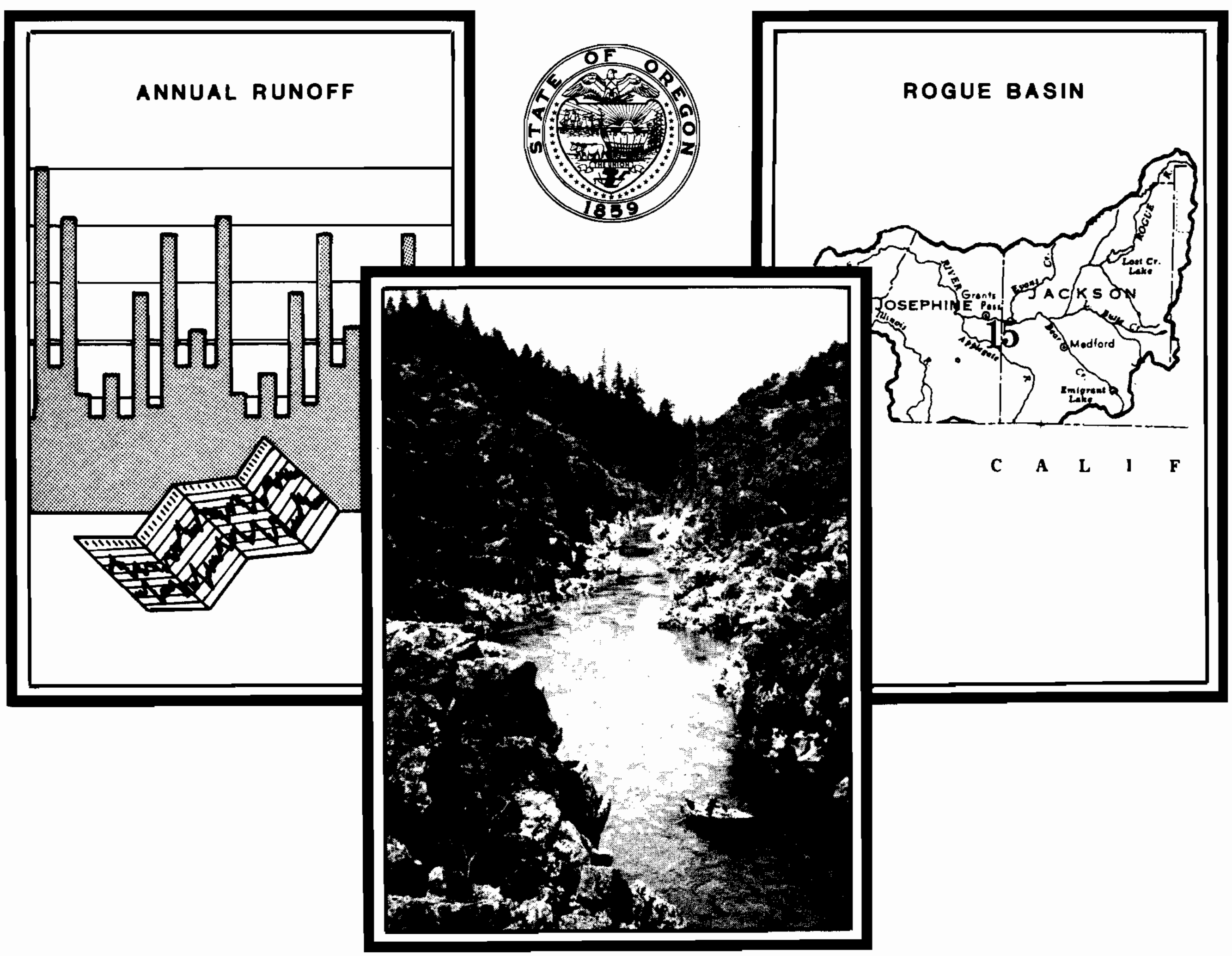
ROGUE RIVER BASIN STUDY

January, 1985

WATER RESOURCES DEPARTMENT

William H. Young, Director



ROGUE RIVER BASIN

STATE OF OREGON
WATER RESOURCES DEPARTMENT
SALEM, OREGON

January, 1985

WILLIAM H. YOUNG, DIRECTOR

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THE ROGUE RIVER BASIN

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PART I - THE ROGUE RIVER BASIN

INTRODUCTION

This report summarizes the data base developed for a comprehensive revision of the Rogue River Basin Program. The Water Policy Review Board initiated the update in 1979 to revise the program that was originally completed in 1959. Modifications of the water use program for the Rogue Basin were adopted April 3, 1964, February 24, 1966, November 2, 1966, September 29, 1969, April 4, 1981, August 5, 1982, September 17, 1982, and October 13, 1983.

The water use program is an integrated, coordinated plan for the use and control of the water resources of the Rogue Basin. The program complies with ORS 536.300 and the policies in ORS 536.310.

The report updates the Rogue Basin Report of 1959. Data was developed from (1) field investigations, (2) review of available reports, (3) analysis of hydrological and geographical data, (4) formal hearings on the water needs and problems in the basin (5) the Jackson and Josephine County Water Resources Advisory Committees to the Rogue Basin revision, and (6) consultations with, or data submitted by local, state, and federal agencies and other groups.

A description of the basin, its development and its natural resources is followed by a more complete discussion of basin water resources and water uses. This is followed by a discussion of the potential for future water use within the basin. Finally, an inventory of resources and an analysis of each subbasin is presented.

NATURAL FEATURES

Location and Description

The Rogue River drains an area of 5169 square miles in Oregon and California. Over 5000 square miles, or 5 percent of Oregon's total land area, lies in southwestern Oregon. The waters of the Rogue River rise at an elevation of 5250 feet* from Boundary Springs on the western slope of the Cascade Range, flow through the Klamath Mountains, and discharge into the Pacific Ocean at Gold Beach. The Rogue River Basin lies between the Klamath River Basin to the east and south, the Umpqua and Coquille River Basins to the north and northwest, and the Chetco River Basin to the southwest. The basin's outline is roughly crescent-shaped, with dimensions of about 110 miles in an east-west direction and 60 miles north and south. The Rogue River Basin includes nearly all of Jackson and Josephine Counties, a large part of Curry County, and minor portions of Klamath, Douglas and Coos Counties in Oregon, and nearly 150 square miles of Siskiyou and Del Norte Counties in Northern California. Following is a tabulation of the drainage areas within the basin by county:

* All elevations are above mean sea level.

TABLE 1

ROGUE RIVER BASIN

COUNTY	STATE	AREA WITHIN ROGUE RIVER BASIN SQUARE MILES	ACRES
Jackson	Oregon	2,549	1,631,360
Josephine	Oregon	1,620	1,036,800
Curry	Oregon	525	336,000
Klamath	Oregon	213	136,320
Douglas	Oregon	113	72,320
Coos	Oregon	2	1,280
Siskiyou	California	88	56,320
Del Norte	California	59	37,760
	TOTALS	5,169	3,308,160
			3,214,080 (OR)

More than 2500 streams, of which only half are named, comprise the Rogue Basin drainage system. The topography of the basin is highly dissected, cut by hundreds of stream valleys, large and small. With nearly 5100 miles of streams in the basin, there is an average of about one mile of watercourse for every square mile of land area. A high percentage of the smaller tributaries, however, are one mile or less in length and flow intermittently. The Rogue Basin stream system is shown on Plate 1.

For the purpose of general discussion, the Rogue Basin can be separated into three distinct regions - eastern, central valley, and western, each differing in topography, climate and degree of development. The eastern region comprises the Cascade Range and drainage from its western slopes; the central valley region is the middle portion of the basin which includes all the major parcels of relatively flat, arable valley land; and the western region comprises the Klamath Mountains and the coastal area.

Eastern Region

The Eastern Region lies almost entirely within Jackson County. It begins at the headwaters of the Rogue River near the north boundary of Crater Lake National Park and drains the western slopes of the Cascade Range. Included in this region are: 1) about 70 miles of the Rogue main stem, from its origin at river mile 215 downstream to elevation 1400 feet, near river mile 148 just below its confluence with Trail Creek; 2) the South and Middle Forks of the Rogue River, both rising at elevation 5600 feet in the Sky Lakes Limited Area, which lies south of Crater Lake along the crest of the Cascade Range; 3) Big Butte Creek watershed, whose origin is near elevation 5800 feet on the northern slope of Mt. McLaughlin, elevation 9495 feet; 4) the upper 26 miles of Little Butte Creek drainage which rises near elevation 5300 feet in the lava flows to the south of Brown Mountain; and 5) Elk and Trail Creeks which flow from elevations 4800 and 3800 feet, respectively, from the northern basin divide between the Rogue River and the Umpqua National Forests.

Approximately 1500 square miles, or 30 percent of the total basin land area, lie within the eastern region. Throughout this region the topography is rugged, precipitous, and in general, heavily forested with only 75 square miles of arable land. The Rogue River and its tributaries in this region are swift-flowing streams having steep gradients coursing through deep, narrow canyons cut into pumice or lava. The main stem Rogue River flows in a generally southwest direction with an average gradient of 57 feet per mile through this section and most of its tributaries enter from the east after flowing westward on steep gradients from the Cascades. A few tributaries such as Elk and Trail Creeks flow south from the Rogue River Mountain Range on the northern basin boundary to enter the Rogue River on its western banks.

The Eastern Region is sparsely populated. The largest communities are Shady Cove and Prospect. The City of Shady Cove has a population of 1097, according to 1980 census information. Prospect is not incorporated, but is a rural community of about 250 people.

Central Valley Region

Below Shady Cove, the Rogue River Valley gradually widens as it enters the Central Valley region of the basin. Nearly one-half of the total basin area and most of the basin population resides in this region which includes most of Josephine County and a large part of Jackson County.

Most of the arable lands of the basin are found in the central region in widely separated, mountain-flanked valleys along the Rogue main stem and in the watersheds of Bear Creek, Evans Creek, Jumpoff Joe Creek, Grave Creek, and Applegate and Illinois Rivers. Bear Creek rises at elevation 5300 in the southeast corner of the Rogue River Basin near Soda Mountain and flows northwest. Evans Creek originates at elevation 4400 near the basin's forested north boundary and flows south. Jumpoff Joe and Grave Creeks originate at elevations of 3200 and 4400, respectively, near the north basin boundary but flow generally to the west. The Applegate River rises from small lakes lying above elevation 5200 in California near the basin's south boundary and flows northwest. The Illinois River also begins in California in the Siskiyou Mountains with headwater elevations at about 4800 feet and flows in a northwest direction.

Ten feet of drop per mile is the average slope of the main stem Rogue River throughout this central region. All of the streams tributary to the Rogue River in this region flow on steep gradients in the upper reaches, but flatten out considerably as they approach the main stem Rogue River. It is in these lower stretches that the valleys broaden out and development occurs.

Central Valley region agricultural lands consist of irregular-shaped areas ranging from 1000 to 46,000 acres in size and generally lie below elevation 2200 feet. Geologically, the lands are primarily intrusive and sedimentary rocks with large areas of alluvium deposits.

Approximately 14 miles below Trail Creek, the Rogue River enters a broad alluvial plain which is the largest body of agricultural land within the basin. This plain, nearly 60 square miles in area, is located at the confluence of Little Butte Creek, Bear Creek, and Rogue River Valleys. The downstream end of this plain is near Gold Ray Dam near river mile 126, where the river enters a shallow canyon with bench lands on either side.

Other fertile valleys are located along Bear Creek, with the cities of Medford and Ashland, and along Evans Creek just above its confluence with the Rogue River. Three other valleys with major development are located further downstream along the main stem Rogue in the vicinity of Grants Pass, in the Applegate River valley, and in the Illinois River valley.

Medford, Grants Pass and Ashland, the main population centers of the Rogue River Basin, are located in the Central Valley region. Medford, with a 1980 population of 39,603, is the largest city in the basin, followed by Grants Pass, with a 1980 population of 14,997 and Ashland, with a 1980 population of 14,943.

Western Region

The Western Region contains about one-fifth of the total basin area and is a mountainous, semi-wilderness region encompassing the lower 65 miles of the Rogue River and the winding canyon country of the lower 45 miles of the Illinois River. Both the Rogue and Illinois Rivers flow through narrow, steep-walled canyons. The main stem Rogue flows in a generally southwest direction through this region to its confluence with the Pacific Ocean at Gold Beach. The Illinois River flows northwesterly where it joins the Rogue River at river mile 27.

Agricultural lands are limited due to the rugged topography and soils and comprise a negligible amount of the land area in this region. The underlying geology in this region consist mostly of massive, thickly-bedded sandstone.

Although the average gradients of the Rogue and the Illinois Rivers are much gentler here (9 and 23 feet per mile, respectively) than in the headwater areas, the land along the river is extremely rugged, precipitous and accessible only by river boat and trail. Both the lower Rogue and Illinois Rivers are part of the State Scenic Waterway system.

Nearly all of the population in this area is concentrated in the coastal town of Gold Beach at the mouth of the Rogue River. There are a few very small communities located along the lower Rogue River with Agness located near the confluence of the Rogue and Illinois Rivers.

Climate

The Rogue River Basin lies slightly south of the major easterly storm path from the Pacific Ocean and the area generally experiences a mild climate. Summers are charcterized by hot, dry weather and the winters are mild and wet. The average annual temperature is about 54 degrees and ranges from an average low of 38 degrees to an average high of 70 degrees Fahrenheit.

Because of the strong maritime influence, there are no major temperature extremes from one season to the next. For example, spring is typically cool with an average temperature of 52 degrees and a daily maximum somewhere in the middle 60's. Temperatures reach their maximum late in July and continue through August. During this period, the daytime average is about 89 degrees with occasional readings of 100 degrees or more. Fall is characterized by cool nights, but with warm, comfortable days with 66 degrees being the usual daytime maximum temperature. The dominance of moist marine air masses provides for relatively mild winters with temperatures only occasionally dropping below freezing.

Detailed climatological data is provided in each of the subbasin inventories in Part V.

Geology, Soil, and Vegetative Cover

The Rogue River Basin was developed largely from rocks of the Klamath Mountain Geologic Province, an area of metamorphosed ancient sediments and related intrusives. The geology of the Eastern Region, however, has been developed in the overlying sediments, lava, and pumice rocks of the Cascade Range Geologic Province which date from early Tertiary period to very recent times (see Table 2). These deposits originated from Mount Mazama, the volcano from which Crater Lake was eventually formed. Numerous basalt eruptions from vents on the slopes of this historic volcano filled the valleys cut into the Tertiary rocks to depths of about 200 feet. These intracanyon lava flows occurred during the Pliocene-Pleistocene epochs between 5 and 2 million years ago. Remnants of the lava fill now form high flat-topped benches along the river.

After the Rogue River had carved out a valley in the intracanyon lava and had nearly reached its present stage, a gigantic mud flow of ash and pumice boulders came down the valley during one of the last eruptions of Mt. Mazama and flowed downstream for many miles. These extensive pumice deposits and underlying fractured and fissured lava flows provide good absorption of rain and melting snow runoff. This helps to retard the winter runoff and sustain the flow of the Rogue River during the summer months.

The western Cascades present an older dissected surface greatly modified by later lava flows and pumice deposits. Weathering and soil development are deep on the peneplane remnants and are especially evident in down-warped areas.

The Klamath Mountain area, however, was eroded at least once in late Tertiary time and subsequently underwent two or three periods of warping and dissection. The resultant topography varies from the very rugged, deeply cut terrain of the uplifted Siskiyou Mountains to the broad, open, alluvial valleys of the down-warped area around Medford. Numerous sites exist for low dams, but sites capable of supporting high storage dams are scarce and generally would require excessive

TABLE 2

GENERALIZED GEOLOGIC TIMETABLE

ERA	PERIOD	EPOCH	AGE IN MILLIONS OF YEARS AGO	MAJOR GEOLOGIC EVENTS
Cenozoic	Quaternary	Holocene	0.011	Glaciers receding. Recent lava flows.
		Pleistocene	2	Volcanic peaks formed. Active glaciation.
	Tertiary	Pliocene	5	Cascade Range growing. Lava flows in south-central Oregon.
		Miocene	26	Seas invade coastal areas. Coast and Cascade Ranges begin uplift.
		Oligocene	37-38	Willamette Valley and parts of Coast Range covered by warm, shallow sea-marine deposits.
		Eocene	53-54	Subtropical climate. Large volcanoes form in area of Cascade Range.
		Paleocene	65	Not mapped in Oregon.
Mesozoic	Cretaceous		136	Intermittent invasions by warm seas.
	Jurassic		190-195	Mountain-building and intrusive volcanic
	Triassic		225	bodies. Volcanoes active in NE and SW Oregon.
Paleozoic	Permian		280	Warm seas with fossiliferous marine deposits.
	Pennsylvanian		325	Intermittent volcanism in NE Oregon.
	Mississippian		350	
	Devonian		400	Rocks exposed in Central and Eastern Oregon
	Silurian		430	
	Ordovician		500	Lower Paleozoic record largely missing.
	Cambrian		600	
Precambrian				No rock of this age known in Oregon.

Source: Baldwin, E.M., Geology of Oregon, 1981.

quantities of construction materials.

Several periods of alluviation are evident throughout the Rogue River Basin dating from late to middle Tertiary time. Gold-bearing gravels are found in terraces as well as in isolated bars well above the present streambeds. Many alluvial basins with transported soils are found in sections along Bear Creek, the Middle Rogue River Basin, Applegate River and the headwaters of the Illinois River. Thin to medium depth clayey loams have formed over the metamorphic rocks of the Klamath Mountain complex, while the deeply weathered granitic rocks have usually become coarse sandy soils. Soils in the western Cascades are thin to medium depth and are silty to clayey.

The rugged mountainous areas of the basin are covered with stands of Ponderosa pine and Douglas fir with some hemlock, red cedar and thick underbrush. Nearly all of the basin has been logged. Extensive timber cutting has occurred since 1940. At lower elevations, the timber thins out until, on the valley floor, it is limited to occasional small woodlots. Almost all of the arable lands in the basin are found in these valleys along the edges of the streams.

Considerable areas are covered with second-growth pine, shrubs and scrubby Oregon white oak. Lining the streambanks are hardwoods such as cottonwood, willow and alder, as well as thick brush. The dry south-facing slopes of the semiarid foothill areas are covered with a sparse growth of oak, madrone and underbrush. There are approximately 170,000 acres of rocky, mountainous land in the extreme southern part of the basin having a sparse cover of stunted fir, ponderosa pine and lodgepole pine.

Untimbered and uncultivated lands in the basin generally support a light cover of annual grasses, weeds and other herbaceous plants. These plants grow in early spring and mature and die in early summer leaving those areas dry or barren throughout the remainder of the year.

CULTURAL DEVELOPMENT

History

The Rogue River Basin area was the home of Indians consisting of both the Takilma and Rogue River Na-Dene (Applegate) groups. Recent archaelogical work at the Applegate project in southwestern Jackson County identified Indian sites that existed as early as 8000 years BC. Also, a continuous record of human occupation can be located up to the Takilma Winter Village sites that date to the 1830's or 1850's.

The Indian tribes of the basin probably sustained themselves hunting deer and small game, catching fish, and gathering roots and berries. They probably had a less elaborate social organization than those of the coastal tribes. Basin tribes placed less emphasis on social status and more on survival skills. These groups, however, are often included with coastal Indians as part of the larger Northwest Coast Culture Area, since they resembled the coastal societies much more than those tribes farther east.

The first white men to explore the Rogue River Basin were probably trappers from the Hudson Bay Company traveling south from Ft. Vancouver during the 1820's or 1830's. During the late 1840's, white people began migrating through the basin along the old North-South Oregon Trail (basically the present I-5 corridor) on their way to California.

The first white settlers arrived in the Jackson County portion of the basin in the 1840's and were primarily supported by farming and livestock production. Basin settlement was dramatically accelerated by the discovery of gold near Jacksonville and Waldo in 1851 and the resulting increase in mining operations and support services. Jackson County was established in 1852, while the Illinois Valley area was separated from Jackson County by legislative action and was founded as Josephine County in 1856. Jacksonville and Kerbyville were the respective county seats in the late 1800's.

Indian distribution in the basin was not static and they were occasionally driven by warfare, disease, or ecological alterations to seek new homes in new areas. With white settlement of the area, the Indians were pushed off their lands. Hate, fear and the white man's vices and diseases took their toll on the Indian population as did the "Indian Wars" of the mid-1850's. The Indians were swiftly defeated and relocated to reservations outside the basin.

By 1853, a road to California was completed and settlement in the Rogue Valley was further stimulated. Growth was, however, moderately retarded during 1855 and 1856 as a result of deteriorating relations between the white settlers and the local Indian population which, in turn, led to hostile encounters between the two groups. Nevertheless, upon the arrival in 1883 of the Oregon and California Railroad, which provided both freight and passenger service, growth in the Grants Pass - Medford area of the Rogue Basin was again accelerated. The Illinois Valley, however, was left without rail service which hindered its development.

Jacksonville and Waldo, which had been the center of mining activities and development for all of southern Oregon in the late 1880's, were supplanted by the Medford and Grants Pass areas as the economic centers of the basin. Lumber and agriculture were dependent upon rail service and the Oregon and California Railroad had bypassed Jacksonville Valley. The Grants Pass - Medford - Ashland areas, which now lie along the Interstate 5 corridor, continue to be the major developed areas in the basin.

Population

The population estimate of the Rogue River Basin was developed by estimating the total number of people in the Rogue Basin portion of Curry County, and adding this population estimate to actual census counts from Jackson and Josephine Counties. All data used is U.S. Bureau of Census information.

Table 3 presents population growth data for the Rogue River Basin from 1930 to 1980. The estimated 1980 population for the Basin was

194,621. Of this total, 68 percent reside in Jackson County, 30 percent live in Josephine County and less than 2 percent are residents of Curry County.

TABLE 3

ROGUE RIVER BASIN POPULATION GROWTH 1930-1980

	CURRY* (in Rogue Basin)	JACKSON	JOSEPHINE	ROGUE BASIN TOTAL*	PCT CHANGE	STATE OF OREGON TOTAL	PCT CHANGE
1930	850	32,918	11,498	45,266	--	953,786	21.8
1940	1,120	36,213	16,301	53,634	18.5	1,089,684	14.2
1950	1,580	58,510	26,543	86,633	61.5	1,521,341	39.6
1960	3,315	73,962	29,917	107,194	23.7	1,768,687	16.3
1970	2,810	94,533	35,746	133,089	24.2	2,091,533	18.3
1980	3,345	132,4565	58,820	194,621	46.2	2,633,105	25.9

* Estimated

The basin's population has increased steadily since the 1930's. The most dramatic growth occurred during the post-war years of the 1940's when the nation's demand for lumber and wood products increased substantially. In the early 1950's when the demand for housing was high, the industry boomed, especially the plywood industry. By the late 1950's the housing demand had declined, and excess capacity in lumber manufacturing reached critical proportions. As a result, many lumber operations ceased production and employment fell. By 1962 the home building industry had recovered and the employment picture in the basin's lumber industry brightened. As a result, the middle 1960's also produced another population influx to the basin.

Population increased during the 1970's, with 46 percent growth during the decade, second only to the 1940-1950 decade. During the 1970's, Josephine and Jackson Counties were the third and sixth fastest growing counties in the state. Over 86 percent of the population growth in both counties in the 1970's resulted from people moving into the basin.

Since 1980, deteriorating economic conditions and increased unemployment in the basin have caused a significant slowdown in the population growth of Jackson County. Josephine County, however, experienced a four percent increase from April 1980 to July 1980 in spite of the economic recession. The length and severity of the current economic downturn may cause the basin population to shrink in the next few years as net out-migration exceeds the net natural increase.

The vast majority of the 1980 basin population, over 77 percent, reside in the Rogue River - Bear Creek urbanized valleys including the cities of Grants Pass, Rogue River, Gold Hill, Central Point, Medford, Phoenix, Talent and Ashland. Local as well as national trends indicate that more and more people will live in urban or urbanizing areas. Therefore, it is expected that the Central Valley region will continue to be urbanized and contain the majority of the basin population. Urban centers in the outlying parts of the basin will probably also experience large population increases.

Population projections vary widely depending upon the demographic and economic assumptions that are made. The projections shown on Table 4 for Jackson and Josephine Counties were all made prior to the 1980 census. They will undoubtedly be updated once 1980 census data on age, sex and net natural increase are available. Assuming that the Curry County portion of the total basin population is about 2 percent, the year 2000 population for the entire Rogue River Basin varies from a low projection of 245,500 to a high projection of 298,600 persons.

The 1980 census median age data also confirms another trend that a fairly large segment of the basin population is retired (age 65 and older). Increasing numbers of out-of-state persons are selecting the Rogue River Basin as a retirement area.

Most of the projected population increase will probably continue to be the result of in-migration. As long as the basin continues to rely heavily on the lumber and wood products industry, employment and population will remain subject to major fluctuations due to cyclic economic events.

Transportation

The populated areas of the Rogue River Basin are readily accessible by a variety of transportation facilities. The basin's major urban areas are linked to other points in Oregon and California by a network of primary and secondary roads, rail and air facilities. The one major linkage that is lacking is paved highway access from the Central Valley region to the coast.

Numerous highways provide access to much of the basin and major population centers. Interstate 5 (I-5), U.S. 199, U.S. 101, and State Routes 140 and 66 connect areas inside and outside the basin. Secondary routes include Oregon 62, 46, and 238 which also serve portions of the basin.

The Southern Pacific railroad provides another major transportation network. Southern Pacific provides only freight service through the major urban areas of the Central Valley region, generally following the same route as I-5 and Highway 99. Because of the mountainous terrain of the railroad right-of-way through the Rogue River Basin, passenger rail service bypasses the area and goes through Klamath Falls instead.

Medford is the only city in the basin served by regularly scheduled commercial airlines. The airport is operated by Jackson County. In anticipation of future growth, the county began improvements to the

TABLE 4

POPULATION PROJECTIONS FOR JACKSON (A) and JOSEPHINE (B) COUNTIES

	1980 (A) / (B)	1985 (A) / (B)	1990 (A) / (B)	1995 (A) / (B)	2000 (A) / (B)
Portland State University High Migration Estimate (1976)	126,800/56,800	142,800/65,500	157,600/73,100	174,200/81,200	190,700/82,200
Arthur J. Young and Co. (1974)	129,400/52,900	148,800/60,900	163,700/67,000	176,000/72,000	189,200/77,000
Bonneville Power Admin. (1979)	127,975/55,850	140,625/64,325	149,600/69,575	157,400/73,300	164,400/76,150
Jackson County Planning (1978)	134,700*/ ----	152,000**/ ----	162,000/ ----	180,000/ ----	196,000/ ----
Josephine County Planning (1979)	-----/56,800	-----/64,812	-----/75,283	-----/85,970	-----/96,630
U.S. Census Bureau (actual)	132,456/58,820				

* 1982
** 1987

airport runways in 1979. A major expansion of the airport terminal was completed in 1980. In addition to the Medford airport, at least four other airports in the basin have paved runways, and there are several other unpaved landing strips accommodating general aviation traffic in the outlying communities.

In 1975, the publicly-owned Rogue Valley Transportation District was formed to provide bus service in the Medford-Ashland vicinity. The public transit district is funded by a property tax assessment, fares paid by riders, and federal and state subsidies. While operating on a small scale initially, the transit district has established the nucleus of a transporation system which could expand significantly throughout the urbanized Central Valley region.

Land Use and Ownership

The Oregon Water Resources Department conducted a comprehensive inventory of land use in the Rogue River Basin during the mid-to late 1970's with technical assistance from the Environmental Remote Sensing Applications Laboratory at Oregon State University. The basin inventory was completed in 1979 using 1974 U-2 photographs updated with August 1978 LANDSAT satellite imagery.

The basin land use inventory classifies all land and water bodies into seven broad categories: irrigated agriculture, nonirrigated agriculture, range, forest, urban, water and other areas (e.g., barren land, lava flows, wetlands, snow and ice fields, etc.). County and basin land use statistics are shown in Table 5 and Plate 2.

Over 2.8 million acres, or nearly 88 percent of the total basin area in Oregon, are classified as forest land. Only 3 percent of the basin, or just over 100,000 acres, is classed as irrigated agricultural lands. Less than 1 percent is classed as urban lands. Those areas classed as water, which include those natural and man-made waterways and impoundments measurable at the mapped scale, comprise only three-tenths of one percent of the total basin area. Approximately 230,000 acres, or 7 percent of the basin are classified as either nonirrigated agricultural land or range land (Plate 2).

These latter two land use categories can be combined to identify all possible irrigable lands for the Rogue River Basin study. Available soils data are then overlaid to include only those areas which are considered to be potentially irrigable, i.e., those areas having soils in Groups I through IV with no severe limitations. Using this methodology, the potentially irrigable lands in each of the seven Rogue subbasins have been identified and are listed in Part V, the Subbasin Inventory section.

The topography and land ownership of the Rogue River Basin illustrate the development problems facing the area. The extremely rugged and forested terrain over much of the basin leaves only the Central Valley region suitable for sustaining major development. In addition, over 2 million acres of land, or roughly two-thirds of the total basin area, are in public ownership. Table 6 provides a breakdown of publicly-owned land within each county of the basin by federal, state

TABLE 5

ROGUE RIVER BASIN

LAND USE CLASSIFICATION BY COUNTY

In Acres

LAND USE	COOS	CURRY	DOUGLAS	JACKSON	JOSEPHINE	KLAMATH	TOTAL	PERCENT TOTAL BASIN
Irrigated Agriculture		263		71,715	29,030		101,008	3.1
Nonirrigated Agriculture		575		22,343	4,234		27,152	.8
Range		5,383	2,337	157,320	35,389	2,048	202,477	6.3
Forest	1,277	325,501	69,558	1,341,830	948,598	129,310	2,816,074	87.6
Water		1,438	6	6,101	286	357	8,188	.3
Urban		321		19,651	8,276		28,248	.9
Other	3	2,519	419	12,400	10,987	4,605	30,933	1.0
TOTAL	1,280	336,000	73,320	1,631,360	1,036,800	136,320	3,214,080	100

TABLE 6

PUBLIC LANDS IN THE ROGUE RIVER BASIN
In Acres

LAND OWNERSHIP	COOS	CURRY	DOUGLAS	JACKSON	JOSEPHINE	KLAMATH	OWNERSHIP TOTALS	TOTAL
FEDERAL								
U.S. Forest Service								
Rogue River National			64,083	413,413	31,086	66,320	574,902	
Forest Siskiyou National Forest	1,200	231,117			369,481		601,798	
Bureau of Land Management		36,606		430,636	296,125		763,367	
National Park Service								
Crater Lake National Park				600		70,000	70,600	
Oregon Caves National Monument					480		480	
Bureau of Reclamation				2,125			2,125	
SUBTOTAL								2,013,272
STATE OF OREGON								
State Forestry					2,482		2,482	
State Land Board		1,240		2,062	4,821		8,123	
State Parks				1,389	1,342		2,731	
Fish and Wildlife			28				28	
SUBTOTAL								13,364
COUNTY				8,487	35,170			43,657
TOTAL	268,963	64,083	858,740	740,987	136,320	1,200	2,070,293	

or county ownership. Ninety-seven percent of the public lands are owned and administered by the federal government, mainly the U.S. Forest Service and the Bureau of Land Management. Much of this public land lacks adequate access. Lands most suited for development are primarily in private ownership.

ECONOMIC DEVELOPMENT AND RELATED NATURAL RESOURCES

General Economic Development

Historically, the Rogue River Basin's economic development has been dependent upon agriculture, mining, and the lumber and forest products industry. Economic expansion began in the basin during the 1850's with the discovery of gold, resulting in rapid development of mining operations and communities. As the most accessible, higher grade gold deposits were processed, the economic base shifted to lumber and agriculture.

The lumber industry experienced tremendous growth during the 1870's and 1880's, due partly to improvements within the industry and the arrival of the railroad in the basin. Mines have produced limited quantities of gold and copper ore in the 20th century. The demand for building materials and wood products have made lumber the most important export commodity of the basin. The railroad provided a practical means for distribution and shipping.

During the 1940's the manufacture of wood products increased substantially and the large post-World War II population increases in the basin were based almost entirely on the mechanization and expansion of the basin's lumber industry. In the late 1950's this trend began to slow and the basin's economy began to change. The lumber and wood products industry, however, has continued to dominate the economy to the most recent recession of 1979-82.

As employment in the timber industry began to decline during the 1960's, other economic activities evolved in the basin. Simultaneous with the growth of the timber industry was the development of horticultural crops in Bear Creek valley. Jackson County soon became famous for its fruit production and the production of fruit has been one of the mainstays of the basin economy.

Significant changes in the structure of the basin economy have occurred in the past two decades. While growth has been substantial, there has been a shift in economic activity and employment from manufacturing and agriculture to nonmanufacturing activities. A detailed view of recent employment statistics (by sector) in the basin from 1960 to 1982 is presented in Table 7.

Agricultural employment in the basin has decreased from 4860 in 1960 to 2420 in 1980, falling from 17 percent of total basin employment to only about 4 percent. Manufacturing employment has expanded 23 percent since 1960, primarily because of strong growth in the nonforest products sector, while over the same period its share of nonfarm payroll employment has dropped from 30 percent to 16 percent.

TABLE 7

JACKSON AND JOSEPHINE COUNTIES
NONAGRICULTURAL WAGE AND SALARY EMPLOYMENT
1960 -- 1982

INDUSTRY	1960	% OF TOTAL	1979	% OF TOTAL	1982*	% OF TOTAL	% CHANGE 60-79	% CHANGE 79-80
TOTAL NONFARM PAYROLL JOBS	24,310	100.0	60,010	100.0	55,130	100.0	146.8	-8.1
Manufacturing	7,370	30.3	12,400	20.7	9,050	16.4	68.2	-27.0
Lumber and Wood Products	6,120	25.2	8,440	14.1	5,100	9.2	37.9	-39.6
Food Products	410	1.7	510	0.8	380	0.7	34.4	-25.5
Other Manufacturing	840	3.4	3,450	5.7	3,580	6.5	310.7	3.8
Nonmanufacturing	16,940	69.7	47,610	79.3	46,080	83.6	181.0	-3.2
Construction	1,080	4.5	2,790	4.6	1,580	2.9	158.3	-43.4
Trans. -Utilities	1,810	7.5	2,830	4.7	2,580	4.7	56.4	-8.8
Retail Trade	5,350	22.0	15,710	26.2	15,780	28.6	193.6	0.4
Finance, Insur., Real Estate	810	3.3	3,000	5.0	3,060	5.5	270.4	2.0
Services	3,050	12.5	10,440	17.4	11,550	21.0	242.3	10.6
Government	4,840	19.9	12,820	21.4	11,530	20.9	164.9	10.1
Agriculture	4,860		2,420					

*Projection

Source: Oregon Department of Human Resources - Employment Division.

Nonmanufacturing jobs, which nearly tripled in 20 years, rose from nearly 70 percent of the nonfarm sector in 1960 to over 83 percent by 1982. The largest percentage growth during that period occurred in retail trade, services, and finance-real estate sectors.

Today, three industries are generally considered to be the major components of the basin's economic base. They are lumber and wood products manufacturing, agriculture and food products, and tourism and recreation. The latter is comprised mainly of parts of retail trade and services. In addition to these three, there are other industries which also bring income to the basin and contribute to the economic base. Included are motor freight, communications and other parts of retail and wholesale trade not involved in tourism or recreation, such as medical services and government. All of these activities bring income into the basin. Finally, the economy is also supported by the income of retired persons living in the area.

Statistically, employment in the basin has been depressed during the past decade. Unemployment is subject to strong seasonal variations compounded by sharp fluctuations reflecting national economic trends. Unemployment is usually highest in the winter months and lowest in August and September because of the outdoor nature of the economic activities; logging, forestry, construction, agriculture, tourism and recreation are closely related to changes in weather.

The current economic downturn, which began in 1979, has had an adverse impact on production and employment in the basin. The reduction of housing starts, nationwide, over the past three years has caused widespread unemployment in construction and wood products industries in the basin. Both industries have experienced a 40 percent reduction in the work force since 1979.

Unemployment in the basin has been much higher than the national average and is consistently well above the Oregon average. Josephine County unemployment rates have traditionally been 2- to 4-points higher than Jackson County rates. For example, during the period of 1972-1981, Josephine County's unemployment rate averaged 11.8 percent, while Jackson County's rate was 9 percent. During the same period, the state of Oregon averaged 7.9 percent and the entire country averaged 6.6 percent. Recently, the unemployment rate in both counties has exceeded 16 percent.

Per capita income is defined as the total personal income divided by total population. It indicates comparative economic health since it accounts for the effects of population change. It can also serve as an indicator of the quality of consumer markets in an area. For example, consumers in counties with high per capita incomes could be expected to have a greater ability to purchase goods and services than would those in areas with low per capita incomes. Table 8 compares per capita income data for Oregon with both Jackson and Josephine Counties.

Per capita personal income in Jackson County rose from $2060 in 1959 to $8102 in 1980, an increase of 293 percent, when it ranked 26th out of 36 counties. Per capita income has been low in Jackson County.

TABLE 8

JACKSON AND JOSEPHINE COUNTIES
PER CAPITA PERSONAL INCOME 1959, 1962, 1965-80

YEAR	OREGON	JACKSON COUNTY	Pct. of OREGON	RANK*	REAL** DOLLARS	JOSEPHINE COUNTY	Pct. of OREGON	RANK*	REAL** DOLLARS
1959	$2,160	$2,060	95.4	12	$2,360	$1,829	84.7	27	$2,095
1962	2,346	2,063	87.9	21	2,277	1,933	82.4	31	2,134
1965	2,688	2,295	85.4	27	2,429	2,115	78.7	34	2,238
1966	2,907	2,459	84.6	29	2,530	2,247	77.3	35	2,312
1967	3,054	2,595	85.0	27	2,595	2,389	78.2	34	2,389
1968	3,287	2,865	87.2	27	2,750	2,603	79.2	34	2,498
1969	3,520	2,987	84.9	25	2,720	2,763	78.4	35	2,516
1970	3,711	3,156	85.0	27	2,714	3,048	82.1	30	2,621
1971	3,956	3,458	87.4	25	2,851	3,248	82.1	30	2,678
1972	4,346	3,865	88.9	27	3,085	3,575	82.3	33	2,853
1973	4,835	4,190	86.7	31	3,148	3,856	79.8	35	2,897
1974	5,334	4,558	85.5	31	3,086	4,023	75.4	36	2,724
1975	5,723	4,904	85.7	28	3,042	4,384	76.6	36	2,720
1976	6,368	5,452	85.6	29	3,198	4,926	77.4	36	2,889
1977	6,982	6,035	86.4	24	3,325	5,503	78.8	32	3,032
1978	7,800	6,800	87.2	27	3,480	5,935	76.1	36	3,037
1979	8,615	7,461	86.6	28	3,432	6,424	74.6	36	2,955
1980	9,296	8,102	87.2	26	3,283	6,972	75.0	36	2,825

*Out of 36 Counties.
**Adjusted using U.S. Consumer Price Index (1967=100)
Source: U.S. Department of Commerce, Bureau of Economic Analasis.
All Urban Consumers

Since 1970, the county's per capita figure has ranked as high as 24th in the state in 1977 and as low as 31st in 1973-74. The per capita figure fluctuated between 85 and 89 percent of the statewide figure during the 1970's.

Josephine County, however, has had the lowest level of per capita income of Oregon's 36 counties for six out of seven years between 1974 and 1980. Since 1970, the county's highest ranking was 30th in 1970 and 1971. Josephine County's per capita figure has ranged between 75 and 82 percent of the statewide figure.

According to the Employment Division, per capita income is so low in Josephine County because of high of unemployment and the large retired population.

Between 1959 and 1980, per capita income in Josephine County rose from only $1829 to $6972, an increase of 281 percent. When the effect of rising consumer prices is considered, the real increase was only 35 percent over the 1959-1980 period. In Jackson County, the real per capita income increased 39 percent over the same period. In both counties, real per capita income fell from 1978 to 1980 by 6 to 7 percent due to the combined effects of inflation and recession.

One use of the trends in real per capita income is to measure the real economic growth of an area. Overall, Josephine County experienced real growth of only 4.3 for the period 1969 to 1980, despite its growth in population and increased employment in most years. Jackson County, on the other hand, experienced real growth of 16.8 percent from 1970 to 1980 in spite of the economic downturn during 1979 and 1980. During the same period Oregon's real economic growth was 14.3 percent, while that for the United States was 9.0 percent.

The future economic strength of the Rogue River Basin lies in the development of a diversified economic base. Industrial and manufacturing development in areas other than wood products would be highly beneficial to the basin economy. Such development would tend to produce a greater resiliency to economic downturns. Although development of a more diverse economic base is slowly occurring in the basin, the timber industry is expected to play a continuing major role.

Lumber and Wood Products

According to the Water Resources Department's land use inventory, over 2.8 million acres of land in the Rogue River Basin or 87.6 percent of the total area is timbered land. Based on information presented in Table 6, there is a total of 1,176,700 acres of forest land managed by the U.S. Forest Service in the basin. Over 830,000 acres, or 70 percent of the national forest land is designated for and capable of producing marketable timber. Timber harvesting activities occur on national forest acreage classified as commercial forest land.

Douglas fir is the predominant wood species in the basin and constitutes about two-thirds of the commercial timber volume. Most of the remainder is made up of other softwood species including other firs, ponderosa and sugar pine, hemlock and red cedar. Alder, maple, oak, madrone and other hardwood species represent less than two percent of the total timber volume.

Reductions in the allowable cut on the Siskiyou and Rogue River National Forest as a result of recent congressional wilderness allocations and the conversion of private timber lands to nonforest uses have also resulted in a reduction of the timber base. Harvest levels over the past decade involved substantial cutting on both private and public land.

The manufacture of lumber and wood products continues to be the basin's largest basic industry. It accounts for about 7 out of every 10 manufacturing jobs. In 1981, the timber industry generated a payroll of $155 million out of a total manufacturing payroll of $207 million.

Because a large part of the demand for wood products is generated by new residential construction, employment in the timber industry shows a direct correlation to trends in the nation's housing industry. Since 1970, for example, wood products employment has had two distinct cycles of high and low employment, corresponding to similar cycles in U.S. housing starts. Wood products employment in the basin peaked in 1973 and 1978, followed by significant reductions in employment in 1975 and 1980-82 due to economic downturns.

In 1960, total basin employment in the timber sector averaged 6120. As Table 9 reveals, 50 percent of the jobs were in sawmills and 29 percent were in plywood and veneer operations. By 1978-79, employment in the timber industry had grown to a peak of 8610, a 40 percent increase over 1960 levels.

As employment expanded during the 1960's and most of the 1970's (except for the 1974-75 recession), a structural shift in the wood products industry took place. In 1978-79, over 45 percent of forest industry employment was in veneer and plywood production compared to 29 percent in 1960. Sawmill employment decreased from 50 percent in 1960 to only 23 percent in 1978-79. Employment in other wood products firms had grown by 1300 and made up almost 20 percent of total jobs, compared with 6 percent in 1960. Table 9 also shows the most recent diminished employment in the major wood products sectors.

The changing structure of the timber industry in the basin is also shown by relative trends in lumber and plywood production since 1960. Lumber output increased rapidly during the 1940's and peaked in the early 1950's. In the early 1960's, however, lumber production in the basin dropped to under 700 million board-feet while plywood output began to rapidly increase.

Between 1960 and 1964, plywood output in the basin doubled. Since then it has far outstripped lumber production and fluctuated depending upon market strength. During peak years, basin plywood output averaged about 1600 million square feet per year. Since 1978 there has been a substantial reduction in plywood production and current levels are down to levels of the early 1960's.

TABLE 9

JACKSON and JOSEPHINE COUNTY FOREST INDUSTRY EMPLOYMENT

EMPLOYMENT SECTOR	1960		1978-79		1980-82	
	JOBS	PCT.	JOBS	PCT.	JOBS	PCT.
Logging	880	14.4	1040	12.1	750	13.2
Sawmills	3100	50.6	1990	23.1	1440	25.3
Veneer and Plywood	1780	29.1	3910	45.4	2340	41.1
Other Wood	360	5.9	1670	19.4	1160	20.4
Total	6120	100.0	8610	100.0	5690	100.0

Source: Josephine County Economic Review -- 1981, Jackson County Economic Review -- 1982, State Employment Division.

Since 1955-56 the basin timber harvest has steadily decreased. In the early 1950's log output on private lands accounted for 75-80 percent of the total basin harvest. This percentage dropped sharply in the late 1950's and has fallen gradually since then to less than one-third. Production of publicly owned lands increased gradually until the late 1960's. Since then it has fluctuated from year-to-year.

During periods of economic recession when the timber demand declines, such as 1974-75 and the present downturn, timber harvest levels also drop. The 1982 harvest of only 59.3 million board-feet was the lowest on publicly-owned lands in many years. This has resulted in severe problems for local governments dependent upon federal timber sale receipts for operating revenues.

Even if the timber industry in Jackson County recovers from the current recession during 1983 and in subsequent years, the long-term employment trend is downward. The current recession has contributed to the decline of the wood products industry as a source of new jobs in the basin.

Three factors will continue to contribute to this downward trend. The first is technological change, leading to the substitution of capital for labor. Labor-intensive unskilled and semiskilled jobs are likely to be mechanized in order to increase productivity and reduce labor cost.

The second factor is growing competition from producers in the southeast part of the nation who are closer to the large eastern markets, experience relatively lower labor costs, and who have access to faster-growing, privately owned timber. Creative development of Pacific Rim countries and other international markets by west coast timber producers may help offset the growth of the southern timber industry.

The third factor is the anticipated decrease in the supply of timber readily available for use in the manufacture of wood products. Beuter, et al., (1976) predicted that even if timber management policies were undertaken that would lead to an increase in the timber harvest on public lands, a significant shortfall in the overall timber supply would occur in southern Oregon during the next 20 years. This study projected that any increase in production from public holdings would be offset by an expected reduction in timber from private holdings. The expected reduction in private timber cutting has been caused by a gap between the harvesting of old-growth timber in earlier years and the maturing of new growth stands.

Agriculture

Agriculture was the primary industry in the Rogue River Basin prior to 1940, but today ranks far behind the timber industry and is being challenged by recreation/tourism and the related trade and services sectors. The U.S. Agricultural Census indicates that increased crop production in the past two decades is the result of advances achieved by mechanization and more intensive use of existing acreage, even with a steadily decreasing agricultural land base. Table 10 presents a breakdown of agricultural land and uses in Jackson and Josephine Counties from 1959 to 1978.

Since 1959, the total number of farms in the Rogue River Basin decreased from 2839 to 1583 in 1978. The average farm size increased from 248 acres in 1959 to a high of 383 acres in 1969, then slowly decreased to 244 acres in 1978. The decrease in farm size from 1969 to 1978 is attributable to the steady decrease in total farm acreage as well as a slight increase in the total number of farms.

According to the 1978 U.S. Census of Agriculture, Jackson and Josephine Counties had a total of 385,801 acres of private farm land, amounting to 13.6 percent of the two counties' land base. This was a 46 percent decrease in farm land from the peak of 719,333 acres in the 1964 census. Based on the general land use tabulation in Table 5, just over 10 percent of Rogue River Basin is classified as irrigated and nonirrigated agricultural land or rangeland. The figures suggest that the basin has lost almost one-half of its productive agricultural land in the 15-year period 1964 to 1978. Table 10 also shows the reduction in harvested cropland, other cropland, woodland and other pasture and rangeland that have occurred since 1959 as well as other changes in farm land use.

Despite a slight increase in irrigated land, there has been an overall reduction in agricultural land in both Jackson and Josephine Counties in the past 20 years. With the pressures of a growing population and expanding urban areas, this trend is likely to continue. Similar reductions in farm land in the next 20 years, however, may not occur at the same rate as the previous two decades with the adoption of the county land use plans with exclusive farm use designations.

The value of agricultural production of both counties in 1978 was nearly $45.5 million, up almost 40 percent from 1974 figures. The largest single component of the total value was the pear crop of Jackson County. Approximately 10,000 acres of commercial pear acreage yielded 76,444 tons in 1981, about equal to 1980's yield of 76,800 tons, according to the Jackson County Extension Service. Jackson County leads the state in pear acreage, followed by Hood River County which has about 9000 acres. Since 1969, Jackson County pear acreage has decreased by about 1200 acres.

The second largest component of the total agricultural production value of both counties in 1978 was the cattle and calf industry. This was followed closely by the dairy products industry, the sales from field crops and grains, hay and silage which support the first two industries, and sales from private nonindustrial forest products. Other major agricultural products include specialty field crops of mint, hops and potatoes, poultry and poultry products, and specialty horticultural crops of bulbs, flowers and nursery plants.

Agricultural employment includes people working as farm operators, unpaid family workers, regular hired workers and seasonal workers. Since 1960 the average employment in basin agriculture has fallen 50 percent from 4860 in 1960 to 2420 in 1980. As the number of farms has decreased, the number of farm operators has also decreased. Reduced

TABLE 10

LAND IN FARMS IN JACKSON and JOSEPHINE COUNTIES

JACKSON AND JOSEPHINE COUNTIES	1959 ACRES	1959 PCT.	1964 ACRES	1964 PCT.	1969 ACRES	1969 PCT.	1974 ACRES	1974 PCT.	1978 ACRES	1978 PCT.
TOTAL LAND AREA	2,852,240	--	2,839,700	--	2,839,808	--	2,839,744	--	2,839,744	--
Proportion in Farms		24.7		25.3		19.3		18.7		13.6
ACRES IN FARMS	703,929	100.0	719,333	100.0	548,017	100.0	530,362	100.0	385,801	100.0
Cropland Harvested	62,046	8.8	58,191	8.1	47,867	8.7	46,951	8.8	44,084	11.7
Cropland Pasture	38,980	5.5	41,047	5.7	40,494	7.4	42,835	8.1	35,022	9.1
Other Cropland	12,262	1.7	8,585	1.2	5,974	1.1	5,661	1.1	6,562	1.7
Woodland (including woodland pasture)	439,078	62.4	193,276	26.9	62,565	11.4	71,969	13.6	78,089	20.2
Other Pasture and	62,874	8.9	418,227	58.1	396,117	72.3	362,946	68.4	210,711	54.6
Rangeland	70,182	10.0	67,666	9.4	58,612	10.7	58,396	11.0	74,269	19.2
Irrigated Land										
NUMBER OF FARMS	2,839	--	2,379	--	1,430	--	1,426	--	1,583	--
AVERAGE SIZE OF FARM	248	--	302	--	383	--	372	--	244	--

Source: U.S. Department of Commerce, Bureau of the Census, Census of Agriculture.

farm acreage, changing production practices, and increased mechanization have gradually reduced the number of regular and seasonal farm workers employed.

Mining

The Rogue River Basin economy was established upon mining with miners first settling the basin shortly after the discovery of gold near Jacksonville and Waldo in 1851. Mining development was initially rapid and it peaked in its early years. Thereafter and into the 20th century, the economy became centered around agriculture while mining started a gradual decline.

Table 11 portrays the reported value of mineral production in Jackson and Josephine Counties for the period 1959-1979. Table 11 shows that total mining activities for both counties has fluctuated from a high value of $8.8 million in 1965 to a low value of $1.75 million in 1968. Since 1977, mineral production data has been withheld in both counties to protect disclosure of specific operators.

Recent mining activity in the basin has primarily involved sand and gravel operations. Alluvial deposits of sand, gravel and rock are located along many rivers and stream beds, with the most abundant sources of gravel found along the Rogue, Illinois, and Applegate Rivers. These materials are used for aggregate, road construction, and commercial and residential building construction.

Limited mining takes place for other minerals including gold, talc, limestone, copper, silver and chromium. Gold and silver were the first minerals to be mined extensively. Over the last 20 years gold production in the basin has averaged over 100 ounces per year, and limited amounts of copper are produced from small deposits of high-grade ore.

Mining payrolls in Jackson and Josephine Counties increased nearly 16 percent from 1976 levels to a total of $18.74 million in 1977, and increased again by an estimated 60 percent up to about $30 million in 1980. Of the total payroll, between 80 to 90 percent is attributable to nonmetallic mineral employment, mainly in sand and gravel and stone production.

Recreation and Tourism

The Rogue River Basin is heavily utilized by outdoor recreationists and tourists throughout the year. Recreation and tourism are considered to be the basin's fastest growing economic activities.

People are attracted to the Rogue River Basin primarily for outdoor recreation and cultural activities. Recreational activites include fishing, hunting, camping, backpacking, hiking, boating, rafting, skiing and other winter sports, picnicking, and natural and historic sightseeing. Facilities for all these activities are available within, or just a short drive from, the urban centers of the basin.

Numerous parks and recreation facilities exist throughout the Basin.

TABLE 11

VALUE OF REPORTED NONFUEL MINERAL PRODUCTION IN JACKSON AND JOSEPHINE COUNTIES
($ x 1000)

YEAR	JACKSON	JOSEPHINE	TOTAL	MINERALS PRODUCED IN APPROXIMATE ORDER OF VALUE
1980	S	S		
1979	W	W	--	Sand and Gravel, Stone and Talc
1978	W	W	--	Sand and Gravel, Stone and Talc
1977	W	W	--	Sand and Gravel, Stone, Talc, Copper and Lead
1976	5,694	644	6,338	Stone, Sand and Gravel and Talc
1975	5,831	W	--	Stone, Sand and Gravel, Gold, Copper, Silver, Lead
1974	5,883	274	6,157	Stone, Sand and Gravel, Gold, Talc, Copper and Silver
1973	2,282	1,132	3,414	Sand and Gravel, Stone, Gold and Talc
1972	1,044	954	1,998	Sand and Gravel, Stone, Gold, Copper and Silver
1971	1,700	2,076	3,776	Sand and Gravel, Stone, Gold
1970	975	799	1,774	Sand and Gravel, Stone, Gold, Talc, Pumice and Mercury
1969	1,049	1,247	2,296	Sand and Gravel, Stone, Gold, Pumice, Talc, Silver
1968	1,191	559	1,750	Sand and Gravel, Stone, Gold, Soapstone, Silver
1967	1,843	298	3,141	Stone, Cement, Sand and Gravel, Clays, Gold, Silver, Mercury
1966	3,402	1,146	4,548	Cement, Stone, Sand and Gravel, Clays, Gold, Pumice, Silver, Lead
1965	6,772	2,034	8,806	Cement, Stone, Sand and Gravel, Clays, Gold, Pumice, Silver, Lead
1964	4,049	1,217	5,266	Cement, Stone, Sand and Gravel, Clays, Pumice, Gold, Silver
1963	4,949	237	5,186	Cement, Stone, Sand and Gravel, Clays, Pumice, Gold, Zinc, Silver
1962	4,423	470	4,893	Cement, Sand and Gravel, Stone, Clays, Copper, Gold, Silver
1961	4,387	753	5,140	Sand and Gravel, Cement, Stone, Clays, Gold, Copper, Silver
1960	3,347	231	3,578	Cement, Stone, Sand and Gravel, Clays, Gold, Mercury, Copper, Silver
1959	4,185	763	4,948	Cement, Stone, Sand and Gravel, Clays, Gold, Mercury, Copper, Silver

W=Withheld to avoid disclosing company proprietary data.
S=Statistics not yet available.

Source: Minerals Yearbook, U.S. Bureau of Mines, 1960-1980.

Most have been developed by federal, state, county and local agencies as well as private enterprise. Crater Lake National Park is the major park facility and is the only national park in the State of Oregon. It is located in the northeastern corner of the basin and contains about 183,180 acres of federally-owned land, mostly within Klamath County. Crater Lake is recognized as one of the natural scenic phenomena of the western United States and annually attracts over 500,000 visitors.

Another major attraction is Oregon Caves National Monument, located in southeastern Josephine County about 14 miles southeast of Cave Junction. The Oregon Caves were discovered in 1874 and proclaimed a national monument in 1909. Oregon Caves attracts over 150,000 visitors each year.

The U.S. Forest Service, in both the Rogue River and Siskiyou National Forests, provides recreational conveniences such as riding and hiking trails, camping and picnicking areas, boating areas, fishing and hunting facilities, and, in general, open natural spaces for public use and enjoyment. There are two wilderness areas in the basin, the Wild Rogue and the Kalmiopsis, encompassing 36,000 and 180,000 acres, respectively. The rugged Kalmiopsis Wilderness includes mountainous areas in Josephine County and Curry County to the west. Much of it lies in the Chetco River Basin outside the Rogue Drainage Basin.

There are a total of 12 state parks or waysides in the Rogue River Basin totalling 2731 acres. In addition, there are numerous county-owned parks and waysides in the basin totalling approximately 10,130 acres. These provide facilities for fishing, camping, and picnicking in addition to boat launching facilities for water-based recreational sports. While Josephine County administers only 16 percent of the county-owned park lands in the basin, its Parks Department estimated total park attendance in 1978 to be nearly 685,000 visitors, up 12 percent from 1977. It is estimated that Jackson County had proportionately more visitors. Nearly half the visitors to the county parks are from California, 40 percent are from Oregon, 7 percent are from outside the region, and 5 percent are from Washington.

For years the Rogue River has been nationally recognized for its outstanding salmon and steelhead fishing, drift boating and jet boat rides, rafting, camping, and natural beauty. The lower 88 miles, extending from its confluence with the Applegate River downstream to Lobster Creek Bridge, have been included in the National Wild and Scenic Rivers System as well as Oregon's State Scenic Waterway System, thereby protecting the natural value of this river corridor for recreational enjoyment.

Some of the major tributaries to the main stem Rogue, namely the Applegate and Illinois Rivers, are also well-suited for the outdoor enthusiast or sportsperson. Both streams are conducive to swimming, boating, fishing and picnicking. The lower 46 miles of the Illinois River, from its confluence with Deer Creek downstream to the Rogue River, is also included in the State Scenic Waterway System and is being studied for inclusion in the national system. As such, the Scenic Waterway portion is very popular with white water boaters in the late spring.

Both the Lost Creek and Applegate Reservoirs are popular attractions for water-based recreational activities.

Recreational use of the Rogue River has become a major contributor to the basin economy. Beneficial economic impacts of recreational activities in Jackson, Josephine and Curry Counties have steadily increased. Estimates of recreation dollars spent in each of these counties have been provided by the county Parks Departments.

For 1979 a conservative estimate of recreation dollars spent in Jackson County due to boating and fishing in the Upper Rogue River Subbasin is $1.2 million; in Josephine County in the Middle and Lower Rogue River Subbasins is $4.75 million; and in the Gold Beach area in Curry County in the Lower Rogue River Subbasin is $2.7 million. These figures indicate dollars spent on boating and fishing only. They do not account for the thousands of people (both local and out-of-basin) who spent money using the waters of the Rogue for swimming or as a setting for camping, picnicking, or indirect tourist expenditures for lodging, dining and services.

A winter sports facility has been provided since 1964 on national forest land on Mt. Ashland for skiing, sledding and other winter sports for local as well as out-of-state residents. Cross-country skiing is also available in Crater Lake National Park or wherever snowpack occurs in the Cascade and Siskiyou Mountains during the winter.

Other significant natural features exist within a short driving time from anywhere in the basin. The Pacific Ocean and coastline, specifically the Port of Gold Beach, is one of the more popular attractions for nonresident users and is only 2 to 2 1/2 hours from the populated Central Valley region.

The Rogue River Basin also provides high quality cultural activities. For example, Ashland is the site of the annual Oregon Shakespearean Festival. The festival consists of Shakespearean and modern plays performed in three theaters during its production season which runs from mid-June to late September. The festival attracts visitors from all over the nation and is a basic part of the cultural-tourist economic sector. Jacksonville, west of Medford, was designated a National Historic Site in the 1960's. It is the site of the Jacksonville Museum and the annual Peter Britt Jazz Festival, which attracts well-known jazz artists to the basin. Recently completed near Central Point, the Jackson County Exposition Park is an auditorium-fairgrounds facility.

Together, recreation, tourism and the related retail and service base industries make the second or third largest contribution to the economic base of the basin. Recreation and tourism are primarily seasonal economic contributors, however, with most activities occurring from spring through early fall.

In 1979, more than 13 million out-of-state visitors spent over $1 billion in Oregon. A 1972 research report on the economic impact of out-of-state travelers in Oregon indicated that the total direct and indirect impact of tourist spending was roughly 2 and 1/2 times the initial expenditures.

Accommodation of nonresident travel accounts for approximately 6.6 percent of the employment force in the State of Oregon, consisting of employment in gasoline stations, hotels and motels, eating and drinking establishments, and amusement and recreation businesses.

For the peak tourist season summer months of July, August and September, the average employee increase is listed in Table 12.

TABLE 12

AVERAGE EMPLOYEE INCREASES DURING THE TOURIST SEASON

TYPE	PERCENTAGE INCREASE
Gas Stations	23
Eating and Drinking Establishments	24
Hotels, Rooming Houses, Camps and Other Lodging	59
Amusement and Recreational Services	76

Source: Mathematical Sciences Northwest, Incorporated, (1974)

Fish Life

The Rogue River Basin fishery contributes economically to both recreational and offshore commercial fishing income. Anadromous fish spawn in nearly every tributary to the Rogue River. While the numbers of fish are no longer as large as reported in the early history of the basin, the Rogue River continues to be a well-known and important fishing stream.

The basin has two races of steelhead, two Chinook salmon runs, coho salmon, sea-run cutthroat, four species of resident trout, six species of warmwater game fish, two species of sturgeon, and shad, which have overlapping or coinciding distributions.

Of the anadromous salmonids, steelhead are the most widely-distributed and the most abundant species (Table 13 and Plate 3). Two distinct races of steelhead exist, summer run and winter run. Summer steelhead enter the river from June to September and move slowly upstream, occasionally holding near the mouth of cooler tributaries. Generally, the first winter freshets cause these fish to move into smaller tributaries of the Middle and Upper Rogue River Subbasins and spawning commences in mid-January (Table 14).

The largest and most widely distributed run of steelhead occurs in the winter. This race enters the river system in mid-December

(Table 14). These fish are found in most small streams of the drainage where the spawning is not precluded by insufficient flows, lack of spawning habitat, or barriers.

Rogue River chinook salmon either enter the system in the spring, remaining through the summer between Gold Ray Dam and Lost Creek Dam, and spawn in that reach early in the fall; or enter early in the fall and spawn through the month of December (Table 14). Fish of the earlier race are called spring chinook. Fall chinook, which display a later migration characteristic, primarily use the river and tributary systems below Gold Ray Dam.

Coho salmon encounter water conditions similar to those experienced by fall chinook. They ascend the system as mature adults in the fall and spawn through January (Table 14). Unlike chinook, coho salmon tend to spawn in smaller tributaries above and below Gold Ray Dam.

Sea-run or anadromous cutthroat trout enter the Rogue River in summer and early fall, migrating as far as the Illinois River. These fish normally do not spawn until the fall and winter freshets are of adequate quantity to permit entry into the tributary spawning streams (Table 14).

Resident trout are native to most streams. Rainbow trout are common in the Middle and Upper Rogue River Subbasins. Cutthroat trout are found in headwater sections of most high elevation tributaries. Through introduction by the Oregon Department of Fish and Wildlife, brown and eastern brook trout inhabit many streams above Prospect. Brown trout are found in North Fork Rogue River between Prospect and Union Creek where they have been introduced.

Lost Creek and Applegate Lakes are stocked with rainbow trout and kokanee salmon produced at the Cole M. Rivers Fish Hatchery. These fish provide the resident fishery and should stimulate the recreational fishing use at each of the project reservoirs.

Warm-water game fish are most abundant in various lakes, reservoirs, and ponds. Harvestable populations, however, are found in some sections of the main stem Rogue River (Table 15). The more prevalent species are black crappie, largemouth bass, bluegill, and brown bullhead.

most of the basin, Roosevelt elk and black bear. These species are found mainly in the highland forest areas. Future populations of these animals will, to some degree, be dependent on the extent of logging operations which provide open areas conducive to forage production and predation.

Blacktailed deer are hunted more than any other single game species in the basin. Some elk and bear are also harvested each year by sportsmen. Although hunting pressure is not significant, the popularity of elk and bear hunting is growing.

In addition to big game, an abundance of fur-bearing animals exists. Beaver, otter, muskrat and raccoon have the greatest water

TABLE 13

ESTIMATED NUMBER OF ADULT ANADROMOUS SALMONIDS ANNUALLY SPAWNING IN ROGUE RIVER BASIN STREAM SYSTEMS[1]

	CHINOOK				STEELHEAD		SEA-RUN
STREAM SYSTEM	SPRING	FALL	COHO	CHUM	SUMMER	WINTER	CUTTHROAT
Rogue River (main stem and unlisted tributaries)	44,275	41,850	2,085	50	36,950	20,140	2,400
Lobster Creek	0	1,100	50	0	0	2,000	200
Illinois River	0	20,000	1,400	0	0	30,000	2,500
Applegate River	0	12,000	1,400	0	13,000	19,000	200
Bear Creek	25	0	25	0	300	2,000	0
Little Butte Creek	0	50	20	0	800	1,600	0
Big Butte Creek	1,200	0	20	0	200	750	0
Total	45,500	75,000	5,000	50	51,250	75,500	5,300

1 Estimates by Oregon Game Commission biologists.

Numbers indicate spawning escapement of adult fish; total run would be computed by adding appropriate sport and commercial harvest data, plus runs of jacks and "half-pounders".

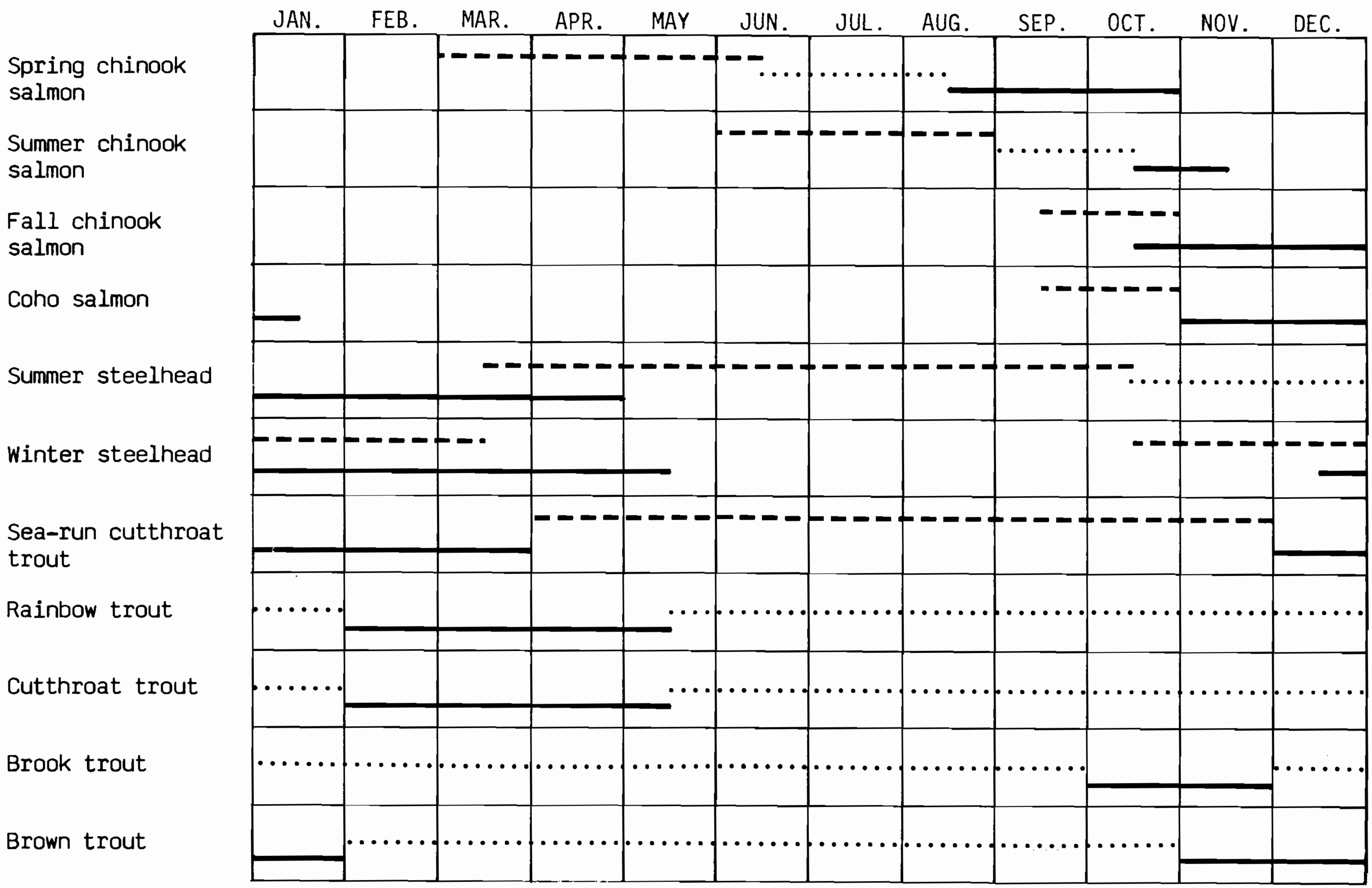
Estimates include hatchery contributions.

Approximately 100,000 "half-pounder" summer steelhead enter the basin each summer. The main stem Rogue and Illinois Rivers accommodate the majority of these fish.

Source: OSGC - 1972

TABLE 14

SPAWNING AND MIGRATION PERIODICITY IN ROGUE RIVER BASIN



NOTE: Dotted lines indicate presence of adult fish in the streams. Dashed lines denote migration period. Spawning occurs when indicated by a solid line.

SOURCE: Basin Investigations - Rogue River Basin, OSGC, 1970.

TABLE 15

DISTRIBUTION OF WARMWATER GAME FISH, ROGUE RIVER BASIN

SPECIES	LOCATION
Largemouth Bass	Lost Creek Lake, Emigrant Reservoir, Selmac Lake, Camp White Ponds, Agate Reservoir, Rogue River at Gold Ray
Crappie	Lost Creek Lake, Emigrant Reservoir, lower Squaw Lake, Camp White Ponds, Selmac Lake, Rogue River at Gold Ray
Bluegill	Lost Creek Lake, Emigrant Reservoir, Selmac Lake, lower Squaw Lake, Camp White Ponds, Rogue River at Gold Ray
Brown Bullhead	Emigrant Reservoir, Howard Prairie Reservoir, Selmac Lake, Squaw Lakes, Camp White Ponds, Rogue River at Gold Ray
Pumpkinseed	Camp White Ponds, Rogue River at Gold Ray
Green Sunfish	Selmac Lake

Source: Basin Investigations-Rogue River Basin, Oregon State Game Commission, 1970.

Most familiar marine nongame fish in the Rogue River estuary are surf smelt, herring, surfperch, and lingcod. Several other groups of fish are less frequently encountered.

The most abundant nongame fish occurring in freshwater are suckers, carp, lamprey, roach, cottids, dace and red-sided shiners. Not all species are found throughout the basin, but overlapping ranges of the various forms encompass nearly all freshwaters of the basin. Most freshwater forms of nongame fish are considered undesirable due to lack of value to the angler and competition with, or predation upon, valuable game species.

Wildlife

The Rogue River Basin has a wide variety of wildlife and the wildlife resources also contribute to the basin economy by attracting large numbers of hunters each year during the hunting season.

Game wildlife can be grouped into four general classes. The big game category includes the Columbian blacktailed deer, which range over requirements, relying on an adequate quantity of fresh water. Mink, skunk, weasel, fox, bobcat, coyote, marten, fisher, and ring-tailed cat have daily water requirements, but are not totally oriented to a water habitat.

Muskrat, skunk, fox and coyote are found predominately at lower elevations. Other fur-bearers, however, are more common in a forest habitat.

Unlike other animals, furbearer harvest is a commercial enterprise. The value of this market, however, fluctuates markedly as consumer demand changes. Species most harvested is the muskrat, followed distantly by the beaver and raccoon.

On the lower valley floors and in the foothills, an abundance of upland game birds can be found and provide the most popular hunting opportunities. This group consists of pheasants, quail, grouse, mourning doves, pigeon and an occasional wild turkey.

Although not located on the major migration routes, waterfowl are fairly plentiful in areas where cropland, irrigation channels or reservoirs provide feeding and nesting habitat. Ducks, Canadian geese, coots, swans, American mergansers and snipe are the most common varieties in the Rogue River Basin. Diving ducks, brant, scooters, and red-breasted mergansers are more likely to be found near the coast. Waterfowl populations do not exhibit the high densities, either during the winter migration or summer nesting period, found in the Willamette Valley or parts of eastern Oregon. While waterfowl hunting pressure is not heavy, it is an important part of the numerous hunting opportunities available to basin sport persons.

In addition to the four game classifications, there is also a wide variety of non-game species in the Rogue River Basin. These non-game species play important roles in the ecological balance of the basin and provide opportunities for observation.

PART II

WATER RESOURCES

PART II

WATER RESOURCES

PART II - WATER RESOURCES

SURFACE WATER

Introduction

Rogue River Basin topography, geology, vegetation, temperature, and distribution of annual precipitation are major factors influencing the seasonal variations in streamflows. Runoff in the basin generally follows the seasonal precipitation pattern, with low flows normally occurring from July through October, which is the period of least rainfall. The following text, graphics, and tables present information pertaining to the basin's hydrologic characteristics.

