	2,250	0	26	18,750
Little River at Peel	1955-1989 2000-2005	21,100	7.5	452	327,600

[1] Period of record includes water years 1909-13, 1924-29, 1955-2005.
Source: US Geological Survey.

Table 2.B-2: Maximum, minimum, and mean discharge levels, and average annual runoff at four locations in the Umpqua River/North Umpqua River sub-basins.

Month	Umpqua sub-basin		North Umpqua sub-basin			
	Umpqua near Elkton 1906-2005		North Umpqua near Winchester 1909-2005[1]		Little River at Peel 1955-89 & 2000-05	
	mean discharge (cfs)	percent of annual	mean discharge (cfs)	percent of annual	mean discharge (cfs)	percent of annual
October	1850	2	1,341	3	98	2
November	6,870	8	3,973	9	532	10
December	13,400	15	6,288	14	951	17
January	15,800	18	6,700	15	939	17
February	14,800	17	6,139	14	792	15
March	12,000	14	5,520	13	780	14
April	9,510	11	4,826	11	634	11
May	6,510	7	3,864	9	426	8
June	3,710	4	2,431	5	167	3
July	1,710	2	1,326	3	56	1
August	1,170	1	989	2	31	1
September	1,190	1	979	2	36	1
Total	**88,520**	**100**	**44,376**	**100**	**5,442**	**100**

[1] Period of record includes water years 1909-13, 1924-29, 1955-2005.
Source: USGS National Water Information System.

Table 2.B-3: Mean monthly discharge and percent of annual discharge from three stations in the Umpqua River/North Umpqua River sub-basins.

Monthly streamflow data show large variations in discharge throughout the year, and the total annual average varies widely between stations, reflecting differences in both climatic and geologic conditions in the sub-basins. About 90 percent of the annual discharge of the

Umpqua River near Elkton occurs during November through May. During this same period, about 85 percent of the annual discharge occurs at the North Umpqua near Winchester, and 92 percent at Little River near Peel.

About one-half the annual discharge of the Umpqua River near Elkton is supplied by the North Umpqua River measured at Winchester. Figure 2.B.2 illustrates comparative mean discharges on a monthly basis for the North, South, and main Umpqua rivers. In January the contribution of the North and South Umpqua Rivers is nearly equal, while during August and September the contribution of the North Umpqua is over 80 percent of the flow in the Umpqua River near Elkton.

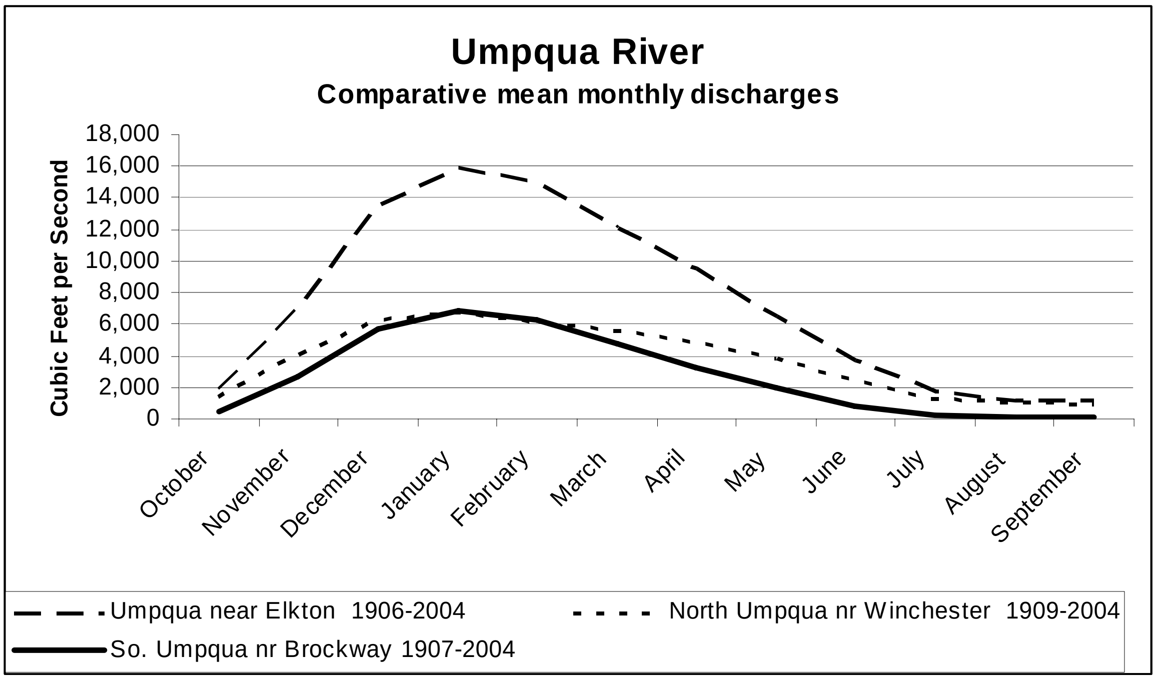

Figure 2.B.2: Relative flows of the North and South Umpqua rivers to the main Umpqua River by month.

<u>Flooding</u>

During periods when flows in the North Umpqua River exceed the two percent probability, or 50-year recurrence, flood damage occurs in some communities and residences. Smaller floods commonly cause stream damage and temporary or permanent habitat loss for aquatic life. In some streams, large wood is flushed out of the system or moved downstream to floodplain locations. Increased erosion levels along streambanks and streambeds can cause temporary pulses of increased sediment and remove gravels from many streams. Effects can be exacerbated by altered riparian habitat in forested or agricultural communities. Fish and other aquatic habitat may also be redistributed downstream. Over-wintering fry are washed out of many streams during peak storm events, causing a decrease in salmonid survival through the winter season.

Table 2.B-4 shows recorded flood levels at four locations throughout the Umpqua River and North Umpqua River sub-basins. The oldest record is on the Umpqua River near Elkton with data from 1906 to the present. Most of the flood history shows peak events in November through February. Exceptions include a large flood at the end of October 1950 and a smaller one in March 1972 at the Umpqua River near Elkton. Since 1955, when all but one of the gages were in operation, the Steamboat Creek near Glide station measured the most flooding with over 27 percent of the years recording a flood. The Umpqua River near Elkton station measured flooding in almost 20 percent of recorded years. Both of these flooded far more than the areas on the North Umpqua River where less than 10 percent of the years recorded flooding.

Date	Stream gage and level of flood stage			
	Umpqua River near Elkton 1906-2005 (33 ft)	North Umpqua River at Winchester 1909-2005 (26 ft)	North Umpqua River below Steamboat near Glide 1972-2005 (20 ft)	Steamboat Creek near Glide 1957-2005 (10 ft)
Nov 23, 1909	6.48	2.10	n/a	n/a
Feb 21, 1927	7.96	---	n/a	n/a
Dec 31, 1942	8.10	---	n/a	n/a
Jan 7, 1948	4.80	---	n/a	n/a
Oct 29-30, 1950	11.20	---	n/a	n/a
Jan 19, 1953	10.00	---	n/a	n/a
Nov 23, 1953	9.40	2.40	n/a	n/a
Dec 22, 1955	13.00	3.14	n/a	7.96
Nov 23, 1961	7.10	---	n/a	4.61
Dec 22-23, 1964	***18.95***	***8.20***	**n/a**	***15.60***
Jan 4, 1966	0.40	---	n/a	---
Jan 17-18, 1971	10.63	0.39	n/a	6.66
Mar 3, 1972	4.35	---	---	---
Jan 15, 1974	11.20	---	---	2.23
Jan 8, 1976	0.24	---	---	---
Dec 6, 1981	6.18	---	4.3	6.74
Feb 17-18, 1983	4.53	---	---	2.27
Feb 13, 1984	2.90	---	---	---
Feb 23, 1986	3.07	---	---	---
Nov 18-19, 1996	***5.41***	***1.6***	***8.93***	***9.54***
Dec 7-8, 1996	6.42	---	---	1.78
Nov 21-22, 1998	---	---	0.85	4.28
Dec 30-31, 2005	6.59	---	5.65	7.76

() indicates the flood level at each station. n/a = station not in operation.
Source: USGS National Water Information System and Douglas County Flood Crest History from the Douglas County website last updated March 15, 2006.

Table 2.B-4: Water height (in feet) above flood level measured at four stream gages throughout the sub-basins.

All gages operating during 1964, showed the largest event occurring in December 1964 when the Umpqua River near Elkton was nearly 19 feet above flood level and Steamboat Creek over 15 feet above. This storm event brought high rainfall that fell on deep accumulated snow in the Cascades causing rapid snowmelt and large-scale, widespread flooding throughout much of the Umpqua Basin. During the 1964 floods, the City of Elkton was evacuated, and damage was widespread throughout the Umpqua Basin. Preliminary flood damage estimates prepared by USCE totaled over $31 million in 1964 dollars for the County as a whole. Most of the resulting floods in these sub-basins were considered 100-year events indicating these flow levels have a one percent probability of occurrence in any given year. Most other gages throughout the North Umpqua corridor also recorded this event as a 100-year flood event while several gages that reflect lower elevation and coastal watersheds with less snow accumulation including Elk Creek and the Smith River did not.

The site on the North Umpqua River below Steamboat Creek measured its biggest event in November 1996. During the storm, Roseburg received a record 4.35 inches in one day, and precipitation in the weeks prior to the storm was above average leading to already saturated soils. The combination of heavy rains, snowmelt, saturated soils, and flooding also resulted in debris flows and landslides. Four people were killed by a debris flow near Rock Creek, a tributary to Hubbard Creek near Millwood. More flooding occurred a few weeks later from December 4^{th}-9^{th} and again on January 1^{st}-2^{nd}. The combined damage from flooding and land disturbances caused over $11 million in damage to public and private property within the Umpqua River basin (USGS 2004). The Umpqua National Forest and Oregon State highways within the County incurred over $7 million in damage. BLM lands, local municipal infrastructure, and private property were each over $1 million in damage.

During the November 1996 major flood event, the North Umpqua River below Steamboat Creek was nearly nine feet over flood level and Steamboat Creek was well over nine feet above flood level Boulder Creek near Toketee Falls measured a flood with a greater than 50-year recurrence interval (2 percent chance or occurrence in any given year). The November storm caused more flooding in the North Umpqua and Calapooya Creek sub-basins, while the December storms caused more flooding in the South Umpqua River and Umpqua River sub-basins. The January storms did not produce the flooding of the earlier events but caused more damage throughout the County due to the saturated conditions.

Although not as great as the 1996 events, significant flooding occurred in late December 2005. The North Umpqua River below Steamboat Creek and Steamboat Creek recorded flows over five and seven feet above flood level respectively. However flows were below flood stage by the time they reached Winchester Dam. The Umpqua River near Elkton also exceeded its capacity by over six feet aided by large flows on the South Umpqua River.

Quality

Water quality and quantity affect the use of water. The quality of water in the Umpqua River and North Umpqua River sub-basins does not always meet state standards for all parameters (see Table 1-1). Failure to meet a standard may vary by season due to changes in quantity of flow as well as other seasonal changes.

Oregon Water Quality Index[23]

"The purpose of the Oregon Water Quality Index (OWQI) is to improve understanding of water quality issues by integrating complex data and generating a score that describes water quality status and evaluates water quality trends," (Cude 2001). While it is not a comprehensive assessment of water quality for any specific use, the index aids in the assessment of water quality for recreational uses (i.e. fishing and swimming), and the goal of the index is to assess water quality as it relates to fish. For a complete description of the index and how it was developed and used, refer to *Oregon Water Quality Index: A Tool for Evaluating Water Quality Management Effectiveness*, (Cude 2001).

The Oregon Water Quality Index is a single number that expresses water quality by integrating measurements of the following eight water quality variables collected at ODEQ monitoring stations:

- temperature
- dissolved oxygen (percent saturation and concentration)
- biochemical oxygen demand
- pH
- total solids
- ammonia and nitrate nitrogen
- total phosphorus
- bacteria

Index values are then used to determine trends in water quality for each site. However, the index does not consider changes in toxic concentrations, habitat, or biology of the streams.

Average Oregon water quality index results for the summer and for the rest of the year, as well as the minimum for the season for the Umpqua River near Elkton and for the North Umpqua River at Garden Valley Road for water years 1996 -2005 are listed in Table 2.B-5. The most current index values at both sites are considered "good" in the ODEQ rating scale. There is no significant trend in water quality at these sites.

[23] Discussion in this section is based largely on the Oregon Water Quality Index Report for the Umpqua Basin Water Years 1986-1995 (Cude). However, current index values and updates to the discussion are from the most current Oregon Water Quality Index Summary Report Water Years 1996-2005.

Site	River mile	Summer average (June – Sept)	Fall, winter, and spring average (Oct – May)	Minimum seasonal average	Rating[1]
Umpqua River at Elkton	48.4	87	87	87	good
North Umpqua River at Garden Valley Road	1.8	90	89	89	good

[1] Based on minimum seasonal average.
Scores: very poor 0-59; poor 60-79; fair 80-84; good 85-89; excellent 90-100.
Source: Oregon Water Quality Index Summary Report Water Years 1996-2005.

Table 2.B-5: Oregon Water Quality Index rating for two sites on the Umpqua River and the North Umpqua River for water years 1996 – 2005.

Water quality within the North Umpqua River is considered "good" with a minimal amount of point and non-point source problems. The waters serve as a high quality source of municipal water for the Roseburg and Glide areas. It also serves as a nationally renowned steelhead and salmon fishery. However, according to the Oregon Water Quality Index Report for the Umpqua Basin (1986-1995), "the river experiences periodically high levels of fecal coliform, total phosphates, and biochemical oxygen demand during heavy precipitation. Wet weather events represent a combination of point and non-point source impacts. The North Umpqua River experiences relatively high summer water temperatures influenced by non-point source impacts." In the previous ten-year period (1986-1995), the North Umpqua River showed a slight decreasing water quality trend. The current period (1996-2005) shows no significant trend indicating a slight improvement in conditions.

The Umpqua River at Elkton is also characterized as "good" with no significant trend in water quality. The confluence of the North and South Umpqua rivers dilute the poor quality of the South Umpqua River. The ability of the Umpqua River to buffer the water quality impacts is visible by the time the flow reaches the town of Umpqua eight miles downstream. The Umpqua River is loaded with fecal coliform, total phosphates, and biochemical oxygen demand from Calapooya Creek just upriver from the town of Umpqua. The measure of water quality slightly improved when the monitoring site was moved from Umpqua to Elkton possibly due to the increased distance from Calapooya Creek. The river is still impacted by biochemical oxygen demand in the wet seasons and by high temperature in the summer.

Point and Non-point Source Pollution

Point-source pollution comes from an identifiable point of discharge into the water. Non-point source pollution includes where the primary sources of pollution cannot be identified as coming from a specific site. These factors may include water temperature, erosion and sedimentation, bacteria, and other items. Point source, and non-point source pollution problems identified in the Little River Watershed and Umpqua Basin TMDL assessments and other monitoring data from the area are summarized below.[24]

Bacteria

The Umpqua River failed to meet the State standard for bacteria (fecal coliform and *E. coli*) from just upriver of Mill Creek to a few miles below its confluence with the North and South Umpqua rivers (river miles 25 to 109). Levels are particularly high in the fall, winter, and spring presumably due to increased runoff during high flows. During these periods, bacteria levels pose a health threat to people using the river for water contact recreation.

Bacteria levels throughout the year are a concern for shellfish growing in the lower Umpqua River and the estuary. Since shellfish filter large volumes of water and accumulate high levels of bacteria that can be a health concern to humans, the State standard where shellfish are grown and harvested is more restrictive than in non-shellfish areas. This section of the Umpqua River has a direct influence on the lower Umpqua River and estuary where commercial and sport shellfish harvest is prevalent; thus bacteria levels measured at the lower shellfish standard throughout the Umpqua River are considered high even in the summer.

Although there are several point-sources of bacteria from wastewater treatment plants, ODEQ determined that these usually meet standards for discharge, thus not contributing significantly to the higher bacteria levels measured. The dominant sources are thought to be non-point sources.

Identification of specific non-point sources for the Umpqua River has not been done at this time. However, in 2004 the Smith River Watershed Council commissioned a study in Smith River and the lower Umpqua River to identify bacteria sources using DNA analysis. Over the course of the study, the overall bacteria levels were generally lower than the State standard. The findings showed the largest proportions of contamination averaged over all sites and flow conditions were from wildlife (70-80 percent) and domesticated animals (15 percent). The contribution from humans was less than one percent.

Most of the sampling in the Smith River study occurred during a period with an absence of larger storm events that typically occur more infrequently, but that likely contribute to the highest runoff. Bacteria levels upriver are highest during peak flows. It is unclear whether the relative inputs of bacteria from different sources would change during peak flow events, or whether all sources would increase proportionately. The ODEQ would like to see additional information to definitively identify the predominant sources of bacteria during peak flows when the overall bacteria levels are beyond the standard. Although some of the sampling for the Smith River study occurred in the lower Umpqua River, no DNA sampling further upriver has been done.

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[24] Stream segments in the Umpqua Basin currently listed for sediment or toxics are not included in the Umpqua Basin TMDL. Sediment listed streams in the Little River Watershed are included within the Little River Watershed TMDL.

The Umpqua Basin TMDL has assigned load allocations to point and non-point sources of bacteria. The sources of bacteria addressed in the TMDL were summarized in the following way:

> Studies by DEQ during storms indicated that forested lands do not contribute any significant bacteria load to streams in the Umpqua Basin, but agricultural, rural residential and urban lands, as well as possible turbulence releasing bacteria from stream sediments were the sources of bacteria. Since relative contributions could not be determined from the data, the load allocations for non-point sources were allocated to all non-point sources in the basin.

Temperature
Water temperature is a major factor affecting water quality. It effects concentrations of other constituents, as well as the chemical and biological interaction of these constituents. It is a primary factor in determining the types of organisms able to inhabit a body of water. Salmonids are among the most sensitive fish; therefore ODEQ surface water temperature standards have been set based on salmonid temperature tolerance levels. The temperature standard varies throughout the Umpqua Basin according to the habitat area and the species that use that area. The standard is based on a seven-day average maximum (7DAM) temperature to avoid short-duration spikes in temperature that likely have minimal impacts on salmonids.

Throughout the Umpqua River and North Umpqua River sub-basins, the maximum desirable water temperature is approximately 55°F during spawning periods. Spawning times vary by stream but are generally between September and June. [25] During the rest of the summer when salmonids are migrating and rearing, the temperature standard is 64°F except in areas considered core cold-water habitat. These core cold-water areas are located in the upper portion of the Umpqua River above the confluence with Calapooya Creek, and throughout the North Umpqua River sub-basin from the mouth to just above the confluence with Boulder Creek (approximately river mile 69). The State standard for these core cold-water areas require temperatures not exceed about 61°F during non-spawning time generally in the summer. Although these are desirable temperatures based on healthy salmonid populations, there is no evidence that all of these streams ever met these standards.

There are 50 streams (or stream portions) that do not currently meet the State standards for temperature within the Umpqua River/North Umpqua River sub-basins. Most of these are within the North Umpqua River sub-basin where temperatures must meet the lower core cold-water habitat standard of 61°F during non-spawning periods. Since the core cold-

[25] Most of the spawning use in the Umpqua River sub-basin is from October to May. However, large portions of the main Umpqua River are not used for spawning. In these areas, the higher temperature of 64°F would be the standard throughout the year. Much of the spawning begins in September and lasts until June in the North Umpqua River sub-basin.

water habitat standard was implemented in 2004, an additional 21 streams (or segments) in the North Umpqua River sub-basin failed to meet this standard.[26]

Streams in the Little River Watershed are within the North Umpqua sub-basin but are included in the approved Little River TMDL. All other temperature listings except several segments on the North Umpqua River are addressed in the Umpqua Basin TMDL. Three segments of the North Umpqua River between the mouth and river mile 68.9 are listed for temperature during the spawning season from September 1 to June 15. These listings require additional data and analysis; thus they are not addressed in the TMDL. Streams listed as water quality impaired for temperature are shown in Table 2.B-6 along with the season of the impairment relative to salmon spawning.

The entire Umpqua River exceeds the temperature standard of 64°F throughout the year. Most of the river is used by salmonids for rearing and migration when temperatures above 64°F may cause health problems for salmonids. The five remaining listed streams in the Umpqua River sub-basin also have temperatures that only exceed standards during non-spawning periods; typically summer months.

The North Umpqua River temperatures are considered high during both spawning and non-spawning periods from the mouth to just above Boulder Creek where the core cold-water habitat ends (river mile 69). Seven other streams in the sub-basin also exceed temperatures during both spawning and non-spawning periods, three exceed only during spawning, and the remaining 27 streams exceed only during non-spawning (Table 2.B-6).

[26] Seven of these streams had previously been listed during spawning periods only.

Umpqua sub-basin			
Stream	**Season**	**Stream**	**Season**
Brush Creek	non-spawning	Miner Creek	non-spawning
Heddin Creek	non-spawning	Rader Creek	non-spawning
Little Wolf Creek	non-spawning	Umpqua River	non-spawning
Lost Creek	non-spawning	Wolf Creek	non-spawning
Lutsinger Creek	non-spawning	Yellow Creek	non-spawning
Mehl Creek	non-spawning		
North Umpqua sub-basin			
Stream	**Season**	**Stream**	**Season**
Big Bend Creek	non-spawning	Lake Creek	non-spawning
Boulder Creek	spawning	Little Rock Creek	non-spawning
Calf Creek	year around	North Fork East Fork Rock Creek	non-spawning
Canton Creek	non-spawning	North Umpqua River	year around
Cedar Creek	non-spawning	Northeast Rock Creek	non-spawning
City Creek	non-spawning	Panther Creek	year around
Copeland Creek	year around	Pass Creek	non-spawning
East Fork Copeland Cr	non-spawning	Rock Creek	year around
East Fork Rock Creek	non-spawning	Scaredman Creek	non-spawning
East Fork Steamboat Cr	non-spawning	Steamboat Creek	year around
East Pass Creek	non-spawning	Steelhead Creek	non-spawning
Fish Creek	non-spawning	Susan Creek	non-spawning
Harrington Creek	non-spawning	Unnamed (tributary to Rock Creek)	spawning
Honey Creek	non-spawning	Watson Creek	spawning
Horse Heaven Creek	non-spawning		
Little River Watershed (TMDL approved)			
Stream	**Season**	**Stream**	**Season**
Black Creek	non-spawning	Flat Rock Branch	non-spawning
Cavitt Creek	non-spawning	Jim Creek	non-spawning
Clover Creek	non-spawning	Little River	year around
Eggleston Creek	non-spawning	Rattlesnake Creek	year around
Emile Creek	non-spawning	Wolf Creek	non-spawning
Source: Oregon DEQ 2004/2006 Integrated Report.			

Table 2.B-6: Stream segments that exceed State water temperature standards (Umpqua River/North Umpqua River sub-basins).

NRD currently monitors 20 temperature-measuring stations in the Umpqua Basin. Data from these stations as well as temperature data from US Geological Survey (USGS) gages, ODEQ sampling sites, the Partnership for the Umpqua Rivers Watershed Council, and other agency sources are the basis for the following discussions of water temperature conditions.

The Partnership for the Umpqua Rivers commissioned temperature studies within the Lower Umpqua River and the Lower North Umpqua River sub-basins in 2000 and 1999 respectively. There were 25 sites continuously monitored within this portion of the Umpqua River sub-basin from about June 21st to September 26th. Monitoring sites where the seven-day average maximum (7DAM) stream temperature was exceeded for at least 20 percent of the time are listed in Table 2.B-7 along with the percent of monitored days that the standard (64°F) was not met. All three Umpqua River sites exceeded the standard for the entire period. Paradise Creek, Sawyer Creek, and Yellow Creek all exceeded or nearly exceeded the standard at least 50 percent of the time.

Site name	Percent exceeded	Site name	Percent exceeded
Umpqua River above Little Mill Creek[1]	100	Paradise Creek below Cedar[2]	27
Weatherly Creek at bridge	44	Upper Mehl Creek	23
Paradise Creek at mouth	48	Waggoner Creek at bridge	38
Umpqua River above Paradise Creek	100	Umpqua River above McGee Creek	100
Sawyer Creek near mouth	53	Yellow Creek at mouth	51
Paradise Creek above Little Paradise[2]	49		

[1] Shorter data collection time due to exposed data monitoring unit during low flows (49 days collected).
[2] Stream temperature monitoring did not begin until 7/16/00 for these sites (60 days collected).

Table 2.B-7: Umpqua River sub-basin sites where 7DAM temperatures exceeded 64°F for at least 20 percent of the monitoring period in summer 2000 (Geyer 2003b).

Sensors were placed at 18 locations within the Lower North Umpqua sub-basin from June 14 until September 6, 1999. Table 2.B-8 shows the location and percent of days for which seven-day average maximum temperatures exceeded 64°F. All but one monitoring site on the North Umpqua River had seven-day average maximum temperatures exceeding 64°F every monitoring day. [27]

Site name	Percent exceeded
North Umpqua at mouth	100
North Umpqua below Winchester Dam	100
North Umpqua above Sutherlin Creek	100
North Umpqua above Rock Creek	100
North Umpqua above Clover Creek	70

Table 2.B-8: Monitoring sites on the North Umpqua River and the percent of days where the 7DAM temperature exceeded 64°F in summer 1999 (Geyer 2003b).

[27] At the time of this study, the temperature standard for the North Umpqua and its tributaries was 64°F during the summer non-spawning season. The current standard is 61°F making these temperatures further exceed the standard.

Stream temperature at a particular point is a function of many local factors that include exposure to solar radiation, longwave heating from the local environment and groundwater interaction. Water's susceptibility to change temperature is a function of both the volume and velocity of flow. Stream temperatures usually follow a warming trend as the distance from the headwaters (and the corresponding stream volume) increases. Stream temperatures typically increase from about 52°F at the headwater source, to the ambient air temperature of downstream locations. Temperature data from within the Umpqua Basin indicates that most streams longer than seven miles will exceed the State standard of 64°F. Presumably the lower core cold-water standard of 61°F is exceeded in even fewer miles (about five). Streams that are exposed to direct sunlight can exceed the standard in a shorter distance. Temperatures may also vary within a given area on the river with cooler temperatures in the deeper water. Isolated points of upwelling ground water may provide some thermal refuge for aquatic life.

Figure 2.B.3 shows the seven-day moving average maximum temperature for five locations along the North Umpqua River. All five sites exceeded the standard for the entire season. The coolest site is located above Rock Creek which is furthest upriver at about river mile 35. The temperatures get progressively warmer as the sites are located further downriver with the warmest sites located at the mouth and at Sutherlin Creek, about five miles from the mouth.

Water temperatures vary with local ambient conditions, direct solar radiation, and proportion of ground water flowing into the stream. The effect of ambient air temperature on stream temperature is reflected in Figure 2.B.3 where stream temperatures vary by site but the daily stream temperature pattern is the same at all five sites; and maximum and minimum seven-day average maximum temperatures typically occur on the same days at each location.

Analysis of temperature data with respect to watershed location indicates that tributaries, with some exceptions, were as much as 10°F cooler than the mainstem portions of the Umpqua and North Umpqua rivers. Some tributary exceptions including Sutherlin Creek, Rock Creek, and Canton Creek are actually warmer than the mainstem North Umpqua River. Comparison of temperatures from the summer 2003 for Canton Creek, Rock Creek and two sites on the main river where these tributaries enter the North Umpqua River are shown in Figure 2.B.4.

Removal of riparian vegetation that provides shade, and channel modification can cause local elevated temperatures. The data suggest that increasing shade on streams that are less than 20 miles from their source area may reduce maximum daily stream temperatures in localized areas. The lower reaches of tributaries may provide important refuge for fish by providing colder water along the warm mainstem waters in the summer months.

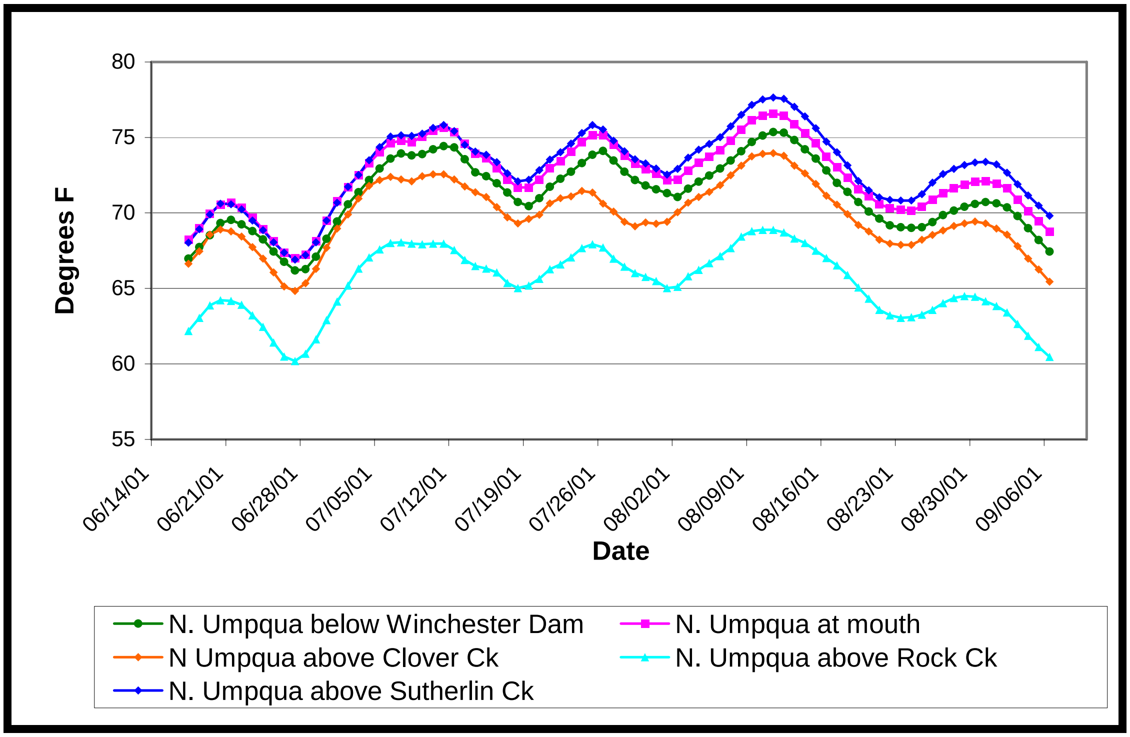

Figure 2.B.3: Seven-day moving average maximum temperature trends for the North Umpqua River during the summer of 1999 (Geyer 2003b).

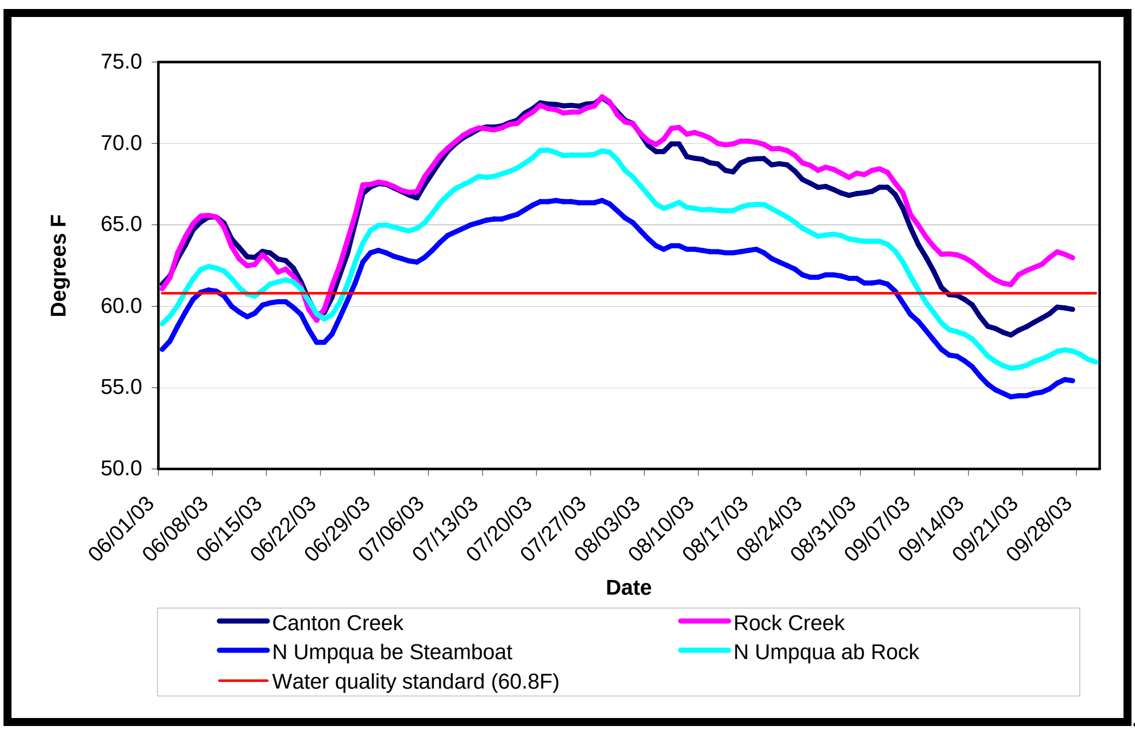

Figure 2.B.4: Canton Creek and Rock Creek 7DAM temperatures in 2003 were warmer than the main North Umpqua River (Winn 2006).

Dissolved Oxygen
Salmonid eggs and smolts are sensitive to dissolved oxygen levels. When levels drop too low for even short periods of time, eggs, smolts, and other aquatic organisms will die. The amount of oxygen that is dissolved in water will vary depending upon temperature, barometric pressure, flow, and time of day. Both cold water and higher barometric pressure dissolve more oxygen than warm water and low pressure. In addition, flowing water contains more dissolved oxygen than still water. Aquatic organisms produce oxygen through photosynthesis and use oxygen during respiration. As a result, dissolved oxygen levels tend to be highest in the afternoon when algal photosynthesis is at its peak, and lowest before dawn after organisms have used oxygen for respiration during the night.

Fish Creek and Steamboat Creek in the North Umpqua sub-basin are listed as water quality impaired during the summer for dissolved oxygen. Low levels occur during the summer when anadromous fish are passing through and rearing in these streams.

Toxics
Toxics may be a concern for fish and aquatic life, drinking water, fishing, and human health. A variety of substances can be toxic including metals, and organic and inorganic chemicals. Some of these substances are found naturally in stream water. The State monitors toxic levels in the water so they are not introduced above natural background levels in amounts, concentrations, or combinations that may be harmful to public health, safety, or welfare; or detrimental to aquatic life, wildlife, or other beneficial uses of the stream.

Three streams in the North Umpqua sub-basin are considered water quality impaired for various toxic substances while many others are a “potential concern” for toxics. These streams with a “potential concern” have been sampled and results have not met State water quality standards but the number of samples is insufficient to determine if they are water quality impaired. They are not currently on the 303(d) list, but may warrant additional monitoring.

Table 2.B-9 shows the streams listed for different toxics and the concern associated with each. Stream segments on the 303(d) list for toxic substances are not addressed by the Umpqua Basin TMDL. They will be addressed in the next round of TMDL analysis in the basin. Toxic levels that may have effects on human health are of particular concern where residents use the stream as a primary water source as well as regularly consume fish from the stream. All three of these streams and the reservoir are used for both purposes.

North Umpqua sub-basin 303(d) listed			
Stream	**River miles**	**Toxic**	**Concern**
Cooper Creek/Cooper Creek Reservoir	0 to 5.9	iron	aquatic life, drinking water, fishing, human health
North Umpqua River	35 to 52	arsenic	drinking water, fishing
Sutherlin Creek	0 to 16	arsenic beryllium iron lead manganese	aquatic life, drinking water, fishing, human health
Sutherlin Creek	4.6 to 10	copper	resident fish and aquatic life

Table 2.B-9: Streams listed as water quality impaired for various toxic substances in the North Umpqua sub-basin.

Table 2.B-10 lists those streams that are not listed as impaired but are of "potential concern with insufficient data" where toxic levels may affect aquatic life or human health throughout the year. Streams that potentially do not meet alkalinity standards may be high in $CaCO_3$; creating health problems for aquatic life.

Potential concern with insufficient data for toxics			
Stream	**River miles**	**Toxic**	**Concern**
Camp Creek	0 to 3.2	alkalinity	aquatic life
Canton Creek	0 to 16.5	alkalinity	aquatic life
Cooper Creek/Reservoir	0 to 5.9	arsenic, beryllium, manganese	aquatic life, human health
Eggleston Creek	0 to 2.7	alkalinity	aquatic life
Emile Creek trib	0 to 1.6	alkalinity	aquatic life
Fish Creek	0 to 18.6	alkalinity	aquatic life
Horse Heaven Creek	0 to 6.3	alkalinity	aquatic life
Lake Creek	0 to 11.5	alkalinity	aquatic life
North Umpqua River	0 to 105.7	alkalinity	aquatic life
Shoup Creek	0 to 3.2	alkalinity	aquatic life
Silent Creek	0 to 5	alkalinity	aquatic life
Sutherlin Creek	0 to 16	mercury	aquatic life, human health
West Fork Wolf Creek	0 to 2.6	alkalinity	aquatic life
Umpqua River	0 to 109.3	alkalinity	aquatic life

Table 2.B-10: Streams with a "potential concern" for toxic substances; where samples failed to meet State standards but sample sizes were insufficient for listing.

pH

The pH is a measure of the hydrogen ion concentration of the surface water in the stream. It determines the acidity or alkalinity of the water. High or low pH levels in streams may adversely affect fish and aquatic life, or restrict water contact recreational use. When pH levels exceed the streams normal range, water can dissolve the protective mucous layer on aquatic organisms such as fish, amphibians, and mollusks; making them more susceptible to diseases. PH can alter the chemical form and affect the availability of nutrients and toxic chemicals; thus potentially impacting resident aquatic life and human health. In mining areas, the presence of low pH and heavy metals can shift the metal ions to more toxic forms in the water.

Table 2.B-11 shows the streams considered water quality impaired for pH. All of these streams are within the North Umpqua River sub-basin. The pH levels are limited only during the summer for all eight streams listed. Five of the streams are within the Little River Watershed and have an approved TMDL to address the pH concern. The Lake Creek and Steamboat Creek segments will be addressed through the Umpqua Basin TMDL approved in April 2007. The one mile section listed on the North Umpqua River is not addressed in a TMDL but is expected to be addressed through other processes related to the relicensing agreement for the North Umpqua Hydroelectric Project.

Stream	River miles	Stream	River miles
Black Creek	0 to 5.2	Little River	0 to 18.2
Cavitt Creek	0 to 2.5	North Umpqua River	77 to 78
Emile Creek	0 to 7.5	Steamboat Creek	0 to 23.4
Lake Creek	0 to 11.5	Wolf Creek	0 to 4.3

Table 2.B-11: Streams in the North Umpqua River sub-basin listed as water quality impaired for pH.

Sedimentation

Sediment is material that enters the stream and settles to the bottom. Some levels of sedimentation are considered normal for streams and can even be beneficial. However, too much fine sediment can form a “sludge” layer on the streambed surface that may smother salmonid eggs laid in gravels in the streambed. The eggs require water to circulate through the gravel providing oxygen to the salmonid eggs. A sludge-like layer can prevent that water circulation causing salmonid eggs to suffocate. Many other aquatic organisms require gravel beds and some like the Pacific lamprey actually thrive in sludgy streams.

Four streams in the North Umpqua sub-basin all within the Steamboat Creek Watershed were previously listed for sediment. Most sediment listings have been based on qualitative rather than quantitative assessments in streams from watershed analyses completed by the US Forest Service. ODEQ de-listed these four streams based on additional data submitted by the Umpqua National Forest. However, based on additional comments received on this proposed de-listing, Canton Creek was placed back on the water quality impaired list for sediment.

ODEQ is developing a new method of determining the condition of streambeds with respect to sediment. Due to the uncertainty in the current measurement of sediment loading, the Umpqua Basin TMDL does not address streams listed for sediment; thus Canton Creek is not addressed in the TMDL. Requests to re-evaluate the allocations for sediment in the Little River TMDL have been declined by ODEQ at this time until it completes work on the sediment criteria (ODEQ 2006).

Cavitt Creek, Jim Creek, and Little River are listed as water quality impaired for sediment. These three streams are all within the Little River Watershed and the sediment listing is being addressed through the approved TMDL for that area.

Other Water Quality Concerns
There are several one mile sections on the upper North Umpqua River (above river mile 75) where the stream is listed as impaired year around for total dissolved gases. These are related to the North Umpqua Hydroelectric Project. Control measures implemented as part of the license agreement for the hydroelectric project will attain the required total dissolved gas saturation levels. In addition, the lower three miles of Potter Creek are considered impaired for biological criteria. This is also expected to be remedied through hydroelectric project control measures.

The lower portions of Camp Creek and Silent Creek are a “potential concern” during the summer for phosphate/phosphorous levels. When nutrient levels get too high, they may affect related parameters such as dissolved oxygen or excessive algae growth, which in turn may negatively impact beneficial uses of that stream such as fish and aquatic life. Both of these streams are also a “potential concern” for alkalinity, and they each flow into Diamond Lake. The Lake has experienced excessive algae blooms and high nutrient levels in large part due to the explosive tui chub population. The Lake has been recently drained and treated to address this problem. See Surface Water – Lakes and Reservoirs section for more information on Diamond Lake.

There are 49 streams in these sub-basins listed for habitat modification and 22 listed with flow modification impairment. Most of those listed for flow modification are within the Umpqua River sub-basin, while those listed for habitat modification are distributed throughout both sub-basins. Streams listed for habitat modifications or flow modifications are considered water quality impaired, however they do not require a TMDL since the impairment is not from a pollutant. These are usually caused by physical changes to the stream environment. They can be related to stream crossings that restrict or change flow patterns, streambank modification, vegetation changes or losses, and loss of streambed material from flooding, dredging, or historic logging practices with log flumes.

These impairments are common throughout the Umpqua Basin. They can affect other parameters including sediment, dissolved oxygen, and temperature by increasing erosion and streamflow velocity, and decreasing shade. Loss of floodplain vegetation can also increase the rate of streamflow and decrease filtering of sediment and toxics. Efforts to improve fish passage and riparian conditions can help to improve these impairments.

Low summer flows have also been exacerbated by water needs at the North Umpqua River Hydroelectric Project. The recent relicensing of the hydroelectric project incorporated increases in the minimum flow requirements to 275 cfs through the bypass reach at the Soda Springs powerhouse located about 60 miles east of Roseburg on the North Umpqua River (US Dept. of Commerce 2002). Although this level of flow is still much less than average expected flows on the river without the bypass, it should improve flows compared to past flow levels since the dams have been operational, and may improve water quality parameters impacted by low summer flows.

Wastewater Permits

ODEQ manages a wastewater permit program that identifies point-sources of wastewater with potential serious water quality or public health impacts. It requires that those facilities obtain and comply with a wastewater discharge permit. Permit conditions generally include effluent limits; monitoring standards; compliance conditions to improve operation; special operating conditions; and other administrative requirements such as prompt reporting of spills.

Since 1973, permits for discharges to surface waters are issued under the National Pollutant Discharge Elimination System (NPDES). The primary purpose of these permits is to insure that wastewater discharges do not cause harm to the receiving waters or endanger public health. Wastewater discharges that affect land quality and/or ground water are regulated under Water Pollution Control Facilities (WPCF) permits. Their primary purpose is to protect public health and ground water.

General permits are issued when an individual permit is not necessary to adequately protect water quality, and there are several minor sources or activities involved in similar operations that are discharging similar types of waste. These general permits can be to surface water discharges or ground water/land discharges. Individual and general wastewater permits to surface water issued in the sub-basins are discussed in this section and listed in Table 2.B-12. Permits for discharges that may affect ground water are discussed in the ground water quality section.

Point source discharges include minor industrial sources such as stormwater and wastewater discharges. There are only two point source discharges into the Umpqua River between Scottsburg and the confluence of the North and South Umpqua Rivers. Most permits are concentrated in areas near Sutherlin to Winchester where several industries, subdivision construction areas, and the Winchester Dam are located; near Glide where Superior Studs, LLC and Treesource Industries, Inc. hold permits for the North Umpqua River; and in the upper North Umpqua River area where Pacificorp holds permits on the North Umpqua and Clearwater River for their North Umpqua Hydroelectric Project. There are no major discharge permits in the sub-basins. Table 2.B-12 lists an inventory of waste discharges in the Umpqua River/North Umpqua River sub-basins.

Umpqua River sub-basin			
Source	**Receiving stream**	**Class**	**Waste type**
Elkton Properties LLC	Umpqua River	minor	stormwater
Manser, James	Umpqua River	minor	stormwater
North Umpqua River sub-basin			
Alcan Aluminum Corporation	Sutherlin Creek	minor	stormwater
Avery, Gordon	Sutherlin Creek	minor	stormwater
Basco Logging, Inc.	North Umpqua R	minor	stormwater
Bayliner Marine Corporation	North Umpqua R	minor	stormwater
Beckley Excavation and Utitlity, Inc.	Sutherlin Creek	minor	stormwater
Bratton, Olen Wayne	unnamed trib to Turkey Creek	minor	stormwater
Douglas County Public Works (2)	North Umpqua R	minor	sewage & wastewater
Douglas County, Inc. (2)	North Umpqua R	minor	stormwater, & wastewater
Farrar, Paul	North Umpqua R	minor	stormwater
FCC Commercial Furniture, Inc.	Sutherlin Creek	minor	stormwater
FCC Commercial Furniture, Inc.	North Umpqua R	minor	stormwater
Gordon Avery Construction Co.	Cooper Creek	minor	stormwater
Gordon Avery Construction Co.	Sutherlin Creek	minor	stormwater
John Talley Construction Inc.	Cooper Creek	minor	stormwater
Kramer, Mike	Sutherlin Creek	minor	stormwater
L&H Lumber Co. (2)	Davis Creek	minor	stormwater
LTM, Incorporated	Dixon Creek	minor	stormwater
LTM, Incorporated	Buckhorn Creek	minor	stormwater
Murphy Company (2)	Sutherlin Creek	minor	stormwater
Norway Development Company	Davis Creek	minor	stormwater
Oregon Dept. of Fish and Wildlife	Rock Creek	minor	wastewater
PacifiCorp (6)	North Umpqua R	minor	wastewater
PacifiCorp (2)	Clearwater River	minor	wastewater & stormwater
Ronald & Carolyn Kenwisher	Sutherlin Creek	minor	stormwater
Superior Studs, LLC (3)	North Umpqua R	minor	stormwater & wastewater
Treesource Industries, Inc.	North Umpqua R	minor	stormwater
USDA; Forest Service	Little River	minor	sewage
Weyerhauser Company	Sutherlin Creek	minor	stormwater
( ) indicates the number of permits held if more than one. Source: ODEQ Wastewater Permits Database accessed 11/30/06.			

Table 2.B-12: Waste discharge permits (Umpqua River/North Umpqua River sub-basins).

The only minor domestic sewage discharge permits in this area are held by Douglas County for the Glide-Idleyld Park sewage treatment facility located near the North Umpqua River below Glide, and the USDA Forest Service, Wolf Creek Civilian Conservation Corps near river mile 11 on Little River. The City of Elkton also holds a sewage discharge permit on the Umpqua River; however the State has classified their permit as “not applicable” indicating it is non-significant based on the amount and/or season of discharge. There are a number of other small sewage permits held in these sub-basins also classified by the State as “not-applicable.” Other incorporated urban areas including Sutherlin and Oakland hold sewage discharge permits into Calapooya Creek assessed in Section 2.C.

Effluent discharges from eleven wastewater treatment plants throughout the Umpqua Basin will be required to meet temperature limits during the non-spawning season (typically summer months). These limits are established in the Umpqua Basin TMDL and are incorporated with permit renewals. Limits are based on streamflow, stream temperature, and amount of discharge. The intent is to maintain the cumulative temperature increase from point sources to less than 0.1°C during the non-spawning months to help meet the temperature standards on streams throughout the basin. The Glide-Idleyld Park facility is the only one located within the North Umpqua River sub-basin, and none are within the Umpqua River sub-basin.

Although only one facility has a restriction within the sub-basins, restrictions on plants located in the South Umpqua, Elk Creek, and Calapooya Creek sub-basins are expected to somewhat improve stream temperatures downstream within the Umpqua River sub-basin.

Surface Water – Lakes and Reservoirs

Quantity

More than half the lakes with surface areas greater than ten acres occurring in the North Umpqua sub-basin are those that result from dams constructed for multiple purpose uses. The minority, natural lakes, are sited on Federal lands within the Umpqua National Forest. There are also a number of natural lakes on Federal lands within the sub-basin with surface areas less than ten acres that are used for public recreation purposes. Table 2.B-13 lists lakes over 10 acres in surface area located within the North Umpqua sub-basin. There are no lakes available for public use in the Umpqua River sub-basin.

About 4,500 acre-feet of storage volume in Diamond Lake results from a flashboard dam providing 18 inches of storage. The additional water storage is released during low flows on the North Umpqua River to allow water use from the river to the ODFW Rock Creek Hatchery. The portion of water rights for the hatchery that allow diversions from the North Umpqua River are junior to North Umpqua River minimum flows; therefore additional storage at Diamond Lake is necessary. The hatchery uses Rock Creek water for much of the year but during the low flow season, water is drawn from the North Umpqua River due to elevated temperatures in Rock Creek.

Plat I Reservoir and Cooper Creek Reservoir were constructed in 1967 and 1970 for the purpose of flood control, irrigation, anadromous fish use, recreation and in the case of Cooper Creek Reservoir, municipal and industrial water supply. Although the two reservoirs are small they have a significant impact on the business and agricultural communities in the Sutherlin area.

The reservoirs were constructed through the cooperation of the North Douglas Soil and Water Conservation District, Sutherlin Water Control District, City of Sutherlin, and Douglas County. Financing was provided through the Watershed Protection and Flood Prevention Act as provided for in Public Law 566, administered by the Natural Resource Conservation Service. The Sutherlin Creek Watershed, Plat I, and Cooper Creek are managed by a nine member Board of Directors of the Sutherlin Water Control District.

Name	Surface area (acres)	Volume (acre-feet)	Use
Plat I Reservoir	150	800	Multi-purpose
Cooper Creek Reservoir	160	5,000	Multi-purpose
Denley Reservoir	16	120	Private Rec., Irrigation
Whistlers Bend Reservoir	35	380	Private Irrigation
Updegrave Reservoir	14	170	Private Rec., Irrigation
Hemlock Lake	28	440	Public Recreation
Twin Lake (east)	14	240	Public Recreation
Soda Springs Reservoir	30	240	Hydroelectric, Public Rec.
Toketee Reservoir	80	850	Hydroelectric, Public Rec.
Lemolo Forebay	23	235	Hydroelectric, Public Rec.
Clearwater #1 Forebay	17	170	Hydroelectric, Public Rec.
Stump Lake	11	55	Hydroelectric, Public Rec.
Lemolo Lake	420	14,000	Hydroelectric, Public Rec.
Skookum Lake	10	110	Public Recreation
Maidu Lake	20	140	Public Recreation
Diamond Lake	3,000	77,000	Public Recreation
Calamut Lake	18	190	Public Recreation
Source: Lakes of Oregon, Volume 6, Douglas County, USGS			

Table 2.B-13: Lakes in the North Umpqua River sub-basin over 10 acres in size.

Plat I Reservoir[28]

Plat I Reservoir, a 30.5 foot high earth fill dam, was completed in 1967. In the early 1990s, it was expanded to add another 400 acre-feet for irrigation use. The reservoir is located 2.5 miles east of Sutherlin on Sutherlin Creek, a tributary of the North Umpqua River, and has approximately 135 acres of water surface at the irrigation pool level, but expands to approximately 290 acres at the top of the emergency spillway at flood capacity. Of the 2,170 acre-feet of active storage, 1,330 acre-feet are used for irrigation and 840 acre-feet are used for flood control.

The primary purpose of the project is for flood protection for the City of Sutherlin and agricultural lands above and below Sutherlin. Flooding was a common occurrence in the City of Sutherlin and large areas of agricultural land were being inundated almost every winter prior to establishment of the reservoir. Every fall the reservoir is drained to a minimum pool level of 85 acre-feet, allowing for over 2,000 acre-feet of fresh water to enter the system the following winter. The construction of the dam has almost completely eliminated the flooding problem.

An estimated 600 acres of agricultural and livestock production are served by water distributed through a pressurized distribution system from the Plat 1 Reservoir.

Although recreation was not originally a planned use for Plat I Reservoir, it is used for waterskiing, boating, swimming, fishing, and water fowl hunting. A boat ramp has been constructed by the County and the site has been maintained as a county park recreational facility. The reservoir is managed for fishing by the Oregon Department of Fish and Wild-life and is stocked with about 1,000 fish per week during the summer season. Fishing includes trout but also features warm-water fish such as bass, panfish, and catfish.

Cooper Creek Reservoir

Cooper Creek Reservoir was constructed with a 95.5 foot high earth fill dam in 1970. It is located 2.5 miles Southeast of Sutherlin on Cooper Creek, a tributary of Sutherlin Creek. The reservoir has 150 acres of water surface to the principle spillway but expands to 180 acres when the level reaches the emergency spillway at flood stage. The active storage capacity at flood stage is 4,830 acre-feet while typical storage is 3,900 acre-feet, of which 3,400 acre-feet are used for recreation, 500 acre-feet provide additional water supply to the City of Sutherlin for municipal and industrial water use, and 930 acre-feet are for flood control.

In 1996, the Sutherlin Water Control District began a new management strategy of drawing down the level of Cooper Creek up to six feet every fall to flush out much of the more stagnant water to improve water quality in the reservoir. This draw-down allows for more

[28] Most of the information on Plat I and Cooper Creek reservoirs is from verbal communication with Blair Nash of the Sutherlin Water Control District on 12/11/06. He obtained information on storage capacities from the Phase 1 Inspection Report completed in September, 1978, and from a report commissioned by Sutherlin in September, 1998 on Plat I accounting for capacity differences due to sediment load in the reservoir.

capacity for flood control during the winter storm events by creating an additional 500 acre-feet of flood storage capacity.

Construction of Cooper Creek Reservoir and Plat I Reservoir has almost completely eliminated the nearly annual flooding of the City of Sutherlin and surrounding agricultural lands.

Cooper Creek Reservoir gets several hundred thousand visits during the year from recreationists. The visits primarily include boating, waterskiing, and fishing. Recreational facilities are managed by the Douglas County Parks Department, and although there is no overnight camping, the parks are open all year with a resident caretaker. The reservoir is managed for fishing by the Oregon Department of Fish and Wildlife and has been stocked with both trout and warm-water fish.

Quality

Cooper Creek Reservoir, Platt I Reservoir, and Diamond Lake all have water quality concerns and are listed on the State's 303(d) list. Cooper Creek Reservoir is considered water quality impaired throughout the year for both iron and mercury. The beneficial uses that may be affected are human health, drinking water, fishing, and aquatic life. The reservoir was also added as a "potential concern" in 2004 for samples with impaired levels of arsenic, beryllium, and manganese throughout the year. However, sample sizes were insufficient to add to the 303(d) list. These substances are monitored by the Sutherlin Water Treatment Facility, as elevated levels may affect human health.

In 2006, the Sutherlin Water Control District began using a management strategy of draining Cooper Creek down between three and six feet to alleviate water quality concerns. This has allowed much of the stagnant water with high levels of these toxic substances to be flushed out of the reservoir. The level was then brought back up with fresh water from the winter storms. This has improved the water quality in Cooper Creek while creating more storage capacity for flood control.[29]

Plat I Reservoir was listed as water quality impaired for mercury in 2002. The beneficial use affected is fishing. Due to elevated mercury levels found in fish, a consumption advisory for fish from the reservoir has been issued. The reservoir is drained down to the minimum of 85 acre-feet every fall to allow for maximum flood control storage capacity. This flushing of the system helps to reduce the contamination levels of mercury. However monitoring is not regularly done since it is not used as a drinking water source; therefore the flushing likely helps control the mercury levels but the actual level during fishing season is potentially still high.

Diamond Lake[30]

Diamond Lake has been listed for algae, pH, and dissolved oxygen. It was added as a "potential concern with insufficient data" for alkalinity and ammonia in 2004; both of

[29] Blair Nash, Sutherlin Water Control District verbal communication 12/11/06.
[30] Jim Muck, ODFW District Biologist and information from the ODFW website.

which may adversely impact aquatic life. Diamond Lake and Lemolo Lake have had public health advisories issued for blue-green algae as recently as fall, 2006.

Diamond Lake has been classified by scientists who study lakes (limnologists) as a highly productive water body due to the availability of nutrients that support the growth of aquatic plants. Periods of high algae abundance in the water (algae blooms) have been observed since the 1930s (Hughes 1970).

Prior to the 1920s, developments at Diamond Lake consisted primarily of unimproved campgrounds. More extensive development began in the 1920s including construction of a resort and lakeside residences. The construction of residences continued until the mid-1950s and expansion of the campground facilities continued up to 1972. Visitor use of the area has increased dramatically since the area was first developed. By the mid-1960s, Forest Service officials were concerned that nutrient-rich sewage and other wastes generated by Diamond Lake visitors could contribute to an increase in the growth of aquatic plants (eutrophication).

Visitor use projections and possible health and aesthetic concerns led Forest Service officials to evaluate the waste collection and treatment needs of the Diamond Lake area and a plan was developed for an improved sanitation system (Burgess 1966). The system was designed to accommodate approximately 15,000 lake-visitors per day, including people using the resort, the south-shore area, the trailer court and various picnic sites and campgrounds (USDA Forest Service 1970). The private residences on the western shore of the lake were not included in the waste collection system. These residences rely primarily on septic systems and simple pit toilets for sewage disposal. As part of the wastewater diversion system, sewage waters were diverted to waste-stabilization ponds (lagoons) located outside the lake's watershed. In some cases, septic-tank drainfield systems and simple pit-toilets were replaced by vaults which temporarily store wastes until they can be hauled away. The first use of the new facilities occurred in 1970 and by December, 1975 all planned connections to the wastewater diversion system were completed (Lauer et al. 1979). The Forest Service continues to operate and maintain these sewage diversion and treatment facilities up to the present time.

In 1971, the Forest Service and US Environmental Protection Agency (EPA) signed a Memorandum of Agreement to systematically study Diamond Lake and assess the effectiveness of nutrient diversion on the condition of the lake (Lauer et al. 1979). From 1971 to 1977 the EPA conducted a research program on Diamond Lake to collect limnological information and identify changes that could be attributed to the nutrient diversion. Following this period of study, the EPA concluded that the lake's eutrophication rate had not been affected to any significant degree by sewage diversion, and nutrients from human sources represented a minor portion of the lake's total nutrient load. These researchers reported that nutrient enrichment in Diamond Lake was primarily a natural phenomenon, with the majority of nutrients derived from natural sources (Lauer et al. 1979).

Other investigators (Davis and Larson 1976; Meyerhoff et al. 1978; Salinas and Larson 1995; Eilers et al. 1997; Eilers et al. 2001b) reached a different conclusion implicating human activities as major sources of nutrient enrichment which has accelerated eutrophication. Eilers et al. (2001a) concluded that Diamond Lake has experienced significant deterioration in the 20th century and these changes are associated to some extent with shoreline development but correspond more closely with changes in the introduced tui chub (*Gila bicolor*) population.

Tui chub are a species of minnow native to the Klamath Basin but not to Diamond Lake. They were likely introduced to the lake by anglers using them as live bait, an illegal practice in Oregon freshwater fisheries. Since discovered in the lake in the 1990s, tui chub have rapidly proliferated and caused water quality problems in the lake as well as upset the aquatic ecosystem. The native trout species has been depleted and the nutrient buildup from the extensive chub population has impacted water quality in the lake.

The Forest Service implemented a monitoring program at Diamond Lake to collect limnological and water-quality information. During the summers of 2001, 2002 and 2003, blooms of the toxin producing blue-green algae (cyanobacteria) *Anabaena flos-aquae* occurred at Diamond Lake. The high abundance and associated public health risks of this planktonic (microscopic free-floating) blue-green algae prompted the Umpqua National Forest in cooperation with Oregon Health Division and Douglas County Health Department to close the lake to water contact activities for periods of time during each of these summer seasons.

In 1998, Diamond Lake was added to the Oregon Department of Environmental Quality's 303(d) list of water quality limited water bodies for the parameters of pH and algae that may impact resident fish and aquatic life, water contact recreation, aesthetics, and fishing. In 2004 it was also added for dissolved oxygen that may impact cold water aquatic life

In 2004, the Forest Service completed an environmental analysis for mitigating the problems at Diamond Lake. In December, 2004 the decision was made to remove the tui chub from Diamond Lake through application of a fish toxicant called rotenone, a plant substance used to kill fish but not toxic to humans, other mammals, or birds.

In the spring and summer of 2006, the lake level was drawn down eight feet and fishing was promoted to remove as many fish as possible. A contractor was hired to net large quantities of tui chub and other fish (up to 4,500 lbs/day) to reach the goal of reducing the biomass in the lake by 50 percent. Rotenone was applied to the lake in September killing all fish in the lake. Residual rotenone levels in the lake since the application have been found to be of no biological relevance to the lake or water flowing downstream. The Forest Service allowed water to flow again downstream to raise the lake level over the winter.

In spring of 2007, ODFW stocked the lake with 75,000 catchable trout and another 75,000 fingerling trout. Some of the larger sized trout are a predacious variety to help minimize the danger posed by any future introduced tui chub or other fish. The amount of fingerling trout released will gradually increase over the next few years depending on the lake's health. There are no plans to stock the lake with lager trout (12-inch) beyond 2008; biologists expect the bug population to rebound quickly allowing fingerling to grow fast.

Water quality in Diamond Lake, along with Lemolo Lake and the North Umpqua River will be monitored for years. Population levels of phytoplankton, zooplankton, benthic invertebrates, flora and fauna in and around Diamond Lake will also be monitored.

Ground Water

Ground water makes up approximately 95 percent of available freshwater resources statewide. According to the 2002 Oregon Water Quality Assessment (ODEQ 2003), 90 percent of all rural residents and a large portion of all Oregon residents rely on ground water for drinking water.[31] Industry and irrigation of agriculture and livestock are also dependent on ground water supplies. Ground water supplies base flow for most of the state's rivers, lakes, streams, and wetlands. Cool groundwater inflow effectively cools streams during the summer months, often providing critical thermal refuge areas for sensitive freshwater species. The magnitude of this effect depends upon the ratio of the groundwater inflow to the amount of surface flow.

The dominant use of ground water in Douglas County is for primary and supplemental sources or drinking water for rural residents. As surface water sources are used to capacity, residents are becoming more dependent on ground water resources. These demands are expected to increase as the population of the County increases especially in rural areas. In the Umpqua River / North Umpqua River sub-basins, approximately 3,858 wells are identified as domestic use wells, while 27 are used for irrigation, 23 for community, 4 for industry, and 2 for livestock.

Quantity

Geologic conditions determine the accessibility and quantities of ground water. In this portion of the basin four of the five major aquifers with discrete geologic conditions that occur within Douglas County are found.

Fluvial deposits occur along the Umpqua River and major tributaries. Permeability and recharge are relatively high. The water table is generally within 25 feet of land surface, and well yields are generally less than 200 gallons per minute (gpm).

The area of the basin north of the City of Roseburg and west of the mouth of Little River has been identified by USGS as the Marine Sedimentary aquifer unit, comprised of Tertiary rocks. Tertiary volcanic rocks of the Western Cascade Range define ground water conditions from Little River upstream to about the mouth of Clearwater River. In both of these aquifers permeability and recharge are generally low, with well yields being less than 20 gpm.

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[31] Over 90 percent (2,459) of Oregon's public water supply systems get their water exclusively from ground water. Over 400,000 residents get their drinking water from individual home water supply wells.

The extreme upper portion of the basin is underlain by Quaternary-Tertiary volcanic rocks of the High Cascade Range. In these areas permeability and recharge may be high locally, and well yields may reach as much as 300 gpm.

Table 2.B-14 lists the number of wells by water yield in the North Umpqua and Umpqua sub-basins. The majority of the wells in the North Umpqua sub-basin yield 1 to 5 gpm and greater than 10 gpm. Most wells (77 percent) have at least 1 gpm indicating adequate ground water in most of the sub-basin, although at least 23 percent likely do not produce enough water to support domestic use without storage or alternative sources of water. The Umpqua River sub-basin is dominated by wells with yields greater than 10 gpm, indicating an abundance of ground water in much of these areas, although about 5 percent have less than 1 gpm indicating some problem areas even for domestic use.

Area	Depth range (feet)	Number of wells by water yield (gpm)			
		<1	1 to 5	> 5 to 10	>10
North Umpqua	31 to 500	233	660	365	553
Umpqua River	10 to 540	52	261	220	488
Source: Oregon Water Resources Department (well data from 1945 to 2007).					

Table 2.B-14: Number of wells by water yields (Umpqua River/North Umpqua sub-basins).

Table 2.B-15 shows a comparison of well data from before and after 1980. The percentage of well yields less than 1 gpm in the North Umpqua sub-basin has risen over 16 percent since 1980. However, the percentage of wells that yield greater than 10 gpm has only reduced slightly in the sub-basin. The Umpqua sub-basin shows more wells in the less than 1 gpm category as well as slightly more with 5 to 10 gpm. Both areas show substantial increases in the depth of drilling. This may indicate that while many wells still meet domestic needs, the ground water level may be dropping in these areas. Both areas show only a slightly smaller or equal percentage of new wells abandoned since 1980.

Nearly all of the sub-basin rural population resides in areas underlain by the lower permeability aquifers. Those residences sited along major streams commonly obtain water supplies from wells. Away from the valley floors of major streams, water supplies are often obtained from springs or other surface water sources. In upland areas, wells are the primary water source. Future population distribution patterns are not expected to change dramatically. Well yields may be adequate for supplying rural domestic needs to the upland areas, including small garden irrigation; however the increases in drilling depths required and substantial increases in wells that yield < 1 gpm should be noted in regulation of future development. This is particularly apparent within the North Umpqua River sub-basin.

Category	North Umpqua River		Umpqua River	
	1950-1980	1981-2007	1945-1980	1981-2007
Total new wells	1,190	1,146	810	641
new wells abandoned	2 %	1 %	1 %	1 %
Yield (gpm)				
< 1	5 %	21 %	2 %	9 %
1 to 5	39 %	34 %	27 %	24 %
> 5 to 10	25 %	15 %	21 %	23 %
> 10	31 %	30 %	51 %	45 %
Depth drilled (feet)				
median depth	102	185	101	170
average depth	132	202	131	204
Source: Oregon Water Resources Department				

Table 2.B-15: Comparison of well data before and after 1980 for areas within the Umpqua River / North Umpqua River sub-basins.

Quality

The quality of ground water resources in the sub-basin is generally acceptable for all uses. Some wells in the Tertiary Rocks of the Coast Range aquifer provide water with high hydrogen-sulfide content (rotten-egg odor), and with high iron bacteria (rust). While unpleasant, the levels of either constituent generally are not at harmful concentrations.

According to the Oregon Department of Human Services, five wells used for public drinking water in the North Umpqua sub-basin showed slightly elevated sodium levels ranging from 20.6 to 87.3 mg/l. One additional well located at the BLM Scaredman Creek campground tested in 2000 with a sodium level of 3,290 mg/l. There is no standard level for sodium although a recommended level for aesthetic quality has been set at 20 mg/l by EPA. Four wells within the Umpqua River sub-basin were also high in sodium ranging from 22.9 to 1,762 mg/l. The higher results occurred at the ODF DL Phipps Nursery where elevated sodium levels have occurred during each sampling period (every 3 to 4 years) since 1993.

In addition to elevated sodium levels, two BLM campgrounds also tested above the drinking water standard for arsenic at different times. Arsenic, in concentrations greater than 0.010 mg/l is considered grounds for rejection of the water supply. Some people who drink water containing arsenic in excess of EPA's standard over many years could experience skin damage or problems with their circulatory system, and may have an increased risk of contracting cancer. Eagle View campground was slightly elevated with a level in 2004 of 0.013 mg/l. In 1991, the BLM Scaredman recreation site tested high in arsenic with a level of 0.043 mg/l. However, there have been no reported occurrences since that time.

In May, 2007 the Oregon Public Health Division developed a Public Health Assessment for the Red Rock Road area near Sutherlin. Red Rock Road is a 17 mile road located 6 miles east of Sutherlin that was constructed with mine tailings contaminated with arsenic and mercury. The road borders Calapooya Creek on the east end and Sutherlin Creek on the west end. Although testing by a contractor in the area did not find evidence of arsenic leaching from the road into ground water, the Public Health Assessment recommends that residents located along or near Red Rock Road or that live in this region of the Sutherlin Valley that rely on ground water wells for domestic water supplies, have their wells tested for arsenic.

The assessment summarizes extensive well testing in Douglas County from the 1970s that found 118 samples in the range of 0.01 to 0.04 mg/l and 16 samples over 0.05 mg/l. The 16 samples with the highest levels represent 7 wells, 6 of which are located in the area east of Sutherlin. At that time, the arsenic standard was 0.05 mg/l. In 2002, EPA adopted the current standard of 0.01 mg/l. It is possible that some residents in the Sutherlin Valley still consume drinking water from wells with arsenic concentrations above the current standard.

2.B.2. Water Use

The following section discusses current and future water use in this area of Douglas County. The types of water uses considered include municipal, rural domestic, industrial, irrigation, aquatic life, recreation and hydroelectric power. Analysis and more detailed discussion of municipal, rural domestic and industrial water use are included in Appendix M. Irrigation water use is analyzed in Appendix I, and water use needs for aquatic life are discussed in Appendix F.

Current

For purposes of this report, the measure of current water use is derived from water use reports showing raw water diversion by each water district and by water rights information provided by the Oregon Water Resources Department. Some water use report information was also obtained from individual water service providers.

The priority date of a water right of record is the governing factor during times of water shortage. If priority dates are the same, then domestic use has preference over all other uses; agricultural purposes are next in line; and all other uses follow. For information on Oregon water law and the 1909 water code, refer to Water Use in Section 2.A.2.

Municipal

Appendix M contains the derivation of water needs for municipal water use in the sub-basins. The information on current municipal water use is summarized in this section for each of the water providers within the sub-basins.

