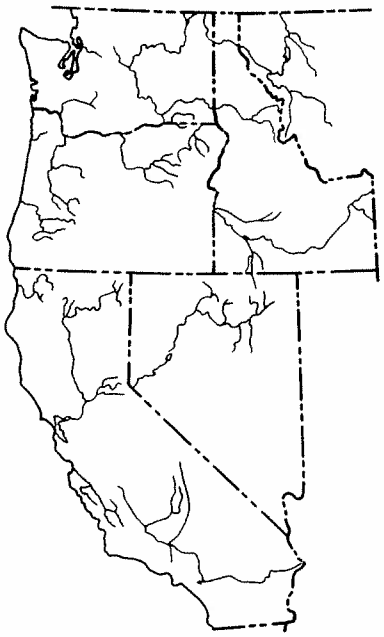
LOW STREAMFLOW CONDITIONS IN THE WESTERN STATES DURING 1987

By Larry L. Hubbard

U.S. GEOLOGICAL SURVEY

Water Resources Investigations Report 87-4267



Portland, Oregon
1987

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CONVERSION FACTORS AND ABBREVIATIONS

The following factors may be used to convert the inch-pound units published herein to the metric (International System) units:

Multiply inch-pound	By	To obtain SI units
	LENGTH	
inch (in.)	25.4	millimeter (mm)
inch (in.)	0.0254	meter (m)
foot (ft)	0.3048	meter (m)
mile (mi)	1.609	kilometer (km)
	AREA	
square mile (mi^2)	2.590	square kilometer (km^2)
acre	0.4047	hectare (ha)
	FLOW	
cubic foot per second (ft^3/s)	0.02832	cubic meter per second (m^3/s)
	SLOPE	
foot per mile (ft/mi)	0.189	meter per kilometer (m/km)

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ABSTRACT

Drought conditions prevailed throughout the States of California, Nevada, Idaho, Oregon, and Washington during the summer of 1987. Streamflows were the lowest since the drought of 1977. Many streams had less discharge in August-September 1987 than in August-September of 1977. At some sites flows for July, August, and September were the minimum ever recorded for those months. The reasons for the low flows, which occurred in spite of near normal precipitation for the 1987 water year (October 1, 1986 to September 30, 1987), were low winter snowpack, unseasonably early melt of that snowpack, and prolonged periods of well-above-average temperatures.

Conditions are conducive for a potentially serious drought in 1988. The low flows and a large demand for water during the summer of 1987 left many storage reservoirs at well-below-average levels. At least four cities had less than a 2-month supply of surface water at the end of September. In some areas, ground-water levels have lowered considerably, as indicated by the need to deepen irrigation wells in Oregon. Cities that used ground water did not experience serious problems in 1987 but could have extreme shortages in 1988 if ground-water supplies are not replenished.

Even though the flow conditions worsened noticeably during the 1987 water year, careful management and conservative water-use practices prevented widespread critical water shortages. The U.S. Geological Survey is measuring the quantity and quality of streamflow in order to assess the extent and severity of the drought.

INTRODUCTION

Background

In 1987, Western states experienced the lowest streamflows since the 1977 drought. Provisional data indicate that summer flows in southern Idaho were the lowest ever recorded for that time of year and in western Washington flows were the lowest in 40 years. Low winter precipitation produced well-below average snowpack, and many Federal and State water agencies are planning for the possibility of an ensuing drought.

Severe water shortages occurred only in localized areas without adequate reservoir storage. In much of the West, storage levels in reservoirs at the beginning of the 1987 water year (October 1, 1986 to September 30, 1987) equalled or exceeded the average for that time of year. The quantity of water in storage and efficient management practices provided an adequate supply of water for most uses, but some municipalities and other water suppliers instituted either voluntary- or mandatory-use restrictions. Some municipal reservoirs became critically low by the end of September.

The 1987 water year may be the beginning of a severe drought in the Western states. If 1988 is another dry year, major water shortages will develop throughout the West. Conditions in 1987 are already approaching those that prevailed during the second year of the 1976-77 drought; another dry year would result in even more extreme conditions.

Purpose and Scope

The purpose of this report is to document the meteorologic and hydrologic conditions for the 1987 water year in order to forewarn of a potential drought and show conditions that could lead to serious water shortages. Tables and illustrations compare precipitation and streamflow during the 1987 water year to the average and minimum flows during the period of record and to the flows of 1977 at selected gaging stations.

Hydrologic and meteorologic data for periods prior to the 1987 water year used in this report are from published records of the U.S. Geological Survey and the National Weather Service. The preliminary 1987 hydrologic and meteorologic data were obtained from 24 selected U.S. Geological Survey stream-gaging stations and 22 National Weather Service weather stations (fig. 1). Other 1987 water-supply information is from data provided by Federal and State agencies, public utilities, and the news media.

METEOROLOGICAL FACTORS

Precipitation and Temperature

There was no consistent precipitation pattern throughout the West during 1987 water year, but generally the fall and winter precipitation was below average, with the December precipitation extremely low at most sites (fig. 2). Above average precipitation occurred in March, May, and July in some areas. The March precipitation fell largely as rain and caused snow to melt, rather than accumulate as it does in March of most years, and the May rainfall further accelerated the snowmelt.

The July rain provided some relief to wilting crops but was not enough to have much impact on streamflow. For example, a 1-day rainfall of over an inch at Spokane, Washington, caused little or no increase in streamflow (R. L. Blazs, Spokane Field Office Chief, U.S. Geological Survey, oral commun., August, 1987).

Total precipitation for the period October 1986 through September 1987 was near normal for most of the weather stations for which records are included in this report (table 2, at back of report). Long periods of hot dry weather separated the periods of precipitation, so that dry conditions developed by the end of summer. In the State of Washington, the Stampede Pass weather station (which is used as an index station in the State) recorded temperatures considerably above normal from February through June, with April and June averaging more than 4 degrees Fahrenheit above normal (Lee Krogh, Hydrologist, National Weather Service, oral commun., September 10, 1987).

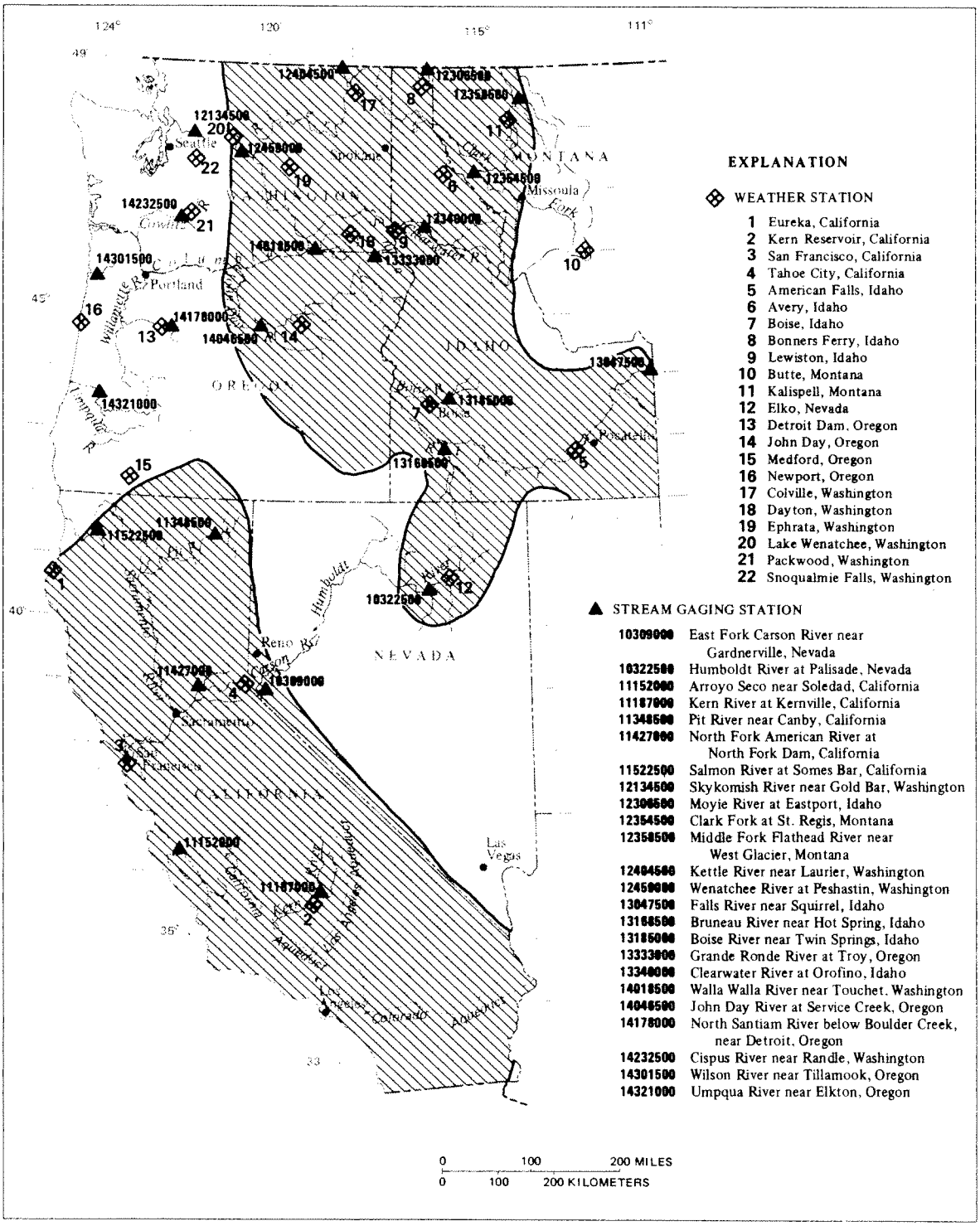

Figure 1.--Map of western states showing selected weather stations and stream-gaging stations. Shaded area shows areas experiencing severe to extreme drought on August 15, 1987.

