UMATILLA RIVER BASIN

STATE WATER RESOURCES BOARD
SALEM, OREGON
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PURPOSE AND INTRODUCTION

The purpose of this report is to set forth in a condensed form the major items considered by the State Water Resources Board in its formulation of an integrated, coordinated program of use and control of the water resources of the Umatilla Basin in Oregon.

The board's investigation activities were completed in June 1963. The study was made in conformity with ORS 536.300 (1) which states:

> "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 the study necessary to formulate and implement an integrated, coordinated water resources program, the board proposes to adopt a program for the Umatilla Drainage Basin. This program will fulfill the requirements of 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."

The program will be based on the standards outlined in ORS 536.310 and the data obtained in the basin investigation. A summary of basic data and factors examined in the study are contained in the report. Detailed information is available for examination in the files of the board in Salem, Oregon.

Data for study and evaluation were secured through (1) physical field activity, (2) review of available reports and data, (3) extensive personal contact, (4) formal hearings on the basin's water needs and problems (Pendleton, June 24, 1963), (5) data supplied by the U. S. Department of Agriculture (Soil Conservation Service, Forest Service, and Economic Research Service) through a cooperative program with the State Water Resources Board, and (6) submission of data to the board, at its request, by local, state, and federal agencies and other groups.

F I N D I N G S   A N D   C O N C L U S I O N S

TOTAL BASIN

A. Water Supply

1. The basin's average annual yield, from streams and groundwater, supplies water to irrigate 75,000 acres and supplies all other consumptive needs. In addition, there is about one-half million acre-feet of surface outflow and an unidentified groundwater supply of comparable quantity.

2. There are sufficient ground and surface water resources to double the presently irrigated acreage, increasing it to 150,000 acres, plus supplying additional needs for domestic, municipal, industrial, and recreation uses.

3. Assuming half the development is from surface sources and half from groundwater there would be a requirement of nearly 224,000 acre-feet from storage and 162,000 acre-feet from groundwater.

4. The surface water supply, even with maximum justifiable control and more efficient utilization, is inadequate in most areas to provide enough water for the above goals. Therefore, the coordinated development of ground and surface water supplies, based on additional studies of both sources, is needed for proper development of the basin.

5. Additional sources which should be investigated include Columbia and John Day Rivers and more efficient use of presently developed supplies.

6. There are numerous potential reservoir sites in the three subbasins, but economically feasible storage is somewhat limited by steep stream gradient in the watershed, geological formations at damsites, soil deposition problems when reservoirs are located adjacent to cropped areas, and rights-of-way acquisition costs.

7. Available data indicate that the groundwater resource is about equal to available surface water supplies and represents an important source for domestic, livestock, municipal, irrigation, and industrial needs, both present and future. Detailed groundwater investigations are needed to determine the developable potential.

B. Water Rights

8. The basin has unappropriated water. The lower areas of

most streams do not have water for further appropriation during much of the low flow season so storage is essential for best use of the water subject to jurisdiction of the State Water Resources Board.

9. No waters have been withdrawn by the State Engineer for out-of-basin diversions. In the Walla Walla Subbasin, water rights have been appropriated for 195 acres in Oregon and used along the state line in Washington for irrigation purposes. The City of Walla Walla has a municipal certificate right to 28 cfs from Mill Creek.

10. There are approximately 2,800 water rights for 2,670 cfs in the basin. Irrigation rights account for the greatest consumptive use with 2,230 cfs for 139,784 acres.

11. Further effort is needed to review present water rights. Over 46 percent of the land holding water rights is not irrigated. About one-half of the 26 power rights, which are for a total of over 500 cfs, have been abandoned or are not fully utilized.

C. Water Use and Control

12. Diversion and pumping requirements for increased domestic, municipal, industrial, livestock, wildlife, and recreation uses of water are estimated at 10,000 acre-feet annually.

13. Additional storage and groundwater withdrawal requirements for irrigation of the better basin lands would be about 386,000 acre-feet, depending on sources used, efficiencies of delivery and application, and use of return flows.

14. Irrigation presently uses, and will continue to use, over 90 percent of the consumptively used water.

15. There are over 150,000 acres of mapped irrigable land within the basin plus fairly large areas which have not been mapped. Suitable land areas greatly exceed water supplies.

16. Irrigation development has been restricted by the economic fact that dryland grain production has been more

acceptable than irrigated agriculture on the best irrigable lands. Proposals to irrigate inferior land have not received sufficient public support for project development.

17. Land quality should weigh heavily toward obtaining approval of large basin reclamation projects. The relative success of these new irrigation proposals can be forejudged by analyzing the soils, water supply, climate, and markets.

18. Over one-third of the irrigated lands do not receive an adequate water supply during the June to September irrigation season in an average water year and experience severe shortages in critically low water years.

19. Worthwhile advantages could be obtained from extensive rehabilitation programs on most irrigated land and distribution facilities. More canal lining, control structures, land leveling, drainage, and sprinkler systems are needed to save water and increase production.

20. There is need to develop upstream benchland where the soils are generally better. Long-range planning should include using Columbia River water on lower lands so that presently available supplies can be used on higher lands.

21. Present use of water for hydroelectric power is decreasing and the future potential is economically and physically limited.

22. Mining use of water is for sand and gravel production, mainly along the Columbia River.

23. Fish life will continue to be an important nonconsumptive user of water of the Umatilla and Walla Walla Rivers and of headwater streams. Summer flows recommended by the Oregon State Game Commission for major streams are considerably in excess of present flows on many streams. An exception is the Walla Walla South Fork.

24. A conflict exists among flood control, irrigation, recreation, industrial, pollution abatement, and fish life uses of water.

25. Restrictions on further appropriations of natural streamflow would not be of material aid on most streams during low flow periods because of overappropriation during this time.

26. Pollution of ground and surface water is localized, intermittent in occurrence, and is not a critical problem except in a few of the urban and industrial areas.

27. Flooding and streambank erosion are serious local problems on about 30,000 acres of valley land and where the streams pass through urban areas. Erosion of cropland and rangeland is also a major problem.

28. Flood damage benefits are not great enough to justify large single-purpose structures. Multipurpose structures are needed and are more easily justified.

29. Small reservoirs on important tributaries could reduce local flooding and erosion and provide late season water for irrigation, livestock, and fish life.

30. Further studies are needed as to possible means of furnishing flow requirements and passage facilities for fish life.

31. Further knowledge of the quantity of surface flows is required. Reestablishment of inactive gages and establishing of stations at new sites are needed throughout the basin.

32. Detailed studies of groundwater yield capabilities are needed.

33. Comprehensive classifications of irrigable lands are needed in designated areas.

34. A joint agency Umatilla Basin Review should be established to achieve the benefits of the multipurpose concept of basin planning. There is need to coordinate individual project plans into basin-wide plans.

SUBBASINS

A. Walla Walla

35. The available water supply within the Oregon portion of the Walla Walla Subbasin will meet local requirements

for domestic, municipal, industrial, and irrigation uses in Oregon but are not sufficient to permit any appreciable transfer of surface water for use in Washington.

36. Developable ground and surface water is sufficient to supply needed supplemental water to 16,000 presently irrigated acres and to develop 14,000 acres of potentially irrigable land.

37. Assuming equal development of lands from ground and surface sources, this would require a diversion of approximately 54,000 acre-feet of surface water from storage and 35,000 acre-feet of groundwater, depending on efficiencies of operation. Further studies are needed to adequately identify both groundwater yield capability and surface flows, but they are believed to be more than sufficient to meet the needs.

38. Land classification surveys show that several thousand acres of presently irrigated lands are rocky or alkaline. There are higher quality soils in proposed development areas where the best use of water would be obtained. This could be done if voluntary arrangement can be worked out.

39. The Oregon State Game Commission's recommendation for 50 cfs summer flow at the state line for anadromous fish passage through the Walla Walla River cannot be achieved with existing stream channel conditions and available supplies. Recommended flows are generally at or below monthly averages for the North and South Forks of the Walla Walla River.

40. The proposed Joe West reservoir site on the Walla Walla River could supply water for irrigation and other uses, and reduce flood damage in the valley.

41. Basin studies indicate that groundwater resources are about equal to surface supplies but their exact location, extent, and recoverability have not been well enough defined.

42. Investigations are needed to determine the potential of groundwater development from behind fault barriers, from the deeper basalts, and through better management of the gravels of the Milton-Freewater area.

FINDINGS AND CONCLUSIONS

B. Umatilla

43. In-basin water supplies are sufficient to develop about 50,000 additional acres of better irrigable land and supply other consumptive uses. Alternative or additional water supplies include transmountain diversions or pumping from the Columbia River.

44. To achieve this goal would require an estimated 250,000 acre-feet of additional water, assuming lands are developed equally by ground and surface water supplies. This would break down to approximately 92,000 acre-feet from groundwater and 155,000 acre-feet from storage.

45. Storable surface flows on the upper Umatilla River (above Pendleton) amount to about 180,000 acre-feet, most of which can be stored at either of two proposed sites, Mission and Thornhollow. Reservoir construction plans at these sites have been hampered by problems encountered with Indian lands, railroad rights-of-way and anadromous fish. Development of a site in this area will be necessary, even with upstream storage, to fully develop the water resource potential of the upper Umatilla River.

46. An upstream site above Meacham Creek, Ryan, should be studied further as a present alternative to the above-mentioned sites for possible flood control benefits to supply municipal needs, and to provide irrigation for additional lands. This location eliminates all of the above-named problems but sacrifices capacity.

47. There are several fault barriers in the Blue Mountain headwaters and synclines (large troughs in the basalt) in the Pendleton plain where a groundwater potential exists. Best proven sources are along the Agency, Umatilla, and Service synclines.

48. An extensive rehabilitation of land and facilities is needed on the larger blocks of irrigated land in the lower valley to increase crop production and to save considerable quantities of water for further reclamation developments. Present rehabilitation efforts should be expanded.

49. Little supplemental water is required for the 35,000 acres presently irrigated because of the supplies obtained from the McKay and Cold Springs Reservoirs.

50. Summer flows recommended by the Oregon State Game Commission for the Umatilla River system are considerably in excess of presently available supplies. Future storage and groundwater development plans should give consideration to enhancement of fish life as one of the ten beneficial uses of water.

51. Power, mining, recreation, wildlife, and pollution abatement do not now and are not expected to utilize appreciable quantities of water in the Umatilla Subbasin.

C. Willow

52. The U. S. Department of Agriculture has estimated there are about 35,000 additional irrigable acres, part of which are in the Boardman area. Surface flows should be enough to provide supplemental water to presently irrigated acreages along Willow Creek. Groundwater studies are needed to properly identify the potential for further irrigation expansion of possibly 11,000 acres.

53. A large amount of water is available from the John Day and Columbia River sources, but these sources also need further investigation as additional supplies.

54. The irrigation potential of the proposed Heppner Reservoir should be reanalyzed as to possible justification for carry-over storage and more supplemental irrigation usage.

55. Groundwater may become quite important in future water resources development of the Willow Subbasin. Studies indicate an appreciable portion of rainfall is not consumed by vegetation and does not run off in surface channels. Geologists are now studying possible groundwater sources.

56. Most irrigable lands within the subbasin have not been classified. Surveys are needed in Rhea Creek Valley, along the lower edge of the wheat belt, along Eightmile and Sixmile Canyons, and south of Boardman to determine irrigation capabilities.

U M A T I L L A   R I V E R   B A S I N   S T U D Y

PART I   THE BASIN

NATURAL FEATURES

Location and Size

The Umatilla Drainage Basin is located in northeastern Oregon as shown by the key map on Plate 1. The total area of the basin, as shown in detail on Plate 1, includes the watersheds of the Walla Walla River, the Umatilla River, and Willow Creek. It is bounded on the east and south by the Blue Mountains, on the west by the John Day Basin, and on the north by the Columbia River and the Washington state line. The entire basin drains an area of 4,554 square miles, or 2,914,560 acres which is about 4.7 percent of the state's area.

The basin measures 110 miles from east to west and 62 miles from north to south, with a roughly rectangular shape.

As shown in Table 1, the basin includes 83.2 percent of Umatilla County, 80.6 percent of Morrow County, and 13.1 percent of Gilliam County plus very small portions of Wallowa and Union Counties.

T A B L E   1

B A S I N   A R E A   B Y   C O U N T Y   A N D   S U B B A S I N

COUNTY	SUBBASIN Walla Walla Sq. Mi.	Umatilla Sq. Mi.	Willow Sq. Mi.	TOTAL Sq. Mi.	PERCENT OF COUNTY	PERCENT OF BASIN
Wallowa	15	-	-	15	0.5	0.3
Umatilla	471	2,210	17	2,698	83.2	59.2
Union	-	18	-	18	0.8	0.4
Morrow	-	438	1,226	1,664	80.6	36.6
Gillian	-	-	159	159	13.1	3.5
TOTAL	486	2,666	1,402	4,554	-	100
% OF BASIN	11	58	31	100	-	-

Data Source: SWRB Map No. 7.8

Subbasin Division

Most of the report reflects conditions of the entire area but the basin was divided into three subbasins in order to make separate analyses of various physical characteristics, water uses and needs, and levels of economic development wherever desirable (Plate 1).

The Walla Walla Subbasin (1) comprises the Walla Walla River and its tributaries in Oregon, plus the Oregon portion of Vansycle Canyon and Mill Creek. The Umatilla Subbasin (2) encompasses the Umatilla Drainage Basin and Juniper Canyon, a relatively small area in the northeast corner, that drains directly into the Columbia River. Willow Creek Subbasin (3) includes the drainages of Willow Creek, Sixmile Creek, a second Juniper Canyon, and the area between Juniper Canyon and Umatilla drainages.

Stream System

The Umatilla Basin contains approximately 10,000 miles of measurable streams. Plate 1 illustrates the stream systems.

Table 2 lists the miles of perennial and intermittent streams by subbasin. All of the perennial streams head in the Blue Mountains of the southern and eastern part of the basin. These streams, along with intermittent streams heading at lower levels, flow in a northwesterly direction into the Columbia River between Heppner Junction, Oregon and Wallula, Washington. Mainly due to prevailing semiarid conditions, all major and most minor streams, on reaching the valleys, are dry in some parts of their channels during the lowest flow period of many years.

TABLE 2

MILES OF STREAMS

SUBBASIN	MILES OF STREAMS					
	PERENNIAL		INTERMITTENT		TOTAL	
	Miles	%	Miles	%	Miles	%
Walla Walla	76	7	987	93	1,063	100
Umatilla	206	4	5,647	96	5,853	100
Willow	0	0	3,184	100	3,184	100
BASIN	282	3	9,818	97	10,100	100

Data Source: Determined from SWRB Map No. 7.8

The Walla Walla Subbasin contains 76 miles of perennial and 987 miles of intermittent streams for a total of 1,063 miles. Principal tributaries of the Walla Walla River in Oregon are its North and South Forks; Mill, Cottonwood, Couse, Dry, and Pine Creeks; and Vansycle Canyon.

T H E   B A S I N

Principal tributaries of the Umatilla River are its North and South Forks along with Meacham, McKay, Birch, and Butter Creeks. Minor tributaries include Tutuilla, Parawa, and Wildhorse Creeks; Alkali and Cold Springs Canyons; and Stage and Despain Gulches. The Umatilla Subbasin contains 206 miles of perennial and 5,647 miles of intermittent streams for a total of 5,853 miles.

Principal tributaries of Willow Creek are Hinton Creek, Rhea Creek, and Eightmile Canyon. Other small streams flowing directly into the Columbia River are Sixmile Canyon and Juniper Canyon. The Willow Subbasin contains 3,184 miles of streams, all of these being intermittent.

Profiles of the most important streams in the Walla Walla, Umatilla, and Willow Subbasins exhibit relatively steep gradients of 100 to 300 feet of drop per mile in their headwaters and 20 to 60 feet per mile in the valley portions. For this reason, suitable on-stream storage in the higher watershed areas has been difficult to find and expensive to construct.

Climate

The Umatilla Drainage Basin climate is temperate and semiarid, characterized by low annual precipitation, low winter temperatures, and high summer temperatures. Most areas of the basin occasionally receive violent-intensity summer storms of small areal extent which cause severe flood damage but add little to the soil moisture.

The diversified topography with its wide range of elevation results in a wide variation in temperature and precipitation within the basin. Normal annual precipitation varies from 50 inches in the extreme eastern Bald Mountain area to less than 8 inches in the Boardman area. Most agricultural areas of the basin receive annual precipitation of between 8 and 20 inches. Figure 1 shows the average annual long-term precipitation of 14.30 inches at Milton-Freewater, 8.61 inches at Hermiston, and 13.47 inches at Heppner. At all three stations the low precipitation months are July, August, and September. Heppner, located at nearly 2,000 feet elevation, reflects the more even distribution of winter-spring precipitation at higher altitudes, showing little change in monthly averages from November through May.

An important supply of water is that of the high mountain

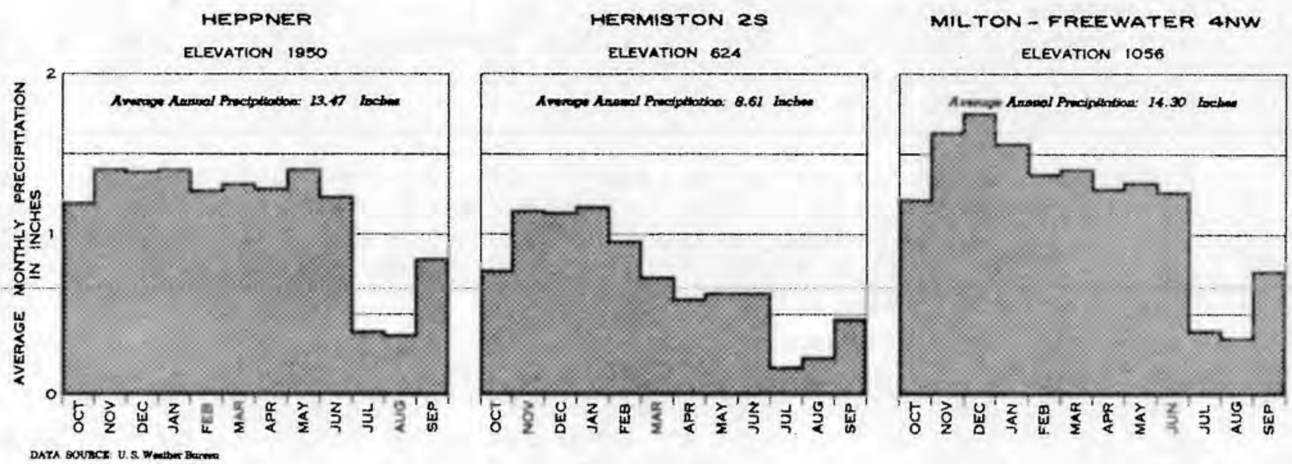


FIGURE 1. Long-term average monthly precipitation at representative stations.

snowpack which provides late spring and early summer flows. Years of heavy mountain snowfall assure greater sustained streamflows and encourages planting of higher return crops. At Meacham in the Blue Mountains the mean annual snowfall is 157 inches while at Pendleton it is 19 inches.

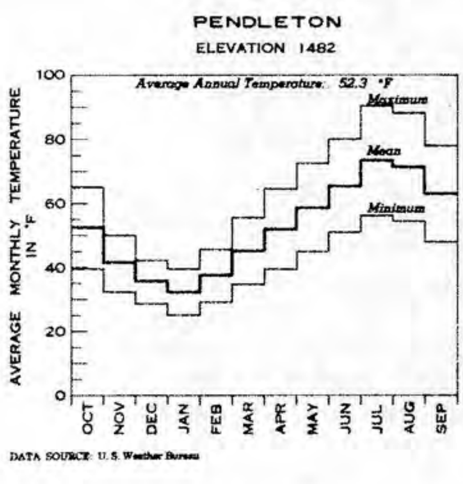


FIGURE 2. Long-term average monthly air temperature at Pendleton.

Average annual temperatures range from 43 degrees Fahrenheit (° F.) at Meacham, with an elevation of 4,050 feet, to 53° F. at Hermiston, with an elevation of 451 feet. The average temperature at Milton-Freewater is 53° F. at 962 feet elevation, and at Heppner is 50° F. at 1,950 feet elevation. Extreme temperatures of record at Pendleton vary from -25° F. to 112° F. as shown in Figure 2.

T H E   B A S I N

CULTURAL DEVELOPMENT

History

The Lewis and Clark expedition of 1805 supplied the first white men to visit the Umatilla River Basin. In 1812 the Wilson-Price-Hunt expedition crossed through the Grande Ronde and Umatilla Valleys, establishing what was later known as the Oregon Trail. A Catholic Mission was established near Pendleton in 1847. Homesteaders moved into the Echo area and a post office was established before 1851. Settlement started in the Milton-Freewater area in 1859 and at Heppner in the early 1870's.

About 1862 early agricultural enterprises began to take definite shape in the form of livestock grazing and simple irrigation diversions for production of winter livestock feed. Development of wheat farming, additional irrigation, and expansion of the livestock industry resulted in a steady growth in population until 1919.

World War II brought on another period of accelerated growth with installation of the Umatilla Ordnance Depot and the Pendleton Air Base. Continued activity along the Columbia River after the war included construction of McNary Dam by the Corps of Engineers, starting in 1947. Present major development is the construction of nearby John Day Dam. There are plans for development of the Boardman area, presently identified as the Space Age Development Park. However, for the long-term, the area is basically a rural community, supported primarily by agriculture and agricultural processing industries.

Population

Estimated population of the Umatilla Basin for 1960 was 48,450. Density of population for the entire basin is 10.6 compared to the state average of 18 people per square mile.

Table 3 shows the basin population distribution by counties and subbasins.

The small mountain portion of Wallowa County within the basin was not included since it has a population of less than 50. Umatilla County has 90 percent of the population with greatest concentrations in the Pendleton, Hermiston,

TABLE 3

COUNTY POPULATION
DISTRIBUTION BY SUBBASIN
1960

SUBBASIN	GILLIAM	MORROW	UMATILLA	TOTAL
Walla Walla	-	-	9,200	9,200
Umatilla	-	200	34,350	34,550
Willow	50	4,500	150	4,700
BASIN	50	4,700	43,700	48,450

Note: Population figures rounded to nearest 50.

Data Source: U. S. Bureau of the Census; Oregon State Highway Department, County Maps.

and Milton-Freewater areas. There are 16 incorporated towns, 5 in Morrow County and 11 in Umatilla County. The 1960 population of incorporated towns and cities over 1,000 was as follows: Pendleton 14,434, Hermiston 4,402, Milton-Freewater 4,110, and Heppner 1,661.

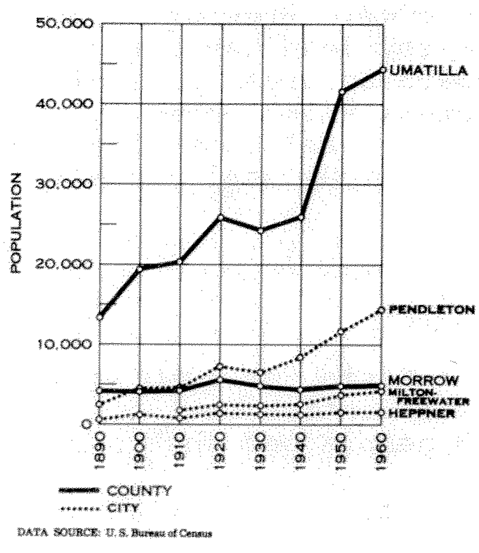


FIGURE 3. Population growth for counties and representative cities.

Population distribution by subbasin is roughly Walla Walla 20 percent, Umatilla 70 percent, and Willow 10 percent.

As shown in Figure 3, Umatilla County had a steady growth until 1920, when easily developed agricultural resources became fully utilized. In the 1940's the population increased rapidly due mainly to military installations and dam construction on the Columbia River. The rural farm population, which is decreasing, is presently estimated at 15 percent of the total. The urban population increase has more than balanced the farm population decrease. Morrow County had practically no change in population between 1930 and 1960, while Umatilla County had a 45 percent increase during this period. Basinwide population increased at an annual rate of 1.7 percent compared to a state growth of 2.1 percent for the 1930-1960 period.

Transportation

The populated parts of the Umatilla Basin are readily accessible by a variety of transportation facilities. The basin is traversed by three federal highways: U. S. 30 bisects the basin in an east-west direction and U. S. 395 in a north-south direction, connecting the main interior towns, while U. S. 730 parallels the Columbia River from near Boardman to the Washington state line. State Highway 11 extends through Milton-Freewater and Pendleton; State Highway 32 links Stanfield with Umatilla; State Highway 207 supplies transport facilities between the Hermiston-Heppner areas; and State Highway 74 extends from Pilot Rock to Heppner, thence down Willow Creek to the Columbia River. Most of the population centers and farming areas are linked with improved roads.

The Union Pacific Railroad and its spur lines serve Pendleton and other towns along the Umatilla River as well as Pilot Rock and Milton-Freewater. A branch line of the Northern Pacific Railroad ties Pendleton with cities to the north. Regular freight and bus service is available to all larger and most smaller towns.

The Port of Umatilla on the Columbia River supplies public dock facilities for the interchange of cargoes between barges and rail or motor freight carriers. The port is planning a 10-year waterfront expansion program to supply a grain storage elevator as well as terminal storage facilities for petroleum, fertilizer, and cement.

United Airlines and West Coast Airlines supply regular service between Pendleton and major cities. Although Pendleton has the only commercial airport, several other basin towns and individuals have public and private airports.

Land Use and Ownership

Land use on the nearly three million acres of the Umatilla Basin breaks down roughly into 48 percent rangeland, 36 percent cropland, 14 percent forest land, and 2 percent in towns and other public facilities. Ownership or administration of the land is 13 percent federal, 2 percent state, 1 percent county and municipal, and 84 percent private.

Table 4 lists the principal land uses by subbasin. Figure 4 shows present land use which has evolved over a 100-year period to fit the physical, climatic, and economic conditions of the basin.