<u>Umpqua River sub-basin</u>

City of Elkton
The City of Elkton supplies water to approximately 218 people. Average annual water use by the City from 2000 to 2006 was 15.5 million gallons per year, equating to an average use over the same period of 200 gallons per capita day. Peak daily use was 360 gallons per

capita day, resulting in a peak diversion requirement during July of 51 gallons per minute. The City holds a 1971 priority water right of 224 gallons per minute from the Umpqua River that is senior to minimum flows established in 1974. In addition, Elkton holds a 1949 water right of 224 gallons per minute from two springs tributary to the Umpqua River that is senior to all instream flows. Current water rights are more than adequate to supply the current population.

North Umpqua River Sub-basin

Two diversions in the lower ten miles of the North Umpqua River provide water to a major portion of the population of Douglas County. Both diversions constitute "inter-basin transfers," in that water is diverted from one stream system, the North Umpqua River, while return flows enter another stream system, the South Umpqua River.

City of Roseburg

The major diversion from the North Umpqua River sub-basin for municipal use is for the City of Roseburg and the community of Dixonville. The diversion is located at Roseburg's treatment plant on the North Umpqua River just downstream of Winchester Dam. The Roseburg water system serves users within the City limits, the urban growth boundary, the community of Dixonville to the east of Roseburg, and unincorporated areas to the south and west of the City. The estimated service area population in 2006 was 24,397 people, and the number of services was 10,516. Average annual water use by the City from 2000 to 2006 was 1.87 billion gallons per year. The average use was calculated for years 2003 to 2006 at 223 gallons per capita day, and peak daily use was 467 gallons per capita day, resulting in a peak diversion requirement during July of 5,816 gallons per minute.

The City has water rights allowing diversion of 11,221 gallons per minute from the North Umpqua River with priority dates senior to 1974 minimum instream flows.[32] The City has a further right of 2,693 gallons per minute from the North Umpqua River with a priority date of 1979.[33] The total allowable diversion rate is 13,914 gallons per minute. The current rights are adequate to meet current demand.

Umpqua Basin Water Association

The Umpqua Basin Water Association (UBWA) also diverts from the North Umpqua River at about river mile 5. Approximately 3,122 services were provided water to approximately 7,212 people in 2006. Growth has averaged about 72 services annually in the last six years. UBWA's service area comprises about 80 square miles and extends into the northern portions of Lookingglass Valley, along the South Umpqua River and areas on both banks of the North Umpqua River. According to UBWA, it may have the greatest length of pipeline per service of any delivery system in the state.

Annual water use from 2000 to 2006 averaged 392.7 million gallons per year. The daily average use for the same period is estimated at 163 gallons per capita day and peak use 294

[32] The City's 1950 water right is held in the name of the Oregon Water Corp. and is designated for the City of Roseburg's municipal and domestic use.

[33] The City of Roseburg also has a 1977 water right for 1,347 gpm that is designated as supplemental municipal water use to be used by Roberts Creek and Winston-Dillard water districts when the South Umpqua River is insufficient to meet their needs. That right is shown in the calculations for those districts.

gallons per capita day. The average maximum diversion requirement occurs in July requiring 1,163 gallons per minute to meet demand. UBWA holds water rights for 4,084 gallons per minute, of which 1,840 gallons per minute are senior to 1974 minimum instream flow requirements; more than adequate to meet current demand.

Glide Water Association

Water service to the community of Glide is provided by the Glide Water Association. Water for 510 services (approximately 1,382 people) is diverted from the North Umpqua River at about river mile 29. Average annual use over the last six years was 54.3 million gallons per year, and average daily use is estimated at 120 gallons per capita day. Peak use occurs in July at an estimated rate of 215 gallons per capita day requiring an average diversion of 145 gallons per minute. The Association holds rights for 987 gallons per minute with priority dates senior to 1974 minimum instream flows, indicating the current demand is met by the existing water rights.

City of Sutherlin

The City of Sutherlin obtains a large portion of its water supply from the Sutherlin Creek drainage. The City has a right to divert 2,244 gallons per minute from Cooper Creek at a point located above Cooper Creek Reservoir under a right with a 1967 priority. It has rights to 1,346 gallons per minute from the North Umpqua River with a priority of 1979, but no facilities have been constructed. Sutherlin has also purchased 500 acre-feet of water stored in Cooper Creek Reservoir for municipal use. The City of Sutherlin uses Calapooya Creek as a primary source and Cooper Creek as a backup source. For this reason, more on the City's municipal use is discussed in Section 2.C. Elk Creek/Calapooya Creek sub-basins.

Rural Domestic

Most of the rural residents live along the Umpqua River with concentrations near Scottsburg, Elkton, and Umpqua; on the outskirts of Sutherlin; in Winchester; around Glide; and out the Cavitt Creek and Little River drainages. Relatively few residents reside above Glide in the North Umpqua River sub-basin with small exceptions around Diamond and Toketee lakes. Many residents in the highest concentration areas around Sutherlin, Glide, and Winchester may eventually be included in nearby water service areas, especially where growth in these areas is significant.

Over 6,200 people (30 percent) in the Umpqua River/North Umpqua River sub-basins are considered rural domestic users that do not receive water service. Over 30 percent (1,978 people) of the rural domestic users obtain water via domestic surface water rights, while 70 percent are presumed on well water.[34] Residents of the communities of Scottsburg and Umpqua obtain water from individual wells, while the majority of the population of Wells Creek is provided water from springs. Rural residents located upstream from Glide include those living in the following communities: Idleyld Park residents that use springs and individual wells; Steamboat Springs residents divert from the North Umpqua River; Dry

[34] Users that are presumed on well water may also periodically or regularly truck in water especially during the summer months.

Creek residents are served by springs; and residents near Toketee Falls that obtain water from the North Umpqua River.

Industrial

There are currently 4,613 gallons per minute in existing industrial water rights within the sub-basins, mostly from the North Umpqua River and several tributaries. They include 3,246 gallons per minute on the North Umpqua River and 1,367 gallons per minute from tributaries listed in Table 2.B-16 for various commercial and manufacturing types of permits. Most are attributed to maintenance of log ponds and other uses related to the wood products industry.

Of the total 4,613 gallons per minute industrial water rights held in the sub-basin, 2,506 gallons per minute are senior to all instream rights and 4,090 gallons per minute are senior to the 1974 minimum instream rights. There are no industrial or commercial water rights held on the Umpqua River.

Stream source	Water rights		Permit type
	gpm	acre-feet	
North Umpqua River	3,246		commercial, manufacturing, log deck sprinklers
Sutherlin Creek	628	363	manufacturing
Little River	150	253	manufacturing
Unnamed stream		1	manufacturing, fire pond
Camas Swale/Log pond	404		manufacturing
Sutherlin Creek/Pond	90		manufacturing
Unnamed stream/reservoir	45		manufacturing, fire pond
Happy Creek	18		commercial
King Creek	9		commercial
A Spring	18		commercial
Lake Creek	5		shop
Total	**4,613**	**617**	

Table 2.B-16: Industrial water rights held in the Umpqua River and North Umpqua River sub-basins (gpm = gallons per minute).

There are two County developed industrial parks between Sutherlin and Roseburg where a number of industries have established. In the Sutherlin Industrial Park, Orenco Systems Inc., Garden Valley Corporation, Umpqua Resources, and Double R Manufacturing have all established operations. A short distance further south the Wilbur-Winchester Park is home to Alcan Cable, Bayliner, and the Weyerhauser pole yard. Some commercial and light industrial businesses within City limits are provided water by City water services.

Irrigation

Irrigation use along the Umpqua River and North Umpqua River is mostly confined to narrow shoestring valley lands adjacent to the streambeds, with the exception of two broader valley areas. Garden Valley, near the confluence of the North and South Umpqua Rivers is one of the more productive floodplain areas within the Umpqua Basin. A variety of crops are grown including orchards, vineyards, berry farms, and vegetable fields, most of which use some irrigation. The valley along Sutherlin Creek is also broad and home to larger fields of agriculture where irrigation is served by releases from Plat I Reservoir.

In areas where valley bottom land is not abundant, there are increasing acres of vineyards being planted. This is the fastest growing crop in the County and is expected to continue to rapidly develop. Vineyards grow well on more difficult hillside acres that have not traditionally been planted in other crops. Some irrigation is used for vineyards especially when they are first established. Many are not irrigated when plants become established with the exception of during severe drought conditions.

Table 2.B-17 summarizes the acres in each area with current irrigation water rights by priority date. Complete information is included in Appendix I.

Reach	Existing irrigated acres by priority date					
	Pre 1958	1958-74	1974-83	1983-91	1991-2007	Total
Umpqua River sub-basin						
Scottsburg to Elk Cr	347	336	1,025	220	18	1.946
Elk Cr to confluence	2,185	1,768	1,314	586	449	6,302
Total Umpqua River	2,532	2,104	2,339	806	467	8,248
North Umpqua River sub-basin						
above Glide	313	31	49	23	1	417
Glide to the mouth	936	919	397	628	231	3,111
Sutherlin Creek	8	559	33	180	0	780
Total N Umpqua River	1,257	1,509	479	831	232	4,308
Source: Oregon Department of Water Resources, 2007 – see Appendix I						

Table 2.B-17: Acres with existing irrigation water rights by priority date.

Table 2.B-18 shows the maximum allowable diversions in acre-feet for each area within the sub-basins and the distribution of the diversions by month. Annual diversions are conservatively calculated at 2.5 acre-feet per acre per season, the maximum allowed under Oregon water law. Given basin climatic conditions, only alfalfa would require diversion of this amount, while other crops would require less. The monthly percent of water use is based on crop distribution in Douglas County and expected water needs for each crop throughout the year. Appendix I contains data on water requirements for irrigated crops, and calculations for determining the monthly distribution requirement.

Month	Percent	Umpqua sub-basin		North Umpqua sub-basin		
		Scottsburg to Elk Creek (1,946)	Elk Creek to confluence (6,302)	Above Glide (417)	Glide to mouth (3,111)	Sutherlin Creek (780)
Mar	0.5	24	79	5	39	10
Apr	4.4	214	693	46	342	86
May	11.4	555	1,796	119	887	222
Jun	18.6	905	2,930	194	1,447	363
Jul	28.5	1,387	4,490	297	2,217	556
Aug	22.9	1,114	3,608	239	1,781	447
Sep	12.6	613	1,985	131	980	246
Oct	1.1	54	173	11	86	21
Total	100.0	4,865	15,755	1,043	7,779	1,950
Source: See Appendix I for calculations.						

Table 2.B-18: Monthly irrigation water requirements in acre-feet for each area.

Aquatic Life

Instream flow

Water use by aquatic life is expressed by State of Oregon minimum flows. Minimum flows vary through the year to meet the needs of aquatic life. Minimum flows at selected locations within the North Umpqua River sub-basin are listed in Table 2.B-19 with their priority dates of right. Minimum flow rights for the Umpqua River are listed in Table 2.A-15 in the assessment of the Lower Umpqua River sub-basin.

The Instream Water Rights Act was passed in 1987, allowing agencies to apply for instream water rights to protect recreation, water quality, and fish and wildlife habitat. Prior to establishment of this act, the Oregon Water Resources Department established minimum flows through the administrative rule making process. Minimum flow values specified in a rule, or “basin program,” were not water rights but were administered as such by the Department. These established flows became instream water rights subsequent to passage of the 1987 Act. Thus water rights allowing direct diversion that have been obtained after the date of establishment of a minimum flow are subject to curtailment as stream flow amounts decrease below that specified minimum flow rate. However, when the junior right includes a "household use" component as with domestic or municipal rights, that amount of use has preference over the minimum flows.

In the case of a reservoir constructed after establishment of a minimum flow, the minimum flow must be released at all times, unless inflow to the reservoir is less than the specified minimum, in which case the amount of inflow must be released. Either type of water right senior to the date of establishment of a minimum flow is not subject to curtailment to meet minimum flows.

Time of year	N Umpqua River from Little River to Umpqua River (cfs)			Little River from Cavitt Creek to N Umpqua River (cfs)	
	10/24/58	**3/26/74**	**1/10/91**	**3/26/74**	**1/10/91**
October					
1 to 15	525	800	1,190	30	42.6
16 to 31	525	800	1,350	70	255
November	525	800	1,350	150	255
December	525	800	1,350	150	255
January	525	800	1,350	150	255
February	525	800	1,350	150	255
March	525	800	1,350	150	255
April	525	800	1,350	150	255
May	525	800	1,350	100	150
June					
1 to 16	525	600	1,350	60	100
17 to 31	525	600	1,350	60	100
July	525	600	1,290	40	51.8
August	525	600	996	20	30.2
September	525	750	982	20	27.3
Source: State of Oregon Water Resources Department.					

Table 2.B-19: Minimum instream flows to support aquatic life in selected areas of the North Umpqua River sub-basin with priority dates of right.

Fish abundance and distribution

Both anadromous and resident species use the Umpqua and North Umpqua rivers for spawning, passage, and rearing. Most adult steelhead and spring chinook use the Umpqua River as a passageway in route to smaller tributaries or to the North or South Umpqua systems although a few coho and fall chinook salmon, and winter steelhead spawn in the Umpqua River. The North Umpqua sub-basin is the major producer of anadromous fish within the Umpqua Basin. The North Umpqua sub-basin has the majority of spawning habitat for summer steelhead and spring chinook and it is home to the ODFW hatchery on Rock Creek, a tributary of the North Umpqua River.

Anadromous fish use the North Umpqua River up to the Soda Springs Dam, part of the North Umpqua Hydroelectric Project located at river mile 70. A fish ladder at the dam is planned for 2010. Fish passage at Soda Springs Dam will allow fish to migrate upstream to Toketee Falls at river mile 74.5 and will allow passage into lower Fish Creek below a series of impassible falls.

The anadromous spawning populations in the sub-basins are comprised of winter and summer steelhead, coho salmon, and fall and spring chinook salmon. Based on 1976 estimates, about 6,930 fish spawned in the Umpqua River sub-basin above Scottsburg; most were coho salmon. This represented about 15 percent of the fish spawning in the entire Umpqua Basin. Almost 75 percent of them spawned in the mainstem Umpqua River including all of the spring and fall chinook salmon and summer steelhead. Tributary streams were heavily used for coho and winter steelhead spawning. The main producers included Weatherby, Paradise, Wagonner, Yellow, Wolf, Couger, and Hubbard creeks each contributing between 1 and 3 percent of the sub-basin spawning population. Over 20 other tributaries also contributed a total of 12 percent of the sub-basin spawning population (see Appendix F).

Based on the 1976 ODFW estimates, over 18,400 anadromous fish spawned in the North Umpqua sub-basin (41 percent of the entire Umpqua Basin), larger than any other sub-basin in the County. Nearly all spring chinook, 5600, spawned in the North Umpqua River, while only 50 spawned in Steamboat Creek. An estimated 26 fall chinook also spawned in the North Umpqua. Coho spawned in about six tributaries, most in Little River, with an estimated 326 spawners of the total 474 coho spawning in the sub-basin. Of the 6,532 summer steelhead, 3,000 spawned in the North Umpqua River, 2,642 spawned in Steamboat Creek and the remainder spawned in about 17 other North Umpqua tributaries. About 3,000 winter steelhead spawned in the North Umpqua River, and Rock Creek was host to an estimated 1,042 spawners. The total winter steelhead spawning estimate was 5,743 fish in both the North Umpqua River and tributaries.

At least one of the species mentioned above are spawning in the Umpqua River/North Umpqua River sub-basins during the months of September through May. During the remaining months of the year anadromous fish are present, either moving upstream to spawning locations or holding until habitat conditions become suitable. Coho spawn from late November through January, fall chinook during November and December and spring chinook spawn during September and October. Winter steelhead spawn from late January through May and summer steelhead spawn during February through early May. Thus, it is important for water quality conditions to remain within limits tolerable to anadromous species during the entire year.

The ODFW maintains a fish counting station at Winchester Dam on the lower North Umpqua River. Since 1976, the counts at Winchester Dam have fluctuated for all species. Actual counts from 2001-2006 are shown in Table 2.B-20 for wild and hatchery fish by species. The increases in coho, chinook, and steelhead can be attributed to supplemental stocking, more restrictive harvest regulations, and improved ocean conditions.

Year	Steelhead		Chinook		Coho	Sea-run cutthroat
	Winter	Summer	Spring	Fall		
1997	5,107	8,009	5,769	118	3,606	91
1998	6,336	9,139	6,959	52	7,367	159
1999	6,949	5,390	7,393	31	5,643	96
2000	9,536	10,087	12,635	202	15,861	93
2001	11,089	11,331	20,694	247	20,468	110
2002	9,325	9,175	24,202	154	13,809	110
2003	14,507	7,997	20,156	581	16,160	34
2004	7,547	9,157	15,433	267	13,398	62
2005	7,419	6,987	9,013	162	13,260	62
2006	9,631	7,669	6,081	76	11,247	---
ODFW Winchester Dam Fish Counts 2007.						

Table 2.B-20: Salmonid fish count data from Winchester Dam from 1997 to 2006.

The Rock Creek Hatchery is located along the lower portion of Rock Creek approximately one quarter mile up from the North Umpqua River. The hatchery currently produces fall and spring chinook, summer and winter steelhead, coho salmon, and rainbow trout. The fall chinook, winter steelhead, and coho salmon are not released in the North Umpqua sub-basin but raised for release in other locations. Rainbow trout are released in the upper elevations of the high cascades in various lakes including Diamond Lake. Table 2.B-21 illustrates production and stocking locations for 2006.

Species	Number produced	Stocking location	Timing of release
fall chinook	70,000	Smith River	October (middle)
spring chinook	75,000	North Umpqua River	October (early)
	267,000		February (early)
coho	60,000	South Umpqua River	May (early)
summer steelhead	100,000	North Umpqua River	March (early)
winter steelhead	90,000	South Umpqua River	May (middle)
rainbow trout	50,100	various standing water bodies	March to September
	3,500		August (late)
	20,000	Diamond Lake	June (early)
Source: Rock Creek Hatchery Operations Plan 2006, and personal communication (2007) Jim Brick and Dave Loomis, ODFW.			

Table 2.B-21: Number of fish by species with stocking location and timing of release for the Rock Creek Hatchery in 2006.

Diamond Lake stocking is highly variable as ODFW is currently ramping up stocking levels following the removal of the tui chub from the lake in 2006. In 2007, 100,000 fingerlings came from the Klamath Hatchery. That number will increase by 100,000 each year until a constant 400,000 will be raised at Klamath Hatchery into the future. Also in 2007, a total of 80,000 catch-able fish came from Island Springs and Desert Springs hatcheries and only 3,500 trophy-sized fish and 3,500 fishwich trout came from Rock Creek Hatchery for stocking in Diamond Lake. The amount and sizes that will be purchased for Diamond Lake in 2008 is not yet determined.

Fishery Concerns

Primary factors limiting production of anadromous species in the Umpqua River/North Umpqua River sub-basins include loss of water quality (primarily stream temperature), manmade barriers to fish passage, lack of pool areas for holding and rearing, and lack of gravels of the proper size distribution and formation for spawning and incubation of eggs. Lack of over-winter habitat is a primary concern in all sub-basins. In addition, there are natural barriers on various tributaries in the North Umpqua drainage that preclude access by anadromous species to areas with usable habitat. The influence of hatchery fish on wild fish has also been identified as a concern on wild populations of coho. Although smolt releases occurred in the past, hatchery coho or winter steelhead are not directly released into the North Umpqua system at this time. Releases of summer steelhead and spring chinook still occur from the ODFW Rock Creek Hatchery facility.

Loss of riparian areas on smaller tributary streams influences both water quality and instream habitat. Decreased shade cover may result in increased stream temperatures on small streams. Removal of large trees in these areas results in fewer sources for stream input. These large wood pieces are vital for creating instream habitat on small and medium sized tributaries.

The Coho Viability Assessment Final Report (Nicholas et al. 2005) identified separate coho population areas for assessment purposes. The report lists the primary and secondary life cycle bottlenecks to coho populations in these areas. The bottlenecks for each of the population areas within the Umpqua River / North Umpqua sub-basins are listed in Table 2.B-22. The Lower Umpqua population area includes from the mouth to Elkton and the Middle Umpqua includes Elkton to the confluence with the North Umpqua River.

Population area	Primary bottleneck	Secondary bottleneck
Lower Umpqua	stream complexity	water quality
Middle Umpqua	water quantity	stream complexity and water quality
North Umpqua	hatchery impacts	stream complexity
Source: Coho Assessment Part 1:Synthesis (Nicholas et al 2005)		

Table 2.B-22: Primary and secondary life cycle bottlenecks for independent coho populations (Umpqua River / North Umpqua River sub-basins).

Loss of stream complexity creates a shortage of winter habitat which results in the loss of juvenile fish, especially during peak storm flows. The amount of high quality winter habitat relative to the total miles available to juvenile coho is very low in all three population areas.

Water quantity is the primary bottleneck identified in the Middle Umpqua population area. Many tributary streams experience very low flows in the hot summer months when precipitation and runoff is low and water user demand is high. This can contribute to higher water temperatures and loss of instream habitat.[35]

Hatchery effects were identified as the primary bottleneck in the North Umpqua population area. ODFW has modified its release practices to discontinue coho releases in the North Umpqua sub-basin.

Fish passage is also a significant limiting factor in the sub-basins. While there are no fish passage barriers on the mainstem Umpqua River, there are locations elsewhere in the sub-basins where obstructions to passage limit use of additional suitable habitat. See Appendix F for locations of all fish passage barriers identified in the Umpqua River /North Umpqua sub-basins.

Enhancement Opportunities

Enhancement programs, such as the construction of structures in the stream, are not generally undertaken on the mainstem Umpqua River or North Umpqua River. However, numerous projects are underway on tributary streams. Enhancement work has occurred throughout the sub-basins. The work has been directed at increasing rearing and spawning areas for coho and steelhead, riparian habitat protection and enhancement, and providing improved fish passage.

Douglas County has typically worked through the Salmon Habitat Improvement Program in conjunction with ODFW fish biologists to accomplish enhancement work. Several opportunities may exist for the County to improve fish habitat. These potential sites are discussed below. However, site reviews should be done to verify potential improvements that may be made.

Sutherlin Creek

The County owns land an industrial park in Sutherlin along Sutherlin Creek which supports both coho and winter steelhead spawning and rearing habitat in this area. Sutherlin Creek has been identified in the Umpqua Basin Action Plan as a target stream to improve instream habitat by placement of large wood. It is also identified as limited by riparian, wetlands, streamflow and flood potential, toxics (including arsenic, beryllium, copper, iron, lead, and manganese), and it has a suspected limitation of sediment and turbidity.

Little Paradise Creek

The County owns over 6 acres of right-of-way along Little Paradise Creek, a tributary of Paradise Creek in the Umpqua River sub-basin. Little Paradise Creek supports coho and winter steelhead spawning and rearing habitat and Paradise Creek also supports fall chinook. Little Paradise Creek is identified by ODEQ has having limitations from habitat modification. Although Little Paradise Creek has not been specifically identified in the Umpqua Basin Action Plan for riparian and instream habitat work, both are limiting in the watershed and improvement is desired where applicable. Little Paradise Creek is the size of

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[35] In some cases water temperature can decrease as surface flows diminish and the proportion of groundwater inflow increases. These residual pools can become very critical aquatic habitat.

stream that improvement of these features can be successful in improving coho and steelhead habitat.

Fish Passage Barriers
The Umpqua Basin Fish Access Team (UBFAT) has completed inventories of stream crossings in the Upper Umpqua River Watershed (from Elkton upriver to the confluence of the North Umpqua River), and the following watersheds in the North Umpqua River sub-basin:

- Rock Creek
- Canton Creek
- Steamboat Creek
- Middle North Umpqua River
- Lower North Umpqua River

No surveys have been done below Elkton to Scottsburg. Crossings were given a score on the severity of the fish passage barrier based on many characteristics including the species and ages of fish blocked, timing of barrier (all year or seasonally), and amount of habitat upstream that is no longer accessible, with higher scores representing more severe barriers. The highest possible score is 105. The highest score in the Umpqua Basin to date is 95.

County-maintained culverts in the Umpqua River sub-basin with a score of 60 or more are listed in Table 2.B-23 with a description of the structure and the score it received. All five culverts are complete barriers to all juvenile and adult anadromous species. There are no county-maintained culverts in the North Umpqua River sub-basin with a score of at least 60. Contact the Douglas Soil and Water Conservation District for current detailed survey and location information on fish passage barriers.

ID number	Location	Sub-watershed (6th field)	Score	Structure type
30108002	Heddin Creek	Mehl Creek	75	CMP, 65 ft long by 11 ft wide
30101009	Cleveland Rapids Road 208	Upper Umpqua River	75	CMP, 27 ft long by 5 ft wide
30103001	Tyee Road	Cougar Creek	60	CMP, 105 ft long by 12 ft wide
30103015	Tyee Road, Rock Creek	Cougar Creek	60	CMP, 90 ft long by 12 ft wide
30105013	Tyee Road, Little Canyon Creek	Lost Creek	83	CMP, 100 ft long by 12 ft wide
Source: UBFAT database as of Oct 2007, Douglas Soil and Water Conservation District.				

Table 2.B-23: Fish passage barriers maintained by Douglas County with a minimum score of 60 in the UBFAT surveys (Umpqua / North Umpqua sub-basins).

Recreation

Table 2.B-24 lists recreation sites with boat launching facilities in each sub-basin. All but one boat launch facility on the main Umpqua River are managed by the Douglas County Parks Department. Tyee boat launch is managed by the Roseburg BLM. The majority of sites in the North Umpqua sub-basin are managed by either the Umpqua National Forest or the County.

Sub-basin	Site name	Agency[1]
Umpqua	Cleveland Rapids Park	DCP
	James Wood Boat Ramp	DCP
	River Forks Park	DCP
	Sawyers Rapids	DCP
	Scott Creek	DCP
	Tyee	BLM
	Umpqua Landing	DCP
	Yellow Creek	DCP
North Umpqua	Amacher Park	DCP
	Colliding Rivers Boat Launch	DCP
	Bogus Creek	USFS
	Cooper Creek Reservoir	DCP
	Diamond Lake	USFS
	Hemlock Meadows	USFS
	Hestness Landing	DCP
	Island	USFS
	Lone Rock	BLM
	Plat I Reservoir	DCP
	Poole Creek	USFS
	Thielsen View	USFS
	Toketee Lake	USFS
	Whistlers Bend Park	DCP

[1] BLM = Bureau of Land Management; DCP = Douglas County Parks Department; OSP = Oregon State Parks; USFS = US Forest Service.

Table 2.B-24: Public boating sites with launching facilities (Umpqua River/North Umpqua River sub-basins).

The North Umpqua River is nationally renowned for its recreational quality. The river is one of the few in Oregon designated for fly-fishing only. In addition, rafting, canoeing, and drift-boating are "world class" experiences. Lower reaches of the North Umpqua contain popular swimming holes that are heavily used due to the close proximity to the population centers of the County.

The Umpqua River Basin is one of the largest producers of anadromous fish in Oregon, exclusive of the Columbia River Basin. During 1997-98 (the last season tag surveys were conducted) an estimated 6,898 salmon and steelhead were caught basin-wide. The North Umpqua sub-basin accounted for 88 percent of the catch of steelhead and 35 percent of all salmon species. The mainstem Umpqua contributed 11 percent of steelhead and 53 percent of all salmon (Table 2.B-25).

Sub-basin	Chinook		Coho	Steelhead		Total
	Spring	Fall		Summer	Winter	
Mainstem Umpqua[1]	0	934	352	194	319	1,799
North Umpqua	628	9	217	3,761	164	4,779
Total sub-basins	628	943	569	3,955	483	6,578
Total Umpqua Basin	634	1,230	569	3,955	510	6,898
Percent of Basin	99	77	100	95	95	95

[1] Mainstem Umpqua includes the entire Umpqua River from the mouth to the confluence of the North and South rivers.
Source: ODFW most recent catch data from 1997.

Table 2.B-25: Numbers of fish caught during the 1997-98 season in the Umpqua River sub-basin relative to the entire Umpqua Basin.

Recreational catch of coho, steelhead, and chinook occurs in the mainstem Umpqua River and the North Umpqua River. In 2001-2002 an estimated 1,876 fall chinook were harvested recreationally in the Umpqua River and Winchester Bay, and 134 were harvested from the North Umpqua River. The ten-year average catch from 1992-93 to 2001-02 for the Umpqua River and bay was 1,984 fish and for the North Umpqua River was 48 fish (Moyers et al 2003).

Warm-water game fish are primarily caught in the mainstem Umpqua River, while striped bass, shad, and sturgeon are exclusively caught there. Small-mouth bass are caught in the North Umpqua River below Winchester Dam. Most larger-sized trout are caught in the North Umpqua River, Smith River, and larger Umpqua sub-basin tributaries.

Cooper Creek Reservoir gets several hundred thousand visits during the year from people recreating. The visits include primarily boating, waterskiing, and fishing. Recreational facilities are managed by the Douglas County Parks Department, and although there is no overnight camping, the parks are open all year with a resident caretaker. The reservoir is managed for fishing by the Oregon Department of Fish and Wildlife and has been stocked with both trout and warm-water fish.

Although recreation was not originally a planned use for Plat I Reservoir, it is used for water-skiing, boating, swimming, fishing, and water fowl hunting. The County constructed a boat ramp and the site is managed as a county park recreational facility. The reservoir is managed for fishing by the Oregon Department of Fish and Wildlife and is stocked with about 1,000 rainbow trout per week during the summer season. Fishing includes trout but also features warm-water fish such as bass, panfish, and catfish.

Hydroelectric Power

There is no hydroelectric power development on the Umpqua River above Scottsburg, or on Sutherlin Creek. On the North Umpqua, a small plant, less than 1,500 kW was built at the time of construction of Winchester Dam in the 1890's, but was taken out of service in the 1960's. In 1983 a 1.5 Mw capacity plant was installed in the north bank at the dam. Operation of the new plant has been curtailed since December 1985, due to environmental issues.

Pacificorp's North Umpqua Hydroelectric Project was constructed between 1947 and 1956 above river mile 68 on the North Umpqua River. The Project encompasses the following eight developments:

- Lemolo No. 1 & 2
- Clearwater No. 1 & 2
- Toketee
- Fish Creek
- Slide Creek
- Soda Springs

Each development typically consists of a dam, waterway (canals and flumes), penstock and powerhouse. Seven of the eight power plants contain a single outdoor generating unit; the Toketee power plant contains three indoor turbine-generators. There are 21.7 miles of canal, 9.8 miles of flume and 5.8 miles of penstock and tunnels, for a total waterway length of 37.3 miles. The Project has a total installed capacity of 185mW, the largest hydroelectric complex in the Umpqua Basin.

The eight hydroelectric developments use water primarily from the North Umpqua River and from two of its major tributaries, the Clearwater River and Fish Creek, to generate electricity.

Three reservoirs, Lemolo, Toketee, and Soda Springs, and four forebays provide limited water storage. These impoundments range in size from about 15 to 450 surface acres. The dams or diversion structures associated with the project developments are predominantly low-earth or rockfill types, with the exception of the Slide Creek and Soda Springs concrete dam developments. The largest dam in the development is at Lemolo 1, a rockfill, concrete facing dam about 120 feet high and 885 feet long.

The license to operate the North Umpqua Hydroelectric Project was renewed by the Federal Energy Regulatory Commission in 2005 for another 35 years. Mitigation measures to address fish and water quality at the site, downstream of the site, and offsite in the Rock Creek Watershed were incorporated into the license renewal.

Summary of Current Surface Water Use

The State determines if new water rights are available by comparing the total of existing consumptive and storage rights, and instream requirements to the 80 percent exceedence flow (or the streamflow that occurs 80 percent of the time) for each month. Where the streamflow is less than the sum of the current rights, no new water rights are available.

The amount of water needed for consumptive use rights in this calculation is an estimate of actual use. Coefficients have been developed for the different types of water rights to estimate actual use. The total allowable right on record would be more than the actual consumptive use estimate used in this calculation.

Figure 2.B.5 and Figure 2.B.6 summarize current water use and availability at two points in the Umpqua and North Umpqua rivers. Figure 2.B.5 shows that flows exceed current requirements by a substantial margin from December through May in the Umpqua River above Little Mill Creek, but fall short of needs from August through October. The deficit, shown in red on the graph, is highest in October where an additional 452 cfs are needed to meet current demands. Current water needs are about equal to streamflow in November, June, and July.

In the North Umpqua River above the mouth (Figure 2.B.6), unregulated flow from July through November is insufficient to meet the existing water needs. The largest deficits occur in July and October with over 300 cfs short in each month. The shortage occurs about one month earlier and lasts one month longer than on the Umpqua River above Little Mill Creek.

Streams in Oregon are administered under the prior rights doctrine, which boils down to "first in time, first in right". As streamflows decrease to amounts less than necessary to meet all water rights and minimum flows, the District 15 Watermaster administers the stream. In the case of irrigation rights, diversions under the most recent water rights are stopped. In the case of municipal rights, diversions are reduced to equal the "human consumption", or domestic component of the right. Domestic rights, which include irrigation of gardens of 1/2 acre or less, would be allowed to continue diversion. Diversions for stock water also would be allowed to continue.

Minimum flows have been established by the State of Oregon, Water Resources Department in 1958, 1974, and 1991, and 1993 on the Umpqua River and North Umpqua River for aquatic life. These minimum flows are instream water rights administered with their appropriate priority date. Other instream requirements may occur for such uses as scenic byways or pollution abatement that would be included in the determination of new water rights.

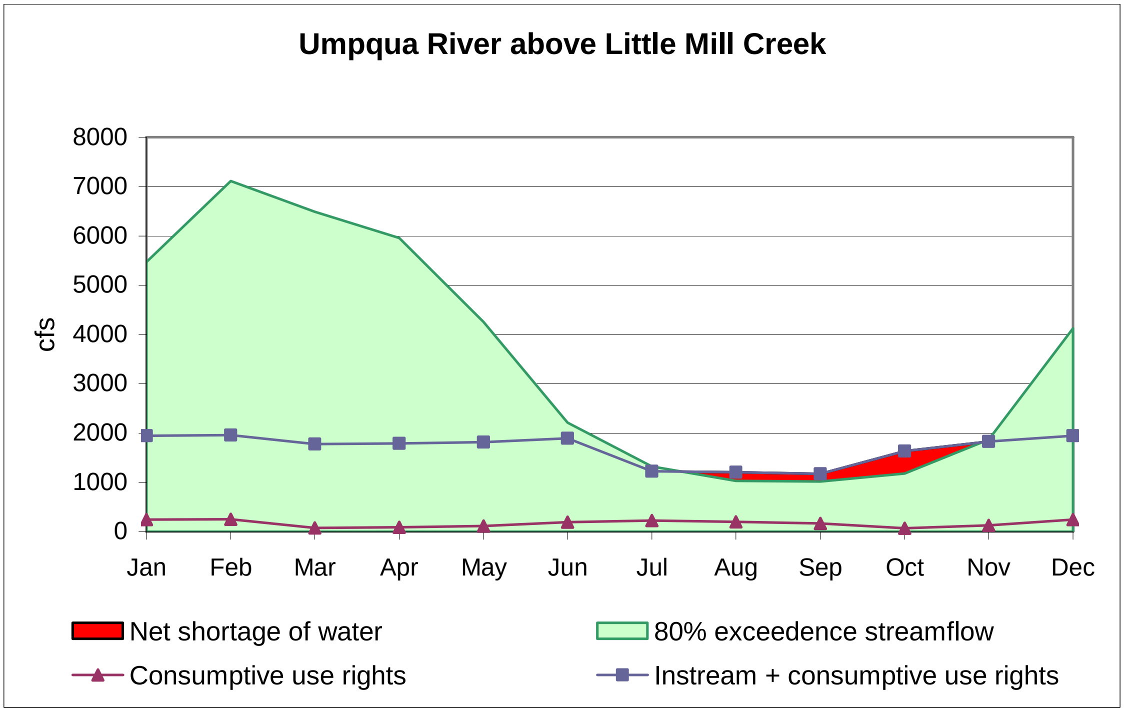

Figure 2.B.5: Water availability in the Umpqua River above Little Mill Creek.

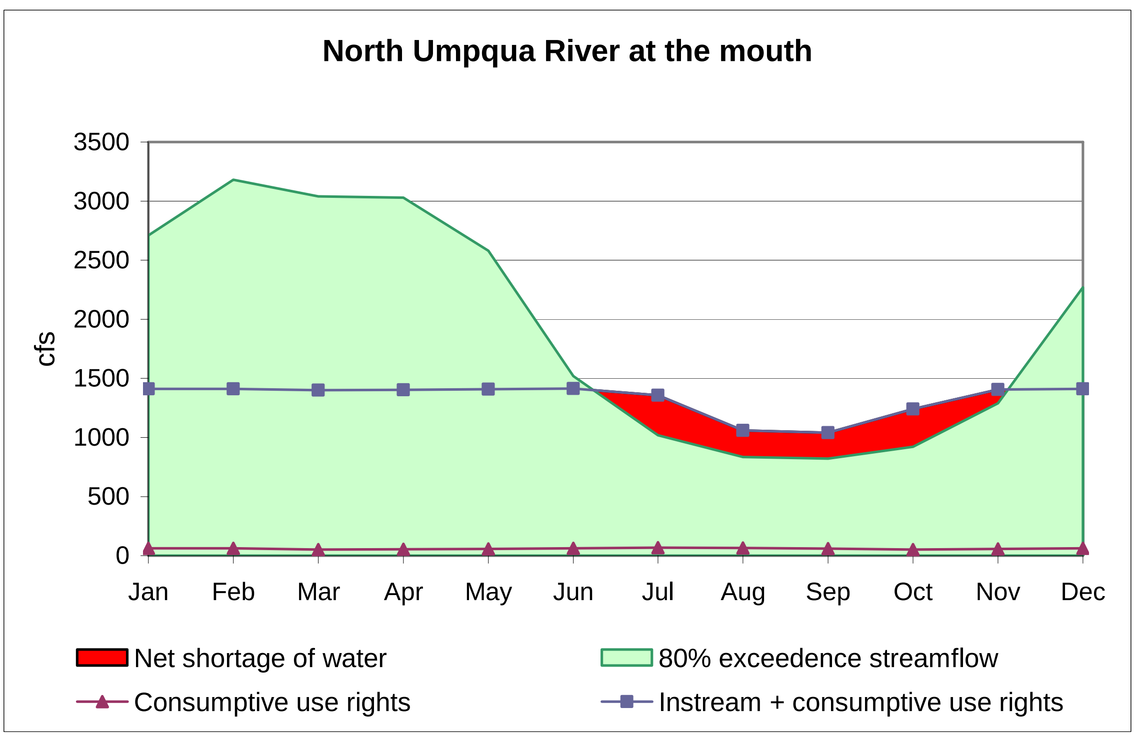

Figure 2.B.6: Water availability in the North Umpqua River at the mouth.

Future

Municipal

Future municipal use is based on information from the Douglas County Comprehensive Plan Population Assessment (Douglas County 2004), U.S. Census data, and reported water use by each of the water providers in the sub-basins. The data include the current populations receiving water service and projections of the future populations in 2050. The projections to 2050 reflect the long-term financial conditions normally encountered with large-scale water resource developments.

Appendix M contains the derivation of water needs for future municipal water use in the sub-basins. This information is summarized below for each of the water providers within the sub-basins.

<u>Umpqua River</u>

City of Elkton
The 2006 sub-basin population served by the City of Elkton water service is 218 people. Based on projected growth for Elkton, the population needing water service in 2050 is expected to be 410 people. The peak demand for water in 2050 will require water diversion of 103 gallons per minute in July to meet the needs of the population.

The City has water rights for 448 gallons per minute, of which 224 gallons per minute are senior to all instream water rights.[36] The water supply appears adequate to meet future demand.

<u>North Umpqua River</u>
Approximately 36 percent of the 2005 population of Douglas County is served by water systems that divert supplies from the North Umpqua River. Most is diverted and distributed by the City of Roseburg and the Umpqua Basin Water Association. Other diversions by the City of Sutherlin from Cooper Creek and Glide Water Association from the North Umpqua River make up the rest.

City of Roseburg
The 2006 sub-basin population served by the City of Roseburg is estimated at 24,397 people. Based on projected growth in the Roseburg area, the population needing water service in 2050 is expected to be 51,234 people. Roseburg has an estimated peak per capita use of 467 gallons per capita day, substantially higher than the County average of 372 gallons per capita day. The estimated peak demand for water in 2050 at that peak use rate will require water diversion of 16,627 gallons per minute in July to meet the needs of the population. The City has water rights for 13,914 gallons per minute, of which 11,221 gallons per minute are senior to all minimum instream flows. However 2,693 gallons per minute are junior to 1974 minimum flows.

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[36] The entire 448 gallons per minute are senior to 1974 minimum instream rights.

Projected diversion rates will exceed allowable diversion rates during July and August. The total annual deficit is estimated to be 702 acre-feet per year. In addition, the 1979 water rights (2,693 gallons per minute) junior to 1974 instream flows are not reliable for future water supply in August and September due to insufficient flows in the North Umpqua River to support all needs including instream requirements. Consequently, in years when flow is insufficient to meet both instream rights and municipal demand, the annual deficit may go up to 1,187 acre-feet per year, with water shortages also occurring in September as well as July and August.[37] The North Umpqua River has been regulated once in the last nine years causing this 1979 water right to be unreliable in mid- to late August through October.

In January, 2007, the City of Roseburg completed a *draft* Long-Range Water Supply Plan. The plan assesses the current reliability of water rights and potential for acquiring additional rights on the North Umpqua River. Reliable water rights of interest to the City to meet municipal demand need to have priority dates prior to the 1974 instream water rights. Several companies and individuals who hold such rights have been contacted to determine interest in assessing selling all or part of their rights to the City. No final determination of how to meet the future water needs has yet been completed.

Umpqua Basin Water Association

The Umpqua Basin Water Association, noted in Appendix M as serving the largest geographic area of any water purveyor in the County, has water rights allowing a total maximum diversion of 4,084 gallons per minute from the North Umpqua River near Brown's Bridge. Of that total 2,244 gallons per minute has a priority date of 1978, junior to the 1974 minimum instream flows. This leaves only 1,840 gallons per minute that are senior to 1974 minimum instream flows.

Based on the estimated population in 2050 of 15,145 people at an estimated peak use of 294 gallons per capita day, the future demand in July and August will be 3,088 gallons per minute. This estimated peak need is less than the total rights now held by the Association. However, streamflow in the North Umpqua is close to being entirely committed during September. Therefore the reliability of the supply is questionable during the low flow and high use months of August and September. If flows are inadequate during August and September, the UBWA will not have an adequate supply to meet expected needs in 2050. The projected deficit would be 213 acre-feet.

Glide Water Association

The Glide Water Association serves water to an estimated 1,382 people. The peak daily need per person is 215 gallons per capita day, substantially less than the County average of 372 gallons per capita day. Using a peak rate of 290 gallons per capita day to serve the future population of 2,294 people will require a peak diversion of 462 gallons per minute. The Association has rights totaling 987 gallons per minute, all of which predate the 1974 minimum flow. The future peak need is less than half of the Association's rights, and no additional water sources are necessary to meet estimated future needs.

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[37] Calculated using 11,221 gpm of current rights in the low flow months of August and September (excludes those rights junior to the 1974 instream rights).

Estimated future municipal water needs, existing water rights, and portions that are senior to minimum flows for the Umpqua River and North Umpqua River sub-basins are listed in Table 2.B-26. In general, flow on the North Umpqua River is sufficient to meet municipal water rights senior to 1974 minimum instream flows. Water rights junior to 1974 minimum instream flow rights may at times be curtailed during August and September.

Community served by right(s)	Water source	Demand during peak month in 2050 (gpm)	Total water rights (gpm)	Rights senior to 1974 minimum instream flows (gpm)
Elkton	Umpqua River	103	448	448
Roseburg	North Umpqua River	16,627	13,914	11,221
UBWA	North Umpqua River	3,088	4,084	1,840
Glide	North Umpqua River	462	987	987

Table 2.B-26: Future peak need relative to existing water rights by priority date. (gpm = gallons per minute)

The City of Sutherlin uses water from Cooper Creek and Cooper Creek Reservoir to meet its municipal needs when the City's rights on Calapooya Creek are insufficient. It also has an undeveloped right on the North Umpqua River. The assessment of future municipal use for the City of Sutherlin is discussed in the Calapooya Creek section of Sub-basin C.

Rural Domestic

The allocated rural population of these sub-basins is expected to increase from 6,279 to 10,423 people. Using a peak per capita need of 290 gallons per capita day, the future rural domestic need is estimated to be 2,080 acre-feet per year, with about half of that need occurring from June through September.

An estimated 30 percent (1,978 people) of the current rural domestic population has domestic surface water rights. New surface water rights may occur to fulfill needs during the wet season but are unlikely to be reliable during the summer months due to low flows on the North Umpqua River. More pressure is expected on ground water supplies and individuals will likely develop more personal storage tanks for use during the summer months. See Appendix M for further details.

Industrial

No large scale industrial water use is foreseen in the Umpqua River sub-basin, although a large private parcel of 120 acres, zoned for industrial use is available on Del Rio Road along the Umpqua River. This is a desirable site with both rail and highway access, but is limited by its lack of available water and sewer. Recently a large warehouse distribution center showed interest in the site. However, the lack of readiness due to water and sewer was a deterrent.

In the North Umpqua, portions of the industrial needs currently are being met by the City of Roseburg water system. Future industrial needs may be supplied by the Roseburg water system as well.

In a study on the feasibility of producing biomass energy in Oregon commissioned by the Oregon Forest Resources Institute in 2006, Douglas County was found to have the highest amount of acreage available and the largest volume available to support biomass energy production, as well as road infrastructure to access the supply (Mason, Bruce & Girard et al 2006). Douglas County commissioners are investigating biomass energy production as a viable option for the County. One possible location for such an operation would be on or near the North Umpqua corridor.

The water need is estimated to be no more than 150 acre-feet per year from the North Umpqua River (See Appendix M). Although new water rights on the North Umpqua River would not likely be reliable, biomass energy is most likely to occur within existing mill sites through expansion of their operations. These sites have existing water rights that may be sufficient for these operations.[38]

Irrigation

Determinations for the future potential irrigation land available in each sub-basin are described in Appendix I and summarized in Table 2.B-27. The U.S. Bureau of Reclamation (USBR) land classification did not survey all of the North Umpqua and Sutherlin Creek drainages. USBR numbers therefore are relatively small compared to areas identified by local reviewers using aerial photo mapping. Therefore the acreage selected for estimating future potential irrigation lands are those identified by aerial photo mapping for these two streams. In the case of the North Umpqua River, it appears that all lands considered irrigable are being irrigated under existing rights. Consequently no expansion of irrigation is foreseen from the North Umpqua River area.

[38] Estimates of water use by biomass energy production can be far less depending on reuse of the steam produced.

Reach	USBR	Aerial photo	Selected	Existing rights	Future potential
Umpqua River sub-basin					
Scottsburg to Elk Creek	3,394	3,800	3,600	1,946	1,654
Elk Creek to confluence	7,391	7,630	7,510	6,302	1,208
North Umpqua River sub-basin					
Above Glide	---	---	---	417	---
Glide to the mouth	957	2,890	2,890	3,111	0
Sutherlin Creek	349	3,240	3,240	1,416[1]	1,824
[1] Approximately 636 acres are within the Sutherlin Creek mapping area but are irrigated from tributaries of Calapooya Creek.					

Table 2.B-27: Existing and future potential irrigation land (Umpqua River/North Umpqua sub-basins).

Water requirements for the future potential irrigated land are based on an average projected need of 2.44 acre-feet per acre per year. Monthly projections for the future needs are shown in Table 2.B-28. Appendix I contains data on present and potential future irrigation lands, and calculations for future water demands.

In addition to these projections, it is important to note that of the existing irrigated land approximately 28 percent in the Umpqua River sub-basin and 11 percent in the North Umpqua sub-basin are irrigated with water rights junior to 1974 instream flow rights. These existing irrigated acres are often subject to curtailment for portions of the irrigation season unless supplemental irrigation rights are available.

Month	Percent	Umpqua River		North Umpqua
		Scottsburg to Elk Creek	Elk Creek to confluence	Sutherlin Creek
Potential acres		1,654	1,208	1,824
Mar	0.5	20	15	22
Apr	4.4	178	130	196
May	11.4	460	336	507
Jun	18.6	751	548	828
Jul	28.5	1,150	840	1,268
Aug	22.9	924	675	1,019
Sep	12.6	509	371	561
Oct	1.1	44	32	49
Total	100.0	4,036	2,947	4,450
Acre-feet projections are based on a future average use of 2.44 acre-feet per acre per year. Monthly distributions are calculated based on projected crops and their water needs. Source: See Appendix I for calculations.				

Table 2.B-28: Future potential irrigation water demands in acre-feet (Umpqua/North Umpqua sub-basins).

Summary of Future Water Use

Table 2.B-29 is a summary of the projected future potential water needs in acre-feet per year for the sub-basins. The irrigation estimates include the projected potential irrigation development as well as the supplemental needs to meet existing irrigation water rights. It is important to note that the estimate of future potential irrigation water use assumes that all land assessed as irrigable would be fully developed for irrigation. This is unlikely, as some landowners may not choose to develop irrigation systems on their land to fully meet the land potential even when water is available. This may be due to costs of system development, operating costs of power or water, legal easements, or potentially other interests for their land.

Industrial future water needs are highly variable as the industry diversifies in the County. Water needs for different types of manufacturing are extremely variable. Areas with available industrial water rights are more likely to attract a variety of industry as water becomes scarce in many other areas.

Rural domestic needs are likely to increase as well. However, the majority of rural domestic users are on ground water and future ground water supply estimates are not available. Rural domestic growth will increase the pressure on ground water supplies and shortages may occur in specific areas.

Reach	Municipal	Industrial	Irrigation	Total
Umpqua River above Scottsburg	0	1,600	12,853[1]	14,453
North Umpqua River	1,615	150	4,797[2]	6,562

[1] Includes 3,612 acres under current irrigation water rights with priority dates of right junior to 1974 instream flows that are subject to curtailment during the low flow season. Approximately 65 percent of the irrigation need occurs when flows are inadequate in July through October.
[2] Includes 213 acres with priority dates of right junior to 1974 instream flow rights and subject to curtailment during low flows in July through October. The additional need would be 346 acre-feet to supplement these irrigation rights.

Table 2.B-29: Future potential water needs in acre-feet per year for the Umpqua River/North Umpqua River sub-basins.

2.B.3. Sub-basin Concerns

Quantity

Unregulated water supplies in the Umpqua River may not be adequate to meet expanded future industrial and irrigation needs.

Unregulated discharge in the North Umpqua River may become inadequate as reliable municipal and industrial surface water sources for the increasing population.

Surface water supplies are inadequate to meet future irrigation potential in Sutherlin Creek.

Quality

Most stream water quality issues will be addressed through implementation of the Umpqua Basin and Little River TMDLs. However, listings for sediment and toxic substances are not addressed by the Umpqua Basin TMDL along with a few isolated stream segments for other parameters.

The main Umpqua River has elevated bacteria levels primarily in the fall, winter, and spring when runoff is higher.

There are 50 streams (or stream portions) that do not currently meet the State standards for stream temperature within the Umpqua River/North Umpqua River sub-basins, including the entire mainstem Umpqua River. Most of these streams are within the North Umpqua River sub-basin.

Elevated temperatures during the summer in Rock Creek have been a problem with regard to operation of the Rock Creek Hatchery. However, the hatchery currently draws water from the North Umpqua River during this period to alleviate the problem.

Cooper Creek and Cooper Creek Reservoir, Sutherlin Creek, and the North Umpqua River have elevated levels of various toxic substances that may affect aquatic life and human health. These streams are not currently addressed by the Umpqua Basin TMDL. Toxic levels that may have effects on human health are of particular concern where residents use the stream as a primary water source as well as regularly consume fish from the stream.

Eight streams within the North Umpqua River sub-basin are considered water quality impaired for pH during the summer. All but one of these listings will be addressed through either the Little River or Umpqua Basin TMDLs. The one mile section listed on the North Umpqua River is not addressed in a TMDL but is expected to be addressed through other processes related to the relicensing agreement for the North Umpqua Hydroelectric Project.

Canton Creek is listed for sediment and is not currently addressed in the Umpqua Basin TMDL.

There are 49 streams in these sub-basins listed for habitat modification and 22 listed with flow modification impairment. Most of those listed for flow modification are within the Umpqua River sub-basin, while those listed for habitat modification are distributed throughout both sub-basins. These modifications are usually caused by physical changes to the stream environment and can affect other pollutant levels such as sediment and dissolved oxygen.

Cooper Creek Reservoir has high mercury and iron levels throughout the year. Some sampling has also shown impaired levels of arsenic, beryllium, and manganese throughout the year, although sample sizes were insufficient to add to the 303(d) list. Plat I was listed as water quality impaired for mercury in 2002. Both reservoirs are drawn down each year to flush some of these contaminants out and provide room for more new runoff to help reduce these levels.

Diamond Lake has been listed for algae, pH, and dissolved oxygen. It has also showed some high alkalinity and ammonia levels. However, this sampling was before the draining of the lake and application of rotenone for removal of the tui chub. The lake has subsequently been refilled and the fish stocking levels are increasing. Future sampling of Diamond Lake should show reductions in these pollutants.

Flooding and Urban Drainage

During periods when flows in the North Umpqua River exceed the 2 percent probability, or 50-year recurrence, flood damage occurs in communities and residences. However, the construction of Cooper Creek Reservoir has alleviated flooding problems for the City of Sutherlin.

The Umpqua River near Elkton station measured flooding in almost 20 percent of recorded years. This frequency of flooding was far more than areas on the North Umpqua River where less than 10 percent of the years recorded flooding.

Other Perceived Concerns

In the North Umpqua River below Glide there is increasing seasonal algae growth, as evidence of the increasing water temperatures in the low flow season. The recent relicensing agreement for the North Umpqua Hydroelectric Project will increase minimum flow releases and may help improve this condition.

The lack of riparian cover on numerous tributary streams exacerbates high water temperature conditions and decreases available large wood for instream structure development. This creates long-term fish habitat concerns.

2.C. Elk Creek / Calapooya Creek Sub-basins

2.C.1. Area Description

The Elk Creek and Calapooya Creek sub-basins (Figure 2.C.1) include the watersheds that drain into the following areas within the Umpqua Basin:

1. Elk Creek from its confluence with the Umpqua River to its origin above Elkhead on the slopes of Ben More Mountain at approximately river mile 47; and

2. Calapooya Creek from its confluence with the Umpqua River to its origin at the confluence of the North and South Forks above Hawthorne at approximately river mile 36.

Communities located along Elk Creek include Elkton located near the confluence of Elk Creek with the Umpqua River; Drain at about river mile 24; Yoncalla located about three miles up Yoncalla Creek, a tributary to Elk Creek at about river mile 26; and Elkhead located along Elk Creek above Drain at about river mile 44. Pass Creek is a major tributary merging with Elk Creek from the north at Drain. Communities along Pass Creek include Leona, Anlauf and Curtin.

State Highway 38 follows the course of Elk Creek from Elkton to Drain, and then traverses up Pass Creek to Curtin where the highway connects with Interstate 5. County Road 389 parallels Yoncalla Creek between Drain and Yoncalla and intersects Interstate 5 near Rice Hill. The sub-basin terrain is hilly and interspersed with shoestring valleys along Elk Creek, with the exception of the area around Yoncalla. Yoncalla Valley, to the north and east of the City of Yoncalla, Pleasant Valley, to the south and east of Yoncalla, and Scotts Valley, about 4 miles east of Yoncalla are relatively broad and level valley areas with a potential for irrigated agriculture if water were available.

Calapooya Creek enters the Umpqua River near the community of Umpqua. Upstream of the confluence, communities include the City of Oakland, Fair Oaks, and Nonpariel. Between the mouth of Calapooya Creek and Oakland, the creek drains a relatively wide valley with a large number of irrigated farms. Upstream near Nonpariel, the City of Sutherlin diverts much of its water supply, and a treatment plant has been constructed near Calapooya Creek. Above Nonpariel the terrain becomes hilly. County roads generally follow the course of Calapooya Creek, and Interstate 5 crosses the creek west of Oakland at about river mile 13.

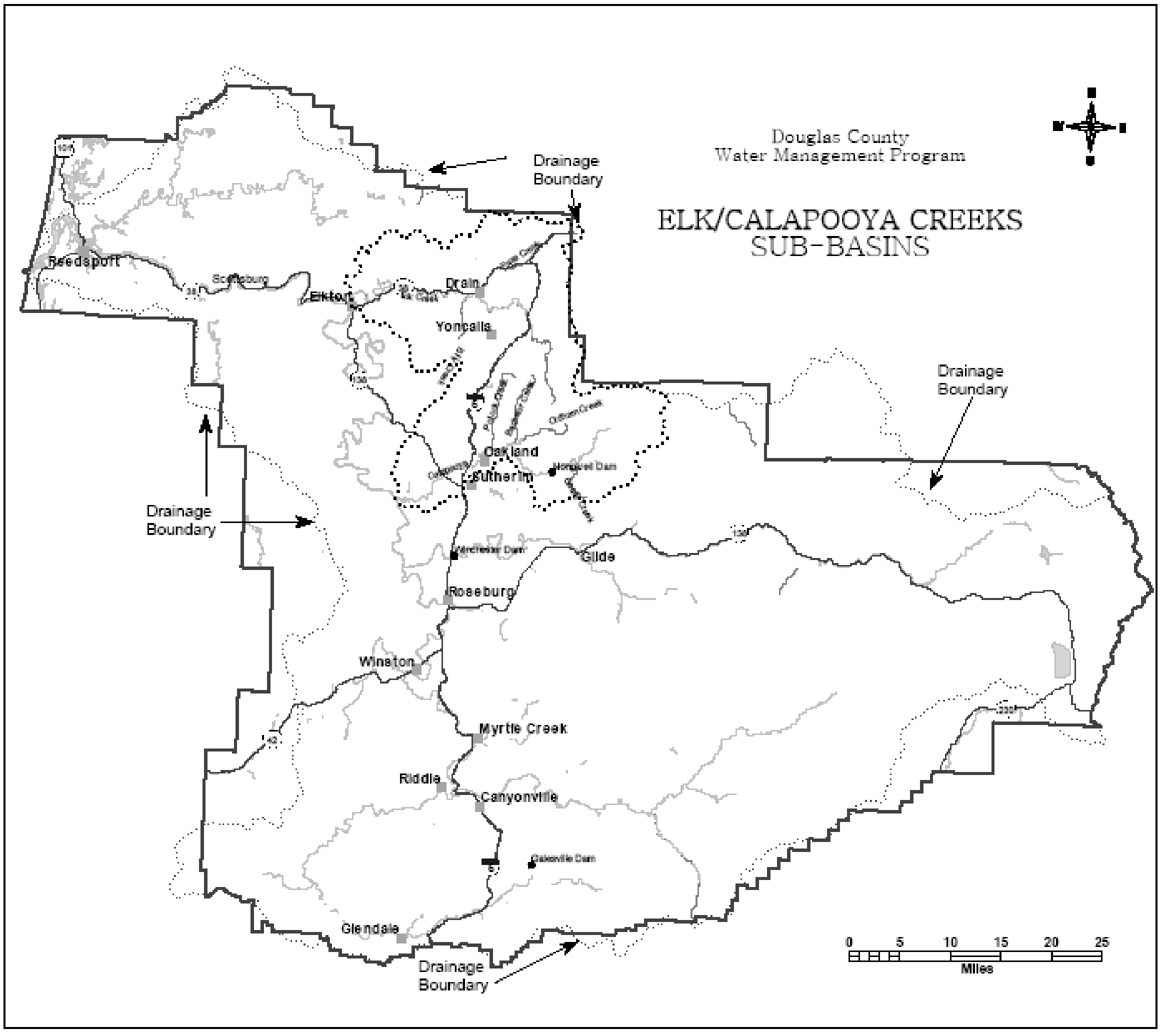

Figure 2.C.1: Elk Creek and Calapooya Creek sub-basins within Douglas County.

Climate

The climate of these sub-basins is mild. Precipitation rarely falls as snow on the lower elevation portions, and summer temperatures are warm. The eastern portion of the Elk Creek Watershed does not exceed 2,300 feet in elevation, and little precipitation occurs as snow during winter. Although not exceptional, the upper portions of the Calapooya Creek drainage receive more snow than the Elk Creek Watershed. The divide between the Calapooya Creek sub-basin and the Rock Creek drainage, a tributary of the North Umpqua River, has peaks exceeding 4,100 feet; and Burnt Mountain in the extreme northeast corner of the Calapooya Creek drainage reaches over 4,400 feet in elevation.

Precipitation

Douglas County operates several precipitation-measuring stations in the Elk Creek and Calapooya Creeks sub-basins. To illustrate rainfall variation, maximum, mean, and minimum monthly values are listed in Table 2.C-1 for stations located in Drain on Elk Creek; in Sutherlin from four different locations; and at Elkhead. The Sutherlin stations include Sutherlin 2ENE (1957-1976), Sutherlin 4ESE (1976-1979), Sutherlin 4NE (1979-1996), and Sutherlin 2W (1996-2006).

Period	Drain 1903 to April 2006			Sutherlin 1957 to April 2006			Elkhead 1955 to 2002		
	max	mean	min	max	mean	min	max	mean	min
Oct	15.77	3.46	0.00	5.85	2.90	0.07	10.60	4.02	0.08
Nov	19.67	7.28	0.72	17.94	6.40	1.16	21.07	8.10	1.81
Dec	19.18	7.72	1.23	15.80	6.96	1.07	22.19	8.73	1.52
Jan	15.53	7.29	0.60	14.43	6.08	0.84	14.95	7.74	0.81
Feb	17.02	5.72	0.30	12.42	4.69	1.10	15.56	6.25	1.04
Mar	13.71	5.02	0.59	9.21	4.48	0.64	11.38	6.03	1.26
April	7.85	3.34	0.79	7.43	3.17	0.74	9.64	4.25	1.15
May	6.34	2.39	0.09	7.00	2.31	0.00	9.23	3.21	0.49
June	4.23	1.33	0.00	4.48	1.17	0.00	4.62	1.59	0.06
July	3.51	0.39	0.00	3.16	0.44	0.00	4.50	0.51	0.00
Aug	3.61	0.58	0.00	4.63	0.77	0.00	4.42	0.86	0.00
Sept	5.17	1.48	0.00	4.85	1.28	0.00	6.62	1.67	0.00
Annual[1]	78.38	45.53	29.84	59.70	40.53	26.59	83.86	52.80	36.56
[1] Values are maximum annual, mean annual, and minimum annual; not total of column entries.									

Table 2.C-1: Monthly and annual maximum, average, and minimum precipitation measured at three locations across the sub-basins.

Over 85 percent of the precipitation occurs from October through April at all three locations with the majority from November to January. The summers are nearly dry averaging less than one inch total in July and August at Drain and just over an inch at Sutherlin and Elkhead. Sutherlin has the lowest average annual precipitation with about 40.5 inches while Elkhead has the highest with almost 53 inches. The maximum recorded annual amount was in 1996 at all three locations, the highest being nearly 84 inches at Elkhead. The minimum annual amount of 26.59 inches occurred at Sutherlin in 1930. All three stations show a dry season from July through August where less than 1.5 inches total occurred on average.

Surface Water - Rivers and Streams

Quantity

There are several stream gages managed by the USGS, Douglas County, and the State of Oregon that have collected historic data within the Elk Creek and Calapooya Creek sub-basins. Representative monthly and annual streamflow data are listed in Table 2.C-2 and Table 2.C-3. Several other gages are currently operated on the North Fork and South Fork of Hinkle Creek, but have not been in operation as long.

Stream gage	Period of record (water year)	Discharge (cfs)			Runoff average (ac-ft/yr)
		max	min	mean	
Elk Creek nr Drain	1955-2005	19,000	0.00	199	143,284
Elk Creek nr Elkhead	1968-1999[1]	6,670	0.00	56	40,573
Calapooya Creek nr Oakland	1955-2001	26,600	0.00	485	349,744

[1] Missing most data between 1972 and 1987.
Source: USGS National Water Information System and Douglas County Natural Resources Division.

Table 2.C-2: Maximum, minimum, and average discharge, and acre-feet of runoff for three locations in the sub-basins.

Month	Elk Creek near Drain		Elk Creek near Elkhead		Calapooya near Oakland	
	mean (cfs)	percent of annual	mean (cfs)	percent of annual	mean (cfs)	percent of annual
October	14	0.7	6.7	1.0	57	1.0
November	206	8.7	70	10.4	522	9.5
December	446	20.6	129	19.2	1,116	20.2
January	469	21.8	154	22.9	1,097	19.9
February	413	18.8	106	15.8	936	17.0
March	299	14.2	87	13.0	806	14.6
April	214	8.6	59	8.8	517	9.4
May	110	4.6	37	5.5	296	5.4
June	37	1.4	15	2.2	110	2.0
July	8	0.3	4.3	0.6	27	0.5
August	3	0.1	1.9	0.3	11	0.2
September	4	0.2	1.8	0.3	15	0.3
Total	**2,222**	**100.0**	**672**	**100.0**	**5,507**	**100.0**

Source: USGS National Water Information System and Douglas County Natural Resources Division.

Table 2.C-3: Mean monthly discharge and the percent of annual discharge from three stations in the sub-basins.

The flow data show large variations in discharge from season to season, reflecting climatic and geologic conditions in the sub-basins. For example, 93.5 percent of the annual discharge measured at Elk Creek near Drain and over 90 percent of the annual discharge measured at both Elk Creek near Elkhead and Calapooya Creek near Oakland occurs within six months from November through April. Less than one percent occurs in each of the summer months of July, August and September, the period of peak needs for out-of-stream uses. In many years portions of both streams have been dry for part of the year, with some remaining pools connected to subsurface flow of groundwater.

<u>Flooding</u>

Flooding is a natural phenomenon that occurs when streamflow overflows the stream banks. Small floods should be expected to occur about every two years. Larger, less frequent events such as the hundred-year event have flows that are on the order of five times larger than the two-year event. Flooding becomes an issue when property is damaged or access is limited by the high water. Elk Creek has flooded portions of the City of Drain during many of the floods listed in Table 2.C-4. Likewise, the low lying riparian agricultural lands along Yoncalla Creek experience flooding that occasionally overflows the main road and threatens some homes. Flooding occurs with similar frequencies in the Calapooya Creek sub-basin, although most of the flooding is limited to riparian agricultural lands.

Generally, streams that are in good condition withstand flooding with a minimum of erosion or channel alteration. Likewise, aquatic and riparian species have adapted to survive these events. Modified streams and drainage systems such as road networks that contribute water to the stream system can be severely damaged during the high flow period if they do not have adequate carrying capacity.

Since the lands adjacent to streams often have high value for development or agriculture, the streams are often modified to reduce flooding. Dikes may be built or the stream enlarged to increase the capacity of the stream. Removal of large debris from the stream channel was a common practice in the past. Unfortunately these methods eliminate habitat, destabilize streams, and direct larger quantities of water downstream to other flood prone areas. The end result is accelerated erosion, increased channel downcutting, lowered water table, and increased flooding downstream.

A more effective approach to flood management includes avoidance of high valued structures within the designated flood zones and sufficient water detention areas along the stream route.

The County regulates development of structures in floodplain areas to prevent loss of property and danger to residents, as well as to maintain existing floodplains for streams. Agricultural landowners in floodplain areas can expect to have some flooding of their agricultural lands. To help mitigate damage that may be caused by excessive flooding in unexpected areas, watershed councils, conservation districts, and the Natural Resources Conservation Service (NRCS) help landowners implement projects such as instream wood placement, proper-sized culvert replacements, channel realignment, and re-establishment of riparian vegetation.

Flood control reservoirs and detention ponds can help reduce the effects of local flooding. Comprehensive planning is needed to manage the water storage throughout the entire drainage system.

Table 2.C-4 shows recorded flood levels for various years since 1955 measured at Elk Creek near Drain and at Calapooya Creek near Oakland. Flood history shows peak events occur in November through February. In almost all years the station on Calapooya Creek measured stream levels significantly higher above the flood stage level than on Elk Creek

Date	Elk Creek near Drain feet above flood stage (16 ft)	Calapooya Creek near Oakland feet above flood stage (14 ft)
Dec 22, 1955	3.06	6.47
Feb 10, 1961	7.70	---
Nov 23, 1961	4.26	7.55
Dec 22-23, 1964	3.48	6.72
Jan 17-18, 1971	---	4.60
Jan 15, 1974	2.76	4.72
Dec 6, 1981	5.97	6.83
Feb 17-18, 1983	1.5	5.16
Nov 18-19, 1996	6.74	7.62
Dec 7-8, 1996	---	4.42
Dec 30-31, 2005	1.46	5.06
Source: Douglas County Flood Crest History from Douglas County website last updated March 15, 2006.		

Table 2.C-4: Water height (in feet) above flood level at two stream gages in the Elk Creek/Calapooya Creek sub-basins for various years since 1955.

The most recent significant flooding occurred in late December 2005. Calapooya Creek recorded flows over five feet above flood level. The Umpqua River near Elkton also exceeded its capacity by over six feet aided by large flows on the South Umpqua River.

Calapooya Creek measured its biggest event in November 1996. During the storm, Drain received 5.92 inches in one day, and precipitation in the weeks prior to the storm was above average leading to already saturated soils. The combination of heavy rains, snowmelt, saturated soils, and flooding also resulted in debris flows and landslides. Four people were killed by a debris flow near Rock Creek, a tributary to Hubbard Creek near Millwood. More flooding occurred a few weeks later from December 4^{th}-9^{th} and again on January 1^{st}-2^{nd}. The combined damage from flooding and land disturbances caused over $11 million in damage to public and private property within the Umpqua River basin (USGS 2004). The Umpqua National Forest and Oregon State highways within the County incurred over $7 million in damage, and BLM lands, local municipal infrastructure, and private property were each over $1 million in damage.