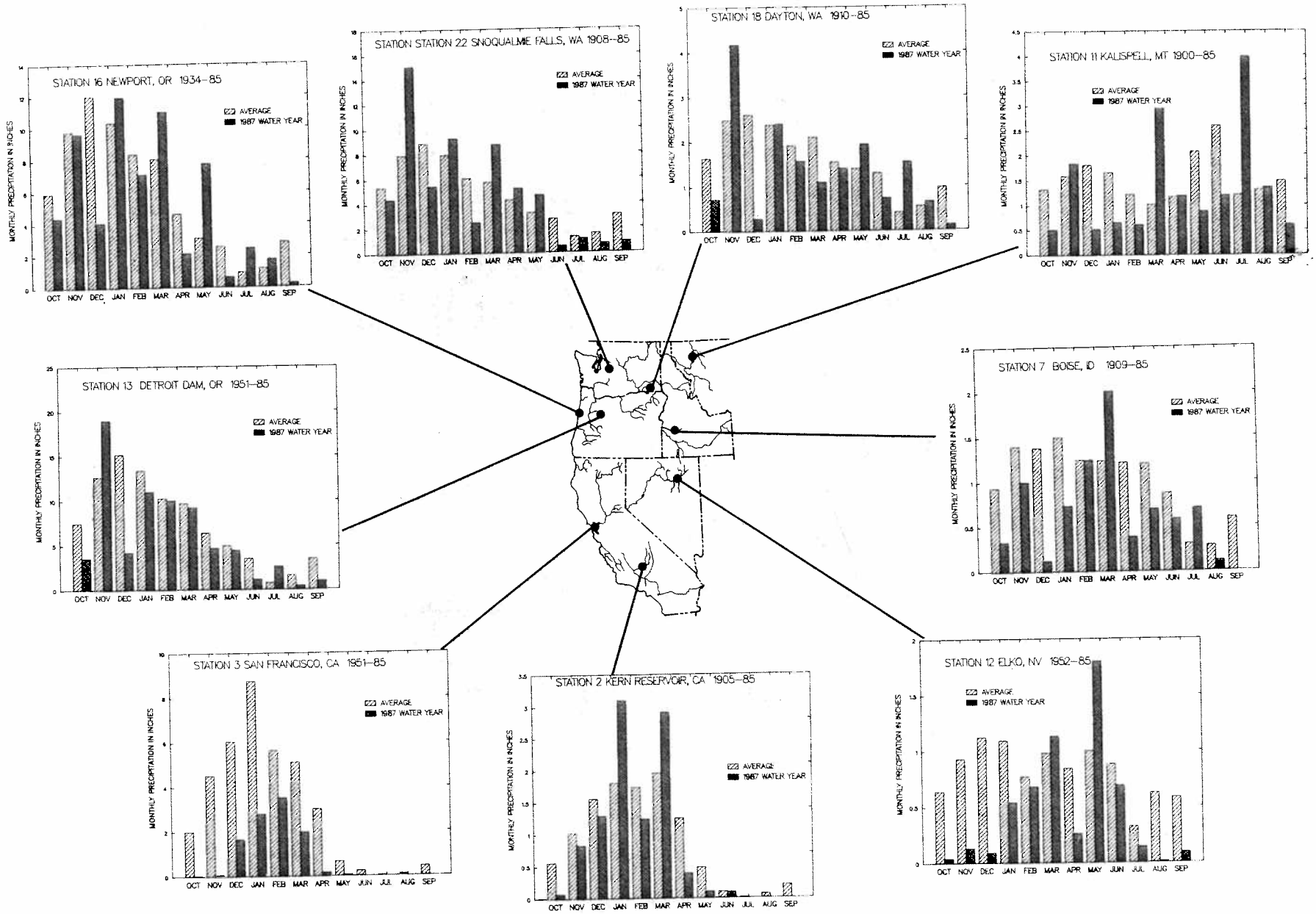

Figure 2.--Monthly precipitation at selected weather stations for 1987 water year and the long-term averages.

Drought Index

The National Weather Service and Soil Conservation Service utilize a drought index, known as the Palmer Index, to rate the severity of a drought (Palmer, 1965). The Palmer Index reflects abnormal wetness or dryness for prolonged periods, long-term moisture, runoff, recharge, deep percolation, and evapotranspiration. A drought-index map for August 15 indicates severe to extreme drought conditions in nearly all of California, north-central Washington, northeastern Oregon, and central and southwestern Idaho (fig. 3). The severe conditions extend into northeastern Nevada, northern Utah, and western Wyoming.

Winter Snowpack

The snowpack for the Western states was well below normal throughout the 1986-87 winter and was greatly depleted by hot weather in April. For example, by May 1, 1987, the snowpacks in the Carson and Humboldt River basins had been depleted to 14 and 17 percent of average, respectively. The snowpack in the Columbia River basin was 53 percent of the weighted average on May 1. This value compares to 31 percent for the 1977 water year. By May 1, the water equivalent of the snowpack statewide in California was only about 20 percent of normal. In Montana, the water content at 30 percent of the snow courses was the lowest ever recorded on May 1.

STREAMFLOW CONDITIONS

The 1987 water year began with below average streamflow at most stations. Streamflow increased during the winter but stayed below average at most stream-gaging stations. The rainfall in March and May of 1987 and the hot weather in April caused early snowmelt and above-average flow in some streams, but in most streams the flow remained below average during the entire spring and summer runoff period. Even in areas receiving above average rainfall, the streamflow decreased rapidly after the early snowmelt and by mid June some streams reached extremely low discharges. Others did not become critically low until August or September. Figures 4 and 5 compare the mean daily discharges in 1987 to the minimum daily discharges for two selected streams during 39 or 49 year periods and to the discharges that were exceeded 50 percent of the time during these same periods.

Throughout the West, total streamflows for the 1987 water year were well below average and are the lowest since 1977. In the Great Basin in northern Nevada, the flows of East Fork Carson River and Humboldt River have averaged only about 40 percent of the long-term average flow (table 3, at back of report). Most 1987 water-year flows in western Oregon and western Washington were about 70 to 80 percent of average. Rivers in the Columbia River basin in Idaho, Montana, Oregon, and Washington ranged from 50 to 80 percent of the long-term average. Flows in the Snake River drainage in Idaho and Oregon have ranged from as low as 40 percent in the Bruneau River in southern Idaho to about 60 percent in the Grande Ronde River in northwestern Oregon. In California, the total flow of the Arroyo Seco was only 30 percent of the long-term average.

