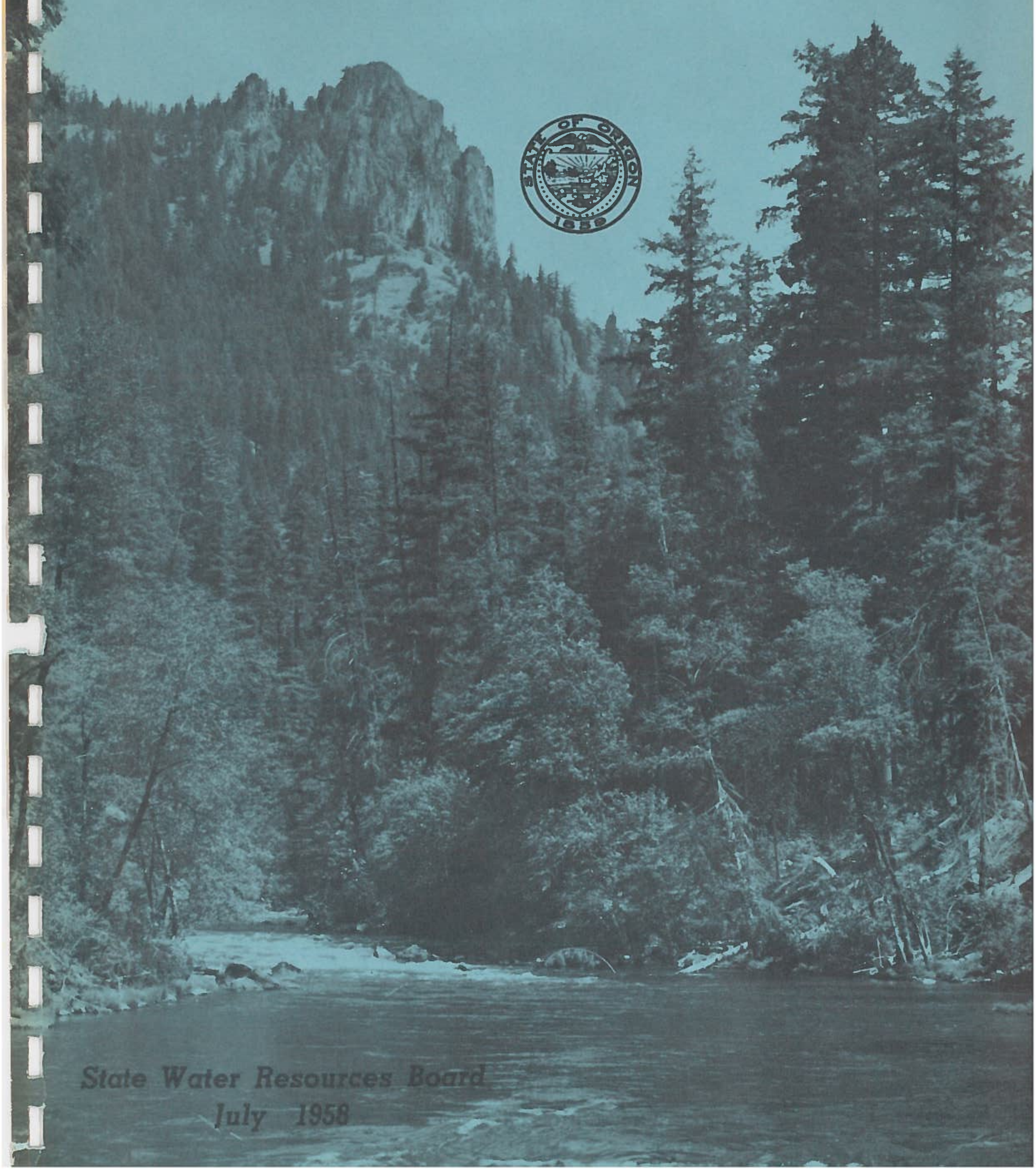
UMPQUA RIVER BASIN



State Water Resources Board
July 1958

UMPQUA RIVER BASIN

STATE WATER RESOURCES BOARD

JULY, 1958

STATE WATER RESOURCES BOARD
Salem, Oregon

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Cover Picture

NORTH UMPQUA RIVER
AT EAGLE ROCK

Price $1.50

TABLE OF CONTENTS

TABLE OF CONTENTS

TABLE OF CONTENTS

TABLE OF CONTENTS

PAGE

TABLE OF CONTENTS

TABLE OF CONTENTS

TABLE OF CONTENTS

TABLE OF CONTENTS

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF FIGURES

LIST OF FIGURES

INTRODUCTION

On December 16, 1955, the State Water Resources Board of Oregon authorized a study of the water resources and water resource problems of the Umpqua River Drainage Basin. This action by the Board was in conformity with ORS 536.300 (1) which states that:

> "The board shall proceed as rapidly as possible to study: existing water resources of this state; means and methods of conserving and augmenting such water resources; existing and contemplated needs and uses of water for domestic, municipal, irrigation, power development, industrial, mining, recreation, wildlife, and fish life uses and for pollution abatement, all of which are declared to be beneficial uses, and all other related subjects, including drainage and reclamation."

Having completed this study and recognizing the need for immediate action in certain phases of the coordinated, integrated water resources program of the State, the Board proposes to adopt an integrated, coordinated program for the Umpqua River Drainage Basin. This action will be in conformity with ORS 536.300 (2) which states:

> "Based upon said studies and after an opportunity to be heard has been given to all other state agencies which may be concerned, the board shall progressively formulate an integrated, coordinated program for the use and control of all the water resources of this state and issue statements thereof."

Three basic techniques were utilized to obtain the data upon which the Board's program was based. They were: (1) a review of all reports and data available in current literature, both published and unpublished, relative to the water resources of Douglas County and items directly affected by water resources and water resource development; (2) limited field reconnaissance work, the magnitude of which was dictated by monetary considerations and the size of the Board's staff; (3) a formal hearing held in Roseburg, Oregon, on October 15 and 16, 1956, of which all other state agencies were duly notified and given an opportunity to *present engineering data, information, and evidence relative to their water resource problems and the proposed solutions of such problems.*

The following report presents in summary form the major items considered by the Board in its adoption of an integrated, coordinated program of the use and control of the water resources of the Umpqua River Basin.

PURPOSE AND AUTHORITY

The purpose of this report and the actions indicated herein, is to implement the water resources policy of the State of Oregon, as prescribed in ORS 536.300. The Legislative Assembly recognizes and declares in ORS 536.220 (1) that:

"(a) The maintenance of the present level of the economic and general welfare of the people of this state and the future growth and development of this state for the increased economic and general welfare of the people thereof are in large part dependent upon a proper utilization and control of the water resources of this state, and such use and control is therefore a matter of greatest concern and highest priority.

"(b) A proper utilization and control of the water resources of this state can be achieved only through a coordinated, integrated state water resources policy, through plans and programs for the development of such water resources and through other activities designed to encourage, promote and secure the maximum beneficial use and control of such water resources, all carried out by a single state agency.

"(c) The economic and general welfare of the people of this state have been seriously impaired and are in danger of further impairment by the exercise of some single-purpose power or influence over the water resources of this state or portions thereof by each of a large number of public authorities, and by an equally large number of legislative declarations by statute of single-purpose policies with regard to such water resources, resulting in friction and duplication of activity among such public authorities, in

confusion as to what is primary and what is secondary beneficial use or control of such water resources and in a consequent failure to utilize and control such water resources for multiple purposes for the maximum beneficial use and control possible and necessary."

The authority for the report, the study on which it is based, and the actions effected are specifically delegated to the State Water Resources Board in ORS 536.300 (1) and (2) which state:

"(1) The board shall proceed as rapidly as possible to study: existing water resources of this state; means and methods of conserving and augmenting such water resources; existing and contemplated needs and uses of water for domestic, municipal, irrigation, power development, industrial, mining, recreation, wildlife, and fish life uses and for pollution abatement, all of which are declared to be beneficial uses, and all other related subjects, including drainage and reclamation.

"(2) Based upon said studies and after an opportunity to be heard has been given to all other state agencies which may be concerned, the board shall progressively formulate an integrated, coordinated program for the use and control of all the water resources of this state and issue statements thereof."

Within the limits of existing data and knowledge, the study has taken into full consideration the following declarations of policy under ORS 536.310:

"(1) Existing rights, established duties of water, and relative priorities concerning the use of the waters of this state and the laws governing the same are to be protected and preserved subject to the principle that all of the waters within this state belong to the public for use by the people for beneficial purposes without waste;

"(2) It is in the public interest that integration and coordination of uses of water and augmentation of existing supplies for all beneficial purposes be achieved for the maximum economic development thereof for the benefit of the state as a whole;

"(3) *That adequate and safe supplies be preserved and protected for human consumption, while conserving maximum supplies for other beneficial uses;*

"(4) *Multiple-purpose impoundment structures are to be preferred over single-purpose structures; upstream impoundments are to be preferred over downstream impoundments. The fishery resource of this state is an important economic and recreational asset. In the planning and construction of impoundment structures and milldams and other artificial obstructions, due regard shall be given to means and methods for its protection;*

"(5) *Competitive exploitation of water resources of this state for single-purpose uses is to be discouraged when other feasible uses are in the general public interest;*

"(6) *In considering the benefits to be derived from drainage, consideration shall also be given to possible harmful effects upon groundwater supplies and protection of wildlife;*

"(7) *The maintenance of minimum perennial stream flows sufficient to support aquatic life and to minimize pollution shall be fostered and encouraged if existing rights and priorities under existing laws will permit;*

"(8) *Watershed development policies shall be favored, whenever possible, for the preservation of balanced multiple uses, and project construction and planning with those ends in view shall be encouraged;*

"(9) *Due regard shall be given in the planning and development of water recreation facilities to safeguard against pollution;*

"(10) *It is of paramount importance in all cooperative programs that the principle of the sovereignty of this state over all the waters within the state be protected and preserved, and such cooperation by the board shall be designed so as to reinforce and strengthen state control;*

"(11) Local development of watershed conservation, when consistent with sound engineering and economic principles, is to be promoted and encouraged; and

"(12) When proposed uses of water are in mutually exclusive conflict or when available supplies of water are insufficient for all who desire to use them, preference shall be given to human consumption purposes over all other uses and for livestock consumption, over any other use, and thereafter other beneficial purposes in such order as may be in the public interest consistent with the principles of this Act under the existing circumstances."

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GENERAL CONCLUSIONS

1. *There is enough water on an annual-yield basis in the Umpqua system to supply all needs; existing and contemplated with the exception of utilization of water to minimize pollution.*

2. *Serious dislocations exist in terms of distribution of the resource with regard to physical location and with respect to availability at time of need.*

3. *Resources would not be sufficient in the summer months of critically low flow years to supply future consumptive and nonconsumptive demands if continued reliance is on existing patterns of stream flow.*

4. *Flows in recent years have generally been above critical flow levels and the impact of accrued rights to use water has not been fully recognized. Streams whose flows are popularly considered to be adequate for all needs would be at marginal levels under present depletion potentials during a critical flow year.*

5. *Depletion potentials on some streams, due to existing consumptive rights, are such that the simultaneous use of any major portion of the existing rights could result in flows approaching zero levels, above areas of major need, during critical flow periods.*

6. *Many streams of the system do not provide enough flow for nonconsumptive needs of the present in periods of relatively low, but not critical, flow.*

7. *In some areas, unavailability of stable supplies of suitable water for industrial uses and pollution abatement is a serious deterrent to the development of potential industries based on the utilization of other natural resources; this will continue if reliance is placed on existing patterns of stream flow.*

8. *Unavailability of stable supplies of water in the future will restrict the agricultural potential of the Basin.*

9. *Full development of the fisheries potentials of the Basin cannot be achieved without physical improvement of low flows.*

10. *All phases of water use will benefit if actual low flow levels are increased.*

11. A critical flow year would result in conflict, or at least a difficult management problem under present patterns of flow, in applying existing legal rights to the use of water on many streams.

12. Future appropriations of water will require full-time watermasters for many streams of the system.

13. Establishment of restrictions on further appropriations could prevent an increase in depletion potential on some streams. This would aid in maintaining higher minimums where streams are not now appropriated beyond their natural capacity at critical periods. For streams seasonally overappropriated, such actions would have limited practical effect until additional flows became available from return flows of future upstream developments or from storage.

14. Certain major sections and numerous minor streams and creeks are by the nature of their topography, location, availability, ownership, or economic potential, available only for limited resource uses.

15. Major quantitative future uses of water in the Umpqua system will be for irrigation, industry, power, fish life, wildlife, and recreation.

16. The flood control problem is the item of major interest and economic importance to the general public of this river system.

17. The probable recurrence frequencies of floods of 1955 magnitude vary for different streams in the Basin. Generally frequencies are higher than those thought representative after the 1950 floods.

18. Increased development is continuing to take place in the 1955 flood plain.

19. Major flood control potential is greatly limited because of the restrictive physiography of the Basin and its effect on project feasibility.

20. Major control of floods will require storage, although local protective works may reduce damage.

21. Major augmentation of the resource in periods of need must come from the storage of surplus winter runoff.

22. *The Basin has substantial potential for the development of hydroelectric energy.*

23. *Drainage and reclamation of drained lands are not major problems at present, nor are they expected to grow to significant proportions in the future if wise planning is exercised.*

24. *Physical potentials for water control are restricted and single-purpose development of available possibilities should not be permitted to limit multi-purpose development.*

25. *An essential requirement in the determination of the most complete program of use and control of the waters of the Umpqua River Basin is the development of criteria that will establish the levels of desirable base flows for fish life, wildlife, recreation, and pollution abatement.*

    These criteria, which would establish the position of desirable base flows relative to other uses, have not been made available to the Board by interested parties.

    It is, therefore, essential that the Board initiate independent studies in an attempt to define and establish the needed criteria.

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CHAPTER I

THE BASIN

The Umpqua River Drainage Basin, an area of approximately 4560 square miles, lies in the southwestern section of Oregon. The boundaries of the Basin are nearly coincidental with the boundaries of Douglas County. The Basin is bounded on the north by the Siuslaw and Willamette River Basins; on the east by the Deschutes and Klamath River Basins; on the south by the Rogue River Basin; and on the west by the Coos-Coquille River Basin and the Pacific Ocean. The Basin boundary is approximately 407 miles in length.

The Umpqua River, which is classified as a Pacific slope stream, discharges directly into the Pacific Ocean near the City of Reedsport. The approximate length of the river is 211 miles from its mouth to its headwaters in the High Cascades, via its main stem and the North Umpqua River. The North Umpqua River to Diamond Lake is approximately 106 miles long. The South Umpqua River to the headwaters of Castle Rock Creek on the Rogue-Umpqua divide is about 104 miles in length.

The Umpqua River Basin is the eleventh largest drainage basin in the State of Oregon.

Of the total length of the river and its tributaries, less than 40 miles is navigable from the mouth by anything other than small craft. The head of navigation, on the main stem, is at river mile 25 downstream from the community of Scottsburg. The lower section of Smith River is navigable by shallow draft vessels for a short distance.

Stream gradients in the system vary greatly. Lake Creek, the major headwater tributary of the North Umpqua River, has an average stream gradient of 86 feet per mile. Lake Creek heads in Diamond Lake. The North Umpqua River from Bradley Creek at an elevation of 4270 feet to Boulder creek at an elevation of 1620 feet, mean sea level, has an average gradient of 83 feet per mile. In this section, there is one almost vertical drop of 150 feet, Bradley Falls (Lemolo), and one drop of 300 feet in one mile, Ireland Falls (Toketee). From Boulder Creek, at mile 68 on the North Umpqua River, to the mouth of the North Umpqua River, the average gradient is approximately 19 feet per mile.

The gradient of the main stem from its confluence with the South Umpqua River to Elk Creek, at Elkton, is about 4½ feet per mile. From Elk Creek to tidewater at Scottsburg, the drop to mean sea level is about 80 feet.

The South Umpqua has a relatively flat gradient from its mouth to its confluence with Cow Creek, slope approximately 6 feet per mile. From its confluence with Cow Creek to its confluence with Elk Creek, the South Umpqua River has an average gradient of 13½ feet per mile increasing to a slope of 42½ feet per mile (average) for the next 24 miles to the mouth of Castle Rock Creek. Cow Creek, the main tributary of the South Umpqua River, has an average gradient of 23 feet per mile from its mouth to the confluence of Dismal Creek in its headwaters.

The climatology of the Basin is characteristic of Western Oregon. Temperatures are generally mild but vary between areas, to a noticeable extent, as elevations vary. The coastal slope seldom experiences freezing temperatures nor do the coastal mountains, except in the higher elevations. Summer temperatures are mild and fairly dry. The Central Valley section is more variable in temperature with recorded values ranging from a minimum of -6°F. to a maximum of 109°F. The average growing season approximates 190 days per year. Summer temperatures run higher than the coastal areas. The temperatures and temperature ranges of the eastern portion of the Basin vary with elevation.

Topographically, the Basin is composed of three definable segments: (1) The Coastal Range; (2) The Central Valley; and (3) The Cascades. The Coastal Range comprises the western segment of the Basin and is basically a low mountain range made up of sedimentary deposits, largely shales, sandstones and conglomerates. The Coast Range has a maximum height of approximately 3000 feet, msl.

The Central Valley section is that section of the Basin lying near the confluence of the North and South Umpqua Rivers. The area comprising this valley section extends down the main stem approximately 12 miles; up the South Umpqua River to its confluence with Cow Creek, including Lookingglass and Flournoy valleys; up the North Umpqua River and Sutherlin Creek to Camas Swale; and up Calapooya Creek to Hinkle Creek. Other valley lands, mostly shoestring in character, are widely scattered about the Basin along the tributaries.

The Cascades section of the Umpqua Basin covers the entire eastern portion of the drainage. Beginning in the foothills east of the valley section, the terrain steepens rapidly to the rugged country of the High Cascades where elevations reach 9000 feet, msl. The Cascades are of volcanic origin and include volcanic adesites, tuffs, breccias, lava flows, and pumice formations.

The southern boundary of the Basin is formed by hills falling, for the most part, in the Klamath-Siskiyou geologic province. These mountains are granite, metamorphosed sediments, and volcanics of an older period than the Coast Range, Western Cascades, or High Cascades.

Eighty-eight percent of the land area of Douglas County is classified as forest land. Of the 2,876,000 acres making up this percentage, about 2,773,000 acres, nearly 85 percent of the Basin total, has commercial potential. Eighty-nine thousand of this is reserved for other purposes.

Agricultural lands in the Basin are estimated at 487,000 acres, approximately 367,000 acres of non-crop pasture lands and 120,000 acres of cropland.

Mineral assets of the Umpqua Basin are difficult to inventory. A variety of mineral deposits exist in the Basin but qualitative and quantitative values have not been fully determined. Mercury and nickel are presently mined and processed in the drainage area of the Umpqua River. Deposits of gold, silver, zinc, chromite, copper, sulphur, coal, and limestone are potentials.

The precipitation pattern of the Basin is characterized by wet winters and dry summers. Rainfall patterns over the watershed are mainly the result of orographic barriers. Magnitude of rainfall is further influenced by seasonal variations in the Northwest's general circulation system. Annual rainfalls vary from 30-110 inches depending on the location. Generally, the coastal mountains vary from 50-110 inches; the Central Valley from 25-50 inches; and the Cascades from 50-75 inches. Variations in the Cascades and coastal mountains follow the elevation trends.

The Basin discharges an estimated average annual yield at its mouth of 6,700,000 acre-feet with estimated extremes of 12,000,000 acre-feet maximum and 2,750,000 acre-feet minimum. The most downstream point where records of basin flows and yields have been kept, near Elkton at river mile 53, has the following measured yield values: (1) mean 5.4 million acre feet; (2) minimum 2.2 million acre-feet; and (3) maximum 9.8 million acre-feet. This represents the yield from about 77 percent of the entire Umpqua watershed. In terms of mean annual runoff (5,048,700 acre-feet), about 81 percent of the total yield occurs between November 1 and May 1. The South Umpqua sub-basin above Brockway represents about 44.6 percent of the area above the Elkton gage, but contributes, on the average, only 36 percent of the mean annual yield. The North Umpqua sub-basin above Rock Creek represents 25 percent of the area above the Elkton gage, but contributes 35.8 percent of the mean annual yield. Legal consumptive rights to use water in the system approach a volume of 400,000 acre-feet per year. About 80 percent of the right to use water is during the period, May 1 to September 1, when less than 20 percent of the yearly supply is available. The ungaged portion of the Basin, about 877 square miles is subject to more than the average precititation of the measured section of the drainage area.

These basic elements, land, minerals, and water coupled with manpower, comprise the basis of past and potential Basin development.

TABLE 1

OREGON DRAINAGE BASINS
(Ranked by Area)

RANK	BASIN	AREA (Sq. Miles)
1	WILLAMETTE	11,741
2	DESCHUTES	10,821
3	MALHEUR LAKE	9,085
4	GOOSE & SUMMER LAKE	8,708
5	JOHN DAY	8,408
6	OWYHEE	6,455
7	ROGUE	5,108
8	GRANDE RONDE	5,095
9	MALHEUR	5,063
10	UMATILLA	4,565
11	UMPQUA	4,560
12	KLAMATH	3,792
13	POWDER	3,480
14	NORTH COAST	2,865
15	MID COAST	2,439
16	COOS-COQUILLE	2,299
17	HOOD	1,015
18	SANDY	575

TABLE 2

POPULATION DISTRIBUTION
DOUGLAS COUNTY

	1950	1958	Percent of Change
County	54,549	62,880	+15.3
Lower Umpqua			
Reedsport	2,288	3,450	+50.8
Elkton	201	200	- 0.5
Drain	1,150	1,440	+25.2
Yoncalla	626	700	+11.8
Oakland	829	970	+17.0
Sutherlin	2,230	2,700	+21.1
North Umpqua			
South Umpqua			
Roseburg	8,390	12,200	+45.4
Riddle	634	1,000	+57.7
Canyonville	861	1,010	+17.3
Glendale	871	1,000	+14.8
Myrtle Creek	1,781	2,250	+26.3
Winston	---	2,450	---


P A C I F I C O C E A N
MID COAST BASIN
WILLAMETTE BASIN
COOS-COQUILLE BASIN
ROG
REEDSPORT
GARDINER
SCOTTSBURG
ELKTON
DRAIN
YONCALLA
KELLOGG
OAKLAND
SUTHERLIN
TYEE
UMPQUA
WILBUR
WINCHESTER
CLEVELAND
DIXONVILLE
ROSEBURG
LOOKINGGLASS
WINSTON
DILLARD
RESTON
OLALLA
MYRTLE CREEK
DAYS CREEK
RIDDLE
CANYONVILLE
AZALEA
WESTFORK STA.
GLENDALE
GLIDE
PEEL
TILLER
ASH
LEGEND :
9999 _ A plain number is the application number for a permit to use water under the provisions of the 1909 water code
C9999 _ A number preceeded by the letter C indicates a vested right to use water as established by adjudication procedures set forth in the 1909 water code
R9999 _ A number preceeded by the letter R is the application number for a permit to store water under the provisions of the 1909 water code
HE99 _ A number preceeded by the letters HE is the application number for a permit to utilize water for the generation of hydroelectric power under the provisions of the Hydroelectric Act of 1931
NOTE :
The priority of rights established by the provisions of the 1909 water code cannot be determined by comparing the relative magnitude of numbers
Numbers as placed on the map indicate the approximate physical locations of diversions for the indicated rights. For precise definition of location, reference should be made to the files in the State Engineers office
For summary of water rights information, including application, permit, and certificate numbers, priority date, types of use, and place of use by township, range, and section, refer to State Water Resources Board Form Engineering No. 1, Basin No. 16 Umpqua River
(Includes all applications, permits, and certificates for the use of water recorded in the State Engineers office as of July 1, 1957.)
NORTH COAST 1
MID COAST 18
WILLAMETTE 2
COOS COQUILLE 17
UMPQUA 16
ROGUE 15


MID COAST BASIN
WILLAMETTE BASIN
COOS-COQUILLE BASIN
PACIFIC OCEAN
YONCALLA
OAKLAND
SUTHERLIN
ROSEBURG
WINSTON
MYRTLE CREEK
RIDDLE


MID COAST BASIN
WILLAMETTE BASIN
COOS-COQUILLE BASIN
PACIFIC OCEAN
REEDSPORT
GARDINER
DRAIN
YONCALLA
ELKHEAD
OAKLAND
WINCHESTER
ROSEBURG
CLEVELAND
LOOKINGGLASS
RESTON
OLALLA
MYRTLE CREEK
DAYS CREEK
CANYONVILLE
TILLER
DREW
ANCHOR
GALESVILLE
AZALEA
GLENDALE
WESTFORK STA.
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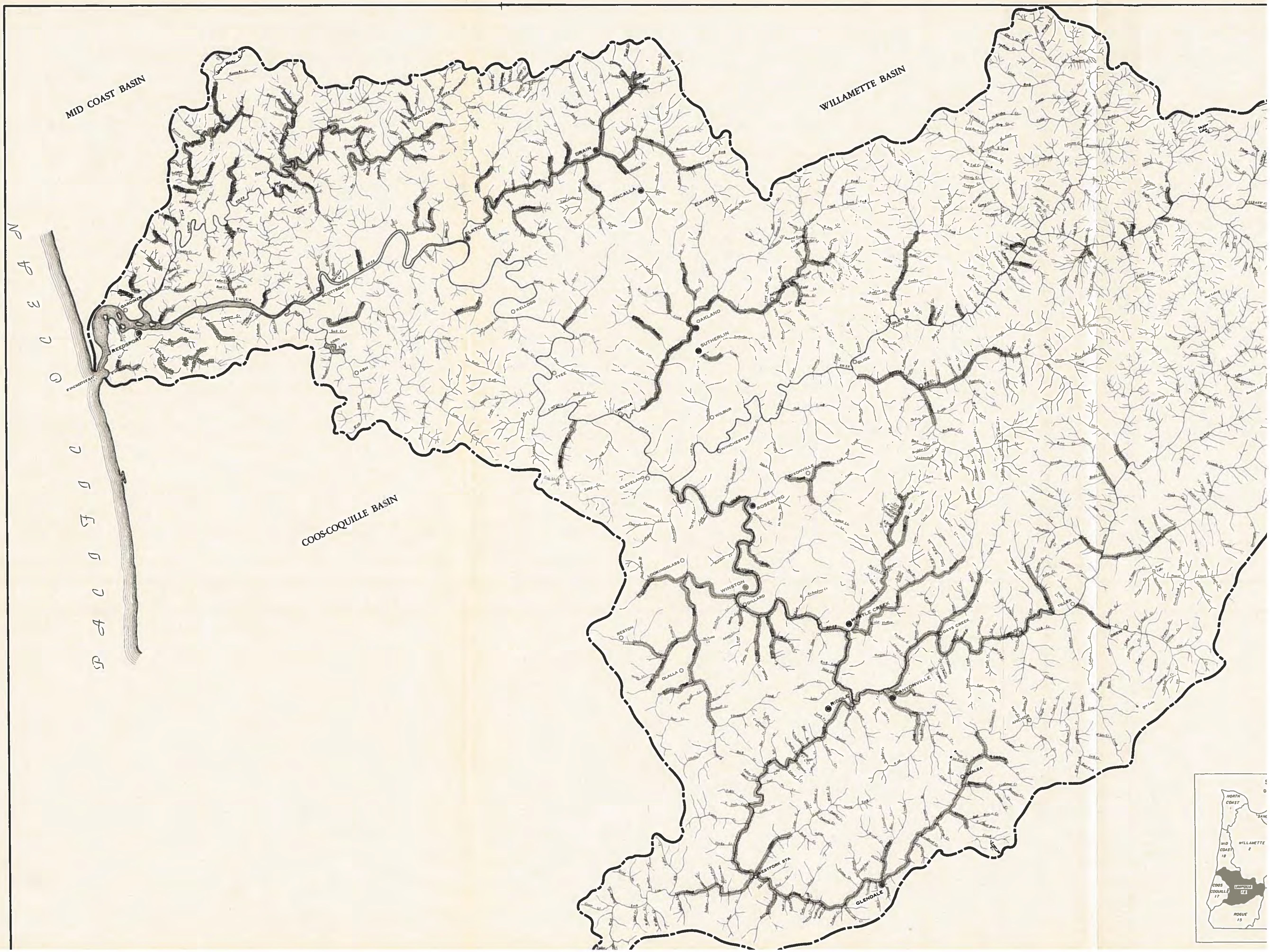
MID COAST
WILLAMETTE
COOS COQUILLE
UMPQUA
ROGUE
KLAMATH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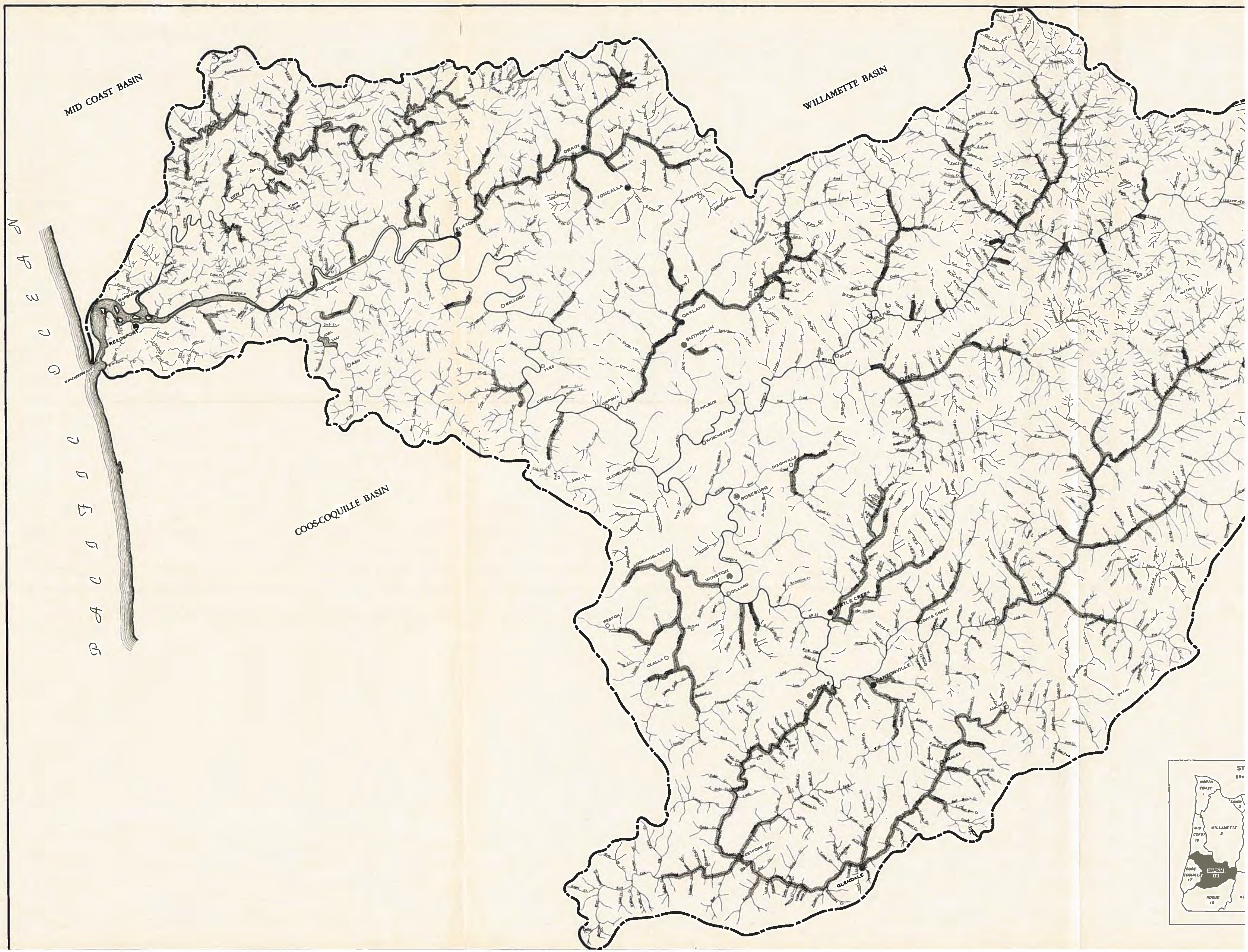
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CANYONVILLE
GLENDALE
NORTH COAST
MID COAST
WILLAMETTE
COOS COQUILLE
ROGUE
UMPQUA

CHAPTER II

WATER AND THE BASIN ECONOMY

Water is one of the most vital assets in the economy of the Umpqua River Basin. Nearly every major economic endeavor in Douglas County is dependent upon water for either its existence or its successful operation.

The economy of the Umpqua River watershed is dominated by its natural resource base activities; all of which require water as the catalyst for successful accomplishment.

Excluding manpower, the natural assets of the Umpqua River system are land (soil), minerals, and water. Water and land provide trees - the greatest single contribution to the existing economy of the Basin. Water and land provide for the growth of food - the economic activity second in importance to the Basin. Water, land (topography), and trees form the nucleus of an item of major economic importance in the Basin - recreation.

Water is also essential to the fisheries resources of the Basin which provide both recreational and commercial activity through game and offshore troll fisheries whose basic existence stems from the waters of the Umpqua River and its tributaries. Other beneficial uses of water; domestic, municipal, industrial, power development, and pollution abatement, result from the efforts of the Basin's populace to utilize the key assets of the Umpqua system to develop and expand their standard of living.

Minerals, which are not necessarily dependent upon water for their existence, do frequently require water to transform them into a developable economic asset for the Basin.

PRESENT BASIN ECONOMY

Forest Products

The major economic activity in the Umpqua River Basin (Douglas County) at the present is in the lumber and wood products industries. The greatest percentage of activity is concentrated in the primary timber operations which include logging, sawmilling, and plywood manufacturing. Very little of the covered employment in Douglas County is in secondary wood remanufacture operations.

Indicative of the economic status of timber operations in the Umpqua Basin is the comparison of employment in the lumber and wood products industries to the total employment in the Basin. The percent of lumber and wood products employment in Douglas County to total employment in 1955, as covered by the Unemployment Compensation Commission, ranges from 63.6 percent during the first quarter downwards to a low of 60.2 percent in the fourth quarter. By the fourth quarter of 1957 the percentage had dropped to 54.3. Average employment in Douglas County for 1955 ranged from a low of 8,400 jobs for a quarter to a high of 10,625 jobs for a similar period. For 1957, the average employment for the maximum and minimum quarters was 8,802, and 6,539, respectively.

Quarterly payrolls in Douglas County varied from 10 to 14 million dollars in the lumber and wood products industries in 1955. In 1957, quarterly payrolls ranged from 8 to 11 million dollars. For the maximum quarter of 1957, the payrolls for the lumber and wood products industries of the county represented about 62 percent of the total covered payroll. The minimum quarterly payroll was 56 percent of the total.

The foregoing figures indicate the decline in level of employment in the primary lumber and wood products field during an economic setback for the nation. This trend is illustrated by Figure No. 7, which shows the average number of covered employees for each year for the period 1946 through 1957. The chart shows clearly the growth in lumber and wood products industries in Douglas County following the completion of World War II, climbing steadily to 1952 when the average employment level for any one year reached a maximum. After maintaining a reasonably level pattern of employment from 1952 to 1956, job opportunities began to decline, dropping to their present status. In addition to being subject to immediate effects from general economic cycles, primary timber operations of a field nature are subject to seasonal variations due to weather and miscellaneous other causes. The effect of seasonal variations on employment and basin economy can be obtained from Figure 8 which shows the average monthly covered employment in the lumber and wood products industry for the ten-year period 1948-1957.

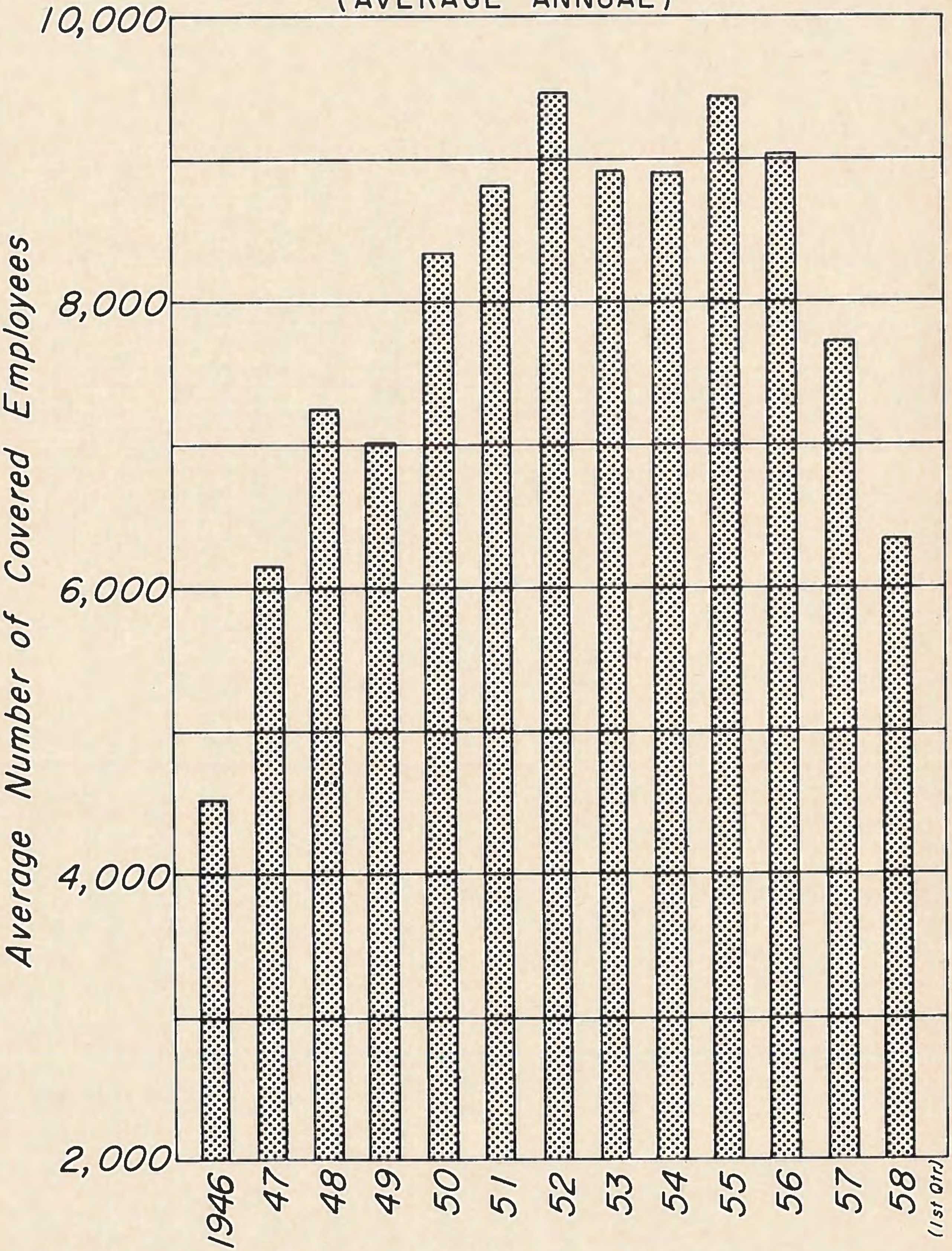
Although the timber operations of Douglas County are the greatest individual contributor to the Basin's economy, they also represent the source of the Basin's major economic problem which is the maintenance of uniform employment.

COVERED EMPLOYMENT

LUMBER & WOOD PRODUCTS INDUSTRY

DOUGLAS COUNTY

(AVERAGE ANNUAL)

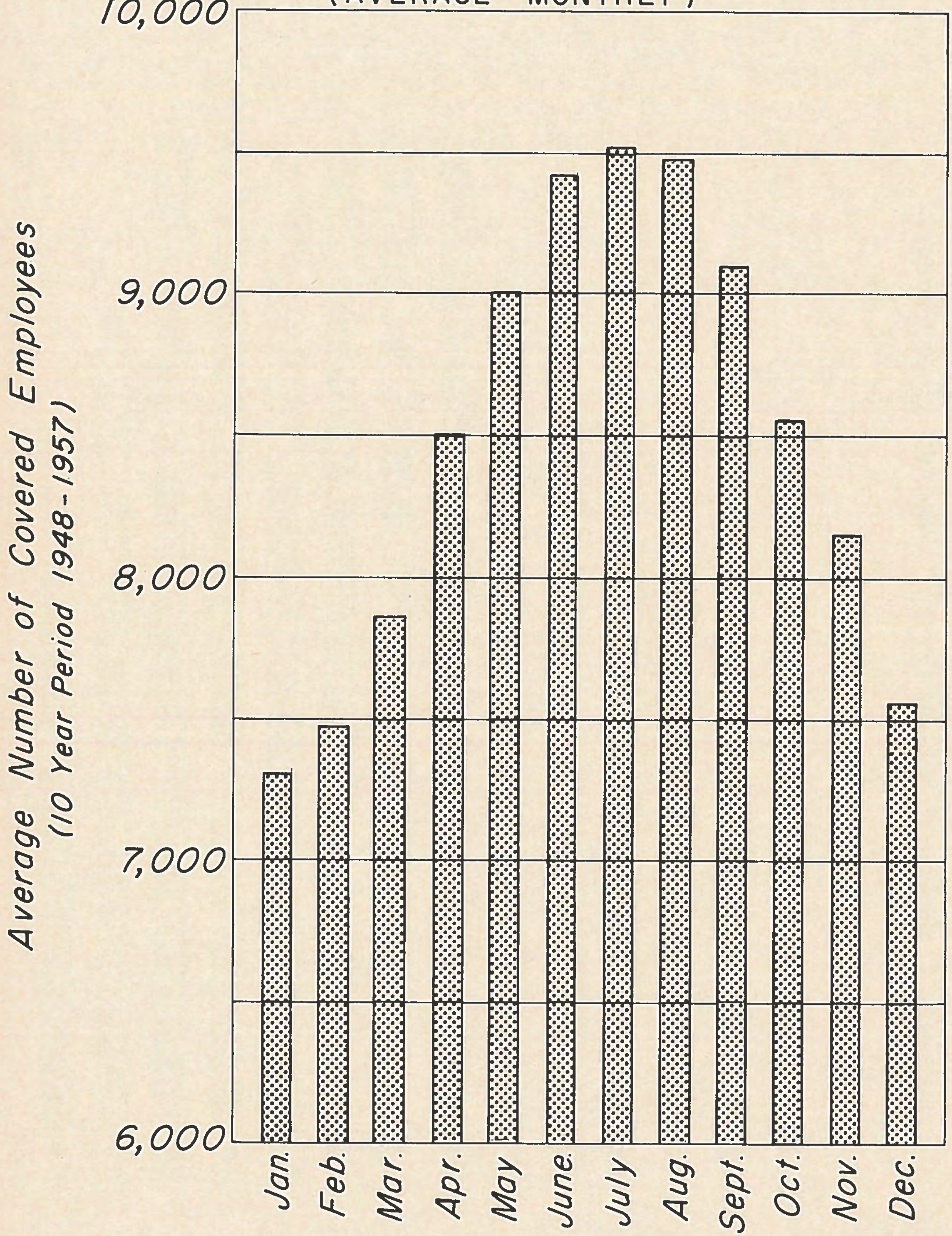


NOTE: Employees covered by Oregon State Unemployment Compensation Commission. Less than 2,000 in years prior to 1946.

File: 16.801

FIGURE 7

COVERED EMPLOYMENT
LUMBER & WOOD PRODUCTS INDUSTRY
DOUGLAS COUNTY
(AVERAGE MONTHLY)



NOTE: Employees covered by Oregon State Unemployment Compensation Commission

File: 16.801

Agriculture

The economic activity, second in importance in the Umpqua River Basin, is agriculture. In 1956 farm products for the Drainage Basin had a gross value of approximately 7 million dollars.

The 1954 Census of Agriculture reported the value of farm products sold at $5,924,102 for 1954, about $9,000 less than the value reported for 1949. In view of the discussion in the previous section pointing out the predominant place of lumber and wood products in the Basin economy, it is significant that nearly $1,242,000 of the total value of agriculture, or farm products, was for farm wood-lot products. This exceeded the value of wood products from farm operations for 1949 by about 40 percent.

The 1954 census showed a downward trend in the number of farms in Douglas County with 2,651 farms in 1950 being reduced to 2,155 farms in 1954. Coincidental with this downward trend in number of farms was a decrease in farm acreage of approximately 35,000 acres during the same period. In terms of value per acre, the trend was upward during the same period with an increase in value of approximately $24.00 per acre on the average.

A significant factor in the agricultural economy of any area is the status of irrigated lands. In Douglas County irrigated acreage was reported as 3,798 acres in 1949 increasing to 10,798 acres reported in 1954. Of the 6,911 acres of irrigated cropland harvested in Douglas County, as reported in the 1954 census, 4,315 acres were devoted to the primary production of hay. The balance was distributed among a variety of products including corn, grain, small grains, annual legumes, and other miscellaneous crops. There were 3,880 acres devoted to irrigated pasture land. Irrigated pasture in Douglas County showed a gain of better than 50 percent from 1949 to 1954 showing the strong influence of livestock production on the agricultural economy of the Basin.

Most of the land in Douglas County suitable for agricultural production is now being utilized for that purpose. Major expansion of the agricultural economy of the Basin will have to come from increased utilization of presently-available land. This will mean reliance on irrigation development for fullest utilization of the agricultural potentials of the Basin.

Mining and Mineral Industries

The third identifiable item in the economy of Douglas County is its mining and mineral industry development. In1954 the gross income in the Umpqua Basin for mining and allied operations was slightly in excess of $2, 000, 000. The covered payrolls of the Unemployment Compensation Commission for 1957 show mining employment to vary from 161 to 192. Approximately 55 percent of the mining during this period was in the metal mining field and the balance, 45 percent, in the nonmetalic mining and quarrying field. Quarterly payrolls for mining in the Umpqua Basin range from $228, 000 for the first quarter of 1957 to approximately $296, 000 for the third quarter. Distribution of quarterly payrolls between metal mining and nonmetalic and quarrying operations maintain approximately the same percentage of distribution as employment.

Covered mining employment represents less than two percent of the total covered employment in Douglas County.

The primary metals industries have become a significant factor in the economy of Douglas County. Primary metals manufacture, plus stone, glass, and clay industries, had only 30 covered employees in April of 1954. By June of that year the number of employees had climbed to 136, largely because of the opening of the nickel processing operations near Riddle. Third quarter payrolls for 1954 in this area of operation, totaled approximately $83, 000. By 1957, employment in the primary metal industries had increased to an average of about 440, excluding stone, clay and glass products. Quarterly payrolls for the first three quarters of 1957 ranged from 600 to 660 thousand dollars. The substantial increase in employment and payrolls in this basic field is a result of the operation of the Hanna Nickel Company at Riddle.

The Hanna Nickel operation was constructed under a federal loan of 24.8 million dollars advanced by the Defense Minerals Procurement Agency for the construction of smelter facilities. This loan is to be liquidated by June 10, 1962. Defense requirements for nickel supplies made it desirable for the federal government to develop domestic sources of this valuable defense material. If the process utilized by the Hanna Company permits production of nickel at a cost competitive with that of other sources, this operation will provide a stable item in the Umpqua Basin's economy, even in times when needs are not based solely on defense requirements.

Recreation, Fish Life, and Wildlife

Recreation, fish life (both sports and commercial), and wildlife are recognized as providing the Umpqua Basin with substantial economic and social benefits. Unfortunately, it is difficult to define by normal economic yardsticks the contributions of these items to the Basin economy.