During the November 1996 major flood event, Calapooya Creek was 7.6 feet over flood level, with streamflow measured at 27,100 cfs; it was considered a greater than 25-year event. Elk Creek at Elkhead measured 6,670 cfs, considered just under a 50-year flood event. The November storm caused more flooding in the North Umpqua, Calapooya Creek, and Elk Creek sub-basins, while the December storms caused more flooding in the South Umpqua and Umpqua sub-basins; although the Umpqua River near Elkton also exceeded its capacity by over six feet aided by large flows on the South Umpqua River in December. The January storms did not produce the flooding of the earlier events but caused more damage throughout the County due to the saturated conditions.

In December, 1964 a large storm event brought high rainfall that fell on deep accumulated snow in the Cascades causing rapid snowmelt and large-scale, widespread flooding throughout much of the Umpqua Basin. Many of the resulting floods in the higher elevation watersheds were considered 100-year events indicating these flow levels have a one percent probability of occurrence in any given year. While both Elk Creek and Calapooya Creek showed flood events for this time, they did not experience the magnitude of many of the floods throughout the South Umpqua and North Umpqua sub-basins. This is presumably due to the lower elevations that drain into these streams where the deeper snow accumulations are not as likely. Flood levels on these streams are more a direct result of high rainfall in a short period of time.

During the 1964 flood the Umpqua River near Elkton was nearly 19 feet above flood level. The City of Elkton was evacuated, and damage was widespread throughout the Umpqua Basin. Preliminary flood damage estimates prepared by USCE totaled over $31 million in 1964 dollars for the County as a whole.

Quality

Water quality and quantity affect the use of water. The quality of water in the Elk Creek and Calapooya Creek sub-basins does not always meet state standards for all parameters (see Table 1-1). Failure to meet a standard may vary by season due to changes in quantity of flow, as well as other seasonal changes.

In the Elk Creek and Calapooya Creek sub-basins, water quality conditions limit the uses that can be made of water resources. Water temperatures seasonally exceed the limits tolerable to anadromous fish in some portions of streams. Nutrient levels become high during low-flow periods, resulting in rampant algae growth that in turn affects dissolved oxygen levels. In combination, conditions reach levels that are critical for aquatic life and the appearance of the streams become aesthetically unpleasant.

Although water quality varies by parameter, a general water quality determination within Calapooya Creek and the lower reaches of Elk Creek can be characterized as fair with problems stemming from both point and non-point sources.[39] Water quality in the upper reaches of Elk Creek near Drain was considered poor in the past; however it has been

[39] Overall water quality evaluations are based on the Oregon Water Quality Index discussed in the following section.

improving in more recent years. Water quality improves downstream by the time it reaches Elkton.

Oregon Water Quality Index[40]

"The purpose of the Oregon Water Quality Index (OWQI) is to improve understanding of water quality issues by integrating complex data and generating a score that describes water quality status and evaluates water quality trends," (Cude 2001). While it is not a comprehensive assessment of water quality for any specific use, the index aids in the assessment of water quality for recreational uses (i.e. fishing and swimming), and the goal of the index is to assess water quality as it relates to fish (Cude 2002). For a complete description of the index and how it was developed and used, refer to *Oregon Water Quality Index: A Tool for Evaluating Water Quality Management Effectiveness*, (Cude 2001).

The Oregon Water Quality Index is a single number that expresses water quality by integrating measurements of the following eight water quality variables collected at ODEQ monitoring stations:

- temperature,
- dissolved oxygen (percent saturation and concentration),
- biochemical oxygen demand,
- pH,
- total solids,
- ammonia and nitrate nitrogen,
- total phosphorus, and
- bacteria.

Index values are then used by the Oregon DEQ to determine trends in water quality for each site. However, the index does not consider changes in concentrations of toxics, habitat, or biology of the streams.

Average Oregon water quality index results for the summer and for the rest of the year, as well as the minimum for the season for three sites in the sub-basins are listed in Table 2.C-5. Index values for Calapooya Creek at Umpqua and for Elk Creek at Elkton are based on water quality data from water years 1996-2005. The values for the site on Elk Creek at Drain are based on data from water years 1986 -1993, after which the monitoring site was moved downstream to its current location at Elkton.

[40] Discussion in this section is based largely on the Oregon Water Quality Index Report for the Umpqua Basin Water Years 1986-1995 (Cude). However, current index values and updates to the discussion are from the most current Oregon Water Quality Index Summary Report Water Years.

Site	River mile	Summer average (June – Sept)	Fall, winter, and spring average (Oct – May)	Minimum seasonal average	Rating[1]
Calapooya Creek at Umpqua	0.4	81	80	80	Fair
Elk Creek at Drain[2]	22.8	72	79	72	Poor
Elk Creek at Elkton	0.2	83	87	83	Fair

[1] Based on minimum seasonal average.
Scores: very poor 0-59; poor 60-79; fair 80-84; good 85-89; excellent 90-100.
[2] Elk Creek at Drain data is based on water years 1986 -1993.
Source: Oregon Water Quality Index Summary Report Water Years 1996-2005.

Table 2.C-5: Oregon Water Quality Index rating for Calapooya Creek near the mouth and two sites on Elk Creek for water years 1996 – 2005[2].

The most current index values on Calapooya Creek and Elk Creek at Elkton are considered "fair" in the ODEQ rating scale. The Calapooya Creek site is located near the creek's convergence with the Umpqua River in an area dominated by agricultural land. The Oregon Water Quality Index Report for the Umpqua Basin states the following summary on Calapooya Creek:

> "The monitoring site on Garden Valley Road at the town of Umpqua represents influences from agricultural lands dominating that portion of the drainage. STPs [sewage treatment plants] at Oakland and Sutherlin discharge to Calapooya Creek. High levels of fecal coliform, total phosphates, total solids, and biochemical oxygen demand load the creek during all flow conditions. This indicates the presence of untreated animal wastes and other organic matter in the creek throughout the year. Heavy precipitation can result in overflow conditions at the STPs. During the low flow summer months, high water temperatures intensify water pollution."

Calapooya Creek has had an overall decreasing trend in water quality ratings based on the 1986-1995 data when the summer season rated as poor. Although there has been some improvement in summer water quality in the last ten years; the fall, winter, and spring index value has remained the same.

The Oregon DEQ monitors Elk Creek from data collected at a station located at Elkton just upstream from its confluence with the Umpqua River. The original site near Drain operated until 1993 was just downstream of Drain's wastewater treatment facility. According to the ODEQ Oregon Water Quality Index Report for the Umpqua Basin, Elk Creek was impacted by high levels of fecal coliform, total phosphates, total solids, and biochemical oxygen demand, and occasionally high temperatures. In the past, the site near Drain reflected generally "poor" water quality conditions throughout the year. Since 1986, the frequency and severity of these impacts has lessened leading to a significant increase in water quality through 1993, after which the monitoring site was moved downstream to Elkton. The index report for the Umpqua Basin further states the following for Elk Creek:

> "After flowing through Drain, Elk Creek meanders through Putnam Valley before dropping through the forested hills above Elkton and into the Umpqua River. This steep gradient change assists the creek in purification and we can see that QWQI scores have improved to generally good quality throughout the year. The river is still impacted by high fecal coliform, total phosphates, total solids, and biochemical oxygen demand in the wet seasons and by high pH, total solids, and temperature in the summer, so the effects of non-point source pollution are more evident."

Point and Non-point Source Pollution

Point-source pollution comes from an identifiable point of discharge into the water. Non-point source pollution includes where the primary sources of pollution cannot be identified as coming from a specific site. These factors may include water temperature, erosion and sedimentation, bacteria, and other items. Point source, and non-point source pollution problems identified in the Umpqua Basin TMDL assessment and other monitoring data from the area are summarized below.

Bacteria

Calapooya Creek, Elk Creek, and Yoncalla Creek failed to meet the State standard for bacteria (*E. coli*) in the fall, winter, and spring seasons. This is presumably due to increased runoff during high flows. During these periods, bacteria levels pose a health threat to people using the river for water contact recreation.

Although there are two point-sources of bacteria from wastewater treatment plants, ODEQ determined that these usually meet standards for discharge, thus not contributing significantly to the higher bacteria levels measured. One exception was the Drain Wastewater Treatment Plant, which reported 12 sewage overflows into Elk Creek between 2000 and 2002. ODEQ determined based on their spill analysis for the TMDL that upgrades to the Drain treatment plant will result in a large reduction of *E. coli* loading into Elk Creek. However, bacteria standards were also not met upstream of this point source indicating pollution problems are also from non-point sources in the sub-basin (ODEQ TMDL 2006).

Identification of specific non-point sources for these streams has not been done. The Umpqua Basin TMDL has assigned load allocations to point and non-point sources of bacteria. The sources of bacteria addressed in the TMDL were summarized in the following way:

> Studies by DEQ during storms indicated that forested lands do not contribute any significant bacteria load to streams in the Umpqua Basin, but agricultural, rural residential and urban lands, as well as possible turbulence releasing bacteria from stream sediments were the sources of bacteria. Since relative contributions could not be determined from the data, the load allocations for non-point sources were allocated to all non-point sources in the basin.

Temperature

Water temperature is a major factor affecting water quality. It effects concentrations of other constituents, as well as the chemical and biological interaction of these constituents. It is a primary factor in determining the types of organisms able to inhabit a body of water. Salmonids are among the most sensitive fish; therefore ODEQ surface water temperature standards have been set based on salmonid temperature tolerance levels. The temperature standard varies throughout the Umpqua Basin according to the habitat area and the species that use that area. The standard is based on a seven-day average maximum (7DAM) temperature to avoid short-duration spikes in temperature that likely have minimal impacts on salmonids.

Throughout the Calapooya Creek and Elk Creek sub-basins, the maximum desirable water temperature is approximately 55°F during spawning periods. Spawning times vary by stream but are generally between October and May. During the rest of the year (primarily summer) when salmonids are migrating and rearing, the temperature standard is 64°F. Although these are desirable temperatures based on healthy salmonid populations, there is no evidence that all of these streams ever met these standards.

There are five streams (or stream portions) that do not currently meet the State standards for temperature within the Calapooya Creek/Elk Creek sub-basins. All five exceed the 7DAM temperature standard of 64°F during the summer non-spawning season when salmonids use the streams for rearing and migrating. Stream temperatures that exceed 64°F may cause health problems for salmonids. Streams segments listed as water quality impaired for temperature are shown in Table 2.C-6 along with the season of the impairment relative to salmon spawning.

Stream	Listed segment (river mile)	Season
Calapooya Creek	0 to 36.1	year around (non-spawning)
Elk Creek	0 to 45.6	year around (non-spawning)
North Fork Tom Folley	0 to 3.9	year around (non-spawning)
Pass Creek	0 to 14.2	year around (non-spawning)
Tom Folley Creek	0 to 8.2	year around (non-spawning)
Source: Oregon DEQ 2004/2006 Integrated Report..		

Table 2.C-6: Stream segments that exceed State water quality temperature standards in the Calapooya Creek / Elk Creek sub-basins.

Temperature data from Douglas County and US Geological Survey (USGS) gages, ODEQ sampling sites, the Partnership for the Umpqua Rivers Watershed Council, and other agency sources are the basis for the following discussions of water temperature conditions.

Although only five streams are currently listed as temperature impaired, numerous other streams have exhibited elevated stream temperatures. The Partnership for the Umpqua Rivers Watershed Council commissioned a water temperature study within the Calapooya

Creek sub-basin in 1999 (Smith 2000a).[41] There were 29 sites continuously monitored within the watershed from June 18 to September 3, 1999. Figure 2.C.2 shows the seven-day moving average maximum temperatures for twelve locations along Calapooya Creek.

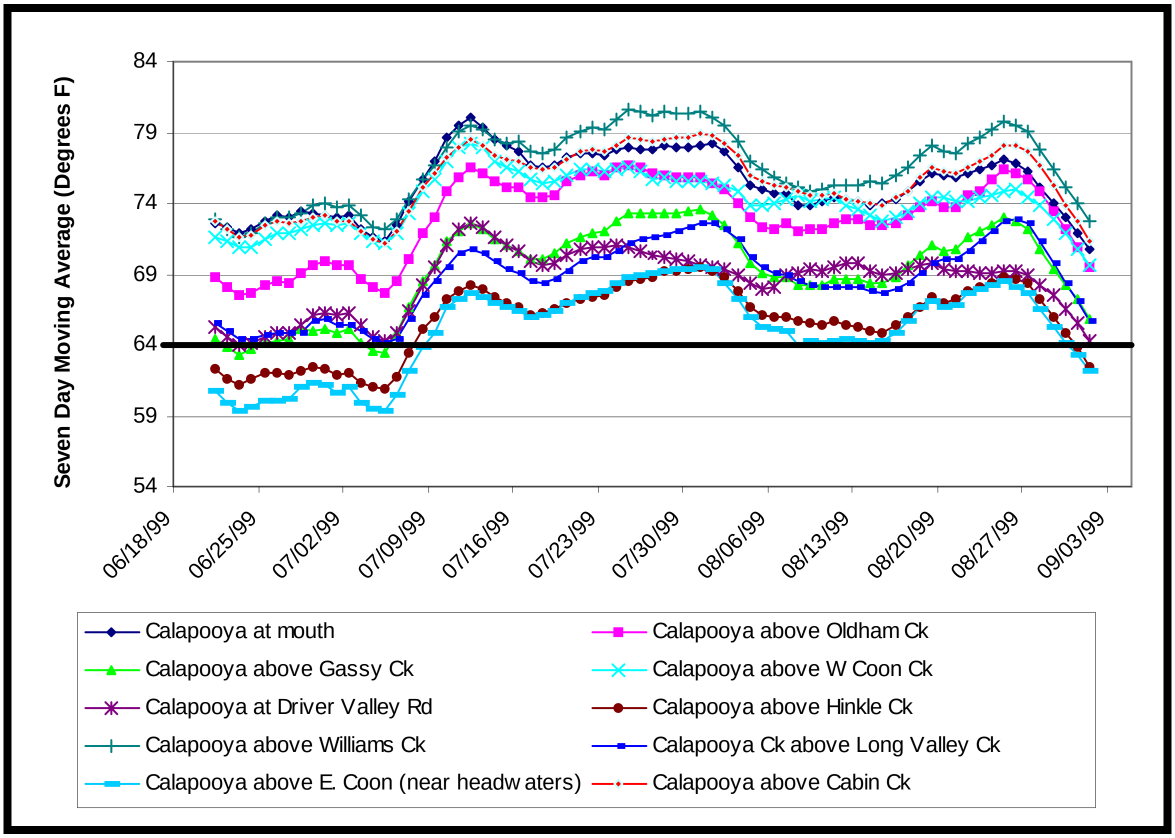

Figure 2.C.2: Summer 1999 temperature trends for Calapooya Creek (Geyer 2003a).

Based on the 1999 data the 7DAM temperature on Calapooya Creek exceeds the standard by the middle of June at all sites except the furthest upstream near Hinkle Creek and West Coon Creek. Even at these upstream locations, the temperature exceeds the standard by early July and stays elevated throughout the summer until September. The locations with the highest temperatures are located furthest from the source ridge including sites above Williams Creek, above Cabin Creek, at the mouth, and above East Coon Creek.

Table 2.C-7 lists the number of days and percent of days for which Calapooya Creek's average maximum temperature exceeded 64°F during the temperature monitoring study. Seven out of 10 sites always exceeded the 64°F standard. Three monitoring sites near the headwaters of Calapooya Creek exceeded the standard at least 73 percent of the time.

[41] Partnership for the Umpqua Rivers Watershed Council was previously known as the Umpqua Basin Watershed Council (UBWC) at the time the temperature study was commissioned.

Sample site	Days with a max 7-day average temp >64°F	Days monitored	Percent of total days >64°F
Calapooya at mouth	73	73	100
Calapooya above W Coon	73	73	100
Calapooya above Williams Ck	73	73	100
Calapooya above Cabin Ck	73	73	100
Calapooya above Oldham	73	73	100
Calapooya at Driver Valley Rd	73	73	100
Calapooya Ck above Long Valley Ck	73	73	100
Calapooya above Gassy	68	73	93
Calapooya above Hinkle Ck	54	73	74
Calapooya above E. Coon (near headwaters)	53	73	73
Source: Calapooya Creek Watershed Assessment and Action Plan (Geyer 2003a)			

Table 2.C-7: Number and percent of days in 1999 for which seven-day moving average maximum temperatures exceeded 64°F (Calapooya Creek sub-basin).

Results of the study show that seasonal seven-day moving average maximums ranged from 82.5° F to 57.5°F, with an average of 72.0° F. Eleven monitoring sites on four streams had seven-day moving average maximum temperatures exceeding the 64°F every day the study was conducted. Eight sites on five streams were below 64°F every day.

Stream temperature at a particular point is a function of many local factors that include exposure to solar radiation, longwave heating from the local environment and groundwater interaction. Water's susceptibility to change temperature is a function of both the volume and velocity of flow. Stream temperatures usually follow a warming trend as the distance from the headwaters and the corresponding stream volume increases. Tributaries are approximately 10°F cooler than the main stem Calapooya. However, all streams that flow more than seven miles from their ridge source frequently exceed the 64°F standard. Maximum temperatures of the coldest streams tend to increase 1.25°F per downsteam mile. Streams that are exposed to direct sunlight can exceed the standard in a shorter distance. Temperatures may also vary within a given area on a stream with cooler temperatures in the deeper water. Isolated points of upwelling ground water may provide some thermal refuge for aquatic life. It appears that many tributaries have the potential to be at cooler temperatures.

Water temperatures vary with local ambient conditions, direct solar radiation, and proportion of ground water flowing into the stream. The effect of ambient air temperature on stream temperature is reflected in Figure 2.C.2 where stream temperatures vary by site but the daily stream temperature pattern is the same at all sites; and maximum and minimum seven-day average maximum temperatures typically occur on the same days at each location.

Removal of riparian vegetation that provides shade, and channel modification can cause local elevated temperatures. Data suggest that increasing shade on streams that are less than 20 miles from their source area may reduce maximum daily stream temperatures in localized areas. Also, the lower reaches of tributaries may provide important refuge for fish from warm main stem waters in the summer months.

Dissolved Oxygen

Salmonid eggs and smolts are sensitive to dissolved oxygen levels. When levels drop too low for even short periods of time, eggs, smolts, and other aquatic organisms will die. The amount of oxygen that is dissolved in water will vary depending upon temperature, barometric pressure, flow, and time of day. Both cold water and higher barometric pressure dissolve more oxygen than warm water, and low pressure. In addition, flowing water contains more dissolved oxygen than still water. Aquatic organisms produce oxygen through photosynthesis and use oxygen during respiration. As a result, dissolved oxygen levels tend to be highest in the afternoon when algal photosynthesis is at its peak, and lowest before dawn after organisms have used oxygen for respiration during the night.

Calapooya Creek (up to stream mile 36.1) and Elk Creek (up to stream mile 45.6) are listed as water quality impaired during the summer for dissolved oxygen. Low levels occur during the summer when anadromous fish are passing through and rearing in these streams. Calapooya Creek is also listed during the spawning period (Oct 15 to May 15) from the mouth to approximately river mile 25 near Nonpareil. This fall, winter, and spring listing is not addressed in the Umpqua Basin TMDL. ODEQ states that the listing "has changed as a result of revised standards and further monitoring is needed to determine pollution limits." It will likely be addressed in the next TMDL cycle estimated to be in 2011 (ODEQ 2006).

Toxics

Toxics may be a concern for fish and aquatic life, drinking water, fishing, and human health. A variety of substances can be toxic including metals, and organic and inorganic chemicals. Some of these substances are found naturally in stream water. The State monitors toxic levels in the water so they are not introduced above natural background levels in amounts, concentrations, or combinations that may be harmful to public health, safety, or welfare; or detrimental to aquatic life, wildlife, or other beneficial uses of the stream.

Two streams in the Calapooya Creek sub-basin are considered water quality impaired for various toxic substances while many others are a "potential concern" for toxics. These streams with a "potential concern" have been sampled and some results have not met State water quality standards but the number of samples is insufficient to determine if they are water quality impaired. They are not currently on the 303(d) list, but may warrant additional monitoring. Table 2.C-8 shows the streams listed for different toxics and the concern associated with each, as well as those streams that are not listed as impaired but are of "potential concern with insufficient data" where toxic levels may affect aquatic life or human health throughout the year.

303(d) listed for toxics			
Stream	**River miles**	**Toxic**	**Concern**
Calapooya Creek	0 to 36.2	iron	aquatic life, human health
Cook Creek	0 to 2.9	beryllium, copper, iron, lead, manganese	human health, resident fish and aquatic life, drinking water, fishing
Potential concern with insufficient data for toxics			
Cabin Creek	0 to 9.2	manganese	human health
Calapooya Creek	0 to 36.0	arsenic, beryllium, manganese	aquatic life, human health
Cook Creek	0 to 2.9	arsenic, mercury	aquatic life, human health
Cox Creek	0 to 2.2	iron, manganese	human health
Elk Creek	0 to 45.6	iron, manganese	aquatic life, human health

Table 2.C-8: Streams listed as water quality impaired for toxics and those categorized with "potential concern" for toxic substances.

Toxic levels that may have effects on human health are of particular concern where residents use the stream as a primary water source as well as regularly consume fish from the stream. These streams potentially include Calapooya Creek and Elk Creek.

Iron, lead, beryllium, manganese, and copper are all metals. According to environmental toxicologists Hickey and Golding (2002):

> Metal pollution of streams and rivers is recognized as one of the major concerns for management of freshwaters. Although industrial and mining activities may be the most important sources of dissolved metals, urban runoff is an increasingly significant source. The chemical contaminant composition of urban runoff varies widely, including mixtures of metals and organics (e.g., polycyclic aromatic hydrocarbons), which together with suspended sediments and hydraulic stressors may adversely affect receiving-water communities. In addition, the bioavailability of metals in the receiving water is affected by numerous factors (e.g., pH, water hardness, and dissolved organic matter), which may modify toxicity in situ (p. 1854).

Mercury and arsenic are metal elements that are highly toxic in small quantities to humans, wildlife, and fish. The Sutherlin Valley has naturally high concentrations of arsenic in soil and bedrock (Silvernale et. al. 1975). It is also found in elevated levels in ground water throughout Southern Oregon (DHS 2006). However, past mining activities appear to be contributing to higher mercury and arsenic levels in both the Calapooya Creek sub-basin and in the neighboring Lower North Umpqua Watershed. The Nonpareil Mine, located in Nonpareil above Calapooya Creek, was active from the late 1800s until 1932. The much larger Bonanza Mine, located on Foster Creek, was active from the late 1800s until 1960.

In 2000, ODEQ concluded that the Bonanza Mine is a significant source of mercury and arsenic contamination in Foster Creek, Banks Creek, and Calapooya Creek (Geyer 2003a). In October 2003, Hart Crowser and ODEQ conducted a site survey of the Bonanza Mine and neighboring Foster Creek. Their summary described Foster Creek in the following way:

> Foster Creek is currently a series of stagnant reaches created by manmade impoundments. The Creek was either dry of less than 6” depth, [or] with very low flow (less than 1 cfs). The channel is incised with steep banks. Debris, i.e. whole truck bodies, stoves, etc., was observed in the creek. The creek does not provide suitable habitat for anadromous fish. A manmade impoundment downstream of the drinking water tank has created a pool and wetland complex. The wetland has been degraded by cattle trampling (hood prints observed).

Concentrations of mercury and arsenic in the soils at the Bonanza Mine site present a health risk to people living on the property. In addition, tailings from the Bonanza Mine were used to construct a 17-mile railroad grade known today as Red Rock Road, most of which has not been sealed with a new surface.[42] Red Rock Road’s mercury and arsenic concentrations exceed safe levels for residential exposure. The road follows Calapooya Creek throughout most of the eastern half of the watershed and continues on along Sutherlin Creek in the Lower North Umpqua Watershed. It appears to be a potential source of continuous metal contamination to both creeks.

In 2006, the Oregon Department of Human Services conducted a public health assessment of Red Rock Road (DHS 2006). They concluded in the draft document released for public review in October 2006 that mercury in the soil along Red Rock Road was not found to pose a health concern, but arsenic contaminated soil may occur at levels that pose a health concern when exposure occurs over a long period of time. The assessment focused on direct ingestion of contaminated soil and did not address runoff into Calapooya Creek. However, they did also recommend ground water wells in the area be tested (see Ground water Quality section for more information).

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[42] According to local residents in the area, tailings from the mine were also used to construct numerous other driveways and roadways in and around the Sutherlin area.

pH
The pH is a measure of the hydrogen ion concentration of the surface water in the stream. It determines the acidity or alkalinity of the water. High or low pH levels in streams may adversely affect fish and aquatic life, or restrict water contact recreational use. When pH levels exceed the stream's normal range, water can dissolve the protective mucous layer on aquatic organisms such as fish, amphibians, and mollusks; making them more susceptible to diseases. pH can alter the chemical form and affect the availability of nutrients and toxic chemicals; thus potentially impacting resident aquatic life and human health. In mining areas, the presence of low pH and heavy metals can shift the metal ions to more toxic forms in the water.

Physical and biological factors cause surface and ground water pH to normally be slightly alkaline or acidic. The chemical composition of rocks and rainfall will influence pH. Respiration and photosynthesis are normal metabolic processes of aquatic organisms that change pH. Carbon dioxide (CO_2) is produced during respiration and used for photosynthesis. The level of dissolved CO_2 in a stream raises and lowers pH. Normally, there is a balance between instream metabolic processes and a natural chemical buffering system that prevents streams from becoming too acidic or alkaline from CO_2. However, stream inputs that increase or decrease respiration and photosynthesis by aquatic organisms can indirectly shift pH by changing CO_2 levels. For example, nitrogen and phosphorus from organic matter such as feces and urine, or from inorganic chemicals such as fertilizers, encourage algae growth in the summer and can result in algae "blooms." When a stream's algae population grows, so does the overall consumption of dissolved CO_2. As CO_2 levels drop, pH elevates and can reach detrimental levels.

In the Umpqua Basin, the acceptable pH range is 6.5 to 8.5. When 10 percent or more of pH measurements from a stream are outside of this range, the stream is designated water quality limited.

Calapooya Creek is 303(d) listed for pH during the summer from the mouth to stream mile 25.3 near Nonpareil. Figure 2.C.3 shows pH levels for Calapooya Creek at Umpqua (near the mouth) from 1981 through 2000. Out of 49 single summer pH samples, nine were outside the 6.5 to 8.5 pH range, which is more than 18 percent of the samples.

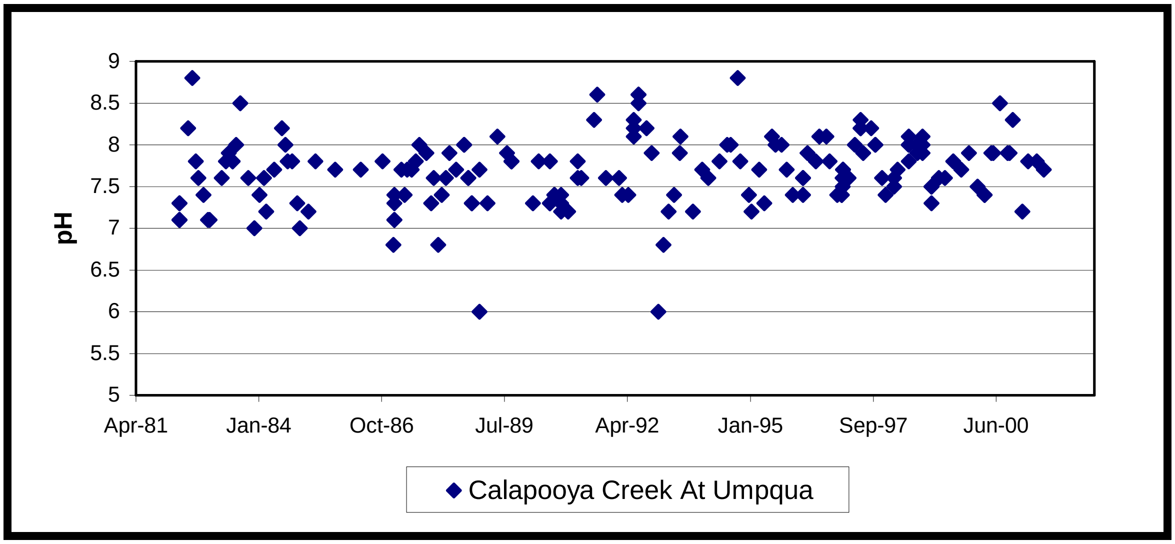

Figure 2.C.3: pH levels for Calapooya Creek at Umpqua (Geyer 2003a).

Other Water Quality Concerns

Elk Creek and Calapooya Creek have some data indicating they do not meet alkalinity standards, however the amount of data is insufficient for listing. High alkalinity indicates they may be high in $CaCO_3$, which can create health problems for aquatic life. In addition, Calapooya Creek potentially does not meet phosphate phosphorus standards. When nutrient levels get too high, they may affect related parameters such as dissolved oxygen or excessive algae growth, which in turn may negatively impact beneficial uses of that stream such as fish and aquatic life. Calapooya Creek has been found to have high algae growth during the low flow season.

There are eight streams in these sub-basins listed for habitat modification and ten listed with flow modification impairment. Most of those listed for flow modification are within the Calapooya Creek sub-basin, while those listed for habitat modification are distributed throughout both sub-basins. Streams listed for habitat modifications or flow modifications are considered water quality impaired, however they do not require a TMDL since the impairment is not from a pollutant. These are usually caused by physical changes to the stream environment. They can be related to stream crossings that restrict or change flow patterns, streambank modification, vegetation changes or losses, and loss of streambed material from flooding, dredging, or historic logging practices with log flumes.

These impairments are common throughout the Umpqua Basin. They can affect other parameters including sediment, dissolved oxygen, and temperature by increasing erosion and streamflow velocity, and decreasing shade. Loss of floodplain vegetation can also increase the rate of streamflow and decrease filtering of sediment and toxics. Efforts to improve fish passage and riparian conditions can help to improve these impairments.

Wastewater Permits

ODEQ manages a wastewater permit program that identifies point-sources of wastewater with potential serious water quality or public health impacts. It requires that those facilities obtain and comply with a wastewater discharge permit. Permit conditions generally include effluent limits; monitoring standards; compliance conditions to improve operation; special operating conditions; and other administrative requirements such as prompt reporting of spills.

Since 1973, permits for discharges to surface waters are issued under the National Pollutant Discharge Elimination System (NPDES). The primary purpose of these permits is to insure that wastewater discharges do not cause harm to the receiving waters or endanger public health. Wastewater discharges that affect land quality and/or ground water are regulated under Water Pollution Control Facilities (WPCF) permits. Their primary purpose is to protect public health and ground water.

General permits are issued when an individual permit is not necessary to adequately protect water quality, and there are several minor sources or activities involved in similar operations that are discharging similar types of waste. These general permits can be to surface water discharges or ground water/land discharges. Individual and general wastewater permits to surface water issued in the sub-basins are discussed in this section and listed in Table 2.C-9. Permits for discharges that may affect ground water are discussed in the ground water quality section.

Calapooya Creek sub-basin			
Source	**Receiving stream**	**Class**	**Waste type**
Avery, Gordon	Calapooya Creek	minor	stormwater
Gordon Avery Construction Co.	Cook Creek	minor	stormwater
L & H Lumber Company	Cook Creek	minor	stormwater
Lone Rock Timber Company	Calapooya Creek	minor	wastewater
Oakland, City of	Calapooya Creek	minor	sewage
Robinson, Sam	Cook Creek	minor	stormwater
Smalley Diesel Center, Inc.	Cook Creek	minor	stormwater
Sonoco Products Company	Calapooya Creek	minor	stormwater
Sutherlin, City of (2)	Calapooya Creek	minor	wastewater & sewage
Elk Creek sub-basin			
Source	**Receiving stream**	**Class**	**Waste type**
Drain, City of	Elk Creek	minor	sewage
Drain, City of	Post Creek	minor	wastewater
Elk River Enterprises, Inc.	Elk Creek	minor	stormwater
Emerad Forest Products, Inc.	Elk Creek	minor	wastewater
Garrett Construction, Inc.	Fitch Creek	minor	stormwater
Patel, Jignesh	Yoncalla Creek	minor	sewage
Rice Hill Owners Association, Inc.	Yoncalla Creek	minor	sewage
Robert Prehall	Yoncalla Creek	minor	stormwater
Roseburg Forest Products	Post Creek	minor	stormwater
W.W.D. Corp.	Post Creek	minor	stormwater
Yoncalla, City of (2)	Yoncalla Creek	minor	sewage & wastewater
( ) indicates the number of permits held if more than one. Source: ODEQ Wastewater Permits Database accessed 11/30/06.			

Table 2.C-9: Waste discharge permits (Calapooya Creek / Elk Creek sub-basins).

Point-source discharges include minor industrial sources such as stormwater and wastewater discharges, as well as minor domestic sewage discharges. There are two each of stormwater and wastewater discharge permits on Calapooya Creek, and four stormwater permits on Cook Creek, a tributary to Calapooya Creek. Both Elk Creek and Yoncalla Creek have one each of wastewater and stormwater permits. Post Creek, a tributary to Elk Creek near Drain has two stormwater and one wastewater permits, while Fitch Creek has a single stormwater permit. There are no major discharge permits in either sub-basin.

The minor domestic sewage discharge permits include two on Calapooya Creek. The City of Oakland discharges at stream mile 13.9 just west of Oakland, and the City of Sutherlin discharges at stream mile 9.8 northeast of Highway 138. In the Elk Creek sub-basin, the City of Drain discharges into Elk Creek at stream mile 23.8 in Drain. Yoncalla Creek has three permits for discharge all within the first eight stream miles, including one held by the City of Yoncalla at stream mile 4.

Effluent discharges from eleven wastewater treatment plants throughout the Umpqua Basin will be required to meet temperature limits during the non-spawning season (typically summer months). These limits are established in the Umpqua Basin TMDL and are incorporated with permit renewals. Limits are based on streamflow, stream temperature, and amount of discharge. The intent is to maintain the cumulative temperature increase from point sources to less than 0.1°C during the non-spawning months to help meet the temperature standards on streams throughout the basin. Three of these facilities are within the Calapooya and Elk Creek sub-basins and are shown in Table 2.C-10 with their temperature limit.

Wastewater treatment plants	Stream	Effluent temperature limit
Oakland WWTP[1]	Calapooya Creek	32.0°C (89.6°F)
Sutherlin WWTP	Calapooya Creek	26.4°C (79.5°F)
Drain WWTP	Elk Creek	25.5°C (77.9°F)

[1] Discharge temperature limited to 32°C to prevent acute impairment or instantaneous lethality to salmonids.
Source: Umpqua Basin TMDL (ODEQ 2006).

Table 2.C-10: Temperature limits for effluent discharges from wastewater treatment plants in the sub-basins.

Surface Water – Lakes and Reservoirs

Quantity

The following discussion includes permitted ponds only. There are also other ponds in the sub-basin such as the Woolley pond in Yoncalla.

Ford's Pond located just west of Sutherlin within the Calapooya Creek sub-basin is privately owned by Lone Rock Timber Company. It has a surface area of 130 acres.

Whipple Reservoir located on Bear Creek, a tributary to Elk Creek, serves as the main public water supply for Drain. It has a storage capacity of 290 acre-feet that covers 20 acres at its normal pool. There is no recreational use. Hayhurst Road Reservoir is also used as a municipal water source for Drain. It holds 70 acre-feet and covers six acres at the surface. Its primary source is from Whipple Memorial Reservoir.

The Smith River Log Pond, located in the Elk Creek sub-basin, is a privately-owned 14 acre pond that stores 40 acre-feet. Once a log pond, it is now permitted for industrial use.

Weaver Reservoir is a privately-owned pond for irrigation that flows into Yoncalla Creek. It covers 13 acres and stores 75 acre-feet of water.

Quality

No information is available on Whipple Reservoir and there are no other public use lakes or ponds in the sub-basins.

Ground Water

Over 70 percent of all Oregon residents and 90 percent of all rural residents rely on ground water for drinking water (ODEQ 2003).[43] Industry and irrigation of agriculture and livestock are also dependent on ground water supplies. Base flow for most of the state's rivers, lakes, streams, and wetlands is from ground water sources. Cool groundwater inflow effectively cools streams during the summer months, often providing critical thermal refuge areas for sensitive freshwater species. The magnitude of this effect depends upon the ratio of the groundwater inflow to the amount of surface flow.

The dominant ground water use in Douglas County is domestic use. It serves as the primary drinking water source for rural residents. As surface water sources are used to capacity, residents are becoming more dependent on ground water resources. These demands are expected to increase as the population of the County increases especially in rural areas. In the Elk Creek / Calapooya Creek sub-basins, approximately 2,544 wells are identified as domestic use wells, while 6 are for community use, 6 for industry, 5 for irrigation, and 2 for livestock watering.

The following assessment of ground water conditions for the Elk Creek sub-basin is based on the USGS report "Availability and Quality of Ground Water in the Drain-Yoncalla Area, Douglas County, Oregon," (Robison et al. 1976). For the Calapooya sub-basin, ground water assessment information comes from the USGS report "Availability and Quality of Ground Water in the Sutherlin Area, Douglas County, Oregon" (Robison et al. 1975). In addition, assessments of ground water in both areas include evaluation of well data from the Oregon Water Resources Department.

Quantity

The majority of both sub-basins is underlain by formations composed of Tertiary marine sedimentary rocks of low permeability. In general, permeability may be sufficient to supply wells for domestic use, but are too low for irrigated agriculture, or large-scale industrial or municipal use.

Table 2.C-11 lists the number of wells by water yield in each sub-basin. The majority of the wells in the Elk Creek sub-basin yield 1 to 5 gpm or greater than 10 gpm. Most wells (94 percent) have at least 1 gpm indicating adequate ground water for domestic use in most of the sub-basin. The Calapooya Creek sub-basin is dominated by wells with yields from 1 to 5 gpm (46 percent) with a wide range of well yields on the remaining 54 percent of wells. Approximately 14 percent have less than 1 gpm and may be inadequate for domestic use without additional storage or water source.

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[43] Over 90 percent (2,459) of Oregon's public water supply systems get their water exclusively from ground water. Over 400,000 residents get their drinking water from individual home water supply wells.

Area	Depth range (feet)	Number of wells by water yield (gpm)			
		<1	1 to 5	> 5 to 10	>10
Elk Creek	24 to 700	56	307	175	382
Calapooya Creek	22 to 900	202	655	253	296
Source: Oregon Water Resources Department (well data from 1952 to 2007).					

Table 2.C-11: Number of wells by water yields (Elk Creek/Calapooya Creek sub-basins).

Table 2.C-12 shows a comparison of well data from before and after 1980. The percentage of well yields less than 1 gpm in both sub-basins has risen 12 to 17 percent since 1980, while the percentage in all other yield categories has decreased. In addition, both areas show substantial increases in the depth of drilling. This may indicate that while many wells still meet domestic needs, the ground water level may be dropping in these areas. Both areas show only a slightly smaller or equal percentage of new wells abandoned since 1980. This may indicate more acceptance of very low yield wells for domestic use.

Category	Elk Creek		Calapooya Creek	
	1955-1980	1981-2007	1952-1980	1981-2007
Total new wells	528	425	828	672
new wells abandoned	2 %	2 %	3 %	1 %
Yield (gpm)				
< 1	1 %	12 %	6 %	23 %
1 to 5	35 %	32 %	49 %	44 %
> 5 to 10	21 %	17 %	21 %	15 %
> 10	43 %	39 %	24 %	18 %
Depth drilled (feet)				
median depth	110	165	100	185
average depth	140	190	133	203
Source: Oregon Water Resources Department				

Table 2.C-12: Comparison of well data before and after 1980 for areas within the Elk Creek and Calapooya Creek sub-basins.

Quality

In the Elk Creek sub-basin samples from 39 wells were chemically analyzed for the USGS report cited above. In the Calapooya Creek sub-basin 31 wells were sampled. The number of samples that exceeded representative standards is listed in Table 2.C-13. It should be noted that the standards apply to public water supplies, and concentrations exceeding the standards may be acceptable to many users.

Constituent	Standard (mg/l)	Sub-basin	
		Elk Creek	Calapooya Creek
Wells sampled		39	31
Iron (Fe)	0.3	7	9
Manganese (Mn)	0.05	16	8
Sulfate (SO_4)	250	0	1
Chloride (Cl)	250	10	6
Fluoride (F)[1]	1.8 - 1.2	4	0
Boron (B)[2]	1	9	6
Arsenic (As)[3]	0.05	0	1
Nitrate + Nitrite expressed as N	10	0	
Nitrate + Nitrite expressed as Nitrate	44		0

[1] Fluoride standard of 1.8 mg/l used in Elk Creek and 1.2 mg/l used in Calapooya Creek. The current standard for fluoride is 2.0 mg/l for children under 9 years and 4 mg/l for all other individuals.
[2] There is currently no recommended standard for boron by the EPA or the State of Oregon. However the World Health Organization currently recommends an upper limit of 0.5 mg/l in drinking water.
[3] The current standard for arsenic is 0.01 mg/l.
Source: USGS WRIR 76-105 (Robison et al. 1976) and USGS WRIR 32-74 (Robison et al. 1974).

Table 2.C-13: Ground water quality (Elk Creek / Calapooya Creek sub-basins).

Of the constituents listed in Table 2.C-13, fluoride, arsenic, and nitrate are considered to have standards that when exceeded, are not suitable for human health. Fluoride is beneficial in moderate amounts because it retards dental decay, but in concentrations of more than several milligrams per liter can eventually cause darkening or mottling of children's teeth. In excess of 4 mg/l it may lead to bone disease including pain and tenderness of the bones. Arsenic, in concentrations greater than 0.01 mg/l is considered grounds for rejection of the water supply. Large amounts of nitrate can cause methemoglobinemia (blue baby effect) in infants. The remaining constituents when present above the recommended standards affect the aesthetic quality and public's acceptance of drinking water.

Mercury has been mined in the upper portions of both Elk Creek and Calapooya Creek sub-basins. Water was sampled from wells in the areas and mercury content was found to be less than the standard of 0.005 mg/l. However, the mercury standard has since been lowered to 0.002 mg/l, and it is unknown if the tested wells exceeded the new standard.

In May, 2007 the Oregon Public Health Division developed a Public Health Assessment for the Red Rock Road area near Sutherlin. Red Rock Road is a 17 mile road located 6 miles east of Sutherlin that was constructed with mine tailings contaminated with arsenic and mercury. The road borders Calapooya Creek on the east end and Sutherlin Creek on the west end. Although testing by a contractor in the area did not find evidence of arsenic leaching from the road into ground water, the assessment recommends that residents located along or near Red Rock Road or that live in this region of the Sutherlin Valley that rely on ground water wells for domestic water supplies, have their wells tested for arsenic.

The assessment summarizes extensive well testing in Douglas County from the 1970s that found 118 samples in the range of 0.01 to 0.04 mg/l and 16 samples over 0.05 mg/l. The 16 samples with the highest levels represent 7 wells, 6 of which are located in the area east of Sutherlin. At that time, the arsenic standard was 0.05 mg/l. In 2002, EPA adopted the current standard of 0.01 mg/l. It is possible that some residents in the Sutherlin Valley area of the Calapooya Creek sub-basin still consume drinking water from wells with arsenic concentrations above the current standard. The assessment found no indication that mercury was a problem.

Exceeding the standards for iron, manganese, sulfate, and chloride affect the aesthetic quality of water and may not meet public acceptance of the source for drinking; however exceedence of these parameters does not adversely affect human health. Excessive iron or manganese causes staining of plumbing fixtures and laundry and can give a peculiar taste to the water. Sulfate in excessive concentrations can have a laxative effect on people not accustomed to the water. Chloride in excess of about 500 mg/l may give a salty or mineral taste to the water. Neither the EPA nor ODEQ have a current standard set for boron. Although a boron concentration of 1 mg/l can be unsuitable for irrigating sensitive plants. The World Health Organization recommends an upper limit of 0.5 mg/l in drinking water.

According to the Oregon Department of Human Services, six wells used for public drinking water in the sub-basins showed elevated sodium levels ranging from 21.3 to 470 mg/l. There is no standard level for sodium although a recommended level for aesthetic quality has been set at 20 mg/l by EPA. Elevated sodium in drinking water does not pose a human health risk but can make the water unacceptable to many users.

Excessive hardness is undesirable but seldom is cause for rejection of a water supply. The USGS rating for hardness is shown in Table 2.C-14 along with the count of samples in each category.

Hardness range ($CaCo_3$ in mg/l)	Rating	Elk Creek	Calapooya Creek
0 to 60	soft	14	12
61 to 120	medium	11	8
121 to 180	hard	5	5
more than 180	very hard	8	6
Source: USGS WRIR 76-105 (Robison et al. 1976) and USGS WRIR 32-74 (Robison et al. 1974).			

Table 2.C-14: Ground water hardness (Elk Creek / Calapooya Creek sub-basins).

2.C.2. Water Use

The following material discusses current and future water use in this portion of Douglas County. Water use purposes considered include municipal, rural domestic, industrial, irrigation, aquatic life, recreation and hydroelectric power. Analysis and more detailed discussion of municipal, rural domestic and industrial water use are included in Appendix M. Irrigation water use is analyzed in Appendix I, and water use needs for Aquatic Life are discussed in Appendix F.

Current

For purposes of this report, the measure of current water use is derived from water use reports showing raw water diversion by each water district and by water rights information provided by the Oregon Water Resources Department. Some water use report information was also obtained from individual water service providers.

The priority date of a water right of record is the governing factor during times of water shortage. If priority dates are the same, then domestic use has preference over all other uses; agricultural purposes are next in line; and all other uses follow. For information on Oregon water law and the 1909 water code, refer to Water Use in Section 2.A.2.

Municipal

Appendix M contains the derivation of water needs for municipal water use in the sub-basins. The information on current municipal water use is summarized in this section for each of the water providers within the sub-basins.

<u>Elk Creek</u>

City of Drain
Average annual water use by the City of Drain for 2000 to 2006 was 99 million gallons per year. The current population served is 1,617 people and the average per capita use is 145 gallons per capita day. Peak use occurs in July averaging 261 gallons per capita day and requires a diversion of 226 gallons per minute.

Drain has two water rights for diversion of 898 gallons per minute each from unregulated flows in Bear Creek with priority dates of 1909 and 1912. Water rights appear adequate to meet current needs. However, flows on Bear Creek are often low and may not fulfill the entire water right. To offset this shortage, the City has a 1971 right for storage and use of up to 1,000 acre-feet in Bear Creek Reservoir (Whipple Memorial Reservoir) located on Bear Creek. This reserve may be used at a maximum rate of 2,244 gallons per minute and provides adequate water when Bear Creek flow is insufficient.

City of Yoncalla
The average annual diversion amount for the City of Yoncalla from 2000 to 2006 is 60.4 MGY. The City serves a current population of 1,311 people with an average daily per capita use of 135 gallons per capita day. The peak use occurs in August when per capita

average peaks at 242 gallons per capita day, substantially lower than the County average of 372 gallons per capita day. During that time, the City is required to divert an average of 182 gallons per minute to fulfill the water needs.

Yoncalla's water rights total 790 gallons per minute with priority dates of 1923 (673 gallons per minute), and 1940 (117 gallons per minute). The 1923 right is split evenly between Adams, Wilson, and North Fork Wilson creeks, while the 1940 right is exclusively from Adams Creek, a tributary to Elk Creek. The City’s primary use is from Wilson Creek. However, when Wilson Creek water is not sufficient to meet demand, the City pumps water from Adams Creek into a pipeline about 4 miles long that discharges into Yoncalla Reservoir near the southern City limits. The City holds a 1980 right to store and use up to 111.5 acre-feet of water from Adams Creek in Yoncalla Reservoir. Intermittent measurements of flow in Adams Creek, near the City's diversion, have shown values as low as 0.28 cubic feet per second (about 125 gallons per minute), and periods of no flow have been reported. Therefore Adams Creek is not a reliable supply of water for the City. However, the reservoir can be filled during high flows in Adams Creek to adequately meet current demand.

Calapooya Creek

City of Oakland

The City of Oakland water system serves an estimated 2006 population of 1,063 people. Total annual raw water use for 2000 to 2006 was 56.6 million gallons per year, for an average daily use of 179 gallons per capita day. On average, peak use occurs in July with a per capita rate of 321 gallons per capita day. The diversion required to meet the peak use in July is 158 gallons per minute. Water is diverted from Calapooya Creek under a 1909 right allowing a maximum of 898 gallons per minute, one of the most senior rights in the sub-basin. The rights are more than adequate to meet current needs.

City of Sutherlin

The City of Sutherlin currently provides water to 2,610 services for an estimated population of 6,421 people. Water use reports for the City of Sutherlin from 2000 to 2006 show an average raw water use of 542.6 million gallons per year. The City average per capita daily use from 2002 to 2006 was 251 gallons per capita day. Peak use occurs in July and August when per capita use elevated to an estimated 467 gallons per capita day requiring a diversion of 1,824 gallons per minute.

Sutherlin has surface water rights on Calapooya Creek, Cooper Creek, a tributary of Sutherlin Creek, and the North Umpqua River. The City also purchases 500 acre-feet from Cooper Creek Reservoir. The City's rights on Calapooya Creek total 1,796 gallons per minute, with priority dates of 1924 (337 gallons per minute), 1941 (1,010 gallons per minute) and 1979 (449 gallons per minute). The 1979 right is junior to 1974 minimum instream flows on the North Umpqua River and may at times be unreliable in the summer. The Cooper Creek right has a 1967 priority and amounts to 2,244 gallons per minute.

The City diverts water initially from Calapooya Creek. When the supply is exhausted, it diverts water from its Cooper Creek right and eventually from the purchased water in Cooper Creek Reservoir if necessary. The City also has a right to divert 1,346 gallons per minute from the North Umpqua River under a 1979 priority, but has not yet constructed facilities to do so. Existing water rights are adequate to meet current demand.

Rural Domestic

Sub-basin C has the highest proportion of residents not within a water service area with the exception of Camas Valley where no providers are available. Nearly 4,700 people (50 percent of the estimated population) are considered rural domestic users within the sub-basin. Only 10 percent of the rural domestic users obtain water via domestic surface water permits while 90 percent are dependent on wells and/or trucked in water.

Concentrations of rural residents occur surrounding each of the communities in the sub-basin. These concentrations extend for over a mile beyond the City limits in Drain, Yoncalla, Oakland, Elkton, and portions of Sutherlin. Many of these residents near City limits may eventually be included in the nearby water service areas, especially where growth in these areas is significant. Other concentrations occur east of Drain along Elk Creek; the Rice Hill and Rice Valley areas near I-5 south of Yoncalla; the Yellow Creek Mountain area located west of Rice Hill; Dodge Canyon along Highway 138; and the Cole Road development to the west. Heaven's Gate Ranch, Inc. has water rights of 200 acre-feet with a priority of 2003 for a housing development on Wheeler Canyon, a tributary to Cabin Creek.

Industrial

There are currently 2,148 gallons per minute in existing industrial water rights within the sub-basins, mostly for log pond maintenance from Elk Creek and Yoncalla Creek, and for gravel manufacturing from Calapooya Creek. Water rights are listed in Table 2.C-15. Some commercial and light industrial businesses within City limits are provided water by City water services.

Elk and Yoncalla creeks have minimum instream flow rights with a priority date of 1974. Elk Creek also has additional instream rights from 1991. All but 6 gallons per minute of the industrial rights in the Elk Creek sub-basin predate the 1974 instream rights. Industrial rights on Johnson Creek and the unnamed tributary to Fitch Creek are from 1981 and 1978 respectively, and thus predate the 1991 instream rights.

In addition to the instream rights with priority dates of 1974 and 1991, Calapooya Creek also has minimum instream requirements with a priority date of 1958. All 899 gallons per minute of industrial rights on Calapooya Creek are junior to the 1958 instream rights but are senior to 1974 instream requirements.

Stream source	Water rights (gpm)	Permit type
Elk Creek & unnamed tributary	682	manufacturing, mill / log pond maintenance
Yoncalla Creek	422	manufacturing, log pond maintenance
Pass Creek & unnamed tributary	139	manufacturing, mill / log pond maintenance, fire suppression
Johnson Creek	4	workshop and honey house
Unnamed tributary to Fitch Creek	2	Truck shop
sub-total Elk Creek sub-basin	**1,249**	
Calapooya Creek	898	Gravel plant manufacturing
A spring tributary to Cabin Creek	1	commercial, wine-making
sub-total Calapooya Creek sub-basin	**899**	
Total	**2,148**	

Table 2.C-15: Industrial water rights held in the Calapooya Creek and Elk Creek sub-basins (gpm = gallons per minute).

Irrigation

In the Elk Creek sub-basin just over 1,840 acres are irrigated under water rights of record. About 1,770 acres are irrigated with rights senior to the first established minimum flows in 1974.

Just over 2,450 acres are irrigated in the Calapooya Creek sub-basin. Of these, almost 1,460 are irrigated under rights predating the 1958 minimum flow rights. Table 2.C-16 summarizes the acres in each area with current irrigation water rights by priority date. Complete information is included in Appendix I.

Table 2.C-17 shows the maximum allowable diversions in acre-feet for each area within the sub-basins and the distribution of the diversions by month. The distribution is based on crop distribution in Douglas County and expected water needs for each crop throughout the year. Annual diversions are conservatively calculated at 2.5 acre-feet per acre per season, the maximum allowed under Oregon water law. Appendix I contains data on water requirements for irrigated crops, and calculations for the monthly diversion distribution.

Reach	Existing irrigated acres by priority date				
	Pre 1958[1]	1958-74	1974-91	1991-2007	Total
Elk Creek					
Upper Elk Creek	469	246	45	0	760
Lower Elk Creek	690	371	26	0	1,087
Total Elk Creek	1,159	617	71	0	1,847
Calapooya Creek					
Above Oakland	626	253	80	0	959
Oakland to Hwy 138	249	355	95	0	699
Hwy 138 to mouth	582	110	107	0	799
Total Calapooya Cr	1,457	718	282	0	2,457

[1] The first established minimum flows on Elk Creek are from 1974.
Source: Oregon Department of Water Resources, 2007 – see Appendix I

Table 2.C-16: Acres with existing irrigation water rights by priority date (Elk Creek / Calapooya Creek sub-basins).

Month	Percent	Elk Creek		Calapooya Creek		
		upper Elk Creek	lower Elk Creek	above Oakland	Oakland to Hwy 138	Hwy 138 to mouth
Existing acres		*760*	*1,087*	*959*	*699*	*799*
Mar	0.5	9	14	12	9	10
Apr	4.4	84	120	106	77	88
May	11.4	217	310	273	199	228
Jun	18.6	353	505	446	325	372
Jul	28.5	542	774	683	498	569
Aug	22.9	435	622	549	400	457
Sep	12.6	239	342	302	220	252
Oct	1.1	21	30	26	19	22
Total	100.0	1,900	2,717	2,397	1,747	1,998

Source: See Appendix I for calculations.

Table 2.C-17: Monthly irrigation water requirements in acre-feet for each area (Elk Creek / Calapooya Creek sub-basins).

Aquatic Life

Instream Flow

Water use by aquatic life is expressed by State of Oregon minimum flows. Minimum flows vary through the year to meet the needs of aquatic life. Minimum flows at selected locations within the Elk Creek and Calapooya Creek sub-basins are listed in Table 2.C-18 with their priority dates of right.

The Instream Water Rights Act was passed in 1987, allowing agencies to apply for instream water rights to protect recreation, water quality, and fish and wildlife habitat.

Prior to establishment of this act, the Oregon Water Resources Department established minimum flows through the administrative rule making process. Minimum flow values specified in a rule, or “basin program,” were not water rights but were administered as such by the Department. These established flows became instream water rights subsequent to passage of the 1987 Act. Thus water rights allowing direct diversion that have been obtained after the date of establishment of a minimum flow are subject to curtailment as stream flow amounts decrease below that specified minimum flow rate. However, when the junior right includes a "household use" component as with domestic or municipal rights, that amount of use has preference over the minimum flows.

In the case of a reservoir constructed after establishment of a minimum flow, the minimum flow must be released at all times, unless inflow to the reservoir is less than the specified minimum, in which case the amount of inflow must be released. Either type of water right senior to the date of establishment of a minimum flow is not subject to curtailment to meet minimum flows.

Time of year	Elk Creek from Brush Creek to the Umpqua River (cfs)		Yoncalla Creek near Elk Creek (cfs)	Calapooya Creek from Williams Creek to the Umpqua River[1] (cfs)		
	3/26/74	1/10/91	3/26/74	10/24/58	3/26/74	1/10/91
October						
1 to 15	10	23.5	2	12	20	29
16 to 31	50	23.5	10	12	50	29
November	110	0.0	15	12	100	70
December	110	0.0	15	12	100	70
January	110	0.0	15	12	100	70
February	110	0.0	15	12	100	70
March	110	0.0	15	12	100	70
April	110	0.0	15	12	100	70
May	80	0.0	10	12	70	50
June	50	0.0	4	12	40	30
July	15	22.5	2	12	12	20
August	10	10.8	1	12	12	18.6
September	10	13.6	1	12	12	17.5

[1] 1991 rights are for Coon Creek to Oldham Creek, which includes the section from Williams Creek to Coon Creek but does not extend all the way to the mouth.
Source: State of Oregon Water Resources Department database located at http://apps.wrd.state.or.us.

Table 2.C-18: Minimum instream flows to support aquatic life by priority dates of right in selected areas of the Elk Creek and Calapooya Creek sub-basins.

<u>Fish Abundance and Distribution</u>

The Elk Creek and Calapooya Creek sub-basins are primarily spawning habitat for coho and winter steelhead. In the Elk Creek sub-basin, they are found primarily in tributaries and in the upper reaches of Elk Creek. ODFW estimated abundance in 1976 was reported at about 964 for coho and 1,243 for steelhead in the Elk Creek sub-basin. Only 5 percent were found in the mainstem Elk Creek. Big Tom Folley Creek, Brush Creek, Billy Creek, and Yoncalla Creek appeared to have the largest spawning numbers compared to other tributaries. See Appendix F for complete distribution estimates.

Estimates in the Calapooya Creek sub-basin were about 499 coho and 862 winter steelhead according to the 1976 ODFW survey. About 85 percent of the coho and 65 percent of the steelhead were found in the tributaries. Other resident species such as cutthroat and rainbow are found throughout the sub-basin. In addition to the large numbers of spawning steelhead using mainstem Calapooya Creek, significant numbers were also found in Hinkle Creek, Coon Creek, and South Fork Calapooya Creek (see Appendix F).

Wild coho abundance in the sub-basins has fluctuated greatly over time. Changes in ocean conditions can play a significant role in these fluctuations but freshwater habitat survival rates are also significant factors in adult returns. Annual estimates of wild coho spawner abundance in the Elk Creek and Calapooya Creek sub-basins combined for the 1994 through 2004 spawning seasons are listed in Table 2.C-19. Numbers of wild returns have generally been higher in the sub-basins since 2000, with a peak return year occurring in 2003.

Season	Total	Season	Total
1994	708	2000	1,864
1995	2,315	2001	2,581
1996	1,709	2002	1,731
1997	196	2003	4,450
1998	379	2004	2,602
1999	434		
Source: ODFW data from the Corvallis Fish Research Lab.			

Table 2.C-19: Wild coho spawner estimates in the Elk Creek and Calapooya Creek sub-basins combined.

ODFW began operations of a temporary fish trap in 2002 at Nonpareil Dam on Calapooya Creek. The fish trap is being run as part of the Umpqua Coho Pedigree Study scheduled to run through 2012.[44] Coho and partial steelhead returns have been counted each year and are listed in Table 2.C-20. Since steelhead are not the focus of the study, the trap has been operated for counting steelhead only when ODFW has available staff; thus the steelhead counts are not complete.

[44] The program was previously known as the Conservation Habitat Improvement Program (CHIP).

Year	Coho	Steelhead[1]
2003	587	641
2004	1,311	266
2005	1,686	239
2006	1,560	406

Source: ODFW Umpqua Coho Pedigree Study data.
[1] Steelhead counts are not complete. The trap is staffed only when personnel are available during the steelhead runs since the focus of the study is coho.

Table 2.C-20: Coho and steelhead counts from Nonpareil Dam on Calapooya Creek.

In addition to coho and winter steelhead, ODFW also reported the mainstem Elk Creek supported 50 spawning fall chinook in the 1976 surveys. This relatively small number of fall chinook use the lower 10 miles of the mainstem Elk Creek. Most migration and spawning occur from the mouth to about 2 miles upstream of Big Tom Folley Creek.

Abundance estimates for fall chinook are not currently being conducted. Unfed fry releases during the mid-1990s in Calapooya Creek did not return as adults in significant favorable numbers. In 2000 ODFW began releasing pre-smolts as a recovery program for fall chinook. In 2003, 272,000 pre-smolts were released. The program is still in operation and is now an augmentation program for anglers on the mainstem Umpqua River. Spawning ground surveys in Calapooya Creek have ranged from a low of 1 fish per mile to a high of 13 fish per mile from 2004 to 2006.

Anadromous and resident fish species use the streams in these sub-basins throughout the year. Given adequate flow conditions in either Elk or Calapooya Creek, coho migrate to their spawning areas beginning in September and spawn from late November through late January. Winter steelhead begin their upstream migration in October and spawn from late January through May. Downstream movement of steelhead is in progress in June and July. Resident trout are present throughout the year. Thus, it is important for water quality conditions to remain within limits tolerable to anadromous and resident species during the entire year.

<u>Fishery Concerns</u>
In both Elk and Calapooya creeks, primary factors that effect anadromous fish are low flows and high water temperatures during summer and early fall months. These conditions effect migration as well as juvenile survival. Although Calapooya Creek has better substrate (gravel) and pools than Elk Creek, both streams lack sufficient pool areas, which adversely effects survival of fry and juveniles.

The Coho Viability Assessment Final Report (Nicholas et al. 2005) identified the primary and secondary life cycle bottlenecks to coho populations in the Middle Umpqua population area, which includes the Elk Creek and Calapooya Creek sub-basins. These bottlenecks are listed in Table 2.C-21. The Middle Umpqua population area includes the Umpqua River and tributaries from Elkton to the confluence with the North Umpqua and South Umpqua rivers.

Population area	Primary bottleneck	Secondary bottleneck
Middle Umpqua	water quantity	stream complexity and water quality
Source: Coho Assessment Part 1:Synthesis (Nicholas et al 2005)		

Table 2.C-21: Primary and secondary life cycle bottlenecks for the Middle Umpqua coho population area.

Water quantity is the primary bottleneck identified in the Middle Umpqua population area. Many tributary streams experience very low flows in the hot summer months when precipitation and runoff is low and water user demand is high. This can contribute to higher water temperatures and loss of instream habitat.[45]

Loss of stream complexity creates a shortage of winter habitat that results in the loss of juvenile fish, especially during peak storm flows. Only 7 percent of the 523 miles available to juvenile coho in the area is considered high quality winter habitat (ODFW 2005).

Loss of riparian areas on smaller tributary streams influences both water quality and instream habitat. Decreased shade cover may result in increased stream temperatures on small streams. Removal of large trees in these areas results in fewer sources for stream input now and into the future. These large wood pieces are vital for creating instream habitat on small and medium sized tributaries. According to the BLM Elk Creek/Umpqua River Watershed Analysis, many of the existing riparian areas on Elk Creek tributaries are less than 80 years old and are not stocked with very large key pieces necessary for stream complexity. This results in a lack of current and future large wood pieces to contribute to stream complexity. Loss of riparian areas in the Calapooya Creek sub-basin is also identified as a limiting factor in the Umpqua Basin Action Plan (see Appendix F).

Although difficult to measure, sediment was also recognized as a potential issue in several Elk Creek sub-watersheds including Upper Elk Creek, Lower Pass Creek, and Upper Pass Creek and is a suspected limiting factor in the Calapooya Creek sub-basin.

Known and suspected limiting factors affecting fish and water quality have been identified in the Umpqua Basin Action Plan (Barnes & Associates 2007) for the Calapooya Creek sub-basin.[46] Specific sites and actions to address these concerns have also been identified in the plan. In addition to those already discussed here, the plan identified fish passage as a known limiting factor and water quality including pH, dissolved oxygen, bacteria, and toxics. See Appendix F.

There are no natural fish passage barriers in either Elk or Calapooya creeks. However, stream connectivity is a significant limiting factor in the sub-basins. Obstructions to fish

[45] In some cases water temperature can decrease as surface flows diminish and the proportion of groundwater inflow increases. These residual pools can become very critical aquatic habitat.
[46] Elk Creek is not covered by the Umpqua Basin Action Plan.

passage limit use of additional suitable habitat in many locations within the sub-basins. See Appendix F for locations of all fish passage barriers identified in the Calapooya Creek sub-basin. The Elk Creek sub-basin has not been surveyed for barriers to date.

Enhancement Opportunities

Numerous enhancement projects have occurred in the sub-basins primarily on tributary streams. The work has been directed at increasing rearing and spawning areas for coho and steelhead, riparian habitat protection and enhancement, and providing improved fish passage.

Douglas County has typically worked through the Salmon Habitat Improvement Program in conjunction with ODFW fish biologists to accomplish enhancement work. Several opportunities may exist for the County to improve fish habitat in these sub-basins. These potential sites are discussed below. However, site reviews should be done to verify potential improvements that may be made.

Bachelor Creek

A significant potion of Bachelor Creek runs through Mildred Kanipe County Park. The stream supports both coho and winter steelhead spawning and rearing habitat. The Douglas Soil and Water Conservation District has been coordinating a multi-year restoration effort at the park that has included riparian restoration work, bridge and culvert replacements and instream revetments to trap sediment and debris, and understory burning to improve oak woodland habitat. In addition, the project has involved numerous schools for educational purposes. Douglas County has been a significant contributor to this effort by providing a grant through the Salmon Habitat Improvement Program (SHIP), as well as providing equipment use when necessary. Work is still being done and more opportunities are available for additional enhancement work.

Elk Creek

Douglas County owns over 8 acres of land along Elk Creek downstream of Drain near Hardscrabble Creek. This area should be evaluated for possible riparian improvement and side channel work. In the upper portion of Elk Creek, the County has purchased land in preparation for the Milltown Hill Reservoir project that includes a large stretch of Elk Creek. However, the future of the Milltown Hill project is currently uncertain. There are potential areas for habitat improvement on these lands, although the County may want to postpone investment of resources in this area until a final decision is made on the future of the Milltown Hill impoundment project. Both of these areas of Elk Creek currently support coho and winter steelhead spawning and rearing habitat that may benefit from enhancement projects.

Pass Creek

Pass Creek Park is a 23 acre county park located on Pass Creek near Bear Creek. There may be opportunity for instream and riparian enhancement work on Pass Creek which supports both coho and winter steelhead spawning and rearing habitat.

Fish Passage Barriers
UBFAT has completed inventories of stream crossings in the Calapooya Creek sub-basin. Crossings were given a score on the severity of the fish passage barrier based on many characteristics including the species and ages of fish blocked, timing of barrier (all year or seasonally), and amount and quality of habitat upstream that is no longer accessible, with higher scores representing more severe barriers. The highest possible score is 105. The highest score to date in the Umpqua Basin is 95.

County-maintained culverts in the sub-basin with a score of 60 or more are listed in Table 2.C-22 with a description of the structure and the score it received. Contact the Douglas Soil and Water Conservation District for current detailed survey and location information on fish passage barriers.

ID number	Location	Sub-watershed (6th field)	Score	Barrier type	Structure type
30206021	Cole Road, Coon Creek	Lower Calapooya Creek	72.5	all juvenile and adult species	CMP, 55 ft long by 10 ft wide
30203004	Keybird Lane 314, Foster Creek	Middle Calapooya Creek	70.6	all juveniles, adult cutthroat, coho	CMP, 72 ft long by 6 ft wide
30204013	Hogan Road, Bachelor Creek	Oldham Creek	81.0	all juvenile and adult species	CMP, 50 ft long by 12.5 ft wide
Source: UBFAT database as of Oct 2007, Douglas Soil and Water Conservation District.					

Table 2.C-22: Fish passage barriers maintained by Douglas County with a minimum score of 60 in the UBFAT surveys (Calapooya Creek sub-basin).

Recreation

There are no recreational sites with boat launching facilities in the Elk Creek or the Calapooya Creek sub-basins. Water-based recreation is limited to trout fishing, rafting and swimming.

Estimated harvest and recreation days spent in the Elk Creek and Calapooya Creek sub-basins for rainbow trout from 1976 are shown in Table 2.C-23. The surveys in the Elk Creek sub-basin showed 74 percent of the harvest and 78 percent of the recreation days occurred in the mainstem of Elk Creek. This is similar to the Calapooya Creek sub-basin where 92 percent of the harvest and 94 percent of the recreation days occurred on mainstem Calapooya Creek.

Location	Harvested	Days spent
Elk Creek	1,000	1,500
Big Tom Folley Creek	20	15
Brush Creek	50	50
Hardscrabble Creek	10	20
Billy Creek	30	20
Bear Creek	10	5
Pass Creek	100	200
Rock Creek	25	25
Yoncalla Creek	100	100
Total Elk Creek sub-basin	**1,345**	**1,935**
Calapooya Creek	3,000	4,000
Hinkle Creek	20	20
Coon Creek	25	50
North Fork Calapooya Creek	100	100
South Fork Calapooya Creek	100	100
Total Calapooya Creek sub-basin	**3,245**	**4,270**
Source: ODFW 1976 unpublished data; 1989 Douglas County Water Resources Management Plan.		

Table 2.C-23: Number of rainbow trout harvested and days spent in 1976 (Elk Creek and Calapooya Creek sub-basins).

Hydroelectric Power

There is no significant hydroelectric development on either Elk Creek or Calapooya Creek. There is a water right for power development on Jimmy Creek, tributary to Elk Creek for operation of a hydraulic ram. The maximum allowable diversion is 0.0023 cfs including use for domestic purposes and lawn irrigation.

Summary of Current Surface Water Use

The State determines if new water rights are available by comparing the total of existing consumptive and storage rights, and instream requirements to the 80 percent exceedence flow (or the streamflow that occurs 80 percent of the time) for each month. Where the streamflow is less than the sum of the current rights, no new water rights are available. The amount of water needed for consumptive use rights in this calculation is an estimate of actual use. Coefficients have been developed for the different types of water rights to estimate actual use. The total allowable right on record would be more than the actual consumptive use estimate used in this calculation.