Data Sources and Hydrologic Records

Weather station records published by the National Oceanic and Atmospheric Administration (NOAA) and snow survey data published by the Soil Conservation Service are the source of all climatological data. Surface water data were obtained from U.S. Geological Survey water supply papers and Oregon Water Resources Department's records or by correlation methods when no records were available.

Meteorological data have historically been recorded at over 50 different stations in and adjacent to the Rogue River Basin. The density of climatological stations and length of records vary largely according to settlement patterns and topographical features. For example, only 30 stations have more than 10 complete years of record. The location of these climatological stations is shown on Plate 4. The more populated valleys in the basin have the greatest density of stations as well as the longest records. There are fewer climatic stations and shorter lengths of record in higher elevations due to the general lack of development.

Hydrologic records are adequate for most of the basin, but are extremely limited in the Lower Rogue River Subbasin. The small amount of development and lack of access and major diversions, however, reduce the need for more gaging stations in this area. In each of the other six Rogue subbasins, there is at least one major tributary that does not have gaged records and annual yields are estimated using hydrologic correlation methods.

The longest record of streamflow in the Rogue River Basin has been for the Rogue River at Raygold gaging station, located just below Gold Ray Dam on the main stem at river mile 125.8. Records have been kept at this station since 1905, a period of over 75 years. Twenty-one other stream gaging stations in the basin have been maintained for periods ranging from 40 to 70 years, and 27 stations for periods ranging from 20 to 39 years. There are 100 stream gaging stations in the basin which have either 10 complete years of flow records or are currently active. Location of these stations is presented on the basin map, Plate 4.

Precipitation

Weather within the Rogue River Basin is generally influenced by an eastward flow of marine air masses moving inland from the Pacific Ocean. Orographic influences, differences in altitude, and distance from the Pacific Ocean all cause marked variations in rainfall conditions. For example, the average annual precipitation at climatological stations of the basin ranges from a low of only 18 inches at Medford in the Bear Creek Valley to 85 inches at Illahe in the Klamath Mountains. An isohyetal map of average annual precipitation has been prepared for the Rogue River Basin and is shown on Plate 4. It illustrates the effects of elevation and topographic barriers upon the moisture-bearing westerly winds.

The initial lifting of air over the Klamath Mountains increases the annual rainfall from about 80 inches at the coast to 120 inches at the higher elevations. The downslope air movement on the leeward side of the mountains into the interior Central Valley region results in a decrease in rainfall to less than 20 inches near Medford. As the air is again lifted and cooled over the Cascade Range, annual precipitation increases to about 70 inches in the eastern region of the basin near Crater Lake. Precipitation in this region is somewhat less than what is deposited over the Klamath Mountains in the western part of the basin due to moisture depletion and a decrease in wind velocity.

Precipitation is typically moderate to heavy during the winter months and extremely light during the summer growing season. Roughly one-half the annual precipitation occurs during the November-January period, when the westerly flow of moist marine air is most prominent. By contrast, only 5 percent of the total annual rainfall occurs during the July-September period when the basin is typically dominated by the Pacific High Pressure center and there is little or no air flow from the ocean. These extreme variations in seasonal precipitation necessitate irrigation of farm lands to aid in producing increased crop yields.

Precipitation occurring as snow in the basin also varies widely, both with respect to elevation and proximity to the ocean. Annual snowfall ranges from only a trace at Gold Beach to more than 200 inches in the high Cascades. Only at the high elevations, however, does snow remain on the ground for long periods. At Central Valley region stations, the average annual snowfall ranges from 4 to 8 inches, or less than one inch of water equivalent, which represents less than 5 percent of the annual precipitation. Approximately one-half and three-fourths of the annual precipitation occurs as snow at the 5000 and 7000 foot elevations, respectively.

Thus, while snowfall is of little significance over the valley floors, its importance increases at the higher elevations. Of particular significance is the accumulation of snow during the winter and early spring months and subsequent depletion during the snowmelt period. Greatest accumulation of snow occurs along the Cascade Range. The 36-year record at Seven Lakes 1 snow course shows an average snow depth of 136 inches and a water equivalent of 57 inches on April 1st.

Table 16 shows snow data for selected snow courses in the basin. Locations of snow courses are shown on the basin map, Plate 4.

Flood-producing storms occur chiefly during the winter months but are not uncommon in late autumn and early spring months. All major storms are of Pacific origin and are associated with a strong onshore flow of moist air. Additional precipitation is produced by frontal activity, with fronts generally moving from west to east at intervals ranging from 12 hours to 48 hours. Further precipitation often results from lifting caused by the cyclonic movement of air flow associated with low pressure centers passing over the area.

Storms vary widely with respect to duration, intensity, and geographical distribution of the precipitation. Precipitation from major storms may exceed 10 inches at Gold Beach near the coast and at Crater Lake in the Cascades, whereas only 3 or 4 inches occur in the Central Valley region near Medford. Storm amounts generally vary in accordance with the normal annual pattern, but considerable variation may occur in individual storms. Typical major storms are generally of 3 to 5 days duration.

In addition to the typical winter storms, convective thunderstorms are also common to the area, and generally occur during the late spring and early summer months. Due to their small areal extent and short duration, these storms rarely produce flooding, except in local areas along small tributaries. Intensity of precipitation in convective-type storms is high, with depths up to one-half inch and one inch occurring in 5 and 15 minutes, respectively. This type of storm generally lasts less than one hour and the total volume of precipitation rarely exceeds of the maximum 15-minute rainfall depth. Lightning and hail often are associated with thunderstorms.

Lakes and Reservoirs

The Rogue River Basin has nearly 100 lakes or reservoirs that are 5 acres or more in surface area (see Table 17). The cumulative surface area for all lakes and reservoirs in the basin is nearly 7800 acres, which is less than one-quarter of one percent of the total basin area.

Approximately 88 percent of the cumulative surface area of all water bodies are man-made storage reservoirs which serve multiple purposes, such as flood control, recreation, irrigation, industrial, and flow augmentation for fish life. This high proportion of storage reservoirs within the basin underscores the scarcity and uniqueness of natural lakes, as well as the need for winter storage to supplement seasonally low streamflows. The three largest reservoirs within the basin are Lost Creek Lake, Applegate Lake and Emigrant Lake, having surface areas of 3430, 990, and 712 acres at full pool, respectively. In addition, Congress has authorized but not funded a multiple-purpose storage project on Elk Creek, which would be a 1290-acre storage reservoir at full pool. There are numerous small, privately constructed storage projects throughout the basin serving multiple purposes.

TABLE 16

ROGUE RIVER BASIN SNOW COURSE DATA 1928 - 1972
(in inches)

STATION NAME	LOCATION	ELEV. (feet above MSL)	JANUARY		FEBRUARY		MARCH		APRIL		MAY		RECORD BEGAN IN
			Snow Depth	Water Equiv.	Snow Depth	Water Equiv.	Snow Depth	Water Equiv.	Snow Depth	Water Equiv.	Snow Depth	Water Equiv.	
ALTHOUSE	T41S-R7W SEC. 17	4530	---	---	13.2	4.4	16.2	5.7	18.5	7.4	---	---	1937
BEAVER DAM CREEK	T38S-R4E SEC. 1	5100	24.1	6.6	31.5	9.7	33.0	11.7	31.5	12.2	---	---	1960
BIG RED MTN.	T40S-R1W SEC. 31	6250	---	---	61.4	20.1	73.2	27.5	78.1	30.7	---	---	1936
BILLY CREEK DIVIDE	T36S-R5W SEC. 30	5300	31.1	9.0	46.9	15.3	55.2	20.7	53.7	22.4	34.4	15.9	1929
DEADWOOD JCT.	T38S-R4E SEC. 8	4600	18.6	4.7	24.0	7.1	25.8	8.4	20.4	7.9	---	---	1960
FISH LAKE	T37S-R4E SEC. 3	4670	22.6	6.2	31.4	10.1	36.2	12.9	36.4	14.8	15.9	7.5	1933
GRAYBACK PEAK	T40S-R5W SEC. 9	6000	---	---	52.9	17.9	58.6	22.9	64.9	27.2	---	---	1936
LITTLE RED MTN.	T40S-R2W SEC. 25	6500	---	---	48.8	16.0	58.5	22.1	60.4	24.3	---	---	1936
PAGE MOUNTAIN	T41S-R7W SEC. 5	4050	---	---	10.4	3.2	14.3	4.3	11.9	4.2	---	---	1955
SEVEN LAKES 1	T34S-R5E SEC. 3	6800	---	---	89.3	31.8	116.1	46.2	136.3	57.2	---	---	1936
SEVEN LAKES 2	T33S-R5E SEC. 26	6200	---	---	75.4	25.5	93.0	35.0	107.6	43.7	---	---	1936
SILVER BURN	T30S-R4E SEC. 30	3720	18.5	4.8	30.8	9.4	32.4	11.7	27.7	10.9	---	---	1937
SISKIYOU SUMMIT	T40S-R2E SEC. 17	4630	13.3	3.7	21.1	6.8	18.0	6.3	9.4	3.8	---	---	1932
SOUTH FORK CANAL	T33S-R3E SEC. 12	3500	6.4	1.6	11.2	3.4	8.0	3.9	2.6	1.0	0	0	1937
WHALEBACK	T31S-R2E SEC. 4	5030	---	---	68.9	22.6	80.1	29.8	86.6	34.8	---	---	1937

Source: Summary of Snow Survey Measurements for Oregon, 1928 - 1972, USDA-SCS, Portland 1973.

Nearly all of the natural lakes in the basin are small (30 acres or less) and are located either on the western slopes of the Cascade Range or high in the Siskiyou Mountains. The largest lake is Fish Lake in the Little Butte Creek Subbasin, which has a surface area of 443 acres. Fish Lake has an outlet structure, however, which has controlled the lake's water level and outflows since 1915. The second largest natural lake is Island Lake of the Upper Rogue Subbasin, which covers an area of 46 acres high in the Cascades. Most of the smaller natural lakes are also found in the Upper Rogue Subbasin in the Sky Lakes limited area, which lies between Crater and Fourmile Lakes along the Cascade Divide. The Seven Lakes Basin, Sky Lakes group and Blue Lake groups are all part of the Sky Lakes limited area. Lakes located just east of the basin boundary include Crater Lake, Fourmile Lake, Lake of the Woods, Howard Prairie and Hyatt Reservoirs, most of which have scenic qualities and provide recreational opportunities.

Streamflow Characteristics

While there are adequate quantities of water available on an annual basis to supply present and future needs, there are seasonal deficiencies on many basin streams in most years. The streamflow regimen of the Rogue River and its tributaries generally follows the seasonal precipitation pattern. For the majority of Rogue Basin tributaries, low flows normally occur from July through September or October. Higher flows, which may fluctuate widely, prevail during the remainder of the year.

Except for extensive areas of porous lava and pumice along the eastern basin boundary, the topography and geology of most of the basin is conducive to rapid runoff. Runoff from many of the tributaries often produces peak flows within hours after passage of a storm front. By examining daily discharge hydrographs for various stations on the main stem and unregulated tributaries, three things become quite evident: 1) the basin's streams respond quite rapidly to precipitation; 2) the magnitude and short duration of floods; and 3) the seasons of high and low runoff.

Thus, topography, geology, temperature, elevation and the distribution of annual precipitation are the major factors influencing the seasonal variation in streamflow. The average annual yield for the main stem Rogue River at Raygold, near Central Point, for the period 1906-1980 is 2,146,000 acre-feet (2,962 cubic feet per second), or nearly 20 inches of runoff over the 2,020 square mile drainage area. The normal annual precipitation for the basin above Raygold is approximately 43 inches, indicating an estimated average annual evapotranspiration loss of 23 inches. Extremes in annual runoff at Raygold have ranged from a low of 839,090 acre-feet (1,159 cubic feet per second) in 1931 to a high of 3,715,450 acre-feet (5,132 cubic feet per second) in 1974, which are equivalent to 7.8 and 34.5 inches of water over the drainage area above the gaging station. Stream gaging records reveal that the three years of lowest annual runoff at Raygold were the water years of 1931, 1977, and 1934, while years of maximum annual runoff occurred in 1974, 1956, and 1975. Table 18 shows the maximum, average, and minimum annual runoff values for the period of record at selected points on the Rogue River and tributaries.

TABLE 17

LAKES AND RESERVOIRS IN ROGUE RIVER BASIN

SUBBASIN	NAME	SURFACE AREA (acres)*	LOCATION TWP	RGE	SEC
UPPER ROGUE					
	Alta, Lake	17	35S	4E	22
	Beal Lake	5	35S	5E	18
	Blue Lake	10	35S	5E	19
	Carey Lake	7	35S	5E	20
	Cliff Lake	8	33S	5E	34
	Dailey Reservoir	60	33S	3E	35
	Dee Lake	20	35S	5E	16
	Elk Creek Reservoir		33S	1E	--
	(proposed)	1,290			
	Grass Lake	28	33S	5E	34
	Hammel Reservoir No. 2	11	35S	1W	10
	Hemlock Lake	7	34S	5E	16
	Horseshoe Lake	23	35S	5E	19
	Indian Lake Reservoir	55	34S	1E	20
	Island Lake	46	34S	5E	16
	Ivern Lake	5	33S	5E	28
	Lost Creek Reservoir	3,430	33S	1-2E	--
	McKee Lake	5	35S	4E	1
	Middle Lake	25	33S	5E	34
	Mud Lake	5	35S	5E	18
	North Blue Lake Group (9)		10	35S	4E
13					
	North Lake	8	33S	5E	34
	PP&L Reservoir	20	32S	3E	30
	Pear Lake	18	35S	5E	19-20
	Red Lake	31	35S	5E	9
	Red Blanket Reservoir	35	32S	3E	27
	South Blue Lake Group (13)		60	35S	5E
19					
	South Lake	9	33S	5E	34
	West, Lake	5	29S	5E	4
	Willow Lake Reservoir	322	35S	3E	34
SUBBASIN	TOTAL	4,285			

* Includes only lakes and reservoirs five acres or more in surface area.

TABLE 17

LAKES AND RESERVOIRS IN ROGUE RIVER BASIN (continued)

SUBBASIN	NAME	SURFACE AREA (acres)*	LOCATION TWP	RGE	SEC
LITTLE BUTTE CREEK					
	Agate Reservoir	216	36S	1W	25
	Bradshaw Reservoir	44	37S	1E	1-2
	Bradshaw Reservoir No. 2	7	37S	2E	7
	Charley Horse Reservoir	6	38S	3E	2
	F.P. 1 Reservoir	5	37S	1E	1
	Fish Lake	443	37S	4E	2-4
	Gardner Reservoir	7	36S	2E	16
	Harper Reservoir	7	36S	1E	30
	Harrison Reservoir	18	37S	1E	1-2
	Lake Creek Reservoir	52	37S	2E	7
	Lost Lake Reservoir	21	37S	2E	35
	Osborne Creek Reservoir	35	36S	1E	25
	Pierce Reservoir	23	27S	1E	29
	Stanley Reservoir	21	36S	1E	12
	Star Lake Reservoir	13	35S	2E	32
	Wade Reservoir	24	36S	2E	10
	Wertz-Hurst Res. 1 and 2	5	38S	2E	7
	Woodrat Knob Reservoir	30	36S	1E	36
	Woolfolk Reservoir	34	35S	1E	34
	Yankee Reservoir	55	36S	1E	28
SUBBASIN	TOTAL	1,066			
BEAR CREEK					
	Emigrant Lake (Reservoir)	712	39S	2E	20
	Hobart Lake	6	40S	3E	9
	Log Pond No. 3	16	37S	2W	14
	Reeder Gulch Reservoir	20	39S	1E	28
	Timber Products Log Pond	16	37S	2W	24
	Wilson Reservoir	5	37S	2W	6
SUBBASIN	TOTAL	775			
APPLEGATE					
	Applegate Lake Reservoir	990	40S	4W	--
	Fish Lake	6	40S	5W	19
	Lippert Reservoir No. 1	6	38S	5W	11
	Lippert Reservoir No. 2	6	38S	5W	11
	Miller Lake	6	40S	5W	28
	Squaw Lakes (2)	89	41S	2W	2
SUBBASIN	TOTAL	1,103			

* Includes only lakes and reservoirs five acres or more in surface area.

TABLE 17

LAKES AND RESERVOIRS IN ROGUE RIVER BASIN (continued)

SUBBASIN	NAME	SURFACE AREA (acres)*	LOCATION TWP	RGE	SEC
MIDDLE ROGUE					
	Bate Log Pond (Reservoir)	12 35S	6W	21	
	Bigham Reservoir	5	35S	2W	22
	Bush Reservoir	5	35S	2W	32
	Gold Ray Reservoir	30	36S	2W	18
	Hoover Reservoir 1	7	36S	1W	22
	Hoover Reservoir 2	9	36S	1W	21
	Hoover Reservoir 3	25	36S	1W	21
	Hoover Reservoir 4	14	36S	1W	22
	James Reservoir 1	8	35S	2W	33
	James Reservoir 2	5	35S	2W	33
	James Reservoir 3	9	35S	2W	33
	Lomoha Lake	9	35S	2W	33
	McCormick Reservoir	5	36S	2W	29
	Medco Pond 3 (Reservoir)	40	37S	1W	6
	Nelson Reservoir 1	7	37S	1W	10
	Quackenbush Reservoir	7	35S	2W	26
	Rogue West Lake (Reservoir)	8 36S	6W	24	
	Sams Valley Reservoir	50	35S	2W	18
	Simpson Reservoir	8	35S	2W	5
	Skou Reservoir	15	35S	2W	26
	Swagerty Reservoir	5	36S	1W	34
	Werner Reservoir	6	35S	6W	28
	Whetstone Pond (Reservoir)	11 36S	1W	19	
	Whetstone Borrow Reservoir	10 36S	1W	19	
	Whetstone Creek Reservoir	9 36S	1W	19	
SUBBASIN	TOTAL	319			
ILLINOIS					
	Bolan Lake	9	41S	6W	7
	East Tannen Lake	5	41S	6W	15
	Esterly Lakes (3)	18	40S	8W	27
	Game Lake	5	36S	12W	--
	Indian Lake Reservoir	10	40S	8W	6
	Puget Pond (Reservoir)	5	39S	8W	9
	Rosenberg Reservoir	5	39S	8W	33
	Rough and Ready Mill Pond	9 40S	8W	8	
	Selmac, Lake	157	38S	7W	18
	Sowell Reservoir	5	39S	8W	26
	Tannen Lake	10	41S	6W	16
SUBBASIN	TOTAL	238			

* Includes only lakes and reservoirs five acres or more in surface area.

TABLE 17

LAKES AND RESERVOIRS IN ROGUE RIVER BASIN (continued)

SUBBASIN	NAME	SURFACE AREA (acres)*	LOCATION TWP	RGE	SEC
LOWER ROGUE	-----	-----			
SUBBASIN	TOTAL	0			
ROGUE BASIN	TOTAL	7,786			

* Includes only lakes and reservoirs five acres or more in surface area.

Annual Yield Frequencies

Annual yield frequency analysis utilizes annual runoff data to formulate a probability distribution which can provide a prediction of the amount of water available 50 percent of the time, 80 percent of the time, etc. These annual yield frequency calculations are especially helpful in determining the minimum amount of runoff expected to be produced in a particular stream four out of five years, commonly referred to as the 80 percent exceedance probability or the Q.80 yield.

Hydrologic and statistical analyses of various flow probabilities were performed on the annual yield records from 42 gaging stations in the Rogue River Basin. Probabilities of occurrence from which annual yields of various magnitudes may be expected to be equalled or exceeded are presented on yield-frequency curves. Frequency curves representing annual yields of 42 stations throughout the basin have been developed as part of the hydrologic analysis.

A regional hydrologic statistical analysis was also performed on 31 unregulated or slightly regulated gaging sites to determine both Upper and a Lower Rogue River Basin regression equations for estimating yields of ungaged tributaries. These stations were selected because they represent a variety of climatic locations and have a limited amount of regulation. Representative equations were developed to estimate either the median (50 percent) or 80 percent annual yield for any ungaged stream in the basin based upon the watershed's average annual precipitation and drainage area.

From data in Table 18, the highest average annual runoff figures are found in the upper reaches of the Illinois River and its headwater tributaries, while the next highest average runoff values are found on Grave Creek and in the smaller main stem headwater tributaries. The lowest average annual runoff occurs in the Bear Creek watershed, followed by the Little and Big Butte Creek watersheds and the middle reaches of the Applegate and Rogue Rivers. Average annual runoff has a high correlation with normal annual precipitation in the Rogue River Basin.

TABLE 18

RUNOFF FOR SELECTED GAGING STATIONS IN ROGUE RIVER BASIN

GAGING STATION	YEARS OF RECORD	DRAINAGE AREA (SQ MILES)	EXTREMES IN ANNUAL RUNOFF MAXIMUM (ACRE-FEET)	EXTREMES IN ANNUAL RUNOFF MINIMUM (ACRE-FEET)	ACRE-FEET (1) AVERAGE	ACRE-FEET (1) PER SQ MILE	AVERAGE RUNOFF (INCHES)
Rogue River above Prospect	60	312	918,000	297,555	593,400	1902	35.7
Big Butte Creek near McLeod	25	245	362,700	57,850	207,900	850	15.9
Elk Creek Near Trail	35	133	317,100	30,190	167,400	1260	23.6
Red Blanket Creek near Prospect	55	45.5	128,140	51,400	84,040	1850	34.6
S. F. Little Butte Cr near Lakecreek	59	138	135,380	15,200	75,350	550	10.2
Bear Creek at Medford	60	289	220,090	6,100	83,320	290	5.4
Rogue River at Raygold	75	2,053	3,715,450	839,090	2,146,000	1,045	19.6
Rogue River at Grants Pass	42	2,459	4,538,615	917,280	2,518,000	1,020	19.2
Grave Cr. at Pease Bridge near Placer	35	22.1	88,325	8,050	42,670	1,930	36.2
Applegate River near Applegate	42	483	1,007,050	60,500	397,000	820	15.4
Applegate River near Copper	42	225	779,725	57,770	321,700	1,430	26.8
Slate Creek at Wonder *	14	31.4	111,500	30,700	58,570	1,865	35.2
East Fork Illinois River near Takilma	39	42.3	228,050	28,670	129,000	3,050	57.2
West Fork Illinois R. below Rock Cr.	26	42.4	294,660	35,260	155,000	3,655	68.5
Illinois River at Kerby *	35	364	1,511,665	417,010	875,300	2,400	45.0
Illinois River near Agness	20	988	5,646,300	579,180	3,023,000	3,060	57.4
Rogue River near Agness	20	3939	8,680,490	1,146,060	4,443,000	1,130	21.1
Sucker Creek near Holland *	24	76.2	245,430	62,480	153,500	2,010	37.8

* Indicates inactive station
(1) Data from USGS Water Data Report OR-78-1, Water Resources Data for Oregon - Water Year 1980.

Flood Characteristics

The largest flood of historical record in the Rogue River Basin, both in volume and peak discharge, occurred in December 1861. It is estimated that the 1861 flood had a volume of 1,260,00 acre-feet and a peak discharge of 145,000 cfs at Raygold. The large volume resulted from two major storms occurring within 5 days of each other. The next largest flood occurred in February 1890 and had an estimated peak discharge of 132,000 cfs at Raygold. Since the Raygold gaging station was established in 1905, there have been three floods of major proportion - the floods of December 1964, February 1927, and December 1955. The peak discharge for the flood of December 23, 1964, was 131,000 cfs. The highest gaged stages of record in the basin were observed during the December 1964 flood on the main stem of the Rogue River and some of its major tributaries.

Floods in the Rogue River Basin are caused primarily by heavy rains during the months of November through March, when the ground is either frozen or saturated. Runoff from such storms occurs immediately and the resulting floods are generally of 2 to 4 days', duration, with relatively high peak discharges. Spring freshets resulting from melting snow are of longer duration but peak discharges are generally not high enough to cause significant damage. Flood runoff from the headwater tributaries along the eastern boundary of the basin is generally reduced by the storage effect of the snowpack and the deep porous soil and rock of volcanic origin.

About 75 percent of the floods of record have occurred during the months of December, January and February. The annual peak flow has occurred in every month from September through April. Table 19 shows a monthly summary of the maximum annual flow events that have been observed on the main stem Rogue River at Raygold for the period of 1906 - 1980.

Flood Frequencies

The purpose of flood frequency analysis is to estimate the probability of peak flows so that structural design can be completed on the basis of a calculated risk. Thus this analysis can estimate the maximum annual discharge for a specific probability or risk level for flood control planning purposes.

Damaging floods in certain parts of the basin are almost an annual occurrence. Those areas subject to occasional flooding are located along the 90-mile reach of the Rogue River extending downstream from the mouth of Big Butte Creek to where the river enters Hellgate Canyon. Serious flooding along this reach should be alleviated by the flood control storage projects that have recently been completed on the main stem at Lost Creek and on the Applegate River. Flooding also occurs along the lower reaches of Little Butte Creek, Evans Creek, Bear Creek and other lesser tributaries, and along the upper reaches of the Illinois River.

TABLE 19

ANNUAL PEAK FLOW EVENTS FOR ROGUE RIVER at RAYGOLD

MAXIMUM DISCHARGE	ANNUAL PEAK FLOW OCCURRENCES-ROGUE R. AT RAYGOLD								
(in 1,000 cfs)	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	Total
140 - 130	-	-	-	1	-	-	-	-	1
130 - 120	-	-	-	-	-	-	-	-	0
120 - 110	-	-	-	-	-	-	-	-	0
110 - 100	-	-	-	1	-	1	-	-	2
100 - 90	-	-	1	-	-	-	-	-	1
90 - 80	-	-	-	1	-	-	-	-	1
80 - 70	-	-	-	-	-	-	-	-	0
70 - 60	-	-	-	-	2	-	1	-	3
60 - 50	-	-	1	-	1	1	-	-	3
50 - 40	-	1	-	4	3	1	1	-	10
40 - 30	-	-	1	1	4	1	2	-	9
30 - 20	-	-	-	5	5	5	2	1	18
20 - 15	-	-	1	2	2	3	1	-	9
15 - 10	-	-	1	3	4	4	-	-	12
10 or less	1	-	1	2	1	-	-	1	6
Totals	1	1	6	20	22	16	7	2	75

Flood damages have historically been severe along the Rogue River in the Gold Hill-Grants Pass reach and along Bear Creek. At Raygold, where observed records began in to 1905, there have been 28 floods above bankfull capacity of 34,000 cfs, or an average of one in every two and one-half years. Flood damages along the main stem will be mitigated by the operation of Lost Creek Project, Applegate Project, and the future construction of Elk Creek Project.

Low Flow Frequencies

Based on streamflow records from 20 unregulated or slightly regulated gaging stations, discharges of less than 5 percent of the average annual yield occur in the basin on the average of 4.5 months, or 138 days per year. This low flow period normally occurs during the period from July through mid-November. Low flow, or drought, frequency analysis provides a prediction as to the low flows that would be expected, for a specified duration period, i.e., 1-day, 7-day, 30-day, etc. Since a low flow duration period can be defined in specific terms for a particular water resource development project, the drought frequency can be analyzed in the same manner as a flood or annual yield frequency.

A statistical analysis of the average annual low flow events for various duration periods, i.e., 1-day, 7-day, 30-day, 120-day, and 183-day, was performed on 20 unregulated gaging station records in the basin. For example, the average low flow that occurs for seven consecutive days once in ten years (the 7-day Q10) for the Grave Creek at Pease Bridge station is 0.4 cfs, while the 30-day Q10 for the Rogue River above Prospect is 300 cubic feet per second.

Pollution abatement and the degree of wastewater treatment is dependent on the quantity of water available for assimilation of the treated effluent when it is discharged, especially in small streams. The 7-day 10-year low flow is frequently used by sanitary engineers as the design flow criteria for wastewater treatment facilities. The critical design flow is not necessarily the absolute minimum, since an economic analysis may show a substantial savings in plant costs if moderate nuisance (without danger to public health) is tolerable at infrequent intervals or if the effluent can be stored during low flow periods.

GROUND WATER

General

Overall, the Rogue River Basin has limited ground water resources. The potential for developing ground water in excess of single residence domestic supplies is slight throughout most of the basin. Chances of obtaining yields adequate to supply limited irrigation projects are better in those aquifers below low relief terrain along or near valley floors where most development occurs. There are several areas where significant amounts of ground water are present in storage, but most of those aquifers are hydraulically connected to the local surface water supplies.

Generally speaking, large water users should not expect to have their needs satisfied solely from ground water supplies. In heavily developed urban or agricultural areas where greater use of, and reliance on, ground water exists or is anticipated, comprehensive aquifer studies are needed. These studies can help determine the effects that large withdrawals might have on surface water resources and other wells in the surrounding area as well as aquifer characteristics, areal extent, and sustainable yield.

Rural residential development has been rapidly increasing throughout the basin over the past 20 years, relying on ground water where surface water supplies are of unreliable quantity or quality. Although "dry holes" are not uncommon in some areas of the basin, sufficient quantities of ground water usually exist to satisfy the needs of single family domestic users.

Most of the rock formations in the Rogue River Basin yield only small amounts of ground water. This occurs because most formations have little or no primary porosity so wells must rely on secondary porosity, or fractures. Wells drilled in volcanic and sedimentary rocks typically have fairly low yields. Ultramafic and mafic igneous rocks produce low well yields and may also have poor quality water.

The primary source of data on ground water for most locations is well log records. Much of the Rogue River Basin consists of steep, rugged topography that is unsuitable for development or is in public ownership. These unpopulated areas occur in the headwaters of most streams as well as along some lower stretches of the Rogue and Illinois Rivers. Little ground water data is presently available for most of these areas.

The rugged terrain and remoteness of much of the basin discourages development and inhibits recharge of ground water supplies. Steep slopes encourage the rapid runoff of precipitation instead of infiltration into ground water supplies. Recharge rates for volcanic and sedimentary rock are variable and are generally less than those found in alluvial valleys. In the highest elevations of the basin, however, precipitation is stored in the snowpack and runoff is delayed, resulting in higher infiltration and recharge rates. Ground water that has been recharged in this manner is discharged slowly by the aquifer to streams at lower elevations, resulting in high sustained base flows. This is especially true in the headwater tributaries of the Upper Rogue River Subbasin draining on the western slope of the Cascades. Big Butte Springs are an example of this phenomenon.

Big Butte Springs, the source of drinking water supplies for much of the Medford urban area, issue from fissures in a lava flow originating from the western flank of Mount McLoughlin, an extinct Cascade volcano. These springs supply a sustained flow of about 26 million gallons per day.

Location and Extent

The greatest ground water potential in the Rogue Basin occurs in the large alluvial valleys. Principal alluvial aquifers are found in the Illinois Valley, Deer Creek Valley, Evans Creek Valley, lower Applegate River Valley, and the Rogue River Valley surrounding Grants Pass. Large quantities of ground water may be stored in the alluvium in these areas, although the total quantity in storage in some of these aquifers cannot be calculated with any degree of accuracy due to the variability in thickness and complex sorting of these sand and gravel deposits.

Ground water in alluvium is generally considered to be in direct hydraulic connection with surface water. Therefore, the withdrawal of large quantities of water from alluvial aquifers could lower water levels in nearby wells or streams.

Another good water-bearing formation may be found in granitic rocks, underlying several areas of high and low relief, southwest, west and northwest of Grants Pass. It may also have a relatively good potential for ground water production, depending upon the degree of fracturing or weathering. Development of ground water from deeper rock formations such as this would probably have less impact on surface water supplies than wells developed in alluvium.

Recharge of both alluvium and granitics is derived primarily from precipitation and to a limited extent from infiltration from surface waters and irrigation ditches. Recharge of alluvium is rapid relative to other formations.

Because of the remote location of the Tertiary-Quaternary volcanic rocks of the High Cascades geologic unit and of the complexity of ground water flow systems within it, it is unlikely that the ground water resource in this aquifer will be developed more than it is at present.

The Tertiary volcanic rocks of the western Cascades unit, the Tertiary sedimentary rocks, and the Paleozoic-Mesozoic rocks each have low permeability capable of yielding only small quantities of ground water. They are however, generally adequate for domestic or livestock use or other small uses.

Significant water level declines due to pumping are generally not known to be a problem in any part of the basin. Local temporary declines, however, can be expected within the low permeability formations as the consequence of normal seasonal pumping stresses.

Water Quality

Since the major source of ground water in the Rogue River Basin is precipitation, the quality of ground water is generally good. The occurrence of ground water developed from shallow wells in alluvium usually has excellent quality and is adequate for most uses. There are a few exceptions where naturally poor quality water from deeper formations intrudes into the shallower aquifer and where ground water is exposed to contamination by human activities. Shallow aquifers are especially prone to contamination. Common sources include septic tank failures, inappropriate solid waste disposal methods, and infiltration of contaminated flood waters.

Ground water originating from deeper formations and regional flow systems is more mineralized than it is in shallow aquifers. The concentration of dissolved minerals depends on the local geology. In general, the more highly mineralized ground water is found at greatest depths in recharge areas beneath uplands and at least depth beneath discharge areas along major streams. High levels of dissolved salts and minerals in localized areas may make the water unsuitable for some uses, but in general, the water quality of the deeper formations is satisfactory for domestic use. Deep ground water is usually hard, with moderate levels of various minerals such as iron. Chloride ions are typically the most abundant dissolved constituent in mineralized ground water. Known ground water quality problems are discussed in greater detail in the Subbasin Inventory Section in Part V.

SURFACE WATER RIGHTS

Surface water rights in the Rogue River Basin date back well into the 1800's. Water claims prior to the 1909 Water Code were recognized and maintained through an adjudication process which legally determined the priority date and the quantity of water that could be diverted for beneficial use. Separate adjudications were completed for different areas of the Rogue Basin, establishing different duties of water by a court decree. For example, the irrigation duty of water was set at 1/80 cubic foot per second per acre from the Rogue River and 1/50 cfs per acre from the Illinois River.

Historically, irrigation has been the major use of water throughout the basin. The irrigation season in the basin is defined to be April 1 to October 31 of each year. As of 1980, existing rights of record for irrigation use, excluding supplemental sources and storage, are estimated to total over 3250 cfs for the entire basin. These rights are concentrated near the most highly developed areas, and as a result sufficient water supplies are not available in many areas during the irrigation season to satisfy all existing needs.

According to surface water rights listed in Table 20, municipal rights total over 265 cfs. Power development rights are estimated to total 3488 cubic feet per second and mining rights total 3154 cubic feet per

TABLE 20

ROGUE RIVER BASIN - SURFACE WATER RIGHTS - (in cfs)

	IRR.	DON.	STK.	MUN.	IND.	FISH	WLDLF.	MIN.	PWR.	TEMP.	REC.	FIRE	STORAGE AC.-FEE
Rogue R. main stem (Headwaters to RM 133)	67.13	.795	.63	—	--	2233	.20	--	675.0	--	--	--	465,000
Big Butte Cr and tribs	221.464	.365	.09	68.5	--	15.5	--	--	100.0	--	--	--	10,000
Other Rogue Tribs (above RM 133)	46.343	3.0025	1.486	.085	3,247	1,83	--	--	378.99	--	2.072	.41	1,000
Rogue R. main stem (RM 133 to RM 67)	288.506	.435	.07	167.50	.81	50.02	--	3.3	2147.0	48.86	2.18	0.6	417
Little Butte Cr and tribs	1117.4	1.227	.227	10.0	13.53	4.14	--	--	113.0	53.31	.45	.02	28,080
Bear Cr and tribs	564.663	2.673	.26	30.577	1.85	2.351	1.77	34.554	55.5	30.0	.974	.10	39,930
Evans Cr and tribs	55.182	.89	.15	--	—	.05	--	78.0	--	--	--	.02	18
Applegate R and tribs	384.264	9.37	1.395	--	5.61	7.11	.014	423.875	5.4	—	.08	--	82,000+
Other Rogue tribs (RM 133 to 67)	301.405	6.688	.198	--	9.282	3.773	.01	1592.49	10.53	23.29	.22	.08	822
Rogue R. main stem (RM 67 to Mouth)	.38	.03	--	10.0	--	--	--	--	--	--	--	--	--
Illinois R and tribs	205.5	2.7	--	3.0	6.8	4.9	0.1	909.1	2.1	—	4.3	--	
Other Rogue tribs (RM 67 to Mouth)	4.42	2.32	--	.77	.02	--	--	113.38	.76	--	.01	.01	--
Rogue R. main stem Total	356.016	1.26	.70	167.50	.81	2283.02	.20	3.3	2822.0	48.86	2.18	.06	
All tributaries total	2900.641	29.2355	3.806	112.932	40.339	39.654	1.894	3151.399	666.28	106.60	8.106	0.64	
TOTALS	3256.657	30.4955	4.506	280.432	41.149	2322.674		2.094	3154.699		3488.28		155.46
10.286	0.70												

second.

High concentrations of water rights on certain streams have led to conflicts in some cases, resulting in administrative or statutory restrictions. In some areas, particularly in the heavily developed Bear Creek Subbasin, municipalities and irrigation districts have had to import water from outside the immediate drainage area in order to assure a reliable supply.

Storage facilities have also been developed to satisfy existing rights and future needs. On many streams where storage has not been developed, existing rights exceed the natural capacity of the stream during the summer and early fall low flow period of most years. Regulation of use is required when conflicts arise.

LEGAL RESTRICTIONS AND LIMITATIONS ON WATER USE

Legislative Withdrawals

Presently there are four legislative withdrawals of, or restrictions on, waters within the Rogue River Basin. These legislative withdrawals, all of which are contained in Chapter 538 of Oregon Revised Statues - 1982 Edition, are cited and summarized below.

The waters of Mill and Barr Creeks and their tributaries are withdrawn from appropriation by ORS 538.220 except for domestic and fish life purposes. The main stem of Mill Creek, however, is open for up to 1 MW of power development.

The waters of main stem Rogue River from the Lost Creek Dam downstream to the mouth are withdrawn from appropriation by ORS 538.270 except for domestic, stock, irrigation, municipal, fish, wildlife and recreational uses. This withdrawal does not apply to any Rogue River tributaries.

The waters of Big Butte Creek and its springs and tributaries are withdrawn by ORS 538.430 for exclusive use by the City of Medford and up to 100 cfs for the Eagle Point Irrigation District. The exception to this statute is for main stem of Clark Creek, which is open for up to 2 MW of power development.

Finally, ORS 542.210 limits and restricts any dams or structures in or on the bed of the Rogue River from Lost Creek Dam downstream to the mouth.

Administrative Withdrawals

In accordance with a January 22, 1959 order by the State Engineer, no more applications for permits will be accepted to appropriate water from Bear Creek or any of its tributaries, or Antelope Creek or any of its tributaries for irrigation, unless they are for the construction of reservoirs and the storage of water from November 1 to March 30 and the appropriation of the stored water. The waters of the Little Butte Creek Basin were classified only for domestic, livestock, irrigation, recreation, wildlife and fish life uses in the May 22, 1959 water use program by the Water Resources Board. On April 3, 1964, the Water Resources Board adopted a Bear Creek Subbasin Program which stated that no applications for appropriation of water shall be accepted except appropriations for beneficial use involving water legally stored in excess of the amount necessary for existing rights.

Further action was taken in the Bear Creek Subbasin by the Water Resources Board in February of 1969 and 1971. These Board actions allowed: 1) the diversion of up to 30 cubic feet per second of water out of Bear Creek for temperature (frost) control during the period February 15 to April 1 of each year; and 2) a diversion for the City of Talent of up to one cubic foot per second from Wagner Creek for municipal use during the period November 1 to April 1 of each water year, respectively. On April 4, 1981, the Water Policy Review Board adopted a program for the Bear Creek Subbasin which accepted applications for the appropriation of water only for power development and for beneficial use involving water legally stored in excess of the amount necessary for existing rights.

In the Illinois River Subbasin, both Sucker and Althouse Creeks and their tributaries have been withdrawn from further appropriation by State Engineer's Order of July 27, 1934. The exceptions to this order include domestic and mining uses, or power development, where such use may be made without actual consumption of water or injury to existing rights.

PART III

WATER USE AND CONTROL

PART III

WATER USE AND CONTROL

PART III - WATER USE AND CONTROL

WATER USE AND RELATED PROBLEMS

General

Water is essential to nearly all phases of human endeavor and accomplishment. As well as being necessary to sustain life, nearly every product is dependent upon water, either directly or indirectly. Thus water is a vital asset in the welfare and economic growth of the Rogue Basin and will likely increase in importance over time.

The Rogue River annually discharges approximately 8.2 million acre-feet of water, on the average, into the Pacific Ocean. Since water is a controlling factor in resource development, the potential of the basin is based primarily on the quantity and quality of water available for development use.

This section discusses ten of the major beneficial uses of water and related problems in the Rogue River Basin: domestic, fish life, industrial, irrigation, mining, municipal, pollution abatement, power development, recreation, and wildlife. Of these uses, irrigation, power development, mining, and fish propagation are the major uses of the surface water in terms of quantity of water appropriated in the basin. Water rights for the above uses comprise 96 percent of the total legal claims to surface water in the basin.

Domestic and livestock, temperature control, municipal, industrial, recreational and wildlife uses are essential to the social and economic development of the basin, but are small in relation to the basin yield. The major consumptive use of water has been for irrigation, but in the past few years interest in hydropower development, fish and wildlife, and recreational uses has been increasing. Water used for mining purposes is also important in evaluating water use in the basin. There is little use of surface or ground waters for pollution abatement or fire suppression purposes.

There is sufficient volume of water in the Rogue River Basin on an annual basis to meet present demands and contemplated future needs. The average annual yield of the basin has been estimated to be 8.2 million acre-feet. Serious water shortages, however, occur seasonally throughout the basin. During late summer, streams reach their natural low flows and in many areas, these low flows occur when the need for water is greatest. Many smaller streams become dry in summer and remain dry until the winter rains begin. Some larger tributaries also experience dry reaches or low flows during late summer and early fall. Table 18 shows some recorded low flows for the Rogue River Basin.

Domestic Use

Domestic and livestock water rights in the Rogue River Basin total 35 cubic feet per second. These rights occur throughout the basin and are limited to household, camps, parks and livestock uses although some of the earliest rights covered purposes which today would be classified as municipal use.

Adequate supplies of water for domestic use, aside from that supplied by municipal systems, influence the location and expansion of rural populations. Limited or expensive domestic supplies can restrict community development while poor quality water is a deterrent to growth and may also be a public health hazard.

Most domestic water supplies in the basin use ground water, particularly the small group domestic systems, due to quantity and quality limitations of many of the basin streams during the low flow season. The development of community water systems serving from 3 up to 500 residences has been a growing trend. A small community system typically utilizes wells, storage facilities and a pipe distribution network to supply area residents. If these systems are properly designed, constructed, maintained and monitored, they can provide an efficient and reliable alternative for individual domestic water supplies.

Adequate ground water supplies can usually be found to satisfy the limited needs of domestic water users. A significant number of the wells in Jackson and Josephine Counties, however, are shallow and water shortages may occur during the dry period of each year.

As the population of the basin increases, greater demand will be placed on the existing domestic supplies. Most areas of the basin do not have surface water supplies of adequate quantity or quality to satisfy the requirements for domestic use. The main stem Rogue and development of ground water have the most promise of continuing to supply rural domestic needs. Furthermore, the expansion of existing municipal water systems to include surrounding urbanizing areas could be costly, but will be required to insure adequate domestic supplies for some rapidly developing areas within urban growth boundaries.

Ground water is the primary domestic source and is generally of adequate quality for domestic use. There are a few exceptions where naturally poor quality water from deep formations intrudes into a shallow aquifer or the ground water is exposed to surface contamination from human activities. Thus shallow ground water systems are susceptible to contamination and may be polluted by surface sources, particularly in areas of dense residential development having no sewage treatment facilities and improperly constructed or maintained septic systems.

Ground water originating from deeper formations has variable quality throughout the basin, but is generally satisfactory for domestic use. Chloride ions are generally the most abundant dissolved constituents in the mineralized ground waters of the basin. Excessive saline waters have been reported south of Grants Pass, near the mouth of Draper Creek northeast of Selma, and near Merlin, all in Josephine County.

In other areas of the basin, the ground water resources remain relatively undeveloped, so the quality or quantity have not been determined. All ground water developed for human consumption in the basin should be analyzed to ascertain its suitability for domestic use.

Surface water supplies are even more susceptible to contamination and some treatment may be necessary for human or livestock consumption. Surface waters tend to carry large sediment loads during high flow periods or increased bacterial counts and algal populations during the low flow periods.

Fish Life

The Rogue River system contains two runs of steelhead, sea-run cutthroat trout, two chinook salmon runs, coho salmon, four species of resident trout, six species of warm-water game fish, two species of sturgeon, and shad, all of which have overlapping or coinciding distributions. Of the seven anadromous species, steelhead are most abundant and most widely distributed. Fish populations are affected by changes in water quantity and quality.

Water supplies in the Rogue River Basin are generally adequate for existing fish populations during most of the year. Sections of many streams throughout the basin, however, become critically low and warm or even dry during the summer when out-of-stream water demand is high and runoff is low. Low summer flows adversely affect fish populations by reducing habitat area, raising water temperatures, reducing flow velocity, increasing disease virulence, and lowering dissolved oxygen levels. The limiting effects of high temperatures, disease, and low dissolved oxygen levels occur regularly in many, but not all, streams each year.

Alteration of the watershed due to logging or development activities can alter the runoff pattern which will often affect or upset the fish growth and migration patterns. Some streams which reportedly sustained large annual anadromous fish runs in the past are no longer capable of doing so because of inadequate flows resulting from excessive depletions and watershed alterations.

Both Lost Creek and Applegate Reservoirs store winter runoff to be released later for downstream flow augmentation during the seasonal low flow periods. Minimum reservoir releases, exclusive of periods of flood regulation, have been assigned to each of the Rogue River Basin Projects. Table 21 shows the recommended minimum reservoir releases by month or other time periods for fishery enhancement purposes at each of the Corps of Engineers' projects. These flows have been designated for each project to aid anadromous fish migration, spawning, and rearing periods.

At Lost Creek, minimum releases for fishery enhancement vary from month to month, with intra-month transition periods. A total of 125,000 and 40,000 acre-feet of storage is provided at Lost Creek and Applegate projects, respectively, for fishery enhancement purposes. Minimum releases from Applegate Reservoir are enhanced by minimum perennial streamflows for aquatic life at three downstream gages of Copper, Applegate and Wilderville.

TABLE 21

ROGUE PROJECT MINIMUM RELEASES

MONTH	MINIMUM RESERVOIR RELEASE IN CUBIC FEET PER SECOND* LOST CREEK	ELK CREEK (not constructed)	APPLEGATE
January	1,000	25	50
February	700	25	50
March	700	25	50
April	700	25	50
May 1 - 15	1,000	25	50
May 16 - 31	1,300	25	50
June 1 - 10	1,500	25	50
June 11 - 30	1,800	25	50
July	2,000	25	50
August 1 - 20	2,000	25	50
August 21 - 31	1,500	25	50
September 1 - 7	1,500	25	50
September 8 - 30	1,000	25	50
October	1,000	25	50
November	1,000	25	50
December	1,000	25	50

* Exclusive of periods of flood regulation. During floods the release may be less than indicated in the above tabulation.

High flows normally do not limit fish production to the same extent as low flows. Excessive flows, however, have been detrimental and can have lasting effects on stream habitat. Fish have been stranded repeatedly in potholes adjoining sections of the middle Rogue and middle and lower Applegate Rivers following flood flows.

The scouring actions of floods can also destroy redds by obliterating gravel beds. Galice Creek of the Middle Rogue River Subbasin, Steves Fork and Sturgis Fork of the upper Applegate River Subbasin, and other streams lost much of their gravel beds during the 1964-65 floods.

The Illinois River system between its forks and Deer Creek is also susceptible to flooding. The damaging effects to aquatic life by flooding in this area, however, is not as pronounced as in higher gradient streams.

Salmon and trout are very sensitive to changing water conditions. Many of the water quality conditions which affect the survival of fish life are directly related to the quantity of water in the stream. Temperature, bacterial and chemical contamination, suspended sediments and dissolved oxygen can become critical parameters during the low flow season. Water quality control and release of stored waters during low flow periods tend to minimize the adverse impacts of many of the above parameters affecting fish life.

According to a 1970 Oregon State Game Commission report, Rogue River Basin Investigation, "Unnatural and excessive quantities of suspended soil or silt in streams are the most frequent forms of pollution in the basin". Spawning beds can be silted in and food producing areas can be damaged by the settling of suspended sediments. Reproduction and normal growth can be severly limited by this condition. In extreme cases, the fish and eggs may be killed.

Water temperature is another quality parameter that can have major affects. If the water is too warm during periods of low flows, the fish may die from disease or lack of oxygen. Low water temperatures are not a major concern in the Rogue River. Storage in Applegate and Lost Creek Reservoirs is being used to augment downstream flows and reduce water temperatures in the Rogue and Applegate Rivers. Lost Creek Reservoir can be drafted at several levels depending on the temperature desired downstream. These reservoirs have no affect on the tributary streams which have the most severe water temperature problems. Flow augmentation is presently not available on most of the tributary streams.

Chemical pollution, such as industrial waste, insecticides, herbicides and other toxicants, occurs in the most heavily populated areas near Medford and Grants Pass. The presence of toxins in the water can be lethal to fish and aquatic life.

Industrial Use

Presently, there are few problems with water quantity for industrial use. Most of the industrial water users are located in the Medford and Grants Pass urban areas and use water from the municipal water systems. The municipal water systems of Medford and Grants Pass supply approximately 25 and 15 percent, respectively, of their total daily usage to industrial users, mostly for log ponds, steam boilers and industrial processes. Other industrial uses are generally small and are obtained by diversions from small streams, and ground water, or storage.

The largest water-using industry in the basin is the wood products industry, which requires large amounts of water in the manufacture of plywood, particle board and veneer. The food processing enterprise is the second largest water-using industry. Fruits, vegetables and dairy products are processed commercially in the basin. Other significant water-using industries in the basin include the electronics industry, film products industry and charcoal products industry.

As part of the Rogue River Basin update, the Water Resources Department conducted a Municipal-Industrial Water Use Survey in 1980 by sending questionnaires to basin municipal and industrial water users. Based on survey results, annual industrial water use shows a fairly even seasonal distribution. The basin industrial use peaks during the month of September at about 11.5 percent of the total annual use. April is the month of lowest use at roughly 6 percent.

Processing, cooling-condensing, facility and equipment washing, and sanitation are the major industrial water use categories accounting for 45, 36, 13, and 4 percent, respectively, of total industrial water use. The remaining two percent is used for various purposes such as dust control and sprinkling.

Nearly all of the industries in the basin responding to the Water Use Survey indicated that their water supply was adequate for presently contemplated needs and uses, regardless of source. Generally, water quality is also satisfactory to meet the present needs of industry in the basin.

The major concern with industrial water use is the effect of industrial discharges on water quality. Effluents from fruit processing, wood products manufacturing, and other industrial water uses, if not properly treated, can contribute directly to the decline of water quality of basin streams.

Irrigation and Agricultural Use

An adequate supply of water for agriculture is an important factor in the economy of the Rogue River Basin. For example, in 1981 the total gross value of all crop production in Jackson and Josephine Counties was estimated by the county Extension Service to be $20.471 and $3.862 million, respectively, for a basin total of $24.333 million. Agricultural production in the Curry County portion of the basin is negligible. Over 60 percent of the total crop production value is attributed to orchard crops of tree fruits and nuts, mostly pears in the Medford area. Specialty crops, such as hops, grapes and nursery products comprise over 20 percent of the total crop value. All of these crops require water for either irrigation or temperature control. Grapes are an example of a high cash value crop which is becoming commercially viable on relatively small acreages. There already are several small wineries in the basin.

Based on the Department's 1979 land use inventory of the Rogue River Basin, there are about 128,200 acres of agricultural croplands in the basin, of which 101,000 acres, or nearly 80 percent, are presently irrigated to some extent (see Table 5 and Plate 2). Approximately 125,150 additional acres have the potential to be irrigated if economically feasible, water supplies are available, and the land is designated in the county land use plans for farm purposes. Crop production from additional acreage could be economically significant to the basin economy. Many marginal dry land farming operations could become significantly more productive if adequate water supplies were available. The Jackson County Soil and Water Conservation District has estimated that the total increased crop value from irrigation water stored in the Lost Creek - Elk Creek reservoir system to Sams Valley Irrigation District could be $3.5 million annually.

Adequate water supplies for irrigation have historically been a problem in the basin and continue to limit agricultural growth. Low streamflows in summer, in conjunction with high average temperatures and little precipitation, make irrigation essential if production from agricultural lands is to be maximized. For example, the average annual precipitation in the Medford area is about 20 inches, with only about 6 inches occurring during the April 1 to November 1 irrigation season. Pasture grass, alfalfa, and orchards with cover require about 30 inches of water per season. For a given crop, the irrigation requirement will vary from one year to the next, depending upon rainfall, temperature, humidity, soil moisture, solar radiation, wind, and length of growing season. Thus, the irrigation requirement for the above crops will average about 24 inches per year. Furthermore, several thousand acres of irrigated lands do not receive a full supply of water which limits the type of crops grown and production.

Irrigation began in Oregon in 1852 on what is now part of the Talent Irrigation District. The practice quickly spread throughout the basin and several private systems were in operation by 1860. These early systems required direct diversion from streams with no provision for storage. Agricultural census information has been available since 1919. Data indicate that irrigation steadily increased in the Central Valley region of the basin until 1944, held constant through 1964, when it began a slow decline to urban and rural development, and increased again with the construction of two Rogue Basin projects and completion of the Talent Project.

Irrigation districts were formed to construct projects and deliver water to help alleviate water shortages in many areas of the Rogue River Basin. The problem was especially intense in the Bear Creek - Little Butte Creek Subbasins where several of the larger irrigation districts were established to overcome the water shortage. Through networks of canals and reservoirs, irrigation districts store and transport water from basin to basin supplying water to subscribers.

The Talent Irrigation District annually diverts an average 17,030 acre-feet from the Little Butte Creek Subbasin to the Klamath River Basin, 38,980 acre-feet from the Klamath Basin back into the Bear Creek Subbasin through the Green Springs power plant, and about 1440 acre-feet from the Little Applegate watershed to Wagner Creek. Medford and Rogue River Valley Irrigation Districts annually divert an average 4910 acre-feet from the Klamath Basin to the Little Butte Creek Subbasin and 25,450 acre-feet from the Little Butte Creek Subbasin to the Bear Creek Subbasin. Eagle Point Irrigation District normally diverts 55,500 acre-feet per year from the Big Butte Creek watershed for use in the Big Butte Creek, Little Butte Creek and Reese Creek watersheds. These average annual diversions are based on records obtained from gaging stations on diversion canals for the respective irrigation districts. The amounts of water diverted may vary greatly from year to year depending on existing crop, soil, weather and water supply and demand conditions.

Major factors affecting future irrigation needs in the Rogue River Basin are conversion of lands from agricultural to nonagricultural uses, insufficient water supplies and the subdivision of irrigated land into smaller parcels or lots. While these smaller parcels may continue to be irrigated, they are usually too small to be of commercial value. Land division can lead to delivery system problems. For example, instead of having to deliver water to one 100-acre parcel of land, there might be 20 5-acre parcels requiring delivery. Land partitioning is occurring in many parts of the basin and will continue placing greater demands on the land and water resources.

To provide adequate water supplies in the Sams Valley and Merlin areas, two irrigation districts have been considered. Sams Valley Irrigation District is presently seeking federal assistance to construct a delivery system to service 15,000 to 19,000 acres of land. Possible sources of water would be the natural flow of the Rogue River or stored water from either Lost Creek or the proposed Elk Creek Reservoir. The original plan for the Merlin Irrigation District is no longer applicable because of the increased rural development within that area. Much of the land identified for irrigation has already been subdivided to nonfarm uses. There is still a great need for stored water in the Merlin area, but the intended uses have been modified to include industrial, municipal and hydropower. Louse Creek, Jumpoff Joe Creek and storage in the potential Sexton Reservoir project could supply the water for a modified Merlin project.

Other factors relating to the water supply include the condition and efficiency of the delivery systems, methods of irrigation, cropping patterns, and the use of water for frost or temperature control. Most of the irrigation districts have open, unlined ditches and canals which lose water through seepage and evaporation. As more efficient irrigation methods are studied and developed, existing water resources will be able to supply irrigation water to more areas.

Many orchards in the basin are currently converting from oil heaters to overhead sprinklers for frost protection. The water necessary to supply this new demand must come from natural streamflow or water allocated from storage since ground water supplies are generally inadequate. The increased use of water for temperature control in summer, however, may offset any water savings realized through research or more efficient irrigation practices.

Historically, there has been more of a problem with quantity than quality of irrigation water in most areas of the basin. One area having acute quantity and quality problems is the highly developed Bear Creek Subbasin.

According to a USGS study on water quality in the Bear Creek Subbasin, the water quality in Bear Creek deteriorates as it moves from the headwaters downstream to the mouth (USGS, 1980). Certain forms of pollution, such as increased turbidity and bacterial levels and decreased dissolved oxygen concentrations, are more frequent during the irrigation season than during the non-irrigation periods. Concentrations of certain forms of nitrates and nitrogen, however, are generally lower during the irrigation season than at other times. Outside the Bear Creek Subbasin, water quality is generally adequate for irrigation purposes.

According to the USGS water quality study, irrigation-related activities that could improve the quality of water are listed below:

1. When irrigation of farm plots is controlled so as not to allow outflow to occur and normal irrigation-return flow is left in streams, water quality of streams will not be directly affected by irrigation-return flow and the quality should improve.

2. Ponds or settling basins can remove some suspended sediment and turbidity-causing materials from irrigation-return flows.

3. The irrigation of pastures removes some nitrate, suspended sediment, and other turbidity-causing material from water. This suggests that grass-lined waste ditches and grass cover orchards could improve irrigation-return flow quality (USGS, 1980).

The Irrigation Subcommittee of the Jackson County Water Resources Advisory Committee has submitted a list of problems and needs relating to irrigation in order of priority:

1. There is insufficient basinwide storage capacity. In Jackson County alone, supplemental irrigation water of 19,000 acre-feet per year to meet water needs during the growing season and 103,000 acre-feet per year to meet expansion of 32,000 acres of agricultural land plus 5000 acre-feet to meet sprinkler frost control is needed.

2. Most of the stored water in the Rogue Basin is allocated and the demand is increasing. The hydrological data provided by the Oregon Water Resources Department shows a positive quantity of water available in the Rogue Basin during winter flows. The limiting factor is providing sufficient water for future irrigation needs which can be solved by identifying suitable storage sites and constructing adequate storage facilitites.

3. There is a general lack of public awareness of irrigation principles.

4. Frost protection and high petroleum prices necessitate additional water use for this purpose.

5. Parcelized subdivision of agricultural lands has resulted in: a) increased water demand; b) increased runoff; c) decreased efficiency: and d) increased work load for irrigation districts.

6. Water quality in the Bear Creek Basin decreases in the downstream reaches due to constant reuse of water and proportional increases in pollution from failing septic systems, urban runoff, industrial discharges and agricultural runoff.

7. Basin ground water resources are typically insufficient for consideration as an additional water supply for anything but individual domestic uses.

Additional irrigation problems identified by the subcommittee include:

There are legal restrictions to supplying water for temperature control prior to April 1 as well as water supply limitations for frost control throughout the frost season.

Irrigation district management policies and procedures vary among irrigation districts in the Rogue Basin--an awkward situation for the many parcels served by more than one irrigation district.

Irrigation districts are generally understaffed to handle any increase in ditch maintenance time (non-irrigation season) or increased administration resulting from the increasing number of parcels served (parcelization).

County land use policies, especially zoning, need to be more responsive in relating water availability to long-term agricultural designations.

Irrigation Subcommittee recommendations relating to problems 1 through 7 above include:

1. Urge the immediate construction of the Elk Creek Project to the Water Policy Review Board.

2. Every tributary stream in the Rogue Basin should be examined for a potential storage site that is consistent with environmentally sound site selection criteria.

3. Priority of storage site identification and selection should be placed in the Bear Creek Valley because of the acute shortage of irrigation water and the present high reuse of existing irrigation water, the concentration of the population center of the Basin and the resulting unacceptable environmental conditions that exist in the Bear Creek Valley.

Mining Use

Present mining activity in the Rogue River Basin consists mainly of sand and gravel operations with intermittent gold mining occurring along the main stem and some of its tributaries during high water periods. Actual basin water use for mining purposes is slight and generally nonconsumptive. Some mining operations, however, may dewater or substantially reduce flows in stretches of streams between the diversion and the return points. Water use for mining is prohibited on many streams during the summer low flow season to minimize potential water use conflicts and water quality concerns. Since much of the mining use is limited to high water periods only, available water supplies for mining are usually more than adequate.

As of 1980, the total rights of record for mining uses in the Rogue River Basin are 3155 cubic feet per second. The majority of these rights date back to the active placer mining years from 1850 - 1940. Few of these rights have been exercised since the mid-1950's, and none to the extent originally anticipated. While the exact number and quantity of unused mining water rights is unknown, there is uncertainty for present and future water users as to the potential for some of these rights to be used. At present there is no actual injury to other water users from mining rights remaining on record since the unused water remains instream. Furthermore, the department may institute legal proceedings on a case-by-case basis if anyone attempts to reactivate unused water rights. Even though few mining rights are presently being exercised, future water requirements for mining probably will not significantly increase above the present level of use.

As with irrigation and industrial uses, water quality does not present a problem to the mining industry, but mining can in some cases affect water quality by increasing erosion and sedimentation and modifying the natural channels. More mining activities within stream beds were allowed in the past than today. Mining activities adjacent to creeks have the potential to increase sediment loadings if practices require multiple creek crossings or utilize the water for washing. Mining activity on steep slopes can aggravate natural erosion rates. Instream quarry and gravel operations, however, create the most adverse impacts by directly altering the streambed and creating turbidity and sedimentation. Any alteration of stream cross-section, slope, friction or length of channel affects flow conditions in upstream and downstream reaches by changing the velocity and stage and thus the discharge.

Municipal Use

This section is based largely upon information obtained from the department's 1980 Municipal-Industrial Water Use Survey of the Rogue River Basin.

Sources of water supply for municipal water systems are fairly evenly distributed among wells, springs and streams. The cities of Medford, Central Point, Eagle Point and Jacksonville, however, all receive their supplies from one municipal water system - the Medford Water Commission.

In terms of volume, springs provide the greatest amount of municipal water. This is because the City of Medford Water Commission, the largest purveyor of municipal water in the basin, obtains about 72 percent of its supply from Big Butte Springs near Butte Falls. This amounted to nearly 4.6 billion gallons (over 14,000 acre-feet) in 1979. The combined diversions of all other municipal systems from surface sources other than springs amounted to about 2.34 billion gallons (nearly 7,200 acre-feet) in 1979, most of it from the Rogue River.

Where smaller municipal systems have no access to dependable and safe surface water supplies, ground water is used. The City of Phoenix, White City and two other small community systems rely entirely upon ground water for their water supplies. Phoenix supplied nearly 122 million gallons of water in 1979. The City of Cave Junction, however, relies on a combination of surface and ground water sources.

The combined total for all municipal systems reporting the annual amount of water delivered was approximately 8.9 billion gallons to domestic, industrial and commercial users in 1979. This amount is equivalent to about 27,250 acre-feet per year or roughly 24.3 million gallons per average day of use. Municipal water rights are described in more detail in the Subbasin Inventory Sections in Part V.

Municipal water use in the basin follows a marked seasonal pattern. Water use during the June through September period accounts for about 50 percent of the total annual use. The months from November through April exhibit fairly consistent levels of water use ranging from 5 to 6 percent of the annual use each month. July is the month of highest use at about 14 percent of the total annual amount; February at 5 percent is the month of lowest use.

Most of the municipal water system survey respondents indicated that 75 to 85 percent of their water is delivered to households. Community systems generally supply 95 to 100 percent of their water to individual residences. Medford Water Commission and the City of Grants Pass are the exceptions to this trend. About 45 percent of the water delivered by the Medford Water Commission, including that supplied to Central Point, Eagle Point and Jacksonville, is delivered to residences. Grants Pass reported only 13 percent of its water supply is provided to households.

Most cities experienced substantial population growth and development during the 1970's, increasing the demand on municipal supplies and requiring the expansion of existing systems. Present water supplies are still generally adequate to meet existing municipal needs (see Table 22). The exception to this is the City of Shady Cove, which does not presently have a municipal water system. Each household in Shady Cove is now being supplied by individual wells. Shady Cove is currently in the process of installing a central sewer system. It is expected that a municipal water system, to provide not only water service but fire protection, will be installed in the near future.

Pollution Abatement

There are insufficient quantities of unappropriated water available to use exclusively for pollution abatement purposes. Inadequately treated effluents compounded by depletions can have adverse effects on some basin streams during seasonal low flow periods.

Adopted minimum perennial streamflows, however, serve a dual function of providing adequate flows for pollution abatement purposes as well as for fish and aquatic life. Minimum streamflows have not historically been adopted to satisfy instream water quality requirements. The use of stored water for flow augmentation during seasonal low flow periods, however, could increase a stream's capacity to assimilate pollutants. A stream's assimilative capacity is related to the physical and chemical characteristics of the water, such as temperature, dissolved oxygen and streamflow.

In general, Rogue River Basin water quality is very good. Pollution has become a major concern in some areas of the basin, particularly the Bear Creek Subbasin and some lower reaches of the Rogue River during low flow periods. With increased development it could become a problem in other areas. As pollution increases, use of water to minimize that pollution could become more cost-effective than relying entirely upon expensive advanced wastewater treatment plants.

TABLE 22

ROGUE RIVER BASIN

1980 MUNICIPAL WATER USAGE

JACKSON COUNTY	EST.POP. SERVED	ANNUAL DEMAND, MIL.GLS.	AVG. DLY. DEMAND, MGD	MAX. DLY. DEMAND, MGD	AVG. DLY. PER CAPITA DEMAND, GAL.
Ashland Water Dept.	15,500	1,341	3.67	7.50	237
Butte Falls	350	19	0.05	0.11	149
Gold Hill	864	93	0.25	0.53	295
Medford Water Commission (includes Central Point, Eagle Point & Jacksonville)	60,389	6,550	17.95	37.10	297
Phoenix Water Dept.	2,306	123	0.34	0.79	146
Rogue River	1,306	70	0.19	0.42	147
Shady Cove	1,090	-----	-----	-----	---
Talent Water Dept.	2,539	103	0.28	0.81	111
Josephine County					
Cave Junction	1,150	108	0.30	-----	258
Grants Pass	15,000	1,309	3.59	-----	239

MGD = million gallons per day

Normally, water quality standards established to meet the most sensitive uses such as recreation, fish and other aquatic life are generally suitable to serve other beneficial uses. Special quality considerations for navigation, mining activities and hydropower development are not deemed necessary.

The Department of Environmental Quality has established water quality standards including descriptive and numerical limits for specific water quality parameters to protect the beneficial uses for which the water is classified.

Existing water quality in most basin streams is generally adequate for most beneficial uses of water. Excessive levels of typical pollutants that could limit or prohibit some uses of water are listed below by source.

1. Sewage-treatment-plant effluent: Ammonia, nitrite, nitrate, and organic nitrogen; total phosphate and orthophosphate; organic material, as measured by ultimate biochemical oxygen demand (BODu) and total organic carbon (TOC); and fecal coliform bacteria.

2. Combined-sewer outflow: Organic material, fecal coliform bacteria, and low dissolved oxygen.

3. Log-pond outflow: Turbidity, suspended sediment, organic material, and ammonia.

4. Ground-water seepage: Nitrate; toxic waste.

5. Irrigation-return flow: Suspended sediment, turbidity, and nitrate from orchards; orthophosphate from pastures; and fecal coliform bacteria from both orchards and pastures.

Power Development

Since 1980 there has been an increased interest in renewable energy resources, especially hydropower development. This renewed interest has been the result of changes in federal law requiring utilities to purchase power generated at hydropower projects, and tax and other financial incentives available to the power developer. The intent of these changes was to stimulate renewable resource development which would supplement the use of, or even reduce the need for, imported oil, other fossil fuels and nuclear generators.

The result has been a significant statewide increase in hydropower permit applications. In a three-year period from January 1980 to January 1983 the department has received 17 preliminary permit applications and 2 municipal applications on Rogue River tributary streams.

In its Regional Conservation and Electric Power Plan of 1983, the Northwest Power Planning Council has indicated that Bonneville Power Administration's (BPA) resource acquisition programs "should be designed to accomodate surplus power conditions without hindering Bonneville's ability to meet long-term resource requirements at the lowest cost and in a manner consistent with the (resource) priorities" of PL 96-501. The Council also stated in its regional energy plan that "each resource must be evaluated on the basis of how it will perform in conjunction with the region's enormously valuable (existing) hydropower system". Some potential hydropower projects in the Rogue River Basin may complement the existing Columbia River hydropower system by providing power during the winter when regional demand is greatest. On the other hand, some hydropower projects may only add to the spring power surplus from the Columbia River power system and may be unavailable during the winter due to low winter flows or frozen streams.

Use of water for hydropower projects can have major impacts on other water uses. The regional power plan requires that "regional resource acquisition decisions must include consideration of environmental quality and the protection, mitigation, and enhancement of fish and wildlife".

Power development may also have adverse impacts on recreation, aesthetic and land uses. Water quality is not a problem for use in power development. Power development may cause water quality problems, however, particularly where dewatering of stream reaches occurs. In such cases, the temperature of the water remaining in the stream may rise to unacceptable levels for aquatic life. The high water temperatures can also stimulate growth of bacteria and algae. Construction activities can alter the streambed and cause sedimentation.

Annual streamflow distribution is a particularly important consideration in power production, especially in the type of existing low-head installations in the Rogue River Basin. Quantities of flow limit the power capacity of potential installations. Power production from run-of-river installations (e.g., not having storage to augment low flows) is dependent upon the discharge characteristics of the stream system involved. Since turbines only operate within a fixed range of flow, seasonal low flow extremes reduce the output from existing Rogue Basin installations while high flows are bypassed.

Power development is not allowed by statute on the Rogue River from its intersection with the south line of Section 27, Township 33 South, Range 1 East of the Willamette Meridian to its confluence with the Pacific Ocean. This is essentially from Lost Creek Dam downstream to the mouth.

The 1981 power capacity in the Rogue River and its tributaries is 112 megawatts.

Recreational Use

A high percentage of today's population participates in some kind of water-oriented recreation. This recreation may be passive or active; but in the majority of cases the recreationist prefers to be near, on, or in water. Swimming, boating, rafting, sailing, water skiing, windsurfing, fishing, camping or picnicking are enhanced by an adequate supply of clean water. Thus, the main factors of water demand for recreation are quantity, quality and accessibility.

The Rogue River Basin has nearly 5100 miles of streams. The basin has three main rivers: the Rogue, the Applegate, and the Illinois. The lower reaches of the Rogue and Illinois Rivers are included in the State Scenic Waterway Program. The lower Rogue River is also part of the national Wild and Scenic River system, while the Illinois River is presently being considered for inclusion in that system. Most unregulated streams in the basin share a common condition; limited or inadequate streamflow from July through October, which creates a problem for recreational use since the majority of recreational use also occurs at that time.

The main stem Rogue has gained an international and national reputation for its salmon and steelhead fishing and whitewater boating. Water released from Lost Creek and Applegate Reservoirs for fishery enhancement also provides streamflows in the main stem to meet the recreational needs during seasonal low flow periods. Driftboats, rafts, jetboats, and fisherman all make use of the lower Rogue River, particularly downstream of Grants Pass. Private and commercially guided river trips also contribute significantly to the local economy.

Recreational use of the Rogue Wild and Scenic River section has shown a remarkable increase. From only 4342 people using the permitted section of the river in 1968, use increased nearly 160 percent to 11,174 visitors in 1981. Noncommercial permitted use, such as drifting by boat, kayak, or raft, increased nearly 500 percent during the 1973-1982 decade. In 1974, a moratorium was placed on the number of commercial outfitters operating on the river. The number of people on commercial trips increased only 38 percent during the 1973-1982 period. Use controls in the form of permits for all types of recreational use in the Wild and Scenic River segment are administered jointly by the U.S. Forest Service and Bureau of Land Management.

Nearly 100 lakes and reservoirs over 5 acres in size throughout the Rogue River Basin also provide numerous recreational opportunities. Most of the natural lakes are small and are found in the eastern part of the basin on the western slopes of the Cascades. The construction of Applegate and Lost Creek Reservoirs and the enlargement of Emigrant Lake in the Talent project have increased the water surface area of lakes in the basin several fold. As recreational facilities are developed on these lakes, the uses are expected to increase. The construction of the proposed Elk Creek Dam would also add to the recreational potential of the basin.

Physical characteristics of water such as clarity, color, temperature, and odor, are important from an aesthetic viewpoint where water is used for recreation purposes. Bacteriological characteristics are important from a health standpoint, and some chemical characteristics are of significance in waters used for human contact or consumption in developments such as campsites and parks. Most waters of the basin are of adequate quality for recreational purposes. Certain areas have water quantity and quality problems during the summer months, limiting recreational potential. Development concentrated in small geographical areas often results in adverse water quality conditions, especially during the summer low flow period. Public health problems can make water unfit for recreational uses such as swimming and fishing. Bear Creek, which drains the most populated area in the basin, has the most severe water quality problems affecting to recreational uses due to both urban and agricultural runoff.