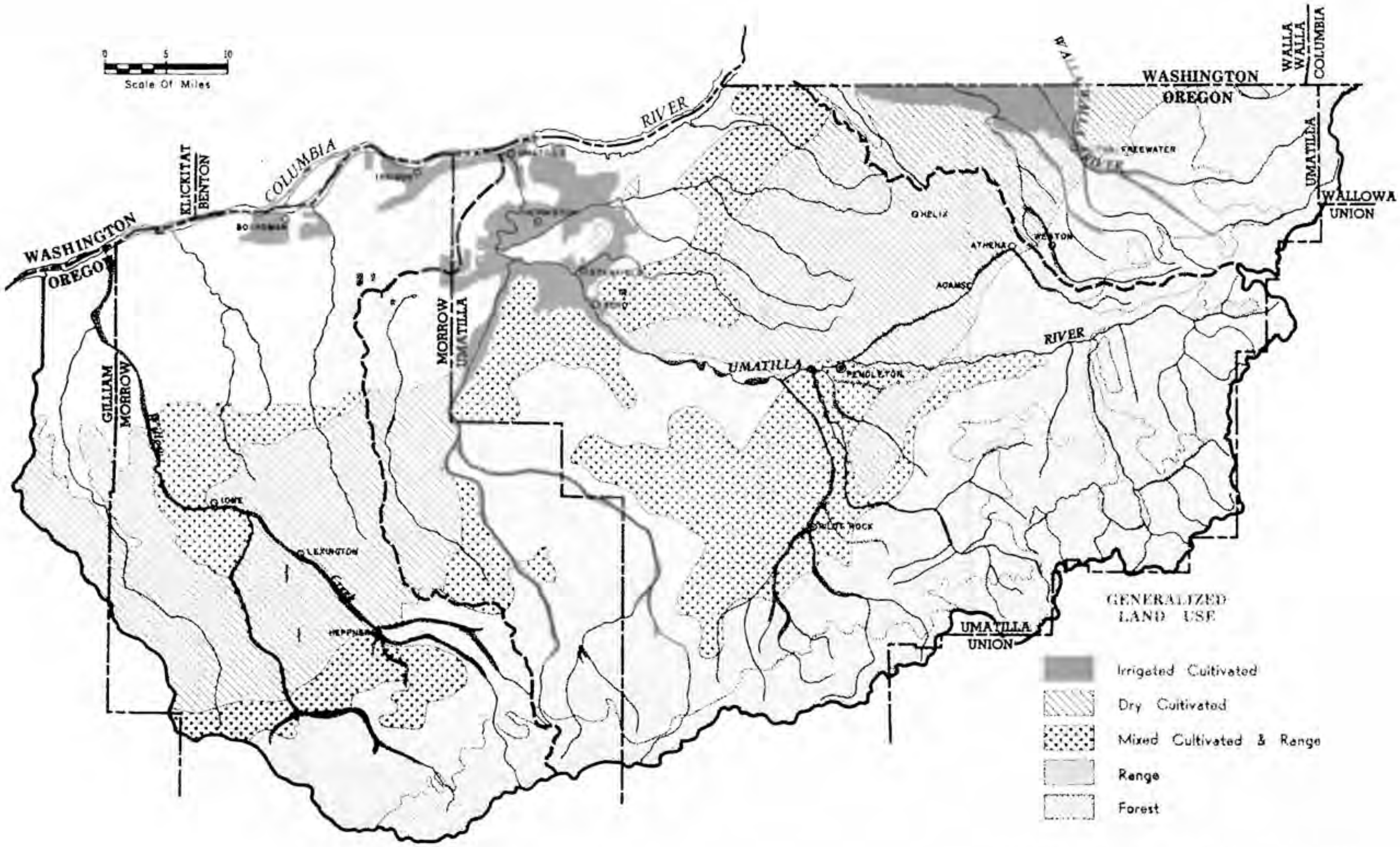
TABLE 4

LAND USE

USE	AREA IN ACRES BY SUBBASINS			
	Walla Walla	Umatilla	Willow	Total Basin
Forest land	88,200	270,320	45,310	403,830
Rangeland	86,300	779,100	526,490	1,391,890
Other; towns, roads, etc.	3,300	23,680	20,650	47,630
Cropland	133,200	633,100	304,850	1,071,150
TOTAL	311,000	1,706,200	897,300	2,914,500

Data Source: Adapted by SWRB from U. S. Dept. of Agriculture Field Party data of 1962

Rangeland, comprising about 1,392,000 acres, constitutes the largest use of land in the basin. The two strips of rangeland include the low sandy terraces along the Columbia River and a strip at higher elevation, between the cropland and the forest land. The lower strip is interspersed with irrigated land where irrigation water is available to supplement the natural rainfall. The higher elevation strip is interspersed with dry cultivated land where soil and rainfall conditions are favorable. Between the two rangeland belts is a large, dry-farmed grain belt, running in a curve through Lexington, Pendleton, and Milton-Freewater. This area of good soils, having between 10 and 20 inches of precipitation, produces the greatest agricultural returns, primarily from grain crops. This area is also interspersed with irrigated lands lying adjacent to streams. The dry-farmed area comprises slightly under one million acres and the irrigated lands total about 74,000 acres. The forest land, comprising 404,000 acres, lies in a band covering the higher elevations of the Blue Mountains, along the south and east sides of the basin. This



DATA SOURCE: U. S. Dept of Agriculture, S.C.S.

FIGURE 4, Generalized land use.

forest belt lies mainly between 3,000 and 5,000 feet elevation and has a normal precipitation of between 20 and 50 inches.

Ownership or administration of basin lands is listed in

TABLE 5

LAND OWNERSHIP AND ADMINISTRATION
(Acres)

SUBBASIN	FEDERAL DEPARTMENTS			STATE OF OREGON	COUNTY AND MUNICIPAL	PRIVATE	TOTAL
	AGRICULTURE	DEFENSE	INTERIOR				
Walla Walla	55,350	-	2,190	40	1,130	252,290	311,000
Umatilla	187,100	5,000	39,020	5,890	1,830	1,467,360	1,706,200
Willow	12,750	56,600	25,270	50,590	80	752,010	897,300
TOTAL	255,200	61,600	66,480	56,520	3,040	2,471,660	2,914,500

Data Source: U. S. Dept. of Agriculture and SWRB

Table 5. Federal land is split between agencies as follows: Agriculture, 255,000 acres; Defense, 61,600 acres; and Interior, 66,480 acres. These lands are mainly national forest, the ordnance depot, sport fisheries and wildlife withdrawals, and Indian lands. Approximately 90 percent of the 56,520 acres of State of Oregon lands are in the Boardman Space Age Industrial Park, while the rest is in road rights-of-way and other very small scattered tracts. County and municipal holdings of 3,040 acres are mainly for public use facilities. Private land holdings comprise 2,471,660 acres, made up principally of range and croplands.

ECONOMY AND RELATED NATURAL RESOURCES

General

The basin economy is primarily dependent upon agriculture. Most of the land area is utilized for small grain and livestock production. Forest and irrigated land broaden the agricultural base while agricultural industries lend stability to income and the labor force.

THE BASIN

Agriculture

Agricultural production and processing ranks as the number one industry as related to the economy of the area. The major source of income in the Umatilla Basin is from small grain production. Wheat and barley comprises about 83 percent of the cropped 1,071,000 acres, of which about 453,000 acres are either fallowed or idle in alternate years. The greatest acreage, about 1,600,000 or 55 percent of the land area, is utilized for range and forest grazing.

In Table 4, land use in the basin breaks down into: forest, 14 percent; range, 48 percent; dryland crops, 34 percent; irrigated crops, 3 percent; and other, 1 percent.

The basin has about 2,380 farms, of which census data show 64 percent are commercial operations, 25 percent are operated on a part-time basis, and 11 percent are operated on a semi-retirement basis.

TABLE 6

GROSS AGRICULTURAL INCOME 1959

COMMODITY	VALUE OF FARM PRODUCTS SOLD
Dairy products	$ 1,366,000
Poultry products	1,152,000
Cattle and calves	9,661,000
Sheep, lambs and wool	1,490,000
Other livestock	1,272,000
TOTAL LIVESTOCK	$14,941,000
Field crops	$28,189,000
Vegetables	5,378,000
Horticultural specialities	577,000
TOTAL CROPS	$34,144,000
Forest products	$ 413,000
TOTAL AGRICULTURAL INCOME	$49,498,000

Data Source: U. S. Bureau of the Census

Agricultural land use in the basin is determined by climatic, economic, and technological factors. With the advent of mechanized farming, the farm size has about doubled since 1935. By 1959 the average farm or ranch contained 1,230 acres and involved an investment of $93,400. The 1959 census showed 56 percent of farmers were full owners, 31 percent were part owners, 12 percent were tenants, and 1 percent were professional managers.

Cattle production has increased while sheep production in the basin has decreased mainly due to depletion of good pasture grasses and economic factors. The Umatilla Basin has a livestock population of 84,300 beef cattle, 4,300 dairy cattle, 86,200 sheep, 16,700 hogs, 2,800 horses and mules, 73,000 laying hens, and 107,000 turkeys according to the latest available census.

Table 6 shows the 1959 value of farm products sold from Umatilla and Morrow Counties, which comprise 96 percent of the basin.

Umatilla County is the main contributor to agricultural income in the basin with its better situated agricultural lands.

The largest contributor is crops with 69 percent and the smallest is forest products with less than 1 percent. Livestock accounts for about 30 percent of the agricultural income. Only moderate changes are expected in this agricultural production and income pattern.

Table 7 shows the agricultural land use in the basin.

TABLE 7

AGRICULTURAL LAND USE

USE	SUBBASIN			TOTAL Acres
	WALLA WALLA Acres	UMATILLA Acres	WILLOW Acres	
GRAZING LAND				
Rangeland, Open	86,300	779,100	526,500	1,391,900
Forested	38,800	133,600	33,300	205,700
SUBTOTAL	125,100	912,700	559,800	1,597,600
CROPLAND				
Wheat	50,000	158,000	110,000	318,000
Barley	16,000	65,000	46,000	127,000
Other Small Grains	1,100	2,800	2,100	6,000
Alfalfa Hay	6,800	13,200	7,100	27,100
Other Hay	3,500	1,600	3,100	8,200
Green Peas	16,100	36,800	-	52,900
Other Vegetables	1,500	2,100	300	3,900
Other Row Crops	4,500	3,500	500	8,500
Orchards and Vineyards	3,100	100	-	3,200
Other Crops	4,200	9,800	1,000	15,000
Pasture	11,200	20,000	16,800	48,000
Idle and Fallow	15,200	320,200	117,900	453,300
SUBTOTAL	133,200	633,100	304,800	1,071,100
TOTAL	258,300	1,545,800	864,600	2,668,700

Data Source: U. S. Dept. of Agriculture

Umatilla County leads the state in both wheat and pea production, as reflected in acreage of these crops for Umatilla and

Walla Walla Subbasins. Other important dryland crops are barley, hay, and pasture.

Heppner, Hermiston, and Pendleton areas also produce hay and pasture on a high percentage of their irrigated lands, while the Milton-Freewater area has a more diversified irrigation agriculture, with greater percentages in fruits and vegetables.

Forestry

Table 8 shows the breakdown of commercial forest areas in the basin. Although forested areas cover only 14 percent of the basin, in addition to lumber production they have important values for grazing, recreation, and upper watershed benefits. Particularly important is the capacity of forested areas to delay winter snowmelt, leading to more stable spring and early summer streamflows. The forested lands comprise about 404,000 acres, lying 3,000 to 5,000 feet elevation, within a 20 to 50-inch rainfall belt.

TABLE 8

COMMERCIAL FOREST AREAS IN ACRES

SUBBASIN	FEDERAL	STATE	PRIVATE	TOTAL
Walla Walla	43,860	-	37,850	81,710
Umatilla	114,680	1,470	122,300	238,450
Willow	11,760	-	32,800	44,560
TOTAL	170,300	1,470	192,950	364,720

Note: There is in addition about 39,000 acres of noncommercial forest land.

Data Source: U. S. Dept. of Agriculture

Commercial forest land amounts to about 365,000 acres or 90 percent of forested areas. The other 10 percent are composed of lands which are not capable of producing commercial sawtimber or pulpwood or are reserved from timber harvest. Timber types break down about as follows: ponderosa pine, 128,100 acres; other softwoods, including lodgepole pine, Douglas-fir, western larch, Englemann spruce, and true firs, 233,000 acres; and hardwood or nonstocked commercial forest areas, 4,000 acres.

About one-half of the forested land is under the ownership or management of the Forest Service, with other minor acreages managed by the Bureau of Indian Affairs and the Bureau of Land Management. Of the remainder, there are three large private parcels and scattered state, county, and municipal tracts.

Harvesting on about 7,500 acres in the Mill Creek watershed has been postponed to protect the water supply for the City of Walla Walla, Washington. About 1,500 acres of statutory reserved forest lands are in small state parks.

There are 12 sawmills located near towns along the lower edge of the forested area which have an installed annual capacity of 170 million board feet.

National forest lands are managed on a sustained yield basis, with a present average annual timber harvest of about 25 million board feet. This is expected to increase somewhat in the future with better utilization of wood products and improved forest management. It should be noted that sustained yields are only applicable over a long-term period, with great variation in cutting on a year-to-year basis. New estimates of allowable cuts are made by the Forest Service at roughly 10-year intervals. Other state and federal lands receive similar management, with an estimated present allowable cut of three million board feet.

On private land there is a present rapid depletion of timber stands which, if continued, will result in near exhaustion of merchantable-sized timber within 25 years. There would then be an extended period of practically no private cutting, following which the production of these lands will be from 20 to 28 million board feet.

The basin's potential sustained yield from all commercial forest lands is estimated between 45 and 60 million board feet annually, depending mainly on intensity of management.

Mining

Mineral production for Morrow and Umatilla Counties, all from sand, gravel, and stone, amounted to approximately 1,100,000 dollars in 1961. There are no other mineral deposits of significant commercial value in the basin. This is due primarily to the lack of mineralization in the Columbia River basalt, which underlies most of the area.

Employment and Manufacturing

According to the Oregon State Department of Employment, Morrow and Umatilla Counties had a 1961 covered employment of 2,668 people in manufacturing. Their 12 million dollar payroll was approximately one-third the entire payroll of these two counties for people covered by unemployment compensation insurance.

Industries contribute an important element of stability to the economy of Pendleton where approximately 1,000 year-around workers are employed in manufacturing or processing of such items as wool, wood, leather, wheat, peas, and animal products. County planning committees have analyzed their available resources and expect future manufacturing expansion to be mainly in the fields of meat and vegetable processing, where more products will be canned, frozen, and packaged locally.

The 1958 census showed Umatilla County to have 98 manufacturing establishments with 2,549 employees and a 25,682,000 dollar value added by manufacturing. By assuming Umatilla County makes up about 90 percent of the basin's industry, the total would be about 2,800 employees and a manufacturing return of $28,250,000 for the entire Umatilla Basin.

Recreation

Several recreation activities are of economic importance to the basin. These include hunting, fishing, water sports, and use of parks and forested areas for camping, picnicking, and related activities.

At the present time the state has seven developed recreation areas, including Battle Mountain, Emigrant Springs, and Hat Rock State Parks. Total visitor day attendance at these parks in 1961 was 21,000, 178,000, and 155,000, respectively.

The forested areas of the basin receive extensive usage, totaling 140,000 visits during 1961. This includes nearly 57,000 visits to winter sports areas. The deer and elk populations attract an average of 20,000 hunters each year, primarily to national forest lands. The basin also includes some of the best pheasant producing and hunting areas of the state and a large number of persons engage in waterfowl hunting, both within the basin and adjacent to it on the Columbia River. Waterfowl rest on the Columbia River, McKay Reservoir, and Cold Springs Reservoir, flying out to feed in neighboring wheatlands which provide the hunting opportunity. Oregon

State Game Commission counts show peak populations of 287,000 birds at McKay Reservoir and 218,000 at Cold Springs Reservoir during migratory flights.

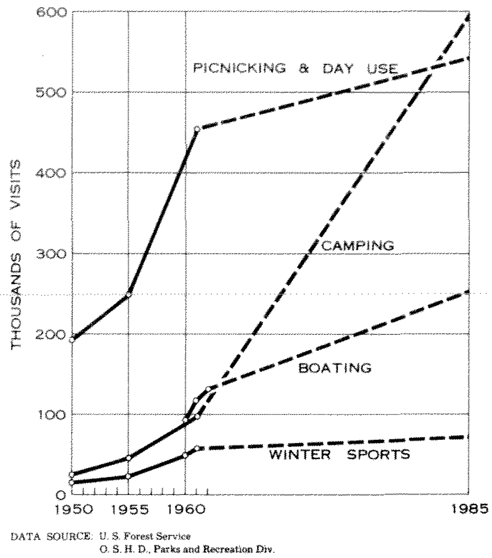


FIGURE 5. Trends in recreational usage.

Boating is a fast growing form of recreation, due primarily to the large surface water areas in and adjacent to the basin. Boating accounted for over 90,000 visitor days in 1960.

Figure 5 illustrates trends and projections in types of recreational usage to the year 1985. Large growth in picnicking, camping, and boating is anticipated. The completion of John Day Dam and Pool will provide opportunities for development of new facilities to meet demands of people within the basin and from nearby areas.

PART II

WATER SUPPLY, USE, AND CONTROL

SURFACE WATER

Introduction

The determination of stream yields, monthly distributions, and extreme discharges is based primarily on U. S. Geological Survey stream gaging records. All hydrological stations, active and inactive, are shown by location on Plate 2. Table A in the Appendix lists these stations by name, giving location, type, and period of record.

Correlations with gaged streams have enabled the extension of short-term streamflow records to the selected base period. Estimates of the yields of some of the ungaged watersheds were made on the basis of precipitation-runoff correlations.

Base Period

In order to facilitate the comparison of the streamflow characteristics of several watersheds within the basin, a representative base period was selected. This period is of a 32-year duration (1930-1961), the mean annual precipitation for this period being nearly equal to the long-term (1905-1961) precipitation mean at Pilot Rock.

Yield

As used here, yield is intended to mean net yield, or that flow which passes a given point. The maximum, minimum, and average annual yields of a number of major streams of the basin are listed in Table 9.

These streams show a wide variation, the lower figures being associated with watersheds having a large percentage of area receiving low precipitation such as Willow Creek, Butter Creek, Birch Creek, and the lower Umatilla River.

Due to the lack of sufficient streamflow recording stations in the Walla Walla and Willow Subbasins, the total basin

TABLE 9

ESTIMATED MINIMUM, MAXIMUM, AND AVERAGE ANNUAL YIELDS OF PRINCIPAL STREAMS 1930-1961

STREAM (GAGE NO.)	DRAINAGE AREA Sq. Mi.	COMPLETE WATER YEARS OF RECORD	MINIMUM YIELD Acre-Feet	MAXIMUM YIELD Acre-Feet	AVERAGE YIELD Acre-Feet	Inches
North Fork Walla Walla River near Milton (110)	42	20	18,230	50,680	35,000*	16
South Fork Walla Walla River near Milton (100)	63	39	89,200	176,000	127,000	38
Umatilla River near Umatilla (335)	2,290	56	123,600	679,800	318,000	3
Umatilla River at Yoakum (260)	1,280	39	270,900	797,100	473,000	7
Umatilla River at Pendleton (210)	637	26	207,000	579,300	358,000*	11
Umatilla River above Meacham Creek (200)	125	27	101,500	257,900	163,000*	25
Butter Creek near Pine City (320)	291	28	3,680	38,140	17,000*	1
Birch Creek at Rieth (250)	291	31	10,660	79,120	34,000	2
McKay Creek near Pendleton (235)	186	34	34,120	125,800	69,250	7
McKay Creek near Pilot Rock (225)	178	32	37,980	136,600	72,000	8
Willow Creek at Heppner (345)	87	10	9,030	24,250	12,900*	3

*Includes correlations.

Data Source: U. S. Geological Survey

surface water yield could not be determined by direct flow correlations. Table 10 is a rough estimate of the total yield, by adding to the gaged yield at the mouth of the Umatilla River (nearly the entire surface output of the Umatilla Subbasin), the yields of the Willow and Walla Walla Subbasins as estimated from streamflow and precipitation. These estimates are considered to be conservative.

TABLE 10

ESTIMATED AVERAGE ANNUAL OUTFLOW BY SUBBASIN 1930 - 1961

SUBBASIN	Sq. Mi.	AVERAGE ANNUAL YIELD Ac. Ft.
Walla Walla	486	140,000
Umatilla	2,666	392,000
Willow	1,402	35,000*
TOTAL OR AVERAGE	4,554	567,000

*Includes 20,000 acre-feet from Umatilla River by West Extension.

Figure 6 shows gaged and/or correlated annual flows for the base period for Willow Creek, Birch Creek, and the Umatilla River at Pendleton. The yield pattern of these streams, typical of those of semiarid regions, exhibits large variations in annual yield from year to year.

Figure 7, illustrating the yield of the North and South Forks of the Walla Walla River, shows that the South Fork varies from the semiarid pattern. This is due primarily to the moderating

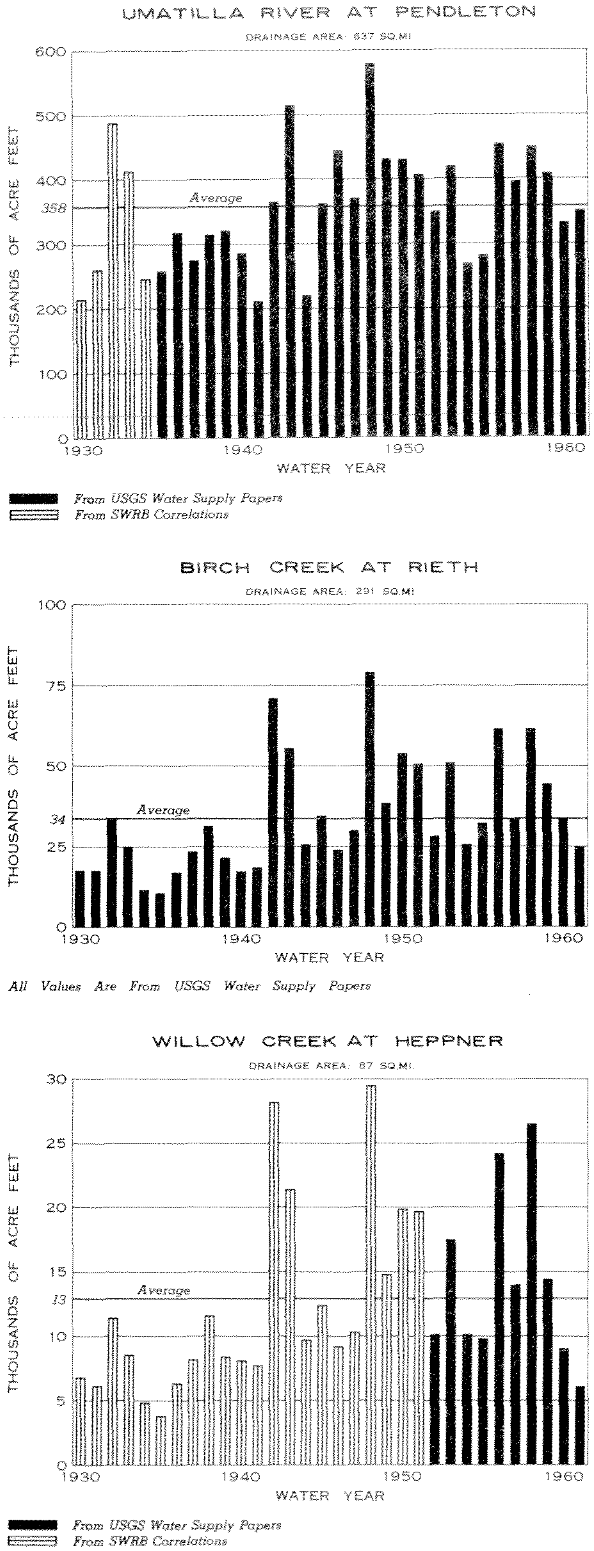


FIGURE 6. Annual yields of selected streams, Umatilla and Willow Subbasins.

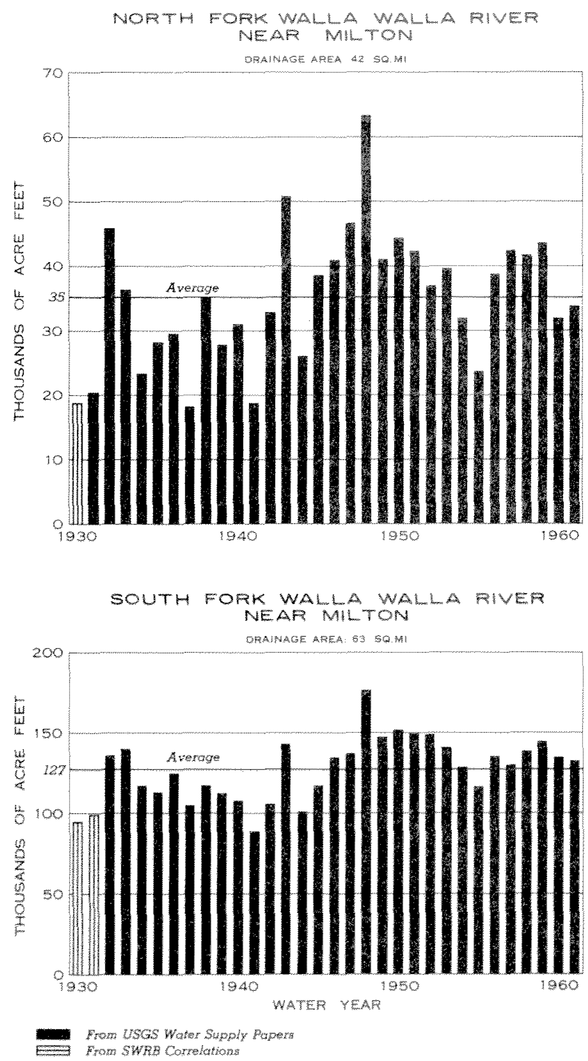


FIGURE 7. Annual yields of the North and South Forks Walla Walla River.

influence of substantial quantities of water percolating into the ground and eventually returning to the stream system from groundwater storage.

Figure 8 is a long-term (1905-1961) annual yield diagram for the Umatilla River at its mouth. It further illustrates the wide variation in annual yields and, in addition, the relationship of the long-term average to the median.

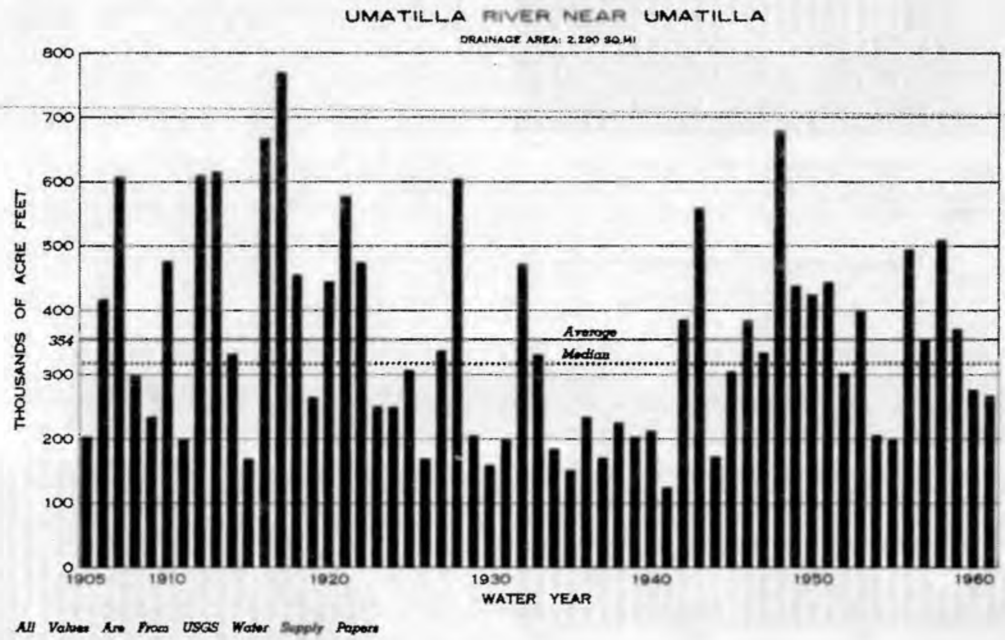


FIGURE 8. Annual yield of the Umatilla River near Umatilla.