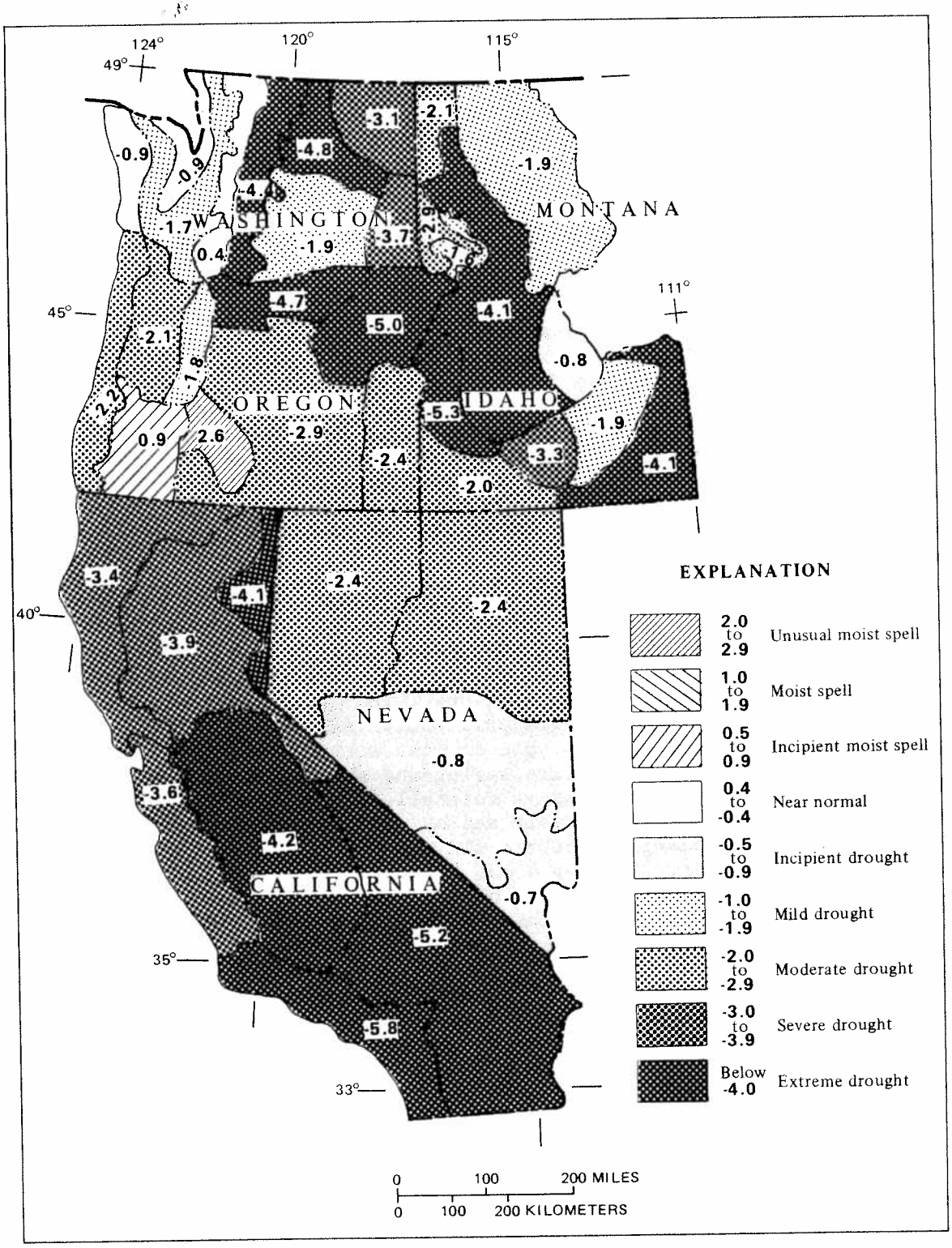

Figure 3.--Map of western states showing Palmer drought index as of August 15, 1977 (Written commun., National Weather Service, 1987).

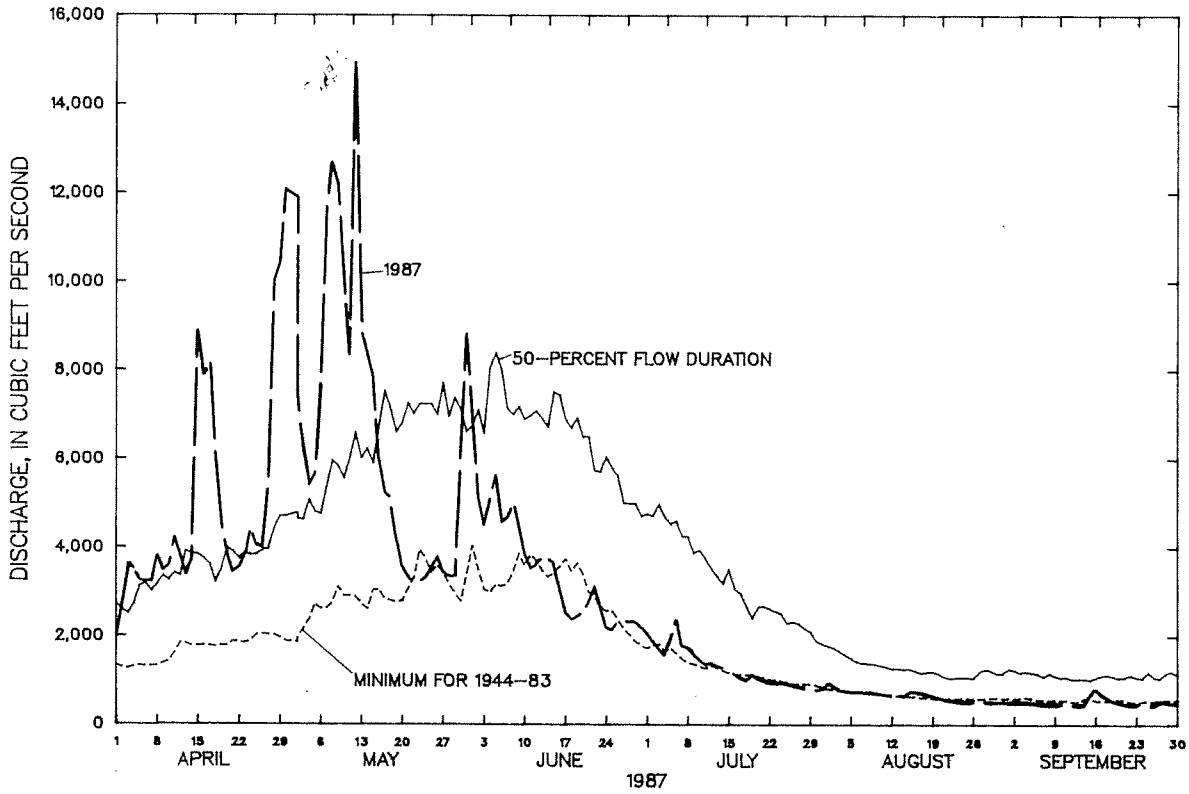

Figure 4.--Minimum daily discharges for 1945-84, discharges that were equalled or exceeded 50 percent of the time, and daily discharges during 1987 for Skykomish River near Goldbar, Washington.

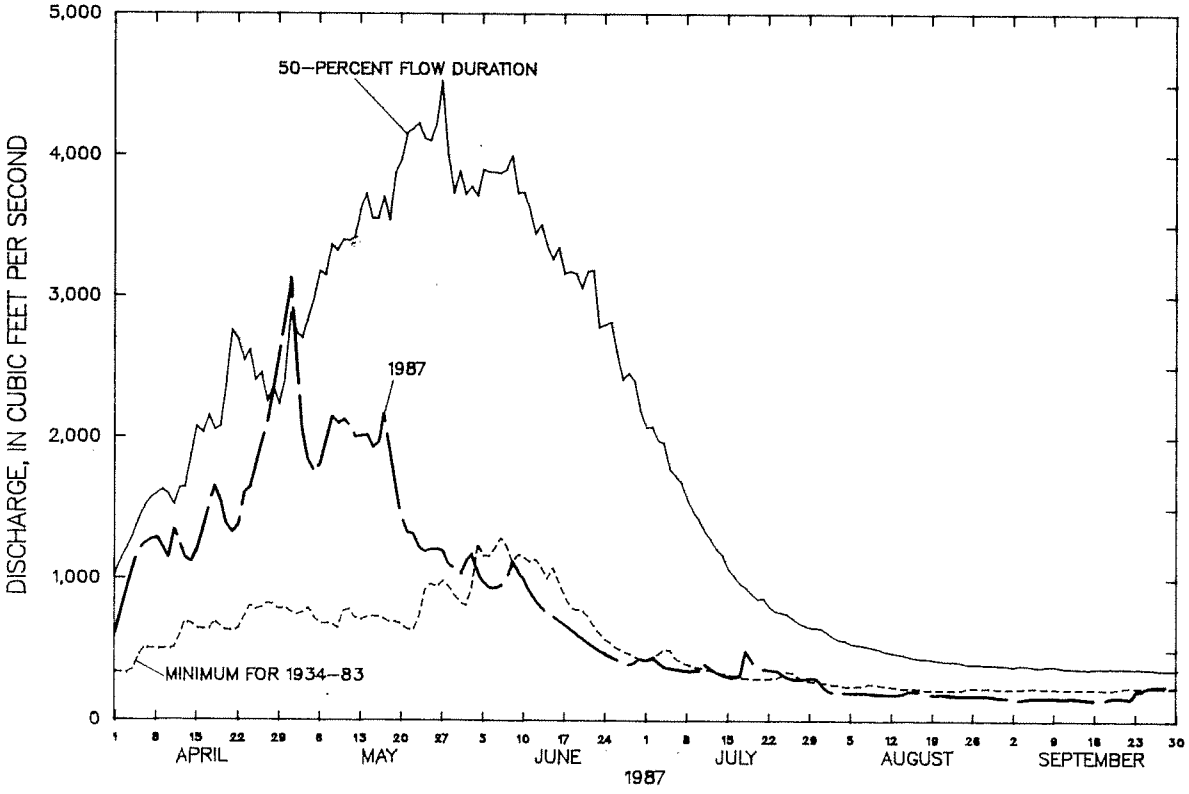

Figure 5.--Minimum daily discharges for 1934-86, discharges that were equalled or exceeded 50 percent of the time, and daily discharge during 1987 at Boise River near Twin Springs, Idaho.

Although total streamflow for the 1987 water year was not as low as the total for the 1977 water year, the monthly mean flows for 1 or more of the summer months (June through September) in 1987 were lower than flows for the same months in 1977 at several stations, as shown in figure 6. At selected stations, the total June-through-September flows in 1987, shown as a percentage of the 1977 flows for the same months, are as follows:

Humboldt River at Palisade, Nevada	21 percent
Skykomish River near Gold Bar, Washington	44 percent
Kettle River near Laurier, Washington	33 percent
Bruneau River near Hotspring, Idaho	25 percent
Boise River near Twin Springs, Idaho	25 percent
Clearwater River at Orofino, Idaho	28 percent
Cispus River near Randle, Washington	49 percent
Grande Ronde River at Troy, Oregon	38 percent

The above comparisons show that for many streams in the West flow conditions leading into the next water year (1988) are much lower than they were in 1977.

Some of the most extreme low flows in the West occurred in southern Idaho. The monthly flows of the Boise River near Twin Springs, Idaho, were the lowest on record (for period 1912-87) for the months of July and August; after April the monthly mean discharges were less than the monthly means that are exceeded 90 percent of the time. The 1987 monthly mean discharges for six streams are compared to those discharges exceeded 50 and 90 percent of the time in figure 7.