Contributions of recreation to economy are generally dealt with by referring to the contribution of tourists and citizens of the state on a statewide basis. Of the 141 million dollars brought into the state by tourists in 1955 and the 70 million dollars spent on outdoor recreation by citizens of Oregon, the portion contributing to the economy of Douglas County is unknown. One of the primary needs for the Umpqua Basin is realistic and unbiased evaluation of the place of recreation in the existing economy of this area. One isolated instance illustrating the value of recreation is the contribution of the Salmon Harbor installation at Winchester Bay near the mouth of the Umpqua River. According to the Supervisor of Parks for Douglas County, this installation boosted the economy of Douglas County by an estimated one and one-half million dollars in 1956. One of the greatest items in the relative economic value of recreational units, is the adequacy of water facilities. 1/

The fisheries resource of the Umpqua Basin contributes to the economy from two points of view: first, the game fishery, and second, the commercial fishery. The commercial fishery consists of several segments: the salmon fishery; the commercial shad fishery; and the clam catch. The Fish Commission of the State of Oregon estimates the wholesale commercial fishing values of the Umpqua Basin resources at $365,000 a year for the offshore salmon troll fishery which approximates three-quarters of a million pounds annually; $130,000 a year for the half-million pound shad fishery; and approximately $30,000 annually for the twenty to thirty thousand pounds of clams harvested each year in the estuary of the Umpqua River. These resources constitute a wholesale commercial value accruing to the fisheries resource of, at a minimum, $525,000 each year.

1/ Reference - comments of C. B. Collins, Douglas County Parks Department; (transcript Umpqua Basin Hearing, 1956, State Water Resources Board)

The economic value of the game fishery of the Umpqua Basin is more difficult to define. Data submitted by the Oregon Game Commission to the State Water Resources Board at its Umpqua Basin hearing, October 15 and 16, 1956, gives a rough base for the estimation of the economic status of the game fishery in the Umpqua system. In their testimony, the Game Commission indicated that approximately 75,000 angler trips were made in the 1955 season in connection with anadromous fishery game activities. In additon to this, an estimated 20 to 25 thousand man days were utilized in the trout fishery. For purposes of simplification, it is assumed that the 25 thousand man days represents an equivalent·number of angler trips.

Testimony introduced at the Board's hearing indicated that the game fishing effort in the Umpqua system in 1955 resulted in a catch including 700 river-caught spring chinook, 800 river-caught fall chinook 7,000 chinook from Winchester Bay, 4,000 silver salmon from the river and 8,200 from the bay, 370 summer steelhead, 6,500 winter steelhead, and approximately 2,500 sea-run cutthroat trout. The catch of resident trout was not established.

For the purpose of establishing order of magnitude values for the economic contribution of the game fishing, two values can be considered: first, the value to the Basin by virtue of the average expenditure for an angler trip; and secondly, the value of fish caught as a food.

The Crosley "National Survey of Fishing and Hunting" indicates the value of an average angler trip at $8.15. Assuming the value of an angler trip at this level for the indicated number of angler trips, the economic benefit would be on the order of $615,000 for the anadromous fishery and $200,000 for the resident trout fishery.

The Fish Commission of the State of Oregon submitted data indicating that the wholesale value of salmon as meat approximates 50 cents per pound. If this figure is applied to the 30,000 plus fish caught in the game fishery, with an estimated total weight of 250,000 pounds, meat value would amount to an additional $125,000. Not all of this value could be assigned to the economic gain of the Umpqua River Basin.

Very little data on the contribution of wildlife to the economy of Douglas County is available. The Game Commission has submitted data indicating that the deer hunting activities in Douglas County contribute over half a million dollars to the channels of trade. This figure was obtained by applying Washington State College study figures, developing the average expenditure per big game hunter, to the 7,890 deer hunters active in the Umpqua Basin in 1955. Supplementing the economic contribution of game hunter expenditure is the estimated value of the meat of the 3,147 deer killed during the 1955 season. The 346,000 pounds of venison at 25 cents a pound results in a meat value of approximately $84,000.

The limited data available on recreation, fish life, and wildlife does not provide an adequate basis for determining the contribution of these activities to the economy of Douglas County. Figures at the best are rough approximations and subject to some very broad qualifying assumptions. The figures indicated do not express to any degree the social values inherent in these three activities.

Power Development

Another significant item in the economy of Douglas County is the availability of relatively inexpensive hydroelectric power from the water resources of the North Umpqua River. The economic value of power development in the Umpqua Basin, although not specifically defined, is actually a real economic asset. If the hydroelectric potentials and developments of the North Umpqua were not available, power supplies would have to come from some alternative source. If that alternative source were thermal generated power, either gas, coal, or oil-fired, costs to the power consumers of the Basin would be substantially higher. The estimated average annual generating capacity from existing installations in the Umpqua Basin amounts to approximately 900 million kilowatt hours. The saving of one mill per kilowatt hour of energy generated over alternative sources would represent a saving of over 900 thousand dollars to the power consumers utilizing energy from the North Umpqua River.

FUTURE BASIN ECONOMY

Forest Products

The dominant position of timber in the present economy of the Umpqua River Basin is fully established. There is, at this time, no evidence to indicate that timber will be replaced in the future as the dominant influence in the economy of the Umpqua Basin. Studies by agencies interested in the conservation and utilization of forest products indicate that demands for wood will increase at least twofold in the next fifty years. In the period 1949 to 1953, the annual cut exceeded the estimated annual regrowth capacity of the forest lands of Douglas County which is placed at something less than three-quarters of a billion board feet. If operations within the sustained annual yield capacities are the basis for primary timber operations of logging, sawmilling, and plywood production for the Umpqua Basin in the future, no major economic growth can be expected to stem from these activities.

On the basis of existing practices, Douglas County could be expected to supply a lesser percentage of the demand in the future than it is presently supplying for existing requirements. Douglas County could, however, supply a greater share of the wood and fiber needed in the future if fuller utilization of its wood resources was accomplished. Forest Service figures indicate overall waste, from logging through the primary manufacturing processes, of approximately fifty percent of the timber cut in the Basin. Full utilization of wasted wood would mean revenue from 750 million board feet of timber, rather than 375 million board feet which would be realized from the sustained yield cut under existing utilization practices.

In the "Summary of Findings" of the publication entitled, "Economic and Industrial Survey of the Inland Umpqua Basin, with Particular Emphasis on Forest Resources and Their Utilization", published by the Roseburg, Myrtle Creek, and Riddle Chambers of Commerce, are several findings which point out very effectively the possibilities of increasing the contribution of lumber and wood products to the economy of the inland Umpqua Basin. They are as follows:

"1. Discourage the entrance of any new primary wood-using establishments except for a pulpmill.

" 2. Encourage the establishment of a pulpmill at or near Winchester.

" 3. Encourage the entrance of several new secondary wood-using establishments which will increase the number of manhours required for every thousand board feet of raw material consumed and reduce labor seasonality.

" 4. Encourage the establishment of plants designed to utilize waste and low grade material.

(a) Extraction of wax, tannin, and dihydroquercetin from bark.

(b) Production of soft and hardboards or paper products from sawmill slabs, edgings, trims, and logging wastes in the form of limbs, stumps, cull trees, decay tree, etc.

(c) Production of consolidated hard and softboards from sawdust and shavings.

(d) Production of wood-sugar molasses from wood wastes which can be sold as cattle, swine, and poultry feed or can be fermented to produce ethyl alcohol.

" 5. Encourage the entrance of sawmills or plants to produce cut-stock for manufactured wood products from the native hardwoods.

" 6. Do anything possible to increase the dry kiln facilities for the area in the form of new kilns for present primary industries or building of separate plants to perform custom kiln drying.

" 7. Do anything possible to increase the number of access roads in areas now void in order to fit into the long range, sustained yield management plan for the area.

" 8. Cutting should be accelerated in the old growth stands within limits of the sustained yield capacity."

All of these recommendations offer possibility for improvement in economic stability and gain for the Inland Umpqua Basin.

Since the issuance of the Chamber report in 1951, additional investigation work has been directed towards the potentials of pulp mill installation in the Basin. There are real potentials for the development of kraft pulp and paper processing operations in the Umpqua River Basin. Studies conducted by Sandwell & Company for the Oregon Development Commission indicate that the development of a pulp and paper operation with a daily capacity of 300 tons is economically feasible at this time. This installation could be supplied with raw materials from available residue from existing mills in the Basin. Wood salvage potentials indicate an ultimate pulping capacity for the Umpqua Drainage Basin ranging from 900 to 1,000 tons per day.

The Sandwell Report of 1958 indicates the process most likely to be developed in the Umpqua River Basin will be a sulphate (kraft) pulp and paper operation (unbleached). Economic considerations dictate an initial installation of 300 tons per day (100,000 tons per year). Manufacturing capacity would probably be distributed between kraft liner board and unbleached kraft paper in approximately equal amounts.

Estimated capital cost for the installation of kraft pulp and paper mills of modern design and integrated character is figured at $100,000 per ton of production per day. This would result in a capital cost for an initial installation of 30 million dollars.

The product value from an operation of this character is estimated at approximately 14 million dollars annually for a full capacity, 340-day-per-year operation. The product value is based on a fifty-fifty distribution of production between unbleached paper at a $155 net mill price and liner board at $115 net mill price.

Important physical features connected with the operation would be wood consumption, estimated at 200,000 cords per annum, water consumption, 2.8 cfs (diversion - 9½ cfs), and power consumption, 28 million kilowatt hours annually. A basic consideration in the contribution of a pulp and paper operation to the economic structure of the Umpqua Basin would be the level of employment that it would provide. Employment resulting from a facility of this kind would consist of two categories: (1) direct mill employment; and (2) service employment in the community resulting from the creation of basic employment at the mill. Average industry figures for direct labor in pulp and paper operations of the type under consideration approximate five manhours per ton of production. Assuming a man year equivalent to 2,000 hours, 100,000 tons of production annually would provide for 250 employees on a direct-labor basis. By comparison, employment connected with Willamette Valley pulp and paper operations, although varied in nature, have a unit value of approximately 1.7 people per ton of production. This figure is probably high for a modern integrated pulp and paper operation. One specific example available in Oregon has a unit employment level of about one person per ton of capacity. Upon this basis the initial production of 300 tons in the Umpqua Basin would provide a direct mill employment for approximately 300 people, 50 of which would be in administrative and supervisory functions. Jobs created in the service and professional fields by virtue of the direct mill employment would contribute substantially to the Basin economy. One index, commonly used, estimates 74 jobs of the service and professional type for every 100 new industrial-base jobs created. Total employment resulting from the initial facility, would approximate 500 people.

The capital investment of 30 to 35 million dollars in a pulp and paper operation would result in the broadening of the taxable assets of the county and the redistribution of tax payments for property owners within the taxing district. Values for goods and services, other than wood, can be viewed only in light of present experiences in the Willamette Basin. Freight costs in the Willamette approximate seven dollars per ton of output; material purchased twenty dollars per ton of output; and utilities six and one-half dollars per ton of output. These goods and services would represent an expenditure in excess of three million dollars annually if the unit values were approximately the same for installations in the Umpqua Basin. The foregoing values indicate in a rough way the possible contributions of a pulp and paper operation to the economy of the county.

Sufficient water resources exist on the North Umpqua and main stem of the Umpqua to provide adequate water for processing operations with a high degree of reliability. Major problems connected with the installation of pulp and paper processing facilities revolve around air and water pollution. Minimum flows in the system at points where potential development sites exist are not sufficient to provide dilution for untreated effluents from conventional kraft mills. Stringent controls will be required to guarantee *that mill effluents do not produce deleterious effects on water to be used for other beneficial uses in the Basin.*

The value for chips is projected by Sandwell & Company to be approximately seven dollars per ton bone dry for Douglas Fir and $13.75 per ton bone dry for selected species such as White Fir.

Agriculture

It has been pointed out previously that about 120,000 acres of the 495,000 acres of agricultural land in Douglas County is physically susceptible to irrigation but only about 60,000 of this amount appears to be economical for irrigation development in the foreseeable future. Land suitable for irrigation development is largely under agricultural crop and pasture land production at the present time. Growth in the agricultural economy of the Basin must come through increased production from the present crop and pasture land. The expansion of agriculture at the expense of depleting timber lands, does not present an economic gain in the overall picture. Although an immediate large scale expansion of irrigation in Douglas County does not appear to be economically feasible now, in the long run, the expansion of the agricultural base by increased irrigation will result in advantages to all segments of the county's economy. In addition to the bolstering of the crop economy of Douglas County, full utilization of irrigation potential would substantially increase the livestock production and the gross income from this agricultural activity.

It is anticipated that the expansion of irrigation in the county would result in an increased tax base because of the higher values of land under irrigation; it would result in increased markets for retail sales and manufacturing; and it could result, in time, in the development of food processing industries with their attendant connected growth.

In its presentation to the Board at the Umpqua Basin hearing, the agricultural subcommittee of the Douglas County Water Resources Advisory Committee made the following statement pertinent to advantages of irrigation, "Irrigation has greatly increased production per acre and gross income per acre. Well developed and well managed pastures under irrigation have produced 500 to 700 pounds of meat per acre, in productive capacity equal to ten or more acres of the best grazing lands. Irrigation permits growing a wider variety of crops, particularly specialty crops of high value per acre. A good example is snap beans for canneries with an average of $1,200 gross income per acre and the same land in alfalfa without irrigation grossing $75 to $100 per acre.

Full development of irrigation in the Umpqua Basin might well triple the present annual gross agricultural income of six to seven million dollars. It is recognized that full development is not economical or possible immediately and gradual development over a number of years is necessary and desirable."

Evaluation techniques for predicting the contribution to river basin economy of agricultural expansion through proposed irrigation development have not developed to the point of general acceptance by all responsible analysts.

Case history studies of the economic impact of specific developments on area economics have been made but possibilities for comparison of conclusions have been restricted because of basic differences in the methodologies of analysis. Three studies which have comparability show indirect income in the affected trading area equal to 120-127 percent of net income from the agricultural development.

The necessary criteria and procedures for determining advance long-term net benefits stemming for irrigation development have not yet been perfected. Prediction of development contributions are realistically judgment decisions made with short term immediate foreseeable values in mind.

More specific data on the future of irrigation in the Umpqua Basin economy will be available when the Bureau of Reclamation completes feasibility studies now under way on projects proposed for this watershed.

<u>Mining and Mineral Industries</u>

Mining and mineral industries are a phase of the Basin's economic picture that can be fairly well defined in terms of their present activity and worth, but which are difficult to establish in terms of future potentials. The Basin does have mineral and mineral industries development potential but this potential is not fully definable from presently-known data.

Recreation, Fish Life, and Wildlife

Recreation offers great potential for contribution to the economy of Douglas County. Unfortunately specific data, evaluating criteria, and evaluating techniques are not available for projecting the future position and contribution of recreation to the economy of the Umpqua River system.

Determination of the future values of wildlife face the same difficulty as the evaluation of recreation in the Basin's economy.

In presenting a basis for the place of fish life in the future growth of the Umpqua Basin, particularly with regard to game fisheries, the Game Commission of Oregon projects that some 180,000 angler trips for sea-run fishes will be made in 1980 and that figure will increase to more than 400,000 trips by the year 2005. The Commission also anticipates the effort expended in the pursuit of resident fish to increase in a parallel fashion. Applying the value of an average angler trip as suggested in the Crosley Report, $8. 15, the value to the Basin of the anadromous game fishery would be in excess of three million dollars annually not including the food value of these fish. Assuming the same ratio of values between angler trips for resident fish and contribution to the present economy and further assuming the same ratio between angler trips and pounds of fish caught, the value of the fisheries resource from a game standpoint is projected to more than four million dollars by the year 2005, based on 1957 values. This very rough value for the economic potential of the future game fishery is predicated on the assumption that the anadromous fisheries and resident fisheries resources will be maintained at such a level as to provide inducement for the contemplated fishing pressure.

In connection with the maintenance of sufficient resources to induce game fishing activity, some preliminary evaluations have been made by the Game Commission towards the contribution which might be made to the economy of the Basin by improvement in streamflows in areas substantially below their potential level of development. The evaluations were done in connection with determining fisheries benefits that might accrue to the Galesville project on Cow Creek, the Olalla project on Olalla Creek, and the Hinkle project on Calapooya Creek. The estimated benefits that would accrue to the Basin in both the offshore troll fishery and the game fishery are estimated at $800,000 annually. The capital cost, exclusive of storage, required to provide maximum protection of existing fisheries resources and realization of maximum potentials, would approach $280,000. Annual operating costs, also exclusive of storage operations, are estimated at less than $40,000. To accomplish these benefits, Commission personnel indicate that 70 cubic feet per second of water must be made specifically available for use of the fisheries resources in the 62 miles of stream involved. If such economic benefits can be derived from the improvement of the stream conditions for 62 miles of stream length in the Umpqua system, the potentials for benefits stemming from this type of water utilization are tremendous. Of considerable significance is the fact that the benefits derived from utilization of water for the maintenance of minimum streamflows for the fisheries resources of Cow Creek may exceed the benefits which could be ascribed to the project at the Galesville location from any other individual use of water. If these benefit values, as preliminary as they may be, can be realized, enhancement of the fishery resources of the Umpqua system may be the most compelling reason for water resource development in the Basin.

Power Development

The 1957 report of the Federal Power Commission indicates that the total hydro generating potential of Douglas County approximates 3,500,000,000 kilowatt hours annually. Preliminary examinations indicate that some 882,000,000 of the remaining 2,600,000,000 kilowatt hours of annual potential are economically feasible in the foreseeable future. Some indication of the value of potential power development to the Basin can be obtained by examining the estimated cost of thermal power operating on modern efficient coal fired steam plants within fifteen miles of major load centers as the alternative source of power for the region by 1975. The cost of such power is about $18 per kilowatt annually for dependable capacity and slightly in excess of 3.3 mills per kilowatt hour of usable energy. Figures on dependable capacity for potential projects in the Umpqua system are not readily available but the annual energy values exceed two and one-half million dollars by themselves. The remaining power potentials of the Umpqua system constitute reserve assets for possible future utilization for benefit of the Basin's economy.

Other Water Uses

Domestic, municipal, and pollution abatement uses of water are factors in the Basin's economy that derive from growth and development and do not basically contribute to that growth and development to the extent of items previously considered. This does not diminish their importance but rather indicates that they are the result rather than the cause of the economy that might develop in the future in the Basin. If requirements for these uses cannot be met by the available water resources, then they impose a restriction on expansion and development.

Value of Water in the Future Economy

It is impossible to place a fixed or even relatively fixed economic value on water of itself. The most reliable measure of its economic value is the value of goods and services that can be created or accomplished by its use or control, balanced against the cost of accomplishment. The benefits, economic or physical, that have accrued or could accrue from the use of the Umpqua River's waters for the development of the Basin's natural resource potentials, have been outlined in this chapter in broad terms. The examination of maximum potentials provides the base to which specific proposals can be compared as an initial test of maximum beneficial use of the Basin's water resources.

Flood Control in the Basin's Economy

Throughout the known history of the Umpqua Basin, floods of significant proportions have occurred. The most recent of consequence was the winter flood of 1955 which resulted in measurable damages in the Basin of over two million dollars. Figures are not available but damages in the South Umpqua watershed could have been substantially greater if the flood in that area had been the maximum basin flood which occurred in 1861.

As the Basin develops; as its low-lying lands become more intensively utilized, both from an urban and agricultural point of view; and as the industrial growth of the county increases, it can be anticipated that the damage potentials of floods of the magnitude of 1955 will increase significantly. Factors involved in basin expansion are too varied to attempt to establish any value of flood control prevention on the projected development basis.

Detailed analyses will be available for examination and evaluation upon completion of studies now under way by the Corps of Engineers.

CHAPTER III

WATER PROBLEMS IN THE BASIN

GENERAL

The study made by the Board of the Umpqua River Basin indicates that the water resources of the Umpqua system are sufficient for all foreseeable needs, present and future, in terms of total quantity, excepting the treatment of major industrial wastes by straight dilution.

Although the quantitative amounts of the resource taken on an overall basis are adequate, the studies of the Board and the evaluations of state, local, and federal agencies, and interested parties show conclusively that serious maldistributions exist in terms of resource availability, with respect to physical location and time. Unregulated resources of the Umpqua system will in general be inadequate for future needs during the low flow months of July, August, and September. There will be years where these dislocations would extend into the months of October, November, and even into the early part of December.

Need for water, for both consumptive and nonconsumptive uses, has expanded manyfold since 1931, the year of the lowest runoff (approximately 2.2 million acre feet). The average yield for the period 1929-1931 for the Umpqua system measured at Elkton was less than three million acre feet. Since 1944, there has not been an annual yield under 4.3 million acre feet. Recurrence of a low yield cycle such as 1929-1931 would result in a critical resource situation.

Broadly stated, the problem in the Umpqua Drainage Basin is to:

A. Provide water of suitable quality where and when needed for all consumptive and nonconsumptive beneficial uses.

B. Regulate the uncontrolled waters of the system to prevent, or at least mitigate, the potential for loss of life or property due to floods.

TYPES OF WATER PROBLEMS

The water problems of the Umpqua system follow these categories:

(1) Problems of quantity.

(2) Problems of quality.

(3) Problems of control.

(4) Problems of conflict.

PROBLEMS OF WATER QUANTITY

In the broadest sense, both items A and B can be included in this category of water problems. Flood control, however, is excluded from this phase and considered under the item of control. Thus, quantity problems discussed here are those related to the need for enough water at a given time and place to supply beneficial uses - consumptive and nonconsumptive.

Domestic

Domestic supplies are household and minor irrigation uses by individuals not served by municipalities or other public corporations. The sources of domestic supplies in the Umpqua Basin are: (1) surface supplies from rivers and springs; and (2) wells.

The established legal rights to appropriate surface water for domestic use, including springs, total less than 20 cubic feet per second for the entire Basin as of July, 1958. Legal rights to appropriate ground water are not established at this time. Rough field reconnaissance indicates that the use of ground water for domestic supplies is limited, and will be limited in the future due to the undependable nature of these supplies with respect to quality and quantity.

Legally established domestic water rights rely primarily on surface waters of the Umpqua system. Domestic permittees utilizing flows of the main stem of the Umpqua or the North Umpqua, have no problems insofar as quantity is concerned. Those individuals relying on tributaries of the South Umpqua have problems of adequate supply during low flow periods.

Municipal

The problems of municipalities and public corporations serving the people of this river system are similar to those of the domestic appropriator but are quantitatively of greater magnitude. Those public corporations relying on the North Umpqua proper and the main stem do not have any serious supply problems at present nor should there be any in the foreseeable future, since sufficient amounts of the resource are available to provide for anticipated municipal requirements.

Municipalities located in the South Umpqua system and, to a lesser extent, on Elk and Calapooya Creeks are in a less desirable position. Supplies in the last few years have just barely been adequate from surface sources and those communities dependent upon ground water supply have been in difficulty. Typical is Tri-City whose individual wells either dry up or have greatly reduced supplies from July through November. Upon occasion, people in this area must haul water. The community has contracted to have specific engineering studies made to solve their problems.

The community of Myrtle Creek has filed on 10 cfs from the South Umpqua for future requirements but in critical supply years, such as 1931, upstream rights to water would exceed the unregulated stream potential at Myrtle Creek. Glendale, Riddle, Canyonville, and other communities have an analogous problem.

It is particularly important to remember that the summer flows of the Umpqua system have generally been good during the period of major growth dating from the end of World War II. The lowest flow of record at the Brockway gage on the South Umpqua since 1945, was 63 cfs, or 75 percent greater than the minimum of record August 12-13, 1926. In the seven years from October 1, 1946, to October 1, 1953, the flow at the Brockway gage dropped below 100 cfs in less than 110 days. Of these, 58 occurred in the months of August and September, 1951, the year of lowest flow since 1945 (63 cfs). Urban expansion in the South Umpqua area could be severely restricted if adequate supplies for municipal purposes are not made available during periods of low summer flow.

TABLE 3

MUNICIPAL WATER SUPPLY DATA - UMPQUA RIVER BASIN

Community	1950 Population	Certified 1958 Population	Source of Water Supply	Legal Diversion Right (cfs)	Use Restrictions	Treatment
Canyonville	861	1,010	O'Shea Creek	1.00	Irrig.	Chlor.
Coos Bay	-	-	North Umpqua (out of basin-use)	100.00	-	-
Drain	1,150	1,440	Bear Creek	4.00	None	Chlor.
Elkton	201	200	Springs, Umpqua River	0.50	None	Chlor.
Gardiner		400 +	Stream at Fisher's Cove	-	0.10 mgd	Chlor.
Glide		100 +	Little River	0.10	Pump Cap.	Chlor.
Glendale	871	1,000	Section Cr., Mill Cr., Springs, & Cow Cr.	1.82	None	Chlor.
Myrtle Creek	1,781	2,250	Harrison-Young Branch of N. Myrtle Cr.	7.17	None	Chlor.
Oakland	829	970	Calapooya Creek & Wells	2.00	None	Chlor.
Reedsport	2,288	3,450	Clear Lake (out of basin)	25.00	None	Chlor.
Riddle	634	1,000	Judd Cr., Unnamed Cr. of S. Umpqua, Wilson Cr. & Cow Cr.	2.75	None	Chlor.
Roberts Cr. Water District *		4,000 +	Cooper Cr. of Roberts Cr. & S. Umpqua River	1.22	None	Chlor., Filter, & Coagu.
Roseburg	8,390	12,200	North Umpqua River	25.00	None	Chlor.
Scottsburg	120	120 +	Creek	-	-	Chlor.
Sutherlin	2,230	2,700	Calapooya Creek	3.00	Irrig.	Chlor., Filter & Coagu.
Winston		2,450	South Umpqua River	2.57	-	-
Yoncalla	626	700	Adams Cr. & Wilson Cr.	1.50	irrig.	Chlor. & Filter
	19,981	33,990				

* Serves Winston-Dillard

\+ Estimated 1956 Population

Irrigation

Future expansion of the agricultural economy of the Basin will be greatly inhibited if availability of water is not increased during periods of low streamflow. Preliminary studies by the Bureau of Reclamation indicate that some 120,000 acres of land in the Basin are irrigable and approximately 60,000 acres appear to have potential from an engineering and economic point of view. To improve the gross agricultural values of the Basin, increased productivity on existing agricultural lands must be achieved by the application of an efficient irrigation economy. The studies of the Board show conclusively that an increase in water requirements by expanded irrigation would be, in many areas, far in excess of stream capability during periods of critically low flows if based on present regimen. The exceptions would be the areas served by the North Umpqua and the Umpqua main stem. Major improvement in the agricultural economy will require the capture of waste waters of winter and spring runoff and their application to beneficial, consumptive use during the periods of low flow.

There is a real need for the completion of economic studies by the Bureau of Reclamation relative to the economic feasibility of developments tentatively proposed in their Special Report on the Umpqua River Basin, dated June, 1956. The funds invested in this report by the Federal Government, Douglas County, and the State of Oregon will not have attained their full purpose until the economic aspects have been evaluated. Completion of the Corps of Engineers studies are also essential to the development of a comprehensive program of water resource development for this river system.

Power Development

The estimated physical power potential of the Umpqua system is about 25 percent developed. A substantial portion of that remaining does not appear to be economically feasible in the foreseeable future. This is particularly applicable to sites in the South Umpqua portion of the Basin. Some of the possibilities examined as far back as the late 1920's are ruled out by urban development which would be destroyed by the construction of originally proposed projects. A few possibilities remain. Tiller on the South Umpqua, where power, as a facet of multi-purpose development, might be practical and desirable, is one.

TABLE 4

LIST OF EXISTING HYDROELECTRIC POWER PROJECTS

Name of Owner	Name of Plant	River	Installed Capacity KW	Av. Annual Generation 1,000 KWH	Gross Head Ft.
The Calif.-Ore. Power Co.	Winchester	N. Umpqua	500	3,900	14
The Calif.-Ore. Power Co.	Soda Springs	N. Umpqua	11,000	55,000	114
The Calif.-Ore. Power Co.	Slide Creek	N. Umpqua	18,000	94,000	179
The Calif.-Ore. Power Co.	Toketee Falls	N. Umpqua	42,550	220,000	448
The Calif.-Ore. Power Co.	Fish Creek	N. Umpqua	11,000	68,000	1,032
The Calif.-Ore. Power Co.	Clearwater 1	N. Umpqua	15,000	54,000	651
The Calif.-Ore. Power Co.	Clearwater 2	N. Umpqua	26,000	88,000	760
The Calif.-Ore. Power Co.	Lemolo 1	N. Umpqua	29,000	120,000	750
The Calif.-Ore. Power Co.	Lemolo 2	N. Umpqua	33,000	162,000	721
			186,050	864,900	

Source: Hydroelectric Power Resources of the United States Developed & dated 1957 by Federal Power Commission, Washington, D. C.

The North Umpqua has undeveloped sites of considerable power potential. Undeveloped power potential for the North Umpqua totals at least 180,000 kilowatts capacity, almost the equivalent of the existing California-Oregon Power Company development above Toketee Falls on this same stream. Future possibilities of a limited nature exist elsewhere in the Umpqua system.

The main stem of the Umpqua has potential for power development. Federal Power Commission figures indicate the possibility of an installed capacity of approximately 130,000 kilowatts. With proper storage facilities, this figure could be revised upward possibly to a range of 200,000-220,000 kilowatts.

TABLE 5

LIST OF POTENTIAL POWER PROJECTS

Name of Project or Site	River	Installed Capacity KW	Av. Annual Generation 1,000 KWH	Gross Head Ft.
LOWER UMPQUA				
12 RB No. 3	Smith	3,000	13,000	130
12 RB No. 1	Smith	5,400	23,600	320
Loon Lake Diversion	Mill Creek	6,500	55,900	385
Scottsburg	Umpqua	38,100	290,000	100
Kelleys Smith Ferry	Umpqua	30,800	236,000	85
Kellogg	Umpqua	23,500	196,000	70
Wolf Creek	Umpqua	37,000	298,000	145
NORTH UMPQUA				
Winchester	N. Umpqua	13,400	89,000	80
Oak Creek	N. Umpqua	11,300	86,500	70
Horseshoe Bend	N. Umpqua	14,000	98,300	90
Glide	N. Umpqua	9,000	62,200	60
Rock Creek	N. Umpqua	51,000	263,000	221
Boundary	N. Umpqua	44,000	216,000	187
Steamboat	N. Umpqua	16,300	113,000	190
Copeland Diversion	N. Umpqua	24,300	175,000	290
Lake Creek No. 3	Lake Creek	3,600	9,800	325
Lake Creek No. 1	Lake Creek	5,000	13,000	480
SOUTH UMPQUA				
Roseburg	S. Umpqua	3,000	22,000	50
Dillard	S. Umpqua	3,600	26,000	60
Ruckles	S. Umpqua	2,800	21,000	50
Myrtle Creek	S. Umpqua	3,900	28,000	70
Riddle Diversion	S. Umpqua	5,800	44,000	125
Days Creek	S. Umpqua	4,900	24,100	100
Perdue	S. Umpqua	4,600	20,800	100
Coffee Creek	S. Umpqua	3,100	20,000	80
Tiller Diversion	S. Umpqua	6,200	39,800	160
Deadman Creek	S. Umpqua	3,100	21,000	175
		377,000	2,514,000	

Source: Hydroelectric Power Resources of the United States Developed & Undeveloped, dated 1957 by Federal Power Commission, Washington, D. C.

Improvements in the flow patterns of the streams of the system by at-site or upstream storage would offer increased power production in many cases. Development of the various sites differs so widely in character that generalizations are improper. Specific studies, both engineering and economic, will be required to fully assess the individual project potentials.

Power supplies within the Basin are adequate for the immediate future. Water quantity can be considered only a problem insofar as the amount available controls the economics of a specific operation and thus to some extent controls the cost of the power production. Adequate supplies can be considered available as long as undeveloped sites remain from which power can be produced at a marketable cost. Use of the waters of the Umpqua system for power generation entails difficulties of another nature, as will be pointed out later.

<u>Industrial</u>

Two problems exist relative to industrial use. The first is the full time availability of water for processing purposes. Under present conditions, insufficient water is available during periods of low flow.

The second quantitative problem is that of dilution water for industrial pollution abatement processes. This is a quantitative problem arising from the effects of industrial waste on the qualitative standards of the surface and ground waters of the state. The adverse environmental and esthetic effects of waste discharge can be mitigated by sufficient quantities of dilution water, but this technique is not basically a solution to the problem--it is generally a temporary expedient brought on by economic pressure or convenience.

A major problem facing Douglas County is the stabilization of its economic base. Since a great portion of the wealth of Douglas County comes from its timber resource, fullest possible utilization is absolutely essential to the long range growth and welfare of the area. At the present time, authorities estimate up to 50 percent of the natural resource of wood harvested within the County each year is wasted. This is in large part due to the fact that secondary utilization of wood materials is practically nonexistent in this area. To utilize this wasted natural resource, secondary wood processing operations, as typified by the pulp and paper industry, are needed within the County. This is predicated *on the assumption that maximum benefit to the County from its own natural resource production would accrue only with the maximum amount of in-County processing.*

The establishment of pulp and paper operations in this river system poses a significant problem with respect to the deleterious effects of their wastes on stream environment. Establishment of industrial operations of this type in interior Douglas County will require stringent treatment standards for industrial waste products. This can readily be understood when it is realized that wastes from kraft plants, limited to adequate control of toxic components, would require 100 percent regulation of the yield of the minimum year, 1931, on the South Umpqua to satisfy the requirement of a 200-ton unbleached kraft pulping operation. Such control is economically impractical. Economical operations of pulp and paper installations require, in general, continuous year-round production ruling out restrictions of output during periods of low streamflow, therefore, four alternatives present themselves: (1) a solution of the industrial wood waste problems by the utilization of suitable treatment techniques; (2) restriction of large waste producing operations to coastal areas where ocean discharge could be acceptable under controlled conditions; (3) abandonment of pollution abatement standards; and (4) exclude industry by a refusal to allocate water for its operational needs. Possibilities (3) and (4) are unacceptable because of their totally negative nature.

Item (2) has the inherent disadvantage that it would divorce the major population center from a primary employment center. The possibilities of secondary wood utilization operations in the lower river are good, but utilization of all the wood available for operations at this point would be unacceptable to many people. Only one solution is totally and permanently acceptable for the Umpqua Basin--the development and use of satisfactory waste treatment techniques. This is a basic responsibility of both industry and the State of Oregon.

<u>Mining</u>

Mining operations in the Umpqua system are, to a large extent, located in the headwaters of the small tributaries and are, insofar as quantity is concerned, an individual problem. Existing rights for this use are often in excess of natural stream flows during summer months.

Operational difficulties and the nature of the permits issued by the State Engineer's office limit many operations to certain periods of the year. There are, however, some unrestricted rights of substantial size (as high as 30 cfs).

Actual use for mining is relatively small at present. Expansion of operations would be faced with a water availability problem during low flow periods.

Mining operations have little effect on downstream quantities available for other purposes, but can have serious qualitative effects as a result of uncontrolled operations.

<u>Recreation</u>

The needs for sufficient quantities of water for recreational uses are of great importance to the Umpqua Basin. Most of the income from outdoor recreation that comes into the County stems from some phase of recreation allied with water. The game fishing of the Umpqua is one of the important recreation values of the Basin. The relationship of fisheries resources to quantity of water (desirable base flows) is discussed in the section on Fish Life Uses.

Recreation requirements for water in the form of minimum flows extend beyond fishing. Approximately 50 percent of the out-of-state visitors coming to Oregon are from California. The Oregon State Parks Division of the Highway Department says, "It is an accepted fact that many want to see a country which offers them a change from their own dry surroundings. They want to see water and enjoy the many types of recreation that water provides."

Developments receiving greatest use in or near the Umpqua Basin are Diamond Lake, Crater Lake National Park, and the areas along the major streams. The greatest expenditures for recreation development have generally been where suitable water facilities are available during the recreation season. If the appeal, and thus the economic value, of these developments is to be continued, the maintenance of adequate water facilities is mandatory. The maintenance of satisfactory facilities requires water of suitable quality and sufficient quantity for the purpose needed. Minimum requirements vary with use, but the higher the standards at a given spot the greater the potential.

TABLE 6

MAJOR OUTDOOR RECREATION FACILITIES

DOUGLAS COUNTY

Improved Parks	Acreage
Fair Oaks	3.37
Mack Brown	3.37
Anna Drain	1.70
Winchester Bay (Salmon Harbor)	90.00
Dave Busenbark	28.60
Richard G. Barker Memorial	10.00
Singleton	3.50
Ziolkouski Beach	4.50
Winston-Dillard	7.25
Barton	27.30
Canyonville	12.00
North Myrtle	19.00
Gardiner Dock	0.25
Smith Springs	10.00
V. T. Jackson	3.00
Stearns	3.50
Cable Crossing	0.50
Lone Rock Wayside	0.50
Winchester River Access	2.00
Hestness Landing	1.09
Angler's Acres	1.50
Total Improved	232.93

Other County Parks	Acreage
Britt Nichols	123.25
James Wood	1.90
Ada	14.00
Otter Slough	30.00
Hedden	0.50
Steamboat Falls	15.41
Sparrow	14.00
Whistler's Bend	160.00
N. Umpqua Recreation Lands	428.00
Total Other	787.06

Recreational Roads	
Cleveland Rapids Road	1.50
Lawson's Bar Road	3.00

Recreational Reserve Lands owned or controlled -- approximately 2,000 acres.

FOREST SERVICE

National Forest Park Areas

12 camp and recreation areas totaling 85 acres, of which three of the most popular are:

Name	Location
Tahkenitch	7 mi. N. Reedsport
Diamond Lake	20 mi. N. Crater Lake
Carter Lake	9 mi. S. Florence

2 Winter Sports Areas	1 Reservoir
2 Resorts and Dude Ranches	3 Dedicated Areas
1 Organized Camp	200 Miles of Roadside, Trailside, and Water Front
70 Summer Homes	

TABLE 6

MAJOR OUTDOOR RECREATION FACILITIES - CONTINUED

STATE OF OREGON

State Parks

Name	Location	Acreage
Bolon Island	City of Reedsport	11.41
Umpqua Lighthouse	5 mi. S. Reedsport	2,747.40
Umpqua Wayside	9 mi. E. Reedsport	31.22
Elk Creek Tunnel	3 mi. E. Elkton	200.00
Hutchinson	10 mi. S. E. Elkton	6.00
Pass Creek	5 mi. S. Cottage Grove	15.00
Umpqua-Myrtle Preserve	11 mi. E. Scottsburg	4.85
Susan Creek	29 mi. N. E. Roseburg	78.96
Roseburg	City of Roseburg	16.34
Canyon Creek *	3 mi. S. Canyonville	80.00
Stage Coach	18 mi. S. Canyonville	80.00
Camas Mountain	3 mi. E. Camas Valley	160.00
Total State Parks		3,431.18

Roadside Rest Areas

Name	Location	Acreage
Umpqua River	13 mi. E. Reedsport	0.50
Cabin Creek	2 mi. N. Oakland	2.00
Cow Creek	24 mi. S. Myrtle Creek	5.00
Canyon Creek	3.6 mi. S. Canyonville	1.50
Packard Creek	5.7 mi. S. Canyonville	3.00
Total Roadside Rest Areas		12.00

* Includes Canyon Creek Roadside Rest Area

Historic Sites-Markers

Scottsburg	Site of Lowertown; wiped out in flood of 1861.
Canyon Creek	Route of Hudson Bay travelers to California.
Mile 28.17	Between Elkton and Scottsburg.

Minimum stream flows for recreation fall into two categories: (1) protection of desired minimums of streams whose natural low flows and depletion potential do not, at present, threaten the maintenance of the desirable physical minimums; and (2) creation of base program flows by the development of storage.

The main stem of the Umpqua, and the North Umpqua, plus some of its upstream tributaries, fall in the first class. Where the use of the resource for recreation is sufficiently valuable when compared to other beneficial uses, the Board can establish minimum perennial or desirable base flows by allocating such quantities of the unappropriated flow as are required.

Most other streams of the Basin fall into the second class. These are the streams with limited recreation development but which have real potential if suitable water could be made available. The South Umpqua and its tributaries are in this class. The answer is to provide storage when and if such storage becomes economically or physically feasible. To guarantee that storage facilities will be available when required, as needed for optimum water use, partial development of the limited number of sites in the system cannot be tolerated.

Fish Life

The major problem of a quantitative nature relative to the use of water resources of the Umpqua Basin for fish life uses lies in the physical accomplishment of base flows below which stream levels will never fall except in extremely unusual conditions not previously experienced.

The State Game Commission of Oregon has testified in a hearing before the Board at Roseburg, Oregon, in the fall of 1956 that sources of past information give fairly reliable evidence of anadromous fish populations of the Umpqua Basin in the days of early white settlers approaching 825,000 fish for anadromous species. They indicate that fish populations for these early periods had runs of the following approximate magnitudes: 25,000 spring chinook, 40,000 fall chinook, 350,000 silver salmon, 12,500 summer steelhead, and 150,000 winter steelhead. In contrast to these populations, the estimated fish population of this same system in 1955 was about 181,000 or roughly 22 percent of the population that is believed to have existed in early days.

Representatives of the State Game Commission have stated that proper management could restore the anadromous populations of the Umpqua system close to the 800,000 population level. To achieve this fisheries management objective, the Game Commission has determined that certain minimum streamflows are desirable and that their importance for the production of fish and fish food cannot be overemphasized. This poses a quantitative water problem of substantial magnitude.

In its study of the Umpqua system, the Board has compared actual flow data information with the values considered desirable by the Game Commission, and these comparisons show that minimum flows have occurred in the past, in some instances frequently, which are less than the desirable base flow levels. The most critical flow levels occurred in the early 1930's when the consumptive uses of water were small in comparison with the potential for consumptive use as expressed by existing legal water rights.

To evaluate, roughly, the potential of the main streams of the system to meet minimum desirable flows for the fisheries resources, comparisons were made between mean monthly flows of record and the desirable minimum flows for fish. These comparisons were made only to see what water would have been available under past circumstances to satisfy these requirements.

The low flow frequency curves, Figure 9, illustrate the situation. For the main stem and the North Umpqua, the occurrence of a month with a mean flow less than that desired for fish, 600 cfs, was an infrequent item.

For the South Umpqua and Cow Creek, the recurrence frequency of mean monthly flows of 100 and 20 cfs, respectively, is about every third and second year showing the futility of relying on existing stream regimen for desirable minimum flows for fish. Realistic accomplishment of desirable flows for the major portions of the South Umpqua watershed must come from a resource augmentation and conservation program not just resource conservation as represented by the commitment of all remaining unappropriated low flow water to the beneficial use of fish life.

The frequency levels indicated are probably conservative because they include early water years not influenced by depletion of water through

UMPQUA RIVER BASIN

LOW FLOW FREQUENCY CURVES

(MINIMUM MONTH)

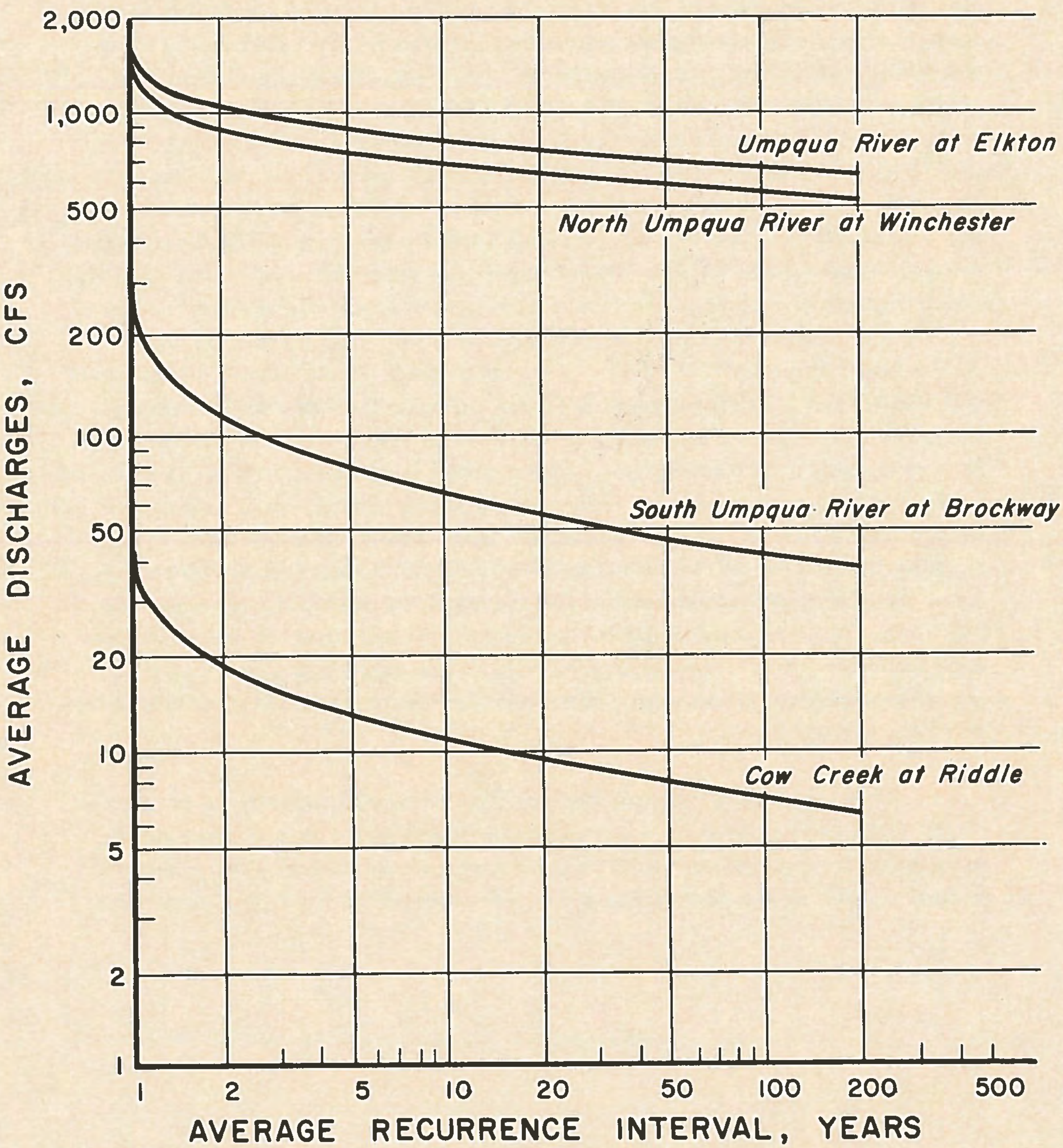


FIGURE 9

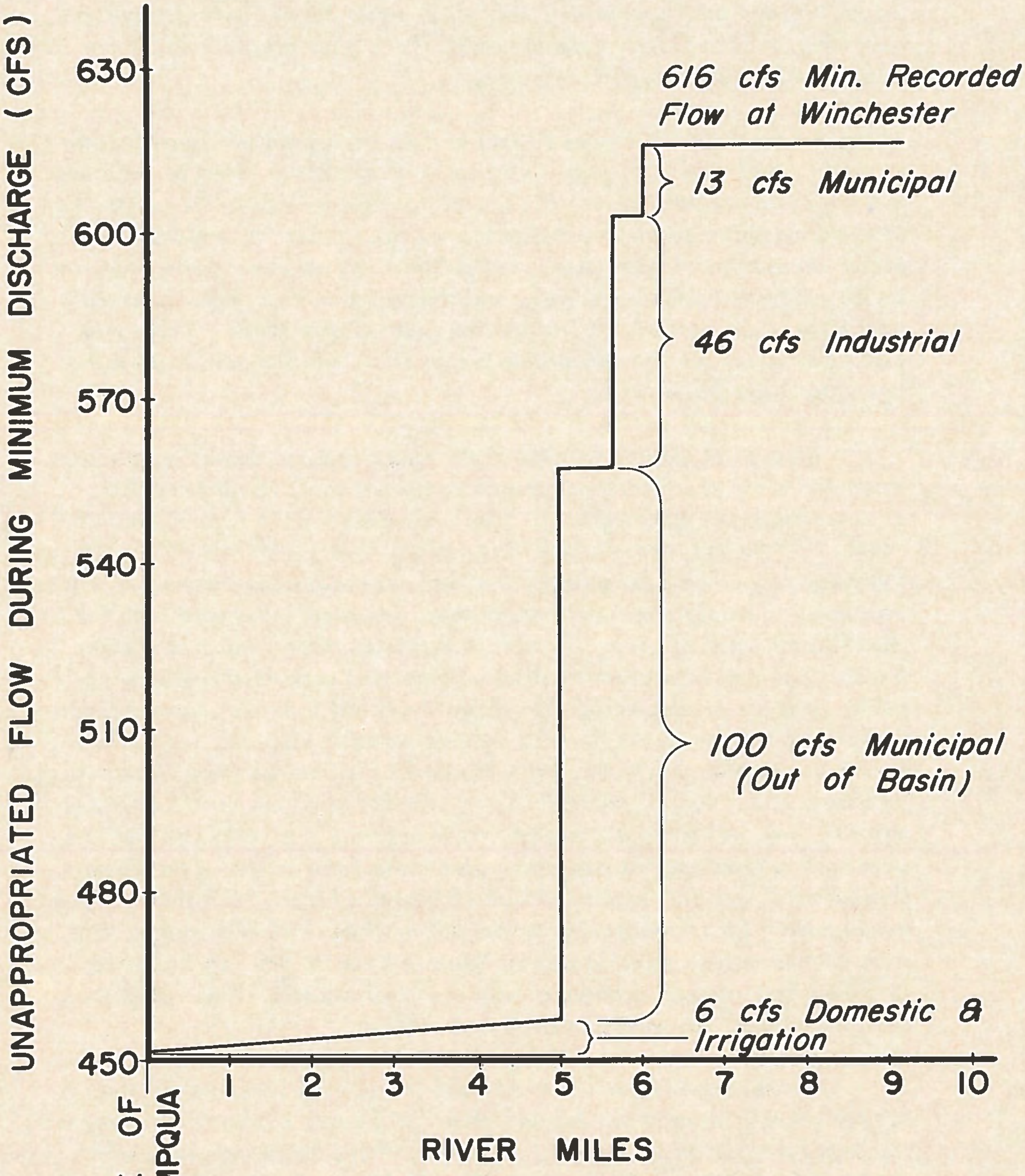
appropriation to beneficial use. These same water years, if repeated now, would most likely show smaller observed flows resulting in a lowering of the plotted curves.