The Bureau of Reclamation in their 1954 and 1959 reports has determined the storable runoff at the Thornhollow damsite. Mission damsite would be similar while the Ryan damsite would yield about one-half the storable water. The average annual storable flow at Thornhollow, based on a 20-year critical period, is 180,000 acre-feet. This allows for downstream user rights. One proposal considers storage of 57,000 acre-feet at the Ryan site where storage is not supplemented by Meacham Creek waters. Direct diversion from Meacham Creek to the reservoir would increase the storage potential to about 90,000 acre-feet.

Diversion requirements to serve the Indian Service and Paradise areas was determined at 4.2 acre-feet per acre in the Bureau of

Reclamation's 30,700-acre development proposal. The 83,500 irrigable acres mapped in five separate areas is far in excess of the available basin water supply.

In 1959 the Bureau of Reclamation determined available storage based on adjudicated rights and permits on the Umatilla River. Rights called for about six acre-feet annually to virtually all of the 30,000 acres of irrigated land from this source. Involved in the determination are appropriation rights of 4.5 acre-feet per acre plus 20 percent diversion losses plus supplemental storage supplies in McKay and Cold Springs Reservoirs for most of the affected lands.

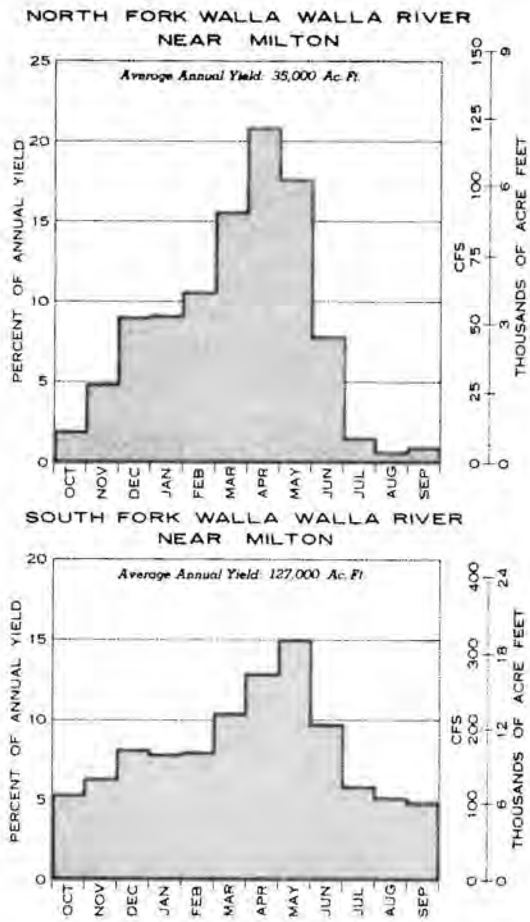


FIGURE 9. Monthly distribution of annual yield at selected stations in the Walla Walla Subbasin.

In the alluvial fan below Milton-Freewater, 57 springs have been surveyed which yield about 50,000 acre-feet per year. Tests by the U. S. Geological Survey, reported in May 1951, listed 15 springs which yielded from 0.42 to 4.15 cubic feet per second (cfs) in mid-August of 1933. Summer flows from these springs are almost entirely utilized for irrigation and domestic purposes.

Seasonal Distribution

The pattern of seasonal distribution of runoff in the basin is generally typical of the semiarid regions which are influenced by snowmelt. Figures 9 through 11 illustrate the seasonal distribution of the annual yield at stream gaging stations in each subbasin. The peak months of discharge are March, April, and May for all streams except the Umatilla River at Umatilla. These three months account for between 50 and 60 percent of the basin's average annual yield. The maximum yield month varies, depending on the

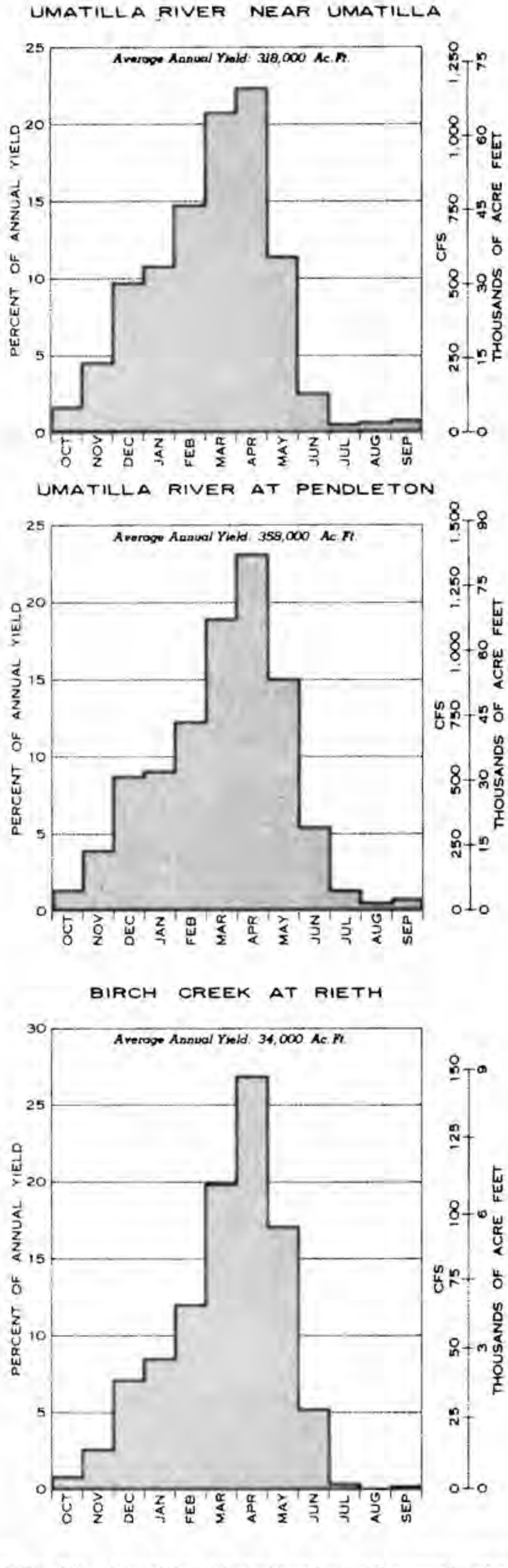


FIGURE 10. Monthly distribution of annual yield at selected stations in the Umatilla Subbasin.

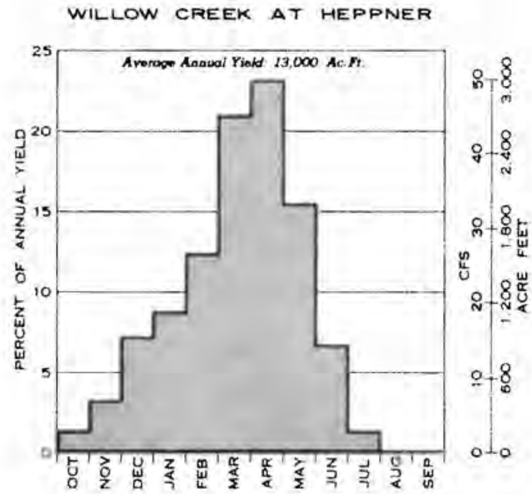


FIGURE 11. Monthly distribution of annual yield of Willow Creek at Heppner.

percentage of the watershed area that is in the higher elevations and thus has later snowmelt. The Walla Walla South Fork distribution pattern, shown in Figure 9, illustrates the influence of groundwater on seasonal discharge. There is a higher base flow and the discharge peaks are more subdued. Figure 10 reflects the extremely low July, August, and September flows of the Umatilla Subbasin and the high percentage (66 percent for Birch Creek) of yearly yield occurring in March, April, and May. Flows follow a similar pattern for the Willow Subbasin, as shown in Figure 11, for Willow Creek at Heppner.

The average monthly discharge of recorded and correlated stations is shown in Table 11.

Seasonal flow variations of the Umatilla River below

TABLE 11

AVERAGE MONTHLY DISCHARGE OF SELECTED STREAMS 1930-1961

SUBBASIN AND STREAM	COMPLETE YEARS OF RECORD	DISCHARGE IN CFS												
		Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Mean
WALLA WALLA														
South Fork Walla Walla near mouth	1908-17 1932-61	115	140	175	170	185	220	305	322	215	125	110	110	180
North Fork Walla Walla near mouth	1931-57	11	28	51	52	66	88	123	100	46	8	4	5	50
UMATILLA														
*Umatilla River at Umatilla	1905-61	80	240	500	550	830	1,070	1,190	590	130	26	32	43	440
Umatilla River at Yoakum	1935-61	80	260	600	610	920	1,220	1,760	1,130	520	360	320	160	660
Umatilla River at Pendleton	1935-61	73	240	510	530	780	1,100	1,380	870	320	72	32	40	500
Umatilla River above Meacham Creek	1934-61	59	130	220	220	290	400	585	460	210	66	45	45	230
Butter Creek at Pine City	1928-61	2	7	17	23	44	66	73	42	13	3	1	1	24
*Birch Creek at Rieth	1930-61	4	15	39	49	73	110	155	95	30	2	0	1	48
*McKay Creek near Pilot Rock	1930-61	7	40	100	120	190	280	280	130	40	5	1	2	100
WILLOW														
Willow Creek near Heppner	1951-61	3	7	15	18	28	44	50	32	14	3	-	-	18
Willow Creek at mouth	1961	3	8	16	20	50	50	55	35	16	2	-	-	20

*Actual records. Other discharges are estimates or correlations extended to the base period.

Data Source: U. S. Geological Survey and SWRB correlations

Pendleton are influenced by storage at McKay and Cold Springs Reservoirs which effect both the high and low flows.

Extreme Discharges

Extreme differences in daily flows are illustrated in Figure 12, a daily flow hydrograph for an average yield year for the Umatilla River at Pendleton. The hydrograph also illustrates the relationship of the average monthly flows to the daily fluctuations. It can be seen that monthly averages result from periods of discharge that vary greatly from the average.

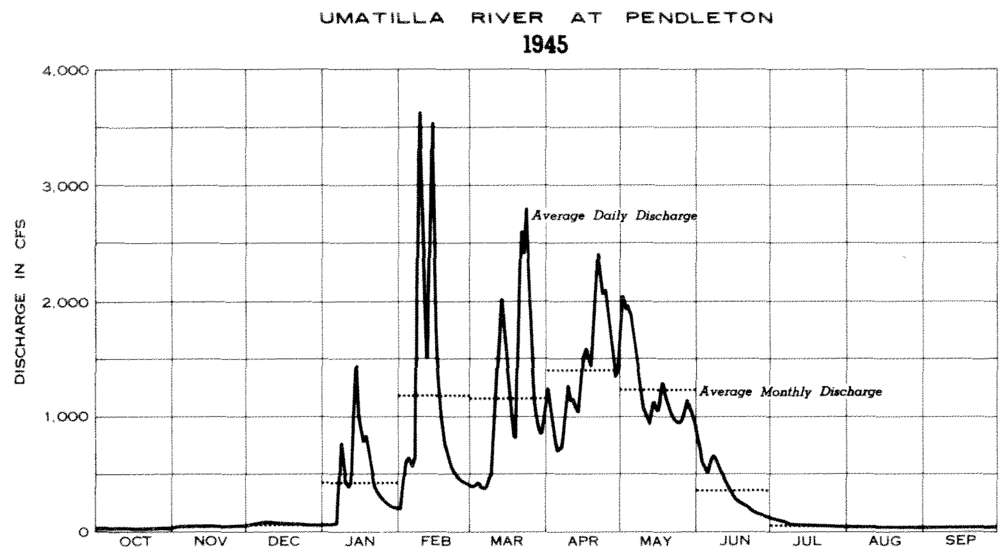


FIGURE 12. Daily discharge hydrograph, Umatilla River at Pendleton.

The western portion of the basin, primarily Willow Creek, Butter Creek, and Birch Creek drainages, is particularly subject to "cloudburst" type storms which cause short periods of heavy discharge. An example of the result of such a storm is shown in Figure 13. An hourly discharge hydrograph for Willow Creek near Arlington shows the minimum discharge of 0 cfs, and the maximum discharge of 1,400 cfs, occurring one-half hour apart. It is important to note that the volume of runoff was quite small. In many cases such storms result in severe damage, but the quantity of water involved is usually insignificant in terms of yield.

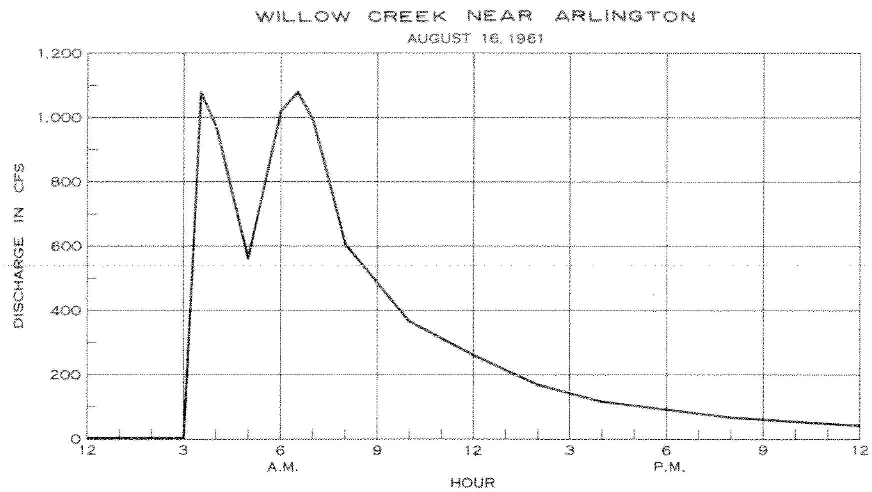


FIGURE 13. Hourly discharge hydrograph, Willow Creek near Arlington.

Maximum and minimum instantaneous discharges at selected stations are listed in Table 12. Most streams in the basin have zero minimum flows at times, with the exception of the upper Umatilla River, Meacham Creek, and the North and South Forks of the Walla Walla River.

Depletion

The State Water Resources Board has prepared a map showing the location of each of the approximately 2,800 water rights which existed in the Umatilla Basin as of January 24, 1963. This map, which may be reviewed at the board office in Salem, shows the application number of each water right permit and certificate at its approximate point of diversion.

Table 13 summarizes the surface water rights of the Umatilla Basin by subbasin and use.

Surface water rights total 2,642 cfs, of which 2,118 are for consumptive purposes and 524 are for nonconsumptive use. Irrigation rights account for the greatest potential consumptive use with 2,029 cfs for 112,547 acres. Total flows in cfs

TABLE 12

MAXIMUM AND MINIMUM FLOWS

NAME	USGS STATION NO.	WATER YEARS OF RECORD	MAXIMUM FLOW		MINIMUM FLOW	
			Cfs	Date	Cfs	Date
Birch Creek at Rieth	250	1921-23 1927-	1,860	6-17-50	0	*
Birch Creek near Pilot Rock	245	1920-28	1,270	4-13-20	0	*
Butter Creek near Pine City	320	1928-	3,800	2-21-49	0	*
McKay Creek near Pendleton	235	1919-23 1925-	3,250	2-10-21	0	*
McKay Creek near Pilot Rock	225	1921, 1927-	6,000	4-1-31	0	*
North Fork Umatilla River near Gibbon	195	1912-16 1940-43	-	-	24	8-21-1914 8-22,25,29-1915 9-3,7-1915
North Fork Walla Walla River near Milton	110	1930-	1,980	12-12-46	0.9	8-17-55 8-28,29-61
Rhea Creek near Heppner	348	1960-	322	3-15-61	0	*
South Fork Walla Walla River below Pacific Power and Light Co's Plant near Milton	105	1904-06 1930-45	3,000	5-30-06	57	7-22-30
South Fork Walla Walla River near Milton	100	1903 1907-18 1931-	2,430	12-12-46	72	2-14-32
Umatilla River above Furnish Reservoir near Yoakum	255	1915-36	15,200	3-19-32	14	8-17-26 8-28-34
Umatilla River above McKay Creek near Pendleton	220	1921-34	13,500	4-1-31	7	8-14-24
Umatilla River above Meacham Creek near Gibbon	200	1933-	6,660	12-12-46	28	9-27-35 1-9-37
Umatilla River at Gibbon	205	1896-99 1903-12	9,500	5-30-06	44	8-13 to 9-4-1911
Umatilla River at Pendleton	210	1891-92 1904-05 1935-	17,000	12-14-82	10	7-13 to 16, 1940
Umatilla River at Yoakum	260	1903-17 1921-33 1935	20,000	5-30-06	12	8-10 to 12-1908 8-4-10
Umatilla River near Umatilla	335	1904-	19,600	5-31-06	0	*
Walla Walla River at Milton	120	1903-05	3,240	3-8-04	97	8-7 to 10 & 13-05
Walla Walla River near Milton	115	1905-06 1918-30	8,130	5-30-06	25	8-18 & 23-29
Willow Creek above Eightmile Canyon near Arlington	355	1905 only	830	6-25-05	0.3	*
Willow Creek at Heppner	345	1951-	36,000	6-14-03	0	*
Willow Creek near Arlington	360	1906, 1960-	2,100	5-30-06	0	*
Willow Creek near Morgan	350	1921, 1929-31	2,000	2-1-30	0	*

*Indicates this flow occurred many times.

Data Source: U. S. Geological Survey and SWRB accounted for by other consumptive use rights are municipal 78.7, industrial 4.8, and domestic 4.7. The largest amount

TABLE 13

SURFACE WATER RIGHTS SUMMARY
As of January 24, 1963

USE	SUBBASIN WALLA WALLA Cfs	SUBBASIN UMATILLA Cfs	SUBBASIN WILLOW Cfs	BASIN Cfs
CONSUMPTIVE				
Domestic	2.68	1.53	0.45	4.66
Municipal	41.44	36.20	1.05	78.69
Irrigation	475.40	1,438.28	115.79	2,029.47
Industrial	1.00	2.82	1.00	4.82
Total Consumptive	520.52	1,478.83	118.29	2,117.64
NONCONSUMPTIVE				
Power	406.48	108.00	0	514.48
Fish Life	1.00	8.50	0	9.50
Total Nonconsumptive	407.48	116.50	0	523.98
TOTAL	928.00	1,595.33	118.29	2,641.62

Data Source: State Engineer

for a nonconsumptive use is for power rights which total 514 cfs. These rights are being decreased due to abandonment and nonuse. A large power dam on the Umatilla River with a right for 108 cfs was breached in 1961, eliminating the last large power development in the Hermiston area. Fish life rights account for the remaining nonconsumptive use, totaling 9.5 cfs.

Table B in the Appendix lists the Surface Water Rights Summary for all primary and secondary streams in the basin. This table shows recorded domestic, municipal, irrigation, industrial, power, and fish life rights. No rights presently exist for the remaining beneficial uses; mining, recreation, wildlife, and pollution abatement.

Except in the upper main stems and headwaters, flows in the major streams are usually depleted during much of the irrigation season. The only appreciable summer flows are on the Walla Walla River above Milton-Freewater and on the Umatilla

River above Echo. These waters have been appropriated mainly for irrigation purposes below the above mentioned points. Storage of surface water and further groundwater development are therefore the principal sources of future supplies for consumptive uses. Other means of obtaining water include transfer of rights between uses. In the headwaters, there still exist limited possibilities for such nonconsumptive uses as fish life and recreation.

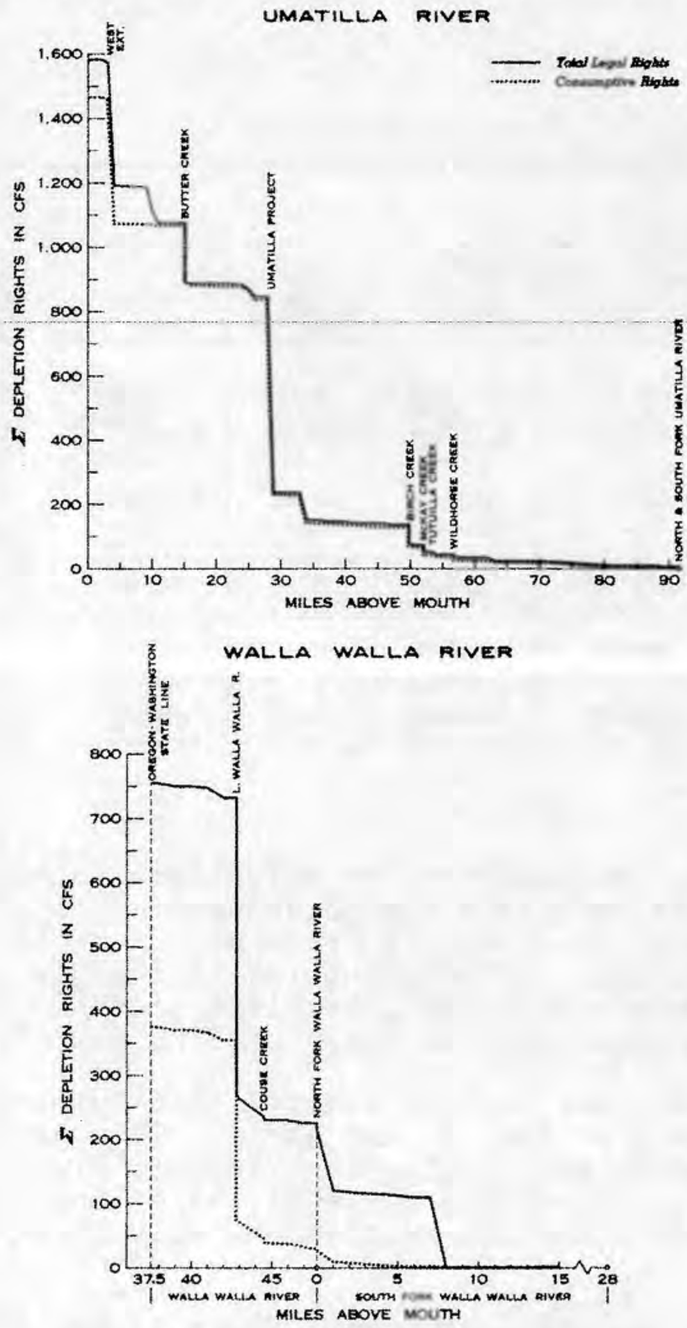


FIGURE 14. Legal depletions by stream mile for Umatilla and Walla Walla Rivers.

By subbasin, the number of surface water rights are approximately as follows: Walla Walla, 1,560; Umatilla, 480; and Willow, 140. The large number of Walla Walla Subbasin rights reflects the predominance of individual and small group users.

Figures 14 and 15 show the legal depletion rights, by stream miles, of the Walla Walla River, Umatilla River, and Willow Creek, as of January 24, 1963.

On the Walla Walla and Umatilla Rivers the depletion pattern reflects diversions to both group irrigation systems and individual users, while Willow Creek is developed primarily by a few individual users. The effects of total tributary rights

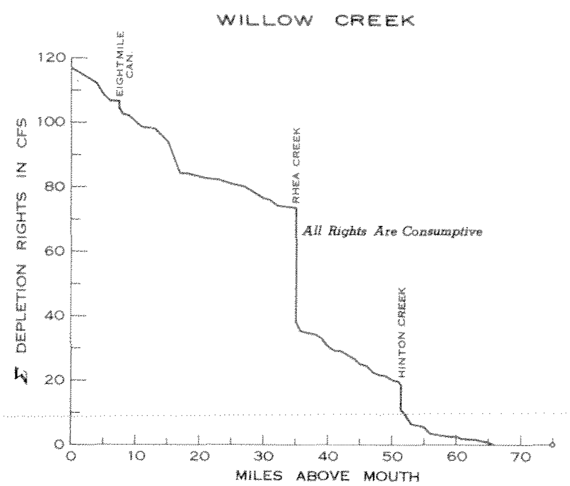


FIGURE 15. Legal depletions by stream mile for Willow Creek.

are shown at each confluence point on the main stem.

Court decrees have established the legal maximum annual surface water depletion for the basin, as shown in Table 14. Irrigation depletion is based on a duty of water of 3 acre-feet per acre in the Umatilla Subbasin above Pendleton and 4.5 below, and 4 acre-feet per acre in the Willow Subbasin. Although quantities are not mentioned in many of the earlier rights, this is the basis used by the State Engineer in approving water rights. This is increased in some cases to allow for canal distribution losses. Supplemental rights are held for the Umatilla Project on storage water from Cold Springs and McKay Reservoirs.

TABLE 14

LEGAL ANNUAL SURFACE WATER DEPLETIONS*

USE	SUBBASIN			BASIN Acre-Feet
	WALLA WALLA Acre-Feet	UMATILLA Acre-Feet	WILLOW Acre-Feet	
CONSUMPTIVE				
Domestic	1,940	1,110	330	3,380
Municipal	30,000	26,210	760	56,970
*Irrigation	61,570	381,260	29,200	472,030
Industrial	720	2,040	720	3,480
Total Consumptive	94,230	410,620	31,010	535,860
NONCONSUMPTIVE				
Power	294,280	78,190	0	372,470
Fish Life	720	6,150	0	6,870
Total Nonconsumptive	295,000	84,340	0	379,340
TOTAL	389,230	494,960	31,010	915,200

*Irrigation depletions estimated.

Data Source: State Engineer

Basin consumptive rights would permit an annual maximum legal depletion of 535,860 acre-feet and nonconsumptive rights of 379,340 acre-feet. Even with winter storage and summer release of surface water, all consumptive rights could not be met to their maximum legal limit on some streams during certain dry years. There are 59,000 acres with surface water rights which are not presently irrigated. To deliver water to this land at a rate of 4 acre-feet per acre would require 236,000 acre-feet.

The above situation is analyzed as a legal rather than a physical factor for the Umatilla Basin. Most of the nonirrigated land holding rights has never been irrigated or has been abandoned for economic reasons. Further, the legal right does not take into account the large return flows from domestic, municipal, industrial, and irrigation usage.

Power accounts for 372,470 acre-feet of the 379,340 total for nonconsumptive water rights. Due to relatively cheap power being developed from the adjoining Columbia River facilities, there has been a decrease in use of power rights, although payment of fees is generally maintained.

Table 15 shows an estimate of actual water consumed by the ten beneficial uses, or a "net consumptive use". This was determined by applying a consumptive use factor of 2 to 2.2 acre-feet for 73,680 acres irrigated in 1962 and a conservative 10 percent for all other consumptive diversions. This resulted in a total water consumption of about 165,000 acre-feet. Consumptive use requirements are roughly one-half of diversion requirements and one-third of the storage requirements.

TABLE 15

ESTIMATED ACTUAL CONSUMPTION IN ACRE-FEET

SUBBASIN	SURFACE WATER	GROUND-WATER	TOTAL CONSUMED
Walla Walla	27,000	33,000	60,000
Umatilla	67,000	13,000	80,000
Willow	22,000	3,000	25,000
TOTAL	116,000	49,000	165,000

To better understand the above figures the relationship between surface water and groundwater use should also be considered. Many municipal, industrial, and irrigation water users draw available flows from streams while these supplies are adequate, then shift to well sources during dry summer periods. Some irrigators have floodwater rights that supply only a small portion of total needs. In the Walla Walla Subbasin some surface flows are spread over gravel beds to build groundwater storage. Recharge of groundwater supplies depends on time, rate, and duration of flows.