COLLECTION OF FIELD DATA

The U.S. Geological Survey offices in Washington, Idaho, Oregon and Nevada, in cooperation with Federal, State and local governments, are making, and have made, special streamflow measurements to document the low flows at active gaging stations, at former stations, and at miscellaneous sites. Many of the sites were measured during the low flows of 1977. The Geological Survey also is studying the effects of the drought on the quality of surface water. Results from these special studies were not available at the time of this report, but the studies will provide data that can be used at a later date for analyzing the severity of the drought. The data will provide insight into the processes associated with droughts and may help to develop methods for coping with droughts.

RESERVOIR STORAGE

At the beginning of the 1987 water year (October 1, 1986) storage in major reservoirs was slightly above the average in California, Oregon, and Idaho, but well below average in Washington; storage in the Yakima Basin was the lowest since 1973 (Soil Conservation Service, 1987e).

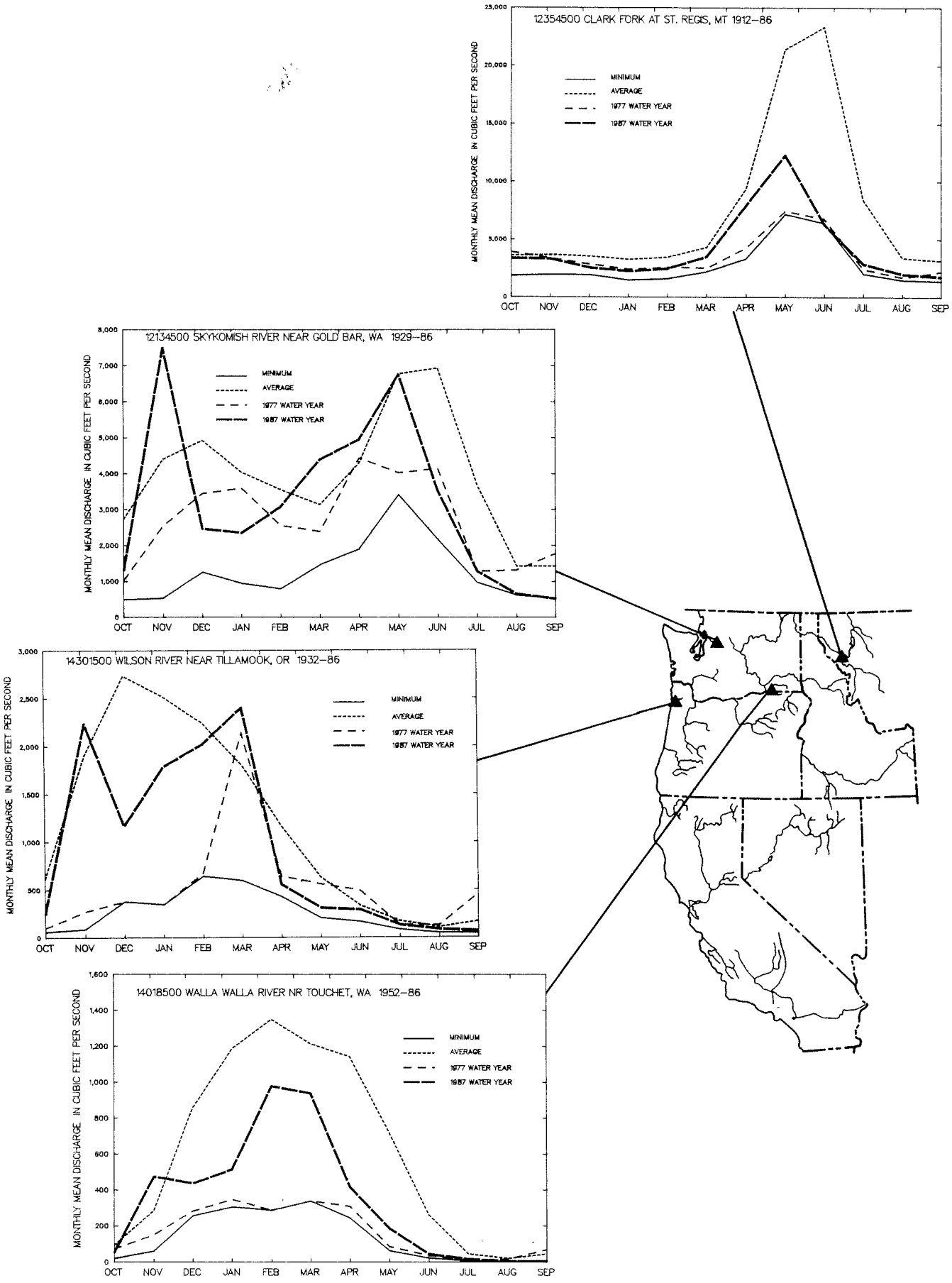

Figure 6.--Long-term average monthly means, historical minimum monthly means, 1977 monthly means and 1987 monthly means at selected streamflow gaging stations.

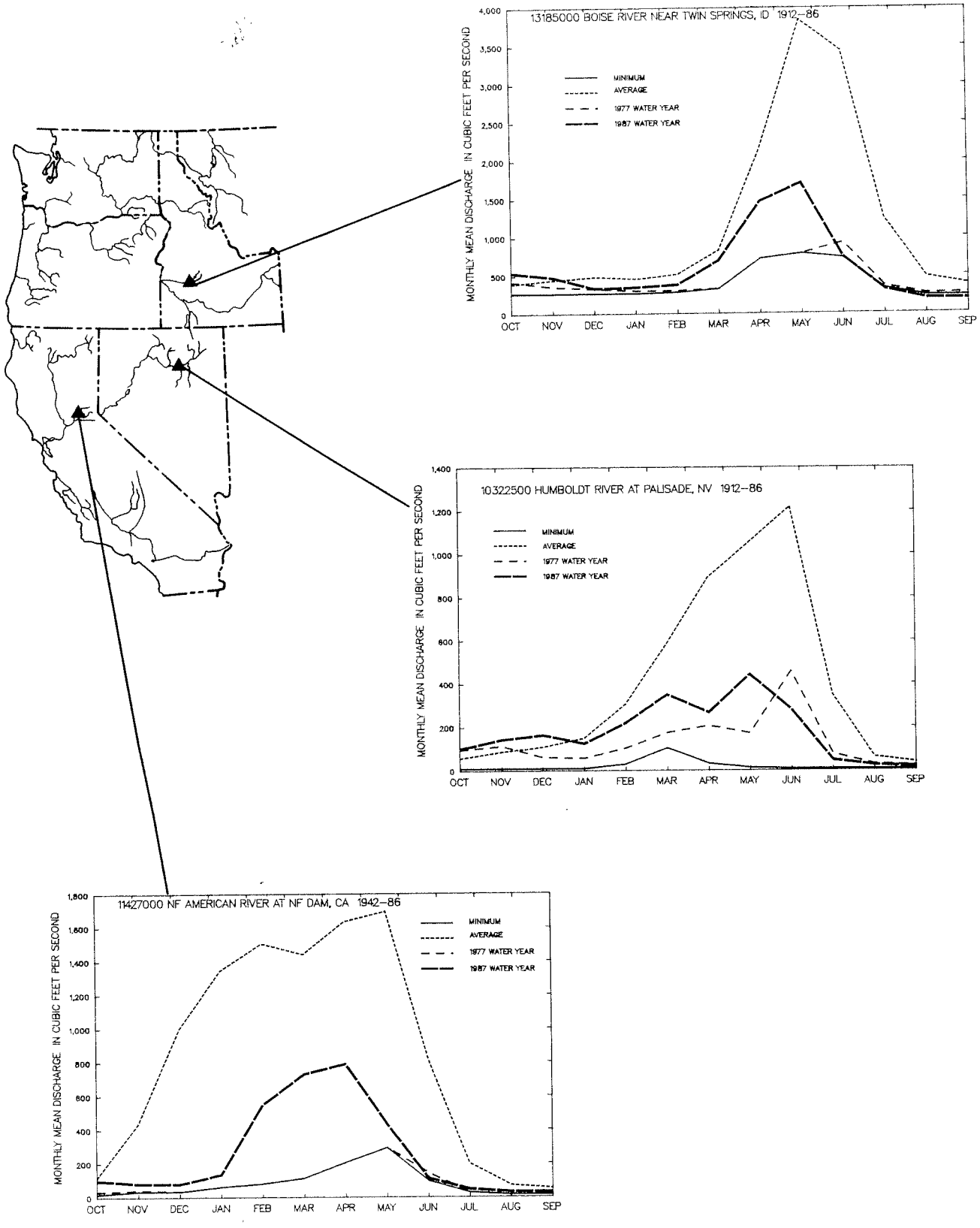

Figure 6.--Long-term average monthly means, historical minimum monthly means, 1977 monthly means and 1987 monthly means at selected streamflow gaging stations--continued.