Not reflected in the Umpqua and North Umpqua curves is a large water right, 100 cfs, which, though on the books, has never been exercised. If this right were exercised to a major degree, it could have substantial effects on the magnitude of low flows.

The expansion of legal rights to use water consumptively has intensified the problem of providing desirable base flows. In many areas the potential exists legally for the complete depletion of stream flows, and in the lower areas of the South Umpqua Basin, legal rights are such that in almost all areas flows would be depleted in dry years below that considered desirable. To illustrate this problem, the specific example of the North Umpqua River between Winchester Dam and the river mouth, a distance of 6½ miles, is considered. If the minimum flow of record (1926) of 616 second feet (average daily) should again occur at the Winchester Dam, the full exercise of consumptive legal rights between Winchester and the mouth of the river would result in the depletion of the flow below the value considered by the Game Commission to be the minimum desirable. Legal rights are such that the flow at the mouth would be reduced to 450 cfs, or 150 cfs less than the recommended value of 600 cfs for the mouth of the North Umpqua (Fig. 10). It is, of course, unrealistic to assume that full utilization of all consumptive water rights will occur simultaneously. However, the margin between the low flow of record and the desired base flow is so small, 16 second feet, that a coincidental use of more than 8 percent of the legal consumptive rights would lower the stream's flow below the desirable level. This potential would become even more critical in light of the estimated future needs of this particular section of the stream, since the additional requirements for consumptive use would represent an additional depletion potential of at least 60 cfs exclusive of major industrial expansion. The concurrence of a high use period, a low flow, and a run of anadromous salmonoids has relatively low probability, but the potential does exist.

This example illustrates the problem of water quantity as it relates to the fisheries resource in the case of the North Umpqua and some of its tributaries where, presently, sufficient water flows during some periods of critical supply in the rest of the Basin. Protection of the fish populations

DEPLETION POTENTIAL
NORTH UMPQUA RIVER
(WINCHESTER TO MOUTH)



NOTE: Depletion Figures Based On Minimum Flow Of Record And Subsequent Application Rights.

could be achieved by restricting future applications for the appropriation of water for consumptive use or for out-of-basin diversion. Such action would prevent the expansion of depletion potential and would serve to maintain the base flows of the stream at the highest possible level consistent with existing runoff conditions.

Throughout the Umpqua River system, and particularly in the basin of the South Umpqua, such an action would have an effect of prolonging the desirable base flows, but would not fully preclude the possibility of flows dropping below the desired level, or, for certain periods, even achieving a point of zero flow. The problems on streams of this type can be solved by only one technique, and that is by making water physically available when needed, to provide the desired base flows. The major sources of water are the winter and spring flows which would have to be stored for later discharge.

Because of the topography of the Umpqua River Basin, supplying water for minimum flows from storage reservoirs conflicts with the fisheries management program itself. Suitable sites for the impoundment of water, from an engineering and economic point of view, are not located in the steep rugged areas above the limits of salmonoid migrations. In some instances, the only sites which would be economically feasible from the most liberal point of view, lie well downstream of the upper migration limits. The desire to preserve as much spawning area in the stream system as possible is sometimes, and in fact frequently in the Umpqua Basin, in direct conflict with the need to provide water in suitable quantities and of a suitable quality to obtain the desirable base program flows whose primary justification is the protection of the fisheries resource, recreation, wildlife, and pollution abatement. It is impossible to evaluate the loss of spawning area against the anticipated gains from increased minimum flows until a specific project location has been selected. If minimum flows are necessary for increased fish propagation, then in the Umpqua system some spawning area must be relinquished in order to provide the water for downstream fisheries needs during low flow periods. The establishment of relative values requires careful analysis.

In some cases, it will be necessary to provide fish passage and handling facilities at dam sites which will still make it possible to utilize the upper reaches of the stream. However, there are instances in which economic feasibility of the project will not allow extensive fish passage or handling facilities. Here the relative gain from desired flow over loss of spawning ground, must be evaluated and weighed in the final decision as to the merits of the project.

One of the biggest deterrents to the accomplishment of this fisheries resource management program is, and has been, the failure to provide funds to include in multi-purpose water resource projects facilities for the improvement, as opposed to maintenance, of the fisheries resource. If fish life is a valuable resource of the Umpqua Basin, and it is generally agreed that this is the case, then it seems reasonable that funds should be spent for its improvement as well as the expenditure of funds to maintain the status quo or something less.

Wildlife

The quantitative problems of water for wildlife uses are similar in character to those of fish life. An adequate and dependable supply of water is needed for the maintenance of bird and animal life. Here again, desirable base flows would be of substantial benefit. It is desirable with wildlife, as with the fisheries resource, to maintain control of the resource as high in the watershed as is economically feasible. The State Game Commission takes the position that the number of animals any given water supply can support is limited by the distance that the animal will willingly travel to reach it. If necessity requires animals or birds to travel further for water than they are willing, a reduction in bird and game potential can be anticipated. The storage of waste winter runoff waters in reservoirs, and their subsequent discharge into streams during periods of low flow, would have beneficial effect, in general, on wildlife.

Pollution Abatement

From a quantitative point of view, water for pollution abatement purposes involves the problem of dilution of industrial, municipal, domestic, mining, and agricultural wastes. Stated simply, sufficient water must be available in any stream to receive the waste products discharged into it, from whatever source, and so dilute those wastes that they will have no deleterious effect on any downstream beneficial uses of water.

The problem of industrial waste as related to the pulp and paper industry of Oregon has been discussed under the heading, "Water for Industrial Uses", primarily because of the large quantitative values involved in the potential industries that seem most possible of development in the

Basin. This is a potential problem, since there are no major sources of industrial waste pollution in the Umpqua Basin at this time. The Sanitary and Engineering Division of the State Board of Health in the Roseburg hearing of the State Water Resources Board in 1956 stated, "Thus far, most of the pollution caused by industry has been in connection with log pond overflows and the discharge of wood waste and other debris." Studies of the staff of the Division of Sanitation and Engineering indicate that oxygen demands of log pond discharges can be extremely high and can cause a serious pollution problem when discharged into small streams. This problem would be extremely acute during summer periods when streamflows are low. A magnitude of the potential for difficulty can be readily understood upon noting that the oxygen demand from a log pond, containing 50 acre-feet of water, would be equivalent to the raw sewage for one day from 100,000 persons, or more than the present population of Douglas County.

The domestic and municipal waste pollution problem of the Umpqua system is not of serious magnitude at this time, largely due to the active efforts of the Sanitary Authority and the program for municipal disposal facilities in the Basin. The quantities required for the dilution of future municipal and domestic wastes are, in comparison to potential industrial needs, relatively small.

PROBLEMS OF WATER QUALITY

It is convenient to divide water quality problems into two main groups: (1) problems relative to groundwater supplies, and (2) problems relative to surface water supplies. In the "Water Quality Inventory Study" conducted in 1955-1956 by the Experiment Station at Oregon State College for the State Water Resources Board, no information was found relative to the quality of water from underground sources in the Umpqua system.

Information on the quality of surface water supplies in the Umpqua Basin was also extremely limited. Prior to June 1, 1956, only 28 spot samples were available for analysis for the waters of this system. In addition, there were two points in the Basin where daily records had been kept for some period of time. At one of these points (the Rock Creek Hatchery in the North Umpqua system) the only test made was for temperature. These temperature data extended from 1943 to 1956. The other instance of daily samples was for the purpose of boiler water analysis taken in the vicinity of the town of Elkton on the main stem of the Umpqua.

TABLE 7

SEWAGE TREATMENT PLANTS

Name	Year Constructed	Treatment Units	Design Pop.	Pop. Served
Drain	Under Construction	ScCmFtDCmEgBo	2,000	
Glendale	1930	Cs	500	800
Glendale	1957	Sc(CmDpCm)FthEgcBo	1,000	
Milo	1956	CiFthCpEh	450	300
Myrtle Creek	1952	ScCmFthCmEgDcpBo	3,000	2,000
N. Roseburg	1951	ScCmFt2hCmEgDfhBo	4,000	5,400
Riddle	1952	ShCmFthCmEgcDcpBo	2,000	1,000
Roseburg	1940	ShCmFtrCmEgDchBo	6,000	9,000
Roseburg	Under Construction	ScCmFtDCmEgBo	20,000	
Sutherlin	1956	ShGhCmFtrCmEgDchBo	3,500	2,500
Sutherlin Hsg	1953	CsEgc	350	350
Winston	1953	CsFsEh	175	150
Winston	1957	ScCmFthCmEgcDcm	3,500	

Treatment Abbreviations

Bo	Open sludge beds	Egc	Gas chlorination, separate contact tank
Ci	Imhoff tank	Eh	By hypochlorite
Cs	Septic tank	Fs	Intermittent sand filters
Cm	Mechanically equipped tank	Fth	High rate or capacity filter
Cp	Plain hopper bottom tank	Ft2h	Two stage high capacity filter
Dch	Digester, fixed cover, heated	Ftr	Standard rate filter with rotary distributor
Dcp	Digester, fixed cover, unheated	Gh	Hand cleaned grit chamber
Dfh	Digester, floating cover, heated	Sc	With shredder or grinder, comminutor
Dp	Unheated	Sh	Hand cleaned bar rack
Eg	By chlorine gas		

Source: Oregon State Sanitary Authority

Because several other areas of the State also lacked data, the State Water Resources Board extended its water quality acquisition program to include a restricted field sampling program of a voluntary nature. This program was started during the summer of 1956 and was continued through the spring of 1957. Within the Umpqua Basin, an additional 52 spot samples were obtained. Sampling was distributed over the Basin as widely as possible. Daily samples were also taken at the outfall of the Roseburg sewage treatment plant. This data, plus information previously held by the City of Roseburg for the same location, gave coverage for a period from August 16, 1954, to April 30, 1957. Daily samples were taken in the Yoncalla area, but the tests for water quality here were limited to turbidity and chloride. These data indicate that the general quality of the surface waters of this system is quite high. Most problems relative to quality result from operations that take place in the Basin on an intermittent basis and with no consistency as to geographical distribution.

It is convenient in discussing qualitative aspects to consider three categories relative to water characteristics. These are: (1) physical, (2) chemical, and (3) biological characteristics. In the Umpqua system, present problems of water quality center about the physical characteristics of the supply. Future problems will include aspects of physical, chemical, and biological characteristics, if anticipated industrial, commercial, and urban development occurs. General problems relating to the various characteristics of water are:

(1) Physical Characteristics

Siltation

Turbidity caused by silt is the most immediate quality problem falling under the category of a physical characteristic. The heavy silt loads carried by the streams of the Basin after intense or protracted rainfalls result from certain land use practices and have been a matter of considerable public attention in the Basin.

The sources of silt are the logging operations, which are widespread; intermittent construction activities; sand and gravel operations; certain agricultural practices; and the erosive actions of natural forces. Sufficient data is not available to present a clear picture of the relative amounts of sediment occurring in the streams of this Basin from the various sources. The Douglas County Water Resources Survey sediment measuring program collects samples at specified stations throughout the Basin with the purpose of developing the variation in silt loadings and the relative effect of logging operations, as well as industrial, construction, and agricultural practices on this particular phase of water quality. The sampling program for the Basin utilizes 12 sampling points, and data is available extending from February 1956, to the present. Figure 11 included in this report gives comparative values for two typical stations in the Basin. The first, on the North Umpqua at Winchester, where suspended solids vary from zero parts per million to a maximum of 220 parts per million; the second, Cow Creek at Riddle, where suspended solids sampling show variations from zero parts per million to 784 parts per million. These values do not represent the maximums that have occurred. One spot sample taken in the 1951-1952 water year was 6850 parts per million with the October-May average running about 550 parts per million. Siltation poses the following problems which are given a general qualification :

Domestic

Problems inherent with domestic supplies where siltation occurs are offensive taste, odor, and appearance. Domestic supply systems generally lack treatment facilities and difficulties with laundering and the operation of household equipment are experienced. This is primarily an individual problem.

Municipal

When heavy silt loads occur in raw water supplies of municipalities, filtration systems are frequently unable to supply the demand placed upon them. This is in part due to the reduction in output because of the necessity of frequent backwashing of filtering equipment to maintain a constant quality standard. Since the backwashing procedure, in most cases, utilizes water already treated, more frequent backwashes cut down on the amount available for public consumption. Difficulties of this type have been experienced in the Basin. Sutherlin is an example.

Operational difficulties related to the maintenance of equipment result from siltation. Water works appurtenances require more frequent cleaning and are also subject, where there are abrasive constituents, to wear and more frequent replacement.

SEDIMENT LOADS

TYPICAL STATIONS UMPQUA RIVER SYSTEM

1957

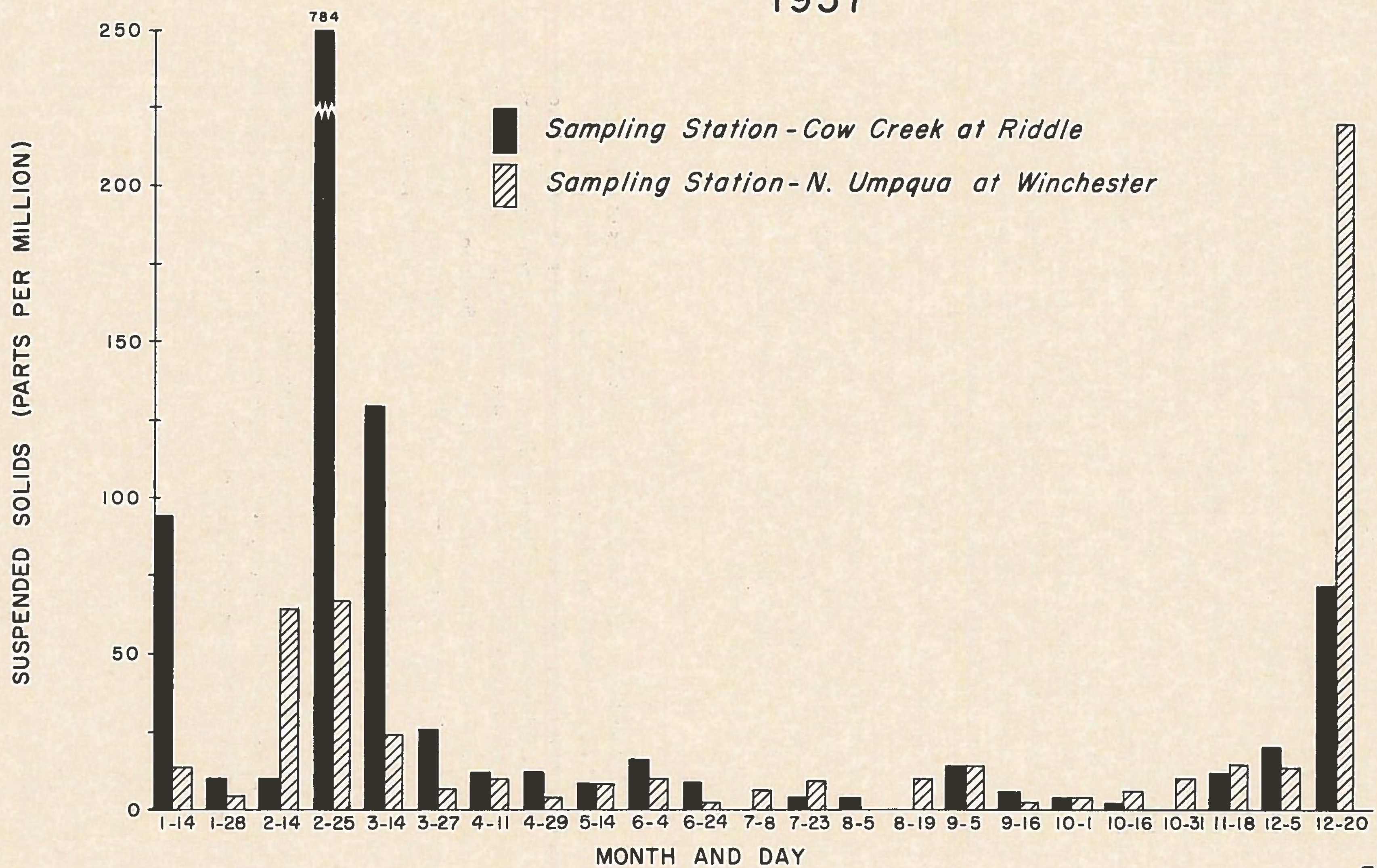


FIGURE 11

Irrigation

The major problem of siltation, as it relates to agriculture, involves the deposition of material upon agricultural lands subject to flooding. The characteristics and volume of the silt takes the inundated land out of production for the current agricultural season and sometimes for substantially longer periods. Areas in the South Umpqua have experienced this problem.

Problems are minor for water used for irrigation and may be treated as difficulties of an individual nature.

Power Development

The effects of siltation on the hydroelectric power developments of the Umpqua system are of no significance under present or anticipated circumstances. Problems are mainly maintenance problems due to the effect of silt on the operation of facilities and mechanical appurtenances.

Industrial

Qualitative problems of industrial use of water vary widely and depend on the specific type of operation involved. Where an industry has its own source of raw water, it must make provisions for treatment facilities if the quality of the raw water is not such that it is adaptable to the processes employed. Where filtration and other types of equipment are required to maintain a uniformly high quality of water, then siltation poses the same operating problems as a municipal operation.

No evidence has been submitted to the Board in its studies that would indicate that this is a major problem at the present time.

Mining

The Board's investigations uncovered no information that would indicate siltation as a major problem in the use of the resource for mining purposes.

Recreation

A stream made turbid from an excessive silt load loses its attractiveness for swimming, water skiing, boating, picknicking, and other pleasure uses. All other items being equal, i. e. safety, convenience, amount of water, surface area, and degree of congestion, a clear supply is more sought after than murky or turbid waters.

Present problems related to silt and recreation involve man-created difficulties. Typical are the unregulated activities of construction, logging, or sand and gravel operations which are generally active during the recreation season.

One of the major problems, the effect of silt on game fishing, is pointed out in the section on Fish Life.

Wildlife

No detailed information on this subject was developed in the Board's investigations, other than the aspect of unpotability of water as a result of excessive siltation.

Fish Life

Fisheries biologists point out several adverse effects of silt on the fisheries resource.

First is the destruction of eggs in the spawning grounds. Silt deposited over the spawning beds change the environment for the eggs and many do not mature. Siltation can change the environment of the stream resulting in destruction of food sources for young fish.

Siltation has been a distinct problem in reducing the success of sport fishermen by creating roily water. Reference to this is made in the "Annual Report of the Game Commission, Fisheries Division, 1955."

Pollution Abatement

Additional organic loading is often experienced during periods of heavy siltation, since many of the operations contributing to heavy silt loads dislodge the surface organic materials and discharge them into the stream. This organic material depletes the dissolved oxygen level. The oxygen depletion reduces the downstream dilution potential of the stream for receiving wastes from other sources. No specific values are available on this item for the Umpqua system.

Temperature

One of the most important physical characteristics of a water supply is its temperature. There is not sufficient data available to establish with any degree of accuracy the variations in water temperature throughout the Umpqua system.

Present problems in the Umpqua system are relatively limited and primarily concern the problems of pollution abatement and protection of the fisheries resource. Problems of temperature related to the various uses are as follows :

Domestic & Municipal

The temperature problems of domestic and municipal water involve consumer preferences for palatability.

No material evidence was developed during the Board's investigation that indicated any present problem of a major nature related to temperatures in municipal operations. Expansion of commercial or industrial activities in the Basin may make this an item of importance.

Irrigation

Data regarding the temperature factor in agricultural applications of water in the Basin is limited.

There are no major water temperature problems related to agriculture presently or are any contemplated in the foreseeable future.

Power Development

No problems were identified with this use.

Industrial

Water temperatures are an important item in industrial processing operations. It is difficult to find an industrial process that does not have some type of temperature control or some temperature limitations in its operational sequences. Obtaining water for cooling purposes is one of the big problems of many industries. The pulp and paper industry is among these. According to the National Council for Stream Improvement of the Pulp, Paper, and Paperboard Industry, a kraft (sulfate) pulping operation requires approximately 20,000 gallons of water per ton of pulp. About one-third of this amount is presumably for cooling. Another one-third is for paper machine overflow. The subject of cooling water for pulp and paper operations is a complex one involving many factors including scale problems, corrosion, organic growth, and others.

Temperature of water discharged from pulp and paper or other industrial operations may be an important factor in the water resource picture of the Umpqua Basin during low periods if full utilization of the timber resources is achieved in the future.

Mining

There are no temperature problems insofar as present mining uses of the waters of the Umpqua River system are concerned.

Recreation

There are two facets of the effect of temperature on recreational uses of water. The first is the effect of temperature on the game fisheries resource of the system. This item will be discussed under the heading of Fish Life.

The second facet is the esthetic aspect of water used for recreational purposes. If the temperature of the waters of the stream is raised too high, it may result in adverse odor, color, or general appearance characteristic which would make the stream undesirable for recreation purposes.

This particular problem is of some consequence in the South Umpqua system at the present time during periods of low flow. Here adverse conditions are experienced when flows drop to such levels that stagnant pools exist in portions of the stream's length. Such conditions can only be rectified by the achievement of base program flows which provide sufficient flows at a suitable temperature.

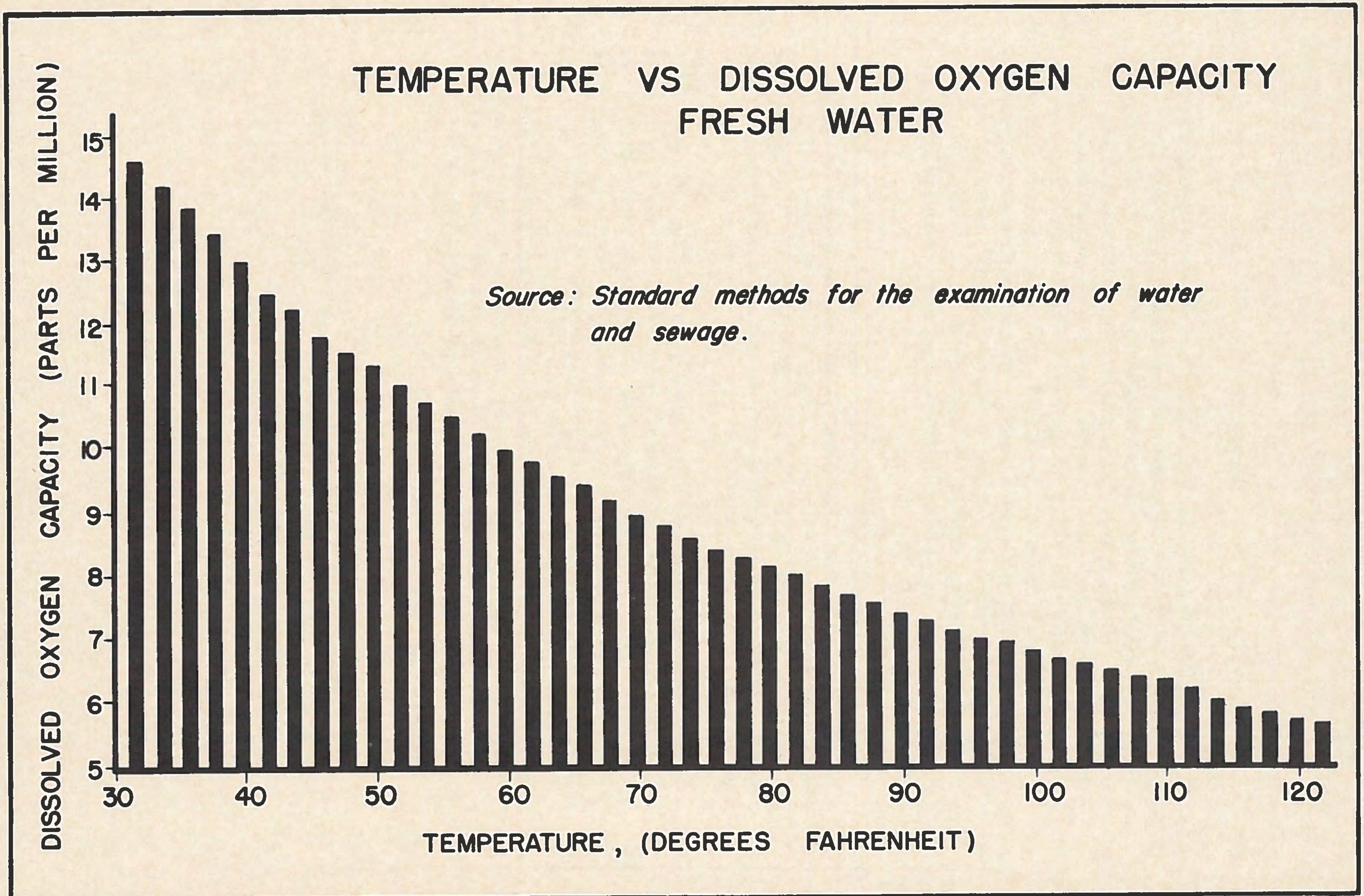

TEMPERATURE VS DISSOLVED OXYGEN CAPACITY
FRESH WATER
Source: Standard methods for the examination of water and sewage.
DISSOLVED OXYGEN CAPACITY (PARTS PER MILLION)
5
6
7
8
9
10
11
12
13
14
15
30
40
50
60
70
80
90
100
110
120
TEMPERATURE, (DEGREES FAHRENHEIT)

FIGURE 12

Fish Life

Anadromous species and the resident trout populations which comprise the basic game and commercial fisheries resource of the system are dependent upon satisfactory water temperatures for their survival and propagation. Maximum spawning success for these species depends on cool, well aerated water whose temperature variation lies with a relatively restricted range. Fish biologists indicate that temperatures for the anadromous species should not exceed the low 60 degree Fahrenheit range. At higher temperatures the fish become less resistant to disease and other adverse factors in their environment. Their tolerance to temperature is influenced by physical, chemical, and biological factors, including the condition of the fish, the concentration of fish, and the volume of water available in their habitat.

As temperatures rise, the ability of that water to retain its dissolved oxygen is lessened. Figure No. 12 indicates the decrease of oxygen-holding capacity of water with a rise in temperature. Dissolved oxygen content less than 5 parts per million would have an adverse effect on the anadromous species of the Umpqua system as well as the resident trout population.

The fisheries resource of the South Umpqua River depends to a substantial degree on the utilization of resting holes. If a low yield year such as 1931 should again occur, the effects on the fisheries resource of this segment of the system could be catastrophic. Low flows under such a condition, plus consumptive uses which have developed since 1931, could result in flows close to zero in the lower portions of the stream system. Some fish would undoubtedly survive in the resting pools of the upper areas, but the possibilities of major losses are quite real. The only solution for the low flow-high temperature problem of this area is to provide water of suitable temperature to improve the minimum flow of the stream.

Wildlife

No specific data was developed in the Board's investigations relative to the effects of temperature on the use of the resource for wildlife purposes.

Pollution Abatement

Temperature is an important item in the use of the resource for pollution abatement purposes. The problem specifically is the effect of temperature on the stream's capacity to receive and reduce pollution elements to their stable condition without reducing the dissolved oxygen content of the water below the level considered necessary for other resource uses. Existing problems are limited in scope and localized in character.

(2) Chemical Characteristics

There are at present no major problems in the Umpqua system which can be attributed to the chemical characteristics of the water.

(3) Biological Characteristics

The investigations of the Board did not uncover any significant problems related to biological characteristics that presently exist in the Umpqua system. Such problems as do prevail are of localized nature and relate generally to the problem of maintaining public health. Restriction on swimming in the lower sections of the South Umpqua during periods of low flow is one of the localized problems. The presence of pathogenic bacteria or viruses which are water-borne and result in disease, or the presence of algae or other organisms in water which create either disease, taste, color, or undesirable odors are problems against which continuous safeguards are maintained by county officials and the State Sanitary Authority.

Physical and chemical characteristics and changes in these characteristics brought about by pollution and other factors result in a biological problem relative to the fish life resource of the Basin. In addition to the factors which result in direct kill of fish, there are items which affect the flora and fauna of the stream system upon which the anadromous and resident fish populations are dependent for their food supplies and favorable environment.

No evidence has come to the Board that would indicate major problems relative to bacteriological characteristics exist for the other beneficial uses of water.

PROBLEMS OF WATER CONTROL

There is one dominant problem with regard to control of the resource in the Umpqua River system. The problem is the control of the serious floods to which this Basin is frequently subjected. No other item in the water resource use and control field has received as much attention from the general population of the Umpqua River Basin. It has been the item of dominant interest to all the groups in this area, including the Water Resources Advisory Committee of Douglas County. Floods within the system are such that they affect much of the population of Douglas County and have serious effects on practically all phases of the Basin's economy. Difficulties resulting from intense floods are: the ever-present danger of the loss of human life when people are trapped in their homes or in dangerous locations by the rapidly rising waters which characterize the floods of the Umpqua system, particularly the South Umpqua; the destruction of agricultural, industrial, commercial, and residential establishments and their contents either by inundation or the driving force of the flood waters; the ruin of agricultural lands by the deposition of the heavy silt loads carried by the streams at flood stage and/or the adverse effects of debris which is either deposited on the land or dragged across the land resulting in an increase in erosion and general damage; the erosion of river banks and agricultural land by the high water stages; the disruption of trasportation within the Basin due to loss of roads, bridges, and the blocking of transportation routes; the damages to the economy of the area resulting from shutdown in operations due to inundation of industrial operations; the destruction of drainage and irrigation appurtenances and facilities; damages to the railroads of the Basin; and numerous other items.

History of Floods

The Umpqua River has a long history of violent floods dating back to the year 1861 when the tragic destruction of the community of Scottsburg occurred on the Lower Umpqua River. Since that time there have been eighteen years of record wherein the flood stage at Elkton has been at or above the thirty-foot gage height which is assumed as the measure of a flood on the Umpqua system. The maximum measured discharge for a flood at Elkton was 218,000 cfs. This was the peak flow recorded during the flood of December, 1955. The records of the U. S. Geological Survey indicate that this is the approximate peak flow experienced during the flood of 1861. There is some evidence, however, that the flood discharge of 1861 may have been substantially higher. The four highest

TABLE 8

MAXIMUM DISCHARGES OF MAJOR FLOODS AT ELKTON AND BROCKWAY SINCE 1890

YEAR OF FLOOD	UMPQUA RIVER AT ELKTON Discharge cfs	Feet above bankfull	S. UMPQUA R. AT BROCKWAY Discharge cfs	Feet above bankfull
February, 1890	No Data	---	130,000	12.1
January, 1907	Incomplete Record		71,000	5.0
February, 1927	185,000	16.0	101,000	10.2
December, 1942	186,000	16.1	70,000	7.5
December, 1945	179,000	15.1	67,700	7.2
January, 1948	154,000	12.8	71,400	8.0
October, 1950	108,000	19.2	102,000	11.4
November, 1953	195,000	17.4	81,800	8.0
January, 1953	199,000	18.0	89,200	9.4
Dec. 22, 1955	218,000 *	20.6	91,300	10.5
Dec. 26, 1955	178,000	15.0	85,300	9.3

* Assumed to equal the historical flood of 1861.

Note:	Discharge at bankfull, cfs	Stage at bankfull, feet
Elkton	86,000	25.0
Brockway	45,400	21.0

flood values for the Umpqua River at Elkton have occurred since the year 1950. In order of magnitude starting with the year of highest peak flow, they are: (1) 1955; (2) 1950; (3) 1953; and (4) 1953. The two floods for the year 1953 did not occur during the same flood season. The highest magnitude (3) occurred in January of 1953 in the 1952-53 water year, and the flood of fourth magnitude occurred in November of 1953 which would be the 1953-54 water year. Flood patterns of 1953 and 1955 were unique. Both these years experienced double flood peaks where the major peaks occurred several days apart. On the South Umpqua River at the gaging station near Brockway, the period of record dating (intermittently) from 1890 shows ten years in which the flows exceeded a flood stage height of 25 feet which is generally considered the flood level at this location. In the case of the South Umpqua, the floods of greatest magnitude have not been concentrated in the period of record covering the past six or seven years. The flood peak of 1950 was the second highest of record and the December 22nd flood peak of 1955 was the fourth highest peak of record. The December 26th peak of 1955 which followed roughly four days after the first peak was the sixth highest flood peak of record on the South Umpqua system.

Economic Impacts

Some idea of the damages occurring from the floods of the Umpqua system can be obtained from Table 9. The table summarizes damages for the flood of December, 1955. Appraised values of property exposed in the Umpqua Basin during the 1955 flood exceeded that of the Rogue River by nearly eight and one-half million dollars. 1/ In addition, the Umpqua Basin has a greater number of acres of field, truck, and special croplands, as well as orchard and small fruit lands subject to difficulties by virtue of being in the flood plain. In relation to field, truck, and special crops, Umpqua River lands in the limits of the 1955 flood exceed those of the Rogue River by some 1,000 acres, and orchard and small fruit lands for the Umpqua exceeded those of the Rogue River by slightly more than 1,000 acres.

TABLE 9

FLOOD DAMAGES
OF DECEMBER, 1955 1/

Type	Direct	Indirect	Total
Agricultural	$ 668,520	$ 5,220	$ 673,740
Residential	233,690	320,180	553,870
Industrial	256,280	195,250	451,530
Commercial	68,020	40,890	108,910
Railroad & Utilities			171,610
Highway & Roads			132,940
Schools & other Public			18,500
Flood Control Structures & Navigation Facilities			24,000
Public Aid & Relief			8,040
Total Private	$1,953,080		
Total Public	190,060		
GRAND TOTAL			$2,143,140

1/ "Report on Floods of December, 1955", Portland, Oregon, District Corps of Engineers, U. S. Army, October, 1956.

Methods of Flood Control

There are two common techniques available by which the flood damages of the Umpqua Basin may be lessened. (1) by the utilization of revetments, levees, and limited local protective works; and (2) reduction of peak flows by utilization of major upstream impoundments. In general, existing local protective works were inadequate during the peak flood stage for those areas in the general vicinity of Roseburg. Investigations by the Corps of Engineers are now under way to establish the need for and merits of additional local protective facilities within the Umpqua River system.

At the present time, no major storage facilities exist in the Umpqua system above the zones subject to extensive flood damage. An investigation of the potentials for flood control reservoirs in the Umpqua system was initiated in 1956 by the Corps of Engineers, but funds were not available to complete this investigation. Requests are presently being made to Congress for the necessary funds to complete this investigation, and if such funds are forthcoming as anticipated, the final analysis of the problem should be available late in 1959. In order to facilitate the development of a coordinated, integrated program for the Umpqua River Basin, the Board was required to make a preliminary evaluation of the flood control problem in the Basin. Discussions were held with various individuals in the Corps of Engineers to obtain as much information as is presently available regarding the flood problems in this area. In addition, the staff of the Board made limited studies designed to point up the specific problems. Some very serious deterrents appear evident in attempting to develop a program for flood control in the Umpqua River Basin by means of storage reservoirs.

Problems in Flood Control Storage

The problems of establishing sufficient impoundments in the Umpqua system to regulate the floods fall into three main categories: (1) physical, (2) economic, and (3) financial.

Because of the particular characteristics of the Basin's physical structure, suitable sites for the impoundment of flood waters are limited. The basic requisites of a flood control reservoir are structural feasibility for impoundment works and reservoir capacity. There are many structural sites for dams in the Umpqua system, but because of the steep gradients and narrow canyons, large structures would be required to develop the storage needed for major regulation of floods. There are sites within the lower section of the South Umpqua River above Roseburg which are suitable from a physical point of view for the construction of major flood control operations, but the very creation of these structures and reservoirs would inundate the most highly developed and valuable land of the river system. To a great extent this land is the basis for the need of control.

Another physical problem is the character of runoff patterns creating the floods. One flood control site is the Tiller site on the South Umpqua River some 27 miles above its confluence with Cow Creek. This storage site would not result in the control of the runoff of the Cow Creek, Lookingglass, Elk, Days, and Myrtle Creek watersheds. Would the Tiller site exercise sufficient physical control to provide protection to the lower areas under the circumstances that existed during the second peak of the 1955 storm? Preliminary evaluations of the second peak runoff indicate that most of the water for this portion of the storm came from sections of the Basin which would not be regulated by construction of the Tiller site. It will be necessary to evaluate the pinch-off ability of the Tiller site on the South Umpqua as related to the volume of water available from the balance of the Basin before any positive conclusions can be reached as to the effectiveness of this site on the floods in the lower valley.

Another site exists on the South Umpqua approximately 12 miles above its confluence with Cow Creek. This is known as the Days Creek site. The location is below Elk Creek and would subject that stream to control. Because of existing developments in the reservoir area, it may prove difficult to justify economically a development at this location.

Damages from the 1955 flood and from the 1950 flood occurred throughout the entire Basin, ranging from damages on Cow Creek, Lower Myrtle Creek, Lookingglass, Deer Creek, Calapooya Creek, and Elk Creek to difficulties along the main stem of the River and the South Umpqua. This means that a full flood control program, attempting to reduce to the minimum damages to all areas in the Basin, would require widespread development and a great number of structures. Control of flood damages on Calapooya Creek would require storage above the community of Oakland, which storage would be of no value to Deer Creek, Lookingglass, or areas of the Umpqua Basin upstream from the confluence of Calapooya Creek and the main stem of the Umpqua River. The same analogy applies to problems on Cow Creek wherein the storage in the headwater areas would alleviate the flood problem for Glendale and Riddle, and to a very limited extent on the South Umpqua, but would have no measurable value towards reducing damages on Lookingglass, Deer Creek, or Calapooya Creek. This widespread distribution of damages along the main River and its tributaries will make it difficult to find economically justified storage.

Under present national practices for flood control justification, the basic economic concept is that the benefits gained must exceed the costs of the development required to achieve the desired flood control. The damages prevented by the flood control development facilities must exceed over the life of the project the cost of amortization, interest on the money borrowed for construction, the depreciation of the structure, and any other costs appertaining thereto. Preliminary indications are that it will be impossible to justify economically the development of major storage anywhere in the Umpqua system for flood control purposes alone. It will be necessary, therefore, to develop facilities for multiple-purpose uses so that all economic benefits that might accrue to a water resource development project can be combined. Frequently, one of the largest economic values of water resource development is the production of hydroelectric power, but the potential for economic justification assistance from this source is limited on the South Umpqua system, due to the character of the stream patterns of this Basin. Some power benefits may accrue at the Tiller location but benefits other than flood control and power will have to be available at this location to make a project feasible.

The final information regarding the economic feasibility of proposed flood control developments in this system will not be available until the Corps of Engineers has completed its flood investigation sometime in late 1959.

The financial problem of the development of flood protective works in the Umpqua Basin centers around the early procurement of the funds necessary for the construction of flood control facilities. At the present time, the funds for water resource development facilities must come from either the local governmental units, private enterprise, or federal agencies. There are no funds available nor any methods of obtaining funds for the development of water resource projects, either flood control or others, through the medium of the state government. To date, the financial resources of local governments are very restricted in comparison to the large expenditures required for major control of the floods of the rivers of Western Oregon, and the prospect of major development through county, municipal, or other local government is highly unlikely. In the case of private enterprise, such flood control benefits as do derive from water resource development are incidental to some other phase of water resource use and control and cannot be considered a major possibility in the solution of the flood control problems of the Umpqua River Basin.

Finances necessary to develop the flood control required for the Umpqua River system will, under existing and foreseeable circumstances, have to come from the federal government through one of the agencies delegated responsibilities in this connection. The primary responsibility for flood control works has been assigned to the Corps of Engineers by the Congress of the United States. The Corps also includes benefits from navigation, power, irrigation, and pollution abatement where they are available. Flood control responsibilities have been also assigned to the Soil Conservation Service of the Department of Agriculture, in connection with its long-range program of soil conservation and watershed management. The Bureau of Reclamation, Department of the Interior, also makes funds available for flood control purposes as one phase of its multi-purpose water resource development projects, although its basic responsibility lies in the field of reclamation.

To obtain funds for flood control works through any of the federal agencies, certain specific steps must be followed, and in the final analysis, all agencies are required to set forth the economic practicality of a project by the methods outlined by the Bureau of the Budget. The Corps of Engineers is the organization most likely to develop the flood control aspects of a water resource use and control of the Umpqua River system, either through its own initiative or as an advisor to the Bureau of Reclamation in setting forth the economic benefits of the flood control feature of the various Bureau projects proposed. The presently outlined preliminary plans of the Bureau of Reclamation in the Umpqua River Basin do not offer any major potential for flood alleviation in the most critically effected areas of this river system.

It appears that any major physical solution to the flood control problem cannot be anticipated within the immediate future.

CONFLICTS

Conflicts do exist in the Umpqua River system between various beneficial uses of water and between beneficial uses and control of the resource. In practically every section of the Basin, exclusive of the main stem and the North Umpqua River, data collected by the Board indicates conclusively that there is conflict between consumptive uses of the resource. This is in large part due to the fact that summer season flows are not large enough to satisfy all consumptive demands. Even though all consumptive rights or uses may not be exercised simultaneously, certainly conflict will exist in critical periods in an area where the legal right to consume water exceeds the natural capacity of the stream. There is not sufficient water in main sections of the streams of the Umpqua system during the periods of low summer flow to satisfy quantitatively the demands for domestic, municipal, irrigation and industrial uses which are the primary consumptive uses of the resource.

If full, or even a high percentage of the consumptive requirements of the system are utilized under normal low flow conditions, the effect on the nonconsumptive uses of the resource would be severe. Depletion of the streams by such consumptive uses would result in a streamflow far below the value required to maintain adequate recreation facilities, water for fish life uses, and water for the satisfaction of pollution abatement requirements.

In addition to the consumptive versus nonconsumptive problem, a specific area of conflict exists in the Umpqua Basin between nonconsumptive uses of water. The problems are: (1) the conflict between the anadromous fisheries resource and the nonconsumptive use of water for power. Actually, the problem here is not a conflict of use as much as it is a conflict due to the physical barriers to fish passage created by the construction of dams or diversion structures for hydroelectric power developments. The problems that exist involve the passage of both upstream and downstream migrants. Although it cannot be said that all interests are fully satisfied, the passage of upstream migrants past structures of relatively low height with small fluctuations in forebay levels have at least been accepted. Considerable controversy exists, however, with regard to structures whose forebay levels vary substantially in elevation. The major source of controversy is still the problem of passage of downstream migrants. Several devices or techniques to fulfill this requirement are now being investigated, particularly the so-called skimmer device being tested at the Pelton project on the

Deschutes River and at Brownlee on the Snake River, plus investigations of electrical barriers which are proposed to divert the downstream migrants into passageways which would take them around a particular facility. These devices or methods are in the investigation or development stages. Although claims have been made as to their effectiveness, full evaluation cannot be made until they have been put into full operation. The locations of conflict between hydroelectric developments, which are essentially nonconsumptive, and the fisheries resource lie along the main stem of the Umpqua and the North Umpqua. Of the remaining hydroelectric potential in the Umpqua River system, approximately 80 percent lies along the main stem and the North Umpqua.

It should be noted that the construction of any water resource facility involving an impoundment structure or barrier across the stream constitutes a physical impediment to the passage of anadromous fish and must be provided with fish passage facilities where it is determined that the resource must be conserved.

The construction of major flood control storage facilities within the Umpqua system would provide exactly the same problems as hydroelectric development. It should be recognized, however, that there are potentials for planning and design where the interests of the fisheries resource and the development of impoundment structures might be compatible. Any control feature of a water resource development involving structures across the paths of anadromous fish runs would constitute a problem. On the other hand, the construction of control facilities should not be a major problem with regard to consumptive uses of water because any control that can be affected in the Umpqua Basin could improve the status of water with regard to quantity in any reach of the Basin downstream from that particular control device. Control structures will have little effect on upstream consumptive uses that exist at present. Certain dislocations may occur in reservoir areas because of inundation or the development of control facilities, but these will be localized in nature.

SUMMARY OF PROBLEMS

The problems of the Umpqua River, as reviewed by the Board, involve no unknown concepts. In essence, the needs are for the conservation, augmentation, and control of the water resources of the Umpqua River system to provide for existing and contemplated needs and uses of water for all purposes, consumptive and nonconsumptive, and for flood control. The *most important need in the Umpqua Basin's program is the capture and control of the waste waters of winter runoff and the augmentation of summer supplies by the release and application of such captured waters to beneficial use during the periods of low water resource availability. A complementary item to the capture of winter runoffs for beneficial uses is the control of peak flows which create a widespread flood hazard.*

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CHAPTER IV

CRITERIA - SUB-BASIN ANALYSIS

For convenience and clarity, the Umpqua River Basin was divided into sub-basins for study and evaluation. This is desirable because of the wide variation in the character and problems of the streams of this system. Differences can be illustrated by the comparison of the hydrologic characteristics of the three main divisions of the Umpqua system, the main stem, the North Umpqua, and the South Umpqua. These streams experience their heaviest runoff during periods of heavy precipitation and their lightest runoff during the dry months, a characteristic applicable to all streams west of the Cascade Mountains. The major difference between the North and the South Umpqua lies in the extent of the variations from the mean flow of the maximum and minimum values for each stream. The flow patterns of these two tributaries are of major influence on main stem hydrology.