Figure 2.C.4 and Figure 2.C.5 summarize current water use and availability at the mouths of Elk Creek and Calapooya Creek. Figure 2.C.4 shows that flows exceed current requirements by a substantial margin from December through May at the mouth of Elk Creek, but fall short of needs for half of the year from June through November. The deficit, shown in red on the graph, is highest in November where an additional 62 cfs are needed to meet current demands.

In Calapooya Creek near the mouth (Figure 2.C.5), unregulated flow in October and November is insufficient to meet the existing water needs. August and September flows are about equal to current demand. The largest deficit occurs in October when an additional 24 cfs is needed to meet current demand.

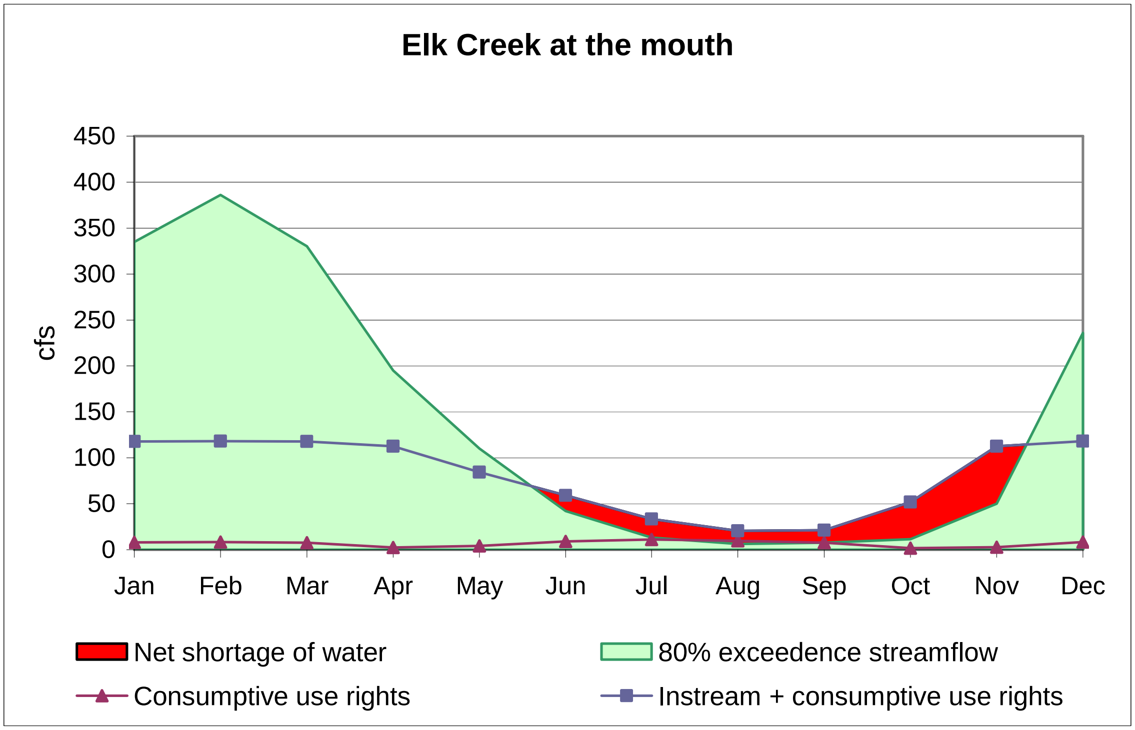

Figure 2.C.4: Water availability in Elk Creek at the mouth.

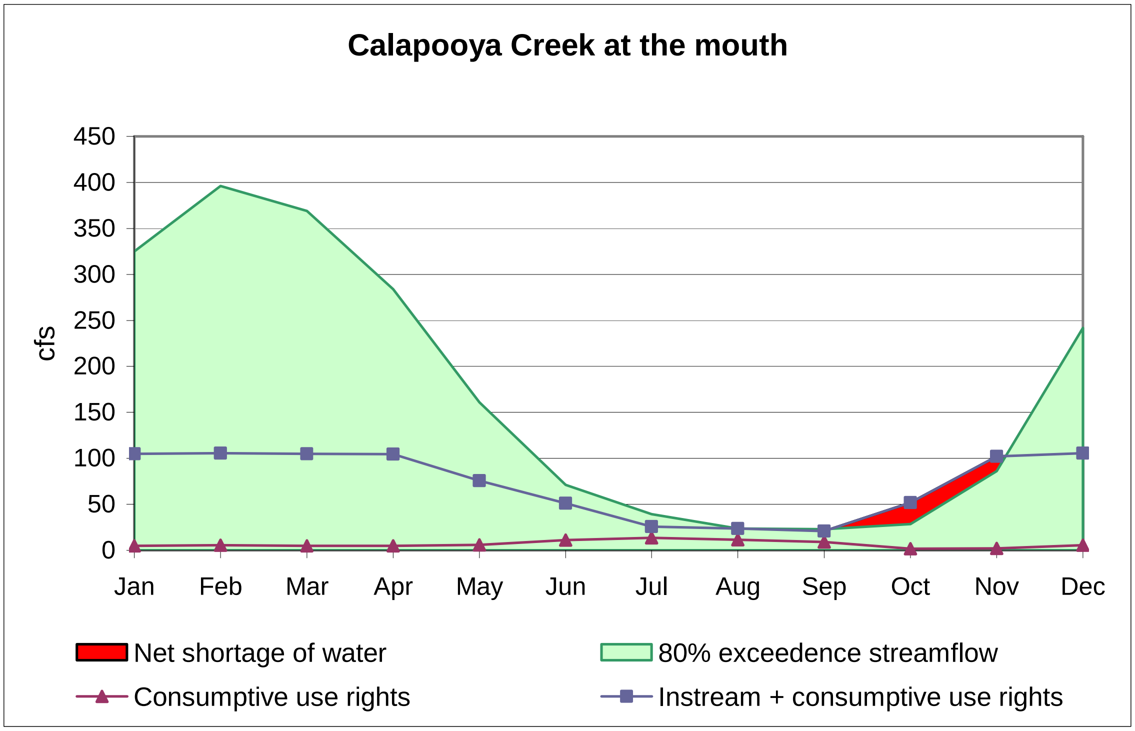

Figure 2.C.5: Water availability in Calapooya Creek at the mouth.

Streams in Oregon are administered under the prior rights doctrine, which boils down to "first in time, first in right". As streamflows decrease to amounts less than necessary to meet all water rights and minimum flows, the District 15 Watermaster administers the stream. In the case of irrigation rights, diversions under the most recent water rights are stopped. In the case of municipal rights, diversions are reduced to equal the "human consumption", or domestic component of the right. Domestic rights, which include irrigation of gardens of 1/2 acre or less, would be allowed to continue diversion. Diversions for stock water also would be allowed to continue.

Minimum flows have been established by the State of Oregon, Water Resources Department in 1974 and 1991 on both Elk Creek and Calapooya Creek for aquatic life needs. Calapooya Creek also has a minimum flow right from 1958. These minimum flows are instream water rights administered with their appropriate priority date. Other instream requirements may occur for such uses as scenic byways or pollution abatement that would be included in the determination of new water rights.

Future

Municipal

Future municipal use is based on information from the Douglas County Comprehensive Plan Population Assessment (Douglas County 2004), U.S. Census data, and reported water use by each of the water providers in the sub-basins. The data include the current populations receiving water service and projections of the future populations in 2050. The projections to 2050 reflect the long-term financial conditions normally encountered with large-scale water resource developments.

Appendix M contains the derivation of water needs for future municipal water use. This information is summarized below for each of the water providers within the sub-basins.

<u>Elk Creek</u>

City of Drain
As discussed under current water use, the City of Drain has an adequate supply to meet its current needs. The projected population in 2050 for the water service area is 2,328 people. Based on a peak per capita rate of 290 gallons per capita day, the estimated peak diversion rate in July will be 469 gallons per minute. Although the amount is within the City's water rights (1,796 gallons per minute), it is doubtful that water flow from Bear Creek will be adequate to meet projected needs. However, the City also holds a permit to store up to 1,000 acre-feet of water in Bear Creek Reservoir, and to divert the stored water at a rate to 2,244 gallons per minute. This stored water should allow the City to meet future demand.

City of Yoncalla
The City of Yoncalla water district population will increase from the current 1,311 people to 2,753 in 2050. At a peak per capita need of 290 gallons per capita day, the future peak diversion rate required is 554 gallons per minute during August, and the total annual demand is 554 acre-feet.

Wilson Creek is a small tributary to Yoncalla Creek which is not always reliable. When water is not available from either Wilson or North Fork Wilson creeks in July through September, the City will have a projected deficit of 64 acre-feet of water. The 111.5 acre-foot storage in Yoncalla Reservoir is adequate to meet that shortfall. However, during very dry years when Adams Creek is also insufficient, the City has no reliable source of water during those months with the exception of the Yoncalla Reservoir. The total deficit would be 203 acre-feet. After use of the City storage from the reservoir, the City would still have a total net deficit of 91 acre-feet. In some exceptionally dry years, it is possible that Wilson Creek may also be unreliable in June and October. This would add 55 and 66 acre-feet respectively to the deficit for a total need of 212 acre-feet.

<u>Calapooya Creek</u>

City of Oakland
The City of Oakland is expected to provide water for 1,530 people in the year 2050. The peak demand is projected at 341 gallons per minute in July, well within the 898 gallons per minute authorized for diversion under current water rights. Since the rights are some of the most senior in the basin (1909), the supply from Calapooya Creek is considered reliable, and will suffice for meeting the City's long-term needs.

City of Sutherlin
The City of Sutherlin is expected to serve an estimated population of 14,048 people in the year 2050. Peak diversion requirements are calculated at 4,415 gallons per minute in July. Excluding the amount the City could divert from the North Umpqua (1,347 gallons per minute), the City's future need is estimated to amount to an additional annual total of 215 acre-feet, over and above current supplies from Calapooya Creek, Cooper Creek and Cooper Creek Reservoir.

Planning by the City and the Umpqua Basin Water Association (UBWA) is currently underway to have the UBWA divert the 1,347 gallons per minute from the North Umpqua water right at their point of diversion on the North Umpqua and pipe it to Sutherlin. Development of this water right should provide adequate water for the City through the year 2050. Although the North Umpqua water right is junior to 1974 instream minimum flows, it is senior to the higher 1991 instream flow requirement. Depending on other more senior rights on the North Umpqua River, Sutherlin will likely have enough water to meet its future peak demand. In addition, peak demand calculated for Sutherlin is much higher per capita (453 gallons per capita day) than the County average of 372 gallons per capita day. It is likely that a more efficient system or higher cost of water may reduce the peak per capita use rate allowing more buffer to meet peak future demand.

Estimated future municipal water needs, existing water rights, and portions that are senior to minimum flows for the Elk Creek and Calapooya Creek sub-basins are listed in Table 2.C-24. The communities in these sub-basins have senior water rights to all minimum flows with the exception of the yet undeveloped rights held by Sutherlin on Cooper Creek and the undeveloped North Umpqua River right. However, several streams have low flows in the summer that do not always fully meet the municipal water rights. In addition, Sutherlin will need to divert the North Umpqua River right to meet peak demand in 2050. In addition, this North Umpqua River right is junior to the 1974 instream flow rights and may not be reliable in August and September, causing a deficit of 103 acre-feet per year.

Community served by right(s)	Water source	Demand during peak month in 2050 (gpm)	Total water rights (gpm)	Rights senior to minimum instream flows (gpm)	
				1958	1974
Drain	Bear Creek[1]	469	1,796	1,796	1,796
Yoncalla	Adams Creek	554	341	341	341
	Wilson Cr, N Fork Wilson Cr		449	449	449
Oakland	Calapooya Creek	341	898	898	898
Sutherlin	Calapooya Creek[2]	4,415	1,347	1,347	1,347
	Cooper Creek		2,244	0	2,244
	North Umpqua River		1,347	0	0

[1] Drain also has a permit to store and use 1,000 AFT in Bear Creek Reservoir.
[2] Sutherlin also has a 1979 right for 449 gpm on Calapooya Creek for winter use only. The City purchases 500 acre-feet from Cooper Creek Reservoir.

Table 2.C-24: Existing water rights relative to future peak need and minimum instream rights (gpm = gallons per minute).

Rural Domestic

The allocated rural population of these sub-basins is expected to increase from 4,689 to 8,206 people. Using a peak per capita need of 290 gallons per capita day, the future rural domestic need is estimated to be 1,885 acre-feet per year. The highest use is projected in July and August when needs are expected at 435 acre-feet for the two months.

Only an estimated 10 percent (487 people) of the current rural domestic population has domestic surface water rights. New surface water rights may occur to fulfill needs during the wet season but are unlikely to be reliable during the summer months due to low flows and minimum instream rights in Calapooya and Elk creeks. More pressure is expected on ground water supplies and individuals will likely develop more personal storage tanks for use during the summer months. Conditions should be monitored as growth occurs, and development of safe and sanitary communal water systems should be encouraged as population densities increase. See Appendix M for further details.

Industrial

Review of the 1989 Water Management Program report indicates that future industrial needs in the sub-basin should recognize the needs of expanded sand and gravel industry. These needs were estimated to be 150 acre-feet per year from each of Calapooya Creek and Elk Creek (see Appendix M). The material is still necessary as the County continues to grow, therefore it is reasonable to continue to expect water need for sand and gravel development.

A pellet mill is being considered for establishment in Oakland. Water needs for pellet production are expected to be minimal. Water use will likely come from existing water rights or ground water development to meet the needs for this industry.

Irrigation

Douglas County and the US Bureau of Reclamation have been formulating a multipurpose water project in the upper Elk Creek sub-basin (Milltown Hill). As part of project formulation, prior land classification studies were confirmed and are used as the measure of irrigation potential in the sub-basin. The potential includes lands in Yoncalla Valley and Scotts Valley.

The data describing potential irrigation lands in the Calapooya Creek sub-basin are not as complete as in other sub-basins in the County. In 1971, USBR prepared irrigation land classification studies for use in Days Creek Project formulation studies. That work covered lower portions of the Calapooya Creek sub-basin. Although the Calapooya Creek sub-basin was not covered completely, these data are preferred when available as USBR is the lead Federal agency with regard to irrigation project formulation. Determinations for the potential irrigation land available in each sub-basin are described in Appendix I and summarized in Table 2.C-25. Based on the mapping, there is no future potential irrigation land in the middle Calapooya Creek area that extends from Oakland to Highway 138.

Reach	USBR	Aerial photo	Selected	Existing rights	Future potential
Elk Creek sub-basin					
Upper Elk Creek	5,646	5,700	5,646	760	4,886
Lower Elk Creek	1,731	1,280	1,731	1,087	644
Total Elk Creek	7,377	6,980	7,377	1,847	5,530
Calapooya Creek sub-basin					
Upper Calapooya	---	1,060	1,060	959	101
Middle Calapooya	627	300	627	699	0
Lower Calapooya	2,792	2,100	2,792	799	1,993
Total Calapooya Creek	3,419	3,460	4,479	2,457	2,094
Source: See Appendix I.					

Table 2.C-25: Existing and future potential irrigation land (Elk Creek/Calapooya Creek sub-basins).

Water requirements for the future potential irrigated land are based on an average projected need of 2.44 acre-feet per acre per year. Monthly projections for the future needs are shown in Table 2.C-26. Appendix I contains data on present and potential future irrigation lands, and calculations for future water demands. Potential demand is highest in the upper Elk Creek (above Drain) and the lower Calapooya Creek areas (below Highway 138). However, it should be noted that more specific land class data would be required for detailed formulation of a water storage project.

Month	Percent	Elk Creek		Calapooya Creek	
		upper	lower	upper	lower
existing acres		*4,886*	*644*	*101*	*1,993*
Mar	0.5	60	8	1	24
Apr	4.4	525	69	11	214
May	11.4	1,359	179	28	554
Jun	18.6	2,217	292	46	905
Jul	28.5	3,398	448	70	1,386
Aug	22.9	2,730	360	56	1,114
Sep	12.6	1,502	198	31	613
Oct	1.1	131	17	3	53
Total	100.0	11,922	1,571	246	4,863

Acre-feet projections are based on a future average need of 2.44 acre-feet per acre per year.
Monthly distributions are calculated based on projected crops and their water needs.
Source: See Appendix I for calculations.

Table 2.C-26: Future irrigation water demands in acre-feet (Elk Creek/Calapooya Creek sub-basins).

Summary of Future Water Use

Table 2.C-27 is a summary of the projected future water needs in acre-feet per year for the sub-basins. The municipal needs in Elk Creek are for the City of Yoncalla. The 212 acre-feet would be the deficit in the driest of years when Wilson, North Fork Wilson, and Adams creeks are unreliable from June through October. It may be more typical that the unreliable period would occur from July through September which would reduce the total municipal need to 91 acre-feet.

Industrial future water needs are highly variable as the industry diversifies in the County. Water needs for different types of manufacturing are extremely variable. Areas with available industrial water rights are more likely to attract a variety of industry as water becomes scarce in many other areas.

Rural domestic needs are likely to increase as well. However, the majority of rural domestic users are on ground water and future ground water supply estimates are not available. Rural domestic growth will increase the pressure on ground water supplies and shortages may occur in specific areas.

Sub-basin	Municipal	Industrial	Irrigation	Total
Elk Creek	212	150	13,493	13,855
Calapooya Creek	0	150	5,109	5,259

Table 2.C-27: Future water needs summary in acre-feet per year for the Elk Creek and Calapooya Creek sub-basins.

2.C.3. Sub-basin Concerns

Quantity

Elk Creek

Unregulated flows in Elk Creek and tributary streams frequently reach zero in the low-flow season. Mean flows in July and August on Elk Creek near Elkhead are less than 2 cfs. Conversely rainy season flooding frequently recurs in portions of the City of Drain and on agricultural lands along Yoncalla Creek.

During the low flow period water quality conditions are adverse to aquatic life, recreational use, and are aesthetically not pleasing.

Adams Creek is not a reliable direct supply of water for the City of Yoncalla during the summer months. The existing reliable water supply from Adams, Wilson, and North Fork Wilson creeks, combined with the current storage in Yoncalla Reservoir is not adequate to meet future anticipated water demands by the City of Yoncalla. However, these sources would be adequate to meet the growth needs of Yoncalla if additional storage capacity is created to store water produced during the winter months from Adams Creek.

Development in the areas outside of the City of Yoncalla, the Rice Hill area in particular, would benefit from a better water supply. Further study is needed to identify appropriate sources.

There is no opportunity for expanded irrigation development in the sub-basin without storage.

Without augmentation from stored water and instream or riparian enhancement, aquatic habitat will not support additional anadromous fish populations, nor will instream recreational opportunities be increased.

Calapooya Creek

During the low flow season, water quality conditions in Calapooya Creek are adverse to aquatic life, instream recreation, and are aesthetically not pleasing.

The expected increase in population at Sutherlin will require additional water supplies be made available to provide a reliable water supply. Alternatives include:

1. Storage sites in the Calapooya Creek sub-basin, or

2. Development of a diversion from the North Umpqua River. This alternative is currently being explored by the City of Sutherlin and the Umpqua Basin Water Association.

There is no opportunity for expanded irrigation development in the sub-basin, without storage.

Without augmentation from stored water and instream or riparian enhancement, aquatic habitat will not support additional anadromous fish populations, nor will opportunities for in-stream recreational uses be increased.

Quality

Most stream water quality issues will be addressed through implementation of the Umpqua Basin TMDL. However, listings for sediment and toxic substances, along with a few isolated stream segments for other parameters are not addressed by the current TMDL.

Water temperatures during low flow periods are intolerable to anadromous species in portions of many streams in both sub-basins.

Calapooya Creek, Elk Creek, and Yoncalla Creek all fail to meet state standards for bacteria in the high flow season presumably due to increased runoff. During these periods, bacteria levels pose a health threat to people using the river for water contact recreation.

Calapooya Creek and Elk Creek are water quality impaired during the summer for dissolved oxygen. Low levels occur when anadromous fish are passing through and rearing in these streams. Calapooya Creek is also listed during the spawning period (Oct 15 to May 15) from the mouth to approximately river mile 25 near Nonpareil. This fall, winter, and spring listing is not addressed in the Umpqua Basin TMDL.

Calapooya Creek and Cook Creek are listed as impaired for various toxic substances. Calapooya Creek is high in iron and Cook Creek is impaired for beryllium, copper, iron, lead, and manganese. These levels create potential problems for both human health and aquatic life. In addition, Cook Creek may affect drinking water and fishing.

Calapooya Creek is also listed as impaired for pH which can cause problems for aquatic life.

There are eight streams in these sub-basins listed for habitat modification and ten listed with flow modification impairment. Most of those listed for flow modification are within the Calapooya Creek sub-basin, while those listed for habitat modification are distributed throughout both sub-basins. These impairments can affect other parameters including sediment, dissolved oxygen, and temperature by increasing erosion and streamflow velocity, and decreasing shade. Loss of floodplain vegetation can also increase the rate of streamflow and decrease filtering of sediment and toxics. Efforts to improve fish passage and riparian conditions can help to improve these impairments.

Flooding and Urban Drainage

Surface flooding occurs frequently in the City of Drain. The low-lying riparian agricultural lands along Yoncalla Creek experience flooding that occasionally overflows the main road and threatens some homes.

Other Perceived Concerns

Some samples indicate that Elk Creek and Calapooya Creek may not meet alkalinity standards due to high $CaCO_3$ which can create health problems for aquatic life.

Calapooya Creek potentially does not meet phosphate phosphorus standards. When nutrient levels get too high, they may affect related parameters such as dissolved oxygen or excessive algae growth, which in turn may negatively impact beneficial uses of that stream such as fish and aquatic life. Calapooya Creek has been found to have high algae growth during the low flow season.

Neither sub-basin has opportunities for growth without adequate water supplies.

2.D. South Umpqua River / Cow Creek Sub-basins

2.D.1. Area Description

The South Umpqua River and Cow Creek sub-basins (Figure 2.D.1) include the following areas within the Umpqua Basin:

1. the South Umpqua River and its tributaries from the river's confluence with the North Umpqua (river mile 0) to its origin at the confluence of Black Rock and Castle Rock Forks (river mile 103), excluding the larger tributaries in Sub-basin E;[47] and

2. the entire drainage of Cow Creek from its confluence with the South Umpqua River near Riddle (South Umpqua river mile 47) to its origin on the crest of the Rogue River Range between Panther Peak and Railroad Gap (South Umpqua river mile 81).

From the confluence of the North and South Umpqua rivers, communities along the South Umpqua River include Roseburg, the county seat and largest city in the County, Green, Winston, Dillard, Myrtle Creek, Tri-City, Canyonville, Days Creek, and Tiller. The stretch of the South Umpqua River between its mouth and Canyonville is paralleled by Interstate 5 through the central portion of the County. The bulk of the County industrial activity and population are located in this section. The terrain is generally hilly with intermittent small valleys, most of which contain irrigated agriculture.

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[47] Sub-basin E tributaries include Deer Creek, Lookingglass Creek, North and South Myrtle creeks, Canyon Creek, Days Creek, Salt Creek and Elk Creek.

Above Canyonville, the terrain becomes progressively more mountainous with elevations exceeding 6,000 feet at peaks along Rocky Ridge, the headwaters of Black Rock Fork. Upstream of Tiller, the majority of lands in the South Umpqua sub-basin are included in the Umpqua National Forest.

Cow Creek enters the South Umpqua River at river mile 47. Communities along Cow Creek include Riddle, Glendale, and Azalea. The topography around Riddle is gently rolling and irrigated agriculture is prevalent.

Above river mile 10 upstream to Glendale at river mile 42, Cow Creek drains the eastern slopes of the Klamath Mountains. Cow Creek flows through a relatively narrow canyon where rights-of-way from both County Road 321 and the railroad are located along the streambanks. Most land is publicly owned and there is little to no potential for out-of-stream water use. However, possible impoundment sites have been identified on West Fork Cow Creek for consumptive uses downstream.

Between Glendale and Azalea, the creek parallels Interstate 5. Much of the irrigated agriculture in the sub-basin occurs along Cow Creek upstream of Glendale.

Upstream of Azalea, at Cow Creek river mile 60, Douglas County's Galesville Dam impounds 42,225 acre-feet in Galesville Reservoir. Completed in 1986, this roller compacted, concrete, 167-foot high structure regulates some of the flow of Cow Creek for irrigation, municipal and industrial, anadromous fish, recreation, and flood control purposes. Releases from the project pass through a 1.8 mW hydroelectric plant at the base of the dam. Revenue generated from the hydroelectric power use is accrued by Douglas County. A park complex has been constructed on the reservoir, including picnic areas and a boat ramp.

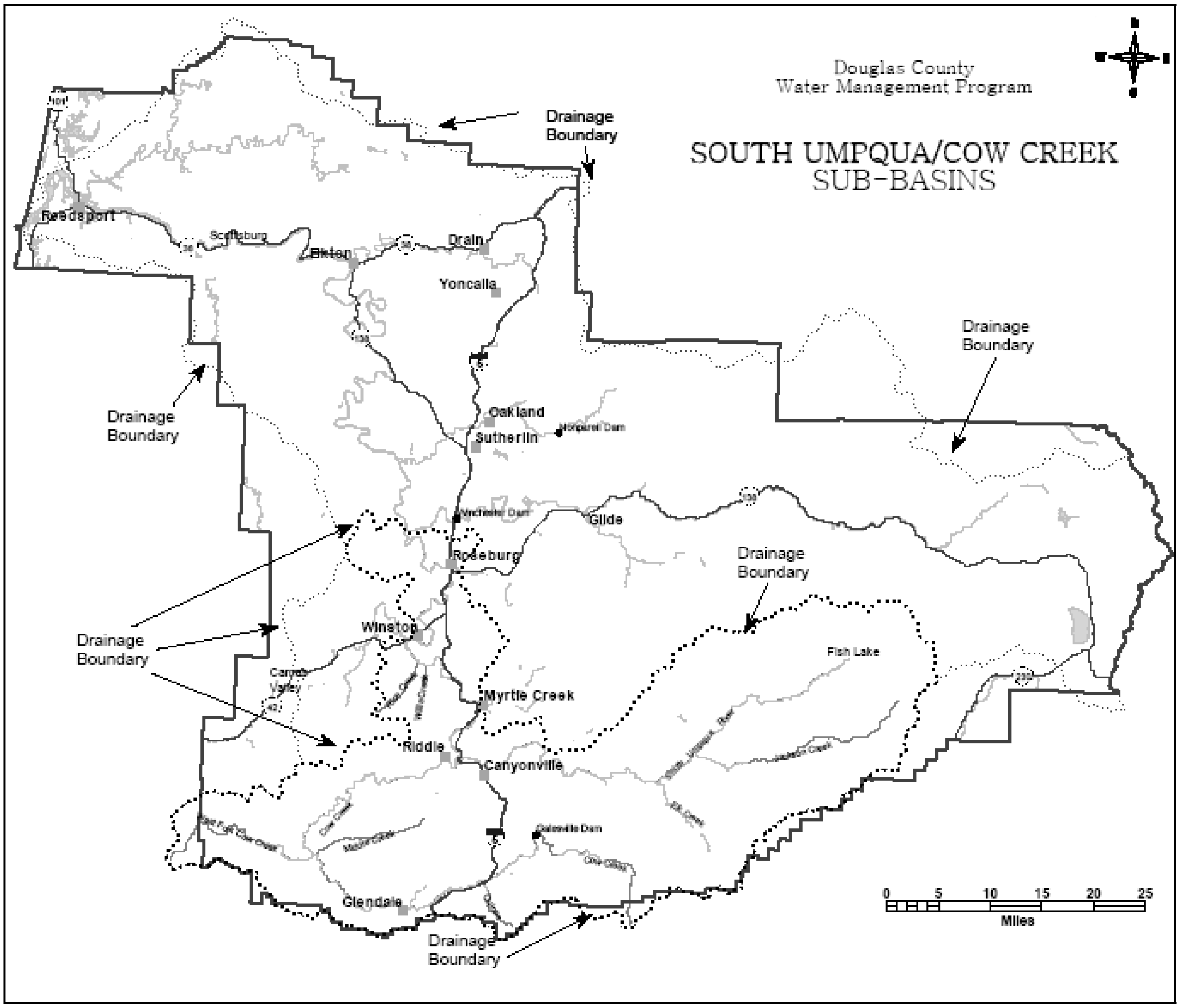

Figure 2.D.1: South Umpqua River and Cow Creek sub-basins within Douglas County.

Climate

The climate of the South Umpqua River sub-basin, particularly the valley portion between Roseburg and Tiller is mild. Average wind velocities in these protected inland valleys are among the lowest in the continental United States. Precipitation rarely occurs as snow on the valley floors, and summer temperatures are warm. Upstream of Tiller, more severe winter conditions are experienced and summer temperatures become cooler as elevation increases.

In the Cow Creek sub-basin, the climate along the lower stretches of the basin near Riddle (about 700 feet elevation) is similar to conditions described for the valley floor. Glendale is located at about elevation 1,400 feet and receives more annual precipitation, and cooler summer temperatures. Most precipitation in the watershed above Galesville Dam occurs as rain.

Precipitation

Douglas County operates and maintains several precipitation measuring stations in the South Umpqua River and Cow Creek sub-basins. Monthly precipitation values representative of conditions in the sub-basins are listed in Table 2.D-1. The Tiller 15ENE station is located 15 miles east-north-east of Tiller near Coyote Point. The Glendale figures incorporate both data from 1951 through 1960 from station Glendale 2NE located two miles northeast of Glendale, and from 1960 through 2006 after the station had been moved to the City of Glendale.

Period	Roseburg (KQEN) 1965 to April 2006			Tiller 15ENE 1956-2006			Glendale 1951 - 2006		
	max	mean	min	max	mean	min	max	mean	min
Oct	4.66	2.20	0.06	7.30	3.25	0.00	8.05	2.87	0.10
Nov	15.91	5.23	1.09	15.10	6.62	1.00	20.20	6.44	0.70
Dec	15.77	5.92	0.84	17.60	6.54	0.90	20.60	8.31	0.70
Jan	11.33	5.45	0.58	10.40	5.36	0.50	17.60	7.51	0.30
Feb	9.75	3.60	1.02	11.00	4.09	1.10	15.50	5.63	0.30
Mar	6.99	3.51	1.01	9.20	4.17	0.00	11.30	4.91	0.55
April	7.05	2.54	0.59	6.80	3.20	0.88	7.70	2.53	0.53
May	6.33	1.80	0.27	6.70	2.41	0.30	6.00	1.67	0.10
June	2.67	0.86	0.00	5.49	1.44	0.00	3.01	0.76	0.00
July	2.98	0.40	0.00	3.60	0.42	0.00	2.70	0.31	0.00
Aug	3.30	0.58	0.00	5.50	0.71	0.00	3.00	0.48	0.00
Sept	3.70	1.05	0.00	6.70	1.23	0.00	5.00	1.02	0.00
Annual[1]	60.19	32.84	21.71	50.10	39.63	24.65	67.67	42.24	21.50

[1] Values are maximum annual, mean annual, and minimum annual; not total of column entries.
Source: Douglas County Natural Resource Division.

Table 2.D-1: Monthly and annual precipitation for three locations across the South Umpqua River / Cow Creek sub-basins.

Over 84 percent of the precipitation occurs from October through April at all three locations (over 90 percent at Glendale) with the majority from November to January. The summers are nearly dry, averaging less than one inch in July and August at both Roseburg and Glendale and just over an inch at Tiller. Roseburg has the lowest average annual precipitation with about 33 inches, while Glendale has the highest with just over 42 inches. The maximum recorded annual amount was in 1996 at all three locations, the highest being nearly 67 inches at Glendale. The minimum annual amount of just less than 22 inches occurred in 1976 at both Glendale and Roseburg. All three stations show a dry season where on average, about one inch or less occurs from July through August, and June is fairly dry with less than an inch on average in Roseburg and Glendale.

Surface Water – Rivers and Streams

Quantity

USGS operates several stream gages in the South Umpqua River and Cow Creek sub-basins. Streamflow data from three gages on the South Umpqua River and three in the Cow Creek sub-basin are presented in Table 2.D-2. Several additional gages are monitored on tributaries to the South Umpqua River. Information from those sites will be discussed in Section E.

Stream gage	Period of record (water year)	Discharge (cfs)			Runoff average (ac-ft/yr)
		max	min	mean	
South Umpqua near Brockway	1907-2005[1]	125,000	16.0	2,740	1,985,000
South Umpqua Near Days Creek	1975-1990	25,200	29.0	1,154	836,101
South Umpqua at Tiller	1911-2005[2]	60,200	20.0	1,019	738,200
Cow Creek Near Riddle	1954-2005	38,400	7.4	903	654,200
Cow Creek near Azalea	1930-2005	10,600	1.1	105	76,360
West Fork Cow Creek near Glendale	1956-2005	15,700	2.5	253	183,000

[1] Period of record includes water years 1907-11, 1924-26, 1943-2005.
[2] Period of record includes water years 1911, 1940-2005.
Source: USGS Water Data Report – Oregon 2005 (WDROR05-Volume 1) and USGS National Water Information System.

Table 2.D-2: Maximum, minimum, and mean discharge, and acre-feet of runoff for six locations in the South Umpqua River and Cow Creek sub-basins.

Representative monthly flow data for the sub-basins are listed in Table 2.D-3 and Table 2.D-4. Mean flows on Cow Creek have been affected since 1985 by flow regulation from the Galesville Dam. The regulated flows tend to decrease normal flows from November through March, and increase flows from June through October. To a lesser degree, these changes also affect values at all downstream stations including the South Umpqua River near Brockway.

Month	South Umpqua near Brockway		South Umpqua near Days Creek		South Umpqua at Tiller	
	mean (cfs)	percent of annual	mean (cfs)	percent of annual	mean (cfs)	percent of annual
October	449	1.4	199	1.4	189	1.5
November	2,586	7.9	1,270	9.1	1,005	8.2
December	5,639	17.1	2,440	17.5	2,012	16.4
January	6,827	20.7	2,000	14.4	2,081	17.0
February	6,162	18.7	2,430	17.4	1,960	16.0
March	4,671	14.2	1,930	13.9	1,706	13.9
April	3,243	9.9	1,620	11.6	1,421	11.6
May	1,909	5.8	1,140	8.2	1,076	8.8
June	865	2.6	532	3.8	509	4.2
July	264	0.8	168	1.2	153	1.2
August	136	0.4	91	0.7	76	0.6
September	149	0.5	110	0.8	74	0.6
Total	**32,900**	**100**	**13,930**	**100**	**12,262**	**100**

Source: USGS Water Data Report – Oregon 2005 (WDROR05-Volume 1) and USGS National Water Information System.

Table 2.D-3: Mean monthly discharge and the percent of annual discharge from three stations along the South Umpqua River.

Month	Cow Creek near Riddle[1]		Cow Creek near Azalea[1]		West Fork Cow Creek	
	mean (cfs)	percent of annual	mean (cfs)	percent of annual	mean (cfs)	percent of annual
October	106	1.3	32	2.5	39	1.3
November	468	5.8	83	6.5	277	9.1
December	1,368	17.1	189	14.9	590	19.4
January	1,834	22.9	239	18.8	653	21.4
February	1,563	19.5	215	17.0	564	18.5
March	1,123	14.0	176	13.9	459	15.1
April	708	8.8	133	10.5	267	8.8
May	409	5.1	78	6.2	116	3.8
June	185	2.3	43	3.4	41	1.3
July	99	1.2	29	2.3	17	0.6
August	78	1.0	26	2.0	10	0.3
September	82	1.0	25	2.0	12	0.4
Total	**8,023**	**100**	**1,268**	**100**	**3,045**	**100**

[1] Monthly flows since 1985 have been affected by regulation form Galesville Reservoir.
Source: USGS Water Data Report – Oregon 2005 (WDROR05-Volume 1) and USGS National Water Information System.

Table 2.D-4: Mean monthly discharge and the percent of annual discharge on Cow Creek and West Fork Cow Creek.

The flow data show large variations in discharge from season to season, reflecting climatic and geologic conditions in the sub-basins. Over 88 percent of the annual discharge of the South Umpqua River near Brockway, and Cow Creek near Riddle occur during the six month period from November through April. Just over one percent or less occurs in July, August, or September, the period of peak needs for out-of-stream uses. The low streamflows are also susceptible to heating to temperatures above those acceptable for aquatic life. These conditions exacerbate resource management and use problems in the basin.

Summer flows on Cow Creek below Galesville Dam have increased substantially since flow regulation began in 1985. Since regulation, mean low flows in July, August and September measured at Cow Creek near Azalea are close to five percent each month, up from one percent prior to regulation. Increases of flow on Cow Creek during the summer have helped provide for out-of-stream use needs and minimum flows for aquatic life.

Flooding

Flooding is a natural phenomenon that occurs when streamflow overflows the stream banks. Small floods should be expected to occur about every two years. Larger, less frequent events such as the hundred-year event have flows that are on the order of five times larger than the two-year event. Flooding becomes an issue when property is damaged or access is limited by the high water.

Flood damage in the Cow Creek and South Umpqua River sub-basins is not unfamiliar. Table 2.D-5 shows flood levels recorded for various years since 1906 measured at two locations on each of the South Umpqua River and Cow Creek. Flood history shows flood events occur most often in December and January. Prior to the construction of Galesville Dam in 1986, Cow Creek flooded regularly. Since the dam was completed, only two floods have occurred at the site near Riddle (1995 and 1996) and none near Azalea.

The largest events occurred in October 1950, December 1964, and January 1974. The January 1974 flood event measured over six feet above flood level at all stations with the exception of the South Umpqua at Tiller, the highest elevation station where it recorded barely over flood stage. The largest flood on the South Umpqua River was in December 1964.

In December, 1964 a large storm event brought high rainfall that fell on deep accumulated snow in the Cascades causing rapid snowmelt and large-scale, widespread flooding throughout much of the Umpqua Basin. Many of the resulting floods in the higher elevation watersheds were considered 100-year events indicating these flow levels have a one percent probability of occurrence in any given year. During the December 1964 flood, 400 persons were evacuated from their homes in Roseburg, and damage was widespread throughout the Umpqua Basin. Preliminary flood damage estimates prepared for the U.S. Army Corps of Engineers totaled over $31.2 million in 1964 dollars for the County as a whole. Flow at Tiller was measured at a maximum of 60,200 cfs, and at Brockway was 125,000 cfs, still the highest recorded discharges at each station.

Date	South Umpqua River		Cow Creek	
	at Brockway (at Winston) 1907-2006[1] (26 ft)	at Tiller 1911, 1940-2006 (18 ft)	near Riddle 1951-2006 (22 ft)	near Azalea 1928-2006 (10 ft)
Jan 04, 1907	3.16	n/a	n/a	n/a
Nov 23, 1909	1.66	n/a	n/a	n/a
Feb 21, 1927	5.20	n/a	n/a	n/a
Dec 31, 1942	2.50	0.96	n/a	---
Dec 28-29, 1945	2.20	0.40	n/a	1.20
Jan 06-07, 1948	3.00	---	n/a	1.50
Oct 29-30, 1950	***6.40***	***4.35***	***6.50***	***4.37***
Jan 18, 1953	4.36	2.20	---	0.91
Nov 23, 1953	3.03	0.82	---	---
Dec 21-22, 1955	5.55	2.85	---	2.76
Dec 26, 1955	---	---	5.35	---
Dec 11, 1956	0.26	4.70	---	---
Jan 29, 1958	0.01	---	---	0.62
Jan 12, 1959	---	---	1.43	---
Jan 20, 1964	0.84	---	1.57	0.81
Dec 22-23, 1964	***8.28***	***7.72***	***5.67***	***5.63***
Jan 03-04, 1966	1.98	---	2.46	---
Jan 26, 1970	---	---	---	2.27
Jan 17-18, 1971	4.62	0.46	3.01	1.80
Mar 02, 1972	---	1.13	---	---
Jan 15-16, 1974	***6.64***	***0.36***	***6.17***	***6.40***
Dec 02, 1980	---	---	---	1.17
Dec 06, 1981	2.74	0.37	2.42	4.94
Feb 17-18, 1983	4.32	---	4.79	4.78
Feb 13, 1984	---	---	---	1.12
Nov 12, 1984	---	---	---	1.93
Jan 09, 1995	---	---	4.22d	---
Nov 18, 1996	---	4.17	d	d
Dec 08, 1996	2.46	---	0.45d	d
Dec 30-31, 2005	0.63	0.40	d	d

() indicates the flood level at each station; n/a = station not in operation; d = discharge affected by diversion; h = historic record.
[1] Period of record includes water years 1907-11, 1924-26, 1943-2006.
Source: USGS National Water Information System and Douglas County Flood Crest History from the Douglas County website last updated March 15, 2006.

Table 2.D-5: Water height (in feet) above flood level at four locations in the South Umpqua River / Cow Creek sub-basins since 1906.

The January 1974 flood caused widespread damage in the South Umpqua sub-basin, with total damages along the South Umpqua River reaching $2,188,600 in 1974 dollars. There was severe erosion of agricultural lands. Over 50 homeowners reported inundation of at least the first floor of their residences. The Tri-City airport runway was undercut and the sewage disposal system for Winston was damaged. The peak flow at Brockway (105,000 cfs) was considered a 1 in 50 year recurrence. Flows at Tiller, however reached only 31,400 cfs, or a 1 in 6 year recurrence.

Cow Creek flows at Riddle reached a maximum of 38,400 cfs on January 15, 1974, slightly less than the maximum discharge of 41,100 cfs recorded at that station on October 29, 1950. Flows at Azalea peaked at 10,600 cfs, determined a 1 in 160 year recurrence, exceeding the December 1964 flood peak of 8,430 cfs. During the 1974 flood, one life was lost, a concrete bridge in Glendale was destroyed and 26 properties sustained structural damage. A bridge on Interstate 5 had to be rebuilt as a result of flood damage. Total damage in the Cow Creek sub-basin was estimated to be $3,259,800 at the time of the flood. In 1986, completion of the Galesville Reservoir located about 2.75 miles upstream of Whitehorse Creek significantly reduced flooding in Cow Creek by diversion and regulation of flows below the dam.

In November 1996, the South Umpqua near Tiller flowed 46,000 cfs; considered greater than a 25-year flood event. During the storm, Roseburg received a record 4.35 inches in one day, and precipitation in the weeks prior to the storm was above average leading to already saturated soils. The combination of heavy rains, snowmelt, saturated soils, and flooding also resulted in debris flows and landslides. More flooding occurred a few weeks later from December 4th-9th and again on January 1st-2nd. The combined damage from flooding and land disturbances caused over $11 million in damage to public and private property within the Umpqua Basin (USGS 2004). The Umpqua National Forest and Oregon State highways within the County incurred over $7 million in damage. BLM lands, local municipal infrastructure, and private property each sustained over $1 million in damage.

During the November 1996 event, the South Umpqua River near Tiller was more than four feet above flood level, while the Brockway station did not record flood levels. However, in December the Brockway station flooded by over two feet with over 76,000 cfs recorded. The November storm caused more flooding in the North Umpqua and Calapooya Creek sub-basins, while the December storms caused more flooding in the South Umpqua River and Umpqua River sub-basins. The January storms did not produce the flooding of the earlier events but caused more damage throughout the County due to the saturated conditions.

Although not as great as the 1996 events, flooding occurred in late December 2005. The South Umpqua River flooded by less than a foot at both the Brockway and Tiller sites. The Umpqua River near Elkton also exceeded its capacity by over six feet aided by large flows on the South Umpqua River.

Generally, streams that are in good condition withstand flooding with a minimum of erosion or channel alteration. Likewise, aquatic and riparian species have adapted to survive these events. Modified streams and drainage systems such as road networks that contribute water to the stream system can be severely damaged during the high flow period if they do not have adequate carrying capacity.

Since the lands adjacent to streams often have high value for development or agriculture, the streams are often modified to reduce flooding. Dikes may be built or the stream enlarged to increase the capacity of the stream. Removal of large debris from the stream channel was a common practice in the past. Unfortunately these methods eliminate habitat, destabilize streams, and direct larger quantities of water downstream to other flood prone areas. The end result is accelerated erosion, increased channel downcutting, lowered water table, and increased flooding downstream.

A more effective approach to flood management includes avoidance of high valued structures within the designated flood zones and sufficient water detention areas along the stream route.

The County regulates development of structures in floodplain areas to prevent loss of property and danger to residents, as well as to maintain existing floodplains for streams. Agricultural landowners in floodplain areas can expect to have some flooding of their agricultural lands. To help mitigate damage that may be caused by excessive flooding in unexpected areas, watershed councils, conservation districts, and the Natural Resources Conservation Service (NRCS) help landowners implement projects such as instream wood placement, proper-sized culvert replacements, channel realignment, and re-establishment of riparian vegetation.

Flood control reservoirs such as Galesville and detention ponds can help reduce the effects of local flooding. Comprehensive planning is necessary to manage the water storage throughout the entire drainage system.

Quality

Water quality and quantity affect the use of water. The quality of water in the South Umpqua River and Cow Creek sub-basins does not always meet state standards for all parameters (see Table 1-1). Failure to meet a standard may vary by season due to changes in quantity of flow, as well as other seasonal changes.

Water quality conditions in the South Umpqua River limit the uses that can be made of water resources. Many of the water quality problems relate to low streamflow and warm summer temperatures. Water temperatures seasonally exceed the limits tolerable to anadromous fish. Wastewater treatment plants supply nutrients to the river that promote excessive algae blooms in these warm water conditions. This in turn affects the dissolved oxygen and pH levels in the river. In combination, conditions reach levels that are critical for aquatic life and the appearance of the streams become aesthetically unpleasant. Reports from the team working on salmon recovery have identified water quality in the South Umpqua River and tributaries as one of the problems limiting coho salmon recovery there (ODEQ 2006).

Oregon Water Quality Index[48]
"The purpose of the Oregon Water Quality Index (OWQI) is to improve understanding of water quality issues by integrating complex data and generating a score that describes water quality status and evaluates water quality trends," (Cude 2001). While it is not a comprehensive assessment of water quality for any specific use, the index aids in the assessment of water quality for recreational uses (i.e. fishing and swimming), and the goal of the index is to assess water quality as it relates to fish. For a complete description of the index and how it was developed and used, refer to *Oregon Water Quality Index: A Tool for Evaluating Water Quality Management Effectiveness,* (Cude 2001).

The Oregon Water Quality Index is a single number that expresses water quality by integrating measurements of the following eight water quality variables collected at ODEQ monitoring stations:

- temperature,
- dissolved oxygen (percent saturation and concentration),
- biochemical oxygen demand,
- pH,
- total solids,
- ammonia and nitrate nitrogen,
- total phosphorus, and
- bacteria.

Index values are then used to determine trends in water quality for each site. However, the index does not consider changes in toxic concentrations, habitat, or biology of the streams. Average Oregon water quality index results for the summer and for the rest of the year, as well as the minimum for the season are listed in Table 2.D-6 for five sites within the sub-basins.

Water quality within the lowest portion of the South Umpqua River can be characterized as "very poor" while the rest of the river and the lower reaches of Cow Creek are considered "poor." The South Umpqua River sub-basin is the most populated in the Umpqua Basin. Water quality impacts stem mainly from municipal point sources and partly from non-point sources.

Although still considered poor, the South Umpqua River at Days Creek Cutoff Road has the highest index rating and is the furthest upstream above all major point sources. Water quality ranges from "poor" in the summer to "excellent" during the rest of the year. Temperature and pH limit water quality during the summer at this site as well as at the Cow Creek site. The Cow Creek site is downstream from mining areas at Nickel Mountain and the wastewater treatment facility at Riddle. The pH is generally higher at the Cow Creek site than the uppermost South Umpqua site, and dissolved oxygen levels are low, indicating eutrophication in the upper parts of the basin. Water quality at the Cow Creek site ranges from "poor" in the summer to "good" for the remainder of the year.

[48] Discussion in this section is based largely on the Oregon Water Quality Index Report for the Umpqua Basin Water Years 1986-1995 (Cude). However, current index values and updates to the discussion are from the most current Oregon Water Quality Index Summary Report Water Years 1996-2005.

Site	River mile	Summer average (June – Sept)	Fall, winter, and spring average (Oct – May)	Minimum seasonal average	Rating[1]
Cow Creek at the mouth (Riddle)	0.3	77	89	77	poor
S. Umpqua R. at Days Creek Cutoff Road	55.5	78	90	78	poor
S. Umpqua R. at Hwy 42 (Winston)	21.2	77	88	77	poor
S. Umpqua R. at Stewart Park (VA Med. Center, Roseburg)	10.7	77	85	77	poor
S. Umpqua R. at Melrose Road	5.1	58	84	58	very poor

[1] Based on minimum seasonal average.
Scores: very poor 0-59; poor 60-79; fair 80-84; good 85-89; excellent 90-100.
Source: Oregon Water Quality Index Summary Report Water Years 1996-2005.

Table 2.D-6: Oregon Water Quality Index rating for Cow Creek at the mouth and four sites on the South Umpqua River for water years 1996 – 2005.

By the time the South Umpqua River reaches the site at Winston, effects of the sewage treatment plants at Canyonville and Myrtle Creek, drainage from Cow Creek, and rural and industrial non-point source pollution is evident. High fecal coliform, total solids, and biochemical oxygen demand indicate the presence of human and animal waste and other organic compounds throughout the year. High temperatures, low flows, and organic inputs cause increases in eutrophication that occasionally results in high pH. The summer rating has decreased by three points from “fair” to “poor” since the previous ten-year assessment. However, there has been a slight increase (one point) for the remainder of the year.

During the summer, water quality in the river is still poor by the time it reaches the site in Roseburg at Stewart Park, and the fall, winter, and spring conditions have deteriorated. According to the Oregon Water Quality Index, there is a significant decrease in water quality at this site over the last ten years (1996 to 2005). By the time flows reach this site, fecal coliform, total phosphates and total solids from Deer Creek have entered the system. There may also be inputs from overflows of the Winston-Green sewage treatment plant during storm events, and urban non-point source pollution from runoff of paved surfaces.

The South Umpqua River at Melrose Road is the furthest downstream site and has the accumulation of all upstream sources that could not be removed by natural self-purification processes. It has also been impacted by a major sewage treatment facility downstream of Roseburg. High levels of fecal coliform, total phosphates, and biochemical oxygen demand have historically been coupled with high water temperatures producing especially high eutrophication at this site. This resulted in high pH and dissolved oxygen levels. In the past, this has resulted in "poor" conditions throughout the year. However, improvements to wastewater treatment plants, including the Roseburg facility have resulted in a significant improvement in water quality. During the fall, winter, and spring, the index value has increased a full ten points to a "fair" rating. However, the summer water quality has decreased (by four points) to a "very poor" rating, possibly from the higher water temperatures and eutrophication at the site.

Point and Non-point Source Pollution

Point source pollution comes from an identifiable point of discharge into the water. Non-point source pollution includes where the primary sources of pollution cannot be identified as coming from a specific site. These factors may include water temperature, erosion and sedimentation, bacteria, and other items. The following discussion of water quality issues in the South Umpqua River and Cow Creek sub-basin are outlined by parameter. Water quality issues for several parameters are attributed to a combination of point and non-point sources of pollution.

Bacteria

The South Umpqua River failed to meet the State standard for bacteria (*E. coli* and fecal coliform) in the summer between Green and Days Creek (river miles 15.9 and 57.7). During the summer, bacteria levels pose a health threat to people using the river for water contact recreation. This segment of the river flows by the cities of Days Creek, Canyonville, Myrtle Creek, Dillard, Winston, Green and within a mile of Riddle. Rice Creek was also found to be water quality limited during sampling for the Umpqua Basin TMDL. However, it is not currently on the 303(d) list.

When bacteria levels are high in the peak streamflow season and low in the summer, it suggests inputs from overflow of wastewater treatment plants as well as stormwater runoff; however, the reverse is true in the South Umpqua River with high bacteria levels in the summer and low in winter. This may suggest that bacteria originate from a point source upriver, the discharge of which is diluted during high streamflow (Tanner and Anderson 1996). However, no point sources have been identified for the high levels of bacteria during the summer in the South Umpqua River.

Although there are seven significant point-sources of bacteria from wastewater treatment plants in this area, ODEQ determined that these usually meet standards for discharge, thus not contributing significantly to the higher bacteria levels measured.[49] According to ODEQ, the dominant sources are thought to be non-point sources (ODEQ 2006). These may include failing septic systems, direct delivery of bacteria from swimmers and watering animals, and illegal discharges during low flow. Deer Creek and North Myrtle Creek, two tributaries to the South Umpqua River are also listed for bacteria in the summer but do not appear to impact concentrations in the South Umpqua River.

[49] Five wastewater treatment plants discharge directly into the South Umpqua River and two into Cow Creek.

There are no point sources of discharge into Rice Creek. Based on the TMDL analysis, Rice Creek will require a 30 percent reduction in *E. coli* concentrations from non-point sources to meet water quality standards

The Umpqua Basin TMDL has assigned load allocations to point and non-point sources of bacteria. The sources of bacteria addressed in the TMDL were summarized in the following way:

> Studies by DEQ during storms indicated that forested lands do not contribute any significant bacteria load to streams in the Umpqua Basin, but agricultural, rural residential and urban lands, as well as possible turbulence releasing bacteria from stream sediments were the sources of bacteria. Since relative contributions could not be determined from the data, the load allocations for non-point sources were allocated to all non-point sources in the basin.

Temperature

Water temperature is a major factor affecting water quality. It effects concentrations of other constituents, as well as the chemical and biological interaction of these constituents. It is a primary factor in determining the types of organisms able to inhabit a body of water. Salmonids are among the most sensitive fish; therefore ODEQ surface water temperature standards have been set based on salmonid temperature tolerance levels. The temperature standard varies throughout the Umpqua Basin according to the habitat area and the species that use that area. The standard is based on a seven-day average maximum (7DAM) temperature to avoid short-duration spikes in temperature that likely have minimal impacts on salmonids.

Throughout the lower elevation areas of the South Umpqua River and Cow Creek sub-basin, the maximum desirable water temperature is approximately 55°F during spawning periods. Spawning times vary by stream but are generally between September and June. During the rest of the year (primarily summer) when salmonids are migrating and rearing, the temperature standard is 64°F. The upper reaches of both sub-basins are considered core cold-water habitat requiring a lower temperature maximum of about 61°F during the non-spawning summer months.[50] Although these are desirable temperatures based on healthy salmonid populations, there is no evidence that all of these streams ever met these standards. Warm-water fish species can tolerate water temperatures up to 86°F to 90°F depending upon dissolved oxygen levels.

Most of the South Umpqua River and 40 streams (or stream segments) within the sub-basins do not currently meet the State standards for temperature. All but eight of those exceed the 7DAM water temperature standard during the summer months only when salmonids use the streams for rearing and migrating. In addition, there are another 24 tributaries to the South Umpqua River that exceed the temperature standards that are discussed in the South Umpqua Tributaries sub-basin (Section 2.E.).

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[50] Core cold-water habitat on the South Umpqua River extends from the headwaters to about Milo; and on Cow Creek from the headwaters to Riffle Creek located about 11 stream miles west of Glendale.

Stream temperatures that exceed 64°F may cause health problems for salmonids. Black Rock Fork, Coffee, Dumont, Jackson, Middle Fork Deadman, Middle, and Wood creeks also exceed the maximum of 55°F during the spawning period from October to May, and Cattle Creek only exceeds the standard during spawning. Stream segments listed as water quality impaired for temperature are shown in Table 2.D-7, along with the season of the impairment relative to salmon spawning.

South Umpqua River sub-basin			
Stream	**Season**	**Stream**	**Season**
South Umpqua River	non-spawning	East Fork Deadman	summer
Beaver Creek	summer	East Fork Stouts Creek	non-spawning
Black Rock Fork	year around	Francis Creek	summer
Boulder Creek	summer	Jackson Creek	year around
Buckeye Creek	summer	Lavadoure Creek	non-spawning
Callahan Creek	summer	Middle Fork Deadman	year around
Castle Rock Fork	summer	Shively Creek	non-spawning
Coffee Creek	year around	Slick Creek	summer
Deadman Creek	non-spawning	Stouts Creek	summer
Dumont Creek	year around		
Cow Creek sub-basin			
Cow Creek	non-spawning	Quartz Creek	summer
Applegate Creek	summer	Quines Creek	summer
Bear Creek	summer	Riffle Creek	summer
Cattle Creek	spawning	Skull Creek	summer
Dads Creek	summer	Snow Creek	summer
Dismal Creek	summer	South Fork Middle Creek	non-spawning
Doe Creek	non-spawning	Union Creek	non-spawning
Elk Valley Creek	summer	West Fork Cow Creek	summer
Fortune Branch Creek	summer	Windy Creek	non-spawning
Middle Creek	year around	Wood Creek	year around
Mitchell Creek	non-spawning	Woodford Creek	summer
Source: Oregon DEQ 2004/2006 Integrated Report.			

Table 2.D-7: Stream segments that exceed State water quality temperature standards in the South Umpqua River and the Cow Creek sub-basins.

Data from county monitoring stations, as well as temperature data from US Geological Survey (USGS) gages, ODEQ sampling sites, the Partnership for the Umpqua Rivers Watershed Council, and other agency sources are the basis for the following discussions of water temperature conditions.

In 1999 the Umpqua Basin Watershed Council (UBWC) in cooperation with the BLM and Umpqua National Forest, undertook a study on water temperature for the entire South Umpqua River sub-basin to determine temperature trends for the South Umpqua River and its tributaries (Smith 2000c).[51] Continuously sampling sensors were placed at 119 locations within the South Umpqua River sub-basin. Sensors were placed at sites between June 24 and June 30, 1999, and removed between September 9 and September 15, 1999.

Figure 2.D.2 and Figure 2.D.3 show the seven-day moving average maximum temperatures for nine sites located in the lower and middle South Umpqua River. Results of the study show that throughout the lower and middle South Umpqua River, seven-day moving average maximum temperatures exceed water quality standards every day of the summer.

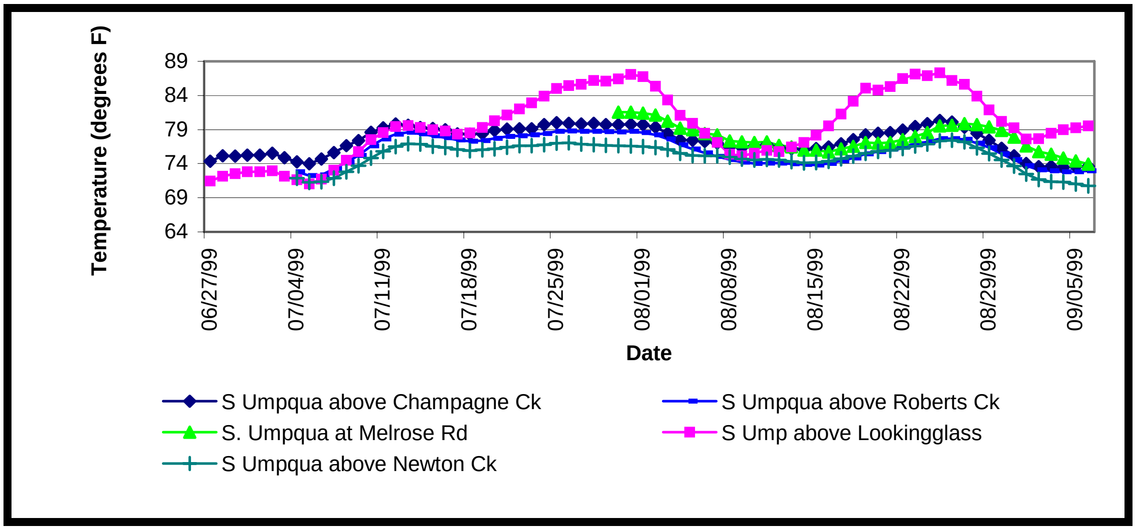

Figure 2.D.2: Seven-day moving average maximum temperature trends for the lower South Umpqua River (Geyer 2003c).

[51] The Umpqua Basin Watershed Council (UBWC) has since changed its name to Partnership for the Umpqua Rivers (PUR).

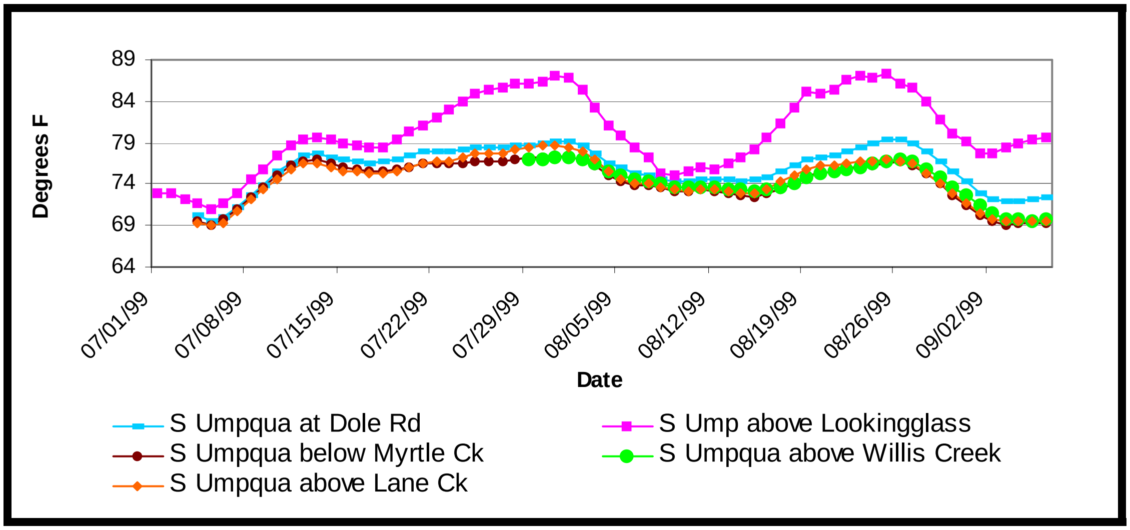

Figure 2.D.3: Seven-day moving average maximum temperature trends for the middle South Umpqua River (Geyer 2003d).

The warmest recorded site was on the South Umpqua River above Lookingglass where temperatures reached over 87°F, substantially warmer than the other sites. One possible explanation is given in the Smith Report as follows:

> The temperature logger was initially in active flow but by the end of the season the flow had receded and the unit was in a pool that was nearly isolated from the main river flows. This area was dominated by bedrock, which may have helped accumulate heat.

However, Smith goes on to say that other sites in similar nearly isolated bedrock conditions revealed cool temperatures perhaps from ground water inputs. In either case, the warm pool area contributes extremely warm water to the South Umpqua River environment.

Water temperatures vary with local ambient conditions, direct solar radiation, and proportion of ground water flowing into the stream. The effect of ambient air temperature on stream temperature is reflected in Figure 2.D.2 and Figure 2.D.3 where stream temperatures vary by site but the daily stream temperature pattern is the same at all sites; and maximum and minimum average temperatures typically occur on the same days at each location.

In the summer of 2000, the Umpqua Basin Watershed Council sponsored another stream temperature study in the Cow Creek watershed. Summer temperature data from 89 continuously monitored sites throughout the sub-basin were analyzed. Results of the study show that seasonal seven-day moving average maximums ranged from 82.5° F to 57.3°F, with an average of 67.0°F. Five sites, four located on Cow Creek and one on the South Umpqua above Cow Creek, exceeded the seven-day moving average maximum temperature of 64°F over 95 percent of the days monitored. Temperatures reached over

82°F at the end of July on these sites. Fifteen sites all located on small tributary streams never exceeded 64°F during the study period.

Streamflow has a substantial effect on temperature. In general, as most streamflows decrease in spring and early summer, water temperatures increase, due to atmospheric warming, solar radiation, reduced ground water input, and the relatively smaller mass of water in the river.

The temperatures in the mainstem of Cow Creek are substantially altered by management of streamflow at the Galesville Reservoir. The introduction of cold water and higher flows during the summer water releases from the reservoir cause an abrupt decrease in stream temperature. This effect appears to diminish further downstream. Stream temperature near the mouth of Cow Creek is similar to the South Umpqua River above the confluence with Cow Creek (Smith 2000b).

Stream temperature at a particular point is a function of many local factors that include exposure to solar radiation, longwave heating from the local environment and groundwater interaction. Water's susceptibility to change temperature is a function of both the volume and velocity of flow. Stream temperatures usually follow a warming trend as the distance from the headwaters and the corresponding stream volume increases. Tributaries are approximately 10°F cooler than the mainstem of Cow Creek, with smaller streams cooler than larger ones. Maximum temperatures of the coldest streams tend to increase 1°F per downstream mile. Streams that are exposed to direct sunlight can exceed the standard in a shorter distance. Temperatures may also vary within a given area on a stream with cooler temperatures in the deeper water. Isolated points of upwelling ground water may provide some thermal refuge for aquatic life. Results from the Smith study in Cow Creek indicate that many of the tributary streams have the potential to be at cooler temperatures.

Dissolved Oxygen

Salmonid eggs and smolts are sensitive to dissolved oxygen levels. When levels drop too low for even short periods of time, eggs, smolts, and other aquatic organisms will die. The amount of oxygen that is dissolved in water will vary depending upon temperature, barometric pressure, flow, and time of day. Both cold water and higher barometric pressure dissolve more oxygen than warm water, and low pressure. In addition, flowing water contains more dissolved oxygen than still water. Aquatic organisms produce oxygen through photosynthesis and use oxygen during respiration. As a result, dissolved oxygen levels tend to be highest in the afternoon when algal photosynthesis is at its peak, and lowest before dawn after organisms have used oxygen for respiration during the night (refer to the Nutrients and algae section for more on this relationship).

The South Umpqua River is listed as water quality impaired during the non-spawning period for dissolved oxygen from the mouth to river mile 68.8 near Milo. Low levels occur during the summer when temperatures are higher, flows are lower, and algae are more abundant. Low dissolved oxygen levels during this period of the year affects anadromous fish while they are passing through and rearing in the river.

During a study by the US Geological Survey in 1990-1992, the frequency and magnitude of dissolved oxygen levels that exceeded water quality standards increased in a downstream direction and in the summer within the South Umpqua River (Tanner and Anderson 1996). This was also the case for pH. The study found that the locations where dissolved oxygen levels were below the 90 percent saturation standard were the same locations where the pH values exceeded the standard of 8.5, and large deviations for one parameter correlated to large deviations of the other as well.

pH

The pH is a measure of the hydrogen ion concentration of the surface water in the stream. It determines the acidity or alkalinity of the water. High or low pH levels in streams may adversely affect fish and aquatic life or restrict water contact recreational use. When pH levels exceed the stream's normal range, water can dissolve the protective mucous layer on aquatic organisms such as fish, amphibians, and mollusks; making them more susceptible to diseases. The pH can alter the chemical form and affect the availability of nutrients and toxic chemicals; thus potentially impacting resident aquatic life and human health. In mining areas, the presence of low pH and heavy metals can shift the metal ions to more toxic forms in the water.

The lower five miles of the South Umpqua River is water quality limited for pH during the fall, winter, and spring seasons. Most of the South Umpqua River (up to river mile 102.2) and the first 29.3 miles of Cow Creek (up to just downstream of Glendale near Dads Creek) are impaired during the summer. Jackson Creek and Black Canyon Creek are both listed as water quality impaired for pH during the summer. The first 25 miles of Jackson Creek exceed the pH standard. Black Canyon Creek discharges into Jackson Creek at about stream mile 10.6; thus Jackson Creek appears to have additional sources from upstream contributing to the pH problems.

In addition to these listings for pH, the South Umpqua River above Green, Cow Creek up to stream mile 80, and the first two miles of an unnamed tributary on Middle Creek are a potential concern for alkalinity as some data have shown they exceed the standard; however additional monitoring is required for listing.

The 1996 report by Tanner and Anderson stated pH levels that exceeded State standards in the South Umpqua River correlated to where dissolved oxygen standards were exceeded. Both parameters increased in magnitude and frequency in the downstream direction and in the summer. Respiration and photosynthesis are normal metabolic processes of aquatic organisms that change pH. Carbon dioxide (CO_2) is produced during respiration and used for photosynthesis. The level of dissolved CO_2 in a stream raises and lowers pH.

Normally, there is a balance between instream metabolic processes and a natural chemical buffering system that prevents streams from becoming too acidic or alkaline from CO_2. However, stream inputs that increase or decrease respiration and photosynthesis by aquatic organisms can indirectly shift pH by changing CO_2 levels. For example, nitrogen and phosphorus from organic matter such as feces and urine, or from inorganic chemicals such as fertilizers, encourage algae growth in the summer and can result in algae "blooms." When a stream's algae population grows, so does the overall consumption of dissolved CO_2. As CO_2 levels drop, pH elevates and can reach detrimental levels. The summer flows in the South Umpqua River are low, temperatures high, and algae bloom is a problem. This likely increases CO_2 consumption and elevates pH (refer to the Nutrients and algae section for more on this relationship).

Although strong correlations were made between high pH and low dissolved oxygen levels in the South Umpqua River, neither Jackson Creek nor Black Canyon Creek have been found to be low in dissolved oxygen indicating a different relationship, and there are no permitted point sources in either creek.

Physical and biological factors also cause surface and ground water pH to normally be slightly alkaline or acidic. The chemical composition of rocks and rainfall will influence pH.

Nutrients and Algae

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

High nutrient levels encourage the growth of algae and aquatic plants. Excessive algal and vegetative growth can result in little or no dissolved oxygen, and interfere with water contact recreation such as swimming. Certain types of algae (such as blue-green algae) produce by-products that are toxic to humans, wildlife, and livestock, as seen in Diamond Lake in the summer of 2002.[52]

There are no Umpqua Basin-based ODEQ values for acceptable stream nutrient levels at this time. The Oregon Watershed Enhancement Board recommends limits of 0.05 mg/l for total phosphorus, and 0.3 mg/l for total nitrate (including nitrites and nitrates). Analysis of data from 1976 to 2000 presented in the Lower South Umpqua River Watershed Assessment (Geyer 2003c) show low nitrate levels for most sites except the South Umpqua at Melrose Road, where eleven percent of the samples exceeded the 0.3 mg/l recommended standard. All sites monitored for phosphorus had samples exceeding the 0.05 mg/l recommended standard.