In considering legal depletions we must also consider the immense daily variations in flow, illustrated by a daily discharge hydrograph of Umatilla River at Pendleton, Figure 10. Many of the high flows each year exist at times and places where full use is impractical. Therefore, even though the minimum annual surface flows exceed the estimated consumptive use by 200,000 acre-feet much of this water does not come at the proper time and place. About 60 percent of this outflow occurs during the March-October irrigation season. Constructing dams which will impound surplus flows for later release will improve the streamflow regimen and allow for expansion of irrigation-agriculture.

GROUNDWATER

General

Groundwater studies made by the U. S. Geological Survey in the Walla Walla and Umatilla Subbasins designate the Columbia River basalt flows as the principal aquifers in the areas. Although no such studies have been made in the Willow Subbasin, well logs show that these flows likewise form the main aquifers. With the exception of these basalts, and old gravels in part of the Walla Walla Subbasin, the other rock types in the Umatilla Basin generally yield little groundwater.

The studies made in the Walla Walla and Umatilla Subbasins include the mapping and description of the various geologic formations, the locations and records of representative wells and springs, and the compilation and interpretation of the geologic and hydrologic data. Although of a preliminary or reconnaissance nature, the studies provide a general appraisal of the groundwater regimen, and provide the basis for future quantitative hydrologic work to delineate the larger groundwater bodies.

A thorough quantitative study, leading to optimum development of the groundwater resources of the basin would require a long-term investigation. This would probably require the drilling of some test wells as well as the collection of precipitation, surface runoff, and water-level records from wells. A minimum of four or five years of record collection would be required before the groundwater fluctuation pattern would begin to show. Although the basin now has 60 observation wells, all but a very few have been established during the past two years. The ultimate goal of the study would be the determination of the approximate location and size of economically recoverable bodies of groundwater, their recharge capabilities, and the safe yield or rate at which water can be withdrawn without depleting them. Such a study should be initiated in conjunction with other water resources studies now planned for the basin.

Geology

The basin is part of the Columbia lava plateau physiographic division and as such is underlain almost entirely by layer upon layer of Columbia River basalt flows. Individual flows range from about 10 to 100 feet in thickness and, although the Umatilla River near Gibbon has worn through 2,500 feet of the formation, its base has not been reached. The porous and permeable tops of some of the flows, as well as cracks and the incomplete closures of one flow over another, form very important aquifers. Old alluvial fan gravels, deposited along the Walla Walla River and other nearby streams from above Milton-Freewater to beyond the state line, also form important aquifers. The gravels exceed 200 feet in depth and make up much of the land surface downgrade from the Milton-Freewater area. Overlying the basalt flows in the northwestern part of the basin are younger sedimentary deposits consisting of fanglomerate or partially cemented alluvial fan material, glacial lake-bed sediments, and glacial stream deposits. Fanglomerate also occurs in a considerable area east and south of Pendleton. A wind-blown silt called loess mantles most of the basin east and northeast of the glacial lake-bed sediments from which much of it was derived. Relatively thin deposits of alluvium occur along the larger streams throughout the basin. The oldest rocks, made up of metamorphic, intrusive igneous, and sedimentary types, are exposed in a relatively small area near the south-central limits of the basin.

Figure 16, on the following page, shows the above rock types and most of the geologic structures described below.

Geologic structure is important in the basin because it determines to a large degree the occurrence and movement of groundwater. The major structures are the Blue Mountain anticline or arch, and the Walla Walla and Umatilla synclines or

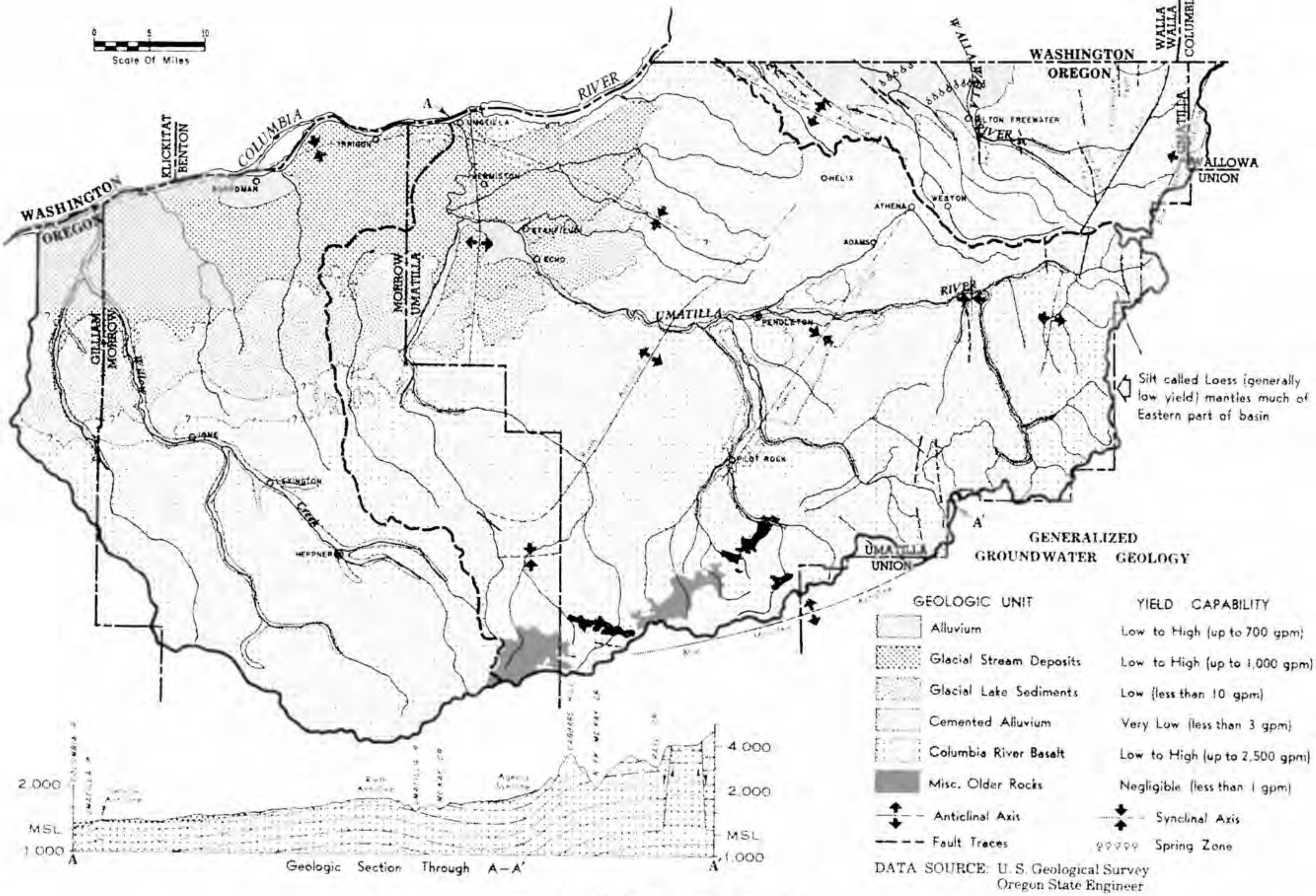


FIGURE 16. Generalized groundwater geology.

troughs. The general regional dip of the basin is northwesterly.

The Walla Walla syncline is predominately in Washington, but its outer reaches form part of the Walla Walla Subbasin in Oregon. It was into this trough that the old, water-bearing gravels were deposited. The eastern part of the subbasin, along the slopes of the Blue Mountains, has an undetermined number of groundwater reservoirs formed by fault barriers in the basalt flows. Some are being investigated for municipal and other water uses. These subsurface structural traps occur in all three subbasins.

The Umatilla syncline is a broad, westerly-sloping trough between two arches called the Blue Mountain and Horse Heaven anticlines. Extending through the Umatilla Subbasin from near the Blue Mountains to the Columbia River, this major syncline is transected and compartmentalized by smaller structures, the most important of which are the northeasterly-trending Rieth anticline and Agency syncline, in the vicinity of Pendleton. These structures, or faulting related to them, have economic significance because they influence the movement of groundwater and cause higher water tables in the interflow zones of the basalt flows underlying the area. The Service anticline trending northerly through the environs of Hermiston is deemed of lesser importance.

In the Willow Subbasin, a probable subsurface basalt barrier is believed to cause an increase in the flow of Willow Creek in the vicinity of Cecil.

A geologic structure map being prepared by the U. S. Geological Survey will delineate a number of structural barriers or traps in the basin.

Occurrence

The Columbia River basalt flows form the most widespread and productive aquifers in the basin. In the Blue Mountains, where precipitation reaches about 50 inches annually, the porous and permeable tops of some flows, as well as incomplete closures between flows, form tabular zones that are infiltrated by large quantities of surface water. The aquifer zones are commonly about 3 or 4 feet thick and, where they are separated by highly jointed or fractured lavas, the total thickness of a single water-bearing stratum may be 25 feet or more. This water moves as groundwater in a generally northwesterly direction through the basin.

The major wells in the basin, yielding up to 2,500 gallons per minute (gpm), are located principally in three general areas; Milton-Freewater to Adams, Pendleton to Pilot Rock, and in a broad area from Umatilla to Butter Creek. Data on 15 wells in these areas, chosen because of either productivity or depth, are shown in Table 16. All of the wells tap basalt aquifers.

TABLE 16

REPRESENTATIVE HIGH-YIELD WELLS

YIELD	DRAW-DOWN Feet	SPECIFIC CAPACITY Gpm per foot of drawdown	DEPTH TO STATIC WATER LEVEL Feet	DEPTH OF WELL Feet	WATER USE
		Milton-Freewater - Adams Area			
1,760	7	251	12	712	Irrigation
1,500	7	214	29	402	Irrigation
1,410	30	47	71	952	Municipal
1,350	81	17	49	528	Industrial
800	-	-	115	2,000	Irrigation
		Pendleton - Pilot Rock Area			
2,500	18	139	139	761	Municipal
2,400	86	28	162	700	Municipal
1,800	12	150	185	774	Municipal
1,500	72	21	6	365	Industrial
585	69	8	153	1,008	Municipal
		Umatilla - Butter Creek Area			
2,400	-	-	-	704	Municipal
2,315	132	18	12	962	Municipal
2,000	35	57	45	280	Irrigation
1,200	107	11	0	980	Irrigation
1,089	108	10	39	505	Domestic

Data Source: State Engineer and U. S. Geological Survey

Groundwater recharge from precipitation falling directly on most of the lower areas in the basin is considered minimal because of low rainfall, high temperatures, and use of most available supplies by existing vegetation.

Figure 16, shown above, is a generalized groundwater geology map showing the estimated yield capabilities of the various rock types in the basin, as well as the geologic structures that influence groundwater movement.

In the Walla Walla Subbasin groundwater occurs principally in the basalts and in the old gravels of the Walla Walla River alluvial fan extending northwesterly from the environs of Milton-Freewater. The U. S. Geological Survey estimates that 40,000 acre-feet of groundwater were used from the gravels and 7,000 acre-feet from the basalts during the year 1958-1959. It also estimates that the entire Walla Walla River drainage, roughly two-thirds of which is in Washington, contains about 500,000 acre-feet of groundwater in the first 100 feet of saturated material, be it gravel or basalt, or both. Although no definite determination has been made, it has been estimated that 175,000 acre-feet of this total may lie in the Oregon part of the drainage area.

The alluvial fan gravels provide the main shallow groundwater supply for the Walla Walla Subbasin. Numerous wells in the gravels yield 300 gpm or more. In addition to supplying many wells these gravels have springs that yield up to 50,000 acre-feet a year. The springs occur in two semicircular zones about 3 and 7 miles northwesterly from Milton-Freewater. A 1933 survey listed 57 springs or spring groups. Measurements indicate that some of the springs are decreasing in flow. This may be due in part to more wells withdrawing water from the gravels, and in part to less percolation because of increased use of sprinkler irrigation.

Winter groundwater tables in the gravels are not recovering to the same elevations formerly reached, being about 5 feet less than in 1940. The gravels are recharged principally by the high flood peak of the Walla Walla River, by irrigation return flow, and by precipitation.

Although the water levels in the basalts underlying the Milton-Freewater area are declining, indications are that the rate of decline is slowing. The larger wells in the basalt now produce up to 1,500 gpm. A 1948 U. S. Geological Survey tabulation of wells in the Columbia River basalt indicates that a properly constructed 10 or 12-inch well, pumped at a rate to produce a drawdown of 50 to 100 feet, yielded an average of 1 gpm per foot of penetration below the regional water table. Present, more efficient wells better this average.

In order to obtain additional water, it has been proposed by the U. S. Geological Survey to drill wells in the permeable groundwater stratas behind the basalt barrier faults and dikes along the slopes of the Blue Mountains. The barriers best suited for investigation are the Couse, Elbow Bend, Hite, and Kooskooskie faults. The City of Milton-Freewater recently drilled such a well behind the Couse Creek fault near the Milton power plant. The well test pumped at 1,250 gpm with 90 feet of drawdown, is 888 feet deep, and has a static water level of 240 feet below land surface. Its diameter decreases from 18 inches to 12 inches at the bottom. These structural traps are believed to hold substantial quantities of groundwater that can economically be used to supplement present supplies during the summer months. The aquifers would recharge during the winter and spring.

In the Umatilla Subbasin groundwater in large quantities accumulates in the basalt interflow zones of the Agency syncline, or trough, underlying the Pendleton plains. The syncline extends in a wide belt from Athena southwesterly to beyond Pilot Rock and from west of Pendleton east to the Blue Mountains. Along the axis of the syncline and to the east, hydrostatic pressure originating in the mountains is sufficient to cause many wells in this belt of confined groundwater to flow at the surface. These artesian wells include the municipal wells of Athena and Pilot Rock. The U. S. Geological Survey estimates that the wells in the basalts of the syncline withdraw about 5,000 acre-feet annually and that not more than a total of 10,000 acre-feet annually are withdrawn from the basalt in the entire subbasin. The quantities now pumped from the Agency syncline are decreasing the available supplies to a point that it is desirable to determine if there are additional groundwater supplies behind the fault barriers higher in the subbasin.

To the west, the Umatilla lowlands extend from the Rieth anticline to the Columbia River. The shallower zones of the nearly horizontal basalt flows of the lowlands are recharged from three principal sources. These are Butter Creek and the many minor creeks crossing the northerly dipping basalt flows of the Blue Mountain slope above Pine City, the Umatilla River where it crosses the westerly dipping basalt flows of the Rieth anticline and, to a lesser extent, the Columbia River and intermittent creeks where they cross the southwesterly dipping basalt flows of the Horse Heaven anticline.

Poor-yielding wells directly west of the axis of the Rieth anticline may indicate that the structure, or faulting associated with it, substantially restricts the movement of groundwater westward. Contributing to the scarcity of groundwater in this area is the draining effect of the 700-foot-deep cut through the anticline by the Umatilla River. Due to the slightly northerly dip of the structure, groundwater for some distance south of the river largely drains to this depth. Wells in this crest area are therefore dependent on perched groundwater bodies which, because of little recharge, generally give small yields. North of the river, in the area directly west of the Reith anticline, wells are deep and have poor yields and low static water levels.

The water in the basalt aquifers of the main part of the Umatilla lowlands is largely confined under pressure, being supplied from higher elevations by the Umatilla River and Butter Creek. Most wells in the Nolin-Pine City-Hermiston area are therefore artesian, although not necessarily flowing at the surface. The Myers artesian well, three and one-half miles east of Echo, is 980 feet deep and flows at a rate of 350 gpm. It test pumped at 1,200 gpm with a drawdown of 86 feet after 20 hours. The two large Vey artesian wells are located about seven miles up the North Fork Butter Creek from Pine City. One well, 500 feet deep, does not flow but pumps about 1,000 gpm with 20 feet of drawdown. The other well, 365 feet deep, had an artesian flow of 1,200 gpm.

Glacial lake-bed sediments in the northwestern part of the basin, loess deposits throughout much of the basin, and three large alluvial deposits along the Umatilla River and lower Butter Creek contain sufficient groundwater for domestic and stock use. Wells in the fanglomerate deposits (partially-cemented alluvial fan material) at the base of the foothills generally yield less than 3 gpm. Two 96-foot wells, located one and one-half miles southwest of Ordnance in glacial stream deposits, yielded 520 gpm during a three-month period with no apparent drawdown and indicate a potentially important aquifer. Another well in this vicinity, tapping these deposits at a depth of 106 feet, was test pumped at 960 gpm for seven hours with no drawdown reported. The abundance of water may be due to structural barriers in the underlying basalt in which case the condition would be unlikely to extend throughout the deposits.

A U. S. Geological Survey open-file report, made available in 1957, lists the total consumption of groundwater in the subbasin at about 16,100 acre-feet per year.

In the Willow Subbasin relatively little is known of the groundwater regimen. A forthcoming geologic structure map by the U. S. Geological Survey will do much in locating local warpings in the regional dip of the basalt flows where groundwater is likely to accumulate. This map will include the entire Umatilla Basin as well as adjacent areas. A pronounced increase in the flow of Willow Creek in the vicinity of Cecil is believed to be due to the presence of a subsurface basalt barrier. A large part of the groundwater recharge in the middle Willow Creek area is from stream losses. Additional water is being sought at Heppner, particularly from the proposed Willow Creek Dam, for both domestic and municipal supplies. Heppner's three municipal wells, all listed as yielding 350 gpm from basalt aquifers, are 159, 211, and 352 feet deep. These wells had corresponding drawdowns of 129, 114, and 114 feet when test pumped.

In the northern part of the subbasin two wells in basalt, located two miles south of Irrigon in the Umatilla Ordnance Depot, test pumped at 1,170 and 1,089 gpm. These wells, 682 and 710 feet deep, respectively, had drawdowns of 14 and 69 feet. A 565-foot well, 10 miles south of Boardman in the proposed Space Age Industrial Park, produced 725 gpm. Pump tests at this rate caused a 100-foot drawdown after 20 hours. The City of Pendleton's Byers Street and Round-Up Park wells, 935 and 761 feet deep, respectively, have yields of 1,800 and 2,500 gpm. These wells likewise tap basalt aquifers and have corresponding drawdowns of only 12 and 18 feet.

An evaluation of available data indicates that substantial quantities of water probably enter the ground, but better basic data and a quantitative groundwater study is needed to locate usable groundwater aquifers.

Depletion

Groundwater rights in the basin total 395 cfs, of which 39 are claimed rights, 147 are inchoate rights, and 209 are perfected rights. A claimed right is a registered claim based on use prior to the Ground Water Act of 1955. An inchoate right is a permit right awaiting final proof by the State Engineer which, after it is finalized by being assigned a certificate, becomes a perfected right. A perfected right is one evidenced by a water right certificate, either by adjudication of a claimed right by the Circuit Court or by final proof of permit by the State Engineer. The three types of rights are summarized by subbasin in Table 17.

A maximum legal annual depletion of 150,000 acre-feet is estimated by assuming an average duty of water of 3 acre-feet per acre for irrigated land and adding to this the withdrawal of the other water rights.

TABLE 17

GROUNDWATER RIGHTS SUMMARY
As of January 24, 1963

USE	WALLA WALLA SUBBASIN			UMATILLA SUBBASIN			WILLOW SUBBASIN			BASIN TOTAL Cfs
	CLAIMED Cfs	INCHOATE Cfs	PERFECTED Cfs	CLAIMED Cfs	INCHOATE Cfs	PERFECTED Cfs	CLAIMED Cfs	INCHOATE Cfs	PERFECTED Cfs	
Domestic	0.04	-	-	0.03	2.33	0.01	-	0.50	-	2.91
Municipal	-	-	15.20	-	8.11	24.97	2.01	1.11	0.78	52.18
Irrigation	36.92	32.24	72.97	0.27	70.29	46.40	-	28.88	12.89	300.86
(Acres)	(3,260)	(2,379)	(7,132)	(42)	(6,684)	(4,332)	-	(2,367)	(1,050)	(27,237)
Industrial	-	0.06	15.42	-	1.00	19.39	-	2.26	0.67	38.80
Recreation	-	-	-	0.06	0.20	-	-	-	-	0.26
TOTAL	36.96	32.30	103.59	0.36	81.93	90.77	2.01	32.75	14.34	395.01

Note: Cfs for claimed rights are estimated.

Data Source: State Engineer

The groundwater withdrawal in the basin is difficult to determine because wells are not metered, irrigation seasons vary for different crops, and water rights differ considerably from one locality to another. Also, not all groundwater uses require water rights. The statewide Ground Water Act of 1955 does not require groundwater rights for watering stock, for irrigating lawns or noncommercial gardens not exceeding one-half acre in area, for single or group domestic purposes not exceeding 15,000 gallons per day (gpd), or for any single industrial or commercial purpose not exceeding 5,000 gpd. The doctrines of prior appropriation and beneficial use without waste are the basis, measure, and extent of the right to appropriate both groundwater and surface water in Oregon.

Table 15 gives an estimate of the actual annual consumption of both groundwater and surface water. This amounts to 33,000 acre-feet of groundwater for the Walla Walla Subbasin, 13,000 for Umatilla Subbasin, and 3,000 for Willow Subbasin. In the Walla Walla Subbasin groundwater consumption exceeds surface water by 6,000 acre-feet, but falls far short in the Umatilla and Willow Subbasins.

WATER SUPPLY, USE, AND CONTROL

LEGAL RESTRICTIONS AND LIMITATIONS ON WATER USE

Supreme Court Decision

The State of Washington brought suit against the State of Oregon "to determine the relative rights on this (Walla Walla River) interstate stream, to the use of waters of the Walla Walla River and its tributaries." In the Report of the Special Master No. 17 Original, October term, 1930, the following decision, quoted in part, was handed down: "The State of Oregon and its appropriators are not diverting and using more of the waters of the Walla Walla River than their equitable portion thereof." Oregon's appropriation rights prior to 1930 were upheld, irrespective of priority.

Statutory

ORS 538.450 (1) grants the City of Pendleton and its water commission rights to waters of Umatilla River under Chapter 243 of Oregon Laws, 1941, as follows:

"Subject to water rights existing on March 8, 1941, there is granted to the City of Pendleton, Umatilla County, and its water commission, the exclusive right to use for public or municipal purposes or use, or for the general use and benefit of people within or without the city, all waters of the north fork of the Umatilla River, the springs at the head which form the stream, and its tributaries to the confluence of the north fork with the main stream of the Umatilla River in the northwest quarter of section 22, township 3 north of range 37 east of the Willamette Meridian, which north fork is a tributary of the Umatilla River situated in Umatilla County."

ORS 538.010 provides for waters diverted by Morrow County from Ditch Creek; rights of use and appropriation; certificate; time limitation.

"(1) The waters of Ditch Creek which were diverted to and became a part of the waters of Willow Creek, under provisions of chapter 324, Oregon Laws 1939, are subject to the same rights of use and appropriation as the original waters of Willow Creek.

"(2) The right of the county court of Morrow County to divert and store the waters of Ditch Creek, acquired under the certificate issued by the State Engineer licensing such diversion and storage, shall date from the time the application to divert and store such waters was filed. The waters shall be used for the purposes, in the manner and under the conditions set forth in the certificate, for such time as the use is for the public interest. If the waters are not used under the license for a five-year period, the license shall expire." This is a trans-mountain diversion from the John Day Basin.

ORS 538.020 provides for rights and easements for the storage and diversion of Ditch Creek waters.

State Engineer Applications Pending

In 1915 the Bureau of Reclamation and State Engineer withdrew and withheld from appropriation 2,000 cfs of the John Day River and its tributaries, supplemented by 250,000 acre-feet of storage in the proposed Dayville Reservoir and 150,000 acre-feet in the proposed Carty Reservoir, for irrigation, power, and domestic purposes (applications 4704 and R-4708). This withdrawal is for the purpose of providing a water supply for the proposed John Day Project, which was studied cooperatively by the State of Oregon and the Bureau of Reclamation. The project considered the irrigation of about 300,000 acres on the Umatilla plateaus between Alkali Canyon and the Umatilla River, using the waters of the John Day River.

The Birch Creek Water Control District has submitted application numbers R-32816 for 5,000 acre-feet of storage on West Birch and R-32817 for 5,000 acre-feet on East Birch, dated December 22, 1958 for irrigation, industrial, municipal, and flood control purposes.

WATER USE AND ASSOCIATED PROBLEMS

Domestic

About 15,000 people in rural areas and unincorporated communities in the basin depend primarily on groundwater for their domestic water supplies (household, stock, lawns, and gardens). Little domestic use is made of streamflows.

Domestic surface water rights total 4.6 cfs for a maximum legal annual depletion of 3,300 acre-feet. The maximum legal annual depletion for domestic groundwater rights is 2.9 cfs or 2,110 acre-feet.

WATER SUPPLY, USE, AND CONTROL

Many adjudicated irrigation rights in Umatilla County provide reasonable amounts of surface water for domestic or household and stock watering purposes. Water for stock use is not generally granted for more than 1/40 of a cfs per 1,000 head. During the irrigation season the water for these domestic purposes is part of the irrigation diversion, but the right to divert water for domestic use continues throughout the year.

Most domestic wells in the basin draw water from alluvial and other sedimentary deposits, the most widespread, of which is a wind-blown silt called loess. The wells are generally less than 100 feet deep and those properly located generally produce sufficient quantities of water. A few domestic wells, several hundred feet deep, tap the Columbia River basalt flows which form the principal groundwater aquifers in the basin. Production of these wells ranges from poor to good.

There are areas of decreasing groundwater in the basin, including lower Butter Creek, Willow Creek, and Milton-Freewater. However, none have been serious enough to be declared critical by the State Engineer.

The quality of water in the sedimentary deposits is generally free of high mineral content except in localized areas such as Charleston, located between Hermiston and Umatilla, where iron and sulfur compounds impart an unpleasant taste and odor. This water can be easily treated for household use. Considerable chemical pollution is believed to occur in the shallow wells in populated areas, particularly in the environs of Milton-Freewater. Although not yet critical, these wells should be monitored to forestall possible serious quality problems. The danger could be averted by the extension of public water services to the rural areas dependent on wells.

The quality of water from the basalt aquifers is generally high and in most cases no treatment is required.

Seasonal domestic well water shortages, due primarily to the considerable increase in the number of wells and resultant withdrawals in excess of recharge, occur in the Willow Creek drainage, in the Milton-Freewater area, and in other localities having a heavy concentration of wells. The alluvial shallow wells in the Milton-Freewater area are particularly low during the nonirrigating seasons. The deeper wells drawing from basalt aquifers in this area are likewise experiencing lower water tables. This is due possibly to pumping in excess of recharge, and resultant adjustments in water table levels. With one exception, water-level measurements of deep wells along Butter Creek do not show declines.

With the present trend to urban living, it is unlikely that future rural domestic water use will greatly exceed that of the present. However, it is probable that there will continue to be shortages due to seasonal lowering of the water tables and to additional municipal, industrial, and irrigation wells in the basin.

Municipal

All 16 incorporated communities in the basin have municipal water systems and, with the exception of Pendleton, all depend primarily on groundwater.