The North Umpqua sub-basin has approximately 20 percent of its land area lying above an elevation of 5,000 feet. This portion of the sub-basin has a heavy snowfall and the snowpack resulting constitutes a storage reservoir for the water resource. In addition, the geological structures of large areas of the Upper North Umpqua watershed are highly porous and also act as a natural reservoir for the storage of water. The character of the flow pattern of the North Umpqua River is affected by these two natural regulatory features. The South Umpqua River, on the other hand, with a small portion of its basin, about three percent, above 5,000 feet, and its limited porous geological structures, has little natural storage. It is a "flashy" stream whose runoff follows the immediate pattern of precipitation quite closely.

The main stem of the Umpqua River reflects, on a modified basis, the characteristics of the dominant hydrologic features of the North and South Umpqua, its two major tributaries.

The main stem is benefited during the summer months by the sustained flow patterns of the North Umpqua. The major portion of flow during summer months of critical supply years originates in the North Umpqua sub-basin. There are five years for which records are available covering the Elkton (main stem), Winchester (North Umpqua), and Brockway (South Umpqua) stream gages. For the average of the two low flow months of these years, the mean flow of the North Umpqua was 87 percent of the mean flow at Elkton while the South Umpqua was 10.5 percent. During the most critical month of these five years, the matching values were 95 percent and 8 percent. The unresolved variance from a total of 100 percent reflects use and/or inflow in the intervening section of the river.

While both branches contribute to flood peaks at Elkton, the percentage contribution is materially different. During the first peak of the 1955 flood, the North Umpqua peak flow was 42.5 percent of the peak flow at Elkton and the South Umpqua peak flow was 41.5 percent. For the second peak, the values were 29.2 percent and 47.6 percent, respectively. The peak values of flow for the North and South Umpqua stations are not necessarily directly additive in contribution to Elkton maximum values because of varying travel times for the respective peaks. The travel times are close enough to make the indicated figures serve as good order of magnitude values.

The natural hydrographic divisions of the Basin dictated the division into three segments utilized in the analysis.

The specific sub-basin evaluations of Chapter V set forth the characteristics of the individual streams within the limits of available information.

The analysis of present needs for the water resource is based on a study of existing water rights within the various sub-basins. An analysis based on known water rights does not present the full picture in all cases. It is known that there are numerous cases of water use for which legal rights have not yet been determined. Funds and personnel limitations did not allow a physical field survey of existing needs.

For purposes of the sub-basin evaluations, the following values were used for determining the percentage of diverted water consumptively used by the various beneficial uses: domestic, 0.75; municipal, 0.50; irrigation, 0.66; power, 0.0; industrial, 0.5; mining, 0.0; recreation, 0.0; wildlife, negligible and assumed, 0.0; fish life, 0.0; and pollution abatement, 0.0. These factors are utilized on a reconnaissance basis. It is recognized that these factors are approximations, but they probably represent a conservative approach.

Data available was insufficient to adequately determine the future requirements for all beneficial uses of water. Fortunately, the studies of the Bureau of Reclamation made it possible to estimate with some degree of accuracy the total potential for the major consumptive use of water, which is irrigation. The following reconnaissance standards were adopted as a means of estimating future needs and are utilized throughout the subbasin presentations, unless otherwise indicated:

(1) Future domestic needs - this value will be determined by taking the known water rights in a given area for domestic use and multiplying the total of these rights by the ratio of nonirrigated, but irrigable, lands in the Basin divided by twice the present irrigated land. This is based on the assumption that the expansion of irrigation within the Basin will allow the support of greater concentration of rural family units. Since the overall existing and contemplated requirements for domestic use are small in relation to the total requirements, use attributed to this factor will be minor;

(2) Future municipal use - projections for this use will be based on the present municipal water rights times a factor of 2.8 (which represents the projected population of Douglas County, 1975, divided by the 1950 population) times a factor of 1.4 (this represents the estimated per capita increase in the use of water between the present and 1975);

(3) Projected irrigation requirements are based on the report of the Bureau of Reclamation for the Umpqua River Basin published in 1956. Consumptive values are based on the use of 2½ acre-feet of water per year per acre of land irrigated. Diversion values for the computation of instantaneous flows are based on a value of 1/80 cubic feet per second per acre of land irrigated. In order to avoid the ridiculously high flows that would be necessary in some stream channels if all diversions were exercised simultaneously, a diversity factor of 2.0 is utilized; 1/

1/ Diversity factor - the ratio of total diversion rights to the sum of rights to divert that are exercised simultaneously under the maximum diversion condition.

(4) Projected power availability - potentials are based on the report of the Federal Power Commission published in 1957, and although there are areas in the Basin where additional federal power site withdrawals exist, these are ignored if the sites are not specifically listed in the FPC 1957 report;

(5) Projected industrial needs - where data is lacking for specific analysis in a basin, existing rights to use water for industrial purposes will be multiplied by the factor 2. 8. This is based on the assumption that light industrial growth will parallel municipal growth and calculation of these two needs should be consistent;

(6) Projected mining needs - values for future uses for this purpose will be individually set forth where there is justification. There will be no attempt to project existing mining on the basis of any factor;

(7) Recreation, wildlife, fish life uses - for the purposes of this report, it has been assumed that the values for "Desirable Minimum Stream Flows for Fishery Management" presented by the State Game Commission at the October 15 & 16, 1956, hearing of the Board in Roseburg, will also provide adequate water for recreation and wildlife. The adoption of this assumption is necessitated by the fact that no specific flow values were submitted to the Board as being necessary or desirable for these purposes.

(8) Projected needs for pollution abatement - for the purpose of this report, normal pollution loads are assumed to have a population equivalent to 2. 5 times the actual urban population of the sub-basin. Major industrial loads will be treated individually where identifiable. Each population unit is assumed to have a demand loading of 0. 2 pounds of 5-day biochemical oxygen demand per day. It is further assumed that overall reduction of 5-day B. O. D. by treatment should be 85 percent of the total pollution loading. Required flows are based on the need for the 1 cfs of flow per 30 pounds of 5-day B. O. D. discharge to the stream daily.

It should be further pointed out that these total water needs are rough values designed to determine the general magnitude of potential needs.

CHAPTER V

SUB-BASIN INVENTORIES

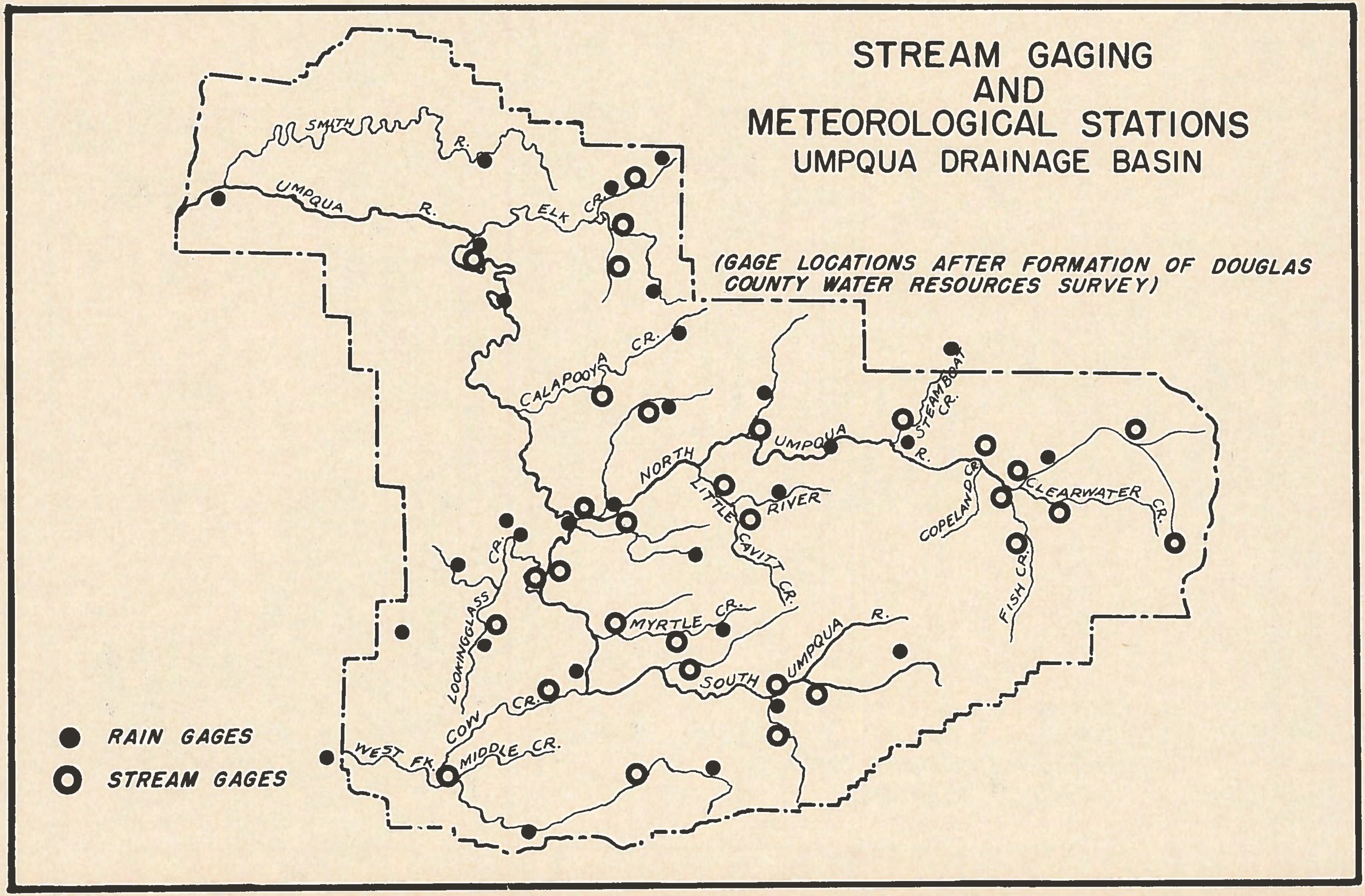

STREAM GAGING
AND
METEOROLOGICAL STATIONS
UMPQUA DRAINAGE BASIN
(GAGE LOCATIONS AFTER FORMATION OF DOUGLAS COUNTY WATER RESOURCES SURVEY)
SMITH R.
UMPQUA R.
ELK CR.
CALAPOOYA CR.
STEAMBOAT CR.
UMPQUA R.
NORTH
LITTLE RIVER
CAVITT CR.
COPELAND CR.
CLEARWATER CR.
FISH CR.
MYRTLE CR.
LOOKINGGLASS CR.
SOUTH UMPQUA R.
COW CR.
WEST FK.
MIDDLE CR.
RAIN GAGES
STREAM GAGES

FIGURE 13

ISOHYETAL MAP
NORMAL ANNUAL PRECIPITATION

MAP BY CORPS OF ENGINEERS PORTLAND, OREGON DISTRICT

DOUGLAS COUNTY OREGON

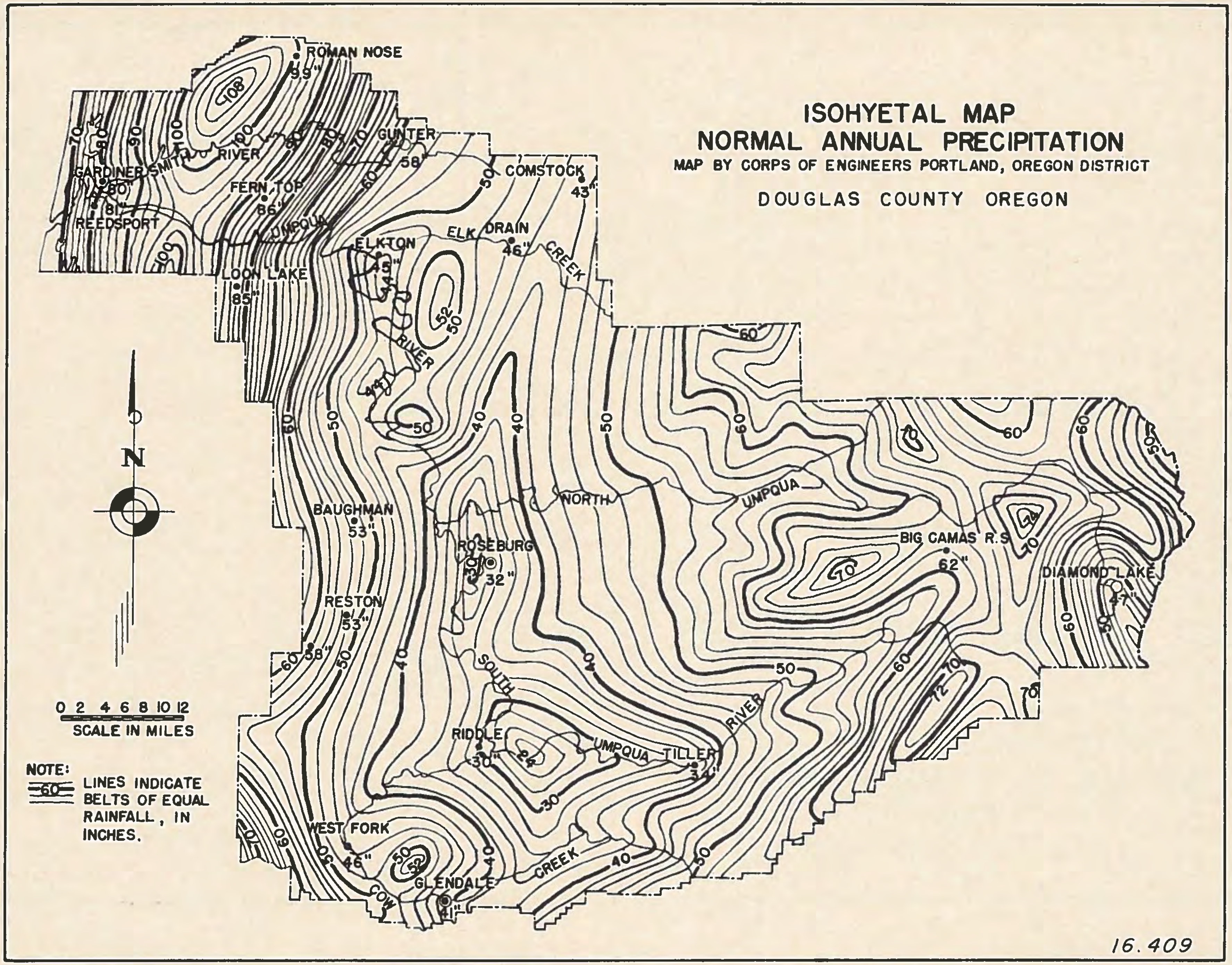


FIGURE 14

TABLE 10

UMPQUA SUB-BASIN AREAS

Sub-basin	Drainage Area Sq. Mi.	Total Sq. Mi.
LOWER UMPQUA RIVER		
Smith River	347	
Mill Creek	135	
Elk Creek	290	
Calapooya Creek	247	
Miscellaneous Streams	471	
		1,490
NORTH UMPQUA RIVER		
Little River	206	
Rock Creek	93	
Steamboat Creek	220	
Copeland Creek	34	
Fish Creek	82	
Clearwater River	70	
Miscellaneous Streams	603	
		1,308
SOUTH UMPQUA RIVER		
Deer Creek	63	
Roberts Creek	24	
Lookingglass Creek	160	
Myrtle Creek	117	
Cow Creek	397	
West Fork Cow Creek	87	
Canyon Creek	37	
Elk Creek	80	
Jackson Creek	155	
Miscellaneous Streams	642	
		1,762
GRAND TOTAL UMPQUA RIVER BASIN		4,560

TABLE 11

INDEX OF SURFACE WATER RECORDS TO SEPTEMBER 30, 1955

Gaging Station	Drainage Area Sq. Mi.	Period of Time
SOUTH UMPQUA RIVER at Tiller	449	1910-11;1939-
Elk Creek near Drew	54	1954-
Cow Creek near Azalea	78	1926-
Cow Creek at Glendale	--	1926-32.
W. Fork Cow Cr. near Glendale	84	1955-
Cow Creek near Riddle	456	1954-
Cow Creek at Riddle	485	1911-12;1926-32.
N. Myrtle Cr. near Myrtle Creek	54	1955-
Lookingglass Creek at Brockway	158	1955-
South Umpqua River near Brockway	1,670	1905-12;1923-26;1942-
NORTH UMPQUA RIVER:		
Lake Creek at Diamond Lake	55	1922-25;1926-53.
Lemolo Res. near Toketee Falls	170	1954-
North Umpqua River below Lemolo Reservoir near Toketee Falls	170	1927-
North Umpqua R. above Clearwater R.	258	1948-54.
Clearwater River above Trap Creek, near Toketee Falls	42	1927-
Clearwater River at mouth, near Toketee Falls	77	1947-54.
North Umpqua River at (near) Toketee Falls (Hoaglin)	339	1908-9;1914-17;1924-48.
Fish Creek at Big Camas ranger station, near Toketee Falls	69	1947-
North Umpqua River above Copeland Creek, near Toketee Falls	475	1949-
North Umpqua River near Hoaglin	856	1911-12;1914-16.
North Umpqua River above Rock Cr., near Glide	886	1924-45.
Little River at Peel	177	1954-
North Umpqua River near Glide	1,210	1915-20;1921-22;1927-38.
North Umpqua River near Oakcreek	1,275	1905-8;1913-15.
North Umpqua River at Winchester	1,344	1908-13;1923-29;1954-
Calapooya Creek near Sutherlin	87	1912-13;1922.
Luse Canal near Sutherlin	--	1912-13
UMPQUA RIVER near Elkton	3,683	1905-
Elk Creek near Yoncalla	3,738	1950.
Elk Creek near Drain	104	1955-
Elk Creek at Drain	168	1950.
Mill Creek near Ash	81	1907-12;1915-17.

Note: Extracted from U.S.G.S. Circ. 394. (Revised 1957)

TABLE 12

COMPARISON
ELKTON, WINCHESTER AND BROCKWAY 1/
YIELDS

Water Year	Gaging Station	Yield in Acre-feet	Percent of Basin Yield
1909-10	Elkton	5,530,000	
	Brockway	1,930,000	34.9
	Winchester	2,860,000	51.7
	Balance	740,000	13.4
1910-11	Elkton	4,640,000	
	Brockway	1,490,000	32.1
	Winchester	2,270,000	48.9
	Balance	880,000	19.0
1923-24	Elkton	2,870,000	
	Brockway	761,000	26.5
	Winchester	1,570,000	54.7
	Balance	539,000	18.8
1924-25	Elkton	6,960,000	
	Brockway	2,190,000	31.5
	Winchester	3,030,000	43.5
	Balance	1,740,000	25.0
1925-26	Elkton	2,920,000	
	Brockway	897,000	30.7
	Winchester	1,440,000	49.3
	Balance	583,000	20.0

1/ Drainage areas below Winchester gage on North Umpqua and below Brockway gage on South Umpqua.

TABLE 13

MAXIMUM-MINIMUM DISCHARGES

Stream	Gaging Station	Location Sec. Twp. R.	Maximum cfs	Minimum cfs	Years of Record
Mill Creek	Ash	2 23S 10W	10,000 (11-23-09)	1.5 (9-13-10)	7
Umpqua River	Elkton	8 23S 7W	218,000 (12-22-55)	640 (7-18-26)	50
North Umpqua R.	Winchester	25 26S 6W	100,000 (11-23-09)	616 (8-17-26)	13
Sutherlin Creek	Sutherlin	16 25S 5W	1,250 (12-26-55)	---	1
North Umpqua R.	Glide	13 26S 4W	90,000 (12-22-55)	552 (8-27-31)	17
Little River	Peel	8 27S 3W	15,800 (12-22-55)	---	2
Cavitt Creek	Peel	14 27S 3W	4,910 (12-26-55)	---	1
Rock Creek	Glide	1 26S 3W	12,300 (12-22-55)	---	1
North Umpqua R.	Rock Creek	12 26S 3W	68,000 (12-22-55)	521 (10-16-31)	21
Steamboat Creek	Glide	31 25S 1E	26,900 (12-22-55)	---	1
North Umpqua R.	Copeland	23 26S 2E	20,600 (12-22-55)	684 (11-23-52)	8
Fish Creek	Big Camas	10 27S 3E	7,650 (12-22-55)	36 (11-27-52)	8
Clearwater R.	Mouth	36 26S 3E	1,380 (1-18-53)	192 (11-19-52)	7
Clearwater R.	Trap Creek	1 27S 4E	487 (10-29-50)	91 (11-4-32)	30
North Umpqua R.	Toketee Falls	35 26S 3E	5,080 (12-31-42)	475 (12-12-31)	28
North Umpqua R.	Clearwater	25 26S 3E	3,680 (1-18-53)	470 (11-22-49)	6
North Umpqua R.	Lemolo	13 26S 5E	1,190 (6-9-33)	206 (12-9-31)	28
Lake Creek	Diamond Lake	30 27S 6E	336 (1-1-43)	0 (8-25-31)	30

TABLE 13

MAXIMUM-MINIMUM DISCHARGES (continued)

Stream	Gaging Station	Location Sec. Twp. R.	Maximum cfs	Minimum cfs	Years of Record
Deer Creek	Roseburg	16 27S 5W	6,800 (12-26-55)	---	1
South Umpqua R.	Brockway	15 28S 6W	102,000 (9-29-50)	36 (8-12-26)	23
Lookingglass Cr.	Brockway	20 28S 6W	34,000 (12-26-55)	---	1
N. Myrtle Cr.	Myrtle Creek	23 29S 5W	2,950 (12-26-55)	---	1
S. Myrtle Cr.	Myrtle Creek	20 29S 4W	2,100 (12-26-55)	---	1
Cow Creek	Riddle	24 30S 6W	38,300 (12-26-55)	7 (8-11-26)	8
W. Fork Cow Cr.	Glendale	11 32S 8W	10,600 (12-21-55)	---	1
Cow Creek	Azalea	4 32S 4W	5,920 (10-29-50)	4 (9-26-31)	31
Days Creek	Days Creek	10 30S 4W	2,500 (12-21-55)	---	1
Elk Creek	Drew	14 31S 2W	7,500 (12-21-55)	0.9 (9-6-55)	1
South Umpqua R.	Tiller	33 30S 2W	37,400 (10-29-50)	20 (9-3-11)	17
Jackson Creek	Tiller	21 30S 1W	10,600 (12-22-55)	---	1

Note: ( ) indicates year when maximum or minimum occurred.

TABLE 14

INDEX OF PRECIPITATION RECORDS

Stream	Station Name	Location Sec.	Twp.	R.	Years of Record
Smith River	Gunter	36	20S	7W	* 1940-
Elk Creek	Elkhead	28	23S	4W	1955-
	Curtin	20	21S	4W	1955-
	Drain	4	22S	5W	* 1902-
Main Umpqua R.	Elkton 4S	32	22S	7W	1950-
	Kellogg	20	23S	7W	1956-
	Reedsport	3	22S	12W	* 1937-
Calapooya Creek	Sutherlin 2ENE	15	25S	5W	1957-
	Sutherlin Camp	21	24S	3W	1955-
North Umpqua R.	Toketee Falls	32	26S	3E	1953-
	Upper Steamboat	20	24S	2E	1956-
	Steamboat	32	25½S	1E	1955-
	Little River	3	27S	2W	1955-
	Idleyld-Rock Cr.	36	25S	3W	1955-
	Winchester	25	26S	6W	1950-
Deer Creek	Dixonville 3SE	5	28S	4W	1958-
South Umpqua R.	Tiller-Coyote	34	29S	1E	1955-
	Tiller	33	30S	2W	* 1936-
	Roseburg	12	27S	6W	1878-
	Riddle 2NNE	12	30S	6W	* 1899-
Lookingglass Cr.	Upper Olallie	5	30S	7W	1956-
	Reston	14	28S	8W	* 1909-
	Flournoy Valley	29	27S	7W	1955-
Myrtle Creek	South Myrtle	16	29S	3W	1955-
Cow Creek	Devils Flat	3	32S	3W	1955-
	Glendale	28	32S	6W	* 1904-
	Marial-West Fork	11	32S	10W	1955-

Note: * Incomplete for some years of record.

TABLE 15

SUMMARY OF WATER RIGHTS IN CUBIC FEET PER SECOND

AS OF JANUARY 1, 1958

Sub-basin	Consumptive Rights							Nonconsumptive Rights			Totals
	Dom.	Camp	Stock	Irrig.	Pond	Munic.	Indust.	Power	Mining	Fish	
LOWER UMPQUA R.											
Smith R.	0.32			0.71				300.00			301.03
Mill Cr.	0.23			1.54		15.00					16.77
Elk Cr.	0.84		0.01	24.76	3.75	5.50	2.81	2.62			40.29
Calapooya Cr.	0.14	0.76	0.05	25.83	2.00	5.00					33.78
Misc. Streams	3.70	0.08	0.02	31.73	2.28	1.00	49.17	0.18			88.16
TOTAL	5.23	0.84	0.08	84.57	8.03	26.50	51.98	302.80			480.03
	Total Consumptive 177.23							Total Nonconsumptive 302.80			
NORTH UMPQUA R.											
Misc. Streams	2.30	1.25	0.03	29.88	6.38	112.00	46.46	3575.65	0.15	61.08	3835.18
	Total Consumptive 198.30							Total Nonconsumptive 3636.88			
SOUTH UMPQUA R.											
Deer Cr.	0.23			4.85	5.96			10.18			21.22
Roberts Cr.	0.04			0.39		0.55					0.98
Lookingglass Cr.	0.11			16.06	0.40			5.17	23.00		44.74
Myrtle Cr.	0.75		0.02	19.80	2.81	1.00	0.67	10.00	14.57		49.62
Cow Cr.	2.94	0.02	0.17	54.67	10.15	4.52	33.14	8.25	262.13	0.17	376.16
Misc. Streams	7.17	—	0.02	77.75	11.09	8.12	1.53	0.07	—	—	105.75
TOTAL	11.24	0.02	0.21	173.52	30.41	14.19	35.34	33.67	299.70	0.17	598.47
	Total Consumptive 264.93							Total Nonconsumptive 333.54			

TABLE 16

FEDERALLY OWNED LAND BY OWNER CLASSIFICATION

Sub-basin	National Forest Land Acres	O & C Acres	Public Domain Acres	O & C in Controversy Acres	Coos Bay Wagon Rd. Acres	Total Sq. Mi.	Percent of Sub-basin
LOWER UMPQUA RIVER							
Smith River	65,920	20,960	1,280			137	39.0
Mill Creek	7,360					12	9.0
Elk Creek		39,360	828			63	22.0
Calapooya Creek		10,880	320			17	7.0
Misc. Streams	18,880	40,960	3,840		128	100	21.0
NORTH UMPQUA RIVER							
Little River	65,280	12,480	960	22,400		158	77.0
Rock Creek	2,080	17,920	640			32	34.0
Steamboat Creek	107,520	5,120		17,280		203	93.0
Copeland Creek	22,400					34	100.0
Fish Creek	52,200					82	100.0
Clearwater River	45,100					70	100.0
Misc. Streams	219,520	18,560	1,280	8,600		389	64.0
SOUTH UMPQUA RIVER							
Deer Creek		2,880	320			5	8.0
Roberts Creek		448	64			1	0.4
Lookingglass Creek		18,880	2,880		6,560	44	28.0
Myrtle Creek	11,520	18,240	1,280			49	42.0
Cow Creek	52,480	32,960	2,688	640		.138	35.0
W. Fork Cow Creek	4,092	768				8	9.0
Canyon Creek	11,520	4,480	320			30	80.0
Elk Creek	34,240	6,400		7,680		76	94.0
Jackson Creek	83,840	4,160	256	10,880		155	100.0
Misc. Streams	145,280	52,160	4,672	29,120		361	56.0
TOTAL UMPQUA BASIN						2,164	47.0

SOUTH UMPQUA SUB-BASIN

GENERAL DATA

Location

The South Umpqua sub-basin comprises the entire southern section of the Umpqua River Basin and Douglas County. It includes all the lands within the Basin south of the sixth standard parallel, plus the drainage area of Deer Creek, and the lower 15 miles of the South Umpqua River which cover ranges 4W, 5W, and 6W of township 27S. Practically the entire drainage area of the South Umpqua falls within the political boundaries of Douglas County. The major tributaries of the South Umpqua River are Myrtle Creek (North and South), Cow Creek and its tributary (West Fork), Elk Creek, Jackson Creek, and that area above Jackson Creek known as the upper South Umpqua.

Size

The South Umpqua River drains an area of approximately 1762 square miles. Its length is approximately 114 miles from its confluence with the North Umpqua to the head of Falcon Creek on the summit between the South Umpqua and the Rogue River. Its principle tributary, Cow Creek, is approximately 69 miles long. Cow Creek has a drainage area of 397 square miles.

Topographic Characteristics

The lower section of the South Umpqua (below its confluence with Cow Creek) contains the major portion of the developable lands of the South Umpqua Basin. In the Melrose Valley, near the confluence of the North and South Umpqua Rivers, lie the most extensive and fertile agricultural lands in the Umpqua Basin. The width of the valley in this general area approaches three miles. Other areas suitable for cultivation are the Edenbower area immediately below Roseburg, the area near Winston, and limited lands downstream from the mouth of Cow Creek and the South Umpqua. Shoestring valleys suitable to very limited development exist intermittently along other portions of the lower South Umpqua and its tributaries, Deer Creek and Myrtle Creek. A relatively large area with potential for irrigation lies in the Lookingglass Valley southeast of Roseburg. With the general exception of the areas *indicated, the South Umpqua sub-basin is rugged and suitable primarily to the production of timber and limited grazing of livestock.*

Elevations vary from 460 feet mean sea level at the mouth of the South Umpqua to 8,000 feet msl in the upper reaches of the South Umpqua at the Umpqua-Rogue Divide. Less than three percent of the sub-basin lies at elevations above 5,000 feet msl. The entire watershed of the South Umpqua above Myrtle Creek is covered with large stands of timber.

Geologic Characteristics

The South Umpqua sub-basin has within its confines three physiographic provinces. The section downstream of Dillard falls within the Coast Range whose rock formations are shales, conglomerates, and sandstones. Above Dillard and including all of Cow Creek and the South Umpqua to Tiller is an area identified as the Klamath-Siskiyou Range. The formations of this province are granite, metamorphized sediments and volcanics of the cretaceous and earlier periods. The balance of the watershed falls in the Western Cascade province, with the exception of the headwaters which originate in the High Cascades.

Meteorologic & Hydrologic Characteristics

Generally speaking, temperatures within the sub-basin are mild, the only exception being the headwaters areas in the High Cascades. Because of the relatively mild temperatures partially due to low elevations, the major portion of precipitation in this sub-basin occurs in the form of rain. Snowpacks are limited and runoff generally follows the rainfall patterns closely. Since the major portion of the drainage area falls within geological provinces that do not contain the porous formations characteristic of the Upper North Umpqua, ground water storage for natural stream regulation is practically nonexistent. Precipitation within the drainage area ranges from an average of about 30 inches per year in the vicinity of Roseburg and the Lookingglass Valley to as high as 90 inches in the headwaters of the West Fork of Cow Creek, and 70 inches in the headwaters of Jackson Creek. Specific precipitation data for the sub-basin is extremely limited. Records have been kept at Roseburg since 1878, and one station was operated for a short period of time at Reston (1909-1917). At Riddle, near the confluence of the South Umpqua and Cow Creek, a weather station has been in operation since 1899. These records show the general character of precipitation patterns for the western portion of the sub-basin (at the lower levels), but are not sufficient to provide reliable information for the analysis of runoff patterns of the major portion of the drainage area.

Stream gaging records for the South Umpqua River date back to 1905 when a gage was established near Brockway. Unfortunately, the record of this gage, which is the measure of yield for the entire sub-basin, is intermittent in character. Gaging records are available for the upper section of Cow Creek above Azalea dating back to 1926, but these cover a small portion of the total drainage area of Cow Creek and do not describe the status of the lower section. At Tiller, on the South Umpqua, records are somewhat limited, but allow an approximation of distribution within the sub-basin. Records for this area do not compare with those available for the North Umpqua as a base for establishing the amount and distribution of resource.

Land Ownership

The west boundary of the Umpqua National Forest intersects the South Umpqua at its confluence with Jackson Creek, and the entire drainage area of the South Umpqua above this point and Jackson Creek falls within the limits of the Umpqua National Forest. Below this point (downstream) substantial areas of land are held by the Bureau of Land Management. In general, BLM lands are held in a checkerboard pattern and cannot be given a precise definition. Land ownership can be summarized by stating that 49 percent of all the lands in South Umpqua watershed are owned or managed by the Federal Government.

Federal power withdrawal sites are located immediately above Roseburg on the main stem of the South Umpqua, Roberts Creek, at the confluence of the South Umpqua and Myrtle Creek, three sites on North and South Myrtle Creek, five sites on Cow Creek, one site on Canyon Creek, four sites on the South Umpqua between Canyonville and Stout Creek, and a blanket from Hatchet Creek to a point one mile above Boulder Creek on the South Umpqua, plus an isolated location on Elk Creek just downstream of Drew.

Transportation Facilities

The lower sections of the South Umpqua and Cow Creek are served by the Southern Pacific Railroad. The section from Roseburg through Dillard, Myrtle Creek, Canyonville, and Azalea is served by State Highway connecting with U. S. 99 at Canyonville. The Lookingglass Valley and lower Cow

Creek up to Crawford Creek are served by county roads and miscellaneous logging access roads which reach into the east slope of the Coast Range. The area downstream from Roseburg is served by the Reedsport-Roseburg highway (State 225) and a network of county roads.

Transportation facilities in the watershed above Tiller are restricted to a state road paralleling the South Umpqua River and various Forest Service and miscellaneous logging access roads in the upper watershed.

Economy

The present economy of this section of the sub-basin has three facets: (1) timber, (2) limited agricultural and livestock development, and (3) industrial development which is primarily mining and processing based on the Hanna nickel plant at Riddle. The communities of Azalea, Glendale, Canyonville, Days Creek and Tiller depend primarily upon timber as the basis for their existence, with some support from agriculture. Riddle and Myrtle Creek depend on timber operations and the existence of the nickel processing operations at Riddle for their economy. Roseburg itself is the center for many primary timber processing operations, as well as the basic wholesale and retail distribution center for the entire Umpqua River Basin. Its economy is stabilized by the agricultural developments of the Melrose and Garden Valley areas. These sections provide a wide diversity of crops, fruits, nuts, berries, alfalfa and many row-type crops.

Population

Most of the population of Douglas County is concentrated in the vicinity of Roseburg.

AMOUNT AND DISTRIBUTION OF RESOURCE

Precipitation

As indicated previously, precipitation information is limited and has not been utilized to any material degree in the analysis of the amount and distribution of the water resource. It has been used where possible as a check in conjunction with the stream gaging information.

Stream Gaging

The record of the gaging station at Brockway on the South Umpqua River reflects the conditions of yield and instantaneous flow that have existed in the past for this drainage area. Annual yields from the watershed have been as low as 0.8 million acre-feet and as high as 3 million acre-feet. Instantaneous flow values range from peak discharges of 100,000 cubic feet per second for short periods during floods to as low as 36 cfs in late summer (August 12-13, 1926). Flows recorded at the Brockway gage in years of normal runoff are frequently below 300 cfs for 3 or 4 months of the year.

Resource Distribution

The South Umpqua sub-basin, which represents 46 percent of the drainage area above the Elkton gage, contributes from 23 to 47 percent of the yield. The South Umpqua River above Tiller, which represents 12 percent of the entire Umpqua Basin, contributes from 11 to 16 percent of the total Umpqua Basin runoff and Cow Creek at Azalea, about 2 percent of the total area, very seldom contributes more than 1.50 to 1.75 percent of the total runoff.

The relative contributions made by West Fork Cow Creek have never been measured, yet this stream with headwaters in the Coast Range has extremely high flows during certain periods of the year. The contribution of North and South Myrtle Creek, which represents a drainage area of 117 square miles is larger than West Fork, has just recently been gaged, and its contribution to yield and flow patterns is not established. The same situation exists for Elk, Lookingglass, Deer, and Olalla Creeks. Until sufficient records are obtained through Douglas County's program, a full hydrologic analysis is of restricted value.

AMOUNT AND DISTRIBUTION OF RESOURCE UNDER APPROPRIATION

The pattern of distribution of water rights within the South Umpqua sub-basin is extremely complex. One simplified method of illustrating the effects of both consumptive and nonconsumptive water rights on a specific section of the stream is by means of the depletion diagram Figure 20. By means of such a diagram, the depletion potential above a specific point can be analyzed. For example, Figure 20 indicates that the total diversion potential of the South Umpqua River is more than 570 cfs. The chart also indicates that approximately 240 cfs of this total is water which can be taken from the stream for consumptive purposes. To supplement a depletion diagram for the South Umpqua River, similar diagrams for each of its tributaries are required. The Figure shows that 48 percent of the consumptive rights to use water in the South Umpqua sub-basin occurs downstream of the confluence of the South Umpqua River and Cow Creek. The depletion potential on the South Umpqua River above mile 42, at the confluence of Cow Creek and the South Umpqua River, is about 31 cfs. This depletion potential is nearly equal to the observed stream flow at the Brockway gage (approximately mile 22) for the critical flow of record (36 cfs). The diagram also indicates the distribution of water rights by the magnitude of the ordinate represented by each incoming tributary. For example, Cow Creek which joins the South Umpqua River at mile 41, represents the largest tributary use of water for consumptive purposes. Diversions for consumptive use total approximately 88 cfs, or roughly one-third of the total diversion potential for consumptive use of water in the South Umpqua sub-basin. For an evaluation of the distribution of rights on Cow Creek itself, reference would be made to a specific depletion diagram for this stream. Figure 20 also indicates that most nonconsumptive diversion rights also occur on Cow Creek.

Total water rights, consumptive and nonconsumptive, for the South Umpqua sub-basin represent approximately thirteen percent of the total known legal rights to use water in the Basin. This would tend to indicate that the problem on the South Umpqua River was less critical than in other areas of the Basin. This is incorrect because the major proportion of the water rights legally established within the Umpqua Basin are for nonconsumptive purposes; nearly 82 percent are for the purpose of hydroelectric power generation. In analyzing the consumptive uses of water, the true status of the South Umpqua River becomes apparent. One-third of the consumptive rights to use water for the entire Umpqua system are located in the South Umpqua sub-basin. Better than 28 percent of the total consumptive rights within the Umpqua Basin are located on Cow Creek and the South Umpqua River and its tributaries below Canyonville.

EXTENT OF THE BOARD'S JURISDICTION

Many portions of the South Umpqua sub-basin have been appropriated above the capacity of the stream to deliver during periods of critically low flow. For this reason, the Board's jurisdiction is limited largely to flows that occur during the high runoff periods of December, January, February, and March. On the South Umpqua River above its confluence with Cow Creek, the Board has undefined jurisdiction. Major jurisdiction would be in the upper portion of the sub-basin. All the watershed above the confluence of the South Umpqua River and Jackson Creek lies within the Umpqua National Forest. To establish the extent of the Board's jurisdiction in any specific location would require a study of existing rights in relation to available resources. The status of the distribution of the resource has not been sufficiently established to make the necessary comparisons.

EXISTING AND FUTURE NEEDS FOR THE RESOURCE

Existing and future water needs for the South Umpqua sub-basin encompass both consumptive and nonconsumptive beneficial uses of water. Because the interrelationships between resource availability and the point of application to beneficial use are so complex in the South Umpqua watershed, the discussion following is directed to overall sub-basin analysis. Specifics are discussed where they can be identified.

There is a serious need for an improvement of water supplies during the critical flow months in order to satisfy both consumptive and nonconsumptive requirements of the present, as well as future. Water supplies are so undependable during summer months that the situation will act as a serious deterrent to expansion of beneficial use during the immediately foreseeable future. Total needs for full development would exceed, by a substantial degree, the amount of water available during the summer months in an average year. In fact, on a straight time-flow relationship, there is not sufficient water during periods of need to provide for the potential requirements of irrigation alone. When the water needs of industrial development, municipal requirements, and other consumptive beneficial uses are superimposed upon irrigation, fish life, and other major needs, the situation existing in the South Umpqua becomes critical.

On the basis of evidence available, it appears that the potential for conflict in the immediate future, and in terms of foreseeable needs, is far more critical than is generally supposed.

Domestic

The existing requirements for domestic use, as defined by rights of record, total approximately 11.24 cubic feet per second for the entire South Umpqua sub-basin. The largest domestic requirement is in the Cow Creek watershed with a total value of 3.00 cfs. Myrtle Creek follows with 1.00 cfs, Lookingglass Creek with 0.21 cfs, and Deer Creek with 0.23 cfs. The balance of the 11.24 cfs is made up of miscellaneous domestic requirements along the main stem and other tributaries.

It is difficult to estimate what future domestic requirements might be for a large portion of existing domestic rights in the South Umpqua are in areas which may ultimately be served by municipal water supplies. A maximum figure for ultimate domestic requirement is estimated at 25 cfs.

Municipal

Present municipal requirements in the South Umpqua sub-basin total 14 cfs. These rights do not reflect the demands of the City of Roseburg which receives its supply from the North Umpqua River. It is anticipated that there will be an immediate change in this value as some of the communities in the South Umpqua are considering making application for additional water supplies.

Utilizing the criteria outlined in Chapter IV, it is estimated that probable municipal requirements for 1975 will approach 55 cfs.

Irrigation

Present rights to divert water for irrigation purposes in the South Umpqua sub-basin total approximately 175 cfs. This is between 25 and 30 percent of the foreseeable potential.

Assuming that the presently-irrigated lands of the South Umpqua sub-basin are adequately irrigated, the future irrigation requirements for the area during the months of June, July, and August, would total approximately 70,000 acre-feet. Supplies, based on the average flow of all years of record for the same irrigation period, June, July, and August, approximate a yield of 42,000 acre-feet. Future potentials that can be identified are the Deer Creek drainage with a 10 cfs requirement in terms of diversion rights; Lookingglass Creek drainage, 118 cfs; Myrtle Creek drainage, 75 cfs; and Cow Creek drainage, 102 cfs. These values represent possible total rights as related to legal applications but should not be construed to be additive in terms of stream withdrawal or depletion potential.

Power Development

Rights of record for power development in the South Umpqua sub-basin total 34 cfs. These rights represent a composite of several individual developments which are not utilized for the sale of power to the public.

Expansion of the present type of power development in the South Umpqua sub-basin is not anticipated in the future. Power development may prove to be practical as a part of the comprehensive development of sites being investigated by the Corps of Engineers and the Bureau of Reclamation. Precise definition of the amounts of water involved will be dependent upon the outcome of economic analyses presently under way by the investigating agencies. It is anticipated that these rights will be confined to the main stem of the South Umpqua River.

Industrial

Present utilization of water for industrial purposes total about 35 cfs for the entire sub-basin. The Cow Creek watershed has rights totaling almost 90 percent of this figure.

Future industrial needs in this sub-basin are difficult to predict. This is due to the fact that the water supply situation has advanced to the point where availability of water determines the extent of industrial growth. Requirements for a pulp and paper operation to serve the wood products potentials of the Umpqua system are excluded on the basis that such development is most likely to occur where main stem or North Umpqua water can be used. Future industrial requirements are estimated at 80 cfs.

Mining

Present rights to utilize South Umpqua waters for mining purposes total 300 cfs. There are 262 cfs of existing mining rights concentrated on Cow Creek and its tributaries. The status of rights on Cow Creek is well established since this sub-basin has been adjudicated by the State Engineer. Some of the mining permits are subject to limitations with regard to period of use. A substantial portion of these rights are not being utilized at the present time.

Although the point of application to beneficial use may change with discovery of additonal mineral resources, it is anticipated that the total use of water for these purposes will not expand materially under foreseeable conditions.

Fish Life, Wildlife, and Recreation

Existing and future needs for these three purposes will be assumed to be met by the requirements for desirable minimum flows set by the Fish and Game Commission in their statement to the Water Resources Board, the Umpqua River Hearing. The key control is the Brockway gage with a basic flow for fish life of 100 cfs. The increase of 40 cfs at this location, over the previous figure of 60 cfs presented to the Water Resources Advisory Committee, was not accompanied by any criteria or standards defining the need for this change. The requirements for the fisheries resources of the South Umpqua River are in direct conflict with consumptive requirements, primarily for irrigation development. The maintenance of a minimum flow of 100 cfs at the Brockway gage constitutes a commitment of 18,000 acre-feet of water during the irrigation season. This would represent the water needed, including transmission and other losses, during June, July, and August for the irrigation of better than 7,000 acres.

Pollution Abatement

In recent years, during low flow periods, the quality of the water in the lower limits of the South Umpqua River has deteriorated to a level that makes swimming inadvisable. This has generally occurred when flows at the Brockway gage have dropped below 100 cfs. This condition will be alleviated to some extent by the completion of facilities presently planned for the treatment of wastes discharged into the South Umpqua.

In the future, expanding population and industrial growth will require a higher degree of treatment for wastes whose residuals will eventually be discharged into the South Umpqua. It is impossible to predict at this stage what the relationships between total treatment, efficiency of treatment, and enhancement of streamflows will have to be to meet requirements of the future.

Flood Control

The status of flood control needs in the South Umpqua sub-basin are illustrated by the damages resulting from the 1955 flood. Of the $2,143,140 total damages, $1,487,150 occurred in the South Umpqua sub-basin. Approximately 50 percent of the flood damages in the 1955 flood occurred in the section of the South Umpqua between Cow Creek and the confluence with the North Umpqua River. Damages on Cow Creek, Myrtle Creek and Deer Creek were not included in this percentage.

Utilizing the flood hydrograph - South Umpqua River near Brockway - Figure 22, a general measure of the flood control problems of the lower

South Umpqua can be identified. In this figure is found the volume of water occurring during the flood period which contributed to flows above bankfull stage at Brockway. The total volume involved approximates 150,000 acre-feet. Assuming a flood of this magnitude, and inability to discharge water between flood peaks, storage effective at Brockway would be required in this amount. Actually this does not represent the total picture in the sub-basin since storage on the main stem controlling to this level would not prevent flood damages on tributary streams. The determination of the best location for flood control storage to maximize the benefits accruing to flood control is complex and will not be available until the studies of the Corps of Engineers are completed in 1959.

Problems will intensify if development in the flood plain continues without the development of adequate control measures.

METHODS OF RESOURCE DEVELOPMENT

The major method of satisfying all the potential needs of the South Umpqua Basin and providing for the regulation of flow necessary to limit flood damage is storage. The South Umpqua sub-basin is deficient in storage sites which have the appearance of physical feasibility and economic practicality.