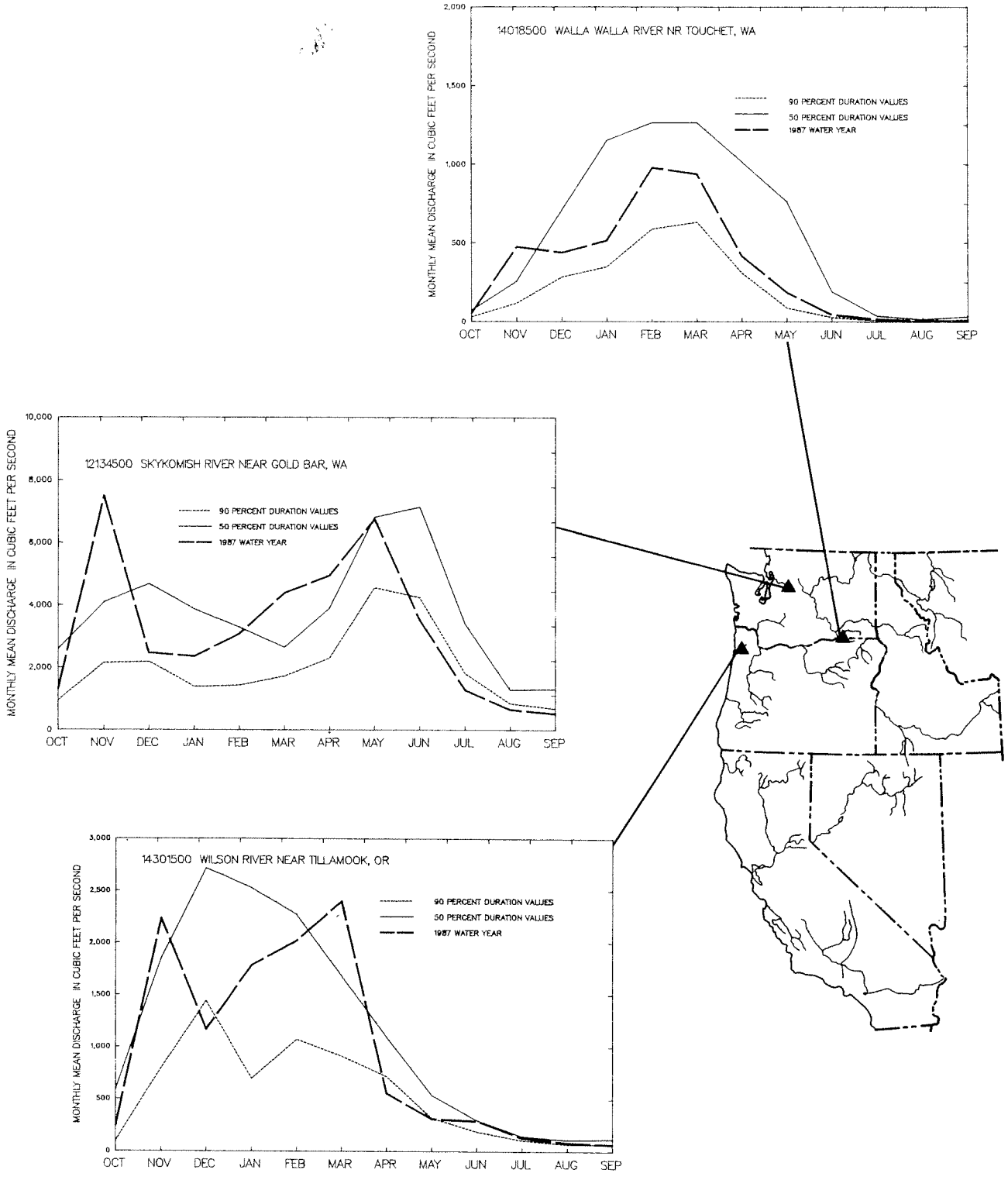

Figure 7.--Fifty-percent and 90-percent flow duration values and 1987 monthly mean flows for selected streamflow gaging stations.

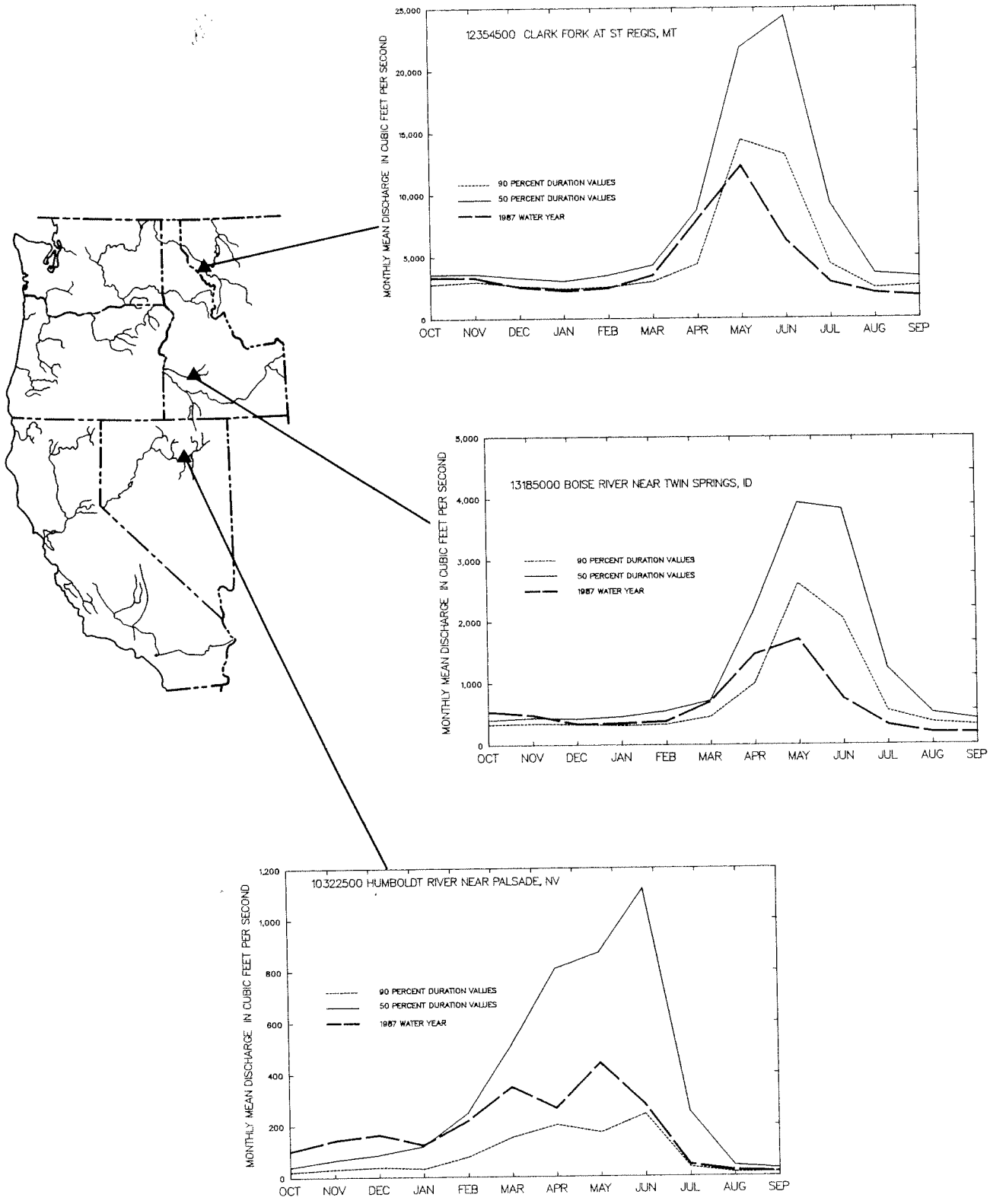

Figure 7.--Fifty-percent and 90-percent flow duration values and 1987 monthly mean flows for selected streamflow gaging stations--continued.

By the end of September 1987, most irrigation reservoirs had been drawn down sufficiently to cause the quantity of water stored to be considerably below the average. Because reservoir storage generally is used to augment summer flows, 1 year of deficient precipitation and low runoff does not normally result in severe water shortages for the year. However, when reservoir storage is depleted at the end of one irrigation season, the coming winter and spring runoff may not increase storage enough to provide needed streamflow in the next irrigation season.

On September 30, 1987, the total storage in 26 major irrigation reservoirs and the total storage in 29 major power and multipurpose reservoirs in the Northwest were 51 percent and 101 percent, respectively, of the 10-year average. Even though it was the tenth worst water year under the Bonneville Power Administration (BPA) system, the major power reservoirs in the Pacific Northwest were essentially full because of conservative operations and reduced power sales (Leslie Ratchye, Assistant to the Area Manager, External Affairs, Bonneville Power Administration, oral commun., August 5, 1987). The total storage in the 150 major California reservoirs was 81 percent of the 10-year average. Examples of end-of-September reservoir storage are shown in table 1. Irrigation storage in 1987 has been depleted to the point that a low-flow year in 1988 could cause critical water shortages in some regions.

Municipal reservoirs have reached critically low levels. The cities of Seattle and Tacoma, Washington; Coos Bay, Oregon; and Willets, California, finished September 1987 with less than a 2-month water supply in storage. In October, Seattle was pumping from a pool that was below the normal outlet from the reservoir; Tacoma was supplementing its supply by pumping water from a natural lake, and the release rate from the dam upstream from the Tacoma intake was less than that required for either municipal or instream uses--let alone being enough for both. Portland, Oregon, pumped heavily from its emergency well field, without which the surface reservoir would have gone dry.

Cities that use mostly ground water have not experienced severe impacts from the drought but could begin to do so within a few months if ground-water levels are not replenished soon. Several Idaho, California, Oregon, and Washington cities could be short of water in 1988 if precipitation continues below normal.