Wildlife

The Rogue River Basin supports a wide variety of game and nongame animals and birds. Wildlife water requirements vary widely, but all need a sufficient quantity of unpolluted water to exist. The present supply of water in the basin is sufficient to supply the needs of most wildlife forms.

Before the basin was settled, wildlife were sustained by the natural streams, lakes, ponds and marshes. The present level of development in the basin has destroyed or changed much of the natural wildlife habitat as well as altered the character of many basin streams.

Wildlife populations are significantly affected by changes in habitat caused by increased development and changed land use patterns. Basin population increases and development pressures have gradually reduced the habitat of wildlife that require wild areas, while logging or construction of ponds, reservoirs and irrigation canals have altered habitat in ways that are beneficial to some species.

Upland game and waterfowl utilize ponds, reservoirs, wetlands, and irrigated areas for habitat. The substantial increase in lake area in the basin due to reservoir construction in the past decade has increased the nesting, feeding and resting habitat for waterfowl, shorebirds and raptors such as bald eagles and osprey. Populations of furbearers such as muskrat, mink and raccoon have also increased in this new habitat. There are numerous sloughs and wetlands providing wildlife habitat along the main stem Rogue River, especially in the section from Shady Cove downstream to Gold Ray Dam.

Although irrigation can alter the natural riparian habitat, irrigation canals can provide an aquatic habitat for a variety of birds and animals. They have created additional riparian zones that are valuable for cover, nesting and feeding for a wide variety of song birds and a few game birds such as quail and doves. Furbearers and big game animals such as deer also utilize the cover in the riparian zone. Irrigated crops, including orchards and hay, meet the roosting, nesting, feeding and cover requirements for a variety of birds and mammals.

Water quality is satisfactory to meet the needs of existing wildlife in the basin. Most wildlife species are located in less developed areas that typically have good quality water.

WATER CONTROL

Flood Control

The Rogue River has a history of flood events which have caused extensive damage throughout the basin. As basin population and development increase, the potential damage caused by a flood also increases. The largest, recent, land-inundating flood in the basin occurred in December, 1964.

The 1964 flood was caused by a combination of melting snow and extremely heavy warm rains. The soil was unable to absorb excess water, causing extremely high levels of runoff, with a peak discharge of 152,000 cubic feet per second in the Rogue River at Grants Pass.

Based on the Portland District Corps of Engineers Postflood Report of 1966, damages related to the 1964 flood exceeded $25 million in the Rogue River Basin. The Corps also estimated that flood control devices existing at the time, such as Emigrant Reservoir and Bear Creek and Pierce Riffle revetments, saved about $580,000 in damages.

The U.S. Congress has authorized three multiple-purpose storage projects on Elk Creek, Applegate River, and Rogue River. Lost Creek Dam on the Rogue River, and Applegate Dam on the Applegate River have been constructed by the Corps of Engineers, while Elk Creek Dam proposed on Elk Creek is in the pre-construction stage and has not yet been funded. The Corps of Engineers estimated that about $8.9 million in damages would have been avoided if Lost Creek and Applegate reservoirs had been in operation during the 1964 flood. The Elk Creek project would have reduced the damage an additional $2.3 million. The Corps also estimated that Elk Creek and Lost Creek Reservoirs would have reduced the peak flow of the Rogue River at Grants Pass from 152,000 to 106,000 cfs, a stage reduction of 6.7 feet. The three reservoirs could have reduced the peak flow of the Rogue River below the confluence with the Applegate River by 25 percent.

The following excerpt from a 1966 Postflood Report by the Corps of Engineers lists the recurrence frequency of the 1964 flood in the basin:

"The relative magnitude of the December 1964 flood at the various gaging stations in the Rogue River Basin varied in terms of probable recurrence frequency. Unit runoff rates were the highest in the southwest portion of the Basin, although the main stem stations in the middle of the Basin experienced record high discharges. The following tabulation shows the probable recurrence frequency of the December 1964 flood at a number of key stations:"

STREAM	STATION	RECURRENCE INTERVAL OF DECEMBER 1964 FLOOD
South Fork Rogue River	Prospect	55 year
Elk Creek	Trail	50 year
Rogue River	Grants Pass	50 year
Rogue River	Raygold	60 year
Rogue River	Dodge Bridge	55 year
Applegate River	Applegate	60 year
Illinois River	Kerby	65 year

Table 23 lists the peak discharges of the major flood events for the Rogue River at Raygold and Grants Pass. The 1964 flood has the largest recorded discharge with only the estimated discharges for the 1861 and 1890 floods being larger.

Flood control by means of storage not only reduces damages to flood plain property but can also provide water for other beneficial uses during low flow periods. In addition to storage, there are alternative methods to decrease the damage caused by floods. County comprehensive land use plans and local zoning laws and ordinances can limit development in areas that are commonly flooded, eliminating some potential flood damage. High-hazard developments can be relocated outside the flood plain. Channel modification can reduce local damages by increasing the water velocity and decreasing the peak stage of the water, but channel alterations can frequently increase impacts downstream. Flood waters can be diverted around developed areas through bypasses or floodways. Building Codes may require flood proofing. The effectiveness of any flood control measure depends on many factors including the location of existing development, physical characteristics of the stream and floodplain, the runoff patterns of the watershed, and the willingness of the basin populace to accept and implement control measures.

TABLE 23

MAJOR FLOODS IN THE ROGUE RIVER BASIN

FLOOD	ROGUE RIVER AT GRANTS PASS PEAK DISCHARGE IN CFS	ROGUE RIVER AT RAYGOLD PEAK DISCHARGE IN CFS
November - December 1861	175,000*	131,000*
February, 1890	160,000*	120,000*
February, 1907	60,500*	60,000*
November, 1909	70,000*	61,700*
February, 1927	138,000*	110,000*
December, 1942	54,400	40,500
December, 1945	70,000	48,000
January, 1948	59,900	46,200
October, 1950	65,400	43,100
January, 1953	77,000	56,500
December, 1955	135,000	110,000
January, 1958	63,200	44,900
December, 1962	99,800	88,900
December, 1964	152,000	131,000
January, 1966	61,800	37,400
January, 1970	59,200	44,400
January, 1971	87,100	60,900
March, 1972	82,500	66,200
January, 1974	96,400	63,600
March, 1975	56,000	41,800

* Estimated Instantaneous Discharge

Reservoir storage provided by Lost Creek, Applegate and the authorized but unconstructed Elk Creek Projects are considered to provide an acceptable level of flood control on the Rogue and Applegate Rivers. Control by the use of levees for local protection would not be cost effective and would involve large commitments of riparian land and money.

Channel alteration would be beneficial in many areas. One method is removal of debris which often acts as a deflector and forces destructive currents directly into the stream banks, resulting in more cutting and more debris being carried away by the waters to lodge further downstream and repeat the process. Debris removal is relatively expensive and requires continual maintenance to keep the stream free of debris.

Emergency evacuation or permanent relocation of development endangered by flooding is a possible and practical method of reducing flood damages. This is especially true in areas where development is so sparse that costly methods of flood protection are not justified.

Bank revetments to prevent erosion are costly and this method of control is usually found only where the property values are sufficiently high to satisfy

economic justification. Some revetments have been financed by the affected property owner(s) in the basin and, where properly constructed to avoid downstream impacts, have proven highly successful.

Watershed management or land treatment can also help reduce flood peaks. In the Rogue River Basin, streamflow and rainfall patterns are similar. Rapid runoff from many of the tributaries often produces peak flows within hours after a storm. Improper land management practices, such as streamside vegetation removal or clearcutting large areas of a watershed, tend to aggravate this condition. The basin topography is such that stream gradients flatten out and the valleys broaden in the lower reaches of the main stem and tributaries. In these regions, flood waters flow with greatest depth and overflow streambanks inundating agricultural lands and eroding drainage improvements adjacent to the streams.

The National Flood Insurance Program, as provided by the Flood Disaster Protection Act of 1968, is administered by the Federal Emergency Management Agency. To qualify for participation in this program, a community must meet certain requirements. These include identification of the 100-year floodplain and adoption and enforcement of land use regulations or other control measures to limit the amount and type of development in floodprone areas. Some of the basin counties have recently adopted local flood control ordinances to meet the requirements of minimizing flood damges.

Generally, county flood control ordinances have these major purposes:

1. To restrict or prohibit uses which are dangerous to health, safety, or property in times of flood, or which cause excessive increases in flood heights or velocities;

2. To require that uses vulnerable to floods, including facilities which serve such uses, be protected against flood damage at the time of initial construction;

3. To protect individuals regarding purchase of lands which are potentially unsuitable for specific purposes because of flood hazard.

These purposes are effectuated by requiring various types of review by the county Planning Director, Planning Commission and Building Safety Director. Regulations govern placement of water, sewer and septic systems; drainage provisions; structural modifications (e.g. anchoring, types of construction material, floor height above base flood level); and construction methods and practices.

Drainage

Drainage applies to systems whose main purpose is removing excess water before it has reached major stream channels. The three most common drainage tasks are urban storm drainage, land drainage and highway drainage.

Some drainage problems exist in the Rogue River Basin which are limited mainly to individual farms or small areas. Drainage situations include such problems as urban stormwater drainage, cropland drainage, wetland alteration, restricted outlets of creeks, the filling in of small drainageways resulting from construction of subdivisions or other types of land use, high water tables resulting from irrigation of higher lands which cause subsurface flows to raise the water table, inadequate or defective diversion structures and conduits, and reduced capacity of waterways from siltation or natural and manmade obstructions.

Urban land drainage, while necessary in the developed portions of the basin, can create water quality problems in receiving waters that can limit its beneficial uses. Bear Creek is an example of a stream receiving drainage from a heavily developed area. Bear Creek has experienced past water quality problems at least partially attributable to pollutants contained in urban runoff.

The soils of some farms in the basin have poor drainage characteristics. Drainageways and subsurface tile drains can be installed to permit better water movement and crop yields. The drainage from these lands, however, may contain soluble constituents from the soil and residual amounts of those materials added to the soil, such as fertilizers, herbicides and pesticides.

The cropland drainage can enter surface streams at many places and can be a nonpoint or diffuse source of contaminants for streams, impacting other beneficial uses of the water.

Alteration of natural wetlands can also impact the uses of surface waters. In the past, wetlands have been altered for other uses - filled for urban or residential development, dredged for recreational uses, or drained for agricultural production. Left in their natural state, however, wetlands provide valuable habitat for wildlife and fish life, help to reduce flood peaks, and assist in maintaining water quality by trapping and storing nutrients and sediments which might otherwise lower the water quality of receiving waters. Wetlands can also provide open space and recreational opportunities in urban areas and serve as outdoor ecological classrooms.

Erosion and Sedimentation

Damages resulting from erosion and sedimentation are significant in the basin, although difficult to evaluate. Some erosion and sedimentation occurs due to geologic causes and is the natural degradation of the earth's crust. The largest areas subject to geologic erosion lie in the National Forest boundaries, and resulting sedimentation generally does not reach major drainage systems due to the high density of natural vegetation.

The rates of erosion and resultant sedimentation have been accelerated by human use and management of lands, vegetation, and streams. Serious erosion and sedimentation problems have been caused by logging and road building practices which have not provided for soil stabilization. Some of these practices have eliminated vegetative cover from much of the volcanic ash and pumice type soils which, when exposed or disturbed, are highly susceptible to erosion.

Erosion rates can increase due to agricultural activities such as removal of the natural vegetative cover of the land, especially in the riparian area; plowing and cultivation which decrease the erosive resistance of the soil; and the trend to large planting and harvesting equipment, which may not be compatible with accepted soil conservation practices for small land areas with steeply sloping lands. Improper farming methods, overgrazing of rangeland, and poor water management also have been responsible for erosion. The resulting sediment deposits have caused problems in irrigation structures, canals, waterways, and reservoirs and accelerated the eutrophication process in standing water and lakes. Erosion can add salts and nutrients, especially phosphorous, to surface water. Some salts and nutrients are contained in the soils and are dissolved during peak runoff periods creating heavy nutrient loadings to surface waters. Other nutrients are transported to waterways attached to the soil particles. Mining operations may also add to the sedimentation problems.

Sediment can blanket game fish habitat and spawning areas, reduce the recreational value of water, is a carrier of plant nutrients, crop chemicals, and plant and animal bacteria, and can increase water treatment costs. Proper erosion control using best management practices is a positive solution to sediment problems.

PART IV

THE BASIN POTENTIAL

PART IV

THE BASIN POTENTIAL

PART IV - THE BASIN POTENTIAL

FUTURE GROWTH

An important factor in determining the future needs of the Rogue River Basin is the rate at which the population of the basin is expected to increase. All three counties in the basin have experienced a rapid rate of growth since 1940 as is shown in Table 3 which charts the population growth data for the Rogue Basin from 1930 to 1980. Of the total estimated 1980 basin population of 194,621, 68 percent reside in Jackson County, 30 percent live in Josephine County, and about 2 percent are residents of Curry County.

The basin's population has been increasing steadily since the 1930's. The most dramatic growth, however, occurred during the post-war years of the 1940's and the decade of the 1970's (see Table 3). Josephine and Jackson Counties were the third and sixth fastest growing counties in the state, respectively. The main source of this population growth in the 1970's was in-migration to the basin.

Over three-fourths of the 1980 basin population reside in the Rogue River-Bear Creek urbanizing valleys. It is expected that the Central Valley region will continue to be urbanized and contain the vast majority of the basin population. Urban centers in the outlying parts of the basin will probably also experience continued population increases.

Basin population projections vary widely depending upon economic and demographic assumptions. The projections shown in Table 4 for Jackson and Josephine Counties were made prior to the 1980 census. Assuming that the Curry County portion of the total basin population is about 2 percent, the year 2000 population for the Rogue Basin varies from a low projection of roughly 250,000 to a high projection of about 300,000 persons.

Most of the projected population increase will probably be the result of in-migration. If as the basin continues to depend heavily upon the lumber and wood products industry, employment and population will be subject to the major fluctuations of the industry due to cyclic economic conditions.

Estimates of population growth for various basin municipalities are included in the following Municipal Use section. Other indicators of growth, including economic trends, are included in the General Economic Development section in Part I.

Future economic growth in the Rogue River Basin lies in the development of a diversified economic base. Industrial and manufacturing development in areas other than wood products would help provide a greater resiliency to economic downturns. Although development of a more diverse economic base is slowly occurring in the basin, the timber industry is expected to play a continuing major role in the basin economy.

AVAILABLE WATER SUPPLY

Increasing population projections and economic growth forecasts imply that, to a large extent, the future of the Rogue River Basin will depend upon the degree of natural resource utilization. Since water is a controlling factor in resource development, the general welfare of the basin is based primarily upon adequate quantities of good quality water available for both instream and out-of-stream uses.

The average yield of water in the basin, approximately 8.2 million acre-feet annually, is sufficient to meet all existing and presently contemplated needs and uses of water. The seasonal distribution of the annual yield, however, is such that in many areas of the basin all present needs cannot be satisfied during periods of low flow while large quantities of water pass to the ocean relatively unused during periods of high flow. The water supply problem facing the basin is not one of quantity but rather one of distribution, particularly during times of need.

Since there is only limited ground water potential in most areas of the basin, major augmentation of the water resources of Rogue River tributary streams during low flow periods will require storage of water during the peak runoff period. The storage of winter runoff and scheduled releases of stored water, along with more efficient water use measures, will be necessary to supply future consumptive and nonconsumptive demands.

Annual yield figures and monthly flow distribution diagrams for major tributary basins are presented in Part V, Subbasin Inventory, in the water resource data section of each subbasin. The monthly flow distribution diagrams show that for many basin tributaries, the lowest streamflows occur during the July through October period when the level of water use or demand is at its highest.

DOMESTIC USE

Most domestic water users in the Rogue River Basin utilize ground water for their supplies. This trend toward developing ground water supplies for domestic use is expected to continue in the future due to quantity and quality concerns of many of the basin streams during the low flow season.

During the 1970's the basin had one of the fastest growing populations in the state. Much of the basin's population increase resulted from an increased rural residential population, particularly on the outskirts of urban areas.

Adequate and safe supplies of domestic water will largely determine the location and expansion of rural populations and residential development. Inadequate or costly domestic supplies can limit community development while poor quality water is a deterrent to growth and may also be a public health hazard.

A recent trend has been the development of community water supply systems serving from a few up to several hundred residences. A small community system typically utilizes wells, storage facilities and a pipe distribution network to supply area residences. If these small community systems are properly designed, constructed and monitored, they can provide an economical and attractive alternative for future domestic water supplies.

As the population of the basin increases, greater demands will be placed on the existing domestic supplies. Most developed areas of the basin do not have surface water supplies of adequate quantity or quality to satisfy the present or future requirements for domestic use. The main stem Rogue River and ground water hold the most promise for meeting future rural domestic water supply needs. Future expansion of existing municipal water systems to include surrounding urbanizing areas may be necessary to insure adequate domestic supplies for some rapidly developing areas within or near urban growth boundaries. The trend toward developing small community systems in outlying areas is likely to continue.

FISH LIFE

According to the Oregon Department of Fish and Wildlife, the Rogue River Basin supports the largest populations of anadromous fish within the State of Oregon. The Rogue River fishery has gained national recognition, as evidenced by the lower Rogue's inclusion in the National Wild and Scenic Rivers and State Scenic Waterway systems. Historically, the Rogue stream system was well-suited to the anadromous fishery resource. Continuing development has had a cumulative adverse impact on the fish resources, especially in the most developed areas.

Fish, particularly salmon and steelhead for which the basin is noted, thrive only in streams with flows of adequate quantity and quality. The stream environment becomes most critical to fish during the summer low flow season. The number of fish produced in a stream, i.e. a stream's carrying capacity, is largely determined by the amount of streamflow available for rearing during summer months.

Annual water supplies in the basin are generally adequate for fish populations. Sections of streams in the Illinois and Applegate River systems and Middle Rogue River Subbasin, however, become critically low and warm or even dry during the summer when irrigation demands are high and runoff is low. Low summer flows limit fish populations by the effects of reduced habitat, increased water temperatures, increased disease virulence, lowered dissolved oxygen levels, and blockage of downstream migration.

Alteration of the watershed sometimes causes changes in the runoff pattern which can often affect or disrupt normal fish growth. Some streams which reportedly sustained large annual anadromous fish runs in the past are no longer capable of doing so because of inadequate flows at critical periods resulting from excessive depletions and watershed alterations.

Adoption of minimum perennial streamflows by the Water Policy Review Board is one method the Board has to protect and maintain existing levels of anadromous fish runs in the basin. At the beginning of the Rogue Basin Update study, the Department of Fish and Wildlife submitted over 40 minimum perennial streamflow requests for specific locations throughout the basin. These requests were in addition to the 15 minimum perennial streamflows previously adopted in the basin by the Board. The requested minimum flow levels are to help maintain the existing fishery resources in certain tributaries. These are listed in the respective Subbasin Inventory sections in Part V. Minimum streamflow requests, however, are in many cases substantially higher than flow levels attainable without additional storage or other water management practices. Storage of winter runoff and scheduled releases of stored water along with other measures, such as the importation of water or more efficient use of water, may be necessary to attain the minimum streamflow requests.

Other management procedures available to the Water Policy Review Board to protect or enhance the basin's fishery potential include withdrawing fully appropriated streams from further appropriation, classifying streams with high fish potential only for water uses having low consumptive demands, or limiting the beneficial use of water only to the high flow months. Implementation of one or more of these management options on high potential fishery streams, where population growth and water use demands are likely to increase, can protect the basin fishery.

Finally, if headwater storage reservoirs were to be built for multipurpose uses, they could provide downstream flow augmentation for fish life as well as other beneficial uses. While storage reservoirs block passage and inundate some fish spawning areas, they might also improve downstream conditions by increasing low flows, helping to maintain suitable water quality, and making additional water available when it is most needed for other beneficial uses. Thus, the losses at reservoir sites could be balanced or overcome by the multiple downstream benefits derived from low flow storage releases.

INDUSTRIAL USE

Presently three industries are generally considered to be the major components of the basin's economic base. They are lumber and wood products manufacturing, agriculture and food products, and tourism and recreation. The latter is comprised mainly of parts of retail trade and services. In addition to these three, there are other industries which also draw income to the basin and comprise an important part of the economic base. Included are motor freight, communications, and other parts of retail and wholesale trade such as medical services and government.

Significant changes in the structure of the basin economy have occurred in the past two decades. There has been a relative shift in economic activity and employment from manufacturing and agriculture to nonmanufacturing activities such as retail trade, services and government.

Today, much employment in the Rogue River Basin is of a cyclic and seasonal character. Unemployment in the basin has been much higher than the national average and consistently above the Oregon average over the past decade. Unemployment is subject to strong seasonal variations compounded by sharp fluctuations reflecting national economic trends. It is usually highest in winter months and lowest in summer. This follows from the outdoor nature of the basin's major economic activities and the seasonal weather patterns. Logging and wood products manufacturing, construction, agriculture and food processing, and tourism and recreation are all activities subject to seasonal shutdowns or limitations. Even the basin's large retail trade and service industries are adversely affected by the fluctuations of the resource-based industries.

The future economic strength of the Rogue River Basin lies in the development of a diversified economic base. Industrial and manufacturing development in areas other than the production of timber and wood products for housing needs would be highly beneficial to the basin economy and employment. Such development would tend to produce stable economic growth and a greater resiliency to economic downturns.

Although development of a more diverse economic base is slowly occurring in the basin, the timber industry is expected to continue to play an important role. The State of Oregon and the Rogue River Basin are major suppliers of timber and wood products. It is anticipated that the level of lumber operations will continue toward a sustained yield of timber in the basin, although the sustained yield today will likely be less than yields in the past.

A number of factors affect the industrial development potential for the Rogue Basin. These include:

1. A market for the lumber and wood products manufactured in the basin; the closest large markets are Portland, Seattle and San Francisco, all of which are hundreds of miles away.

2. The availability and cost of raw materials; the productive forest and agricultural land base has steadily been reduced due to reservations for other uses and rural residential development.

3. The availability, adequacy and cost of utility items; water, power, fuel, transportation, waste treatment facilities, and related items, all of which are becoming increasingly expensive.

4. The cost, size, and character of the local labor market.

5. The state and local tax situation with respect to the industry and industry-employed personnel.

6. The character of site terrain, proximity to labor market, proximity to transportation facilities, requirements for air and water pollution abatement, and other items which overlap the utility factors.

7. The competitive characteristics of the area, including its quality of life, as compared with the desirability of locating the facilities in other drainage basins or general geographic areas. The Rogue River Basin is generally regarded as having a high quality of life.

The most favorable potential industrial sites are located in the Medford-White City area in Jackson County and the Grants Pass-Merlin and Cave Junction areas in Josephine County. Future industrial expansion is expected to occur in these areas which are presently planned and zoned for industrial use in the county comprehensive land use plans. Furthermore, terrain for plant construction in these areas is suitable, utilities are generally more adequate than in other areas, and the proximity to labor markets is advantageous. Potential limitations to industrial growth include the cost of transportation of finished products to market, the cost of supplying adequate process water of suitable quality and quantity, and the cost of providing adequate treatment facilities for industrial wastes.

Other than raw material and transportation cost factors, the greatest deterrents to development of the basin industrial potential are possible water resource conflicts and restrictions on industrial water use. Streamflows of most main stem tributaries are currently not sufficient during the summer months to supply future consumptive and nonconsumptive demands without flow augmentation. Statutory restrictions preclude the use of the natural flow of the main stem Rogue for industrial water supply. Legal restrictions throughout the basin, in the form of statutory or administrative withdrawals, preclude future industrial use of other affected waters. Therefore any future industrial water demands will necessarily have to be satisfied by either municipal supplies, stored water, or ground water, or by amending or rescinding legal restrictions.

Most industrial users currently rely on municipal systems for their water supplies. For example, approximately 25 percent and over 50 percent of Medford and Grants Pass municipal water supplies, respectively, are now used by industry. This trend is expected to continue. Also, 15,000 acre-feet of water stored in Lost Creek reservoir are available for municipal and industrial use. While there is some ground water potential in the Grants Pass-Merlin and Illinois Valley areas, there is only limited ground water potential in most other areas of the basin. This is particularly true in the Bear Creek Subbasin where much of the industrial expansion is expected to occur.

Water and air pollution control requirements for future industrial activities in the basin could also be a deterrent for industrial growth. Detailed evaluation of proposed operations would be required and wastewater treatment limitations prescribed by the Department of Environmental Quality before any major development could be allowed to proceed. The maintenance of state water quality standards in surface waters will require strictly designed and carefully controlled waste treatment facilities. Thus waste treatment costs, especially those discharging to small streams, could be a major deterrent to the development of some types of industry. Seasonal air pollution problems exist in the Medford and Grants Pass areas due to atmospheric inversion conditions which prevent the dispersion of smoke and odors into the upper atmosphere.

Major industrial water users presently include plywood, pulp and paper, lumber, and food processing industries. Oregon's Long-Range Requirements for Water report predicts a significant increase in water use for both the pulp and paper and food processing industries in the basin. Other industrial water uses that are projected to increase include sand and gravel, metallic ore, and cement production. According to the report, no future increase in water use is expected for plywood or lumber production. Projected water intake and consumption for various industrial uses in the basin are included in Table 24.

"Clean" industrial development that does not require vast amounts of natural resources, particularly water, such as electronics, high technology, or the manufacturing of furniture, would be well-suited to the Rogue River Basin. Retail trades and services relating to tourism and recreational activities of the basin rely on small quantities from municipal water supplies. This sector of the economy has shown a significant increase since 1970 and should continue to grow in the future.

TABLE 24

INDUSTRIAL WATER USE IN THE ROGUE RIVER BASIN

INDUSTRY	INTAKE (ACRE-FEET/YEAR)		CONSUMPTION (ACRE-FEET/YEAR)	
	1966	2020	1966	2020
Lumber	22,400	5,800	4,000	1,000
Plywood	10,600	10,600	1,000	1,000
Pulp and Paper	-----	37,600	-----	9,400
Food Processing	-----	-----	290	590
Sand and Gravel	800	4,000	40	210
Metallic Ores	-----	160	-----	140
Cement	-----	100	-----	100
TOTAL	33,800	58,260	5,330	12,440

Source: Oregon's Long-Range Requirements for Water, 1969.

IRRIGATION

Less than half of the 220,000 acres of irrigable lands in the basin are presently being irrigated. The lack of available water supplies limits the agricultural potential of the basin. Dry farming is generally unprofitable because of the existing rainfall patterns, but most of the potentially irrigable areas can become productive lands through irrigation. Additionally, some of the presently irrigated lands in the basin need supplemental water supplies to reach full productivity.

With the present levels of appropriation and the low summer flows, future irrigation water cannot be supplied solely from natural flow. Future irrigation development will have to depend on the storage of winter runoff, more efficient farming methods, the use of ground water where available, and the importation of water from other areas.

Storage of winter runoff is accepted as the most practical means of augmenting summer supplies. There has been growing public concern about the costs of large storage projects, both economically and environmentally. Two of the three dams comprising the Rogue River Basin Project have been completed. Both Applegate and Lost Creek Dams are multi-purpose projects which provide approximately 51,000 acre-feet of storage for irrigation purposes.

The third and final part of the Rogue River Basin Project, already authorized, is Elk Creek Dam. It has not been constructed but has received partial funding. It will provide an additional 53,000 acre-feet of storage for irrigation purposes, making the total Lost Creek-Elk Creek irrigation storage 88,000 acre-feet.

Other potential sites have been identified throughout the basin which could also provide water for irrigation uses. The most notable of these sites are Sexton, Hull Mountain, Pease Bridge, and Sucker Creek. All of these sites have been studied by Federal agencies and none were found to be economically feasible. Future increased demand for water, however, may change the economics of these projects.

There are large areas of potentially irrigable lands in the basin. Sams Valley Irrigation District has been organized and is seeking Bureau of Reclamation financial assistance to provide water to irrigate nearly 16,000 acres. This future development will rely on 35,000 acre-feet of water from both Lost Creek and Elk Creek Reservoirs as well as water rights from the Rogue River. Evans and Illinois Valleys have large areas of potentially irrigable lands which would require additional water to achieve full productivity. The current trend of subdivision of lands and urban encroachment creates water delivery problems and may preclude maximum productivity from the present potentially irrigable land base.

Irrigation water supply is not presently adequate for all irrigated lands in the basin. The Talent Project has been unable to satisfy all the needs of the Bear Creek Valley and cannot provide for future irrigation expansion. Other irrigation districts located outside the Bear Creek Valley have also indicated a need for additional water to satisfy present irrigation demand.

MINING USE

Mineral resources "stored" in the Rogue River Basin are not sufficiently well known to adequately project the magnitude of industrial growth that could result from their extraction and processing.

Considerable interest has been shown in recent years regarding mineral exploration in the basin, particularly volcanogenic sulfide deposit exploration. A 1981 article in Oregon Geology describes the genesis of volcanogenic sulfide deposits in southwestern Oregon, where much of the state's recent exploration activity has been centered. Massive mineral deposits were found along the "Big Yank Lode" mineralized zone in north-central Josephine County. Several large energy and mining companies are presently engaged in extensive geophysical surveys, test drilling, mapping and assessment work throughout Josephine County, particularly in the Middle Rogue and Illinois River Subbasins. Most of this recent exploration activity is focused on gold, silver, barite, nickel, copper, zinc, and chromite in the massive sulfide zones. In 1981 there were 12 mineral exploration sites or areas identified within the basin as well as five active mines.

The 1980 water rights for mining uses in the basin totalled 3155 cubic feet per second. Few of these rights have been exercised since the 1950's, and not to the extent originally anticipated. Since the present use of water for mining purposes is slight and generally nonconsumptive, future mining use requirements will probably not increase above the present level of rights.

On the basis of available data, it is anticipated that foreseeable needs for mineral processing industries will not significantly increase above the present level of use. This projection could be substantially altered, however, if the newly discovered massive sulfide deposits are extracted and processed on a large scale within the basin.

Future development of these deposits will depend upon a detailed knowledge of the nature and extent of such deposits, the cost of extraction and processing, and the prevailing world market prices. There is some potential for a mineral processing facility in Josephine County.

MUNICIPAL USE

Presently there are ten municipal water systems in the Rogue River Basin which serve a population of 113,500 people. By the year 2000, however, it is estimated that the population supplied by these municipal systems will nearly double to 197,800. Industrial and commercial development and population growth will place greater demands on existing municipal systems and supplies in the future.

The City of Medford has substantial water reserved for the future with its exclusive control and use of the water of Big Butte Springs in the Big Butte Creek watershed plus an additional right to divert 100 cubic feet per second of water from the Rogue River to provide for future expansion. The City of Grants Pass also has large quantities reserved for the future with water rights totalling 37.5 cubic feet per second of natural flow from the main stem Rogue and up to 6700 acre-feet per year of stored water from Lost Creek reservoir. These are the two largest municipal water systems in the basin, representing over 75 percent of the total basin population served by municipal water systems.

Most of the remaining eight municipal water suppliers have indicated that their present water supplies or rights should be adequate through the year 2000, barring major changes in the rate of population growth or industrial- commercial development. Exceptions to this are the City of Phoenix and the Cherry Heights water system in Medford. Both systems draw their municipal supplies from well systems in the Bear Creek Subbasin. Both systems have indicated their present supplies will be inadequate in 20 years and a need to find a new source of water in the near future. Another exception is the City of Shady Cove, which does not presently have a municipal water system, but is currently in the planning stages to provide municipal water service.

A common problem facing many municipal water systems in the basin is the lack of adequate reservoir storage capacity. Storage capacity is necessary to provide a system with a buffer for summer peak demand periods, for emergency reserves, for line pressure equalization, and for fire fighting.

Many of the cities in the basin have applied for the use of water stored in Lost Creek Reservoir. To date, only the City of Phoenix has signed a contract with the Bureau of Reclamation to use water from Lost Creek Reservoir.

Estimated water requirements for the year 2000 for ten basin municipalities were determined largely from completed comprehensive plans, particularly estimates of future urban growth boundaries and population as well as estimates of the types of land uses such as residential, commercial and industrial. Table 25 lists the year 2000 estimated water requirements for Rogue River Basin municipalities in annual, average daily, and maximum day requirements as well as the estimated year 2000 populations supplied by each municipal system. The estimated maximum day requirement is important because it represents the maximum amount of water which could be diverted or required on a peak use day. Also, there is a definite relationship between maximum daily requirements and storage requirements since maximum municipal use generally takes place during the low flow summer months. Winter requirements can normally be met from direct streamflow diversions since basin streams are flowing the greatest amount at that time and municipal requirements are at their lowest.

A largely unknown factor is the per capita water requirement by the year 2000 compared to the present per capita requirement. There are several factors which can affect per capita use such as the amount of water used by industry relative to commercial and residential uses, the relative price of water in the future with higher priced water tending to reduce consumption, and future residential development and

TABLE 25

ROGUE RIVER BASIN
PROJECTED MUNICIPAL WATER REQUIREMENTS

WATER SYSTEM JACKSON COUNTY	EST. YEAR 2000 POP. SUPPLIED	ANNUAL DEMAND IN MILL. GALS.	ESTIMATED YEAR 2000 WATER REQUIREMENTS AVG. DAILY DEMAND, MGD	MAX. DAY DEMAND, MGD	AVG. DAILY PER CAPITA DEMAND, IN GALS.
Ashland	23,300	2,300	6.30	12.80	270
Butte Falls	600	32	0.09	0.19	146
Gold Hill	1,600	85	0.23	0.51	145
Medford*	111,000	10,600	29.04	60.00	262
Phoenix	5,420	290	0.79	1.74	147
Rogue River	4,000	213	0.58	1.28	146
Shady Cove	4,000	213	0.58	1.28	146
Talent	6,800	363	0.99	2.18	146
Sub-Total	156,720	14,096	38.62	79.98	---
Josephine County					
Cave Junction	2,050	186	0.51	1.40	248
Grants Pass	39,000	3,603	9.87	26.65	253
Sub-Total	41,050	3,789	10.38	28.05	---
TOTALS	197,770	17,885	49.00	108.03	248

*(includes Central Point, Eagle Point and Jacksonville)

living styles. Indications are that future per capita use will probably be similar to present use or tend to decline due to future water pricing and conservation measures. All of the following per capita use estimates, however, are based on current per capita water requirements.

Sufficient data are not available for estimating municipal water requirements beyond the year 2000 with any accuracy. It is important, however, that municipal supply systems plan for water needs at least 50 years in advance. Many of the present water uses are based on water rights considerably older than 50 years. Most basin municipal supply systems will have adequate water sources well beyond the year 2000 although some improvements, such as development of additional storage for Ashland and Cave Junction municipal water systems, may be expensive. The City of Butte Falls has not identified plans for its water needs beyond the year 2000.

Most water requirements beyond the year 2000 for basin municipalities will probably have to come from storage on the Rogue River or its tributaries. Lost Creek reservoir has 10,000 acre-feet of storage reserved for municipal/industrial uses and an additional 10,000 acre-feet would be available in the proposed Elk Creek reservoir. According to information received by the Jackson and Josephine County Water Resources Advisory Committees, the total amount of storage needed for basin municipal and industrial requirements in the next 50-years is estimated to slightly exceed the proposed 20,000 acre-feet available from Lost Creek and Elk Creek projects.

Thus the construction of the proposed Elk Creek Dam, along with the storage provided by the existing Lost Creek reservoir, would help to insure that sufficient municipal (and industrial) water supplies are available for basin municipal water systems for the next 50 years.

POLLUTION ABATEMENT

In determining the projected quality of streamflow and pollution abatement needs for the Rogue River Basin, Oregon's Long-Range Requirements for Water (OLRRW) study divided basin streams into reaches according to physical characteristics. Accepted scientific procedures and assumptions were used to project necessary streamflow requirements to assimilate the projected municipal and industrial waste loadings as well as the irrigation return flows.

The OLRRW analyses indicate the water quality problems that presently exist would be magnified in the future. The main stem Rogue was projected to receive large quantities of irrigation return flow in its upper and middle reaches. Because the streams in the Upper Rogue Subbasin are cold and turbulent, the effect on dissolved oxygen in this subbasin should be negligible. Irrigation use tends to increase the water temperature and the concentration of phosphates, nitrates and suspended solids. Those incremental changes would probably have major impact in the Central Valley region. The major manufacturing and population centers are also located in the Medford-Grants Pass areas. Future large waste inputs combined with the relatively slow stream velocities in the valley would depress dissolved oxygen (DO) levels below each of these municipal areas to minimum water quality standards. The municipal and industrial waste effluents, in combination with significant Central Valley irrigation return flows, would also adversely affect Middle Rogue River water quality. Thus, the Central Valley region would continue to receive the greatest waste loadings. Water quality in these reaches, especially during the summer months, would be characterized by minimum DO levels with elevated temperature, nutrient and suspended solids levels. After flowing through the developed Central Valley area the Rogue River enters a mountainous, wilderness region. Here it tumbles through a steep canyon. No significant waste loads were projected in the Lower Rogue River Subbasin; thus dissolved oxygen levels would be in a recovery state throughout the lower reaches of the Rogue River.

The principal tributaries of the Rogue River that will likely encounter some water quality problems are Bear Creek, Applegate River and Illinois River. The Medford area wastewater treatment plant will continue to discharge directly to the Rogue River. Ashland is projected to continue discharging to Bear Creek. This waste input will cause minimum DO levels to exist throughout the year. Elevated nutrient (especially phosphates and nitrates) and solids concentrations will continue to be a problem, both from point and nonpoint waste loadings. Consequently, unless advanced waste treatment or streamflow augmentation is provided, algae growths will continue to exist in Bear Creek.

Irrigation return flows may cause water quality deficiencies in the lower Applegate River. Higher levels of temperature and nutrients will probably exist. During the summer months, minimum DO levels will also be attained, although mitigated somewhat by the operation of Applegate Dam. On the Illinois River, projected municipal and industrial wastes at the Cave Junction-Kerby area will combine with the irrigation return flows during the low flow season to cause minimum DO levels. However, dissolved oxygen recovery will take place as the Illinois River flows through its lower canyon reaches.

In summary the water quality in the Rogue River Basin will probably continue to be adequate for most beneficial uses. These uses include such diverse purposes as waste assimilation, recreation and the protection of the anadromous fishery; nevertheless, certain problems may become critical. Dissolved oxygen levels could be near minimum state standards throughout the year below Ashland on Bear Creek as well as below Medford and Grants Pass on the Rogue River. Nutrient and solids levels will continue to pose a problem, especially with regard to algae growth. Perhaps the most critical parameter is water temperature. The multi-reuse of water during the summer months could increase temperature levels significantly. Thus, even given the realistic treatment efficiency of 90 percent assumed in the OLRRW analysis, control of these problems could require further refinement of type and degree of treatment in some areas of the basin.

POWER DEVELOPMENT

Except for the expansion of PP&L's Prospect hydroelectric project, future power development in the Rogue River Basin is expected to take the form of relatively small hydroelectric projects scattered throughout the basin. Due to high economic costs, potential environmental impacts, and projected power surplus into the mid-1990's for the Pacific Northwest, no large scale hydroelectric projects are anticipated in the basin in the foreseeable future.

Estimates of total hydroelectric potential are variable, depending upon assumptions made concerning levels of development and estimated flows. An OSU survey of low-head hydroelectric power potential in the Rogue River Basin identified 135 stream reaches having significant hydropower development potential. Based on the 80 percent exceedance streamflows, the total theoretical installed capacity for all sites in the basin is over 281 megawatts. Twenty-seven of the 135 reaches are located on the main stem Rogue, however, and have a total theoretical installed capacity of about 169 megawatts. This represents about 60 percent of the basin potential. The total theoretical generating capacity for the Rogue River Basin for various flow frequencies is listed below:

Percent Chance of Exceedance	Total Theoretical Plant Size MW
95	165
80	281
50	787
30	1471
10	3068

The total basin potential cannot be realized because many of the identified reaches have existing statutes or water use policies precluding power development, greatly reducing the estimated generating capacity. The high level of interest in small hydropower development that currently exists is unpredictable. It is subject to various economic and political variables, including but not limited to regional energy policies, regional power supply and demand, avoided power costs offered by electric utilities and numerous economic incentives from various government entities.

The long-term cummulative effects of small-scale hydropower development is not specifically known for this basin. Potential cumulative impacts will likely be an increasing concern as additional development is proposed and reviewed.

RECREATIONAL USE

The Rogue River Basin is one of the state's most diverse vacation areas. With its access to the scenic and popular Pacific Coast, its forested mountains and wilderness areas, majestic Crater Lake in the High Cascades, Oregon Caves National Monument, and the nationally renowned Rogue River, the basin has an abundance of sightseeing opportunities, numerous cultural events and year-round recreational activities.

Although the basin's rugged scenic beauty is largely responsible for its recreational and tourist appeal, its vacation resorts, outdoor adventure opportunities and wealth of cultural and historic attractions have also grown significantly in the past two decades. The annual Shakespearean Festival in Ashland and the Peter Britt Jazz Festival in Jacksonville draws artists and spectators from nearly every state and many nations. The historic Jacksonville Museum, quartered in the 19th century courthouse which was the seat of Jackson County government for 43 years, draws thousands of visitors annually. The Rogue River, which is a designated state and national wild and scenic waterway, is nationally renowned for its salmon and steelhead fishery and exciting whitewater adventures. Grants Pass is the departure point for most lower Rogue River guided fishing and boating trips in the scenic waterway section. The lower Illinois River, one of the Rogue's major tributaries, has also been designated a state scenic waterway. There are also two designated wilderness areas located in the basin.

Adequate quantities of high quality water are important to recreation and tourism in the basin. Water supplies are also essential in parks and campgrounds for both recreational and utilitarian or maintenance purposes. Boating, fishing, swimming, water sports and sightseeing are some of the uses of the lakes, reservoirs, streams and rivers upon which the many local, county, state and federal parks are located. In addition, some water is necessarily used for drinking, washing, cleaning, sewage disposal, and irrigation of parklands.

Recreation and tourism is currently the basin's third largest industry. The basin recreational potential is significant and development is expected to expand to meet the demand of an increasing population and tourist business. Therefore, the future recreational needs of the basin must be addressed. The outdoor recreational needs for both Jackson and Josephine Counties were assessed in 1978 by the Pacific Northwest River Basins Commission in its Oregon Comprehensive Outdoor Recreation Plan. The projected demand for various recreation activities through the year 2000 for the basin is listed in the following table.

TABLE 26

JACKSON AND JOSEPHINE COUNTIES
OUTDOOR RECREATION DEMAND*

ACTIVITY	1975	1980	1990	2000
Camping	672,300	754,500	917,800	1,051,800
Picnicking	2,153,500	2,474,000	3,034,600	3,487,100
Swimming Pool	2,582,560	2,979,680	3,519,120	3,853,280
Non-Pool	645,640	744,920	879,780	963,320
Sightseeing	2,060,900	2,356,100	2,848,800	3,195,500
Fishing	1,033,600	1,182,700	1,372,000	1,481,900
Boating	683,400	734,300	875,600	969,800
Water Skiing	251,500	289,200	345,100	383,000
Walking & Hiking	5,286,900	6,061,100	7,107,600	7,753,500
Hunting	278,400	318,500	372,400	403,500
Outdoor Games	3,563,800	4,113,100	4,874,400	5,356,400
Bicycling	4,361,900	5,025,100	5,893,100	6,404,300
Golfing	220,900	255,800	300,900	327,600
Horseback	891,500	1,024,900	1,205,200	1,316,900
Cultural Events	493,700	562,400	654,900	708,300
Snow	507,100	585,000	706,300	799,200
Other	2,051,700	2,351,100	3,044,900	3,704,100

*Activity occasions generated

Source: Recreation Data Subcommittee, Pacific Northwest River Basins Commission, 1978.

WILDLIFE

Settlement and development of an area has the effect of restricting the numbers of the more wilderness-type animals, while at the same time improving the habitat for other forms, resulting in population increases of the more adaptable species. According to the Oregon Fish and Wildlife Department, the number of animals any given water supply can support is limited by the distance an animal will willingly travel to reach it. Since wild animals do not tolerate crowding, the maintenance of bird and animal life depends upon the adequacy of available water supplies.

Thus future development can both benefit or impact wildlife in the basin. By eliminating open irrigation canals and developing closed pressure systems, established aquatic and riparian habitats are lost. By replacing irrigated lands with housing developments, shopping centers, and freeways, additional habitat is lost. Through careful planning, however, some wildlife can benefit from increased habitat due to logging activities using best management practices, and pond or reservoir construction. With fish life, wildlife can also benefit from improved downstream flows from stored water.

Total wildlife population in the basin probably will remain about the same as it is at present. Consumption of water by wildlife is and will remain relatively insignificant; however, many wildlife species depend upon the riparian vegetation zone found along the basin's rivers, lakes, canals and reservoirs. The riparian zone habitat significantly increased with the construction of Lost Creek and Applegate Reservoirs, and will further increase when the Elk Creek project is constructed.

Riparian wildlife habitat is dependent upon surface elevations of the various reservoir pools. These riparian zones are used for waterfowl nesting, deer fawning, furbearer reproduction, upland bird wintering, colony bird nesting, pheasant and quail nesting, and dove cover. The timing, rate of change, and duration of reservoir fluctuations, as well as maximum and minimum elevations, are critical to wildlife habitat. For example, water level fluctuations from project operations have in some cases led to barren vegetation zones, exposing wildlife to increased predation.

In addition to reservoir-related effects, a number of other development activities have caused land and stream alterations which severely affect wildlife. These include construction of roads and project facilities, draining and filling of wetlands, stream channelization, shoreline riprapping, and maintenance of transmission corridors.

While the development of the Rogue River Basin projects may have caused some significant adverse effects on wildlife, many beneficial effects have also resulted. For example, the creation of Lost Creek and Applegate Reservoirs has provided important nesting, feeding and wintering habitat for increased numbers of waterfowl. Since these are multiple purpose reservoirs and storage is also used for irrigation, the irrigation water will allow for development of extensive cropland areas that could not otherwise exist in a dry climate. These areas also provide some wildlife habitat.

About 88 percent of the total basin land area is classified as forest or water. In addition, over 2 million acres, or roughly two-thirds of the total basin area, is in public ownership and generally unavailable for private development. Furthermore, there are two designated wilderness areas, several areas being considered for inclusion in the wilderness sytem, and numerous national, state and county park lands in the basin. These lands are not available for private development and provide important wildlife habitat.

WATER CONTROL

Flood Control

In keeping with the existing Rogue River Basin water use policy, future flood control from storage will be provided by projects which incorporate the multiple-purpose concept. The Rogue Basin Project included the construction of these multiple-purpose storage projects that would provide up to 280,000 acre-feet of flood control storage. Two of the dams, Lost Creek and Applegate, have already been built and the third one, Elk Creek, has been authorized but not constructed.

Lost Creek Dam can provide up to 180,000 acre-feet of flood control storage. Lost Creek and Elk Creek Dams operating together will provide up to 225,000 acre-feet of flood control storage for the main stem Rogue. Applegate Dam provides up to 55,000 acre-feet of flood control storage on the Applegate River.

According to a Federal Emergency Management Agency (FEMA) report, Lost Creek Dam will have the following impact on flood flows in the Rogue River:

TABLE 27

FLOOD FLOW FREQUENCIES

	NATURAL FLOWS		(CUBIC FEET PER SECOND)	
LOCATION	10-Year	50-Year	100-Year	500-Year
Dodge Bridge	48,000	80,000	98,000	145,000
Raygold	64,000	110,000	135,000	200,000
Grants Pass	91,000	150,000	180,000	270,000

	REGULATED FLOW		(CUBIC FEET PER SECOND)	
LOCATION	10-Year	50-Year	100-Year	500-Year
Dodge Bridge	29,000	46,000	62,000	135,000
Raygold	50,000	84,000	105,000	180,000
Grants Pass	73,000	128,000	144,000	260,000

Future flood control storage will be needed primarily on streams tributary to the Rogue River. Those streams having the most potential to cause flood damage or flood most frequently were identified in recent F.E.M.A. reports concerning the areas of Josephine and Jackson Counties.

The following streams have been identified as having high flood or damage potential:

Streams	Drainage Area
Lazy Creek at mouth	5.2
Unnamed Tributary to Larson Creek at mouth	3.9
Griffin Creek at Pine Street in Central Point	28.8
Pleasant Creek at mouth	193.0
Foots Creek at mouth	27.0
Little Butte Creek at Main Street in Eagle Point	290.0
Lone Pine Creek at Crater Lake Highway	4.5
Larson Creek at mouth	7.0
Crooked Creek at mouth	5.6
Daisy Creek at Phoenix Canal	2.5
Evans Creek at mouth	225.0
Wagner Creek at mouth	23.8
Ashland Creek at Ashland	27.5
Coleman Creek at Phoenix	7.0
Clay Creek at Ashland	2.0
Bear Creek at Medford	284.0
Jumpoff Joe Creek at mouth	110.0
Louse Creek at mouth	30.9
Slate Creek at mouth	44.6
Murphy Creek at mouth	15.2
Illinois River near Kerby	380.0
East Fork Illinois River at mouth	234.0
West Fork Illinois River at mouth	112.0
Deer Creek near Selma (River mile 3.5)	101.0

Potential reservoir sites have been identified on several of these streams. Projects at these sites could provide some flood control storage, depending on the need for flood control at downstream points and the size of the reservoir. The existing Emigrant Dam could provide some flood control for the Bear Creek Valley. Its primary purpose, however, is irrigation.

On those streams where flood control storage is not feasible, alternate measures will be needed to protect development in the watershed. These measures may include the construction of dikes, revetments and flood channels, or nonstructural measures such as special zoning of lands in the floodplains and flood prone areas.

Potential Reservoir Sites

Each subbasin inventory in Part V of the report, except the Lower Rogue River Subbasin, includes a more detailed narrative about potential reservoir sites. A brief analysis of the better sites is given in each inventory. These identified sites appear to have the greatest potential for storage development and could be protected from further development through identification in the county land use plans. These sites may have drawbacks and might cause certain adverse impacts, however, the positive attributes make them more attractive than the majority of potential sites in the basin.

Table 28 is a list of all potential damsites identified in the basin that were eliminated from further consideration. Many of these sites, particularly those on the Rogue River, are primarily hydropower and not multiple purpose storage sites. The list includes sites identified in the 1959 Rogue Basin Report, or by the Soil Conservation Service, the Bureau of Reclamation, the State Engineer, and from other studies in the basin. Checkmarks in the appropriate columns indicate the reason(s) for eliminating each site from further investigation. Since the conditions and needs change from one subbasin to the next, the criteria for rating the sites might vary from area to area. For example, a potential site on Trail Creek might be eliminated from consideration because of existing developments in the area, while the same level of development may not preclude consideration of a site on Jumpoff Joe Creek.

The reasons for eliminating sites included lack of runoff, statutory restrictions, poor embankment/capacity ratio, adverse impacts, soils and geology limitations, impacts on or by existing dams or structures, existing development in the reservoir site, and "other" which includes any other reason not listed. "Other" may include conflicts with minimum perennial streamflows or an alternate site located on the same stream that appears to have greater potential.

Lack of runoff eliminated several sites on small streams in the eastern and central parts of the basin. These areas, particularly in the vicinity of Medford, get only 20 to 30 inches of rainfall per year. Statutory restrictions preclude the building of dams or structures on the main stem Rogue River below Lost Creek Dam and reserve of the waters of Big Butte Creek for municipal use for the

City of Medford, which precludes dam development in the Big Butte Creek watershed.

The embankment/capacity (E/C) ratio compares the estimated cubic yards of fill needed for the dam with the acre-foot storage capacity of the reservoir. Poor topography results in high (poor) E/C ratios which result in relatively high project costs. Adverse impacts include destruction of the environment, harmful impacts on fish life and wildlife or other negative affects which may outweigh the benefits derived from a structure.

Soils and geology limitations include such things as lack of adequate fill material at the site, faulting in the reservoir or at the damsite, and poor foundation structure at the damsite. These limitations could add a large expense to the project cost or make the project infeasible.

Impacts on or by existing dams or structures include both the effects that the proposed project would have on the operation of existing dams and reservoirs and vice-versa. Existing development in the site includes roads, powerlines, houses, etc. that would be displaced by the project. Other is a category that includes possible conflicts with existing minimum flows, the absence of benefits derived from such a project, or maybe even a better site located at another point on the stream.

The inclusion of a site in the table does not completely preclude its future development, but only indicates that these sites are considered infeasible or less desirable at the present time. The increasing need for water and changing levels of development in the basin could make some of these projects more practical and attractive in the future.

TABLE 28

ROGUE RIVER BASIN POTENTIAL DAMSITE EVALUATION

SITE NAME	STREAM	LOCATION T	R	S	BASIS FOR ELIMINATION: LACK OF RUNOFF	STATUTORY RESTRICTION OR WITHDRAWAL	POOR E/C RATIO	ADVERSE IMPACTS	SOILS & GEOLOGY LIMITATIONS	IMPACT EXISTING RESERVOIR	DEV. IN SITE	OTHER
Agate	Dry Creek	36S	1W	25			AGATE DAM CONSTRUCTED					
Ament	Rogue River	36S	5W	23		x		x				
Antelope Creek	Antelope Creek	37S	1E	15			x			x		x
Antelope Creek	Antelope Creek	37S	1E	5			x	x		x		
Applegate	Applegate River	38S	4W	22			APPLEGATE DAM CONSTRUCTED					
Applegate	Applegate River	37S	6W	15			APPLEGATE DAM CONSTRUCTED					
Ashland	Bear Creek	39S	1E	3/10						x		
Bald Mountain	Illinois River	37S	11W	2		x		x				
Big Butte Creek	Big Butte Creek	34S	2E	30		x		x				
Big Butte Creek	Big Butte Creek	34S	1E	14		x		x				
Brownsboro	Little Butte Creek	36S	1E	5				x			x	
Butte Creek	Rogue River	33S	1E	34				x		x		x
Butte Falls	Big Butte Creek	35S	2E	11		x		x				
Carberry Creek	Carberry Creek	40S	4W	27						x		
Cascade	Rogue River	33S	2E	17				x		x		x
Cascade Gorge	Rogue River	33S	3E	6				x		x		x
Castle Creek	Rogue River	30S	3E	26				x		x		x
Clawson	Emigrant Creek	39S	1E	12						x		
Clear Creek	Illinois River	37S	10W	2		x		x				x
Collier Bar	Illinois River	36S	11W	28		x		x				x
Copper	Applegate River	40S	4W	36			APPLEGATE DAM CONSTRUCTED					
Copper Canyon	Rogue River	35S	12W	11		x		x				x
Cove Creek	Cove Creek	39S	2E	8			x					x
Crooks Creek	Crooks Creek	38S	7W	9				x			x	x
Crooks Creek	Crooks Creek	38S	7W	4			x	x			x	
Dead Indian - (Constructed as part of Talent Project)												
Debenger Gap	Rogue River	35S	1W	8		x		x		x		
Deer Creek	Deer Creek	38S	6W	18				x	x			
Deer Creek	Deer Creek	38S	7W	13				x	x			x
Devils Stairs	Rogue River	33S	10W	17		x		x				x
Diamond	Rogue River	30S	3E					x		x		
Dog Creek	Dog Creek	34S	6W	8			x					x

TABLE 28 (continued)

SITE NAME	STREAM	LOCATION T	R	S	BASIS FOR ELIMINATION: LACK OF RUNOFF	STATUTORY RESTRICTION OR WITHDRAWAL	POOR E/C RATIO	ADVERSE IMPACTS	SOILS & GEOLOGY LIMITATIONS	IMPACT EXISTING RESERVOIR	DEVELOPMENT IN SITE	DEVELOPMENT OTHER
Dry Creek	Dry Creek	35S	1W	5	x		x					
Dry Creek	(See Agate)											
Emigrant Creek	Emigrant Creek	39S	2E	7			x	x		x		
Emigrant	(Enlarged as part of Talent Project)											
Evans Creek	Evans Creek	34S	3W	26				x			x	x
Evans Valley	Evans Creek	35S	4W	33				x			x	x
Fall Creek	Illinois River	37S	9W	33		x		x				
Fielder	(See Evans Valley)											
French Gulch							APPLEGATE RESERVOIR CONSTRUCTED					
Gaerky Creek	Gaerky Creek	39S	1E	2	x		x					x
Gold Hill	Rogue River	36S	3W	15		x		x			x	x
Gold Hill	Rogue River	36S	3W	11		x		x			x	x
Grave Creek	Grave Creek	34S	5W	1				x				x
Grave Creek	Grave Creek	33S	4W	29			x					x
Grayback	Sucker Creek	39S	7W	23								x
Grays Creek	Grays Creek	37S	5W		x		x					
Grizzly - Klamath Basin												
Hamaker	Rogue River	29S	4E	20						x		x
Hellgate	Rogue River	35S	7W	10		x		x			x	x
Homestead Gulch	Evans Creek	35S	3W	7				x			x	x
Horseshoe Bend	Rogue River	33S	9W	23/26		x		x				x
Howard Prairie - (Constructed as part of Talent Project)												
Indian Creek	Indian Creek	34S	1W	15	x		x			x	x	x
Indian Creek	Indian Creek	34S	1W	23	x		x			x		
Indian Hill	Wood Creek	40S	8W	19/20								x
Josephine Creek	Illinois River	38S	8W	29				x			x	x
Jumpoff Joe	Jumpoff Joe Creek	34S	5W	36			x					x
Kanutchan Creek	Kanutchan Creek	35S	1E	33	x		x					x
Keone Creek - Klamath Basin - Part of Talent Project												
Kerby	(See Josephine Creek)											
Kerby Peak	(See Deer Creek)											
Lake Creek	Little Butte Creek	36S	2E	19				x			x	x
Lewis Creek	Rogue River	34S	1W	2		x		x		x		x

TABLE 28 (continued)

SITE NAME	STREAM	LOCATION T	R	S	LACK OF RUNOFF	STATUTORY RESTRICTION OR WITHDRAWAL	POOR E/C RATIO	ADVERSE IMPACTS	SOILS & GEOLOGY LIMITATIONS	IMPACT EXISTING RESERVOIR	DEVELOPMENT IN SITE	OTHER
Lick Creek	Lick Creek	36S	1E	3/2			x					x
Limpy Creek	Limpy Creek	36S	7W	15				x				x
Little Applegate	Little Applegate R	39S	3W	11			x	x				x
Little Butte	Little Butte Creek	36S	1E	5				x			x	x
Little Butte	Little Butte Creek	36S	1E	14/11				x			x	x
Little Butte Creek	Rogue River	36S	2W	12		x		x		x		
Lone Mountain	West Fork Illinois R	40S	9W	26				x	x	x		x
Long Branch	Rogue River	34S	1W	21		x		x				x
Long Branch	Long Branch Creek	34S	1W	17			x				x	x
Long Creek	Rogue River	35S	1W	17			x				x	x
Louse Creek	Louse Creek	35S	5W	29			x					x
Lower Althouse Creek	Althouse Creek	40S	7W	7								x
Lower Evans	(See Evans Creek)											x
McKee Bridge	Applegate River	39S	3W	33				x		x		x
McMullin Creek	McMullin Creek	38S	7W	30			x	x		x		
McMullin Creek	McMullin Creek						(Constructed - Lake Selmac)					
McNeil Creek	McNeil Creek	34S	1E	23		x		x				
McNeil Creek #1	McNeil Creek	34S	1E	36		x		x				x
McNeil Creek #2	Big Butte Creek	34S	2E	30		x		x				x
Munger Creek	Munger Creek	38S	5W	31			x					x
Murphy	Applegate River						APPLEGATE DAM CONSTRUCTED					
Pickett Creek	Pickett Creek	35S	7W	27			x	x				
Ramey Falls	Rogue River	34S	8W	6		x		x				
Rancheria	S Fk Big Butte Cr	35S	2E	12		x		x			x	x
Red Blanket Creek	Red Blanket Creek	32S	4E	12			x			x		
Reese Creek	Rogue River	35S	1W	17		x		x		x		
Reese Creek	Reese Creek	35S	1W	10				x			x	
Riter Creek	Rogue River	32S	3E	8				x		x		
Rock Creek	Rock Creek	33S	3W	34			x	x				x
Rock Point	Rogue River	36S	3W	19		x		x		x		x
Rough and Ready	Rough and Ready Cr	40S	9W	14/15				x	x		x	
Ruch	Applegate River	39S	3W	3				x		x	x	
Salt Creek	Salt Creek	36S	2E	6/5/7/8			x					x

TABLE 28 (continued)

SITE NAME	STREAM	LOCATION T	R	S	LACK OF RUNOFF	STATUTORY RESTRICTION OR WITHDRAWAL	POOR E/C RATIO	ADVERSE IMPACTS	SOILS & GEOLOGY LIMITATIONS	IMPACT EXISTING RESERVOIR	DEVELOPMENT IN SITE	OTHER
					BASIS FOR ELIMINATION							
Shady Cove	(See Indian Creek)											
Slate Creek	Slate Creek	37S	7W	10				x				x
South Fork	S Fk Rogue River	COPCO	DIV.	DAM								
South Fork Big Butte	S Fk Big Butte Cr	35S	2E	11		x		x				
South Fork L Butte	S Fk L Butte Cr	37S	2E	4				x			x	x
South Fork L Butte	S Fk L Butte Cr	37S	2E	13				x				x
Squaw Creek	(See Copper)											
Stairs Creek	(See Devils Stairs)											
Swing Bridge	Rogue River	34S	8W	2		x		x				x
Taylor Creek	Rogue River	35S	7W	5		x		x				
Thompson Creek	Thompson Creek	38S	7W	21			x	x			x	
Top Creek	Rogue River	31S	3E	19		x		x		x		x
Trail Creek	Rogue River	34S	1W	10		x		x		x	x	
Trail Creek	Trail Creek	33S	1W	33			x				x	x
Tyler Creek	Tyler Creek	40S	3E	8	x		x					x
Tyler Creek (Hobart)	Tyler Creek	40S	3E	9	x					x		x
Union Creek	Rogue River	30S	3E	35						x		x
Upper Brownsboro	(See Little Butte)											
Upper Evans	(See Evans Creek)											
Upper Kerby	(See Josephine Creek)											
Wagner Creek	Wagner Creek	39S	1W	11		x	x				x	
Wagner Creek	Wagner Creek	39S	1W	2		x	x				x	
Ward Creek	Ward Creek	36S	4W	13	x		x					x
W F Evans Creek	W F Evans Creek	34S	3W	23			x					x
W F Evans Creek	W F Evans Creek	34S	3W	15			x					x
W F Illinois	W F Illinois R	40S	9W	26				x	x		x	x
West Fork Illinois	W F Illinois R	41S	9W	4				x	x		x	
W F Williams Cr	W F Williams Cr	39S	5W	4			x				x	x
W F Williams Cr	W F Williams Cr	39S	5W	7								x
Wilderville	Slate Creek	37S	7W	2/1							x	x
Williams Creek	Williams Creek	38S	5W	14/13			x				x	x

PART V

SUBBASIN INVENTORY

PART V

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PART V

SECTION 1 - UPPER ROGUE RIVER BASIN

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UPPER ROGUE RIVER BASIN

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SECTION 1 - UPPER ROGUE RIVER BASIN

CONCLUSIONS

The water resources of the Upper Rogue River Basin are an important part of the total resources available in the basin. In addition to supplying the basic needs for human and livestock consumption, water is also needed to maintain or develop other resources such as fish life, irrigated agriculture and power development. Existing and future requirements for water in the basin include domestic, livestock, municipal, industrial, irrigation, agriculture, power development, mining, recreation, wildlife and fish life uses.

There are sufficient supplies of water on an annual basis to supply these needs. The location and timing of these supplies have resulted in seasonal water shortages. Continued economic development in some areas of the basin will be slowed without developing additional water supplies. Based on an analysis of Upper Rogue River Basin water resource problems and information regarding alternative sources of water, it is concluded that:

1. Domestic, livestock and wildlife requirements, although important, do not require large quantities of water. Supplies appear adequate for present and contemplated requirements for these uses.

2. Existing municipal and industrial water supplies are currently adequate, but additional dependable supplies for future growth may be necessary. Most water is exported to other basins. There are statutory restrictions on Industrial use from the Rogue River downstream of River Mile 157.

3. Existing water supplies for irrigation are not adequate to meet existing needs in the basin. Late summer shortages occur in most years. An additional 20,000 acres of land within the basin could be irrigated if dependable water supplies were available.

4. There is some potential for power development in the basin. Currently, power is a major use of water in the Upper Rogue River Basin.

5. Mining does not represent a significant use of water and is not expected to substantially increase in the future.

6. Recreation is a significant use of water in the Upper Rogue River Basin. Lost Creek Lake will provide important recreational opportunities as a lake and by providing additional flows downstream in the Rogue River.

7. Fish life represents an important resource in the basin. Seasonal low flows can limit the potential of this resource on some streams. Lost Creek Dam will enhance the Rogue River fish resource through the augmentation of downstream flows.

8. Elk Creek, Trail Creek, and Indian Creek may all be fully appropriated during some time periods.

9. Big Butte Creek and tributaries are reserved for municipal use by the City of Medford. Mill and Barr Creeks are closed to further appropriation except for domestic, fish protection and limited power development.

10. Elk Creek Dam will provide flood control and stored water for other beneficial uses.

11. Ground water potential in the basin is very limited. Areas near Shady Cove and Prospect may have greater potential than the remainder of the basin.

12. There is a State Engineer's Withdrawal of some of the waters of the Upper Rogue River Basin for future federal projects.

SUBBASIN INVENTORY - UPPER ROGUE RIVER BASIN

GENERAL DATA

Basin Description

All of the Rogue River watershed above river mile 133 is included in the Upper Rogue River Basin. The area is located in the northeastern corner of the Rogue River Basin. Encompassing 1,250 square miles, it is the largest of the seven hydrologic divisions of the Rogue River Basin containing about one-fourth of the total land area within the basin. Approximately 945 square miles, or 75 percent of the area is located in Jackson County. Approximately 200 square miles occur in Klamath County, with about one-half of that inside the boundaries of Crater Lake National Park. The remaining 105 square miles are located in the southeastern corner of Douglas County. The Rogue Range mountains form the northern boundary between the Umpqua and Rogue River Basins. The eastern boundary is the Cascade Range separating the Klamath and Rogue Basins, while the southern boundary is the divide between Big Butte and Little Butte Creek drainages. Finally, the western boundary divides the tributaries flowing into the Rogue River above mile 133 from the tributaries entering the Rogue River below river mile 133.

The Rogue River has its origins in the northeastern corner of the basin. From there it flows southwest to its confluence with the South Fork Rogue River at the upper end of Lost Creek Reservoir. Below the reservoir the Rogue River flows west, being joined by Big Butte Creek from the south, Elk and Trail Creeks from the north. At the confluence of Trail Creek, the Rogue River begins to flow south.

Geology

Topography, Drainage and Stratigraphy

The Upper Rogue River Basin lies entirely within the Cascade Range physiographic province characterized by mountainous terrain with steep slopes and moderate or high stream gradients. The Cascade Range forms a north-south trending volcanic belt across Oregon and divides the state into Eastern and Western Oregon. It extends from Central Washington through Oregon to Northern California.

Two subregions are generally recognized that divide the Upper Rogue River Basin into two equal parts from north to south: the High Cascades on the east and the dissected Western Cascades. The High Cascades feature many peaks on the eastern edge of this basin above 7000 feet in elevation, with the highest point being Mt. McLoughlin, elevation 9495, located in the southeast corner of the Cascade Divide. Lava flows and glaciation have produced many small lakes, especially in the uppermost reaches of the Middle Fork Rogue River and Big Butte Creek watersheds. The Western Cascades are geologically much older than the High Cascades and are deeply dissected. Most of the surface consists of steep, north-south ridges between the gorges cut through weak rock zones by Elk and Trail Creeks and other smaller western Rogue River tributaries.

The main stem Rogue River travels on a steep gradient in its headwater areas, averaging 71 feet of drop per mile above river mile 167. The headwater gradients of the main tributaries are even more extreme with Elk Creek dropping nearly 500 feet per mile for its first five miles; South Fork Rogue River averages 140 feet per mile for its upper 20 miles; Middle Fork Rogue River averages 200 feet per mile for its upper 13 miles; and Big Butte Creek has tributary headwater slopes averaging 100 feet per mile for its upper four miles. Below river mile 167 the slope of the Rogue River begins to decrease until at river mile 156 a fairly constant drop of 14 feet per mile is reached and maintained for the rest of this section. The average drop of the main stem Rogue River between miles 167 and 156 is 27 feet per mile.

From its headwaters, at river mile 213 and elevation 5100, the Rogue River flows in a southwest direction to river mile 180 where it takes a nearly southern course to the town of Prospect, near river mile 171. Here it swings again to a southwest heading for another 23 miles and then continues south for the remainder of the Upper Rogue River Basin.

The Rogue South Fork and Big Butte Creek flow in a generally northwest direction from their headwaters on the western slope of the Cascades while Elk Creek travels from the north to its juncture with the Rogue River.

Soils

Most of the soils in the Upper Rogue River Basin are derived from the volcanic rocks of Mt. Mazama. Steep slopes and shallow soils limit the use of most of the basin to timber production. Soils lying above an elevation of 3000 feet tend to be thin, have a high rock fragment content, and occur at slopes of 35 to 100 percent. These characteristics tend to produce low water holding capacities in soils, even where the soil mantle may be five feet thick, and allow rapid runoff resulting in soil erosion. Rapid runoff also results in droughty conditions in these soils throughout the summer months.

Soils lying below 3000 feet elevation are thicker, usually between three and four feet in depth, have a lower rock fragment content, and occupy generally less steep slopes ranging from 12 to 40 percent. These soils support a higher density vegatative cover than the higher elevation soils. The exception to this occurs on south-facing slopes where vegetative cover is typically sparse, which makes these slopes particularly susceptible to erosion damage. These soils have medium water holding capacity due to clayey subsoils limiting infiltration, which results in moderate to rapid runoff and moderate erosion. Thus the use of these cobbly soils is also restricted. Pasture, hay and timber production are primary uses of these soils.

Extensive agricultural use is concentrated in the lower portion of the Upper Rogue River Basin, and to a limited extent on alluvial soils adjacent to some tributary streams. These soils are generally deep, but may contain a clay hardpan which restricts proper drainage. Careful water management practices, and more recently the use of sprinkler irrigation systems, have overcome some of the drainage problems. Thus, the lower portion of this basin has become the major agricultural area, producing hay, pasture, grains and specialty crops - most notably pears.

Climate

The climate of the Upper Rogue River Basin is characterized by wet, mild winters. The moist westerly flow of air from the Pacific Ocean during the winter and spring months results in both rain and snow storms depending upon the elevation. Flood-producing storms occur chiefly during the winter months but are not uncommon in spring. Major storms are characterized by a strong on-shore flow of moist air from the west and southwest.

Thunderstorms are also common to the area, generally occurring during the late spring and early summer months. Due to limited areal extent and short duration, thunderstorms involve small isolated tributaries and rarely produce floods except in localized areas. Rainfall intensity of thunderstorms is high, however, and depths up to one-inch have occured in less than 15 minutes, although duration is usually less than one hour. Hail often accompanies these violent storms.

During the summer months, weather patterns come primarily from the south. As a result, the Upper Rogue River Basin has hot dry summers similar to the mediterranean climate of California. The average frost free period varies from 145 days at Lost Creek Dam to 99 days at Prospect to only 16 days at Crater Lake just to the east of the Upper Rogue River Basin. Low humidity and high temperatures common in July and August result in high rates of evapotranspiration with subsequent stress on crops.

Air temperatures recorded at Prospect have varied from a high of 106°F in July and September to a low of minus 12°F in January. Temperatures at Prospect range from an average of 35.7°F in January to 66.4°F in July. Table 29 displays the average monthly temperatures for Prospect, Butte Falls and Crater Lake.

History

The Upper Rogue River Basin was first settled in the 1840's. Farming and ranching in the fertile Rogue River Valley brought the first settlers. The agricultural base was expanded in the 1850's to provide for the needs of the miners when gold was discovered near Jacksonville. Indian wars in the late 1800's brought in the military, and the townsite of Shady Cove was established at a military ferry crossing. At the conclusion of the Indian wars, agriculture continued to expand, and a new industry began to develop--timber.

New harvesting methods and equipment and the completion of the Oregon and California Railroad helped to spur the development of the timber industry. The railroad provided access to markets for both lumber and agricultural products.

Population

The population of the Upper Rogue River Basin increased significantly during the 1970's. The estimated 1970 population for the basin was 4100.

The basin population continued to grow, and the 1980 census estimated it to be 6657, a 62 percent increase over the 1970 population. The largest city in the basin is Shady Cove with a 1980 census population of 1097. Although the townsite has been settled since the late 1800's, the city was not incorporated until 1972.

Butte Falls is the only other incorporated city in the basin and it had an estimated population of 428 in 1980. Most of the basin upstream of Prospect is part of the Rogue River National Forest and is sparsely populated.

Economy

The present economy of the Upper Rogue River Basin is based on the abundant land and water resources. Lumber, recreation/tourism and agriculture are the three primary industries in the basin.

Most of this basin is forest land and contains a large supply of saw log timber. Approximately 60 percent of the land is held in federal ownership and is managed on a sustained yield basis. Several logging companies and sawmills are located within the basin, but most secondary wood products such as plywood and veneers are made outside the basin in the Medford area.