Storage Possibilities

The storage possibilities and their problems for the South Umpqua River are set off by areas as follows:

Deer Creek

The major possibility for storage on Deer Creek is a reservoir located immediately above the community of Dixonville. A dam across the valley approximately a quarter of a mile above the confluence of the North and South Forks would store a maximum of 100,000 acre-feet for a 160-foot structure. Development at this point would inundate some of the best agricultural land in the Deer Creek watershed. This is land which is presently quite fully developed. The development of storage at this location would probably inundate and take out of production more and better quality agricultural land than could be reclaimed by the use of the water from this watershed for irrigation purposes. In addition, the annual yield potential of the watershed above this site would not be sufficient to fill a a reservoir of this capacity each year.

The only value of storage of this section of Deer Creek would be for the purposes of alleviating flood damages in lower Deer Creek and particularly within the confines of the City of Roseburg. It is doubtful that the cost of construction of a flood control structure at this point could be balanced by the benefits derived. There is some potential for small development in the upper section of the South Fork of Deer Creek, but storage capacities here would be of an order of magnitude which cannot be determined from the topographic sheets available for present studies.

Myrtle Creek

Storage potential examined on the Myrtle Creek, including both North and South Myrtle Creek, would amount to a maximum of 100,000 acre-feet. This would include sites on the South Myrtle Creek at its confluence with School Hollow and on North Myrtle Creek in the section of the stream between the confluence of Myrtle Creek and Slide Creek and the confluence of Myrtle Creek and Lee Creek. Water stored in either one of these sites would be available for industrial use in the community of Myrtle Creek. It could be used for pollution abatement purposes, or it could be utilized for limited agricultural development below either of the proposed sites.

The construction of these reservoirs would represent a substantial measure of flood control for the community of Myrtle Creek, but it is very unlikely that the economic benefits derived could even begin to pay for the costs of structures of the size required.

The primary disadvantage of these developments is the fact that the creation of the storage reservoirs would necessitate inundation of lands which are presently being utilized for agricultural purposes and represent a fairly high degree of development.

In both cases, the entire normal yield of the area would probably be required to fill the reservoirs each year, although specific information to substantiate this assumption is not available.

Construction of the reservoirs would also require about six miles of road relocation in a very difficult terrain on North Myrtle Creek, and approximately seven or eight miles on South Myrtle Creek. It does not appear that development of either of these sites will be economically feasible within the foreseeable future.

Lookingglass-Olalla Creek

Two possibilities exist for major storage in this particular sub-basin. First is a site on Lookingglass Creek in section 32, township 27S, range 7W just below the junction of Lookingglass Creek and Flournoy Creek. A 240-foot structure at this point would store a maximum of 150,000 acre-feet. The development of a reservoir in this position would inundate Flournoy Valley which is fairly extensively developed and the benefits to be derived from such a project are unestablished. Since the total annual yield to this reservoir would be substantially less than the capacity indicated, development of this particular site is not deemed feasible.

The second possibility in this sub-basin is the Olalla site investigated by the Bureau of Reclamation in its 1955 Evaluation Report. A damsite exists on Olalla Creek in the section of the stream between its confluence with Berry Creek and the intersection with the south boundary of section 8, township 29S, range 7W. Preliminary investigations by the Bureau of Reclamation indicate that the storage of approximately 15,000 acre-feet at this location would provide for the irrigation of all lands servicable from this project. Field reconnaissance indicates that a substantially larger reservoir might be physically feasible. Total capacity for a 240-foot structure in this stretch of the stream would amount to 115,000 acre-feet as a maximum. Data on yield available at the reservoir location is not fully established at this time. Although maximum development would represent substantial storage, this reservoir would control only fifteen percent of the sub-basin runoff. Under this circumstance, a large percentage of this sub-basin would continue to contribute to the flood problems of the Roseburg area.

There does not appear to be any power potential at the Olalla site that would represent a substantial contribution to the benefits accruing to a project at this point. Preliminary evaluations indicate that benefits to the project from power would not be sufficient to justify the power installations alone.

Flood control benefits would accrue to the Olalla project. In addition to the benefits of capacity usable for flood control and irrigation, additional capacity serving flood control and the maintenance of minimum flows seems highly desirable and of major economic significance. Minimum flow may result in material benefits to the project.

The primary enhancement from minimum flows in Olalla and

Lookingglass Creeks will accrue to the fisheries resource. With a firm minimum water supply of 25 cfs discharging at the project, enhancement would mean approximately 2000 more silver salmon spawning; 2000 additional silver salmon for the off-shore troll fishery; 1000 steelhead; slightly increased trout angling in Olalla and Lookingglass Creeks, by a few hundred angler days; and reservoir trout angling effort of approximately 3000 angler trips annually.

When the physical fisheries enhancements are translated into angler expenditures and commercial profits, the annual economic benefits accruing to the maintenance of a minimum flow becomes significant, equalling or exceeding the benefits from flood control.

Development of the Olalla site would cut off spawning areas in upper Olalla and Berry Creeks. Passage facilities or artificial spawning channels, egg-taking, hatching facilities, and rearing ponds would be necessary to prevent or mitigate losses from project construction. The capital cost of facilities to maintain, above reservoir, fisheries resources would be approximately equal to the benefits from two years of project operation and operating costs would approach 15 percent of the capital cost of the facilities.

Enhancement figures were qualified by the Game Commission because flow studies indicated water to maintain the 25 cfs minimum would be available in only seven of ten years. The assumption that enhancements would be proportional to the seven to ten ratio is, in their minds, questionable. The primary difficulty stems from the fact that flow data on Olalla Creek is based on correlation studies with a limited amount of actual stream measurement.

Enhancements are predicated on adequate protective measures including screening of diversions and protection of fish from other adverse features resulting from project construction and development.

Development at this site would necessitate the relocation of several miles of county road serving the headwater areas of this sub-basin. The relocation of farms and other existing facilities would be limited.

This particular site appears to have real potential from a physical and economic point of view.

Cow Creek

The total physical site capacity for the Cow Creek watershed amounts to some 800,000 acre-feet based on the limited knowledge available; however, only a small portion of this storage appears feasible from an economic point of view. The most practical appearing development is the so-called Galesville site located on Cow Creek below its confluence with McGinnis Creek. At this point, a 130-foot structure could store a maximum of 55,000 acre-feet. This is about one-half the amount of yield to this site during an average year. Development of this project could supply irrigation water for the entire sub-basin with sufficient surplus water to provide for the desired base flows set forth in the requests of the Oregon Game Commission. Sufficient capacity would be available to provide water for all uses except the dilution of pulp and paper operation effluents.

The contribution of this site to flood control would be limited to the protection of property and lives in the upper Cow Creek area and would have limited effect on the flood problems of the lower Cow Creek region and negligible effect on the South Umpqua River.

Any storage project constructed in the upper limits of the Cow Creek area which provides flows for release to the benefit of the fisheries resource during low flow periods will provide substantial benefits. Specific comments have been received from the Oregon State Game Commission outlining benefits that might accrue to the construction of the Galesville project. Storage at the Galesville project or any of the projects previously studied upstream from that location, McGinnis Creek, Meadows, or Dismal, that would provide for a minimum regulated flow of 25 cubic feet per second in Cow Creek would result in substantial fisheries benefits. These benefits would accrue from increases in salmon spawning areas, salmon and steelhead rearing areas, survival and escapement during what would normally be low flow periods, increased trout fishing where supplemental waters are available, and increased trout fishing made possible by the construction of the reservoir.

A relatively small amount of spawning gravel would be eliminated by the construction of a project in this area and provisions to accomodate approximately 300 silver salmon and 300 winter steelhead by artificial spawning channels, holding ponds, and egg-taking and hatching facilities would reduce loss to the existing fisheries resource to a negligible level. Costs are low in view of the large benefits that would accrue to this project. from an increase of 9000 silver salmon spawners; 9000 silver salmon to ocean troll fisheries; 4300 steelhead; increase of 3000-4000 angler trips per year for downstream fishing and approximately 3000 fishing trips annually to the impoundment.

It would be essential that all diversion structures and channels be adequately protected to maintain a maximum enhancement of the fisheries resource at all locations downstream of the project.

If the benefits, indicated on a preliminary basis, are developed and accepted as being the benefits that would accrue to the fisheries resource from this project, it is quite possible that these benefits may be the factor which provides the greatest increment of benefits to the project from a multi-purpose water use basis.

Relocations within the project area would be at a minimum and are confined to limited farm relocation problems and relocation of existing unsurfaced county roads serving the headwater areas of Cow Creek.

South Umpqua above Canyonville

The total storage potential on the South Umpqua River above Canyonville exceeds 500,000 acre-feet. About 210,000 acre-feet is concentrated in the area between Canyonville and Milo. Development of the major portion of this storage does not seem practical because of the extensive relocation of highways and the inundation of valuable agricultural lands, particularly in the section between Milo and Canyonville. Storage for flood control purposes could be developed at the so-called Days Creek site, but the economic potentials of this particular site are doubtful. Possibilities of storage for flood control purposes in this area are being studied by the Corps of Engineers in its Umpqua Basin Flood Control Study, but specific data will not be available until the completion of this investigation.

The Bureau of Reclamation has made preliminary reconnaissance investigations on the potentials of the Tiller site which is located above the community of Tiller and just below the confluence of the South Umpqua River and Jackson Creek. Preliminary studies by the Bureau indicate that a structure approximately 190 feet high with a crest length of approximately 620 feet would have a capacity of 54,000 acre-feet and would serve 28,000 acres of irrigable land in the South Umpqua sub-basin below Tiller. The Bureau indicates that the geological setting is favorable and that additional capacity could be provided for other desired uses. Reconnaissance studies of the

Board indicate that structures up to 350-400 feet in height are a possibility. Storage would range upward to a quarter of a million acre-feet. Size of structure and reservoir capacity will be determined by detailed cost benefit studies.

Evaluations are presently underway to determine the benefits or detriments that would accrue to the construction of the Tiller project in connection with the fisheries resource. Preliminary figures indicate that benefits will probably not exceed the cost associated with loss or mitigation of loss for the fisheries resource. Should the final analysis prove benefits to be in excess of costs, they will probably not be sufficiently greater to constitute an important item in economic justification of the project. If this proves to be the case, the major benefits accruing to the Tiller project will have to come from irrigation, flood control, and possibly power.

The primary relocation problem connected with the construction of the Tiller project would be the relocation of roads serving the upper South Umpqua sub-basin and the Umpqua National Forest lands. Final economic evaluation of the Tiller site will not be available until the investigations of the Corps of Engineers and the Bureau of Reclamation are completed.

There are no major storage sites available on the South Umpqua River above the mouth of Jackson Creek. There is a small site available on Jackson Creek, but its maximum capacity would be about 19,000 acre-feet and would require a 150-foot structure to develop this storage. Economic justification is unlikely.

There is a limited possibility for storage development on Elk Creek, a tributary of the South Umpqua River, whose confluence with the main stem is just below the community of Tiller. A structural site exists on Elk Creek just above its confluence with Drew Creek and the construction of a 250-foot structure at this point would result in a maximum storage development of 60,000 acre-feet. In addition to inundating the community of Drew and the agricultural development in the reservoir site, relocation of several miles of State Highway 42 would be required. The Bureau indicates that comparative cost studies indicate storage at the Elk Creek site would be less economical than that at Tiller.

In order to satisfy existing and future needs of the South Umpqua sub-basin, it will be necessary to investigate every possible storage site *which might ultimately prove physically and financially sound. The benefits to be derived from any storage development would be: stabilized stream flow for fish, recreation and pollution abatement; water for consumptive use by industries and municipalities; irrigation use; power and flood control.*

SOUTH UMPQUA

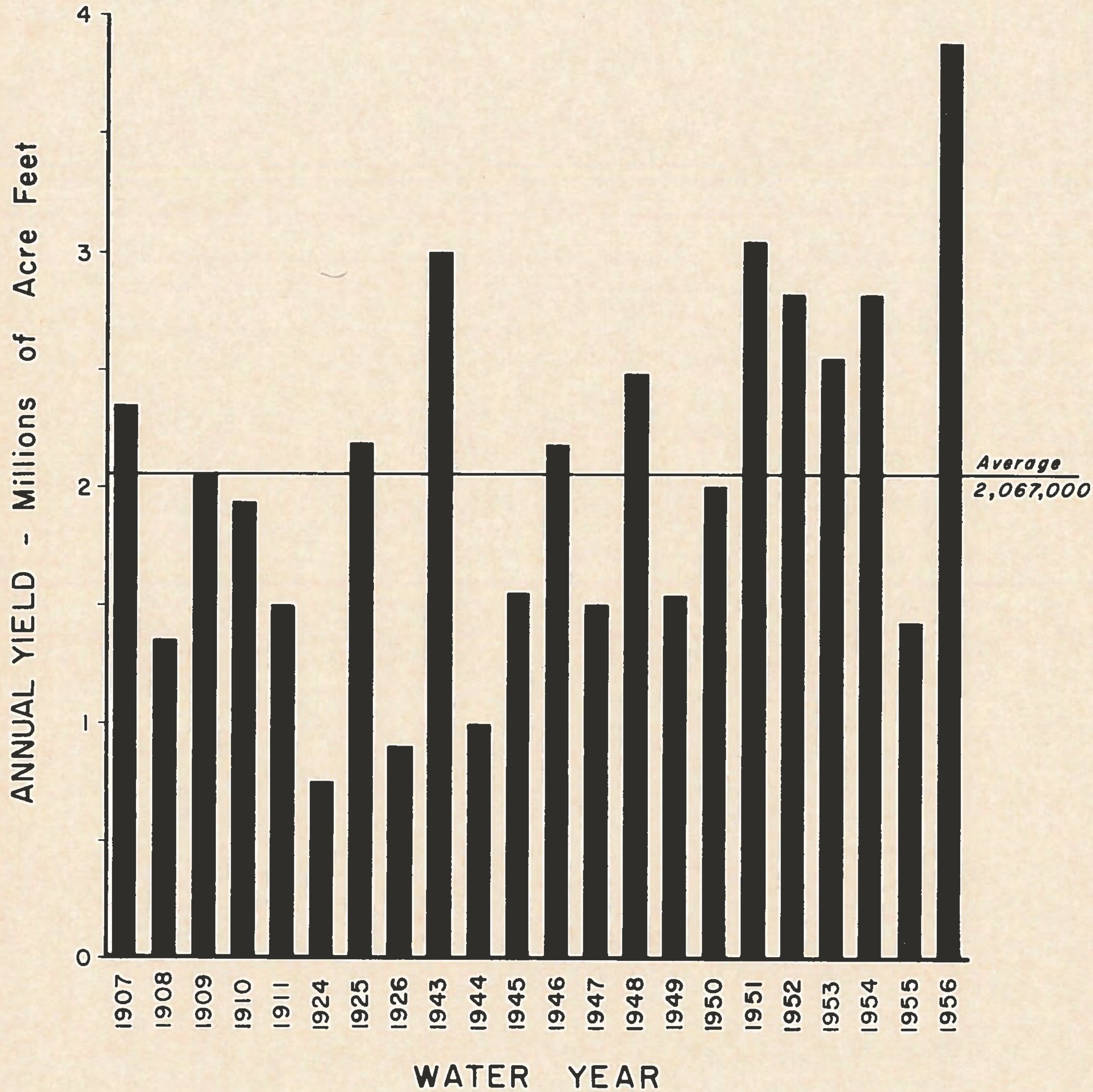
UMPQUA RIVER BASIN

YIELD DIAGRAM

ANNUAL YIELD
OF

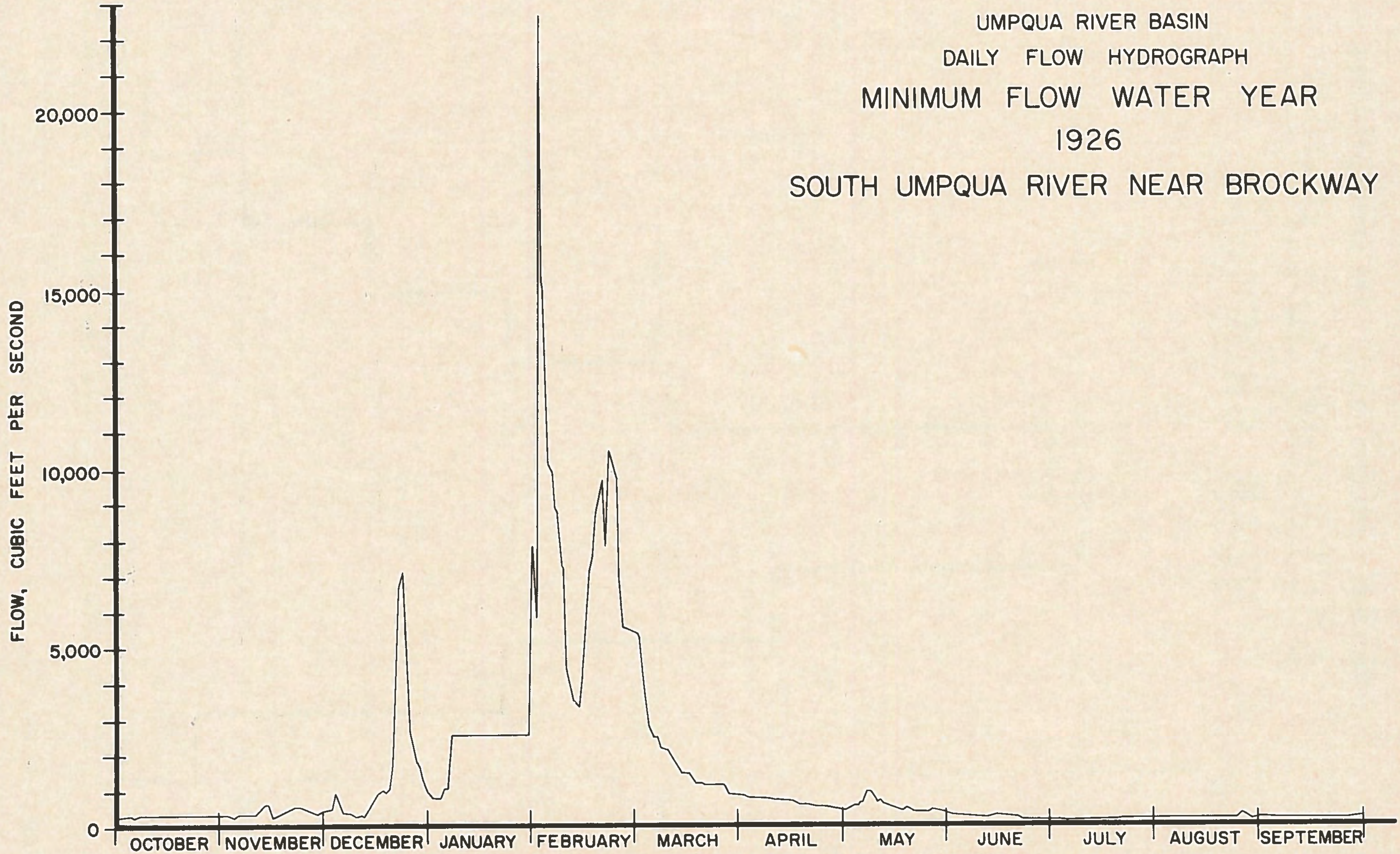
SOUTH UMPQUA RIVER NEAR BROCKWAY

Drainage Area 1,640 Sq. Mi.



Note: Records incomplete for years not shown.

Drawn: Dec., 1957
File No. 16.220
FIGURE 16

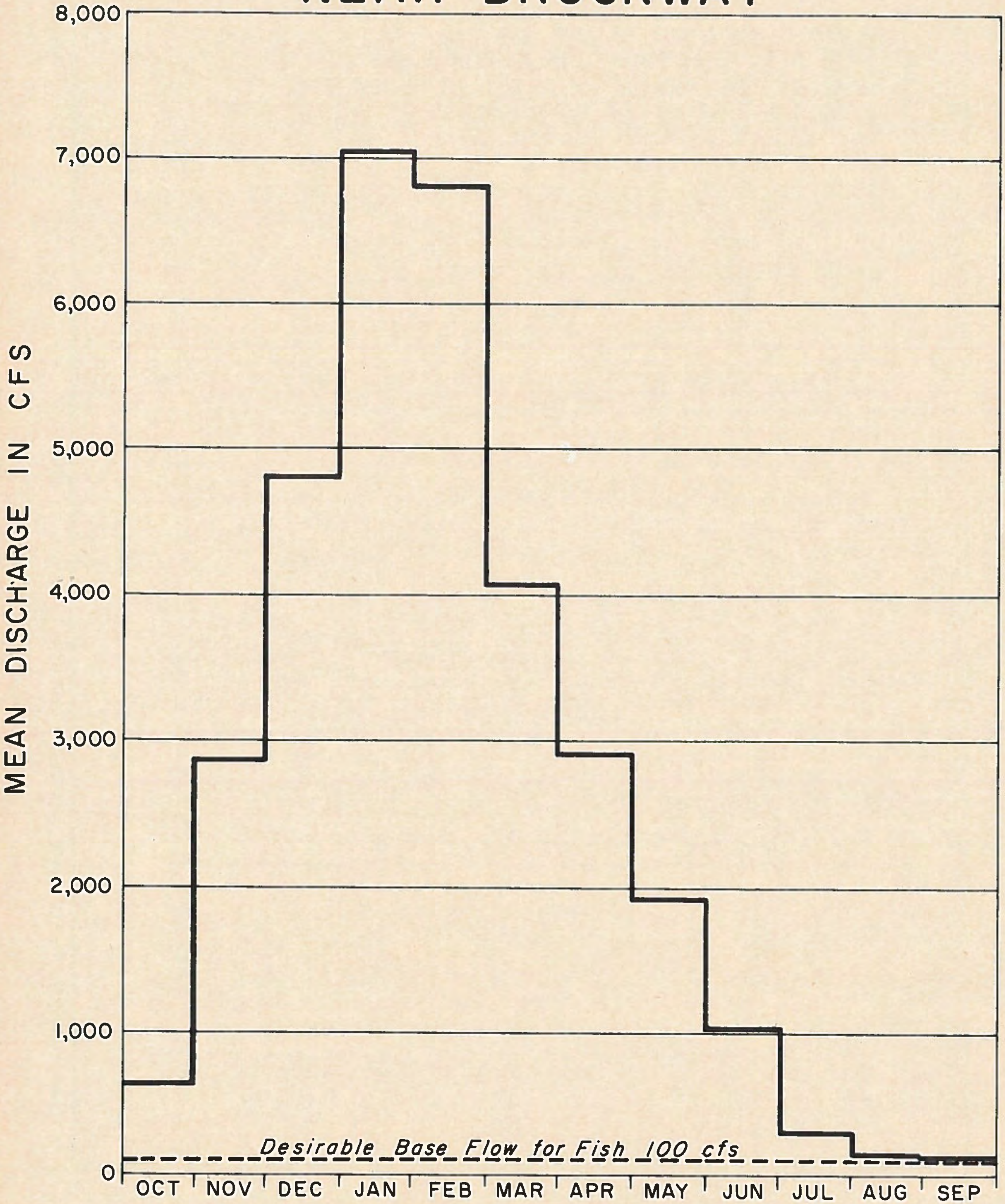


File No. 16.202
FIGURE 17

UMPQUA RIVER BASIN

MEAN MONTHLY HYDROGRAPH

SOUTH UMPQUA RIVER
NEAR BROCKWAY



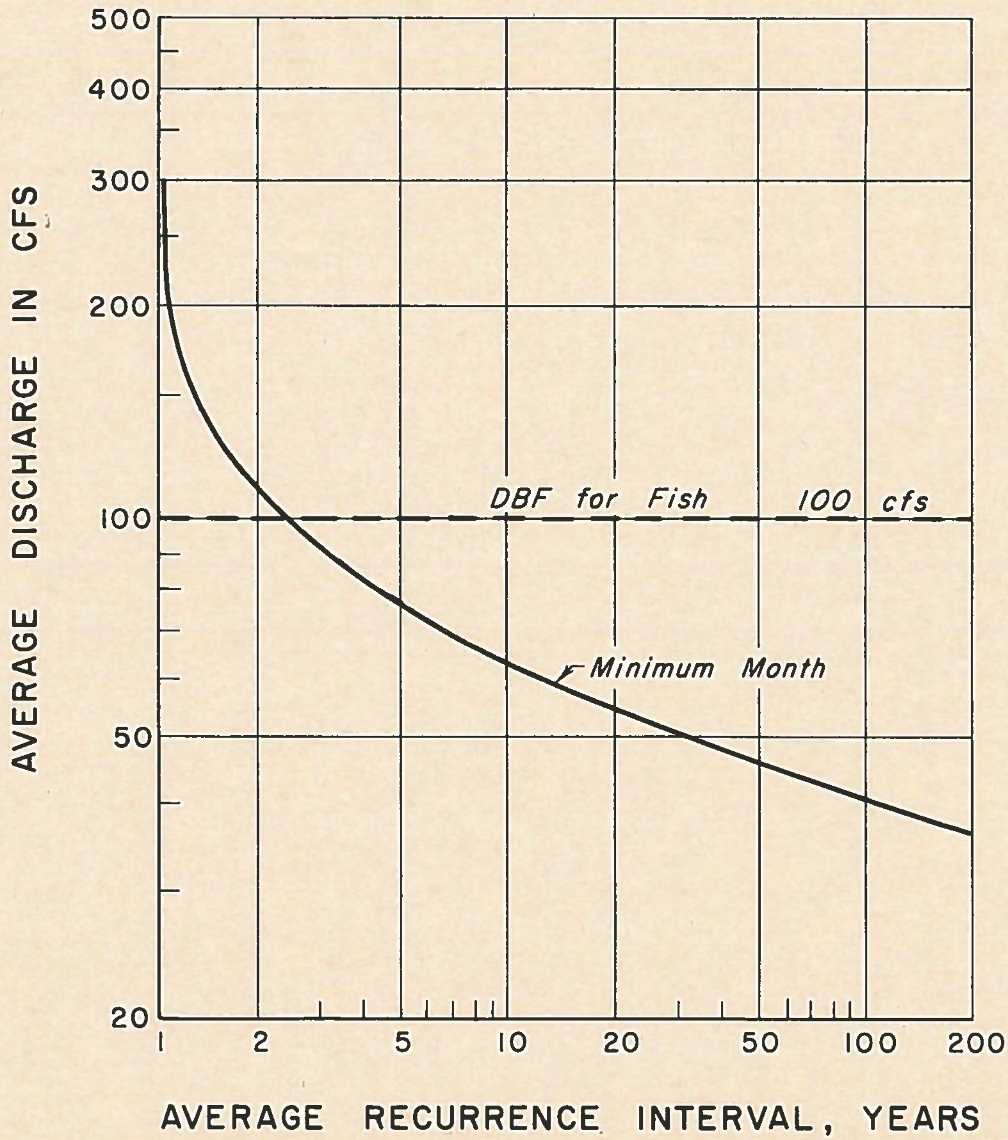
YEARS OF RECORD 1906 - 1912
1924 - 1926
1942 - 1955

File: 16.202
FIGURE 18

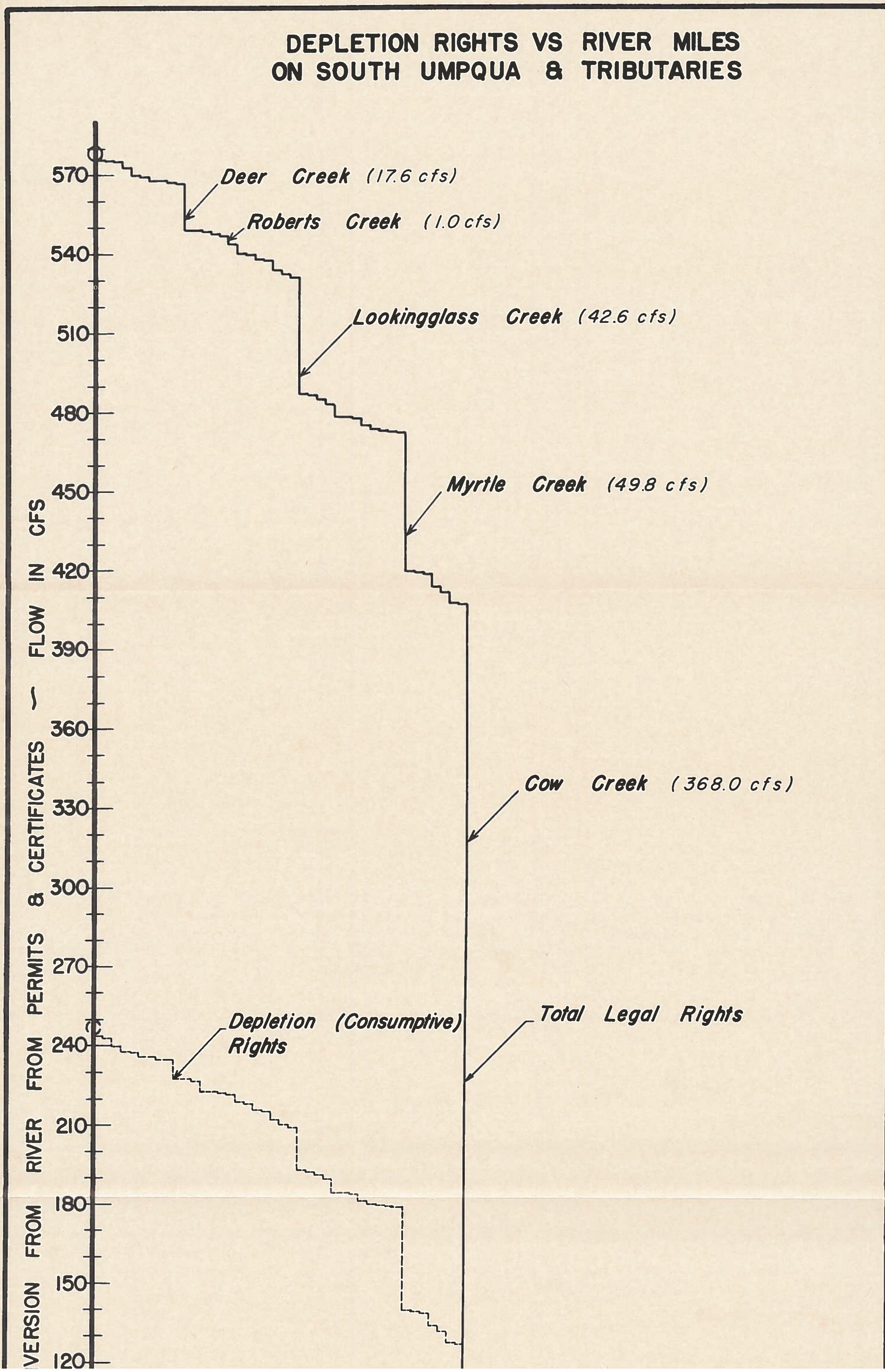
UMPQUA RIVER BASIN

SOUTH UMPQUA AT BROCKWAY

LOW FLOW FREQUENCY CURVE AND DESIRABLE BASE FLOW FOR FISH



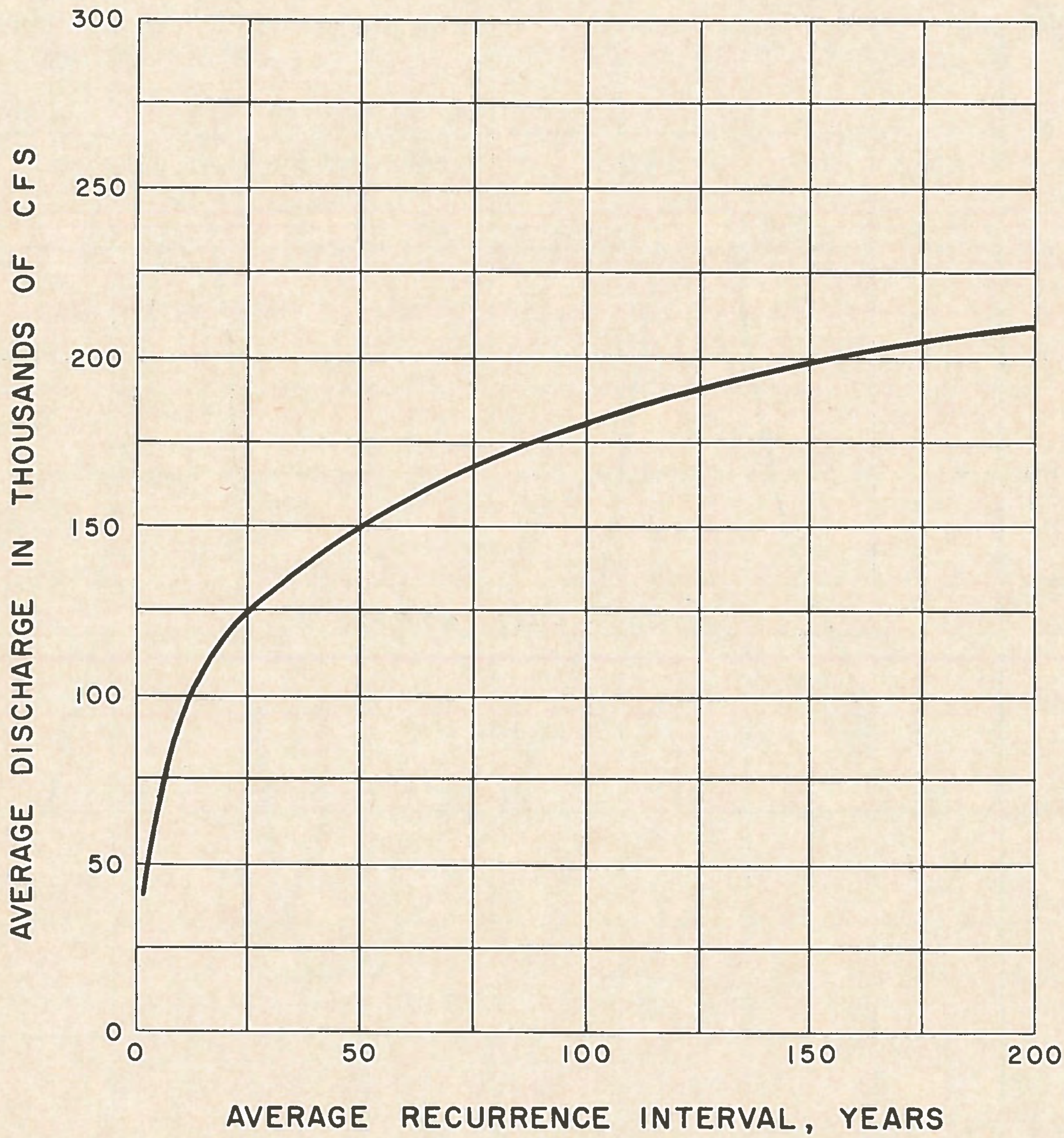
Drawn: Jan., 1958
File No. 16.203
FIGURE 19


DEPLETION RIGHTS VS RIVER MILES
ON SOUTH UMPQUA & TRIBUTARIES
Deer Creek (17.6 cfs)
Roberts Creek (1.0 cfs)
Lookingglass Creek (42.6 cfs)
Myrtle Creek (49.8 cfs)
Cow Creek (368.0 cfs)
Total Legal Rights
Depletion (Consumptive) Rights
DIVERSION FROM RIVER FROM PERMITS & CERTIFICATES ~ FLOW IN CFS
570
540
510
480
450
420
390
360
330
300
270
240
210
180
150
120

UMPQUA RIVER BASIN

SOUTH UMPQUA RIVER NEAR BROCKWAY

FLOOD FREQUENCY CURVE



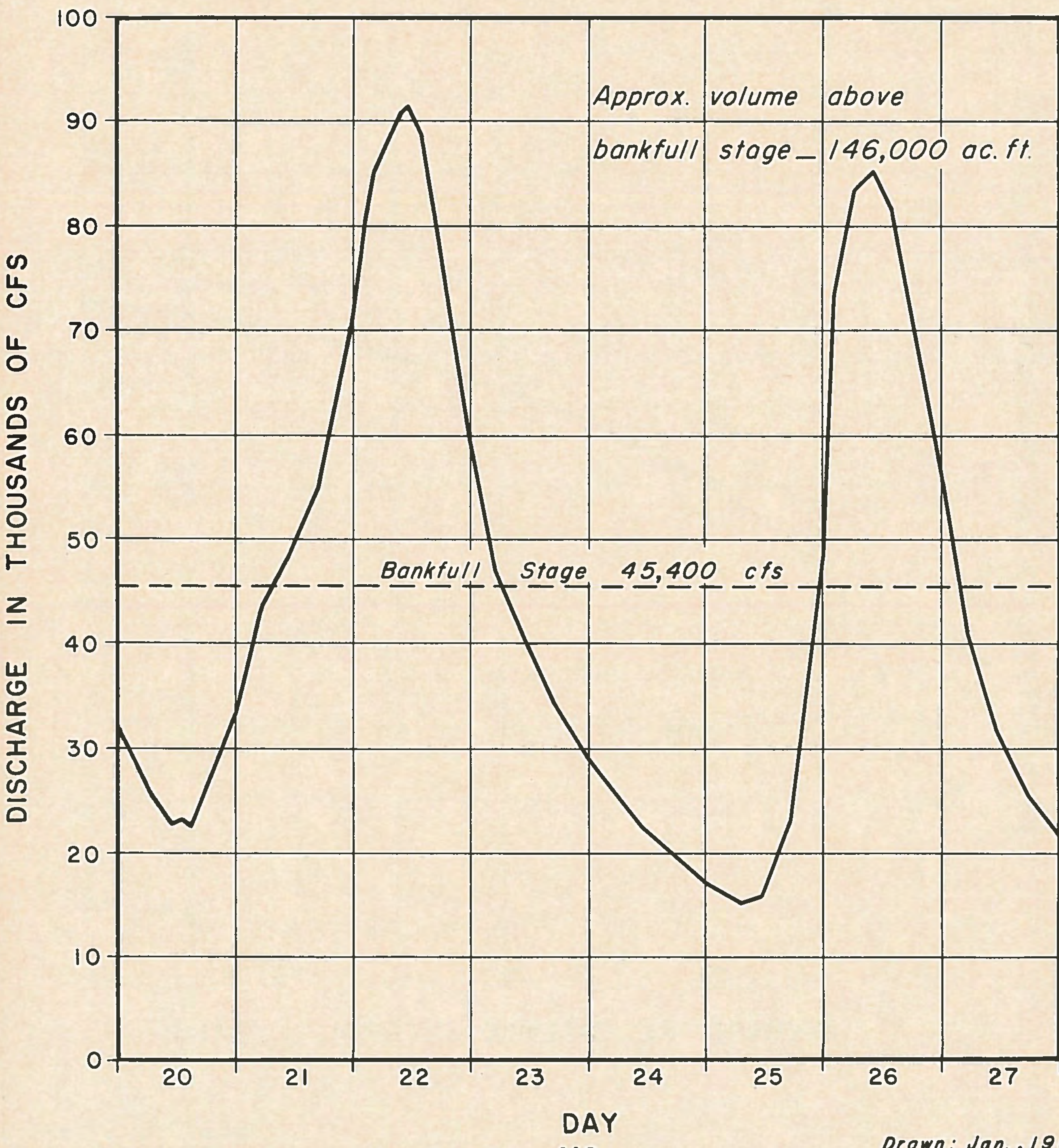
Drawn: Dec., 1957
File No. 16.203
FIGURE 21

UMPQUA RIVER BASIN

FLOOD HYDROGRAPH

SOUTH UMPQUA RIVER NEAR BROCKWAY

DECEMBER 1955



Drawn: Jan., 1958
File No. 16.202
FIGURE 22

SOUTH UMPQUA

MINERAL DEPOSITS

TABLE 17

DESIRABLE MINIMUM STREAMFLOWS FOR FISHERY MANAGEMENT*

SOUTH UMPQUA WATERSHED

Stream	Desired Minimum cfs	Location at Required Flow
South Umpqua River	100	Winston bridge gage
" " "	60	Tiller
Deer Creek	3	mouth
Lookingglass Creek	5	mouth
Tenmile Creek	3	mouth
Olalla Creek	3	mouth
Rice Creek	2	mouth
Willis Creek	2	mouth
Myrtle Creek	15	mouth
North Myrtle Cr.	8	above South Myrtle Cr.
" " "	4	above Slide Creek
Slide Creek	2	mouth
South Myrtle Creek	8	above North Myrtle Cr.
" " "	4	above Letitia Creek
Cow Creek	20	at Riddle
" "	12	Glendale
" "	10	4 mi. east of Azalea
" "	8	above Applegate Creek
West Fork Cow Cr.	8	mouth
Middle Creek	4	mouth
Windy Creek	2	mouth
Quines Creek	2	mouth
Starveout Creek	2	mouth
Applegate Creek	2	mouth
Canyon Creek	5	mouth
" "	2	above West Fork
West Fork Canyon Cr.	3	mouth
Days Creek	5	mouth
Coffee Creek	3	mouth
Elk Creek	5	mouth
Jackson Creek	30	mouth
Beaver Creek	8	mouth
Deadman Creek	3	mouth
Dumont Creek	3	mouth
Boulder Creek	5	mouth

TABLE 17 (Continued)

DESIRABLE MINIMUM STREAMFLOWS FOR FISHERY MANAGEMENT*

SOUTH UMPQUA WATERSHED

Stream	Desired Minimum cfs	Location at Required Flow
South Umpqua River		
Buckeye Creek	5	mouth
Quartz Creek	5	mouth
Black Rock Creek	10	mouth
Castle Rock Creek	15	mouth
Fish Lake Creek	5	mouth

* As requested by the Oregon State Game Commission.

NORTH UMPQUA SUB-BASIN

GENERAL DATA

Location

The North Umpqua sub-basin covers the north central, and northeastern portions of the Umpqua Basin. The major tributaries within this area are Little River, Rock, Canton, Steamboat, Copeland, Fish, Clearwater, and Lake Creeks.

Size

The North Umpqua River has a drainage area of approximately 1,308 square miles. It joins the South Umpqua River forming the main stem at River mile 105. The total length of the North Umpqua River to its headwaters in Diamond Lake is approximately 100 miles.

Topographic Characteristics

The entire sub-basin is extremely rugged, characterized by precipitous slopes and steep stream gradients. The greater majority of the terrain is covered by dense forest; primarily of Douglas Fir, other species occurring in lesser percentages. Very little land is available for agricultural, industrial, or urban development above the community of Glide. From Glide to the confluence of the North and South Umpqua Rivers, there are sections of land along the river suitable for agricultural and limited industrial growth. The area with the greatest potential for development lies in that section of the river below mile 6. Nowhere within the subbasin are there lands suitable for development that lie more than a mile from the banks of the river, with the exception of the area below mile 6 where development sites lie as far away as Sutherlin and the Camas Swale areas. Elevation within this sub-basin varies from 460 feet, mean sea level, at the mouth of the river, to more than 9,000 feet in the peaks of the Cascade Range.

Geologic Characteristics

The geological province known as the Western Cascades, which encompasses practically all the drainage area below the mouth of Fish Creek, has a rock formation described as "volcanic andesites". The area above the mouth of Fish Creek in the High Cascades consists of andesites, basalts, tuffs, and other volcanic formations. The porous volcanic structures of the upper North Umpqua River provide the groundwater storage which is a *primary factor in its relatively uniform stream flow pattern.*

Meteorologic & Hydrologic Characteristics

Summer temperatures within this sub-basin are mild. Summer precipitation is relatively light. During winter seasons, temperatures are generally below freezing at elevations above 5,000 feet and precipitation is relatively heavy. Precipitation ranges from 60 to 80 inches throughout the sub-basin in a normal year. The snowpacks which result from the large portion of the sub-basin above 5,000 feet elevation (20 percent) further contribute to the uniform runoff.

Stream gaging records for the North Umpqua River date back as far as 1908. Coverage in terms of location and time is probably better than for any other area within the Umpqua Basin.

Precipitation information within the sub-basin is so meager as to be without major value in hydrological analysis.

Land Ownership

Eight miles above the confluence of Rock Creek and the North Umpqua River at mile 41.5, the boundary line of the Umpqua National Forest intersects the North Umpqua River. More than 73 percent of the sub-basin above this point lies within the Umpqua National Forest boundary. When O & C lands are considered with National Forests, 74 percent of the total North Umpqua sub-basin is in federal ownership.

Nearly the entire length of the North Umpqua River and its tributaries above, not including Rock Creek, are covered by federal power withdrawal sites. The exact boundary of these sites have not been investigated.

Transportation Facilities

Transportation facilities in the area are limited to the road from Roseburg to Glide paralleling the North Umpqua River up to the California-Oregon Power Company's project in the vicinity of Toketee Falls. This road continues on over the High Cascades, connecting with roads to Diamond Lake and Crescent Lake. A well-built logging road extends from this road up Steamboat Creek and over the divide into the Willamette River Basin. The area is served by other logging access and Forest Service roads of an unimproved nature. In general, these roads follow the streams quite closely. There are no rail facilities above mile 6 in this sub-basin.

Economy

That portion of the sub-basin above the community of Glide is presently, and can be considered for the foreseeable future, a cropland for the timber which will support the timber economy of Douglas County. No other development potential of any magnitude exists above Glide, with the exception of recreation. Between the communities of Winchester and Glide, there are agricultural lands lying adjacent to the river banks. Practically all of the suitable land in this section is being utilized. Less than 16 percent has been developed to its full agricultural capabilities, according to information from the Bureau of Reclamation. Along Sutherlin Creek, a tributary of the North Umpqua River at river mile 4.5, there is considerable potential for development of irrigated lands. The Sutherlin Creek area offers the greatest potential for industrial site development because of the transportation facilities provided by U. S. Highway 99, Southern Pacific Railroad, and the county road network in this area. This area also offers a substantial labor pool from the community of Roseburg.

Development of the North Umpqua sub-basin can be thought of in two basic sections; one, above Glide where the entire sub-basin will be dedicated to permanent timber cropland, and two, that area below Glide which has potential for agricultural, industrial and urban growth.

Population

About 98 percent of the population of this sub-basin is concentrated at or below the community of Glide. The only permanent population above Glide are isolated units in the area of lower Rock Creek and operation and maintenance personnel attached to the California-Oregon Power Company hydroelectric developments in the vicinity of Toketee Falls.

AMOUNT AND DISTRIBUTION OF RESOURCE

Compared with other sections of the Umpqua Basin, data for the determination of yield and runoff patterns for the upper North Umpqua River are very good.

Precipitation

There are no precipitation records for this sub-basin that would be of much value in determining either runoff or yield patterns. The most extensive data would be from the meteorological station established at Winchester which has been in operation less than seven years.

Stream Gaging

Coverage of this sub-basin by stream gaging is good. Although intermittent, the records at Winchester provide an opportunity to establish the pattern of runoff for the entire sub-basin as well as finite values for sub-basin yield. Additional stations at Oak Creek, Glide, Rock Creek, Toketee Falls, Copeland Creek, Lake Creek, and other points make it possible to establish with some degree of accuracy the distribution of the waters of this sub-basin in terms of location and time. The minimum daily flow recorded for this sub-basin (measured at Winchester) was 616 cfs in August, 1926. The maximum discharge for the sub-basin recorded at the same point in November, 1909, was 100,000 cfs.

Minimum yield of record for the sub-basin amounted to slightly less than one and one-half million acre-feet in the water year 1926. The maximum yield was recorded in the water year 1956 and it amounted to slightly more than four million acre-feet.

Resource Distribution

Sufficient information is available to show the approximate patterns of yield and flow within the North Umpqua sub-basin. Reference to the percent yields of the various sub-basins within the Umpqua River system will show that for the available periods of record, the yield for the North Umpqua River above Winchester is about 50 percent of the normal total yield at the Elkton gage. If note is taken of the readings of the gage near Glide, it will be found that 60 percent of the total yield at the Elkton gage in 1931, the low yield year of record, originated above this point, an area representing only 33 percent of the total drainage basin above the Elkton gage.