Municipal wells vary from 50 feet to 1,245 feet in depth and draw principally from Columbia River basalts. The largest producer is Pendleton's Round-Up Park well which yields 2,500 gpm. The water is of good quality and, with the exception of the three largest Cities, Pendleton, Hermiston, and Milton-Freewater, no treatment is required. Pendleton uses chlorination and fluoridation, Hermiston uses aeration, and Milton-Freewater uses filtration and chlorination.

Municipal water rights for the basin total 188.7 cfs; with 151.4 cfs in the Walla Walla Subbasin, 36.2 cfs in the Umatilla Subbasin, and 1.1 cfs in the Willow Subbasin. These rights allow a maximum annual legal depletion for the basin of 136,660 acre-feet, which for the above-mentioned subbasins breaks down to 109,700; 26,200; and 760 acre-feet, respectively.

Table 18 lists the municipal water systems and the results of questionnaires sent out by local water resource committees, pertaining to supply source and present use. These systems supply approximately 33,000 persons or about 68 percent of the basin's population. Several water districts and water supply companies supplying unincorporated communities such as Irrigon, Rieth, and Umapine, were included in the preceding section on domestic water.

In the Walla Walla Subbasin municipal water use averages about 4,000 acre-feet per year. Milton-Freewater is supplied by six wells, 500 to 900 feet deep, that furnish approximately 3,376 acre-feet or 90 percent of its water. Water for summer supplemental purposes is obtained from the Walla Walla River. Two of

TABLE 18

MUNICIPAL WATER SYSTEMS

CITY	SOURCE OF SUPPLY (Well Depth)	TREATMENT	POPULATION SERVED or (City Pop.)	ANNUAL USE Ac.-Ft.	POTENTIAL SOURCE OF SUPPLY
WALLA WALLA SUBBASIN					
Milton-Freewater	Wells, S. Fork Walla Walla, (90% from wells)	Pressure Filter Cl_2	4,110	3,800	Wells, Walla Walla River
Weston	Spring, Pine Creek wells (150) (239) (534)	Cl_2	800	170	Spring, wells
SUBBASIN TOTAL			4,910	3,970	
UMATILLA SUBBASIN					
Adams	Wells (165) (650)	None	200	20	Wells
Athena	Wells (680) (1,245)	None	1,000	330	Wells
Echo	Wells (496) (50)	None	522	160	Wells
Helix	Wells (603) (50)	None	172	40	Wells
Hermiston	Wells (962) (918) (500)	Aeration	4,500	690	Wells
McNary	Wells		290	240	Adequate
Pendleton	Thornhollow Springs, wells	Cl_2 and fluoride	15,600	4,750	Wells, Umatilla River storage
Pilot Rock	Wells (309) (486)	None	1,765	310	
Stanfield	Wells (187) (60)	None	750	80	Wells
Umatilla	Wells (536) (785)	None	656	320	Columbia River
SUBBASIN TOTAL			25,455	6,940	
WILLOW SUBBASIN					
Boardman	Well (178)	None	(156)	(Under relocation)	
Heppner	Wells (211) (352)	None	(1,657)	460	Wells
Ione	Well (142)	None	(346)	210	Wells
Lexington	Well (581)	None	(240)	200	Wells
SUBBASIN TOTAL			2,243	870	

Data Source: Oregon State Sanitary Authority and questionnaires the three large operating canneries supplement their wells with city water. The remaining cannery uses city water exclusively. The city is drilling an additional well in a nearby fault-barrier groundwater reservoir to supply additional water for increased cannery production. It is probable that wells so situated could supply sufficient water for the foreseeable growth of the city. Weston supplements its well supply with spring water.

In the Umatilla Subbasin municipal water use approximates 7,000 acre-feet per year. Pendleton's primary supply is from the Thornhollow springs, supplemented by five wells during low flow periods. The springs are situated along the Umatilla River and become so turbid during flood stages that the city then depends entirely on its wells. Possible Umatilla River storage, currently being studied by the Bureau of Reclamation, could provide supplemental water for Pendleton. The City of Umatilla may eventually supplement its supply with water from the Columbia River.

All nine cities in this subbasin will probably drill additional wells as water needs increase, even though some may also go to surface supplies. Groundwater requires little or no treatment so this economic advantage is particularly attractive to the smaller communities.

In the Willow Subbasin the municipal water use of Heppner, Lexington, and Ione is estimated at less than 870 acre-feet per year. Groundwater is the most likely source of additional supply. The proposed Boardman Space Age Industrial Park, located in the northern part of the subbasin, has one 561-foot well that produces 725 gpm. If the park develops it may become economically feasible to treat water from the Columbia River.

Irrigation

History of Development

According to the Supreme Court hearings of 1935, the water users of Oregon began to appropriate, divert, and use water from the Walla Walla River in Oregon beginning in the year 1862. Each year thereafter users made new appropriations and increased the amount of water so appropriated, diverted, and used until by the year 1891 there were about 2,500 acres of land irrigated, using approximately 100 cubic feet per second of water diverted from the Walla Walla River. By 1935, approximately 11,000 acres in 1,044 farms were allocated surface water from the Walla Walla River and tributaries. Irrigation expansion since 1949 has been accomplished primarily by development of groundwater supplies, which now provide for over half the 26,000 acres presently irrigated in the subbasin.

Numerous studies have been undertaken to develop and control the unused water in the basin. U. S. Geological Survey geologists have estimated that 500,000 acre-feet of groundwater is stored in the entire Walla Walla River drainage basin (Oregon and Washington), of which only 46,000 acre-feet is pumped at the present time. Geologists have stated that some of the presently unused groundwater could be developed and utilized in the Oregon portion of the basin by pumping from behind fault barriers during the period of low summer flows. The Bureau of Reclamation is making detailed studies of the feasibility of storing 20,000 to 57,000 acre-feet of water at various reservoir sites. Using floodwater to recharge groundwater basins for later pumping has been tried in limited areas and will also receive further consideration.

The largest area of irrigation development in the basin is designated as the Umatilla Project. It lies principally in the northwest corner of the Umatilla Subbasin but the West Extension is along the northern edge of the Willow Subbasin.

Irrigation practices in the area were started about 1862 to provide a feed base for ranching interests. The big expansion of irrigated acreage came after 1908 when water was delivered to the first unit of the Hermiston Irrigation District. Promoters were able to sell 10 to 40-acre private land units of raw brushland to settlers, mainly from the Midwest, at prices of $50 to $250 per acre. Promoters took pictures of favored spots, secured testimonials of unusual yields, and carried on one of the most intensive promotional campaigns in irrigation development history. By 1923, settlement reached its zenith and abandonment soon started exceeding the rate of new unit sales because of questionable soils and water supplies.

The West Extension Irrigation District, started in 1917, had a similar experience with inadequate water supplies, questionable soils, and promotional misconceptions. Later evaluations of water supply and irrigable acres reduced the Hermiston development from 20,000 to about 7,000 acres and the West Extension from 17,000 to about 5,500 irrigated acres.

Westland Irrigation District went through numerous reorganizations, refinancing, and land abandonments in the reduction of its irrigated area from 8,000 to about 6,350 acres. The Stanfield Irrigation District went through the same difficulties to a lesser degree in establishing its presently irrigated area of 5,600 acres.

Cold Springs Reservoir, with 50,000 acre-feet of active storage capacity, was completed in 1908 to supply supplemental irrigation water to the Hermiston Irrigation District. McKay Dam, with 73,800 acre-feet of active storage capacity, was completed in 1927. Table 19 shows the water contracted for and space reserved in McKay Reservoir. The Stanfield and Westland Irrigation Districts are each assigned a minimum of 30 percent of this storage water after Umatilla River natural flows are exhausted, usually about the middle of June.

TABLE 19

McKAY RESERVOIR USAGE

USER	CONTRACTED Acre-Feet	PERCENTAGE	RESERVED
Westland	22,140	30	7,380
Stanfield	22,140	30	3,690
Teel	10,332	14	-
Private	5,962	8	-
TOTAL	60,574	82	11,070

Data Source: U. S. Bureau of Reclamation

The amount contracted for and reserved equals 71,644 acre-feet according to the Bureau of Reclamation. The McKay Reservoir has completely filled only four times since it was constructed.

Nearly 30,000 acres under 11 irrigation districts or ditch companies are now supplied with Umatilla River water in the Umatilla-Hermiston-Stanfield area. The entire Umatilla Subbasin has 35,270 irrigated acres.

Small strips of irrigated land extend upstream from the Umatilla Project along the Umatilla River, Butter Creek, Birch Creek, and several smaller streams.

The agricultural census for 1920 listed a total of 7,160 acres under irrigation along Willow Creek. The present irrigated acreage is 6,120 on Willow Creek, 250 on Eightmile Creek, and 6,140 in the Boardman area, making a total of 12,510 acres in this subbasin.

Development of the West Extension Division was discussed under the Umatilla Subbasin as a part of the Hermiston Project. Although the irrigated lands of the Division nearby all in the Willow Subbasin.

Diversion rights for Willow Creek were adjudicated by court decree in 1910, followed by supplemental decrees in 1917. This creek has always had large but erratic early spring flows and little water for later irrigation purposes. The Corps of Engineers are now investigating a 12,000 acre-foot multipurpose dam above Heppner which would supply supplemental irrigation water along Willow Creek.

Use and Problems

Irrigation rights for surface water cover the following acreages and flows by subbasins: Walla Walla, 475 cfs for 20,520 acres; Umatilla, 1,440 cfs for 84,720 acres; and Willow, 116 cfs for 7,300 acres. Groundwater has been appropriated as follows: Walla Walla, 142 cfs for 12,760 acres; Umatilla, 117 cfs for 11,060 acres; and Willow, 42 cfs for 3,430 acres. Together these rights cover a total of nearly 140,000 acres, 65,000 more than the presently irrigated 75,000 acres. This common occurrence in semidesert areas reflects the lack of additional readily available supplies. The only economically available water left for appropriation is groundwater and proposed stored water. Waste and drainage water irrigation rights for 28 cfs for the three subbasins are distributed as follows: Walla Walla, 17.2 cfs; Umatilla, 10.5 cfs; and Willow, 1.2 cfs.

Based on census data for 1959 the basin had 1,374 farms reporting irrigation. Forty-eight percent of these had less than 20 acres being irrigated, while 39 percent had from 20 to 99 acres. Of the remaining 13 percent with 100 acres or over, only 14 farms had more than 500 acres under irrigation.

Table 20 shows irrigated

TABLE 20

UMATILLA PROJECT
IRRIGATED AREA AND CROP CENSUS

IRRIGATION DISTRICT	NUMBER OF FARMS	IRRIGATED AREA 1/ (Acres)	GROSS CROP VALUE Total	Per Acre
Hermiston	526	7,060	$ 456,400	$ 65
West Extension	263	5,540	388,600	70
Stanfield	165	5,590	845,600	151
Westland	111	6,360	527,200	83
Temporary Service	-	450	38,000	85
TOTAL	1,065	25,000	$2,255,800	

1/ Includes full and supplemental irrigation service.

Data Source: U. S. Bureau of Reclamation 1960-61 Crop Census areas and crop values for individual districts of the Umatilla Project, and Table 21 gives yields and values for the major

TABLE 21

UMATILLA PROJECT
PRODUCTION OF MAJOR CROPS

IRRIGATED CROPS	ACRES	UNIT	YIELD PER ACRE	VALUE PER UNIT	VALUE PER ACRE
Irrigated pasture	12,490	AUM	7.2	$ 7.09	$ 51
Alfalfa hay	5,170	Ton	3.2	23.38	75
Field corn	2,610	Bu.	84.0	1.43	120
Sweet corn	1,060	Ton	4.5	21.95	99
Watermelons	830	Ton	8.7	38.72	337
Other hay	540	Ton	1.7	17.71	30

Data Source: U. S. Bureau of Reclamation 1960-61 Crop Census

irrigated crops of the project. The Hermiston District had the largest area under irrigation and Stanfield the greatest crop value per acre. The crop with the highest return per acre for 1960-1961 was watermelons, followed by field and sweet corn.

Table 22 lists the irrigated land use for the entire Umatilla

TABLE 22

IRRIGATED ACREAGES BY CROPS
1962

IRRIGATED CROPS	SUBBASIN			TOTAL Acres
	WALLA WALLA Acres	UMATILLA Acres	WILLOW Acres	
Small grain	4,000	2,140	590	6,730
Hay	8,900	12,720	7,030	26,650
Pasture	5,430	14,000	4,000	23,430
Vegetables	1,500	2,100	300	3,900
Row crops	4,520	3,500	530	8,550
Orchards and vineyards	3,050	100	20	3,170
Other crops	500	710	40	1,250
TOTAL	25,900	35,270	12,510	73,680

Data Source: U. S. Dept. of Agriculture

Basin. About two-thirds of this acreage is cropped to hay and pasture, followed by row crops and small grain. Grain crops, with low water requirements, are planted extensively during water-short years.

In the Walla Walla Subbasin, orchards are staging a strong comeback from the November 1955 freeze when 12 degrees below zero temperatures killed most of the 4,700 acres of orchards. Recovery plantings are expected to exceed 3,300 acres, with apples leading, followed by prunes, cherries, and peaches. Other crops and their acreages are quite similar to the above reported Hermiston Project. In the higher valleys near Heppner, Pilot Rock, and Pendleton, irrigated crops consist almost entirely of hay, pasture, and grains for livestock feed.

The source of water for irrigation and the method of application is shown by acreages for the three subbasins in Table 23.

TABLE 23

IRRIGATION SOURCE AND APPLICATION
1962

SOURCE AND APPLICATION	SUBBASIN			TOTAL ACRES IRRIGATED
	WALLA WALLA ACRES IRRIGATED	UMATILLA ACRES IRRIGATED	WILLOW ACRES IRRIGATED	
IRRIGATION WATER SOURCE				
Streamflow	12,000	10,120	10,970	33,090
Storage reservoir	-	20,010	140	20,150
Groundwater	13,900	5,140	1,400	20,440
TOTAL	25,900	35,270	12,510	73,680
METHOD OF APPLICATION				
Sprinkler	11,200	10,730	3,220	25,150
Gravity	14,700	24,540	9,290	48,530
TOTAL	25,900	35,270	12,510	73,680

Data Source: U. S. Dept. of Agriculture

In the Umatilla and Willow Subbasins surface source provides most of the water, while in the Walla Walla Subbasin groundwater accounts for over 50 percent of the total. Use of surface flows is predominate in all three subbasins for early season irrigation, with storage releases and groundwater used more extensively as streamflows decrease.

Irrigation water is applied primarily by the gravity method in all three subbasins, ranging from 57 percent of the acreage for the Walla Walla to 74 percent for the Willow. This also changes during the season, sprinkler irrigation being increasingly used as the season progresses and more groundwater is used.

Table 24 lists the total water-use requirement and that portion which must be supplied by irrigation for various crops grown in

TABLE 24

NET IRRIGATION REQUIREMENTS

IRRIGATED CROPS	Hermiston Area Elevation-612 Feet Growing Season-169 Days		Milton-Freewater Area Elevation-1,100 Feet Growing Season-197 Days		Pendleton-Heppner Area Elevation-1,748+ Feet Growing Season-163 Days	
	Net Require. in Inches		Net Require. in Inches		Net Require. in Inches	
	Total	Irrigation	Total	Irrigation	Total	Irrigation
Alfalfa and ladino	30.8	28.3	31.6	25.1	28.3	23.9
Other hay	27.2	24.7	27.9	21.3	25.0	20.6
Grass pasture	29.0	26.5	29.7	23.2	26.7	22.2
Small grain	17.6	16.1	16.1	11.9	16.9	14.1
Corn	23.8	22.0	22.3	17.8	-	-
Grain sorghum	19.6	17.9	-	-	-	-
Bush beans	14.5	13.0	13.2	9.1	-	-
Onions and potatoes	21.0	19.2	19.6	15.1	-	-
Tomatoes	19.6	17.9	18.3	13.8	-	-
Sugar beets	-	-	27.9	21.3	-	-
Orchards	25.4	22.9	26.0	19.5	-	-
Orchards with cover	30.8	28.3	31.6	25.1	-	-

Data Source: Oregon State College Agricultural Experiment Station Bulletin 500

the basin. These figures do not include distribution or application losses. Alfalfa and ladino clover have the greatest total net requirement, bush beans the least. By analyzing crop types to be grown and using Table 24 for consumptive water requirements, the storage, diversion, and headgate requirements can be determined.

Tables 20 through 24 may be used as a basic data source for determining such factors as water requirements and economic benefits of proposed water resource developments. Improved land classification is also needed in many areas in order to determine which lands produce the better yields with lowest water requirements.

Irrigation water costs are listed below on federally developed irrigation projects. Individuals and privately organized groups developed the irrigation systems in the Walla Walla Subbasin, in the upper reaches of the Umatilla Subbasin and along Willow Creek. The Abstract of Taxes for 1962-1963, Umatilla County, Oregon, shows assessment per acre for the Westland Irrigation District, $4.00; West Extension Irrigation District, $3.70; and Stanfield Irrigation District, $6.50. In addition, they show the following special taxes levied on the following water control districts: Rieth Water Supervisory District No. 1, 10.0 mills; Birch Creek Water Control District No. 1, 1.3 mills; Milton-Freewater Water Control District No. 1, 0.8 mills; and Umatilla River Water Control District No. 1, 20.0 mills. Irrigation charges on the Hermiston Irrigation District were reported to be $6.00 per acre.

Certain problems exist which have hindered improvement in irrigation practices. Some of the most outstanding problems, requiring special effort to correct are: (1) much of the more easily reached and quickly used valley lands were too sandy or gravelly and were not the best lands available for gravity irrigation agriculture; (2) the need to store spring floodwaters in the soil due to shortage of late summer water and insufficient surface storage has encouraged over-irrigation early in the season; (3) the economic factor of low water cost does not stimulate a desire for improvement in water distribution, or for land leveling and control structures; (4) the high incidence of small part-time irrigated farms has not encouraged progressive development of land and water resources; and (5) not enough technical data is presently available to determine desirable basin-wide plans and programs for full use of water resources through reorganization, rehabilitation, and extension of water use facilities. Suggestions for correcting most of these problems are given in the Water Resource Development Potential section. Basin-wide studies underway or planned should lead to improvements in many of these practices.

Much has been done to increase irrigation efficiences in the basin by public and private groups as well as individuals. As an example, in the Hermiston irrigated area, the West Umatilla Soil Conservation District reports that they have completed lining 30,000 feet of canals, installed 57,000 feet of irrigation pipelines, completed land leveling on 11,000 acres, constructed 59,000 feet of drainage ditches, installed 4,700 water control structures, and installed 17,000 feet of drain tile since their program was established. This is a start toward improving irrigation efficiencies in that area, which at present are reported to vary between 20 and 30 percent. Similar programs are being undertaken in the other irrigated areas of the basin. Another trend which increases irrigation efficiencies is the use of sprinklers rather than gravity methods of irrigation. Sprinklers are now used on about one-third of the irrigated lands, as shown in Table 23.

Irrigation management problems are so many and varied within the basin that only a few of the outstanding problems and some of the proposed solutions will be discussed by subbasin.

Much of the irrigated portion of the Walla Walla Valley has gravelly soils that the Bureau of Reclamation has tentatively classified as economically irrigable only by sprinkler methods. High water requirements, well recharge problems, water spreading to recharge the groundwater aquifers, and the development of additional surface storage facilities are the subject of extensive studies. Other studies include: (1) a small watershed project application under Public Law 566 proposes to store water on Couse, Dry, and Pine Creeks to supply supplemental water for the Hudson Bay Company lands; and (2) Milton-Freewater's efforts to develop additional domestic water by drilling a well into a fault-barrier aquifer immediately above the city.

Irrigation management problems within the Umatilla Subbasin are presently the subject of extensive federal, state, and local studies and meetings. The major problems involve location of storage reservoirs on the Umatilla River, which lands should be irrigated from stored water and what other uses are to be served. These three studies will be discussed further under the Water Resource Development Potential section.

Water deliveries are made to numerous individual systems, seven organized ditch companies, and one irrigation district. The numerous gravity-type water diversions from the Umatilla River and adjoining creeks cause problems of erosion, silt, and debris deposits in structures, resulting in large maintenance costs, and create obstruction to fish passage. The 1950 Census of Agriculture data indicated there were 372 individual diversion dams used in the subbasin. Of these, 200 were of concrete or masonry and the rest were of timber, earth, gravel, rock, manure, and straw. Most temporary dams usually require replacement after each flood. The 1950 census also indicated 542 miles of open ditches and 48 miles of flumes, pipelines, and siphons, most of which are subject to high transmission losses, siltation, and washout damage. Considerable improvement has been made since 1950 on these water distribution problems but much more rehabilitation is needed.

Table 25, entitled Irrigation Water Distribution, Umatilla Project, reflects high distribution losses encountered on the coarse-textured soils of this project. A fairly large percentage of this water is reclaimed in downstream return flows and wells. Crop irrigation efficiencies have been estimated at less than 20 percent, and this wasted water creates drainage and alkali problems on about 1,600 acres.

Legally, this project is entitled to about 6 acre-feet per acre from streamflow and storage sources. With water available and no large rights below, the average diversion has been about 12 acre-feet per irrigated acre. Much of the water is passed directly through the system and out the drains during periods that it is not needed.

Various studies are in progress by the Extension Service, Bureau of Reclamation, and Soil Conservation Service on means of improving irrigation efficiencies through land leveling and better water distribution methods.

The Willow Creek Subbasin has major problems of flood control and shortage of late season water along with distribution problems mentioned above. Most farmers divert or pump water from the streams on an individual basis. Plans are being made for a flood control reservoir, supplemental irrigation water, structure installation, land leveling, and adoption of improved irrigation methods.

According to the Bureau of Reclamation, in 1960 the West Extension Irrigation District diverted 70,650 acre-feet or 12.7 acre-feet per acre to the land. Records for the last 10 years show an average of over 80,000 acre-feet diverted. This high diversion requirement reflects the need for rehabilitation through canal lining, land management, and drainage. It also reflects extensive nonuse of flows going through the 150 cfs main canal.

TABLE 25

UMATILLA PROJECT
IRRIGATION WATER DISTRIBUTION

YEAR	DITCH OR DISTRICT	IRRIGATED AREA Acres	SOURCE Streams Ac.-Ft.	Reservoirs Ac.-Ft.	Other Ac.-Ft.	TOTAL SUPPLY Ac.-Ft.	MAIN CANAL WASTE AND LOSSES Ac.-Ft.	DELIVERY TO LATERALS Ac.-Ft.	LATERAL WASTE & LOSSES Ac.-Ft.	DELIVERED TO FARMS Total Ac.-Ft.	Per Acre Ac.-Ft.-Ac.
1952	Umatilla-E. Division	5,931	18,527	55,758	1,040	75,325		75,325	29,242	46,083	7.77
1955	Umatilla-E. Division	7,020	23,483	57,318	1,456	82,257		82,257	27,418	54,839	7.81
1958	Umatilla-E. Division	7,418	18,904	57,388	1,248	77,540		77,540	25,846	51,694	6.97
1959	Umatilla-E. Division	7,572	20,033	59,634	1,248	80,915		80,915	26,972	53,943	7.13
1960	Umatilla-E. Division	7,363	17,975	62,117	1,248	81,340		81,340	27,113	54,227	7.36
	AVERAGE	7,061	19,784	58,443	1,248	80,513		80,513	27,318	52,157	7.41
1952	Umatilla-W. Extension	5,544	81,504			81,504	26,904	54,600	8,157	46,443	8.37
1955	Umatilla-W. Extension	6,154	87,733			87,733	37,154	50,579	14,366	36,213	5.88
1956	Umatilla-W. Extension	6,255	87,504			87,504	35,886	51,618	10,763	40,855	6.53
1957	Umatilla-W. Extension	6,165	79,753			79,753	29,437	50,316	5,582	44,734	7.25
1958	Umatilla-W. Extension	5,870	78,880			78,880	24,664	54,216	4,857	49,359	8.45
1959	Umatilla-W. Extension	5,481	80,109			80,109	17,628	62,481	7,306	55,175	10.07
1960	Umatilla-W. Extension	5,575	70,653			70,653	19,000	51,653	4,153	47,500	8.52
	AVERAGE	5,863	80,876			80,876	27,239	53,637	7,883	45,754	7.86
1952	Umatilla-Westland	5,353	68,044			68,044	Not available	Not available	Not available	Not available	12.71 1/
1955	Umatilla-Westland	5,786	84,733			84,733	"	"	"	"	14.60 1/
1956	Umatilla-Westland	5,716	77,513			77,513	"	"	"	"	13.55 1/
1957	Umatilla-Westland	5,816	73,234			73,234	"	"	"	"	12.59 1/
1958	Umatilla-Westland	6,072	74,890			74,890	"	"	"	"	12.33 1/
	AVERAGE	5,748	75,682			75,682	"	"	"	"	13.15 1/
1952	Umatilla-Stanfield	5,095	22,311	19,444		41,755	8,250	33,505	3,786	29,719	5.83
1955	Umatilla-Stanfield	5,377	20,699	25,450		46,149	9,130	37,019	3,784	33,345	5.20
1956	Umatilla-Stanfield	5,282	19,006	23,277		42,283	8,457	33,826	3,383	30,443	5.85
1957	Umatilla-Stanfield	5,107	13,801	25,852		39,653	7,831	31,822	3,163	28,639	5.61
1958	Umatilla-Stanfield	5,479	13,862	26,342		40,204	8,041	32,163	3,217	28,946	5.28
1959	Umatilla-Stanfield	5,007	17,884	22,372		40,256	7,971	32,285	3,222	29,063	5.81
1960	Umatilla-Stanfield	4,943	6,420	22,290		28,710	5,767	22,943	2,307	20,636	4.17
	AVERAGE	5,184	16,283	23,575		39,858	7,921	31,937	3,253	28,684	5.53

1/ Less distribution losses.

Data Source: U. S. Bureau of Reclamation Crop Census of 1961 and Economic Reports

Industrial

The major industrial water users of the basin are the food processing and lumber manufacturing concerns. Groundwater is their primary water source, with rights totaling 39 cfs. Surface water rights total 5 cfs, mainly for lumber mills.

Ground and surface water rights by subbasin total 16.5 cfs for the Walla Walla, allowing for a legal annual depletion of 12,000 acre-feet; 23.2 cfs for the Umatilla, allowing 17,000 acre-feet and 3.9 cfs for the Willow, allowing 3,000 acre-feet. In addition there is a power right on the Walla Walla River for 31 cfs which has been converted to industrial cooling for a cannery. The actual water consumed is considerably less than the total legal right because of intermittent use by most industries and because of the nonconsumptive nature of most industrial uses.

In the Walla Walla Subbasin the major industrial users are the canneries at Milton-Freewater. It has been predicted by local sources that the present level of cannery development will not change greatly. However, if additional irrigated land is developed the cannery season would be extended and thereby the present rate of use would be extended to a longer period.

In the Umatilla Subbasin the major industrial rights are for wood products manufacturing at Pendleton and Pilot Rock. No substantial increase is expected in this type of industry in the interior of the basin. Any major development would likely be limited to locations along the Columbia River where water supply and water transportation are available.

There are a number of canneries and food processing plants located in Pendleton which utilize municipal water. Increase in this industry would likely be similar to the situation in Milton-Freewater, with the result of the increase being a longer canning season.