Table 2.D-8 shows the number and percent of lower South Umpqua River sites that were sampled more than once and exceeded OWEB's recommended phosphorus standard. All of these monitoring sites had a least 25 percent of samples exceeding 0.05 mg/l. Therefore, the South Umpqua River is 303(d) listed for phosphorus from the mouth to the confluence with Roberts Creek at river mile 15.9.

[52] Diamond Lake is within the North Umpqua sub-basin and the Umpqua National Forest in the extreme eastern portion of the Umpqua Basin.

South Umpqua River monitoring location	Total samples	Samples >0.05 mg/l	Percent of samples >0.05mg/l
Hwy 42 (Winston)	172	43	25%
Stewart Park Road (Roseburg)	104	28	27%
Melrose Road	174	149	86%
Winston/Green Wastewater treatment plant	8	5	63%
300 feet downstream from RUSA outfall[1]	3	3	100%
[1] Roseburg Urban Sanitary Authority Source: Lower South Umpqua Watershed Assessment (Geyer 2003c).			

Table 2.D-8: Number and percent of lower South Umpqua River phosphorus samples exceeding 0.05 mg/l.

Nutrients are strongly correlated with pH and dissolved oxygen in the production of algae. Consequently, the measure of nutrients in the river is difficult and often an underestimate since large amounts are taken up and stored within algal mats in the South Umpqua River (Tanner and Anderson 1996). The South Umpqua River is listed as water quality impaired for algae and aquatic weeds and for chlorophyll a from the mouth to river mile 57.7 near Days Creek.

Chlorophyll is a green pigment in plants used to absorb sunlight and convert it to sugar during photosynthesis. Chlorophyll a is the predominant type found in algae and cyanobacteria (blue-green algae), and its abundance is a good indicator of the amount of algae present. Excessive quantities of chlorophyll a can indicate the presence of algae blooms, usually consisting of a single species of algae that is undesirable for fish and other predators to consume. Unconsumed algae can sink to the bottom and decay, using up the oxygen required by other plants and benthic organisms to survive. The presence of too many nutrients, such as nitrogen and phosphorus, can stimulate algal blooms and result in reduced water clarity.[53]

In their study of nutrients, algae, and low flow conditions on the South Umpqua River, Tanner and Anderson (1996) relate algae production to nutrient uptake in the following:

> Nutrient uptake by periphytic algae is a function of many different chemical and physical factors, including stream velocity, substrate (attachment points for algal cells), light availability, and temperature.

They go on to characterize the South Umpqua River in the following manner:

> There is a downstream continuum of increasing algal growth and eutrophication during summer as the South Umpqua River flows from the

[53] Information on chlorophyll a is from the Aquatic Ecosystem Health website at *www.wsroc.com.au/wqm/* and from the Chesapeake Bay Water Program – Chlorophyll a and Water Clarity website at *www.chesapeakebay.net/wqcchlorophylla.htm*.

> Umpqua National Forest towards the mouth near Roseburg. The headwaters generally are clear, attached algal growth in most places is limited, concentrations of nutrients are low, and water temperatures are cool. In contrast, nearer to the mouth of the South Umpqua River, there are large and pervasive mats of periphyton, large amounts of sloughed and decaying algae drifting downstream, and warm water temperatures.

Tanner and Anderson determined that although five wastewater treatment plants were shown to contribute less than 15 percent of the flow in the South Umpqua River, they were responsible for more than 90 percent of the nitrogen and phosphorus during low summer flows. These nutrient inputs were strongly correlated and possibly responsible for the abundant periphytic algae growth that covered the rocky channel. The respiration of the abundant algae at night caused decreased dissolved oxygen concentrations to below the State standard of 90 percent saturation, and the day-time photosynthesis caused many areas to exceed the State pH standard of 8.5.

Tanner and Anderson suggest that reducing the dissolved-inorganic dissolved nitrogen and soluble-reactive phosphorus loads from wastewater treatment plant effluent, flow augmentation (although predicting the magnitude of the improvement is difficult), and storage of effluent from wastewater treatment plants during the summer months are possible alternatives to improve water quality conditions in the South Umpqua River.

Toxics

Toxics may be a concern for fish and aquatic life, drinking water, fishing, and human health. A variety of substances can be toxic including metals, and organic and inorganic chemicals. Some of these substances are found naturally in stream water. The State monitors toxic levels in the water so they are not introduced above natural background levels in amounts, concentrations, or combinations that may be harmful to public health, safety, or welfare; or detrimental to aquatic life, wildlife, or other beneficial uses of the stream. The South Umpqua River and Cow Creek are both considered water quality impaired for chlorine. In addition, the lowest 16 miles of the South Umpqua River below Green is listed for cadmium and arsenic. Several other stream segments are a potential concern for other toxic substances as well.

Chlorine

In 1998 the South Umpqua River from the mouth to river mile 51 near Canyonville and the lowest two miles of Cow Creek were added to the 303(d) list for chlorine. The beneficial uses affected by this toxicity are resident fish and aquatic life, anadromous fish passage, and drinking water. Chlorine is toxic to fish and aquatic life in very small concentrations. Chlorine becomes more toxic in low pH levels and in combination with other toxics, such as cyanide and ammonia. The South Umpqua River is considered low in pH and has been listed in the past for ammonia although it currently is attaining some criteria for ammonia and is not listed.

According to ODEQ, chlorine toxicity in the South Umpqua River was associated with major discharges from the Canyonville sewage treatment plant, and in Cow Creek, with discharges from the Riddle sewage treatment plant. In 2004, both listings were reclassified by ODEQ as water quality limited but not needing a TMDL because other control measures are in place that should alleviate the impairment. Permits for both treatment plants were renewed in 2004 and 2005 with limitations for chlorine and a compliance schedule to bring chlorine levels in each stream within acceptable levels by 2009.

Arsenic
Arsenic is a metal element that is naturally found in Oregon soils, volcanic rocks, and geothermic water sources. Beneficial uses affected by arsenic are fishing and drinking water. In 2002 the South Umpqua River was listed for arsenic in the lower 16 miles downriver from Green. Two of thirteen samples (15.4 percent) exceeded the State maximum standard of 0.0022 μg/l set for drinking water combined with fish ingestion.[54] In May, 2004 the State Environmental Quality Commission adopted a lower standard of 0.0018μg/l. However the new standard has not yet been adopted by EPA.

The Canada-based Environmental Bureau of Investigation characterizes arsenic in the following way:

> Arsenic is highly reactive and can easily undergo many chemical transformations. Most arsenic compounds can dissolve in water. Arsenic is easily adsorbed by iron and manganese and reacts with clay particles, which explains why it is often found in sediments. Some fish and shellfish can accumulate arsenic in their tissues, but mostly in a form non-toxic to humans.
>
> Arsenic is acutely toxic to animals and may cause death. In animals, the effects of chronic exposure may include shortened life expectancy, decrease in reproduction, and behavioral effects. Arsenic appears to be more toxic to aquatic species than land animals. Studies in animals show that doses of arsenic that are large enough to cause illness in pregnant females may cause low birth weight, fetal malformations, or even fetal death.[55]

Arsenic is known to exist in the soil and rock in the region but other possible sources of arsenic pollution in the South Umpqua River are unknown. According to OSHA common sources of exposure to higher-than-average levels of arsenic include near or in hazardous waste sites and areas with high levels naturally occurring in soil, rocks, and water.

Cadmium
The lower 16 miles of the South Umpqua River are also listed for cadmium. The listing is based on 3 of 15 samples (20 percent) that exceeded 0.66 μg/l. The beneficial uses affected by cadmium are resident fish and aquatic life. According to the Kentucky Department of Natural Resources' River Assessment Monitoring Project:

[54] The State standard for fish ingestion only was 0.0175μg/l.
[55] From the website of the Canada-based Environmental Bureau of Investigation.

> Cadmium is a non-essential element and it diminishes plant growth. It is considered a potential carcinogen. It also has been shown to cause toxic effects to the kidneys, bone defects, high blood pressure, and reproductive effects.[56]

The Environmental Bureau of Investigation in Canada summarizes the sources of cadmium in the environment in the following way:

> The largest source of cadmium release to the general environment is the burning of fossil fuels (such as coal or oil) or the incineration of municipal waste materials. Cadmium may also escape into the air from zinc, lead, or copper smelters. It can enter water from disposal of wastewater from households or industries. Fertilizers often contain some cadmium.[57]

According to the New York University Medical Center website when cadmium enters the air, it binds to small particles and then falls to the ground or water as rain or snow, and may contaminate fish, plants, and animals. Improper waste disposal and spills at hazardous waste sites may cause cadmium to leak into nearby water and soil.[58]

Several other toxics are considered a potential concern due to samples taken that did not meet water quality standards; however there was insufficient data to list these streams. They are not currently on the 303(d) list, but may warrant additional monitoring. They include Cow Creek for beryllium in the first 80 miles, Middle Creek (tributary to Cow Creek) for iron in the lowest 12.8 miles, and South Fork Middle Creek for nickel in the lowest 4.4 miles.

Iron, nickel, and beryllium, along with arsenic and cadmium are all metals. According to environmental toxicologists Hickey and Golding (2002):

> Metal pollution of streams and rivers is recognized as one of the major concerns for management of freshwaters. Although industrial and mining activities may be the most important sources of dissolved metals, urban runoff is an increasingly significant source. The chemical contaminant composition of urban runoff varies widely, including mixtures of metals and organics (e.g., polycyclic aromatic hydrocarbons), which together with suspended sediments and hydraulic stressors may adversely affect receiving-water communities. In addition, the bioavailability of metals in the receiving water is affected by numerous factors (e.g., pH, water hardness, and dissolved organic matter), which may modify toxicity in situ (p. 1854).

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[56] From the website of the Kentucky Bureau of Natural Resources.
[57] Source: Canada-based Environmental Bureau of Investigation website accessed on 1/17/07.
[58] Source: New York University Medical Center website accessed on 1/17/07.

Organic Compounds
Monitoring in the 1970s and 1980s detected six organic compounds. A general description of these toxics taken from the Lower South Umpqua Watershed Assessment and Action Plan (Geyer 2003c) are provided below.

From 1970 through 1980, the US Geological Survey sampled the South Umpqua River for organic compounds below the Roseburg Urban Sanitary Authority (RUSA) wastewater treatment plant. Organic compounds refer to carbon-based chemicals, which include herbicides, fungicides, and insecticides. In the past, these chemicals persisted in natural systems and sometimes impacted non-target plants, animals, and humans.

The following six organic compounds were detected in the South Umpqua River during the sampling period at levels below those considered hazardous to human health:

- [2,4-dichlorophenoxy] acetic acid (2,4-D);
- gamma-1,2,3,4,5,6-hexachlorocyclohexane (lindane);
- 2,4,5-trichlorophenoxypropionic acid (silvex);
- dieldrin;
- 2,4,5-trichlorophenoxyacetic acid (2,4,5-T); and
- polychlorinated biphenyls (PCBs).

Little is known about the non-lethal effects of these residual toxics in the watershed.

Use of all of these substances has been banned except for Lindane and 2,4-D. Lindane is an ingredient in fungicides and insecticides, including lotions, creams, and shampoos used to control lice and mites in humans. 2,4-D is an herbicide used to control many types of broadleaf weeds. It is used in cultivated agriculture, pasture and rangeland applications, forest management, domestic homes and gardens, and to control aquatic vegetation.

Sediment
Sediment includes both organic and inorganic material that enters the stream and eventually settles to the bottom. Those causing water quality concerns are typically fine particles that have the potential of forming a sludge layer on the streambed. This causes problems for fish and aquatic life since they use the gravel beds to spawn. The sludge layer can prevent water flow through gravel; thus preventing oxygen flow to redds.

Turbidity is a measure of water clarity and is closely related to sediment. High turbidity levels usually indicate large amounts of suspended sediment that can cause problems for aquatic life, water supply, and aesthetic quality. High turbidity levels can make it difficult for sight-feeding aquatic organisms to see and find food. It can also clog water filters and the respiratory structures of fish and other aquatic life. Suspended sediment is also a carrier of other pollutants including bacteria and toxins.

Elevated sediment or turbidity levels are often associated with streambank erosion that may be due to a host of activities or events. Construction of freeway, highway and access roads, involving fill slopes near waterways, can create a ready source of turbidity. Brush and tree removal along stream banks destroys root systems that resist hydraulic forces during high flows. Concentrated stream access for livestock watering can create localized sources of turbidity.

The upper portion of the South Umpqua River is currently listed as water quality impaired for sediment from river mile 80 to 102. The first 25 miles of Jackson Creek and the lowest 2.1 miles of Beaver Creek, a tributary to Jackson Creek are also currently listed. The listings are based on an evaluation by the US Forest Service in 1995 stating that habitat conditions for coho, sea-run cutthroat, and spring chinook are degraded due to “high cobble embeddedness” on Beaver Creek and “excessive fine sediment” on the South Umpqua River and Jackson Creek with evidence that these conditions are affecting biological communities. These evaluations coupled with the fact that coho and sea-run cutthroat trout, which were petitioned for listing under the Endangered Species Act, and an “at risk” stock of spring chinook occur in the stream. Neither coho nor cutthroat trout were listed at the time; however coho was recently listed in February, 2008 and there remain concerns for cutthroat trout and spring chinook populations in many areas of the Umpqua Basin. The West Fork Cow Creek is listed with a potential concern for sediment from the mouth to stream mile 22.2.

The Umpqua Basin TMDL does not address sediment. ODEQ states the following in regard to these listings:

> Extensive re-analysis of the data supporting the listings in light of recent scientific advances indicates that there is no clear evidence that sediment levels are impairing salmonid habitat or spawning. ODEQ is currently developing a new method of determining the condition of streambeds with respect to sedimentation. Until the Department completes this work, these three South Umpqua streams will remain on the 303(d) list and will be reassessed when data relevant to the new criteria have been collected.

Other Water Quality Concerns

The South Umpqua River and Cow Creek are listed for habitat modification and flow modification. Nine tributaries in Cow Creek are also listed for habitat modification impairment and three for flow modification. Streams listed for these two parameters are considered water quality impaired, however they do not require a TMDL since the impairment is not from a pollutant. They are usually caused by physical changes to the stream environment. They can be related to stream crossings that restrict or change flow patterns, streambank modification, vegetation changes or losses, and loss of streambed material from flooding or dredging.

These impairments are common throughout the Umpqua Basin. They can affect other parameters including sediment, dissolved oxygen, and temperature by increasing erosion and streamflow velocity, and decreasing shade. Loss of floodplain vegetation can also increase the rate of streamflow and decrease filtering of sediment and toxics. Efforts to improve fish passage and riparian conditions can help to improve these impairments.

Wastewater Permits
ODEQ manages a wastewater permit program that identifies point-sources of wastewater with potential serious water quality or public health impacts. It requires that those facilities obtain and comply with a wastewater discharge permit. Permit conditions generally include effluent limits; monitoring standards; compliance conditions to improve operation; special operating conditions; and other administrative requirements such as prompt reporting of spills.

Since 1973, permits for discharges to surface waters are issued under the National Pollutant Discharge Elimination System (NPDES). The primary purpose of these permits is to insure that wastewater discharges do not cause harm to the receiving waters or endanger public health. Wastewater discharges that affect land quality and/or ground water are regulated under Water Pollution Control Facilities (WPCF) permits. Their primary purpose is to protect public health and ground water.

General permits are issued when an individual permit is not necessary to adequately protect water quality, and there are several minor sources or activities involved in similar operations that are discharging similar types of waste. These general permits can be to surface water discharges or ground water/land discharges. Individual and general wastewater permits to surface water issued in the South Umpqua River and Cow Creek sub-basins are discussed in this section and listed in Table 2.D-9, Table 2.D-10, and Table 2.D-11. Permits for discharges that may affect ground water are discussed in the Ground Water Quality section.

South Umpqua River			
Source	**Receiving stream**	**River mile**	**Waste category**
Loosley Development Company LLC	South Umpqua River	7.58	stormwater
Bill Bertagna		7.60	stormwater
Roseburg Urban Sanitary Authority		7.65	stormwater & domestic
Oregon Dept. of Transportation		10.14	stormwater
Durham School Services, L.P.		10.24	industrial
Roseburg, City of		10.30	stormwater
Kaj LLC, A LLC of California		10.40	stormwater
Beckley Excavation and Utility, Inc.		10.54	stormwater
Roberson, Hutzel		10.90	stormwater
Hummelt Development Company		11.36	stormwater
Umpqua Dairy Products Co.		12.10	stormwater
Ross Bros. Construction, Inc.		12.54	stormwater
Douglas County Public Works		12.60	stormwater
Douglas County Public Works		14.09	industrial
Sun Studs, LLC		14.13	industrial
Lone Rock Timber Company (2)		15.20	industrial & stormwater
Sun Studs, LLC		15.20	stormwater
The Mentone Company, LLC		15.24	stormwater
United Parcel Service, Inc.		15.30	stormwater
McGovern Metals Co., Inc.		16.00	stormwater
Ronald Poteet		16.36	stormwater
Umpqua Community Development Corporation		17.98	stormwater
L.H. Broyhill, Inc.		18.04	stormwater
Hayden Enterprises, Inc.		18.67	stormwater
Hayden Enterprises, Inc.		18.72	stormwater
Hayden Enterprises, Inc.		19.02	stormwater
Winston Green Regional Treatment Facility		20.59	domestic
Winston Green Regional Treatment Facility		20.70	stormwater
Lance Short		21.96	stormwater
Hoover Treated Wood Products, Inc.		23.20	industrial
Siebum, Robert & Sara		23.70	stormwater
Hoover Treated Wood Products, Inc.		24.20	stormwater
Townes, Travis		24.53	stormwater
Roseburg Forest Products Co.		27.66	industrial
Roseburg Forest Products Co. (2)		28.10	stormwater & industrial

South Umpqua River (continued)			
Source	**Receiving stream**	**River mile**	**Waste category**
Umpqua Lumber Co.	South Umpqua River	31.31	industrial
LTM, Incorporated		30.61	stormwater
Umpqua Lumber Co. (2)		31.60	stormwater & industrial
Laidlaw Transit, Inc.		39.70	stormwater
Shirtcliff, John		42.97	industrial
Canyonville, City of		50.65	domestic
Shadow Ranch Mobile Park, Inc.		65.20	stormwater
Legacy Builders, Inc.		67.52	stormwater
USDA; Forest Service		74.70	domestic
Pacificorp		78.90	industrial
Theiss Roland		81.53	stormwater
( ) indicates the number of permits held if more than one. Source: ODEQ Wastewater Permits Database accessed 11/30/06.			

Table 2.D-9: Waste discharge permits for the South Umpqua River.

Point-source discharges include minor industrial sources such as stormwater and industrial wastewater discharges, as well as minor domestic sewage discharges. There are no major discharge permits in the South Umpqua River or Cow Creek sub-basins. There are 49 discharge permits into the South Umpqua River. Approximately 77 percent of those occur in the first 40 miles of the river. In addition, 32 permits are shown here on tributaries to the South Umpqua River, and many more large tributaries with numerous point-sources of discharge discussed in Section 2.E. join the South Umpqua River in this area. Cow Creek has 18 permits directly and two additional on tributaries. It merges with the South Umpqua River just above this lower 40-mile section at about river mile 46.

South Umpqua Tributaries			
Source	**Receiving stream**	**River mile**	**Waste category**
Roseburg Forest Products	Beals Creek	0.25	stormwater
Kent Creek Quarry, Inc.	Kent Creek	1.50	stormwater
D.R. Johnson Lumber Co.	Lane Creek	0.30	stormwater
C & D Lumber Co. (3)	Lane Creek	0.40	industrial & stormwater
Herbert, Milton DBA	Lane Creek	0.47	industrial
Herbert, Milton DBA	Lane Creek	1.10	stormwater
D.R. Johnson Lumber Co.	Lane Creek	1.13	industrial
Huffman and Wright Logging, Co.	Lick Creek	0.44	stormwater
Basco Bros. LLC	Newton Creek	2.11	stormwater
Tabor, Jerry	Newton Creek	2.36	stormwater
Vargas-Bozo, Inc.	Newton Creek	2.40	stormwater
Zahler, Norman	Newton Creek	2.45	stormwater
John Atkinson	unnamed trib to Newton Cr	0.45	stormwater
Tabor, Jerry	unnamed trib to Newton Cr	0.68	stormwater
LTM, Incorporated	Parrott Creek	0.22	stormwater
Clarks Branch Water Association	Richardson Creek	1.00	industrial
Pacific Trust	Roberts Creek	0.09	stormwater
Roseburg Forest Products	Roberts Creek	0.11	stormwater
LTM, Incorporated	Roberts Creek	0.52	stormwater
Earwood, Fred	Roberts Creek	1.39	stormwater
Erik Hellenthal	Roberts Creek	1.52	stormwater
LTM, Incorporated	Roberts Creek	8.07	stormwater
LTM, Incorporated	unnamed trib to Roberts Cr	0.66	stormwater
Sun Studs, LLC	unnamed trib to Roberts Cr	2.60	stormwater
Dunn, Scott	unnamed trib to S.Umpqua	0.35	stormwater
Westbrooks, Shawn & Jodi	unnamed trib to S.Umpqua	0.37	stormwater
Hy-Mt, LLC	unnamed trib to S.Umpqua	0.38	stormwater
Goat Rock Mining Corp.	unnamed trib to S.Umpqua	1.42	stormwater
Roseburg, City of	Sweetbrier Creek	0.73	stormwater
Sierra Construction Co.	Sweetbrier Creek	0.78	stormwater
( ) indicates the number of permits held if more than one. Source: ODEQ Wastewater Permits Database accessed 11/30/06.			

Table 2.D-10: Wastewater permits for tributaries of the South Umpqua River.[59]

[59] Does not include those tributaries in the Cow Creek sub-basin, or those assessed in the South Umpqua Tributaries sub-basins in Section 2.E.

Cow Creek sub-basin			
Source	**Receiving stream**	**River mile**	**Waste category**
Lookingglass Creek Estates LLC	Applegate Creek	0.29	stormwater
Arden Development, Inc.	Crawford Creek	0.50	industrial
Arden Inc., DBA Green Diamond Products	Cow Creek	2.28	stormwater
Riddle, City of	Cow Creek	1.90	domestic
Roseburg Forest Products Co.	Cow Creek	2.30	stormwater
Roseburg Forest Products Co.	Cow Creek	2.90	stormwater
Roseburg Forest Products Co.	Cow Creek	3.00	industrial
LTM, Incorporated	Cow Creek	6.29	stormwater
Superior Lumber, LLC (2)	Cow Creek	38.00	stormwater & industrial
Glendale, City of	Cow Creek	40.04	domestic
Superior Lumber Co.	Cow Creek	40.90	industrial
Superior Lumber Co.	Cow Creek	42.00	stormwater
( ) indicates the number of permits held if more than one. Source: ODEQ Wastewater Permits Database accessed 11/30/06.			

Table 2.D-11: Wastewater permits within the Cow Creek sub-basin.

The lower portion of the South Umpqua River travels through the highest populated areas in the Umpqua Basin and thus gets the heaviest use. The lower forty miles includes water quality impairments related to bacteria, temperature, dissolved oxygen, pH, phosphorus, algae, chlorine, arsenic, and cadmium. Many of the point source discharges are contributors to these problems in conjunction with non-point factors including low summer flows, and the geology and soils of the area.

Four permits on the South Umpqua River are for municipal domestic sewage treatment waste. These domestic waste permits discharge at widely spread intervals including river mile 7.65 for Roseburg (RUSA); 20.59 for Winston-Green; 50.65 for Canyonville; and 74.75 for the US Forest Service. There are also two domestic treatment plants on Cow Creek for Riddle and Glendale and one on North Myrtle for Myrtle Creek. The Myrtle Creek plant is on North Myrtle that eventually joins the South Umpqua River by way of Myrtle Creek at river mile 38. Cow Creek enters the South Umpqua system at about river mile 46, and the Riddle plant is just two miles up Cow Creek. The Glendale plant is more diluted by Cow Creek by the time it reaches the South Umpqua since it is located at Cow Creek stream mile 40.

The effluent from these treatment facilities has been determined a primary factor in increased nitrogen and phosphorus loads in the South Umpqua River (Tanner and Anderson 1996). This has led to additional water quality problems with algae, dissolved oxygen, and pH (see discussion by parameter in the previous section). The Riddle and Canyonville facilities were found to be factors in increased chlorine levels in the river through their effluent treatment practices. These two facilities recently renewed their discharge permits with ODEQ. The new permits outline limits to the levels of chlorine discharged over time. This is expected to improve water quality in the South Umpqua River in the next several years.[60]

Effluent discharges from eleven wastewater treatment plants throughout the Umpqua Basin will be required to meet temperature limits during the non-spawning season (typically summer months). These limits are established in the Umpqua Basin TMDL and are incorporated with permit renewals. Limits are based on streamflow, stream temperature, and amount of discharge. The intent is to maintain the cumulative temperature increase from point sources to less than 0.1°C during the non-spawning months to help meet the temperature standards on streams throughout the basin. Seven of these facilities are within the South Umpqua River and Cow Creek sub-basins and are shown in Table 2.D-12 with their effluent temperature limit. These limits are not only intended to help reduce stream temperatures within Cow Creek and the South Umpqua River but further contribute to lowering temperatures downriver in the main Umpqua River.

Wastewater treatment plants	Stream	Effluent temperature limit
Glendale WWTP	Cow Creek	30.3°C (86.5°F)
Riddle WWTP[1]	Cow Creek	32.0°C (89.6°F)
Myrtle Creek WWTP	South Umpqua River	30.0°C (86.0°F)
Canyonville WWTP[1]	South Umpqua River	32.0°C (89.6°F)
R.U.S.A. Roseburg WWTP	South Umpqua River	28.3°C (82.9°F)
Tiller Ranger Station[1]	South Umpqua River	32.0°C (89.6°F)
Winston-Green WWTP	South Umpqua River	32.0°C (89.6°F)

[1] Discharge temperature limited to 32°C to prevent acute impairment or instantaneous lethality to salmonids.
Source: Umpqua Basin TMDL (ODEQ 2006).

Table 2.D-12: Temperature limits for effluent discharges from wastewater treatment plants in the sub-basins.

The Cow Creek Band of the Umpqua Tribe of Indians has developed a freshwater supply and effluent treatment facility in the Jordan Creek drainage. The system is designed to meet the current sewage needs of its businesses in the Canyonville area. This will significantly reduce use of the City of Canyonville's wastewater treatment plant and supplement the wastewater treatment capacity of the City of Canyonville.

The Tribe's system is designed to pump sewage to a lagoon, treat it, and store it in a reservoir that will be used during the low flow season to supplement irrigation needs in the Jordan Creek sub-basin. Thus the inputs to the South Umpqua River will be reduced. Although agreements are not yet finalized, the intent of the new system will be to also treat sewage waste from the City of Canyonville's wastewater treatment facility during the low flow season when the treated effluent can be used for irrigation purposes and

[60] Information from the ODEQ wastewater permits database.

when low flows on the South Umpqua River are most likely to be negatively impacted by sewage waste discharge.

Surface Water – Lakes and Reservoirs

Quantity

In the South Umpqua and Cow Creek sub-basins, lakes and reservoirs with surface areas greater than five acres that show measurable in or outflow are listed in Table 2.D-13 with their storage capacity and use.

Name	Surface area (acres)	Volume (acre-feet)	Use
Buckeye Lake	11	210	public recreation
Creekside Freshwater Reservoir		385	quasi municipal
Creekside Effluent Reservoir		250	irrigation
Dollar Fish Pond	16	70	public recreation
Fish Lake	96	6,100	public recreation
Galesville Reservoir	630	42,225	irrigation, hydroelectric power, flood control, public recreation
Herbert County Park Pond	8	40	public recreation
Skookum Pond	16	80	public recreation
Triangle Lake	5	25	public recreation
Source: Lakes of Oregon, Volume 6, Douglas County, USGS; and Wayne Shammel, Cow Creek Band of the Umpqua Tribe of Indians.			

Table 2.D-13: Lakes and reservoirs over 5 acres with outflow in the South Umpqua River and Cow Creek sub-basins.

The Cow Creek Band of the Umpqua Tribe of Indians recently completed construction of the Creekside freshwater reservoir and Creekside effluent reservoir in a dry basin adjacent to Jordan Creek. The freshwater reservoir has a capacity of approximately 385 acre-feet. Water from the South Umpqua River is pumped uphill to supply the freshwater reservoir. The water is used for municipal use including commercial businesses owned by the Tribe.[61]

The effluent reservoir has an approximate capacity of 250 acre-feet. The freshwater reservoir is the source of water for the effluent reservoir. Water is pumped from the freshwater reservoir to a sewage lagoon for treatment of wastewater that is eventually stored in the effluent reservoir. The effluent reservoir water is designated for irrigation use during the low flow season.

[61] Some water is also provided to businesses such as the Best Western Hotel that is not owned by the Tribe. This is due to construction on I-5 that made it difficult for Canyonville to supply water to the opposite side of the freeway (personal communication 2/4/08, Wayne Shammel, General Manager, Cow Creek Band of the Umpqua Tribe of Indians).

The Cow Creek sub-basin has two reservoirs and no natural lakes over five acres in surface area. Dollar Fish Pond was created from an old log pond. The Galesville Reservoir, constructed in 1985 is formed by a roller compacted concrete dam. Miwaleta Park incorporates the reservoir and is operated by Douglas County. The park includes day-use facilities and a boat launching ramp. The rest of the lakes listed are in the South Umpqua sub-basin.

Quality

In the lakes in the South Umpqua sub-basin, lake-water quality is acceptable, although late summer algae blooms at the lower elevation sites hamper some recreational uses. The quality of water in Galesville Reservoir has been generally good for recreational purposes, although in 2001 the Oregon Health Division Fish Consumption Advisory issued a high mercury warning for the Galesville Reservoir. The warning gives recommended maximum fish consumption for resident fish caught from the reservoir to maintain human health. Although the warning addresses all people consuming fish from the reservoir, it is more serious for young children under six and pregnant women or women of child-bearing age.

Ground Water

Over 70 percent of all Oregon residents and 90 percent of all rural residents rely on ground water for drinking water (ODEQ 2003).[62] Industry and irrigation of agriculture and livestock are also dependent on ground water supplies. Base flow for most of the state's rivers, lakes, streams, and wetlands is from ground water sources. Cool groundwater inflow effectively cools streams during the summer months, often providing critical thermal refuge areas for sensitive freshwater species. The magnitude of this effect depends upon the ratio of the groundwater inflow to the amount of surface flow.

The dominant ground water use in Douglas County is for domestic purposes. It serves as the primary drinking water source for rural residents. As surface water sources are used to capacity, residents are becoming more dependent on ground water resources. These demands are expected to increase as the population of the County increases especially in rural areas. In the South Umpqua River and Cow Creek sub-basins, approximately 2,138 wells are currently identified as domestic use wells, while 11 are for community use, 43 for irrigation, 4 for industry, and 1 for livestock watering.

Quantity

Geologic conditions determine the accessibility and quantities of ground water. In this portion of the basin, five of the seven major areas of discrete geologic conditions, or aquifer units present in the County are encountered.

[62] Over 90 percent (2,459) of Oregon's public water supply systems get their water exclusively from ground water. Over 400,000 residents get their drinking water from individual home water supply wells.

1. Fluvial deposits occur along the South Umpqua River and major tributaries such as Cow Creek in its lower reaches. Permeability and recharge are relatively high in this aquifer. The water table is generally within 25 feet of the land surface, and well yields are generally less than 200 gpm. Where shallow wells are located in close proximity to stream channels, ground water-surface water interference is possible. Along Cow Creek, such interference could result in diversion of water released from Galesville Reservoir for other purposes.
2. Downstream of the mouth of Lookingglass Creek is the Marine Sedimentary aquifer unit comprised of Tertiary rocks. Well yields in this area are generally less than 20 gpm.
3. The South Umpqua drainage upstream of the mouth of Lookingglass Creek to the mouth of Jackson Creek, including all but the extreme upper portions of the Cow Creek drainage, is underlain by Mesozoic-Paleozoic bedrock of the Klamath Mountains. Well yields in this aquifer are typically less than 10 gpm.
4. A small portion of the Cow Creek drainage above Galesville Reservoir is included in the Granitic Saprolite of the Klamath Mountains. Well yields in this area may be as high as 50 gpm if drilled in areas of weathered rock. Although areas with un-weathered rock may produce much lower yields.
5. The South Umpqua drainage area above Jackson Creek is underlain by Tertiary volcanic rocks of the Western Cascade Range. Wells constructed in this aquifer generally yield less than 20 gpm.

Nearly all of the rural population of both sub-basins resides in areas underlain by the lower permeability aquifers. Those residences sited along major streams obtain water supplies from wells. Away from these valley floors, it is common for water to be obtained from springs or other surface water sources. In upland areas, wells are the primary water source.

Table 2.D-14 lists the number of wells by water yield in each sub-basin. Well yields in both sub-basins are widely distributed across the four yield categories, indicating wide distribution across the different aquifer units discussed above. Each sub-basin has the fewest number of wells in the >5 to 10 gpm category. Approximately 27 percent of those in the South Umpqua and 22 percent in the Cow Creek sub-basin yielded less than 1 gpm. This indicates that significant wells do not yield adequate water for even domestic needs without supplementing with other water sources or storage.

Area	Depth range (feet)	Number of wells by water yield (gpm)			
		<1	1 to 5	> 5 to 10	>10
South Umpqua	14 to 650	430	541	245	390
Cow Creek	20 to 700	111	127	75	190
Source: Oregon Water Resources Department (well data from 1925 to 2007).					

Table 2.D-14: Number of wells by water yield in the South Umpqua River and Cow Creek sub-basins.

Table 2.D-15 shows a comparison of well data from before and after 1980. The percentage of well yields less than 1 gpm in both sub-basins has risen 15 to 21 percent since 1980, while the percentage in all other yield categories has decreased. In addition, both areas show substantial increases in the depth of drilling. Deeper drilling combined with decreased yields may indicate that while many wells still meet domestic needs, the ground water level may be dropping in some areas. The South Umpqua River sub-basin shows a slight decrease in new wells abandoned while Cow Creek sub-basin has a slight increase. Many people may be using very low yield wells to supplement other water sources rather than abandoning the wells.

Category	South Umpqua River		Cow Creek	
	1925-1980	1981-2007	1954-1980	1981-2007
Total new wells	850	792	119	319
new wells abandoned	2 %	1 %	0 %	1 %
Yield (gpm)				
< 1	19 %	34 %	6 %	27 %
1 to 5	35 %	32 %	29 %	24 %
> 5 to 10	19 %	12 %	24 %	12 %
> 10	27 %	22 %	41 %	37 %
Depth drilled (feet)				
median depth	110	185	114	175
average depth	135	212	120	188
Source: Oregon Water Resources Department				

Table 2.D-15: Comparison of well data before and after 1980 for areas within the South Umpqua River and Cow Creek sub-basins.

Quality

The quality of ground water resources in the sub-basins is generally acceptable for all uses. Shallow wells less than 25 feet deep in the Fluvial deposits may be susceptible to contamination from surface sources and must be carefully monitored. Some wells in the Tertiary rocks of the Coast Range aquifer provide water with high hydrogen sulfide content (rotten-egg odor), and with high iron bacteria (rust). While unpleasant, the levels of either constituent generally are not at harmful concentrations. Water from a few wells in the Melrose area contains high chloride concentrations.

Table 2.D-16 shows analysis of 14 well samples taken by the USGS in the South Umpqua River sub-basin from 1972 to 1976. Of the constituents listed, fluoride, arsenic, and nitrate are considered to have standards that when exceeded, are not suitable for human health. Fluoride is beneficial in moderate amounts because it retards dental decay, but in concentrations of more than several milligrams per liter can eventually cause darkening or mottling of children's teeth. In excess of 4 mg/l it may lead to bone disease including pain and tenderness of the bones. Arsenic, in concentrations greater than 0.01 mg/l is considered grounds for rejection of the water supply. Large amounts of nitrate can cause methemoglobinemia (blue baby effect) in infants.

Exposure to high boron concentrations may cause male reproductive problems. Although there is no current EPA or Oregon standard for boron, the World Health Organization recommends a maximum of 0.5 mg/l in drinking water. The remaining constituents when present above the recommended standards may affect the aesthetic quality and public's acceptance of drinking water.

Constituent	Standard (mg/l)	Number of wells exceeding standard
Iron (Fe)	0.3	1
Manganese (Mn)	0.05	3
Sulfate (SO_4)	250	0
Chloride (Cl)	250	2
Fluoride (F)[1]	2.0	0
Arsenic (As)	0.01	0
Nitrate + Nitrite expressed as N	10	0
Sodium (Na)[2]	20	10
Boron (B)[3]	0.5	3

[1] The current standard for fluoride is 2.0 mg/l for children under 9 years and 4 mg/l for all other individuals.
[2] The standard for sodium is not a requirement but a recommendation as levels above 20 mg/l may cause an unacceptable salt taste in the water for many people.
[3] There is currently no recommended standard for boron by the EPA or the State of Oregon. However the World Health Organization currently recommends an upper limit of 0.5 mg/l in drinking water.
Source: USGS Water Resources Department

Table 2.D-16: Ground water quality of 14 sampled wells from 1972 to 1976 in the South Umpqua River sub-basin.

According to the Oregon Department of Human Services, six wells used for public drinking water in the sub-basins showed elevated sodium levels ranging from 20.9 to 313 mg/l. There is no standard level for sodium although a recommended level for aesthetic quality has been set at 20 mg/l by EPA. Elevated sodium in drinking water does not pose a human health risk but can make the water unacceptable to many users. In addition, one well tested in 1996 in Riddle exceeded the 2.0 mg/l standard for Barium with a result of 4.75 mg/l. Barium may cause gastrointestinal disturbances and muscular weakness from short-term high exposure or high blood pressure from long-term high exposure.

2.D.2. Water Use

The following material discusses current and future water use in this portion of Douglas County. Water use purposes considered include municipal, rural domestic, industrial, irrigation, aquatic life, recreation and hydroelectric power. Analyses and more detailed discussion of municipal, rural domestic and industrial water use are included in Appendix M. Irrigation water use is analyzed in Appendix I, and water use needs for Aquatic Life are discussed in Appendix F.

Current

For purposes of this report, the measure of current water use is derived from water use reports showing raw water diversion by each water district and by water rights information provided by the Oregon Water Resources Department. Some water use report information was also obtained from individual water service providers.

The priority date of a water right of record is the governing factor during times of water shortage. If priority dates are the same, then domestic use has preference over all other uses; agricultural purposes are next in line; and all other uses follow. For information on Oregon water law and the 1909 water code, refer to Water Use in Section 2.A.2.

Municipal

Appendix M contains the derivation of water needs for municipal water use in the sub-basins. The information on current municipal water use is summarized in this section for each of the water providers within the sub-basins.

<u>South Umpqua River</u>

Roberts Creek Water District
The Roberts Creek Water District provides water service to the community of Green and to rural residents located upstream along Roberts Creek. The estimated 2006 population served by the district is 7,483 people. Average annual use for water years 2000 to 2006 was 410 million gallons per year. The average daily use in 2006 was 150 gallons per capita day, less than the County average of 187 gallons per capita day. Peak use occurs in July with an average of 310 gallons per capita day, requiring a diversion of 1,207 gallons per minute.

Roberts Creek Water District has water rights that total 2,160 gallons per minute with priority dates of 1948, 1952, and 1973; all senior to most of the instream flow rights on the South Umpqua River.[63] The 1952 right of 65 gallons per minute is only available during the summer. The City of Roseburg also has a 1977 water right on the North Umpqua River of 449 gallons per minute that is specifically designated to be used by the Roberts Creek Water District. The District has a total useable water right of 2,609 gallons per minute for the summer months and 2,545 gallons per minute for the rest of the year. The water rights are adequate to meet current demand.

Winston-Dillard Water District
The estimated population provided water in 2006 by the Winston Dillard Water District was 5,742 people, with an average per capita daily use of 139 gallons per capita day. Annual water use for the district for the last seven years (2000 to 2006) averaged 297 million gallons per year. The peak per capita use over the same period is estimated to be 291 gallons per capita day. This peak rate requires a diversion in July of 1,207 gallons per minute.

[63] There is a small instream flow right from 1958.

The District has water rights to divert 1,867 gallons per minute from the South Umpqua River and another 898 gallons per minute are diverted by the City of Roseburg from the North Umpqua River and used by Winston-Dillard. Total rights are 2,765 gallons per minute. However, only 1,867 gallons per minute are considered reliable in August due to low flow conditions that have caused curtailment of some of the rights from the South Umpqua River. Current reliable water rights are adequate to meet current demand.

City of Myrtle Creek

In 2006, the City of Myrtle Creek provided water service to an estimated population of 3,409 people. Average annual use was 177.1 million gallons per year and the average daily use per person between 2000 and 2006 was 147 gallons per capita day. The peak daily use was estimated at 309 gallons per capita day. This peak rate requires diversion of 587 gallons per minute during the month of July.

Myrtle Creek has water rights totaling 3,552 gallons per minute, of which 1,872 are senior to all instream flow rights in the South Umpqua River. The 1978 water right of 680 gallons per minute is primarily from an unnamed tributary to Harrison Young Branch in the North Myrtle Creek system.[64] This right is junior to downstream South Umpqua River 1974 instream rights, making it an unreliable source. The 1993 water right of 1,001 gallons per minute is only available January 1st through March 31st. During the summer low flow months on the South Umpqua River, 1,872 gallons per minute is considered from reliable sources not likely to be curtailed. Current rights are adequate to meet current municipal water use needs.

Tri City Water District

The Tri City Water District serves the urban unincorporated area of Tri City. The estimated 2006 population of the district is 3,810 people. Average annual water use for 2000 through 2006 was 197.3 million gallons per year. The per capita daily average is only 137 gallons per capita day, and peak daily use is estimated at 283 gallons per capita day during July and August. The peak rate (283 gallons per capita day) is substantially lower than the County average of 372 gallons per capita day. The required diversion to meet the peak monthly demand is 561 gallons per minute during July.

The District has water rights with priority dates of 1952 and 1956 that total 648 gallons per minute of which 56 gallons per minute are only available during the irrigation season.[65] The District also has a right to divert up to 1,346 gallons per minute with a priority date of 1973, and up to 191 gallons per minute with priority 1979. Due to the flow regime in the South Umpqua River, the 1979 right is considered unreliable during July through October and the 1973 right is unreliable in August and September, leaving the District with a total reliable right of only 649 gallons per minute during August and September. The District also currently purchases 95 acre-feet of water from Galesville Reservoir. The existing reliable water rights are adequate to meet current demand.

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[64] An unnamed stream provides 600 gpm of this right while eight unnamed springs provide an additional 80 gpm of this right.

[65] The Tri City Water District recently transferred 143.6 gpm of irrigation rights to municipal use under a priority of 1956 increasing that right from 449 gpm previously.

Cow Creek

City of Riddle
The City of Riddle diverts water from Cow Creek and several tributaries of Cow Creek to serve an estimated 2006 population of 1,720 people. Average use for the last seven years is estimated at 182 gallons per capita day, similar to the average for Douglas County (186 gallons per capita day). The projected peak use per person is 381 gallons per capita day during the month of July. Peak diversion for the month averages 276 gallons per minute to meet the demand.

The City has water rights that total 2,581 gallons per minute with priority dates of 1909, 1912, 1947, and 1980.[66] The 1,346 gallons per minute from the 1980 right is junior to 1958 and 1974 minimum instream flows. Due to the flow regime in Cow Creek the 1980 right is considered unreliable during the months of July through October. This reduces the current rights to 1,234 gallons per minute during the peak use period, ample to meet current peak demand. The City also purchases 10 acre-feet of water from Galesville Reservoir.

South Umpqua Water Association
The South Umpqua Water Association serves an estimated 2006 population of 795 people. The service area is mostly outside Riddle with some customers near Canyonville. Average daily use per person is estimated at only 76 gallons per capita day, and the projected peak use per person is 157 gallons per capita day. This is substantially lower than all of the other municipalities and water districts. The population is rural, and the use is quasi-municipal indicating some use is likely a mix of domestic and other uses such as irrigation of yards and small gardens rather than strictly municipal. Rural customers often have well water and use of the Association water is supplemental to developed wells or springs on the property, which is likely contributing to the very low average per capita use.

The Association has a 1970 water right for 301 gallons per minute from Cow Creek that is diverted by the City of Riddle and sent to the Water Association. This water right is junior to 1958 minimum instream flows on Cow Creek and is not considered reliable in the month of August. Current water rights are adequate to meet demand in all other months. The South Umpqua Water Association purchases up to 30 acre-feet from Galesville Reservoir to meet demand in August when low flows may curtail the water right.

City of Glendale
The estimated 2006 population served by the Glendale Water District is 1,029 people. Average annual use is 66.3 million gallons per year, and the average use per person is 190 gallons per capita day. Peak daily use per person in July is estimated at 394 gallons per capita day, requiring an average diversion of 156 gallons per minute during the month to meet demand.

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[66] The City also diverts water for the South Umpqua Water Association's 1970 water right. That water right is shown in the assessment of water for the South Umpqua Water Association.

The City of Glendale diverts water directly from Cow Creek and from several small Cow Creek tributaries including Mill Creek, Section Creek, and Stranns Spring. The City has developed a two-acre reservoir on Section Creek and another two-acre reservoir on Mill Creek. The total water rights for the City of Glendale amount to 1,445 gallons per minute. However, due to the flow regimes in Mill and Section creeks, available water from those sources amounts to only about 45 gallons per minute during the low flow period. In addition, the Cow Creek water right is junior to minimum instream flows from 1958 and is not reliable during low flow periods. Consequently during the summer from July through September, the current water rights amount to only 269 gallons per minute plus the 4 acre-feet of storage in the reservoirs. This reliable water right is adequate to meet current demand.

Rural Domestic

The South Umpqua River/Cow Creek sub-basins have the highest concentration of the County's population but the lowest percentage of rural domestic users with fewer than 12 percent depending on ground water or domestic surface rights. Although a small percentage, this still amounts to over 5,700 people. Approximately 1,061 of these users are thought to obtain water via domestic surface water rights while the remaining over 4,600 are likely to obtain water from ground water sources and some truck-hauled water.

Concentrations of rural domestic water users occur all along the South Umpqua River with most residing between Roseburg and Canyonville. Some domestic use however continues upriver to the confluence with Dumont Creek. Elk Creek also has somewhat sparse but continuous development. Cow Creek has concentrated rural domestic development from east of Glendale to the Galesville Dam with concentrations near Fortune Branch, Galesville, and Azalea. Somewhat sparse development continues up Cow Creek above the dam. An area with over 100 people also occurs south of the dam near Cedar Springs Mountain.

In the Cow Creek sub-basin, residents of Azalea obtain water from individually owned springs and/or wells. Residents of the community of Tiller in the South Umpqua sub-basin obtain water from individually owned springs and/or wells. The USFS headquarters has a treatment plant and obtains water from the South Umpqua River. Days Creek residents also are supplied by individual wells or springs, although Milo Academy treats water diverted from the South Umpqua River.

Industrial

Much of the approximately 3,130 acres of land designated for industrial use in the rural unincorporated areas of Douglas County occurs along the South Umpqua River below the confluence with Cow Creek. There are two county-developed industrial parks within the sub-basins. South of Roseburg in the Oak Creek Industrial Park, Ingram Book Distribution Center is the only industry currently established. In the South Umpqua Valley Industrial Park near Riddle, Roseburg Trailer Works and WinCo Foods are operating. Alfa Leisure, a manufacturer of recreational vehicles is currently planning to occupy the last available space at this site. In addition, most cities have some industrial zone development and many have city water rights for industrial use.

Water rights for commercial and industrial purposes exist along both Cow Creek and the South Umpqua River. There are currently 8,136 gallons per minute in existing industrial water rights on the South Umpqua River. The vast majority occur along the South Umpqua River between the confluence with Brockway and with Cow Creek. Most rights are for wood products manufacturing, log storage and pond maintenance, gravel manufacturing, and fire suppression. Approximately 3,842 gallons per minute of industrial water rights are held by Roseburg Forest Products.

Industrial rights on Cow Creek total 5,682 gallons per minute. Primary uses are for wood product manufacturing, railroad use, mining-primarily nickel, and road construction work by the County. In the Cow Creek sub-basin rights for mining purposes total about 88 cfs (over 39,000 gallons per minute) from all tributaries. Many of these rights are non-consumptive (water goes back into the stream) and many are no longer active. The primary nickel mine has shutdown. Consequently, many of the industrial water rights for mining are no longer used. However, the water rights are still on record, and some water is used for processing industrial abrasives. Industrial water rights on the South Umpqua River and Cow Creek are listed in Table 2.D-17.

The South Umpqua River has minimum instream flow rights with priority dates of 1958, 1974, 1983, and 1991 depending on the section of river. Over 40 percent of the industrial water rights are senior to all instream flow rights and over 80 percent are senior to the 1974 instream rights. Some of the more recent water rights are not held during the summer peak season and water is purchased from Galesville Reservoir to supplement during that time. Cow Creek also has minimum instream flows for 1958 and 1974. Approximately 61 percent of the industrial rights are senior to all instream rights and 68 percent are senior to the 1974 requirement.

Stream source	Water rights (gpm)	Permit type
Above Days Creek	457	commercial service station, café and apartment complex, and industrial quartz and silica wash
Days Creek to Cow Creek	583	manufacturing, log pond maintenance
Cow Creek to Brockway	5,651	manufacturing, mill and log pond maintenance, fire suppression, gravel plant, commercial meat packing
Brockway to the mouth	1,445	log pond maintenance and County industrial rights
South Umpqua River sub-total	**8,136**	
Upper Cow Creek	2,096	wood product manufacturing, railroad use, road construction
Lower Cow Creek	3,586	wood product manufacturing and log pond, railroad use, mining
Cow Creek sub-total	**5,682**	
Total	**13,818**	

Table 2.D-17: Industrial water rights on the South Umpqua River and Cow Creek.

Irrigation

There are water rights allowing diversion from mainstem Cow Creek for irrigation of nearly 3,900 acres in the Cow Creek sub-basin. Over 2,100 acres are irrigated under rights acquired prior to 1958, the year of the initial minimum instream flow rights established by the State of Oregon.

From mainstem South Umpqua, 9,030 acres have irrigation water rights. Almost 4,000 acres are irrigated under rights acquired prior to 1958. Table 2.D-18 summarizes the acres in each area with current irrigation water rights by priority date. Complete information is included in Appendix I.

Galesville Reservoir has contracts for purchased irrigation water that total 2,223 acres as of October 2007. Of this amount 1,377 acres are irrigated from South Umpqua River diversions and 340 acres come from Cow Creek. The remaining 506 acres are irrigated from main Umpqua River diversions. The total cfs under purchase is 23.34.

The State of Oregon establishes the irrigation season and maximum annual diversion (duty) for irrigation water rights. The season for most of the Umpqua Basin runs from March 1 through October 31. However, the season on Roberts Creek is May 15 to September 15 and on Cow Creek is April 1 through October 1. The duty is 2.5 acre-feet per acre per season for most of the basin, although the Cow Creek Decree allows 3.5 acre-feet per acre per season.

Reach	Existing irrigated acres by priority date					
	Pre 1958	1958-74	1974-83	1983-91	1991-2007	Total
South Umpqua River						
above Days Creek	395	413	59	1	0	868
Days Cr to Cow Cr	754	714	586	639	0	2,693
Cow Cr to Brockway Cr	1,126	390	187	155	0	1,858
Brockway Cr to mouth	1,720	1,031	837	22	1	3,611
Total S Umpqua River	3,995	2,548	1,669	817	1	9,030
Cow Creek						
Upper Cow Creek[1]	1,674	217	611	7	0	2,509
Lower Cow Creek[1]	430	172	148	631	0	1,381
Total Cow Creek	2,104	389	759	638	0	3,890

[1] Upper and lower Cow Creek are divided at the confluence of West Fork Cow Creek.
Source: Oregon Department of Water Resources, 2007 – see Appendix I

Table 2.D-18: Acres with existing irrigation water rights by priority date (South Umpqua River/Cow Creek sub-basins).

Table 2.D-19 shows the maximum allowable diversions in acre-feet for each area within the sub-basins and the distribution of the diversions by month. Annual diversions are calculated at 2.5 acre-feet per acre per season in the South Umpqua River areas and 3.5 acre-feet per acre in the Cow Creek areas. The monthly percent distribution of water need is based on crop distribution in Douglas County and expected water needs for each crop throughout the year. Appendix I contains data on water requirements for irrigated crops, and calculations for the monthly percent distributions.

Month	Percent	South Umpqua River[1]				Cow Creek[2]	
		above Days Cr	Days Cr to Cow Cr	Cow Cr to Brockway	Brockway to mouth	upper	lower
Existing acres		*868*	*2,693*	*1,858*	*3,611*	*2,509*	*1,381*
Mar	0.5	10	34	23	45	44	24
Apr	4.4	95	296	204	397	386	213
May	11.4	247	767	529	1,029	1,001	551
Jun	18.6	403	1,252	864	1,679	1,633	899
Jul	28.5	618	1,919	1,324	2,573	2,503	1,377
Aug	22.9	497	1,542	1,064	2,067	2,011	1,107
Sep	12.6	273	848	585	1,138	1,203	662
Oct[3]	1.1	24	74	51	99	---	---
Total	100.0	2,169	6,732	4,644	9,027	8,781	4,833

[1] Based on 2.5 acre-feet per acre per year
[2] Based on 3.5 acre-feet per acre per year.
[3] Water need added to September in the Cow Creek sub-basin due to the shorter irrigation season.
Source: See Appendix I for calculations.

Table 2.D-19: Monthly irrigation water requirements in acre-feet for each area.

The calculated average crop water needs show a small portion of water (about 1 percent) is required in October for grapes and pasture land. Since the season in Cow Creek does not include October, the 1 percent is added to September's requirement in the Cow Creek sub-basin.

Aquatic Life

Instream Flow

Water use by aquatic life is expressed by State of Oregon minimum flows. Minimum flows vary through the year to meet the needs of aquatic life. Minimum flows at selected locations within the South Umpqua River and Cow Creek sub-basins are listed in Table 2.D-20 and Table 2.D-21 with the priority dates when they were established.

Time of year	South Umpqua River (cfs)				
	Elk Creek to Cow Creek		Brockway to the mouth		
	3/26/74	1/10/91	10/24/58	3/26/74	11/3/83
October					
1 to 15	80	110	60	90	122
16 to 31	180	110	60	300	300
November	300	425	60	400	400
December	250	425	60	350	350
January	250	425	60	350	350
February	250	425	60	350	350
March	250	425	60	350	350
April	250	425	60	350	350
May	180	250	60	275	275
June	140	168	60	225	225
July	90	154	60	150	150
August	60	82.5	60	90	122
September	60	72.9	60	90	122
Source: State of Oregon Water Resources Department database.					

Table 2.D-20: Minimum instream flows to support aquatic life in portions of the South Umpqua River with priority dates of right.

Time of year	Cow Creek (cfs)				
	Gage 14-3090 (at stream mile 58.2) to Windy Cr		Windy Cr to Middle Cr	Middle Creek to the mouth	
	3/26/74	8/21/90[1]	3/26/74	10/24/58	3/26/74
October					
1 to 15	10	10	30	11	30
16 to 31	30	30	50	11	80
November	60	0	70	11	150
December	60	0	70	11	150
January	60	0	70	11	135
February	60	0	70	11	135
March	60	0	70	11	135
April	60	0	70	11	135
May	40	0	50	11	100
June	20	20	35	11	70
July	10	10	20	11	50
August	10	10	20	11	20
September	10	10	20	11	20

[1] 1990 rights were added with the source being stored water from Galesville Dam released into Cow Creek.
Source: State of Oregon Water Resources Department database.

Table 2.D-21: Minimum instream flows to support aquatic life in portions of Cow Creek with priority dates of right.

The Instream Water Rights Act was passed in 1987, allowing agencies to apply for instream water rights to protect recreation, water quality, and fish and wildlife habitat. Prior to establishment of this act, the Oregon Water Resources Department established minimum flows through the administrative rule making process. Minimum flow values specified in a rule, or "basin program," were not water rights but were administered as such by the Department. These established flows became instream water rights subsequent to passage of the 1987 Act. Thus water rights allowing direct diversion that have been obtained after the date of establishment of a minimum flow are subject to curtailment as stream flow amounts decrease below that specified minimum flow rate. However, when the junior right includes a "household use" component as with domestic or municipal rights, that amount of use has preference over the minimum flows.

In the case of a reservoir constructed after establishment of a minimum flow, the minimum flow must be released at all times, unless inflow to the reservoir is less than the specified minimum, in which case the amount of inflow must be released. Either type of water right senior to the date of establishment of a minimum flow is not subject to curtailment to meet minimum flows.

The County augments streamflow using Galesville Reservoir. The storage allocation within the reservoir for streamflow augmentation is 4,000 acre-feet. The County releases water to meet minimum streamflow requirements when low streamflow conditions downstream warrant the need.

Fish Abundance and Distribution

Anadromous and resident fish species use the mainstem Umpqua River, and the North and South Umpqua rivers for spawning, passage, and rearing. Species of major importance in the South Umpqua River sub-basin include sea-run cutthroat trout, fall chinook, spring chinook, coho and winter steelhead. Non-anadromous species such as resident rainbow and cutthroat trout also are present. In addition, small-mouth bass were illegally introduced to the South Umpqua sub-basin in the 1960s and have become an established non-native species that contributes a significant fishery in the lower South Umpqua River during the summer months.

Total counts of anadromous species in the South Umpqua sub-basin are not available because of a lack of counting facilities. The ODFW estimated numbers of spawners basin-wide in 1976 and additional limited data are available to characterize the present situation.[67] Fish populations fluctuate widely and supplementation programs may influence the abundance of fish.

Table 2.D-22 shows the general pattern of spawner distribution estimates from 1976 in the mainstem Umpqua, North Umpqua, South Umpqua, and Smith rivers for comparison. The South Umpqua River and tributaries contributed about 14 percent of the total basin-wide spawner estimates, and were dominated by coho and winter steelhead. No summer steelhead were reported. Spring and fall chinook using the South Umpqua comprised about 8 and 6 percent respectively of the total spawner estimates in the South Umpqua River and tributaries.

Species	Mainstem Umpqua	Smith River	North Umpqua	South Umpqua	Total
Spring chinook	150	0	5,650	500	**6,300**
Fall chinook	750	305	26	404	**1,485**
Coho	7,779	2,980	592	1,854	**13,209**
Summer steelhead	200	0	6,532	0	**6,732**
Winter steelhead	4,282	0	5,807	3,723	**17,817**
Total	**13,161**	**7,290**	**18,697**	**6,481**	**45,543**
Source: ODFW 1976 unpublished; 1989 Douglas County Water Management Plan.					

Table 2.D-22: Estimated spawner populations in the Umpqua Basin in 1976.

An estimated 6,481 anadromous fish spawned in the South Umpqua River sub-basin including all tributaries. Approximately 25 percent spawned in the mainstem South Umpqua River and 75 percent in its tributaries. Cow Creek, the largest tributary, supported about 33 percent of the spawners in the sub-basin according to the 1976 estimates. The distribution by species occurring in Cow Creek is shown in Table 2.D-23.

[67] The data are unpublished estimates that have not been verified. It is used here solely for comparative purposes and not to indicate precise numbers of spawners.

Species	South Umpqua and tributaries	Cow Creek
Spring chinook	500	0
Fall chinook	404	54
Coho	1,854	565
Winter steelhead	3,723	1,548
Total	**6,481**	**2,167**
Source: ODFW 1976 unpublished; 1989 Douglas County Water Management Plan.		

Table 2.D-23: Spawning estimates from 1976 by species in the South Umpqua River and tributaries.

Distribution and abundance varies by area. For example, winter steelhead and coho primarily use tributaries to the South Umpqua River. These two species represent about 75 percent of the spawning population estimated in 1976 in the South Umpqua sub-basin. About 79 percent of the estimated coho spawning occurred in the tributaries and only 21 percent in the South Umpqua River. Winter steelhead spawn primarily in the tributaries with only about 13 percent occurring in the South Umpqua River.

Winter steelhead numbers currently average about 8,100 fish, of which about 40 percent are of hatchery origin. About 90,000 smolts are released annually into the South Umpqua River near the confluence with Canyon Creek. The adults use the South Umpqua River above Tiller and a majority of the tributaries in the sub-basin, but do not use the lower South Umpqua except for migration. About 60,000 hatchery coho salmon smolts and eggs reared in hatch boxes at various locations in the South Umpqua tributaries are released into Cow Creek below Galesville Dam to provide a return adult fishery and to provide broodstock for spawning in tributaries above Tiller. Galesville Reservoir supports a trout and warm-water fishery. Excess hatchery coho and winter steelhead are also released into the reservoir to complement the fishery.

Based on the 1976 estimates for the South Umpqua sub-basin, spring chinook occur only in the South Umpqua River along with most (87 percent) of the fall chinook. A few fall chinook (54) were estimated to spawn in Cow Creek. The total estimates for spring and fall chinook were only 500 and 454 spawners respectively. See Appendix F for the distribution of spawners by species and stream.

The estimated abundance of various species has increased in some cases dramatically since 1976. Fall chinook are now estimated to number between 10,000 and 11,000 fish with about 50 percent in the South Umpqua River between Roseburg and Days Creek, and the rest in the Cow Creek sub-basin. The increases are attributed to recovery of habitat conditions by reduced siltation; increased numbers of fish returning from the ocean; and improved flow and temperature conditions within both the South Umpqua River and Cow Creek sub-basins due to the operation of Galesville Reservoir. Spring chinook averaged about 152 fish from 2000 to 2002 based on scuba dive counts. They occur primarily in the upper South Umpqua River above Tiller. Redd counts from 1980 to 2001 illustrated in Figure 2.D.4 show that the run is building.

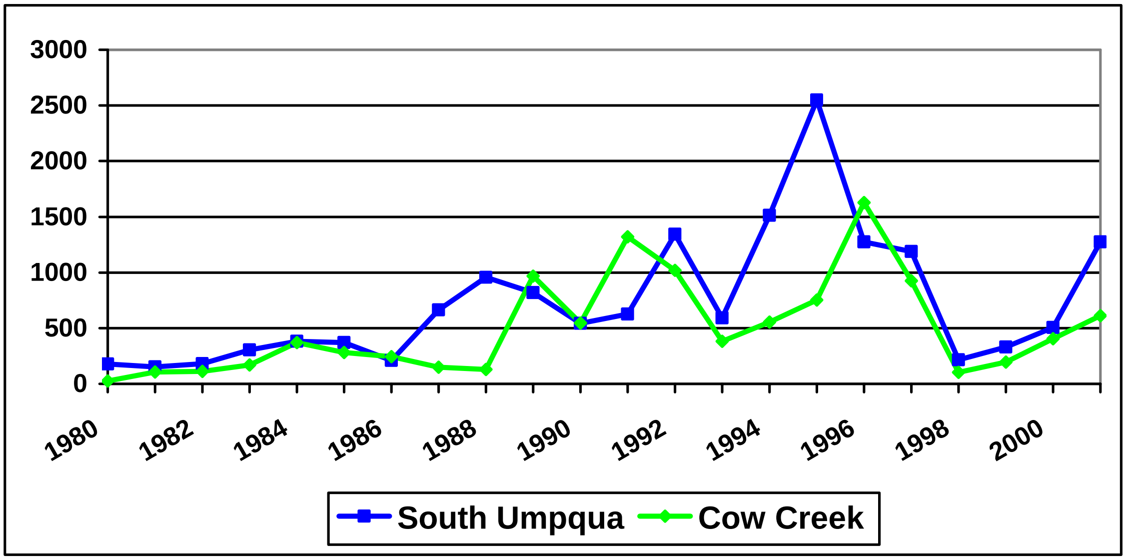

Figure 2.D.4: Fall chinook redd counts from 1980 through 2001 (Moyer et al 2003).

Although fish are found in all tributaries, Cow Creek is one of the primary stream systems that support salmonids. However, survey data in Cow Creek is limited. Summer steelhead and spring chinook are not reported, and although coho salmon and winter steelhead are known to use the system, no detailed surveys exist for these species in the Cow Creek sub-basin. About 7,000 fall chinook spawn in Cow Creek.

Anadromous species are passing through the South Umpqua/Cow Creek sub-basins in all months of the year. Winter steelhead begin moving through the system in June and continue until mid-January. Fall chinook appear in mid-August and are moving through the sub-basins until late October, whereas spring chinook are migrating from early February through June. Sea-run cutthroat begin moving in early May and continue moving until early February. Coho are making passage during September through mid-November. In addition, resident small-mouth bass spawn in the sub-basins in May and June. Thus it is important that water quality conditions remain within limits tolerable to anadromous species during the entire year.

Fishery Concerns

Inadequate flows and elevated water temperatures especially in the lower mainstem South Umpqua River and most tributaries are primary factors affecting migration and rearing of salmonids. In addition, adequate pools for rearing and gravels for spawning generally are in low supply. Fish passage barriers from inadequate culverts in many areas prevent access to fish habitat for anadromous species.

The Coho Viability Assessment Final Report (Nicholas et al. 2005) identified separate coho population areas for assessment purposes. The report lists the primary and secondary life cycle bottlenecks to coho populations in the South Umpqua population area, which includes the South Umpqua River, Cow Creek, and all tributary sub-basins. These bottlenecks are listed in Table 2.D-24.

Population Area	Primary bottleneck	Secondary bottleneck
South Umpqua	water quantity	stream complexity and water quality
Source: Coho Assessment Part 1:Synthesis (Nicholas et al 2005)		

Table 2.D-24: Primary and secondary life cycle bottlenecks for the South Umpqua coho population area.

Although water quantity has been improved since the operations of Galesville Reservoir began operation in 1986, low streamflow in the South Umpqua River and most tributaries is still the primary bottleneck to coho productivity in the sub-basin. Streams experience very low flows in the hot summer months when precipitation and runoff is low and water user demand is high. Low flows in the main river contribute to higher water temperatures, slow moving water, and algae blooms. These conditions promote elevated pH and low dissolved oxygen levels creating water quality problems for fish.

Loss of stream complexity creates a shortage of winter habitat that results in the loss of juvenile fish, especially during peak storm flows. Only 3 percent of the 741 miles available to juvenile coho in the population area is considered high quality winter habitat (ODFW 2005).

Several specific known and suspected limiting factors affecting fish and water quality have been identified in the Umpqua Basin Action Plan (Barnes & Associates 2007) for the South Umpqua River and Cow Creek sub-basins. Specific sites and actions to address these concerns have also been identified in the plan. Known and suspected limiting factors are summarized in Table 2.D-25 and Table 2.D-26 by watersheds in the sub-basins. Refer to the Action Plan for details on the specific streams.

Limiting factor	Lower South Umpqua	Middle South Umpqua	South Umpqua River	Tiller Region[1]
Stream morphology	suspected	known	known	known
Fish passage	suspected	suspected	known	inconclusive
Channel modification	inconclusive	suspected	suspected	suspected
Riparian	known	known	known	known
Wetlands	known	known	suspected	suspected
Temperature	known	known	known	known
Sedimentation	inconclusive	not limiting	inconclusive	known
Other water quality	pH, DO, bacteria, toxics, nutrients (known)	pH, DO, bacteria (known)	pH, DO, bacteria (known)	pH (known)
Water availability	known	known	known	known
Streamflow, flood potential	known	known	known	known

[1] Tiller Region includes the smaller 6th field watersheds of Elk Creek-S Umpqua, Jackson Creek, and Middle South Umpqua-Dumont Creek.
Source: Umpqua Basin Action Plan (Barnes & Associates 2007).

Table 2.D-25: Known and suspected limiting factors to fish and water quality (South Umpqua River sub-basin).

Limiting factor	Lower Cow Creek	Middle Cow Creek	Upper Cow Creek	West Fork Cow Creek
Stream morphology	known	known	known	known
Fish passage	known	known	known	suspected
Channel modification	not limiting	suspected	not limiting	not limiting
Riparian	known	not limiting	not limiting	suspected
Wetlands	known	known	not limiting	not limiting
Temperature	known	known	known	known
Sedimentation	inconclusive	suspected	inconclusive	inconclusive
Other water quality	toxics-Formosa Mine (known)	DO, pH (known)	pH, toxics-mercury (known)	inconclusive
Water availability	known	known	known	known
Streamflow, flood potential	known	known	known	known

Source: Umpqua Basin Action Plan (Barnes & Associates 2007).

Table 2.D-26: Known and suspected limiting factors to fish and water quality (Cow Creek sub-basin).

Loss of healthy riparian areas is a limiting factor in all of the South Umpqua sub-basin watersheds and the Lower Cow Creek Watershed. Riparian areas on smaller tributary streams influence both water quality and instream habitat. Decreased shade cover may result in increased stream temperatures on small streams. Loss of large trees in these areas results in fewer sources for stream input now and into the future. These large wood pieces are vital for creating instream habitat on small and medium sized tributaries. Lack of current and future large wood pieces contributes to the loss of stream complexity.

Loss of functioning wetlands has adversely impacted streamflows and water quality in both sub-basins. Wetlands act to filter sediment and toxics and slow water movement during peak flows. They also contribute cool ground water back to streams and the river during the low flow season when temperatures are elevated. This helps buffer increases in stream temperatures during the summer.

Fish passage is a limiting factor in many tributaries in the sub-basins. Passage barriers may block access to all fish, juvenile fish only, or during high or low flow conditions only. Galesville Dam is a complete barrier to anadromous fish in upper Cow Creek. See Appendix F for a complete list of fish passage barriers identified in the Umpqua Basin Action Plan.

Enhancement Opportunities

Enhancement projects have been undertaken in many locations within the sub-basins. These efforts have improved fish passage, instream habitat, and riparian conditions for coho, cutthroat, spring chinook, and winter steelhead.

Douglas County owns 36 acres along the junction of Cow Creek and Whitehorse Creek and below Galesville Reservoir. In 2007 the County initiated an instream structure placement project to increase dissolved oxygen levels in Cow Creek. Whitehorse Creek is a tributary just downstream of this area. Whitehorse Creek is known spawning and rearing habitat for coho and winter steelhead and has been identified by ODEQ as having habitat modification concerns. This area along County property may have opportunities for instream and/or riparian work to improve habitat conditions.