AMOUNT AND DISTRIBUTION OF RESOURCE UNDER APPROPRIATION

For purposes of discussion, it is convenient to divide the North Umpqua sub-basin into three sections. First is the section between the mouth of the North Umpqua River and the mouth of Rock Creek in which practically all of the consumptive water rights are included. Second is the section between the mouth of Rock Creek and Toketee Falls. Appropriations of water within this section including Canton and Steamboat Creeks, are extremely small totaling less than one cubic foot per second. The third is the section above Toketee Falls wherein the water rights are large in magnitude, due to the nonconsumptive use of water in the hydroelectric developments of the California-Oregon Power Company.

For practical purposes, all the consumptive use in the North Umpqua sub-basin occurs between the mouth of the North Umpqua and River Mile 34. In terms of instantaneous flow, this would amount to 191 cfs. Volumetrically, this would amount to consumptive use in the amount of 140,000 acre-feet per year. Consumptive uses in the other two sections of the sub-basin are too small to merit attention in a reconnaissance investigation.

Although not an established legal right, the California-Oregon Power Company's claim to a vested right at the Winchester dam would probably be sustained by an adjudication proceeding. The only factor presently unknown would be its priority status with regard to minor irrigation uses practiced above Winchester in years prior to the formulation and adoption of the 1909 Water Code. It is assumed that consumptive rights above this point would be negligible. Any program developed for that section of the North Umpqua sub-basin above Winchester would be subject to the limitations imposed by this claimed right of 705 cfs. If valid, this right practically guarantees a legal but not actual minimum flow at Winchester dam of 705 cfs.

There exists at the present time two filings on water for municipal and industrial purposes whose diversions would be located downstream of the Winchester dam. One of these, the filing by the City of Coos Bay, proposes a diversion of 100 cfs from the North Umpqua River which would be diverted out of the Umpqua River Basin by means of pipelines and tunnels. The application states that this water will be used for municipal purposes and industrial supply for pulp and paper processing.

EXTENT OF BOARD'S JURISDICTION

In the minimum year of record, the yield of the North Umpqua sub-basin was approximately 1,440,000 acre-feet of water. As pointed out, consumptive uses amount to approximately 140,000 acre-feet leaving 1,300,000 acre-feet of which that portion running off when the flow was above 700 second feet, would be under the jurisdiction of the Board, both on a nonconsumptive and consumptive basis.

The broad generalization of the preceding paragraph is not sufficient to fully describe the extent of the Board's jurisdiction. To do this, it is necessary to study the individual sections.

That area above mile 63 (the site of the COPCO "Soda Springs Plant") has its status fairly well defined. The Board would have consumptive jurisdiction only when flows exceeded 1,600 cubic feet per second at Soda Springs project. This would confine the Board's jurisdiction to the months of January, February, March and April during a normal year, and to an even more restricted period in critical years. The waters over which the Board's jurisdiction might extend are strictly the flood or freshet flows.

The second section is from mile 33, one mile below the mouth of Rock Creek to mile 63. Total rights, consumptive and nonconsumptive, for this section are less than 1.0 cfs including the Canton, Steamboat, and Copeland Creeks. The Board's jurisdiction here is limited only by downstream rights. Using the 705 cfs figure for Winchester, minimum flow plus consumptive rights between Winchester and mile 34 (13.3 cfs), the Board's jurisdiction over consumptive use is limited to flows over 720 cfs. This is based on the assumption that the 705 cfs nonconsumptive right at Winchester will satisfy all known rights downstream from that point.

Analysis of section three, from Winchester to the mouth of the North Umpqua River, is more complex. Assuming 705 cfs at Winchester as a starting point, and further assuming the real possibility of zero flow at the mouth of the South Umpqua River, we find that the flow from the North Umpqua River must provide water for all existing rights on the main stem of the Umpqua River. Total consumptive rights on the main stem are 76 cfs. Consumptive rights from the mouth of the North Umpqua River to Winchester total 152 cfs. On this basis, the Board has consumptive jurisdiction for flows exceeding 228 cfs immediately below the Winchester dam.

EXISTING AND FUTURE NEEDS FOR THE RESOURCE

The anticipated needs of the North Umpqua sub-basin would represent an annual volumetric requirement of 726,000 acre-feet. In most of the sub-basin presentations given, the requirements shown have consisted of needs within the physical boundaries of the sub-basin. This circumstance does not hold in the case of the North Umpqua. It is anticipated that a portion of the needs for sub-basin resources lie outside of the physical boundaries of this sub-basin. Specific instances will be indentified under particular use.

Domestic

As the fringe area adjacent to the Roseburg metropolitan area increases, there will be an additional demand for domestic water to satisfy this type of development. In addition, there will be a growth in rural domestic use as lands within the sub-basin are brought under irrigation. The formula indicated in the criteria has been utilized in establishing this value but there has been no attempt to try to predict domestic requirements for fringe areas. When demands for domestic water in fringe areas becomes sufficiently large to present a problem, the private utilities supplying municipal water for the City of Roseburg will probably find it physically possible and profitable to supply these needs by an extension of their system.

Municipal

At the present time the legal right to use water for municipal purposes within the sub-basin boundaries is quite small. However, two very important circumstances exist. First, the Oregon Water Corporation, which supplies the City of Roseburg, has rights to the use of 12 cfs from the North Umpqua River. This water is diverted from a pool at Winchester dam. Practically the entire output of the COPCO unit at Winchester, 500 kilowatts, is utilized in pumping this water. In effect, this is an out-of-basin diversion. The Oregon Water Corporation has also filed on an additional 13 cfs to supplement its present right and provide for future growth. Mr. A. Andrews, manager for the Oregon Water Corporation in Roseburg, indicates that the company is now using, during periods of maximum demand, almost all of the 12 cfs right.

The second item of considerable interest relative to municipal supplies from the North Umpqua River, is the filing presently held by the City of Coos Bay. This is the filing which makes application for a right to divert 100 cfs from the North Umpqua River immediately below Winchester dam. The application on file in the State Engineer's office covering this action indicates that this water will be used for municipal and industrial purposes, specifically pulp and paper processing. The diversion of this amount of water from the North Umpqua River during periods of minimum flow (616 cfs) at Winchester dam would, when existing consumptive rights from that point to the river mouth are considered, result in the flow of less than 500 cfs at the mouth of the North Umpqua.

Projecting existing municipal requirements to the future by use of the formula indicated in the "Criteria - Sub-basin Analysis", would be erroneous in the case of the North Umpqua. To present a more realistic analysis, the 100 cfs filing has been eliminated from the formula calculations, and future requirements are predicated on extension of the future municipal needs of the City of Roseburg, plus the Coos Bay filing. These would be represented by a flow of 146 cfs.

Irrigation

Based on the Bureau of Reclamation figures, maximum possible irrigation diversion requirements would amount to 113 cfs, annual use in terms of acre-feet per year, 24,000 acre-feet. This figure, which covers somewhat more than 9,000 acres (not including the upper areas of Sutherlin Creek which has been combined into the requirements for the Calapooya area). A possibility for interchange exists in this instance. If storage possibilities on the Calapooya Creek do not prove to be feasible, the lands of Sutherlin Creek could be irrigated by pumping water from the North Umpqua River up Sutherlin Creek to the Camas Swale area. This could be accomplished by means of a ten-mile pipeline.

Power Development

Needs for power within the sub-basin would be relatively small. However, in light of transmission techniques, a problem of power potential of a stream and needs for power within the sub-basin of that stream cannot be necessarily coordinated. Although the possibilities for power use within the sub-basin are limited to potential industrial development in the Winchester area, the needs for power throughout the entire Umpqua Basin will grow tremendously as the economy of the Basin and the state expands. Of the total lands considered irrigable in Douglas County, some 63,000 acres would fall in the category of feasible, insofar as development is concerned. Nearly all of this land will be irrigated by sprinkler methods. Obviously, this would require substantial amounts of electrical energy just to provide power to the pumps necessary for these operations. For full development, a conservative figure for power needs covering this purpose is 15,000 kilowatts generating capacity, assuming again an 0.5 diversity factor in regard to irrigation. If there is an expansion of the timber economy of the Roseburg area by virtue of a pulp and paper plant, additional power will be required for this purpose. Other than Mill Creek and Smith River, the North Umpqua River offers the only feasible development of hydroelectric energy within Douglas County. A list of the sites existing on the North

Umpqua River at the present time is given in Table 4. The installed capacity of these units, all of which are operated by the California-Oregon Power Company, is 186,050 kilowatts with an average annual generation of 864,900,000 kilowatt hours per year. This is apparently sufficient to supply all of the requirements within this area for the immediate future. It should be pointed out that COPCO's output is supplemented by power supplied through the Bonneville Power Administration at the Douglas County REA and the Hanna Corporation nickel processing operation which utilizes low cost power for reduction of its basic ores.

Table 5, shows the undeveloped hydroelectric power sites still available on the North Umpqua River. These are Oak Creek, installed capacity 11,300 kilowatts; Horseshoe Bend, 14,000 kilowatts; Glide, 9,000 kilowatts; Rock Creek, 51,000 kilowatts; Boundary, 44,000 kilowatts; Steamboat, 16,300 kilowatts; Copeland Diversion, 24,300 kilowatts. Such large structures would be required in case of the Oak Creek, Horseshoe Bend, and Glide projects in relation to their power outputs that their development in the foreseeable future appears unlikely. The Rock Creek and Boundary sites offer potential for fair amounts of power, but as outlined in Water Supply Paper 636-F of the U. S. Geological Survey, these would be run-of-river operations.

If the power requirements of the Umpqua River Basin expand beyond the capabilities of the existing facilities, it would appear that the feasible source of hydroelectric power from within the Basin would be the developable sites on the North Umpqua River and possibly the Tiller site on the South Umpqua River.

<u>Industrial</u>

Industrial rights for the use of water in this sub-basin are negligible (actually less than 0. 15 cfs). However, an application is on file in the State Engineer's office requesting the right to divert 46. 42 cfs from the North Umpqua River.

One of the largest requirements for industrial water that would probably develop in this sub-basin is for process water in the pulp and paper industry. As indicated before, we have utilized a figure of 10 cfs per hundred tons per day of pulp as an average figure for the various types of pulp and paper processes. In terms of existing facilities and water resources, the Roseburg-Sutherlin-Oakland area or the Reedsport area offer the best possibilities for pulp and paper plant sites. These are the only points in the Umpqua Basin which have suitable transportation facilities and adequate water for process use. This does not imply that either one of these locations may be satisfactory from the point of view of waste disposal.

Mining

Although there is a potential for expanded mining activities, particularly in the headwaters of Canton Creek and Rock Creek, this use is of a nonconsumptive nature and so small that it can be eliminated.

Fish Life, Wildlife, and Recreation

In reporting to the Water Resources Board on their requirements for desirable stream flows on the North Umpqua River, the Game Commission indicated the following desired flows: North Umpqua at the Southern Pacific Railroad bridge, 600 cfs; North Umpqua, one mile west of Glide, 600 cfs; North Umpqua, one-half mile above Rock Creek, 550 cfs; North Umpqua above Copeland Creek, 500 cfs.

If the minimum flows indicated could be maintained, they would probably fulfill the minimum requirements for recreation and wildlife, as well as fish life uses. Under the existing conditions of appropriation and filing, it is conceivable that the flow of 600 cfs could be maintained immediately downstream of Winchester dam, which is approximately one-fourth mile above the Southern Pacific Railroad bridge; however, it should be pointed out that this is the area in which the diversion right of 46.42 cfs for industrial purposes and 100 cfs for diversion to the Coos-Coquille Basin by the City of Coos Bay are located. Development and exercise of these filings would reduce the flow of the North Umpqua River to less than 500 cfs and the exercise of all potential rights below this section would reduce the flow at the mouth of the North Umpqua River to less than 450 cfs.

On this basis, it can be presumed that existing supplies below Winchester dam are not sufficient to provide for all needs, and the situation will become more critical as additional development takes place.

Pollution Abatement

Existing needs for pollution abatement in terms of dilution of present loads in the North Umpqua sub-basin indicate a need for a minimum of 6.0 cfs for this purpose, if it is assumed that the degree of treatment indicated in the "Criteria - Sub-basin Analysis" is fully established.

Pollution abatement requirements for the future are approximately 13 cfs. This is projected from existing requirements and does not take into account the construction of pulp and/or paper processing operations in this area. In the tentative standards set forth at the Roseburg hearing of October 15 and 16, 1956, the State Board of Health, through its Sanitary Engineering Division, advised that some authorities feel that a flow of approximately 500 cfs is required to dilute the waste from each hundred tons of pulp produced per day. This value is based on adequate control of toxic waste materials.

If such a standard were adopted, there would be extensive periods during the summer months when the flow in the North Umpqua River would limit pulp and paper capacity to about 200 tons per day. During critical flow years, the restriction would be even greater and untreated wastes from process capacities much above 100 tons could not be tolerated.

METHODS OF RESOURCE DEVELOPMENT

A reconnaissance study of the North Umpqua sub-basin was made from topographic maps covering that area of the sub-basin from River mile 30 to 63. Topographic maps available for that area above mile 63 were at 1/125,000 scale and unsuitable for analyzing storage capacities. It can be pointed out, however, that this area of the sub-basin (above mile 63) contains no major reservoir sites. Any impoundment structures would have to be located in the steep-walled canyons of the North Umpqua River and its tributaries, and while many structural sites are available, the amount of water that could be impounded in relation to the size and cost of the structure is so small that it rules out development for the basic purpose of providing regulation for flow. In developing the power potential of the area above mile 63, COPCO has utilized total storage of about 17,000 acre-feet, not all of which is active storage. Of this storage, 13,900 acre-feet are in the reservoir for Lemolo No. 1, located at the junction of Lake Creek and the North Umpqua River.

Storage Possibilities - North Umpqua

Between the community of Glide and mile 63, there are several possible storage sites and these are dealt with in Water Supply Paper 636-F, U. S. Geological Survey. Reservoir sites indicated in the report were all located on the main stem of the North Umpqua River and were to be used to regulate streamflow for the purposes of producing hydroelectric power. In every case, these reservoirs would require impoundment structures approximately 200 feet or more in height, and the storage obtained would be relatively small in relation to the cost of the structure.

The Copeland site near the Illahe ranger station would require a dam 200 feet high to provide a storage capacity of 40,000 acre-feet.

The Steamboat site would require a dam 190 feet high. Storage capacity at this height would amount to 28,000 acre-feet. This site would be approximately two and one-half miles above the mouth of Steamboat Creek.

The Boundary site, one mile below Fall Creek just west of the National Forest line, would require a 225-foot structure to achieve a storage capacity of 79,000 acre-feet.

The Clark Ranch site, about four miles above the mouth of Rock Creek, would require a structure 110 feet high to achieve 24,000 acre-feet of storage.

The Rock Creek site, which is located about one mile above Rock Creek, would require a sixty-foot structure to obtain storage of 17,000 acre-feet.

The Horseshoe Bend site, located at mile 21.5 on the North Umpqua River near the mouth of Cooper Creek, would provide 28,000 acre-feet of storage. However, construction of this project would result in the dislocation of the heavily developed area in and immediately below the community of Glide and it would, therefore, appear that the possibilities of developing this site are limited.

The Oak Creek site, four miles downstream from Horseshoe Bend at the confluence of the North Umpqua River and Oak Creek, would have a storage of 22,000 acre-feet with a sixty-foot structure. Here, again, severe dislocations of existing facilities would take place, particularly of summer homes and farms located in this area.

Storage Possibilities - North Umpqua Tributaries

Quadrangle maps of the U. S. Geological Survey, available in late June, 1957, indicate limited possibilities for storage on tributaries of the North Umpqua River.

Rock Creek

Reconnaissance examinations indicate a possibility of storage on Rock Creek with a maximum potential of 110,000 acre-feet. Such development would require a reservoir approximately six miles long, extending from the intersection of the south boundary of section 30, township 25S, range 2W to above the confluence of Rock Creek and Herrington Creek in section 11, township 25S, range 2W.

Water from storage in this general area could be utilized for the improvement of minimum flow conditions in the lower section of the North Umpqua and the main stem of the Umpqua River. Such storage would add significant amounts to minimum flows during critical yield years.

Primary losses occasioned by storage on this tributary would be the effects on the anadromous fish runs of Rock Creek. This stream is a spawning area for silver salmon and steelhead trout. The upstream limits of the migration are far above the potential structural site. Substantial spawning areas lie above the potential dam site. In addition, the location of a reservoir in this area would require the relocation of some five miles of county road and would also inundate the present logging operation and mill plant in section 21, township 25S, range 2W. Potential for the development of this site is limited.

Steamboat Creek

Only one major storage possibility exists on Steamboat Creek and Canton Creek, its major tributary. The possibility lies in the structural site located in the vicinity of Black Gorge on Steamboat Creek, section 27, township 25S, range 1E. Maximum storage potential for this development would approximate 240,000 acre-feet and the reservoir would extend some five and one-half miles from Black Gorge to the confluence of Steamboat Creek and Big Bend Creek.

The benefits from this particular development have not been fully established, but would be similar to the benefits derived from storage on Rock Creek, although of lesser magnitude.

This development would also interfere with the steelhead runs that occur on Steamboat Creek and would be particularly adverse in light of the fisheries management program of the Oregon State Game Commission. The Game Commission for the past several years has closed Steamboat Creek and its tributaries to fishing in order to develop more fully the potential of this stream as a spawning area for steelhead. This development would also require extensive relocation of county roads in areas of extremely difficult terrain. Such a development would substantially alter the type of recreation presently available on this stretch of the river and would inundate Steamboat Falls.

Little River

Potential for storage exists on Little River. The major possibility, from a physical point of view, would be offered by a 300-foot-plus section storing a maximum of 280,000 acre-feet. If structurally and economically feasible, the site of the impoundment structure would be approximately one mile above the confluence of Little River and Cavitt Creek. Data on this development has become available only recently, and full analysis has not been completed. In general, the evaluations would be similar to those of Rock and Steamboat Creeks, none of which have had studies relative to their power potential.

Development in this area and at the Cavitt Creek site in section 34, township 27S, range 3W, with a capacity of 30,000 acre-feet, would both raise difficulties with respect to the anadromous fish runs. Chinook salmon, silver salmon, and steelhead trout all use this stream system as a spawning area. Development on Little River would also cause serious dislocations of suburban developments in the vicinity of Boundary Creek and Wolf Creek.

All the structures indicated in this section on Tributary Storage would probably be expensive in relation to the number of acre-feet of water stored and would not appear feasible in the immediate future. Full economic and structural feasibility would require detailed site investigations and analyses.

Gains from Storage

If economical storage could be developed on the North Umpqua River, a more stabilized stream flow would provide additional flows to meet the present unsatisfied requirements of nonconsumptive use for fish life and additional water during low flow periods which could be utilized in dilution of domestic and industrial wastes.

Losses from Storage

Major loss from storage would probably be damage to anadromous fish runs. Although it might not properly be characterized as a loss, there would be a change in the recreation and scenic patterns of the river itself by the creation of slack waters behind impoundment structures.

NORTH UMPQUA

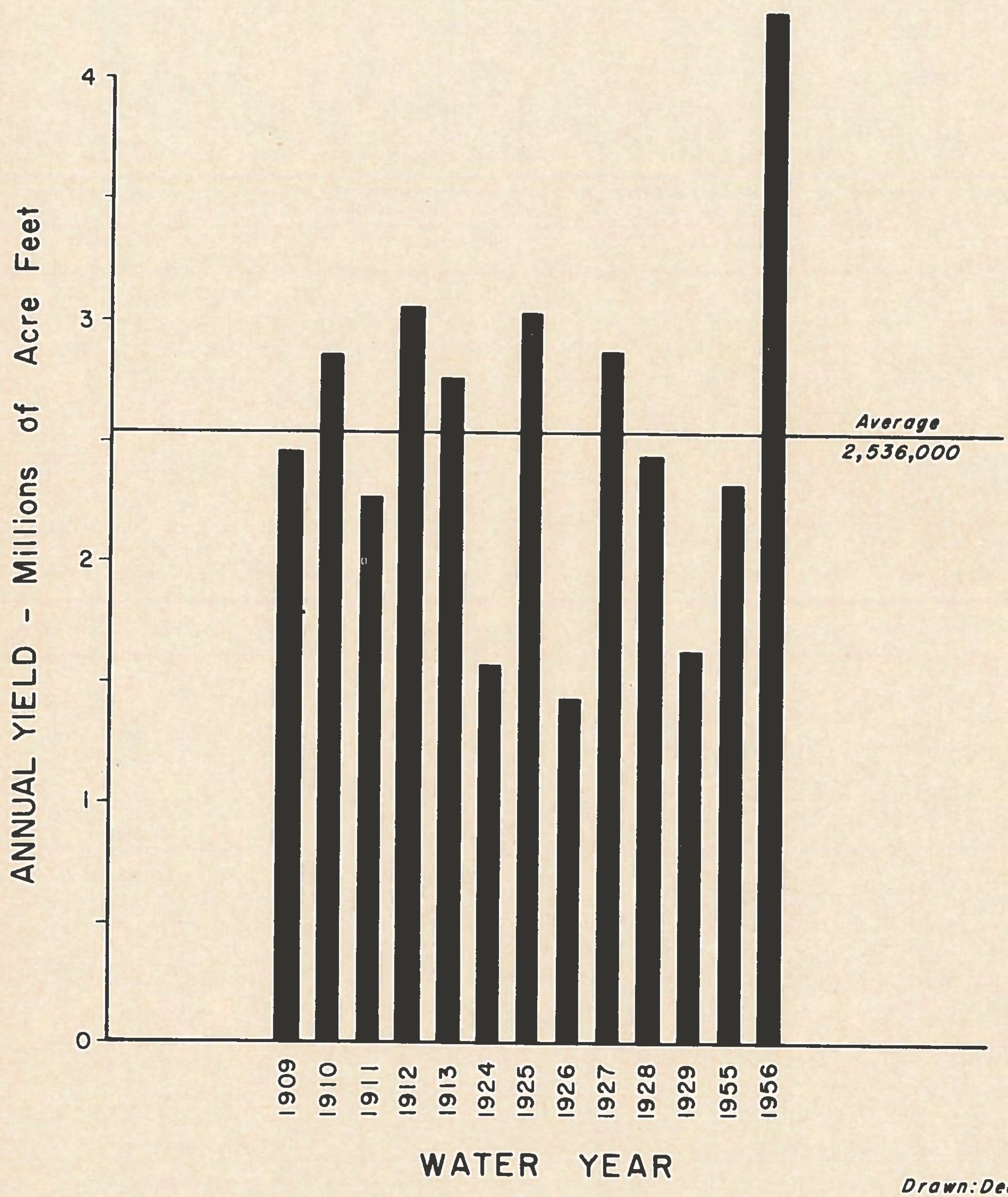
UMPQUA RIVER BASIN

YIELD DIAGRAM

ANNUAL YIELD
OF

NORTH UMPQUA RIVER AT WINCHESTER

Drainage Area 1,350 Sq. Mi.



NOTE: Records Incomplete for years not shown.

Drawn: Dec., 1957
File No. 16.220

FIGURE 25

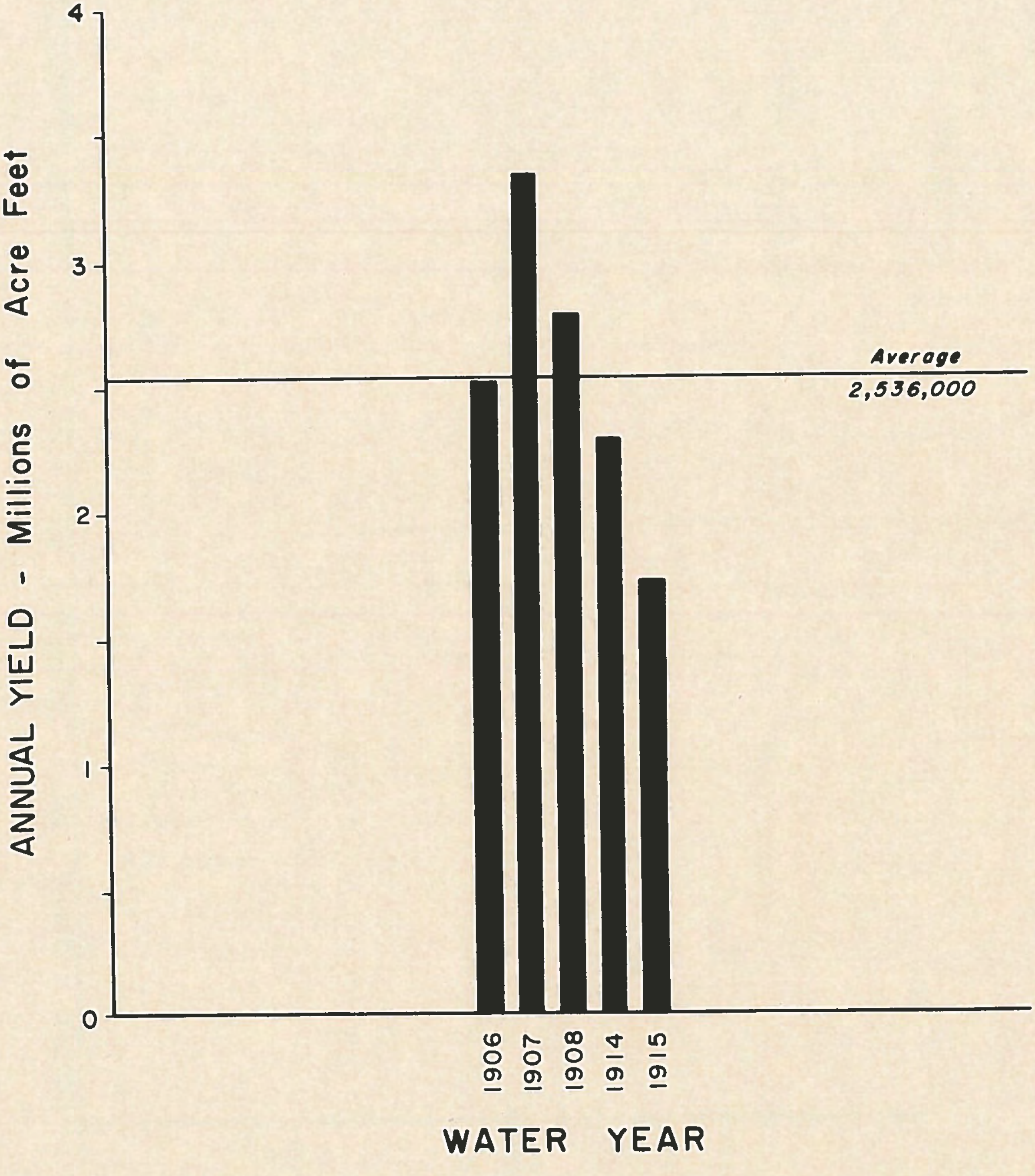
UMPQUA RIVER BASIN

YIELD DIAGRAM

ANNUAL YIELD
OF

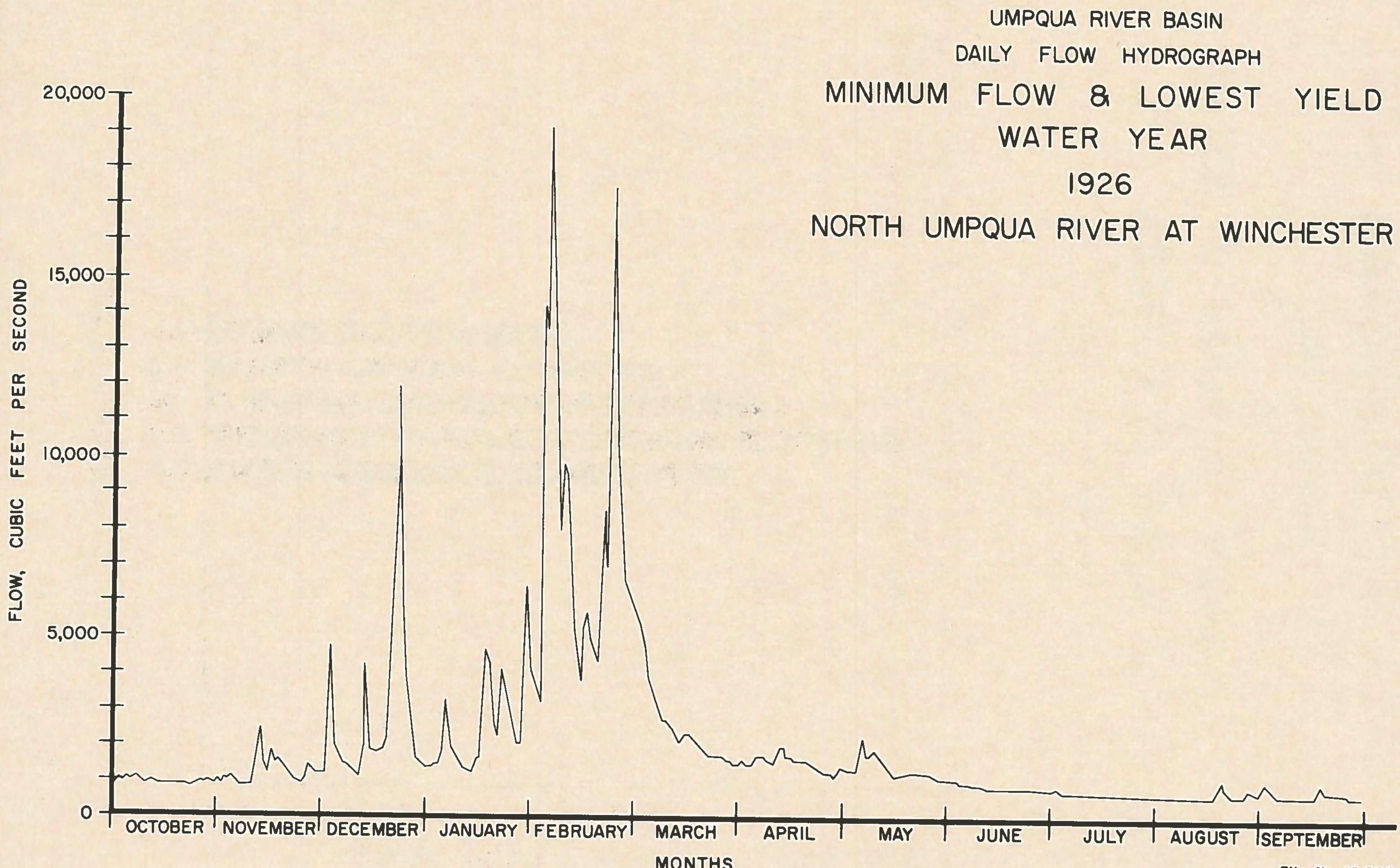
NORTH UMPQUA RIVER NEAR OAKCREEK

Drainage Area 1,276 Sq. Mi.



Drawn: Dec., 1957
File No. 16.220
FIGURE 26

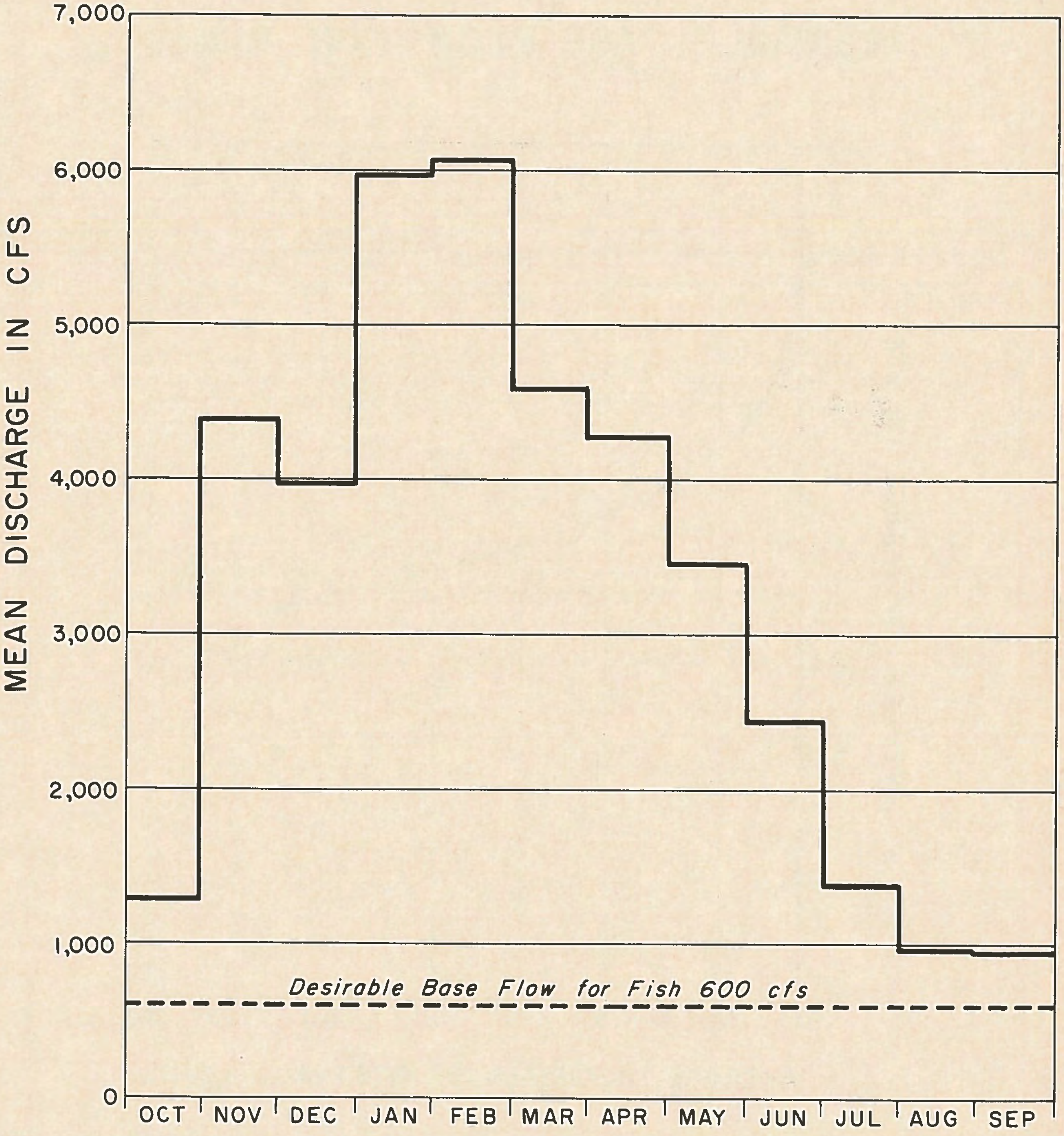
NOTE: Records incomplete for years not shown.



File No. 16.202
FIGURE 27

UMPQUA RIVER BASIN
MEAN MONTHLY HYDROGRAPH

NORTH UMPQUA RIVER AT WINCHESTER



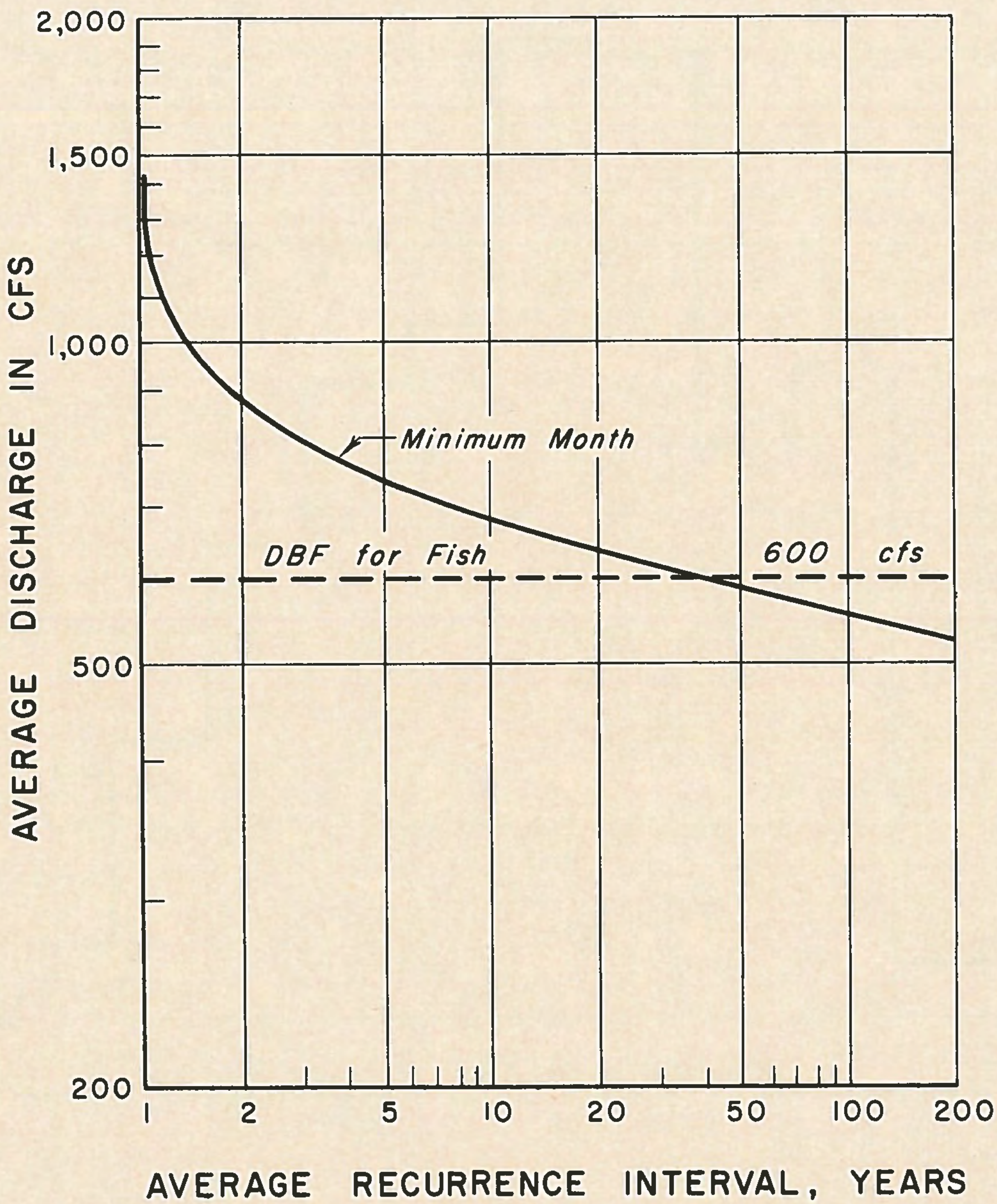
YEARS OF RECORD 1909 - 1913
1924 - 1929

File : 16.202

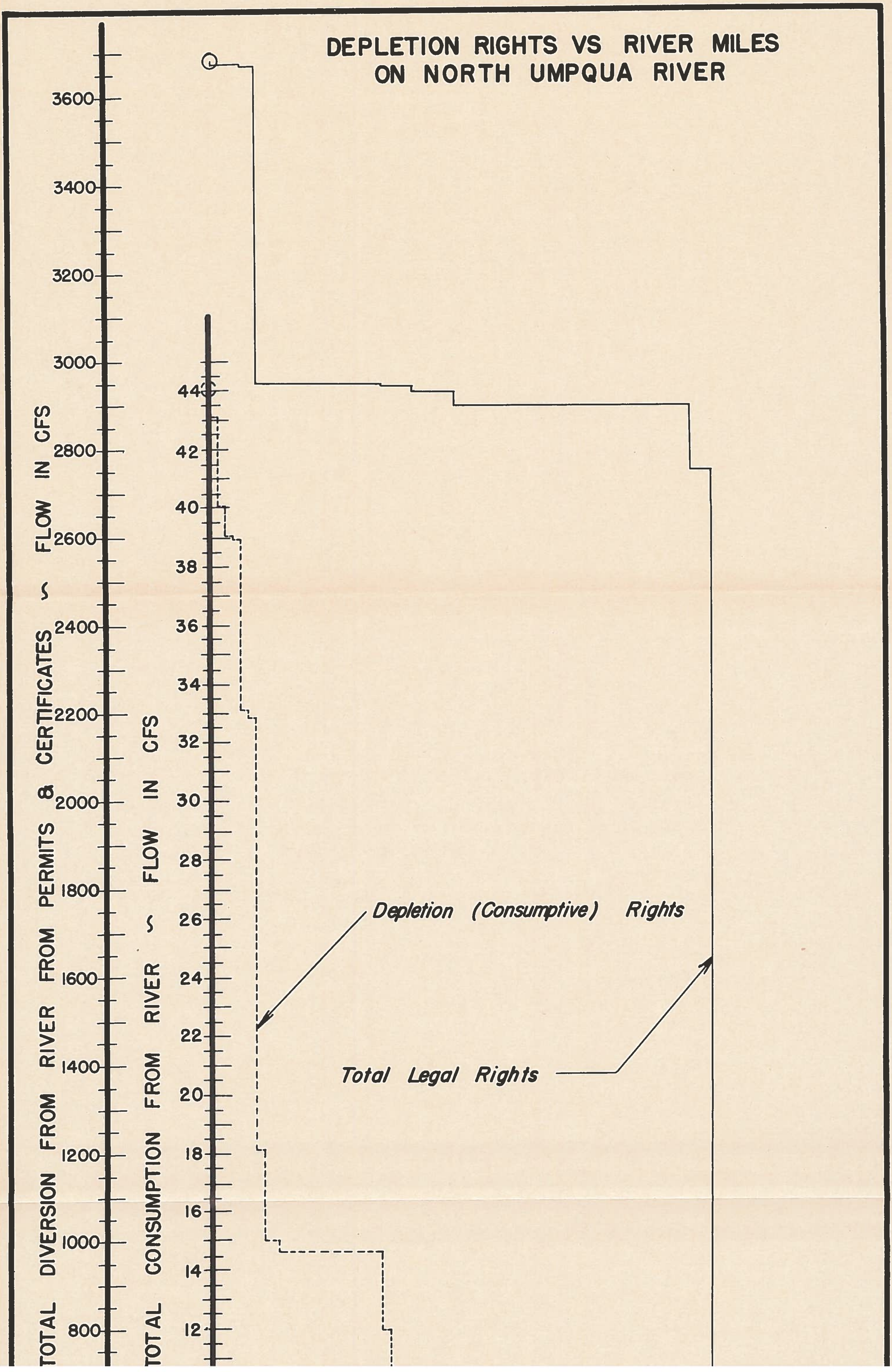
UMPQUA RIVER BASIN

NORTH UMPQUA AT WINCHESTER

LOW FLOW FREQUENCY CURVE
AND
DESIRABLE BASE FLOW FOR FISH



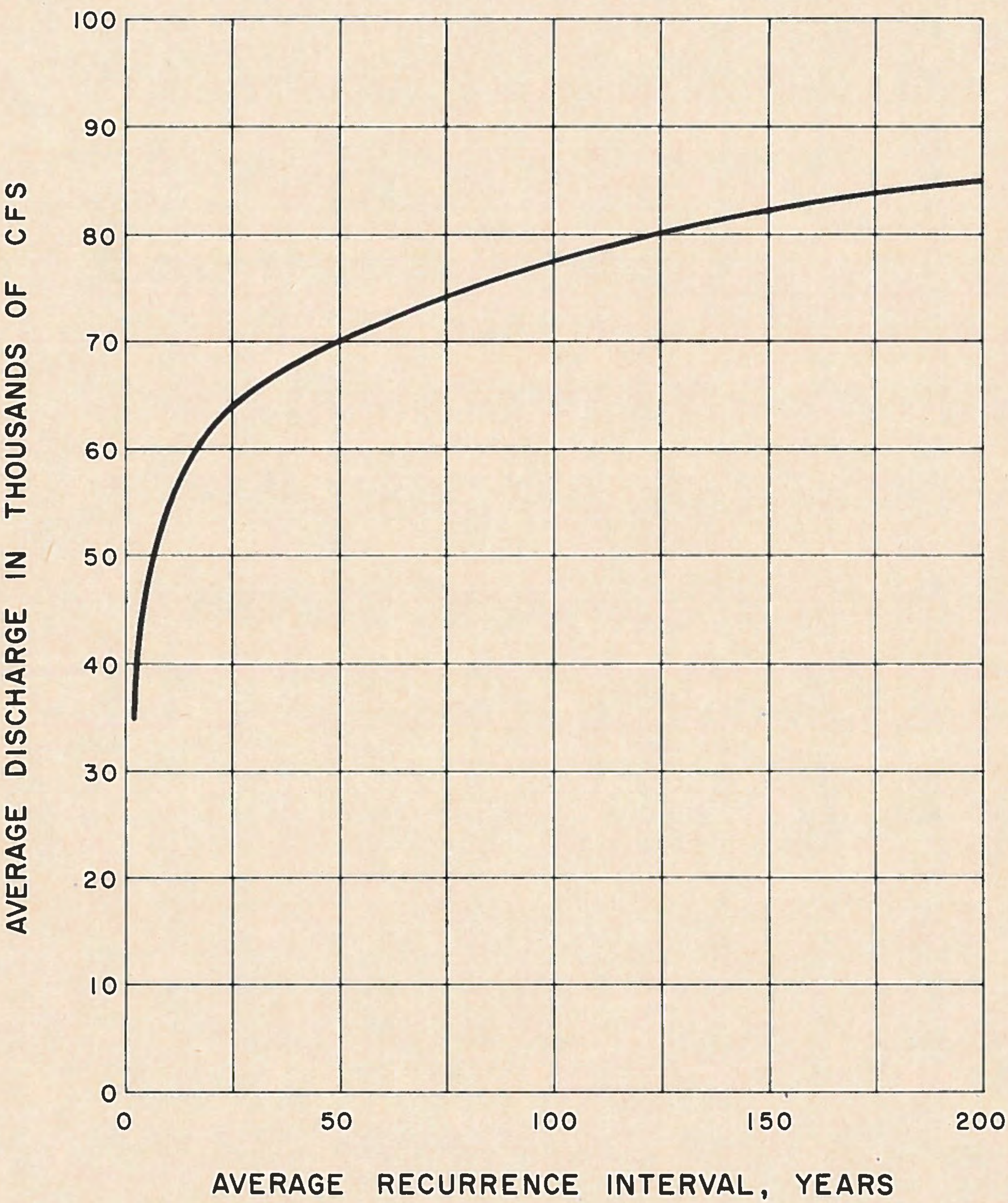
Drawn: Jan., 1958
File No. 16.203
FIGURE 29


DEPLETION RIGHTS VS RIVER MILES
ON NORTH UMPQUA RIVER
TOTAL DIVERSION FROM RIVER FROM PERMITS & CERTIFICATES ~ FLOW IN CFS
3600
3400
3200
3000
2800
2600
2400
2200
2000
1800
1600
1400
1200
1000
800
TOTAL CONSUMPTION FROM RIVER ~ FLOW IN CFS
44
42
40
38
36
34
32
30
28
26
24
22
20
18
16
14
12
Depletion (Consumptive) Rights
Total Legal Rights