In the Willow Subbasin present industrial water use is primarily for lumber operations near Heppner. Late summer shortages for these operations are reported to amount to 400 acre-feet. No additional industrial water requirements are foreseen for this area.

The proposed Boardman Space Age Industrial Park in the northern part of the Willow Subbasin will probably require industrial water development. A successful test well has been dug in the area. Large water demands could probably be best met from the Columbia River.

Power

There are 25 power rights for water in the Umatilla Basin totaling 514.5 cfs. Of these, three rights for 155.9 cfs are abandoned or unused. Several other rights are not being utilized for power production but are being kept active by annual payment of fees. There are 22 rights for 406.5 cfs in the Walla Walla Subbasin and three rights for 108.0 cfs in the Umatilla Subbasin. The Willow Subbasin has no water power rights.

Good undeveloped power sites within the basin are scarce and power can presently be obtained more economically from outside. An ample electric power supply is available for potential needs from a private power company and an electric cooperative, their source of energy being the Bonneville Power Administration.

No additional use of water for power is expected in the foreseeable future.

Recreation

There are no water rights for recreation in the Umatilla Basin. This does not, of course, reflect the degree to which recreation is dependent on water. Water is the most important prerequisite for much recreational use or development.

The rivers and reservoirs in or adjacent to the basin provide areas for water-based recreation and the habitat for fish, waterfowl, and small game.

The use of large areas of surface water for boating and water skiing is continually increasing. At present there are 21 square miles of reservoir surface water, and with the completion of the John Day Dam there will be almost 85 square miles of reservoir surface water either in or adjacent to the basin.

The most important water-based recreation is boating, but the nearly 1,000 boats registered in Umatilla and Morrow Counties account for a per capita ownership of only one boat per 50 persons, far below the state average. This indicates that the trend of boating should continue to increase. The large expanse of water that will be available for recreation will also attract boaters from areas outside of the basin.

Fishing is an important form of water-based recreation. Each type of fish is dependent on water conditions favorable to their own particular habitat needs. Trout, steelhead, sturgeon, crappie, sunfish, perch, catfish, bass, carp, and suckers inhabit the streams and reservoirs of the basin. Warm water fishing is the most popular, followed by trout and steelhead fishing. The warm water fishing is principally done on the reservoirs while the trout, steelhead, and sturgeon fishing is done on the rivers and streams. Irrigation depletions leave sections of the Umatilla River, Walla Walla River, and Willow Creek dry many times each year. This condition makes it difficult to maintain fish populations on these streams. Proposed storage projects may include fishery benefits by increasing streamflow during critical periods.

Drawdown of the irrigation reservoirs in the late summer months has reduced their ability to produce fish and decreased the recreational attractiveness of the area. This results in a drastic reduction in the recreational use of these reservoirs. The use of groundwater to supplement fish life needs should be studied.

Wildlife

The basin contains an extensive and diverse wildlife population including elk, deer, upland game, small game, and waterfowl.

No water rights have been issued for wildlife use although water areas at Cold Springs and McKay Reservoirs have been set aside as national waterfowl refuges.

Several problems exist relative to water supply for wildlife. The rapid drawdown of reservoirs, and the wide fluctuations in water levels of marshes and ponds, which are fed by irrigation water, causes many waterfowl nests to be abandoned. Rapid depletion of streamflow in the spring and early summer causes similar problems of receding water levels.

Lack of adequate water supplies is a seriously limiting factor to upland game use of dry land areas.

With the exception of the possible regulatory effect of storage releases on water elevation, the water-related wildlife problems are largely those of improving habitat by providing additional water supplies in dry areas.

Fish Life

Before 1914, large runs of spring and fall chinook salmon and steelhead trout were reported in the Walla Walla and Umatilla River systems, and it has been reported that in early times anadromous salmonoids were found in Willow Creek. The only species of anadromous fish now known to be present in the Walla Walla River is steelhead trout, and except for a remnant of spring chinook salmon, the same is true for the Umatilla River. Other fish present are rainbow trout, bass, Dolly Varden trout, whitefish, channel catfish, crappie, perch, squawfish, and chiselmouth. The distribution of resident and steelhead trout is shown on Figure 17.

Fish life will probably be an increasing nonconsumptive user of water of the Umatilla River and of headwater streams. Normal and summer flows recommended by the Oregon State Game Commission for major streams are considerably in excess of presently available supplies.

The principal factors limiting production of anadromous fish are obstructions to passage, depleted streamflows, warm water during the summer, pollution, and unscreened diversions. The Walla Walla and Umatilla Rivers appear to have a considerable potential for salmon and steelhead production if streamflows can be augmented and fish passage facilities provided. Three larger diversion dams and 34 temporary dams with unscreened diversions make migratory fish passage hazardous along the Walla Walla River. Ten dams and eleven unscreened diversions cause a similar problem on the Umatilla River. The unscreened irrigation ditches take a large toll of young migrant salmonoids as they move downstream toward the ocean. Both rivers are often dry during three or four low flow months in certain lower sections. Table 11 shows the monthly average discharge in cfs for the North and South Forks of the Walla Walla River, the South Fork having higher base flows due to groundwater influence.

In the Oregon portion of the Walla Walla River watershed, only the North Fork, South Fork, and main stem are suitable for anadromous fish runs. Below Milton-Freewater, the river traverses permeable materials where complete low flows and much of the flood flows go to groundwater recharge. To overcome this problem for fish runs, two possibilities for maintaining fish passage flows have been considered: (1) directing fish passage through the more stable Little Walla Walla River bypass; and (2) lining a portion of the Walla Walla River channel with impervious materials. In recent years sportsmen have been

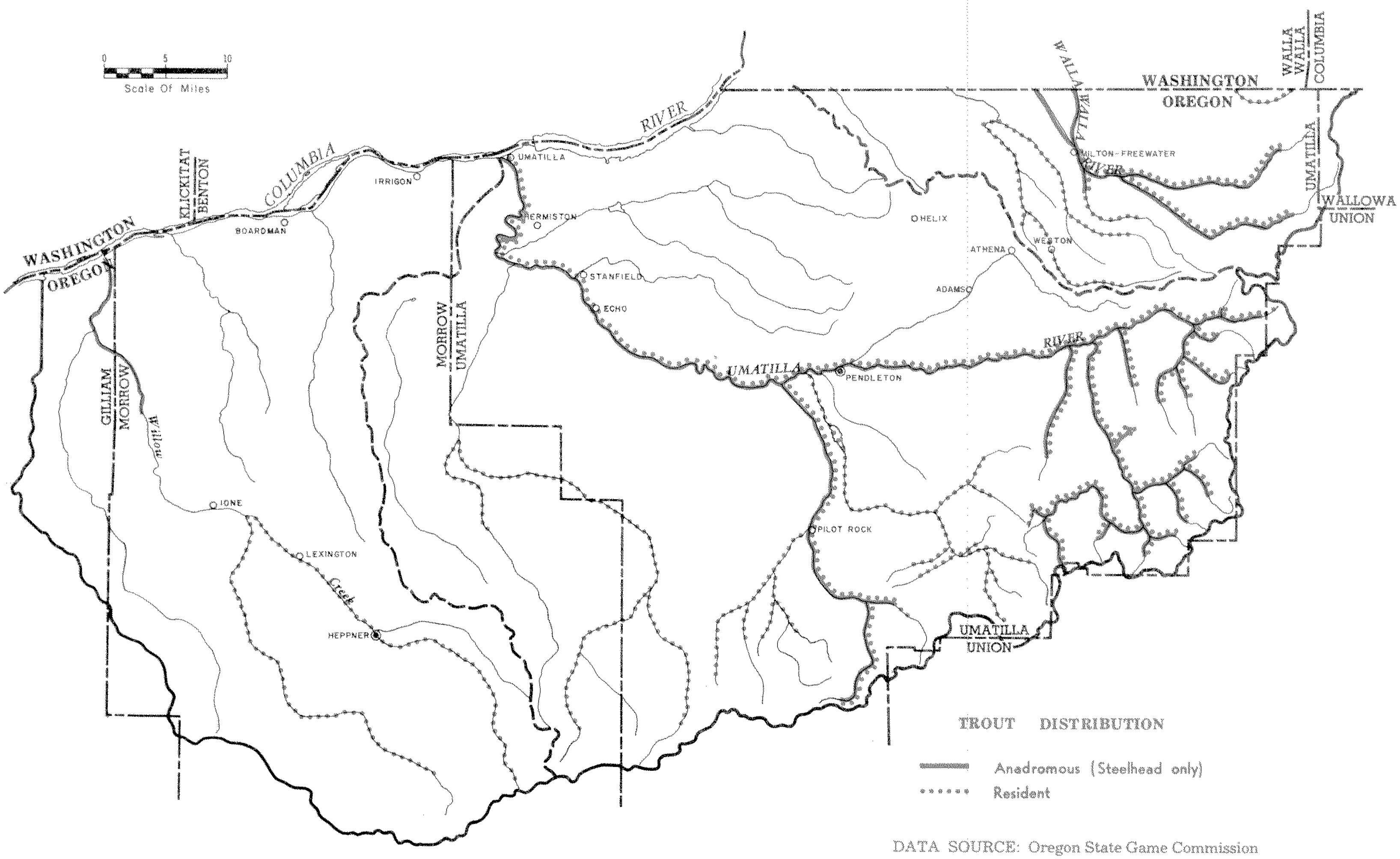


FIGURE 17. Distribution of resident and steelhead trout.

attempting to improve bypass facilities through barriers at the Hudson Bay Dam, the Little Walla Walla Irrigation Company dam on the main stem, and at the Centennial Mill Company dam on the Little Walla Walla River where anadromous fish passage is restricted. These fish barriers are all in the vicinity of Milton-Freewater.

Above Milton-Freewater, the North Fork has the best spawning gravels and fewer temporary diversion barriers. Upstream water developments would be required to increase summer flows and decrease water temperatures. Studies are underway to determine the feasibility of pumping groundwater from behind fault-barriers and establishing rearing ponds above presently irrigated lands.

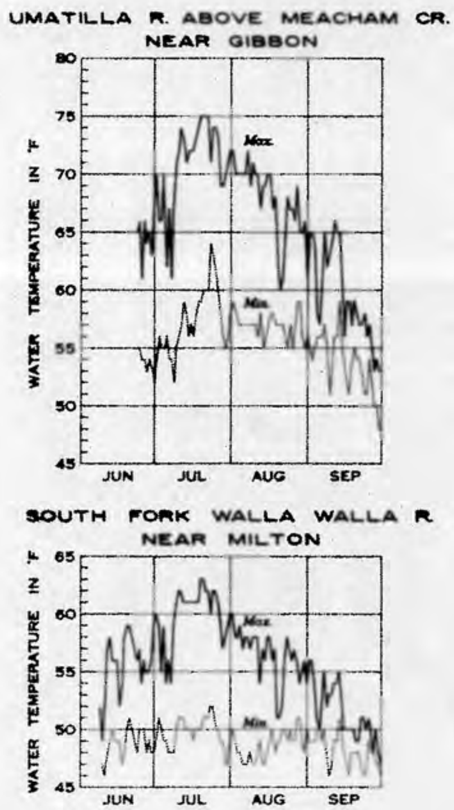


FIGURE 18. Daily water temperatures for selected streams in the Umatilla Basin.

The South Fork has more native trout but fewer steelhead than the North Fork. In 1960 there were 17 unscreened diversions on the lower 10 miles of the stream. Flows and stream temperatures were found favorable for rearing salmon in impoundments. Figure 18 shows minimum and maximum water temperatures on the South Fork Walla Walla River. Pine and Dry Creeks have intermittent flows and lack stability for steelhead or salmon production.

In the Umatilla Subbasin the Umatilla River and Birch and Meacham Creeks are the most important for anadromous fish use. The other tributaries are mainly used by resident fish. Existing lakes and ponds having fair to good fishing include McKay Reservoir, Cold Springs Reservoir, Weston Pond, Meacham Lake, and Dodd Pond with a total surface area of 2,850 acres.

Obstructions on the Umatilla River at low flow include 11 man-made dams. There is insufficient water for transporting and rearing fish during certain critical periods. Improved adult fish passage conditions are needed at the Three Mile and Cold Springs Dams where fish ladder improvement is recommended. Protection to downstream migrants should be provided by screening numerous diversion inlets. The Oregon State Game Commission recommends minimum summer flows of 80 cfs at Umatilla to enhance fish passage. Of the four large proposed storage sites on the upper Umatilla River, the Ryan Creek site would be the most compatible with anadromous fish runs. Although it would block some spawning beds in the North and South Forks it would leave unharmed the good spawning beds on upper Meacham Creek and down the main stem of the Umatilla River. Adequate flows in downstream areas would allow reintroduction of fall chinook. Birch Creek is in need of similar improvements as recommended on other basin streams.

According to a U. S. Fish and Wildlife Service 1959 report, anadromous fish benefits will be minor without fish passage facilities through the proposed Thornhollow Reservoir and without reserving 35,000 acre-feet of water exclusively for stabilizing streamflows. The Ryan site is least detrimental to anadromous fish passage to most favorable spawning gravels.

Figure 18 shows minimum and maximum water temperatures on the Umatilla River two miles above Meacham Creek. It can be seen that daily temperatures often rise above the upper desirable limit of 65 degrees.

Lower Meacham Creek experiences temperatures which prevent any summer salmonid rearing even though it maintains an adequate flow. Similar conditions exist on portions of Birch, Butter, and Squaw Creeks, and other Umatilla River tributaries.

Willow Creek has no anadromous fish runs, but has a resident rainbow trout population upstream from Heppner and in upper Rhea Creek. The Oregon State Game Commission supplements these with annual stocks of hatchery-reared rainbow. The storage and release of sufficient water to maintain streamflow would undoubtedly restore game fish resources in the system. Other problems include high summer temperatures, some logging and domestic pollution, seepage from the stream to groundwater below Ione, heavy irrigation usage, and frequent floods which reportedly wash the fish downstream.

The proposed Heppner Reservoir would provide resident fishery benefits in the pool area and reasonable minimum releases below the reservoir could create additional trout fishery benefits according to the Oregon State Game Commission.

The Oregon State Game Commission has recently completed a report to the State Water Resources Board pertaining to the fish and wildlife resources of the Umatilla Basin. A principal goal of their study was to recommend a minimum streamflow regimen for the several streams and their tributaries sufficient to accommodate resident and anadromous fish movements, reproducing, and rearing. The recommendations reflect their judgment, based on field surveys, of the water needs to maintain production at existing levels and where possible to permit population increases to levels closer to those that the streams can support. Present studies indicate that water supplies are available to meet only a small part of these needs. A list of recommended flows is included in the Appendix, Table C.

Rearing flows are those occurring in the low flow periods as opposed to spawning flows which are those occurring from January through May. Most recommendations are for steelhead and resident trout production, with steelhead and chinook salmon production requirements given for the lower Umatilla River and the Walla Walla River below Milton-Freewater. If salmon runs are to become established the desirable rearing flows would also accommodate steelhead and resident trout.

In most cases, flows are recommended for the entire spawning period, but only a single flow representing the minimum necessary for rearing is listed for the most severe summer low flow period. The complete Oregon State Game Commission report, giving details of the methods used in determining flows and establishing desirable production levels is on file at the State Water Resources Board office in Salem.

Pollution Abatement

Pollution abatement is not a major water user in the basin due to a relatively small industrial development and a sparse population.

All major population centers, with the exception of Umatilla, are served by secondary or lagoon type sewage treatment plants. Table 26 lists these systems and Table 27 shows sewerage projects which are planned.

Most of the smaller communities have individual sewage disposal facilities consisting of septic tanks that discharge effluents into the ground. In the Milton-Freewater area this has caused major concern due to the contamination of groundwater which is used for domestic supply.

TABLE 26

SEWERAGE SYSTEMS
PUBLIC

LOCATION	YEAR BUILT	TREATMENT	DESIGN POPULATION	POPULATION SERVED (Est.)	RECEIVING STREAM
Athena	1953	Secondary	1,200*	850	Wildhorse Creek
Heppner	1953	Secondary	2,500	1,600	Willow Creek
Hermiston	1951	Secondary	10,000	4,400	Umatilla River
McNary 1/	1947	Primary	2,500	200	Columbia River
Milton-Freewater	1958	Secondary	5,000	4,500	Land
Pendleton 2/	1949-1953	Secondary	20,000*	16,000	Umatilla River
Pendleton Airport 1/ 3/	1942	Secondary	6,000	500	Ditch to Umatilla
Pilot Rock	1959	Lagoon	2,500	1,600	Birch Creek
Stanfield	1952	Secondary	1,500	860	Umatilla River
Umatilla	1951	Primary	3,500	800	Columbia River
Umatilla Agency 1/		Septic tank	100	100	Umatilla River
Umatilla Ordnance 1/	1941	Septic tank	1,000	-	Land
Weston	1958	Secondary	1,000	800	Pine Creek

1/ Semi-public.

2/ Also serves Eastern Oregon State Hospital (population 2,000).

3/ Present plant inadequate.

* Plus additional capacity for industrial wastes.

Data Source: Oregon State Sanitary Authority

Stream pollution is intermittent and not normally a major problem. It usually occurs locally as a result of logging operations, soil erosion, irrigation return flows, or from municipal or cannery wastes.

In the Umatilla Subbasin, periodic pollution of streamflow has occurred on Wildhorse Creek as a result of failures in cannery wastes disposal facilities. Cannery wastes are receiving study in the Pendleton area due to their effects on efficiency of the municipal disposal plant.

In the Willow Creek area, an extensive program is underway at Heppner to improve disposal problems created by sewage and industrial wastes.

It will be necessary to maintain a high degree of treatment throughout the basin and to continue to expand the utiliza-

TABLE 27

SEWERAGE WORKS PROJECTS NEEDED
As of June 30, 1962

COMMUNITY	REQUIRED PROJECT	DESIGN POPULATION EQUIVALENT OF TREATMENT WORKS	STATUS OF REPORT
Boardman	Sewer system, treatment plant	400	Preliminary engineering study underway
Echo	Sewer system, treatment plant	650	Preliminary engineering study and report complete
Hermiston	Sewer extensions	-	Final engineering plans being prepared
Pendleton	Interceptor and lift station	-	Final engineering plans being prepared
Umatilla	Additions to enlargement or improvement of existing plant	1,500	Preliminary engineering study underway

Data Source: Oregon State Sanitary Authority

tion of effluents for irrigation in order to minimize pollution of streamflow. The high value of water for other uses makes use of water for dilution in lieu of treatment undesirable.

WATER CONTROL

Flood Control

Flood problems in the Umatilla Basin can be divided into two classes, differing both by hydrologic nature and by their season of occurrence. Fall, winter, and spring floods are of broad areal extent resulting from heavy rainfall or a combination of rainfall and rapid snowmelt. Late spring and summer flooding is usually of limited areal extent and results from high intensity, cloudburst-type storms.

Basin-wide flood problems and related proposals for alleviation of these flood problems have been under study by the Corps of Engineers since 1928. At that time Congress authorized the

Corps of Engineers to make preliminary examinations of the needs and potentials of each of the river basins for flood control, power, navigation, irrigation, and other water uses. These studies have been updated periodically and the present status will be discussed by subbasin. Location of existing projects is shown on Plate 3.

Flood control in the Walla Walla Subbasin to date has consisted of protective works along the lower Walla Walla River below Milton-Freewater, repair and restoration of flood control works destroyed by earlier floods in the vicinity of Milton-Freewater, and the removal of snags and debris and channel clearing and straightening on the Walla Walla River.

A review of reports of the Walla Walla River and tributaries to determine the advisability of providing additional flood protection in the area from Milton-Freewater to the mouth of Mill Creek has been assigned to the Walla Walla District, Corps of Engineers. Work to date has consisted of discussions and exchange of information with the Bureau of Reclamation which is currently investigating the possibilities of upstream storage for irrigation. It is expected that the Corps of Engineers' studies will be devoted to the provision of flood protection by means of levees in combination with the upstream storage which is under study by the Bureau of Reclamation.

In the Umatilla Subbasin, flood flows on the Umatilla River and tributaries usually occur between the months of December and June. They result from heavy rainfall or a combination of rainfall and snowmelt. The Corps of Engineers has estimated that 17,620 acres along the Umatilla main stem and 11,900 acres along tributaries are subject to flooding.

Flood protection by reservoirs alone, levee and channel improvements alone, and a combination of reservoirs and channel improvements have been considered by the Corps of Engineers. Neither method, studied separately, has shown economic feasibility in the past. According to the 1955 Corps of Engineers' report, the most practical plan of flood protection along the Umatilla River is a combination of storage and supplemental levees. Multiple-purpose storage has been studied by the Corps of Engineers and the Bureau of Reclamation with the finding that conservation of water for irrigation would be the primary purpose of the reservoir and the major factor in the economic feasibility. Suitable sites include Ryan Creek, Gibbon, Thornhollow, and Mission. Storage at any of these sites would have multiple-purpose benefits, including flood control. Corps of Engineers' studies of several combinations of levees and reservoirs indicated that a plan which would combine levees with storage at Ryan Creek and Mission sites would be the most feasible from an engineering standpoint.

Storage and channel protective works are being planned by U. S. Department of Agriculture under Public Law 566 for Tutuilla and Birch Creeks, which enter the Umatilla River near Pendleton. There are other proposed channel improvements in the vicinity of Hermiston and Pilot Rock.

In the Willow Creek Subbasin flood problems often result from the high intensity, small area cloudburst storms. In order to provide protection against such flooding it is necessary to provide storage reservoirs. At the present time a study is underway by the Corps of Engineers in cooperation with the Bureau of Reclamation for storage above Heppner on Willow Creek. This would be a multiple-purpose dam with preliminary proposals for total storage varying from 9,700 acre-feet to 12,500 acre-feet. Storage allocations include up to 1,400 acre-feet for sediment, 300 acre-feet for fish and recreation, 8,300 acre-feet for irrigation, and 1,300 acre-feet for flood control. The flood control storage is relatively small because of the small volume of water involved in the cloudburst-type storms. Figure 13, showing an hourly discharge hydrograph for Willow Creek near the mouth, indicates the short duration and resulting limited volume of water accruing from this type of flood.

A secondary feature of this particular study includes a channel through Heppner with a 1,500 cfs capacity for protection against peak discharges from the reservoir.

Drainage

The U. S. Department of Agriculture has reported that about 14,800 acres of arable land are affected by excessive wetness. Some of this land is or has been made acceptable for present use, but about 9,300 acres need drainage for best production under present use, of which 500 are in Walla Walla Subbasin, 7,200 in Umatilla Subbasin, and 1,600 in Willow Subbasin. Drainage problems are most noticeable west of Milton-Freewater, around Hermiston and in the Boardman area.

Excessive wetness is often a water management problem, caused by an excess of irrigation water. Possible control measures involve more storage reservoirs, better land development, improved irrigation practices, lined distribution systems, and properly installed drains. Recognized problems include the water user's attempt to store winter surplus water in the soil to compensate for low late-season supplies. An expanded educational program is needed on improved irrigation methods to prevent waste of valuable water and soil nutrients.

Poorly drained lands have not created a salt buildup in most areas due to the good to excellent water quality. A few small areas of high alkalinity exist or are developing.

Land use in alkaline or excessively wet areas has gradually shifted away from intensive use to pasture. Long-range plans must consider reclamation, the continued shifting of irrigation from affected areas to more highly productive land, and developing better class lands for irrigation agriculture.

Erosion

Erosion problems exist to varying degrees throughout the more than one million acres of cropland in the Umatilla Basin. Fortunately, much of the grain lands are comprised of deep loess soils that will retain productivity under the severe wind and water erosion action that is characteristic in the basin. The three major types of soil losses are rill and sheet erosion on unprotected fields, wind erosion on unprotected fields, and channel cutting by streams. An intensified conservation program is needed, including floodwater storage, channel stabilization, strip cropping, stubble mulch, grassed waterways, cover crops, and permanent grasses for erodible areas.

Wind erosion is the main problem in areas having less than 10 inches of rainfall annually. Young crops growing in erosive soils must be protected from wind damage. The loose earth also drifts into structures, ditches, buildings, and roadways. Sediment produced by erosion covers crops, ditches, and drains which perennially increases the cost of maintaining public and private facilities.

Development of storage projects in lower portions of the basin is seriously hampered by sediment, deposited by floods in both the perennial and intermittent streams. The Cold Springs Reservoir constructed in 1906 has been reduced in capacity by 10 percent due to sedimentation. The Furnish Reservoir on the Umatilla River was abandoned after 22 years due to filling with sediment. A possible solution involves storing as much floodwater as is economically feasible in headwaters of streams, then controlling the remainder with land treatment measures and control structures.

WATER RESOURCE DEVELOPMENT POTENTIAL

General

Studies indicate that the water resource development potential of the Umatilla Basin is about double the present level. Such development would be from both surface flows and groundwater and would increase the irrigated acreage from 75,000 to 150,000 and increase other consumptive uses proportionately.

Table 9 lists the minimum, maximum, and average yield of principal streams in the basin. To obtain the maximum storage potential, the yield from lesser streams were included where they could help serve proposed developments. Annual storable surface water averages about 500,000 acre-feet but usable quantities in dry years are closer to 220,000 acre-feet.

These determinations are based on constructing storage reservoirs with a nominal carry-over capacity and accepting a maximum 30 percent shortage during dry years of record. Plus factors not fully analyzed include storage for groundwater recharge, return flows for lower lying lands, transmountain diversions, and pumping from the Columbia River.

Table 28 lists the 386,000 acre-feet of irrigation storage and groundwater withdrawal requirements needed to double the present irrigated acreage and furnish supplemental supplies where required. As in the past, future irrigation requirements will equal over 90 percent of the total consumptive water requirements for the basin. Nonconsumptive requirements must be determined on an individual project basis.

Table 28 is based on assumptions which must be varied for individual projects but should quite closely reflect the water quantities to be developed for the best irrigable lands by subbasin. The storage requirement is based on 6 acre-feet per irrigable acre. The diversion requirement would be about 4.2 acre-feet and crop irrigation requirement varies around 2.1 acre-feet per acre. Return flows recaptured in drains, streams, and wells should average 1.8 acre-feet per irrigated acre.

Supplemental irrigation requirements are based on an average requirement of 1.5 acre-feet per presently irrigated acre. The actual requirement on different farms will vary from under one-half acre-foot to over two acre-feet due to differences in water rights, distribution facilities, soil characteristics, and crops grown.

TABLE 28

IRRIGATION STORAGE AND GROUNDWATER WITHDRAWAL REQUIREMENTS

SUBBASIN	NEW IRRIGATION DEVELOPMENT Acres	SUPPLEMENTAL SUPPLIES Acres	WATER REQUIRED Acre-Feet
WALLA WALLA			
Storage	7,000	8,000	54,000
Groundwater	7,000	8,000	35,200
UMATILLA			
Storage	25,000	3,500	155,200
Groundwater	25,000	1,500	91,900
WILLOW			
Storage	2,000	2,000	15,000
Groundwater	9,000	2,000	34,900
TOTAL			
Storage	34,000	13,500	224,200
Groundwater	41,000	11,500	162,000
TOTAL	75,000	25,000	386,200

Data Source: U. S. Bureau of Reclamation and OSU Experiment Station

Groundwater withdrawal is based on pumping 3.6 acre-feet per irrigable acre for potentially irrigable lands to be served. The withdrawal requirement will be somewhat less where individual farmers develop wells to serve adjacent lands and somewhat more where group facilities must use longer distribution lines.