Fish Passage Barriers

The Umpqua Basin Fish Access Team has now completed passage barrier surveys in the Lower South Umpqua River, Middle South Umpqua-Rice Creek, South Umpqua River, and the Lower Cow Creek watersheds within the sub-basins. Crossings were given a score on the severity of the fish passage barrier based on many characteristics including the species and ages of fish blocked, timing of barrier (all year or seasonally), and amount and quality of habitat upstream that is no longer accessible, with higher scores representing more severe barriers. The highest possible score is 105. The highest score in the Umpqua Basin is 95.

Ten county-maintained culverts have been surveyed in the South Umpqua River sub-basin and one in Cow Creek with a score of 60 or more. These passage barriers are listed in Table 2.D-27 with a description of the structure and the score it received. All are barriers to all juvenile and adult species with the exception of one that allows chinook to pass. Contact the Douglas Soil and Water Conservation District for current detailed survey and location information on fish passage barriers.

ID number	Location	Sub-watershed (6th field)	Score	Barrier type	Structure type
20905014	County 39A, Russell Creek	Lower Cow Creek	77	all	CON, 26 ft long by 28 ft wide
21303019	Austin Road, Roberts Creek	Roberts Creek	72.5	all	CON, 25 ft long by 66 ft wide
21305025	Melrose Road, Stockel Creek	Lower South Umpqua River	72.0	all	CMP, 100 ft long by 5.5 ft wide
21304003	209 Bronco Drive	Champagne Creek	64.0	all juveniles, adult cutthroat, coho	CON, 53 ft long, by 6.5 ft wide
21001001	Riddle bypass	Judd Creek	73.0	all	CON, 110 ft long by 10 ft wide
21003003	Rice Creek Road	Rice Creek	67.0	all	CMP, 70 ft long by 5.5 ft wide
21002012	Dole Road 6228	Willis Creek	80.0	all	CMP, 60 ft long by 11 ft wide
21002007	Richardson Road	Willis Creek	75.0	all	CMP, 80 ft long by 8 ft wide
21002009	Clarks Branch Rd	Willis Creek	60.0	all	CMP, 80 ft long by 7 ft wide
20504003	County 1 - St. John Creek Park	Saint John Creek	85.0	all	CMP, 100 ft long by 16.5 ft wide
20502001	County 1 - mouth of Corn Creek	Corn Creek	69.0	all	CMP, 90 ft long by 11 ft wide
Source: UBFAT database as of Oct 2007, Douglas Soil and Water Conservation District.					

Table 2.D-27: Fish passage barriers maintained by Douglas County with a minimum score of 60 in the UBFAT surveys (South Umpqua /Cow Creek sub-basins).

Recreation

Table 2.D-28 lists recreation sites with boat launching facilities and recreational activities in the South Umpqua and Cow Creek sub-basins. All sites are managed by the Douglas County Parks Department with the exception of Three C Rock in the South Umpqua River sub-basin that is managed by the U.S. Forest Service.

Sub-basin	Site name	Agency[1]
South Umpqua River	Canyonville County Park	DCP
	Happy Valley Boat Ramp	DCP
	Three C Rock	USFS
Cow Creek	Chief Miwaleta Park (Galesville Reservoir)	DCP
[1] DCP = Douglas County Parks Department; USFS = US Forest Service.		

Table 2.D-28: Public boating sites with launching facilities (South Umpqua River / Cow Creek sub-basins).

Water-based recreation activities in Cow Creek include swimming and inner-tube and raft drifting. Seasonal low flow and water quality conditions preclude intense use of the South Umpqua River for drift boating, rafting, and swimming. The lower South Umpqua River periodically has been closed to swimming due to poor water quality conditions. During the low-flow season, the South Umpqua River below Cow Creek becomes a series of narrow channels bounded on each side by rock outcrops. The channels connect pools of slow moving water predominantly algae covered. Comparison of these conditions with those in the North Umpqua River usually results in recreationists choosing the North Umpqua River for water-based activities.

The Umpqua River Basin is one of the largest producers of anadromous fish in Oregon, exclusive of the Columbia River Basin. During 1997-98 an estimated 6,898 salmon and steelhead were harvested. The harvest by recreational anglers was primarily steelhead (65 percent) with the remainder comprised of 27 percent chinook and 8 percent coho. The estimated harvest by species within the basin is shown in Table 2.D-29 for 1997-98, the last season angler tag surveys have been reported by ODFW. There are several hundred salmon and steelhead that are caught and released by anglers in addition to these harvest numbers, but overall catch numbers are not available for most fisheries.

Sub-basin	Chinook		Coho	Steelhead		Total
	Spring	Fall		Summer	Winter	
Smith River	0	287	0	0	13	300
Mainstem Umpqua	0	934	352	194	319	1,799
North Umpqua	628	9	217	3,761	164	4,779
South Umpqua	6	0	0	0	14	20
Total	634	1,230	569	3,955	510	6,898
Source: ODFW most recent catch data from 1997.						

Table 2.D-29: Numbers of fish caught during the 1997-98 season in the Umpqua Basin.

Angling opportunities in the South Umpqua River sub-basin is limited to trout, winter steelhead, spring chinook, and warm-water game fish species. The South Umpqua accounted for less than 1 percent of the total steelhead and salmon harvest.

Small-mouth bass is a warm-water species inhabiting the Umpqua Basin that was illegally introduced into the South Umpqua River in the 1960s. Together with other warm-water species, it provides a significant fishery in both the South Umpqua and mainstem Umpqua rivers.

Resident trout are found throughout the sub-basins. Surveys of resident trout harvest from 1976 within the sub-basins show the tributaries are the primary location for angling opportunities (Table 2.D-30 and Table 2.D-31). Although more recent harvest data is not available, this information is useful in determining the tributaries that produce the most recreational trout harvest within the sub-basins.

Stream	Harvest	Days	Stream	Harvest	Days
Champagne Creek	30	60	Days Creek[1]	120	200
Deer Creek[1]	410	825	Shively Creek	20	50
Roberts Creek	75	100	Stouts Creek	50	100
Lookingglass Creek[1]	240	600	Coffee Creek	50	100
Kent Creek	10	25	Elk Creek[1]	200	400
Rice Creek	20	50	Jackson Creek	350	800
Willis Creek	25	50	Deadman Creek	70	140
Clark Branch	10	25	Dumont Creek	70	120
North Myrtle Creek[1]	365	650	Boulder Creek	110	110
South Myrtle Creek[1]	330	575	Buckeye Creek	10	20
Lane Creek	10	25	Quartz Creek	20	20
Jordan Creek	20	25	Skillet Creek	10	20
Canyon Creek[1]	100	200	Black Rock Fork	25	50
O'Shea Creek	20	50	Castle Rock Fork	100	150
Morgan Creek	10	25	**Tributary Total**	**2,880**	**5,565**

[1] Tributary stream assessed in Section 2.E South Umpqua Tributaries sub-basin.
Source: ODFW 1976 unpublished data, 1989 Douglas County Water Management Plan.

Table 2.D-30: Recreational harvest and days spent for resident trout on South Umpqua River tributaries excluding Cow Creek sub-basin in 1976.

Stream	Harvest	Days	Stream	Harvest	Days
Cow Creek	2,500	3,000	Windy Creek	60	125
Union Creek	20	20	Quines Creek	20	20
West Fork Cow Creek	120	120	Applegate Creek	20	10
Middle Creek	50	50	East Fork Cow Creek	30	100
South Fork Middle Creek	20	10	South Fork Cow Creek	100	40
			Total	**2,940**	**3,495**

Source: ODFW 1976 unpublished data, 1989 Douglas County Water Management Plan.

Table 2.D-31: Recreational harvest and days spent for resident trout in the Cow Creek sub-basin in 1976.

Cow Creek is by far the dominant contributor to the resident trout recreational harvest with 43 percent of all resident trout harvest in the sub-basins. The other South Umpqua tributaries with the highest harvest levels are those assessed in the South Umpqua Tributaries sub-basin Section 2.E. They include Deer, Lookingglass, North Myrtle, South Myrtle, Canyon, Days, and Elk creeks. In addition, Jackson, Boulder, Castle Rock Fork, West Fork Cow, and South Fork Cow creeks were all significant contributors to the overall harvest level.

Hydroelectric Power

There is no hydroelectric development on the South Umpqua River. In the Cow Creek sub-basin the only hydroelectric development is located at Douglas County's Galesville Project. A 1.8 mW plant is located at the base of Galesville Dam. Hydroelectric production is a secondary purpose at the project. Releases for primary project purposes, such as irrigation, municipal/industrial or aquatic life uses are routed through the plant when reservoir water surface elevations and release quantities are adequate to generate energy.

Summary of Current Surface Water Use

The State determines if new water rights are available by comparing the total of existing consumptive and storage rights, and instream requirements to the 80 percent exceedence flow (or the streamflow that occurs 80 percent of the time) for each month. Where the streamflow is less than the sum of the current rights, no new water rights are available. The amount of water needed for consumptive use rights in this calculation is an estimate of actual use. Coefficients have been developed for the different types of water rights to estimate actual use. The total allowable right on record would be more than the actual consumptive use estimate used in this calculation.

South Umpqua River

Figure 2.D.5 and Figure 2.D.6 summarize current water use and availability in the South Umpqua River above Cow Creek and at the mouth of the river. Both locations show that flows exceed current requirements by a substantial margin from December through May, but fall short of needs from July through November. The deficit, shown in red on the graph, is highest in November on the South Umpqua River above Cow Creek where an additional 271 cfs are needed to meet current demands. The shortage is much greater above Cow Creek than at the mouth where flows are supplemented by the Galesville Reservoir and a substantial number of large tributaries contribute to the flow of the river.

Irrigation is the dominant consumptive use from May through September at both South Umpqua River locations. Municipal use is also high at the mouth. Water use for storage exceeds consumptive uses during the high flow season from November through February at the mouth. Storage use is not significant above Cow Creek. Instream flow requirements are higher than the 80 percent exceedence flow from August through November in both locations.

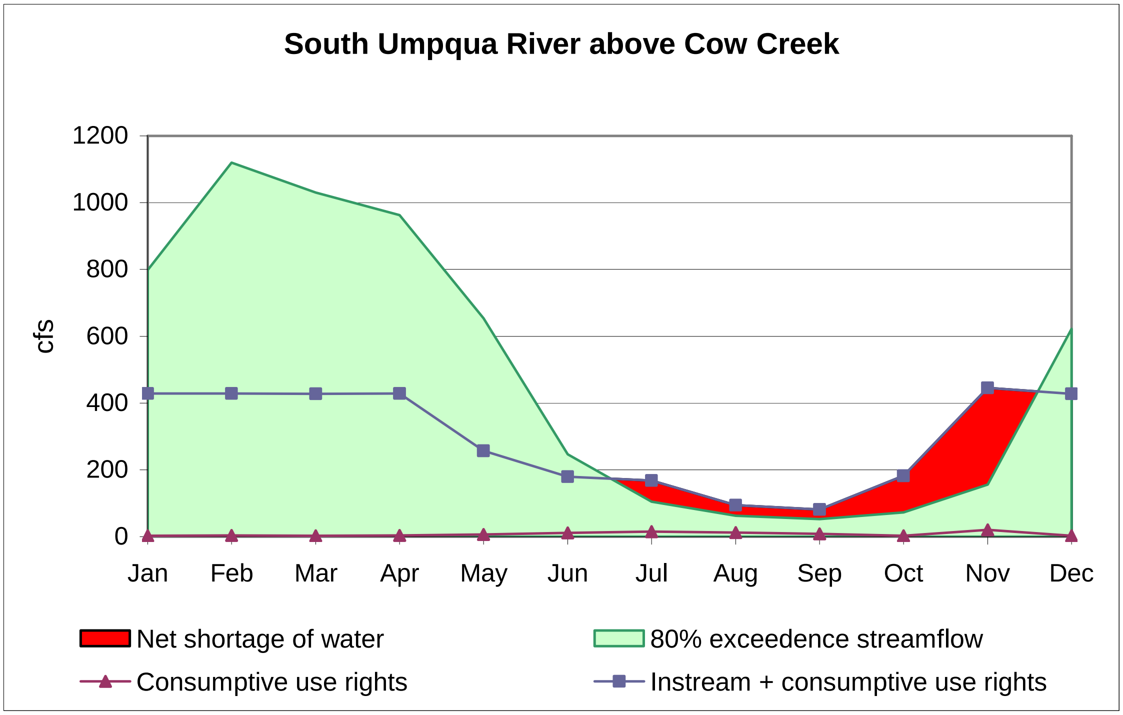

Figure 2.D.5: Water availability in the South Umpqua River above Cow Creek.

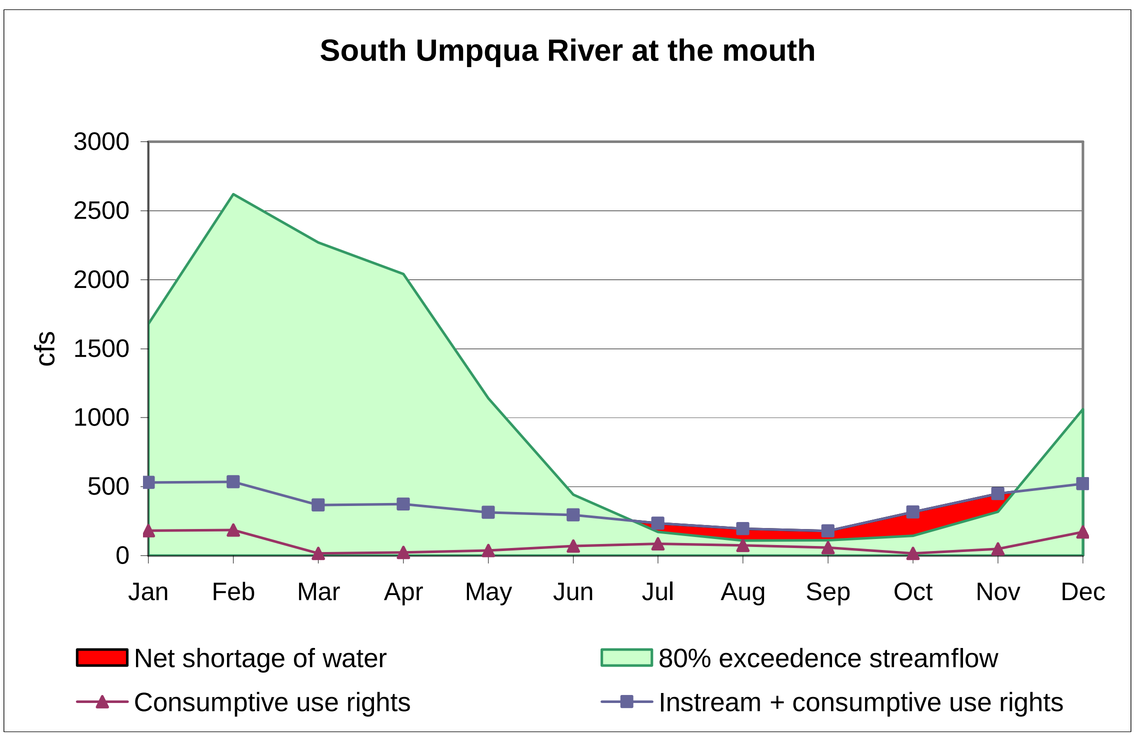

Figure 2.D.6: Water availability in the South Umpqua River at the mouth.

<u>Cow Creek</u>
In Cow Creek, unregulated streamflow is insufficient to meet existing water needs from July through November at both the mouth of Cow Creek and above Middle Creek. Flows are also insufficient in December at the upstream location above Middle Creek (Figure 2.D.7 and Figure 2.D.8). Flows exceed current requirements by a substantial margin from January through May. Streamflow is about equal to current demand in June. The largest deficits occur in October and November at both locations and in December at Cow Creek above Middle Creek. Deficits in these months range from 36 to 67 cfs to meet current demands, and are mitigated by regulation from Galesville Reservoir.

Irrigation is the dominant consumptive use during the summer months from May through September at both locations. At the downriver location near the mouth, irrigation demand is also high in April and October along with significant municipal use. Water use for storage exceeds consumptive uses during the high flow season from November through March at both locations in Cow Creek. Instream flow requirements are higher than the 80 percent exceedence streamflow from August through November above Middle Creek and in October and November at the mouth. Instream flows are supplemented by Galesville Reservoir in both Cow Creek and on the South Umpqua River below Cow Creek.

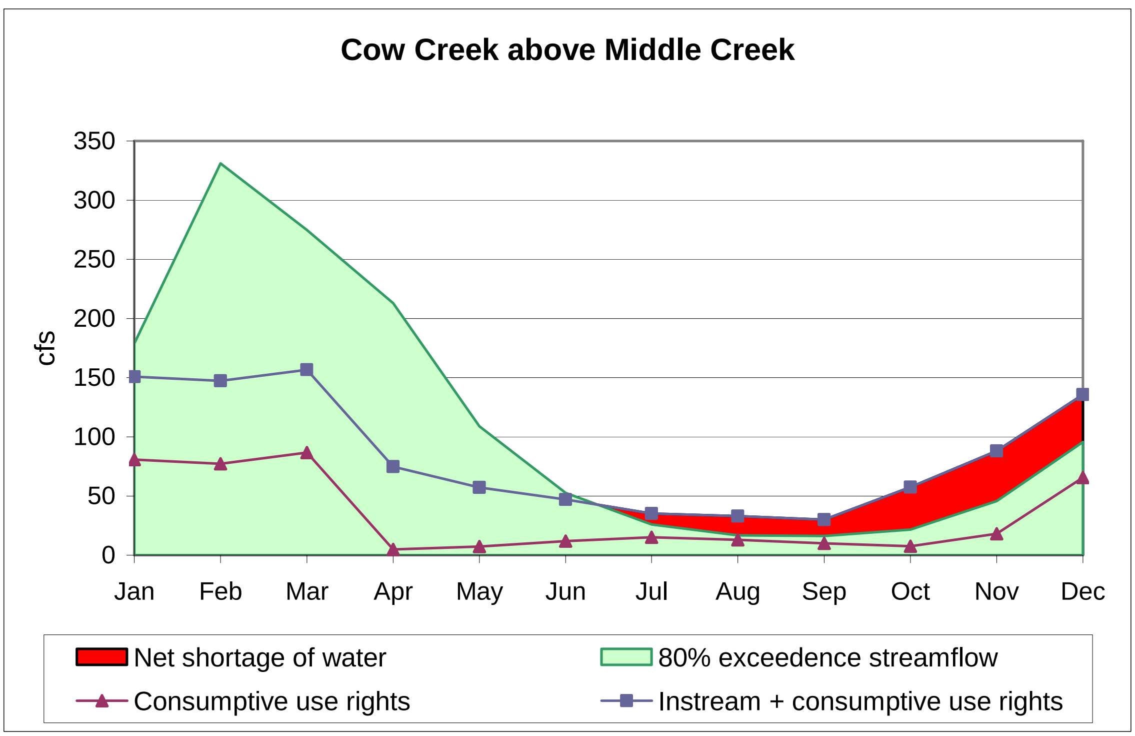

Figure 2.D.7: Water availability in Cow Creek above Middle Creek.

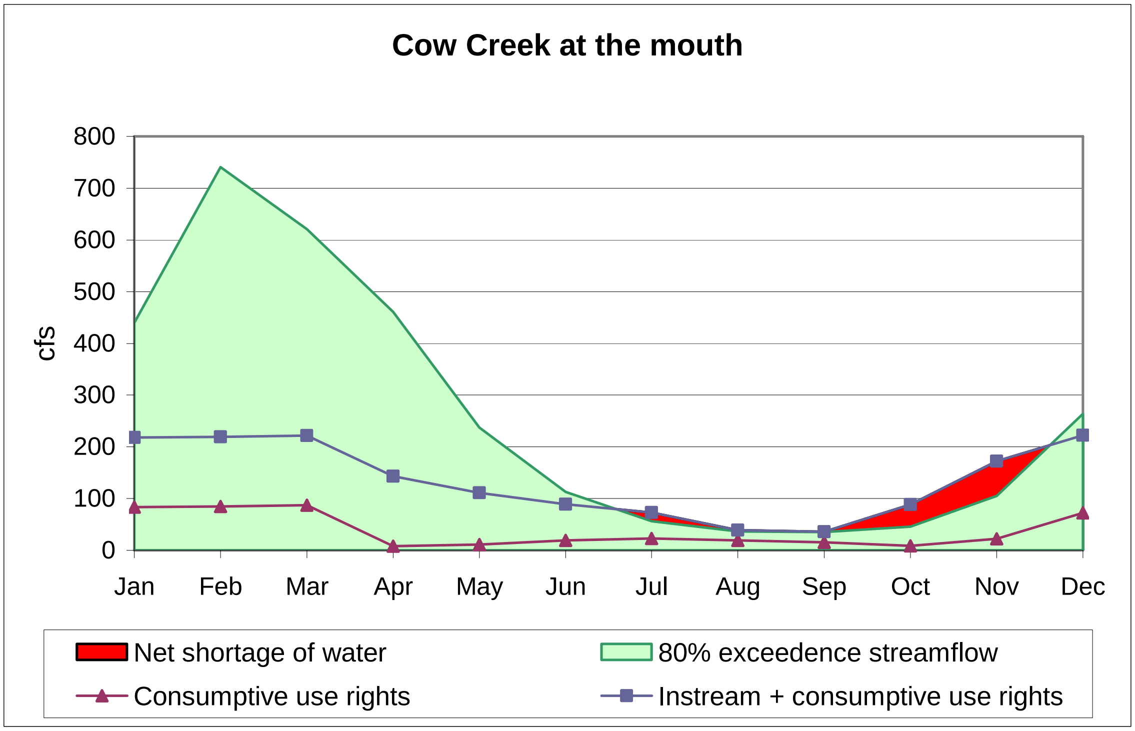

Figure 2.D.8: Water availability in Cow Creek at the mouth.

Galesville Reservoir
In summary, there is no unregulated flow available for any further expansion of water use during July through November in the sub-basins. In fact, there are deficiencies in meeting existing needs. However, over 17,500 acre-feet of water is currently available for purchase from the Galesville Reservoir. Table 2.D-32 shows the allocation of storage in the reservoir along with the portion currently available for use. This water may be purchased for use at locations in the Cow Creek and South Umpqua River sub-basins that are downstream of the reservoir. This does not provide water to meet the needs upriver shown in Figure 2.D.5 or above the reservoir in the Cow Creek sub-basin.

Designated use	Allocated (ac-ft)	Committed[1] (ac-ft)	Available[1] (ac-ft)
Fish enhancement	4,000	4,000	0
Municipal	4,450	185	4,265
Industrial	2,400	1,024	1,376
Irrigation	10,951	3,006	7,945
Recreation	16,424	16,424	0
Multiple purpose	4,000	24	3,976
Total	**42,225**	**24,663**	**17,562**

[1] Effective as of October 30, 2007.
Source: Douglas County Natural Resources Division.

Table 2.D-32: Allocated use and availability of water in Galesville Reservoir.

Streams in Oregon are administered under the prior rights doctrine, which boils down to "first in time, first in right". As streamflows decrease to amounts less than necessary to meet all water rights and minimum flows, the District 15 Watermaster administers the stream. In the case of irrigation rights, diversions under the most recent water rights are stopped. In the case of municipal rights, diversions are reduced to equal the "human consumption", or domestic component of the right. Domestic rights, which include irrigation of gardens of 1/2 acre or less, would be allowed to continue diversion. Diversions for stock water also would be allowed to continue.

Minimum flows have been established by the State of Oregon, Water Resources Department in 1958, 1974 and 1983 on the lower South Umpqua River from Brockway to the mouth and in 1974 and 1991 upriver between Elk Creek and Cow Creek on the South Umpqua River. The requirements are for meeting the needs of aquatic life. Cow Creek also has minimum flow rights from 1958 and 1974 on the lower section below Middle Creek and from 1974 and 1990 above Middle Creek. The 1990 requirements are met with water allocated from Galesville Reservoir. These minimum flows are instream water rights administered with their appropriate priority date. Other instream requirements may occur for such uses as scenic byways or pollution abatement that would be included in the determination of new water rights.

Analysis in the 1989 Douglas County Water Management Plan showed that prior to construction of the Galesville Reservoir, streamflow by about July first on lower Cow Creek decreased to levels about equal to existing water rights at that time (1989). By the end of August, flow had decreased to levels equal to water rights acquired prior to 1974, but flows were not available to meet minimum flows established by the State in 1974. Water was not available for diversion in August by holders of rights more recent than 1974. Flows increased during September and early October, but minimum instream flows in late October remained greater than available streamflows.

Since that time, flows have increased on Cow Creek with regulation from the reservoir. However, much of the additional streamflow if released to meet purchased supplemental water rights for those subject to curtailment. In addition, flows in Cow Creek and the South Umpqua River have increased as releases from the reservoir are used to meet instream aquatic life needs. This additional flow is not available to new water rights without purchase from Galesville Reservoir. However, Table 2.D-32 shows the available water in Galesville that can be used for new or supplemental water rights in the sub-basins.

Future

Municipal

Future municipal use is based on information from the Douglas County Comprehensive Plan Population Assessment (Douglas County 2004), U.S. Census data, and reported water use by each of the water providers in the sub-basins. The data include the current populations receiving water service and projections of the future populations in 2050. The projections to 2050 reflect the long-term financial conditions normally encountered with large-scale water resource developments.

Appendix M contains the derivation of water needs for future municipal water use in the sub-basins. This information is summarized below for each of the water providers within the sub-basins.

<u>South Umpqua River</u>

Roberts Creek Water District
Roberts Creek Water District serves an estimated 2006 population of 7,483 people and estimated peak day use is 310 gallons per capita per day. The allocated population in 2050 is estimated to be 15,549 people, requiring a peak rate of diversion of 3,345 gallons per minute in July.

The District has a total useable water right of 2,609 gallons per minute for the summer months and 2,545 gallons per minute for the rest of the year. With these levels of diversion, the District will not have adequate supply in July, August, and September to meet year 2050 peak need projections. The deficit is projected at 207 acre-feet annually.

There have been several years with low flows when the Watermaster curtailed the 1973 water right during July, August, and September. If the 1973 water right is unreliable during these summer months, the total deficit would increase to 937 acre-feet in the year 2050. These rights appear adequate for meeting future needs in all other months. However, the North Umpqua River has been regulated on one occasion that curtailed the 1977 water right in August through October. Should that right not be reliable the total annual deficit would increase to 1,058 acre-feet per year.

The Roberts Creek Water District has a contract to purchase up to 750 acre-feet of water from the Ben Irving Reservoir. This would alleviate a large portion of the deficit. The amount of deficit is shown in Table 2.D-33 for the different scenarios of curtailment and use of storage water that might occur.

Water right(s) curtailed	Projected annual deficit in year 2050 without storage (acre-feet)	Projected annual deficit in year 2050 with 750 acre-feet storage (acre-feet)
none	207	0
1973 South Umpqua only	937	187
1977 North Umpqua and 1973 South Umpqua	1,058	308

Table 2.D-33: Projected water deficit to meet water needs in the year 2050.

Although most of the water in Ben Irving Reservoir (about 75 percent) is currently designated for irrigation use, there is 1,500 acre-feet designated municipal, and 500 acre-feet designated as multi-purpose. All of the municipal water is currently under contract with Roberts Creek and Winston-Dillard water districts, but the 500 acre-feet of multi-purpose water is not obligated at this time. This water could be made available for additional municipal use eliminating any projected deficit. In addition, there appears to be ample water available in Ben Irving Reservoir to supply current and future irrigation needs in the Lookingglass sub-basin as well as meet municipal needs from the water districts. The Lookingglass-Olalla Water Control District and Douglas County could consider some of the water currently designated for irrigation to be re-designated for municipal use should the need arise.

Winston-Dillard Water District
The 2006 population served by the Winston-Dillard Water District is estimated to be 5,742 people, and peak per capita use is 291 gallons per capita-day. For a 2050 population of 13,321 people, future peak needs are estimated at 2,694 gallons per minute in July.

The District has a total useable water right of 2,765 gallons per minute throughout the year with the exception of August, when the available water right is 1,867 gallons per minute. The reliable water rights appear adequate to meet future peak demand in 2050 in all months except August. However, the surplus in July is only 71 gpm, which is not sufficient to cover possible variation in use or population growth. Future demand will exceed allowable diversions from both the North and South Umpqua rivers. The annual deficit is projected to be a minimum of 98 acre-feet, although an additional 100 acre-feet to insure adequate water during June and July is also recommended. Should the North Umpqua River water right become inadequate, deficits will occur throughout the summer from June through September with the additional loss of 898 gallons per minute.

The District has an agreement with the Lookingglass-Olalla Water Control District for purchase of up to 750 acre-feet of water stored in Ben Irving Reservoir. The stored water would eliminate the projected deficit even if the North Umpqua water right should become unreliable in the future. Stored water from Ben Irving Reservoir should continue to be available for municipal use by the District. For more on the availability of water from the Ben Irving Reservoir, see the discussion of the Roberts Creek Water District.

City of Myrtle Creek
The City of Myrtle Creek provided water service to an estimated 2006 population of 3,409 people. The peak daily use was estimated at 309 gallons per capita day, requiring a diversion of 587 gallons per minute in July and nearly that in August. At that peak rate, the peak day diversion requirement to meet the projected 2050 population of 7,160 people is 1,534 gallons per minute.

Although the water rights for the City total 3,552 gallons per minute, only 1,872 gallons per minute is considered from reliable sources during the summer low flow months on the South Umpqua River. This amount appears adequate to meet peak future demands to 2050.

Tri City Water District
The estimated 2006 population of the Tri City Water District is 3,810 people. The population is expected to increase to 8,001 people in 2050 based on predicted growth at 2.5 percent. Current peak daily use is estimated at 283 gallons per capita day during July and August. Assuming the peak rate increases to 290 gallons per capita day in the future, the estimated 2050 peak diversion will require 1,611 gallons per minute.

The District has water rights that total 2,186 gallons per minute during the summer peak season. However, due to low flows on the South Umpqua River, only 649 gallons per minute is considered reliable during August and September. The water rights appear to be adequate to meet year 2050 demand in all months except August and September when both the 1973 and 1979 water rights are not reliable. The annual deficit is projected at 193 acre-feet per year.

The Tri City Water District currently purchases 95 acre-feet of water from Galesville Reservoir which should help supplement this deficit. However, assuming the water from Galesville Reservoir is available, there is still a 98 acre-foot annual deficit projected in 2050 when the 1973 water right is curtailed.

Cow Creek

City of Riddle
The City of Riddle serves an estimated 2006 population of 1,720 people. The projected peak use is 381 gallons per capita day during the month of July. The population in 2050 is expected to increase to 2,972 people based on an average annual growth rate of 1.5 percent. To meet peak demand for that population at the same estimated peak rate of 381 gallons per capita day, the required diversion would be 787 gallons per minute.

The City has water rights that total 2,581 gallons per minute. Due to the flow regime in Cow Creek during the months of July through October, the reliable water rights are reduced to 1,234 gallons per minute during the peak use period. This appears adequate to meet the year 2050 peak demand. The City also purchases 10 acre-feet of water from Galesville Reservoir. This stored water provides a buffer for when some of the smaller streams are inadequate such as Spring Branch, a tributary to Judd Creek. It will also provide additional water for increases in population growth or water use beyond those predicted.

South Umpqua Water Association
The South Umpqua Water Association's estimated population in 2006 was 795 people. The peak use was calculated at 157 gallons per capita day, much lower than the County average of 372 gallons per capita day. The population is expected to increase at an average annual rate of 1.5 percent to 1,320 people in 2050. Assuming the peak use rate increases to 290 gallons per capita day, the required peak diversion to meet demand will be 266 gallons per minute.

The Association has a 1970 water right for 301 gallons per minute from Cow Creek that is diverted by the City of Riddle and sent to the Association. This water right is junior to

1958 minimum instream flows on Cow Creek and is not considered reliable in the month of August. The water right adequately meets future peak demand for all months except August. The projected annual deficit in 2050 is 36 acre-feet.

The South Umpqua Water Association purchases up to 30 acre-feet of water annually from Galesville Reservoir that may help to supplement the shortage. However, even with this purchased water, an annual deficit of 6 acre-feet is projected. The Association could choose to purchase more water from Galesville to accommodate the shortfall.

City of Glendale

The estimated 2006 population served by the City of Glendale is 1,029 people. Peak daily use per person is estimated at 394 gallons per capita day. The 2050 projected population is 1,481 people served by the City based on an average annual growth rate of 1.0 percent. The peak diversion requirement to meet the needs in July of 2050 will be 405 gallons per minute.

The City of Glendale diverts water directly from Cow Creek and from several small Cow Creek tributaries including Mill Creek, Section Creek, and Stranns Spring. The total water rights for the City of Glendale amount to 1,445 gallons per minute. However, due to the flow regimes in Mill and Section creeks, available water from those sources amounts to only about 45 gallons per minute during the low flow period. In addition, the Cow Creek water right is junior to minimum instream flows from 1958 and is not reliable during low flow periods. Consequently, during the summer from July through September, the current water rights amount to only 269 gallons per minute plus the 4 acre-feet of storage in the reservoirs.

The available water from existing water rights will not be adequate to meet the peak needs in 2050 for the months of July, August, and September. The annual deficit is expected to be 41 acre-feet. The City currently stores four acre-feet in Mill Creek and Section Creek reservoirs. Use of that water brings the annual expected deficit to 37 acre-feet.

Glendale currently purchases 40 acre-feet of water from the Galesville Reservoir. Given the County policy of retaining 500 acre-feet of storage in Galesville for municipal and industrial needs in this portion of the Cow Creek sub-basin, an adequate supply may be acquired by the City to meet its future needs. With continued use of current purchased water levels from Galesville, the City should meet its peak demand throughout the year in 2050.

Projected municipal water needs in 2050 during the peak month, existing water rights, and portions that are senior to minimum flows in the South Umpqua River and Cow Creek sub-basins are listed in Table 2.D-34. Although curtailment of water rights due to more senior minimum instream flow rights often causes shortages to some water providers, there may also problems with small tributary streams running dry or too low to fulfill the rights. These shortages are discussed in the individual sections by provider but are not shown here.

Water provider	Water source	Projected peak month need in 2050 (gpm)	Total water rights (gpm)	Rights senior to minimum instream flows (gpm)	
				1958	1974
Roberts Creek	South Umpqua River	3,345	2,161	366	2,161
	North Umpqua River		448	0	0
Winston-Dillard	South Umpqua River	2,694	1,867	969	1,867
	North Umpqua River		898	0	0
Myrtle Creek	South Umpqua River	1,534	1,347	1,347	1,347
	Tributaries & springs		2,551	525	525
Tri City	South Umpqua River	1,611	2,186	648	1,994
Riddle	Cow Creek	787	1,795	449	449
	Tributaries to Cow Cr		786	786	786
South Umpqua Water Assn.	Cow Creek	266	301	0	301
Glendale	Cow Creek	405	180	0	180
	Mill and Section creeks		1,042	593	1,042
	Stranns Spring		224	224	224

See Appendix M for detailed calculations by water provider.

Table 2.D-34: Municipal water rights and amount senior to minimum flows relative to projected peak month needs in 2050 for each provider within the sub-basins. (gpm = gallons per minute)

Rural Domestic

The allocated rural population of these sub-basins is expected to increase from 5,729 to 10,026 people based on the rural estimated growth rate for the County of 1.5 percent. However, this area of the County is one of the faster growing segments and may exceed that level of growth. Based on the County Comprehensive Plan Population Assessment, portions of the South Umpqua River and Cow Creek sub-basins are expected to grow at a rate as high as 2.3 percent and others at as low as 1.4 percent.

Using a peak per capita need of 290 gallons per capita day, the future rural domestic need is estimated to be 2,035 acre-feet per year. The highest use is projected in June through September when needs are expected at nearly 950 acre-feet for the four months.

Over 18 percent (1,061 people) of the current rural domestic population is estimated to obtain water via domestic surface water rights. New surface water rights may occur to fulfill future needs during the wet season but are unlikely to be reliable during the summer months due to low flows and minimum instream rights in the South Umpqua River. Individuals with access to the Umpqua River or Cow Creek (below the reservoir) may purchase water from Galesville Reservoir to meet domestic needs. More pressure is expected on ground water supplies especially in areas located further up tributaries where purchased water may not be obtainable. Some individuals will likely develop more personal storage tanks for use during the summer months. Conditions should be monitored as growth occurs, and development of safe and sanitary communal water systems should be encouraged as population densities increase. See Appendix M for further details.

The Cow Creek Band of the Umpqua Tribe of Indians has developed the Creekside Reservoir in a dry basin adjacent to Jordan Creek, a tributary to the South Umpqua River. The reservoir is anticipated to provide domestic water needs to a future neighborhood development in the area. This will likely account for 50 to 100 households or 150 to 300 people of the anticipated future rural population.

Industrial

The majority of industrial water use in the basin is for lumber and wood products processing mills, including ponds. In recent years some mills have installed small steam-electric plants fueled by mill wastes for which water has been appropriated for cooling purposes.

In a study on the feasibility of producing biomass energy in Oregon commissioned by the Oregon Forest Resources Institute in 2006, Douglas County was found to have the highest amount of acreage available and the largest volume available to support biomass energy production, as well as road infrastructure to access the supply (Mason, Bruce & Girard et al 2006). Douglas County commissioners are investigating biomass energy production as a viable option for the County.

Based on the study, it is reasonable to assume that Douglas County could support two energy plants that produce 10 to 15 MW of electricity per year. Since it is important for these plants to be located near their fuel source, one would likely be located in the southern portion of the County along the South Umpqua River near Cow Creek and another could be located further north near the North Umpqua corridor. These sites could also use existing mills that have interest and capability to expand for power production.

Water is necessary to produce steam and cool the system. Most of the water used can be re-used over and over reducing the consumptive use of the system. However, water may need to be cooled before running back into the stream. Small amounts of water are lost to evaporation. Estimates of total water used are about 20 acre-feet per MW per year but are reduced to 0.008 acre-feet when water is re-used.[68] This would amount to 0.144 acre-feet for each plant at 18 MW produced, a very small requirement overall. If water is not re-used, consumption could be as high as 300 acre-feet per year for each biomass energy plant (see Appendix M).

Cooling water needs in the months of May through October could not be met from unregulated flows in the South Umpqua. Thus about 150 acre-feet per year would need to come from stored water for use in the South Umpqua sub-basin or from existing water rights.

[68] Information from the Environmental Working Group Report; Green Energy Guide; A Consumer's Guide to Sustainable Electricity located at www.EWG.org.

Douglas County Forest Products along with Roseburg Forest Products and DR Johnson Lumber Company currently produce biomass energy that provides power to their mills.[69] One existing byproduct from this energy production is excess steam. Manufacturers need to find use for the steam to heat buildings, kilns or other types of use. These mill sites, as well as several located along the South Umpqua already hold industrial water rights that may supply the needs of a biomass electric plant.

The two industrial sites along the South Umpqua River owned by the County have water rights associated with them that would adequately meet these needs. The South Umpqua Valley Industrial Site has a 1993 water right from the South Umpqua River of 0.8 cfs from December 1st through April 30th. During the rest of the year when water is low in the South Umpqua, the County has a contract to buy water from Galesville of up to 95 acre-feet. The Oak Creek industrial site has a 1994 water right on the river of 2.02 cfs and another on Cow Creek for .01 cfs useable from January 1st to April 30th. It also has a year around right to use up to 306.2 acre-feet from Galesville. These industrial water rights for the Oak Creek site are also used for irrigation and would need to be shared. Still both sites appear to have ample water.

The 1989 Water Management Program report included water use estimates for other industrial users, such as sand and gravel processing and the potential introduction of a large food processing plant. Those estimates are still considered valid for planning purposes. Water use estimates for those industries are summarized in Table 2.D-35 during the peak season by sub-basin. In addition, Alfa Leisure, a manufacturer of recreational vehicles is currently planning to occupy the last available space in the South Umpqua Valley Industrial Park near Riddle.

Stream	Industry	Water use (acre-feet)						
		May	June	July	Aug	Sept	Oct	Total
South Umpqua River	sand & gravel	14	23	30	30	30	23	150
	food processing	40	112	112	112	112	112	600
	biomass energy[1]	25	25	25	25	25	25	150
Cow Creek	sand & gravel	16	22	30	30	30	22	150

[1] Estimates for non-consumptive use are 300 AFT per year (20 AFT per MW per year) in total. From Pacific Northwest River Basins Commission Report sited in 1989 Water Resources Management Plan. Consumptive use could be less than 0.2 acre-feet per year if water were re-used.

Table 2.D-35: Potential future industrial water use needs by sub-basin.

Irrigation

Determinations for the future potential irrigation land available in each sub-basin are described in Appendix I and summarized in Table 2.D-36. The U.S. Bureau of Reclamation (USBR) land classification estimates in the Cow Creek sub-basin are based on surveys done for the Galesville Reservoir project completed in 1985. Although the USBR land classification numbers are far higher than those done by aerial surveys in the Cow Creek sub-basin, these data are preferred when available as USBR is the lead

[69] Bob Ragon, Executive Director, Douglas Timber Operators, personal communication (6/20/07).

Federal agency with regard to irrigation project formulation. In the case of the South Umpqua River, USBR estimates are somewhat lower in the upper portions of the sub-basin but higher in the lower portion.

Based on USBR projections and current irrigation water rights, there is future potential irrigation land in all areas except the South Umpqua River above Cow Creek. No aerial surveys were completed in Windy Creek although existing rights seem to show there is no future for expanding irrigation in the Windy Creek area. The area with the highest potential for expanded irrigation land is along the South Umpqua River below Cow Creek. Estimates in this area are probably somewhat high since land surveys were completed in 1971 and some land considered for potential irrigation may have been developed for other uses. The lower to middle South Umpqua River area has been one of the fastest growing regions of the County, thus industrial and urban development has likely removed some of this land from consideration.

Reach	USBR	Aerial photo	Selected	Existing rights	Future potential
Cow Creek sub-basin					
Upper Cow Creek[1]	4,206	1,570	4,206	2,383[3]	1,823
Lower Cow Creek[2]	2,652	1,600	2,652	1,381	1,271
subtotal Cow Creek	**6,858**	**3,170**	**6,858**	**3,764**	**3,094**
Windy Creek	333	---	333	358	0
South Umpqua River					
Tiller to Cow Creek	3,295	4,770	3,295	3,561	0
Cow Creek to Brockway	4,615	4,920	4,615	1,858	2,757
Brockway to the mouth	7,256	6,240	7,256	3,611	3,645
subtotal S. Umpqua River	**15,166**	**15,930**	**15,166**	**9,030**	**6,402**

[1] Above West Fork Cow Creek to Galesville Reservoir
[2] Below West Fork Cow Creek
[3] 126 acres not included here have irrigation water rights from diversions located above Galesville Reservoir.

Table 2.D-36: Existing and future potential irrigation acres (South Umpqua River/Cow Creek sub-basins).

Water requirements for future potential irrigated land are based on an average projected need of 2.44 acre-feet per acre per year. Appendix I contains data on present and potential future irrigation lands, and calculations for future water demands. Monthly and total annual projections for the future needs are shown in Table 2.D-37 by stream reach.

Month	Percent	Cow Creek		South Umpqua River	
		upper	lower	Cow Creek to Brockway	Brockway to the mouth
Potential acres		1,823	1,271	2,757	3,645
Mar	0.5	22	15	34	44
Apr	4.4	196	136	296	391
May	11.4	507	354	767	1,014
Jun	18.6	827	577	1,251	1,654
Jul	28.5	1,268	884	1,917	2,535
Aug	22.9	1,019	710	1,540	2,037
Sep	12.6	560	391	848	1,121
Oct	1.1	49	34	74	98
Total	100.0	4,448	3,101	6,727	8,894

Acre-feet projections are based on a future average need of 2.44 acre-feet per acre per year.
Monthly distributions are calculated based on projected crops and their water needs.
Source: See Appendix I for calculations.

Table 2.D-37: Future irrigation water demands in acre-feet (South Umpqua River / Cow Creek sub-basins).

Galesville Reservoir

Galesville Reservoir, located at approximately stream mile 60 on Cow Creek has a capacity of 42,225 acre-feet of storage. The water is designated for a number of uses including 10,951 acre-feet for irrigation. As of October, 2007, approximately 3,005 acre-feet of the water designated for irrigation had been committed leaving a potential of 7,945 acre-feet available for purchase for irrigation uses downstream.

According to Table 2.D-36, there is approximately 9,496 acres of future potential land to be irrigated in the Cow Creek and South Umpqua River sub-basins. At a projected demand of 2.44 acre-feet per acre, the total demand would be 23,170 acre-feet per year to meet all potential future irrigation in the sub-basins, far more than the available 7,945 in Galesville Reservoir.

The South Umpqua River from Brockway to the mouth shows projected irrigation needs that total 8,894 acre-feet. These are also located downstream of Ben Irving Reservoir and thus could potentially be met by purchased water from either source. The remaining 14,276 acre-feet are diverted upstream of the Ben Irving source. With the Galesville balance of 7,945, the total deficit is at least 6,331 acre-feet to meet irrigation needs in the sub-basins.

Galesville Reservoir with the current allocations of water is not sufficient to meet all of the potential irrigation needs in these sub-basins. In addition, water purchased from Galesville can also be diverted from the Umpqua River for use in that sub-basin. The potential irrigation need in the Umpqua River above Scottsburg is 6,983 acre-feet per year. These acres can also be irrigated with water purchased from Ben Irving Reservoir if available.

2.D.3. Sub-basin Concerns

Quantity

Future population growth is estimated to create a need for an additional 1,408 acre-feet of water within the South Umpqua River sub-basin beyond what is currently under water right or purchased from reservoirs. This can be met by available water in Galesville Reservoir.

There is a potential for increased irrigation water use of 15,225 acre-feet over and above Galesville reservoir capabilities in the sub-basins. The estimated potential total future capacity of irrigation use in both sub-basins is 23,170 acre-feet. Galesville Reservoir currently has 7,945 acre-feet available for irrigation. Of the total estimated capacity of use, 7,549 acre-feet is in the Cow Creek sub-basin, and 15,621 acre-feet in the South Umpqua River sub-basin. Approximately 8,894 acre-feet of estimated use is not accessible by Ben Irving Reservoir. This area between Cow Creek and Brockway in the South Umpqua River sub-basin would need to be supplied by either Galesville Reservoir or a new source of storage. Since Galesville is the only site able to serve upper Cow Creek, it is possible that some of the present contemplated Galesville service area will need to acquire water from future storage.

Quality

Most stream water quality issues will be addressed through implementation of the Umpqua Basin TMDL. However, listings for sediment and toxic substances, along with a few isolated stream segments for other parameters are not addressed by the current TMDL.

Water temperatures during low flow periods in portions of many streams are intolerable to anadromous species in both sub-basins. Although temperatures have improved on Cow Creek since flow regulation began, the effects are diminished by the time Cow Creek reaches the South Umpqua River. Most problems occur in the summer months during salmonid rearing and migrating and are being addressed by the current Umpqua Basin TMDL. A few stream segments also have elevated temperatures during the spawning season, which is not addressed by the current TMDL.

Water quality conditions are unacceptable in the South Umpqua River during periods of the year. During the summer, bacteria levels pose a health threat to people using the South Umpqua River for water contact recreation in the areas near Days Creek, Canyonville, Riddle, Myrtle Creek, Dillard, Winston, and Green.

The South Umpqua River has low dissolved oxygen levels that are correlated in some areas to problem pH levels. The summer flows in the South Umpqua River are low, temperatures high, and algae bloom is a problem. This likely increases CO_2 consumption and elevates pH. Cow Creek, Jackson Creek, and Black Canyon Creek also have elevated pH levels. Nutrient levels in the South Umpqua River are also a potential problem that contribute to the pH and dissolved oxygen impairments.

The South Umpqua River and Cow Creek are both considered water quality impaired for chlorine. In addition, the lowest 16 miles of the South Umpqua River below Green is listed for cadmium and arsenic. Several other stream segments are a potential concern for other toxic substances as well. These are not addressed by the current TMDL.

The upper portion of the South Umpqua River is considered impaired for sediment from river mile 80 to 102. West Fork Cow Creek has a potential sediment problem from the mouth to stream mile 22.2. These are not addressed in the current TMDL.

Increasing streamflow in the South Umpqua River during the low flow months by an estimated 600 cfs is believed to be adequate to:

- minimize the needs for tertiary treatment;
- decrease coliform bacteria counts to levels acceptable for swimming; and
- provide flows adequate for boating/rafting.

Douglas County should include these considerations as objectives in its water resources planning efforts.

Flooding and Urban Drainage

Flooding will continue to recur in the South Umpqua sub-basins even with Galesville Reservoir in operation. Occasional flooding in Cow Creek sub-basin may occur but levels and frequency is substantially reduced with regulation of flows from Galesville Reservoir. Flooding is more likely near the lower end of Cow Creek near Riddle.

Aquatic Life

Primary habitat parameters for all salmonids in the sub-basin are water quality (primarily stream temperatures), pool areas for holding and rearing, and gravel areas for spawning and incubation of eggs. Primary factors limiting production in the sub-basin generally can be attributed to a lack of gravel and large wood, and high summer water temperatures in the mainstem South Umpqua River and tributaries. Low summer flows in the South Umpqua River can adversely affect migrating adults and juveniles.

Numerous efforts are being undertaken in the tributaries by various agencies, public groups, and private landowners to improve instream and riparian habitat, and to improve fish passage to areas currently restricted by improper culverts and other obstructions.

Other Perceived Concerns

In the lower portions of both the Cow Creek and South Umpqua sub-basins, unregulated development on riparian lands has adversely affected water quality, particularly water temperatures. Loss of healthy wetland function has also contributed to flooding and water quality problems in these areas.

Alternatives to Address Concerns

Structural

The County should continue formulation studies of both the Honeysuckle site on West Fork Cow Creek and the Golden Gulch site on Elk Creek near Tiller. Such studies should include provision for a coordinated water quality improvement program for the South Umpqua River.

Non-structural

Land use regulation of riparian and wetland habitat should be strengthened, particularly with regard to the South Umpqua and Cow Creek sub-basins.

The County should actively promote reestablishment of riparian and wetland habitat lost to previous unregulated land use development, including freeway construction, and flooding.

Enhancement Programs

Enhancement programs such as construction of structures in the stream are generally not undertaken on the mainstem South Umpqua River. However, numerous projects are underway on tributary streams. These programs are sponsored either solely or in cooperation with the Salmon Steelhead Enhancement Program of the ODFW, the Salmon Steelhead Improvement Program of Douglas County, the U.S. Forest Service, the Bureau of Land Management, Partnership for the Umpqua Rivers (PUR) Watershed Council, Douglas Soil and Water Conservation District (DSWCD), the Natural Resources Conservation Service, Oregon Department of Forestry, private groups such as the Steamboaters, and many private landowners.

Douglas County should partner with ODFW, PUR, and/or DSWCD to improve fish passage on the ten county-maintained culverts identified in the South Umpqua River sub-basin and one in Cow Creek. Incorporating these areas in road maintenance planning may help increase anadromous habitat conditions within the sub-basins. These passage barriers are listed in Table 2.D-27 with a description of the structure and the score it received.

Of major significance is the hatchery supplementation programs provided by the Oregon Department of Fish and Wildlife. These programs provide for production and release of winter steelhead, coho, and trout in the river and its tributaries as well as lakes in the Umpqua Basin. Approximately 60,000 coho salmon smolts are raised at the Rock Creek

Hatchery on Rock Creek, a tributary to the North Umpqua River and eggs reared in hatch boxes at various locations in the South Umpqua tributaries. The coho are for release into Cow Creek below Galesville Dam to provide a return adult fishery and to provide broodstock for spawning in tributaries above Tiller. Approximately 90,000 winter steelhead are also produced at Rock Creek for release into the South Umpqua River near Canyonville. Rainbow trout are stocked into this sub-basin from other areas of the Umpqua Basin and from the Klamath and Wizard Falls hatcheries.

2.E. South Umpqua Tributaries / Loogkingglass Creek Sub-basins

2.E.1. Area Description

The South Umpqua Tributaries and Lookingglass Creek sub-basins (Figure 2.E.1) include the following areas within the Umpqua Basin:

1. Tributary streams to the South Umpqua River with the exception of Cow Creek and Lookingglass Creek (see below). Major tributaries include Deer Creek, North and South Myrtle creeks, Canyon Creek, Days Creek, Salt Creek and Elk Creek; and

2. Lookingglass Creek from its confluence with the Umpqua River at Winston-Dillard (river mile 0) to its origin on the eastern slopes of Mt. Gurney in the Coast Range (river mile 16).

The areas include 160 square miles of which 18,880 acres are Oregon and California railroad lands (0 & C lands) managed by the Federal Government. Extensive private timber holdings as well as agricultural lands are also located within the sub-basins.

Olalla Creek, a major tributary of Lookingglass Creek, rises in the divide between the South Umpqua River sub-basin and Camas Valley. Berry Creek Reservoir is located on Berry Creek, a tributary to Olalla Creek. Lookingglass Creek drains the northwest portion of the South Umpqua River sub-basin. It drains the slopes of Reston Ridge and discharges into the South Umpqua River just upstream from the City of Winston.

The Deer Creek watershed lies in central Douglas County and drains a relatively low elevation area to the east of Roseburg. Deer Creek is a tributary to the South Umpqua River, discharging into the river at Roseburg. The drainage includes 63 square miles including 2,880 acres of 0 & C lands managed by BLM. Deer Creek and its tributaries flow through a large amount of agricultural grazing areas.

The Myrtle Creek watershed includes the drainage areas of North and South Myrtle Creek, above the City of Myrtle Creek. The watershed drains a total area of 117 square miles, of which 11,520 acres are in National Forest and 18,240 acres are managed by the Bureau of Land Management.

Canyon Creek sub-basin is a broad watershed that includes West Fork Canyon Creek, a large tributary to Canyon Creek. The sub-basin drains the north slopes of Buckhorn Mountain and east slopes of Silver Butte, flowing into the South Umpqua River near the City of Canyonville.

Days Creek watershed is located just south of the South Myrtle Creek watershed. It drains a relatively narrow divide flowing into the South Umpqua River at the community of Days Creek.

Elk Creek is a relatively large South Umpqua tributary sub-basin that is within the Umpqua National Forest, although most land adjacent to the creek is private. The sub-basin drains the east side of Callahan Ridge and extends to slopes between 4,500 and 5,000 feet along the south and east ridgelines of the watershed. Elk Creek drains into the South Umpqua River near Tiller. The Salt Creek sub-basin is a very small watershed located directly north of Tiller and Elk Creek.

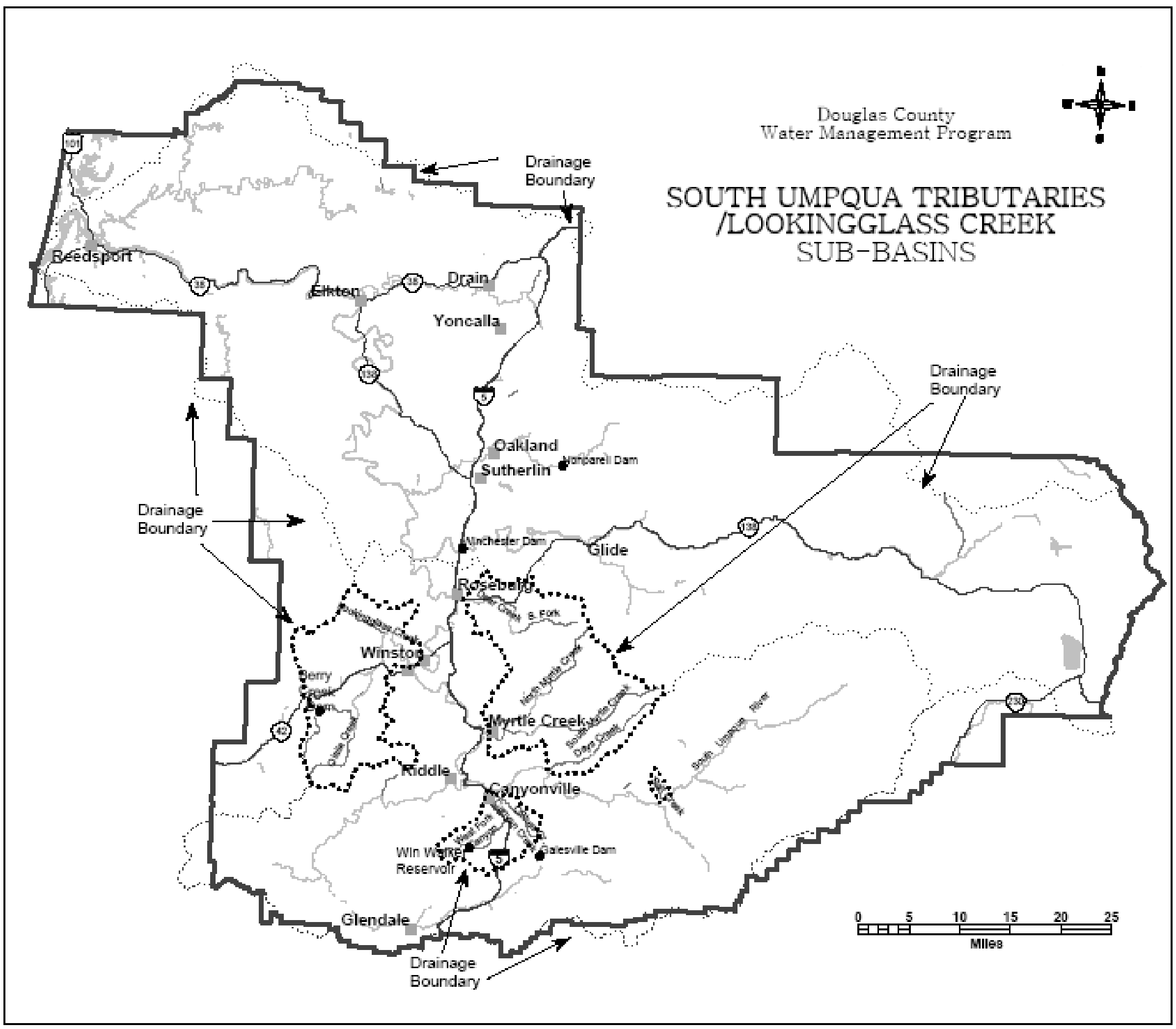

Figure 2.E.1: South Umpqua Tributaries/Lookingglass Creek sub-basins.

Climate

The climates of these sub-basins are mild. Precipitation rarely falls as snow in the lower elevation portions, and summer temperatures are warm.

Precipitation

To illustrate the range of precipitation throughout the area, data from three precipitation stations operated and maintained by Douglas County in the South Umpqua Tributaries and Lookingglass Creek sub-basins is presented in Table 2.E-1. The stations include South Deer Creek, Upper Olalla, and Tiller. The Upper Olalla station was discontinued in 1997; however in 2005 it was reestablished one mile north. A full year of data at the new location has yet to be collected.

Period	South Deer Creek 1958 to April 2006			Upper Olalla 1958 to 1997			Tiller 1956 to June 2005		
	max	mean	min	max	mean	min	max	mean	min
Oct	5.63	2.61	0.03	7.52	2.86	0.17	7.00	2.98	0.00
Nov	14.11	5.59	0.77	19.81	6.99	0.89	16.00	5.72	0.80
Dec	14.72	5.98	0.92	19.22	7.64	0.83	16.50	6.06	1.00
Jan	10.42	5.15	0.73	15.35	7.11	0.59	9.55	5.16	1.20
Feb	8.98	3.75	0.95	13.72	5.16	0.98	9.50	3.94	0.90
Mar	7.67	3.83	0.65	10.89	4.88	0.00	7.50	3.94	0.57
April	6.65	2.92	0.96	6.49	3.06	0.80	6.40	2.97	0.98
May	7.43	2.33	0.26	5.41	1.85	0.34	6.10	2.21	0.10
June	7.24	1.26	0.00	3.61	0.90	0.00	4.10	1.26	0.00
July	2.47	0.41	0.00	2.32	0.33	0.00	2.74	0.48	0.00
Aug	3.44	0.67	0.00	2.57	0.55	0.00	4.20	0.67	0.00
Sept	4.56	1.15	0.00	4.74	1.09	0.00	6.60	1.15	0.00
Annual[1]	59.87	35.49	23.30	65.46	41.70	25.31	59.27	36.87	24.90

[1]Values are maximum annual, average annual, and minimum annual; not total of column entries.
Source: Douglas County Natural Resource Division.

Table 2.E-1: Monthly and annual maximum, average, and minimum precipitation measured at three locations across the sub-basins.

South Deer Creek and Tiller have similar precipitation patterns and overall amounts with averages in the mid- 30s and maximums over 59 inches. Both stations measured their maximum annual precipitation in 1996, a year with some of the heaviest precipitation on record around the County. Although the Upper Olalla station measured its maximum annual in 1983, it was missing data in September of 1996; thus it may also have had its highest year then. Upper Olalla gets more precipitation with an annual average of near 42 inches. Nearly half of its seasonal average fell in November, 1973 and again in December, 1996 when almost 20 inches of precipitation occurred. All three stations show a dry season in July and August where barely one inch total for the two months was measured on average.

Surface Water – Rivers and Streams

Quantity

The USGS, Oregon Water Resources Department, and Douglas County have operated many stream gages in the South Umpqua Tributaries and Lookingglass Creek sub-basins. Most have been discontinued with the exception of Olalla Creek near Tenmile located in the Lookingglass Creek sub-basin. Representative stream discharge and annual flow data from two gages in the Lookingglass Creek sub-basin and six other gages on tributaries within the South Umpqua River sub-basin are presented in Table 2.E-2.

Stream gage	Period of record (water year)	Discharge (cfs)			Runoff average (ac-ft/yr)
		max	min	mean	
Lookingglass Creek at Brockway	1956-2000	35,000	0	299	216,633
Olalla Creek near Tenmile	1956-2005[1]	9,160	0	106[2] 88[3]	76,800[2] 63,695[3]
Other tributaries in the South Umpqua River sub-basin					
Deer Creek near Roseburg	1955-1978	8,880	0	76	55,125
South Fork Deer Creek near Dixonville	1989-2000	1,910	0.25	22	15,940
North Myrtle Creek near Myrtle Creek	1955-1986	3,700	0	73	53,192
South Myrtle Creek near Myrtle Creek	1955-1972	3,050	0.2	66	47,819
Days Creek at Days Creek	1955-1972	3,450	0	45	32,604
Elk Creek near Drew	1955-2000	8,880	0	81	58,687

[1] Period of record is missing water years 1977-78.
[2] Prior to construction and regulation by of Berry Creek Dam 1957-76.
[3] After construction and regulation by Berry Creek dam 1981-1992
Source: USGS National Water Information System and Douglas County Natural Resources Division.

Table 2.E-2: Maximum, minimum, and average discharge, and acre-feet of runoff for stations within the South Umpqua River Tributaries including the Loogkingglass sub-basin.

Similar to the South Umpqua River, low summer flows are not uncommon in the tributaries to the South Umpqua River. Many of the streams have gone dry in numerous years. The Berry Creek Dam was constructed in 1980 on Berry Creek, a tributary to Olalla Creek. The averages for Olalla Creek include pre- and post- dam streamflow data. Maximum flow on Olalla Creek occurred in 1966 prior to dam construction. The highest discharge on record since the dam is 6,970 cfs in 1983 and the minimum 1.7 cfs in October, 1982. The lower peak flow and higher minimum is reflective of regulation of flow by the dam.

The maximum discharge of 35,000 cfs on Lookingglass Creek at Brockway occurred in December, 1955, the first year of record. Since that time, the three highest discharges occurred in December or January of three consecutive water years from 1964 to 1966 ranging from 18,000 to 20,300 cfs.

Representative monthly flow data for three of the tributaries in the South Umpqua River sub-basin and two streams in the Lookingglass Creek sub-basin are shown in Table 2.E-3, and Table 2.E-4. The flow data show large variations in discharge from season to season, reflecting climatic and geologic conditions in the sub-basins. All of the streams discharge no more than one percent of the annual total in each of July, August and September, except Olalla Creek since the Berry Creek dam construction and flow regulation began in 1980. During many summers there is no flow in Deer Creek, Days Creek, or Elk Creek.

Month	South Fork Deer Creek		Deer Creek near Roseburg		North Myrtle Creek	
	mean (cfs)	percent of annual	mean (cfs)	percent of annual	mean (cfs)	percent of annual
October	2.8	1.0	7.1	0.8	12	1.4
November	22	8.2	76.6	8.3	73	8.3
December	50	18.6	199.7	21.7	172	19.5
January	58	21.6	213.2	23.1	180	20.4
February	41	15.2	157.8	17.2	165	18.7
March	32	11.9	145.1	15.8	132	15
April	27	10.0	64.3	7.0	78	8.9
May	22	8.2	36.3	3.9	40	4.5
June	8.4	3.1	10.5	1.1	15	1.7
July	2.8	1.0	2.8	0.3	5.8	0.7
August	1.8	0.7	1.8	0.2	3.5	0.4
September	1.4	0.5	3.5	0.4	5.1	0.6
Total	**269**	**100**	**919**	**100**	**881**	**100**
Source: USGS National Water Information System and the Douglas County Natural Resources Division.						

Table 2.E-3: Mean monthly and percent of annual streamflow data within the South Umpqua Tributaries sub-basins.

Month	Olalla Creek				Lookingglass Creek			
	prior to dam[1]		after dam[2]		prior to dam[1]		after dam[2]	
	mean (cfs)	% of annual	mean (cfs)	% of annual	mean (cfs)	% of annual	mean (cfs)	% of annual
Oct	8.3	0.7	19	1.9	14	0.4	24	0.9
Nov	103	8.2	73	7.3	256	7.6	220	7.9
Dec	234	18.6	194	19.5	741	21.9	580	21.0
Jan	323	25.7	210	21.1	873	25.8	617	22.3
Feb	242	19.3	195	19.6	674	19.9	597	21.6
Mar	210	16.7	128	12.8	519	15.3	357	12.9
Apr	86	6.9	84	8.4	207	6.1	243	8.8
May	37	2.9	35	3.5	87	2.6	76	2.7
Jun	8.1	0.7	15	1.5	16	0.5	25	0.9
Jul	2.0	0.2	13	1.3	1.8	0.1	8.5	0.3
Aug	0.5	<0.05	15	1.5	0.1	0	7.2	0.3
Sept	0.7	0.1	16	1.6	0.9	0	11	0.4
Total	**1,255**	**100**	**997**	**100**	**3,390**	**100**	**2,766**	**100**

[1] Data from water years 1956-1977.
[2] Data from water years 1979-2005.
Source: USGS National Water Information System and the Douglas County Natural Resources Division.

Table 2.E-4: Mean monthly and percent of annual streamflow data within the Loogkingglass Creek sub-basin.

Data for Olalla Creek near Tenmile and Lookingglass Creek at Brockway are separated into before and after regulation of flow by Berry Creek Dam. In these streams flow regulation tends to generally decrease discharge in the November through March period, with increases appearing in the June through October period. The change in monthly flow before and after regulation is illustrated in Figure 2.E.2. The magnitude of the percent increase during the summer is greater in Olalla Creek. Streamflow in Lookingglass Creek at Brockway near the South Umpqua River, which includes Olalla Creek flows, is much greater than Olalla Creek only. Thus the percent increase in total streamflow from regulation is much less. However, the mean streamflow in Lookingglass Creek increased in August from 0.1 to 7.2 cfs and in September from 0.9 to 11 cfs before and after regulation of flow.

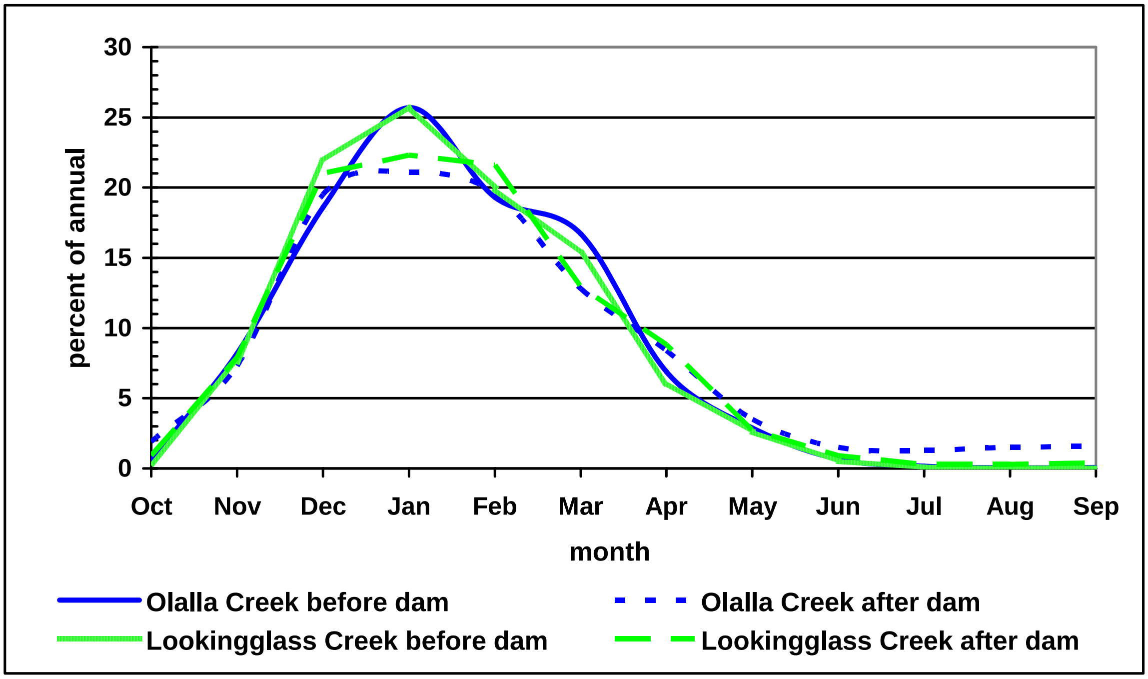

Figure 2.E.2: Monthly streamflow on Olalla and Lookingglass creeks before and after regulation of flows by Berry Creek Dam.