UMPQUA RIVER BASIN

NORTH UMPQUA RIVER NEAR GLIDE

FLOOD FREQUENCY CURVE



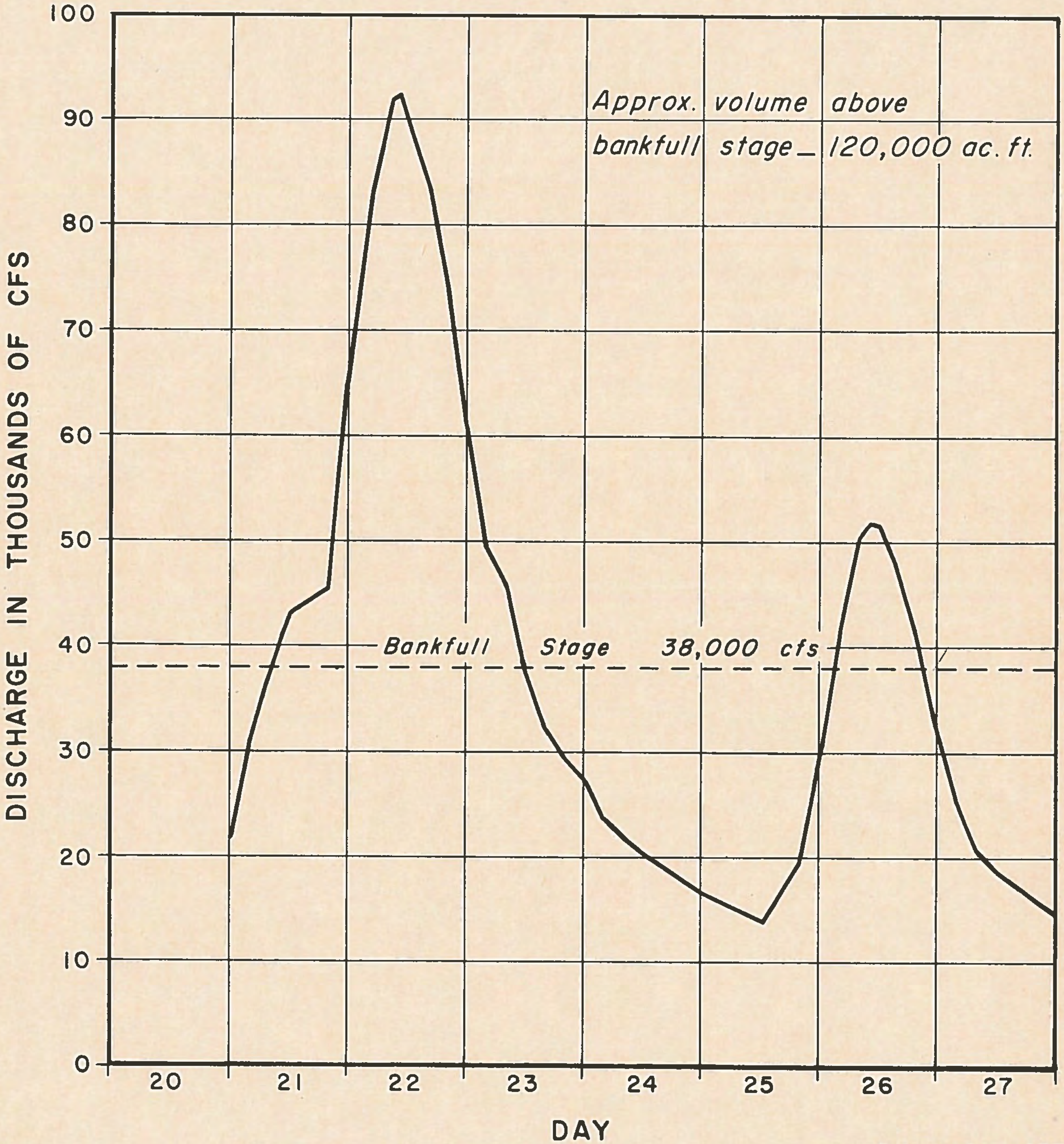
Drawn: Dec., 1957
File No. 16.203
FIGURE 31

UMPQUA RIVER BASIN

FLOOD HYDROGRAPH

NORTH UMPQUA RIVER AT WINCHESTER

DECEMBER 1955



Drawn: Jan., 1958
File No. 16.202
FIGURE 32

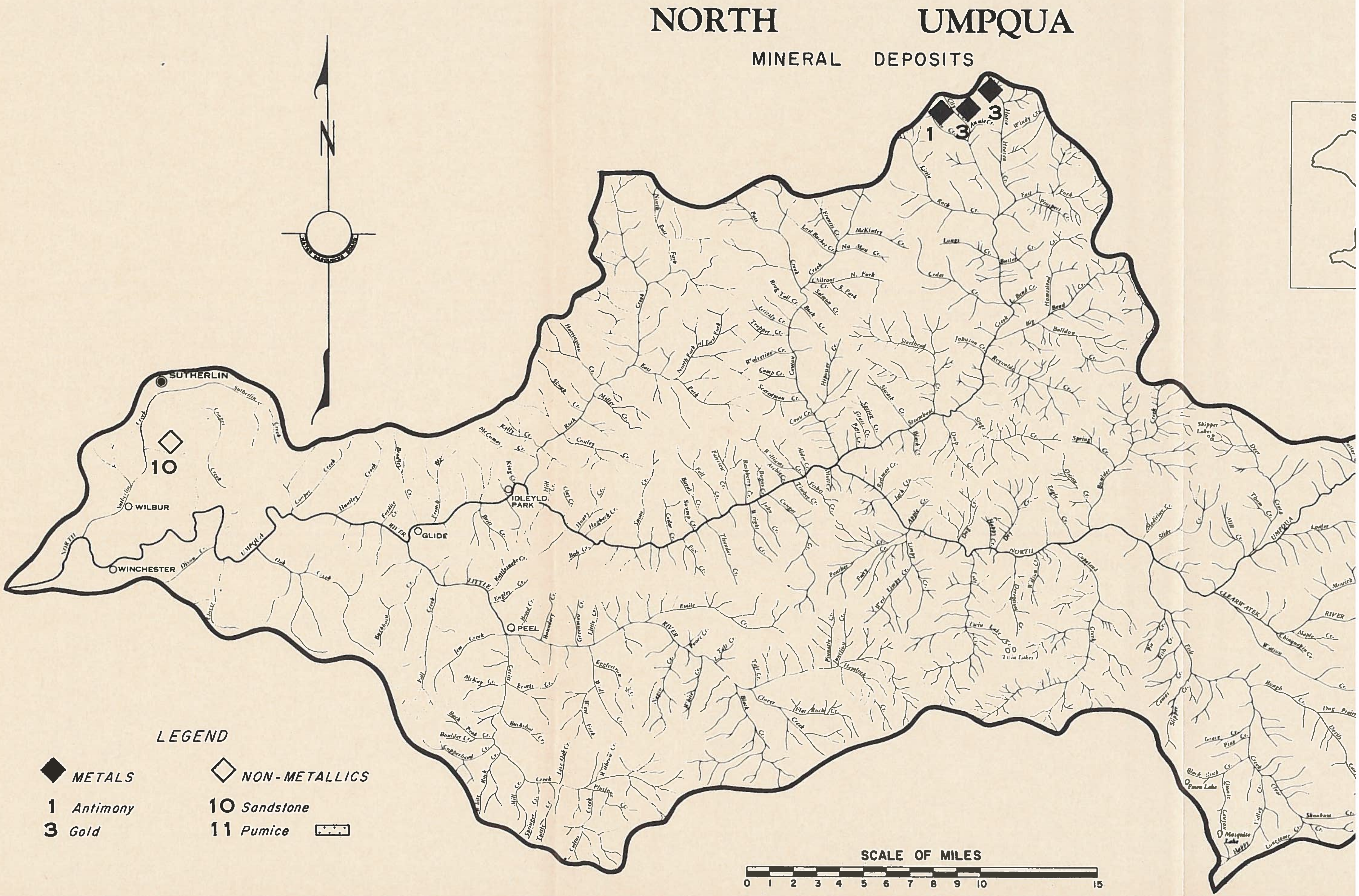

NORTH UMPQUA
MINERAL DEPOSITS
N
SUTHERLIN
WILBUR
WINCHESTER
GLIDE
IDLEYLD PARK
PEEL
UMPQUA
NORTH
RIVER
LITTLE
CLEARWATER
10
1
3
3
LEGEND
METALS
1 Antimony
3 Gold
NON-METALLICS
10 Sandstone
11 Pumice
SCALE OF MILES
0 1 2 3 4 5 6 7 8 9 10 15

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 exent 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

TABLE OF CONTENTS

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 case, more than one geologic formation.

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

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

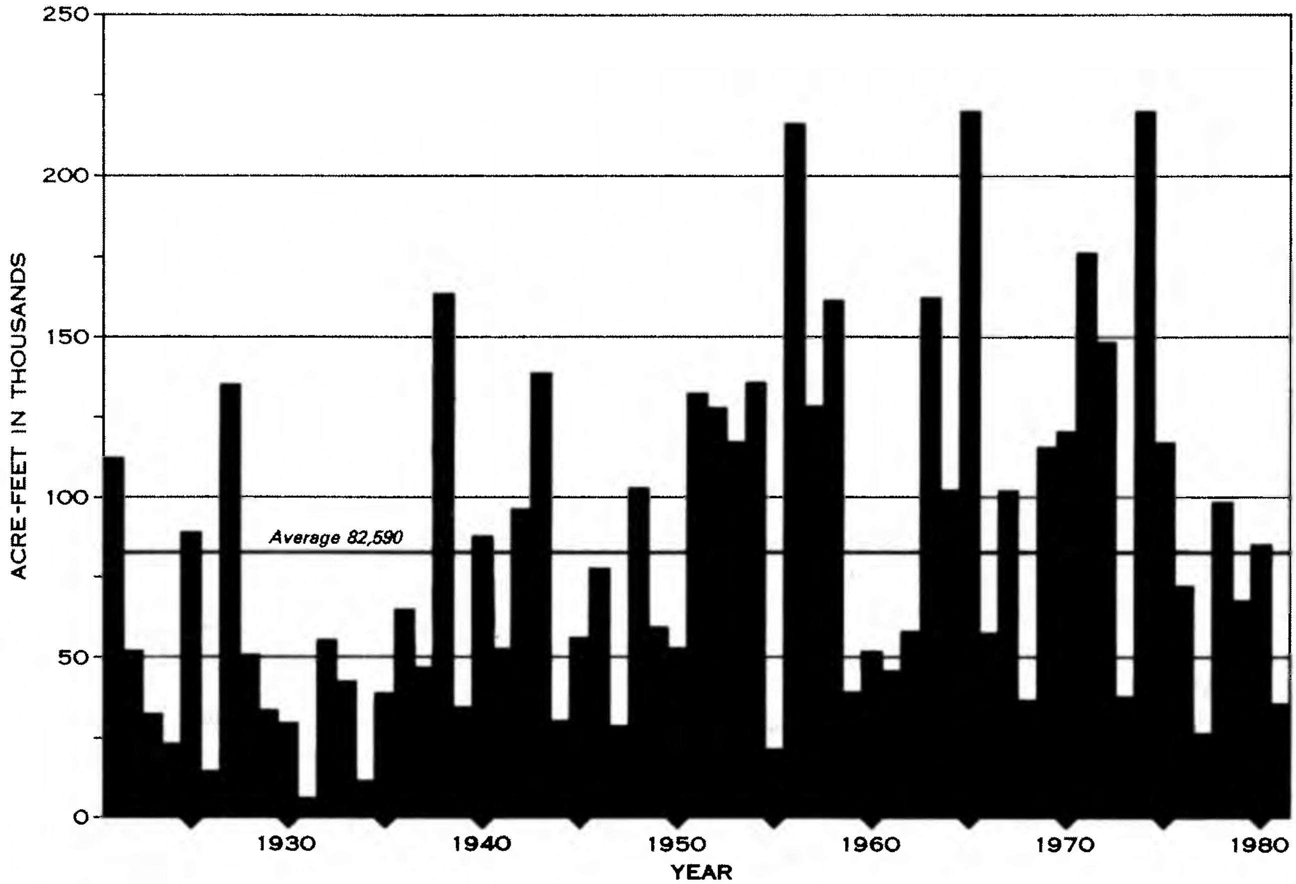
(1) 11/1 to 5/1

Figure 7

RUNOFF
Bear Creek At Medford

DRAINAGE AREA 289 SQ. MI.

ANNUAL



MONTHLY DISTRIBUTION

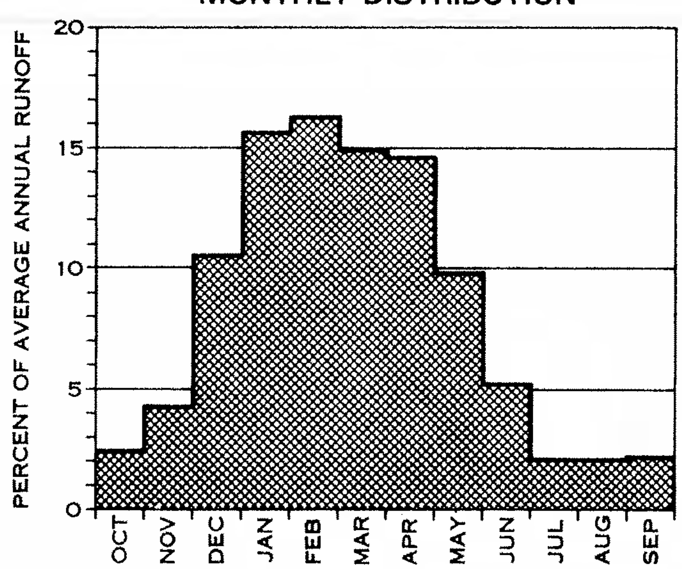
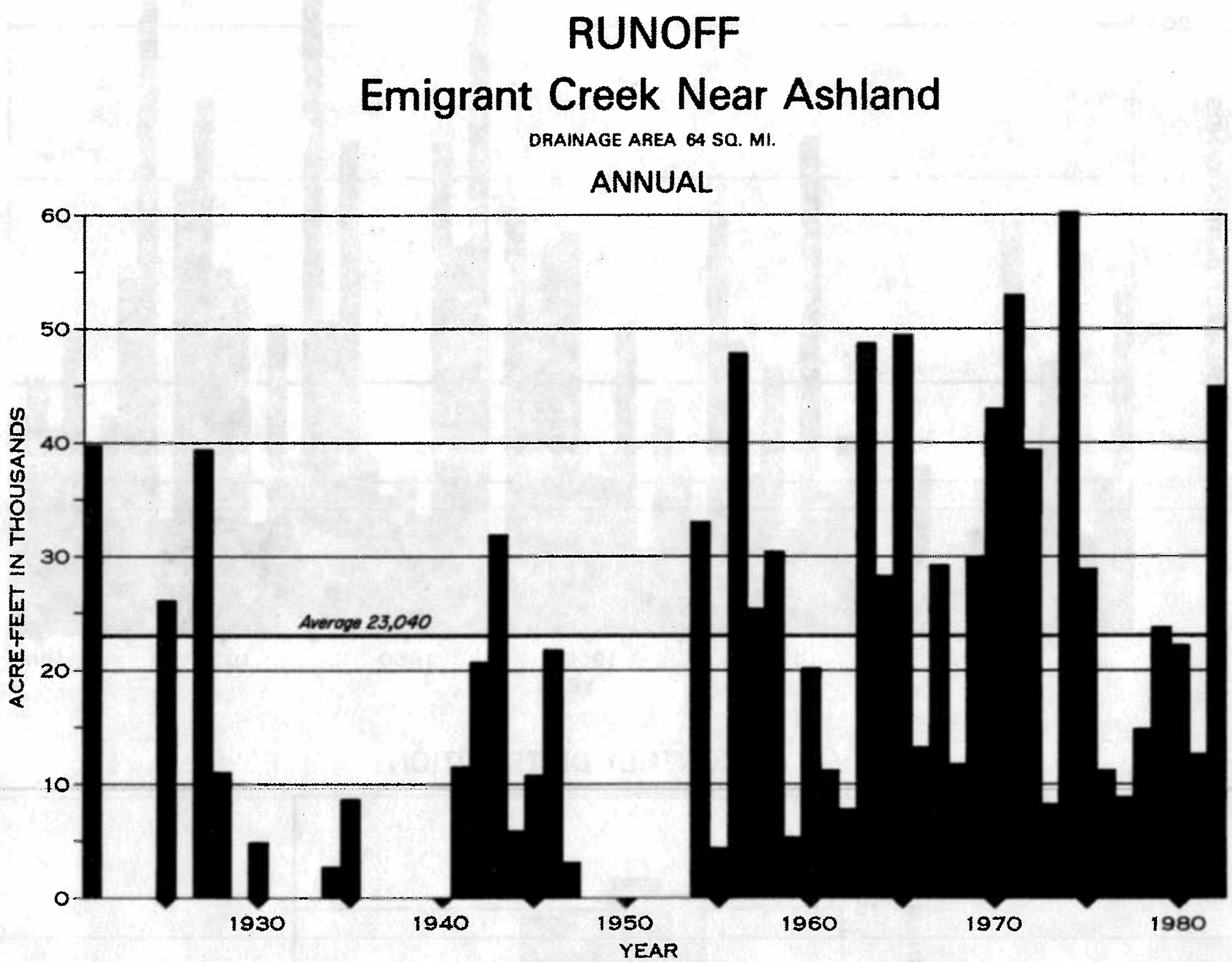


Figure 8



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

effect on the fisheries resource must be made.

There are areas within the Lower Umpqua sub-basin where watershed treatment and management would be physically desirable. Suitable criteria and data for determining cost and benefit are not available to evaluate the contribution of any resource augmentation or conservation program based on watershed management.

Smith River

For the foreseeable future, the primary key to development of water resource of the Smith River watershed is water management and regulation through storage.

Storage Possibilities

The total storage potential for the Smith River watershed is approximately 307,000 acre-feet and the yield of the watershed is approximately 600,000 acre-feet of water per year. Of the total storage, 77,000 acre-feet is on the North Fork of the Smith River, considered by the Oregon State Game Commission to be an excellent spawning stream for silver and chinook salmon and steelhead trout. The other 230,000 acre-feet of storage is concentrated in reservoir sites in the vicinity of the town of Gunter. Utilization of a potential damsite approximately three miles downstream from Gunter could develop any amount of storage up to the practical yield of the drainage area above the site which is estimated at 100,000 acre-feet per year. Active storage of only 60,000 acre-feet of water at this site would provide a sustained flow at Smith River Falls of 300 cfs for a period of 100 days.

The storage potentials indicated above are based on rough reconnaissance data and show the physical potential for impoundment as determined from the examination of topographic maps and very limited field observation.

Information has not been obtained on geology, detailed hydrology, or costs and benefits which are factors essential to the development of project specifics.

Other Methods

There are none that offer any material advantages at this time.

Mill Creek

There is little interest in water resource development within the Mill Creek drainage area. Present problems are insignificant with the exception of minimum flows for fish. Existing problems of consumptive nature are insignificant.

Storage Possibilities

A U. S. Geological Survey of a localized nature indicates that total storage potential for the area at Loon Lake is about 150,000 acre-feet; at the lower Lake Creek site, 50,000 acre-feet. This capacity for storage approaches the average annual yield of record for the watershed. Such storage, if developed, probably would provide full regulation of the watershed (above Loon Lake) yield in a year of average yield.

The reconnaissance investigations of the Board show potential for storage on Camp Creek, which is one of the primary tributaries of the Mill Creek watershed. In the vicinity of the confluence of Camp Creek and Little Camp Creek, potential exists for storage with a maximum capacity of some 40,000 acre-feet. Map reconnaissance indicates that structural sites may exist in township 23S, range 9W, section 12. No specific site evaluation has been made relative to structural possibilities or limitations. Storage of this capacity could provide for full regulation of the flow of the Camp Creek drainage above this point in a normal runoff year.

Other Methods

None

Elk Creek

Full development of the Elk Creek watershed is dependent upon the storage of water. Total storage potential amounts to 430,000 acre-feet. Substantial portions of this storage potential have been ruled out on the basis of reconnaissance investigations.

Storage Possibilities

Bully Creek, a tributary of Elk Creek, discharging into the main stem about two miles downstream from Drain, has a 80,000 acre-feet 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

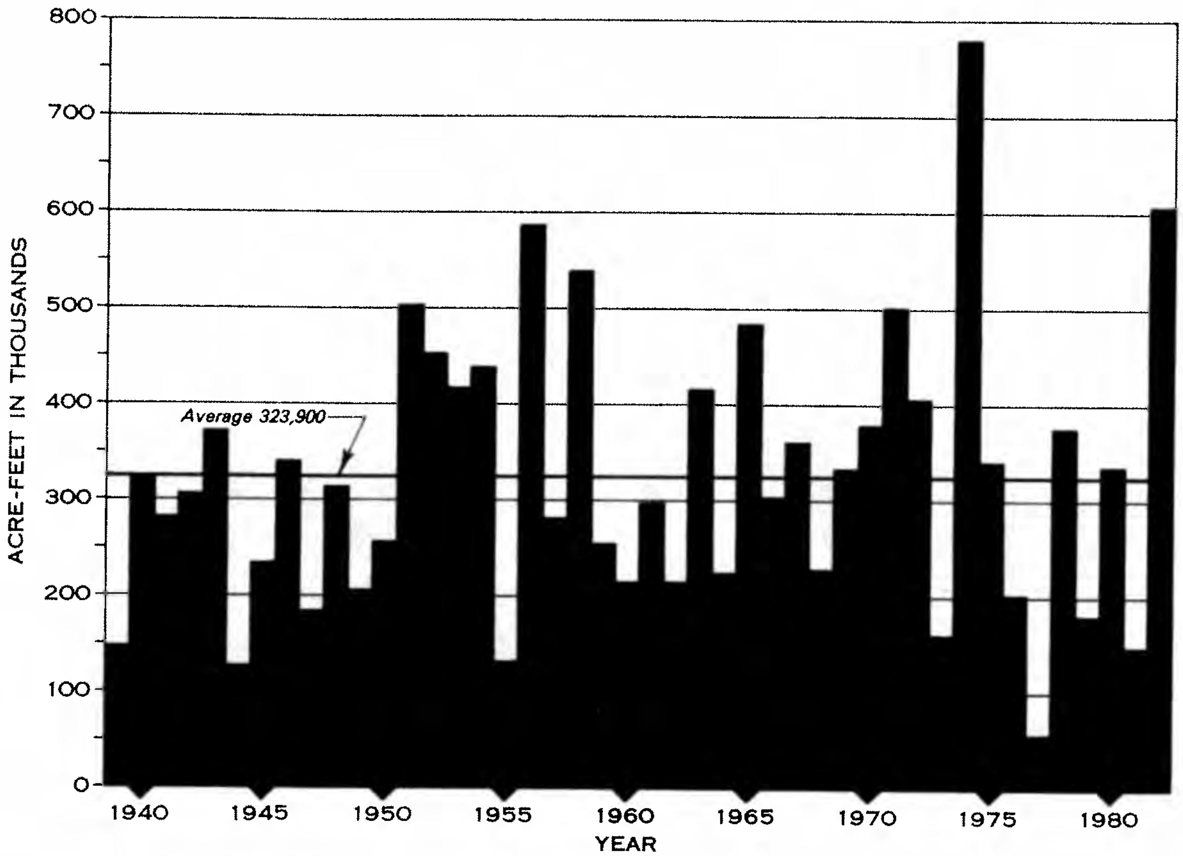
Figure 9

RUNOFF

Applegate River Near Copper

DRAINAGE AREA 223 SQ. MI.

ANNUAL



MONTHLY DISTRIBUTION

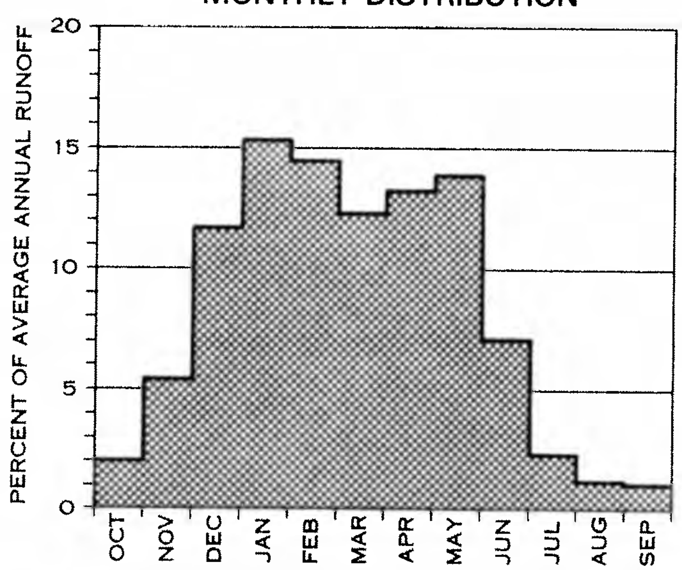
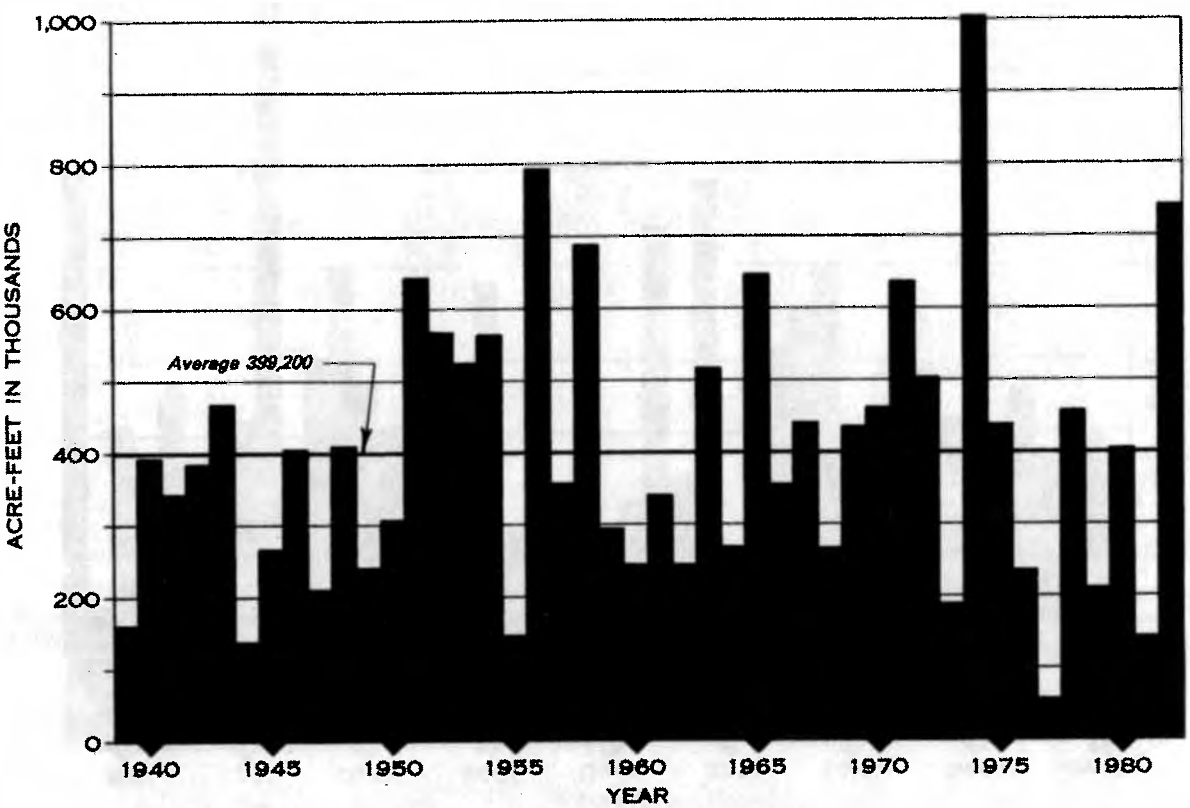


Figure 10

RUNOFF
Applegate River Near Applegate

DRAINAGE AREA 483 SQ. MI.

ANNUAL



MONTHLY DISTRIBUTION

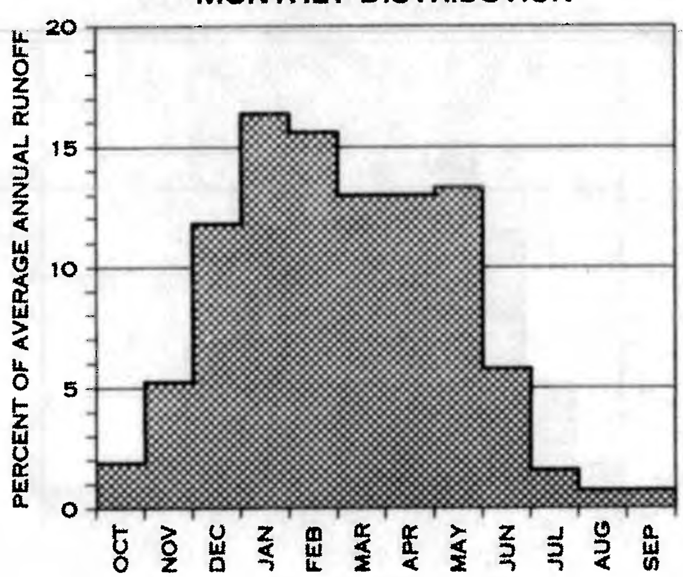


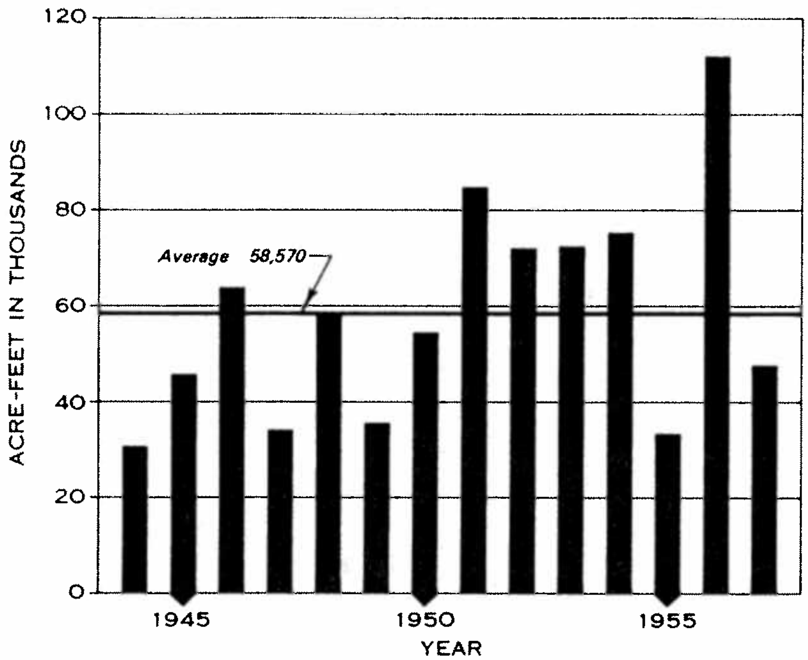
Figure 11

RUNOFF

Slate Creek At Wonder

DRAINAGE AREA 31.4 SQ. MI.

ANNUAL



MONTHLY DISTRIBUTION

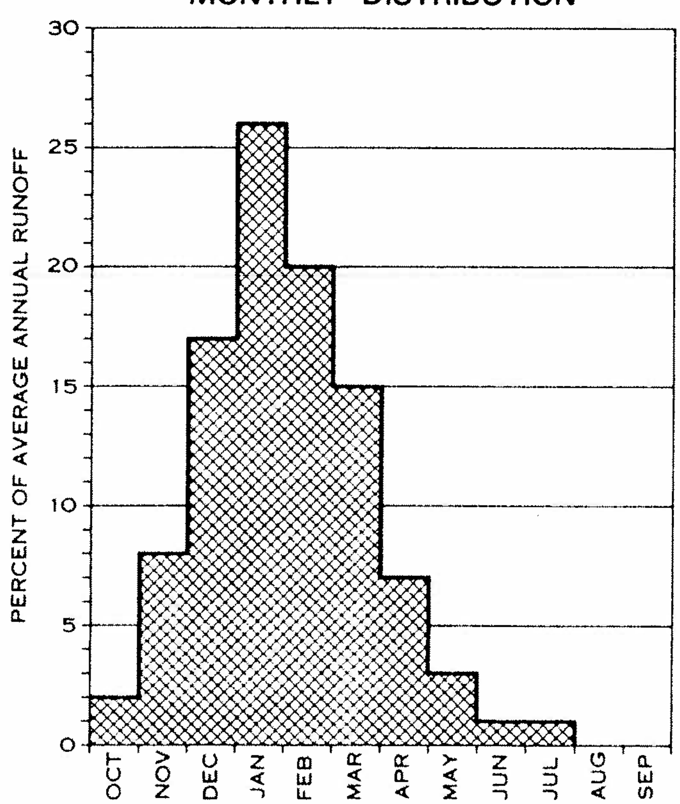


Figure 12

RUNOFF

Powell Creek Near Williams

DRAINAGE AREA 8.17 SQ. MI.

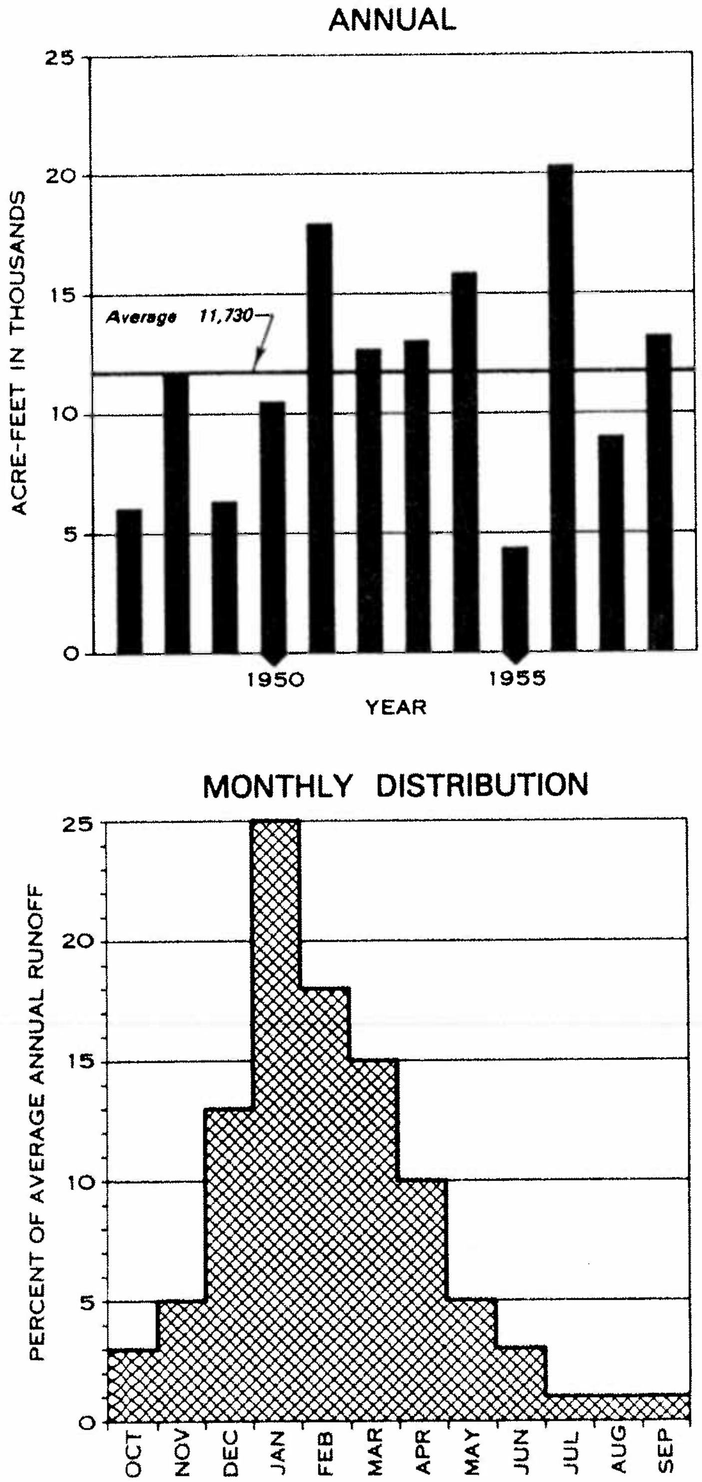


TABLE 51

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	NOV-MAY	FLOW, CFS b/ JUN-OCT	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

TABLE OF CONTENTS

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.

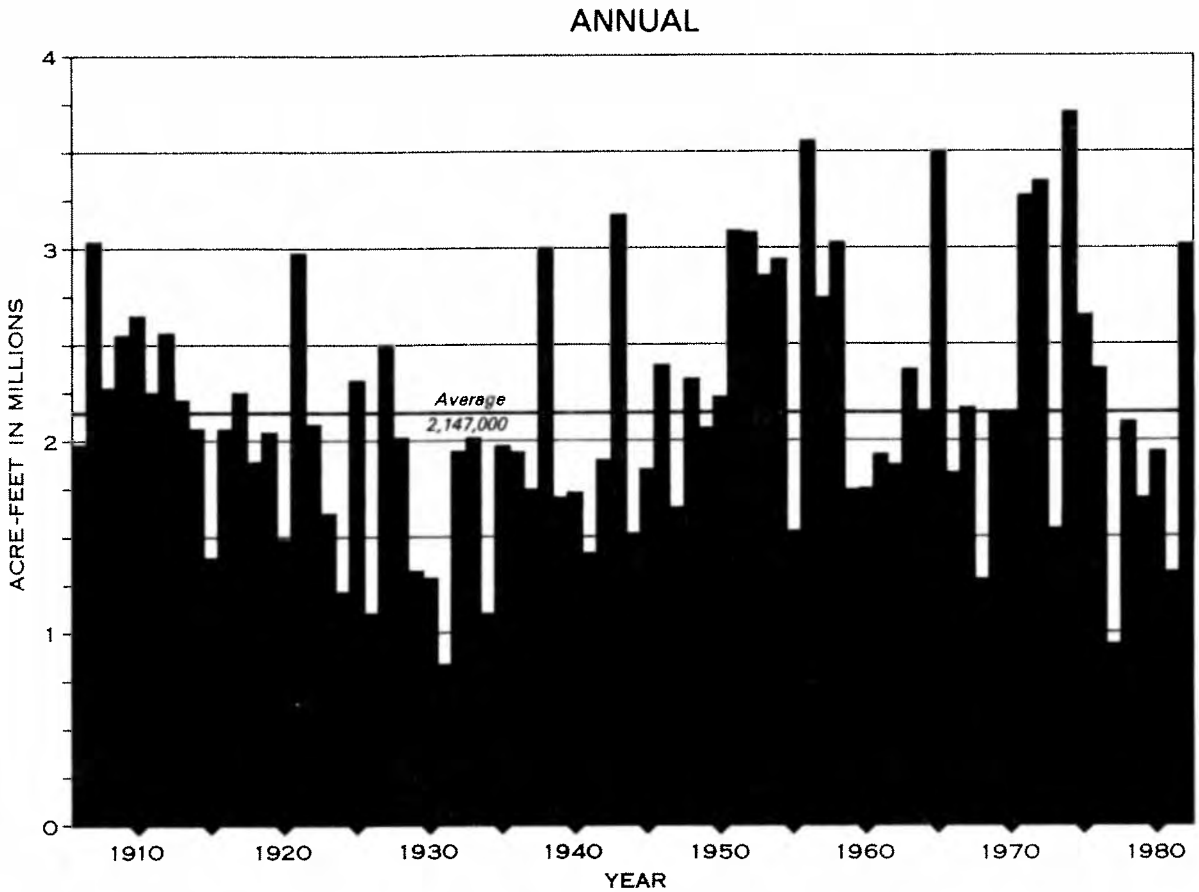
Monthly distribution diagrams for the three points are shown in Figures 13-15. These diagrams show the percentage of annual runoff that occurs during each month. For example, on Grave Creek over 21 percent of the runoff occurs in January. Most of the tributary streams in this basin have runoff characteristics 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.



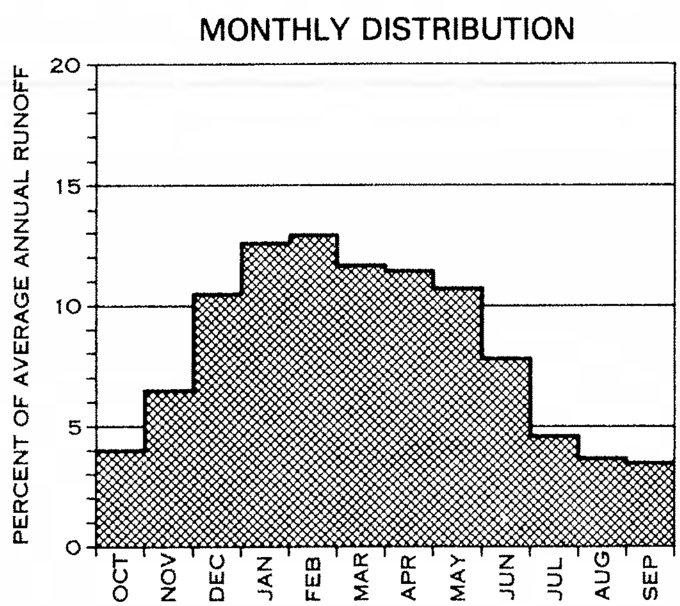


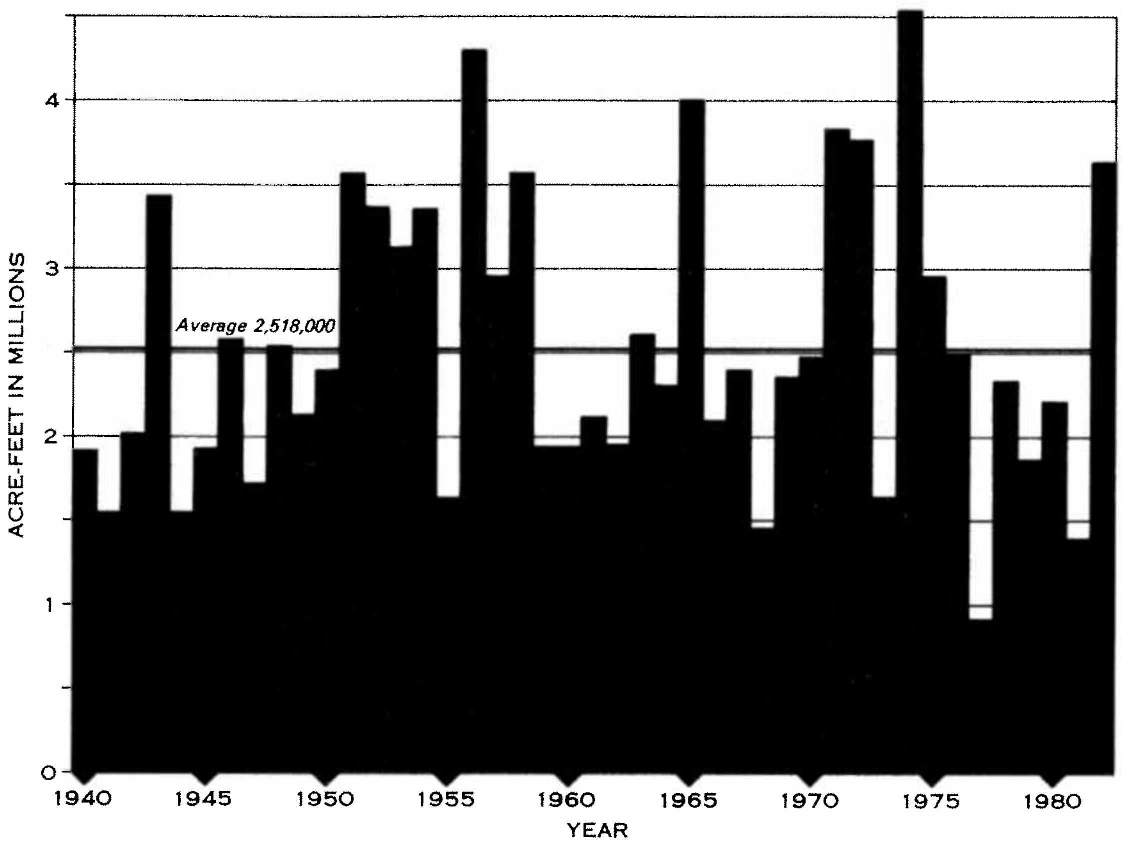
Figure 14

RUNOFF

Rogue River At Grants Pass

DRAINAGE AREA 2,459 SQ. MI.

ANNUAL



MONTHLY DISTRIBUTION

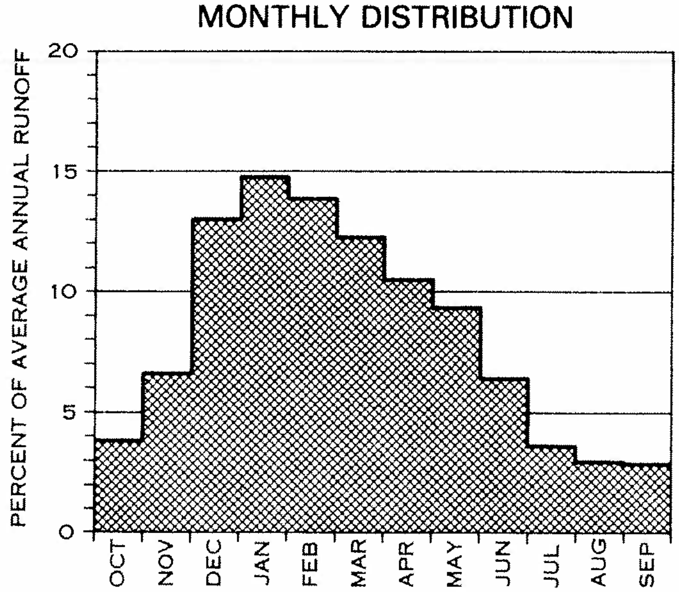
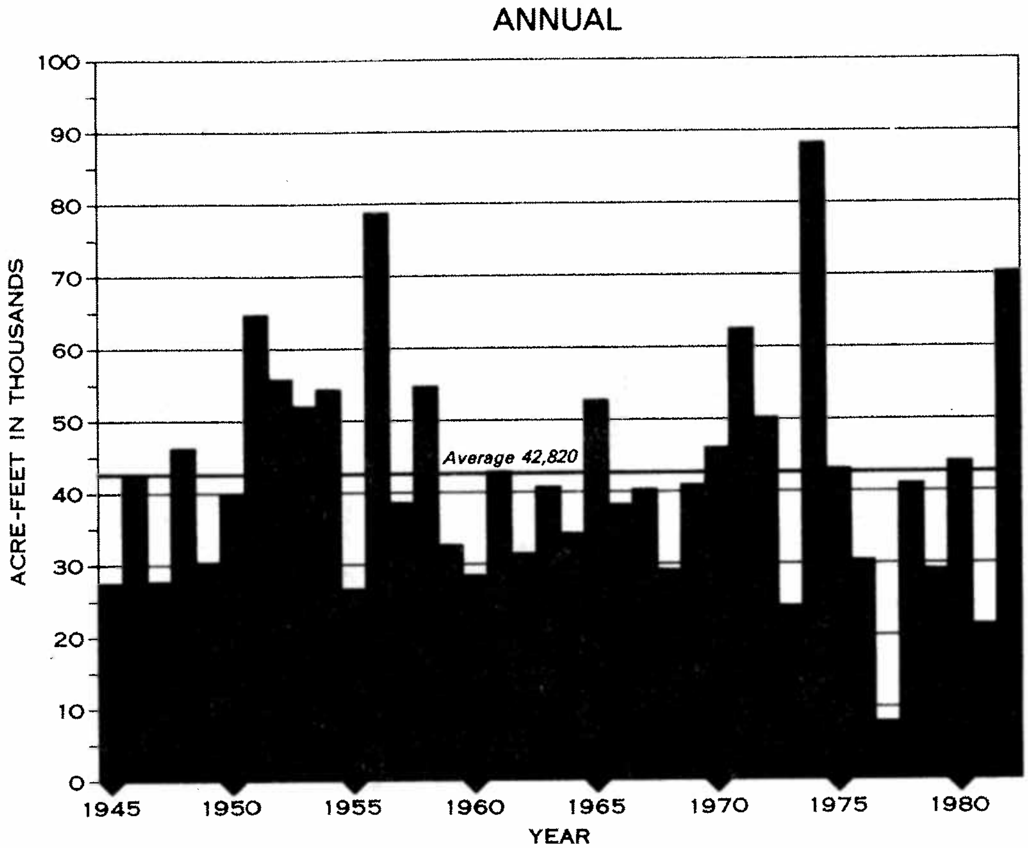


Figure 15

RUNOFF
Grave Creek At Pease Bridge

DRAINAGE AREA 23 SQ. MI.