In addition, the forest resource provides excellent recreational opportunities. Camping, picnicking, hiking and sightseeing bring many visitors to the area each year. In addition, there are several

TABLE 29

UPPER ROGUE RIVER BASIN
AVERAGE MONTHLY TEMPERATURE (F°) AND PRECIPITATION (in.)

Prospect

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	AVG. ANNUAL
Temp	36	40	42	47	54	60	67	66	61	52	43	37	51
Precip	6.7	4.6	4.5	2.6	2.3	1.3	0.3	0.9	1.3	3.5	6.4	7.3	41.7

Period of record: 1952-1981

Crater Lake

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	AVG. ANNUAL
Temp	25	27	27	31	39	46	55	54	49	41	32	27	38
Precip	10.7	7.9	7.8	4.5	3.0	2.2	0.6	1.3	2.2	5.0	9.6	11.8	66.6

Period of record: 1952-1981

Butte Falls

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	AVG. ANNUAL
Precip	5.4	3.6	3.9	2.4	2.1	1.4	0.3	0.7	1.3	3.3	5.4	6.0	35.8

Period of Record: 1954-1981

Source: U.S. Department of Commerce, National Oceanic and Atmospheric Administration.

specific attractions in or adjacent to the basin which attracts tourists. Crater Lake National Park is located just east of the basin and is responsible for bringing thousands of visitors through each year. State Highway 62 goes through the Upper Rogue River Basin and is one of three routes to the park. The businesses located along this highway rely heavily on the seasonal tourist trade.

Lakes and reservoirs in the basin also provide numerous recreational opportunities. Many small lakes lie south of Crater Lake along the Cascade Divide. Located within the Sky Lakes Limited Area, they comprise the Seven Lakes Basin, Sky Lakes group and Blue Canyon Lakes. This area is a very popular hiking and fishing area. Lost Creek Reservoir above McLeod, and Willow Creek Reservoir above Butte Falls both provide boating and fishing opportunities. Additional recreation facilities will be available when the authorized Elk Creek Reservoir is constructed.

Agriculture becomes the dominant economic factor in the lower third of the basin. Livestock and the associated forage crops are the most prevalent agricultural enterprises. Cereal grains are the second most common crop and are grown under both dryland and irrigated conditions. Pears are probably the highest value crop grown in the basin and contribute significantly to the basin's economy.

Land Use

The Oregon Water Resources Department conducted a land use inventory of the Rogue River Basin in late 1978. Results of the inventory for the Upper Rogue River Basin are shown on Table 30.

Approximately 93 percent of this basin is classified as forest land. Most of the forest land is owned by the Federal Government and is managed by either the U.S. Forest Service or the Bureau of Land Management. The National Park Service manages 286 square miles within the boundaries of Crater Lake National Park, about 110 square miles of which is in the Upper Rogue River Basin.

Most of the agricultural land is located in the lower portion of the basin. A large block of agricultural land is located along either side of the Rogue River below the City of Shady Cove. Additional farm lands occur along Big Butte Creek and along the Eagle Point Canal.

Approximately 36,400 acres, or 4.5 percent of the total basin area, are classified as non-irrigated agricultural land and range land. These categories were combined to define possible irrigable lands for this study. Jackson County soils data were then overlaid to delineate only those areas which were considered to be potentially irrigable, i.e., those areas with soils in groups I through IV having no severe limitations. Based on this methodology, over 20,000 acres of land in the Upper Rogue River Basin have the potential to be irrigated. This represents only 2.5 percent of the total basin area. Over 7000 acres are presently classified as irrigated land (See Table 30). A land use map of the Rogue River Basin is shown in Plate 2.

TABLE 30

LAND USE: UPPER ROGUE RIVER BASIN

USE	ACRES	PERCENTAGE OF BASIN
Irrigated Agricultural land	7,130	0.9
Non-Irrigated Agricultural land	5,780	0.7
Range land	30,580	3.8
Forest land	748,740	93.0
Water bodies	4,130	0.5
Urban Areas	750	0.1
Other	7,570	1.0
Total	804,680	100.0

The topography and land ownership of the Upper Rogue River Basin illustrate the basic development problems facing the area. The extremely rugged terrain leaves very little area suitable for sustaining development. In addition, a large portion of the basin is in public ownership. Most of the land suitable for development, however, is in private ownership.

WATER RESOURCE DATA

Precipitation

The higher levels of the Upper Rogue River Basin above 4000 feet in elevation experience average annual precipitation of about 60 inches. Below 2500 feet, the average annual precipitation drops to 30 inches. About 75 percent of the annual precipitation occurs during the months of November through April with an average annual snowfall of 68 inches in the valleys and 318 inches in the mountains.

Average monthly precipitation for Prospect, Crater Lake and Butte Falls is displayed in Table 29. An isohyetal map of the Rogue River Basin is shown in Plate 4.

Streamflow

There are 19 active stream gaging stations in this basin including the gage on Lost Creek Lake. Stream gaging records are published in water supply papers by the U.S. Geological Survey and the Oregon Water Resources Department.

Annual yield diagrams compiled for two points along the Rogue and on Big Butte, Elk, and Red Blanket Creeks are shown in Figures 1-5. These diagrams show the annual yields for the period of record at each site. On the long record for Rogue River above Prospect, (Station 14328000) the dry and wet cycles can be seen during the 30's and 50's respectively.

Monthly runoff distributions for various stations in the Upper Rogue River Basin are shown in Figures 1-5. Monthly distribution of runoff is quite different for the sites depending on location. Elk Creek's monthly distribution curve resembles a precipitation curve for the area with peaks in the December through March period. The Rogue River above Prospect has a much different runoff distribution, since much of the watershed lies above 4000 feet in elevation which is covered by snowpack. The snow melts in the spring causing the peak runoff to occur in May. The effect of both winter rains and spring snowmelt is evident in flows of the Rogue River further downstream with a January or February rain-caused peak followed by an April or May spring-freshet peak.

The maximum recorded discharge for the Rogue River at Dodge Bridge occurred on December 22, 1964. The flow was estimated to be 87,600 cfs. Elk Creek near Trail and the Rogue River above Prospect also reached maximum recorded discharges on the same day. They are estimated to be 19,200 cfs and 22,400 cfs, respectively.

Ground Water

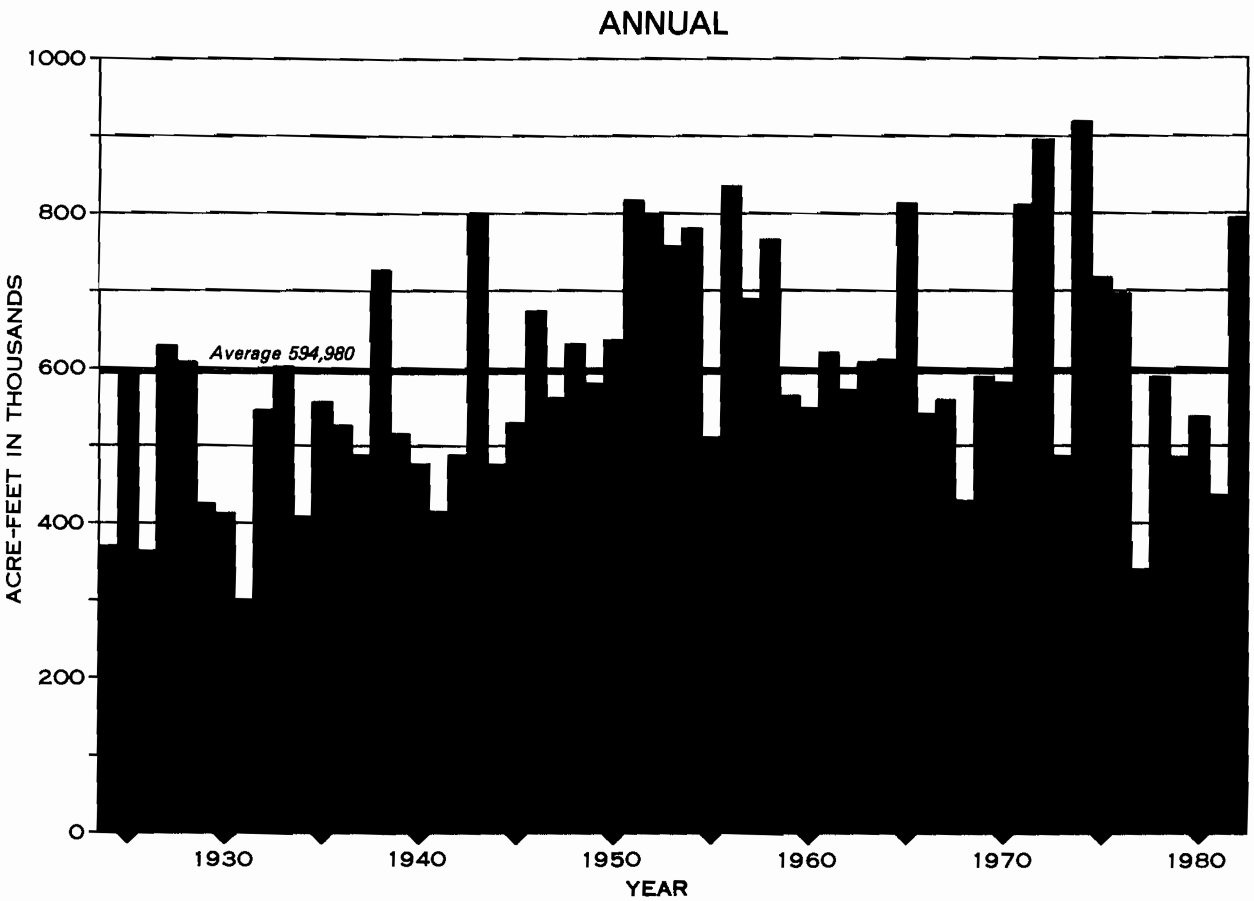
The ground water resource in the Upper Rogue River Basin remains largely unexplored in the mountainous eastern section. The aquifer underlies rugged mountainous areas and is recharged every year by the high levels of precipitation. This ground water is discharged slowly to the headwater streams of the Upper Rogue system resulting in high base flows.

Other than a few areas of alluvium, the rest of this basin consists of low permeability rocks, capable of yielding only small quanitities of ground water, generally only adequate for domestic, livestock or other small uses. At Shady Cove, along the Rogue River, there apparently are two or more small basins filled with as much as 50 feet of saturated alluvial deposits. If these deposits are coarse grained and are hydraulically connected with the Rigue River, they could be a source for a small community water supply. Test drilling and aquifer testing will be required to properly evaluate these areas.

In Township 32 South, Range 3 East, near Prospect, east of the Rogue River Gorge, most wells are less than 150 feet deep and are completed in basalt which is overlain by a small but variable thickness of saturated pumice that was deposited in the area following the eruption of Mount Mazama. Wells are completed in the basalt because the pumice tends to float and clog pumps and plumbing. One 42-foot. deep well in this area reportedly pumped 265 gallons per minute when tested. Much of the water obtained from the basalt probably is induced recharge from the overlying pumice beds.

Figure 1

RUNOFF
Rogue River Above Prospect
DRAINAGE AREA 312 SQ. MI.



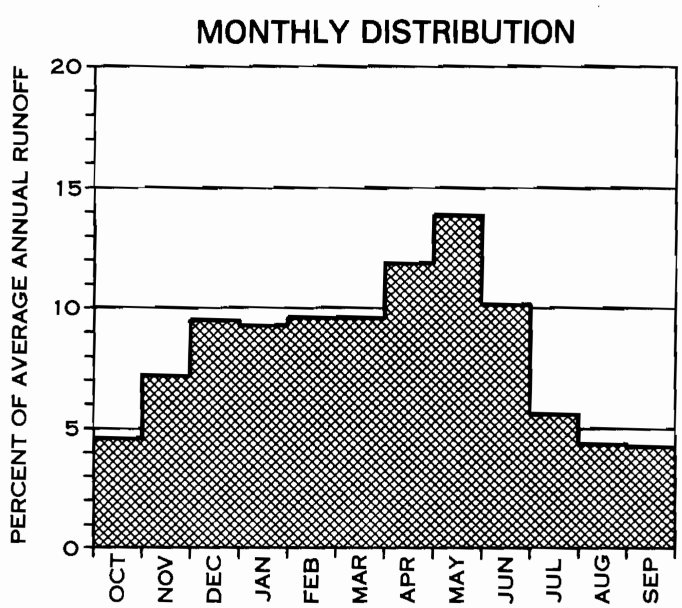
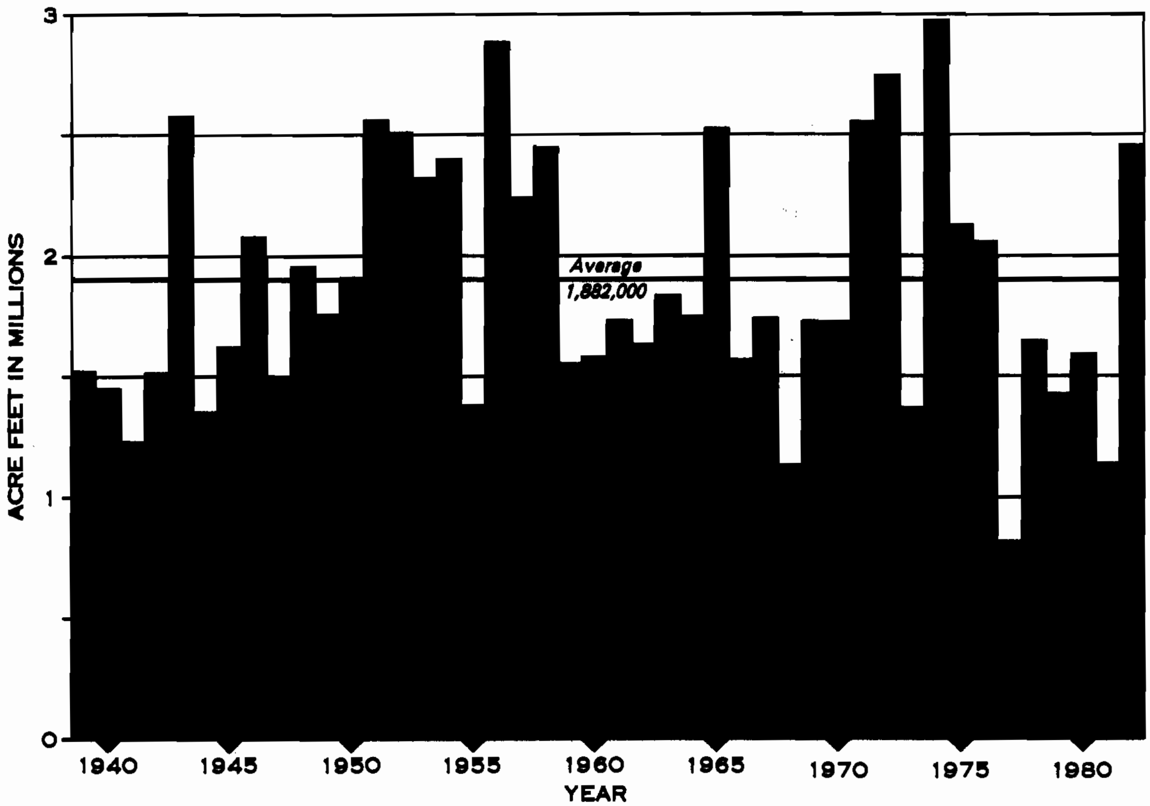


Figure 2

RUNOFF
Rogue River At Dodge Bridge

DRAINAGE AREA 1,215 SQ. MI.

ANNUAL



MONTHLY DISTRIBUTION

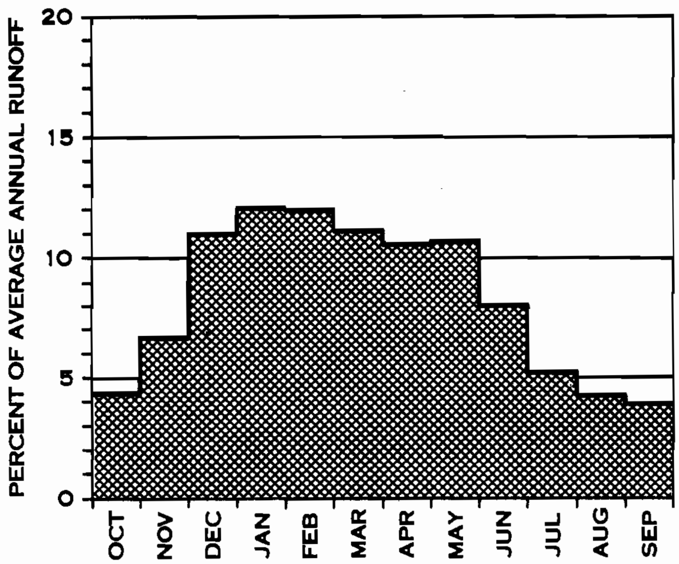
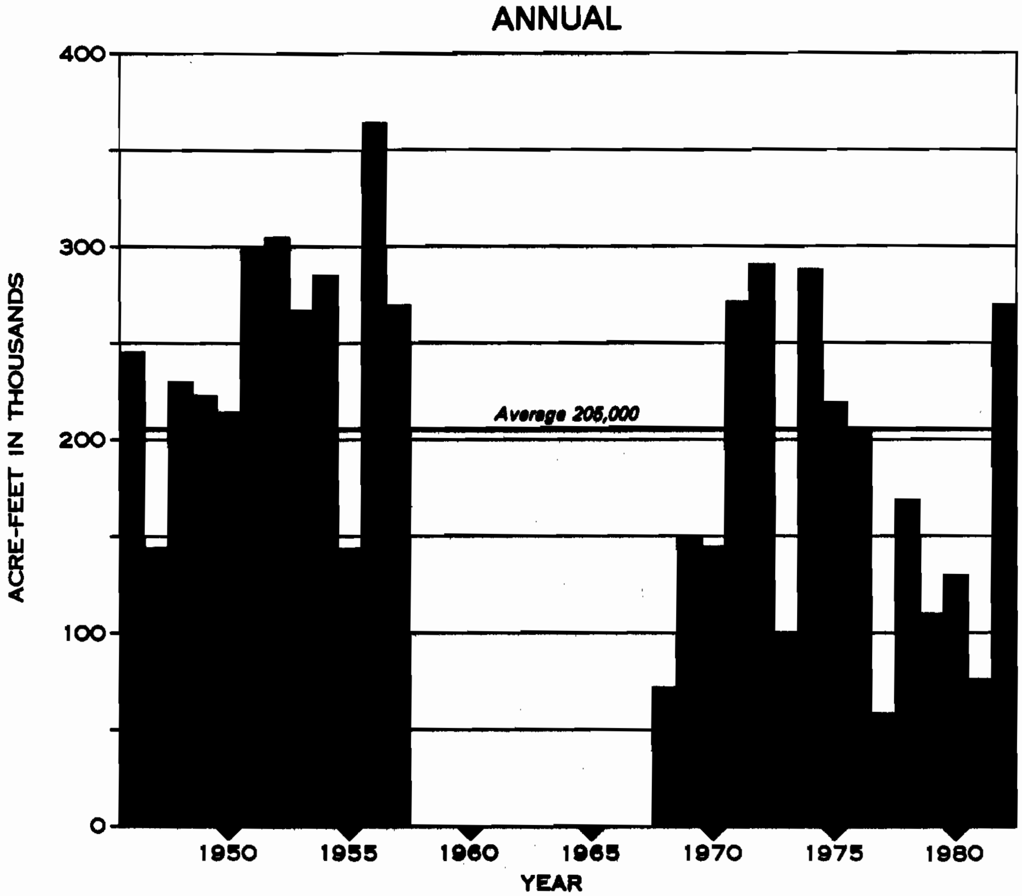


Figure 3

RUNOFF

Big Butte Creek Near McLeod

DRAINAGE AREA 245 SQ. MI.



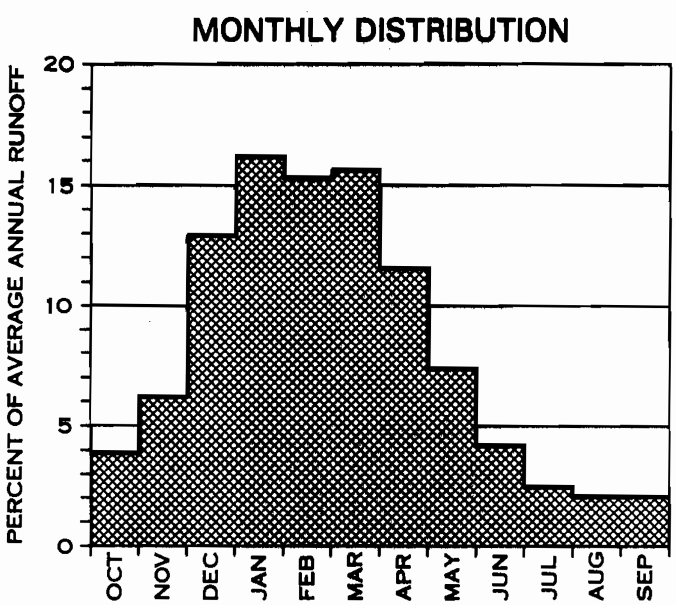


Figure 4

RUNOFF
Elk Creek Near Trail

DRAINAGE AREA 133 SQ. MI.

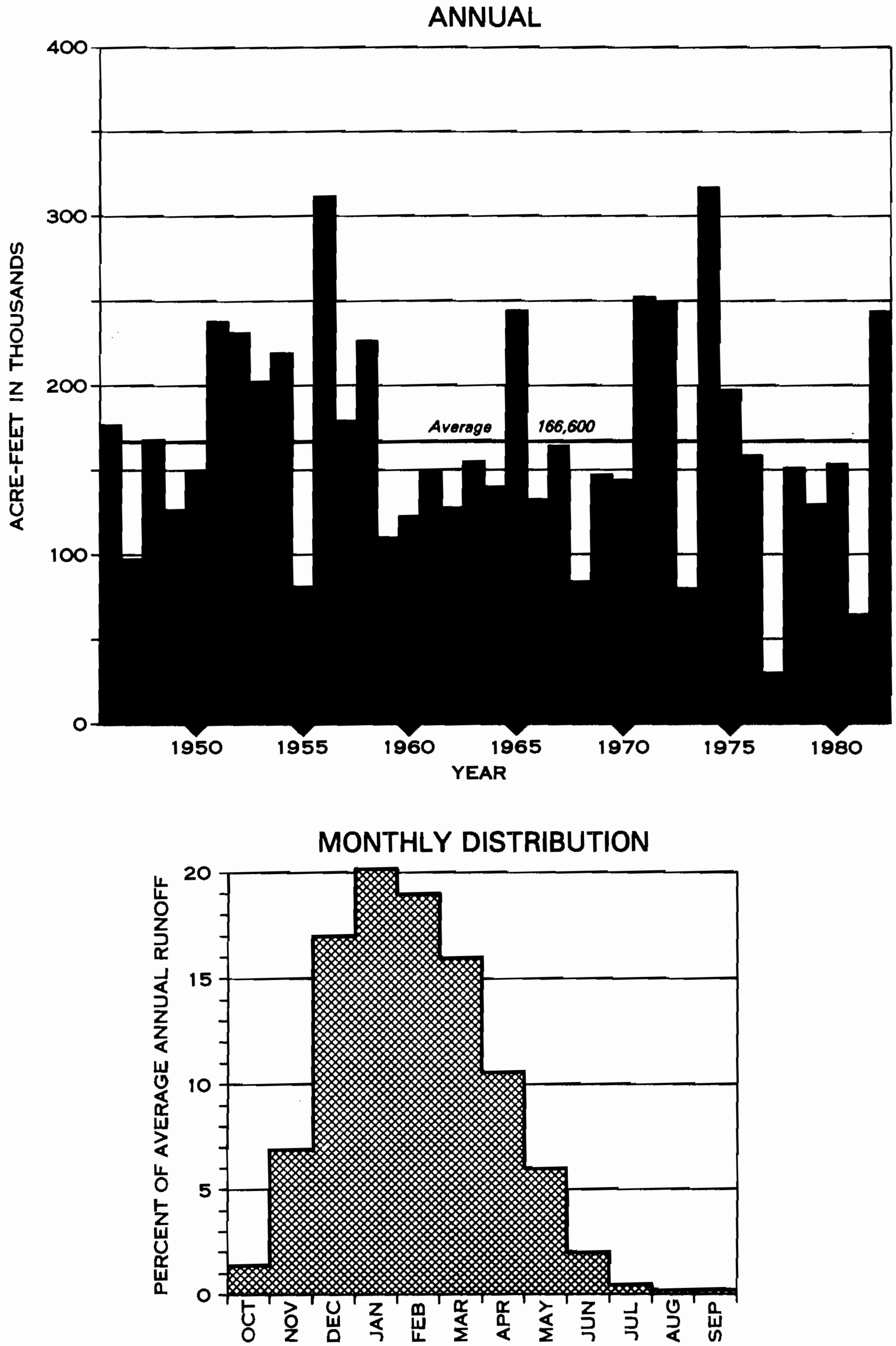
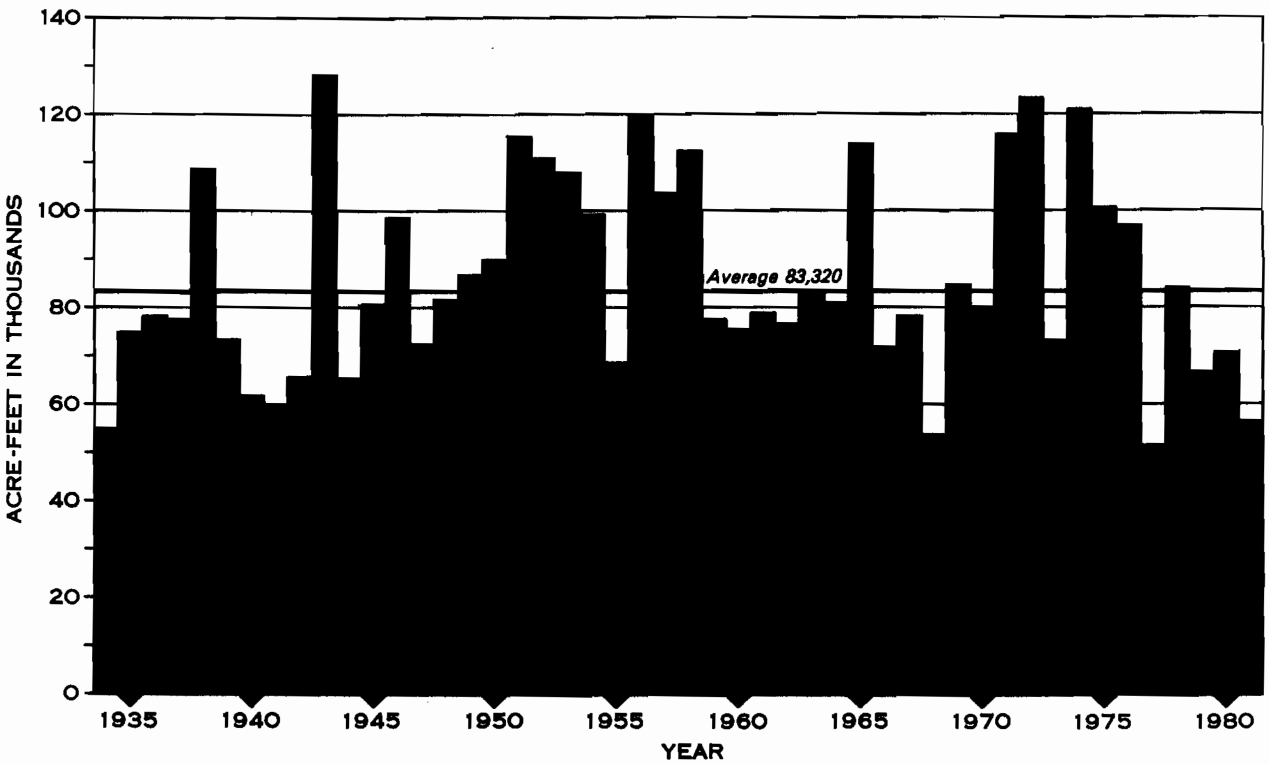


Figure 5

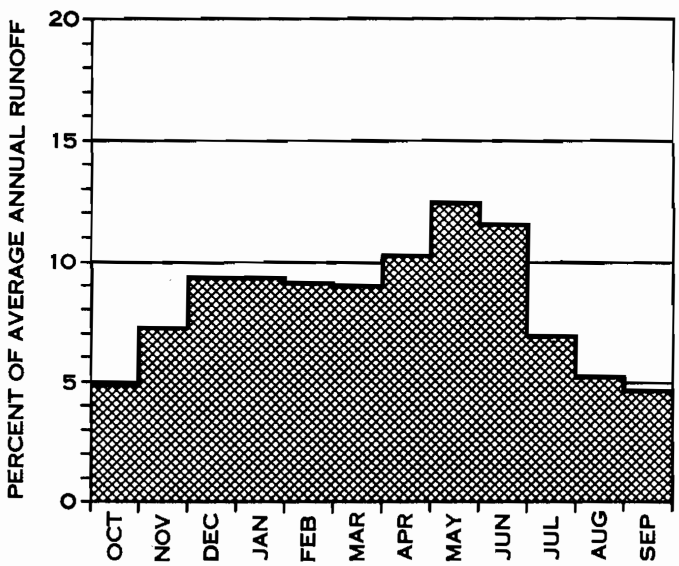
RUNOFF
Red Blanket Creek Near Prospect

DRAINAGE AREA 45 SQ. MI.

ANNUAL



MONTHLY DISTRIBUTION



Significant water level declines due to pumping are not known to be a problem in any part of the Upper Rogue River Basin. Local temporary declines can be expected within the low permeability formations due to seasonal pumping stress.

Water Rights

Table 31 is a summary of the water rights by stream and classification in the Upper Rogue River Basin. Power development and fish propagation rights are the largest groups totaling over 3400 cfs. Two thousand cfs of the fish rights is storage release from Lost Creek Reservoir. Downstream fish enhancement is allocated 125,000 acre-feet of stored water from the project. Over 1150 cfs is appropriated for power production. This figure does not include any water released from Lost Creek Dam to produce power.

Irrigation rights total about 345 cfs. Eagle Point Irrigation District (EPID) has rights to divert up to 195 cfs from the Big Butte Creek system, including 95 cfs of stored water from Willow Lake. The City of Medford and EPID have exclusive rights to all waters in the Big Butte Creek watershed not already under appropriation. Recent changes in the law now allow a limited amount of power development on Clark Creek, a tributary of Big Butte Creek.

Medford is the largest municipal user in the basin with 67 cfs of existing rights from the Big Butte Creek system.

TABLE 31

UPPER ROGUE RIVER BASIN - SURFACE WATER RIGHTS - in cfs
July, 1981

	IRR	DOM	STK	MUN	IND	FISH	WLDLF	MIN	PWR	TEMP	REC	FIRE
Rogue R. - Main stem	51.54	.585	.02			2233*	.20		400.0			
Big Butte Cr. and tribs.	221.464**	.365	.09	68.5		15.5			100.0			
Elk Cr. and Tribs.	12.789	.3595	.003		.04							
N. Fk. Rogue R. (Main stem)	15.59	.21	.61						275			
Tribs.	7.384	1.083	1.15		1.697	.63			.24		2.022	.40
S. Fk. Rogue R. and Tribs.	3.917	.08	.065						150			
Middle Fk. Rogue and Tribs.	5.313	.028							225			
Trail Cr. and Tribs.	4.785	.358	.01		.51	.02			3.75			.01
Reese Cr. and Tribs.	4.01	.039				1.66						
Rogue Tribs.	18.145	1.055	.258	.085	1.0	1.18					.05	
TOTALS	344.937**	4.1625	2.206	68.585	3.247	2,251.99	.20		1153.99		2.072	.41

* Stored Water - Lost Creek Reservoir (2000 cfs)
** Includes 95 cfs storage release from Willow Creek Reservoir

Lakes and Reservoirs

The Upper Rogue River Basin has the largest number of lakes and reservoirs of any subbasin in the Rogue River drainage system. Its 28 lakes and reservoirs with surface areas 5 acres or more make up nearly 28 percent of the total number of lakes and reservoirs in the Rogue River Basin, and over 54 percent of the total surface area of all lakes and reservoirs in the basin. Table 17 lists all lakes in the basin with surface areas of at least 5 acres.

Nearly all of the natural lakes in this region are small and located on the western slopes of the Cascade Range. The largest natural lake is Island Lake, with an area of 46 acres. However, Crater Lake is located just east of the basin, and is the largest lake in the area with a surface area of 14,720 acres. Most of the smaller lakes lie south of Crater Lake along the Cascade Divide within the Sky Lakes limited area. They comprise the Seven Lakes Basin, Sky Lakes group, and the Blue Canyon Lakes.

There are also a number of storage reservoirs within the basin that serve multiple purposes, such as recreation, flood control, flow augmentation and irrigation. The largest of these is Lost Creek Reservoir, which has a surface area of 3430 acres. Tne Corps of Engineers is also proposing to build a multiple-purpose project on Elk Creek which would be a 1290-acre storage reservoir. One privately constructed irrigation reservoir, Willow Lake, is located on Big Butte Creek.

Potential Reservoir Sites

Several potential reservoir sites were examined in the Upper Rogue River Basin (see Table 32), but all were eliminated from future consideration because of various physical and hydrological characteristics (see Table 28). The Elk Creek Project was authorized by Congress and though construction has not yet begun, it is still part of the Rogue River Basin Project. It will provide flood control and stored water for many beneficial uses.

WATER NEEDS AND RELATED PROBLEMS

Agriculture

Eagle Point Irrigation District is the largest user of irrigation water from this basin. Though not all lands are located within the Upper Rogue River Basin, the source of water is the Big Butte Creek watershed. Eagle Point Irrigation District estimates it needs 4000 acre-feet of additional water to provide a full supply to existing irrigated lands. Medford and Rogue River Valley Irrigation Districts also use Big Butte Creek water and could use an additional 13,000 acre-feet to supplement existing supplies.

TABLE 32

UPPER ROGUE RIVER BASIN - POTENTIAL RESERVOIR SITES

STREAM	LOCATION	DRAINAGE AREA (sq mi.)	NORMAL ANNUAL PRECIPITATION (inches)	ANNUAL Q80 YIELD (af)	RESERVOIR CAPACITY (af)	DAM HEIGHT (feet)
Indian Cr	34S, 1W Sec 23 NW 1/4	10.5	20	2900	1400	70
Long Br	34S, 1W, Sec 17 S 1/2	8.4	28	4250	2600	70
Dry Cr	35S, 1W Sec 5 N 1/2	6.1	22	2070	1000	50
Reese Cr	35S, 1W Sec 10 SE 1/4	18	23.5	7200	1150	65

Lost Creek Reservoir provides 315,000 acre-feet of storage for multiple uses. 35,000 acre-feet is allocated for irrigation, but before this water can be used in most areas, a distribution system will have to be constructed.

Presently, most canals and ditches are unlined in the Eagle Point Irrigation District. This condition leads to excessive seepage and water loss. Due to the high cost of lining the existing distribution system, it is currently infeasible to line the system. As future needs for water increase, this may become a more cost-effective option to enhance the supply of water.

Stored water will be the primary source of water for any future development. There is potential to irrigate 1000 more acres in Eagle Point Irrigation District and 19,000 acres in the Sams Valley Irrigation District according to a 1980 Bureau of Reclamation report.

Based on the land use map and soils maps, it is estimated that there are about 20,000 acres of potentially irrigable land in the basin. These areas consist of non-irrigated farm land located primarily in the southwest portion of the basin and designated rangelands with soils suitable for irrigation. The availability of water to irrigate these lands was not specifically determined. It is known, however, that sufficient quanitites of water are not available for irrigation throughout much of the basin and several streams are closed to irrigation, including Big Butte Creek. Lands located along the Rogue River will not receive a full irrigation supply because of prior downstream legal claims to the water.

Elk Creek Dam has been authorized, but not funded, so no construction activity has taken place. The construction of a distribution system would be required to transport the waters of Lost Creek and Elk Creek Reservoirs to needed areas.

In addition to the increased need for irrigation water, frost control in the orchards will rely less on burning oil and more on sprinkling water in the future, particularly as the price of oil increase. It is estimated that 5000 acre-feet of water will be needed annually to provide adequate protection if existing orchards are converted to overhead sprinkler systems.

Mining

There are no water rights for mining in the Upper Rogue River Basin. Pumice is the only mineral which may be mined, and it should not significantly affect the water resources of the basin.

Domestic

Most domestic water supplies are obtained from ground water sources with only 4 cubic feet per second obtained from the Rogue River and its tributaries. While domestic use does not require large quantities of surface water, it is an important beneficial use. Water supplies are expected to be adequate for future needs.

Floods

Flooding is sometimes a problem on the Rogue River. Intense winter rains and saturated soil can create flood conditions in a short period of time. The size of the December, 1964 flood was increased by rapidly melting snow and much of Shady Cove and Trail were inundated with bridges and highways severely damaged or destroyed along the Upper Rogue River. A Sawmill at Shady Cove was also destroyed. Damages caused by the 1964 flood were estimated to be millions of dollars in this basin.

Lost Creek Dam will decrease the damage caused by future floods on the main stem Rogue River at downstream points. Table 27 shows the estimated reduction in flows from the operation of Lost Creek Dam at three of these points. The construction of the proposed Elk Creek project will provide additional flood protection for points downstream of the confluence of Elk Creek and the Rogue River. Shady Cove could benefit from both projects.

Industrial

Existing industrial rights are primarily for boilers and log ponds. Future uses are not expected to require large quantities of water. Additionally, industrial use of the main stem of the Rogue River below the south line of Section 10, Township 34 South, Range 2 West, WM, (near Shady Cove) is prohibited by ORS 538.270.

Aquatic Life and Wildlife

Fish resources are very valuable to the Rogue River Basin economy, directly and indirectly. The Upper Rogue River Basin provides spawning areas for anadromous fish, including coho and spring chinook salmon, and summer and winter steelhead, as well as providing habitat for the resident trout population.

The Cole M. Rivers Fish Hatchery was constructed at Lost Creek Dam to mitigate the negative impacts that Elk Creek, Lost Creek, and Applegate Dams have on the Rogue River fishery. Lost Creek Dam blocks the passage of winter and summer steelhead and spring chinook to some upstream spawning areas but, Lost Creek Reservoir provides 125,000 acre-feet of storage, allocated for release to enhance the downstream flows in the Rogue River. This water can be used to augment summer flows and maintain lower water temperatures downstream in the Rogue main stem.

Elk Creek provides large spawning areas for coho salmon, and winter and summer steelhead. The construction of Elk Creek Dam would block the migration of these fish to the upstream spawning areas, effecively eliminating the anadromous fish on that stream. Table 33 shows the minimum flows recommended by the Department of Fish and Wildlife for Elk Creek, as well as, Indian, Reese, and Trail Creeks in the Environmental Investigations (OSGC, 1970 and 1972). There is an established minimum flow of 835 cfs at river mile 164 on the Rogue River with priority dates of May 22, 1959 for 635 cfs and February 24, 1966 for 200 cfs.

Coho salmon and summer steelhead also spawn in Indian and Trail Creeks. Trail Creek also supports a run of winter steelhead. Table 14 shows the spawning and migration periods for anadromous fish species of this basin.

In addition to the anadromous fish, there is a resident trout population throughout much of the basin. Rainbow, brown, brook, and cutthroat trout are all found in the Upper Rogue River Basin. Mill Creek, Barr Creek, Union Creek and the Rogue River above Prospect provide valuable habitat for the trout population above Lost Creek Reservoir. Elk Creek and Big Butte Creek are the primary trout streams below Lost Creek Dam.

Mill and Barr Creeks have been legislatively withdrawn from appropriation to protect the resident trout population. Portions of Mill Creek have recently been opened to a limited amount of power development.

The Pacific Power and Light power plants in the basin divert large quanitities of water from the South, North and Middle Forks of the Rogue River and Red Blanket Creek, removing most of the flow in sections of these streams during the summer periods. Now that Lost Creek Dam is constructed, these Pacific Power and Light diversions will not affect anadromous fish, however, they could create problems for the trout populations in the affected stream reaches.

Increased development in the basin has placed greater demands on the existing water resource, causing shortages for the fish during the natural low flow periods in summer. Continued development could cause greater water shortages and have increased adverse affects on the fishery.

Wildlife in the basin includes bear, deer, beaver, raccoon, skunk, muskrat, water fowl, upland game, many species of bird, and numerous other small species of mammals. No specific water requirements for wildlife have been identified and existing supplies appear to be adequate.

Municipal

The water resource of the Upper Rogue River Basin provides the municipal requirements for several communities. The City of Butte Falls obtains its water supply from springs located southeast of the City on Ginger Creek. Although increased storage capacity and improved distribution facilities have been recommended, the available water supply is adequate for both existing and contemplated needs.

Oregon Revised Statute 538.730 grants the City of Medford exclusive rights to the waters of Big Butte Creek, its headwater springs and tributaries subject to rights existing on May 29, 1925. These rights are used to provide part of the municipal needs of Medford and several other communities. Water from Big Butte Springs is transported through Eagle Point to Medford in two 24-inch pipelines. Existing use from this source is approximately 19,000 acre-feet per year, and may increase to 21,500 acre-feet per year based on existing plans. Additional information on the Medford municipal requirements can be found in the Bear Creek Basin section.

Lost Creek and the proposed Elk Creek Reservoirs have been identified as potential water sources for many communities including Talent, Phoenix, Medford, Shady Cove, Rogue River and Grants Pass. The City of Phoenix is the only community which has signed a contract with the Corps of Engineers for a municipal water supply. The City's application specifies a diversion rate of 5 cubic feet per second of water up to 1600 acre-feet per year.

The City of Shady Cove is also expected to utilize water from Lost Creek Reservoir. Currently, the city residents depend on individual wells and septic tank systems. The City is now constructing a municipal sewerage system, and plans for a water supply system have been developed. A water right application has been filed for 9.7 cfs of water up to 2304 acre-feet per year.

The City of Rogue River may also contract for water from Lost Creek Reservoir. The City has an unused permit for two cubic feet per second of water from the Rogue River, but has been using wells to provide the municipal supplies. Existing plans identify Lost Creek Reservoir as a potential source.

The Cities of Medford, Talent, and Grants Pass have also identified the Lost Creek Reservoir at a potential source, but do not have plans to use this source in the near future.

Recreation

Although there are few water rights specifically for recreation, the value of water for recreational purposes should not be overlooked. Most of the Forest Service campgrounds are located adjacent to streams, and the recreational and aesthetic value of water features at campgrounds has long been recognized. Many of these campgrounds are used by visitors to Crater Lake National Park. Camping facilities within the park are not adequate to meet the peak demand, and facilities outside the park boundaries are depended upon to accommodate many of the tourists. The scenic value of the Rogue River and the many campgrounds available help attract tourists to this basin. The Rogue River above Prospect provides many recreational opportunities, including fishing, hiking and picnicking.

Lost Creek Reservoir is the largest reservoir in the area, and is heavily used for water skiing, boating, fishing and swimming. The reservoir receives heavy weekend use from residents of the Upper Rogue River, Little Butte Creek, Bear Creek and Middle Rogue River Basins. In addition to Lost Creek Reservoir, Willow Creek Reservoir and the Rogue River are used for boating and fishing.

There are also many small lakes in the Cascades and tributary streams that provide excellent fishing and recreational opportunities within the basin. Hiking and backpacking are popular sports in the Cascade Moutains, but access is much more limited.

Power Development

There are four Pacific Power and Light hydropower plants near Prospect on the main stem Rogue River and on the South Fork Rogue River with a total installed capacity of 44 megawatts. Another plant near Eagle Point can generate 2.8 megawatts. The powerhouse at Lost Creek Dam has a generating capacity of 49 megawatts. See Table 31 for a water rights summary for power development. One of the PP&L plants near Prospect has the capability to be expanded from 32 to 48 megawatts. The proposed Elk Creek project does not include hydropower facilities. It was determined that the generation of power was not economically feasible for that project. However, this does not rule out future hydropower potential after Elk Creek Dam is built. Other sites which are presently being investigated include projects near Union Creek and Prospect on the main stem Rogue River. New legislation which allows a limited amount of power development on Mill Creek and Clark Creek should result in additional power development in the basin.

OSU Water Resources Research Institute has identified 34 stream reaches in the Upper Rogue River Basin with hydropower potential. Ten of these reaches are on the main stem Rogue and the other 24 scattered throughout the basin on major tributaries such as South and Middle Fork Rogue River, Elk Creek and Big Butte Creek. The actual power potential of the various reaches is uncertain.

The increased interest in hydroelectric development in the Upper Rogue River Basin may lead to competition between water users. One potential area of conflict may develop between instream uses for recreation and fish life and power development, particularly in areas of high recreational use such as Union Creek. There is a significant resident trout population above Lost Creek Reservoir which could be affected by increased power development.

Water Quality

Water quality problems in this basin are less severe than elsewhere in the Rogue watershed. There is relatively little population or development within the basin and limited potential for future growth.

Existing problems include turbidity and sedimentation and high water temperatures. Turbidity and sedimentation are results of erosion, both natural and man-made. Certain land use and construction practices add to the erosion problem, particularly logging and road construction. High water temperatures naturally occur during the low flow periods of late summer. Large water diversions aggravate the problem by further reducing instream flows.

Continued water quality declines are not anticipated unless there are substantial changes in land use practices or major new developments in the basin.

DATA ANALYSIS AND FINDINGS

There are sufficient quantities of water on an annual basis within the basin to meet identified needs. Seasonal shortages during the summer and surpluses during the winter occur in many areas of the basin.

A limited amount of flooding occurs most years with larger floods occuring less frequently. Past floods, such as the December, 1964 flood, have caused extensive damage in the Rogue River Basin. Lost Creek Dam was constructed to help control flooding at downstream points. The proposed Elk Creek project will provide additional protection from future floods after it is constructed. The 1964 flood caused extensive erosion damage to roads, farmlands and streambeds. Additionally, many developments located along the Rogue were flooded or destroyed during that flood.

In addition to storage projects, local protective structures and zoning regulations may provide the most effective method of controlling flood damages in the area.

Natural low flows occur during the summer months in most years. During these times of low flows, there is not sufficient quantities of water to meet existing and future needs. Several streams were analyzed on an 80 percent probability basis and found to be deficient in water supply to meet existing needs for the entire year.

Elk, Trail, Reese, and Indian Creeks provide valuable habitat and spawning areas for summer steelhead and coho salmon. All four streams appear to be fully appropriated during part of the summer. There are only limited areas of potentially irrigable lands on these streams, being less than 20 acres, 100 acres, 400 acres, and 780 acres on Indian, Trail, Elk, and Reese Creeks, respectively. Five cubic feet per second, the amount of water necessary to provide a full irrigation supply for 400 acres, may not be available for diversion from Elk Creek during the entire irrigation season. Similar situations may also exist on Trail, Reese, and Indian Creeks even though less water is needed to satisfy the potential irrigation demand.

Other potential uses from these streams may include domestic, livestock, and recreation. Municipal, industrial, mining and power development are not expected to be important future uses on these streams.

The water shortage is quite severe on Indian Creek. Table 33 lists the estimated flows. A use classification would allow human and livestock consumption as well as instream use for recreation, fishlife and wildlife during the entire year. Other uses would have to rely on stored water to satisfy their needs.

Reese Creek also suffers water shortages during the summr months. Generally, any flow in Reese Creek during late summer is EPID water which was imported from another watershed to irrigate lands within the district. Excess water and return flows account for the water remaining in the stream. A use classification allowing domestic and livestock uses would help preserve instream flows. The adoption of a minimum perennial streamflow is another option that may be used to preserve instream flows and maintain the existing fishery.

Flow data for Trail and Elk Creeks are listed in Table 33. Use classifications and/or minimum flows could be utilized to preserve flows for instream uses, yet allow rural development to take place. For part of the year, there appears to be flows adequate to meet the minimum flows requested by fish and wildlife. The establishment of minimum flows would preserve instream flows for fish life, but would limit consumptive uses to only the flow over and above the established minimum. The use classification may make administration of a minimum flow easier by reducing the permit applications.

The proposed Elk Creek Project may conflict with any adopted minimum flow on Elk Creek, greatly reducing or totally eliminating any benefits derived from those flows. However, until the Elk Creek Project is constructed, adopting minimum flows from November through May could provide added protection for fish life.

Water quality is generally good in this basin. There are problems related to low flows, but few problems related to pollution from developments such as human and industrial wastes. There is potential to develop more irrigation in the lower portion of the basin, but no related water quality problems are anticipated.

Elk Creek Reservoir, if constructed, may improve the water quality downstream in the Rogue River by augmenting low summer flows, reducing water temperatures and diluting pollutants at downstream points. Major changes in present forestry and land use practices are not anticipated which could result in a deterioration of water quality in the basin.

TABLE 33

UPPER ROGUE RIVER BASIN
MINIMUM FLOW POINTS
FLOW ANALYSIS

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
Trail Cr. near mouth												
Est. Q80 flow	11	54	125	158	139	124	79	60/32	16	4	2	2/2
Req. Min. flow	30	40	40	40	40	40	40	30/20	10	5	3	10/30
Elk Cr. Sta. 14338000												
Est. Q80 flow	24	125	287	365	321	285	183	105	47/25	12/6	4/4	4
Req. Min. flow	100	70	70	70	70	70	70	60	50/30	20/10	10/100	100
Indian Cr. near mouth												
Est. Q80 flow	1	4	8	10	9	7	6	5/3	2	1	-	-
Req. Min. flow	6	10	10	10	10	10	10	6/2	1	1	1	3/6
Reese Cr. near mouth												
Est. Q80 flow	2	10	19	24	21	17	13	9	4	1	1	1
Req. Min. flow	10	15	15	15	15	15	15	10/6	4	2	1	3/10

Section 2

LITTLE BUTTE CREEK BASIN

PART V

SECTION 2 - LITTLE BUTTE CREEK BASIN

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PART V

SECTION 2 - LITTLE BUTTE CREEK BASIN

CONCLUSIONS

The water resources of the Little Butte Creek Basin are an important part of the total resources available in the Rogue River Basin. In addition to supplying the basic needs for human and livestock consumption, water is also needed to maintain or develop other resources such as fish life and irrigated agriculture.

Existing and future requirements for water in the basin include domestic, livestock, municipal, industrial, irrigation, agriculture, power development, recreation, wildlife and fish life uses.

There are sufficient supplies of water on an annual basis to supply these needs. The location and timing of these supplies have resulted in seasonal water shortages. Continued economic development in the basin may be slowed without developing additional water supplies. Based on an analysis of Little Butte Creek Basin water resource problems and information regarding alternative sources of water, it is concluded that:

1. Domestic, livestock and wildlife requirements, although important, do not require large quantities of water. Supplies appear adequate for present and contemplated requirements for these uses.

2. Existing municipal and industrial water supplies are currently adequate. Additional dependable supplies for future growth may be necessary from such sources as Lost Creek and Elk Creek Reservoirs.

3. Existing water supplies for irrigation are not adequate at all places in the basin. Late summer shortages occur in most years. Large quantities of water are exported to the Bear Creek Basin which greatly decreases the already short supply. Potential to develop an additional 16,600 acres of land exists if dependable water supplies were available.

4. There is little potential for power development in the basin.

5. Fish Life represents an important resource in the basin, but seasonal low flows greatly limit the potential of this resource. Consideration should be given to methods of augmenting these flows.

6. Minimum perennial streamflows have been established on Lakecreek, South Fork Little Butte Creek and Little Butte Creek.

7. Existing streamflows may be fully appropriated during some time periods in Lakecreek, Antelope Creek, North Fork Little Butte Creek, South Fork Little Butte Creek and Little Butte Creek.

8. Antelope Creek is closed to further appropriation for irrigation except for stored water by administrative order.

9. Little potential exists of developing ground water to meet existing and future needs in the basin, particularly large water users.

10. Storage of winter runoff represents an important source of water. Potential reservoir sites were identified on Lake and South Fork Little Butte Creeks. The existing minimum flows on these streams may conflict with these storage projects.

SUBBASIN INVENTORY - LITTLE BUTTE CREEK BASIN

GENERAL DATA

Basin Description

Located in the eastern part of the Rogue River Basin, Little Butte Creek extends from its confluence with the Rogue River near mile 132 to its headwaters in the Cascade Mountains. This basin is bounded on the north by Big Butte Creek, on the south by Bear Creek, on the west by the Rogue River, and on the east by the Cascade Divide. Containing only 374 square miles, Little Butte Creek Basin is one of the smaller basins within the Rogue River drainage. It is located almost entirely within Jackson County with only 19 square miles in Klamath County.

Little Butte Creek and its tributaries flow in a northwestern direction. The North and South Forks are the two largest tributaries. The North Fork begins at Fish Lake and flows west to the confluence of the two forks. The South Fork drains most of the Cascade Divide within the basin and flows in a northwest direction. Antelope Creek drains the southwestern part of the basin and flows into Little Butte Creek approximately one mile below the City of Eagle Point.

Geology

Topography, Drainage and Stratigraphy

The Little Butte Creek Basin lies almost entirely within the Cascade Range physiographic province, which is characterized by mountainous terrain with steep slopes and moderate or high stream gradients. The extreme western portion of the basin, including the lower reaches of Little Butte Creek, lies within the Klamath Mountain region and is known locally as the Agate Desert. The Cascade Range forms a north-south trending volcanic belt across Oregon and divides the state into Eastern and Western Oregon.

Two subregions split the Cascade Range province longitudinally from north to south: the High Cascades in the eastern third of the basin and the dissected Western Cascades. The High Cascades area, which is generally considered to be above 4800 feet in elevation, has an irregular plateau land surface floored by lava. Young volcanic cones rise above the rolling upland plateau; most prominent of these in the watershed is Brown Mountain. From these geologically youthful cones and from other vents came the extensive lava flows underlying the present land surface. Valley profile may represent valley-in-valley forms, where more recent lavas filled old valleys and these flows have been partially eroded by drainage patterns. Lava tongues or canyon flows are particularly well shown in the Little Butte Creek Valley.

Below 4800 feet the watershed lies mostly in the Western Cascades region, which is geologically much older than the High Cascades. The land surface in this region is a deeply dissected, irregular plateau underlain by 3000 to 4000 feet to lava. This part of the watershed is characterized by a rugged topography with many moderately steep-walled canyons, a few gently-sloping canyons, and high sharp ridges.

The Cascade slope in the Little Butte Creek Basin ranges from an altitude of 7311 feet above mean sea level at the west of Brown Mountain down to about 1200 feet at the confluence with the Rogue River, a total relief of over 6100 feet. There are several other peaks with elevations greater than 5000 feet, nearly all of which are in or near the southeast corner of the basin.

A well-developed dendritic drainage pattern has developed over the watershed area in response to approximately 25-30 inches of annual precipitation. Basin streams descend rather gently on the surface of the upland plateau, but plunge steeply down the western slope before leveling out on the main stem. Steep gradients of 200 to 300 feet per mile for the upper reaches of the North and South Forks have resulted in deep canyons cut mostly in jointed lavas of the western slope. In areas underlain by softer, more easily eroded materials, such as tuff or tuff-breccia, broad canyons have developed with rather gently sloping walls. The gradient of Little Butte Creek averages about 25 feet of drop per mile. Little Butte Creek and its major tributaries flow in a generally northwest direction and enter the Rogue River at river mile 132 near the City of Eagle Point.

Soils

The soils of the lower portion of this basin are intensively used for agriculture and homesites. Derived from volcanic alluvium, these soils are generally deep, but may contain a clay hardpan which restricts drainage. The soils usually contain a high proportion of clay, and water infiltration is often slow. Drainage tiles have been used to facilitate the removal of excess irrigation water and the use of sprinkler irrigation techniques has also reduced the problems. These soils produce a variety of crops including forage crops, grains and specialty crops such as pears.

The same soil characteristics which affect the irrigation drainage patterns also limit the use of these soils for septic tanks. The use of larger drainfields can often compensate for the slow percolation rates, but as the population in this basin increases, the capacity of the soil to effectively absorb the effluent may be exceeded.

Climate

The climate of the Little Butte Creek Basin is wet and mild in winter. The moist westerly flow of air from the Pacific Ocean during the winter months result in both rain and snow storms depending upon the elevation of observation.

During the summer months, weather patterns come primarily from the south. As a result, the Little Butte Creek Basin has hot dry summers similar to those in California. The average frost free period varies from about 150 days at Modoc Orchard to 73 days at Howard Prairie Dam. Low humidity and high temperatures common in July and August result in high rates of evapotranspiration, with subsequent stress on the crops.

Precipitation varies from 20-inches to over 50-inches depending on location and elevation. Eagle Point, located on the valley floor, receives about 20-inches of precipitation, while the higher peaks in the upper watershed may get over 50-inches. Table 34 shows the monthly average precipitation at Lakecreek and Howard Prairie Dam.

History

Agriculture was the impetus for the settlement of the Little Butte Creek Basin. During the early days, the food produced provided the needs of the gold miners in the neighboring Bear Creek Valley. The forest in the upper portion of the basin provided timber for the houses, flumes and commercial buildings during the gold mining period. When the railroad was built through Medford, an outside market became available for the agricultural and timber products.

Eagle Point was incorporated in 1911, and has maintained a slow but steady rate of growth until recently. The high regional growth experienced in the last 10 years is also reflected in the growth of Eagle Point.

Population

Little Butte Creek Basin currently has an estimated population of 4707. Eagle Point is the largest city in the basin with a population of 2764. The growth rate during the last ten years has been 123 percent. Most of this growth can be attributed to the growth in the Medford area. The expanding regional population has resulted in Eagle Point becoming a popular suburb of Medford.

The White City area with a population of 5445 is located in both the Little Butte Creek and Middle Rogue River Basins. The percentage of this population located in the Little Butte Creek Basin is unknown. The economic activity of White City affects Little Butte Creek, Bear Creek and the Middle Rogue drainage basins.

Economy

The economy of the Little Butte Creek Basin has traditionally been based on the agriculture and wood products industries. In Jackson County, the forest industry employment has decreased about 13 percent during the period 1960-1982. During that same period, the population increased over 80 percent, indicating a large decline in the wood products industry on a per capita basis. Though this decline is for

TABLE 34

LITTLE BUTTE CREEK BASIN
AVERAGE MONTHLY PRECIPITATION (IN.)

Lakecreek, Oregon

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
3.5	2.6	3.0	1.9	2.3	1.5	0.3	0.6	0.9	2.5	3.4	4.5	27.0

Period of Record: 1952, 1956-1971

Howard Prairie Dam

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
5.3	3.2	3.6	2.3	1.7	1.2	0.3	0.9	1.0	2.5	5.0	6.3	33.3

Period of Record: 1961-1981

Source: U.S. Department of Commerce, National Oceanic and Atmospheric Administration

all of Jackson County, the same trend holds true for the Little Butte Creek Basin. The agricultural sector of the economy has also not kept up with the population increase. The employment declines in the wood products and agriculture industries have been partially counteracted by increases in the service and trade sectors of the economy. The upper portion of the basin is used primarily for timber production, but recreation is an important and increasing use of this area. Fish Lake is a very popular recreational area on the North Fork Little Butte Creek. Fourmile Lake and Lake of the Woods, are located just outside the basin, but are accessible from State Highway 140 through the basin.

Irrigated agriculture dominates much of the lower portion of the basin. Pears, forage crops and grain are the main crops grown in the area. Dams were constructed at Fourmile and Fish Lakes to increase the storage for irrigation purposes. Much of this water is used outside the watershed.

Commercial and industrial activity has been increasing in the lower portion of the basin. Eagle Point is a regional service center for both Little Butte Creek and Upper Rogue River Basins. Commercial activity such as grocery stores, restaurants and shopping centers have increased with the growing population.

Industrial activity is concentrated primarily in White City and along State Highway 62 between White City and Eagle Point. Lumber and wood products, agricultural products and construction companies are the largest industrial concerns.

Land Use

Plate 2 shows the land use patterns in the Little Butte Creek Basin. A land use tabulation of the Little Butte Creek Basin is listed in Table 35. Most of the upper portion of the basin is publicly-owned forest land managed by the Forest Service. The lower part of the basin is primarily agricultural land surrounding the City of Eagle Point. Several smaller parcels of irrigated land extend up both sides of Little Butte Creek and the lower five miles of both the North and South Forks. Finally, large blocks of rangeland occur throughout the basin, but are more common in the lower two-thirds of the basin.

About 46,730 acres (or 20 percent of the basin) are classified as non-irrigated agriculture and range lands. Using soil classification maps it was determined that about 16,650 acres of the above total are potentially irrigable. No consideration was given to water supply or the feasiblity of actually irrigating these lands.

TABLE 35

LAND USE: LITTLE BUTTE CREEK BASIN

USE	ACRES	PERCENTAGE OF BASIN
Irrigated Agricultural land	11,750	5.0
Non-Irrigated Agricultural land	1,350	0.6
Range land	45,380	19.4
Forest land	169,420	72.2
Water bodies	840	0.4
Urban Areas	510	0.2
Other	5,210	2.2
Total	234,460	100.0

WATER RESOURCE DATA

Precipitation

There are no precipitation or temperature gages presently in operation in the Little Butte Creek watershed. There are, however, three snow courses in the basin currently in operation.

Mean annual precipitation varies from 20 inches on the valley floor at Eagle Point to more than 40 inches in the upper watershed at Fish Lake to over 50 inches on the high peaks in the upper watershed. Snow makes up only a minor portion of the total precipitation on the lowlands, but nearly all precipitation in the higher elevations is in the form of snow. Average annual snow depths vary from less than one foot in the lowlands to about 4.5 feet in the highlands. Of the 4.5 foot average snowfall in the highlands, the water equivalent is about 20 inches. Average annual and monthly precipitation values for Howard

Prairie Dam and Lakecreek are displayed in Table 34.

An isohyetal map of the Rogue River Basin is shown in Plate 5.

Streamflow

Currently, there are six active gaging stations in the Little Butte Creek Basin, four on streams and two on reservoirs. The station locations are shown on Plate 4.

Figure 6 shows the annual yield for South Fork Little Butte Creek near Lakecreek for the period of record. The average annual yield for the South Fork is 76,000 acre-feet. The water diverted by the Talent project from the headwaters of the South Fork Little Butte Creek is not included in the 76,000 acre-feet annual yield.

The monthly distribution for the South Fork Little Butte Creek near Lakecreek is shown in Figure 6. The peak runoff occurs during April caused by melting snow. The smaller, lower elevation streams in this basin have runoff characteristics more closely related to the rainfall, with the peak runoff during January-February. Since the completion of the Talent Project, an average 17,030 acre-feet has been diverted annually from the headwaters of South Fork Little Butte Creek for use in the Bear Creek Basin. This diversion reduces the natural yield and alters the runoff characteristics.

Fish Lake and Cascade Canal have significant impacts on the flows in North Fork Little Butte Creek during the irrigation season. These flows are heavily regulated and augmented by waters intended for Rogue River Valley and Medford Irrigation Districts. These Irrigation District's make large diversions above the confluence of the North and South Forks, depleting the streamflows to a point where only enough water is left to satisfy prior downstream rights on Little Butte Creek.

The maximum recorded flow of 7600 cfs in South Fork Little Butte Creek at Station 14341500 occurred on December 2, 1962. On the North Fork Little Butte Creek at Station 14343000, the maximum flow of 1750 cfs was measured on December 22, 1964. Estimated peak discharge frequencies are discussed in the "Water Needs and Related Problems: Floods" section.

Ground Water

The Little Butte Creek Basin consists mostly of tertiary volcanic rocks. These are low permeability rocks capable of yielding only small quantities of ground water. Generally, wells drilled in these rocks are only adequate for domestic, livestock or other small uses.

The area at the mouths of Antelope and Little Butte Creeks consists of alluvium similar to the Bear Creek area. The best water-bearing materials within the alluvium are sand and gravel beds. Generally, these materials are only a few feet thick and too small in extent to be sources of major quantities of ground water. In general, the alluvium contains a large percentage of clay and yields only small-to-moderate quantities of water to wells. The alluvium is recharged mainly by precipitation and, less importantly, by infiltration of excess irrigation waters.

Significant water level declines due to pumping are not known to be a problem in any part of the Rogue River Basin above River Mile 118. Local temporary declines can be expected within the low permeability formations as the result of seasonal pumping stresses.

Water Rights

The amount of appropriated water in the Little Butte Creek Basin is shown in Table 36. The Medford, Rogue River Valley, and Talent Irrigation Districts are the largest users of irrigation water in this basin. These three districts have rights to divert over 900 cfs from the Little Butte Creek system. This 900 cfs and the listing on Table 36 do not include water rights for supplemental irrigation from the Little Butte Creek Watershed. Antelope Creek was closed to further appropriation for irrigation in 1959 by order of the State Engineer.

Medford and Rogue River Valley Irrigation Districts annually divert an average 4,900 acre-feet from the Klamath Basin to the Little Butte Creek Basin then redivert much of the water to the Bear Creek Basin.

Table 39 gives the location and amount of established minimum flows within the basin. These flows are for instream use to maintain the fishery resources of the basin.

Lakes and Reservoirs

There are 20 lakes and reservoirs with a surface area of at least 5 acres in the Little Butte Creek Basin. Fish Lake is the largest with a surface area of 443 acres. Agate Reservoir has a surface area of 216 acres, with all the remaining reservoirs having a surface area of less than 60 acres. Table 17 lists the location and size of all the reservoirs in this basin with a surface area of at least 5 acres.

In addition to the reservoirs located within the basin, two lakes in the Klamath River Basin are related to the water resources of the Little Butte Creek Basin. Fourmile Lake provides part of the water supply for Fish Lake through the Cascade Canal and Howard Prairie Lake receives water from several tributaries of the South Fork Little Butte Creek. Thus, the lakes and reservoirs in the upper Little Butte Creek and Klamath River Basins are part of a network of interbasin water storage and transfer facilities.

Potential Reservoir Sites

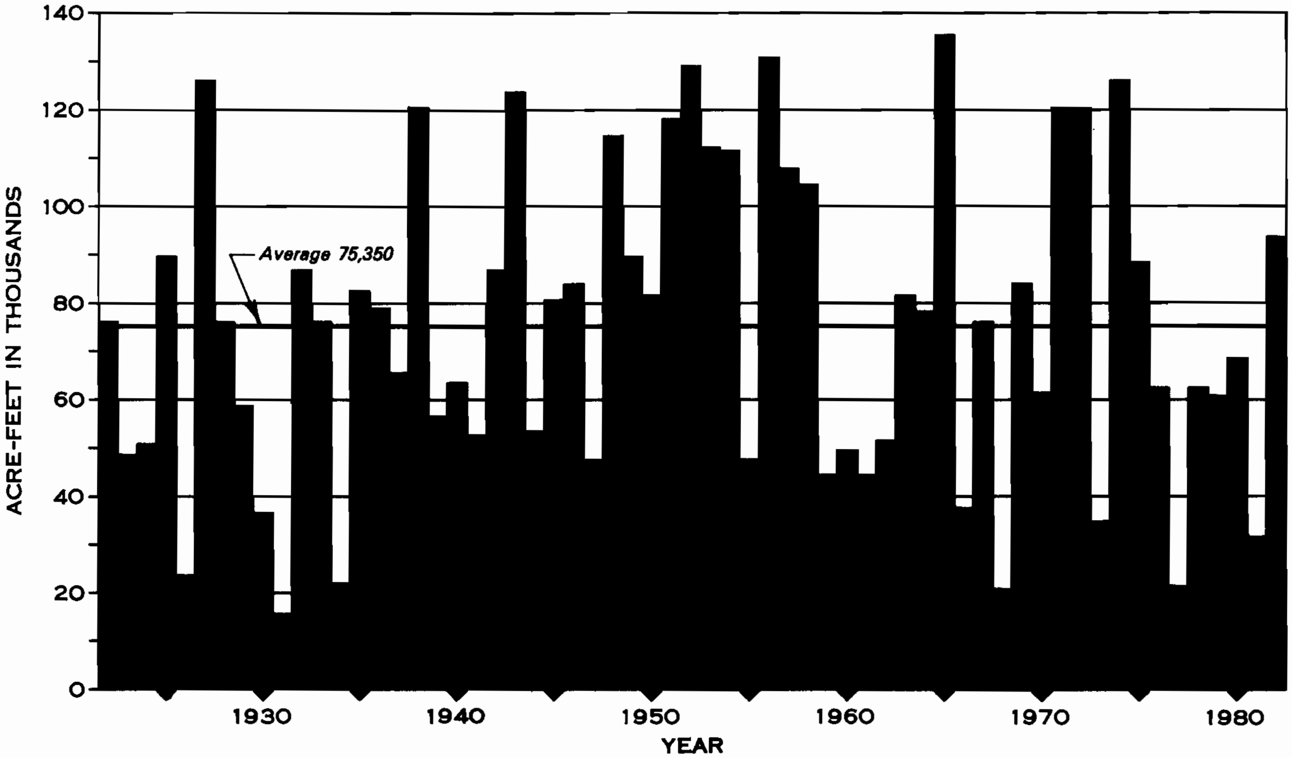
Numerous potential reservoirs sites were investigated as part of this study. (see Table 37). Many of the sites were eliminated from future consideration for one or more of the following reasons; 1) poor geologic conditions, 2) insufficient quantities of, or poor quality borrow material in the immediate reservoir area, 3) poor E/C ratio, 4) inundation of farmland, buildings or other structures, 5) adverse environmental impacts, or 6) insufficient runoff (see Table 28).

Figure 6

RUNOFF
South Fork Little Butte Creek Near Lakecreek

DRAINAGE AREA 138 SQ. MI.

ANNUAL



MONTHLY DISTRIBUTION

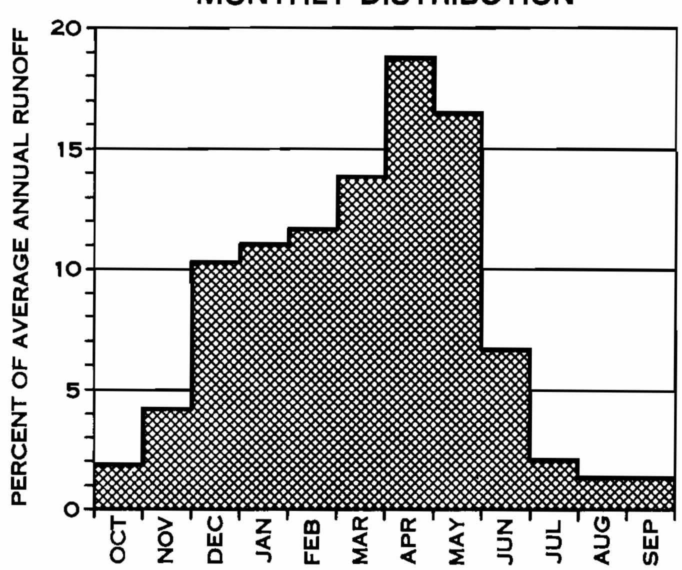


TABLE 36

LITTLE BUTTE CREEK BASIN
SURFACE WATER RIGHTS - in cfs
July, 1981

SUBBASIN 2	IRR	DOM	STK	MUN	IND	FISH	WILD-LIFE	MIN	PWR	TEMP	REC	FIRE
Little Butte Cr.	38.708	.105							40.5			
N. Fk. Little Butte and misc.	673.29	.035	.02	10.0	12.53	3.13			12.5	3.3	.05	.02
S. Fk. Little Butte and misc.	337.63	.535	.155						60.0	40.23	.25	
Antelope Cr. and misc.	17.81	.067	.04		1.0					9.78	.05	
Little Butte misc.	49.961	.485	.012			1.01					.10	
TOTALS	1117.4	1.227	.227	10.00	13.53	4.14			113	53.31	.45	.02

Note: 344.33 cfs of N. Fk. Little Butte Cr. from Permit 407 (Fish Lake).

TABLE 37

LITTLE BUTTE CREEK BASIN - POTENTIAL RESERVOIR SITES

STREAM	LOCATION	DRAINAGE AREA (sq mi)	NORMAL ANNUAL PRECIPITATION (inches)	ANNUAL Q80 YIELD (af)	RESERVOIR CAPACITY (af)	DAM HEIGHT (feet)
Lick Creek	36S, 1E, Section 2 & 3	15.8	31.4	9,700	3,300	80
Salt Br	36S, 2E, SW Corner Sec 5	14.2	36.1	10,400	5,200	120
Kanutchan Creek	35S, 1E, Sec 33 NE 1/4	3.7	27	1,850	720	60
Antelope Creek	37S, 1E, Sec 5 NW 1/4	43	26.1	18,500	9,860	110
Antelope Creek	37S, 1E, Sec 15 NW 1/4	36	26.5	15,400	5,500	110
L. Butte Creek	36S, 1E, Sec 5 NW 1/4	274	-	75,700	11,200	70
S. Fk. L. Butte Cr	36S, 2E, Sec 29 SE 1/4	138	30	44,300	17,000	140
Lake Cr	36S, 2E, Sec 30 E 1/2	14.2	28.6	5,080	2,900	60

Two of the potential sites warrant identification in the existing county land use planning process pending future water resource development decisions at the local, state and federal level. These two potential project sites are discussed below, not necessarily in order of priority.

There may be a conflict between existing minimum flows and the amount of water available for storage at these two sites. However, until one or both of these projects is determined to be economically feasible, there is no need to change the minimum perennial streamflows on these streams.