<u>Flooding</u>
Flooding of riparian agricultural lands occurs frequently in these tributary sub-basins eroding streambanks and contributing to siltation problems in the streams and in the South Umpqua River. Flooding of some residences is a recurring problem along Deer Creek. Table 2.E-5 lists the flood history since the 1950s on Lookingglass Creek and Deer Creek.

In November 1996, South Fork Deer Creek flowed 1,720 cfs; considered just under a 10-year flood event, and Deer Creek near Roseburg measured over four feet above flood level. During the storm, Roseburg received a record 4.35 inches in one day, and precipitation in the weeks prior to the storm was above average leading to already saturated soils. The combination of heavy rains, snowmelt, saturated soils, and flooding also resulted in debris flows and landslides. More flooding occurred a few weeks later from December 4th-9th and again on January 1st-2nd. Olalla Creek and Days Creek streamflow during December were considered just under 25-year recurrence intervals. Deer Creek again flooded measuring nearly four feet above flood level.

Date	Lookingglass Creek at Brockway[d] 1956-2005 (18 ft)	Deer Creek near Roseburg 1950-2006 (10 ft)
Oct 29-30, 1950	n/a	3.38
Dec 22-26, 1955	*6.93*	*3.67*
Dec 20-21, 1957	1.96	1.36
Jan 12, 1959	2.27	---
Feb 10, 1961	---	1.84
Nov 23, 1961	1.51	2.45
Dec 02, 1962	---	0.37
Jan 19-20, 1964	0.95	1.60
Dec 22, 1964	2.00e	1.88
Dec 28, 1965	---	3.49m 4.76m
Jan 04, 1966	4.64	---
Dec 04, 1966	---	0.92
Dec 21, 1969	---	1.50e
Jan 17, 1971	---	3.43
Jan 22, 1972	---	1.81
Jan 15, 1974	---	2.73
Dec 06, 1981	---	5.39
Feb 17-18, 1983	---	4.29
Nov 18-19, 1996	---	4.35
Dec 07-08, 1996	---	3.96
Nov 21-22, 1998	---	2.76
Dec 30-31, 2005	---	3.68 3.44

() indicates the flood level at each station; d = discharge affected by diversion or regulation after 1980; n/a = station not in operation; e = estimate based on discharge; m = multiple values recorded.
Source: USGS National Water Information System and Douglas County Flood Crest History from the Douglas County website last updated March 15, 2006.

Table 2.E-5: Water height (in feet) above flood level in two tributaries to the South Umpqua River since 1956.

The November storm caused more flooding in the North Umpqua and Calapooya sub-basins, while the December storms caused more flooding in the South Umpqua River and Umpqua River sub-basins. The January storms did not produce the flooding of the earlier events, but caused more damage throughout the County due to the saturated conditions.

The combined damage from flooding and land disturbances caused over $11 million in damage to public and private property within the Umpqua River basin (USGS 2004). The Umpqua National Forest and Oregon State highways within the County incurred over $7 million in damage; and BLM lands, local municipal infrastructure, and private property were each over $1 million in damage.

Flooding also occurred at the end of December 2005 and early January 2006. Deer Creek exceeded its flood level by about 3.5 feet near Roseburg. Although there is no flood gage at the Olalla Creek near Tenmile station, December 31, 2005 had a peak discharge of 4,260 cfs which was the fifth highest discharge since 1979. Lookingglass Creek did not flood, but had a peak discharge of over 14,600 cfs in January 2006, its highest peak flow since 1971 (equal to the flow in 1983). Very high flows in many tributaries contributed to higher flows in the South Umpqua and Umpqua rivers resulting in flooding downriver at numerous sites.

Quality

Water quality and quantity affect the use of water. The quality of water in the South Umpqua Tributaries and Cow Creek sub-basins does not always meet state standards for all parameters (see Table 1-1). Failure to meet a standard may vary by season due to changes in quantity of flow, as well as other seasonal changes.

Numerous sites on the South Umpqua River show poor overall water quality as discussed in Section 2.D.1. Although there are no stations that measure overall water quality related to the Oregon Water Quality Index rating on the tributaries, several of the major tributaries are likely contributing to degradation of water quality in the South Umpqua River. Water temperatures on many streams seasonally exceed the limits tolerable to anadromous fish. Reports from the team working on salmon recovery have identified water quality in the South Umpqua River and tributaries as one of the problems limiting coho salmon recovery there (ODEQ 2006).

<u>Point and Non-point Source Pollution</u>
Point source pollution comes from an identifiable point of discharge into the water. Non-point source pollution includes where the primary sources of pollution cannot be identified as coming from a specific site. These factors may include water temperature, erosion and sedimentation, bacteria, and other items. The following discussion of water quality issues in the South Umpqua Tributaries and Lookingglass sub-basins are outlined by parameter. Water quality issues for several parameters are attributed to a combination of point and non-point sources of pollution.

Bacteria
Deer Creek, North Fork Deer Creek, and Myrtle Creek in the South Umpqua Tributaries sub-basin all failed to meet State water quality standards for bacteria during some portion of the year. Listings are shown in Table 2.E-6. Elevated bacteria levels pose a health threat to people using the river for water contact recreation. Roberts Creek and an unnamed creek near the Douglas County Landfill also had samples with high concentrations of *E. coli*. However, these three streams are not currently on the 303(d) list.

Stream	Segment (river mile)	Criteria	Season
Deer Creek	0 to 9.6	*E. coli*	fall, winter, spring
Deer Creek	0 to 9.6	fecal coliform	year around
North Fork Deer Creek	0 to 6.7	*E. coli*	year around
Myrtle Creek	0 to 18.3	*E. coli*	summer
Source: Oregon DEQ 2004/2006 Integrated Report.			

Table 2.E-6: South Umpqua River tributaries water quality limited for bacteria.

There are no known facilities that discharge fecal bacteria into Deer Creek. Elevated levels are thus attributed to non-point sources. The TMDL attributes input from many sources since elevated levels are widespread throughout the sub-basin and throughout the year. It associates sources with agriculture, residential and urban land uses in the following discussion:

> During the summer period, two sampling sites showed large increases in *E. coli* concentrations: Deer Creek near Roseburg and North Fork Deer Creek upstream of rive mile 2.9. The former is likely due to urban sources like storm drains and the later to agricultural sources such as livestock. …Forested land does not appear to cause or contribute to bacteria water quality violations in the Deer Creek Watershed.

There are no point sources of discharge into Myrtle Creek. Based on the TMDL analysis, Myrtle Creek will require a 69 percent reduction in *E. coli* concentrations from non-point sources to meet water quality standards.

The Umpqua Basin TMDL has assigned load allocations to point and non-point sources of bacteria. The sources of bacteria addressed in the TMDL were summarized in the following way:

> Studies by DEQ during storms indicated that forested lands do not contribute any significant bacteria load to streams in the Umpqua Basin, but agricultural, rural residential and urban lands, as well as possible turbulence releasing bacteria from stream sediments were the sources of bacteria. Since relative contributions could not be determined from the data, the load allocations for non-point sources were allocated to all non-point sources in the basin.

Temperature

Water temperature is a major factor affecting water quality. It effects concentrations of other constituents, as well as the chemical and biological interaction of these constituents. It is a primary factor in determining the types of organisms able to inhabit a body of water. Salmonids are among the most sensitive fish; therefore ODEQ surface water temperature standards have been set based on salmonid temperature tolerance levels. The temperature standard varies throughout the Umpqua Basin according to the habitat area and the species that use that area. The standard is based on a seven-day average maximum (7DAM) temperature to avoid short-duration spikes in temperature that likely have minimal impacts on salmonids.

Throughout the South Umpqua Tributaries and Lookingglass Creek sub-basins, the maximum desirable water temperature is approximately 55°F during spawning periods. Spawning times vary by stream but are generally between September and June. During the rest of the year (primarily summer) when salmonids are migrating and rearing, the temperature standard is 64°F for tributary reaches that discharge into the lower segments of the South Umpqua River. These streams include Deer Creek, North and South Myrtle creeks, Canyon Creek, Days Creek, and Lookingglass Creek. Stream temperatures that exceed 64°F may cause health problems for salmonids.

The upper reaches of the South Umpqua River are considered core cold-water habitat requiring a lower temperature maximum of about 61°F during the non-spawning summer months.[70] Tributaries with core cold-water habitat include Salt Creek and Elk Creek, as well as many other tributaries in the upper reaches of the sub-basin. Although these are desirable temperatures based on healthy salmonid populations, there is no evidence that all of these streams ever met these standards. Warm-water fish species can tolerate water temperatures up to 86 to 90°F depending upon dissolved oxygen levels.

Four streams in the Lookingglass Creek sub-basin have segments that exceed State water temperature standards when salmonids are rearing and migrating in the streams. This is generally during the warmer summer months when the standard is 64°F. Twenty other streams in the South Umpqua Tributaries sub-basin have segments that exceed water quality standards for temperature. Table 2.E-7 lists the streams currently on the 303(d) list for stream temperature in the sub-basins along with the season of impairment relative to salmonid spawning.

[70] Core cold-water habitat on the South Umpqua River extends from the headwaters to about Milo; tributary streams above Milo are also within the core cold-water habitat area.

Stream	Season	Stream	Season
Deer Creek sub-basin		Days Creek sub-basin	
Deer Creek	year around	Days Creek	non-spawning
Myrtle Creek sub-basin		Fate Creek	non-spawning
Buck Fork	non-spawning	Elk Creek sub-basin	
Johnson Creek	non-spawning	Brownie Creek	summer
Letitia Creek	non-spawning	Drew Creek	summer
Louis Creek	non-spawning	Elk Creek	non-spawning
North Myrtle Creek	non-spawning	Flat Creek	summer
Riser Creek	non-spawning	Joe Hall Creek	summer
School Hollow Creek	non-spawning	Lookingglass Creek sub-basin	
South Myrtle Creek	non-spawning	Lookingglass Creek	non-spawning
Weaver Creek	non-spawning	Olalla Creek	non-spawning
Canyon Creek sub-basin		Rice Creek	non-spawning
Canyon Creek	year around	Thompson Creek	non-spawning
unnamed tributary	year around		
West Fork Canyon Creek	year around		
Source: Oregon DEQ 2004/2006 Integrated Report.			

Table 2.E-7: Streams that exceed State water quality temperature standards in the South Umpqua Tributaries and Lookingglass Creek sub-basins.

Deer Creek exceeds the standard throughout the year from the mouth to stream mile 9.6. The Partnership for the Umpqua Rivers (PUR) Watershed Council sponsored a study that conducted temperature monitoring in 1999 throughout the South Umpqua Watershed including the Deer Creek sub-basin. The data was collected as part of the South Umpqua Watershed Temperature Study 1999 (Smith, 2003c). Results of that monitoring found warm stream temperatures not only on Deer Creek, but throughout the sub-basin. The PUR's Watershed Assessment for Deer Creek states the following:

> The seven-day moving average [temperature] reached above 64°F at every sample location in the watershed. …The warmest water temperatures occurred on August 25th. On this day, the maximum seven-day average temperatures at two sites on the mainstem [Deer Creek] were 73.1° and 75.7°F; on North Fork Deer Creek 70.0°F and 66.3°F; and on South Fork Deer Creek 71.7°F and 75.6°F (Kincaid 2002).

Myrtle Creek sub-basin has seven streams listed for stream temperature including North and South Myrtle creeks. All are in the warmer non-spawning portion of the season. Temperature monitoring in summer 1999 found seven-day average maximum temperatures exceeded standards for the entire monitoring period from late June to middle of September in the lower reaches of North Myrtle Creek with a maximum reaching almost 75°F; and for nearly the entire monitoring period in South Myrtle Creek with a maximum reaching over 71°F (Geyer, 2003e).

The three streams listed in the Canyon Creek sub-basin exceed temperature standards throughout the year indicating that even in the spawning season that occurs in the winter months the temperature exceeds 55°F. Most of the listings in the Elk Creek sub-basin are for the summer season only when salmonids are rearing and migrating. This sub-basin is in the upper reaches of the South Umpqua River sub-basin and requires a lower summer standard of 61°F for core cold-water habitat. Elk Creek is also warm during the winter spawning season.

Days and Fate creeks in the Days Creek sub-basin and all four streams listed in the Lookingglass Creek sub-basin exceed stream temperature standards only during the rearing and migrating season. The Olalla/Lookingglass Watershed Assessment (DeVore and Geyer, 2003) summarized temperature monitoring data collected in the summer of 1999 from several locations in the Lookingglass Creek sub-basin. Figure 2.E.3, taken from the watershed assessment shows the moving seven-day average maximum temperatures of six monitored sites within the Lookingglass Creek sub-basin.

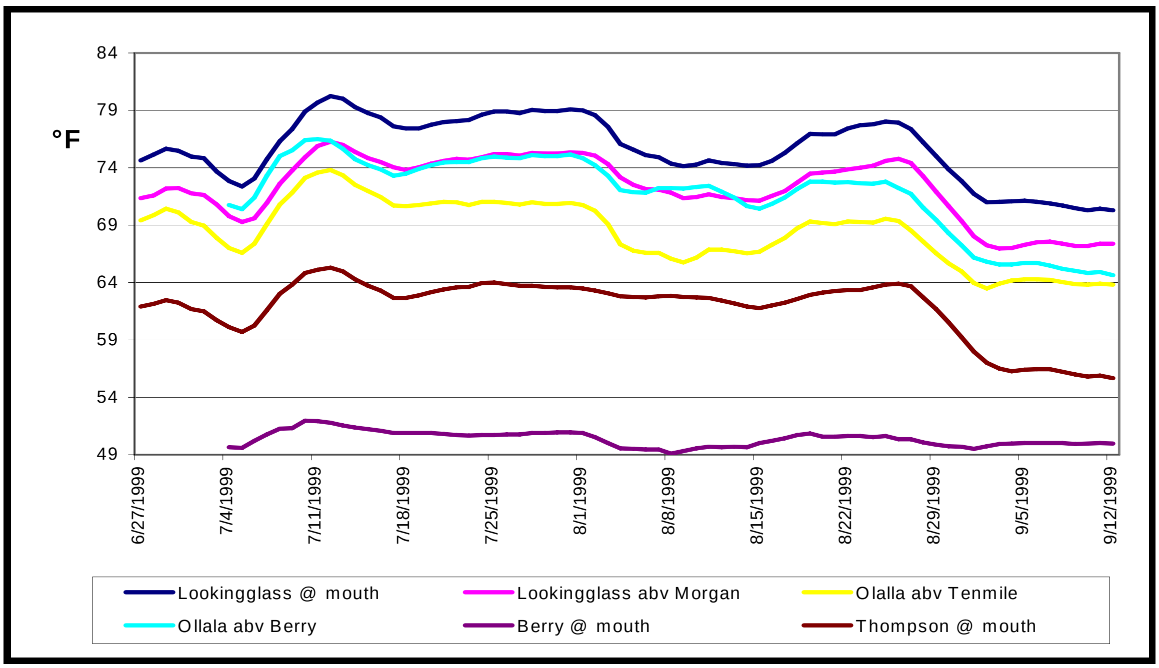

Figure 2.E.3: Summer 1999 temperature trends for several streams in the Lookingglass Creek sub-basin (DeVore and Geyer, 2003).

Both sites on each of Lookingglass and Olalla creeks exceeded the 64°F standard for all or most of the summer. Lookingglass Creek above Tenmile dropped back below the standard in early September. Thompson Creek, although listed for temperature, did not exceed the standard except for a short duration in the middle of July.

The monitoring site at the mouth of Berry Creek is located just below the Ben Irving Reservoir where the deep massive quantity of water in the reservoir maintains cooler water temperatures and isolates the temperature readings from seasonal variations (Smith, 2003c). Although Olalla Creek sustains temperatures above the State standard of 64°F for most of the season, the reservoir has a noticeable cooling effect on Olalla Creek. The moving average for Olalla Creek above Berry Creek is considerably warmer (up to 5°F at times) than downstream where the cooler Berry Creek water mixes with Olalla Creek reflected in the lower moving seven-day average at the Olalla Creek above Tenmile site (see Figure 2.E.3). This effect appears to diminish further downstream. Stream temperatures near the mouth of Lookingglass Creek are similar to the South Umpqua River above the confluence with Lookingglass Creek.[71] Refer to the Olalla/Lookingglass Watershed Assessment for more details on temperature in the Lookingglass Creek sub-basin (Devore and Geyer, 2003).

Water temperatures vary with local ambient conditions, direct solar radiation, and proportion of ground water flowing into the stream. The effect of ambient air temperature on stream temperature is reflected in Figure 2.E.3 where stream temperatures vary by site but the daily stream temperature pattern is the same at all sites; and maximum and minimum seven-day average maximum temperatures typically occur on the same days at each location.[72]

Stream temperature at a particular point is a function of many local factors that include exposure to solar radiation, longwave heating from the local environment and groundwater interaction. Water's susceptibility to change temperature is a function of both the volume and velocity of flow. Stream temperatures usually follow a warming trend as the distance from the headwaters and the corresponding stream volume increases and the proportion of ground water inflow decreases. Tributaries tend to be approximately 10°F cooler than the mainstem of the South Umpqua River, with smaller streams cooler than larger ones. Streams that are exposed to direct sunlight can exceed the standard in a shorter distance than those with ample shade. Temperatures may also vary within a given area on a stream with cooler temperatures in the deeper water. Isolated points of upwelling ground water may provide some thermal refuge for aquatic life.

Results from the Smith study in the South Umpqua Watershed indicate that many of the tributary streams have the potential to be at cooler temperatures. In addition, Smith hypothesizes that there may be an optimal stream size most conducive to providing cold-water fish habitat:

> …the quality of the fish habitat tends to be related to the size of the stream. The very small streams may be the coldest but they may not have a sufficient volume of water for adequate rearing during the summer months. The large streams have sufficient water, but may get too warm. If temperature is limiting the health and development of the fish, there

[71] Lookingglass Creek appears slightly warmer than the South Umpqua River in late June and cooler by late July. The monitor on the South Umpqua above Lookingglass Creek was warmer than other South Umpqua River sites due to the location of the monitor in a nearly isolated bedrock channel by later in the summer that showed substantially warmer temperatures than the main flow of the river.

[72] The seasonal pattern is quite different at the mouth of Berry Creek site due to the cooling effects of the Ben Irving Reservoir.

> may be an optimum stream size range that has the right mix of water and temperature. If this proves to be the case, these areas should be identified and receive management emphasis.

Dissolved Oxygen

Salmonid eggs and smolts are sensitive to dissolved oxygen levels. When levels drop too low for even short periods of time, eggs, smolts, and other aquatic organisms will die. The amount of oxygen that is dissolved in water will vary depending upon temperature, barometric pressure, flow, and time of day. Both cold water and higher barometric pressure dissolve more oxygen than warm water, and low pressure. In addition, flowing water contains more dissolved oxygen than still water. Aquatic organisms produce oxygen through photosynthesis and use oxygen during respiration. As a result, dissolved oxygen levels tend to be highest in the afternoon when algal photosynthesis is at its peak, and lowest before dawn after organisms have used oxygen for respiration during the night.

Deer Creek is listed as water quality impaired during the spawning season from October 15th to May 15th from the mouth to stream mile 9.6. Measuring biological oxygen demand is often used to determine influences on dissolved oxygen. ODEQ determined that there are no point sources of biological oxygen demand in Deer Creek and that a 50 percent reduction in biological oxygen demand would be necessary from primarily non-point sources to meet the dissolved oxygen standard in Deer Creek.

Low dissolved oxygen levels are associated with warm stream temperatures, and high bacteria levels. Deer Creek is considered water quality impaired for both of these parameters as well. Reducing bacteria and temperature in Deer Creek should also help increase dissolved oxygen levels (ODEQ 2006).

Although ODEQ determined that point sources did not contribute significantly to low dissolved oxygen levels, wastewater discharge permits will be reviewed during their permit renewals to insure compliance with the Umpqua Basin TMDL.

Toxics

Toxics may be a concern for fish and aquatic life, drinking water, fishing, and human health. A variety of substances can be toxic including metals, and organic and inorganic chemicals. Some of these substances are found naturally in stream water. The State monitors toxic levels in the water so they are not introduced above natural background levels in amounts, concentrations, or combinations that may be harmful to public health, safety, or welfare; or detrimental to aquatic life, wildlife, or other beneficial uses of the stream. Olalla Creek is considered water quality impaired for iron from the mouth to stream mile 21.8. Elevated iron levels in Olalla Creek may pose problems for both aquatic life and human health. This listing is based on two samples taken in 1995 at stream mile 11.3 that both failed to meet the criteria for iron.

Sediment
Sediment includes both organic and inorganic material that enters the stream and eventually settles to the bottom. Those causing water quality concerns are typically fine particles that have the potential of forming a sludge layer on the streambed. This causes problems for fish and aquatic life since they use the gravel beds to spawn. The sludge layer can prevent water flow through gravel; thus preventing oxygen flow to redds.

Turbidity is a measure of water clarity and is closely related to sediment. High turbidity levels usually indicate large amounts of suspended sediment that can cause problems for aquatic life, water supply, and aesthetic quality. High turbidity levels can make it difficult for sight-feeding aquatic organisms to see and find food. It can also clog water filters and the respiratory structures of fish and other aquatic life. Suspended sediment is also a carrier of other pollutants including bacteria and toxins.

There are no streams in the South Umpqua Tributaries or Lookingglass Creek sub-basin currently listed as water quality impaired for sediment.

Other Water Quality Concerns
There are 20 streams listed for habitat modification impairments, of which only one is in the Lookingglass Creek sub-basin. There are also 20 streams listed for flow modification, of which four are in the Lookingglass Creek sub-basin. Streams listed for these two parameters are considered water quality impaired, however they do not require a TMDL since the impairment is not from a pollutant. They are usually caused by physical changes to the stream environment. They can be related to stream crossings that restrict or change flow patterns, streambank modification, vegetation changes or losses, and loss of streambed material from flooding, dredging, or historic logging practices with log flumes.

These impairments are common throughout the Umpqua Basin. They can affect other parameters including sediment, dissolved oxygen, and temperature by increasing erosion and streamflow velocity, and decreasing shade. Loss of floodplain vegetation can also increase the rate of streamflow and decrease filtering of sediment and toxics. Efforts to improve fish passage and riparian conditions can help to improve these impairments.

Wastewater Permits
ODEQ manages a wastewater permit program that identifies point-sources of wastewater with potential serious water quality or public health impacts. It requires that those facilities obtain and comply with a wastewater discharge permit. Permit conditions generally include effluent limits; monitoring standards; compliance conditions to improve operation; special operating conditions; and other administrative requirements such as prompt reporting of spills.

Since 1973, permits for discharges to surface waters are issued under the National Pollutant Discharge Elimination System (NPDES). The primary purpose of these permits is to insure that wastewater discharges do not cause harm to the receiving waters or endanger public health. Wastewater discharges that affect land quality and/or ground water are regulated under Water Pollution Control Facilities (WPCF) permits. Their primary purpose is to protect public health and ground water.

General permits are issued when an individual permit is not necessary to adequately protect water quality, and there are several minor sources or activities involved in similar operations that are discharging similar types of waste. These general permits can be to surface water discharges or ground water/land discharges. Individual and general wastewater permits to surface water issued in the South Umpqua Tributaries and Lookingglass Creek sub-basins are discussed in this section and listed in Table 2.E-8. Permits for discharges that may affect ground water are discussed in the Ground Water Quality section.

Point-source discharges include minor industrial sources such as stormwater and industrial wastewater discharges, as well as minor domestic sewage discharges.
The City of Myrtle Creek holds the only permit in the sub-basins for domestic sewage discharge. The first 0.5 miles of North Myrtle Creek was previously water quality limited for ammonia due to discharge of effluent high in ammonia from the Myrtle Creek wastewater treatment plant. This listing is being removed based on the permit renewal that stipulates removal of ammonia from discharges at the plant.

There are a total of 51 discharge permits into tributaries within the South Umpqua River sub-basin. Most are for stormwater discharge. Approximately 31 percent of those occur in the Deer Creek sub-basin. There are also concentrations on Newton and Roberts creeks. All three of these tributaries drain into the South Umpqua River within or near Roseburg. This is also where large concentrations of discharge permits are held within the mainstem South Umpqua River (see Wastewater Permits in Section 2.D.1). There are no permits held for tributaries in the upper reaches of the South Umpqua sub-basin. Only one permit is held within the Lookingglass Creek sub-basin.

This lower portion of the South Umpqua River travels through the highest populated areas in the Umpqua Basin and thus gets the heaviest use. The lower forty miles include water quality impairments related to bacteria, temperature, dissolved oxygen, pH, phosphorus, algae, chlorine, arsenic, and cadmium. Many of the point source discharges are contributors to these problems in conjunction with non-point factors including low summer flows, and the geology and soils of the area.

Source	Receiving stream	River mile	Waste category
Deer Creek sub-basin			
Hamilton, Kurt	Deer Creek	1.24	stormwater
Hayes, Richard E.	Deer Creek	1.80	stormwater
Concord Enterprises, Inc.	Deer Creek	1.83	stormwater
Carrico, Robert	Deer Creek	2.52	stormwater
Nordic Veneer, Inc. (2)	Deer Creek	3.00	stormwater and industrial
Litherland, Jim	Deer Creek	3.16	stormwater
Kramer, Michael	unnamed trib to Deer Creek	0.15	stormwater
Tabor, Jerry	unnamed trib to Deer Creek	0.16	stormwater
Rocky Ridge Venture, LLC.	unnamed trib to Deer Creek	0.18	stormwater
Debell Homes & Development Co. LLC	unnamed trib to Deer Creek	0.37	stormwater
MRB Enterprises, Inc.	unnamed trib to Deer Creek	0.55	stormwater
Concord Enterprises, Inc.	unnamed trib to Deer Creek	0.77	stormwater
Rose Village LLC	unnamed trib to Deer Creek	1.16	stormwater
Roseburg Forest Products	North Fork Deer Creek	1.20	stormwater
Cal Cedar Properties, Inc.	Shick Creek	0.33	stormwater
Myrtle Creek sub-basin			
Myrtle Creek, City of	North Myrtle Creek	0.33	domestic
Hamilton, Kurt	North Myrtle Creek	1.03	stormwater
Adams, Gregg (2)	South Myrtle Creek	0.58	stormwater
Canyon Creek sub-basin			
Stagecoach Land Co. LLC	Canyon Creek	1.11	stormwater
Baughman, Tim & Carol	Canyon Creek	1.16	stormwater
Canyonville, City of	Canyon Creek	1.50	industrial
Place Family, LLC. (2)	Canyon Creek	1.50	stormwater
Lookingglass Creek sub-basin			
Safari Estate, LLC	Lookingglass Creek	0.50	stormwater
( ) indicates the number of permits held if more than one. Source: ODEQ Wastewater Permits Database accessed 11/30/06.			

Table 2.E-8: Waste discharge permits in the Deer Creek, Myrtle Creek, Canyon Creek, and Lookingglass Creek sub-basins.

Surface Water – Lakes and Reservoirs

Quantity

Ben Irving Reservoir

Ben Irving Reservoir was created in 1980 on Berry Creek, a tributary of Olalla Creek in the Lookingglass Creek sub-basin. It was named for the Douglas County Water

Resources Survey Director whose career spanned the years from 1909 through 1967. The reservoir is impounded behind Berry Creek Dam on Berry Creek, a tributary to Olalla Creek in the Lookingglass Creek sub-basin. The dam is an earth-fill structure with a concrete overflow spillway that blocks a narrow valley with rock outcrops on either side. The watershed above the dam has an area of 17.5 square miles. The dam height is 130 feet and provides a storage capacity of 11,250 acre-feet. At full pool, the reservoir covers 250 acres.

It is primarily used for recreation and irrigation. The County has developed picnic sites and a boat ramp on the north shore for recreational use. The reservoir has been stocked with large-mouth bass and trout. Activities include swimming, waterskiing, and reservoir fishing.

Win Walker Reservoir

The City of Canyonville, with the assistance of Douglas County, constructed a concrete gravity dam on West Fork Canyon Creek in 1982 for storage of 300 acre-feet for its municipal water supply. The resulting Win Walker Reservoir has a water surface area of 35 acres at full pool. The reservoir is closed to recreation use.

The City of Canyonville also has a 2.5 acre reservoir on O'Shea Creek that provides 25 acre-feet at full pool for municipal uses. O'Shea Creek is located outside of the Canyon Creek sub-basin to the east.

Iverson Reservoir

Iverson Reservoir is a five acre reservoir on Tenmile Creek with a storage capacity of 50 acre-feet used for private recreation. There are no other lakes in the South Umpqua Tributaries/Lookingglass Creek sub-basins.

Quality

There is a moderate turbidity problem in Ben Irving Reservoir. Under increasingly more stringent watershed management processes, the condition is expected to gradually improve. The turbidity of the stored water is not severe enough to affect benefits obtained by release of colder water in larger volumes than would otherwise be present in Olalla and Lookingglass Creeks.

The quality of water stored in Canyonville's reservoir is acceptable for diversion by the City.

Ground Water

Over 90 percent (2,459) of Oregon's public water supply systems get their water exclusively from ground water. Over 90 percent of all rural residents rely on ground water for drinking water (ODEQ 2003). Industry and irrigation of agriculture and livestock are also dependent on ground water supplies. Base flow for most of the state's rivers, lakes, streams, and wetlands is from ground water sources. Cool groundwater inflow effectively cools streams during the summer months, often providing critical thermal refuge areas for sensitive freshwater species. The magnitude of this effect depends upon the ratio of the groundwater inflow to the amount of surface flow.

The dominant ground water use in Douglas County is for domestic purposes. It serves as the primary drinking water source for rural residents. As surface water sources are used to capacity, residents are becoming more dependent on ground water resources. These demands are expected to increase as the population of the County increases especially in rural areas. In the South Umpqua Tributaries sub-basins, approximately 1,776 wells are identified as domestic use wells. There are also 4 wells for livestock watering and 9 wells for irrigation all but one of which are located in the Lookingglass Creek sub-basin. South Myrtle Creek also has 1 community and 1 industrial use well.

Quantity

The majority of the South Umpqua Tributaries and Lookingglass sub-basins are underlain by formations composed of Tertiary marine sedimentary rocks of low permeability. In general, permeability may be sufficient to supply wells for domestic use, but are too low for irrigated agriculture, large scale industrial or municipal use. However, there are isolated wells in the Lookingglass and Flournoy valleys that do provide sufficient yields for irrigation purposes.

Table 2.E-9 lists the number of wells by water yield in each sub-basin. All sub-basins show the highest proportion of well yields in the 1 to 5 gpm category, which is adequate to meet most domestic use needs. However, large portions show well yields of < 1 gpm in all sub-basins ranging from 14 percent in Deer Creek to 40 percent in Days Creek. This indicates that significant wells do not yield adequate water for even domestic needs without supplementing with other water sources or storage. The Days Creek sub-basin also has the lowest percentage of wells with the highest yields of > 10 gpm (7 percent) and > 5 to 10 gpm (13 percent). The depth range across all sub-basins is relatively similar.

Area	Depth range (feet)	Number of wells by water yield (gpm)			
		<1	1 to 5	> 5 to 10	>10
Deer Creek	12 to 505	26	73	46	42
North Myrtle Creek	29 to 510	38	55	32	25
South Myrtle Creek	25 to 445	19	48	24	25
Days Creek	25 to 405	21	21	7	4
Lookingglass Creek	20 to 574	206	403	192	353
Source: Oregon Water Resources Department (well data from 1955 to 2007).					

Table 2.E-9: Number of wells by water yields within the South Umpqua Tributaries and Lookingglass Creek sub-basins.

Table 2.E-10 and Table 2.E-11 show comparisons of well data from before and after 1980 in each sub-basin. The distribution of well yields in Deer Creek has stayed relatively constant between the two time periods with 5 percent fewer abandoned new

wells. Although well yields are fairly constant, the drilling depth has increased indicating a possible drop in water table in some areas.

In North and South Myrtle creeks sub-basins there have been substantial increases in the proportion of new wells yielding less than 1 gpm. In North Myrtle Creek the proportion is five times greater than it was prior to 1981. The proportion of all other yield categories has decreased since 1980 except wells that yield >5 to 10 gpm in South Myrtle Creek, where there has been an increase of 10 percent. Drilling depths have increased but not substantially in these two sub-basins.

Category	Deer Creek		North Myrtle Creek		South Myrtle Creek	
	1955-1980	1981-2007	1957-1980	1981-2007	1957-1980	1981-2007
Total new wells	111	112	89	80	63	55
new wells abandoned	8 %	3 %	0 %	0 %	0 %	0 %
Yield (gpm)						
< 1	14 %	13 %	8 %	41 %	10 %	22 %
1 to 5	40 %	39 %	49 %	26 %	43 %	40 %
> 5 to 10	25 %	24 %	25 %	18 %	16 %	26 %
> 10	21 %	24 %	18 %	15 %	31 %	12 %
Depth drilled (feet)						
median depth	103	245	120	160	115	125
average depth	138	250	136	166	143	162
Source: Oregon Water Resources Department						

Table 2.E-10: Comparison of well data before and after 1980 for Deer Creek and North and South Myrtle creeks sub-basins.

Category	Days Creek		Lookingglass Creek	
	1959-1980	1981-2007	1955-1980	1981-2007
Total new wells	28	23	695	455
new wells abandoned	0 %	0 %	1 %	0 %
Yield (gpm)				
< 1	32 %	48 %	13 %	24 %
1 to 5	54 %	24 %	36 %	33 %
> 5 to 10	7 %	20 %	18 %	15 %
> 10	7 %	8 %	33 %	28 %
Depth drilled (feet)				
median depth	115	188	90	170
average depth	136	218	110	187
Source: Oregon Water Resources Department				

Table 2.E-11: Comparison of well data before and after 1980 for the Days Creek and Lookingglass Creek sub-basins.

In Days Creek the number of new wells is relatively small with only 51 new wells in both categories combined (Table 2.E-11). The small number of wells may indicate less reliable information to determine trends in ground water availability. There are no records of abandoned wells in Days Creek from any time period. Well yields of <1 gpm have increased 16 percent. However, higher yield wells > 5 to 10 gpm have increased 13 percent and those over 10 gpm have also increased slightly. Well depths have increased 38 percent. This may indicate that water in some of the lower yield areas is still available but at greater depths and lower yields, while other areas still produce water at higher yields.

Well data from the Lookingglass Creek sub-basin show an increase of 11 percent in wells that yield < 1 gpm since 1980 while all higher yield categories show a decreasing trend. There are also slightly fewer new wells abandoned indicating more acceptance of low yield wells for both primary and supplemental domestic use. The average drilling depth has increased 41 percent to 187 feet. Deeper drilling combined with decreased yields may indicate that while many wells still meet domestic needs, the ground water level may be dropping in some areas.

Quality

Current ground water quality information in the sub-basins is limited. The USGS sampled wells in the sub-basins in the 1970s to assess ground water quality in the area. Sampling from the 1970s was done on 13 wells in the Lookingglass Creek sub-basin and on 15 wells in the South Umpqua tributaries. The number of samples that exceeded representative standards for each parameter is shown in Table 2.E-12. The standards listed in Table 2.E-12 were in effect at the time the samples were taken. Standards that have changed since that time are also noted in the table. The standards apply to public drinking water supplies. Concentrations exceeding the standards may be acceptable to many users.

Of the constituents listed, fluoride, arsenic, and nitrate are considered to have standards that when exceeded, are not suitable for human health. Fluoride is beneficial in moderate amounts because it retards dental decay, but in concentrations of more than several milligrams per liter can eventually cause darkening or mottling of children's teeth. In excess of 4 mg/l it may lead to bone disease including pain and tenderness of the bones. Arsenic in concentrations greater than the standard is considered grounds for rejection of the water supply. Large amounts of nitrate can cause methemoglobinemia (blue baby effect) in infants. No samples exceeded standards in these parameters.

Three samples were high in boron in the South Umpqua Tributaries and 2 in the Lookingglass Creek sub-basin when analyzed at the previous standard of 0.75 mg/l. However, there is no current EPA or Oregon standard for boron. Exposure to high boron concentrations may cause male reproductive problems. The World Health Organization currently recommends a maximum of 0.5 mg/l in drinking water. At the lower standard, there may be more wells that do not meet World Health Organization recommendations.

The remaining constituents when present above the recommended standards may affect the aesthetic quality and public's acceptance of drinking water. Almost half of the samples in the South Umpqua Tributaries were high in iron and manganese, and over half in the Lookingglass Creek area were high in manganese. Excessive iron or manganese causes staining of plumbing fixtures and laundry and can give a peculiar taste to the water. Sulfate in excessive concentrations can have a laxative effect on persons not accustomed to the water. Excessive chloride may give a salty or mineral taste to the water.

Parameter	Standard (mg/l)	Sub-basin	
		Lookingglass Creek	South Umpqua Tributaries
Wells sampled		13	15
Iron (Fe)	0.3	1	7
Manganese (Mn)	0.05	8	7
Sulfate (SO_4)	250	0	0
Chloride (Cl)	250	0	2
Fluoride (F)[1]	1.8	0	0
Boron (B)[2]	0.75	2	3
Arsenic (As)	0.01	0	0
Nitrate + Nitrite expressed as N	10	0	0

[1] The current standard for fluoride is 2.0 mg/l for children under 9 years and 4 mg/l for all other individuals.
[2] There is currently no recommended standard for boron by the EPA or the State of Oregon. However, the World Health Organization currently recommends an upper limit of 0.5 mg/l in drinking water.
Source: Douglas County Water Resources Management Plan (1989).

Table 2.E-12: Ground water quality from wells in the Lookingglass Creek / South Umpqua Tributaries sub-basins.

Excessive hardness is undesirable but seldom is cause for rejection of a water supply. The USGS rating for hardness is shown in Table 2.E-13, along with the count of samples in each category. Ground water in the South Umpqua Tributaries tends to be hard or very hard with 60 percent of the samples in these categories. Well samples in the Lookingglass Creek sub-basin showed only 17 percent in the hard or very hard ranges.

Hardness range ($CaCo_3$ in mg/l)	Rating	Sub-basin	
		Lookingglass Creek	South Umpqua Tributaries
0 to 60	soft	7	2
61 to 120	medium	4	4
121 to 180	hard	1	6
more than 180	very hard	1	3

Source: Douglas County Water Resources Management Plan (1989).

Table 2.E-13: Ground water hardness in the Lookingglass Creek / South Umpqua Tributaries sub-basins.

According to the Oregon Department of Human Services, at least three wells used for public drinking water in the Lookingglass Creek sub-basin have shown slightly elevated sodium levels between 1992 and 2005 ranging from 29.6 to 133 mg/l. There is no standard level for sodium although a recommended level for aesthetic quality has been set at 20 mg/l by EPA. Elevated sodium in drinking water does not pose a human health risk but can make the water unacceptable to many users.

2.E.2. Water Use

The following material discusses current and future water use in this portion of Douglas County. Water use purposes considered include municipal, rural domestic, industrial, irrigation, aquatic life, recreation and hydroelectric power. Analysis and more detailed discussion of municipal, rural domestic and industrial water use are included in Appendix M. Irrigation water use is analyzed in Appendix I, and water use needs for Aquatic Life are discussed in Appendix F.

Current

For purposes of this report, the measure of current water use is derived from water use reports showing raw water diversion by each water district and by water rights information provided by the Oregon Water Resources Department. Some water use report information was also obtained from individual water service providers.

The priority date of a water right of record is the governing factor during times of water shortage. If priority dates are the same, then domestic use has preference over all other uses; agricultural purposes are next in line; and all other uses follow. For information on Oregon water law and the 1909 water code, refer to Water Use in Section 2.A.2.

Municipal

Appendix M contains the derivation of water needs for municipal water use in the sub-basins. The information on current municipal water use is summarized in this section for the City of Canyonville, the only water service provider within the sub-basins.

Several other cities and water districts provide water to residents within the sub-basins. However, water for those services is diverted from the North Umpqua River, South Umpqua River, or Cow Creek. Therefore they are summarized in the municipal use sections of sub-basins B and D. Winston-Dillard Water District and Roberts Creek Water District each purchase portions of their water supplies from Ben Irving Reservoir. Discussion of water use by these communities is contained in the South Umpqua sub-basin section and in Appendix M.

The City of Canyonville diverts its water supply from Canyon Creek, a tributary of the South Umpqua River. Average water use between 2000 and 2006, as reported by the City is 151.7 million gallons per year to 594 services. Based on an estimated 2.4 people per service, the average population served was 1,432 people. This equates to a peak daily use of about 618 gallons per capita per day, far higher than the County average of 372 gallons per capita day. The City has provided water to the Seven Feathers Hotel and Casino, Best Western Hotel, and several associated businesses at the truck stop which probably inflate the average rate of use per person. The peak use rate requires an average diversion during the month of July of 424 gallons per minute to meet current peak demand

The City has water rights on Canyon and O'Shea creeks with priority dates of primarily 1927, 1929, 1948, 1951, 1969, and 1977 that total 1,357 gallons per minute. There are also two small water rights with priority dates of 1912 and 1947 that total 12 gallons per minute available during the irrigation season only. The 1977 water right for 449 gallons per minute on Canyon Creek is not reliable during July, August, and September since it is junior to 1974 minimum instream flows on the South Umpqua River. This leaves 920 gallons per minute in available water right during the peak season. The City constructed Win Walker Reservoir on Canyon Creek in 1981 with financial assistance from Douglas County and Farmers Home Administration. The reservoir has a storage capacity of 300 acre-feet, and together with water rights on Canyon Creek provides the primary water source for the City of Canyonville.

The water rights from O'Shea Creek total 450 gallons per minute. These water rights have not been used in recent years due to the system needing upgrades. Over the last four years, the City has been replacing rusted pipe and upgrading the diversion site to enable use of O'Shea Creek again. Although not immediately necessary to meet current demand, the additional source is desirable as a backup in the event that Canyon Creek becomes contaminated; a real possibility as Interstate 5 crosses the creek below Win Walker Reservoir nine times increasing the likelihood of contamination from an accident. The final upgrades to the O'Shea Creek Project are anticipated in 2007 (Skoog 2006).

In 2007, the Cow Creek Band of the Umpqua Tribe of Indians completed development of the Creekside freshwater reservoir that now supplies water for all quasi-municipal Tribal needs that were previously supplied by the City of Canyonville. Water pumped from the South Umpqua River is the source for the 385 acre-foot reservoir. The removal of the Tribe's properties and businesses from using Canyonville's water system will provide the City with more available water to meet future growth in the area. The City and Tribal water systems are cross-pressurized so in the event one system fails, the other provides backup. The backup system agreement is expected to be finalized between the Tribe and the City of Canyonville by 2009.[73]

Rural Domestic

An estimated 13, 823 people reside in the South Umpqua Tributaries sub-basins. Over 40 percent (5,562 people) of those are considered rural domestic users that do not obtain water from a service provider. Most of these people obtain water from ground water wells, springs and some trucked in water. There are 254 domestic surface water rights. With an average of 2.9 people per water right, the estimated population who obtain water

[73] Personal communication 2/4/2008, Wayne Shammel, General Manager for the Cow Creek Band of the Umpqua Tribe of Indians.

from streams and rivers through personal domestic water rights is 737 people, leaving 4,825 people using wells, springs, or trucked in water.

The Lookingglass Olalla Water Control Board regulates the water from Ben Irving Reservoir. The water from the reservoir is designated for residents within the Lookingglass Creek sub-basin. Over 3,000 of the rural domestic users live in the Lookingglass Creek sub-basin within the area covered by the Water Control Board. However, the control board is not a water service provider and thus residents within this area are considered rural domestic users with the exception of those in the lower sub-basin along Lookingglass Creek that are within the Umpqua Basin Water Association area.

Areas in the Lookingglass Creek sub-basin with the highest density include Tenmile along Highway 42, and to the north along Sugar Pine Ridge and Porter Creek. Most of the Myrtle Creek and Deer Creek drainages have rural domestic residents throughout with the highest concentrations around the City of Myrtle Creek; about five miles up North Myrtle Creek near Big Lick Creek; along lower Deer Creek through Dixonville; and on South Fork Deer Creek. The Canyon Creek and Salt Creek watersheds have somewhat smaller populations with the exception of the areas adjacent to Canyonville.

Industrial

There are currently industrial water rights that total 3,457 gallons per minute in all of the sub-basins. About 65 percent of the water rights occur in the Deer Creek sub-basin and the rest are in the Lookingglass and Myrtle Creek sub-basins. Most are related to wood product manufacturing or log pond use and maintenance. The total water rights and type of permits are listed in Table 2.E-14.

Stream source	Water rights (gpm)	Permit type
Deer Creek	1,459	wood manufacturing and mill pond log storage and maintenance
North Fork Deer Creek	785	
Deer Creek sub-total	2,244	
North Fork Myrtle Creek	359	sawmill, log pond, and boiler use
South Fork Myrtle Creek	2	commercial laundry
Myrtle Creek sub-total	361	
Olalla Creek	22	log storage
Tenmile Creek	202	washing rock products, winery
McNabb Creek	628	chemical mixing, road construction
Lookingglass Creek sub-total	852	
Total	**3,457**	

Table 2.E-14: Industrial and commercial water rights in the South Umpqua Tributaries sub-basins.

There are minimum instream water rights held on Deer Creek, North and South Myrtle creeks, Lookingglass, Olalla, and Tenmile creeks. All have instream rights with priority dates of 1974 and 1991 except Olalla Creek which only has a 1974 right. All of the industrial and commercial water rights listed here are senior to 1974 minimum instream flow rights with the exception of the 628 gallons per minute held by the Bureau of Land Management on McNabb Creek which has a priority date of 1984.

Other light industrial and commercial businesses operate within City service areas for water and are provided water service through City industrial and municipal water rights.

Irrigation

Lookingglass Creek and South Myrtle Creek have existing irrigation water rights for over 900 acres in each sub-basin and North Myrtle has 684 acres tied to existing irrigation water rights. Over 80 percent in each sub-basin of existing irrigation water rights have priority dates senior to 1974 instream flow rights for aquatic life except in Days Creek where only 68 percent are senior to 1974. Table 2.E-15 summarizes the acres in each area with current irrigation water rights by priority date. Complete information is included in Appendix I.

Reach	Existing irrigated acres by priority date			
	Pre 1974	1974-1991	1991-2007	Total
Deer Creek	193	29	0	222
Lookingglass Creek	788	37	130	955
North Myrtle Creek	607	77	0	684
South Myrtle Creek	736	159	24	919
Days Creek	122	55	0	177
Source: Oregon Department of Water Resources, 2007 – see Appendix I				

Table 2.E-15: Acres with existing irrigation water rights by priority date (South Umpqua Tributaries sub-basins).

Ben Irving Reservoir has contracts for purchased irrigation water that total 1,518 acres as of October 2007. The Lookingglass-Olalla Water Control District calculates an estimated use of 2 acre-feet per acre. Based on that estimate, a current total of 3,036 acre-feet are currently allocated to irrigation from the reservoir. The storage allocation for irrigation is 8,446 acre-feet, indicating less than 36 percent of the allocation for irrigation is currently under contract.

The State of Oregon establishes the irrigation season and maximum annual diversion (duty) for irrigation water rights. The season for most of the Umpqua Basin including the South Umpqua Tributaries runs from March 1 through October 31, and the duty is 2.5 acre-feet per acre per season.

Table 2.E-16 shows the maximum allowable diversions in acre-feet for each tributary and the estimated distribution of the diversions by month. The monthly percent distribution of water is based on crop distribution in Douglas County and expected water needs for each crop throughout the year. Appendix I contains data on water requirements for irrigated crops and calculations of the monthly percent distributions.

Month	Percent	Deer Creek	Lookingglass Creek	North Myrtle Creek	South Myrtle Creek	Days Creek
Existing acres		*222*	*955*	*684*	*919*	*177*
Mar	0.5	3	12	9	12	2
Apr	4.4	25	105	75	101	19
May	11.4	63	272	195	262	50
Jun	18.6	103	444	318	427	82
Jul	28.5	158	681	487	655	126
Aug	22.9	127	547	392	526	101
Sep	12.6	70	301	215	289	56
Oct[3]	1.1	6	26	19	25	5
Total	100.0	555	2,388	1,710	2,297	443

Table 2.E-16: Monthly irrigation water requirements in acre-feet for each area.

Aquatic Life

Instream Flow

Water use by aquatic life is expressed by State of Oregon minimum flows. Minimum flows vary through the year to meet the needs of aquatic life. Minimum flows at selected locations within the Lookingglass Creek and South Umpqua Tributaries sub-basins are listed in Table 2.E-17, Table 2.E-18, and Table 2.E-19 with the priority dates when they were established.

Time of year	Lookingglass Creek sub-basin (cfs)				
	Tenmile Creek		Olalla Creek	Lookingglass Creek	
	3/26/74	1/10/91[1]	3/26/74	3/26/74	1/10/91[1]
October					
1 to 15	5	2.1	5	10	4.7
16 to 31	15	2.1	30	40	4.7
November	30	17.1	75	90	43.1
December	40	45.0	75	90	75.0
January	40	40.0	75	90	75.0
February	40	40.0	75	90	75.0
March	40	40.0	75	90	75.0
April	30	40.0	60	60	75.0
May	20	17.0	30	30	41.1
June	10	6.8	20	15	16.1
July	3	2.0	5	10	4.8
August	2	1.4	5	5	2.2
September	2	1.1	5	5	1.3

[1] Values are rounded to the nearest tenth.
Source: State of Oregon Water Resources Department database.

Table 2.E-17: Minimum instream flows to support aquatic life in portions of the Lookingglass Creek sub-basin with priority dates of right.

Time of year	Other South Umpqua River tributaries (cfs)					
	Deer Creek		North Myrtle Creek		South Myrtle Creek	
	3/26/74	1/10/91[1]	3/26/74	1/10/91[1]	3/26/74	1/10/91[1]
Oct						
1 to 15	4	4.8	6	8.5	5	9.5
16 to 31	10	4.8	20	8.5	20	9.5
Nov	30	19.9	35	25.8	35	24.9
Dec	30	85.0	35	35.0	35	35.0
Jan	30	85.0	35	35.0	35	35.0
Feb	30	85.0	35	35.0	35	35.0
Mar	30	85.0	35	35.0	35	35.0
Apr	30	58.7	35	35.0	35	35.0
May	15	24.0	20	20.0	20	20.0
June	10	10.3	10	10.0	10	10.0
July	4	4.5	6	6.0	5	5.0
Aug	4	2.7	3	4.6	2	5.0
Sept	4	2.9	3	5.2	2	5.0

[1] Values are rounded to the nearest tenth.
Source: State of Oregon Water Resources Department database.

Table 2.E-18: Minimum instream flows to support aquatic life in various tributaries to the South Umpqua River with priority dates of right.

Time of year	Other South Umpqua River tributaries (cfs)		
	Canyon Creek	**Days Creek**	**Elk Creek**
	3/26/74	**3/26/74**	**3/26/74**
Oct			
1 to 15	5	5	5
16 to 31	15	15	25
Nov	30	30	55
Dec	30	30	55
Jan	30	30	55
Feb	30	30	55
Mar	30	30	55
Apr	30	30	55
May	15	20	25
June	5	8	15
July	2	4	5
Aug	2	2	3
Sept	2	2	3
Source: State of Oregon Water Resources Department database.			

Table 2.E-19: Minimum instream flows to support aquatic life in various tributaries to the South Umpqua River with priority dates of right.

The Instream Water Rights Act was passed in 1987, allowing agencies to apply for instream water rights to protect recreation, water quality, and fish and wildlife habitat. Prior to establishment of this act, the Oregon Water Resources Department established minimum flows through the administrative rule making process. Minimum flow values specified in a rule, or "basin program," were not water rights but were administered as such by the Department. These established flows became instream water rights subsequent to passage of the 1987 Act. Thus water rights allowing direct diversion that have been obtained after the date of establishment of a minimum flow are subject to curtailment as stream flow amounts decrease below that specified minimum flow rate. However, when the junior right includes a "household use" component as with domestic or municipal rights, that amount of use has preference over the minimum flows.

In the case of a reservoir constructed after establishment of a minimum flow, the minimum flow must be released at all times, unless inflow to the reservoir is less than the specified minimum, in which case the amount of inflow must be released. Either type of water right senior to the date of establishment of a minimum flow is not subject to curtailment to meet minimum flows.

The County augments streamflow using Ben Irving Reservoir. The storage allocation within Ben Irving Reservoir for streamflow augmentation is 750 acre-feet. The County releases water to meet minimum streamflow requirements when low streamflow conditions warrant the need.

<u>Fish Abundance and Distribution</u>

Lookinqqlass Creek Sub-basin
Rainbow trout occur in numerous streams within the sub-basin. Anadromous fish species in the Lookingglass Creek sub-basin are steelhead, coho salmon, chinook salmon, cutthroat trout, and lamprey. Abundance estimates have not recently been completed for this sub-basin. According to a watershed assessment by DeVore and Geyer in 2003, many medium and large tributaries are within the distribution of one or more salmonid species; however ranges have not been verified for each tributary.

Although recent surveys are not available, historic estimates done by ODFW in 1976 of spawning fish by stream illustrate which tributaries provide some of the primary habitat for coho and winter steelhead. Table 2.E-20 shows the coho and winter steelhead spawning estimates by stream in the Lookingglass Creek sub-basin.

Stream	Coho	Winter steelhead	Total
Lookingglass Creek	20	20	40
Olalla Creek	25	50	75
Tenmile Creek	22	42	64
Shield Creek	4	6	10
Sucicide Creek	4	10	14
Berry Creek	4	6	10
Byron Creek	2	2	4
Thompson Creek	6	10	16
Total	87	146	233
Source: ODFW 1976 unpublished data. From the Douglas County Water Resources Management Plan 1989.			

Table 2.E-20: Estimated spawning anadromous fish from 1976 by species (Lookingglass Creek sub-basin).

Lookingglass Creek, Olalla Creek, and Tenmile Creek had the greatest abundance of spawning fish. Approximately 77 percent of coho and 78 percent of steelhead in the Lookingglass Creek sub-basin used these tributaries for spawning. The total coho and winter steelhead spawning population was estimated at 233 fish in 1976.

Coho are spawning in the sub-basin from late November through early January, while winter steelhead spawn from late January through May. Ben Irving Reservoir, established in 1980, provides increased streamflows to Olalla Creek and additional rearing potential for coho and winter steelhead.

DeVore and Geyer (2003) also state that largemouth bass and other non-native species may occasionally enter the mouth of Lookingglass Creek, and there is a good small-mouth bass population in the lower several miles. Other non-natives have been accidentally or intentionally introduced to the watershed, but have not established reproducing populations.

Fall chinook supplementation is being considered by ODFW as an alternative through the STEP program.

South Umpqua Tributaries Sub-basins
There are no recent fish survey data for these tributary sub-basins. Information from the StreamNet database as of October, 2007, show coho and winter steelhead use portions of all of the sub-basins for spawning and rearing.

StreamNet is a cooperative fisheries data project of the Pacific States Marine Fisheries Commission designed to "…create, maintain, and enhance high quality, regionally consistent data on fish and related aquatic resources…" Information in the database is based on the best professional judgment of local fish biologists combined with actual sightings of fish from various surveys.

According to 1976 ODFW spawning estimates, coho and winter steelhead use many tributaries throughout the sub-basins (see Table 2.E-21). Most of the coho and steelhead used the mainstem in each sub-basin with the exception of Deer Creek. North Fork Deer and South Fork Deer creeks combined, provided 85 percent and 86 percent of the coho and winter steelhead respectively, in that sub-basin.

The lower reaches of Deer Creek are relatively wide with abundant gravel deposits. According to the StreamNet database, Deer Creek is shown as likely spawning and rearing habitat for fall chinook.

The 1976 data showed over half of the coho and steelhead within the North Myrtle Creek sub-basin used North Myrtle Creek mainstem for spawning. The remainder were distributed among Bilge, Slide, Frozen, Riser, Lee, and Buck Fork creeks. Slide Creek had larger numbers of spawners than other tributaries and provided habitat for 14 percent each of coho and steelhead. Rainbow and cutthroat trout are also present.

South Myrtle Creek mainstem contributed over 60 percent each of coho and steelhead spawning within the sub-basin. Louis Creek and Weaver Creek provided over 20 percent each of the estimated coho and steelhead spawners. Ben Branch, Long Wiley, and Leticia creeks contributed the remainder of the habitat. There is some potential for fall chinook below the confluence of North and South Myrtle creeks due to the size of the stream and presence of gravel for spawning.

Days Creek provided over 77 percent each of the coho and steelhead spawners in the sub-basin. Only Woods and Fate creeks also showed spawning estimates within the Days Creek sub-basin.

As in the Lookingglass sub-basin, coho are spawning in these streams from late November through late January. Winter steelhead use the streams from late January through May. See Appendix F for detailed data on aquatic life.

Stream / Location	Coho	Winter steelhead	Total
Deer Creek	12	25	37
Demonty Bridge	2	4	6
North Fork Deer Creek	25	75	100
South Fork Deer Creek	52	104	156
Total Deer Creek sub-basin	**91**	**208**	**208**
North Myrtle Creek	100	150	250
Bilger Creek	12	25	37
Frozen Creek	12	19	31
Slide Creek	25	40	65
Riser Creek	10	10	20
Lee Creek	10	15	25
Buck Fork Creek	12	20	32
Total North Myrtle sub-basin	**181**	**279**	**460**
South Myrtle Creek	100	150	250
Ben Branch Creek	4	6	10
Louis Creek	25	25	50
Long Wiley Creek	12	15	27
Letitia Creek	4	6	10
Weaver Creek	18	25	43
Total South Myrtle Creek sub-basin	**163**	**227**	**390**
Days Creek	60	100	160
Woods Creek	10	20	30
Fate Creek	8	8	16
Total Days Creek sub-basin	**78**	**128**	**206**
Source: ODFW 1976 unpublished data. From the Douglas County Water Resources Management Plan 1989.			

Table 2.E-21: Estimated numbers of spawning coho and winter steelhead from 1976 (South Umpqua River Tributaries sub-basins).

<u>Fishery Concerns</u>

Primary concerns are low flows and elevated water temperatures in all sub-basins. Although streamflow in Olalla Creek has improved with regulation by the Berry Creek Dam, Lookingglass Creek is wide with abundant bedrock and warm summer flows in the lower reaches. Days Creek does have abundant gravel deposits, and "potholes" that provide some refuge for coho and steelhead during marginal flows. Continued development along Deer Creek is also a potential concern.

Several specific known and suspected limiting factors affecting fish and water quality have been identified in the Umpqua Basin Action Plan (Barnes & Associates 2007) for the Lookingglass Creek, Deer Creek, and Myrtle Creek sub-basins. These are summarized in Table 2.E-22. Specific sites and actions to address these concerns have also been identified in the plan. Refer to the Action Plan for details on the specific streams.

Loss of stream complexity and riparian zones are significant limiting factors. Insufficient instream structure that provides pools, gravels, and hiding cover causes a decrease in spawning and winter habitat. Insufficient winter habitat results in loss of juvenile fish during peak storm flows. Loss of riparian cover eliminates sources of large wood for stream complexity and decreases shade on smaller tributaries. This results in higher solar inputs and increased temperatures on many streams.

Fish passage is a limiting factor in some tributaries within the sub-basins. Passage barriers may block access to all fish, juvenile fish only, or during high or low flow conditions only. Fish passage barriers that have been identified in the Umpqua Basin Action Plan are listed in Appendix F. See Enhancement Opportunities section for county-maintained fish passage barriers inventoried by the Umpqua Basin Fish Access Team (UBFAT).

Limiting factor	Lookingglass Creek sub-basin	Deer Creek	Myrtle Creek[1]
Stream morphology (complexity)	known	known	known
Fish passage	known	known	known
Channel modification	inconclusive	suspected	not limiting
Riparian	suspected	known	known
Wetlands	known	known	known
Temperature	known	known	known
Sedimentation	inconclusive	inconclusive	inconclusive
Other water quality	toxics (known) DO, bacteria (inconclusive)	bacteria (known)	bacteria (known)
Water availability	known	known	suspected
Streamflow, flood potential	known	known	suspected

[1] Myrtle Creek contains both the North and South Myrtle creeks sub-basins combined.
Source: Umpqua Basin Action Plan (Barnes & Associates 2007).

Table 2.E-22: Known and suspected limiting factors to fish and water quality (Lookingglass, Deer, and Myrtle creeks sub-basins).

Although water availability and flood potential issues have been improved since the construction of Berry Creek Dam, they are still known limiting factors in Olalla, Lookingglass, Morgan, and Tenmile creeks (Barnes & Associates 2007). Berry Creek Dam (Ben Irving Reservoir) provides additional potential flow to Olalla Creek. About 750 acre-feet of storage was dedicated by Douglas County for fish releases.

Loss of healthy riparian areas is a known or suspected limiting factor in all three sub-basins. Riparian areas on smaller tributary streams influence both water quality and instream habitat. Decreased shade cover may result in increased stream temperatures on small streams. Loss of large trees in these areas results in fewer sources for stream input now and into the future. These large wood pieces are vital for creating instream habitat on small and medium sized tributaries. Lack of current and future large wood pieces contributes to the loss of stream complexity.

Loss of functioning wetlands is a known limiting factor in all three sub-basins that adversely impacts streamflows and water quality. Wetlands act to filter sediment and toxics and slow water movement during peak flows. They also contribute cool ground water back to streams during the low flow season when temperatures are elevated. This helps buffer increases in stream temperatures during the summer.

Enhancement Opportunities

Enhancement projects have been undertaken in many locations within the sub-basins. These efforts have improved fish passage, instream habitat, and riparian conditions for coho, cutthroat, and winter steelhead.

Douglas County owns land along Tenmile Creek west of Reston that is spawning and rearing habitat for coho salmon and winter steelhead. Tenmile Creek has been identified as limited by stream complexity, riparian conditions, wetlands, water availability, flood potential, and possibly sediment. This area along County property may have opportunities for instream and/or riparian work to improve habitat conditions for both coho and winter steelhead.

Fish Passage Barriers

UBFAT has completed inventories of stream crossings in the Lookingglass Creek and the South Umpqua Tributaries sub-basins. Crossings were given a score on the severity of the fish passage barrier based on many characteristics including the species and ages of fish blocked, timing of barrier (all year or seasonally), and amount and quality of habitat upstream that is no longer accessible, with higher scores representing more severe barriers. The highest possible score is 105. The highest score in the Umpqua Basin to date is 95.

Two county-maintained culverts have been surveyed in the Lookingglass Creek sub-basin with a score of 60 or more. Twelve have been identified in the South Umpqua Tributaries sub-basins, most in the North Myrtle Creek sub-basin. Table 2.E-23 lists these barriers with a description of the structure and the score they received.

ID number	Location	Sub-watershed (6th field)	Score	Barrier type	Structure type
21205001	Coos Bay Road at Colwell Road junction	Morgan Creek	66	all	CMP, 85 ft long by 6 ft wide
21204004	Reston Road	Tenmile Creek	70	all	CMP, 80 ft long by 6 ft wide
21301014	Melton Creek Road	Upper Deer Creek	63	all	CMP, 61 ft long by 5 ft wide
21301004	Strawberry Mountain Lane	Upper Deer Creek	80	all	CMP, 52.7 ft long by 11.3 ft wide
21302011	Buckhorn Road - Dixonville	Lower Deer Creek	78	all	CMP, 100 ft long by 6 ft wide
21101003	County Road 18	Upper South Myrtle Creek	95	all	CON, 25 ft long by 9 ft wide
21101004	County Road 15	Upper South Myrtle Creek	66	all	CMP, 175 ft long by 7 ft wide
21104008	Bilger Creek Road	Lower North Myrtle Creek	69	all juveniles, adult cutthroat, coho	CMP, 60 ft long by 6.5 ft wide
21104007	Bilger Creek Road	Lower North Myrtle Creek	61	all	CMP, 60 ft long by 6 ft wide
21104006	Bilger Creek Road	Lower North Myrtle Creek	61	all	CMP, 60 ft long by 6 ft wide
21104002	North Myrtle Road	Lower North Myrtle Creek	83	all	CMP, 55 ft long by 12 ft wide
21104001	Frozen Creek Road	Lower North Myrtle Creek	61	all	CMP, 40 ft long by 8 ft wide
20505001	Woods Creek Road, 200m junction County Road 34	Days Creek	85	all	CON, 40 ft long by 11 ft wide
20505002	Woods Creek Road, 50m junction 30-4-3.1	Days Creek	80	all	CMP, 50 ft long by 10.5 ft wide
Source: UBFAT database as of Oct 2007, Douglas Soil and Water Conservation District.					

Table 2.E-23: Fish passage barriers maintained by Douglas County with a minimum score of 60 in the UBFAT surveys. (Lookingglass / South Umpqua Tributaries sub-basins).

All are barriers to all juvenile and adult species, except one in North Myrtle Creek, which allows chinook passage. The passage barrier on County Road 18 in Upper South Myrtle Creek has the highest rating of all fish passage barriers that have been inventoried to date in the Umpqua Basin. This makes it one of the highest priorities for restoration in the County. Contact the Douglas Soil and Water Conservation District for current detailed survey and location information on fish passage barriers.

Recreation

The only water-based recreation facility with public access in this portion of Douglas County is at Ben Irving Reservoir. Douglas County Parks Department has installed picnic tables and a boat ramp on the north shore at the County Park on the reservoir. The reservoir has been stocked with large-mouth bass and trout managed by ODFW. Activities include swimming, waterskiing and reservoir fishing.

Iverson Reservoir is a five acre reservoir on Tenmile Creek with a storage capacity of 50 acre-feet used for private recreation.

Resident trout are found throughout the sub-basins. Surveys of resident trout harvest from 1976 within the South Umpqua River sub-basin and all the tributary sub-basins show the tributaries of the main river are the primary location for angling opportunities. Although more recent harvest data is not available, this information is useful in determining the tributaries that produce the most recreational trout harvest within the sub-basins.

Table 2.D-30 and Table 2.D-31 in Section 2.D.2 show the harvest and days spent in each tributary to the South Umpqua River. It also shows that the largest contributors to sport harvest other than Cow Creek were the main channels in each of the Lookingglass Creek and South Umpqua River Tributaries sub-basins, along with Jackson Creek.

Table 2.E-24 shows the harvest level and days spent for each stream in the sub-basins as well as the percent of total harvest in all tributaries to the South Umpqua River except Cow Creek.

With the exception of Cow Creek, Deer Creek had the highest harvest level of rainbow trout with 410 fish harvested. This accounted for about 14 percent of the total harvest and 15 percent of the recreation days spent in the South Umpqua tributaries. North and South Myrtle also had substantial harvest levels with 365 and 330 fish respectively. Rainbow trout catch and recreation days are about equally divided between Lookingglass Creek and Olalla Creek. Total estimated catch is 240 fish in 600 recreation days.

Stream	Harvest	Percent of harvest	Days	Percent of days spent
Deer Creek	410	14	825	15
Lookingglass Creek	240	8	600	11
North Myrtle Creek	365	13	650	12
South Myrtle Creek	330	11	575	10
Canyon Creek	100	3	200	4
Days Creek	120	4	200	4
Elk Creek	200	7	400	7
subtotal	**1,765**	**61**	**3,450**	**62**
Total all South Umpqua tributaries	**2,880**	**100**	**5,565**	**100**
Source: ODFW unpublished data, Douglas County Water Management Plan 1989.				

Table 2.E-24: Recreational harvest and days spent for resident trout on South Umpqua River tributaries excluding Cow Creek sub-basin in 1976.

Hydroelectric Power

There is no substantial hydroelectric development in the sub-basins. One private permit for the use of four cfs from a tributary of Deer Creek is used to generate 55 kW of power.

Summary of Current Surface Water Use

In summary, there is no unregulated flow available for any further expansion of water use during June through December in the Lookingglass or any of the South Umpqua Tributaries sub-basins. In fact, there are deficiencies in meeting existing needs during these months in every sub-basin. Most sub-basins also have shortages earlier in the spring as well. The following discussion includes specific months of the year in each sub-basin where new water rights are not available and deficiencies in meeting current rights likely occur in many years.

Streams in Oregon are administered under the prior rights doctrine, which boils down to "first in time, first in right". As streamflows decrease to amounts less than necessary to meet all water rights and minimum flows, the District 15 Watermaster administers the stream. In the case of irrigation rights, diversions under the most recent water rights are stopped. In the case of municipal rights, diversions are reduced to equal the "human consumption", or domestic component of the right. Domestic rights, which include irrigation of gardens of 1/2 acre or less, would be allowed to continue diversion. Diversions for stock water also would be allowed to continue.

Minimum flows have been established by the State of Oregon, Water Resources Department in 1974 on all main channels in the sub-basins and including Tenmile, and Olalla creeks in the Lookingglass Creek sub-basin. Additional instream flow rights were added in 1991 on all of these streams except Olalla, Canyon and Days creeks. The requirements are for meeting the needs of aquatic life. These minimum flows are instream water rights administered with their appropriate priority date. Other instream requirements may occur for such uses as scenic byways or pollution abatement that would be included in the determination of new water rights.

The State determines if new water rights are available by comparing the total of existing consumptive use rights (including storage rights), and instream requirements to the 80 percent exceedence flow (or the streamflow that occurs 80 percent of the time) for each month. Where the streamflow is less than the sum of the current rights, no new water rights are available. The amount of water for consumptive use rights in this calculation is an estimate of actual use. Coefficients have been developed for the different types of water rights to estimate actual use. The total allowable right on record would be more than the actual consumptive use estimate used in this calculation.

<u>Lookingglass Creek</u>
Figure 2.E.4 summarizes current water use and availability in Lookingglass Creek at the mouth. The chart shows that flows only exceed current requirements in February through April, but fall short of needs from June through January. The deficit, shown in red on the graph, is highest in November where an additional 87 cfs are needed to meet current demands. Streamflow is about equal to demand in May.