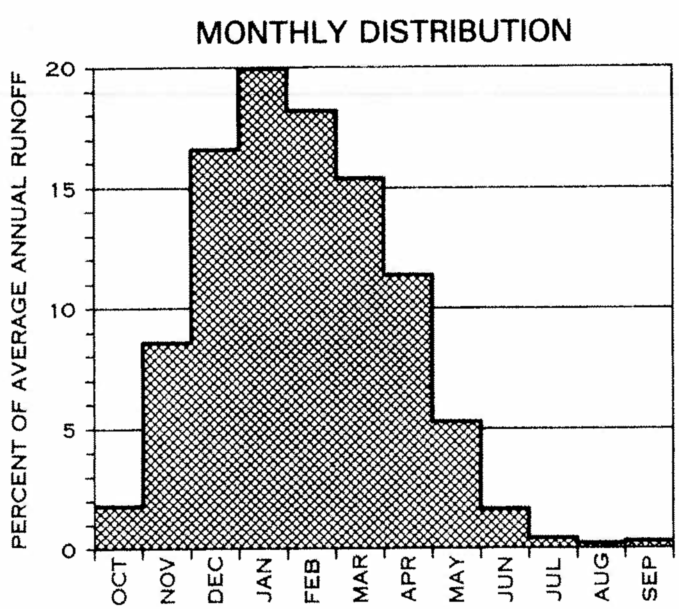


TABLE 57

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] 17[2] 45				.02
Grave Creek	33.31	1.335	.01		2.2	1.53		70.84 353.35[2]				.02 .20
Jumpoff Joe Creek	26.975	.563	.01		3.75	.47		47.51 155.00[2]	.55[2]			.01
Foots Creek	3.933	.566						26.67 39.25[2]			.01	
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
Rogue River Misc.	217.951	3.754	.178		3.107	1.273	.01	.15 115.530 206.75[2] 65.05[3]	7.98	20.84	.21	.05
TOTALS	645.093	8.013	.418	167.50	10.092	53.843	.01	697.39 16[1] 895.35[2] 65.05[3]	2156.98 .55[2]	72.15	2.40	.16

(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	20/5C
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

TABLE OF CONTENTS

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

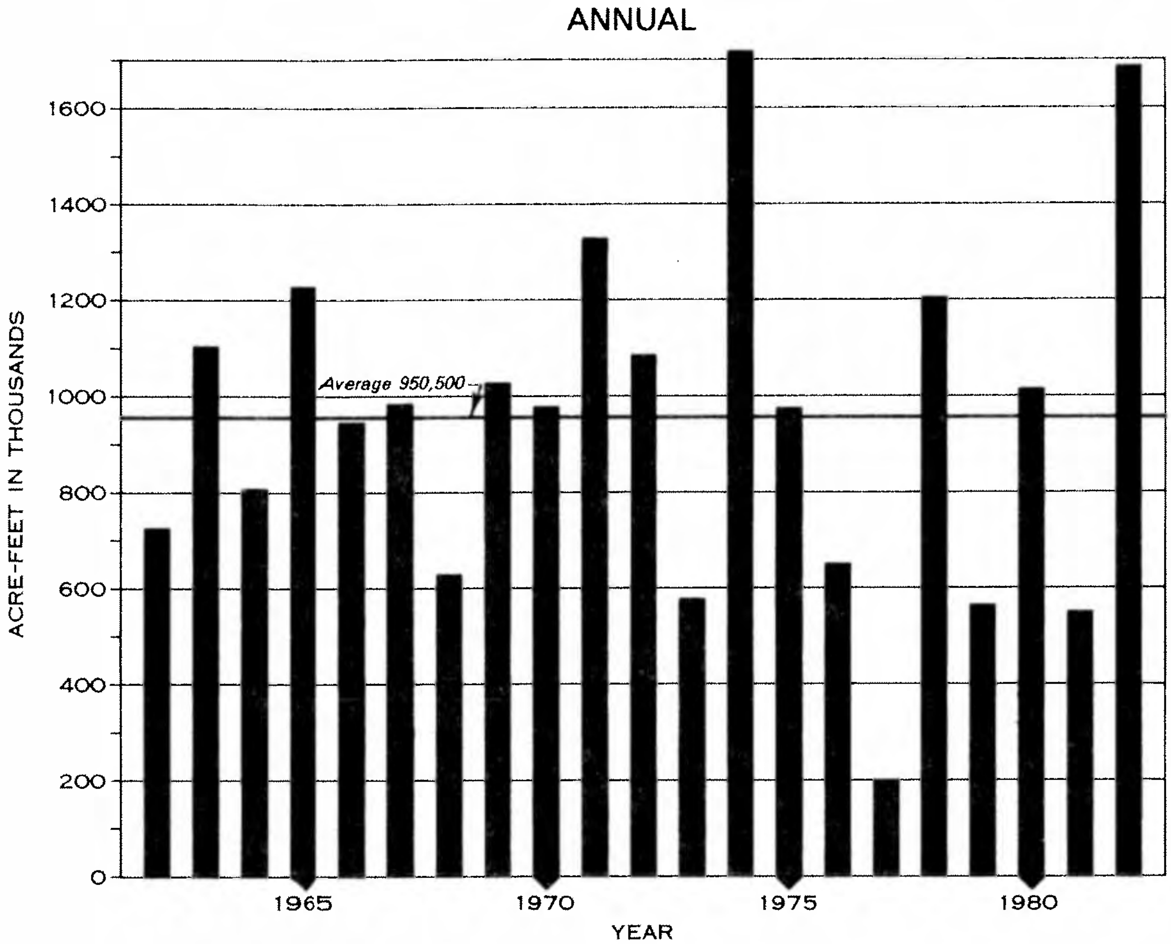
Ground water is limited in many of the bedrock units underlying the Illinois River Basin. Water is generally contained only in fractures since metamorphism has eliminated most of the primary porosity. These rock formations occur principally in the highlands. Although precipitation is relatively high, 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

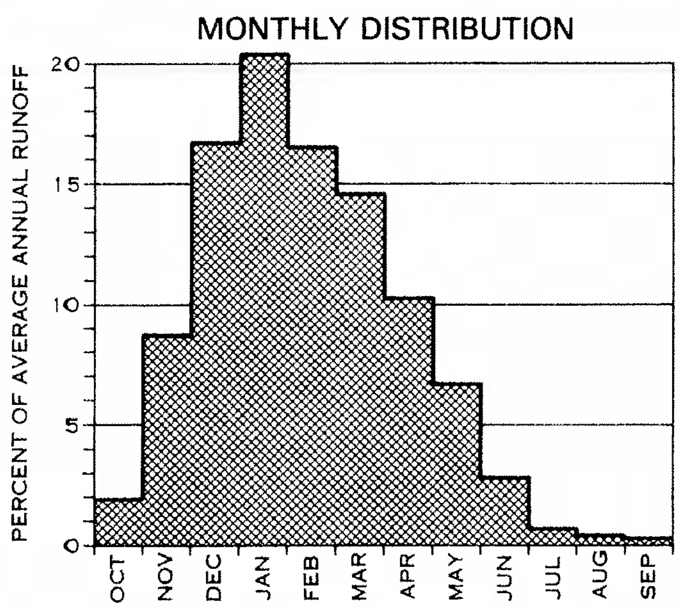
Figure 16

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.

Sucker Creek Reservoir Site Investigation

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.

Mining

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

TABLE OF CONTENTS

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

Period of record: 1952, 1957; 1959-62; 1966, 1968,; 1970-76; 1978-1981 (19 years)

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	AVG
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

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

Period of Record: 1952-57; 1959-66; 1969; 1971-73; 1978-81 (22 years)

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	AVG
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

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.

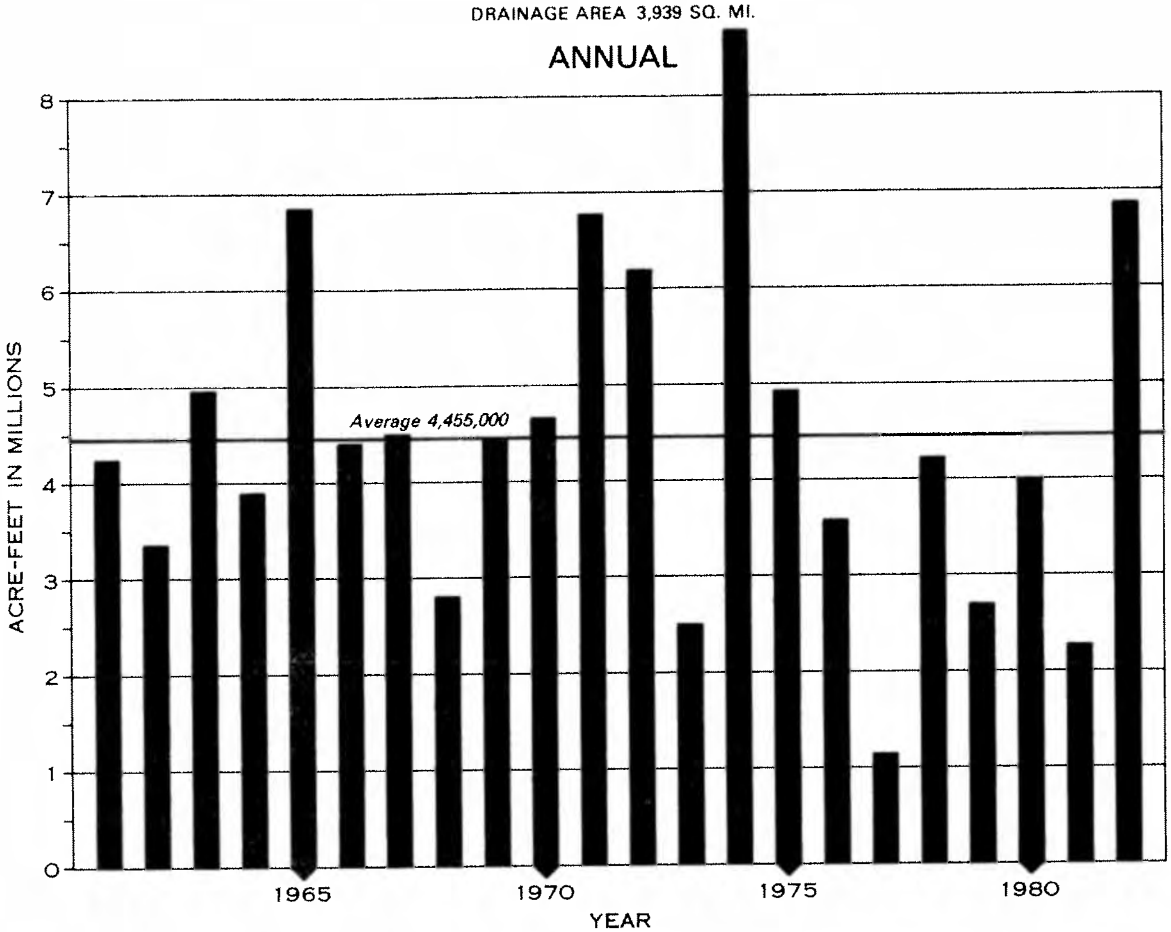
The annual yields for all years of record are shown in Figure 17. The average yield for this station over the period of record is 4,564,000 acre-feet annually. The Q_{80} annual yield for the Rogue River at Agness is 2,900,000 acre-feet.

Figure 17

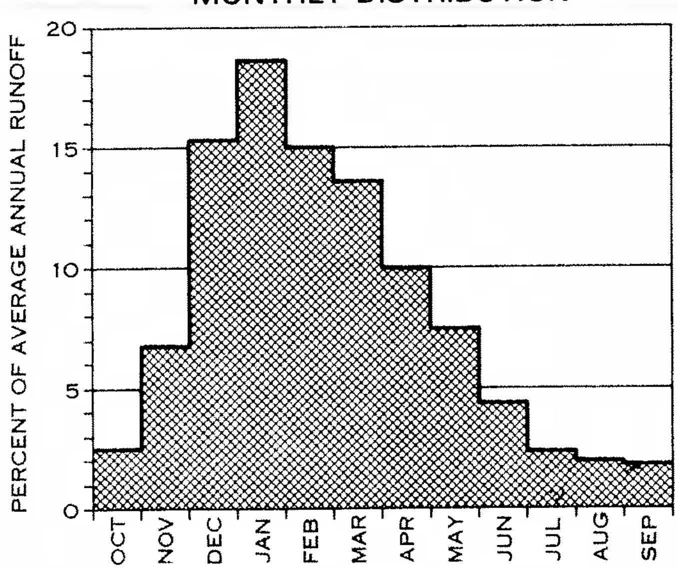
RUNOFF
Rogue River Near Agness

DRAINAGE AREA 3,939 SQ. MI.

ANNUAL



MONTHLY DISTRIBUTION



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.

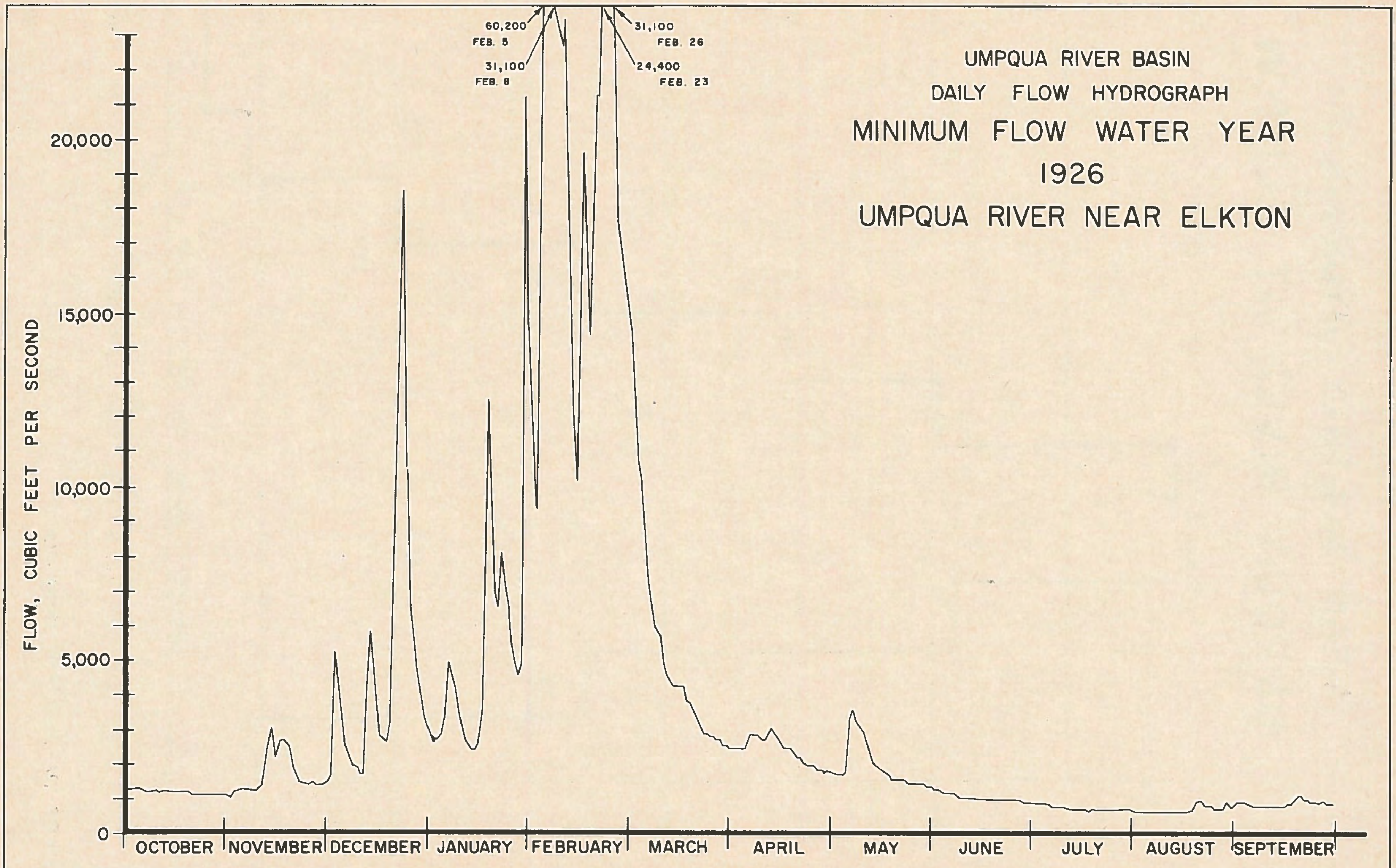
DATA ANALYSIS AND FINDINGS

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.

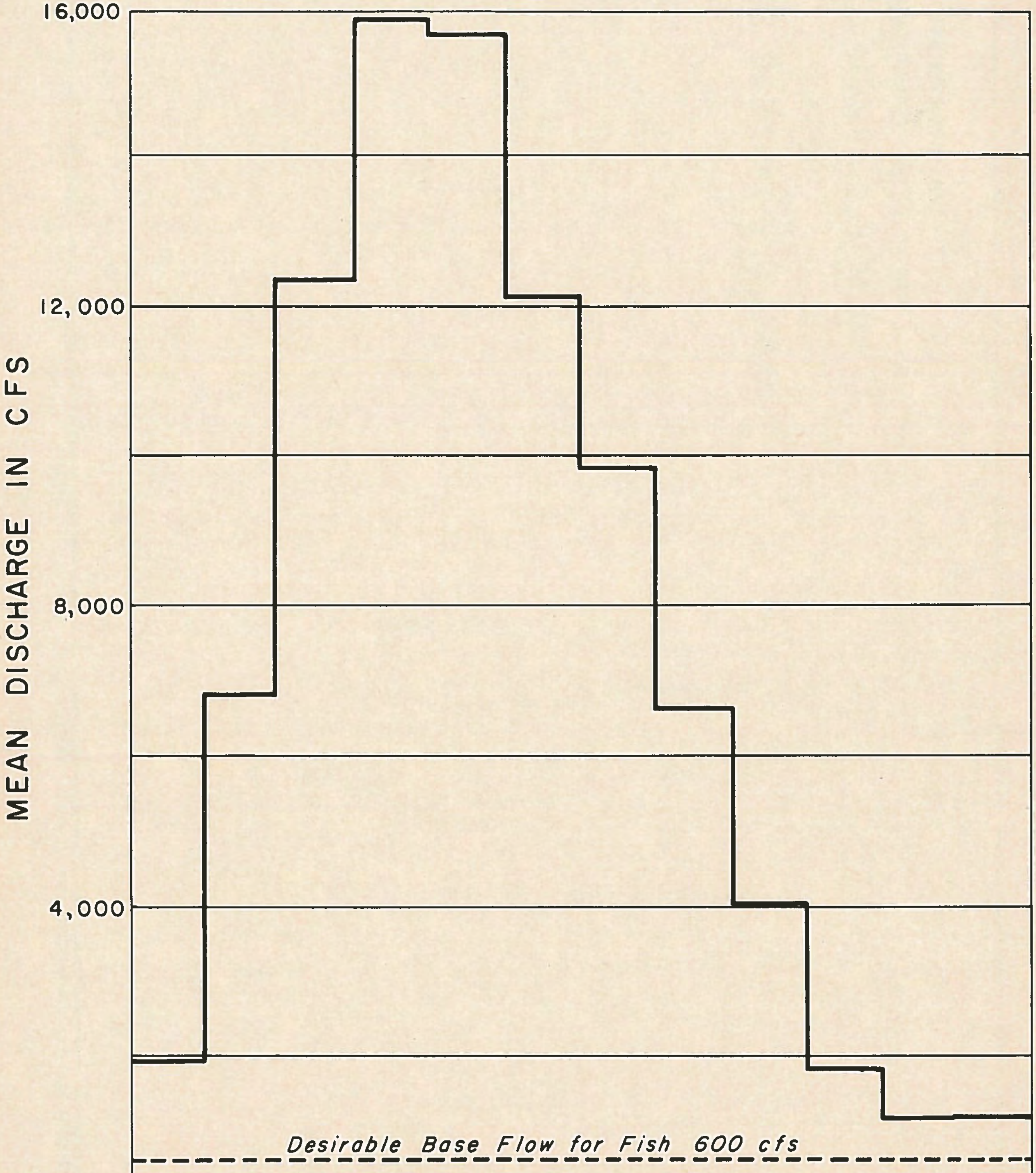
Water shortages occur during the summer months in most years. Water requirements for domestic, livestock and wildlife uses are relatively small and existing supplies appear adequate. Water supplies may not be adequate for irrigation, municipal, industrial or other uses of water during the summer months.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



File No. 16.202
FIGURE 36

UMPQUA RIVER BASIN
MEAN MONTHLY HYDROGRAPH
UMPQUA RIVER AT ELKTON



YEARS OF RECORD 1906 - 1956

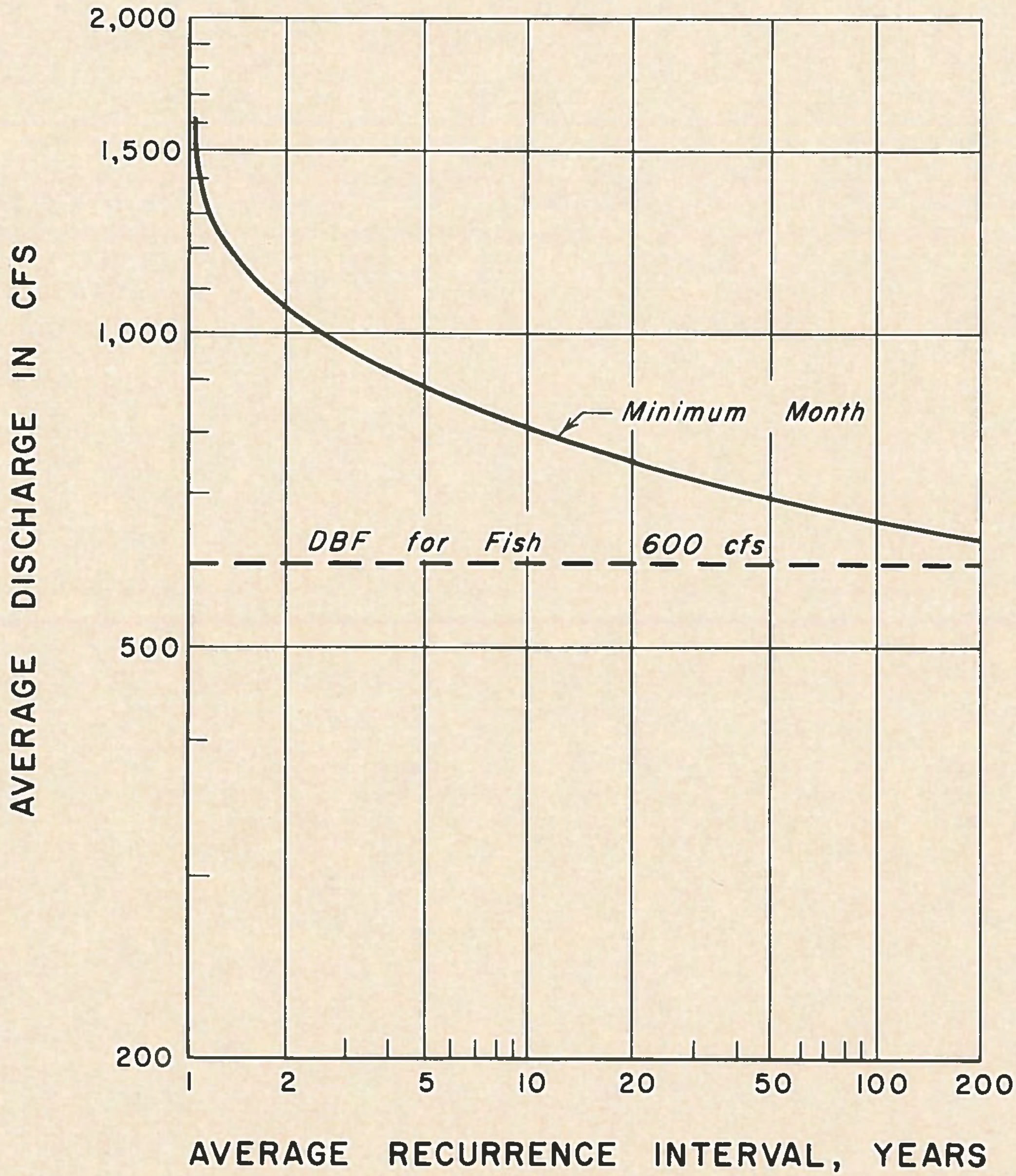
File: 16.202

FIGURE 37

UMPQUA RIVER BASIN

UMPQUA RIVER AT ELKTON

LOW FLOW FREQUENCY CURVE
AND
DESIRABLE BASE FLOW FOR FISH

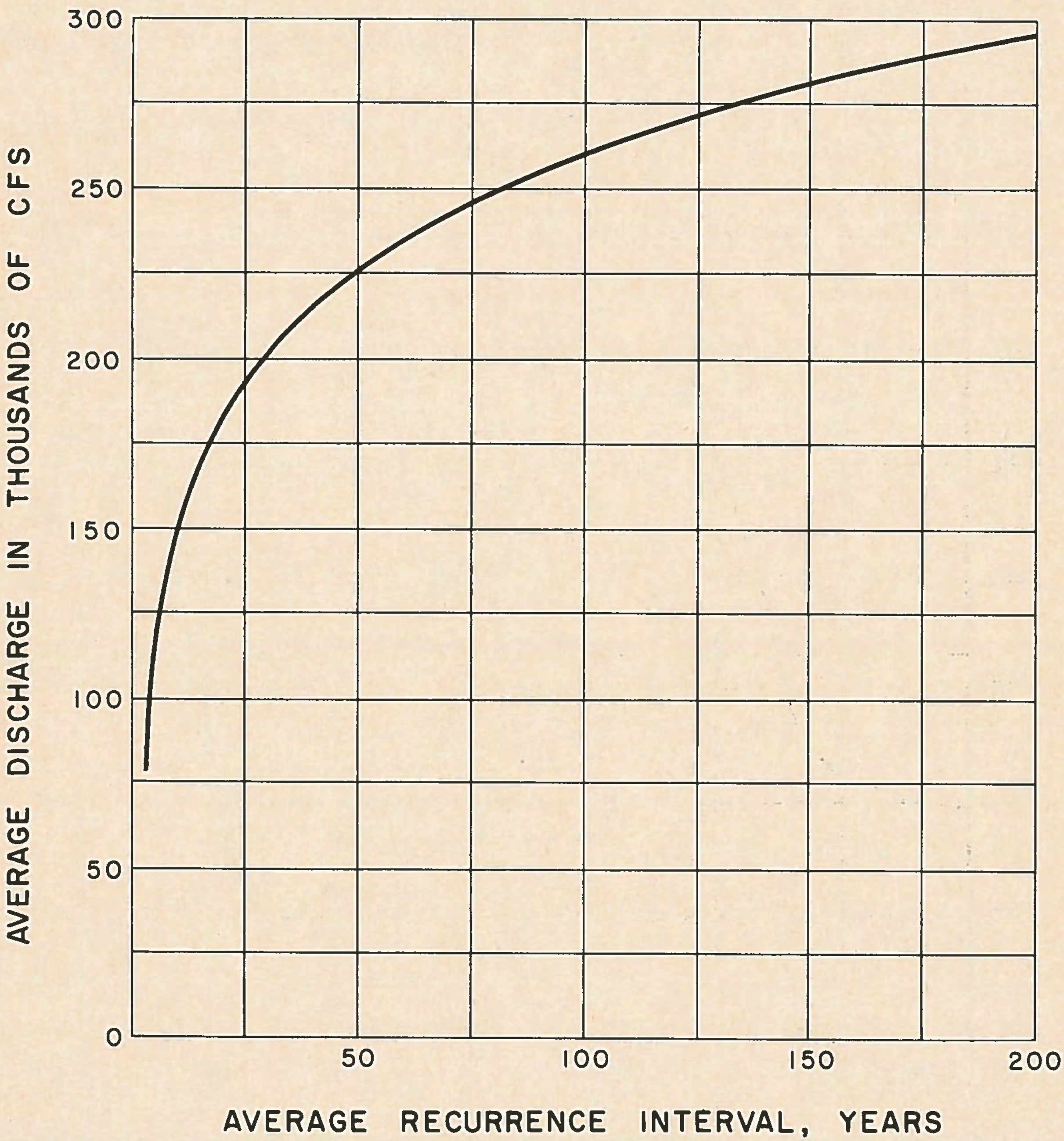


Drawn: Jan., 1958
File No. 16.203
FIGURE 38

UMPQUA RIVER BASIN

UMPQUA RIVER AT ELKTON

FLOOD FREQUENCY CURVE



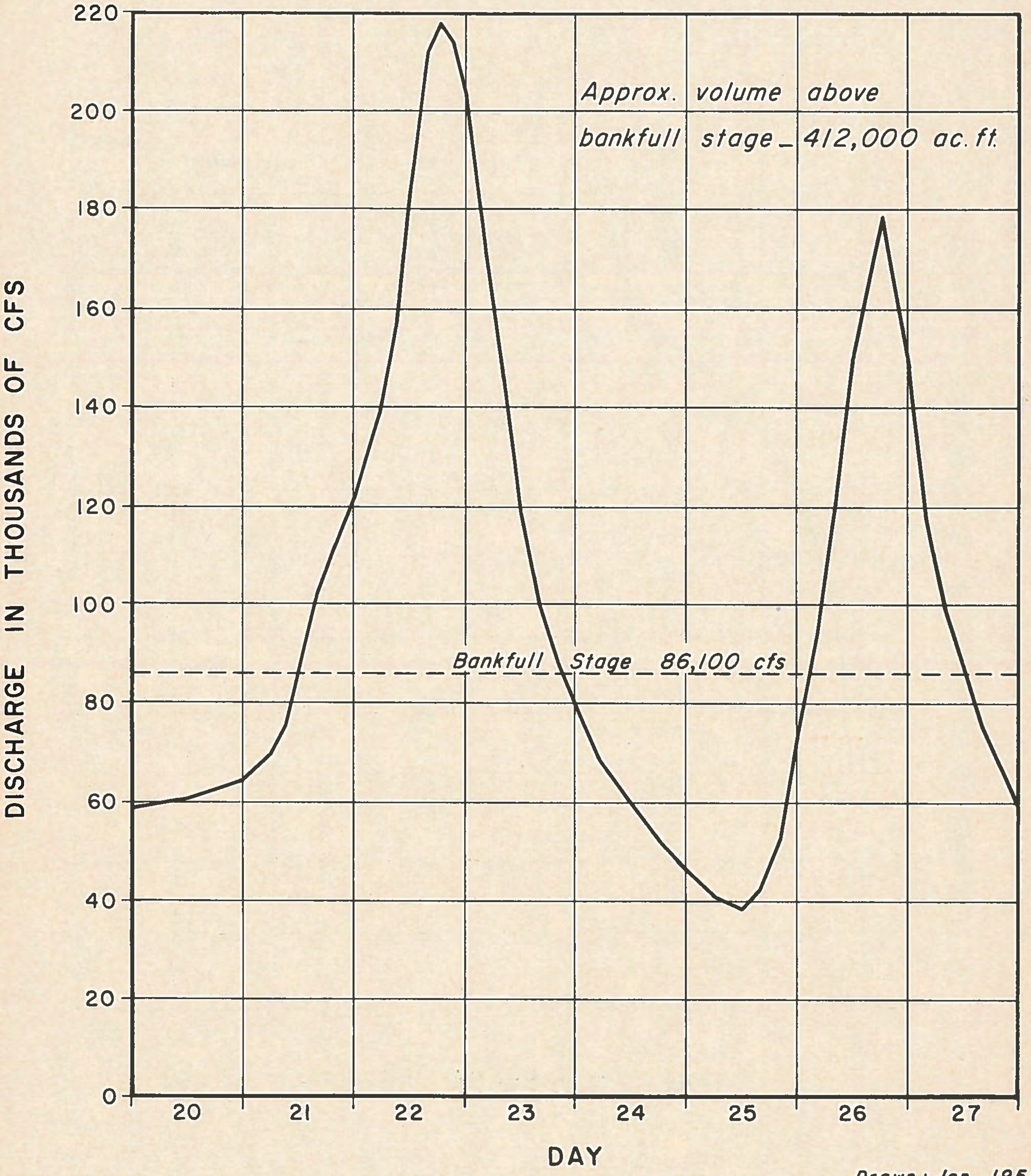
Drawn: Dec., 1957
File No. 16.203
FIGURE 40

UMPQUA RIVER BASIN

FLOOD HYDROGRAPH

UMPQUA RIVER AT ELKTON

DECEMBER 1955



Drawn: Jan., 1958
File No. 16.202
FIGURE 41

TABLE 19

DESIRABLE MINIMUM STREAMFLOWS FOR FISHERY MANAGEMENT*

LOWER UMPQUA WATERSHED

Stream	Desired Minimum cfs	Location at Required Flow
Main stem Umpqua River	600	4 mi. south of Elkton
Winchester Creek	2	head of tidewater
Schofield Creek	3	head of tidewater
Smith River	20	at falls
" "	10	Gunter
North Fork Smith R.	12	4 mi. above mouth
Wassen Creek	5	head of tidewater
Spencer Creek	3	mouth
West Fork Smith R.	5	mouth
Dean Creek	2	head of tidewater
Mill Creek	12	head of tidewater
Camp Creek	6	mouth
Lake Creek	6	mouth
Paradise Creek	5	mouth
Elk Creek	10	mouth
" "	5	above Pass Creek
Big Tom Folley Creek	3	mouth
Brush Creek	3	mouth
Hardscrabble Creek	3	mouth
Billy Creek	3	mouth
Pass Creek	3	mouth
Sand Creek	2	mouth
Yellow Creek	3	mouth
Wolf Creek	3	mouth
" "	2	above Little Wolf Cr.
Little Wolf Creek	2	mouth
Hubbard Creek	5	mouth
Calapooya Creek	12	mouth
" "	6	above Hinkle Creek
Cabin Creek	2	mouth
Pollock Creek	2	mouth
Oldham Creek	3	mouth
Hinkle Creek	3	mouth

* As requested by the Oregon State Game Commission.

APPENDIX

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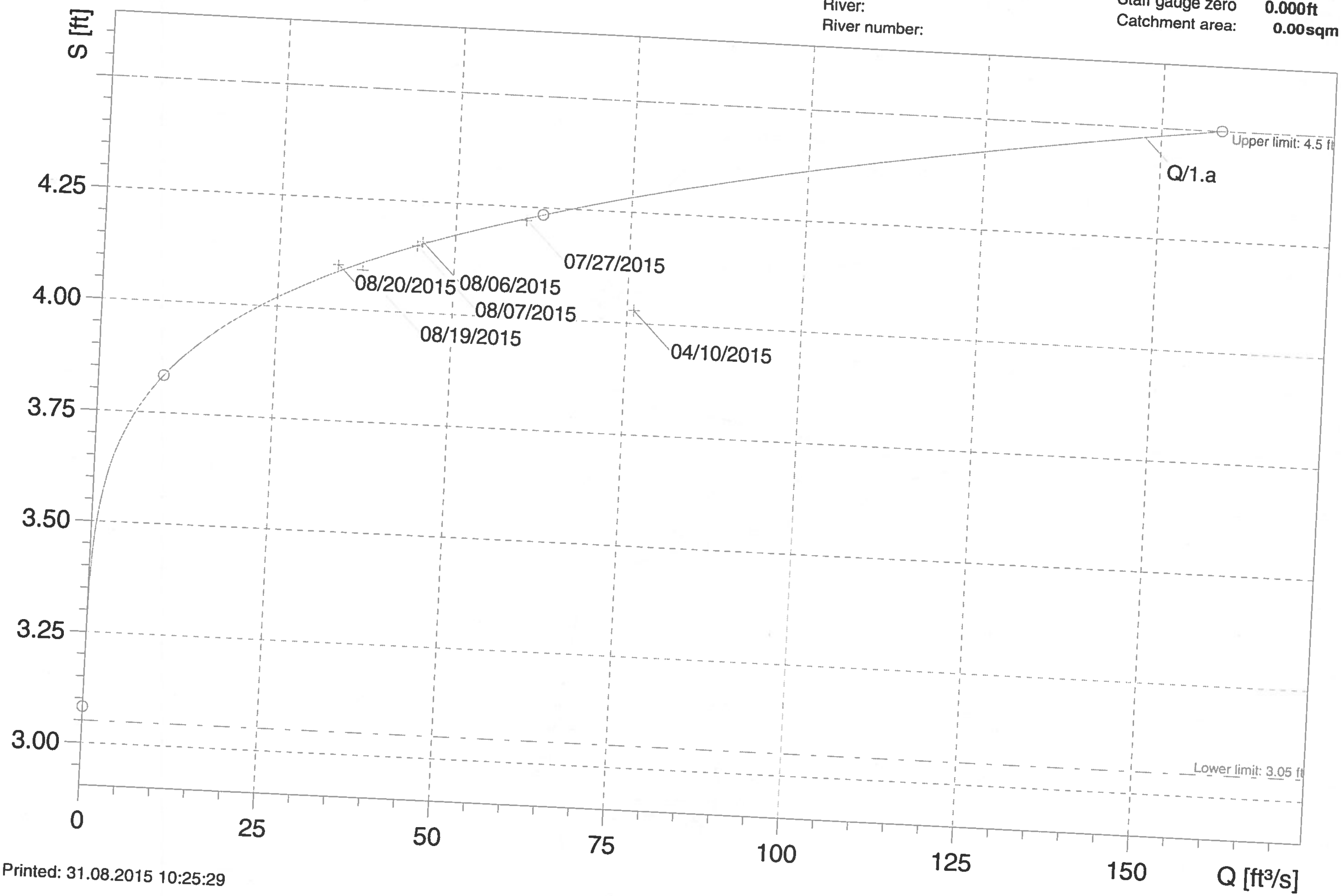
END

Site / WALLOWA R AB WALLOWA LAKE NR JOSEPH

Parameter Q

Station number: **13325500**
River:
River number:

Staff gauge zero **0.000ft**
Catchment area: **0.00sqm**



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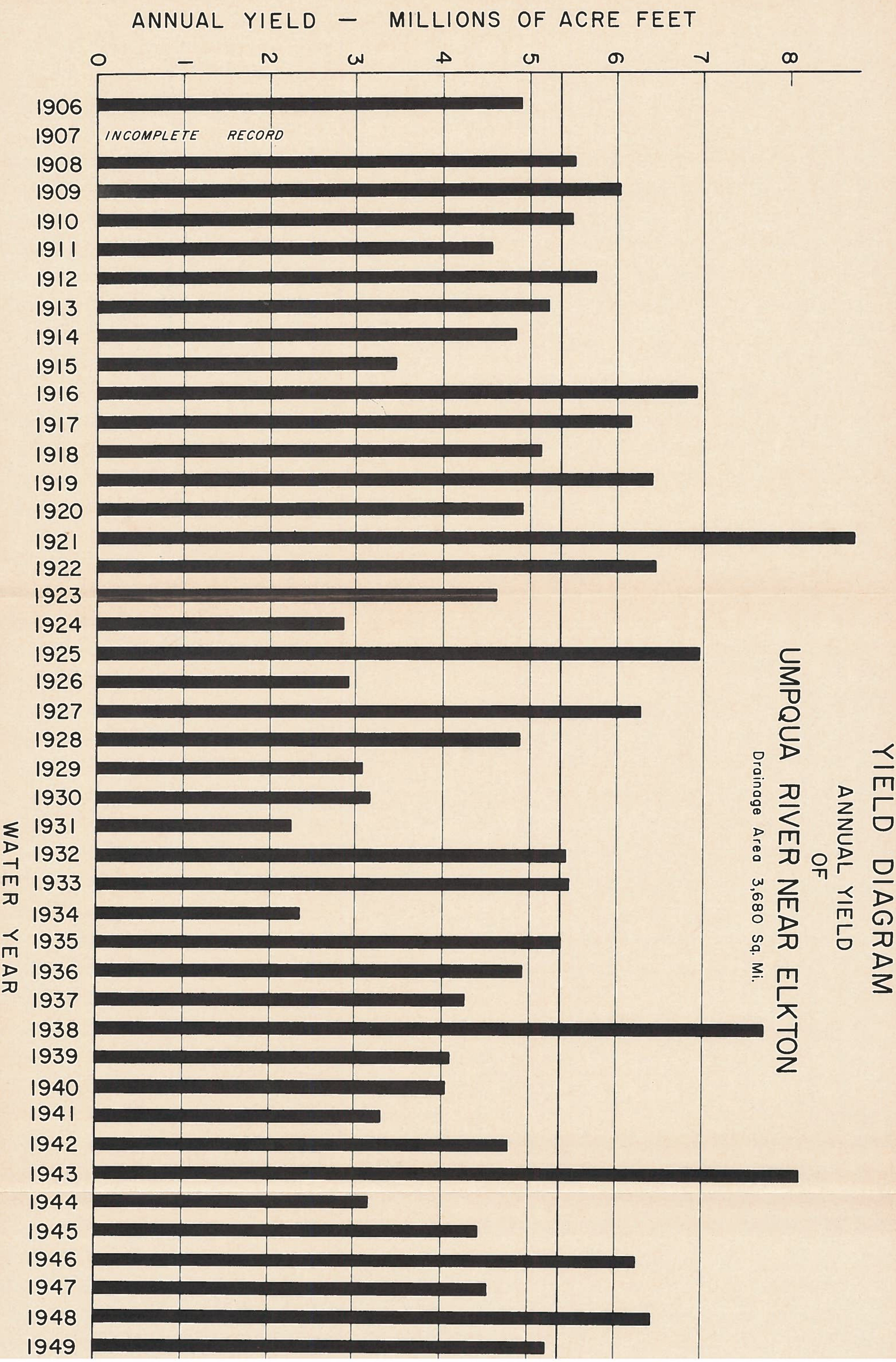
LOWER UMPQUA
MINERAL DEPOSITS

LOWER UMPQUA


ANNUAL YIELD — MILLIONS OF ACRE FEET
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7
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1907
INCOMPLETE RECORD
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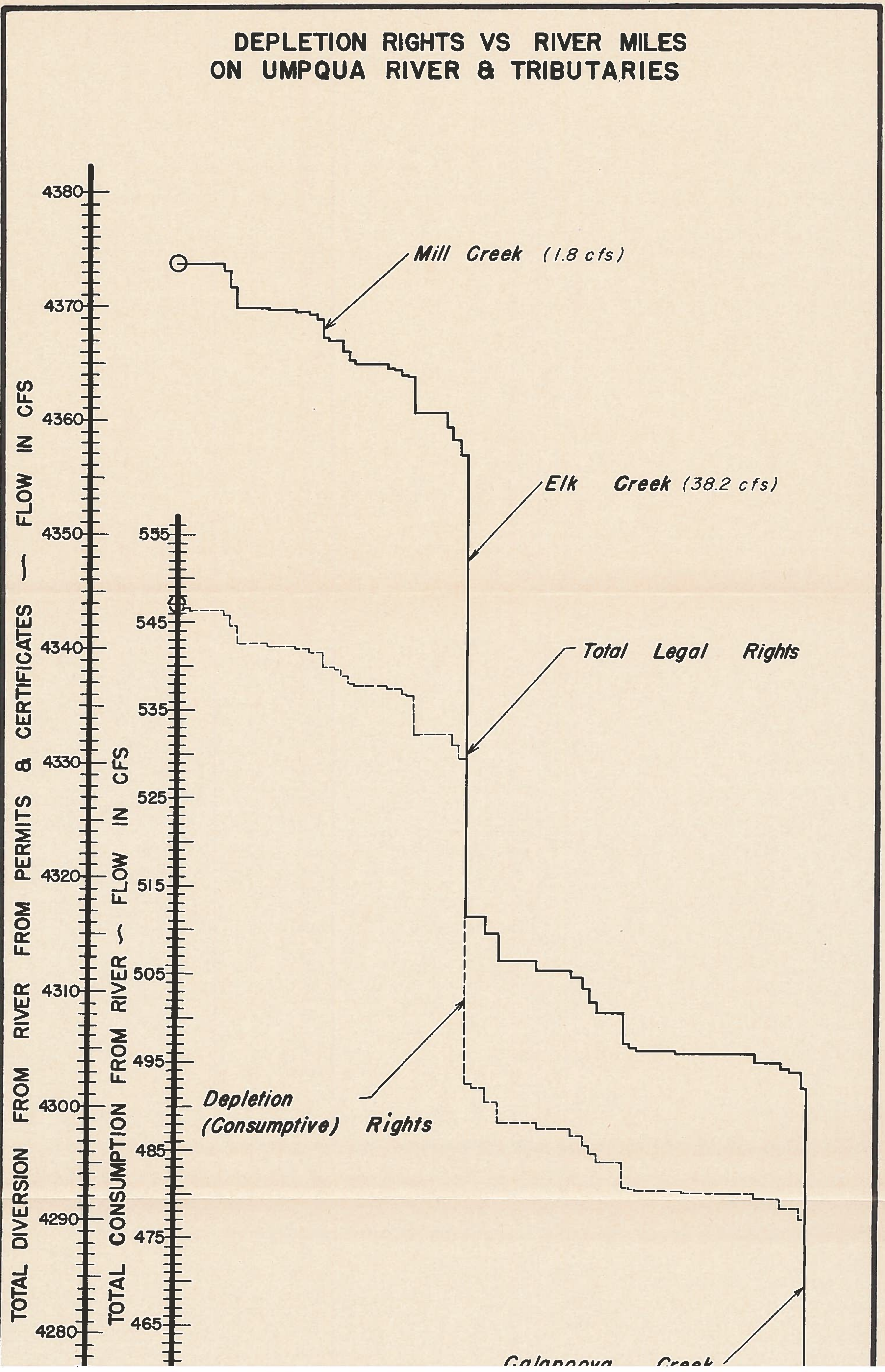
WATER YEAR
YIELD DIAGRAM
ANNUAL YIELD
OF
UMPQUA RIVER NEAR ELKTON
Drainage Area 3,680 Sq. Mi.


DEPLETION RIGHTS VS RIVER MILES
ON UMPQUA RIVER & TRIBUTARIES
TOTAL DIVERSION FROM RIVER FROM PERMITS & CERTIFICATES ~ FLOW IN CFS
TOTAL CONSUMPTION FROM RIVER ~ FLOW IN CFS
4380
4370
4360
4350
4340
4330
4320
4310
4300
4290
4280
555
545
535
525
515
505
495
485
475
465
Mill Creek (1.8 cfs)
Elk Creek (38.2 cfs)
Total Legal Rights
Depletion (Consumptive) Rights