Site Name: Lake Creek
Location: Township 36 South, Range 2 East, Section 30, East 1/2
Dimensions: The proposed earthfill dam is 60 feet high and 620 feet long. The elevation at the top of the dam is 1760 feet above mean sea level. About 118,000 cubic yards of fill material is required for the construction of the dam. The reservoir could store about 2,900 acre-feet with a surface area of 120 acres. The embankment/capacity (EC) ratio of the project is 41.

Hydrology: The drainage area above this site is over 14 square miles. The normal annual preciptation for the watershed is 20.6 inches. The Q80 annual runoff is estimated to be 5,100 acre-feet with about 3,800 acre-feet of runoff during the November through March period. The existing minimum flow on Lake Creek requires 3,600 acre-feet of water during the November - March period, which leaves no water for storage.

Soils: The only available soils data found for this area is in a report done on a dam site on the South Fork Little Butte Creek entitled "Little Butte Creek Watershed Preliminary Investigation Report," by the State Engineer of Oregon in 1971. According to this report, the predominant soils along the bottom lands and gently sloping terraces are siltly Chehalis and clayey Abiqua series. These soils are well drained and generally deeper than 40 inches. The Abiqua series should provide sufficient quantities of clay for the zoned embankment.

Geology: The 1971 report states, "The reservoir site is principally underlain by rocks of the Roxy formation which comprises a variety of volcanic rocks. These include massive and blocky basalt, dense andesite, flow breccias, rhyolite, agglomerate and fine-grained tuffs. Most of the flows range from 10 to 100 feet thick and are intercalated with much fragmented material. Tuff and breccia beds commonly are of small extent and, in general, not more than a few feet thick. A few beds, however, approach 150 feet in thickness. Cavity and joint filling with secondary minerals, principally zeolites, is a dominant feature in nearly all rock types of the formation at the reservoir site." It concludes that the geologic structure in the area is sound and should support an earthfill dam.

Since the Lake Creek site is only about a mile away from the South Fork site and the geological formation is similar on available maps, the same conclusions can be drawn for the Lake Creek site. Before any work is done at this site, an in depth geological analysis should be performed.

Comments: This is a good reservoir site. The limited development in the reservoir site, includes a barn and a private road. The county road may be affected by a reservoir at this site. The land is privately owned and is now used exclusively for farming.

Alternate sources of water were investigated for this site, but all required the construction of many miles of new canals to transport water from the North and South Forks of Little Butte Creek. This would add greatly to the overall costs of the project, making it much less attractive. Exempting stored water from the existing minimum flow seems to be the only feasible way to provide water for this project.

Site Name: South Fork Little Butte Creek
Location: Township 36 South, Range 2 East, Section 29, SE 1/4 SE 1/4
Note: This site was investigated in 1970-1971 and a report "Little Butte Creek Watershed - Preliminary Investigation Report" was published in September, 1971. Most of the following dimensions and conclusions come from that report. No new investigation was done for this site.

Dimensions: An earthfill, rock faced dam, 140 feet high and 2,800 feet long would create a 16,000 to 17,000 acre-foot reservoir. The elevation a the top of the dam is 1,840 feet above mean sea level. The maximum surface area of the reservoir would be 380 acres. No E/C ratio was computed for this particular dam, however, the E/C ratio of a smaller dam was computed to use for comparison with other sites and is 53.

Hydrology: The drainage area above this site is 138 square miles. The normal annual precipitation is less than 30 inches. The Q80 annual yield at gaging station 14341500 is about 44,300 acre-feet. The amount of runoff during November - March is estimated to be 23,500 acre-feet. Due to snowpack, the South Fork maintains large flows through May and somtimes June. This makes it possible to store water later than March. The established minimum flow on the South Fork requires 21,000 acre-feet of water from November through March which could interfere with the operation of the reservoir.

Soils: The State Engineer's report states that, "Stream bottomlands are characterized by nearly level, recent bottomlands along the streams; but also include small areas of older, nearly level to gently sloping terraces and fans above present bottomlands. The major soils on the recent bottomlands are silty Chehalis and clayey Abiqua series. They are all well drained. These series are normally deeper than forty inches to gravel. Occurring within these soils are isolated pockets of river wash and inclusions of wet soils." There is an adequate supply of clay in the reservoir site that can be used for dam construction, according to the report.

Geology: The report gives a good geologic description of the reservoir and dam site area which will not be duplicated here. The concluding statement from that report follows:

> "There are no apparent detrimental features associated with this site. Strength of abutment and foundation rock is more than sufficient to support an earthfill dam structure. Leakage would not be expected to be excessive, however, minor leakage might occur in the abutment and foundation areas. A dam at this site would require a grout curtain extending at least ten feet into fresh rock and be extended into the abutment and foundation rock. Weathering is moderately deep at the damsite; at least five feet of stripping would be required at each abutment. The dam structure should be keyed into the foundation rock at the base of the structure. A possible slide area at mid-elevation at the left abutment should be investigated by drilling prior to final acceptance of this site. This was not drilled because the project proved infeasible prior to planned drilling.
>
> Several faults are present in the reservoir area, but are not expected to constitute a hazard to the project."

General Comments: Presently, there are only a few places in the reservior site that would be affected. A segment of the county road would be flooded by this reservoir. The area is now used for farming.

The report includes an economic analysis of a multipurpose facility at this site. The benefit/cost ratio was 0.9:1 in 1971. As times change, the benefit/cost ratio may become 1:1 or better, making this a more feasible project.

A project at this site would destroy all anadromous fish runs on the South Fork above this point. Mitigation of this adverse affect could add to the overall cost of the project. Since there is a need for stored water in the area, exempting storage from the existing minimum flow is one option that should be considered.

WATER NEEDS AND RELATED PROBLEMS

Agriculture

The Little Butte Creek Basin has a history of water shortages. Fourmile Lake and Fish Lake were enlarged and fitted with outlet structures to ease the water shortage that existed 50 years ago. Based on the condition of limited supply, the State Engineer withdrew Antelope Creek from further appropriation for irrigation, except for the use of stored water, in 1959.

A major cause of the water shortage in the basin is the level of transbasin diversion that occurs. Thousands of acre-feet of water are diverted to other watersheds each year for major irrigation developments. Portions of Eagle Point and Rogue River Valley Irrigation Districts are within the Little Butte Creek Drainage, however, Little Butte Creek water is used to irrigate areas outside the basin.

Due to the high level of appropriation, water shortages occur on an annual basis. The Watermaster distributes water during most years to water rights with priority dates in the 1800's. During most years, there is not enough water to satisfy existing and anticpated irrigation demands.

Based on land use and soils maps, there is an estimated 16,600 acres of potentially irrigable land in the basin. The majority of these lands, about 15,300 acres, are classified as range lands with soils suitable for irrigation. No consideration was given to water availability or the practicality of actually irrigating. Development of the entire 16,600 acres would increase the irrigation in the watershed by 140 percent.

In the future, lands developed for irrigation will have to rely on storage for water supply because: (1) there is little potential for developing a ground water resource in the subbasin; and (2) the surface water resource is presently inadequate to meet existing needs. Two potential storage sites were identified for future consideration in this basin. As water becomes more valuable, storage projects which are now economically infeasible may become cost-effective.

In order to utilize water from Lost Creek Reservoir or the proposed Elk Creek Reservoir in the Little Butte Creek basin, a system of canals and/or pumping stations would have to be constructed to serve the areas that currently do not have access to such a delivery system.

Mining

There are no water rights for mining in this basin. Manganese is known to occur in several locations within the Little Butte Creek Basin, but no mining activity has occurred since the early 1900's. There are not any known plans to develop these deposits in the forseeable future.

Domestic

Existing domestic needs are small with most supplies coming from ground water sources. Future requirements are not expected to increase significantly, and available supplies appear adequate.

Floods

Development in the basin is mostly residential and agricultural in nature. The flood of December, 1964, was the largest on record, but did less extensive damage in the Little Butte Creek basin than surrounding areas because of the limited development and location within the watershed.

Streambank and field erosion are common problems caused by flooding. Erosion caused by the 1964 flood completely obliterated existing roads and farm lands. The City of Eagle Point also sustained considerable damage during this flood. It was estimated by the State Engineer that approximately $440,000 worth of damage occurred during the December, 1964 flood.

Flood frequencies for Little Butte Creek at Eagle Point, South Fork Little Butte Creek at Station 14341500, and North Fork Little Butte Creek at Station 14343000 are shown on Table 38.

TABLE 38

ESTIMATED FLOOD FREQUENCIES IN LITTLE BUTTE CREEK BASIN

FLOODING SOURCE AND LOCATION	DRAINAGE AREA	PEAK DISCHARGES (CFS) 10-YEAR	50-YEAR	100-YEAR
North Fork Little Butte Creek at Gaging Station 14343000	43.8	571	1057	1331
Little Butte Creek at Main Street in Eagle Point	290	7426	11,743	13,822
South Fork Little Butte Creek at Gaging Station 14341500	138	3310	6330	7950

Industrial

Most of the water rights for industrial use are related to Medford and Rogue River Valley Irrigation Districts. These rights date back to the early 1900's and are for the waters of Fish Lake. Currently, few industries are using water from Little Butte Creek. Most of the existing industry is supplied by the Medford municipal system, and this arrangement is expected to continue.

Aquatic Life and Wildlife

Little Butte Creek and its tributaries, particularly the South Fork Little Butte Creek, make a significant contribution to the Rogue River Basin anadromous fishery. These streams provide spawning areas for summer and winter steelhead and coho and chinook salmon (see Figure 4). Resident trout can also be found along the entire length of Little Butte Creek and many of its tributaries. Table 14 lists the timing of runs of anadromous fish in this basin.

Minimum flows were established on four streams to help perpetuate the fishery. The flow points are listed in Table 39. Two additional points, the North Fork Little Butte Creek at Station 14343000 and Antelope Creek above Rio Canyon, were also considered for minimum flows. The requested minimum flows for these two points, as listed in Basin Investigations - Rogue River Basin (OSGC-1970), are listed in Table 40.

Sufficient water to adequately provide for spawning and rearing of anadromous fish in some of the small tributaries, as well as the main stem, is not always available. Data on flows and the availability of water can be found in the entitled "Amount and Distribution of the Resource" and the accompanying figures.

Reservoirs located upstream in the watershed could provide water during low flow periods. Two potential storage sites in this basin on Lake Creek and South Fork Little Butte Creek were identified for inclusion in local land use plans, to insure their availability in the future. Conflicts with existing minimum flows and beneficial and/or adverse impacts to the fish population would have to be identified and resolved before these dams are constructed.

The wildlife of the area consists mostly of blacktail deer, upland game, waterfowl and beaver. The water needs of these animals is slight and are currently being met.

Municipal

Municipal requirements were anticipated during the planning and enlargement of Fourmile and Fish Lakes by the Rogue River Valley Canal Company. One municipal right for 10 cfs was included in the original water right, but has not been used.

The only municipal water supply system is for the City of Eagle Point. The city contracts with Medford for both water and sewer service.

Recreation

Fish Lake and Agate Reservoir are both heavily used for recreation by the local population. During the late summer months, however, these reservoirs are drawn down for irrigation, thus reducing their value for recreation. Highway 140 through this basin provides access to Fourmile Lake, Lake of the Woods, Howard Prairie and Hyatt Reservoirs. These lakes and reservoirs are all located in Klamath Basin.

Power Development

The Nichols Drop Power Plant is the largest power development in the basin and uses water from Big Butte Creek and the Eagle Point irrigation canal. Several other small power developments exist for family or small industrial uses. There are two small private hydropower projects presently being proposed on the North Fork Little Butte Creek. Both projects would utilize irrigation water which is diverted at downstream points.

In addition to the potential reservoir sites, WRRI identified five stream reaches in the basin that may also have power potential. The stream bed slopes vary from 9 to 41 feet per mile for these reaches on Antelope, North Fork, South Fork and main stem Little Butte Creeks. The feasibility of actually developing any of these reaches is unknown.

Water Quality

Low summer flows combined with high water temperatures are the primary water quality problems. Water temperatures during the summer often exceed the 68 degrees recommended for anadromous fish life and temperatures over 80 degrees have been recorded. Existing laws and regulations for pollution control should help limit future water quality problems.

The ground water quality problems in the area are generally related to regional discharge from deep flow systems.

DATA ANALYSIS AND FINDINGS

The total annual runoff within the basin is sufficient to meet identified water needs. Seasonal and geographical variations in the occurrence of runoff have resulted in shortages during the summer and surpluses during the winter in much of the basin.

Flooding occurs to a limited extent in most years. The less frequent large floods cause extensive damage. Construction of reservoirs with flood control storage, particularly on the larger tributaries, would help reduce this damage. It is doubtful that adequate storage sites exist in this basin to completely control flooding, but it is certain that such projects would not be justified solely on the basis of flood control. Local protective structures and zoning regulations in conjunction with multi-purpose reservoirs may provide the most effective method of controlling flood damages.

Water shortages occur during the summer months in most years. Water requirements for domestic, livestock, industrial, wildlife and municipal uses are relatively small and existing supplies may be adequate. Water supplies may not be adequate for irrigation and other uses.

Fish and Wildlife recommended minimum perennial streamflows at several stream points in the Little Butte Creek system. These points are located on high priority anadromous fish streams, which make a significant contribution to the Rogue fishery. There are established minimum perennial streamflows at three of these points (see Table 39). Flow estimates were based on only a limited analysis. No new use classifications or changes in the existing minimum flows at those points are recommended.

A more indepth flow analysis was performed on Antelope Creek above Rio Canyon and North Fork Little Butte Creek at USGS Station 14343000. Table 40 shows the estimated flows and the requested minimum flows at these two points.

The flow in North Fork Little Butte Creek is heavily regulated by Fish Lake and Cascade Canal during the irrigation season. Though it cannot be determined exactly from existing records, most of the summer flow at Station 14343000 is water which gets diverted at downstream points. Rogue River Valley and Medford Irrigation Districts use this water to irrigate lands, most of which are outside the Little Butte Creek Basin. The water that remains in the stream is needed to satisfy existing rights at downstream points.

There appears to be no unappropriated water at this point. A use classification could possibly provide some protection for fish life but, none is being recommended because: 1) much of the land in the upper reaches of North Fork Little Butte Creek is federally owned and 2) most development occurs downstream.

Antelope Creek, above Rio Canyon, also appears to have very little flow during July through September (see Table 41). No new minimum flow or use classifications were recommended because 1) there is a minimum flow at the mouth of Antelope Creek, 2) further appropriations for irrigation are not allowed by order of the State Engineer. The Antelope Creek area is becoming more heavily developed with homes in a rural setting which will require water for domestic and garden uses.

Though no potential reservoir sites were recommended for future development on Antelope Creek or North Fork Little Butte Creek, stored water remains the best source of water to augment summer flow. As future demand for water increases and priorities change, storage sites which are currently infeasible now may become cost effective solutions to the water shortage problems.

Potential storage sites on Lake Creek and South Fork Little Butte Creek are being recommended for inclusion in the local land use plans so that they might be preserved for future development. There are established minimum flows on both Lake Creek and South Fork Little Butte Creek (see Table 39) that could interfere with the operation of these future reservoirs. There could also be significant impacts on anadromous fish if a dam is constructed on South Fork Little Butte Creek, particularly if located low in the watershed.

There appears to be only limited potential to develop ground water in the basin. Most wells have low yields, capable of satisfying domestic needs, but not irrigation or other large uses.

It is not possible to analyze the water resources of Little Butte Creek and tributaries without mentioning the present situation of trans-basin diversions. The City of Eagle Point contracts with the City of Medford and is supplied from the Big Butte Basin. Medford, Rogue River Valley and Talent Irrigation Districts all divert water from the Little Butte Creek Basin for use in the Bear Creek and Middle Rogue River Basins. Water from the Klamath River Basin is also diverted through the Little Butte Creek Basin for use in the Middle Rogue River Basin.

Regionally, the greatest future demands of the waters of the Little Butte Creek watershed will be for irrigation, agricultural use, domestic use, and fish and aquatic life. Until other sources are found and developed, stored water, conservation and the importation of water from other areas are the most realistic means of satisfying those future needs.

TABLE 39

LITTLE BUTTE CREEK BASIN
ESTABLISHED MINIMUM FLOWS IN CFS

STREAM	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JULY	AUG	SEPT
Antelope Creek at Mouth South Fork	20	25	25	25	25	25	25	10	5	5	5	5/20
Little Butte Creek at Station - 14341500	50	70	70	70	70	70	70	30	30	20	20	20/50
Little Butte Creek at Mouth	120	100	100	100	100	100	100	60	60	20	20	120
Lake Creek at Mouth	8	12	12	12	12	12	12	4	1	1	1	1/8

TABLE 40

LITTLE BUTTE CREEK BASIN
MINIMUM FLOW POINTS
FLOW ANALYSIS

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT
North Fork Little Butte Sta - 14343000 *												
Est. Q80 Flow (Regulated)	28	34	44	48	45	57	57	62	60	72	72	51
Req. Min Flow	20	20	30	30	30	30	30	20	20	15	15	15
Antelope Creek Above Rio Canyon **												
Est. Q80 Flow	5	19	36	46	40	33	25	17	7	2	1	1
Req. Min Flow	20	20	25	25	25	25	25	15/10	5	3	2	2/8

* North Fork Little Butte - Heavily regulated by upstream diversions
** There is a use limitation on Antelope Creek

Section 3

BEAR CREEK BASIN

PART V

SECTION 3 - BEAR CREEK BASIN

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PART V

SECTION 3 - BEAR CREEK BASIN

CONCLUSIONS

The water resources of the Bear Creek Basin are an important part of the total resources available in the Rogue River Basin. In addition to supplying the basic needs for human and livestock consumption, water is also needed to maintain or develop other resources such as fish life, irrigated agriculture, and industry.

Existing and future requirements for water in the basin include domestic, livestock, municipal, industrial, irrigation, agricultural use, power development, mining, recreation, wildlife and fish life uses.

There are not sufficient supplies of water on an annual basis to supply existing needs. The location and timing of the supply results in severe seasonal water shortages. Continued economic development in the basin will be slowed without developing additional water supplies. Based on an analysis of Bear Creek Basin water resource problems and information regarding alternative sources of water, it is concluded that:

1. The existing water use program essentially closes Bear Creek and its tributaries to appropriation except for power development and the use of stored water.

2. Domestic, livestock and wildlife requirements, although important, do not require large quantities of water. Supplies appear adequate for present and contemplated requirements for these uses.

3. Existing municipal and industrial water supplies within the basin are not adequate and additional dependable supplies for future growth may be necessary. Most municipal water is imported from other basins and future supplies will probably also be imported.

4. Existing water supplies for irrigation are not adequate to meet existing needs in the basin. Large quantities of water are imported from Klamath, Little Butte Creek, Big Butte Creek and Applegate River Basins. An additional 21,700 acres of land within the basin has the potential to be irrigated if dependable water supplies were available.

5. Power does not represent a significant factor in existing and presently contemplated needs and uses of water.

6. Mining does not represent a significant factor in existing and contemplated needs and uses of water.

7. Fish life represents an important resource in the basin. Consideration should be given to methods of augmenting these flows.

8. Recreation on Emigrant Lake and the utilization of regulated flows

for recreation is an important use of water in the basin.

9. Ground water does not represent a significant alternative source of water.

10. Storage of winter runoff represents an important source of water. A potential reservoir site on Walker Creek has been identified for future consideration.

11. There are serious water quality problems in the Bear Creek Basin.

SUBBASIN INVENTORY - BEAR CREEK BASIN

GENERAL DATA

Basin Description

Located in the extreme southeast corner of the Rogue River Basin, Bear Creek flows down the western slopes of the Cascade Divide and joins the Rogue River at river mile 127. The Bear Creek Basin is the smallest of the seven hydrologic divisions in the Rogue drainage. Bounded on the east by the Little Butte Creek Basin, and on the west by the Applegate River Basin, this 341 square mile basin is entirely within Jackson County.

Geology

Topography and Drainage

Bear Creek Basin lies almost entirely within the Klamath Mountains physiographic province, which has the oldest rocks in Western Oregon and may contain some of the oldest formations in Oregon. The Klamath Mountain region is typically rugged with narrow canyons and much lower than the peaks of Cascade Range. Local differences in elevation range from 2000 feet to 5000 feet, and slopes of 30 degrees are common in the mountains. Elevations within the watershed range from 7533 feet at the summit of Mt. Ashland down to 1160 feet at the confluence of Bear Creek and the Rogue River, a difference of 6373 feet.

The major feature of the watershed is the Bear Creek Valley. The valley is oriented from southeast to northwest, is about 25 miles long and ranges from two to six miles wide. Upper Bear Creek Valley lies between the Siskiyou Mountains on the southwest and the Western Cascades on the northeast and opens to the Rogue River Valley on the northwest. Although the Bear Creek Valley has more expanse of agricultural lands than any other valley in the Rogue River Basin, two-thirds of its area is unsuitable for farming due to mountainous or forested terrain and urbanization.

The rocks of the rugged Siskiyou Mountain region of the Klamath Mountains province southwest of Bear Creek are nearly all structurally complex metamorphic and intrusive rocks. Rocks in the valley and the more subdued Western Cascades highlands to the northeast are gently dipping sedimentary and volcanic rocks. The oldest rock units in the basin are exposed south and west of Medford and progressively younger rocks are found toward the northeast.

The gradient of Bear Creek is rather mild compared to other streams in the Rogue River Basin, averaging just over 30 feet of drop per mile. The slope of Ashland Creek, however, one of Bear Creek's major tributaries, is over 400 feet per mile. Bear Creek and its extension, Emigrant Creek, flow in a northwest direction and enter the Rogue River near river mile 127, while most of its tributaries flow generally towards the north or the south depending on which side of Bear Creek they rise.

Stratigraphy

The board Bear Creek Valley separates the eastern part of the Klamath Mountains province from the Western Cascades province. The Siskiyou Mountain region is located in the southern portion of watershed. The valley floor itself is overlain by alluvium, consisting of sand, silt, and gravels deposited by water in recent times.

The foothills and mountains to the north and east of Bear Creek are geologically younger than those to the south and west and are considered to be in the Western Cascades region.

Soils

The soils of the Bear Creek Valley represent a transition between soils derived from the volcanic rocks of the Cascade Range and those derived from the granitic and metamorphic rocks of the Siskiyou Mountains. Alluvial material from both mountain ranges are washed down Bear Creek and its tributaries to form deep soils which are intensely used for agriculture and homesites. Many of these soils are affected by a high water table within 2-3 feet of the surface. This water table limits agricultural production to crops with shallow root systems, or requires the installation of tile drains. Additionally, septic tank drain fields may have severe problems.

Soils on the higher alluvial terraces are generally not affected by the water table and support a valuable and diversified agricultural industry. Some of these soils do contain a high proportion of clay which may restrict drainage, but proper irrigation management and the use of sprinkler irrigation systems have greatly reduced the problem.

Many of the agricultural fields have been converted to homesites for the expanding population. Where large septic tank drainfields have been constructed to compensate for the drainage problems, few problems have been encountered. In some cases, however, inadequate drainfields have been built, which may contribute to the water qualtity problems. Additionally, as the housing density increases, these soils may become fully saturated with septic tank effluent, causing additional pollution.

Climate

The Bear Creek Basin has a moderate climate with marked seasonal characteristics. Late fall, winter and early spring months are damp, cloudy and cool under the influence of marine air. Late spring, summer and early fall are warm, dry and sunny due to the dry continental nature of the prevailing winds that cross the area. The average frost-free period in the lowlands varies from 140 days to 165 days. Low humidity and high temperatures are common in July and August.

Air temperatures at Medford airport vary from an average of 38°F in January to 72°F in July. Average monthly temperatures and precipitation for Medford airport, Ashland and Green Springs Power Plant are displayed in Table 41.

TABLE 41

BEAR CREEK BASIN
AVERAGE MONTHLY TEMPERATURE (F°) and PRECIPITATON (in) at:

Ashland, OR

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
Temp:	38	42	44	49	56	63	70	68	62	53	43	38	52
Precip:	2.7	1.8	1.9	1.4	1.3	1.1	0.3	0.5	0.9	1.7	2.6	3.2	19.2

Medford, OR

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
Temp:	38	43	46	50	58	65	72	71	65	54	44	38	54
Precip:	3.3	2.1	1.9	1.0	1.2	0.7	0.3	0.5	0.8	1.6	3.0	3.6	19.9

Period of record: 1952-1981

Green Springs Power Plant

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
Precip:	3.3	2.0	2.4	1.9	1.3	1.0	0.2	0.6	0.9	1.9	3.2	4.1	22.8

Period of record: 1961-1981

Source: U.S. Department of Commerce, National Oceanic and Atmospheric Administration

History

Although agricultural opportunities brought the first settlers to the Bear Creek Basin, the discovery of gold near Jacksonville was the primary catalyst for the settlement of this area. The population of Jacksonville grew rapidly until 1883 when the Oregon and California Railroad bypassed Jacksonville and went through Medford.

The railroad provided transporation to outside markets for the agricultural and timber products. Thus, Medford and the surrounding communities in the Bear Creek Basin became an industrial and marketing center. Agricultural products such as pears were brought to Medford, processed and shipped to outside markets by train. Similarly, timber was brought to Medford, made into wood products and shipped to other states.

From this industrial base, the economy and settlement of the basin has continued to expand. Support services such as medical facilities, banking and retail trade have added to the economy.

Population

The commercial and industrial opportunities in the Bear Creek Basin have been responsible, in part, for the large population concentration in the basin. The population of this basin exceeds 100,000 people and is the largest in the entire Rogue River Drainage.

Medford is the largest city with a population of 39,603. Other cities and the 1980 census populations include Ashland - 14,943, Central Point - 6,357, Talent - 2,577, Phoenix - 2,309 and Jacksonville - 2,030. All of these cities experienced population growth during the last ten years. Ashland had the slowest rate of growth with 21 percent increase between the 1970 and 1980 census. Talent experienced the largest growth rate at 82 percent, followed closely by Phoenix at 78 percent.

Additional growth has occurred in the unincorporated areas of the basin. Many of the large farms have been divided into smaller parcels of 10-20 acres suitable for part time farming or hobby-type farms.

Economy

The economy of the basin is dominated by the industrial base. Central to this base is the wood products industry. Drawing on the timber resources from throughout the Rogue River drainage, lumber, plywood, veneer and furniture products are manufactured. Employment in the wood products sector of the economy has been declining since 1978. Lumber production has shown a gradual decline since 1960 and plywood production has decline greatly since 1977.

The services sector is the second largest part of the economy. Included in this category are regional medical services, financial services and numerous motels, restaurants and shops catering to the increasing recreation and tourist market. Interstate Highway 5 passes through the center of this basin bringing in many tourists. Many of these tourists are just passing through the basin to other destinations. Other tourists are utilizing the many year round recreational opportunities in the basin. These include fishing, hunting, hiking, swimming and skiing. Of special note is the Shakespearean Festival held each year in Ashland, which attracts patrons from all over the United States, and the Peter Britt Jazz Festival in Jacksonville.

Agriculture is the third largest contributor to the economy. The horticultural crops, most notably the pear crop, are the most important income producers. However, a significant factor in the agricultural segment of the economy is its lack of expansion in the last few years. Many of the pear orchards are over 70 years old, and production is declining. The production of other high value crops has not increased, causing the agricultural segment of the economy to drop from first place to third.

Land Use

Plate 2 shows the land use patterns in the Bear Creek Basin. The acreages within each category are listed in Table 42.

Although over half of the basin is classified as forest land, most of these lands occur at the upper end of the basin, and along the divides between the Bear Creek and the Applegate River and Little Butte Creek Basins.

TABLE 42

LAND USE: BEAR CREEK BASIN

USE	ACRES	PERCENTAGE OF BASIN
Irrigated Agricultural land	29,030	12.2
Non-Irrigated Agricultural land	7,210	3.0
Range land	44,730	18.8
Forest land	140,320	58.9
Water bodies	1,060	0.4
Urban Areas	15,230	6.4
Other	730	0.3
Total	238,310	100

This basin has the highest concentration of agricultural lands and specifically, irrigated lands within the Rogue River drainage system.

The basin also contains over half of the urban land within the Rogue River Basin. Thus, the land use patterns reflect the high degree of development within this basin, and the corresponding pressures on the water resources.

WATER RESOURCE DATA

Precipitation

The rain shadow created by the Siskiyous and Coast Range results in relatively light annual rainfall, most of which falls during the winter season. Average annual precipitation in the valley is about 21 inches varying slightly from the lower end to the upper end of the valley. Sparse summertime rainfall occurs as thunderstorm activity in the mountains to the south and east for the most part, but occasionally spreads over the valley. Snowfall is quite heavy in the surrounding mountains during the winter. Some areas accumulate depths in excess of 100 inches per year with an equivalent water content of about 39 inches. Valley snowfall is light, individual storm accumulations of snow seldom last more than 24 hours.

Average monthly rainfall for Medford airport, Ashland and Green Springs Power Plant is displayed in Table 41. An isohyetal map of the Rogue River Basin is depicted in Plate 4.

Streamflow

There is currently one active stream gaging station in this basin, not counting stations located on canals or reservoirs. Plate 4 shows the locations of the active gaging station, as well as inactive stations with 10 or more years of record.

The annual yields for Bear Creek at Medford and Emigrant Creek near Ashland are shown in Figures 7 and 8. These annual yield diagrams show the yields for the period of record at each site. These annual yields are not adjusted for transbasin diversions by the Talent Project or for irrigation diversions. The long-term average yield for Bear Creek at Medford is about 82,590 acre-feet per year.

The monthly distribution for Bear Creek at Medford is shown in Figure 7. This distribution reflects the storage in Emigrant Lake and irrigation diversions upstream of the station. In 1960, Emigrant Lake was enlarged from 7000 to 39,000 acre-feet which altered the monthly distribution by reducing the winter flows and increasing the summer flows.

Peak discharges were computed for Wagner Creek at the mouth, Ashland Creek at Ashland and Bear Creek at Medford. These discharges were published in a 1982 FEMA report along with their recurrence intervals. Table 43 lists the discharges as they appeared in the FEMA report. The 100 year flood for Bear Creek at Medford is estimated to be 20,500 cubic feet per second. The peak recorded discharge for Bear Creek at Medford of 14,500 cfs occurred in December, 1962.

Ground Water

The Bear Creek Basin consists of four aquifer units, including Quaternary alluvium, Tertiary volcanic rocks of the western Cascades, Tertiary sedimentary rocks, and Paleozoic - Mesozoic rocks. Each of these aquifer units may include a variety of rock types and, in each

TABLE 43

ESTIMATED FLOOD FREQUENCIES IN BEAR CREEK BASIN

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (SQUARE MILES)	PEAK DISCHARGE (CFS 10-YEAR	50-YEAR	100-YEAR
Wagner Creek At Mouth	23.8	776	1,634	2,146
Ashland Creek At Ashland	27.50	827	1,723	2,259
Bear Creek At Medford (U.S. Geological Survey Gage 14-357500)	284.00	6,770	15,440	20,500

case, more than one geologic formation.

Alluvium underlies much of the floor of Bear Creek Valley. The best water-bearing materials within the alluvium are sand and gravel beds. Generally, these materials are only a few feet thick and too small in extent to be sources of major quantities of ground water. In general, the alluvium contains a large percentage of clay and yields only small-to-moderate quantities of water to wells. The alluvium is recharged mainly by precipitation and, to a lesser extent by infiltration of excess irrigation waters.

The Tertiary volcanic rocks of the western Cascades, the Tertiary sedimentary rocks, and the Palezoic-Mesozoic rocks each consist of low-permeability rocks capable of yielding only small quantities of ground water usually adequate for domestic or livestock use or other small uses.

Significant water level declines due to pumping are not known to be a problem in any part of the Bear Creek Basin. Local temporary declines can be expected, however, within the low permeability formations as the result of normal seasonal pumping stresses.

Water Rights

Table 44 lists the amounts of appropriation for several streams in the basin. Some supplemental irrigation water is included with irrigation because no separation is made between sources and uses on several permits. Talent, Rogue River Valley and Medford Irrigation Districts

TABLE 44

BEAR CREEK BASIN
SURFACE WATER RIGHTS - in cfs
July, 1981

	IRR	DOM	STK	MUN	IND	FISH	WLDLF	MIN	PWR	TEMP	REC	FIRE
Bear Cr.	69.194				1.0					1.45		
Ashland Cr. and misc.	5.164	.10		28.542	.7				54.0		.224	
Emigrant Cr. and misc.	60.048	.795	.10			.05	.25		1.5			
Griffin Cr. and misc.	78.467	.07				.03		1.0		2.5		.05
Wagner Cr. and misc.	35.196							5.20			.25	.01
Walker Cr. and misc.	8.712	.272	.01				1.52					
Bear Cr. misc.	304.457	1.436	.15	2.035	.15	.421		9.604 18.75[1]		11.73		.04
Rogue R. and misc.	3.425					1.85				14.32	.50	
TOTALS	564.663	2.673	.26	30.577	1.85	2.351	1.77	15.804 18.75(1)	55.5	30.0	.974	.10

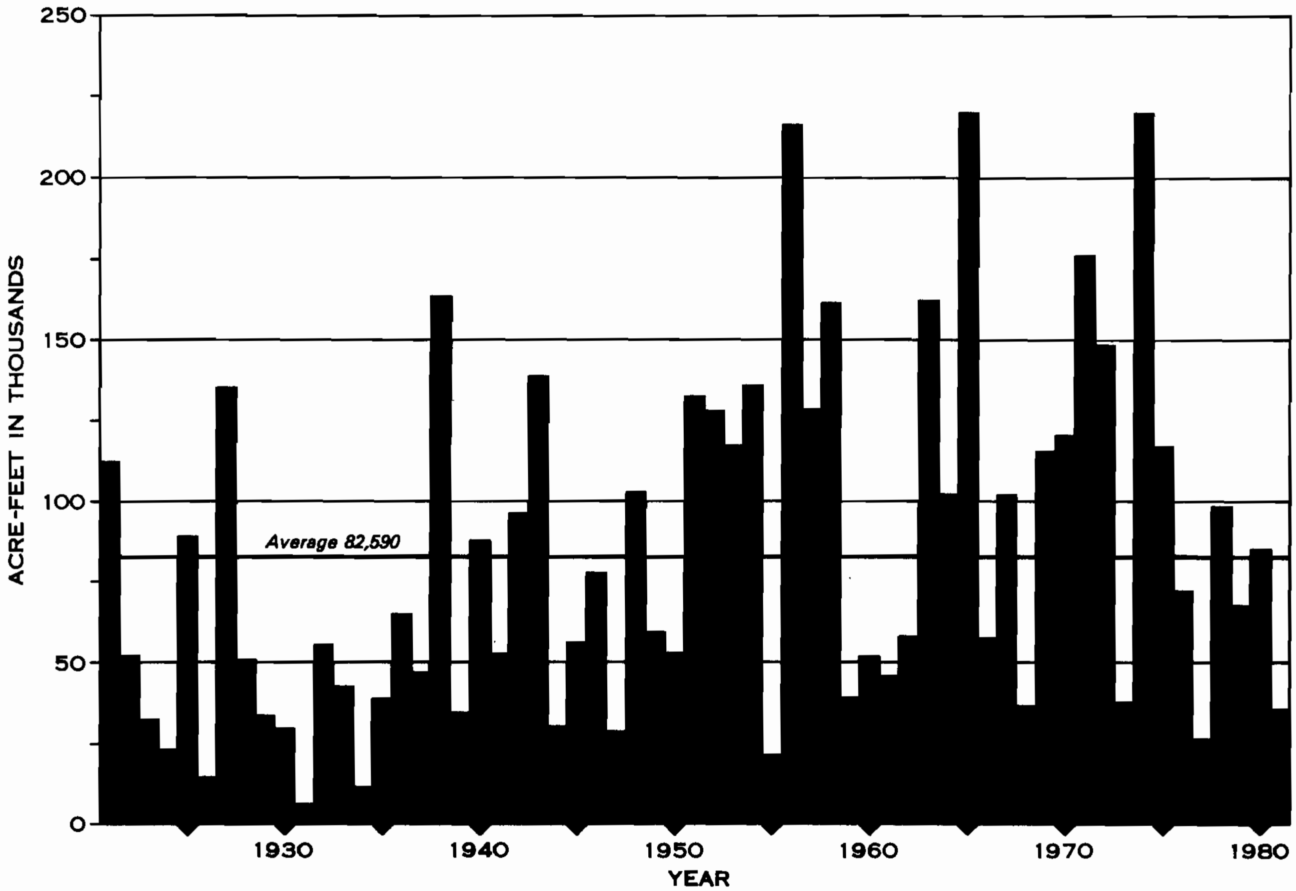
(1) 11/1 to 5/1

Figure 7

RUNOFF
Bear Creek At Medford

DRAINAGE AREA 289 SQ. MI.

ANNUAL



MONTHLY DISTRIBUTION

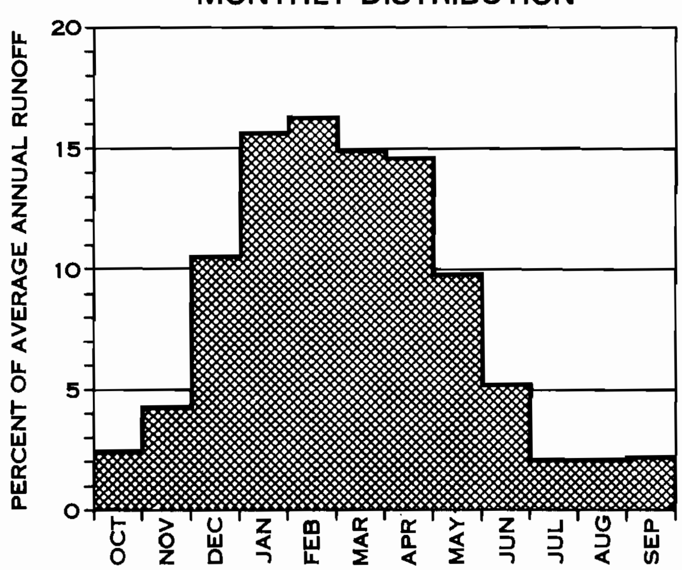
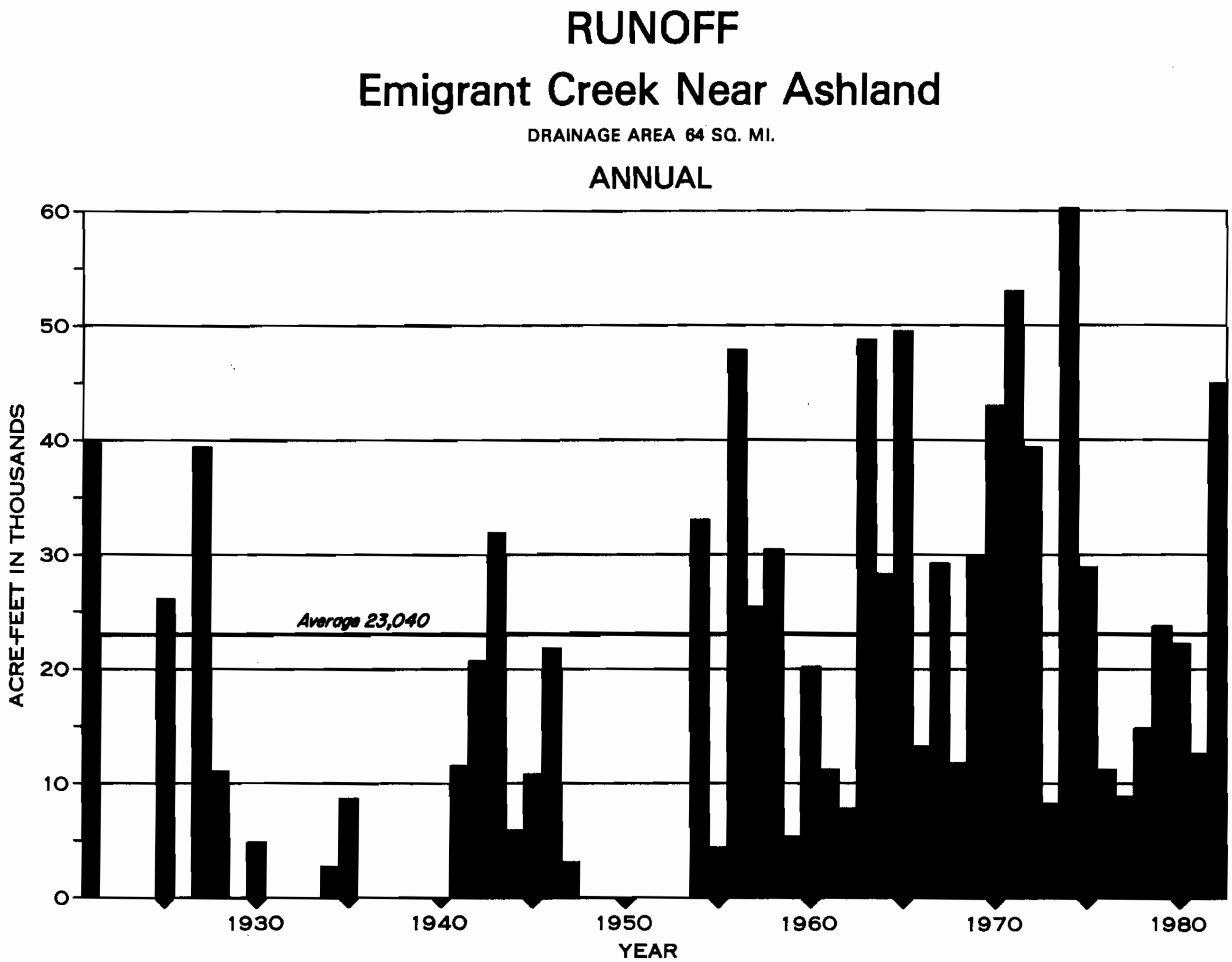


Figure 8


RUNOFF
Emigrant Creek Near Ashland
DRAINAGE AREA 64 SQ. MI.
ANNUAL
ACRE-FEET IN THOUSANDS
60
50
40
30
20
10
0
Average 23,040
1930
1940
1950
1960
1970
1980
YEAR

are the largest users of irrigation water in the basin. The City of Ashland is the largest appropriator of municipal water in the Bear Creek Basin. Ashland has rights totaling over 27 cfs from Ashland Creek.

The Water Use Program allows the diversion of 30 cfs from Bear Creek during the period February 15 to April 1 of each year for temperature (frost) control purposes. Permits have been issued for the entire 30 cfs, so any additional water for temperature control will have to come from storage or imported from other watersheds.

Lakes and Reservoirs

Emigrant Lake is the largest reservoir in the Bear Creek Basin. This 712-acre reservoir is a heavily used recreation area and is part of the water supply system for the Talent Irrigation District. Additional water supplies are provided by interbasin transfer of water from Hyatt and Howard Prairie Reservoirs in the Klamath Basin.

Numerous other lakes and reservoirs occur in the Bear Creek Basin, however, most are smaller with a surface area less than 40 acres. Table 17 lists all lakes and reservoirs with a surface area of five acres or more.

Potential Reservoir Sites

The Bear Creek Basin has very few potential reservoir sites and only one was considered feasible enough for further investigation (see Table 45). Most tributaries to Bear Creek are in steep narrow canyons. Most sites considered had small drainage areas with little runoff, requiring large dams to create small reservoirs.

All sites other than Walker Creek were eliminated during the initial stages of the investigation because of poor topography and lack of runoff (see Table 27). A description of the Walker Creek site follows.

Site Name: Walker Creek
Location: T39S, R1E, Section 12, NE 1/4

Dimensions: An earthfill dam, 85 feet high and 680 feet long would impound about 3,300 acre-feet. This site would require 256,000 cubic yards of fill material giving this project an embankment-to-capacity (E/C) ratio of 78. The surface area of this reservoir would be about 93 acres. A larger reservoir may be possible at this site, but due to the limitation of using topographic maps with 80 foot contour intervals, it cannot be determined at this time.

Hydrology: The drainage area above this site is over 40 square miles. The normal annual precipitation for the watershed is approximately 27 inches. The estimated Q80 annual runoff is about 17,000 acre-feet. The estimated runoff for November through March is 7,400 acre-feet. This estimate of winter runoff should be on the low side. The runoff distribution used for this site is the average Upper Rogue distribution. Much of the drainage area above this site is over 4,000 feet in elevation, which means that snowpack may delay the runoff until later in the spring.

Soils: The Carney series consists of moderately well drained, clay soils, 20-40-inches deep, formed in colluvium. Permeability is very slow and the shrink swell potential is very high. On slopes greater than five percent, these soils have severe limitations as reservoir areas. The Carney series soils also have severe limitations for embankments due to low strength and shrink-swell.

TABLE 45

BEAR CREEK BASIN - POTENTIAL RESERVOIR SITE

STREAM	LOCATION	DRAINAGE AREA (sq mi)	NORMAL ANNUAL PRECIPITATION (inches)	ANNUAL Q80 (af)	RESERVOIR CAPACITY (af)	DAM HEIGHT (feet)
Walker Cr	39S, 1E, Sec 12, NE 1/4	40	27	17,000	3,300	85

Witzel series soils consist of well drained soils, 12-20-inches deep, formed in colluvium. They have moderately slow permeability and a low shrink-swell potential. The limitations for embankments and reservoirs are due mainly to steep slopes and shallowness of the soils.

There is a lack of good quality fill material for a dam at this site. Sufficient quantities of clay should be available. The lack of fill material could add to the cost of this project.

Geology: The dam site consists of hard sandstone, shale, siltstone and conglomerate. Slides are rare in this formation. These rocks also have a low infiltration rate. The soils covering this formation are generally clayey and impermeable.

The reservoir site consists of sedimentary rocks as described above as well as volcanic rocks consisting of basaltic and andesitic flows, agglomerates and tuffs with interbedded sandstone and shale. The flow rocks are hard and stable, but the tuffs and sedimentary rocks may be prone to slides in places.

General Comments: The development in the reservoir site includes about a mile of Dead Indian Road, a Talent Irrigation District siphon on the East Lateral, one or two homesites and some small power lines that supply upstream users.

A reservoir at this site could provide water for irrigation and flow augmentation during the low flow periods and flood control during the winter and early spring. There is a great need for additional stored water in the Bear Creek Basin.

This is the best site investigated in the Bear Creek drainage. Presently, this project seems to be infeasible on an economic basis. The lack of quality fill material and the E/C ratio could significantly add to the cost of this project. In the future, as demand increases, a project at this site may become more cost effective.

WATER NEEDS AND RELATED PROBLEMS

Agriculture

The waters of Bear Creek have been closed to appropriation for irrigation since 1959. This does not include stored water, ground water or water imported from other basins. This precludes any future use of the waters of Bear Creek for irrigation, unless it is stored water.

Portions of the Talent, Medford, and Rogue River Valley Irrigation Districts are located in this subbasin. Talent and Rogue River Valley Irrigation Districts have irrigable areas which are not presently being irrigated and all three irrigation districts have irrigated areas which do not receive a full supply of water. Each of these irrigation districts import large quantities of water from outside the Bear Creek Basin.

On average, Talent Irrigation District imports 40,420 acre-feet per year from the Klamath, Applegate and Little Butte Creek Basins. Rogue River Valley and Medford Irrigation Districts together import 30,360 acre-feet annually from the Klamath and Little Butte Creek Basins. The majority of the lands within these irrigation districts are located in the Bear Creek Basin.

The completion of the Talent Project has eased the water shortage problem in the Bear Creek drainage. More water is needed, however, some areas presently being irrigated do not receive a full water supply and any new areas being developed for irrigation will require a new water supply.

An estimated 21,700 acres of potentially irrigable lands exist in the basin. Over 7000 of these acres are non-irrigated agricultural lands as identified in the land use map developed in 1978 by the Water Resources Department. The remainder of the potentially irrigable lands were identified using soils, maps and all "range" lands. Any "range" land with soil adequate for irrigation is called potentially irrigable. No consideration was given to availability of water or to the actual feasibility of irrigating these lands.

Temperature control, particularly frost protection, is placing increased demands on the existing resource. Due to the price of oil for smudge pots, some orchards have converted to overhead sprinkler systems. As orchards convert from oil heat to water, more water will be needed. Converting the 6000 acres of orchard presently using oil heat to water would require an additional 5000 acre-feet annually. The water is now provided from natural flow and the irrigation allotment for the orchard, but the demand may soon overtake the supply. In 1969, the Water Resources Board allowed the diversion of up to 30 cfs from Bear Creek for temperature control during the period February 15 to April 1 of each year.

One potential storage site in the basin was recommended for identification in the local comprehensive land use plan. It is located on Walker Creek below the confluence of Cove Creek. A storage site on

Walker Creek could provide water for irrigation and other beneficial uses while providing some flood protection.

Other options to satisfy future needs could include conservation, new irrigation methods and systems, and increased storage in other basins that could be diverted or pumped into the Bear Creek watershed.

Mining

Gold mining has been the most notable mining activity in the basin. Most of the mining water rights have priority dates in the 1860's and are for placer mining. Most of these rights have not been used in recent years, but could become active if gold prices increase enough to make gold mining feasible.

Other potential mining activity could include tungsten, coal, granite and sand and gravel production. Existing mining and environmental regulations should minimize the effects of mining on the water resources.

Domestic

Most domestic water supplies are obtained from groundwater sources. Continued population expansion will increase the demand on the available supply. A regional municipal water supply system could help supply the increasing demands of the area.

Floods

Since it is the most heavily developed area of the Rogue River Basin, the Bear Creek valley has the greatest potential for damage caused by flooding. Since the heavily developed areas lie outside the Rogue River floodplain, most damage caused by the December, 1964 flood was caused by Bear Creek and its tributaries. The December, 1964 peak flow in Bear Creek at Medford was less than the recorded peak flow in December, 1962. The operation of Emigrant Reservoir reduced the peak flow at Medford by 19 percent.

The major damage caused by flooding along Bear Creek was to agricultural and commercial development. The agricultural damage occured mainly from Central Point to the mouth of Bear Creek. Erosion was widespread, accounting for much of th agricultural losses. The commercial losses were concentrated in the Medford area.

Table 43 lists the estimated flood frequencies for three points in the Bear Creek Basin.

Industrial

Most industries in the basin use Medford's water supply system. Future development is expected to also use this source.

Aquatic Life and Wildlife

The Oregon Department of Fish and Wildlife indicates that water quality is the major problem affecting fish life in Bear Creek. Fish species found in Bear Creek and its less polluted tributaries include: Fall Chinook and Coho salmon, winter and summer steelhead, rainbow and cutthroat trout, largemouth bass, bullhead catfish, black crappie, pumpkinseed, bluegill, bridgelip sucker, lamprey, carp and cottids.

Anadromous fish spawning areas are shown in Plate 3. The timing of the anadromous fish runs are shown in Table 14. Maintaining the anadromous fish runs at their present levels will depend on reversing the trend of declining water quality. This may require increased flows achieved through the development of storage and/or curtailment of certain uses. The fishery needs are in direct conflict with some other uses, so compromises will have to be worked out.

Currently, there are no established minimum flows on Bear Creek. The basin is closed to appropriation except for power development and the use of stored water.

Municipal

The City of Medford operates the largest municipal water system in the basin. In addition to supplying the water requirements for itself, Medford supplies water for the Cities of Central Point, Eagle Point and Jacksonville. The City of Medford also supplies water for eight water districts and associations serving unincorporated areas near Medford.

To provide this water, the City has developed its rights to Big Butte Springs and Willow Creek Reservoir. These sources can provide 41 cfs or up to approximately 30,000 acre-feet per year. Medford also uses up to 16 cfs from the Rogue River. The diversion and water treatment facilities for Medford's Rogue River supply are designed for eventual expansion to a capacity of 100 cfs, corresponding to the City's water right on the Rogue River. The city has also applied for a permit to appropriate water from Lost Creek Reservoir.

The City of Phoenix currently obtains its water supply from seven wells near the city. Future requirements are expected to be provided by the Lost Creek Reservoir under contract with the Bureau of Reclamation.

The City of Talent obtains its water from the Talent Irrigation District, and Wagner Creek. During the months of April through October, water is supplied by the Talent Irrigation District. During the remainder of the year, Wagner Creek is the water source. These sources have been inadequate, and in 1979 an agreement was made to obtain 600 acre-feet of water from Hyatt, Howard Prairie and Emigrant Reservoirs. The contract expires in 1995, and other sources of water may have to be found at that time.

The City of Ashland currently obtains its water supplies from Ashland Creek and the Reeder Reservoir. Additional storage sites have been identified on Ashland, Neil, Cove or Walker Creeks, although definite plans have not been developed.

Recreation

Emigrant Reservoir is the primary water-based recreational site in the basin. Additional sites are available on Hyatt and Howard Prairie Reservoirs in the Klamath River Basin. Future recreational developments will probably occur outside this basin. With its large population, the Bear Creek Basin has the greatest need for recreational facilities. Bear Creek cannot meet these recreational needs because of poor water quality and low flows during portions of the year.

Power Development

Green Springs Power Plant is located upstream of Emigrant Lake near Emigrant Creek and has an installed capacity of 16 megawatts. The water for the plant is provided via the Green Springs Power Canal which is supplied by Hyatt and Howard Prairie Reservoirs. The amount of water diverted through the power plant averaged about 39,000 acre-feet per year during 1961-1978.

Emigrant Dam has no hydropower facilities. Talent Irrigation District is proposing to construct hydro facilities to utilize the flows in its irrigation canals.

OSU Water Resources Research Institute has identified four stream reaches in the basin having hydropower potential. Three of the reaches are on Bear Creek and one is on Emigrant Creek below Emigrant Reservoir. The feasibility of developing hydropower on any of these four stream reaches has not been determined.

One potential reservoir site on Walker Creek may have hydropower potential, but this potential may be limited by other needs and uses of the water, particularly irrigation.

Water Quality

The Bear Creek Basin has the most severe water quality problems of any basin within the Rogue River drainage. Several streams have been posted as potential health hazards, and there have been numerous studies done to identify the sources of the pollution and correct the problem.

High levels of coliform bacteria have been found in several streams and irrigation canals. Probable sources for these bacteria include inadequate septic drainage fields and runoff from irrigated pastures. The pastures also tend to concentrate levels of nitrogen and phosphate in the runoff water, but reduce the amount of suspended sediment in the water. Orchards were found to be sources of dissolved nitrogen, as well as concentrating the amounts of bacteria, suspended sediment and phosphate in the water.

Potential solutions to water quality problems include improved irrigation water management practices, upgrading municipal sewage treatment plants and augmentation of streamflow during the low flow season.

The ground water quality problems in the area are generally related to regional discharge from deep flow systems.

DATA ANALYSIS AND FINDINGS

The total annual volume of runoff within the basin is not sufficient to meet present and/or future water needs. Seasonal variations in the water supply intensify water shortages throughout the basin. During the winter months, surpluses occur, sometimes to the point of flooding.

Due to the heavy development and large population in the Bear Creek Valley, there is a great potential for damage from flooding. Emigrant Reservoir provides only limited flood control for the watershed, so to insure more complete flood protection for the valley, additional storage projects are required. A potential reservoir site was identified just below the confluence of Walker and Cove Creeks. It would provide flood control of approximately 40 square miles of the watershed above Ashland and Medford. Multipurpose reservoirs along with local protective works and zoning regulations may provide the best protection against flood damages.

Chronic water shortages occur annually in this basin. Great steps have been taken to alleviate these shortages by local communities and irrigation districts. The City of Medford transports its water from the Upper and Middle Rogue River Basins. Medford, Talent and Rogue River Valley Irrigation Districts divert large quantities of water from other basins for irrigation within the Bear Creek Basin.

In 1959, the State Engineer closed the Bear Creek Basin to all further appropriation for irrigation except for water legally stored in excess of the amount necessary for existing rights. In 1964, the Water Resources Board closed the Bear Creek Basin to all appropriation except for the use of stored water. During 1981, power development was added to the program as the only beneficial use allowed from natural flow.

During parts of the year, the water resource was fully appropriated in 1959 and remains fully appropriated today, particularly during the irrigation season. There is not sufficient supplies to satisfy present irrigation, municipal, industrial, fish life, agricultural use, or domestic needs. Future needs will have to rely on less water or develop alternate sources of water to satisfy those needs.

Potential storage sites are very rare in the basin. Only one potential reservoir site is recommended for identification in the county comprehensive land use plan. It would be a multipurpose project with as many beneficial uses as possible. It could not satisfy all existing and presently contemplated needs for water, however, any additional stored water would help ease the water quantity problems.

The limited ground water resource is capable of satisfying the needs of small users, such as domestic supplies. There does not appear to be sufficient quantities of ground water to supply irrigation or any other large use.

Wagner Creek was analyzed for the purpose of establishing a minimum perennial streamflow at its mouth. It was determined from the analysis that sufficient quantities of unappropriated water are not available. Table 46 shows estimated flows and the requested minimum flows for Wagner Creek.

Increased transbasin diversions may be required to meet the area's future needs. Conservation and more efficient use of present supplies should also be considered. Lining irrigation ditches is expensive, but may become cost effective as the demand for water increases.

Closely related to the water quantity problems are the basin's water quality problems. A 1980 USGS report on water quality in the Bear Creek Basin discussed some of the pollution problems and possible solutions. These problems are most severe during low flow periods when irrigation water is reused a number of times and pollutants become more concentrated. Domestic sewer systems and overland flows contribute fecal coliform bacteria to the surface water supply. Erosion, caused by livestock grazing along streambanks and inappropriate land use practices result in increased turbidity and sedimentation in basin streams.

The augmentation of flows in Bear Creek and irrigation canals could assist in assimilation of pollutants, thereby helping to reduce some water quality problems. Pollution abatement is not considered a beneficial use of water in the present water use program. There may not be adequate quantities of water for pollution abatement using only flow augmentation. Other methods for minimizing pollution may also be needed including reducing erosion, greater use of sprinkler irrigation and areawide sewage treatment plants to reduce inadequate septic tank and drainfield leaching.

The withdrawal of all waters from further appropriation in the Bear Creek Basin precludes some policy options. The development of storage projects, conservation practices, ground water studies and research into more efficient water use methods could help alleviate water shortages in this basin.

TABLE 46

BEAR CREEK BASIN
MINIMUM FLOW POINT
FLOW ANALYSIS

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT
Wagner Creek near mouth Est. Q80	8	12	17	19	19	20	24	29	22	12	8	8
Req. Min. Flows	12	12	18	18	18	18	18	12/4	1	1	1	1/4

Section 4

APPLEGATE RIVER BASIN

PART IV

SECTION 4 - APPLEGATE RIVER BASIN

TABLE OF CONTENTS

PART IV

SECTION 4 - APPLEGATE RIVER BASIN

CONCLUSIONS

The water resources of the Applegate River Basin are an important component of the total resources of the Rogue watershed. The waters of the Applegate River supply the basic needs of human and livestock consumption, as well as providing water for irrigation, fish life, wildlife, mining, recreation and power development uses. Future requirements for water in the basin will include domestic, livestock, irrigation, agricultural use, power development, mining, fish life, wildlife, and recreation.

There are sufficient supplies of water on an annual basis to supply these needs, but the location and timing of these supplies have resulted in seasonal shortages and surpluses. The completion of Applegate Dam has eased these problems in portions of the watershed, however, the water supply problems on many tributary streams will remain unchanged.

There is considerable development in the basin and development is expected to increase in the future. Based on an analysis of the water resources of the Applegate River Basin, the following conclusions were drawn:

1. Domestic, livestock and wildlife requirements are important, but do not require large quantities of water.

2. Existing municipal and industrial water supplies are currently adequate. Increasing residential population may require a community or rural domestic water system in the future.

3. Existing water supplies for irrigation are not adequate. Some additional irrigation development will be attainable through the use of stored water from Applegate Reservoir.

4. There is limited potential for power development in the basin.

5. Many of the water rights for mining have not been used for years, and may never be used to the extent originally intended.

6. Recreation on Applegate Lake and recreational use of regulated streamflow in the Applegate River represent significant future water uses.

7. Fish life represents an important resource in the basin, but seasonal low flows greatly limit the potential of this resource. Storage release from Applegate Dam will enhance the fish life, however, consideration should be given to methods of augmenting flows on tributary streams.

8. The ground water supplies in the basin are limited with only those

wells in the shallow alluvial materials producing larger quantities of water.

9. Storage of winter runoff represents an important source of water.

SUBBASIN INVENTORY - APPLEGATE RIVER BASIN

GENERAL DATA

Basin Description

The Applegate River and its tributaries comprise the southern half of the central portion of the Rogue River Basin. The Applegate River drains an area of approximately 768 square miles along its roughly 58 mile course. About 420 square miles are located in Jackson County, 260 in Josephine County, and 88 in Siskiyou County, California.

From its headwaters in the Siskiyou Mountains in northern California, the Applegate River flows northeasterly until it is joined by the Little Applegate River and then to the northwest to its confluence with the Rogue River, near river mile 95, west of Grants Pass.

The basin contains about 700 miles of streams. Major tributaries of the Applegate River are Slate Creek, Williams Creek, Little Applegate River and Carberry Creek. These four streams contribute about 50 percent of the total runoff from the Applegate River Basin.

Elevations along the Applegate River range from 850 feet at its mouth to about 5,500 feet at Fish Lake, and along the Little Applegate River from 1,450 feet at its confluence with the Applegate River to 6,240 feet at its source. Many peaks in the basin have elevations greater than 5,000 feet. Dutchman's Peak, located in the southeast corner of the basin at the head of Yale Creek is the highest at 7,418 feet.

About 80 percent of the basin is mountainous and unsuitable for agriculture. Approximately 50 percent of the basin is publicly owned timberland.

Geology

The mountainous area west of the Cascade Range in southwestern Oregon and northwestern California is known as the Klamath Mountain Physiographic Province. The Applegate River Basin, and the Siskiyou Mountains forming the southern basin boundary, are within the Klamath Mountain province.

The oldest rocks in western Oregon, pre-Silurian schists, are found in the upper reaches of the Applegate watershed along Squaw Creek. These schists were formed from ancient volcanic and sedimentary deposits which were subjected to intense heat and pressure. Actual age of the schists is unknown. Several million years later, rocks of the Applegate Group were deposited. These rocks are thought to be of Triassic age, about 230 million years old. Originally of sedimentary and volcanic origin, the Applegate rocks were altered to metasediments and metavolcanics during subsequent episodes of mountain building. The Galice sedimentary formation of Jurassic age makes up most of the bedrock in the Slate Creek watershed, northwest of the area occupied by the Applegate Group.

At the end of Jurassic time, the period of mountain building known as Nevadan Orogeny once again deformed the Klamath Mountains. Intrusions on peridotite, now altered to serpentine, were also emplaced at this time. Granite and related rock bodies intruded the older rocks during Jurassic and Cretaceous time.

Except for recent river terrace deposits, and alluvium along the stream channels, little remains of post-Cretaceous deposits.

Soils

The Applegate watershed consists mostly of moderately deep well-drained soils formed on forested upland slopes. These soils support forests and are generally removed from agriculture areas.

The predominant soils in the valleys are usually moderately deep and well-drained, formed from alluvium and granitic fans. These soils are capable of producing hay crops and supporting pasture lands.

The soils in the lower portions of the watershed are generally better suited for cultivation than those in the upper sections. Irrigated agriculture is located primarily along the Applegate River and major stream valleys where suitable soils and water are available.

Climate

The climate of the Applegate River Basin is characterized by mild, wet winters and warm, dry summers. Annual precipitation varies from about 30 inches at the mouth of the Applegate River to over 60 inches in the higher elevations. About 17 percent of the annual precipitation occurs during the irrigation season, near the town of Williams. Less than 2 percent of the average annual precipitation occurs during July and August. Precipitation and temperatuare data is shown in Table 47.

In the higher elevations, about 30 percent of the annual precipitation occurs during the April 1 to October 30 period. Snow depth averages about 19 inches at Williams. Average air temperatures in the valley, near elevation 1,500, range from 43°F to 78°F during the summer and 32°F to 55°F in the winter.

The average annual growing season is 240 days near the mouth of the Applegate River, but decreases to 180 days at the highest elevations.

History

As with other areas of the Rogue River Basin, gold mining was the main attraction to early settlers. Agricultural development occurred to support the mining activity in the area and when the mines were depleted, agriculture became the mainstay of the area. Irrigation has

TABLE 47

AVERAGE MONTHLY TEMPERATURE (F°) AND PRECIPITATION (IN.)

RUCH

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Average
Temp.	39	43	46	49	53	64	70	69	64	54	44	39	53
Precip.	5.2	2.5	2.7	1.6	0.9	0.8	0.3	0.6	1.0	1.8	3.8	5.3	26.5

WILLIAMS

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Average
Precip.	7.5	4.1	3.7	1.8	1.3	0.6	0.3	0.5	0.8	2.9	5.1	6.8	35.4

BUNCOM

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Average
Precip.	4.0	2.4	1.9	1.3	1.5	1.1	0.2	0.4	0.6	2.3	3.1	4.2	23.0

Source: U.S. Department of Commerce, National Oceanic and Atmospheric Administration

occured since the 1860's in some parts of the valley.

Over the years, many small rural communities have developed within the basin including Applegate, Ruch, Williams and Murphy.

Economy

The economy of the area is based primarily on agriculture and wood products. There are no large population centers in the basin, however, many of the people who live in the Applegate watershed work in Grants Pass, Medford, or one of the other cities outside the basin.

Population

Total pupulation in the Applegate Valley was 3,025 in 1970. Jackson County Planning Department estimates the number of residents in the Jackson County portion of the basin in 1978 to be about 2,085. The Josephine County Planning Department has conservatively estimated its portion of the Applegate River Basin population in 1979 to be about 6,800. Many residents commute to employment outside the Applegate Basin.

Land Use

The Oregon Water Resources Department conducted a land use inventory of the Applegate River Basin in late 1978. With technical assistance from the Environmental Remote Sensing Applications Laboratory at Oregon State University, the Department used Landsat data and U-2 photographs to classify all land and water bodies in the basin into seven broad categories: irrigated agricultural land, non-irrigated agricultural land, rangeland, forest land, urban areas, water bodies and special areas (e.g., barren land, lava flows, wet lands, ice and snow fields). Results of the inventory are shown in Table 48. The land use is mapped in Plate 2.

TABLE 48

LAND USE - APPLEGATE RIVER BASIN

	Jackson County (Acres)	Josephine County (Acres)	Basin Total (Acres)
Irrigated Agricultural Land	7,880	10,690	18,570
Non-Irrigated Agricultural Land	1,190	380	1,570
Rangeland	11,480	8,470	19,950
Forest Land	238,990	151,340	390,330
Water Bodies	100	20	120
Urban Areas	10	1,340	1,350
Other	1,820	1,850	3,670
Total	261,470	174,090	435,560

Data Source: WRD, 1978

WATER RESOURCES DATA

Precipitation

Climatological data from stations at Williams, Copper, Buncom and Ruch in the Applegate Valley, and from nearby stations were used to determine average annual precipitation in the study area. Isohyetals, which are lines of equal rainfall derived from these data, were used to estimate runoff. An isohyetal map of the Rogue River Basin is shown in Plate 4.

Streamflow

Streamflow generally follows the pattern of precipitation. About 25 percent of the average annual runoff occurs during the November through March period. Low flows prevail from July to September. High or flood flows tend to be flashy and may occur anytime between November and March according to the Final Environmental Impact Statement for Applegate Lake completed by the U.S. Army Corps of Engineers - Portland District, dated September 28, 1971.

There are presently seven active streamflow gaging stations in the valley and the gage on Applegate Lake.

Star Gulch near Ruch (14-3622.50)
Elliot Creek near Copper (14-3616.00)
Carberry Creek near Copper (14-3617.00)
Middle Fork Applegate River near Copper (14-3615.90).
Applegate River near Copper (14-3620.00).
Applegate River near Applegate (14-3660.00).
Applegate River near Wilderville (14-3695.00).

Several of the active stations have been installed since 1977 and will be used in project operations at Applegate Dam.

Annual recorded yields at various locations in the basin are shown in Figures 9 to 12. The figures also show distribution of the average annual streamflow by month. Table 49 shows average annual runoff from selected streams in the basin. The figures shown are based on rainfall data. Peak runoff occurs during the months of January and February. Some of the hydrographs also depict secondary peaks during spring months.

Maximum recorded flows are shown in Table 50. The table also shows recurrence intervals of various levels of flooding. The flood levels shown are flows that may be expected under natural conditions. It is estimated that Applegate Dam will reduce 10 and 20 year flood flows by over 50 percent and the 50 and 100 year flood flows by 34 and 14 percent, respectively.

TABLE 49

APPLEGATE RIVER BASIN
RUNOFF FROM TRIBUTARY STREAMS

STREAM	DRAINAGE AREA SQUARE MILES	AVERAGE ANNUAL RUNOFF INCHES	ACRE-FEET
Slate Creek	44	33	77,400
Murphy Creek	16	25	21,300
Williams Creek	70	27	100,700
Powell Creek	10.4	27	14,900
Thompson Creek	31	17	28,100
Humbug Creek	12	5	3,200
Forest Creek	36.4	4.4	8,600
Little Applegate River	113	9	54,200
Squaw Creek	30.5	27	44,200
Carberry Creek	74	27	107,300
Applegate River at Cooper	223	27	323,100
Applegate River at Ranch	302	21	333,100
Applegate River at Applegate	483	15	399,900
Applegate River at Wilderville	698	16	584,000
Applegate River at Mouth	768	16	670,000

Yields shown are based on precipitation data

TABLE 50

FLOOD FREQUENCY

APPLEGATE RIVER BASIN

Discharge in cfs [1]

STATION	MAXIMUM RECORDED FLOOD	2 YEARS	10 YEARS	25 YEARS	50 YEARS	100 YEARS
Applegate R. nr. Copper, 1938 - 1977	29,800 1-15-74	6,800	18,000	24,100	28,600	33,000
Applegate R. nr. Applegate, 1938 - 1977	37,200	9,300	25,300	33,800	39,900	45,700

1 USGS preliminary computations based on recorded flows. Adjusted flows following Water Resources Council guidelines are higher.

Ground Water

Most of the Applegate River Basin is underlain by ancient volcanic and sedimentary rocks, with some intrusive granitoid rocks. These formations are tightly cemented or close-grained, and yield little water. Recent alluvial deposits in the valley bottoms yield larger amounts of water, but may be subject to contamination from septic tanks and other near-surface pollution sources.

Ground water tapped from deeper horizons is often saline or brackish and may contain any of several undesirable ions in solution. Prospects for developing ground water in excess of single residence, domestic supplies appear slight throughout most of the Applegate Basin.

Water Rights

Table 51 summarizes water rights in the Applegate River Basin as of April 1980. The majority of rights, 424 cfs, are for mining. Irrigation rights total 381 cfs. The total amount of water from which applications have been filed is about 836 cfs. This total does not include applications involving water stored in Applegate Lake.

Mining was an early, significant water use in the basin. Most of the mining rights were established in the Rogue River Basin Decree of 1919. Although few of these rights are currently exercised, the rights remain of record because of the difficulty of proving abandonment. A number of these rights, however, have been voluntarily canceled through the efforts of area Watermasters.

Rights of record exceed the amount of water that actually exists in many of the streams in the basin. In fact, many of the tributary streams are fully appropriated during the later summer months reflecting both seasonal low flows and current levels of use. During some low flow years, diversions are limited to water users with priority dates earlier than 1900 during the months of July, August and September.

Lakes and Reservoirs

A list of lakes and reservoirs larger than one acre in size was compiled by the State Water Resources Board in 1973. At that time there was some 340 lakes and reservoirs in the Rogue River Basin. Thirty-three of these were in the Applegate River Basin, with a combined total surface area of 159 acres. As a comparison, the size of Applegate Reservoir near Copper is about 988 acres at full pool and 360 acres at minimum conservation pool, larger than the basin's other lakes and reservoirs combined. The 1973 compilation of lakes and reservoirs is shown in Table 17. Ponds smaller than one acre are not listed.