EFFECTS OF LOW STREAMFLOWS

Even though low flows occurred during the 1987 water year, no widespread critical water shortages were observed because many agencies, utilities, and private companies adjusted their water-management practices. For example, the State of Washington Legislature approved Second Substitute Senate Bill 5993 (Hedia Adelsman, State of Washington Department of Ecology, written commun., 1987). This 1987 Emergency Water Supply Alleviation Bill gives the Department of Ecology authority to issue temporary permits for withdrawals of surface and ground waters, construct facilities, and make temporary changes of water rights consistent with State law. Also in Washington State, the Cities of Seattle and Tacoma imposed restrictions on domestic water use. Nearly all of the cities around San Franciso Bay entered into a large-scale publicity campaign to promote a voluntary reduction in water use.

Table 1.--September 1987 month-end contents of major reservoirs in the West compared to the 10-year average month-end September contents

RESERVOIRS	NUMBER OF RESERVOIRS	CONTENT, IN ACRE-FEET		PERCENT OF AVERAGE
		SEPTEMBER	1975-84 AVERAGE	
IRRIGATION RESERVOIRS:				
YAKIMA RIVER BASIN (WA)	5	94,000	390,000	24
UPPER SNAKE RIVER BASIN (ID)	8	1,040,000	2,450,000	42
OWYHEE AND MALHEUR RIVER BASINS (OR,ID,NV)	2	562,000	928,000	61
BOISE AND PAYETTE RIVER BASINS (ID)	6	718,000	1,150,000	62
DESCHUTES RIVER BASIN (OR)	5	210,000	267,000	79
FLOOD CONTROL RESERVOIRS:				
WILLAMETTE RIVER BASIN (OR)	5	201,000	221,000	91
HYDROELECTRIC POWER RESERVOIRS:				
COLUMBIA RIVER BASIN (PACIFIC NORTHWEST)	17	59,300,000	58,000,000	102
BASINS WEST OF CASCADE RANGE (OR, WA)	12	5,500,000	6,070,000	91
MAJOR CALIFORNIA RESERVOIRS	150	18,800,000	23,300,000	81

Even in years of average streamflow, there is strong competition among various water-using interests; the competition becomes extremely intense in a dry year. In May 1987, the U.S. Army Corps of Engineers (COE) and the Oregon Water Resources Department (OWRD) began a series of coordinating meetings with other State and Federal agencies representing various water interests (recreation, fisheries, water quality, navigation, etc.). These meetings were held to provide the COE with information necessary to optimize the operation of their reservoirs in the Willamette system in order to minimize the negative effects on the various water uses. In general, adequate flows were maintained to meet power-generation and irrigation requirements.

In order to maintain at least a few high-quality recreational reservoirs in the Willamette River basin, three reservoirs that filled to normal levels were maintained at levels suitable for recreation, while reservoirs that did not fill were drafted heavily to augment summer flows for fisheries, water quality, and other management purposes (Dave Jarrett, Hydrographer, Oregon Water Resources Department, oral commun., 1987). On August 19, 1987, representatives from various State and Federal agencies met and agreed to the State of Oregon's request for special flow releases from the Lost Creek Reservoir on the Rogue River to avert a major fish kill during the fall Chinook Salmon run. Because of the advance planning, the effects of low flows on regulated rivers in Oregon generally were minimized during the year.

Delivery of irrigation water in some regions was curtailed, but no widespread irrigation crises were reported. Severe shortages did occur within some small areas of Idaho. A project on Big Wood River in Idaho had to greatly curtail its delivery in June (San Francisco Examiner, June 14, 1987). In southwestern Oregon, the Watermaster reported increased well-construction activity to deepen or replace irrigation wells that went dry during the irrigation season. The Division of Emergency Management in Washington State reported that some irrigation wells were drying up in Kittitas, Chelan, and Okanogan Counties in eastern Washington (Division of Emergency Management, written commun., 1987). Under Oregon water law, water delivery is based on the date of the water right, with the oldest water right being the last to be cut off. Water rights dating back to 1885 were cut off on one stream in northeastern Oregon.

FOREST FIRES

As in most years of low summer precipition, forest fires were numerous in the summer of 1987. On August 5, the decline in percent moisture in combustible forest fuels was 15 days ahead of normal in western Washington and 30-35 days ahead of normal in the Cascades, eastern Washington, and the Olympic peninsula (Howard Thronsen, Fire Prevention Specialist, Washington State Department of Natural Resources, oral commun., 1987). Green-vegetation drying was 30 days ahead of normal at that time, and some surface-water sources used for fire suppression were dried up. In early October the U.S. Forest Service reported that the moisture content of dead and downed trees in the forests of California was less than that of kiln dried lumber.

The forest material had a water content of 4 to 6 percent; kiln dried lumber has a moisture content of 14 to 16 percent (R. E.Greffenius, U.S. Forest Service, oral commun, October 15, 1987). The fire season began earlier than usual in Oregon, according to Jim Fisher of the Oregon State Forestry Department. Soils and forest fuels had dried out 4 to 6 weeks earlier than in most years. By early September, more than 500,000 acres of forests had burned in northern California and more than 100,000 acres had burned in Oregon (The Portland Oregonian, September 10, 1987).

SUMMARY

Below average streamflows were common throughout the West in 1987. Annual flows were the lowest since the drought of 1977. Summer flows of many streams reached levels that were lower than those in 1977, but total flows for the year generally exceeded those of 1977. At some sites flows for July, August, and September were the lowest ever recorded for those months. Reasons for the low flows, which occurred in spite of near normal precipitation for the year, include a low winter snowpack, unseasonably early melt of that snowpack, and prolonged periods of well-above-average temperatures.

Even though the flow conditions worsened noticeably during the year, widespread critical water shortages did not occur. This probably was due to careful management and conservative water-use practices by many agencies, utilities, and private companies.

Conditions are conducive for a potentially serious drought in 1988. The low flows during 1987 left many storage reservoirs at well-below-average levels, and in some areas, ground-water levels have been lowered considerably, as indicated by the need to deepen irrigation wells in Oregon. The western states need at least average rainfall and an adequate snowpack to avert critical water shortages in the coming year.

U.S. Geological Survey offices are cooperating with local, State, and Federal agencies in special measuring programs to document the degree and extent of the drought. Increased insight into the hyrologic and climatological processes associated with droughts may improve our ability to anticipate the possibility of a drought and to cope with its detrimental effects.

SELECTED REFERENCES

California Department of Water Resources, 1987, Water conditions in California: California Cooperative Snow Survey Bulletins.

Columbia River Water Management Group, 1986, Columbia River water management report for water year 1986, 200 p.

Matthai, Howard F., 1979, Hydrologic and human aspects of the 1976-77 drought: U.S. Geological Survey Professional Paper 1130, 84 p.

Palmer, W. C., 1965, Meterological drought: U.S. Weather Bureau Research Paper no. 45, 58 p.

Oregonian, September 10, 1987, Portland, Oregon.

San Franciso Examiner, June 14, 1987, San Francisco, California.

Soil Conservation Service, 1987a, Water supply outlook for Idaho.

_____1987b, Water supply outlook for Nevada.

_____1987c, Water supply outlook for Oregon.

_____1987d, Water supply outlook for Washington.

_____1987e, Water supply outlook for western United States.

Table 2.--Comparison of 1987 monthly precipitation with average monthly precipitation, historic minimum monthly precipitation, and 1977 monthly precipitation

[Values in inches, except as noted]

STATION 1 EUREKA, CA
YEARS OF RECORD 100

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT-SEP
AVERAGE	2.67	5.41	6.42	6.60	5.74	5.23	3.15	1.76	0.68	0.12	0.24	0.87	38.89
MINIMUM	0.00	0.00	0.52	0.66	0.50	0.07	0.00	0.00	0.00	0.00	0.00	0.00	
1977	0.28	2.98	0.52	1.90	2.24	4.33	1.20	2.10	0.07	0.00	0.20	3.35	
1987	1.75	1.85	3.83	6.48	3.38	6.10	1.15	0.41	0.26	0.20	0.06	0.02	25.49
1987 (PERCENT OF AVG)	66	34	60	98	59	117	37	23	38	167	25	2	66

STATION 2 KERN RIVER PH1
YEARS OF RECORD 83

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT-SEP
AVERAGE	0.55	1.02	1.54	1.81	1.74	1.97	1.24	0.48	0.10	0.01	0.06	0.20	10.72
MINIMUM	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
1977	0.47	0.59	0.20	0.73	0.48	1.96	0.00	0.86	0.95	0.00	0.95	0.00	
1987	0.07	0.83	1.29	3.10	1.24	2.91	0.39	0.10	0.09	0.00	0.00	0.00	10.02
1987 (PERCENT OF AVG)	13	81	84	171	71	148	31	21	90				93

STATION 3 SAN FRANCISCO, CA (AIRPORT)
YEARS OF RECORD 59

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT-SEP
AVERAGE	1.06	2.35	3.55	4.65	3.25	2.64	1.53	0.32	0.11	0.03	0.05	0.19	19.73
MINIMUM	0.00	0.00	0.00	0.37	0.00	0.18	0.00	0.00	0.00	0.00	0.00	0.00	
1977	0.34	1.37	2.70	2.22	1.04	2.01	0.00	0.41	0.00	0.35	0.00	0.47	
1987	0.02	0.06	1.66	2.80	3.52	1.98	0.16	0.06	0.00	0.00	0.00	0.00	10.26
1987 (PERCENT OF AVG)	2	3	47	60	108	75	10	19					52