The interrelationship between all beneficial uses of water must be determined and compromises achieved if maximum beneficial use of the water resources is to be made. A joint agency Umatilla Basin Review should be established to achieve the benefits of the multipurpose concept of basin planning. There is a need to coordinate individual project plans into basin wide plans.

Although detailed studies are needed in order to locate more groundwater aquifers and identify their characteristics, analysis of available data and evaluation of the relationship between precipitation, runoff, and consumptive use from existing ground cover lends weight to the conclusion that there is sufficient groundwater when used in conjunction with surface water to provide for development of the better lands in most areas. The economic and physical feasibility of developing both ground and surface water should be determined concurrently in each area under consideration.

Table 29 compares estimated present water use and estimated future water use if the better lands are fully developed. Because of variations in amount of diversions for present use, their relations are shown in terms of consumptive use, present and future.

TABLE 29

ESTIMATED PRESENT AND FUTURE CONSUMPTIVE USE REQUIREMENTS 1/
Acre-Feet

SUBBASIN	DOMESTIC	MUNICIPAL	INDUSTRIAL	IRRIGATION	TOTAL
WALLA WALLA					
Present	120	400	450	59,000	60,000
Future	120	700	1,200	118,000	120,000
UMATILLA					
Present	300	700	1,000	78,000	80,000
Future	300	1,000	1,200	178,000	180,000
WILLOW					
Present	60	90	50	25,000	25,000
Future	60	130	150	60,000	60,000
BASIN TOTAL					
Present	480	1,190	1,500	162,000	165,000
Future	480	1,830	2,350	356,000	360,000

1/ Consumptive use requirements are based upon a conservative 10 percent of the diversion requirement for domestic, municipal and industrial uses and from 2.2 acre-feet per acre for irrigation. These values represent the water actually consumed and should not be confused with diversion requirements.

The present consumptive use of applied water within the Umatilla Basin resulting from irrigation of agricultural lands, use of water for urban and domestic areas, and use of water for industrial purposes averages about 165,000 acre-feet annually. Under probable future conditions of development, the consumptive use of applied water will average 360,000 acre-feet annually.

Because of the relatively small quantity of water required to meet anticipated needs for domestic, municipal, and industrial purposes, it is assumed that in most cases little difficulty will be encountered in securing adequate supplies. In many instances it will be feasible to develop such water supplies in conjunction with irrigation developments. For these reasons the following discussion of development potential by subbasin will deal primarily with the water requirements for developing the irrigation potential of the better lands.

Walla Walla Subbasin

The Walla Walla Subbasin, with an area of about 490 square miles, has an average annual available yield from streamflow for storage of approximately 140,000 acre-feet. This subbasin is unique in that more than half of the total present consumption comes from groundwater. With proper management, groundwater will play an equally important role in future resource developments.

Providing adequate conservation works are built, the water supply within the Walla Walla Subbasin above the Oregon-Washington state line will meet ultimate local requirements for domestic, municipal, irrigation, and industrial uses in Oregon but will not allow for any appreciable transfer of surface water to the Washington portions.

Domestic use in the subbasin is about 1,200 acre-feet per year at present, with little anticipated increase in the future. Municipal use requirements are about 4,000 acre-feet with an anticipated increase to 7,000 and industrial requirements are about 4,500 with an anticipated increase to 12,000 acre-feet per year.

Seasonal domestic well water shortages in the Milton-Freewater area may be considerably alleviated by the proposed developments which will increase late season water supplies. The municipal supplies for both Milton-Freewater and Weston are and will continue to be primarily from groundwater.

Major seasonal industrial water users in the Walla Walla Subbasin are the canneries in Milton-Freewater. Although present indications are for minor change in the present level of industrial development, additional expansion could come through further irrigation development or changes in cropping practices. Additional water use by industry would probably be through an extension of the cannery season, resulting in water demands over a longer period. Possibilities for expansion of industrial supplies would be either through municipal supplies, through further development of groundwater, the present major source, or sharing in multipurpose storage project uses.

Irrigation rights in the Walla Walla Subbasin include 475 cfs for 20,500 acres of surface flows and 142 cfs for 12,800 acres by groundwater supplies.

There are 19,000 acres of potentially irrigable land and 25,900 acres of presently irrigated land in the Walla Walla Subbasin according to the U. S. Department of Agriculture. The better irrigable lands lie in the Gardena, Spofford, and Couse-Dry-Pine Creek areas. These are located as shown on Plate 3.

Due to the gravelly soils and shortages of late season water in the Walla Walla Valley, there is need for additional supplemental irrigation for about 16,000 acres of the presently irrigated acreage. To serve both the supplemental needs and provide for development of 14,000 new acres of better potentially irrigable land, there would be a storage and groundwater withdrawal requirement of approximately 89,000 acre-feet.

An evaluation of the previously identified surface yields, groundwater potential, and present water utilization makes it appear feasible to serve about half of the land through development of the groundwater resources. This would require approximately 54,000 acre-feet from storage and 35,000 acre-feet from groundwater as shown in Table 28. Therefore, it is important that studies be conducted to identify the location and physical characteristics of the major groundwater aquifers, including safe annual yields from these aquifers, possible recharge programs, and cost of development of this water. These studies should be conducted along with present surface water storage investigations in order to make full use of the area's water resources in providing for future needs.

Present studies in the subbasin include the Oregon portion of the Bureau of Reclamation's study of the Walla Walla Project, tentatively providing supplemental water to about 16,000 acres and a full supply of water for about 2,000 acres not presently irrigated. This study is considering a dam and reservoir (Joe West) on the Walla Walla River for 50,000 acre-feet of storage. The South Fork with the lesser North Fork, has an average annual yield of 162,000 acre-feet and a summer base flow of about 100 cfs which are both favorable to the proposed storage dam.

Another study is being conducted by the U. S. Department of Agriculture for a possible Public Law 566 project including storage reservoirs for Couse, Dry, and Pine Creeks. Project functions being considered in addition to irrigation include flood control and domestic, municipal, and industrial water supplies.

There are problems of considerable magnitude involved in supplying 50 cfs flows recommended by the Oregon State Game Commission for the Walla Walla River at the state line. Possible solutions include release of surface flows from possible storage projects, or groundwater pumping, combined with a specially constructed channel section to prevent large seepage losses.

Flood control work in the basin consists of protective works along the lower Walla Walla River, and channel clearing and straightening. Present studies being made by the Corps of Engineers cover the area from Milton-Freewater north into Washington. These studies are being coordinated with those of the Bureau of Reclamation.

For adequate information on surface flows to aid in future studies, stream gages are needed on the Walla Walla River, Little Walla Walla River, and Pine Creek at the state line; and on Pine and Couse Creeks where they enter the valley.

Groundwater studies should specifically include investigation of areas behind fault barriers such as Couse, Elbow Bend, and Hite, as well as better management of the shallow gravels of the Milton-Freewater area and capability of the deeper basalts of the area.

Umatilla Subbasin

The Umatilla Subbasin has an area of about 2,700 square miles and an average annual available yield from streams for storage of 325,000 acre-feet. A maximum legal diversion of nearly 410,000 acre-feet is allowed by rights from surface flow for consumptive purposes, over 90 percent of this being for irrigation. Surface water makes up about 75 percent of the estimated total water consumption in the subbasin.

Domestic supplies are generally from groundwater and are quite adequate in the subbasin, with some quality problems due to iron and sulphur compounds in the groundwater in the Hermiston-Umatilla area. It is not expected that there will be much increase in future demands for domestic water, the current total supply being estimated at about 3,000 acre-feet.

Municipal systems depend primarily on wells, tapping the Columbia basalts, the exception being Pendleton, which relies mainly on springs, supplemented by wells. Only Pendleton and Hermiston treat their supplies.

WATER SUPPLY, USE, AND CONTROL

Present municipal supplies are estimated at 7,000 acre-feet annually and are expected to increase to over 10,000 acre-feet in the future. Future supplies are expected to come mainly from additional wells. No major problems are foreseen. Municipal water may also be developed in conjunction with multipurpose storage projects on the Umatilla River.

Industrial water needs are expected to increase from a presently estimated 10,000 acre-feet to about 12,000. Present industrial rights are for wood products manufacturing, with little increase seen for the future. There might be some increase in industrial use at Pendleton if additional irrigated land is developed, extending the canning season. This would probably come from Pendleton's municipal supplies.

Most new major water-using industries would probably locate along the Columbia River where both water supply and water transportation are available.

Umatilla Subbasin irrigation rights include 1,440 cfs for 85,000 acres by surface flows and 117 cfs for 11,100 acres by groundwater.

The U. S. Department of Agriculture has estimated there are about 125,000 acres of potentially irrigable land and 35,000 acres presently irrigated. The best lands are located in the North Reservation, Paradise, and Butter Creek areas. Lands with a lower irrigability classification are found in the South Reservation, Stanfield Extension, Teel, and Birch Creek areas.

The quality of lands developed for irrigation projects has proven of great importance in the past. Better yields with less water requirement have been demonstrated in the Butter Creek area when compared to some of the sandier areas. There is also an advantage in irrigating the higher lands and letting return flows provide for some of the lower areas. Another possibility which has been considered is pumping from the Columbia River for lower lands, releasing water presently committed to these lands for use on higher land. Continued land classification is needed to better identify irrigation potential of about 100,000 acres in this subbasin.

Evaluation of known information indicates that the in-basin water supply is inadequate to develop all the irrigable land. It is indicated, however, that there is sufficient developable water, both surface and ground, to provide for at least 50,000 acres of the better lands, in addition to supplying relatively small requirements for supplemental irrigation, domestic, municipal, and industrial uses. Storage and groundwater withdrawal for irrigation would be about 247,000 acre-feet.

Studies indicate that it may be feasible to provide about one-half the consumptive requirement through development of the groundwater resource. Table 28 shows this broken down to a storage requirement of 155,200 acre-feet and groundwater withdrawal of 91,900 acre-feet. This again points out the importance of conducting groundwater studies jointly with surface storage investigations.

An analysis of water requirements versus yields indicate that worthwhile advantages could be obtained from an extensive rehabilitation program on the large irrigated blocks. More canal lining, control structures, land leveling, drainage, and sprinkler systems are needed to save water and increase production. Project farmers have already made extensive progress in this direction.

Studies indicated that very little supplemental water is required for the 30,000 acres presently irrigated from the McKay and Cold Springs Reservoirs. About 4,000 acres of higher elevation land need supplemental supplies. Better water utilization in the future could make a portion of present supplies available for additional irrigation developments.

Several studies have been made by the Bureau of Reclamation for development of the Umatilla River by storage projects. Principal sites investigated have been Mission, Thornhollow, and Ryan, all upstream from Pendleton.

The Bureau of Reclamation has estimated the Mission and Thornhollow sites would have about 180,000 acre-feet of storable water, considering downstream rights, and Ryan up to 90,000 with Meacham Creek additions. Mission or Thornhollow would fully utilize the resources of the Umatilla River above these sites.

Development efforts for Mission or Thornhollow Reservoirs have been hampered by problems encountered because of Indian lands, railroad rights-of-way and anadromous fish runs. Because of the problems involved for these sites the Ryan site should be further investigated for flood control benefits, municipal use, and development of new irrigated lands. Due to the smaller reservoir capacity of Ryan, additional storage would be needed above Pendleton to fully utilize storable water. Plate 3 in the Appendix locates numerous other possible reservoir sites.

A restudy of the Umatilla River Basin is being planned by the Bureau of Reclamation. It is important that all possible beneficial uses be considered.

Summer flows recommended by the Oregon State Game Commission are considerably in excess of presently available supplies. Future water development plans should consider possible benefits for fish life.

Wildlife problems related to water are mainly associated with locating and improving springs, pools, and wells to avoid concentrated range grazing. Water resource developments may thus also have wildlife enhancement benefits.

Power, mining, and pollution abatement are not considered potentially important users of water in this area.

The Corps of Engineers list flooding problems for over 17,000 acres along the Umatilla main stem and 12,000 acres along tributaries. Protection has been considered by storage alone, by levee and channel improvement, and by combinations of these. As mentioned above, the principal sites being considered in the Umatilla have flood control benefits. Storage at Ryan plus another site and construction of levees has been considered the most feasible from an engineering standpoint.

To aid in further studies of the area better knowledge of the flows of streams and of diversion flows are needed. Stream gages should be established at the mouth of Meacham, Wildhorse, Tutuilla, and Butter Creeks. Gaging is also needed on Stage Gulch, Despain Gulch, and Squaw Creek; on Stanfield, Hermiston, and Butter Creek drains; and on various spillway gages of the Stanfield, Westland, Hermiston, and West Extension Irrigation Districts.

Groundwater investigations should include studies of areas behind fault barriers and of synclines such as Agency, Umatilla, and Service.

Willow Subbasin

The Willow Subbasin contains about 1,400 square miles, Willow Creek has an average annual surface outflow of only about 15,000 acre-feet per year, but a headwater yield of over 18,000 acre-feet. Surface outflows from the Boardman area, much of which is irrigation return flows, raise the average subbasin outflow total to 35,000 acre-feet annually.

Present rights for surface flow allow a maximum depletion of about 31,000 acre-feet per year for consumptive purposes. There are no nonconsumptive rights for surface flow in the subbasin. Present consumption of surface water is estimated to be about seven times that of groundwater.

Although there is not a large consumption of water by domestic users there are problems of seasonal shortages in the Willow Creek area. Possible solutions include deepening of private wells or group action to develop ground or surface supplies. Present diversion for domestic use is estimated at 600 acre-feet per year, with little change seen in future needs for this purpose.

Municipal requirements are expected to increase from a presently estimated 900 acre-feet annually to about 1,300 acre-feet. No treatment is required for present supplies, which are entirely from wells.

Industrial needs have an estimated growth potential from the present 500 acre-feet to about 1,500. Industrial needs will probably be provided in conjunction with or in similar manner to municipal development.

Future supplies for municipal and industrial use will probably be principally from groundwater, with alternate sources including storage at the proposed Corps of Engineers' dam above Heppner, Columbia River water for the proposed Space Age Industrial Park in the Boardman area, or from the John Day River as part of a possible multipurpose diversion project.

Irrigation rights within the subbasin amount to 116 cfs for 7,300 acres from surface flow and 42 cfs for 3,430 acres from groundwater.

The U. S. Department of Agriculture lists 12,500 acres presently irrigated and 35,000 acres potentially irrigable within the Willow Subbasin, including the Boardman area (see Plate 3). Studies indicate a need for flood control development and for supplemental water to Willow Creek irrigated lands and further irrigation development of 11,000 acres (Table 28) from basin water sources. About half of this present irrigation is along

Willow Creek and half in the Boardman area, principally part of the West Extension Division of the Umatilla Project.

There is need for supplemental water for much of the acreage along Willow Creek.

Consideration is being given by the Corps of Engineers to construction of the Heppner Dam on Willow Creek for supplemental irrigation, flood control, and recreation purposes. The irrigation potential should be appraised along the lines of storing two to three acre-feet per irrigable acre in the Heppner Dam so that this water would be available for irrigation usage in the most productive summer period. Consideration should be given to maximum justifiable carry-over storage in wet years. Similar storage possibilities exist on Rhea Creek as indicated on Plate 3. Studies are being conducted by the Bureau of Reclamation in conjunction with the Corps of Engineers to determine the physical and economic feasibility of constructing a dam above Heppner.

For development of supplies for irrigating new lands consideration should be given to groundwater development, pumping from the Columbia River, and diversion by pumping from the John Day River.

More studies are still needed on large and small transmountain diversions to use surplus water from the John Day Basin. There are presently small diversions through the Smith and Saylor Thompson Ditches. The Camas Creek proposed diversion to Butter Creek is still in the study stage.

Preliminary studies have indicated there is an appreciable portion of rainfall which is not consumed by vegetation and does not run off as surface flow. Whether this could in part be recovered annually as groundwater is being studied by U. S. Geological Survey geologists who are conducting a groundwater study of the area.

There is a need for further classification of most of the irrigable lands. Surveys are needed along Rhea Creek, along the lower edge of the wheat belt, along Eightmile and Sixmile Canyons, and in the area south of Boardman. These surveys should establish the irrigation capabilities of these lands for future planning studies. To serve about 11,000 acres of better irrigable lands and supply supplemental water to 4,000 acres would require about 50,000 acre-feet from ground and surface supplies.

Table 28 shows a breakdown of 15,000 acre-feet from surface supplies and 34,900 acre-feet from groundwater.

Willow Creek has no anadromous fish runs but does have resident trout. A proposed dam at Heppner could increase fishery benefits with proper reservoir management. Consideration should also be given to enhance the fishery benefits in headwater streams.

Power, mining, wildlife, and pollution abatement are not considered potential users of significant quantities of water. Recreation may be a secondary benefit for the Heppner Project.

Flood control problems are serious on Willow Creek where a study by the Corps of Engineers has resulted in a proposal for a dam and reservoir just south of Heppner. This is currently planned as a multipurpose project including irrigation, flood control, recreation, fish life, and possible municipal uses.

A P P E N D I X

A U T H O R I T Y

The authority for the preparation and presentation of this report is set forth 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 ground water supplies and protection of wildlife;

"(7) The maintenance of minimum perennial streamflows 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."

S T A T U T O R Y   R E F E R E N C E S

ORS 538.450

"Pendleton; right to waters of Umatilla River.

"(1) Subject to water rights existing on March 8, 1941, there is granted to the city of Pendleton, Umatilla County, and its water commission, the exclusive right to use for public or municipal purposes or use, or for the general use and benefit of people within or without the city, all waters of the north fork of the Umatilla River, the springs at the head which form the stream, and its tributaries to the confluence of the north fork with the main stream of the Umatilla River in the northwest quarter of section 22, township 3 north of range 37 east of the Willamette Meridian, which north fork is a tributary of the Umatilla River situated in Umatilla County.

"(2) The city of Pendleton, its water commission, any of the city's agents, agencies and officers, and others on its behalf, may appropriate all such waters for these purposes and uses, and application therefor may be made for the benefit and use of the city, as above set forth, either by the city in its own name, or by any of its agents, agencies or officers or by any other persons on its behalf.

"(3) No person shall appropriate or be granted a permit to the use of any of such waters, except as provided in this section. But the city of Pendleton may, under this grant, divert such waters from their watershed and convey them to the city and elsewhere for use by it for public or municipal purposes or use or for the general use and benefit of people within or without the city. All of such waters are withdrawn from future appropriation, except for use and benefit of the city as set forth in this section."

ORS 538.010

"Waters diverted from Ditch Creek; rights of use and appropriation; certificate; time limitation.

"(1) The waters of Ditch Creek which were diverted to and became a part of the waters of Willow Creek, under the provisions of chapter 324, Oregon Laws 1939, are subject to the same rights of use and appropriation as the original waters of Willow Creek.

"(2) The right of the county court of Morrow County to divert and store the waters of Ditch Creek, acquired under the certificate issued by the State Engineer licensing such diversion and storage, shall date from the time the application to divert and store such waters was filed. The waters shall be used for the purposes, in the manner and under the conditions set forth in the certificate, for such time as the use is for the public interest. If the waters are not used under the license for a five-year period, the license shall expire."

ORS 538.020

"Acquisition of property necessary for storage and diversion. The county court of Morrow County may, for the purposes set forth in chapter 324, Oregon Laws 1939, acquire, in the name of the county and for the use of the public, by purchase, eminent domain proceedings, lease, grant, gift, bequest, devise or any other legal means, real and personal property, rights of way, easements and other property rights or privileges necessary to effect the storage and diversion of the waters referred to in that Act, and maintain and care for such property and rights in the manner provided by statute for the care and maintenance of other county property."

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TABLE A

HYDROLOGICAL STATION SUMMARY

MAP INDEX NO.	NAME	USGS STA. NO.	LOCATION			ACTIVE*	DRAINAGE AREA Sq. Mi.	TYPE	WATER YEARS OF RECORD	COMPLETE WATER YEARS*
			Twp.	Rng.	Sec.					
	STREAM GAGING									
1	ALLEN CANAL AT ECHO	300	3N	29E	16	X	-	Recorder	1921-	4
2	BIRCH CREEK AT RIETH	250	2N	31E	13	X	291	Recorder	1921-23 1927-	32
3	BIRCH CREEK NEAR PILOT ROCK	245	1N	32E	15		240	Staff	1920-26	7
4	BUTTER CREEK NEAR PINE CITY	320	1N	28E	22	X	291	Recorder	1928-	29
5	FURNISH CANAL NEAR ECHO	270	3N	29E	36	X	-	Recorder	1921-	29
6	MAXWELL CANAL NEAR HERMISTON	315	4N	28E	19	X	-	Recorder	1921-	11
7	McKAY CREEK AT MOUTH NEAR PENDLETON	240	2N	32E	8		190	Staff	1903-04 1922-24	1
8	McKAY CREEK NEAR PENDLETON	235	2N	34E	34	X	186	Recorder	1919-23 1925-	35
9	McKAY CREEK NEAR PILOT ROCK	225	1N	32E	23	X	178	Recorder	1921, 1927-	33
10	McKAY RESERVOIR NEAR PENDLETON	230	2N	32E	34	X	186	Staff	1928-	33
11	NORTH FORK UMATILLA RIVER NEAR GIBBON	195	3N	37E	22		31	Recorder	1912-16 1940-43	6
12	NORTH FORK WALLA WALLA RIVER NEAR MILTON	110	5N	36E	23	X	42	Recorder	1930-	31
13	RHEA CREEK NEAR HEPPNER	348	3S	26E	31	X	120	Recorder	1960-	1
14	SOUTH FORK WALLA WALLA RIVER BELOW PACIFIC POWER AND LIGHT CO'S PLANT NEAR MILTON	105	5N	36E	26		80	Recorder	1904-06 1930-45	17
15	SOUTH FORK WALLA WALLA RIVER NEAR MILTON	100	4N	37E	15	X	63	Recorder	1903, 1907-18 1931-	40
16	UMATILLA PROJECT FEED CANAL NEAR ECHO	290	3N	29E	22	X	-	Recorder	1921-	38
17	UMATILLA RIVER ABOVE FURNISH RESERVOIR NEAR YOAKUM	255	2N	31E	17		1260	Recorder	1915-36	19
18	UMATILLA RIVER ABOVE McKAY CREEK NEAR PENDLETON	220	2N	32E	8		700	Recorder	1921-34	11
19	UMATILLA RIVER ABOVE MEACHAM CREEK NEAR GIBBON	200	3N	36E	21	X	125	Recorder	1933-	28
20	UMATILLA RIVER AT GIBBON	205	3N	35E	36		310	Staff	1896-99 1903-12	8

TABLE A

HYDROLOGICAL STATION SUMMARY
(Continued)

MAP INDEX NO.	NAME	USGS STA. NO.	LOCATION Twp.	Rng.	Sec.	ACTIVE*	DRAINAGE AREA Sq. Mi.	TYPE	WATER YEARS OF RECORD	COMPLETE WATER YEARS*
	STREAM GAGING									
21	UMATILLA RIVER AT PENDLETON	210	2N	32E	2	X	637	Recorder	1891-92 1904-05 1935-	27
22	UMATILLA RIVER AT YOAKUM	260	2N	30E	2	X	1280	Recorder	1903-17 1921-33 1935-	40
23	UMATILLA RIVER NEAR UMATILLA	335	5N	28E	21	X	2290	Recorder	1904-	57
24	WALLA WALLA RIVER AT MILTON	120	5N	35E	13		155	Staff	1903-05	2
25	WALLA WALLA RIVER BELOW FREEWATER	125	6N	35E	25		160	Recorder	1941-48	6
26	WALLA WALLA RIVER NEAR MILTON	115	5N	36E	21		130	Recorder	1905-06 1918-30	5
27	WEST DIVISION MAIN CANAL NEAR UMATILLA	325	5N	28E	18	X	-	Recorder	1921-	38
28	WESTERN LAND CANAL NEAR ECHO	305	3N	29E	17	X	-	Recorder	1921-	18
29	WILLOW CREEK ABOVE EIGHTMILE CANYON NEAR ARLINGTON	355	3N	22E	26		680	Staff	1905	0
30	WILLOW CREEK AT HEPPNER	345	2S	26E	35	X	87	Recorder	1951-	11
31	WILLOW CREEK NEAR ARLINGTON	360	3N	22E	12	X	850	Recorder	1906, 1960-	1
32	WILLOW CREEK NEAR MORGAN	350	1N	23E	27		630	Staff	1921, 1929-31	3
	WATER TEMPERATURE									
33	SOUTH FORK WALLA WALLA RIVER NEAR MILTON	100	4N	37E	15		63		1960	1
34	UMATILLA RIVER ABOVE MEACHAM CREEK NEAR GIBBON	200	3N	36E	21		125		1960	1
	WATER QUALITY								PERIOD OF RECORD	
35	UMATILLA RIVER AT GIBBON	205	3N	35E	36		310		Aug. 1911	
36	UMATILLA RIVER AT REITH BRIDGE		2N	31E	13	X			May 1960- May 1962	1

TABLE A

HYDROLOGICAL STATION SUMMARY
(Continued)

MAP INDEX NO.	NAME	USGS STA. NO.	LOCATION Twp.	Rng.	Sec.	ACTIVE*	DRAINAGE AREA Sq. Mi.	TYPE	PERIOD OF RECORD	COMPLETE WATER YEARS*
	WATER QUALITY									
37	UMATILLA RIVER AT YOAKUM	260	2N	30E	2		1280		Aug. 1911-Aug. 1912	
38	UMATILLA RIVER NEAR UMATILLA	335	5N	28E	21	X	2290		Aug. 1911-Aug. 1912 May 1960-May 1962	1
	RESERVOIR SEDIMENTATION									
39	COLD SPRINGS RESERVOIR		4N	29E	3				1908-51	
40	McKAY RESERVOIR		2N	32E			186		1926-46	
	STREAM SEDIMENTATION									
41	UMATILLA RIVER AT GIBBON	205	3N	35E	36		310		Aug. 1911	
42	UMATILLA RIVER AT YOAKUM	260	2N	30E	2		1280		Aug. 1911-Aug. 1912	
43	UMATILLA RIVER NEAR HERMISTON		4N	28E	4				Apr., May, Nov. 1951-May 1952	
44	UMATILLA RIVER NEAR UMATILLA	335	5N	28E	21		2290		Aug. 1911-Aug. 1912	
	CLIMATOLOGICAL						ELEV.		WATER YEARS OF RECORD	
45	ATHENA		4N	35E	18		1700	Prec., Temp.	1936-39	
46	BLUE MOUNTAIN SAW MILL		4N	37E	34		4200	Prec.	1908-17	
47	CALIFORNIA GULCH		2S	32E	27		3222	Prec.	1909-15	
48	ECHO (Formerly Butter Cr.)		3N	29E	16	X	644	Prec., Temp.	1904-	
49	ELLA		2N	24E	27		830	Prec., Temp.	1898-14	
50	GIBBON (Formerly Bingham Spr.)		3N	37E	21		2370	Prec.	1908-18	
51	GLENCOE		2S	25E	17		1700	Prec.	1910-20	
52	GURDANE		3S	30E	33		3500	Prec., Temp.	1910-14	
53	HEPPNER		2S	26E	35	X	1950	Prec., Temp.	1889-	

TABLE A

HYDROLOGICAL STATION SUMMARY
(Continued)

MAP INDEX NO.	NAME	LOCATION Twp.	Rng.	Sec.	ACTIVE*	ELEV.	TYPE	WATER YEARS OF RECORD*
	CLIMATOLOGICAL							
54	HERMISTON 2 S (Formerly Hermiston)	4N	28E	23	X	624	Prec., Temp.	1906-
55	IONE 18 S (Formerly Gooseberry)	3S	24E	7	X	1925	Prec.	1935-
56	MEACHAM W. B. AIRPORT	1S	35E	11	X	4050	Prec., Temp.	1904-06 1908-13 1928-
57	MILTON 6 SE (Formerly Power House)	5N	36E	26		1315	Prec., Temp.	1908-50
58	MILTON-FREEWATER 4 NW (Formerly Milton-Freewater)	6N	35E	27	X	962	Prec., Temp.	1915-
59	MORGAN 3 NE (Formerly Morgan)	1N	23E	12	X	905	Prec.	1923-
60	PENDLETON BRANCH EXPERIMENTAL STATION (Formerly Pendleton Field Station)	3N	33E	24	X	1487	Prec., Temp.	1933-43 1956-
61	PENDLETON ROUNDUP PARK (Formerly Pendleton)	2N	32E	10		1056	Prec., Temp.	1890-1956
62	PENDLETON W. B. AIRPORT (Formerly Pendleton Airport 8 NW)	3N	32E	32	X	1492	Prec., Temp.	1943-
63	PILOT ROCK 1 SE (Formerly Pilot Rock)	1S	32E	16	X	1697	Prec., Temp.	1909-
64	RAY CREEK	3S	25E	18		2000	Prec.	1909-19
65	STANFIELD	4N	29E	28		592	Prec., Temp.	1914-19
66	TOLLGATE	4N	38E	33	X	4890	Prec.	1940-
67	UMATILLA	5N	28E	17	X	270	Prec., Temp.	1877-
68	WALLA WALLA 13 ESE (Formerly Walla Walla Intake)	6N	38E	15	X	2400	Prec., Temp.	1940-
69	WESTON	4N	35E	22	X	1866	Prec.	1955-
70	WESTON 2 SE	4N	35E	26		2100	Prec., Temp.	1889-1955
71	WESTON 5 ESE	4N	36E	33	X	3222	Prec.	1955-

TABLE A

HYDROLOGICAL STATION SUMMARY
(Continued)

MAP INDEX NO.	NAME	USGS STA. NO.	LOCATION			ACTIVE*	ELEV.	TYPE	YEARS OF RECORD
			Twp.	Rng.	Sec.				
	SNOW SURVEY AND SOIL MOISTURE								
72	ARBUCKLE MOUNTAIN	19D2	4S	29E	33	X	5400	Snow	1929-63
73	ATHENA WESTON	18D14m	4N	35E	21	X	1700	Soil	1960-63
74	BATTLE MT. SUMMIT	18D12m	3S	31E	29	X	4340	Snow, Soil	1959-63
75	EMIGRANT SPRINGS	18D4m	1N	35E	29	X	3925	Snow, Soil	1929-63
76	LUCKY STRIKE	18D6	3S	32E	28	X	5050	Snow	1939-63
77	MEACHAM	18D5	1S	35E	24/25	X	4300	Snow	1929-63
78	PAXTON'S CAMP		4N	37E	25		4500	Snow	1929-32
79	PAXTON'S CAMP ½ E		4N	37E	26		4500	Snow	1928-29
80	PEARSON CREEK	18D15	2S	33E	31		3000	Snow	1959-61
81	TOLLGATE	18D3m	4N	38E	32	X	5070	Snow, Soil	1931-63
82	WALLA WALL DIVERSION	18D13	6N	38E	22	X	2400	Snow	-

*Through Water Year 1961.