Potential Reservoir Sites

In addition to existing small reservoirs and the Applegate Reservoir, several other possible sites for reservoirs have been suggested over the years. Most of these sites can be eliminated from serious

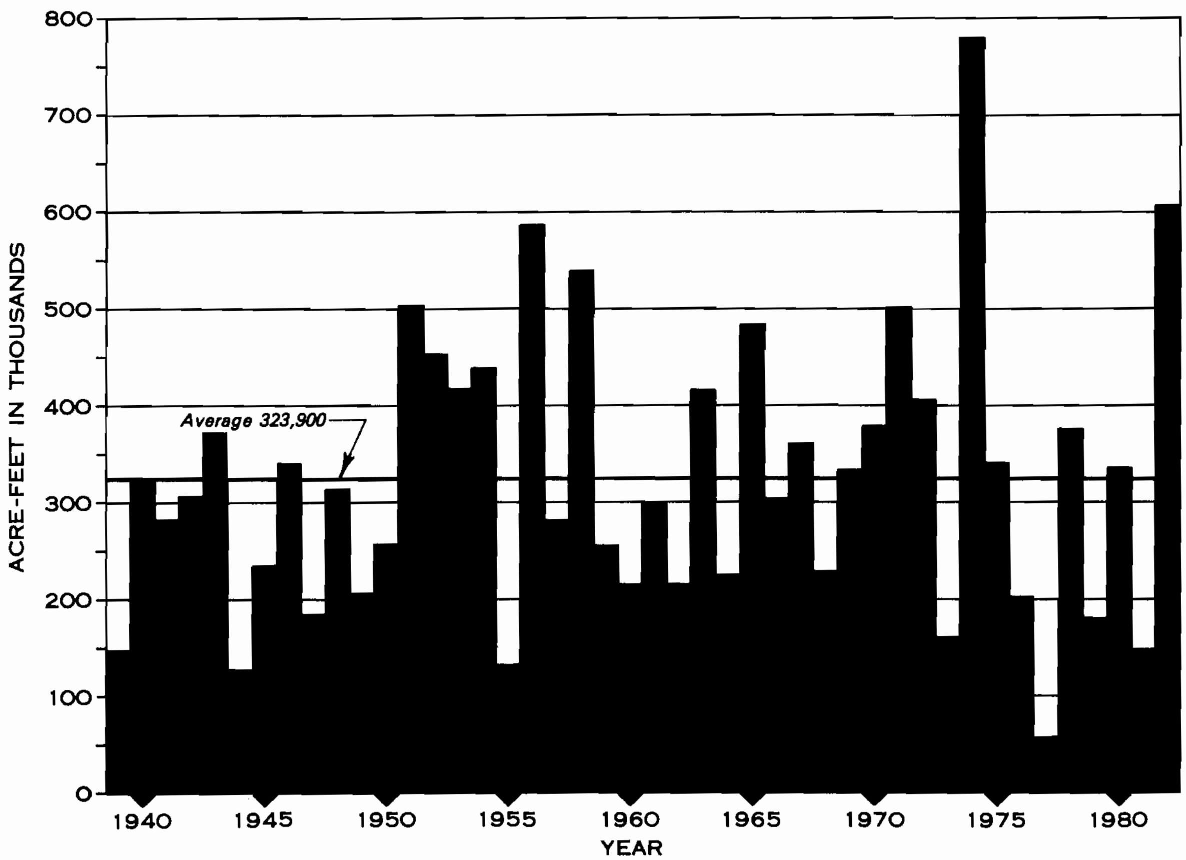
Figure 9

RUNOFF

Applegate River Near Copper

DRAINAGE AREA 223 SQ. MI.

ANNUAL



MONTHLY DISTRIBUTION

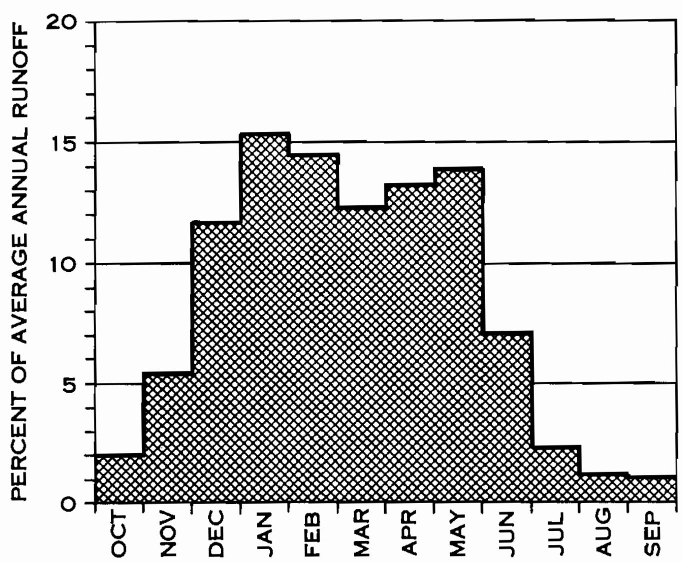
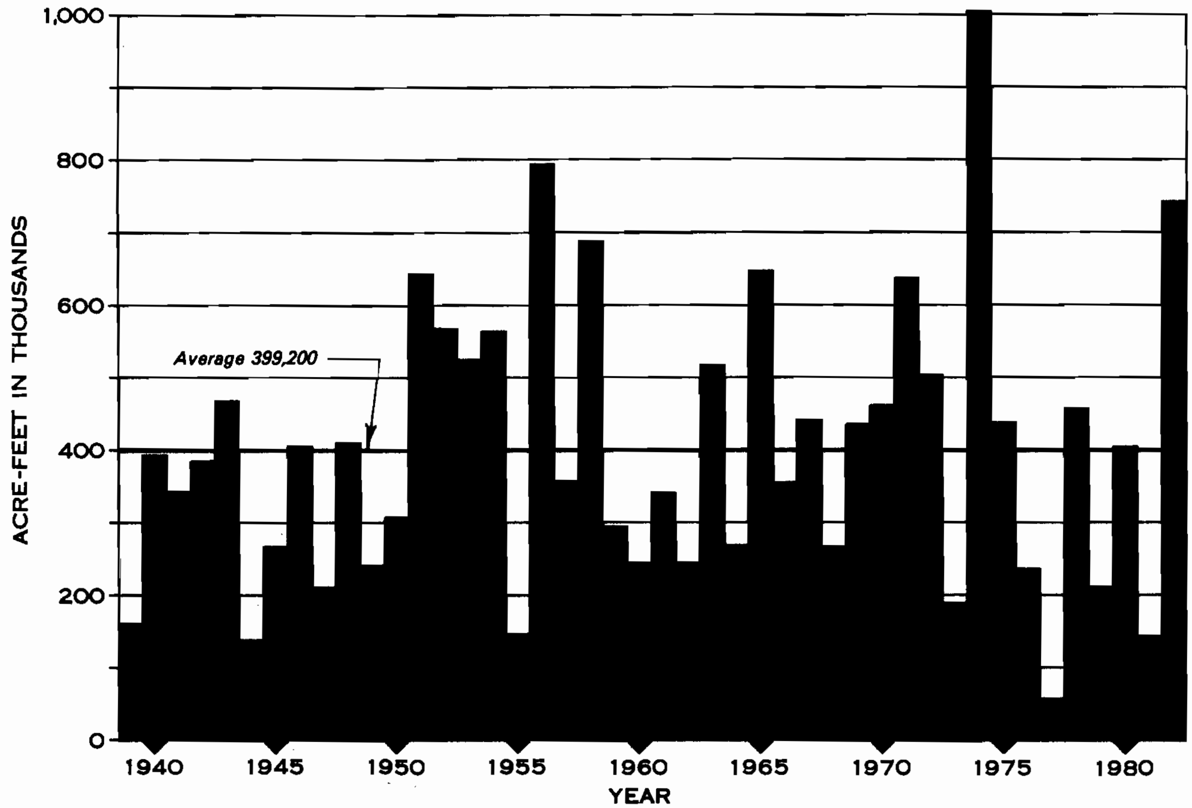


Figure 10

RUNOFF
Applegate River Near Applegate

DRAINAGE AREA 483 SQ. MI.

ANNUAL



MONTHLY DISTRIBUTION

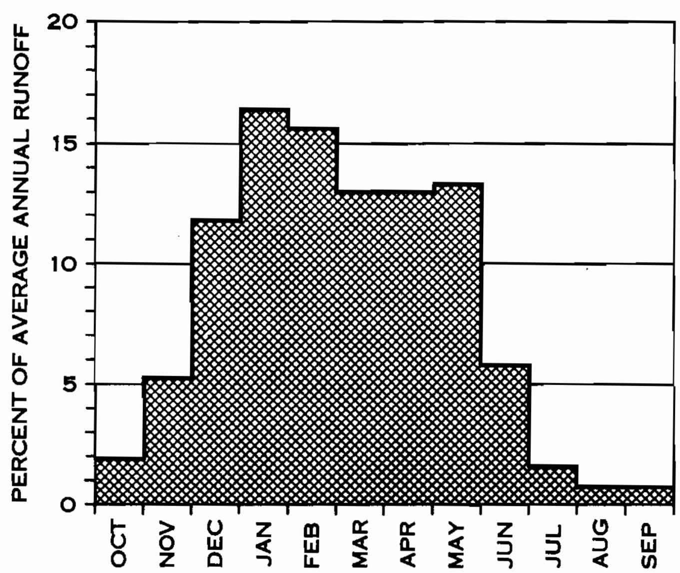


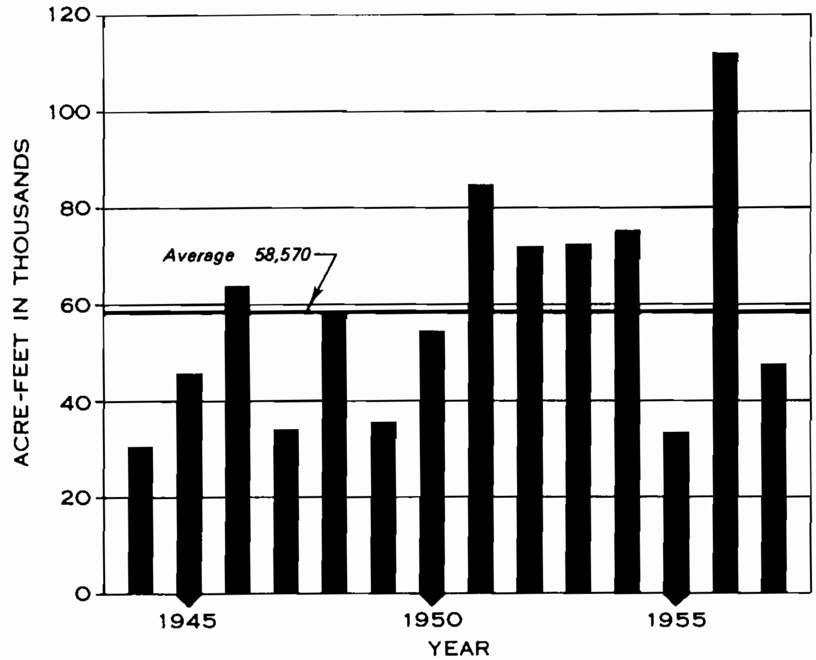
Figure 11

RUNOFF

Slate Creek At Wonder

DRAINAGE AREA 31.4 SQ. MI.

ANNUAL



MONTHLY DISTRIBUTION

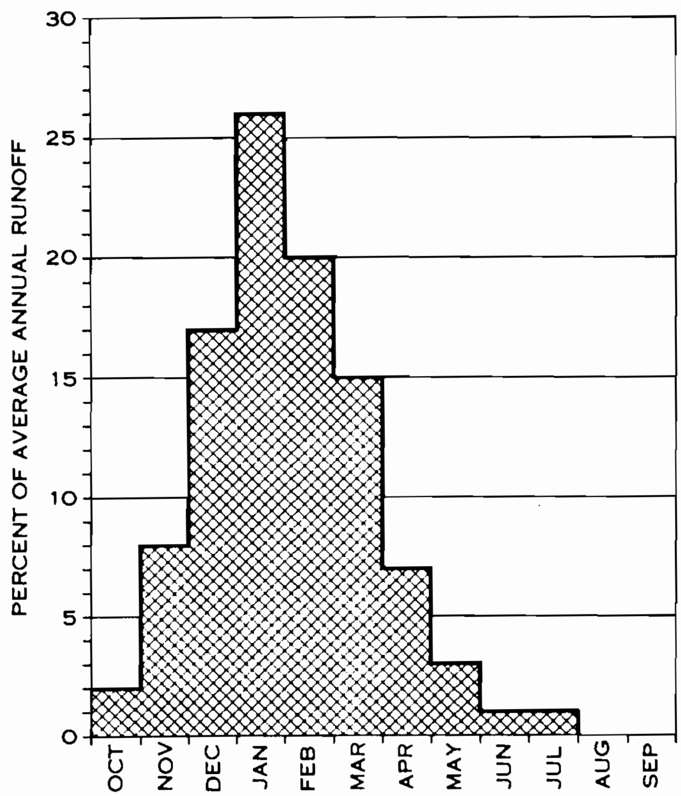


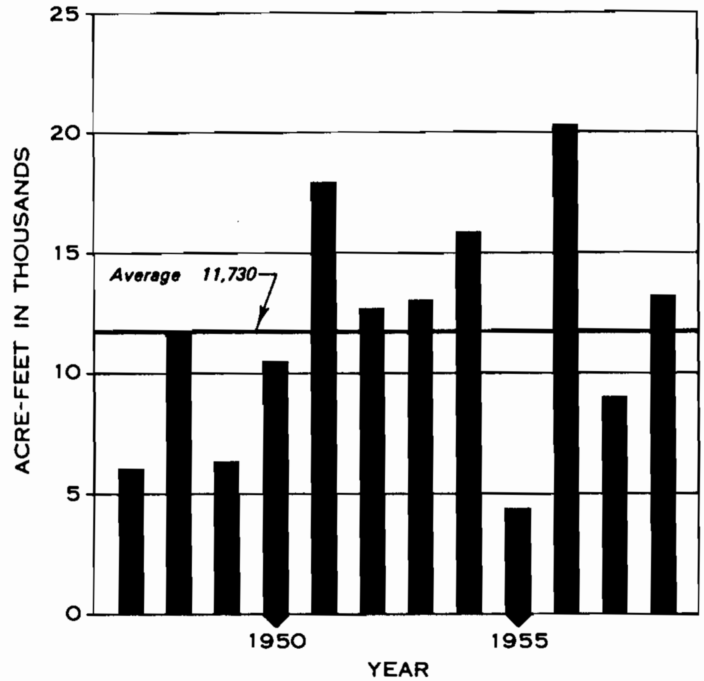
Figure 12

RUNOFF

Powell Creek Near Williams

DRAINAGE AREA 8.17 SQ. MI.

ANNUAL



MONTHLY DISTRIBUTION

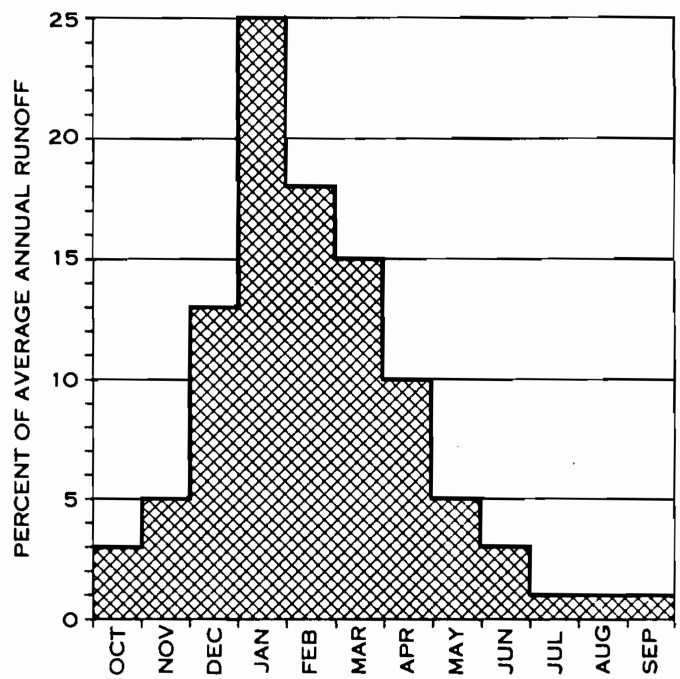


TABLE 51

APPLEGATE RIVER BASIN
SURFACE WATER RIGHTS -- in cfs
April, 1980

	DO	MU	IN	IR	RE	MI	PW	FS	ST	WL
Applegate River and Misc.	1.63		1.6	192.804	.08	57.355		.02	.215	.01
Carberry Creek and Misc.	.065			3.68		52.0(a)				
Sturgis Creek and Misc.	1.03			10.605		8.0				
Squaw Creek and Misc.	.025			7.02		3.99		2.20		
Palmer Creek and Misc.	.01			.69		4.97		.04		
Star Gulch and Misc.	.01			.3		39.99(b)				
Little Applegate River and Misc.	5.18		.5	81.967		42.99	.15		.03	
Sterling Creek and Misc.	.05		1.0	4.095		11.0		.02	.015	
Spenser Gulch and Misc.				.401						
Forest Creek and Misc.	.085			4.985		53.08(c)			.005	
Humbug Creek and Misc.	.065			7.875		26.09(9d)				
Thompson Creek and Misc.	0.4		.04	16.422		.09		.01		
Williams Creek and Misc.	.145		.2	38.974		17.1(e)	2.5		1.11	.01
Munger Creek and Misc.	.02		1.0	8.818		10.0(f)			.005	
West Fork Williams Creek and Misc.	.07			13.77						.004
Marble Creek and Misc.	.03			.65						
East Fork Williams Creek and Misc.	.045			17.255		52.26(g)	1.15	.02	.01	
Powell Creek and Misc.	.02		.1	.55		.99				

TABLE 51 (continued)

APPLEGATE RIVER BASIN
SURFACE WATER RIGHTS -- in cfs
April, 1980

	DO	MU	IN	IR	RE	MI	PW	FS	ST	WL
Caris Creek and Misc.	.045			2.3		30.0(h)				
Board Shanty Creek and Misc.	.025			3.328		10.0(i)				
Gray Creek and Misc.	.02			.885						
Murphy Creek and Misc.	.04		.02	4.032						
Cheney Creek and Misc.	.015			3.545						
Slate Creek and Misc.	.73		1.15	10.04				4.5	.015	
Waters Creek and Misc.	.025			.73						
The Canyon and Misc.	.01			2.393			1.6	.3		
Totals	9.37		5.61	384.264	.08	423.875	5.4	7.11	1.395	.014

Irrigation Season: April 1 - November 1 of each year
Duty of Water: 1/40 - 1/80 of a cfs per acre and 4 1/2 acre-feet per acre per season

consideration for one or more of the following reasons:

1. Location on the main stem Applegate River;
2. Inundates valuable farmland, buildings and roads;
3. Not cost-effective;
4. So close to Applegate Dam that functions would overlap; or
5. Poor geologic conditions.

A site inventory is given in Table 52. Sites eliminated from consideration are shown on Table 28. A few sites warrant further consideration. More detailed studies may show that some of the following sites should be identified in county comprehensive land use plans.

Three possible sites exist on tributaries of Slate Creek. On site is on Elliott Creek in Section 15, Township 37 South, Range 7 West, Willamette Meridian; one is on Waters Creek in Section 8, and one is on Slate Creek just below Ramsey Creek, in Section 18. Bedrock in the area consists of thinly bedded rocks of the Galice formation. There may be foundation problems at one or all of these sites.

There is a potential site on East Fork Williams Creek in Section 23, Township 39 South, Range 5 West, just below Glade Fork (Site 141). Water from a reservoir at this location could be used to irrigate lands in the Williams Creek Valley. This site was investigated by the Soil Conservation Service in 1972. A dam 106 feet high could store about 2,800 acre-feet of water. Because such a large dam would be required for the amount of water stored, storage is probably not cost effective at this time. Bedrock at the site consists of altered volcanic rocks of the Applegate formation underlying the right abutment area, and intrusive granitoid rock (probably quartz diorite) underlying the left abutment. As demands increase, the site may become more attractive, therefore preservation of the site for future use should be considered.

One site above Applegate Reservoir should also be considered for preservation for possible future use. This site is on Carberry Creek in Section 27, Township 40 South, Range 4 West. A reservoir at this site could supply water to augment storage in Applegate Reservoir. At present, little development has occurred in the reservoir site area. Metamorphosed sedimentary and/or volcanic rocks of the Applegate formation underlie the damsite.

Site 26 in Section 29, Township 39 South, Range 2 West, on the Little Applegate River below Yale Creek should also be considered for preservation. A reservoir for flood control and irrigation at this location was judged unsatisfactory by the Corps of Engineers in 1962. However, changing conditions and increasing demands for water in the Applegate Valley may make this site more attractive in the future. Unconsolidated recent alluvium overlies metamorphosed volcanic rocks of the Applegate formation at the site.

Sites for large reservoirs are scarce in the basin. A few sites were investigated by the Bureau of Reclamation, U.S. Geological Survey, and Corps of Engineers several years ago. The major sites, almost all on

TABLE 52

RESERVOIR SITE INVENTORY
APPLEGATE RIVER BASIN

SITE		STREAM	LOCATION Sec.	T(S)	R(W)	DAM HT. (ft)	EMB VOL. 1/	AV.AN. RUNOFF 2/	STOR CAP. 2/	SURFACE AREA (Acres)	DRAINAGE AREA (Sq. Mi.)	DATA SOURCE
110 3/	Elliott Cr.	Elliott Cr.	15	37	7	80		3.7	2.8	87	2.52	SCS
111	Ramsey	Slate Cr.	18	37	7	220	2.84	34.0	22.0	240	14.7	SCS
26	Yale Cr.	Little Apple-gate	29	39	2						84.0	COE
29	Carberry Cr.	Carberry Cr.	27	40	4							USGS
141	East Fork Williams Cr.	East Fork Williams Cr.	23	39	5	106	.66	7.9	2.8		5.5	SCS

1/ 1,000,000 cubic yards

2/ 1,000 acre-feet

3/ Number assigned by SCS

the main stem Applegate River, would have inundated roads, buildings and farmlands, blocked fish passage and were considered too expensive at the time. The site near Copper ultimately selected for Applegate Dam was determined to provide the most benefits with the least environmental impacts.

WATER NEEDS AND RELATED PROBLEMS

A 1932 USGS Water Supply Paper 638B noted:

"The Applegate River drains and agricultural area and during the summer is almost entirely used for irrigation." The same observation could be made today.

Annual flow pattern of the Applegate River is highly erratic, and flows ranging from a mere trickle to a record high in 1974 of 37,200 cfs, have been measured near Applegate. This 1974 flood was severe in terms of flood damage costs due to riparian development and high price levels. Low flows occur during July, August and September at a time when ambient air temperatures are high, resulting in high water temperatures. Maximum daily water temperatures on the Applegate River have exceeded 82°F near Applegate during the summer, seriously affecting aquatic life. This situation is further aggravated by water withdrawals mostly for agricultural purposes. Water rights for the river often exceed natural low summer flows. During the summer months, flows at Copper exceed those at the mouth most of the time. This situation occurs in spite of the fact that several major tributaries (Little Applegate River, Thompson and Williams Creeks) enter the river between the two points.

Fortunately, due to the natural porosity of soils in the valley, a large amount of the water withdrawn returns to the river at downstream points, and may be reused several times in the lower valley prior to reaching the confluence with the Rogue. Water supplies for irrigation purposes are unreliable, and water is in short supply in the river's lower reach during low flow years except for rights with priorities earlier than 1900. Although sprinkler systems have been installed on many fields, flooding is still the predominant irrigation method in the upper basin.

The Rogue Basin Decree did not establish a general duty (allowable total quantity) of water, but rather provided specific diversion rates (1/80 cfs per acre - Rogue River, 1/40 cfs per acre - tributaries) for the irrigation season (April 1 to October 31). Four and one-half acre-feet per acre is the total annual quantity generally allowed for irrigation in the Applegate River Basin.

The consensus of local users is that the current legal entitlements are not sufficient for flood irrigation. No site specific data appears to be available to either confirm or refute actual crop needs in the basin. Many users are accustomed to diverting more than actual entitlements early in the season, reflecting in part, probable late season shortages. This custom occurs in other areas of the state as well. The combined effects of the establishement of minimum flows and storage in Applegate Lake will virtually eliminate "excess" flows, and will likely restrict this practice in the future.

Agriculture

Agricultural land for which primary water right permits have been issued totalled 21,440 acres as of July, 1978. This includes about half of the basin's 41,700 acres of Class I-IV land. Livestock production is the major agricultural endeavor in the basin and the production of hay and pasture accounts for most of the irrigation use. Some potential for crop diversification appears to exist, but will be dependent on adequate supplies of water.

The Applegate Reservoir will store enough water to irrigate 1,350 acres of presently dry land. Additional reservoir storage, however, will still be needed to assure adequate water during dry years.

Mining

Placer gold was first discovered in Oregon near Jacksonville in 1852. The hand methods used in early mining were replaced by hydraulic mining and later by dredging.

In terms of rights of record, mining is the most significant water use in the basin. Almost all these rights date from the active placer mining years prior to 1940. Almost none of these rights have been exercised since the mid-1950's, and none to the extent originally anticipated. Several ditches, originally constructed to convey water to placer mines, now carry irrigation water. Until canceled, however, these recorded mining rights could conceivably be exercised in the future and will continue to cloud any assessment of "unappropriated" water in the basin.

Present needs for use of water for mining is small. Although there are some small operations in the main stream channels, only one diversion for mining purposes is known to exist in the upper basin. A relatively recent increase in mining activity has been noted in upper tributary areas of Josephine County.

Future requirements for mining are not known. The seasonal availability of water and water quality considerations will probably restrict any future large mining uses to the winter months.

Domestic

Domestic use in the Applegate River Basin presently consumes little surface water. Domestic water rights on file with the Water Resources Department total about 9 cfs. Generally, these sources are small springs although some domestic water still comes from creeks. Most homes in the valley rely on wells for domestic water. Except for valley alluvium, the tightly cemented geologic formations yield very little water. The area north and west of Ruch has been identified as a potential ground water supply problem area. Southeast of Ruch there are many good yielding wells, extending nearly to the mouth of Little Applegate River.

Portions of the basin have been and are being converted to 5-10 acre residential farms. Increasing pressure on the area's limited springs and ground water aquifers for domestic supplies is likely to continue in the future.

Flooding

The Applegate River Valley from Applegate Dam to the mouth, and the lower valleys of Little Applegate, Thompson Creek and Williams Creek have been identified by the Corps of Engineers as flood-prone areas. Even with the operation of Applegate Dam, flood damages will continue to occur.

Industrial

Consumption of water by industries constitutes a minor use in the Applegate River Basin. Industrial water use is not expected to increase greatly in the near future.

Aquatic Life and Wildlife

Fall Chinook and Coho salmon, steelhead and resident rainbow and cutthroat trout, as well as several nongame species, are found in the main stem Applegate River or its tributaries. Low summer flows limit fish populations through reduced habitat, heightened water temperatures, increased disease virulence, and lowered dissolved oxygen levels. Water temperatures recorded at Applegate and Wilderville are given in Table 53.

The Applegate River and most of its tributaries experience natural low flows from July through September, which are further reduced by extensive agricultural diversions.

Summer flows, diminished to a fraction of natural runoff, permit invasion of stream-bottom aquatic vegetation. As warm, low flows persist, plant decomposition creates a critical dissolved oxygen deficiency.

Additionally, several diversion dams on the Applegate River and tributary streams restrict or completely block passage of anadromous fish.

Wildlife in the basin include bear, deer, beaver, coyote, mink, muskrat, racoon, skunk, weasel and other smaller species; no specific water requirements for wildlife have been identified.

Municipal

No current municipal use is known to occur in the basin. Development of a dense urban area requiring a municipal type water system in the Applegate Valley appears unlikely in the near future. Josephine County has indicated interest in obtaining municipal supplies from Applegate Lake. If density in the valley population increases, a rural domestic water system may become desirable.

TABLE 53

WATER TEMPERATURE AND FLOW DATA a/
APPLEGATE RIVER BASIN

LOCATION	RIVER MILE	TEMPERATURE, °C JUNE-OCT	TEMPERATURE, °C NOV-MAY	FLOW, CFS b/ JUN-OCT	FLOW, CFS b/ NOV-MAY
Applegate River	(enter Rogue River near 94.8				
1. Applegate	24.8	9.5-26	4-13	11--716	77--1,150
2. Wilderville	2.6	12-28	5-14	---	---

a/ Data Period: 1960 - 1972
b/ Flows observed during survey dates through 10/74

Recreation

The Applegate River below Copper has historically been a popular swimming and rafting stream. Fishing is the major water associated type of recreation in the basin. Other recreational use of water is slight.

The fishery in this system is primarily a late winter steelhead fishery from the bank. The Applegate River is currently closed to boat angling. Steelhead anglers from the Grants Pass and Medford areas exert heavy pressure on the 34 miles of the stream open to this fishery. Trout angling in the upper watershed opens strongly, but slows to a camper-tourist fishery later in the season. Hatchery trout are planted to supplement the wild fish stock.

Some change in historical recreation patterns should occur as a result of the operation of Applegate Dam. Increased use appears likely as a result of the lake. Increased summer flows with cooler water temperatures could also affect recreational use in the upper portions of the main stem.

No specific water requirements for recreation have been identified.

Power Development

At least 14 potentially feasible hydroelectric sites have been identified by O.S.U.'s Water Resources Research Institute within the basin. Several of these sites are located on the main stem below Applegate Lake. The nature of the streamflow in the basin will probably dictate seasonal operations in any further hydroelectric projects. Plans are presently being considered to fit Applegate Dam with power generating facilities that could utilize water released from storage and natural flows.

Water Quality

Little information is currently available on water quality in the basin. The residents of The Valley rely on septic tanks. The Department of Environmental Quality identified low flows, temperature and coliforms as limiting water quality factors in the basin in its State-Wide Water Quality Management Plan of 1969.

DATA ANALYSIS AND FINDINGS

As with other basins, the total volume of runoff is sufficient, on an annual basis, to meet identified needs. Seasonal and areal variations occur, however, resulting in shortages during the summer and surpluses during the winter in most parts of the basin.

Minor flooding in the Applegate River Basin occurs during most years with major floods occuring less frequently. The major damage caused by flooding is to the agricultural lands and related developments. Applegate dam will help control floods on the main stem, however, additional storage and protective works may be needed, particularly on tributary streams.

Seasonal water shortages will continue to be the major water resource concern in the basin even with Applegate Dam. The significant growth in the resident population experienced in recent years is a reflection of desirable qualities of the basin. Development of additional water supplies could become increasingly important in the future to maintain the economic viability of the agricultural sector in the face of potential development pressures. Consideration should be given to the protection of potential reservoir sites from incompatible development. These potential sites have been identified on Elliott Creek, Waters Creek and Little Applegate River.

Existing land use trends suggest domestic needs of the Applegate River Basin will increase in the future. Most of these supplies will be extracted from ground water sources. Most available springs are currently utilized. Other surface sources may not be of suitable quantity or quality, even with treatment, for domestic use. A substantial increase in resident population may necessitate a consideration of a domestic water system in the basin in the future.

Downstream flow augmentation provided by Applegate Lake should substantially benefit fishery resources in the main stem in the future. There is little likelihood, however, for summer flow enhancement on many Applegate tributaries. Many tributary streams have been identified by ODFW as high priority anadromous fish streams.

Minimum perennial streamflows were requested for the Applegate River, Palmer Creek, Beaver Creek, Little Applegate River, Forest Creek, Thompson Creek, Williams Creek, Cheney Creek, and Slate Creek. An analysis was done to determine water availability at three points on the Applegate River below the dam as well as the streams identified by ODFW.

It was determined that natural streamflows and water released from storage could be used for the three minimum perennial streamflows on the Applegate River. Due to the estimated lack of available water on the tributary streams, use classifications or withdrawals may be justified in addition to or in lieu of the minimum perennial streamflows. The flows requested by ODFW can not be met during the natural low flow periods.

Suitable water storage sites are limited. Future development of water storage will affect winter flows and will necessitate careful evaluation of associated benefits and impacts. Maintenance of fish resources may not be possible on some streams.

Current diversions of water for irrigation in excess of legal entitlements may benefit individual users, but over all, may not reflect best management practices in terms of resource utilization. Existing data is not site specific. Additional study will be necessary to document whether or not these practices reflect a beneficial water use that should be legitimized and included under water right permits. No governmental agency has been identified to conduct such a study although both the state Extension Service and the Soil Conservation Service have the necessary expertise.

Achievement of the full benefits of Applegate Dam will require the close coordination and cooperation of the Corps of Engineers, local Watermasters, the Department of Fish and Wildlife, and downstream water users.

TABLE 54

APPLEGATE RIVER BASIN
MINIMUM FLOW POINTS
FLOW ANALYSIS

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT
Applegate River near Copper												
Req. Min. Flows	130	100	100	100	100	170	170	170	200	230	200	200/130
Applegate River near Applegate												
Req. Min. Flows	240	240	200	200	200	265	265	265	265	230	200	200
Applegate River near Wilderville												
Req. Min. Flows	360	360	300	300	300	340	340	360	360	120	120	120
Palmer Creek at Mouth												
Est. Q80	3	9	18	22	20	16	12	9	3	1	1	1
Req. Min. Flows	15	15	20	20	20	20	20	12/6	2	1	1	5/10
Beaver Creek at Mouth												
Est. Q80 Flows	3	14	26	34	30	24	18	13	5	2	1	1
Req. Min. Flows	15	15	20	20	20	20	20	12/6	2	1	1	5/10
Little Applegate River at Mouth												
Est. Q80	12	29	61	121	93	73	66	65	41	12	6	6
Req. Min. Flows	30	50	50	50	50	50	50	50/40	30	20/12	8	15/30
Forest Creek at Mouth												
Est. Q80 Flows	3	7	15	30	26	19	17	16	11	3	1	1
Req. Min. Flows	5	7	7	7	7	7	7	4	2	1	1	2/5

TABLE 54 (continued)

APPLEGATE RIVER BASIN
MINIMUM FLOW POINTS
FLOW ANALYSIS

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT
Thompson Creek at Mouth												
Est. Q80 Flows	9	17	40	75	61	44	30	14	8	4	3	3
Req. Min. Flows	10	20	20	20	20	20	20	20/15	12/8	5	2/1	4/10
Williams Creek at Mouth												
Est. Q80 Flows	28	51	125	237	193	139	96	65	36	18	11	10
Req. Min. Flows	50/80	80	80	65	65	65	65	65/50	40/25	15/8	5	20/15
Chaney Creek at Mouth												
Est. Q80 Flows	3	9	19	25	21	17	13	9	4	1	1	1
Req. Min. Flows	12	15	15	15	15	15	15	15/12	9/6	3	1	4/12
Slate Creek at Mouth												
Est. Q80 Flows	16	62	133	206	177	123	60	26	11	4	1	1
Req. Min. Flows	40/60	60	60	50	50	50	50	50/40	30/10	3	1	10/46

Section 5

MIDDLE ROGUE RIVER BASIN

PART V

SECTION 5 - MIDDLE ROGUE BASIN

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PART V

SECTION 5 - MIDDLE ROGUE RIVER BASIN

CONCLUSIONS

The water resources of the Middle Rogue River Basin are an important part of the total resources available in the basin. In addition to supplying the basic needs for human and livestock consumption, water is also needed to maintain or develop other resources such as fish life, irrigated agriculture, and mining.

Existing and future requirements for water in the basin include domestic, livestock, municipal, industrial, irrigation, agriculture use, power development, mining, recreation, wildlife and fish life uses.

There are sufficient supplies of water on an annual basis to supply these needs. The location and timing of these supplies result in severe seasonal water shortages. Continued economic development in the basin may be slowed without developing additional water supplies. Based on an analysis of Middle Rogue River Basin water resource problems and information regarding alternative sources of water, it is concluded that:

1. Domestic, livestock and wildlife requirements, although important, do not require large quantities of water. Supplies appear adequate for present and contemplated requirements for these uses.

2. Existing municipal and industrial water supplies are currently adequate, but additional dependable supplies for future growth may be necessary.

3. Existing water supplies for irrigation are not adequate to meet existing needs in the basin. Late summer shortages occur in most years. An additional 34,000 acres of land within the basin could be irrigated if dependable water supplies were available.

4. There is significant potential for power development in the basin. Existing statutes preclude any power development on the main stem Rogue.

5. Many of the water rights for mining have not been used for years, and may never be used to the extent originally envisioned.

6. The Rogue River between river miles 95 and 11 is designated a state and federal scenic waterway. It represents a major water-related recreational resource. Augmentation of summer flows from Lost Creek and Applegate Reservoirs should enhance the recreational potential.

7. Fish life represents an important resource in the basin, but seasonal low flows greatly limit the potential of this resource. Consideration should be given to methods of augmenting flows on tributary streams.

8. Existing streamflows may be fully appropriated during some time periods in Evans Creek, Grave Creek, Jumpoff Joe Creek as well as numerous other smaller drainages in the basin.

9. Perennial minimum streamflows have been established on Wolf, Grave, Fruitdale, Kane, Sams and Sardine Creeks and at two points on the Rogue River.

10. Generally, ground water does not have the potential to produce large quantities of water throughout most of the basin. A possible exception may be in the Grants Pass area, where large quantities of ground water may exist. The testing and development of these ground water resources is in the public interest.

11. Storage of winter runoff represents an important source of water. Potential reservoir sites on Grave, Jumpoff Joe, Evans and West Fork Evans Creeks have been identified for future consideration.

GENERAL DATA

Basin Description

The Middle Rogue River Basin is a subdivision of the main stem Rogue River between river miles 68 and 133. Containing 943 square miles, the Middle Rogue River Basin is the third largest division of the Rogue drainage. It is located almost entirely within Josephine and Jackson Counties with 500 square miles in Josephine County, 440 square miles in Jackson and only three square miles in Douglas County. The basin is bounded on the north by the Rogue Range separating the Rogue and Umpqua drainages. The remaining boundaries are formed by the other six hydrologic divisions within the Rogue River Basin.

Beginning at river mile 133, the Rogue River flows southwest through broad valleys. It then turns west toward Grants Pass and the confluence of the Applegate River. Approximately three miles below the Applegate River the Rogue River turns northwest toward the confluence of Grave Creek and the boundary with the Lower Rogue River Basin. Stream gradients are relatively mild throughout this portion of the Rogue River dropping only about 600 feet in 65 miles.

Geology

Topography and Drainage

The Middle Rogue River Basin lies entirely within the Klamath Mountains physiographic province, which has the oldest rocks in Western Oregon and may contain some of the oldest formations in the state. The Klamath Mountains region is typically mature and rugged with narrow winding valleys and sharp divides. Local differences in elevation range from 1000 up to 6000 feet, although differences between valley bottoms and nearby ridges are usually less than 3500 feet. Slopes of 30 degrees are common in the mountains.

Terrain within the basin is varied. Low relief and subdued topography of the Grants Pass-Merlin area contrast sharply with the rugged hills and steep canyons along the western and northern basin boundaries.

Nearly all the valley lands in the basin lie below the 1300 foot level with those of Sams Valley between 1250 and 1300; along Evans Creek 950 to 1300; Grave Creek from 620 up; and along the Rogue River from 600 to 1200. King Mountain, elevation 5265, located in the upper Grave Creek drainage near the northern basin boundary, is the highest point in the basin. There are several other peaks, however, above 4000 feet in the northern part of the basin.

The topography of the basin reflects long-term stream erosion of a slowly rising upland. This has resulted in the development of a ridge system at a roughly uniform altitude. Although locally controlled by geologic structure, stream drainage patterns are dendritic.

The main stem of the Rogue River flows in a westerly direction to river mile 95 and then travels generally northward through the remainder of the basin. Both Grave and Jumpoff Joe Creeks parallel the Rogue River in its central section and enter the Rogue traveling in a westerly direction. Evans Creek rises from the northern divide separating the Rogue River Basin from the Umpqua River Basin and travels in generally a south-southwest direction to its confluence with the Rogue main stem at the City of Rogue River.

Stream gradients vary widely from headwaters to mouth throughout the basin with the Rogue averaging approximately nine feet of drop per mile; Evans Creek, dropping 270 feet per mile in its headwater areas and then leveling off to an average of 30 feet of drop per mile below river mile 28; Jumpoff Joe Creek averaging approximately 120 feet per mile; Grave Creek 160 feet per mile in the headwater region and approximately 35 feet per mile below river mile 20.

Structure

Episodic vertical movement of the earth's crust is clearly displayed throughout the geologically old Klamath Mountains province. The region has experienced at least three successive cycles of erosion and considerable faulting, folding and weathering, resulting in a very complex geologic structure. The first cycle produced what is known as the "Klamath peneplain," remnants of which appear only at the higher elevations in the basin. The second cycle produced the flatter valleys from which numerous terraces and benchlands still remain, at elevations up to 300 feet above the level of the nearest stream. The third cycle produced the steep valleys along the present streams and the recent valley fill in the open valleys. Most of the alluvial material in the larger valleys in the basin originates from this third cycle of erosion.

This portion of the Klamath Mountains geologic province has been subject to a northwest-southeast compressional stress probably due to regional tectonic movements. Pre-Cretaceous age rock outcrops show the effects of this deformation as northeast-southwest trending thrust faults, high angle faults, and folds. Most rock units dip rather steeply to the southeast from 30 to 80 degrees.

A wide diversity of geologic units occur in the Middle Rogue River Basin. These units differ in age and rock type and result in very complex formations in the area. Natural forces have further complicated these formations by obscuring both age and geologic history, making interpretation difficult. Generally, the rock formations are older in the eastern part of the basin and are successively younger westward.

Soils

Most of the soils in the Middle Rogue River Basin are relatively shallow gravelly soils derived from granitic or metamorphic rocks. Timber production and pasture are the primary uses of these soils.

Within the valleys formed by the Rogue River, Evans Creek, Jumpoff Joe and Grave Creeks, the soils are deeper and support a diverse agricultural industry. In a few areas, the soil contains a high proportion of clay which may restrict drainage. This problem is most common near the upper end of the basin in the Sams Valley area and reflects the volcanic rock origin of these soils.

Climate

The Middle Rogue River Basin experiences mild wet winters and hot dry summers. The climate is greatly influenced by the coast winds from the west. The frost free period ranges from 147 days at Sexton Summit to 172 days at Grants Pass. Air temperatures at Grants Pass vary from an average of 39°F in January to 71°F in July. Average monthly temperatures and precipitation for Grants Pass and Sexton Summit are displayed in Table 55.

History

In the 1840's, livestock was brought to the Rogue River Valley by a few settlers. With the discovery of gold in both the Illinois River and Bear Creek Basins, activity within the Middle Rogue River Basin increased. Additional deposits of gold were found on Grave, Wolf, Coyote, Williams and Louse Creeks. The Greenback mine located northeast of Grants Pass was one of the largest mines in the area.

Gold mining in the Middle Rogue River Basin had the same effects that were experienced in the other basins. Agricultural production increased to provide for the needs of the miners. New farms and ranches were established along the Rogue River, Evans, Jumpoff Joe and Grave Creeks. The demand for lumber increased and new equipment and methods became available to supply these needs.

The completion of the railroad in 1883 provided access to outside markets and brought prosperity to Grants Pass. The location of the town permitted it to serve the needs of the miners in the Middle Rogue and Illinois River Basins and as a central marketing place for the agricultural and timber products. Growth was rapid. The City was incorporated in 1885, and quickly became the economic center of Josephine County. A year later the county seat was moved from Kerby to Grants Pass.

Population

Today, Grants Pass is the second largest city in the Rogue River drainage and has a population of 14,997. Other cities in the Middle Rogue River Basin and their 1980 census count include: Rogue River - 1308 and Gold Hill - 904. The total population of the basin is estimated at 55,338.

The population has grown steadily since the 1920's, with large increases during the 1970's. Both Rogue River and Gold Hill have increased by 50 percent in the last ten years. Grants Pass has increased only 20 percent during the same period, but this figure does not include the suburbs surrounding the city. No data were available to estimate the growth of these suburbs. As a whole, the population of Josephine County grew about 65% during the 1970's.

Economy

Although gold provided the base for the economy for many years, its position has long since been replaced by other resources in the basin. Lumber and wood products are a major contributor to the economy. The importance of the timber industry to the economy has been declining in recent years. Past timber cutting practices have resulted in a harvest rate which is greater than the rate of regeneration. Current forest management activities are designed to maintain a sustained yield of the timber. Thus the activity in this sector of the economy can be expected to remain stable.

Other sectors of the economy have been growing. There has been an increase in the number of industries which do not require a resource-related location. Examples of these industries would include recreational equipment, electronic components and clothing manufacturers. The City of Grants Pass has been actively pursuing these industries, and their impact on the basin economy can be expected to increase.

The trades and services segments of the economy have also been increasing. Part of this increase can be attributed to the larger regional market served by Grants Pass. Another factor is the increased recreational and tourism activities throughout the Rogue River drainage.

Interstate Highway 5 passes through many of the cities and towns in the basin. The interstate highway provides access to many of the tourist attractions in the Rogue River Basin and is also the major route between California and the Pacific Northwest states.

Another important segment of the economy is the large agricultural industry. Large blocks of farm land are found in Sams Valley, along Evans, Jumpoff Joe and Grave Creeks, and along the Rogue River. There is extensive agricultural development in the Grants Pass area. Although agriculture has consistently been an important part of the economy, growth in this sector has been slow and sporadic - being

TABLE 55

AVERAGE MONTHLY TEMPERATURE (F°) AND PRECIPITATION (IN.)

MIDDLE ROGUE RIVER BASIN

SEXTON SUMMIT

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL AVERAGE
Temperature	35	38	38	42	49	56	64	63	60	51	41	37	48
Precipitation	6.8	4.3	4.0	2.1	1.9	1.0	0.3	0.7	1.3	3.1	5.7	6.5	37.7

GRANTS PASS

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL AVERAGE
Temperature	40	44	48	52	59	66	72	70	65	55	46	41	55
Precipitation	6.2	4.2	3.4	1.7	1.4	0.6	0.2	0.5	0.9	2.5	4.7	6.0	32.3

Period of Record: 1952-1981
Source: U.S. Department of Commerce, National Oceanic and Atmospheric Administration

closely linked to the availability of water, storage and conveyance systems. As a result, the value of agriculture to the economy has dropped to third place behind the trades and services and the timber industry.

Land Use

Plate 2 shows the land use patterns in the Middle Rogue River Basin. The acreages within each category are listed in Table 56.

Eighty-four percent of the basin area is classified as mountainous forested terrain unsuitable for farming. About 6 percent is agricultural lands. The majority of these agricultural lands are located along the main stem Rogue River, particularly west of Grants Pass and in the Rogue River-Gold Hill area, the middle and lower reaches of Evans and Jumpoff Joe Creeks, and throughout the Sams Valley area. About 7 percent of the basin is classified as range lands. These areas are located primarily in the Sams Valley area and along portions of Grave Creek and Jumpoff Joe Creek. The remaining three percent are rock outcrops or urban land and are unsuitable for agriculture.

Although most of this basin is classified as forest land, large blocks of agricultural land occur in several areas. These include Sams Valley near the boundary with the Upper Rogue River Basin, an area south of the Rogue River between Little Butte Creek and Bear Creek Basins and an area west of Grants Pass. Additional agricultural areas occur along Evans Creek, Jumpoff Joe Creek and the Rogue River from Gold Hill to the City of Rogue River.

TABLE 56

LAND USE: MIDDLE ROGUE RIVER BASIN

USE	ACRES	PERCENTAGE OF BASIN
Irrigated Agricultural land	25,810	4.4
Non-Irrigated Agricultural land	9,140	1.5
Range land	41,700	7.0
Forest land	499,630	84.3
Water bodies	400	0.1
Urban Areas	9,410	1.6
Other	6,450	1.1
Total	592,540	100.0

WATER RESOURCE DATA

Precipitation

Average annual precipitation is about 32 inches in the vicinity of Grants Pass and in Sams Valley, 35 inches near Wolf Creek and Merlin and 50 inches in the Galice area. Less than 20 percent of the annual precipitation occurs during the irrigation season, May 15 - October 15 with the exception of the area surrounding Merlin where nearly 30 percent of the precipitation occurs during this period. Snowfall is light in the valley regions ranging from below nine inches annually at Grants Pass to below 15 inches at Wolf Creek. At higher elevations such as Sexton Summit, the average annual snowfall increases to over 100 inches.

Average monthly and annual precipitation for Grants Pass and Sexton Summit is displayed in Table 55. An isohyetal map of the Rogue River Basin is shown in Plate 4 in Part 1 of the Rogue River Basin Report.

Streamflow

There are currently four active stream gaging stations in the Middle Rogue River Basin excluding canals and gaged diversions. The gaging stations are Rogue River at Raygold and Grants Pass, Grave Creek at Pease Bridge and Jumpoff Joe Creek near Pleasant Valley. The locations of these stations are shown on Plate 4.

Annual yields for all years of record are shown for the Rogue River at Grants Pass and Raygold, and Grave Creek at Pease Bridge in Figures 13-15. The average annual yields for all years of record are: Rogue River at Grants Pass, 2,542,000 acre-feet; Rogue River at Raygold, 2,155,000 acre-feet and Grave Creek at Pease Bridge, 43,040 acre-feet.

Monthly distribution diagrams for the three points are shown in Figures 13-15. These diagrams show the percentage of annual runoff that occurs during each month. For example, on Grave Creek over 21 percent of the runoff occurs in January. Most of the tributary streams in this basin have runoff characteristics similar to Grave Creek with the maximum period of runoff coinciding with the periods of high precipitation. As a result, the flows drop to almost nothing during summer and early fall.

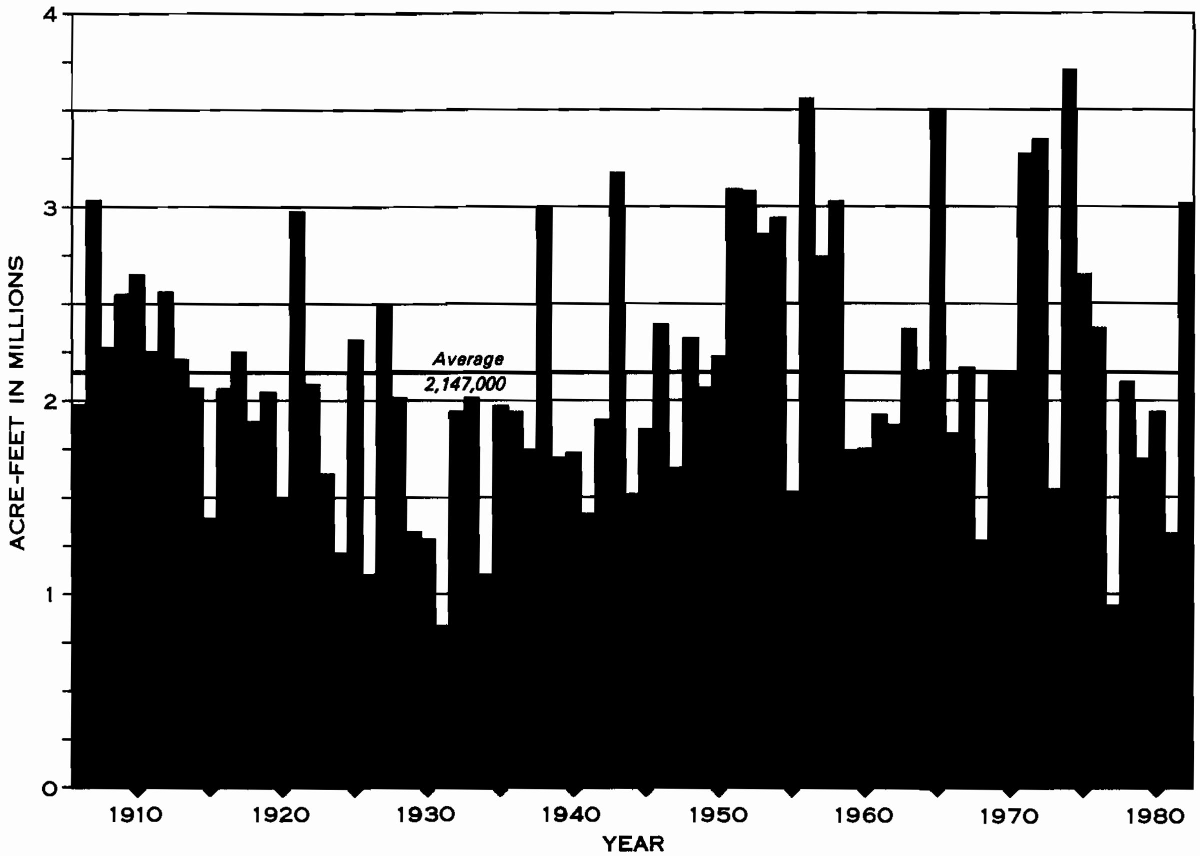
Flood flows for various recurrence intervals are shown in Table 57 for selected points in the basin. These flood flows were calculated by the USGS based on peak discharge measurements and area correlation. The discharges for the Rogue River are now partially regulated by Lost Creek Reservoir which reduces the peak natural flows with its flood control storage. Applegate Reservoir also partially regulates the flows in the Applegate River which in turn affects the flows in the Rogue River below the confluence with the Applegate.

Figure 13

RUNOFF
Rogue River At Raygold

DRAINAGE AREA 2,053 SQ. MI.

ANNUAL



MONTHLY DISTRIBUTION

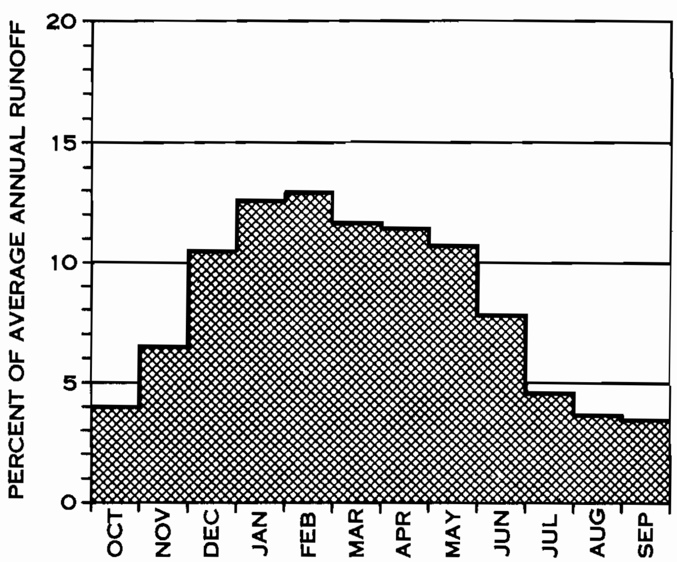


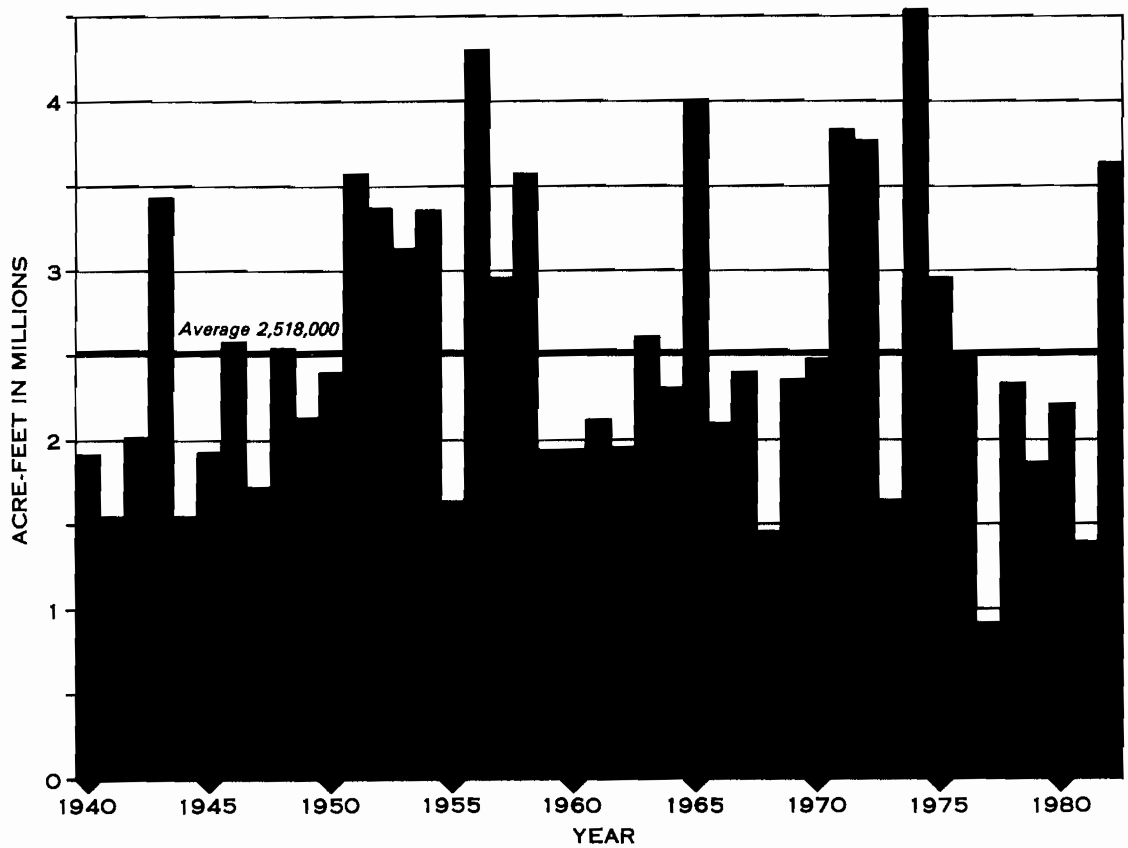
Figure 14

RUNOFF

Rogue River At Grants Pass

DRAINAGE AREA 2,459 SQ. MI.

ANNUAL



MONTHLY DISTRIBUTION

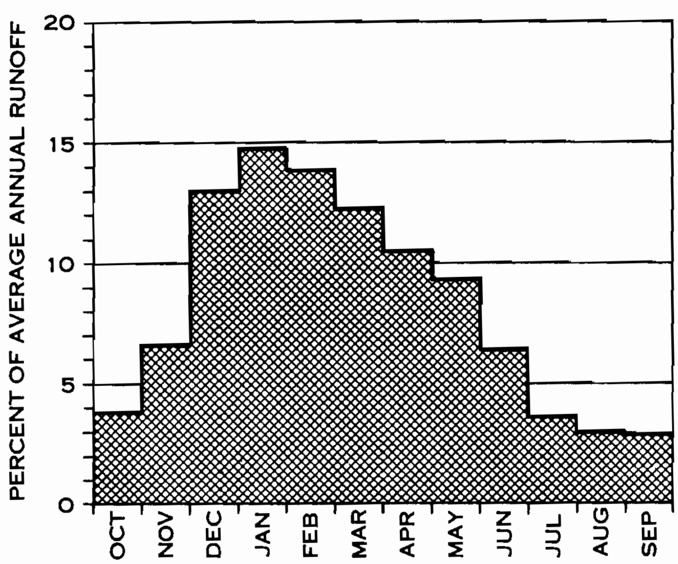
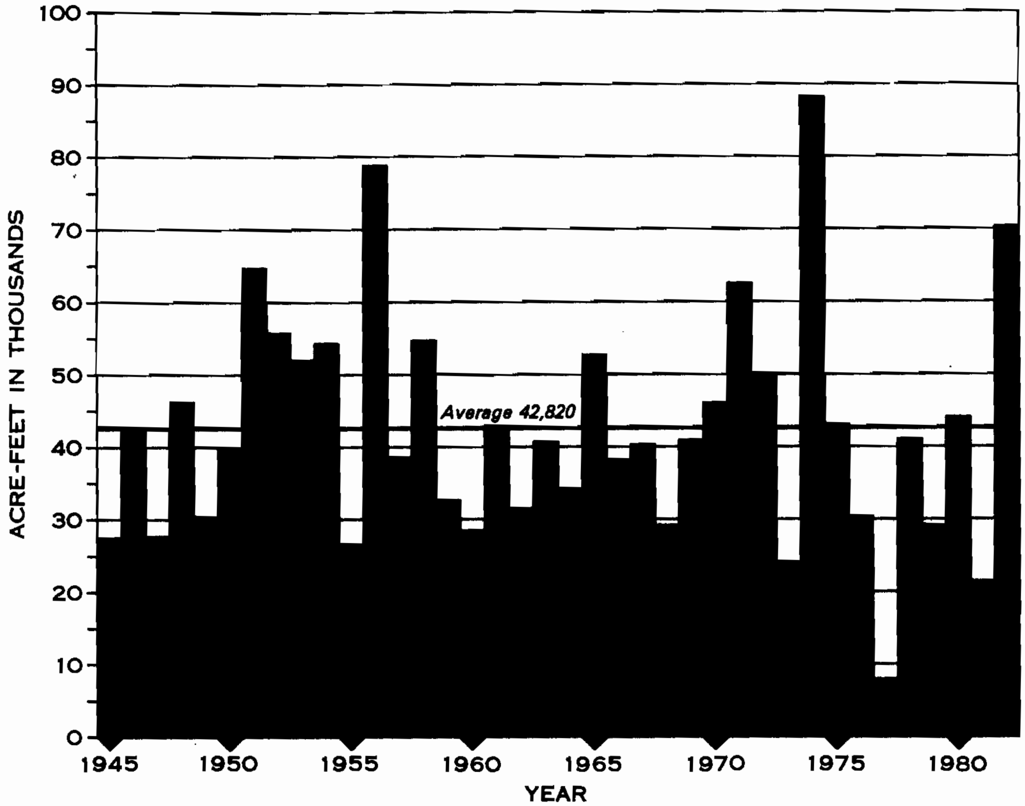


Figure 15

RUNOFF
Grave Creek At Pease Bridge

DRAINAGE AREA 23 SQ. MI.

ANNUAL



MONTHLY DISTRIBUTION

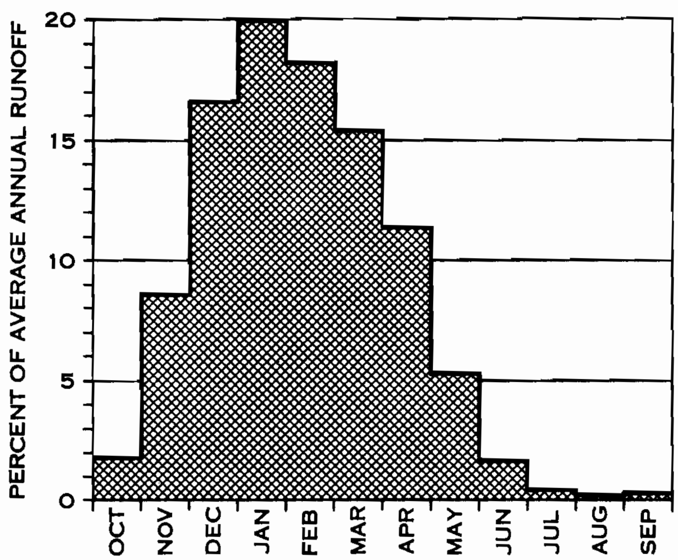


TABLE 57

MIDDLE ROGUE RIVER BASIN
FLOOD FREQUENCIES
(in cfs

	Q10 (10 year)	Q02 (50 year)	Q01 (100 year)
Rogue at Grants Pass *	73,000	128,000	144,000
Rogue at Raygold *	50,000	84,000	105,000
Grave Creek at Pease Bridge	3,680	5,690	6,600
Evans Creek at Mouth	14,800	25,900	31,300
Jumpoff Joe Creek at Mouth	9,330	14,600	16,500

* Regulated by Lost Creek Reservoir

Ground Water

The availability of ground water in the Middle Rogue River Basin is quite variable. Production rates of wells can differ greatly throughout the basin. Sufficient ground water for domestic use is generally available, however, in some areas, the quantity and quality of ground water make it unacceptable for even this modest use.

Generally, wells drilled in the metavolcanic and metasedimentary rocks of the Rogue Formation and the Applegate Group produce adequate domestic supplies with some wells yielding up to 50 gallons per minute. The Rogue Formation is located at the western end of the basin, while the Applegate Group is more diverse being east of Grants Pass on both sides of the Rogue River extending past Gold Hill, including the upper portions of Evans, Louse and Jumpoff Joe Creeks as well as the western portion of Sams Valley.

Sedimentary rocks of the Galice Formation and ultramafic rocks, particularly serpentinite, usually produce barely enough water for domestic use. In addition, both units are known to yield water of unacceptable quality and insufficient quantity for household use. These rocks must be considered marginal sources of ground water. These formations are located in a band that runs in a northeastern line starting in the southwest corner of the basin and extending to the headwaters of Jumpoff Joe Creek.

The most commonly developed aquifer in the Middle Rogue River Basin is the weathered and fractured granodiorite underlying the Grants Pass area. Yields of wells typically range from 5 to 50 gallons per minute. Lower yields are reported, but are rare. Production rates depend upon the degree and nature of fracturing and weathering; generally the most heavily weathered portion of this unit produces less than the more heavily fractured zones. These rocks are predominantly located southwest and northwest of Grants Pass extending north to Pleasant Valley and south to the basin border.

Alluvial sand and gravel is potentially the most important aquifer in the Grants Pass area. Yields in wells which develop the older alluvial material range from 1 to 2 gallons per minute to over 50 gallons per minute. This rate of production is dependent upon the amount of cementation, size and sorting of the alluvial material, and the manner of well design, construction and development. This aquifer is capable of yielding sufficient quantities of water for irrigation purposes and may be able to support major development locally.

Younger cemented alluvial material generally has a higher hydraulic conductivity than older alluvium. In general, these two units are difficult to distinguish from one another. Differentiating between the two depends as much upon their respective definitions and geomorphic positions as on any major lithologic differences between them. Many of the same generalizations which describe older alluvium may apply to younger alluvium as well. These alluvial materials are located primarily along the Rogue River from Grants Pass to Hellgate Canyon.

It is estimated that approximately 100,000 acre-feet of water are stored in the Grants Pass basin. Approximately 30,000 acre-feet of water are stored in the Evans Valley area. It should be emphasized that these volumes are estimates of the total water stored under these alluvial plains and do not reflect the amount of that water that may be of unacceptable quality, nor how much is actually recoverable.

Younger alluvium and to a lesser extent, older alluvium and weathered and fractured granodiorite are in hydraulic connection with surface water. Streams, ponds, and leaky irrigation ditches provide a source of ground water recharge in areas of the Middle Rogue River Basin. Extensive development of the ground water resources in these areas may have a significant impact upon streamflows and water levels. The nature of this impact will depend upon the location and volume of the withdrawals, the timing of the withdrawals, and details of the ground water system itself. It is estimated that about 25,000 acre-feet of water per year could be withdrawn from the alluvium and granodiorite in the Grants Pass area with only a slight impact upon streamflow. About 10,000 acre-feet could be developed in the Evans Valley area with only a slight impact upon streamflow. As accelerated ground water development is anticipated, more detailed studies should be performed to provide information necessary to guide rational, efficient and maximum utilization of the resource.

Water Rights

Table 58 shows the amount and type of water rights for the various streams in this basin. Power and mining rights total over 3800 cubic feet per second. Over 50 percent of the mining rights are limited to the October 1 to June 1 period during each water year. The third largest use of water in the basin is for irrigation. Over 288 cfs, or 45 percent of the total irrigation water, is diverted from the Rogue River. Municipal use of water in the basin totals over 167 cfs.

There is very little storage in this basin, consisting mostly of small private reservoirs. Merlin Irrigation District applied for 50,000 acre-feet of storage on Jumpoff Joe Creek, but it has yet to be developed.

Lakes and Reservoirs

Most of the lakes and reservoirs in the Middle Rogue River Basin are located in Sams Valley. Only four of the reservoirs with a surface area greater than five acres are not in Sams Valley. Gold Ray Reservoir is located on the Rogue River at river mile 125.5. The Rogue West Lake is located just west of Grants Pass and Bates Log Ponds and Werner Reservoir are located near Merlin on Jumpoff Joe Creek. None of the reservoirs exceed a surface area of 50 acres. Table 17 lists the lakes and reservoirs with surface areas greater than 5.0 acres.

Potential Reservoir Sites

Many potential reservoir sites in the basin were reviewed (see Table 59) and four sites were found to have sufficient merit to justify further investigation. It is not known whether any of these sites will become economically feasible in the future. Three sites have previously been studied by the Bureau of Reclamation. A brief analysis is given for each of the four sites.

Site name: Upper West Fork Evans Creek
Location : Township 33 South, Range 3 West, on line between Section 32 and 33

Dimension: The proposed earthfill dam is 100 feet high and 520 feet long. The elevation at the top of the dam is 2,000 feet above mean sea level. 270,000 cubic yards of fill material is estimated to be required for the dam. The reservoir could store a maximum 12,200 acre-feet, having a maximum surface area of 305 acres. The embankment/capacity ratio for this project is 22.

Hydrology: The drainage area above this site is 24 square miles. The normal annual precipitation for the watershed is 48-inches. The Q80 annual runoff is estimated to be 18,000 acre-feet with about 14,500 acre-feet of runoff during November through March. Storing 12,200 out of the 14,500 acre-feet allows releasing enough water to maintain a 7 cubic feet per second flow during the storage season.

Soils: The predominant soils in the site area are the Holland Series. These consist of deep, loamy, reddish brown, well drained soils from granitic materials in the Siskiyou Mountains. They occur on gently sloping to steep footslopes and alluvial fans.

The depth to weathered bedrock is from 40 to 100 inches and is usually deeper than 60-inches. Subsoil textures are clay loam or sandy clay loam. The bedrock can be ripped, but is not considered suitable for construction material. Manufactured material or suitable clayey soils must be used for embankments and fills. These soils have only slight limitations for reservoir slopes, but are not suitable for dam construction. Quality fill material may have to be hauled to the site, which would increase the cost of this project significantly.

TABLE 58
SURFACE WATER RIGHTS - in cfs
MIDDLE ROGUE RIVER BASIN
July, 1981

SUBBASIN 5	IRR	DOM	STK	MUN	IND	FISH	WLDLF	MIN	PWR	TEMP	REC	FIRE
Rogue River	288.506	.435	.07	167.50	.81	50.02		3.3	2147.0	48.86	2.18	.06
Evans Creek	55.182	.89	.15			.05		16[1]				.02
								17[2]				
								45				
Grave Creek	33.31	1.335	.01		2.2	1.53		70.84				.02
								353.35[2]				.20
Jumpoff Joe Creek	26.975	.563	.01		3.75	.47		47.51				.01
								155.00[2]	.55[2]			
Foots Creek	3.933	.566						26.67			.01	
								39.25[2]				
Galice Creek	.23							232.97	2.0			
Sardine Creek	6.751	.385				.50		1.38				
								20.0[2]				
Taylor Creek	.455	.02						54.04				
								30.0[2]				
Sams Creek	11.80	.065			.225			20[2]		2.45		.01
								.15				
Rogue River Misc.	217.951	3.754	.178		3.107	1.273	.01	115.530	7.98	20.84	.21	.05
								206.75[2]				
								65.05[3]				
TOTALS	645.093	8.013	.418	167.50	10.092	53.843	.01	697.39	2156.98	72.15	2.40	.16
								16[1]	.55[2]			
								895.35[2]				
								65.05[3]				

(1) 10/1 - 5/1
(2) 10/1 - 6/1
(3) INCLUDES POWER

Geology: The damsite is located in an area of layered amphibolite that is isoclinally folded. The parent rocks were probably andesitic to basaltic volcanic rocks, with relatively thin interlayered fine-grained sedimentary rocks that were later metamorphosed. This rock is very hard and competent, if it isn't decomposed. This rock should be structurally sound enough to support a dam.

The reservoir area is mostly Quartz Diorite. This formation is deeply weathered and land slides are common. This shouldn't be a problem except the possible impact on development around the reservoir.

Comments: This site has only moderate development consisting of two miles of BLM road, the Elderberry Flat Recreation area, and a high voltage power line. The road and recreation area would be flooded by this site. The power line might have to be relocated.

The reservoir site is overgrown with brush and trees. The area would need clearing if the proposed project is constructed.

Most of the reservoir area is located on federal lands. The privately owned lands in the site area are located in Township 33 South, Range 3 West, Section 30, SW 1/4, WM. Since little private land is involved, protecting this site for future storage may require no action.

The area is zoned Forest Resources in the Jackson County Comprehensive Plan. This will limit future development in the area and will effectively reserve this area for a future storage site.

Site Name: Pease Bridge (Grave Creek)
Location: Township 34 South, Range 4 West, Section 6, SE 1/4, WM.

Dimensions: The proposed earthfill dam is 80 feet high and 830 feet long. 278,000 cubic yards of fill material is required to build this dam. The elevation of the top of the dam would be 2,440 feet above mean sea level. The reservoir would hold 11,000 acre-feet and have a maximum surface area of 345 acres. The embankment/capacity ratio for this project is 25.

Hydrology: The drainage area above this site is 22 square miles. The normal annual precipitation for the watershed is 54-inches. The Q80 annual yield is estimated to be 28,000 acre-feet. About 22,000 acre-feet of runoff occurs during November through March. The existing minimum flow on Grave Creek above the confluence with Wolf Creek, requires the passage of 6,800 acre-feet at the proposed site during the storage season. The quantity of water for storage is reduced to 15,200 acre-feet.

Soils: The predominant soils at this site are alluvial river wash material and Pollard Clay loam. The alluvial material occurs along the low stream terraces and consists of course riverwash materials. The Pollard series consists of red, clayey, well drained soils, 40 to 60 inches deep.

The Pollard soils make good reservoir sites and are satisfactory fill material for dam construction. The alluvial material along the stream makes poor fill material for dams, but may be satisfactory for the reservoir site when mixed with the Pollard soils.

There should be adequate quantities of fill materials present at this site. The Pollard soils also contain enough clay for the core of the dam.

Geology: A 1950, Bureau of Reclamation report indicates that a dam site just downstream from this site could support a 150 feet high earthfill dam. If the geology remains constant upstream to the Pease Bridge site, it should be sound.

The site area consists of 50-200' of Grave Creek Strata on top of shale. The Grave Creek Strata consists of fine grained sandstone, mudstone, and siltstone. Under this is thinly bedded black to gray, weathering shale, mudstone and sandstone. Sandstone can be a very hard, competent rock depending on its degrees of cementation and/or metamorphison.

However, the contact with the underlying shale potentially could become a lubricating surface that could facilitate slumping and/or sliding of the overlying Grave Creek strata.

Comments: There are 8 to 9 residences which could be affected by this project. Some of these places are semi-permanent in appearance. About three miles of BLM road and Pease Bridge would be flooded and have to be relocated. Minor power lines to the affected homes would also have to be relocated.