STATION 4 TAHOE CITY, CA
YEARS OF RECORD 77

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT-SEP
AVERAGE	1.81	3.70	5.62	6.03	5.12	3.92	2.16	1.11	0.66	0.27	0.29	0.60	31.29
MINIMUM	0.00	0.00	0.23	0.35	0.00	0.11	0.06	0.00	0.00	0.00	0.00	0.00	
1977	1.05	0.67	0.29	1.07	2.96	0.62	0.08	1.50	0.41	0.06	0.04	0.15	
1987	0.11	0.63	0.48	3.34	4.82	2.78	0.61	0.28	0.94	0.38	0.10	0.00	14.47
1987 (PERCENT OF AVG)	6	17	9	55	94	71	28	25	142	141	34		46

Table 2.--Comparison of 1987 monthly precipitation with average monthly precipitation, historic minimum monthly precipitation, and 1977 monthly precipitation--Continued

[Values in inches, except as noted]

STATION 5 AMERICAN FALLS, ID
PERIOD OF RECORD 1949-85

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT-SEP
AVERAGE	0.93	1.04	0.95	1.11	0.80	0.96	1.06	1.43	0.96	0.56	0.64	0.74	11.18
MINIMUM	0.00	0.00	0.11	0.13	0.09	0.11	0.13	0.26	0.08	0.00	0.03	0.00	
1977	0.76	0.00	0.11	0.46	0.43	0.83	0.15	2.25	0.91	0.86	0.30	0.94	
1987	0.38	0.34	0.18	0.80	0.76	1.21	0.17	3.23	1.50	1.26	0.04	0.00	9.87
1987 (PERCENT OF AVG)	41	33	19	72	95	126	16	226	156	225	6		88

STATION 6 AVERY, ID
PERIOD OF RECORD 1914-85

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT-SEP
AVERAGE	2.84	3.87	4.35	4.39	3.25	3.28	2.50	2.46	2.36	1.07	1.24	1.92	33.53
MINIMUM	0.06	0.18	0.47	0.59	0.50	0.74	0.15	0.22	0.00	0.00	0.00	0.00	
1977	1.85	2.17	2.79	2.89	2.30	3.51	0.41	5.08	1.16	1.92	3.40	4.14	
1987	1.36	5.54	1.83	2.64	2.32	3.52	2.61	2.28	1.25	2.67	0.68	0.05	26.75
1987 (PERCENT OF AVG)	48	143	42	60	71	107	104	93	53	250	55	3	80

STATION 7 BOISE,ID
PERIOD OF RECORD 1909-85

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT-SEP
AVERAGE	0.94	1.40	1.38	1.50	1.24	1.23	1.21	1.20	0.87	0.30	0.28	0.59	12.14
MINIMUM	0.00	0.01	0.09	0.12	0.19	0.18	0.09	0.01	0.00	0.00	0.00	0.00	
1977	0.52	0.14	0.09	0.65	0.57	0.86	0.19	1.80	1.26	0.41	0.73	1.20	
1987	0.33	1.00	0.12	0.73	1.24	2.01	0.38	0.69	0.58	0.70	0.11	0.00	7.89
1987 (PERCENT OF AVG)	35	71	9	49	100	163	31	58	67	233	39		65

STATION 8 BONNERS FERRY, ID
PERIOD OF RECORD 1928-85

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT-SEP
AVERAGE	2.09	3.13	3.48	3.00	2.05	1.67	1.30	1.52	1.69	0.87	0.94	1.33	23.07
MINIMUM	0.04	0.15	0.21	0.22	0.40	0.32	0.12	0.24	0.06	0.00	0.00	0.10	
1977	0.84	1.06	0.85	0.96	0.79	0.89	0.33	1.08	0.99	0.59	1.77	1.88	
1987	1.14	4.44	1.49	1.46	1.88	3.84	1.47	1.05	1.49	1.38	0.83	0.36	20.83
1987 (PERCENT OF AVG)	55	142	43	49	92	230	113	69	88	159		27	90

Table 2.--Comparison of 1987 monthly precipitation with average monthly precipitation, historic minimum monthly precipitation, and 1977 monthly precipitation--Continued

[Values in inches, except as noted]

STATION 9 LEWISTON, ID
PERIOD OF RECORD 1948-85

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT-SEP
AVERAGE	1.09	1.18	1.28	1.29	0.93	1.05	1.12	1.47	1.45	0.60	0.73	0.80	12.99
MINIMUM	0.01	0.23	0.14	0.24	0.21	0.25	0.05	0.27	0.24	0.00	0.00	0.00	
1977	1.13	0.23	0.26	0.34	0.36	0.92	0.10	1.63	0.35	0.39	1.65	2.22	
1987	0.30	1.44	0.53	0.56	0.44	0.91	0.83	0.84	1.44	2.60	0.34	0.01	10.24
1987 (PERCENT OF AVG)	28	122	41	43	47	87	74	57	99	433	47	1	79

STATION 10 BUTTE, MT
PERIOD OF RECORD 1900-85

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT-SEP
AVERAGE	0.82	0.60	0.61	0.61	0.54	0.82	1.04	1.89	2.32	1.21	1.12	1.15	12.73
MINIMUM	0.00	0.00	0.02	0.00	0.02	0.07	0.11	0.09	0.29	0.04	0.00	0.00	
1977	0.32	0.15	0.06	0.77	0.04	0.71	0.67	1.61	1.78	1.84	1.34	3.15	
1987	0.26	1.34	0.10	0.22	0.36	0.87	0.36	3.88	0.49	4.44	1.51	0.07	13.90
1987 (PERCENT OF AVG)	32	223	16	36	67	106	35	205	21	367	135	6	109

STATION 11 KALISPELL, MT
PERIOD OF RECORD 1900-85

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT-SEP
AVERAGE	1.33	1.59	1.81	1.66	1.22	1.02	1.18	2.07	2.59	1.21	1.31	1.48	18.47
MINIMUM	0.00	0.12	0.32	0.20	0.00	0.17	0.20	0.43	0.33	0.02	0.00	0.09	
1977	0.38	0.47	0.65	0.81	0.97	1.18	0.43	1.40	0.43	2.57	1.13	2.19	
1987	0.51	1.84	0.52	0.66	0.61	2.96	1.19	0.88	1.20	3.98	1.35	0.60	16.30
1987 (PERCENT OF AVG)	38	116	29	40	50	290	101	43	46	329	103	41	88

STATION 12 ELKO, NV
PERIOD OF RECORD 1952-85

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT-SEP
AVERAGE	0.64	0.93	1.12	1.09	0.77	0.98	0.84	1.00	0.88	0.32	0.62	0.58	9.77
MINIMUM	0.00	0.00	0.00	0.04	0.08	0.13	0.14	0.00	0.01	0.00	0.00	0.00	
1977	0.58	0.26	0.00	0.30	0.26	0.13	0.18	1.44	1.02	0.22	1.57	0.26	
1987	0.04	0.13	0.09	0.54	0.68	1.13	0.26	1.80	0.69	0.14	0.01	0.09	5.60
1987 (PERCENT OF AVG)	6	14	8	50	88	115	31	180	78	44	2	16	57

Table 2.--Comparison of 1987 monthly precipitation with average monthly precipitation, historic minimum monthly precipitation, and 1977 monthly precipitation--Continued

[Values in inches, except as noted]

STATION 13 DETROIT DAM, OR
PERIOD OF RECORD 1951-85

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT-SEP
AVERAGE	7.46	12.62	15.14	13.36	10.24	9.68	6.32	4.91	3.45	0.74	1.56	3.44	88.92
MINIMUM	0.51	2.71	3.56	0.43	3.68	1.76	2.52	1.35	0.35	0.00	0.00	0.01	
1977	2.66	2.86	3.56	1.98	5.19	12.15	3.07	10.60	1.28	0.45	3.33	6.40	
1987	3.55	18.99	4.21	11.00	10.01	9.20	4.64	4.42	1.14	2.60	0.40	0.95	71.11
1987 (PERCENT OF AVG)	48	150	28	82	98	95	73	90	33	351	26	28	80

STATION 14 JOHN DAY, OR
PERIOD OF RECORD 1912-85

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT-SEP
AVERAGE	1.11	1.45	1.56	1.53	1.11	1.30	1.42	1.54	1.38	0.48	0.69	0.85	14.42
MINIMUM	0.00	0.06	0.13	0.10	0.04	0.16	0.25	0.04	0.00	0.00	0.00	0.00	
1977	0.60	0.55	0.19	0.47	0.23	1.17	0.64	1.98	0.81	0.07	1.08	1.43	
1987	0.80	1.92	0.14	0.78	0.50	0.82	0.58	1.92	1.72	1.84	0.11	0.00	11.13
1987 (PERCENT OF AVG)	72	132	9	51	45	63	41	125	125	383	16		77

STATION 15 NEWPORT, OR
PERIOD OF RECORD 1934-85

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT-SEP
AVERAGE	5.95	9.83	12.01	10.36	8.37	8.06	4.63	3.09	2.57	0.92	1.17	2.81	69.77
MINIMUM	0.53	1.14	2.86	0.68	2.66	1.35	0.86	0.36	0.14	0.00	0.03	0.03	
1977	2.34	2.06	2.86	2.30	7.09	8.82	1.20	6.21	1.15	2.30	3.07	5.37	
1987	4.42	9.68	4.08	11.94	7.12	11.02	2.11	7.75	0.63	2.43	0.10	0.21	61.49
1987 (PERCENT OF AVG)	74	98	34	115	85	137	46	251	25	264	9	7	88