Data Source: U. S. Geological Survey, U. S. Weather Bureau, U. S. Soil Conservation Service, State Sanitary Authority

TABLE B

SURFACE WATER RIGHTS SUMMARY
As of January 24, 1963

STREAM	CONSUMPTIVE RIGHTS						NONCONSUMPTIVE RIGHTS		
	DOM. Cfs	MU. Cfs	IND. Cfs	IRRIGATION Cfs	IRRIGATION Acres	TOTAL Cfs	POWER Cfs	FISH Cfs	TOTAL Cfs
SUBBASIN 1									
Cottonwood Creek	0.02					0.02			
Lone Fir Creek	0.02			0.51	17	0.53			
Mill Creek		28.00				28.00			
Mud Creek	0.16			30.82	2,359	30.98	6.73		6.73
North Fork Walla Walla R.	0.02			7.88	211	7.90	1.00		1.00
Pine Creek	0.09	0.40		83.00	5,917	83.49	22.00		22.00
Raymond Gulch	0.01			0.07	3	0.08			
South Fork Walla Walla R.	0.19	5.80		17.88	497	23.87	190.50		190.50
Walla Walla River	2.17	7.24	1.00	335.24	11,520	345.65	186.25	1.00	187.25
Total Subbasin 1	2.68	41.44	1.00	475.40	20,524	520.52	406.48	1.00	407.48
SUBBASIN 2									
Cold Springs Canyon				0.04	3	0.04			
Columbia River Misc.	0.06			10.80	1,112	10.86			
Birch Creek	0.37		1.00	59.31	4,651	60.68			
Butter Creek	0.26			156.46	8,402	156.72			
McKay Creek	0.06			22.05	1,743	22.11			
Meacham Creek	0.08			1.09	51	1.17			
North Fork Umatilla R.	0.02	8.00				8.02			
Sand Hollow	0.01			1.86	114	1.87			
Tutuilla Creek	0.09			2.51	193	2.60			
Umatilla River	0.53	28.20	1.82	1,178.41	67,991	1,208.96	108.00	8.50	116.50
Wildhorse Creek	0.05			5.75	464	5.80			
Total Subbasin 2	1.53	36.20	2.82	1,438.28	84,724	1,478.83	108.00	8.50	116.50
SUBBASIN 3									
Columbia River Misc.				1.78	149	1.78			
Eightmile Canyon	0.02			1.90	121	1.92			
Juniper Canyon					11				
Rhea Creek	0.02		1.00	34.48	2,130	35.50			
Willow Creek	0.41	1.05		77.63	4,888	79.09			
Total Subbasin 3	0.45	1.05	1.00	115.79	7,299	118.29			0
BASIN TOTAL	4.66	78.69	4.82	2,029.47	112,547	2,117.64	514.48	9.50	523.98

Consumptive Rights = 2,117.64 cfs
Nonconsumptive Rights = 523.98 cfs
Total = 2,641.62 cfs

TABLE C

RECOMMENDED MINIMUM FLOWS FOR FISH LIFE

STREAM	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	LOCATION
Umatilla River	250	300	300	300	300	200 100	80	80	80	80 1/	100 200	250 2/	Mouth
Umatilla River	250	300	300	300	300	200 100	80	80	80	80 1/	100 200	250 2/	Echo
Umatilla River									60				Pendleton
Birch Creek	40	40	40	40	40 3/				8				Mouth
East Birch Creek	30	30	30	30	30 3/				5				Mouth (Pilot Rock)
East Birch Creek	12	12	12	12	12 3/								Confluence of Pearson Creek
Pearson Creek	18	18	18	18	18 3/								Mouth
West Birch Creek	20	20	20	20	20 3/				5				Mouth (Pilot Rock)
Bridge Creek	7	7	7	7	7 3/				1				Mouth
Stanley Creek	6	6	6	6	6 3/				1				Mouth
Meacham Creek	100	100	100	100	100 3/				12				Mouth
Meacham Creek	35	35	35	35	35 3/								Confluence of North Fork
Camp Creek	11	11	11	11	11 3/								Mouth
North Fork Meacham Creek	50	50	50	50	50 3/								Mouth
McKay Creek	60	60	60	60	60 4/				10				Entering McKay Reservoir
Johnson Creek	25	25	25	25	25 4/								Mouth
North Fork McKay Creek	20	20	20	20	20 4/								Mouth
North Fork Umatilla River	40	40	40	40	40 3/				20				Mouth
South Fork Umatilla River	70	70	70	70	70 3/				10				Mouth
South Fork Umatilla River	35	35	35	35	35 3/				4				Confluence of Thomas Creek
Buck Creek	16	16	16	16	16 3/				2				Mouth
Thomas Creek	25	25	25	25	25 3/				2				Mouth
Squaw Creek	40	40	40	40	40 3/				2				Mouth
Willow Creek	30	30	30	30	30 3/				8				Mouth
Rhea Creek	15	15	15	15	15 3/				4				Mouth
Walla Walla River	100	125	125	125	125	100 75	50	50	50	50	60 75	100 2/	State line (river mile 37.4)
Couse Creek	25	25	25	25	25 3/				2				Mouth
Mill Creek									12				State line
North Fork Walla Walla River	40	40	40	40	40	20 10	5	5	5	6 7	10 20	20	Mouth
South Fork Walla Walla River	80	80	80	80	80	80	80	80	80	80	80	80	Mouth

1/ A minimum flow of 300 cfs would be required in fall months for fall chinook spawning in the lower Umatilla River.
2/ A flow of 250 cfs may be required to provide adequate adult steelhead passage during parts of late November.
3/ Steelhead spawning flow. Flow near listed volume would also provide good angling flow during early trout season. Adequate flow levels to accomodate adult steelhead passage were not determined in most streams for months of November and December.
4/ Flow for trout production only. Listed flow would be adequate for trout spawning and would provide good angling volume during early trout season.

Data Source: Oregon State Game Commission

TABLE D

DAM AND RESERVOIR SITES

MAP INDEX NO.	SITE NAME	DRAINAGE AREA	REPORTED AVERAGE ANNUAL YIELD	PURPOSE	DAM		RESERVOIR		LOCATION				SOURCE NO.
					HEIGHT	CREST LENGTH	MAX. POOL AREA	TOTAL STORAGE					
		Sq. Mi.	Ac. Ft.		Feet	Feet	Acres	Ac. Ft.	Twp.	Rng.	Sec.	Str. Mile	
	WALLA WALLA SUBBASIN												
	WALLA WALLA RIVER												
1	Milton			I-FC								46	3
2	Joe West			I-FC	160			30,000	5N	36E	20	48	3
	PINE CREEK												
3	Pine Creek 1	57	13,800	I-FC-R	60	850	100	2,400	6N	34E	35	11	1,3
4	Pine Creek 2								5N	34E	1	13	3
5	Pine Creek 3	14	8,000	I-FC-R	165	800	189	12,470	3N	35E	1	28	1
	DRY CREEK												
6	Dry Creek	15	8,000	I-FC-R	100	800	10	4,000	4N	36E	16	17	1
	COTTONWOOD CREEK												
7	Cottonwood Creek	13	8,300	I-FC-R	140	1,100	130	7,280	6N	37E	32		1
	COUSE CREEK												
8	Couse Creek	14	9,000	I-FC-R	130	950	83	9,850	4N	36E	3		1
	NORTH FORK WALLA WALLA												
	LITTLE MEADOW CREEK												
9	Little Meadow	1		I				600	5N	37E	12		3
	BIG MEADOW CREEK												
10	Big Meadow	1		I				600	5N	38E	8		3
	SOUTH FORK WALLA WALLA												
11	Harris	57	127,000	I-FC	325			30,000	4N	37E			3
12	Harris Alternate	55	127,000	I-FC	275			20,000	4N	37E			3

TABLE D

DAM AND RESERVOIR SITES
(Continued)

MAP INDEX NO.	SITE NAME	DRAINAGE AREA Sq. Mi.	REPORTED AVERAGE ANNUAL YIELD Ac. Ft.	PURPOSE	DAM HEIGHT Feet	DAM CREST LENGTH Feet	RESERVOIR MAX. POOL AREA Acres	RESERVOIR TOTAL STORAGE Ac. Ft.	LOCATION Twp.	LOCATION Rng.	LOCATION Sec.	LOCATION Str. Mile	SOURCE NO.
	UMATILLA SUBBASIN												
	UMATILLA RIVER												
13	Mission	440		I-FC	170	4,900	2,300	142,000	2N	33E	12	64	2,3
14	Homly	374							2N	34E	1	72	2
15	Thornhollow	355		I-FC	230	2,450		150,000	2N	35E	4	75	3
	Thornhollow Low	355	265,000	I-FC			1,000	58,000	2N	35E	4	75	2
16	Gibbon	254		I-FC				139,000	3N	36E	31	80	2,3
17	Ryan Creek	125		I-FC	258	1,560	600	57,600	3N	36E	22	84	2,3
18	Lacy Pocket	90							3N	37E	17	90	2
	SAND HOLLOW												
19	Sand Hollow	74	4,000	I-FC	50	1,300	125	2,500	2N	26E	25,26	-	1
	BUTTER CREEK												
	SOUTH FORK BUTTER CREEK												
20	South Fork Butter Creek	75	10,000	I-FC-R	77	850	100	3,080	1N	27E	27	6	1
	NORTH FORK BUTTER CREEK												
21	Butter Creek 1	291	17,000	I-FC-R	80	1,400	324	10,370	1N	28E	22	9	1
22	Butter Creek 2	170		I-FC-R	100	1,700	800		1S	30E	33	26	1,3
23	Butter Creek 3	167		I-FC-R	90	1,400	400	14,400	2S	30E	9	28	1
	STAGE GULCH												
24	Stage Gulch 1	85	4,500	I-FC	50	1,000	300	6,000	4N	29E	36	-	1
25	Stage Gulch 2								3N	30E, 31E	1, 6	-	3
26	Stage Gulch 3								3N	31E	22	-	3
	ALKALI CANYON												
27	Alkali Canyon	52	4,200	I-FC	70	750	150	4,200	3N	29E	33	-	1
	COOMBS CANYON												
28	Coombs Canyon	40	3,200	I-FC	60	1,050	125	3,000	2N	31E	25	-	1

TABLE D

DAM AND RESERVOIR SITES
(Continued)

MAP INDEX NO.	SITE NAME	DRAINAGE AREA Sq. Mi.	REPORTED AVERAGE ANNUAL YIELD Ac. Ft.	PURPOSE	DAM HEIGHT Feet	DAM CREST LENGTH Feet	RESERVOIR MAX. POOL AREA Acres	RESERVOIR TOTAL STORAGE Ac. Ft.	LOCATION Twp.	LOCATION Rng.	LOCATION Sec.	LOCATION Str. Mile	SOURCE NO.
	UMATILLA SUBBASIN												
	BIRCH CREEK												
	WEST BIRCH CREEK												
29	Birch Creek	119	28,600	I-FC-R	70	1,850	256	5,000	1S	32E	17	1	1
30	West Birch Creek								2S	32E	31	13	3
	EAST BIRCH CREEK												
31	Birch Creek	72	17,300	I-FC-R	89	3,000	160	5,000	1S	32E	33	4	1
32	East Birch Creek								2S	33E	7,18	11	3
	McKAY CREEK												
33	McKay Creek	60	36,800	I-FC-R	100	1,260	400	16,000	1S	34E	29	28	1
	TUTUILLA CREEK												
34	Tutuilla Creek	62	11,600	I-FC-R	120	2,300	820	11,600	2N	32E	15	1	1
	WILDHORSE CREEK												
35	Wildhorse Creek	15	7,200	I-FC-R	100	1,300	400	16,000	3N	35E	3	24	1
	GREASEWOOD CREEK												
36	Greasewood Creek	32	2,500	I-FC	50	1,900	324	6,480	3N	34E	18	-	1
	WILLOW CREEK SUBBASIN												
	WILLOW CREEK												
37	Willow Creek (Heppner)	100	12,900	I-FC-R	145	1,700	220	11,500	2S	26E	35	52	2
38	Willow Creek 2	71	13,300	I-FC-R	67	850	54	1,450	3S	27E	6	54	1
39	Willow Creek 3	54	11,500	I-R	38	400	20	300	3S	27E	1	60	1
40	Willow Creek 4	22	5,900	I-R	53	400	20	420	3S	28E	29	65	1

TABLE D

DAM AND RESERVOIR SITES
(Continued)

MAP INDEX NO.	SITE NAME	DRAINAGE AREA Sq. Mi.	REPORTED AVERAGE ANNUAL YIELD Ac. Ft.	PURPOSE	DAM		RESERVOIR		LOCATION				SOURCE NO.
					HEIGHT Feet	CREST LENGTH Feet	MAX. POOL AREA Acres	TOTAL STORAGE Ac. Ft.	Twp.	Rng.	Sec.	Str. Mile	
	WILLOW CREEK SUBBASIN												
	EIGHTMILE CANYON												
41	Eightmile Canyon 1	262	12,600	I-FC	50	2,640	150	3,000	3N	22E	26	0	1
42	Eightmile Canyon 2	161	7,700	I-FC	40	650	75	1,200	1N	22E	28	14	1
43	Eightmile Reservoir	161		I	300		2,000	197,000	1N	22E	33	15	3
	RHEA CREEK												
44	Rhea Creek	130		I-FC	115	1,500	170	4,800	3S	26E	31	25	2
45	Rhea Creek 2	38	8,200	I-FC-R	100	1,600	259	10,360	4S	27E	20	34	1
46	Rhea Creek 3	33	7,000	I-FC-R	160	1,000	130	8,320	4S	27E	29	35	1
47	Rhea Creek 4	9	2,600	I-FC-R	67	700	80	1,050	5S	27E	2	39	1
	BALM FORK												
48	Balm Canyon 1	25	3,500	I-FC-R	60	200	20	460	4S	26E	14	0	1
49	Balm Canyon 2	24	3,300	I-FC-R	48	275	20	470	4S	26E	15	1	1
	HINTON CREEK												
50	Hinton Creek 1	11	1,800	I-R	32	765	25	230	3S	28E	6	-	1
51	Hinton Creek 2	10	1,600	I-R	43	750		290	3S	28E	8	-	1
52	Hinton Creek 3	7	1,200	I-R	53	535	30	350	3S	28E	16	-	1
	SIXMILE CANYON												
53	Sixmile Canyon (Carty West)	65	7,000	I-FC	50	1,300	640	12,800	3N	24E	33	-	1,3
54	Sixmile Canyon 2	33	3,500	I-FC	50	1,000	350	7,000	2N	24E	18	-	1
55	Carty East			I					3N	24E	35	-	3
	Carty East and West			I			5,600	145,000					2
	JUNIPER CANYON												
56	Juniper				22				3N	25E	13		2
57	Juniper Canyon	33	3,500		60	1,300	200	4,800	1N	25E	10		1
58	Sanford Canyon	18	1,900		84	1,000	300	10,000	1N	25E	1		1

Note: This table includes damsites with conflicting reservoir areas.

Purposes: I - Irrigation
FC - Flood Control
R - Recreation, Fish and Wildlife

Data Source: 1 - U. S. Dept. of Agriculture
2 - U. S. Corps of Engineers
3 - U. S. Bureau of Reclamation

ABBREVIATIONS AND SYMBOLS

Ac.	Acre
Ac.ft.	Acre-feet
Assoc., Assn.	Association
Ave.	Average
BLM	Bureau of Land Management
Br.	Branch
Can.	Canyon
Cfs	Cubic feet per second
Ch.	Chlorination
Co.	County
Cr.	Creek
Dept.	Department
Div.	Division
Dom.	Domestic
Dr.	Drainage
Elev.	Elevation
° F.	Degrees Fahrenheit
FC	Flood control
Fig.	Figure
Fk.	Fork
Ft.	Foot, feet
F.W.	Forest Wayside
G.	Gulch
Gpd	Gallons per day
Gpm	Gallons per minute
Hol.	Hollow
I.,Irrig.	Irrigation
Ind.	Industrial
Jct.	Junction
Kw	Kilowatts
Kwh	Kilowatt hours
L.	Lake, Little
Max.	Maximum
Mdw.	Meadow
Mgd	Million gallons per day
Mi.	Mile
Min.	Minimum, mining
Misc.	Miscellaneous
Mt.	Mount, mountain
Mun.	Municipal
No.	Number
ORS	Oregon Revised Statute
OSHD	Oregon State Highway Department
P.	Power
P.L.	Public Law
Ppm	Parts per million
Prec.	Precipitation
Pt.	Point
PUD	People's Utility District
Q	Rate of flow
R.,Rng.	Range
R.,Rec.	Recreation
R.,Riv.	River
REA	Rural Electrification Administration
Res.	Reservoir
RS	Ranger Station
SCS	Soil Conservation Service
Sec.	Section
Spr.	Spring
Sq.	Square
Sta.	Station
Str.	Stream
S.P.	State Park
SWRB	State Water Resources Board
Temp.	Temperature
T.,Twp.	Township
USFS	United States Forest Service
USGS	United States Geological Survey
WSP	Water supply papers
Yr.	Year
Σ	Sigma (a summation)

APPROXIMATE
HYDRAULIC EQUIVALENTS

1 acre foot
- = a volume 1 acre in area and 1 foot in depth
- = 326,000 gallons
- = 43,560 cubic feet
- = 0.5 cubic feet per second for 1 day

1 cubic foot per second
- = 7.5 gallons per second
- = 450 gallons per minute
- = 2.0 acre-feet per day
- = 650,000 gallons per day

1 inch per day
- = 0.04 cubic feet per second per acre
- = 27 cubic feet per second per square mile
- = 19 gallons per minute per acre

1 inch per hour
- = 1.0 cubic feet per second per acre
- = 640 cubic feet per second per square mile
- = 450 gallons per minute per acre

1 million gallons per day
- = 690 gallons per minute
- = 1.5 cubic feet per second
- = 3.0 acre-feet per day

A C K N O W L E D G M E N T

The following County Water Resources Advisory Committee members are listed in recognition of their work as general committee chairmen, secretaries, and subcommittee chairmen or co-chairmen.

COMMITTEE	MORROW COUNTY	EAST UMATILLA	UMATILLA BASIN
GENERAL			
Chairman	Judge Oscar Peterson	Glen Gibbons	Arnold Hoeft
Secretary	-	David Burkhart	William Wall
SUBCOMMITTEE			
Agriculture	N. C. Anderson	Ralph Smuckal	John Madison
	Joe Hay		
Domestic	Orville Cutsforth	Phil Gibbons	-
Fish & Wildlife	Glen Ward	Wm. Widner	Clayton Case
Flood Control	Oliver Creswick	Arthur Shumway	-
	Ralph Richards		
Industrial & Mining	Clarence Rosewall	Phil Gibbons	Herbert Smith
Municipal	Victor Groshens	Robt. Burlingame	J. R. Woodward
			Ray Struthers
Pollution	Dr. Tibbles	C. E. Van Dillon	Robert Marsland
		Wm. Widner	
Recreation	Orville Cutsforth	Ed Anderson	Clayton Case
Watershed	Ralph Richards	Arthur Shumway	Al Ord
		Robt. Lonzway	


UMATILLA DRAINAGE BASIN
STATE WATER RESOURCES BOARD
SALEM, OREGON
May 1962
PLATE I
FILE NO. 7.6
SCALE OF MILES
SUBBASINS
1 WALLA WALLA
2 UMATILLA
3 WILLOW
Numbers on streams indicate miles above mouth
LEGEND
COUNTY SEATS
OTHER INCORPORATED CITIES
UNINCORPORATED TOWNS
STREAM OR CANAL GAGE
CANAL OR DITCH
PIPELINE OR FLUME
NUMBERED HIGHWAY
OTHER IMPROVED ROADS
COUNTY KEY
PLANIMETRIC KEY
DRAINAGE BASIN KEY
JOHN DAY BASIN
GRANDE RONDE BASIN
INDIAN RESERVATION
WALLA WALLA
PENDLETON
HERMISTON
HEPPNER
MILTON-FREEWATER
UMATILLA
STANFIELD
ECHO
PILOT ROCK
ATHENA
WESTON
ADAMS
HELIX
IONE
LEXINGTON
IRRIGON
BOARDMAN
WASHINGTON
OREGON

STATE WATER RESOURCES BOARD
SALEM, OREGON
May 1962
UMATILLA DRAINAGE BASIN
WATER RESOURCE DEVELOPMENT
PLATE 2
FILE NO. 7.6
LEGEND
EXISTING
Irrigated Land
POTENTIAL
Irrigation Project Division
1,000 acres Irrigable Land
Bank Protection and/or Channel Improvement
Dam Site (Index numbers refer to SWRB Potential Dam Site Summary.)
Watershed Studied By USDA (Letters refer to Watershed Reconnaissance Data Summary.)
DATA SOURCE: U. S. Dept. of Agriculture
Corps of Engineers
U. S. Bureau of Reclamation
SCALE OF MILES
SUBBASINS
1 WALLA WALLA
2 UMATILLA
3 WILLOW
Numbers on streams indicate miles above mouth
LEGEND
COUNTY SEATS
OTHER INCORPORATED CITIES
UNINCORPORATED TOWNS
STREAM OR CANAL GAGE
CANAL OR DITCH
PIPELINE OR FLUME
NUMBERED HIGHWAY
OTHER IMPROVED ROADS
COUNTY KEY
PLANIMETRIC KEY
DRAINAGE BASIN KEY
WALLA WALLA PROJECT
PENDLETON PROJECT
JOHN DAY PROJECT
UMATILLA PROJECT
JOHN DAY BASIN
GRANDE RONDE BASIN
INDIAN RESERVATION
John Day Pool elev. 265'
PENDLETON
HEPPNER
MILTON-FREEWATER
WALLA WALLA


UMATILLA
DRAINAGE BASIN
HYDROLOGICAL STATIONS
AND
AVERAGE ANNUAL PRECIPITATION
STATE WATER RESOURCES BOARD
SALEM, OREGON
May 1962
PLATE 3 FILE NO. 7.6
SUBBASINS
1 WALLA WALLA
2 UMATILLA
3 WILLOW
Numbers on streams indicate miles above mouth
LEGEND
ACTIVE INACTIVE
Stream Gaging Station
Water Temp. Station
Water Quality Station
Stream Sedimentation Station
Reservoir Sedimentation Station
Climatological Station (precipitation only)
Climatological Station (precipitation and air temp.)
Snow Survey Course and/or Soil Moisture Station
40 Precipitation in inches
NOTE: Index numbers refer to SWRB Hydrological Station Summary.
SCALE OF MILES
LEGEND
COUNTY SEATS
OTHER INCORPORATED CITIES
UNINCORPORATED TOWNS
STREAM OR CANAL GAGE
CANAL OR DITCH
PIPELINE OR FLUME
NUMBERED HIGHWAY
OTHER IMPROVED ROADS
COUNTY KEY
PLANIMETRIC KEY
DRAINAGE BASIN KEY
JOHN DAY BASIN
GRANDE RONDE BASIN
INDIAN RESERVATION
WALLA WALLA
PENDLETON
HERMISTON
UMATILLA
HEPPNER
MILTON-FREEWATER
ATHENA
WESTON
PILOT ROCK
ECHO
STANFIELD
IONE
LEXINGTON
BOARDMAN
IRRIGON
WASHINGTON
OREGON