This site is located about 1/4 mile upstream from the Pease Bridge #2 site referred to in the 1950 Bureau report. The Pease Bridge #2 site was briefly analyzed and found to have an E/C ratio of 32, store 14,800 acre-feet, have a maximum surface area of 370 acres, and require 467,000 cubic yards of fill. Other characteristics are the same for both sites.

The reservoir area consists of public and private lands. It is zoned as Forest Resource land in the county plan. Under this zoning, the area is protected from intensive development. Land parcels are generally 40 acres or larger and can be used for ranching, grazing, limited mining operations, recreation, and watershed protection. This zoning should effectively protect the area for future use as a storage site.

Site Name: East Fork Evans Creek (Hull Mountain, Meadows)
Location: Township 34 South, Range 2 West, Section 19, SE 1/4

Remarks: This site was analyzed by the Bureau of Reclamation, which determined that the benefit/cost ratio for this project is 0.88. Their 1974 report was used as an aide in analyzing this site. The dimensions and capacities listed below are different from the Bureau's numbers. This was done to allow comparisons between the potential storage sites.

Dimension: An earthfill dam 90 feet high and 470 feet long would require 198,000 cubic yards of fill material. The elevation of the dam would be 1,710 feet above mean sea level. The reservoir would store 17,400 acre-feet and have a surface area of 485 acres. The embankment/capacity ratio is 11.

Hydrology: The drainage area above the site is 37 square miles. The normal annual precipitation for the watershed is 40 inches. The Q80 annual runoff is estimated to be 22,500 acre-feet. About 17,900 acre-feet of runoff occurs during November through March.

Soils: The reservoir area is a wide alluvial valley along Evans Creek and its tributaries. The soils consist of unconsolidated gravels, sand, silt and clay. Much of the area is in the flood plain, where soils can vary significantly. A soil survey would have to be done to determine the suitability of the area as a storage site.

Geology: The reservoir would be located in an area of older alluvium. This is unconsolidated material formed along the stream terraces. The dam site lies in an area of May Creek Schist. This is hard, competent rock and should provide adequate support for a dam structure. A thorough investigation of the dam site should be performed before any work is done as there is some potential for slope failure in the steep areas.

Comments: The biggest drawback of this site is the high level of development in the reservoir area. Several miles of road and 10+ houses could be flooded by this project, in addition to farm and grazing lands. The area is zoned mostly exclusive farm use with parcels being 5 or 10 acres and larger.

This potential site has many attractive features that outweigh the drawbacks such as a low embankment/capacity ratio, good water supply, high recreation potential, and an attractive reservoir area.

There is a requested minimum flow point on the East Fork Evans Creek just above the confluence with the West Fork, that if established, could interfere with the development of this project. Exempting storage from the minimum flow would help protect this site for future use.

Site Name: Sexton (Jumpoff Joe Creek)
Location: Township 34 South, Range 6 West, Section 36, NE 1/4, WM.

Remarks: This site has been studied by the Bureau of Reclamation, which published a report in June, 1959, that discussed the feasibility of the Sexton project site on Jumpoff Joe Creek. At that time, this project was found to not be cost effective. Increased demand for water or re-evaluation may make a project at this site cost effective.

The Bureau's project would store 39,000 acre-feet with 1000 acre-feet of dead storage. The dam would be 205 feet high and 1000 feet long. Storage for irrigation and flood control were the two major functions of this project. Since 1959, the proposed reservoir site has become heavily developed with houses. Land needing irrigation in 1959 may now be a subdivision, decreasing the demand for irrigation. Greater demand now exists for industrial, domestic, and municipal supplies in the Merlin area.

The following description of a project at this site is smaller than the Bureau's in order to compare it with other potential reservoir sites in the area.

Dimension: An earthfill dam, 140 feet high and 800 feet long would require 805,000 cubic yards of fill. The elevation of the dam would be 1320 feet above mean sea level. The reservoir would store 21,800 acre-feet and have a surface area of 390 acres. The embankment/capacity ratio is 37.

Hydrology: The drainage area above the site is 33 square miles. The normal annual precipitation for the watershed is 41 inches. The Q80 annual runoff is estimated at 24,500 acre-feet. The Q80 runoff for November through March is estimated to be 21,800 acre-feet.

Soils: The predominant soil in the reservoir site is alluvial material. The stream valley is made up of course to fine river wash material. Other soils in the area include Jumpoff and Manzanita series soils.

The Jumpoff series soils are not very suitable for dam embankment construction. They have a high shrink-swell potential and low strength. The Manzanita series soils are suitable for embankment material, but there may not be adequate quantities available in the immediate damsite area. The alluvial materials can be quite variable, but may not be suitable for embankment construction.

Geology: The damsite consists of metavolcanic rocks of the Applegate Group on the south side and landslide deposits on the north. The metavolcanic rock should provide an adequate foundation on one end, but the landslide area may complicate the dam construction, making a solid foundation more difficult to achieve.

The reservoir site consists mostly of stream deposited alluvial material. There is the possibility of faulting at two places in the reservoir site, one located in the west half of Section 31 and the other in the SE 1/4 of Section 32.

An extensive geological analysis of the area should be performed as well as reviewing any studies done by the Bureau of Reclamation, before a final decision is made on this site.

General Comments: This is the best reservoir site on Jumpoff Joe Creek. There are roads, power lines and at least 20 houses in the site. This reservoir site should be identified in the county comprehensive land use plan.

The Bureau Report also lists alternative plans to the 39,000 acre-foot impoundments, some of which may be more feasible in the future.

TABLE 59

POTENTIAL RESERVOIR SITES
MIDDLE ROGUE RIVER BASIN

STREAM	LOCATION	DRAINAGE AREA (sq mi)	NORMAL ANNUAL PRECIPITATION (inches)	ANNUAL Q80 YIELD (af)	RESERVOIR CAPACITY (af)	DAM HEIGHT (feet)
Ward Creek	36S, 4W, Section 13, NW 1/4	6.9	20.4	2,000	1,060	60
E. Fk. Evans Creek	34S, 2W, Section 19, SE 1/4	37	45	22,500	17,400	90
Evans Creek	34S, 3W, Section 26, SW 1/4	116	44	69,200	52,000	200
W. Fk. Evans Creek	34S, 3W, Section 23, NE 1/4	61	48	40,000	31,100	210
W. Fk. Evans Creek	34S, 3W, Section 15, SE 1/4	59	48	40,000	29,600	220
W. Fk. Evans Creek	33S, 3W, Section 32 & 33	24	52	18,000	12,200	100
Rock Creek	33S, 3W, Section 34, NE 1/4	14	52.7	11,200	6,900	120
Jumpoff Joe Creek	34S, 6W, Section 36, NE 1/4	33	41	24,500	21,800	140
Jumpoff Joe Creek	34S, 5W, Section 36, SE 1/4	5.6	48	6,100	5,800	120
Louse Creek	35S, 5W, Section 29, NE 1/4	12.7	38	11,200	8,300	160
Dog Creek	34S, 6W, Section 8, NE 1/4	4.3	45	3,600	2,560	80
Limpy Creek	36S, 7W, Section 15, NE 1/4	7	41.3	7,080	2,400	80
Pickett Creek	35S, 7W, Section 27, NE 1/4	10	48.8	13,000	7,700	160
Grave Creek	34S, 5W, Section 1, NE 1/4	27	54	34,300	33,600	150
Grave Creek	34S, 4W, Section 6, SE 1/4	22	54	28,000	11,000	80
Grave Creek	33S, 4W, Section 29, SE 1/4	17	54	21,600	14,700	160

WATER NEEDS AND RELATED PROBLEMS

Agriculture

Tributary streams in this basin have runoff characteristics closely related to precipitation patterns, creating water shortages during the summer months. Since there is little developed storage in the basin, the irrigation needs are supplied by natural stream flows, so shortages occur during summer months. This creates acute water shortages throughout the basin for areas without access to the Rogue River. There are inadequate water supplies during low flow periods to meet existing needs, much less additional future needs.

Presently, there are inadequate irrigation supplies on Jumpoff Joe, Grave, Evans, Sams, Louse and Kane Creeks, many of their tributaries and numerous other streams in the basin. With the present flow and use regime, even the Rogue River cannot be depended on to satisfy all existing needs in the basin during low flow periods. It is estimated that about 3000 acres of land within the Gold Hill, Table Rock, and Sams Valley Improvement Companies need supplemental water to satisfy existing needs.

Based on land use and soils maps, it is estimated that over 34,000 acres of potentially irrigable lands exist in the Middle Rogue River Basin. These areas are non-irrigated agricultural lands and range lands with soils that are classified suitable for irrigation. These lands are scattered throughout the basin.

About 19,000 acres of new lands could be irrigated in the Sams Valley Irrigation District if the water were available. Another 1000 acres could be irrigated in the Kane Creek watershed and surrounding area. The probable sources of water for irrigation of these areas would have to be Lost Creek Reservoir and the proposed Elk Creek Project.

Merlin Irrigation District, though never formed, applied for 50,000 acre-feet of storage water from Jumpoff Joe and Louse Creeks for irrigation of over 9000 acres in the Merlin area. A dam would be located on Jumpoff Joe at the Sexton site with 38,000 acre-feet of active storage. The project benefits would include irrigation, flood control, recreation and fishery enhancement. To satisfy future needs, this project may have more water allocated for municipal and industrial use and less for irrigation uses. The Sexton Reservoir site was considered for future development in spite of intense residential development in the project area for two reasons: the great need for additional water supplies in the area; and the Sexton site is the best damsite in the Jumpoff Joe Creek watershed.

Any future irrigation in the Grave Creek and Evans Creek drainages will require new sources of water, such as stored water or ground water. Potential storage sites on the West and East Forks of Evans Creek and Grave Creek at Pease Bridge have been identified and should be preserved for future use, when greater demand may make these projects more cost effective. There is potential to develop the ground water resource in the Evans Valley area.

The Grants Pass Irrigation District presently obtains most of its water from the Rogue River. There is potential to irrigate an additional 2500 acres of land in the district. Future supplies of water will have to come from storage such as Lost Creek Reservoir, the proposed Elk Creek project, or ground water.

The City of Medford has proposed to use 15 cubic feet per second of effluent from its sewage treatment plant for irrigation of 1200 acres which are not now irrigated. The effluent is currently being discharged into the Rogue River and used by downstream appropriators. It has been determined that the released effluent is now part of the Rogue River flow regime and cannot be withheld unless it is replaced by water from another source such as Lost Creek Reservoir. This becomes a critical problem when the natural flow in the Rogue River drops below the level needed to satisfy existing rights and the established minimum flow at Gold Ray Dam. In order to provide a dependable irrigation supply for these lands, new water will be needed to replace the effluent not discharged into the Rogue River. The most likely source for this water is storage release from Lost Creek Reservoir or the Elk Creek Project.

Mining

Mining rights in the Middle Rogue River Basin total over 1670 cfs. Much less water is actually being diverted out of the streams, since over half of the total rights are limited to the November through May period. Only a small number of the mines are permanent operations and many of the mining claims have long since been abandoned.

The mining claims are located predominantly on tributaries of the Rogue and not on the main stem. Grave Creek, Jumpoff Joe Creek, and Evans Creek and their tributaries have substantial mining rights. Many smaller tributaries to the Rogue River also have significant mining rights. There is widespread recreational mining in the Middle Rogue River Basin. This activity takes place on the Rogue River and some tributaries, but should not require significant quantities of water in the future.

There are many mineral deposits of economic significance in this region consisting of chromite, cobalt, copper, gold, nickel, quicksilver, tungsten, asbestos, barite, granite, limestone, semiprecious gems, and silica. A few such deposits are presently being developed to a small extent with processing plants located in the Grants Pass area and future development depends upon more detailed knowledge of the size and quality of such deposits. Mining activities may not increase over present use levels. The amount of water needed for mining purposes will surely be less than existing rights of record.

Domestic

Rights for domestic use of surface water total just over 8 cfs. About 95 percent of these domestic rights are from tributary streams and springs of the Rogue River. Future domestic supplies will depend on surface water, the development of any available ground water resources, and the City of Grants Pass providing service for surrounding areas.

Floods

The Rogue River and its tributaries caused extensive damage in the Middle Rogue River Basin during the December, 1964 flood. The peak flow at Grants Pass during the 1964 flood was 152,000 cfs. The December, 1964 flood was the largest recorded peak flow at Grants Pass, however, the estimated peak flows for the 1861 and 1890 floods are greater, being 175,000 and 160,000 cfs respectively. Table 57 shows some expected flood flows for various recurrence intervals at selected points in the Middle Rogue River Basin.

The damages in the basin caused by the 1964 flood were very severe and widespread. Almost no development along the river was left untouched by the floodwaters. Some of the greatest damage along the Rogue River occurred in this basin. Hundreds of houses and commercial buildings were damaged or destroyed by the flood waters. Bridges, roads, railroads, powerhouses, and a gas pipeline also sustained extensive damage. Hundreds of acres of valuable farm land eroded away while hundreds more were covered with debris carried by the floodwaters. Irrigation distribution systems received extensive damage where floodwaters washed out ditches and other facilities.

The Corps of Engineers have estimated that Lost Creek and Elk Creek reservoirs could have reduced the peak flow at Grants Pass by 46,000 cfs to 106,000 cfs and lowered the stage 6.7 feet. Applegate Reservoir would have reduced the flow in the Applegate River and Rogue River below the confluence an estimated 17,500 cfs. These three projects would reduce flood damage along the Rogue and Applegate Rivers, however, no relief would be provided along other tributary streams such as Grave Creek or Jumpoff Joe Creek.

Industrial

Industrial rights for the use of water are scattered throughout the basin. Most are small, less than one cubic foot per second and are for such uses as milling, manufacturing, sawmills and bottling plants. Future industrial development may occur near Merlin, Oak Grove, and Grants Pass.

Future industrial needs will be supplied by municipal water systems, ground water or stored water. ORS 538.270 excludes industrial use from the main stem Rogue River.

Aquatic Life and Wildlife

The Middle Rogue River Basin includes 65 miles of main stem Rogue as well as major tributaries including Grave, Evans, and Jumpoff Joe Creeks which provide spawning areas for all species of anadromous fish that migrate up the Rogue River. Many of the smaller tributaries also provide valuable spawning areas for those anadromous fish. Plate 3 and Table 14 show the spawning areas and timing of anadromous fish runs, respectively. The resident fishery includes several species of trout, as well as some nongame species, that in times of low water levels compete with the trout for food and oxygen.

As with other areas in the basin, the Middle Rogue River Basin suffers from low flows during the summer months. The tributaries are affected most severely, with many streams almost drying up during late summer. Along with the low water conditions, high water temperatures can be fatal to the fish population. During periods of low flows, consumptive uses of water such as irrigation can further deplete the resource available to the fish. There are eight established minimum flows in this basin (Table 61) with 15 more being considered. All but two of the existing minimum flow points are located on tributaries of the Rogue River. See Table 60 for the requested minimum flow points and the minimum flows recommended by the Department of Fish and Wildlife. Many of these streams are small, yet still provide important spawning areas for anadromous fish.

Additional water to augment existing flows will probably come from storage. Water stored in winter could be released during the normal low flow period of summer when conditions are critical for the fish. Only a few tributary streams have potential reservoir sites, so alternate sources of water, where possible, would have to be developed. Seasonal withdrawals, use limitations, and establishment of minimum flows are possible policy strategies for maintaining the fishery at its present level.

The wildlife resource is small in the more heavily developed sections of the basin. In other areas, the needs are easily satisfied due to the low levels of human development. Wildlife needs, although not quantified, will probably remain constant unless habitat is appreciably changed by future development.

Municipal

The City of Grants Pass has the largest municipal water supply system in the basin. The city has one right for 12.5 cubic feet per second from the Rogue River. This right is adequate for existing and future needs for the next few years. Population growth in the area is creating a demand for greater water supplies. The city has obtained two permits totaling 50 cfs from the Rogue River, and has applied for 6700 acre-feet from Lost Creek Reservoir to satisfy future water requirements.

Water for the suburban areas around Grants Pass is currently provided by individual wells or small water associations utilizing wells. Additional studies are required to determine if available ground water supplies are adequate for the increasing development or if a regional water supply system is needed.

Both the City of Gold Hill and the City of Rogue River have municipal supply systems. Gold Hill has a right for three cubic feet per second from the Rogue River. Although this right should be adequate for existing and future uses, the city has filed an application for 100 acre-feet from Lost Creek Reservoir. The City of Rogue River currently obtains its water from wells. The city has also obtained a permit for two cubic feet per second from the Rogue River.

Finally, Sams Valley Irrigation District has applied for two cubic feet per second, up to 350 acre-feet, from Lost Creek Reservoir for potential municipal use in the Sams Valley area.

Recreation

The lower portion of the Rogue River is included in both state and federal wild and scenic waterway designations. The entire river below Grants Pass is heavily used for recreational boating and fishing trips. The Savage Rapids and Gold Ray impoundments also receive heavy recreational use.

Power Development

There is significant power potential in the Middle Rogue River Basin, however, much of the potential is precluded by law or would conflict with other beneficial uses of water. ORS 538.270 prohibits power development on the main stem Rogue below river mile 157. The greatest potential conflict that from power development would be with fish life, particularly the anadromous fish runs in the basin.

There are three dams on the Rogue main stem in the Middle Rogue River Basin located at Gold Ray, Gold Hill and Savage Rapids. There is a pumping station at Savage Rapids Dam which utilizes direct coupled turbines to drive the pumps. Presently, the developments at Gold Ray and Gold Hill are not producing power.

OSU's Water Resources Research Institute has identified 20 stream reaches in the Middle Rogue River Basin with hydropower potential. Seven of these sites were located on the main stem Rogue. While the feasibility of developing hydropower facilities on these stream reaches has not been determined, power development is statutorily precluded on the Rogue River and many of the tributaries do not provide adequate flows year around.

Water Quality

Water quality is generally good in the Middle Rogue River Basin. High water temperatures often occur on many of the tributary streams during the summer months. Naturally low streamflows during these months, combined with irrigation withdrawals and return flows result in water temperatures above the 68 degrees recommended for fish life. Similar problems occurred on the main stem of the Rogue River prior to the construction of Lost Creek Reservoir. Currently, however, water is being released from the deeper and colder portion of the reservoir to help reduce water temperatures downstream.

The area of greatest potential for future water quality problems is Grants Pass and vicinity. It has the greatest population and development in the Middle Rogue River Basin. Several small streams in the area could be affected by effluents and return flows, particularly during low flow periods.

Generally, ground water quality is adequate for most uses, however, brackish ground water has been encountered south of Grants Pass.

DATA ANALYSIS AND FINDNGS

Although the total annual volume of runoff within the basin is sufficient to meet identified water needs, seasonal and areal variations of occurrence have resulted in shortages during the summer and surpluses during the winter in some parts of the basin.

Flooding occurs to a limited extent in most years, and larger floods can cause extensive damage. Construction of storage reservoirs to control flooding throughout the basin would help reduce this damage. Lost Creek Dam and to a lesser extent Applegate Dam will reduce future flood damage by decreasing peak flows. Elk Creek Dam could decrease peak flows in the basin by providing additional flood control storage at an upstream point after it is constructed. Local protective structures and zoning regulations in conjunction with multipurpose reservoirs may provide the most effective method of controlling flood damages.

Water shortages occur during the summer months in most years. Water requirements for domestic, livestock and wildlife uses are relatively small and existing supplies appear adequate. Water supplies may not be adequate for irrigation, municipal, industrial or other uses of water during the summer months. The extent of the shortages and potential solutions to the supply problems vary in different parts of the basin. Nineteen locations were analyzed in this basin to determine available yield on an 80 percent basis. Fifteen of these points currently have no established minimum flows and four do.

The four streams with established minimum flows are Kane, Sardine, Sams, and Fruitdale Creeks. All four streams have relatively small drainage areas and usually flow intermittently during the summer. The established minimum flows are listed in Table 61 and the estimated streamflows for these four streams are shown in Table 60.

Fruitdale Creek, a tributary to the Rogue River at Grants Pass, appears to be fully appropriated during the summer. During the irrigation season, much of the water in the lower reach of the stream is water diverted from the Rogue River to irrigate lands within the Grants Pass Irrigation District. There are insufficient quantities of water to meet the needs of most uses during the irrigation season. Future uses may include domestic, irrigation, fish life and livestock use.

Like Fruitdale Creek, Sams Creek, a tributary to the Rogue near river mile 123, appears to be fully appropriated during the summer months. There is considerable agricultural development in Sams Valley and very little runoff during the summer months. There are not sufficient quantities of water to provide for future irrigation development and there are thousands of acres of potentially irrigable lands in the Sams Valley area. Future uses may include domestic, livestock, fish life, and irrigation.

Sardine Creek, a tributary of the Rogue River near river mile 118, appears to be fully appropriated during the summer months. Future uses may include domestic, livestock, fish life, irrigation and mining. As with Fruitdale and Sams Creek, there are not adequate quantities of water to meet existing needs and increased future use could make the shortage more acute.

Kane Creek, a tributary of the Rogue River at Gold Hill, is fully appropriated during the summer months. There are approximately 1000 acres of potentially irrigable land along Kane Creek, but no water to meet the needs of future irrigation development. Future uses may include domestic, livestock, irrigation, and fish life.

All four of these streams provide important spawning and rearing areas for summer steelhead. The existing minimum flows on these streams provide some protection for fish life, however, increasing rural residential development on these streams is creating greater demand for the water. There may be water available in April or May, but it quickly disappears making irrigation of lawns, gardens, or crops virtually impossible. Lawns and gardens are important aspects of the rural domestic life style.

Fifteen other streams were also analyzed for possible establishment of minimum flows. Table 60 shows the estimated Q80 flows. In many cases, there is little natural flow from July through October.

Seasonal withdrawals, use classifications, and minimum perennial streamflows are possible policy strategies for maintaining the fishery at its present level.

All of these streams either provide important fish spawning areas or contribute critical flow to areas that do. Summer steelhead use all 15 of these streams for reproduction and rearing. Several of the streams listed in Table 60 are also used by winter steelhead, fall chinook and coho salmon.

The streams analyzed vary greatly in drainage area and level of development. Several larger streams have potential reservoir sites that could be developed in the future to help reduce the impacts of natural low flows by releasing stored water. Unfortunately, many of these smaller streams do not have attractive storage sites or sufficient runoff to provide enough stored water to meet existing and future needs. A description of each stream follows.

Birdseye Creek is a small tributary of the Rogue River near mile 113. It appears to be fully appropriated during the summer. There is some residential development in the area and presently not all requirements of water can be met from natural streamflow. About 50 acres of potentially irrigable land has been identified in the watershed, but there is not enough water to provide a reliable irrigation supply from Birdseye Creek. Increased residential development can be expected in the area, however, there may not be enough water to irrigate lawns and gardens. According to the Department of Fish and Wildlife, Birdseye Creek is important to the maintenance of the summer steelhead run in the Rogue River. Birdseye Creek provides spawning area for summer steelhead and increased use of water will further endanger existing anadromous fish runs. As shown in Table 60, the requested minimum flows cannot be met during most of the year. Anticipated future uses include domestic, irrigation, livestock and fish life.

Foots Creek is another small tributary of the Rogue River near mile 113. It is also a valuable summer steelhead and coho salmon stream. There is considerable development in the watershed including rural residential and farm use. The stream appears to be fully appropriated during the summer. The avalable flows are sufficient to meet the requested minimum flows December through April. Increased rural residential development can be expected in the future, but there may not be enough water for the irrigation of lawns and gardens. There are an estimated 350 acres of potentially irrigable land in the watershed, however, the future uses may include domestic, livestock, irrigation and fish life.

Galls Creek is a tributary of the Rogue River near river mile 118. It has a small drainage area and when the data in Table 60 is considered, the requested minimum flows could be achieved during limited winter months. Galls Creek is a valuable summer steelhead stream, providing habitat and spawning areas. There is considerable rural residential development in the watershed which is expected to increase in the future and may include irrigation of lawns and gardens. There are an estimated 380 acres of potentially irrigable land in the drainage, although the actual total may be considerably smaller, but future irrigation development could deplete spring flows below present levels. Future uses may include domestic, livestock, irrigation and fish life.

Ward Creek is a tributary of the main stem Rogue at the City of Rogue River. The data in Table 60 show that the requested minimum flows cannot be met any time during the year. This stream is valuable to the summer steelhead, providing habitat and spawning areas. There is a great deal of residential development in the watershed with the potential for much more. This development may include the irrigation of lawns and gardens which would place additional pressure on the existing surface water supplies. There are an estimated 400 acres of potentially irrigable land that could need a water supply if developed. Future uses may include domestic, livestock, irrigation and fish life uses.

Snider Creek is a tributary to the Rogue River near river mile 129. This stream appears to be fully appropriated throughout the summer. The requested minimum flows shown in Table 60 can be met only during December through March. It contributes to the summer steelhead run, but is not as important as Foots, Galls, Ward or Birdseye Creeks. There is some rural residential development in the watershed and extensive irrigation (about 400 acres) requiring 5 cfs for a full irrigation supply. The stream is in Sams Valley and there are thousands of acres of potentially irrigable land in the area. Rural residential development may be a major concern in the future. Future uses may include domestic, livestock, irrigation and fish life.

Limpy Creek is a tributary of the Rogue River near river mile 92. It appears to be fully appropriated during much of the summer. The requested minimum flows can be met only during the winter months. There is little rural residential development in the watershed and a moderate amount of irrigation along the lower reaches of the stream. There is little rural potentially irrigable land in the watershed for future development. Increased residential development in the area should not cause a major increase in water consumption. Limpy Creek provides habitat and spawning areas for minor runs of summer and winter steelhead and coho salmon. It may be less important to the fish resource than Birdseye or Foots Creek, but nevertheless, it contributes to the overall basin fishery. Future uses may include domestic, livestock, irrigation and fish life.

Shan Creek is a small tributary to the Rogue River near river mile 91. The stream appears to be fully appropriated during the summer and the requested minimum flows can be met November through June. There is moderate rural residential development in the lower mile of the watershed and little or no development in the upper reaches which consists mostly of federal land. Shan Creek supports a small run of summer steelhead and a resident trout population. There are about 80 acres of potentially irrigable land in the watershed, but a full water supply for irrigation may not be available from natural flow. Future uses may include domestic, livestock, irrigation and fish life.

Pickett Creek is tributary to the Rogue River near river mile 86. It appears to be fully appropriated August and September and the requested minimum flows can be met November through June. While not as important as Foots or Galls Creek to the summer steelhead run, Pickett Creek does benefit the summer and winter steelhead and coho salmon runs. There is only moderate development in the watershed and limited potential for future irrigation development. Future uses may include domestic, livestock, irrigation and fish life.

Evans Creek is a large tributary of the Rogue River near river mile 111. The drainage area of Evans Creek is approximately 224 square miles. The watershed is a moderately developed rural residential area. There is a much higher level of development in the lower sections of the drainage between Wimer and Rogue River than in the upper portions above Wimer. Pleasant Creek, a tributary of Evans Creek near stream mile 8, also has a considerable amount of rural residential development.

Every year, water shortages occur in Evans Creek during the natural low flow periods of summer. There is extensive use of water for irrigation. Present demand exceeds existing supplies during low flows, causing distribution problems for the watermaster. There is between 3500 and 4000 acres of potentially irrigable land in the watershed. The irrigation of any additional land will aggravate water shortages unless alternate sources can be developed.

Evans Creek supports runs of summer and winter steelhead, and coho and fall chinook salmon. Of the four species, only the fall chinook salmon fail to utilize the major tributaries and upper portions of the watershed. Four points requested by the Department of Fish and Wildlife for the purpose of establishing minimum flows were analyzed. Table 60 shows the estimated flows and the requested minimum flows.

The requested minimum flows can not be met throughout the year, particularly during the summer months.

Future uses may include irrigation, domestic, livestock, mining, fish life, power development and recreation. Future supplies of the water will have to be supplied from storage to meet increased needs. Two potential reservoir sites were identified in the watershed on West Fork Evans Creek and on Evans Creek at Meadows. Storage at these sites could be used for all beneficial uses, the most likely uses being irrigation, supplemental irrigation, domestic, livestock, power, fish life and recreation.

There does not appear to be sufficient ground water resources in the upper sections of the watershed to provide future needs except for domestic uses. Most wells have low yields and cannot meet the demands of irrigation or other large uses. There may be usable quantities of ground water in some lower portions of the watershed, particularly the alluvial valley along lower Evans Creek. Wells in this area may produce enough water for irrigation and other uses.

Jumpoff Joe Creek is tributary to Rogue River near river mile 83. It has a drainage area of about 100 square miles. About 81 square miles of the drainage area were included in the hydrologic analysis. There is an active stream gaging station on Jumpoff Joe Creek near stream mile 10.

The lower portions of the Jumpoff Joe watershed consists of rural residential development including the community of Merlin which is located near the confluence of Louse and Jumpoff Joe Creeks. There are plans to develop an industrial park east of Merlin on Louse Creek. There is also a considerable amount of irrigation in tne watershed. Land parcelization, however, has reduced the size of units being irrigated.

Water shortages are an annual event on Jumpoff Joe Creek. Louse and Jumpoff Joe Creeks appear to be fully appropriated throughout the summer. There are not sufficient quantities of water to meet present demand for irrigation, industrial and domestic uses. There is great potential for rural residential development in this area. There is also significant irrigation potential in the area. Almost 4000 acres of potentially irrigable land were identified in this watershed. Increased residential development will decrease agricultural potential by limiting the area available for irrigation.

The Jumpoff Joe Creek watershed supports runs of summer and winter steelhead as well as coho and fall chinook salmon. Existing flow regimes cannot meet all the needs of the anadromous fish runs. Increased depletions will further impact existing fish runs.

Future uses of water in the Jumpoff Joe Creek watershed will include irrigation, domestic, livestock, industrial, mining, recreation and fish life. There are insufficient quantities of surface water throughout much of the year to meet present and future uses. The development of ground water and storage projects will have to provide the water for future needs. There may be significant ground water supplies in the Grants Pass - Merlin area which may be able to satisfy much of the future demand.

One potential reservoir site on Jumpoff Joe Creek near stream mile 11 is recommended for future consideration. It has been studied by federal agencies in the past and it could provide water for many beneficial uses. Such a project may not be cost effective now, but as demand for water increases in the future development may become feasible.

Grave Creek is a tributary to the Rogue River near river mile 68. It has a drainage area over 160 square miles. Table 60 shows the results of the hydrologic analysis as well as the requested minimum flows for Grave Creek at the mouth. The stream appears to be fully appropriated throughout the summer.

Present uses of water in the watershed are irrigation, domestic, industrial, livestock, mining, recreation, fish life, and fire protection. Due to natural low flows and high consumption during the summer, Grave Creek becomes intermittent in certain reaches nearly every year. Most development in the watershed is situated above the confluence of Wolf and Grave Creeks with moderate development along both streams. Future development should also occur predominantly above the confluence of Wolf and Grave Creeks and may include rural residential, agricultural, and commercial developments.

According to the Department of Fish and Wildlife, Grave Creek supports runs of summer and winter steelhead, and coho and fall chinook salmon. Minimum flows have been established on Wolf Creek at the mouth and Grave Creek above the confluence with Wolf Creek. These flows are listed in Table 61. During the summer, the established flows are rarely met with the present flow regime. Additional water to augment flows may be required to maintain and/or enhance the anadromous fish runs on Grave Creek.

Future water uses in the watershed will include irrigation, domestic, mining, power development, recreation, fish life, and livestock. Future needs will require additional supplies of water since present supplies are inadequate to meet existing needs. The ground water resource in the area appears to have only limited potential, able to satisfy small uses such as domestic and livestock.

Storage of winter runoff is the most likely source of future water supplies. One site on Grave Creek near Pease Bridge has been studied in the past and is recommended for further consideration. Such a reservoir could provide water for all beneficial uses including the augmentation of low summer flows. Future demand may make the project more cost effective than at the present.

Two other small tributaries of the Rogue River were identified by Oregon Department of Fish and Wildlife as being valuable to the anadromous fishery of the basin.

Although Galice and Taylor Creeks have relatively little development in the watersheds, the Oregon Department of Fish and Wildlife felt that certain stream reaches should be protected from potential power development. The stream reaches of concern are the prime spawning areas for anadromous fish. Power development within these reaches could have major adverse impacts on fish life.

The greatest concentration of population and development along the Rogue River occurs in the Middle Rogue River Basin. The Rogue River is the most reliable source of water on an annual basis for this area. Future development along the main stem may include rural residential, irrigation, municipal, industrial, and recreational uses. Statutes and water use policies may limit water appropriation for certain types of development.

Future development along the main stem Rogue that requires large quantities of water may conflict with the fish resource and existing minimum flows. Lost Creek Reservoir could provide stored water to supply many uses along the Rogue River. Presently, much of the water allocated for irrigation and municipal uses in Lost Creek Reservoir remains unsold.

TABLE 60

MIDDLE ROGUE RIVER BASIN
MINIMUM FLOW POINTS - FLOW ANALYSIS

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT
Fruitdale Creek												
Est. Q80 Flow	1	4	8	10	9	7	5	4	2	-	-	-
Sams Creek												
Est. Q80 Flow	2	9	17	21	19	15	11	8	3	1	-	-
Sardine Creek												
Est. Q80 Flow	2	8	15	19	17	13	10	7	3	1	-	-
Kane Creek												
Est. Q80 Flow	1	3	7	9	8	6	5	3	1	-	-	-
Birdseye Creek												
Est. Q80 Flow	1	5	9	11	10	8	6	5/3	2	1	--	--
Req. Min. Flow	8	12	12	12	12	12	12	8/4	2	1	1	3/8
Foots Creek												
Est. Q80 Flow	3	13	25	31	27	22	17	11	5	1	1	1/1
Req. Min. Flow	10	15	15	15	15	15	15	12	4	2	2	4/10
Galls Creek												
Est. Q80 Flow	1	5	11	13	12	9	7	6/4	2	1	--	--
Req. Min. Flow	4	4	6	9	9	9	9	6/3	1	1	1	1/2
Limpy Creek												
Est. Q80 Flow	2	10	18	23	20	17	13	11/7	4	1	1	1/1
Req. Min. Flow	8	12	12	12	12	12	12	8/5	3	2	1	3/8
Pickett Creek												
Est. Q80 Flow	6	22	42	53	46	38	28	24/16	8	3	1	1/1
Req. Min. Flow	8	12	12	12	12	12	12	8/5	3	1	1	3/8
Shan Creek												
Est. Q80 Flow	3	11	21	26	23	18	14	12/8	4	1	1	1/1
Req. Min. Flow	8	10	10	10	10	10	10	8/5	3	2	1	3/8
Ward Creek												
Est. Q80 Flow	1	4	7	9	8	7	5	3	1	--	--	--
Req. Min. Flow	12	18	18	18	18	18	18	15	5	2	2	5/12

TABLE 60 (continued)

MIDDLE ROGUE RIVER BASIN
MINIMUM FLOW POINTS - FLOW ANALYSIS

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT
Snider Creek												
Est. Q80 Flow	2	8	16	20	18	15	11	10/6	3	1	1	1
Req. Min. Flow	10	10	15	15	15	15	15	8/4	1	1	1	1/3
Grave Creek at Mouth												
Est. Q80 Flow	35/65	228	429	564	491	436	311	143	45	14	8/6	5/7
Req. Min. Flow	60/100	100	100	80	80	80	80	60	40	15	8/6	20/60
Evans Creek Near Mouth												
Est. Q80 Flow	38/70	99	320	418	439	244	141	89	61/41	20	12/10	10/10
Req. Min. Flow	70/150	150	150	100	100	100	100	80	60/40	20	15/8	25/70
Pleasant Creek Near Mouth												
Est. Q80 Flow	11	21	66	87	91	51	29	18	13/9	5/3	2	2/2
Req. Min. Flow	25	35	35	35	35	35	35	20	12/6	3/2	2	8/25
W. Fk. Evans Creek Near MP 2.2												
Est. Q80 Flow	19	35	113	147	155	86	50	31	22/14	8/6	4	3/3
Req. Min. Flow	60	80	80	80	80	80	80	50	35/25	20/15	10	20/60
Evans Creek Above W. Fk. Evans Creek												
Est. Q80 Flow	12	22	71	93	97	54	31	22/18	13/9	4	2	2/2
Req. Min. Flow	35	50	50	50	50	50	50	40/30	20/10	3	2	12/35
Jumpoff Joe Creek Near MP 3.8												
Est. Q80 Flow	9/25	68	152	208	193	142	77	33	16/8	3	1	2/2
Req. Min. Flow	50/65	65	65	60	60	60	60	40	30/15	8	5	20/50
Louse Creek Above Harris Creek												
Est. Q80 Flow	4	17	39	53	49	36	20	9	4/2	1	--	1/1
Req. Min. Flow	20	25	25	25	25	25	25	15	9/3	1	1	7/20

TABLE 61

MIDDLE ROGUE RIVER BASIN
ESTABLISHED MINIMUM FLOWS IN CFS

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT
Wolf Cr. at Mouth	18	18	25	25	25	25	25	15	15	1	1	1
Sardine Cr. at Mouth	8	12	12	12	12	12	12	4	1	1	1	1/8
Kane Cr. above confluence of Blackwell	4	4	4	4	4	4	4	2	1	1	1	1
Sams Cr. at Mouth	2/5	5	5	5	5	5	5	2	1	1	1	1/2
Grave Cr. above Wolf Cr.	40	80	80	80	80	80	80	40	40	5	5	5/40
Fruitdale Cr. at Mouth	4	4	4	4	4	4	4	2	1	1	1	1/4
Rogue River at Raygold	1200 Entire year											
Rogue River at Savage Rapids Dam	1200 Entire year											

Section 6

ILLINOIS RIVER BASIN

PART VI

SECTION 6 - ILLINOIS RIVER BASIN

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PART VI

SECTION 6 - ILLINOIS RIVER BASIN

CONCLUSIONS

The water resources of the Illinois River Basin are an important part of the total resources available in the basin. In addition to supplying the basic needs for human and livestock consumption, water is also needed to maintain or develop other resources such as fish life, irrigated agriculture, and mining.
Existing and future requirements for water in the basin include domestic, livestock, municipal, industrial, irrigation, agriculture, power development, mining, recreation, wildlife and fish life uses.

There are sufficient supplies of water on an annual basis to supply these needs. The location and timing of these supplies, however, have resulted in seasonal water shortages. Continued economic development in the basin is not possible without developing additional water supplies. Based on an analysis of basin water resource problems and information regarding alternative sources of water, it is concluded that:

1. Domestic, livestock and wildlife requirements, although important, do not require large quantities of water. Supplies appear adequate for present and contemplated requirements for these uses.

2. Existing municipal and industrial water supplies are currently adequate, but additional dependable supplies for future growth may be necessary.

3. Existing water supplies for irrigation are not adequate at all places in the basin. Late summer shortages occur in most years. An additional 8,200 acres of land within the basin could be irrigated if dependable water supplies were available.

4. There is some potential for power development in the basin.

5. Many of the water rights for mining have not been used for years, and may never be used to the extent originally envisioned.

6. The lower Illinois River has been designated a State Scenic Waterway under ORS 390.825. As such, it represents a significant water related recreational resource. While state laws and regulations govern the uses of adjacent lands there are no assurances that adequate water supplies will reach this portion of the Illinois River. Augmentation of summer flows would increase the recreation potential.

7. Fish life represents an important resource in the basin, but seasonal low flows greatly limit the potential of this resource. Consideration should be given to methods of augmenting these flows.

8. Existing streamflows may be fully appropriated during some time periods in Deer Creek, West Fork Illinois River and East Fork

Illinois River drainages.

9. Sucker and Althouse Creeks have been withdrawn from further appropriation by a State Engineer's Order dated July 27, 1934.

10. Ground water represents a significant alternative source for water supplies. An estimated 18,000 acre-feet per year could be developed in the Deer Creek drainage and 56,000 acre-feet per year could be developed in the Illinois Valley area south of Kerby with minimal impact on the surface water resources. The testing and development of these ground water resources is in the public interest.

11. Storage of winter streamflows represents an important source of water. Potential reservoir sites on Sucker, Althouse and Wood Creeks have been identified for future consideration. The existing withdrawal order on Sucker and Althouse Creeks may prevent or limit the use of water from these potential reservoirs.

SUBBASIN INVENTORY - ILLINOIS RIVER BASIN

GENERAL DATA

Basin Description

The Illinois River flows into the the Rogue River at river mile 27, approximately 20 miles northeast of Gold Beach, Oregon. It is a major tributary of the Rogue River system and drains all of southwestern Josephine County and a small portion of eastern Curry County, Oregon. In addition, the headwaters of both the East and West Forks of the Illinois River drain small areas of Del Norte County, California. The total area drained by the Illinois River is approximately 990 square miles. Only the 923 square miles occurring within Oregon, however, will be considered.

Terrain within the Illinois River Basin is rugged with the exception of the broad alluvial plain south and east of the city of Cave Junction, locally referred to as the Illinois Valley. Most of the population of the basin is located on this plain and a smaller alluvial plain in the Deer Creek watershed near the town of Selma. Little development has occurred outside these alluvial plains. Furthermore, the federal government owns or manages vast tracts of undeveloped land within the basin, most of which is also outside these alluvial plains.

Geology

Topography

The topography of the Illinois River Basin is geologically mature. Steep valley slopes, sharp divides and rugged terrain are typical, especially in the headwater and lower canyon areas. The majority of basin lands have between 11 and 60 percent slopes. Maximum relief is approximately 7,000 feet, although differences between valley bottoms and nearby ridges are usually less than 3,500 feet. Valley floors are generally narrow and underlain by only a thin layer, if any, of alluvial material.

Much of the basin lies between 2,000 and 4,000 feet in elevation, with only 9 percent lying above 4,000 feet. Winter snowpack accumulates above elevation of 4,000 feet. With only a minor portion of the basin above this elevation and very slight summer precipitation, the basin normally experiences low summer streamflows.

The topography of the Illinois River Basin reflects long-term stream erosion of a slowly rising upland. This has resulted in development of a ridge system at roughly the same altitude. Although locally controlled by structure, stream drainage patterns are dendritic.

Episodic vertical movement of the earth's crust is well displayed throughout the Illinois River Basin. Numerous bench gravel deposits occur locally at elevations up to 300 feet above the level of the nearest stream. In some areas two or more levels of terraces have been dissected by the most recent stream activity.

Two alluvial plains within the valley exhibit "old age" rather than "mature topography." They are the small alluvial plain near Selma along Deer Creek and the larger alluvial plain surrounding the confluence of the East and West Forks of the Illinois River with Sucker and Althouse Creeks near Cave Junction. In this report these plains are referred to as the Deer Creek Valley alluvial plain and the Illinois Valley alluvial plain, respectively. These relatively flat portions of the basin have slopes of less than 10 percent and are filled with up to 180 feet of alluvial material.

Stratigraphy

The Illinois River Basin is part of the Klamath Mountain geologic province which has been the subject of numerous geologic studies. Lack of rock outcrops, deep weathering, complex deformation, and low-grade metamorphism have complicated the area's geologic and stratigraphic history. It is clear, however, that geologic structure has affected the permeability of the fractured bedrock aquifers, the shape and thickness of alluvial basins and perhaps certain aspects of the regional ground water flow regime.

A wide diversity of geologic units, both in age and rock type, occur in the basin. The geologic history of the Klamath Mountains province began during the Paleozoic era with deposition of volcanic tuffs and sedimentary rocks which were subsequently metamorphosed. A period of extensive faulting, folding and erosion resulted in a complex intermingling of most of the older rock units. Late in the Triassic period, over 200 million years ago, additional volcanic and sedimentary materials were deposited. During the Jurassic period sandstones, siltstones and shales were laid down. These strata were intruded with ultramafic rocks during the late Jurassic or early Cretaceous times. These intrusions now appear in elongated serpentine outcrops and are generally associated with fault zones. Serpentinite is not common in the earth's crust and has a shiny green color which is striking when it appears in an outcrop. Other rocks which were intruded include granites, diorites and granodiorites. Apparently the Klamath Mountains were truncated and underwent a peneplanation process during the Miocene and Pliocene epochs.

Landsliding is the most common geologic hazard in the basin, and is prevalent within the main corridor of the lower Illinois River. Many of the steep slopes within the Illinois River canyon have experienced active sliding. Most of the slides carry rock, soil and vegetative cover into the river channel where it is washed downstream. Slides occur in all of the different rock formations, although serpentinite and partly serpentinized peridotite appear to be more susceptible to sliding and shearing.

Major thrust faults occur in the drainage basin. Historic records, however, indicate little seismic activity.

Soils

The soils in the Illinois River Basin are characterized by a high degree of variation. For the purpose of this report, however, the soils can be grouped into three broad categories:

1. Residual soils overlaying the parent rock.
2. Old valley fill soils overlaying the alluvium.
3. Recent alluvial deposits adjacent to the rivers.

The residual soils were formed in place by the weathering of rock material. These soils are typically found on the hillsides and mountainous portions of the basin. The normal erosion processes continually removes surface materials and exposes new material to the weathering process. As a result, these soils are classified as relatively young. They are generally shallow, contain many rock fragments, and have a very thin humus layer. Most of these soils have a coniferous forest vegetative cover.

The old valley-fill soils were developed by the erosion and transport of the residual soil materials into the valleys. These soils constitute the major agricultural areas. A combination of geologic uplifting and continual down-cutting of the streams has resulted in soils left above the current flood plain on benches. These soils have weathered in place for many years, and as a result have developed distinct layers. Although the surface layer is usually crumbly and easily tilled, many of these soils contain a hard pan composed of clays or iron compounds in subsoil layers. These hard pans restrict drainage and may even require tile drainage systems. The conversion of flood irrigation systems to sprinkler irrigation has overcome the drainage problem in many areas.

Recent alluvial soils are located adjacent to the streams or in low depression areas. Although ideally suited for agricultural production, they are limited in extent, and are, therefore, not as important to the agricultural community as the old valley-fill soils.

Climate

The climate of the Illinois River Basin is sub-humid to humid with marked marine influences. During the winter months, most storms originate in the North Pacific. These storms bring cool, moist air to the basin. The coastal mountains, however, provide some protection from the more violent storms common to the Oregon Coast.

During the summer months, weather patterns come primarily from the south. As a result, the basin has warm, dry summers similar to the mediterranean climate of California. The average frost-free period is about 170 days. Low humidity and high temperatures common in July and August result in high rates of evapotranspiration, with subsequent stress on the crops.

Air temperatures at Cave Junction vary from an average of 39°F in January to a 69°F average in July. Table 64 lists average monthly temperature and precipitation data for Cave Junction.

History

Although fur trappers from the Hudson Bay Company traveled in the basin during the 1820's and 1830's, the discovery of gold in 1851 on Josephine Creek was the catalyst for the early settlement of the Illinois River Basin. The most famous and richest gold workings in the basin occurred in the Josephine Creek, Althouse Creek and Democrat Gulch watersheds and near Waldo. Mining towns such as Waldo and Kerby were quickly established to provide the basic goods and services needed by the miners. Waldo also became the first county seat for Josephine County. Although gold was the most highly sought metal, a significant amount of copper and chromium were also produced. Mining flourished in the basin until the 1870's.

Agriculture came to the Illinois Valley shortly after the discovery of gold. Initially established to provide food for the mining communities, farming has continued to be an important part of the basin economy.

The basin's timber resource has also been important from the beginning of settlement. Early settlers harvested timber for the construction of buildings and mining flumes, and for heating and cooking. Commercial logging activities were precluded by the steep rugged terrain until the 1940's when more advanced harvesting techniques and better transportation facilities became available. Today, logging and wood-processing enterprises contribute significantly to the basin economy, although not as much as in the 1970's.

Commercial salmon fishing on the lower Rogue River was an important economic activity until 1935. The basin's recreation and tourist business started soon after the railroad arrived in 1884 when sportsmen first came to fish for salmon, steelhead and trout.

Population

The population of the Illinois River Basin has dramatically increased during the last 10 years. The 1970 census listed the population of Cave Junction as 415 people. The 1980 census showed a population of 1,023 -- an increase of 147 percent. The Cave Junction Census Division, which includes all of the basin south of Kerby, showed a similar increase. For example, the population of the entire census division jumped from 2,866 to 6,782, an increase of 140 percent over the same period. The area north of Kerby, including Selma and Dryden in the Deer Creek drainage, is included in the Wilderville Census Division. Since the census division includes parts of both the Applegate and Illinois River Basins, it was not possible to separate the population of only the Illinois Basin portion. The area north and west of the confluence of Deer Creek and Illinois River is part of the rugged Illinois River Canyon, and is relatively unpopulated.

The population of Josephine County also experienced a large increase in the 1970-1980 decade. The county's population increase of 23,000 people (64.5 percent) was the largest of any prior 10 year period and followed two decades of relatively slow expansion.

The major source of population growth during the 1970's was in-migration which accounted for roughly 90 percent of the increase.

People moved to Josephine County (and the Illinois River Basin) during the 1970's for several reasons. They came to retire, change lifestyles, seek job opportunities, and escape crowded urban areas. Many have been attracted to the area by the moderate climate and numerous recreational opportunities.

A study by the Josephine County Planning Department shows 44 percent of all property owners in the Illinois Valley area do not reside in Josephine County. From this data, it can be inferred that, for the 1980's, a continued influx of residents can be anticipated. The trend of residential development in the basin is rural; one to ten acre lot sizes rather than urban type development.

It is expected that the increased population in the Illinois River Basin will result in greater demands on many of the natural resources. Increased domestic and municipal water needs will be competing with agriculture, recreation, fish life and other beneficial uses for the limited water supplies.

Economy

Economic expansion in Josephine County began during the 1850's with the discovery of gold. After the most easily mined gold had been discovered and processed, agriculture became the major economic activity. Mining and lumber were second and third, respectively. As late as 1940, according to U.S. Census records, 1,685 persons were employed in agriculture, 470 in mining (primarily chromium), and 370 in logging and lumber production. Between 1917 and 1958, 118,000 tons of chromium were mined. After 1940, however, employment dropped sharply in that industry. By 1960, most mining consisted of sand and gravel operations.

During the 1940's the manufacture of wood products increased substantially, fueled by war demands and the enormously expanding market for housing which occurred after 1945. By 1950, 2,380 persons were employed in wood products according to the U.S Census.

Since 1950, agriculture has undergone a significant reduction in output and employment. Presently, two industries make up most of the economic base of Josephine County -- wood products and tourism.

The overall growth from 1960 to 1980 and the relative shift from agriculture and manufacturing to retail trade, government, and services can be seen in Table 62. Employment in agriculture fell from an average of 1,340 in 1960 to 420 in 1980, a reduction of 69 percent. Nonmanufacturing jobs, which nearly tripled in 20 years, rose from 65 percent to 78 percent indicating that employment in retail trade and services related to tourism has been steadily growing.

Statistically, the employment picture in Josephine County has been gloomy over the past decade. Unemployment in the county is subject to strong seasonal variations compounded by sharp fluctuations reflecting national economic trends. Unemployment is usually highest in the winter months and lowest in August and September. This follows from the outdoor nature of much of the economic activity. Logging, forestry, construction, agriculture, tourism and recreation are closely related to changes in weather.

Unemployment in the county has been far higher than the national average and is consistently well above the Oregon average. In early 1981, the unemployment rate exceeded 16 percent. In the 1971-1980 decade the rate fluctuated around 11 percent.

In 1979, Josephine County had the third lowest percapita personal income in Oregon according to percapita personal income data gathered by the Bureau of Economic Analysis, U.S. Department of Commerce. In 1980, the county had the sixth highest unemployment rate (13 percent) in the state.

The economy of the Illinois River Basin is based on the area's abundant timber resource and the numerous recreational activities and scenic qualities which attract tourists. Although mining was at one time the foundation of the economy, little mining activity remains. If mineral prices continue to rise, however, some mines may be re-opened for production.

The future economic strength of the basin lies in the development of a diversified economic base. Industrial and manufacturing development in areas other than wood products would be highly desirable. Such development would tend to produce a greater resiliency to economic downturns. Although development of a more diverse economic base is slowly occurring, the timber industry is expected to continue to play a major role.

Most of the Illinois River Basin is classified as forest land, and

TABLE 62
EMPLOYMENT CHANGES 1960-1980
JOSEPHINE COUNTY

	1960	PERCENT OF TOTAL	1980	PERCENT OF TOTAL	PERCENT CHANGE 1960-1980
Nonag Wage and Salary	6,610	100.0	15,780	100.0	+138.7
Manufacturing	2,320	35.1	3,450	21.9	48.7
Lumber and Wood	2,170	32.8	2,200	13.9	1.4
Other Manufacturing	150	2.3	1,250	7.9	733.3
Nonmanufacturing	4,290	64.9	12,330	78.1	187.4
Construction	230	3.5	520	3.3	126.1
Transportation-Utilities	370	5.6	620	3.9	67.6
Trade	1,320	20.0	3,870	24.5	193.2
Finance, Ins, Real Estate	230	3.5	880	5.6	283.6
Services	750	11.3	2,870	18.2	282.7
Government	1,390	21.0	3,570	22.6	156.8
Agriculture	1,340	---	420	---	-68.7

SOURCE: Oregon Department of Human Resources, Employment Division, 1981.

much of the work force is involved in the timber industry either directly or indirectly. Most forests are managed by the U.S. Forest Service, the Bureau of Land Management, state, or county forestry agencies. Privately-owned woodlots, however, contribute significantly to the basin's economy.

Agriculture is not as significant to the overall basin economy as it once was and is expected to play a lesser role in the future. Dairy and beef cattle are the most important agricultural enterprises, and much of the irrigated land is used to produce feed for cattle. Dryland crops include grains, hay and pasture. Over 9,600 acres or 90 percent of the basin's agricultural land is zoned for exclusive farm use.

Tourism and recreational activities have steadily become an important economic factor. The Oregon Caves National Monument is just one of the many natural attractions that annually bring tourists to the Illinois River Basin. Rugged mountains and clear running streams entice thousands of visitors each year. Abundant fish and wildlife resources attract fishermen and hunters.The Kalmiopsis Wilderness area, managed by the U.S. Forest Service as part of the Siskiyou National Forest, includes much of the lower Illinois River in the scenic Illinois River Canyon area. The main stem Illinois River from Deer Creek to its mouth is part of the state Scenic Waterway System and is being considered for inclusion to the federal Wild and Scenic River system.

These attractions are critical to the economic viability of motels, restaurants and other businesses which rely on the tourist trade. Development of recreation and tourist facilities may contribute to further expansion of the economic base.

Land Use

The Oregon Water Resources Department conducted a land use inventory of the Illinois River Basin in late 1978. With technical assistance from the Environmental Remote Sensing Applications Laboratory at Oregon State University, the Department used LANDSAT data and U-2 photographs to classify all land and water bodies in the basin into seven broad categories: irrigated agricultural land, non-irrigated agricultural land, range land, forest land, urban areas, water bodies and other areas (e.g., barren land, lava flows, wetlands, ice and snow fields).

Although 95 percent of the basin is classified as forest land, approximately 16,500 acres are classified as non-irrigated agricultural land and range land. These categories were combined to define possible irrigable lands for this study. Areas having soils in groups I through IV with no severe limitations were considered to be potentially irrigable. Based on this methodology, over 8,200 acres of land in the basin have the potential to be irrigated if and when dependable water supplies become available. Eighty-five hundred acres are presently classified as irrigated land. Results of the inventory are shown in Table 63.

Extremely rugged terrain leaves very little area suitable for sustaining development. A vast portion of the land is in public ownership and much of the basin lacks adequate access. Lands suitable for development, however, are mostly in private ownership.

Over 80 percent of the Illinois River Basin is publicly owned. These lands are being managed by the U.S. Forest Service (71%), the Bureau of Land Management (10%), the State of Oregon (1/2%), and Josephine County (1/2%).

TABLE 63

LAND USE: ILLINOIS RIVER BASIN

USE	ACRES	PERCENTAGE OF BASIN
Irrigated Agricultural land	8,458	1
Non-Irrigated Agricultural land	1,519	*
Range land	14,945	3
Forest land	559,973	95
Water bodies	676	*
Urban Areas	199	*
Other	4,817	*
Total	590,587	

* Less Than 1%

WATER RESOURCE DATA

Precipitation

The only active climatological station in the Illinois River Basin is at Cave Junction. For the period of record, 1963 through 1980, the average annual precipitation and temperature for Cave Junction was 58.9 inches and 53°F, respectively. Table 64 lists the average monthly temperature and precipitation at Cave Junction.

Annual precipitation varies widely in the basin, ranging from an estimated high of 110 inches in the lower Illinois River Canyon area to about 35 inches per year east of Selma. Most precipitation falls during the winter between the months of November and April in the form of rain below 4,000 feet elevation and snow above 4,000 feet elevation. Less than 20 percent of the precipitation occurs during the April 1 - October 31 irrigation season, and only two percent falls during the June - August time period when peak crop water requirements occur. Where terrain is steep, precipitation runs off rapidly. This is particularly true in areas of heavy clay soils, areas of thin soils overlying bedrock, areas of sparse natural vegetation, or areas which have been clearcut.

In addition to the precipitation data from the Cave Junction Station, three precipitation gages are maintained by the Water Resources Department. These stations have cumulative gages which are read at irregular intervals, so monthly data are not available. Plate 4 shows the location of the climatological stations in the Illinois River Basin.

Information from these and other climatological stations in the Rogue River Basin was used, in part, to develop an isohyetal or precipitation contour map (Plate 4). The map depicts estimated average annual precipitation at any location in the basin.

Streamflow

From its origin in the Siskiyou Mountains in Northern California, the Illinois River flows in a northwesterly direction to its confluence with the Rogue River near Agness. The basin contains over 1,100 miles of streams. Major tributaries include Indigo Creek, Silver Creek, Briggs Creek, Josephine Creek, Elk Creek, Deer Creek, Sucker Creek and Althouse Creek. Stream gradients are extremely variable due to the differences among the geologic units and the relative tectonic movement of various portions of the basin.

There are six active stream-gaging stations located in the Illinois River Basin as shown on Plate 4. These are located on: 1) the East Fork near the Oregon-California border, 2) the West Fork above O'Brien, 3) Sucker Creek below Little Grayback Creek, 4) the main stem Illinois River below Kerby, 5) the main stem near the confluence with the Rogue River at Agness, and 6) Elk Creek near O'Brien. The observed average discharge of the Illinois Basin at Agness is 3,098,000 acre-feet per year. This yield includes the cumulative

TABLE 64

AVERAGE MONTHLY TEMPERATURE (F°) AND PRECIPITATION (in.)

AT CAVE JUNCTION, OREGON

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL AVERAGE
Temperature	39	43	46	49	57	64	69	68	63	54	45	40	53
Precipitation	12.2	7.0	6.6	3.6	1.6	0.4	0.2	0.7	1.4	3.4	9.9	11.9	58.9

Period of Record: 1963-1980
Source: U.S. Department of Commerce, National Oceanic and Atmospheric Administration.

effects of irrigation, municipal, domestic and other water withdrawals and return flows. Figure 16 shows the variations that can occur in the annual runoff. Within the period of record depicted on Figure 16, the Illinois River has varied from the high runoff experienced in 1974 to the low water conditions in 1977. Table 65 lists the estimated Q.80 annual runoff for various streams in the basin.

Streamflows generally follow the pattern of precipitation which can be seen by comparing the monthly streamflow distribution near Kerby (Figure 16) with the

TABLE 65

ILLINOIS RIVER BASIN
RUNOFF FROM TRIBUTARY STREAMS

GAGING STATION	STREAM	DRAINAGE AREA SQUARE MILES	Q.80 ANNUAL RUNOFF ACRE-FEET
	Sucker Creek	98	110,600
	Althouse Creek*	44	50,200
	Rough and Ready Creek	37	82,000
	Elk Creek*	27	63,700
	Wood Creek	7	13,850
	Elder Creek	9	13,500
	Chapman Creek	4	5,200
	Deer Creek	115	126,200
	Clear Creek	12	16,200
	Mendenhall Creek	6	10,000
3755	West Fork near O'Brien*	42	105,300
3725	East Fork near Takilma*	42	89,500
3771	Illinois River near Kerby*	380	600,000
3782	Illinois River near Agness*	988	1,947,900

* These areas include lands located in California.

monthly precipitation listed in Table 64. Flows in ungaged streams were estimated using multiple linear regression equations reflecting data from 17 gaging stations in the lower Rogue area. Table 65 lists the estimated flows which have an 80% probability of being equalled or exceeded in any one year.

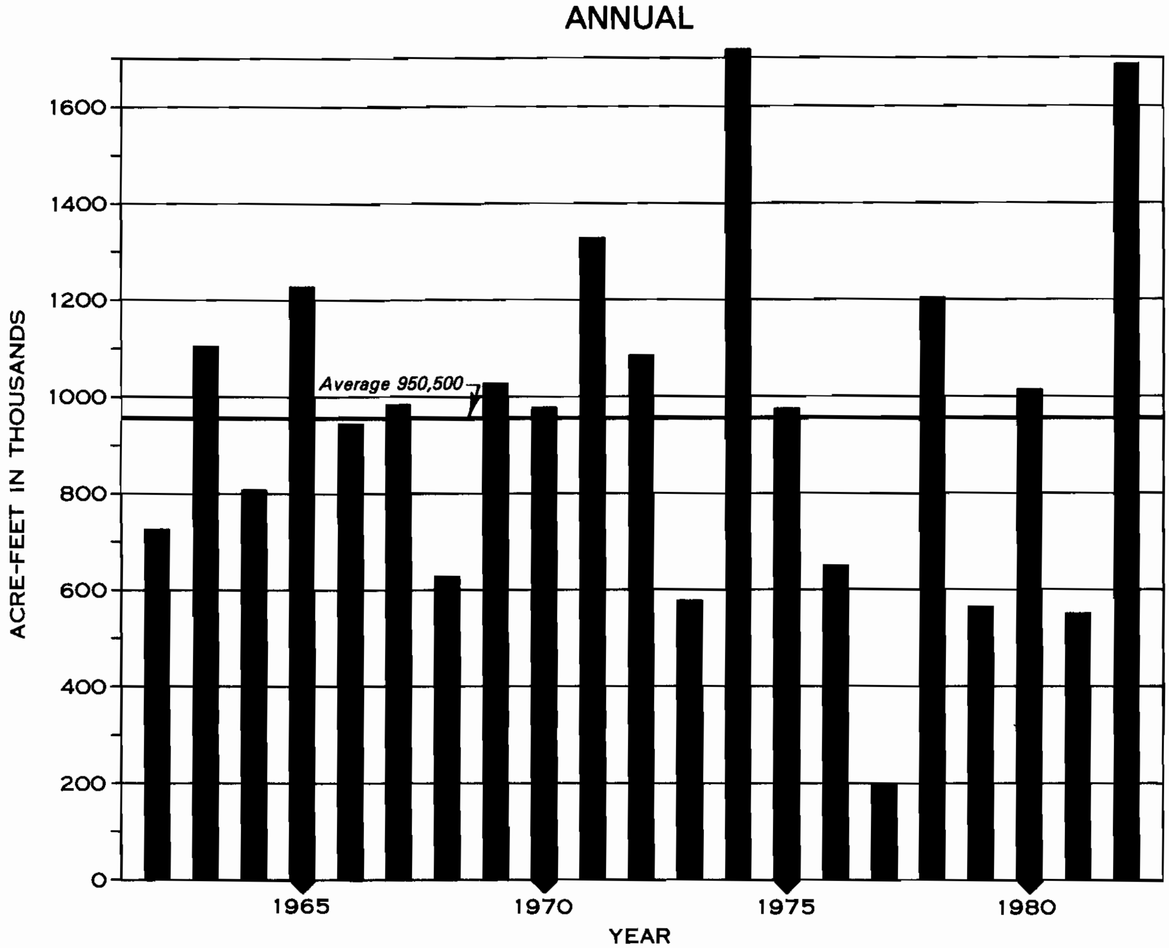
Ground Water

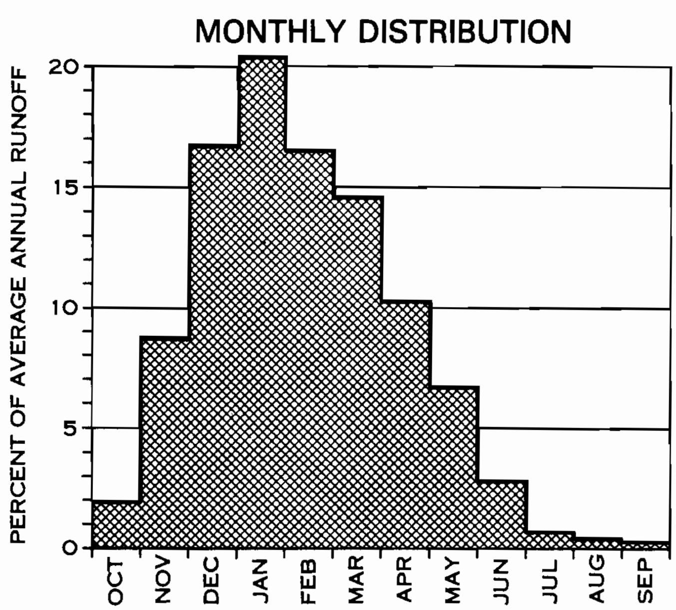
Ground water is limited in many of the bedrock units underlying the Illinois River Basin. Water is generally contained only in fractures since metamorphism has eliminated most of the primary porosity. These rock formations occur principally in the highlands. Although precipitation is relatively high, recharge and water transmission are relatively poor because the steep slopes and generally low porosity cause rapid surface runoff and little infiltration. Ground water production is variable, but most wells constructed in these units are capable of producing at least enough water for domestic purposes. In

Figure 16

RUNOFF
Illinois River Near Kerby

DRAINAGE AREA 380 SQ. MI.





some areas, much larger yields may be obtained where more extensive fracturing has increased the secondary porosity.

Alluvial material in the Deer Creek Valley and Illinois Valley above Kerby has the greatest ground water development potential. The recent alluvium is limited to active stream courses or flood plains. Usually unconsolidated, and relatively thin, it is comprised of clay, silt, sand, gravel, and mixtures of all these components. Water quality in the unconfined alluvial aquifer is generally good, but, beacuse of direct contact with the land surface, is highly susceptible to contamination.

The older alluvium underlying most of the valley is generally more compacted and/or cemented by calcite or iron oxide. Water quality in this formation is generally good, although areas of poor quality saline water exist two miles southwest of Cave Junction and near Lake Selmac. These local areas of poor quality water may occur due to fractures in the underlying metamorphic rock. Potential problems may be avoided by not drilling wells to the bottom of the alluvial aquifer.

Recharge to aquifers is primarily from two sources; precipitation and infiltration from surface water bodies. Precipitation is the more important factor in the upper reaches of the basin, while infiltration from surface water bodies becomes more important in the alluvial aquifer on the valley floor, especially in the late summer months. Most upland area streams are "gaining (effluent) streams" and gain water from ground water flow. However, in the Deer Creek Valley and Illinois Valley above Kerby, many streams are locally "losing (influent) streams". Some stream reaches actually become dry in late summer, particularly along the lower reaches of Deer Creek, Sucker Creek, Rough and Ready Creek, and the East Fork Illinois River, following the seasonal decline of the local water table.

Hydrographs of shallow wells drilled in the alluvial materials show an immediate rise in ground water levels after the beginning of fall rains. Some wells in the Illinois Valley show two periods of rise during the year. The first is due to precipitation during the beginning of the winter rainy season, while the second begins in late June and is probably due to recharge from irrigation ditches and application of irrigation water. Four conclusions may be drawn about the alluvial aquifer from these observations: 1) infiltration from irrigation ditches and gravity irrigation is an effective, important, and fairly rapid recharge mechanism; 2) the local ground water reservoir is kept nearly full by essentially year-round recharge; 3) movement of surface water into shallow ground water systems is fairly rapid; 4) the shallow ground water is highly susceptible to contamination from pollution sources at the surface, such as overloaded or improperly constructed septic systems, surface contamination and instream sources of pollution.

Calculations based on the area and depth of alluvial deposits, water table fluctuations, as well as precipitation and streamflow records indicate that an average of approximately 56,000 acre-feet of water are annually recharged to (and discharged from) the ground water systems in the Illinois Valley alluvial aquifer. Similar calculations for the Deer Creek drainage indicate that an average of approximately 18,000 acre-feet of water are recharged to (and discharged from) the local ground water systems annually. This water, if developed, could probably be withdrawn from these aquifers with minimal impact on the hydrologic system. Potential impact upon streams and other surface water bodies is difficult to assess, but will depend upon the location and volume of the withdrawals, the timing of the withdrawals, and the characteristics of the ground water system. Impacts could be minimized if large production wells are placed as far from surface water bodies as possible. As accelerated ground water development is anticipated, detailed aquifer studies and tests should be conducted to provide information necessary to guide the most efficient utilization of this ground water resource.

Ground water in most areas of the basin is of adequate quality for most beneficial uses. Exceptions include areas underlain by mafic and ultramafic rocks, scattered areas underlain by Galice formations metasedimentary rocks, and areas of regional ground water flow discharge. Water quality constraints for the above ground water systems are excessive hardness and magnesium, excess chloride and/or iron concentrations, and highly mineralized water, respectively.

Water Rights

Water supplies are not always adequate to meet existing needs. During low flow periods, some water users receive little or no water. Increased population and rural development could intensify the shortage problem, particularly during below average runoff years.

Through 1980, surface water rights in the Illinois River total over 1,100 cfs. Quantitatively, mining and irrigation account for over 97% of these rights. The remaining 3% include domestic, livestock, municipal, industrial, power, fish, wildlife, and recreational uses. Table 66 summarizes the surface water rights in the basin, while Table 68 summarizes the ground water rights. Table 67 does not include uses which are exempt from permits under ORS 537.545.

Mining rights account for 909 cfs or 79 percent of the total rights in the basin. Most of these water rights are on the East Fork Illinois River and its tributaries. Water rights for mining purposes are exercised seasonally. Many rights are no longer used and are not expected to be fully exercised in the near future due to 1) the economics of mineral development, and 2) existing mining, land use and water quality regulations. Even though not likely used, these rights remain on record because of the difficulty of proving abandonment. At least one active placer mining operation is located on Sucker Creek.

Irrigation rights from surface water account for 205 cfs, and comprise the largest consumptive use of water in the basin. In the Illinois River Basin both the irrigation season (April 1 to October 31) and the duty of water have been established by court decree. The established duty of water is 1/50 cfs per acre with a maximum quantity allowed of 3.5 acre-feet per acre per season.

TABLE 66

ILLINOIS RIVER BASIN
SURFACE WATER RIGHTS - in cfs
December, 1980

USE	MAIN STEM ILLINOIS	E. FORK ILLINOIS	W. FORK ILLINOIS	DEER CREEK	OTHER TRIBS.	TOTALS
Irrigation	15.5	111.0	14.4	35.5	32.1	205.5
Domestic/Livestock	0.1	1.0	0.4	0.7	0.5	2.7
Municipal	0.0	3.0	0.0	0.0	0.0	3.0
Industrial	0.0	2.8	3.4	0.1	0.5	6.8
Power	0.0	2.1	0.0	0.0	0.0	2.1
Mining	5.0	577.6	38.5	2.3	285.7	909.1
Recreation	0.0	0.5	1.5	0.0	2.3	4.3
Fish Life	0.1	0.5	3.9	0.1	0.3	4.9
Wildlife	0.0	0.1	0.0	0.0	0.0	0.1
TOTAL	17.7	698.6	62.1	38.7	321.4	1,143.5

TABLE 67

SUMMARY OF GROUND WATER RIGHTS*
ILLINOIS RIVER BASIN

LOCATION TOWNSHIP	RANGE	SECTION	NUMBER OF PERMITS ISSUED	PERMITTED INSTANTANEOUS DIVERSION, CFS	ANNUAL PERMITTED WITHDRAWAL AC-FT/YEAR	AQUIFER UNIT **
T38S	R7W	9	3	0.99	195	Qal
		10	2	0.28	54.5	Jgs
		14	1	0.25	50	Qal
		17	3	2.02	357.5	Qal
		21	1	0.25	50	Qal
		24	1	0.36	72.1	Qal
T38S	R8W	11	1	0.08	16.25	Qal
		12	2	0.14	29.75	Qal
		13	2	0.29	58.35	Qal
		15	1	0.07	13	Jgs
		22	1	0.08	15	Jgs
T39S	R7W	19	1	0.5	100	Qal
		27	1	0.7	140	Qal
		31	2	2.5	392.5	Qal
		32	6	1.165	209	Qal
		33	4	0.9	160.25	Qal
T39S	R8W	22	4	0.42	96.7	Qal
		25	2	0.050	10	TRav
		28	2	0.14	27.5	Qal
		32	2	0.18	35	Jgs/Qal
		33	1	0.05	10	Qal
		34	1	0.02	4	Qal
		35	2	0.95	198.1	Qal
		36	2	0.15	30.5	Qal
		Municipal	1	1.0	724	Qal

TABLE 67 (continued)

SUMMARY OF GROUND WATER RIGHTS*
ILLINOIS RIVER BASIN

LOCATION TOWNSHIP	RANGE	SECTION	NUMBER OF PERMITS ISSUED	PERMITTED INSTANTANEOUS DIVERSION, CFS	ANNUAL PERMITTED WITHDRAWAL AC-FT/YEAR	AQUIFER UNIT **
T40S	R7W	1	1	0.125	25	Qal
		2	1	0.125	25	
		4	1	0.11	22	Qal
		5	3	1.33	267.5	Qal
		6	2	0.52	74.9	Qal
		7	2	0.14	27.57	Qal
T40S	R8W	1	3	1.64	299.75	Qal
		2	2	.26	50	Qal
		5	3	0.61		Qal
		11	1	0.31	61.25	Qal
T40S	R8W	13	1	0.06	12.5	Qal
		23	1	0.35	20	Qal
		30	1	0.21	41	Qal
T41S	R8W	3	1	0.05	9	Qal

* As of September 1980

** Aquifer Units
Qal: Alluvial Materials
Jgs: Galice Formation
TRav: Applegate Group

Many of the streams are either dry or are fully appropriated during the summer months. Both Althouse and Sucker Creeks have been closed to further appropriation by order of the State Engineer dated July 27, 1934, except for domestic and livestock use or power and mining development which do not consumptively use the water or cause injury to existing rights.