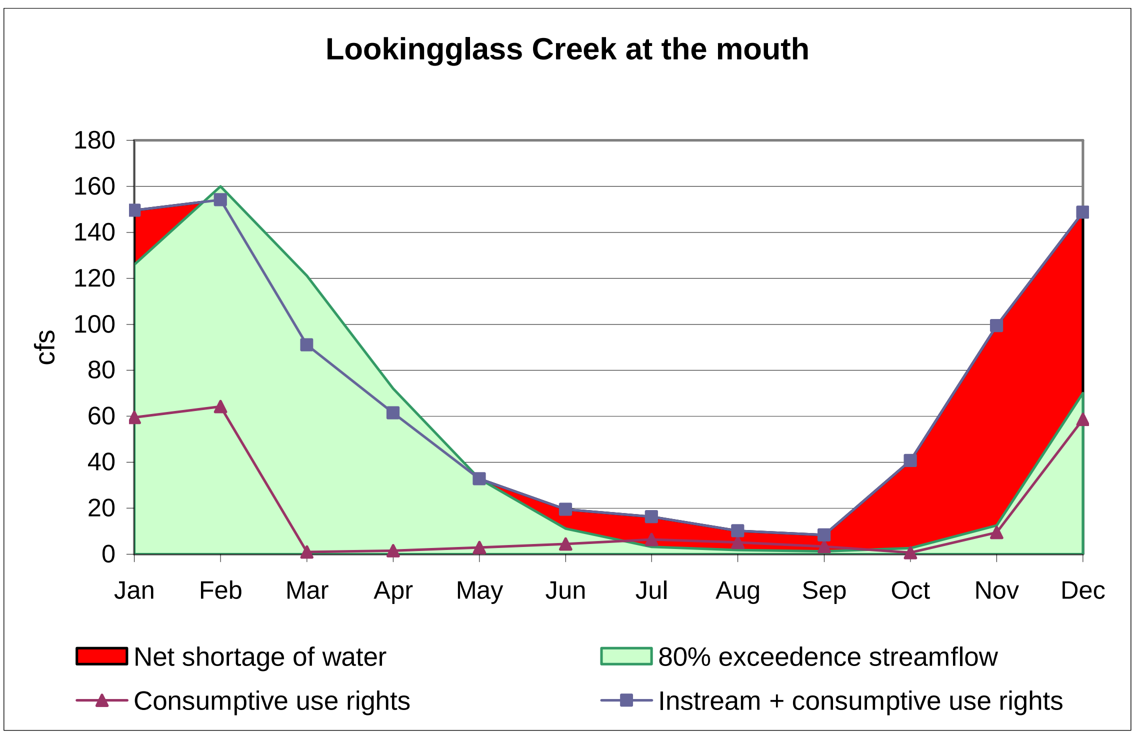

Figure 2.E.4: Water availability in Lookingglass Creek at the mouth.

The dominant use is for instream minimum flow requirements to meet aquatic life needs. The graph shows that even with some augmentation effects from Berry Creek Dam, instream flow requirements exceed expected streamflow for half the year from June through December at the mouth of Lookingglass Creek. In January, they exceed flow when combined with storage use. Storage use (combined with all consumptive uses in the graph) occurs in November through February.

Lookingglass Creek has established minimum instream flow rights from 1974 and 1991. Prior to operation of Berry Creek Dam in 1980, streamflows in lower Lookingglass Creek were less than the 1974 minimum instream requirements in the later half of April and May through October (Tucson Myers et al. 1989). Augmentation of flows has allowed adequate water to meet all current rights through May.

Consumptive uses are dominated by irrigation from April through September. Irrigation use exceeds expected streamflow in July through September. There are also some small amounts of domestic, industrial, and agriculture uses occurring throughout the year.

Deer Creek

Figure 2.E.5 shows that expected streamflow at the mouth of Deer Creek is not enough to meet current demand throughout the entire year. Expected streamflow in Deer Creek at the mouth is highest in February with less than 57 cfs expected. Expected streamflow in August and September is reduced to less than 2 cfs. Minimum instream flow rights alone exceed expected streamflow in every month.

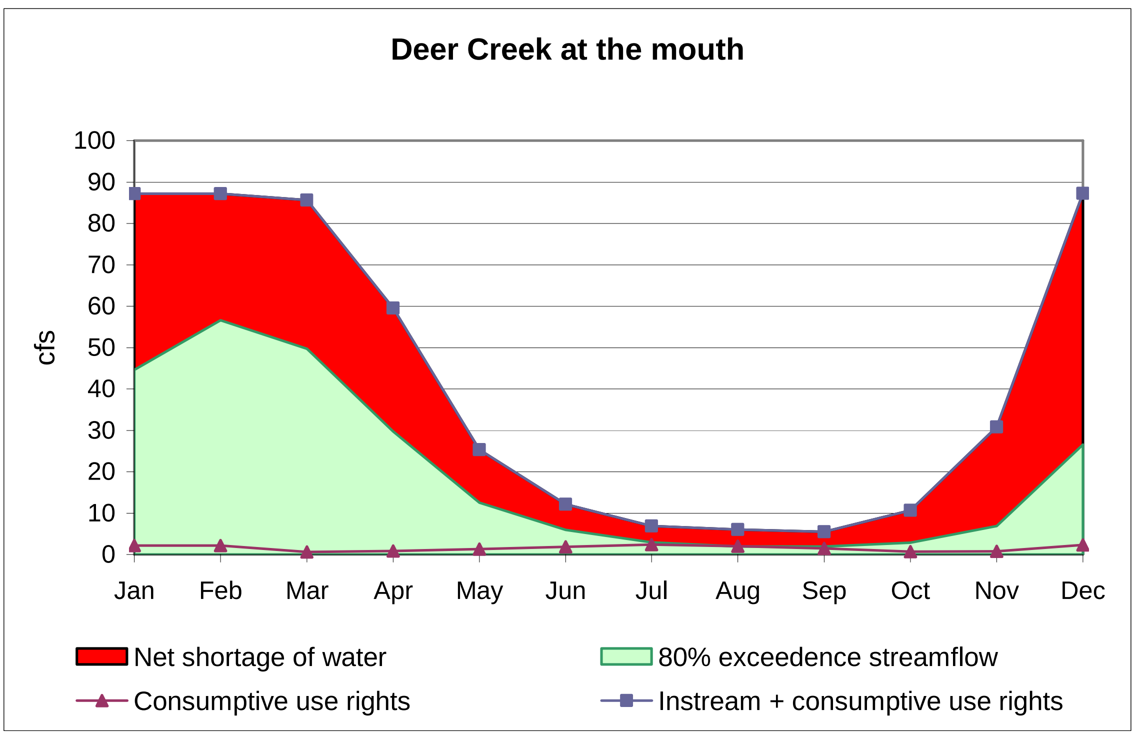

Figure 2.E.5: Water availability in Deer Creek at the mouth.

In July through September, consumptive uses are nearly equal to expected streamflow ranging from slightly below in July and September to slightly above in August. However, the addition of instream minimum flows creates a larger deficit in each month. The combination of irrigation and industrial uses alone are equal to expected streamflow in August. Consumptive use also includes small amounts of domestic and agriculture use.

Deer Creek has established minimum instream flow rights from 1974 and 1991. According to analysis from the 1989 Douglas County Water Management Program, water is not available for rights acquired after 1974 in any month. For water rights with priority dates senior to 1974 instream requirements, there is inadequate water beginning in early July through September (Tucson Myers et al. 1989).

North Myrtle and South Myrtle Creeks

Figure 2.E.6 and Figure 2.E.7 illustrate the water availability and use at the mouths of North Myrtle Creek and South Myrtle Creek. Both show a similar pattern of expected streamflow and water availability. However, the deficit shown in red begins several months earlier in April on North Myrtle Creek, than in June on South Myrtle Creek.

Minimum instream flow requirements are similar at both locations throughout most of the year. However, these instream uses exceed expected streamflow on North Myrtle Creek from May through December; and beginning three months later on South Myrtle Creek from August through December.

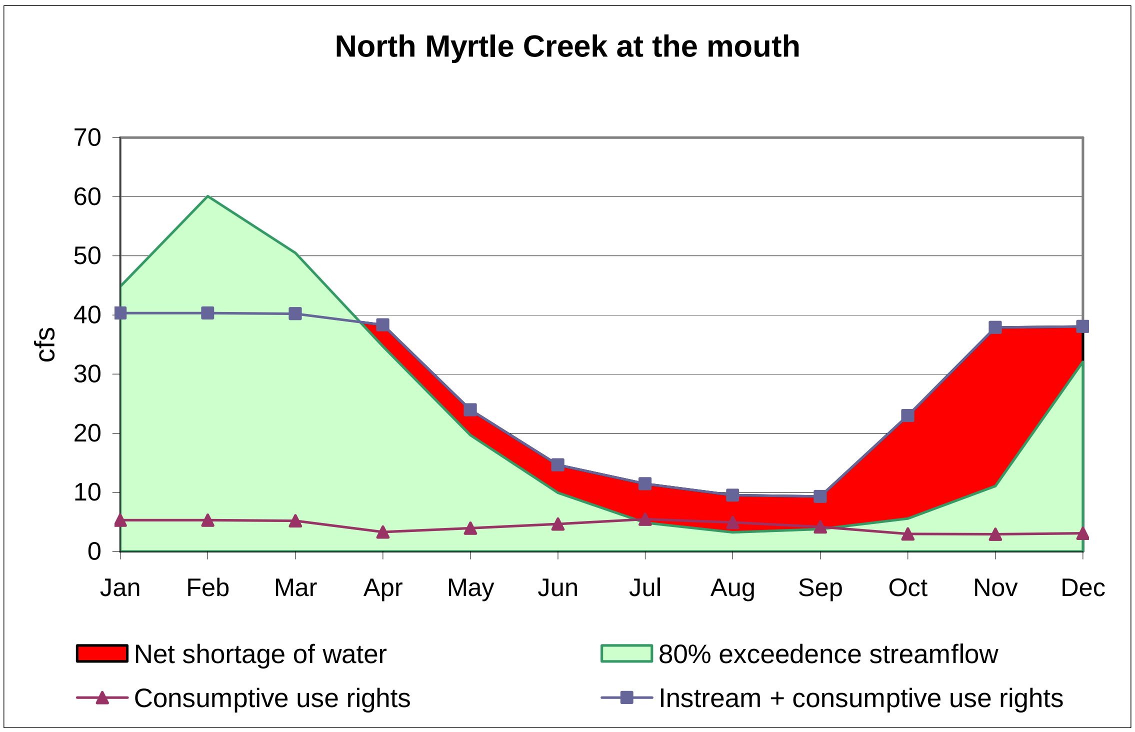

Figure 2.E.6: Water availability in North Myrtle Creek at the mouth.

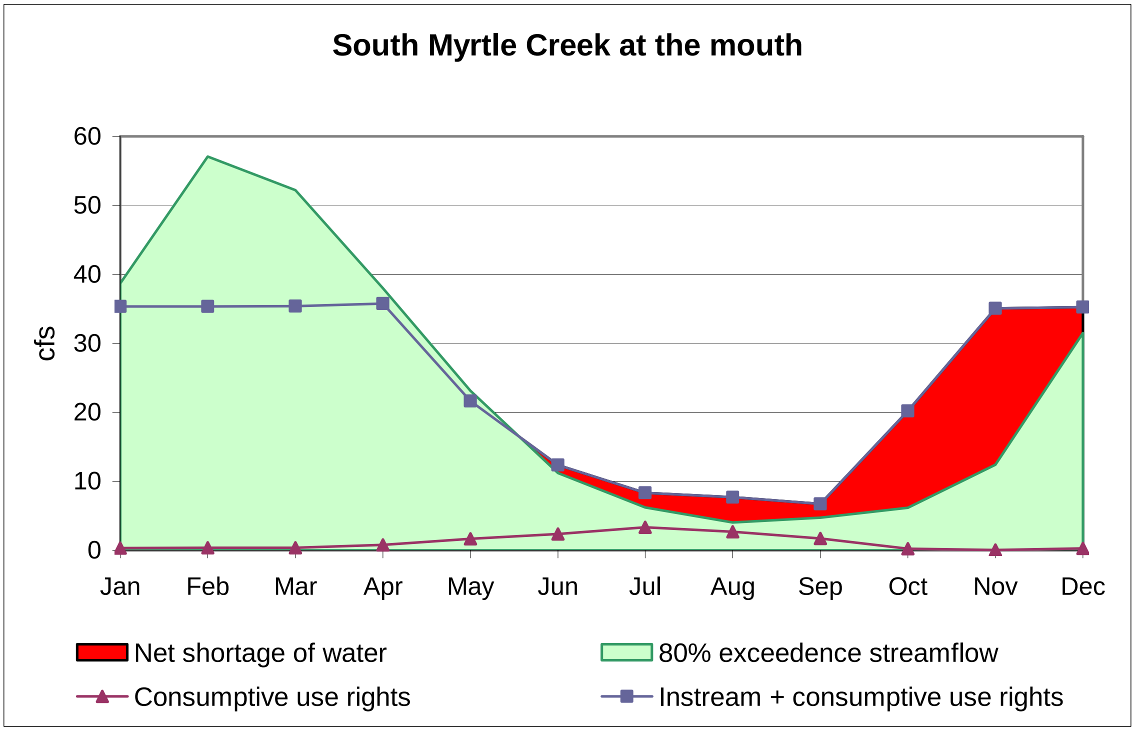

Figure 2.E.7: Water availability in South Myrtle Creek at the mouth.

There is also a significant difference in consumptive uses between the two streams. There are municipal rights on North Myrtle Creek held by the City of Myrtle Creek. Although higher in the winter months, these rights are a constant 2.66 cfs from April through December. Combined with estimated uses for irrigation and smaller amounts for industrial, domestic, and agriculture, the consumptive uses are higher on North Myrtle Creek. Although expected streamflow is slightly higher as well, the increased consumptive uses combined with instream minimum flows on North Myrtle Creek create a deficit earlier in the year.

Both North Myrtle and South Myrtle creeks have established minimum flow requirements with priority dates of 1974 and 1991. Expected streamflows are adequate to meet nearly all water rights senior to the 1974 minimum flow in all months on North Myrtle Creek and in all but July and August on South Myrtle Creek (Tucson Myers et al. 1989).

Days Creek and Canyon Creek

Figure 2.E.8 and Figure 2.E.9 illustrate water availability and use at the mouths of Days and Canyon creeks. Similar to Deer Creek, there is a deficit for nearly the entire year. February has the highest expected streamflow, and is the only month where the current uses are about equal to expected streamflow in Days Creek and slightly lower than expected flow in Canyon Creek. It is also the only month where instream minimum flow requirements do no exceed expected streamflow.

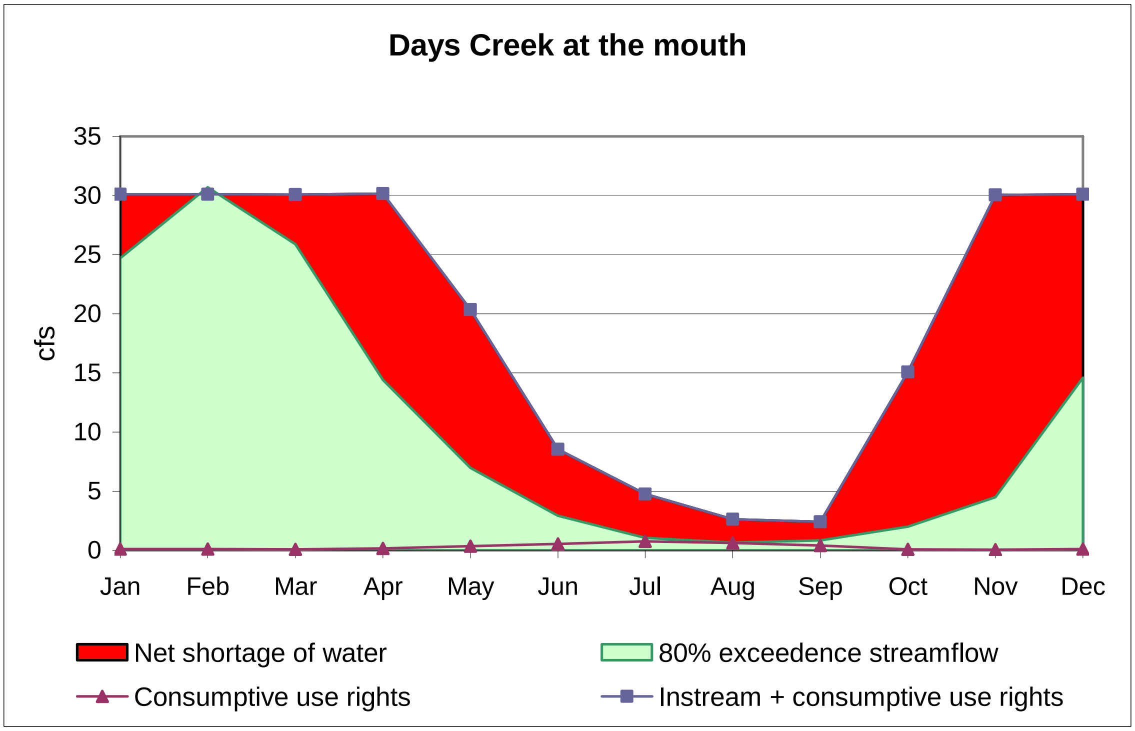

Figure 2.E.8: Water availability in Days Creek at the mouth.

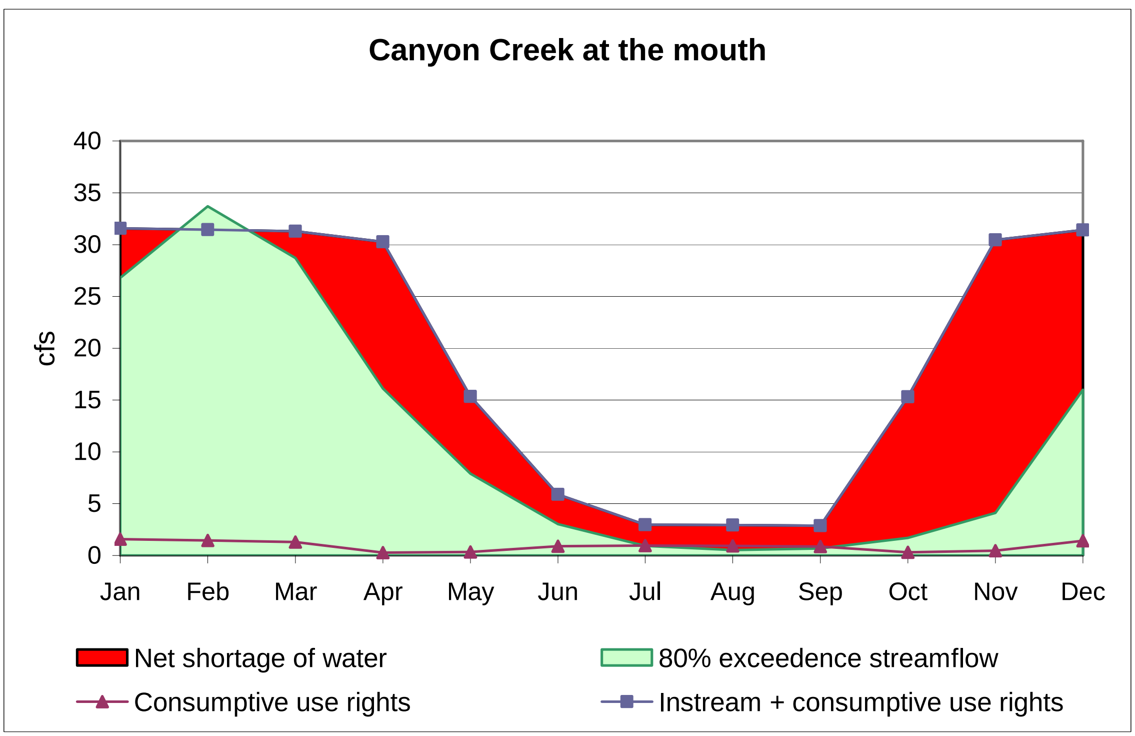

Figure 2.E.9: Water availability at the mouth of Canyon Creek.

Expected streamflow is reduced to approximately one or less cfs from July through September. Consumptive uses are less than 1 cfs in each month of the year in Days Creek and less than 1.6 cfs in each month for Canyon Creek.

In July, August, and September, consumptive uses are about equal to or slightly higher than expected streamflow on Canyon Creek and equal or slightly less on Days Creek. Primary consumptive uses on Days Creek are for irrigation from April through October. Some domestic and agriculture uses occur throughout the year. In Canyon Creek, the primary consumptive use is municipal for the City of Canyonville. Smaller amounts are diverted for irrigation and domestic uses.

Days Creek and Canyon Creek have established minimum instream flow requirements with priority dates of 1974. Water rights senior to the 1974 minimum flows are adequately supplied. The municipal rights on Canyon Creek are junior to the 1974 instream flow right, along with four irrigation rights that total 0.55 cfs in the Canyon Creek sub-basin. Approximately 1.3 cfs from 14 water rights for irrigation in the Days Creek sub-basin is junior to the 1974 instream flow requirement on Days Creek. These rights are subject to curtailment during low flow years.

Elk Creek

Figure 2.E.10 shows the availability of water at the mouth of Elk Creek is similar to South Myrtle Creek. There is abundant water to meet current estimated uses from February through April. However, estimated needs exceed flows from June through January and are about equal in May. Instream flow requirements established in 1974 exceed expected streamflows in each of these months showing a deficit. There are small amounts of irrigation, agriculture, and domestic use needs in Elk Creek. The uses are dominated by instream minimum flow needs.

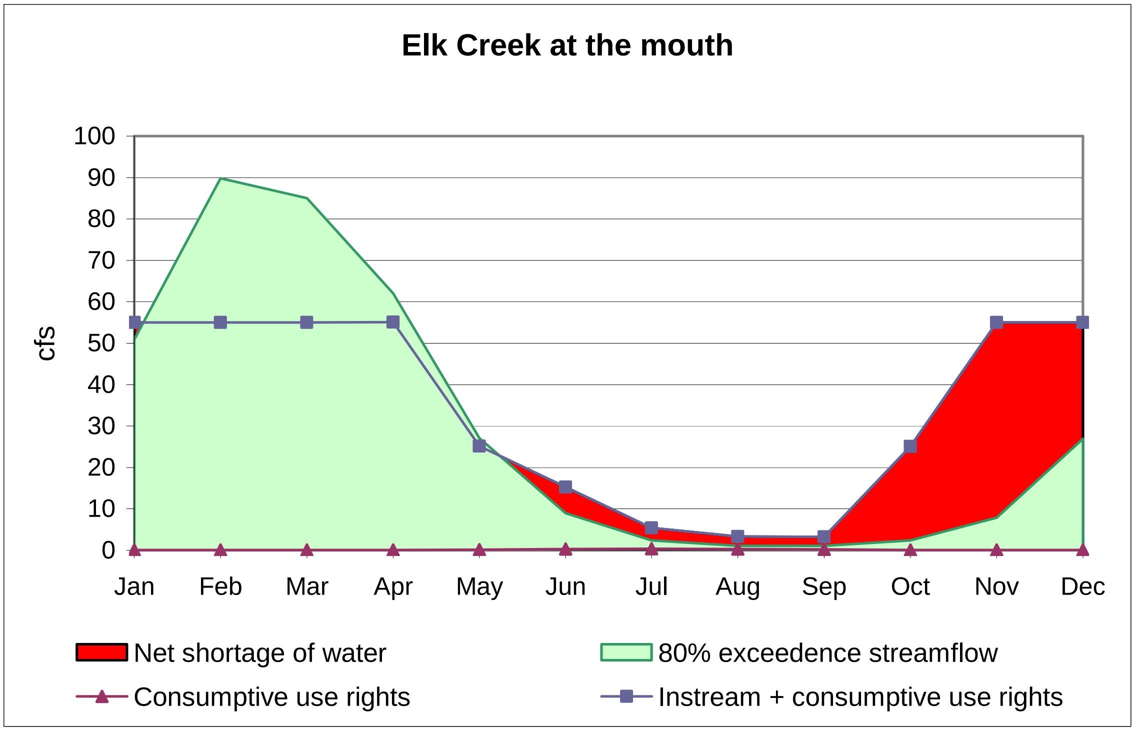

Figure 2.E.10: Water availability and use at the mouth of Elk Creek, tributary to the South Umpqua River.

Future

Municipal

Future municipal use is based on information from the Douglas County Comprehensive Plan Population Assessment (Douglas County 2004), U.S. Census data, and reported water use by each of the water providers in the sub-basins. The data include the current populations receiving water service and projections of the future populations in 2050. The projections to 2050 reflect the long-term financial conditions normally encountered with large-scale water resource developments.

Appendix M contains the derivation of water needs for future municipal water use in the sub-basins. This information is summarized below for the City of Canyonville, the only major water provider within the sub-basins. The City of Myrtle Creek is located near the South Umpqua River and Myrtle Creek. Although some water is diverted from a tributary of North Myrtle Creek, most comes from the South Umpqua River and is assessed in Section D, South Umpqua River sub-basin.

The population of the City of Canyonville water service area is estimated to increase from 1,501 people in 2006 to 3,814 people in 2050 based on average annual growth of 3.5 percent. Growth in the Canyonville area is among the highest in the County. Based on current peak daily use, the future peak daily requirement will be 618 gallons per minute. Although it is important to note that the current peak daily use is probably higher than most due to the high water use by several hotels and the casino. This may result in a somewhat inflated future peak daily requirement if growth is more residential than commercial.

The future peak diversion requirement is calculated at 1,636 gallons per minute. The City's water rights appear adequate to meet the needs of the projected population except in July, August, and September, when approximately 223 acre-feet of stored water from Win Walker Reservoir will be necessary to augment allowable diversions. The amount of storage appears adequate to meet the City's future needs.

In 2007, the Cow Creek Band of the Umpqua Tribe of Indians completed enough work on their new water system to begin supplying water from their Creekside Reservoir to businesses owned by the Tribe including the Seven Feathers Hotel and Casino Resort and several other hotels. Water for these establishments had previously come from Canyonville municipal water supplies. Water now supplied by the Tribe's system to meet these commercial needs will enable the City of Canyonville to meet anticipated increased needs from municipal growth. The removal of commercial businesses from the City water system may also reduce the average rate of use.

The City and Tribal water systems are cross-pressurized so in the event one system fails, the other provides backup. The backup system agreement should be finalized between the Tribe and the City of Canyonville by 2009.[74]

The Tribe's water system is also intended to provide water for future commercial development in the area surrounding Canyonville. The planned development includes a theme park, retail theme village (10 to 15 gift shops), and expansion of existing facilities. The reservoir is estimated to meet the future water needs of the Tribe for approximately 10 to 15 years, although the possibility of a water theme park could use substantial amounts of water from the reservoir affecting the longevity of the reservoir to meet needs. The planned increase in commercial development will likely contribute to increased residential growth within Canyonville.

In addition to providing water to the area, the new system will allow sewage treatment for all Tribe facilities and businesses as well as sewage for the City of Canyonville during low flow months. This will take pressure off of the Canyonville wastewater treatment plant and reduce the water need to treat the sewage at the Canyonville plant.

The new system will remove significant waste, especially during the low flow months that has previously ended up in the South Umpqua River. The waste will be pumped into a lagoon where it will be treated and transported to an effluent reservoir that will be used as irrigation water in the wetland areas of Jordan Creek. This will also provide water for irrigation in the low flow season.

[74] Personal communication 2/4/2008, Wayne Shammel, Cow Creek Band of the Umpqua Tribe General Manager.

No other future municipal use is expected from South Umpqua tributaries unless storage is constructed on an appropriate stream.

Rural Domestic

The allocated rural population of these sub-basins is expected to increase from 5,562 to 9,734 people based on the rural estimated growth rate for the County of 1.5 percent. Based on a peak per capita need of 290 gallons per capita day, the future rural domestic need is estimated to be 1,888 acre-feet per year. The highest use is projected in June through September when needs are expected at over 900 acre-feet for the four months.

Only about 13 percent (737 people) of the current rural domestic population in the Lookingglass and all South Umpqua Tributaries sub-basins are estimated to obtain water via domestic surface water rights. New surface water rights may occur to fulfill future needs during the wet season but are unlikely to be reliable during the summer months due to low flows and minimum instream rights in most of the tributary streams as well as the South Umpqua River.

Residents with access downstream of Ben Irving Reservoir may purchase water from the Lookingglass Olalla Water Control Board to meet domestic needs. More pressure is expected on ground water supplies especially in areas located further up tributaries where purchased water may not be obtainable. Some individuals will likely develop more personal storage tanks for use during the summer months. Conditions should be monitored as growth occurs, and development of safe and sanitary communal water systems should be encouraged as population densities increase. See Appendix M for further details.

Industrial

New businesses are developing along Alder and Jordan creeks near Canyonville including a new recreational vehicle park. Other new commercial businesses are likely as the City of Canyonville has one of the County's fastest growth rates and the Cow Creek Band of the Umpqua Tribe of Indians has been investing in the truck stop at Canyonville. The Tribe currently has plans for a theme park, retail outlet village (10 to 15 gift shops), and expansion of 150 rooms to the Seven Feathers Hotel, as well as expansion of other existing businesses.

Water for Tribal expansion will come from the new Creekside freshwater reservoir development. The new water system is anticipated to meet the needs of Tribal properties for approximately 10 to 15 years. In 2007, the Tribe began to use water from the Creekside Reservoir. This has significantly reduced the use of the City of Canyonville's water system and will allow for additional water available for expansion of private industry in the Canyonville area.

Due to construction on Interstate-5, water supply to the Best Western Hotel located across the freeway from Canyonville was blocked. To meet the hotel's need and allow continued construction, the Tribe is now also supplying water to the Best Western Hotel.

No other large-scale industrial water use increases are expected at this time in the sub-basins.

Irrigation

Future irrigation water needs are based on the future estimated amount of land capable of sustaining long-term irrigation and the predicted amount of water use need, based on plant requirements of predicted future crops. Two estimates for potential irrigation land are used; one from the U.S. Bureau of Agriculture (USBR) and another from aerial photos surveys done by local agricultural leaders. Details of these surveys are described in Appendix I and summarized in Table 2.E-25.

Reach	USBR	Aerial photo	Selected	Existing rights	Future potential
Deer Creek	----	2,790	2,790	222	2,568
Lookingglass Creek	10,565	9,960	10,565	955	9,610
North Myrtle Creek	273	320	320	684	0
South Myrtle Creek	325	1,040	1,040	919	121
Days Creek	550	750	550	177	373
Source: See Appendix I for information.					

Table 2.E-25: Existing and future potential irrigation acres (South Umpqua Tributaries sub-basins).

The USBR land classification estimate in the Lookingglass Creek sub-basin is based on some of the oldest County surveys completed in 1962. For the remaining South Umpqua Tributaries sub-basins, the surveys were completed in 1971. There is no USBR survey information from the Deer Creek sub-basin. The USBR land survey numbers are generally preferred as USBR is the lead Federal agency with regard to irrigation project formulation. In the case of North and South Myrtle creeks, the existing rights are much higher than the survey potential from USBR. It is possible the USBR surveys did not fully extend up these drainages. For this reason, the aerial photo survey estimates are preferred in these sub-basins.

Based on the projections and current irrigation water rights, there is future potential irrigation land in all areas except North Myrtle Creek. South Myrtle Creek shows only 121 potential future acres based on the higher aerial photo survey estimate. The area with the highest potential for expanded irrigation land is the Lookingglass Creek sub-basin. Deer Creek also shows over 2,500 acres of suitable irrigation land that could be irrigated. Estimates in these areas are probably somewhat high since land surveys were completed in 1971, and some land considered for potential irrigation may have been developed for other uses. The lower to middle South Umpqua River area has been one of the fastest growing regions of the County. Industrial and urban development in these sub-basins primarily near the South Umpqua River has likely removed some of this land from consideration.

Water requirements for future potential irrigated land are based on an average projected need of 2.44 acre-feet per acre per year. Appendix I contains data on present and potential future irrigation lands, and calculations for future water demands. Monthly and total annual projections for the future needs by stream are shown in Table 2.E-26.

Month	Percent	Deer Creek	Lookingglass Creek	South Myrtle Creek	Days Creek
Potential acres		*2,568*	*9,610*	*121*	*373*
Mar	0.5	31	117	1	5
Apr	4.4	276	1032	13	40
May	11.4	714	2,673	34	104
Jun	18.6	1,165	4,361	55	169
Jul	28.5	1,786	6,683	84	259
Aug	22.9	1,435	5,370	68	208
Sep	12.6	790	2,954	37	115
Oct	1.1	69	258	3	10
Total acre-feet		**6,266**	**23,448**	**295**	**910**
Acre-feet projections are based on a future average need of 2.44 acre-feet per acre per year. Monthly distributions are based on projected crops and their water needs. See Appendix I for calculations.					

Table 2.E-26: Future irrigation water demands in acre-feet (South Umpqua Tributaries sub-basins).

<u>Ben Irving Reservoir</u>
Ben Irving Reservoir, located on Berry Creek, a tributary to Olalla Creek, has a capacity of 11,250 acre-feet of storage. Although the water is designated for a number of uses, the primary designation is for irrigation with an allocation of 8,446 acre-feet. As of October, 2007, approximately 3,036 acre-feet of water for irrigating 1,518 acres had been committed leaving a potential of 5,410 acre-feet available for purchase for irrigation uses downstream.

According to Table 2.E-25, there is approximately 9,610 acres of future potential land to be irrigated in the Lookingglass Creek sub-basin. At a projected demand of 2.44 acre-feet per acre, the total demand would be 23,448 acre-feet per year to meet all potential future irrigation in the sub-basin, far more than the available 5,410 acre-feet in Ben Irving Reservoir. In addition, potential irrigation land located along Tenmile Creek or further upstream could not be accessed by diversion of water purchased from Ben Irving Reservoir.

2.E.3. Sub-basin Concerns

Quantity

In all sub-basins, streamflows during June through December are inadequate to meet existing needs.[75] Many sub-basins have insufficient flows for most of the year. Without augmentation from storage, potential additional irrigation use and instream minimum flow requirements will not be met.

A total future potential irrigation use of 30,919 acre-feet is projected in all sub-basins. Of the total, 23,448 acre-feet is in the Lookingglass Creek sub-basin. Ben Irving Reservoir currently has 5,410 acre-feet available for irrigation. The potential future capacity of irrigation water use would require 18,038 acre-feet over and above Ben Irving Reservoir capabilities in the Lookingglass Creek sub-basin assuming the 5,410 acre-feet can supply irrigation land downstream of the reservoir within the sub-basin.

The remaining potential future water use for irrigation is estimated at 7,471 acre-feet in the South Umpqua Tributaries sub-basins. Deer Creek has the majority with 6,266 acre-feet of potential use for irrigation. Days Creek and South Myrtle Creek have 910 and 295 acre-feet of potential irrigation use respectively.

Ground water supplies should be monitored to ensure that future supplies for increased populations are adequate. Over the last 25 years, all sub-basins except Deer Creek show substantial increases in the percent of wells with less than 1 gpm flow.

Quality

Most stream water quality issues will be addressed through implementation of the Umpqua Basin TMDL. However, listings for sediment and toxic substances, along with a few isolated stream segments for other parameters are not addressed by the current TMDL.

Water temperatures during low flow periods are intolerable to anadromous species in portions of many streams in all sub-basins. The low flow periods generally occur in the summer when salmonids are rearing and migrating through the streams. Four streams in the Lookingglass Creek sub-basin and twenty other streams in the South Umpqua Tributaries sub-basins have segments that exceed State water temperature standards during this period.

Segments of Deer Creek, Canyon Creek, West Fork Canyon Creek, and an unnamed tributary in Canyon Creek also exceed temperature standards during the rest of the year when salmonids are spawning. Stream temperature listing during this portion of the year are not addressed by the Umpqua Basin TMDL but remedies that address temperatures in the summer months will likely improve conditions year around as well.

[75] Based on expected streamflows 80 percent of the time.

During the summer, bacteria levels pose a threat to people using Deer Creek, North Fork Deer Creek, Myrtle Creek, and Rice Creek for water contact recreation. Deer Creek and North Fork Deer Creek also have elevated levels during the rest of the year.[76]

Low dissolved oxygen levels are associated with warm stream temperatures, and high bacteria levels. In addition to the listings for temperature and bacteria, the first 9.6 miles of Deer Creek is also listed for inadequate dissolved oxygen levels during the spawning season (October 15th to May 15th). This can cause eggs, smolts, and other aquatic organisms to die when levels are too low.

Olalla Creek is considered water quality impaired for iron from the mouth to stream mile 21.8. The impairment may adversely affect both aquatic life and human health. Toxic impairments are not addressed by the current Umpqua Basin TMDL.

The first 25 miles of Jackson Creek and the lowest 2.1 miles of Beaver Creek, a tributary to Jackson Creek are considered high in sediment that may affect aquatic life. Sediment listings are not addressed in the current TMDL.

There are 20 streams listed for habitat modification impairments, and 20 listed for flow modifications. These impairments are usually caused by physical changes to the stream environment. They can be related to stream crossings that restrict or change flow patterns, streambank modification, vegetation changes or losses, and loss of streambed material from flooding, dredging, or historic logging practices with log flumes.

Flooding and Urban Drainage

Flooding of riparian agricultural lands occurs frequently in these tributary sub-basins. Although regular flooding is expected in the floodplain areas, excessive frequent flooding can erode streambanks and contribute to siltation problems in streams and in the South Umpqua River. In addition, flooding of some residences is a recurring problem along Deer Creek.

Aquatic Life

Inadequate flows, elevated water temperatures, lack of pool areas for holding and rearing, and lack of gravel areas for spawning and incubation of eggs adversely affect aquatic habitat in all sub-basins.

Numerous efforts are being undertaken in many tributaries by various agencies, public groups, and private landowners to improve instream and riparian habitat, and to improve fish passage to areas currently restricted by improper culverts and other obstructions.

[76] Rice Creek was found to be water quality limited during sampling for the TMDL analysis but is not yet on the 303(d) list.

Alternatives to Address Concerns

Structural

Small storage facilities located in upper watershed areas of Deer, North and South Myrtle and Days creeks appear capable of providing stored water to meet future needs for irrigation and rural domestic. In addition, the Lookingglass Creek sub-basin may benefit from small storage facility up Tenmile Creek to help meet future irrigation potential that may not be met by Ben Irving Reservoir. Stored water also could become available for release for streamflow augmentation in these sub-basins as well as in Elk and Canyon creeks sub-basins.

Non-structural

Continued completion of riparian vegetation improvement projects through Douglas County's SHIP and similar programs by other agencies will help to mitigate elevated stream temperatures, erosion and sedimentation problems, and help meet future aquatic instream habitat needs in the sub-basins.

Road construction and maintenance standards should be developed and implemented that reflect the needs for the following:

- improve and protect riparian vegetation;
- locate and construct culverts to allow fish passage into tributary streams;
- and minimize erosion of cut and fill slopes.

Douglas County, along with numerous other entities will act as a “designated management agency” according to the stipulations in the Umpqua Basin TMDL. These agencies have legal authority to ensure that targets identified in the TMDL are met. Douglas County has authority for regulating the TMDL on rural and urban/non-resource land in the County. Land uses on these areas include the following:

- All non-agricultural, non-forestry-related land uses including transportation uses (road, bridge, and ditch maintenance and construction practices)
- Designing and siting of housing/home, commercial, and industrial sites in urban and rural areas
- Golf courses and parks
- Operation of Berry Creek Dam/Ben Irving Reservoir
- Riparian protection
- Other land uses as applicable to the TMDL

The County will create an implementation plan for the TMDL, which will assist in review of corrective work being funded by the County and various agencies, as well as with activities under the Stream Habitat Improvement Program, the Salmon and Trout Enhancement Program, and other related programs.

2.F. Camas Valley Sub-basin

2.F.1. Area Description

Camas Valley is a rural area of roughly 5,000 acres in the southwestern part of Douglas County (see Figure 2.F.1). The sub-basin is located outside of the Umpqua Basin on the western slopes of the Coast Range. It lies within the Coquille River basin, and includes the origin of the Middle Fork Coquille River, a tributary to the South Fork Coquille River.

The valley has a pastoral setting, surrounded by steep, forested mountains that rise to an elevation of 2,500 feet. The valley itself has an elevation of about 1,100 feet. State Highway 42 links the area with Roseburg to the east and Myrtle Point, Coquille, and the Pacific Coast to the west.

The unincorporated community of Camas Valley consists of scattered houses and commercial establishments along Highway 42. The present population of the valley totals about 900.

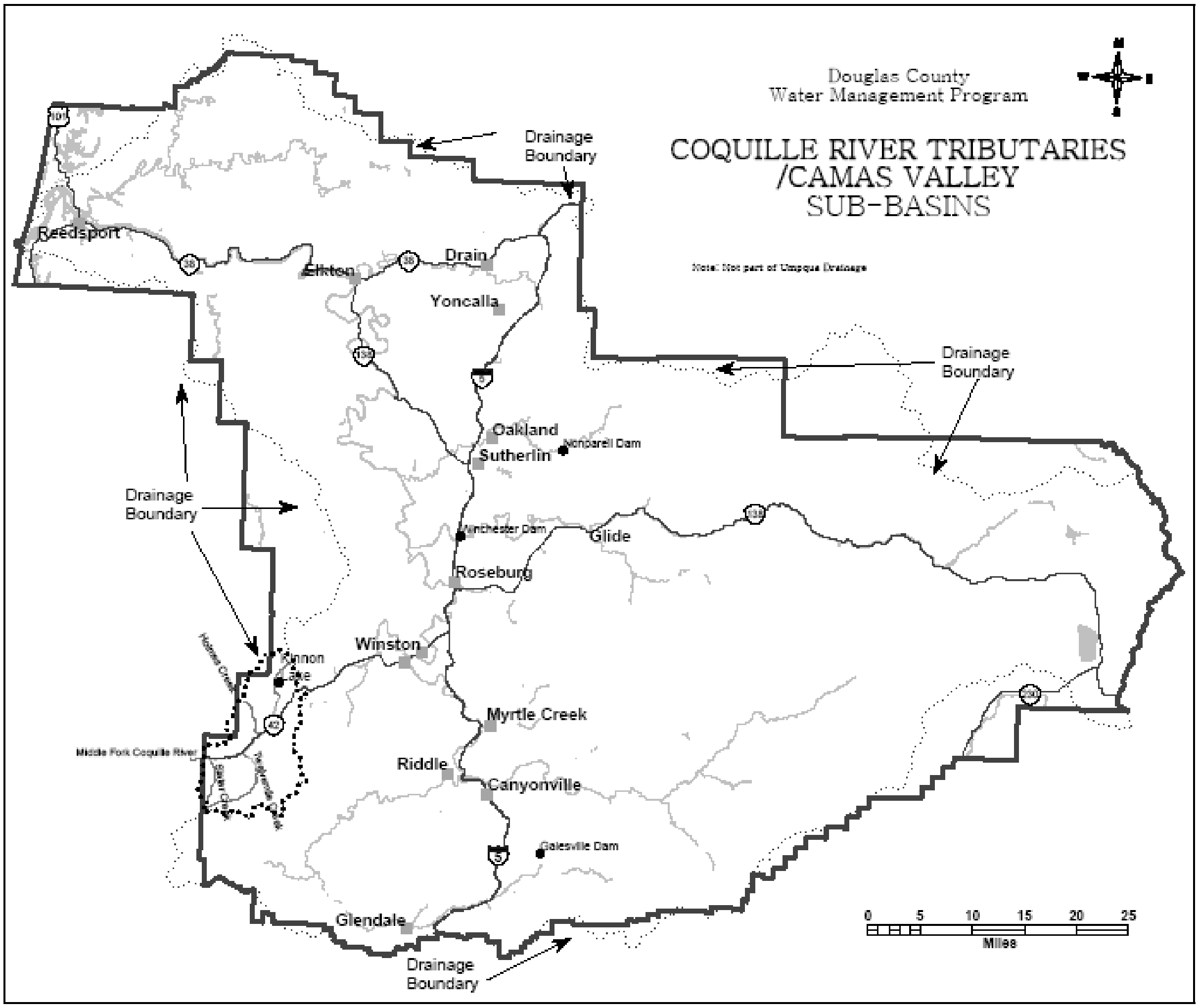

Figure 2.F.1: Camas Valley sub-basin within Douglas County.

Climate

The climate of the Camas Valley sub-basin is mild. Precipitation rarely falls as snow on the lower elevations, and summer temperatures are warm.

Precipitation

Precipitation data for Camas Mountain were collected from 1963 through 1975, and for Camas Valley from 1957 through 1977. Records from Camas Valley after 1973 are incomplete; thus annual data is primarily based on 1958 through 1968.

Average annual precipitation was 47 inches in the valley and 48.5 inches at Camas Mountain, significantly higher than at upper Olalla (42 inches) or Roseburg (33 inches). Annual maximum, minimum, and average precipitation is similar at both stations with values approximately 1.5 inches greater at Camas Mountain. The highest precipitation occurs at Camas Mountain in December and January averaging well over ten inches;

approximately two inches more per month than at Camas Valley. The maximum recorded annual amount is 59.70 inches in 1971 at Camas Mountain while the minimum, occurring in 1965, was 36.69 inches at Camas Valley. Both stations show a long dry period from June through August where 1.5 inches total or less occurs on average.

To illustrate the seasonal variability of precipitation, the maximum, mean, and minimum monthly amounts for the two stations are listed in Table 2.F-1.

Period	Monthly and annual precipitation (inches)					
	Camas Mountain 1963-1976			Camas Valley 1957-1977		
	max	mean	min	max	mean	min
October	5.43	3.06	0.95	8.34	3.71	1.10
November	19.60	8.60	3.10	23.68	8.17	2.14
December	19.99	10.41	3.94	18.80	8.71	3.14
January	17.00	10.80	6.40	14.84	8.41	1.57
February	10.03	4.80	1.76	13.74	5.64	0.00
March	8.66	4.89	0.00	9.49	5.59	0.94
April	5.08	3.02	0.95	6.10	2.56	0.70
May	2.24	1.48	0.54	5.37	2.04	0.40
June	2.45	0.81	0.12	1.99	0.61	0.00
July	0.62	0.13	0.00	1.37	0.20	0.00
August	2.46	0.62	0.00	2.16	0.48	0.00
September	3.18	1.12	0.00	3.26	1.25	0.00
Annual[1]	59.70	48.57	37.98	58.19	47.07	36.69

[1] Values are maximum annual, mean annual, and minimum annual; not total of column entries.

Table 2.F-1: Monthly and annual maximum, average, and minimum precipitation measured at Camas Mountain and Camas Valley stations.

Surface Water – Rivers and Streams

Quantity

Current water demands within Camas Valley are relatively small. However, periodic shortages of surface water occur during June through October. This particularly impacts irrigation use and aquatic life. The limitation on consumptive uses at this time of year will become more serious as demands increase in the future.

<u>Flooding</u>

Camas Valley sits near the upper end of the Middle Fork of the Coquille River. Flooding of the Coquille River is not uncommon along the lower reaches but not common in the Camas Valley. Recent localized flooding in 2006 caused the Camas Valley Post Office to close. The flooding was due to high precipitation on already saturated soils combined with poor drainage near the structure, but was not the result of streams exceeding capacity.

Quality

Water quality and quantity affect the use of water. The quality of water in the Camas Valley sub-basin does not always meet state standards for all parameters. Failure to meet a standard may vary by season due to changes in quantity of flow, as well as other seasonal changes. The main river extending through the area is the Middle Fork Coquille River. The first 33 miles of the river are in Coos County; however the upper 17 miles of the river and its upper tributaries are within Douglas County.

Oregon Water Quality Index[77]

The Oregon Water Quality Index is a single number that expresses water quality by integrating measurements of the following eight water quality variables: temperature, dissolved oxygen (percent saturation and concentration), biochemical oxygen demand, pH, total solids, ammonia and nitrate nitrogen, total phosphorus, and bacteria. Index values are then used to determine trends in water quality for each site. It is important to note, however that the index does not consider changes in toxics concentrations, habitat, or biology of the streams.

There are no sites within the Camas Valley sub-basin in Douglas County for determining an average Oregon water quality index. However one site located near the mouth of the Middle Fork Coquille River gives an indication of water quality for the entire river including the portion that extends through the sub-basin. The river is rated as "good" overall with slightly better quality in the summer. Results from this site for each season are listed in Table 2.F-2.

Site	River mile	Summer average (June – Sept)	Fall, winter, and spring average (Oct – May)	Minimum seasonal average	Rating[1]
Middle Fork Coquille River at HWY 42	0.2	88	85	85	good

[1] Based on minimum seasonal average.
Scores: very poor 0-59; poor 60-79; fair 80-84; good 85-89; excellent 90-100.
Source: Oregon Water Quality Index Summary Report Water Years 1996-2005.

Table 2.F-2: Oregon Water Quality Index rating for the Middle Fork Coquille River at HWY 42 for water years 1996 – 2005.

The Middle Fork Coquille River supports a small rural population and has no significant point sources of pollution. In the past, this measuring site located near the river mouth has occasionally measured high levels of fecal coliform, total phosphates, and nitrate nitrogen during high flows; and high temperatures during low flows. High levels of total solids and biochemical oxygen demand accompanied these impacts throughout the year.

[77] Discussion in this section is based largely on the Oregon Water Quality Index Report for the South Coast Basin Water Years 1986-1995 (Cude). However, current index values and updates to the discussion are from the most current Oregon Water Quality Index Summary Report Water Years 1996-2005.

High levels of nutrients (phosphates and nitrogen) contribute to eutrophication in the river. However, the current ratings for the river shown in Table 2.F-2 have improved since the previous decade. On average, index values are good throughout the year with the best quality in the summer.

Point and Non-point Source Pollution

Point source pollution comes from an identifiable point of discharge into the water. Non-point source pollution includes where the primary sources of pollution cannot be identified as coming from a specific site. The following water quality issues in the sub-basin are all from non-point sources. There are no significant identifiable point sources of discharge into the sub-basin.

Temperature

The primary water quality problems in the Camas Valley sub-basin are from non-point sources causing elevated stream temperatures during the summer. There are six streams listed in Table 2.F-3 considered water quality impaired for stream temperature in the sub-basin. Streams in the sub-basin are required to meet the core cold-water criteria of 61°F during the non-spawning season. The streams listed in Table 2.F-3 exceed that standard during the summer months. The Middle Fork Coquille River is only impaired above river mile 11.2 where the core cold-water designation begins. This implies that the temperature in these streams may not be a detriment to salmonids; however colder temperatures are necessary to help reduce warmer downriver temperatures in the Coquille River that perhaps are negatively impacting salmonids.

Battle Creek, Boulder Creek, Dice Creek, and Twelvemile Creek are all located within the Twelvemile drainage that discharges into the Middle Fork Coquille River about three miles below the Camas Valley at river mile 26. Bingham Creek is a tributary to Holmes Creek that discharges into the Middle Fork Coquille River just below the Camas Valley.

Stream	Listed segment (river mile)	Season
Battle Creek	0 to 1.5	non-spawning
Bingham Creek	0 to 2.0	non-spawning
Boulder Creek	0 to 4.1	non-spawning
Dice Creek	0 to 4.2	non-spawning
Middle Fork Coquille River	11.2 to 39.6	non-spawning
Twelvemile Creek	0 to 10.2	non-spawning
Source: Oregon DEQ 2004/2006 Integrated Report.		

Table 2.F-3: Streams that exceed State water quality temperature standards in the Camas Valley sub-basin.

Other Water Quality Concerns

The Middle Fork Coquille River is listed for dissolved oxygen from the mouth to river mile 11.2 in Curry County. The upper reaches of the river above river mile 26 are within Douglas County. The cause of the low dissolved oxygen levels downriver is unknown but reducing river temperatures may have some effect at improving dissolved oxygen levels since cold water can hold more oxygen than warm water. The amount of oxygen that is dissolved in water will vary depending upon temperature, barometric pressure, flow, and time of day. Both cold water and higher barometric pressure dissolve more oxygen than warm water, and low pressure. In addition, flowing water contains more dissolved oxygen than still water. Salmonid eggs and smolts are sensitive to dissolved oxygen levels. When levels drop too low for even short periods of time, eggs, smolts, and other aquatic organisms will die.

Panther Creek and the Middle Fork Coquille River are considered water quality impaired for habitat modification. Although streams listed for habitat modification are considered water quality impaired, they do not require a TMDL since the impairment is not from a pollutant. It is usually caused by physical changes to the stream environment. It may be related to stream crossings that restrict or change flow patterns, streambank modification, vegetation changes or losses, and loss of streambed material from flooding, dredging, or historic logging practices with log flumes.

These impairments are common throughout the Umpqua Basin. They can affect other parameters including sediment, dissolved oxygen, and temperature by increasing erosion and streamflow velocity, and decreasing shade. Loss of floodplain vegetation can also increase the rate of streamflow and decrease filtering of sediment and toxics. Efforts to improve fish passage and riparian conditions can help to improve these impairments.

Wastewater Permits

ODEQ manages a wastewater permit program that identifies point sources of wastewater with potential serious water quality or public health impacts. It requires that those facilities obtain and comply with a wastewater discharge permit. Permit conditions generally include effluent limits; monitoring standards; compliance conditions to improve operation; special operating conditions; and other administrative requirements such as prompt reporting of spills. There are currently no active wastewater permits within the Camas Valley on record with the ODEQ.

Surface Water – Lakes and Reservoirs

Quantity and Quality

Kinnan Reservoir is a 23 acre, 340 acre-feet, privately-owned reservoir for private recreation that flows into the Middle Fork of the Coquille River. The Camas Valley sub-basin has no natural lakes or reservoirs for public use. There is no water quality information on Kinnan Reservoir.

Ground Water

There is no public domestic water service in the sub-basin. Ground water from private wells is the primary source of drinking water for residents in the Camas Valley. There are 310 wells established for domestic use on record in the sub-basin, of which seven have been abandoned. Demands on ground water are expected to increase as the population of the sub-basin increases.

Quantity

Geological conditions determine the accessibility and quantities of ground water. The Camas Valley sub-basin is located in the Coast Range which consists largely of marine sediments of low permeability and water holding capacity. Even when saturated these sedimentary formations contribute little recharge to stream flows after the rains have stopped. Many small streams dry up completely in the absence of surface runoff because there is little or no recharge from ground and land water storage. The transmissibility necessary for the movement of water is very low in the tight marine material.

Wells are the primary water source for the rural population of the Camas Valley sub-basin. Table 2.F-4 lists the numbers of wells by water yield that occur within Douglas County in the Camas Valley area. The majority of wells (33 percent) yield less than 1 gpm. Many of these wells are likely inadequate to meet domestic use needs without other supplemental water sources. Approximately 65 percent of the wells are less than 5 gpm. However, 22 percent of wells yield over 10 gpm. The depth of the wells ranged from 10 to 445 feet with a median depth of 125 feet.

Area	Depth range (feet)	Number of wells by water yield (gpm)			
		<1	1 to 5	> 5 to 10	>10
Camas Valley	10 to 445	104	102	41	68
Source: Oregon Water Resources Department (well data from 1955 to 2007).					

Table 2.F-4: Number of wells by water yields within the Camas Valley sub-basin.

Table 2.F-5 shows a comparison of well data from before and after 1980. The percentage of well yields less than 1 gpm has increased 6 percent since 1980, while the percentage with yields between 1 and 10 gpm has decreased. However, eight new wells have been drilled since 1980 that produce greater than 10 gpm resulting in an increase of 5 percent in that category. There has been a slight increase in new wells abandoned and an increase in average drilling depth of 26 percent since 1980. Deeper drilling combined with decreased yields may indicate that while many wells still meet domestic needs, the ground water level may be dropping in some areas. It may also be an indication of well drilling expanding into areas less likely to produce adequate ground water.

Category	Camas Valley	
	1955-1980	1981-2007
Total new wells	150	148
new wells abandoned	1 %	3 %
Yield (gpm)		
< 1	30 %	36 %
1 to 5	36 %	29 %
> 5 to 10	15 %	11 %
> 10	19 %	24 %
Depth drilled (feet)		
median depth	100	160
average depth	130	175
Source: Oregon Water Resources Department		

Table 2.F-5: Comparison of well data before and after 1980 for the Camas Valley sub-basin.

It appears that the aquifer is moderately productive. There is potential for additional wells to be drilled although placement is important. A small group-domestic system could potentially be established. The area north and northeast of the town of Camas Valley appears to have the most productive wells.

Quality

The quality of the well water is generally good. A few wells have problems with significant iron, chloride and dissolved solids concentrations, but none of these exceed permissible limits. High manganese in a few wells does not present a human health hazard but can be aesthetically unacceptable to residents. It may cause staining of plumbing fixtures and laundry and can give a peculiar taste to the water.

Table 2.F-6 shows sample results from five wells taken in 1973 and 1976 by the USGS. In addition to a few high manganese results, three of the five were high in boron. The EPA standard at the time of testing was 0.75 mg/l. However, there is no current EPA or Oregon standard for boron. The World Health Organization currently recommends a maximum of 0.5 mg/l in drinking water. Exposure to high boron concentrations may cause male reproductive problems.

A high value of dissolved arsenic (0.15 mg/l) was determined for a sample from a well at the Camas Valley School in 1973. However, a later sampling produced a value of only 0.002 mg/l, which is consistent with arsenic concentrations of other wells in the area. Another 1973 sample taken on the same day from a private well in the area exceeded the current standard for arsenic with a value of 0.016 mg/l. This did not exceed the standard at the time and thus was not re-sampled.

Parameter	Standard (mg/l)	Number exceeding standard
Iron (Fe)	0.3	0
Manganese (Mn)	0.05	2
Sulfate (SO_4)	250	0
Chloride (Cl)	250	0
Fluoride (F)[1]	2.0	0
Boron (B)[2]	0.5	3
Arsenic (As)	0.01	1
Nitrate + Nitrite expressed as N	10	0

[1] The current standard for fluoride is 2.0 mg/l for children under 9 years and 4 mg/l for all other individuals.
[2] There is currently no recommended standard for boron by the EPA or the State of Oregon. However, the World Health Organization currently recommends an upper limit of 0.5 mg/l in drinking water.
Source: USGS Water Resources Department.

Table 2.F-6: Ground water quality from 1973-1976 from five wells in the Camas Valley sub-basin.

There is also reported bacteriological contamination of some wells as evidenced by occasional high coliform counts. This is a sanitary problem due to septic tanks or infiltration from feeding areas and not a reflection on the natural quality of the ground water. A few wells are reported to have odor problems when the water table is low, indicating hydrogen sulfide (H_2S) concentrations.

All five wells showed somewhat elevated sodium levels that may cause a salty taste to the water, and levels of $CaCO_3$ indicated ground water is quite soft at all measured locations.

2.F.2. Water Use

The following material discusses current and future water use in this portion of Douglas County. The types of water use considered include municipal, rural domestic, industrial, irrigation, aquatic life, recreation and hydroelectric power. Analysis and more detailed discussion of rural domestic water use are included in Appendix M.

Current

For purposes of this report, the measure of current water use is derived from water rights information provided by the Oregon Water Resources Department. The priority date of a water right of record is the governing factor during times of water shortage. If priority dates are the same, then domestic use has preference over all other uses; agricultural purposes are next in line; and all other uses follow. For information on Oregon water law and the 1909 water code, refer to Water Use in Section 2.A.2.

Municipal and Industrial

There is no municipal water system in Camas Valley, nor is there a water district or water association. All houses, farms and ranches have individual wells to meet their domestic needs. The entire domestic water demand of the area is essentially of a rural character. Subsequently, it is assumed that the domestic requirements will continue to be met by individual wells. There is no anticipated future demand on surface streams and reservoirs.

There is only one industrial plant in Camas Valley with minimal water needs. The plant owner has constructed an 800 acre-foot reservoir that should provide more than adequate water supply for any possible future expansion.

Rural Domestic

There is an estimated population of 710 people in the Camas Valley sub-basin. All are considered rural domestic users since there is no water service provider. The majority of the population is centered on Highway 42 along the Middle Fork Coquille River. There are 17 domestic surface water rights in the sub-basin that provide water for an estimated 49 people leaving 661 residents obtaining water through primarily ground water wells and springs.

Irrigation

Approximately 486 acres are irrigated under existing water rights in Camas Valley. About 89 percent of these lands are associated with water rights senior to 1980 instream rights on the upper Middle Fork Coquille River. However, the middle and lower reaches of the Middle Fork Coquille River have instream rights dating back to 1964. Only 60 percent of the irrigation land is associated with rights senior to the 1964 instream rights. Therefore an estimated 292 acres would generally have full supplies of water to meet irrigation needs and 194 acres may not always have adequate supplies of irrigation water due to seasonal curtailment for instream rights downstream. Based on an average use of 2.5 acre-feet per year, the amount of additional water needed to supply these rights is estimated at 400 acre-feet per year (see Supplemental Requirements section).

Aquatic Life

<u>Instream Flows</u>
Adequate stream flows are critical to sustaining aquatic life and maintaining water quality. As a result, Oregon water law has recognized both of these needs. In the Middle Fork Coquille River, maintaining adequate flows for fishery resources also will improve water quality. Maintaining adequate streamflows has value for recreation and aesthetic enjoyment as well.

Table 2.F-7 lists the minimum instream water rights in the Middle Fork Coquille River that extend up to the Camas Valley. There are also instream rights with a priority date of 1964 on the lower reaches of the Middle Fork Coquille River that may affect rights held

upstream. Streamflow is often inadequate in the upper Middle Fork Coquille River to meet these instream water requirements.

Time of year	**Middle Fork Coquille River from the headwaters to Twelvemile Creek (cfs)**	
	4/1/80	**6/30/92[1]**
October	---	---
1 to 15	20	2.7
16 to 31	50	2.7
November	50	34.1
December	50	60.0
January	---	---
1 to 15	50	60.0
16 to 31	35	60.0
February	35	60.0
March	35	60.0
April	35	58.3
May	35	30.4
June	---	---
1 to 15	25	18.2
16 to 30	8	18.2
July	---	4.3
August	---	2.3
September	---	1.8

[1] Values are rounded to the nearest tenth.
Source: State of Oregon Water Resources Department.

Table 2.F-7: Minimum instream flows to support aquatic life in the upper portion of the Middle Fork Coquille River with priority dates of right.

Fish Abundance and Distribution

There are few anadromous fish in the upper reaches of the Middle Fork of the South Fork Coquille River. The area is generally high gradient with large substrate. The upper limit of anadromous fish is near Twelvemile Creek where a 17-foot high vertical rock falls prevents further migration. Below the falls, fish move into Slater Creek, but most are in the Middle Fork Coquille River below the falls. Anadromous species in the area include winter steelhead, sea-run cutthroat trout, coho, and Pacific lamprey.[78] Resident species in the basin are mainly cutthroat trout with rainbow trout possible in some areas.

Fishery Concerns

Anadromous fish are not present above Twelvemile Creek primarily because of the barrier falls. In addition, the gradient near the falls is too high for many anadromous species to pass through. The elevation drops approximately 35 feet in about 1,000 linear feet of stream.

[78] Personal communication, Alan Ritchey, ODFW Assistant District Fish Biologist on 1/28/08.

Low flows and high water temperatures are also common during summer months when anadromous fish are rearing and migrating in the Middle Fork Coquille River and Slater Creek. High stream temperatures may also affect resident species in the upper portions of Camas Valley.

Recreation and Hydroelectric Power

There are no recreational sites with boat launching facilities and no hydroelectric power development in the Camas Valley sub-basin.

Supplemental Requirements

The amount of water needed to supplement existing deficient stream flows totals 400 acre-feet per year for irrigation rights. The supplemental water needs for irrigation are summarized by month in Table 2.F-8.

Month	Percent[1]	Middle Fork Coquille River[2] (acre-feet)	Supplemental water needs[3] (acre-feet)
Acres requiring supplemental water		*194*	
Mar	0.5	2.42	0
Apr	4.4	21.3	0
May	11.4	55	0
Jun	18.6	90	90
Jul	28.5	138	138
Aug	22.9	111	111
Sep	12.6	61	61
Oct	1.1	5	0
Total acre-feet		**485**	**400**

[1] Distribution based on projected crop distribution and crop needs (see Appendix I).
[2] Based on current duty of 2.5 acre-feet per acre per year.
[3] Assumes streamflows are insufficient to meet both instream and irrigation rights in June through September.

Table 2.F-8: Current supplemental water needs for irrigation in the Camas Valley sub-basin.

Future

Municipal

There is no municipal water system in Camas Valley, nor is there a water district or water association. The entire domestic water demand of the area is of a rural nature and water needs are being met by ground water wells. There is no anticipated further development of a municipal water system. Wells will continue to meet the domestic water needs and there will be little demand on surface streams and reservoirs.

Industrial

There is only one industrial plant in Camas Valley. The owner has constructed an 800 acre-foot reservoir that is considered a more than adequate water supply for any possible future expansion.

It is unlikely that any water intensive industry, such as canning plants, wood products plants, or sawmills will be located in the valley in the future. Consequently, it appears reasonable not to project any industrial water requirements.

Rural Domestic

The rural domestic population is expected to increase from 710 people to 1,243 people by 2050. At a peak per capita use of 290 gallons per capita day, the annual water demand is expected to be 253 acre-feet per year. The population is expected to continue to get water from ground water sources and individual storage tanks in the future. Possible development of community wells may help some residents especially in the area north and northeast of the town of Camas Valley.

Irrigation

Estimates of future irrigation needs were derived from the needs of a full season crop on potentially irrigable lands. These potential irrigable lands were identified from a 1978 soils survey performed by the Natural Resources Conservation Service (previously the Soil Conservation Service). According to the 1989 Water Resources Management Plan, the total future potential irrigable land estimate was 910 acres in 1989. Existing irrigation water rights at that time were for 370 acres, equating to a total possible 1,280 acres of potential irrigation land in the Camas Valley. Current irrigation water rights are held on 486 acres in the Camas Valley. Therefore, the estimate of future potential irrigable land is 794 acres in the Camas Valley area. Water requirements for future irrigation are presented in Table 2.F-9.

Month	Percent[1]	Middle Fork Coquille River[2] (acre-feet)
Future potential acres		*794*
Mar	0.5	10
Apr	4.4	85
May	11.4	221
Jun	18.6	360
Jul	28.5	552
Aug	22.9	444
Sep	12.6	244
Oct	1.1	21
Total acre-feet		**1,937**

[1] Distribution based on projected crop distribution and crop needs (see Appendix I).
[2] Based on projected average use of 2.44 acre-feet per acre per year.

Table 2.F-9: Future irrigation water demands in acre-feet (Camas Valley).

The total future need for irrigation is estimated at 1,937 acre-feet per season. The needs are highest in the low flow summer months. In addition to these predictions, there is an estimated 400 acre-feet per year needed to fulfill current irrigation rights that are not reliable (Table 2.F-10).

Month	Percent[1]	Middle Fork Coquille River[2] (acre-feet)	Supplemental water needs[3] (acre-feet)
Acres requiring supplemental water		*194*	
Mar	0.5	2.42	0
Apr	4.4	21.3	0
May	11.4	55	0
Jun	18.6	90	90
Jul	28.5	138	138
Aug	22.9	111	111
Sep	12.6	61	61
Oct	1.1	5	0
Total acre-feet		**485**	**400**

[1] Distribution based on projected crop distribution and crop needs (see Appendix I).
[2] Based on current duty of 2.5 acre-feet per acre per year.
[3] Assumes streamflows are insufficient to meet both instream and irrigation rights in June through September.

Table 2.F-10: Existing supplemental irrigation water needs in acre-feet (Camas Valley).

Summary of Future Use

The estimated future needs in the Camas Valley sub-basin are primarily for irrigation and instream water requirements. The total future need for irrigation is shown by month in Table 2.F-11. Shortages on existing rights occur primarily in the low flow summer months when flows are insufficient to meet 1964 instream minimum requirements. However, future irrigation rights will likely fall short for most of the season given the additional instream water requirements established in 1980 and 1992 on the upper Middle Fork Coquille River. Thus needs are shown for each month of the irrigation season on future irrigation rights. The total annual shortage is estimated at 2,337 acre-feet.

Month	Percent[1]	Supplemental water needs[2] (acre-feet)	Future water needs (acre-feet)	Total (acre-feet)
Mar	0.5	0	10	10
Apr	4.4	0	85	85
May	11.4	0	221	221
Jun	18.6	90	360	450
Jul	28.5	138	552	690
Aug	22.9	111	444	555
Sep	12.6	61	244	305
Oct	1.1	0	21	21
Total acre-feet		**400**	**1,937**	**2,337**

[1] Distribution based on projected crop distribution and crop needs (see Appendix I).
[2] Assumes streamflows are insufficient to meet both instream and irrigation rights in June through September.

Table 2.F-11: Future irrigation water needs from the Middle Fork Coquille River.

In addition there will be shortages to meet the minimum instream flow requirements. However, some or all of these may be met by providing additional flow from storage releases to meet downstream irrigation needs.

2.F.3. Sub-basin Concerns

Quantity

Stream flows during June through October are inadequate to meet existing needs. Without augmentation from storage, future potential irrigation use and instream flow requirements will not be met.

Ground water supplies should be monitored to ensure that future supplies for increased populations are adequate. Consideration of community well development may be necessary to help meet area domestic needs.

Quality

Some ground water well testing from the 1970s showed some wells with potentially high boron levels that may warrant additional monitoring.

Elevated stream temperatures during low flow summer months may negatively affect aquatic life during rearing and migrating. Known areas of concern are on the lower reaches of Battle, Boulder, and Dice creeks, and the lower 10 miles of Twelvemile Creek all within the Twelvemile Creek watershed. The Middle Fork Coquille River from about river mile 11 to 40 (through the Camas Valley) is also a known concern.

Habitat modification on Panther Creek and the Middle Fork Coquille River may also be a result of physical changes to the stream habitat for aquatic life that can increase sediment to spawning grounds.

Alternatives to Address Concerns

Ground water will likely meet the future needs of domestic water users. Individual well owners may need to purchase additional storage tanks for under-producing wells. Irrigation needs would likely necessitate additional water storage. It is possible that needs could be met by local efforts rather than a County sponsored project.

The existing 800 acre-foot private reservoir located in the vicinity of Lake Creek could potentially be enlarged to provide water to irrigation uses downstream. Another site upstream of the reservoir could possibly hold several hundred acre-feet to supplement needs. However, the technical, economic and legal feasibility of both projects would have to be investigated prior to any recommendations. Local interest in putting new land into irrigation would also have to be ascertained.

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