The City of Cave Junction has the only municipal water rights in the basin (4 cfs). Three cfs are surface water rights and one cfs is obtained from ground water. Most of the basin's population relies upon individual or small group water supply systems. Surface water rights for domestic and livestock use amount to almost 3 cfs throughout the basin. Ground water is also relied upon for domestic and livestock uses, but data are not available to determine the annual quantity of water used.

Industrial water rights (7 cfs) are used primarily in the timber industry. One mill also has a power right for 2 cfs.

Some of the small reservoirs built for irrigation also have rights for recreation, fish propagation and wildlife enchancement. Water rights for commercial fish propagation uses total approximately 3 cfs. In addition to the recreation rights on these small reservoirs, Josephine County has a right for 1 cfs to operate Lake Selmac, and the U.S. Forest Service has water rights for several of its campgrounds.

Lakes and Reservoirs

Table 17 lists the lakes and reservoirs in the basin with a surface area of at least one acre. All of the natural lakes are small, and most are located in the higher elevations of the Siskiyou Mountains. Esterly Lakes are the largest group of natural lakes with a total surface area of 18 acres. Lake Selmac is the largest reservoir. This 157-acre reservoir is a popular recreation area located on McMullin Creek near Selma.

Potential Reservoir Sites

Numerous potential reservoirs sites were investigated in the Illinois River Basin. These are listed in Table 68. Many of the sites were eliminated from consideration for one or more of the following reasons; 1) poor geologic conditions, 2) insufficient quantities of, or poor quality borrow material in the immediate reservoir area, 3) relatively high costs, 4) inundation of farmland, buildings or other structures, or 5) adverse environmental impacts. Sites eliminated from consideration are shown in Table 27.

The following potential reservoir sites warrant protection through the existing county land use planning process pending future water resource development decisions at the local, state and federal level. The most promising of the potential project sites are discussed below, not necessarily in priority order.

TABLE 68

POTENTIAL RESERVOIRS - ILLINOIS RIVER BASIN

SITE NO.	STREAM	LOCATION	DRAINAGE AREA (SQ. MI.)	NORMAL ANNUAL PRECIPITATION (INCHES)	ANNUAL Q.80 (AC-FT)	RESERVOIR CAPACITY (AC-FT)	DAM HEIGHT (FEET)
1	W. Fork Illinois	40S, 9W, Section 26 below Little Rock Creek	45	79	110,700	25,000	160
2	W. Fork Illinois	41S, 9W, Section 4 below Whiskey Creek	11.7	88	38,600	8,400	160
3	Wood Cr.	40S, 8W, Section 32, SE 1/4 NW 1/4	3.5	67	7,100	4,500	95
4	Lower Althouse Cr.	40S, 7W, Section 7 SE 1/4 SE 1/4	32	57	44,700	7,200	80
5	Upper Althouse Cr.	40S, 7W, Section 4 SW 1/4 SW 1/4	29	58	40,600	9,600	120
6	Sucker Cr.	39S, 7W, Section 25, NE 1/4	76	57	100,000	40,000	230
6a	Sucker Cr.	39S, 7W, Section 25, NE 1/4	76	57	100,000	22,000	160
7	Deer Cr.	38S, 8W, Section 18	24	42	32,200	31,000	130
8	Deer Cr.	38S, 7W, Section 13 below White Creek	30	42	46,500	25,000	80
9	Thompson Cr.	38S, 7W, Section 21, NW 1/4	10	42	10,100	9,800	80
10	Rough & Ready Cr.	40S, 9W, Section 14/15 on line	34	82	91,000	13,000	130
11	McMullen Cr.	38S, 7W, Section 30, E 1/2	7.2	42	7,600	6,800	80
12	Crooks Cr.	38S, 7W, Section 4, SE 1/4	8	36	6,200	6,500	80
13	Draper Cr.	37S, 7W, Section 31, SW 1/4 NE 1/4	2.6	39	2,500	2,700	60

Wood Creek Reservoir Site Investigation

This potential dam site is located in the SE 1/4 of NW 1/4 of Section 32, Township 40 South, Range 8 West, Willamette Meridian. The dam would be 95 feet high and 840 feet long. The reservoir could have a capacity of about 4,500 acre-feet, with 106 acres of surface area.

The drainage area above this site is 3.5 square miles. The estimated Q.80 annual runoff is 7,000 acre-feet. About 75 percent of this runoff (5,200 acre-feet) occurs during the November through March rainy season. The only upstream water right that could affect reservoir filling during this period is for domestic use of .015 cubic feet per second, which is about one acre-foot per month.

Most of the area is covered by clay and gravelly loams up to four feet deep. These soils have no severe limitations for constructing dam embankments. There should be a sufficient supply of acceptable borrow material from these soils to construct a 95 foot high dam at this site.

This area is underlain by Marine Sedimentary Rock of Cretaceous Age. It is comprised primarily of sandstone with subordinate conglomerate. This formation has some primary permeability which may cause some leakage in a reservoir. Geologic test drilling would be needed before dam construction.

There is little development in the potential reservoir site. One ranch would be flooded and one or two houses downstream from the dam might be affected. The dam would eliminate anadromous fish runs and inundate existing spawning beds upstream of this site. Water stored by this potential project could be used for both instream and out-of-stream uses in the West Fork Illinois River.

Upper Althouse Creek Reservoir Site Investigation

Another potential earthfill dam on Althouse Creek is located in SW 1/4 of SW 1/4 of Section 4, Township 40 South, Range 7 West, Willamette Meridian, and would be 120 feet high and 1070 feet long. The reservoir could have a capacity of approximately 9,600 acre-feet with a 156-acre surface area.

The drainage area above this site is 29 square miles. The estimated Q.80 runoff is slightly over 40,000 acre-feet per year. Three-quarters of this runoff (over 30,000 acre-feet) occurs during the November through March winter storage season. As with the lower proposed site, 350 acre-feet would be needed to satisfy the existing consumptive water rights upstream during the storage season. There are also 350 cfs of mining rights throughout the Althouse Creek drainage that should not affect winter runoff since they are considered nonconsumptive. There should be sufficient runoff to maintain instream flows below the dam as well as fill the potential reservoir.

The main drawback to this site is an apparent lack of good quality borrow material for embankment construction. The predominant soil series in the proposed reservoir site is the Cornutt-Dubakella complex. This is a shallow soil, only two to three and one-half feet deep, formed in colluvium from various formations. The soil complex has moderate to severe limitations for embankment construction due to its thinness, stoniness and resistance to compaction. Several mine tailing piles are also present in the potential dam site area. These consist of large gravels and are generally unsuitable as a source of borrow material. Since the third dominant soil series in the area is also unsuitable for use in constructing an earthfill dam, some borrow material may need to be brought into this proposed site.

The site area is underlain by metamorphosed rocks of the Applegate Group. Geologic test drilling to assess site suitability will be necessary due to the possibility of the occurrence of serpentinite in shear zones, or extensive fracturing of the metavolcanic rocks which could cause seepage problems.

There is one new house immediately below the proposed dam site which could be affected by the dam construction. There is only one dirt road to relocate. The lack of development and the abundant supply of water in Althouse Creek makes this site very attractive. Limitations of the site include the shortage of high quality borrow material in the vicinity of the potential project and potential impacts on anadromous fish passage as well as upstream spawning areas.

Water stored in the reservoir could be used to satisfy various instream and out-of-stream water needs on Althouse Creek and in the East Fork Illinois River. Possible uses include irrigation, municipal, industrial, and power development. An increased flow during the summer could also enhance the downstream fisheries habitat in both Althouse Creek and the East Fork Illinois River.

<u>Sucker Creek Reservoir Site Investigation</u>

This potential dam and reservoir site was investigated by the Bureau of Reclamation in the early 1950's and 1960's. Most of the data in this study has been taken from their 1964 report on the proposed Illinois Valley project.

Located in the NE 1/4 of Section 25, Township 39 South, Range 7 West, Willamette Meridian, an earthfill dam at this site would be 230 feet high, 1,550 feet long, and have a base width of 1,400 feet. The reservoir's usable capacity would be 39,000 acre-feet and have a surface area of 465 acres.

The drainage area above this site is 76 square miles. The estimated Q.80 runoff is over 100,000 acre-feet per year. About 64 percent of this runoff (64,000 acre-feet) occurs during the winter storage period of November through March. The consumptive water rights above the site total less than two cubic feet per second for nonirrigation purposes. There are some nonconsumptive mining rights above this site, but they should not affect its storage potential.

According to the Bureau report, there is sufficient borrow material in the area for construction of the dam. Small geologic faults may occur in the dam site, and further geologic investigations may be necessary. The reservoir site appears to be water tight and should have little seepage.

This site could supply water for irrigation of an estimated 11,000 acres of good quality dry land and supplemental irrigation of another 1,100 acres. This project, as outlined by the Bureau, would include an extensive network of canals and ditches for delivering the water to these lands.

The site appears to be the best potential reservoir site in the basin. It could supply water for most of the irrigable lands in the Illinois Valley, excluding Deer Creek. The major development in the area that would be affected is Highway 46 which leads to the Oregon Caves. Several miles of road would have to be relocated on steep slopes. Several private residences and at least four active mining claims are also located within the potential reservoir area.

An alternate plan would be to construct a smaller dam. In this case, a dam 160 feet high and 1,100 feet long would form a 22,000 acre-foot reservoir. The dam would require about 1,441,000 cubic yards of material to build. A smaller dam would not warrant a water distribution system as extensive as that proposed by the Bureau, since less water could be utilized for irrigation. The smaller dam, however, would be less effective in controlling floods or generating power than a larger one.

The anadromous fish runs and upstream spawning areas would be adversely affected by either size project, so facilities would have to be provided to mitigate these affects. Numerous benefits could result from construction of this potential project. For example, it could provide a large reservoir for water recreation and sports in an area lacking these types of opportunities. Reservoir storage could provide resident trout fishery values. Reservoir releases could maintain instream flows for fish flows below the dam, as well as provide flow augmentation for water quality control in the East Fork Illinois River and the main stem Illinois. Finally, flood control benefits in the populated Illinois Valley would also result from storage operation of the potential project.

WATER NEEDS AND RELATED PROBLEMS

Agriculture

Since the valley has the highest summer temperatures and least amount of precipitation of any valley in western Oregon, a critical element for agricultural operations in the Illinois Valley is the availability of irrigation water. With the exception of the Deer Creek drainage area, almost all of the irrigated lands are located upstream from Kerby. Information from the Watermaster indicates most of these lands have an inadequate supply of water, and distribution occurs to supply farmers with priority dates in the 1800's. Distribution occurs most often on Sucker Creek where water deliveries are curtailed beginning in July in most years.

The following streams as either dry in the summer, or do not have sufficient flow to satisfy all existing rights.

1. Deer Creek and its tributaries of:
   a. Anderson Creek
   b. Thompson Creek
   c. North Fork Deer Creek
   d. South Fork Deer Creek

2. East Fork Illinois River and its tributaries of:
   a. Sucker Creek
   b. Althouse Creek
   c. Elder Creek
   d. Little Elder Creek

If existing water supplies could be supplemented with storage or ground water, agriculture could expand by increasing the acreage irrigated and by switching to higher value crops requiring a firm water supply. The Josephine County Draft Comprehensive Land Use Plan (April 1981) indicates a potential for fruit and vegetable production, but noted that both transportation and water availability problems would have to be solved first.

The basin's soils limit intensive farming in much of the Illinois Valley area. Livestock production is the basis of the farm economy. Pasture and forage production are the most common agricultural uses of cleared lands. The dairy industry is one of the better livestock enterprises. The second largest dairy in the State of Oregon is located in the Illinois Valley.

Although the production of crops is not as extensive as livestock production, it still plays an important role. Grass, hay, and silage are the most extensive crops grown. Production of ornamental nursery stock appears to have potential as does Christmas tree production and vineyards.

Local government is concerned about the trend of taking agricultural lands out of production. The goals and objectives of Josephine County are to provide tax incentives encouraging maintenance of land in agricultural production, and exclusive farm use zoning which would prevent further subdivision of agricultural lands.

The potential for expanding the agricultural land base is confined to the alluvial valleys. Any increase in areas for agricultural use is dependent on the availability of water for irrigation. Even in the valleys, there are serious limitations such as soil texture and the erosion potential. The feasibility of expanding the irrigation system depends primarily on the development of firm water supplies from either storage or ground water resources.

<u>Mining</u>

Rich placer deposits of gold were first discovered in the Illinois River Basin in 1851, in the Josephine Creek and Takilma-Waldo districts. The hand methods used in early mining were eventually replaced by hydraulic mining and later by dredging operations. In terms of water rights, mining is the most significant water use in the basin. Almost all these rights date from the active placer mining years - 1940 and before. More than $10 million worth of gold, chromite, copper and platinum is estimated to have been produced. Very few of these rights have been exercised since the mid-1950's, and none have been developed to the extent originally anticipated. Most placer deposits of the Illinois Basin have not been mined recently (for 30-40 years), other than by recreationists, due to the high cost of mining. Until cancelled, however, these recorded mining rights could conceivably be exercised in the future and will continue to cloud a realistic assessment of "unappropriated" water in the basin.

Future mineral production will probably be limited to the extraction of gold, silver, nickel, cobalt and chromite found within the basin. However, high production costs and existing regulations governing mining and environmental protection are expected to make large-scale gold mining a risky venture, which will limit its impact on the basin's water resources.

Based on April 1982 information from the Department of Geology and Mineral Industries, there presently is one active placer mining operation on Sucker Creek and six other mineral exploration sites or areas within the Illinois Basin. Steep terrain, thick vegetation and overburden make prospecting and exploration in the basin very difficult. Some large mining firms believe the area has mineral potential. Commercial mineral production depends basically upon market prices, extraction techniques, and various future price relationships. Minerals having the best chance of future production include nickel, cobalt, chromium and possibly copper.

Most mining in the basin now consists of sand and gravel operations. Alluvial deposits of sand, gravel and rock are located in most river and stream beds and total over 1 billion cubic yards, of which 640 million cubic yards lie along the Illinois River riparian areas.

Sand and gravel has been and, is being, removed from the Illinois River in the valley area. No substitute source of sand and gravel at a comparable price exists. These materials are used for aggregate in making concrete and other products used in road construction, and commercial and residential building.

Domestic

Adequate supplies of domestic water have played a major role in determining the location and expansion of rural populations. In general, domestic water supplies meet the needs of the population, but there are localized water quality problems.

Most domestic water in the Illinois River Basin is presently obtained from ground water. As the basin's population continues to grow, so will the demand for domestic water. Future supplies will probably come from ground water sources, since ground water is well suited to provide the basic needs of small users in outlying rural areas. Some of the domestic uses within the Cave Junction urban service area may eventually be included in the public water system now serving Cave Junction, which may require upgrading or expansion of the municipal water supply system.

Floods

Since the Illinois River and its tributaries are unregulated, flooding is a problem, particularly in years of high runoff. The streams in this basin are flashy in nature with runoff occurring rapidly after rainfall. Most floods crest within 24 hours and recede rapidly. Flooding generally occurs during the heavy rain periods of December, January and February. Although the severity of floods has varied greatly, overbank flows occur almost every year, and sometimes more than once in a single year. The largest recorded flood occurred on December 22, 1964, with peak flows of 92,200 cfs near Kerby and 225,000 cfs near Agness. The 1955 flood was the previous record flood with a peak flow of 56,800 cfs near Kerby. Table 69 lists the estimated flood frequencies at various locations in the basin.

Currently, there are no flood protection facilities in the basin. Studies indicate that storage facilities for flood control alone would not be justified. The topography and hydrology of the basin would probably require several storage sites. Local protective works, storage, and zoning of flood-prone land may provide the most effective protection from flooding and would help reduce damages.

Industrial

Industrial water rights in the Illinois River Basin are primarily for mill ponds, milling and lumber production. Southwestern Oregon has the largest established wood product manufacturing capacity in the state. Public lands play an important role in meeting the needs of mills. Nearly 60 percent of the commercial forest land is under public ownership. Of the volume of logs used in Curry County, 66 percent come from lands in private ownership, while in Josephine County, 94 percent of the logs come from government-owned lands.

Although employment in the wood products industry has steadily increased during the past two decades, the long-run forecast is for a reduction in the number of timber sector jobs. Two factors are likely to contribute to this trend. The first, technological change with capital being substituted for labor, has been occurring for some time. Labor-intensive unskilled and semi-skilled production jobs are likely to be mechanized in order to increase productivity and reduce labor costs. The second factor is an expected decrease in the supply of timber available for use in the manufacturing of wood products, especially from private timber lands.

The year-to-year demand for wood products depends to a large extent on residential construction. Although a perfect correlation between the two does not occur, there is a direct relationship. Employment in wood products tends to vary in the same direction as the level of residential construction.

TABLE 69

ESTIMATED FLOOD FREQUENCIES IN ILLINOIS RIVER BASIN

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (SQUARE MILES)	PEAK DISCHARGES (CFS) 10-YEAR	50-YEAR	100-YEAR
Illinois River				
At Gaging Station 14377100 (near Kerby)	380	54,900	77,300	86,800
At Former Gaging Station 14377000 (at Kerby)	364	47,000	66,500	74,600
Below Confluence of East and West Forks Illinois River	346	44,900	63,500	71,200
East Fork Illinois River				
At Confluence with Illinois River	234	28,100	43,800	49,200
Below Sucker Creek	215	26,100	40,500	45,500
Below Little Edler Creek	67.6	9,670	14,600	16,400
Below Page Creek	50.1	9,060	12,800	14,500
West Fork Illinois River				
At Confluence with Illinois River	112	20,600	31,400	35,100
At U.S. Highway 199	105	19,400	29,500	33,000
At Rockydale Road	54.6	10,900	16,400	18,400
At River Mile 10.3 Near O'Brien	47.5	10,600	14,400	15,700
Dear Creek				
At River Mile 3.5 Near Selma	101	10,800	16,800	19,000
Below McMullin Creek	74.0	8,250	12,700	14,400
Below Crooks Creek	47.7	5,610	8,580	9,690

Source: Federal Emergency Management Agency
Flood Insurance Study; Josephine County, 1981.

Most of the growth in manufacturing that has taken place since 1960 has been in the nonforest products sector. Some of the gain in such industries as food products, printing and publishing, asphalt-concrete products, and small metal fabrication and repair businesses has occurred because of growth in local demand resulting primarily from increases in population. Other sectors including apparel, fiberglass containers, and electronic equipment have grown substantially since 1960. Nearly all of the demand for products from these industries comes from outside the county. Most of these industries have low water requirements.

Two potential industrial sites in the Illinois River Basin have been included in the Josephine County Comprehensive Land Use Plan; one near Kerby, and one in the Rough and Ready Flats area south of Cave Junction. Although no specific industry was projected to develop at these sites, the plan did discuss food processing, ore processing and refining, and other light manufacturing industries such as electronics, sport and recreation equipment. The scenic and recreational qualities of the Illinois River Basin may prove to be a valuable asset to attract these manufacturing industries. Water requirements for the latter industries are generally low, and could probably be provided by municipal supply systems or ground water resources.

The ore processing and food processing industries are more likely to require large amounts of water. The future of these industries in the basin will require the development of adequate water supplies and the concurrent development of the mineral or agricultural resources.

Aquatic Life and Wildlife

The fishery resource of the Illinois River Basin is very valuable due to its contribution to both recreational and offshore commercial fishing interests. Fall and Spring Chinook and Coho salmon, winter and summer steelhead, and resident rainbow, cutthroat, brook and brown trout, as well as several nongame fish species, are found in the main stem Illinois River or its tributaries. Anadromous fish spawn in nearly every tributary.

The Illinois River and most of its tributaries experience a natural low flow period from July through September. On some streams these seasonal low flows are further reduced by extensive agricultural diversions.

There are three major concerns of fisheries biologists for the anadromous fish resources of the Illinois River Basin. The first concern relates to the basin's ability to rear adequate numbers of juvenile anadromous salmonids to the smolt stage to insure the survival of the species. The rearing period is the 1 to 3 year time period in which the juvenile coho salmon and steelhead remain in the stream habitat until ready to migrate downstream to the ocean. Factors used to determine existing and potential smolt production include habitat capability, spawning ground counts, and electro-shock fish counts.

Fisheries biologists with the Siskiyou National Forest, Bureau of Land Management, and Oregon Department of Fish and Wildlife concur that any increase of maximum summer water temperatures in basin streams would have severe adverse impacts on the basin's ability to rear adequate numbers of juvenile coho salmon and steelhead. Based on existing high water temperatures that have been recorded in some streams of the Illinois River Basin, fisheries biologists contend that an average maximum water temperature increase of 2° F would have an anticipated impact of reducing the existing smolt production capability by approximately 50 percent.

The second concern addresses the major limiting aspects of the basin's anadromous salmonid rearing habitat which includes water availability, pool depth and size, and water temperature. According to U.S. Forest Service biologists major salmonid species problems occur in the upper Illinois River and tributaries due to annual seasonal low flows compounded by summer water withdrawals.

Availability of summer flow in the Illinois River drainage was probably a limiting factor of salmonid habitat capability long before water withdrawal became a major concern. Lack of high elevation drainage reduces the opportunity for heavy snowpack and summer recharge area throughout the Illinois River system. The compounding effect of increasing demand for, and withdrawal of, surface water now presents a serious concern to the future of the salmonid fisheries.

According to Siskiyou National Forest fish biologists, major salmonid fish species problems are occurring in the upper Illinois River and tributaries because of diminished habitat. Historically, juvenile salmon and steelhead overpopulated headwater habitat areas on National Forest land and were forced downstream to find suitable habitat. Water withdrawals in the lower portion of the watershed have reduced summer flows which also reduces habitat. This problem is very severe on the mainstem between Briggs Creek and the confluence of the East and West Forks of the Illinois River.

Availability of summer pool area is another major limiting factor to the rearing of juvenile salmonids in streams of the Siskiyou Forest. Stream surveys throughout the majority of Illinois River drainage habitat have shown an average pool/riffle ratio of 2:8. An ideal pool/riffle ratio for rearing of juvenile salmonids is 1:1.

Fish population sampling of Illinois River tributaries has shown pool depths of at least 3 feet to be necessary for rearing of juvenile pre-smolt coho salmon and steelhead. The three foot minimum pool depth is especially vital for the one year plus (1+) age class salmonid and is associated with cover from predation, feeding area, and escape from warm water temperatures. Water withdrawals have seriously reduced the capability and suitability of many Illinois River tributary streams for rearing of juvenile steelhead and coho.

Associated with lack of flow is increased water temperature outside the tolerance limits of salmonid fish species. Long before water temperatures become lethal to salmonids of the Illinois River drainage such things as fish disease problems, plus competition for food and space by the more temperature tolerant non-game fish, seriously limit the basin's ability to rear juvenile salmonids (see Table 70 for temperature tolerance of salmonid fish species).

Thus, juvenile anadromous fish use the tributaries to migrate downstream during the spring and early summer, and inadequate or non-existent summer flows make downstream migration difficult or impassible. Low summer flows can also limit resident and rearing anadromous fish populations through reduced habitat, elevated water temperatures, increased disease virulence, and lowered dissolved oxygen levels.

A minimum streamflow of 80 cfs at the mouth of the Illinois River was included in the first Rogue River Basin Program statement adopted in 1959. Since that time, Environmental Investigations - Rogue River Basin (OSGC, 1970 and 1972) have been completed by the State Game Commission, and more recent field data have been gathered by the Oregon Department of Fish and Wildlife to determine specific streamflow requirements of fish life for each month of the year. Specific flow criteria were identified for upstream migration of adult fish, for spawning activities, for rearing of juvenile fish and for outmigration of young salmon and trout. The Department's requested minimum streamflows listed in Table 72 were based on the complex relationship between these biological activities and streamflow requirements and reflect the additional knowledge gained since the original minimum flows were adopted.

Wildlife in the basin include some bear, deer, beaver, coyote, mink, muskrat, raccoon, skunk, weasel and other smaller species. Most wildlife inhabit the sparsely populated public lands and/or headwater areas. No specific water requirements for wildlife have been identified but existing supplies appear to be adequate.

TABLE 70

PREFERRED OPTIMUM AND UPPER LETHAL TEMPERATURES OF VARIOUS SALMONIDS 1/

SPECIES	PREFERRED TEMPERATURE RANGE °F	OPTIMUM TEMPERATURE °F	UPPER LETHAL TEMPERATURE °F
Chinook Salmon	45.1 - 58.3	54.0 2/	77.4
Coho Salmon	53.2 - 58.3	58.0 3/	78.4
Steelhead	45.1 - 58.3	50.0	75.2
Cutthroat	49.1 - 55.2		73.4

1/ All data from "Habitat Requirements of Anadromous Salmonids" by D.W. Reiser and T.C. Bjornn, Idaho Cooperative Fishery Research Unit, University of Idaho, Moscow 1979.
2/ Illinois River and tributaries.
3/ Upper River above Kerby.

Municipal

Cave Junction has the only municipal water rights in the Illinois River Basin. These rights, totaling 4 cfs, satisfy the current and anticipated needs of this municipality. However, if the population of the basin continues to grow as it has in the last 10 years, additional municipal supplies may be needed. Increased development of ground water supplies and the potential Sucker Creek reservoir have been suggested as alternative water sources in the draft Josephine County Comprehensive Land Use Plan.

Recreation

The mountains, forests, and streams of the Illinois River Basin, as well as the nearby ocean, provide a wide range of recreational opportunities. Recreation and tourism has evolved as a major seasonal contributor to the basin economy. The coast is the largest attraction for non-resident users.

Recreation attractions of national significance besides the Oregon Coast existing near the basin include Crater Lake National Park, Redwood National Park, the Rogue Wild and Scenic River, plus the Wild Rogue and Kalmiopsis Wilderness Areas. Recreation areas located within the basin include Oregon Caves National Monument, Illinois River State Park, the Kalmiopsis Wilderness Area, and the Illinois River State Scenic Waterway. There are 14 motels, five private campgrounds with over 200 units, and nine publicly-owned campgrounds with 182 units within the basin. Numerous restaurants and cafes operate in the Cave Junction-Kerby area and rely on the tourist trade.

Land is readily available for recreational purposes. Nearly two million acres are in public ownership in Josephine and Curry Counties. Of the total acreage, less than 0.1 of one percent is water surface area. The majority of water-oriented recreation is associated with the streams and rivers, due to the lack of lakes. Lake Selmac is the largest body of water in the basin. This 157-acre reservoir is a popular recreation area located on McMullin Creek near Selma.

The FY 1982 recreation visitor day (RVD) use in the Siskiyou National Forest portion of the Illinois River drainage was approximately 31,350 RVD's. This use is directly associated with rivers, streams and streamside corridor areas as shown in Table 71.

Swimming is an important use of the river during the hot summer months because there are no public swimming pools in the basin. Numerous natural holes and pools attract a good deal of use, particularly in the readily accessible areas in the valley.

Many people are attracted to the Illinois River to fish during the annual steelhead and salmon runs. Because of easy access, the sections of river between Pomeroy Dam and Briggs Creek, and from Lawson Creek to the mouth, are most heavily fished. Fishermen also motor-bike into Pine Flat. Fishing is not allowed in either the East or West Fork Illinois River during the spawning season. An estimated 9,000 recreation vistor days of use occurred on the Illinois River in

1982.

Before 1970, very few people had drifted or rafted the lower Illinois River. In 1982, an estimated 2,400 people floated the river. This increase can be attributed to the popularity of rafting, improvements in floating equipment, and people who, as they become more adept at rafting, are seeking more difficult rivers to run. The Illinois River also provides a high level of solitude and a primitive setting, along with an outstanding white water experience, which greater numbers of recreationists are seeking. Public demand for the wilderness type of experience the Illinois River provides can be expected to increase.

TABLE 71

1982 ILLINOIS RIVER BASIN RECREATION VISITOR DAYS
ON SISKIYOU NATIONAL FOREST LANDS

TYPE USE	RVD's 1/
Fishing (cold water - salmon, steelhead, trout) 2/	9,050
Swimming and Water Play 2/	9,700
Picnicking and Ramping 2/	7,950
Diving (scuba) 2/	1,400
Rafters (1/4 commercial, 3/4 private) 2/	2,400
Canoes and Drift Boaters (upper river) 3/	400
Hunting 4/	450
TOTAL RVD'S	31,350

1/ Recreation Visitor Days (RVD) - as defined by the Forest Service, Region 6, one RVD represents 12 hours of use.

2/ Illinois River and Tributaries

3/ Upper river above Kerby.

4/ Water and associated water influence corridors.

The rafting season has been mostly limited to May and June. Prior to May, weather is often cold and rainy. By July, streamflow is generally insufficient to allow a comfortable trip. Although trips have been taken later in the year, there is much difficulty in attempting to cross gravel bars.

The difficulty of floating the river varies according to streamflow. Some rapids become more difficult to run at higher flows while others become easier. At least one rapid would meet the Class V criteria using the "International Scale of River Difficulty." A difficulty rating of Class IV best fits most river conditions for the river between Nancy and Briggs Creeks.

Best rafting flows on the Illinois River occur from March to early June when flows exceed 300 cfs. Favorable water temperatures and weather during May and June combine to create the most pleasant rafting conditions. On other rivers heaviest use demands occur during July and August. Of the season between May and November, however, rafting the lower river can be considered good for only about 40 percent of the time.

A study prepared by the U.S. Forest Service to evaluate the Illinois River for federal Wild and Scenic River designation indicated that a flow of 125 cfs at the Kerby gage is the minimum flow needed for floating the river, and 200 cfs is the desired flow. To provide adequate streamflows for lower Illinois River water-based recreation activities, multiple purpose headwater impoundments would need to be developed to assist in augmenting flows during the low flow summer months.

Power Development

One power right for approximately 2 cfs to operate a mill is located on the East Fork Illinois River. One small hydroelectric generating facility is being considered on Althouse Creek. An Oregon State University Water Resources Research Institute study has indicated that there is at least a 20 MW physical potential for small hydropower projects on various streams throughout the basin. Furthermore, hydropower should be considered in any plans for reservoir construction in the basin. One large hydroelectric project has been proposed at Buzzards Roost on the lower Illinois River that would have a 250 MW generating capacity. Approximately 18 miles of the State Scenic Waterway would be affected by this proposed project, such development would be contrary to state law.

Water Quality

The water quality in the Illinois River Basin is generally good. Water temperature, however, is often above the recommended temperature for anadromous fish during the summer months (see Table 71). Peak water temperatures above 68°F have been recorded at the stream-gaging station below Kerby, in Deer Creek, and in the East and West Forks of the Illinois River and various other tributaries.

DATA ANALYSIS AND FINDINGS

Although the total annual volume of runoff within the basin is sufficient to meet identified water needs, seasonal and geographic variations of occurrence have resulted in shortages during the summer and surpluses during the winter in some parts of the basin.

Flooding occurs to a limited extent in most years, and larger floods can cause extensive damage. Construction of storage reservoirs to control flooding throughout the basin would help reduce this damage. Previous studies by federal agencies, however, have concluded that the available dam sites would not completely control flooding and would not be justified solely on the basis of flood control. Local protective structures and zoning regulations in conjunction with multipurpose reservoirs may provide the most effective method of controlling flood damages.

Water shortages occur during the summer months in most years. Water requirements for domestic, livestock and wildlife uses are relatively small and existing supplies appear adequate. Water supplies may not be adequate for irrigation, municipal, industrial or other uses of water during the summer months. The extent of the shortages and potential solutions to the supply problems vary in different parts of the basin. The Illinois River Basin was divided into four watershed areas to study water availability and alternative future water uses. These areas are: 1) West Fork Illinois River; 2) East Fork Illinois River; 3) Deer Creek, and 4) the main stem Illinois River.

West Fork Illinois River

The estimated monthly flows and the requested minimum flows for the West Fork are listed in Table 72. According to the Watermaster, the stream is dry at times in the summer below some of the larger diversions, but usually begins to flow again a short distance downstream. The additional water may come from tributaries, irrigation return flows or ground water discharge; and when combined with similarly derived discharge from the East Fork Illinois River, provides most of the flow of the main stem Illinois River near Cave Junction.

Future water needs could include irrigation, municipal or industrial supplies, and minimum flows for fish life. Potentially irrigable land includes 1,300 acres along the West Fork Illinois River, plus additional acreage along the main stem. One large block of irrigable land occurs near the confluence of Rough and Ready Creek. The remainder occurs in smaller blocks along the West Fork and the main stem of the Illinois River.

Although the City of Cave Junction currently obtains its water from wells and the East Fork Illinois River, the West Fork Illinois River is another potential source. Additionally, if the population continues to increase, Kerby may either develop a municipal water supply system, or purchase water from Cave Junction. Finally, the proposed industrial parks at Cave Junction and Kerby may use the municipal system, or develop separate water supply systems. Although the West Fork Illinois River drainage may produce enough water annually to supply these needs, most of the runoff occurs during the winter months. Alternative sources must be developed to meet the needs during the low flow season.

Ground water is one potential water source. It is currently being used to a limited extent for irrigation and domestic use, and additional development and aquifer testing should occur to determine ground water quality and potential impacts to nearly surface water. Although information is not available to determine the maximum amount of water available from this part of the aquifer, the development of this source should be encouraged.

Storage of winter runoff would provide a firm source of water during the low flow season. One potential reservoir site has been identified on Wood Creek. This potential reservoir could provide 4,500 acre-feet for irrigation of 750 acres along the West Fork, and additional beneficial uses downstream. Additionally, if the streambed is used for conveyance, streamflows would be enhanced during the critical low flow months. The Wood Creek site has the greatest potential of those investigated in the West Fork drainage, and consideration should be given at the county level to protecting this site until its need arises, funds become available and additional studies are completed.

The development and utilization of these alternative water sources may help to assure adequate supplies of water for all future beneficial uses. Additional benefits could include the augmentation of streamflow conditions for beneficial instream uses of water. The small flows which disappear below some of the larger diversions and re-appear further downstream provide some habitat for the fish life until streamflows increase in the fall and the fish can escape the small pools.

Streamflows in the West Fork Illinois River generally begin to increase in late October and November.

During the months of November through May, streamflows should generally be adequate to provide for both the requested minimum flows and other beneficial uses of water. Even on Wood Creek, there may be sufficient flows to fill the potential reservoir and help contribute to minimum flows at the mouth in some years.

During the months of June and October there may be a conflict between instream and out-of-stream uses. The availability of ground water as an alternative source of water could help to reduce the conflict. Table 72 lists the estimated flow and the requested minimum flows in the West Fork Illinois River drainage.

East Fork Illinois River

There is not sufficient water in the East Fork Illinois River watershed to supply existing or contemplated uses without the development of alternative sources of water. Many streams are either dry in places during parts of the irrigation season, or do not have sufficient flow to satisfy existing water rights. Both Sucker and Althouse Creeks have been withdrawn from further appropriation by order of the State Engineer dated July 27, 1934: "For any purpose other than domestic use, or for power or mining developments where such use may be made without actual consumption of water or injury to existing rights." Even with the withdrawal order, conflicts are common, and regulation by the Watermaster begins during July in most years.

Future uses of water from the East Fork Illinois River may include power generation, mining, irrigation, municipal, industrial and fish life.

Power generation and mining could require large amounts of water, but are generally considered to be nonconsumptive uses. Conflicts may occur when diversion structures block fish access to spawning areas, or heavy siltation from mining activities creates water quality problems. These problems can, however, be mitigated or corrected under existing laws and regulations.

Future irrigation, municipal and potential industrial water uses may be the major out-of-stream uses from the East Fork Illinois River. Irrigation is currently the largest water use and land resources exist for an additional 3,500 acres of irrigated agriculture. Future municipal and industrial uses at Cave Junction or Kerby may also require large quantities of water. Full development of these potential water uses will probably require the concurrent development of a firm water supply.

Potential reservoir sites exist on both Sucker and Althouse Creeks. The Sucker Creek site could provide up to 40,000 acre-feet of storage for such uses as minimum flows for fish life, irrigation of over 9,000 acres, and municipal and industrial water supplies. Although power generation was not included in the original study proposal by the Bureau of Reclamation, this potential should be investigated in any future studies.

One potential reservoir site has been identified on Althouse Creek. The Upper Althouse Creek site could provide about 7,200 acre-feet of storage.

Available ground water supplies may also provide an alternative source of water. The City of Cave Junction currently obtains a portion of its supply from wells and ground water is increasingly being used as a source of irrigation and domestic water within the East Fork Illinois River drainage. Information is not available to determine the maximum amount of water that can be withdrawn from this portion of the alluvial aquifer. Development and testing of this resource is encouraged to determine potential impacts to nearby surface waters and ground water quality.

The development and utilization of these alternative water sources may help to assure adequate supplies of water for all future beneficial uses. Additional benefits could include the augmentation of streamflows for instream uses. The small flows which disappear below some of the larger diversions and reappear further downstream provide some habitat for the fish life until streamflows increase in the fall when the fish can escape the small pools. The potential to increase flows through riparian zone improvement, storage, and more efficient water use is not known.

Adoption of minimum streamflows in the East Fork Illinois River could help maintain fish habitat and the associated sport fishery in the basin.

During the months of November through May, available streamflows should generally be adequate to provide the requested minimum flows, storage in the identified potential reservoirs, and other beneficial uses of water. In most years, however, there could be conflicts between out-of-stream and instream water uses during the months of June through October. Use of ground water for irrigation could help reduce the potential conflicts. Table 72 lists the estimated flows as well as the requested minimum flows.

Deer Creek

There is not sufficient available flow in most years in the Deer Creek drainage during the irrigation season to support existing and contemplated beneficial uses of water. The Watermaster has indicated that portions of Deer Creek and its tributaries are either dry at times during the summer months, or do not have sufficient water to satisfy all existing water rights. The estimated flows and the requested minimum flows for Deer Creek and tributaries are listed in Table 72.

Future water uses may include the potential irrigation of an additional 2,300 acres, as well as mining, domestic, and fish life uses. Development of this potential using surface water supplies will only aggravate the existing shortages. Alternative sources of water need to be developed to supplement existing supplies during the low flow season.

Estimates of available ground water supplies from the alluvial aquifer suggest that this alternative source could supply an additional 18,000 acre-feet of water annually for irrigation and domestic use. Development and testing of the ground water resource is encouraged to determine potential impacts to nearby surface water and ground water quality.

Several potential reservoir sites have been investigated in the Deer Creek watershed. However, only the potential site on Draper Creek appears to be feasible. Hydrologic investigation of Draper Creek indicates that there may be insufficient water to completely fill the potential reservoir in most years. A smaller reservoir, however, would provide very limited benefits to the local area.

There could be potential conflicts between instream and out-of-stream future beneficial uses during many months of the year. However, the development of ground water supplies to supplement existing irrigation and provide for future beneficial uses would allow the use of remaining unappropriated streamflows for maintaining fish and aquatic life.

Main stem Illinois River

The Illinois Valley between the confluence of Deer Creek and the East and West Forks Illinois River is the most heavily populated area in the basin. Future water needs encompass virtually all beneficial uses, both instream and out-of-stream. Some of these needs could be met with available ground water supplies, but the Illinois River may also be used.

Even though upstream points may go dry during the low flow periods, recorded flows at the Kerby gage have always indicated some water remaining in the stream. The return flows from existing irrigation diversions and ground water discharge contribute to the gaged streamflow.

The availability of some water during the seasonal low flow months may provide a portion of the future water needs. However, long term development potentials will probably require the utilization of alternative sources of water. These sources include the development of available ground water supplies and the potential upstream storage sites previously discussed.

Ground water supplies may provide a significant portion of future needs, although currently there is little utilization of this resource except for domestic use. The Illinois Valley alluvial aquifer may provide up to 56,000 acre-feet annually for all beneficial uses with minimal impact on the hydrologic system. A portion of this unconfined aquifer occurs in the area surrounding Cave Junction.

The potential reservoir sites on Sucker, Althouse and Wood Creeks may provide a partial solution to water supply problems in the main stem Illinois River. It may be desirable to identify these sites through the county land use planning process until the need for the water arises, funds become available and/or additional detailed feasibility studies are completed.

Estimated streamflows at the gage below Kerby are adequate four out of five years to provide the Department of Fish and Wildlife's requested minimum flows during the winter months, with additional flows available for other beneficial uses. Since out-of-stream uses such as municipal, industrial and irrigation could better utilize the ground water resource, the requested minimum flows could be established with minimal impact on other beneficial uses of water. The recommended minimum flows for the main stem Illinois River near Kerby are listed in Table 72.

The lower Illinois River from the confluence of Deer Creek to the Rogue River has been designated a State Scenic Waterway. Within this area, the Illinois River flows through deep canyons and dense forests. Very little development has occurred and access is limited. Most of the land on either side of the river is National Forest land and is managed to protect and enhance the scenic qualities near the river. The area has also been recommended for wilderness classification in 1977 by the U.S. Forest Service using the RARE II process.

While existing laws and administrative procedures may protect the scenic waterway from developments which are incompatible with the intended uses, additional measures may be needed to insure that adequate water supplies are provided to this reach of the river. The adoption of the recommended minimum streamflows in conjunction with the proposed classification for domestic and livestock uses may help provide this assurance.

The original minimum flow of 80 cfs for the main stem Illinois River at the mouth was adopted in the 1959 Illinois River Basin Program statement. Since that time, additional data has been collected on the biological needs and water requirements of the fishery resource. The requested minimum flows reflect this additional data (Table 72).

Most of the water needed to meet the minimum flows may come from tributaries within the section designated as a scenic waterway. Although the water use potential is extremely limited by the rugged topography and limited access, some potential exists. Minimum streamflows may help insure that this potential is not developed to the detriment of the fishery and recreational resource.

TABLE 72

ILLINOIS RIVER BASIN
MINIMUM FLOW POINTS - FLOW ANALYSIS
(cfs)

	OCT 1-15/16-31	NOV	DEC	JAN	FEB	MAR	APR	MAY 1-15/16-31	JUN 1-15/16-30	JUL	AUG	SEP 1-15/16-30
Illinois River: to be measured at USGS stream gage 14378200 (NW 1/4, Sec. 29, T35S, R11W) near Agness and maintained to the mouth.												
EST. Q_{80} FLOW	456/558	3350	5823	6887	5075	4879	2953	2245/1209	579	286/190	152	190
REQ. MIN. FLOW	450/600	600	600	500	500	500	500	500/450	400	400/350	350	400
Deer Creek: to be maintained at or near its confluence with the Illinois River (NE 1/4 Sec. 18 T38S, R8W).												
EST. Q_{80} FLOW	52/64	196	393	457	383	225	212	178/96	53	16	7	5
REQ. MIN. FLOW	30/80	80	80	60	60	60	60	40/30	20	10	5	5
Anderson Creek: to be maintained at or near its confluence with Clear Creek (S 1/2, Sec. 2 T38S, R8W).												
EST. Q_{80} FLOW	2	6	13	15	11	7	7	4	3/1	1	-	-
REQ. MIN. FLOW	20	20	30	30	30	30	30	20	8/2	1	1	1/8
Clear Creek: to be maintained at or near its confluence with Deer Creek (SE 1/4, Sec. 10, T38S, R8W).												
EST. Q_{80} FLOW	7	25	50	59	43	30	27	18	9/5	2	1	1
REQ. MIN. FLOW	20	20	30	30	30	30	30	20	8/2	1	1	1/8

TABLE 72 (continued)

ILLINOIS RIVER BASIN
MINIMUM FLOW POINTS - FLOW ANALYSIS
(cfs)

	OCT 1-15/16-31	NOV	DEC	JAN	FEB	MAR	APR	MAY 1-15/16-31	JUN 1-15/16-30	JUL	AUG	SEP 1-15/16-30
Thompson Creek: to be maintained at or near its confluence with McMullin Creek (NW 1/4, Sec. 18, T38S, R7W).												
EST. Q_{80} FLOW	5	18	36	42	31	21	20	17/9	5	1	1	1
REQ. MIN. FLOW	20	23	23	23	23	23	23	10/4	2	1	1	3/10
Illinois River: to be maintained at USGS stream gage 14377100 (SE 1/4, Sec. 29, T38S, R8W) near Kerby.												
EST. Q_{80} FLOW	172/210	879	1630	1986	1769	1445	1046	781/521	263	67	31	25/31
REQ. MIN. FLOW	130/160	160	160	130	130	130	130	90/70	60	55	50	50/130
RECOMMENDED MINIMUM FLOW	-	160	160	130	130	130	130	90/70	60/60	No Minimum Flow		
East Fork Illinois River: to be measured at or near the bridge for U.S. Highway 199 (SE 1/4 Sec. 21, T39S, R8W) and maintained to the mouth.												
EST. Q_{80} FLOW	88/108	450	835	1017	906	740	536	333	135	34	16	13/15
REQ. MIN. FLOW	70/100	100	100	80	80	80	80	70	70	60	40	40/70
Chapman Creek: to be maintained at or near its confluence with East Fork Illinois River (SW 1/4, Sec. 26, T39S, R8W).												
EST. Q_{80} FLOW	2	8	15	17	14	12	9	8/4	3	1	1	-
REQ. MIN. FLOW	6	8	8	8	8	8	8	6/2	1	1	1	1

TABLE 72 (continued)

ILLINOIS RIVER BASIN
MINIMUM FLOW POINTS - FLOW ANALYSIS
(cfs)

	OCT 1-15/16-31	NOV	DEC	JAN	FEB	MAR	APR	MAY 1-15/16-31	JUN 1-15/16-30	JUL	AUG	SEP 1-15/16-30
Little Elder Creek: to be measured at or near the bridge on Takilma Road (SE 1/4, Sec. 23, T40S, R8W) and maintained to the mouth.												
EST. Q_{80} FLOW	2	9	16	19	15	13	10	9/5	3	1	1	1
REQ. MIN. FLOW	8	8	10	10	10	10	10	7/2	1	1	1	1/8
Elder Creek: to be measured at or near the bridge of Takilma Road (SE 1/4, Sec. 23, T40S, R8W) and maintained to the mouth.												
EST. Q_{80} FLOW	5	21	38	44	35	31	23	21/11	7	2	1	1
REQ. MIN. FLOW	15	15	20	20	20	20	20	12/6	2	1	1	1/5
Page Creek: to be maintained at or near its confluence with the East Fork Illinois River (NE 1/4, Sec. 3, T41S, R8W).												
EST. Q_{80} FLOW	2	10	19	23	18	16	12	8	3	1	1	1
REQ. MIN. FLOW	4	6	6	6	6	6	6	4	1	1	1	1
West Fork Illinois River: to be measured at or near the U.S. Highway 199 bridge (NE 1/4, Sec. 5, T40S, R8W) and maintained to the mouth.												
EST. Q_{80} FLOW	66/80	440	766	841	687	645	333	149	53/29	18	11	11/13
REQ. MIN. FLOW	80/125	125	125	100	100	100	100	80	50/30	20	8	30/80

TABLE 72 (continued)

ILLINOIS RIVER BASIN
MINIMUM FLOW POINTS - FLOW ANALYSIS
(cfs)

	OCT 1-15/16-31	NOV	DEC	JAN	FEB	MAR	APR	MAY 1-15/16-31	JUN 1-15/16-30	JUL	AUG	SEP 1-15/16-30
Mendenhall Creek; to be maintained at or near its confluence with West Fork Illinois River (NE 1/4, Sec. 5, T40S, R8W).												
EST. Q_{80} FLOW	3	15	28	33	26	23	17	16/8	5	2	1	1/1
REQ. MIN. FLOW	8	12	15	15	15	15	15	8/1	1	1	1	1/5
Wood Creek: to be maintained at or near its confluence with West Fork Illinois River (SE 1/4, Sec. 19, T40S, R8W).												
EST. Q_{80} FLOW	5	21	39	46	36	32	24	21/11	7	2	1	1/1
REQ. MIN. FLOW	15	15	20	20	20	20	20	10/3	1	1	1	1/5
West Fork Illinois River: to be maintained at USGS stream gage 14375500 (SE 1/4, Sec. 34, T40S, R9W) near O'Brien.												
EST. Q_{80} FLOW	32	192	334	367	300	281	145	91/39	22/14	8	5	5/5
REQ. MIN. FLOW	40	50	70	70	70	70	70	60/50	40/20	12	8	8/20

Section 7

LOWER ROGUE RIVER BASIN

PART VII

SECTION 7 - LOWER ROGUE RIVER BASIN

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PART VII

SECTION 7 - LOWER ROGUE RIVER BASIN

CONCLUSIONS

The water resources of the Lower Rogue River Basin are an important part of the total resources available in the basin. In addition to supplying the basic needs for human and livestock consumption, water is also needed to maintain or develop other resources such as fish life, irrigated agriculture, and mining.

Existing and future requirements for water in the basin include domestic, livestock, municipal, industrial, irrigation, agricultural use, power development, mining, recreation, wildlife and fish life uses.

There are sufficient supplies of water on an annual basis to supply these needs. The location and timing of these supplies have resulted in seasonal water shortages. There is little development in the basin outside of the Gold Beach area and little future development should occur due to basin topography and water availability. Based on an analysis of the water resources in the Lower Rogue River Basin, the following conclusions were drawn:

1. Domestic, livestock and wildlife requirements, although important, do not require large quantities of water. Supplies appear adequate for present and contemplated requirements for these uses.

2. Existing municipal and industrial water supplies are currently adequate, but additional dependable supplies for future growth may be necessary.

3. Existing water supplies for irrigation are not adequate at all times in all places. Late summer shortages occur in most years. There is only limited irrigation potential (about 1300 acres) in the basin, scattered throughout small stream valleys.

4. There is significant potential for power development in the basin, but existing statutes and conflicts with fish life may preclude some development.

5. Many of the water rights for mining have not been used for years and may never be used to the extent originally envisioned.

6. The Rogue River from its confluence with Applegate River near river mile 95 to Lobster Creek Bridge near river mile 11 is a State Scenic Waterway and Federal Wild and Scenic River. The Lower Rogue River represents a major water-related recreational resource; it is world famous as a fishing and boating stream. Flow augmentation from Applegate and Lost Creek Reservoirs will enhance recreation opportunities in late summer.

7. Fish life represents an important resource in the basin. Flow

augmentation from Applegate and Lost Creek Reservoirs will enhance fish life.

8. There is only limited ground water potential in the basin. Most wells only produce enough to satisfy single domestic needs.

9. No potential storage sites were identified in this basin.

SECTION 7 - LOWER ROGUE RIVER BASIN

GENERAL DATA

Basin Description

This basin includes all of the Rogue River and its tributaries downstream from river mile 68 excluding the Illinois River. The boundaries of this basin are the Umpqua River Basin to the north, the Middle Rogue and Illinois River drainages to the east and south respectively, and the South Coast Basin and Pacific Ocean to the West. The Rogue River divides the South Coast Basin into two sections.

The Lower Rogue River Basin is included in portions of four counties; with 397 square miles in Curry County, 98 square miles in Josephine County, five in Douglas County and three in Coos County. Containing 503 square miles, this basin is the fifth largest of the seven hydrologic divisions and accounts for approximately ten percent of the total land area in the entire Rogue River drainage.

Geology

Topography and Drainage

The Lower Rogue River Basin lies entirely within the Klamath Mountains physiographic province, which has the oldest rocks in Western Oregon and may contain some of the oldest formations in the state. The Klamath Mountains region is typically mature and rugged with narrow winding valleys and sharp divides. The elevations of the Klamath Mountains are generally higher than the Coast Range. This basin is nearly all mountainous with slopes up to 30 degrees. The only significant tracts of agricultural land are located near the mouth of the Rogue River at Gold Beach.

River bottom elevations range from mean sea level at the mouth to 620 feet at river mile 68. The highest point in the basin is Brandy Peak, elevation 5316, which is located at the Curry-Josephine County line at the head of Shasta Costa Creek. There is only one other peak in the basin above elevation 4000 feet and an additional seven peaks having elevations greater than 3000 feet.

The topography of the basin reflects long-term stream erosion of a slowly rising upland. This has resulted in the development of a ridge system at a roughly uniform altitude. Although locally controlled by structure, stream drainage patterns are dendritic.

The main stem of the Rogue River flows in a west-northwestern direction to Marial at river mile 48 and then travels in a southwestern direction before draining into the Pacific Ocean at Gold Beach. The Rogue main stem, which was designated a National Wild and Scenic River by Congress in 1978, flows through the Wild Rogue Wilderness area in this basin. The major tributaries to the Rogue River include Mule Creek, Shasta Costa Creek, Quosatana Creek, and Lobster Creek.

The main stem Rogue has an average gradient in this section of slightly over nine feet per mile. Although the river gradient through the upper reaches of the basin down to Agness averages 13 feet per mile, the lower 28 river miles to the mouth drop a total of only 100 feet.

Structure

Episodic vertical movement of the earth's crust is clearly displayed throughout the geologically old Klamath Mountains province. The region has experienced at least three successive cycles of erosion and considerable faulting, folding and weathering, resulting in a very complex geologic structure. The first cycle produced what is known as the "Klamath peneplain," remnants of which appear only at the higher elevations in the basin. The second cycle produced the flatter valleys from which numerous terraces and benchlands still remain, at elevations up to 300 feet above the level of the nearest stream. The third cycle produced the steep valleys along the present streams and the recent valley fill in the open valleys. Most of the alluvial material in the larger valleys in the basin originates from this third cycle of erosion.

A wide diversity of geologic units occur in the Lower Rogue River Basin. These units differ in age and rock type and result in very complex formations in the area. Natural forces have further complicated these formations by obscuring both age and geologic history, making interpretation difficult. Generally, the rock formations are older in the eastern part of the basin and are successively younger westward.

Soils

The soils of the Lower Rogue River Basin are derived from the granitic, metamorphic and sedimentary rocks of the Coastal Range. The variety of the rock parent material results in high variability of soil types. The primary use of these soils is timber production and only a few small areas of alluvial soils are used for agricultural purposes.

Climate

Temperature averages in the basin are mild and vary from 47°F to 64°F during the summer and 41°F to 55°F during the winter along the coast and from 48°F to 80°F during the summer and 38°F to 54°F during the winter in the mountainous regions.

TABLE 73

LOWER ROGUE RIVER BASIN

AVERAGE MONTHLY TEMPERATURE AND PRECIPITATION

Illahe

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	AVG
Temp.	43	46	49	52	58	64	70	69	66	57	48	43	55
Precip.	16.1	11.3	10.5	4.8	2.8	1.0	0.2	0.8	2.1	6.0	13.4	17.0	86.0

Temp. — Period of record: 1952, 1957; 1959-62; 1966, 1968,; 1970-76; 1978-1981 (19 years)

Precip. — Period of record: 1952-62; 1964-66; 1968-81 (28 years)

Gold Beach

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	AVG
Temp.	47	48	48	50	53	57	59	60	59	55	51	48	53
Precip.	14.3	10.4	10.6	6.1	4.1	1.5	0.4	1.2	2.7	5.7	11.8	14.2	83.0

Temp. — Period of Record: 1952-57; 1959-66; 1969; 1971-73; 1978-81 (22 years)

Precip. — Period of record: 1952-1981 (30 years)

Source: U.S. Department of Commerce, National Oceanic and Atmospheric Administration

The average frost-free period varies from 205 days at Illahe to 300 days at Gold Beach. Average monthly temperatures at Illahe and Gold Beach are displayed in Table 73.

History

Gold and timber have been key elements in the history of the Lower Rogue River Basin. Numerous gold mines were worked throughout this basin. At one time, a mill processed gold quartz at Blossom Bar near river mile 45. Some of the machinery is still visible to people hiking in the area or floating down the Rogue River. Beach mining at the mouth of the Rogue River was also prevalent. Because of this activity, the town of Ellensburg was eventually renamed Gold Beach.

Forest products became important in the early economy and a substantial lumber production and export industry developed. The importance of this resource has continued to the present.

Population

Almost the entire population of the Lower Rogue River Basin is centered around the City of Gold Beach at the mouth of the Rogue River. Gold Beach is located in both the South Coast and Rogue River Basins and has economic ties to both. The 1980 census population of the city was 1515 and the surrounding area 4852. The Agness division, which included much of Lower Rogue River Basin had a 1980 population of only 104.

Economy

The economy of this basin is based on the timber and recreational resources. Essentially, all of the timber harvested is taken out through Gold Beach. Recreational income is generated by such activities as fishing, hiking, sightseeing, jet boat and float trips on the Lower Rogue River. There are also many commercial interests which are directly related to the fishing activities in the area.

Land Use

Plate 2 shows the land use patterns in the Lower Rogue River Basin. The acreages within each category are listed in Table 74.

Essentially the entire Lower Rogue River Basin is rugged forest land. A few small parcels of agriculture land are scattered along the Rogue River, but they account for less than one percent of the total area in the basin.

TABLE 74

LAND USE: LOWER ROGUE RIVER BASIN

USE	ACRES	PERCENTAGE OF BASIN
Irrigated Agricultural land	260	0.1
Non-Irrigated Agricultural land	520	0.2
Range land	5,010	1.6
Forest land	303,480	96.8
Water bodies	1,440	0.5
Urban Areas	320	0.1
Other	2,220	0.7
Total	313,250	100.0

WATER RESOURCE DATA

Precipitation

Average annual precipitation is high in the Lower Rogue River Basin, ranging from 83 inches near the mouth of the Rogue River to a maximum rainfall in the northwest corner of the basin of nearly 120 inches per year. The average annual rainfall along the Rogue River from its mouth at Gold Beach to river mile 40 near Marial increases from 83 to 100 inches annually. Then from Marial to its confluence with Grave Creek precipitation decreases to about 50 inches annually.

Approximately 20 percent of the annual rainfall occurs during the May 15 - October 15 period.

Average monthly precipitation for Gold Beach and Illahe is displayed in Table 73. An isohyetal map of the Rogue River Basin is shown in Plate 4.

Streamflow

Figure 23 is the monthly distribution which shows the percentage of the annual yield that normally runs off during each month. The peak runoff usually occurs in January as a result of winter rains. Snow melt in the Cascades has little effect in the Lower Rogue River Basin compared to the effects from heavy winter rains. No low flow or flood flow data has been prepared for this basin.

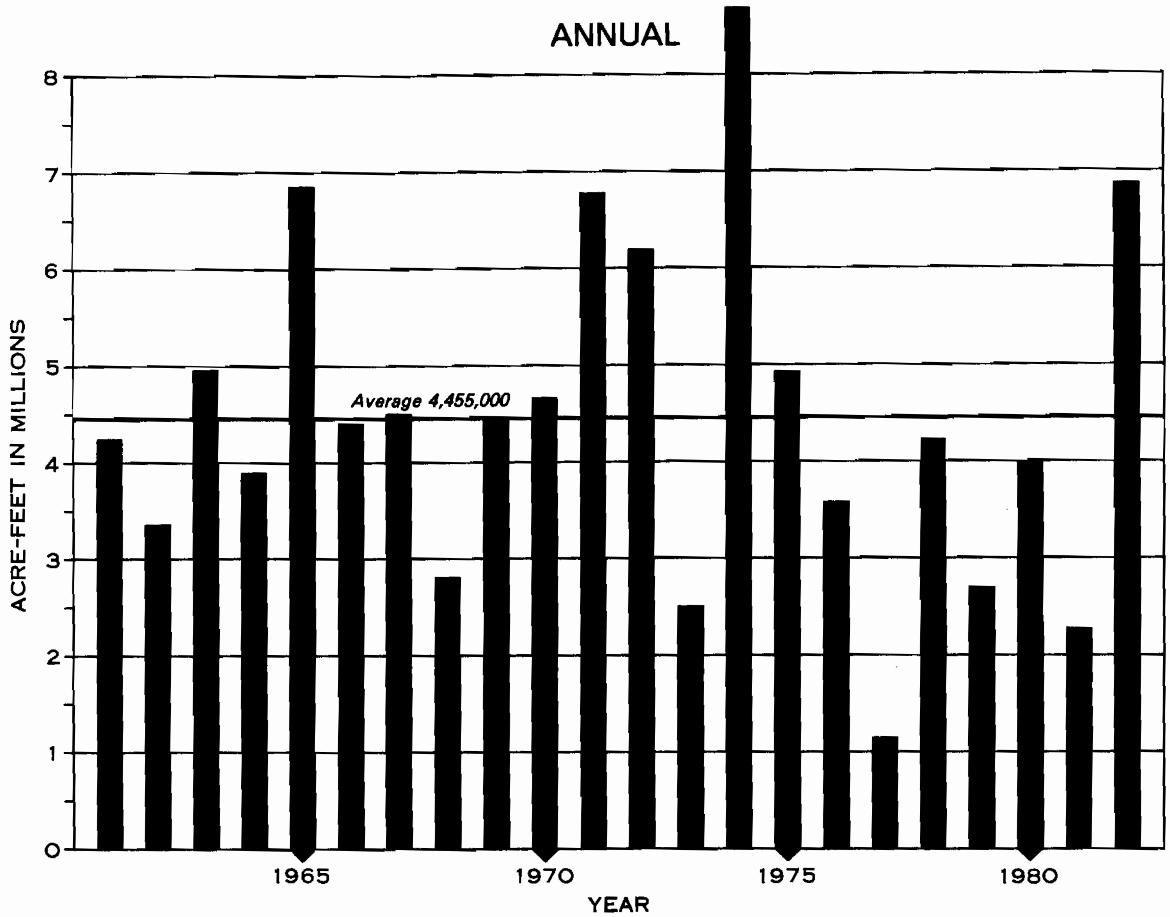
There is only one active stream gaging station in the lower basin located on the Rogue River near Agness. It has been in operation since 1961. The location of the station is shown on Plate 4.

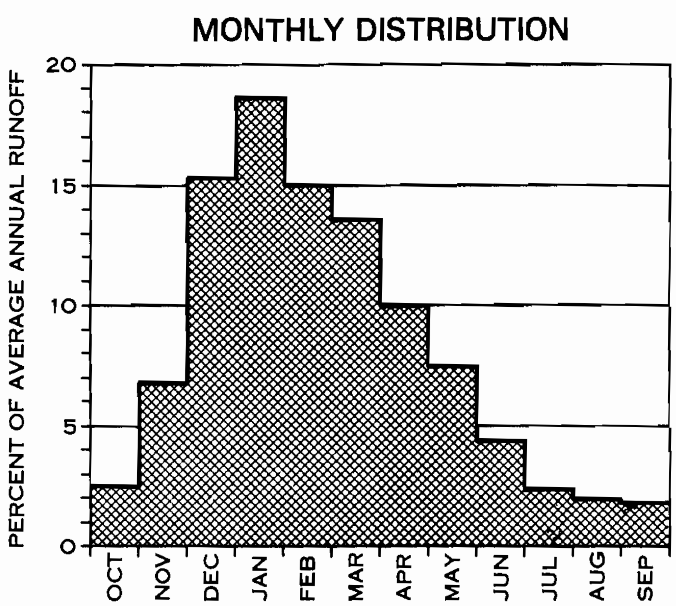
The annual yields for all years of record are shown in Figure 17. The average yield for this station over the period of record is 4,564,000 acre-feet annually. The Q_{80} annual yield for the Rogue River at Agness is 2,900,000 acre-feet.

Figure 17

RUNOFF
Rogue River Near Agness

DRAINAGE AREA 3,939 SQ. MI.





Ground Water

This subbasin is largely undeveloped, with wells located primarily around Agness-Illahe and Gold Beach. Metamorphosed sedimentary rocks of the Galice Formation and its equivalent, the Colebrook Schist, underlie a significant area of the Lower Rogue River Basin. Ground water in these rocks is contained within secondary porosity, since methamorphism has eliminated primary porosity. Even where intensively fractured, this secondary porosity is extremely low. Numerous dry holes are reported and yields of 1 to 3 gallons per minute are considered good for wells developing water from Galice meta-sediments or Colebrook Schist. Although these units occur extensively at higher elevations in areas of higher precipitation, steep slopes and extremely low permeability combine to maximize surface runoff and minimize ground water recharge.

Also found in the basin are, marine sedimentary rocks of the Dothan Formation and Umpqua Group. These rock units are only occasionally developed as sources of ground water. Most units were fine-grained and/or poorly sorted and lithification and cementation has eliminated most primary porosity. Secondary porosity is generally low. A few "dry" wells are reported; typical yields are 3-10 gallons per minute or less.

Numerous wells have been drilled in the Agness-Illahe area for domestic and school use. These wells produce from 0 to 30 gallons per minute with most producing under 10 gallons per minute, generally capable of only meeting domestic needs.

The only other area in the basin with significant ground water development is in the vicinity of Gold Beach. This area consists of alluvium which extends up the Rogue River about six miles. There are a few wells which produce large quantities of water. These wells are generally considered to be hydraulically connected to the Rogue River.

Generally, there appears to be very little potential for development of a significant ground water resource in the basin. Wells in most areas are capable of supplying only small quantities of water and some wells are dry holes. Ground water should not be expected to supply large quantities of water to satisfy any future needs that may develop in this basin.

Water Rights

Table 75 lists the quantity of water appropriated for the different uses in this basin. Water rights for mining is the largest use of water in the Lower Rogue River Basin, totaling over 113 cfs. Municipal rights total almost 11 cfs with 10 cubic feet per second of municipal rights from the main stem Rogue River.

Most tributary streams in this basin have flow characteristics closely related to rainfall since runoff is dependent upon precipitation. This condition results in high winter flows and low summer flows.

TABLE 75

LOWER ROGUE RIVER BASIN

SURFACE WATER RIGHTS - in cfs

July, 1981

	Main stem Rogue River	Tributaries	Total
Irrigation	.38	4.42	4.80
Domestic/Livestock	.03	2.32	2.35
Municipal	10.0	.77	10.77
Industrial	-	.02	.02
Power	-	.76	.76
Mining	-	113.38	113.38
Recreation	-	.01	.01
Fish Life	-	-	-
Wildlife	-	-	-
Fire Protection	-	.01	.01
Total	10.41	121.69	132.10

Lakes And Reservoirs

There are no lakes or reservoirs with a surface area greater than five acres in the Lower Rogue River Basin. The largest lakes are Frog Lake (four acres) and Lake of the Woods (three acres); both located approximately six miles east of Gold Beach. A third lake also named Lake of the Woods (two acres) is located approximately three miles northwest of Agness. All three lakes are accessible only by trails.

Potential Reservoir Sites

No potential reservoir sites were identified in this basin. Most tributaries are small and located in steep rugged terrain. No consideration was given to dams on the Rogue main stem due to existing statutory restrictions and adverse environmental impacts.

WATER NEEDS AND RELATED PROBLEMS

Agriculture

There is only limited agricultural development in the Lower Rogue River Basin. Much of the irrigated area occurs on tributaries with a few irrigated areas lying along the Rogue River. Only about 800 acres of potentially irrigable lands were identified in the entire basin. The actual irrigation of these lands may be infeasible due to lack of water or other limiting factors which were not considered. Increased irrigation in the future should not require large amounts of water.

Mining

The majority of water rights in the Lower Rogue River Basin are for mining purposes. Most of these rights are not being exercised either because the mineral deposits have been largely depleted or it is not economicaly feasible to do so. The mining rights are located predominantly on the tributary streams of the Rogue River. Recreational mining is a common practice in the basin.

Mineral deposits of significance in the Lower Rogue River Basin include gold, vanadium, asbestos, coal, and semiprecious gems, but it is unlikely that these will be developed to any great extent in the future.

Domestic

Most domestic water needs are obtained from wells. Since most of this area is federally owned and relatively uninhabited, domestic water requirements are not great or expected to increase significantly.

Floods

The December, 1964 flood produced the highest peak flows recorded on the Rogue River at the Agness gage. The peak discharge was 290,000 cubic feet per second. The water destroyed the county bridge at Agness which was normally 90 feet above the river. Most of the flood damage in the Lower Rogue River Basin occurred at Gold Beach and the surrounding area. Many commercial and residential buildings were damaged or destroyed. Boat rental and sales facilities as well harbor installations sustained extensive damage from the flood. Storage of flood flows by Applegate and Lost Creek Projects should reduce future flood peaks in the basin.

Industrial

Industrial water rights are primarily in the area of Gold Beach. These industries include lumber and wood products and canneries. Water supplies for future industrial development could be supplied by the City of Gold Beach.

Aquatic Life And Wildlife

The Lower Rogue River provides a migration route for all anadromous fish spawning in the Rogue River Basin. It is very important to maintain adequate streamflows to enable the fish to reach the spawning areas. Presently, the minimum flow at the mouth of the Rogue River is set at 935 cfs for the entire year. No new minimum flows are being considered in this basin.

Sturgeon, shad, three species of salmon, summer and winter steelhead, and sea-run cutthroat trout spawn in the Lower Rogue River Basin. The main stem Rogue River, Lobster Creek and Mule Creek provide the largest spawning areas with many smaller tributaries also contributing to the total spawning areas. These areas are shown in Plate 3. The resident fish population is comprised mostly of trout, particularly in the larger tributary streams.

There is little development in this basin to compete with fish for the water. Growing demands for the water upstream due to increased development, however, could reduce available supplies in the Lower Rogue River. This problem could result in a reduction of the fishery as it now exists.

The operation of Lost Creek and Applegate Reservoirs should contribute significantly to the maintenance of the Rogue River fishery by maintaining instream flows and lowering the water temperatures during the summer. Since no potential storage sites were identified in the Lower Rogue River Basin, all flow augmentation will have to originate in the upper reaches of the Rogue system.

Wildlife needs for water are small and easily satisfied due to the low level of development in this area. Future needs should remain constant unless development significantly changes the environment, which is unlikely.

Municipal

The City of Gold Beach is the only municipality in the Lower Rogue River Basin. In addition to the water requirements within the city limits, Gold Beach also supplies water for several other communities along the Rogue River. Water supplies appear to be adequate for both existing and contemplated uses. The city is supplied primarily from wells and the Rogue River.

The community of Agness is supplied by individual domestic systems which depend on wells, springs, and small streams. Future requirements are expected to remain small.

Recreation

The Rogue River is included in both state and national wild and scenic waterway programs. The recreational value of this river is one of the primary uses of the Lower Rogue River. Although no specific water requirements have been identified for this use, the value of tourist activity should be emphasized. Storage releases from Lost Creek and Applegate Reservoirs should maintain higher flows during summer and early fall than those that previously occurred. These higher flows should provide safer boating opportunities as well as enhancing the fish resource.

Power Development

There is practically no power development in the Lower Rogue River Basin. O.S.U. Water Resources Research Institute identified 17 stream reaches in this basin having some hydropower potential. Seven of these stream reaches are located on the Rogue main stem. Six out of the seven main stem reaches are within the Wild and Scenic Waterway which precludes any hydropower development. A more detailed investigation of the other stream reaches will have to be performed to determine the feasibility of the specific projects.

Water Quality

Water quality within the Lower Rogue River is generally very good. Upstream pollution which occurs primarily in the Bear Creek Basin is counteracted by dilution and natural aeration in the middle and lower portions of the river. High water temperatures in the main stem during late summer should no longer be a problem with temperature-controlled storage releases from Lost Creek Reservoir.

DATA ANALYSIS AND FINDINGS

The total annual volume of runoff within the Lower Rogue Basin is sufficient to meet identified water needs, but seasonal and geographical variations of occurrence have resulted in shortages during the summer and surpluses during the winter in parts of the basin.

Some flooding occurs in most years. Larger floods occur less often, but can cause extensive damage, particularly in the developed areas such as Gold Beach or Agness. The operation of Applegate and Lost Creek Dams should reduce peak flows on the Rogue River. An added reduction in flow could result from the construction of Elk Creek Dam. Local protective structures and zoning regulations in conjunction with multi-purpose reservoirs may provide the most effective method of controlling flood damages.

Water shortages occur during the summer months in most years. Water requirements for domestic, livestock and wildlife uses are relatively small and existing supplies appear adequate. Water supplies may not be adequate for irrigation, municipal, industrial or other uses of water during the summer months. Conflicts may arise between the City of Gold Beach and the established minimum flow at the mouth of the Rogue River. No potential reservoir sites were identified to help alleviate low summer flows. The ground water potential appears to be quite limited, capable of supplying only low yielding wells. Any large future needs will have to rely on storage at upstream points when natural flows cannot satisfy those needs.

No hydrologic analysis was performed on any streams or points in this basin for the establishment of minimum flows. Likewise, no reevaluation of the existing minimum flow at the mouth of the Rogue River was done. The low level of development in the basin and the designated Wild and Scenic River along with the established minimum flow should help protect the waters of the Rogue River in this basin.