STATION 16 MEDFORD, OR
PERIOD OF RECORD 1912-85

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT-SEP
AVERAGE	1.60	2.87	3.20	2.73	2.11	1.66	1.20	1.15	0.82	0.25	0.32	0.73	18.64
MINIMUM	0.00	0.01	0.36	0.19	0.10	0.00	0.16	0.00	0.00	0.00	0.00	0.00	
1977	0.18	.43	0.36	1.17	.67	1.12	0.81	2.37	0.53	0.23	0.36	4.22	
1987	1.49	2.45	0.72	2.32	2.24	1.34	0.45	0.95	0.12	1.34	0.00	0.00	13.42
1987 (PERCENT OF AVG)	93	85	23	85	106	81	38	83	15	536			72

Table 2.--Comparison of 1987 monthly precipitation with average monthly precipitation, historic minimum monthly precipitation, and 1977 monthly precipitation--Continued

[Values in inches, except as noted]

STATION 17 COLVILLE, WA
PERIOD OF RECORD 1928-85

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT-SEP
AVERAGE	1.32	2.09	2.27	1.92	1.45	1.31	1.03	1.52	1.60	0.80	0.83	0.91	17.05
MINIMUM	0.07	0.00	0.54	0.40	0.11	0.15	0.03	0.07	0.16	0.00	0.00	0.01	
1977	0.81	0.37	0.74	0.72	0.36	0.93	0.13	2.10	1.18	0.40	1.23	1.50	
1987	0.87	1.67	1.49	1.60	0.67	3.57	1.22	1.72	1.91	1.60	0.70	0.37	17.39
1987 (PERCENT OF AVG)	66	80	66	83	46	273	118	113	119	200	84	41	102

STATION 18 DAYTON, WA
PERIOD OF RECORD 1910-85

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT-SEP
AVERAGE	1.63	2.50	2.61	2.38	1.91	2.10	1.54	1.39	1.29	0.41	0.54	0.96	19.26
MINIMUM	0.00	0.04	0.84	0.31	0.31	0.35	0.26	0.12	0.18	0.00	0.00	0.01	
1977	0.38	1.08	0.96	0.31	0.42	1.61	0.48	1.48	0.49	0.27	2.33	1.09	
1987	0.72	4.18	0.28	2.40	1.56	1.09	1.40	1.93	0.73	1.53	0.64	0.12	16.66
1987 (PERCENT OF AVG)	44	167	11	101	82	52	91	139	57	373	119	13	87

STATION 19 EPHRATA, WA
PERIOD OF RECORD 1926-85

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT-SEP
AVERAGE	0.60	1.04	1.14	0.92	0.72	0.64	0.49	0.60	0.72	0.24	0.26	0.43	7.80
MINIMUM	0.01	0.00	0.07	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	
1977	0.12	0.00	0.07	0.00	0.46	0.30	0.01	0.37	0.44	0.02	0.63	0.71	
1987	0.48	0.69	1.29	0.81	0.38	1.34	0.10	0.24	0.69	1.28	0.02	0.02	7.34
1987 (PERCENT OF AVG)	80	66	113	88	53	209	20	40	96	533	8	5	94

STATION 20 LAKE WENATCHEE, WA
PERIOD OF RECORD 1915-85

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT-SEP
AVERAGE	3.40	5.94	8.01	7.27	4.96	3.35	1.53	1.17	1.01	0.47	0.66	1.30	39.07
MINIMUM	0.05	0.19	1.63	0.75	0.50	0.20	0.10	0.03	0.00	0.00	0.00	0.04	
1977	0.71	1.69	3.89	2.44	4.11	4.19	0.66	1.38	0.75	0.52	1.70	2.36	
1987	1.81	11.10	3.38	5.12	3.48	4.14	1.59	2.19	0.68	0.82	0.04	0.17	34.52
1987 (PERCENT OF AVG)	53	187	42	70	70	124	104	187	67	174	6	13	88

Table 2.--Comparison of 1987 monthly precipitation with average monthly precipitation, historic minimum monthly precipitation, and 1977 monthly precipitation--Continued

[Values in inches, except as noted]

STATION 21 PACKWOOD, WA
PERIOD OF RECORD 1928-85

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT-SEP
AVERAGE	5.04	8.03	9.82	8.94	6.25	5.32	3.18	2.29	2.11	0.66	1.07	2.26	54.97
MINIMUM	0.81	0.73	2.48	0.59	0.99	1.39	0.58	0.24	0.10	0.00	0.00	0.00	
1977	4.02	2.43	2.48	2.15	3.23	6.12	1.40	3.69	1.11	0.41	2.84	4.60	
1987	3.44	11.67	5.01	7.55	4.46	6.79	3.14	3.27	0.72	1.84	0.11	0.51	48.51
1987 (PERCENT OF AVG)	68	145	51	84	71	128	99	143	34	279	10	23	88

STATION 22 SNOQUALMIE FALLS, WA
PERIOD OF RECORD 1908-85

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT-SEP
AVERAGE	5.40	7.96	8.87	7.95	6.06	5.75	4.30	3.26	2.73	1.29	1.55	3.08	58.20
MINIMUM	0.75	1.33	2.04	1.11	0.69	1.00	0.80	0.69	0.06	0.00	0.00	0.06	
1977	3.09	2.38	4.96	2.95	3.35	5.98	2.47	4.90	0.76	1.45	4.14	3.88	
1987	4.41	15.09	5.43	9.26	2.49	8.75	5.21	4.67	0.52	1.11	0.71	0.88	58.53
1987 (PERCENT OF AVG)	82	190	61	116	41	152	121	143	19	86	46	29	101

Table 3.--Comparison of 1987 monthly mean flows with historic monthly mean flows, historic minimum monthly mean flows, and 1977 monthly mean flows

[Units are cubic feet per second, except as noted]

STATION 10309000 EAST FORK CARSON RIVER NR GARDNERVILLE, NV
PERIOD OF RECORD 1940-86

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT-SEP
AVERAGE	89	143	185	189	223	273	590	1199	1043	400	146	97	381
MINIMUM	32	45	46	49	59	68	185	205	182	63	30	19	
1977	63	53	49	49	59	68	185	205	259	63	30	19	
1987	115	91	85	80	88	120	454	542	186	88	53	35	161
1987 (PERCENT OF AVG)	129	64	46	42	39	44	77	45	18	22	36	36	42

STATION 10322500 HUMBOLDT RIVER AT PALISADE, NV
PERIOD OF RECORD 1912-86

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT-SEP
AVERAGE	58	88	110	150	306	584	890	1052	1217	346	60	36	408
MINIMUM	10	10	10	10	30	104	30	11	6	6	4	7	
1977	97	115	61	57	104	174	206	170	456	73	27	20	
1987	102	144	165	124	219	349	265	441	278	44	21	15	181
1987 (PERCENT OF AVG)	176	164	150	83	72	60	30	42	23	13	33	42	44

STATION 11152000 ARROYO SECO NR SOLEDAD, CA
PERIOD OF RECORD 1902-86

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT-SEP
AVERAGE	10	59	177	387	591	461	269	97	40	15	6	5	176
MINIMUM	0	0	8	10	12	19	8	4	1	0	0	0	
1977	1	3	10	24	12	19	8	4	3	0	0	0	
1987	18	21	28	38	190	152	54	23	8	3	0	0	45
1987 (PERCENT OF AVG)	180	36	16	10	32	33	20	24	20	20			33

STATION 11187000 KERN RIVER AT KERNVILLE, CA
PERIOD OF RECORD 1954-86

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT-SEP
AVERAGE	250	280	465	510	658	796	1271	2218	2331	1187	521	310	900
MINIMUM	90	114	137	150	164	186	344	366	281	118	113	95	
1977	276	176	143	168	187	186	344	366	554	166	144	95	
1987	363	313	286	284	356	447	821	1139	832	307	191	163	459
1987 (PERCENT OF AVG)	145	112	62	56	54	56	65	51	36	26	37	53	51

Table 3.--Comparison of 1987 monthly mean flows with historic monthly mean flows, historic minimum monthly mean flows, and 1977 monthly mean flows--Continued

[Units are cubic feet per second, except as noted]

STATION 11348500 PIT RIVER NR CANBY, CA
PERIOD OF RECORD 1932-86

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT-SEP
AVERAGE	82	107	207	313	440	546	494	441	279	70	47	69	258
MINIMUM	0	13	31	15	19	6	1	7	14	7	0	0	
1977	72	79	79	57	98	71	18	144	73	18	21	31	
1987	81	84	87	100	151	197	94	108	69	57	27	28	90
1987 (PERCENT OF AVG)	99	79	42	32	34	36	19	24	25	81	57	41	35

STATION 11427000 NF AMERICAN RIVER AT NF DAM, CA
PERIOD OF RECORD 1942-86

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT-SEP
AVERAGE	117	434	999	1345	1506	1441	1636	1696	821	198	68	51	859
MINIMUM	18	36	34	62	81	114	207	294	95	26	13	15	
1977	33	42	34	62	81	114	207	294	142	26	13	15	
1987	99	80	78	136	548	730	790	432	110	45	29	28	259
1987 (PERCENT OF AVG)	85	18	8	10	36	51	48	25	13	23	45	55	30

STATION 11522500 SALMON RIVER AT SOMES BAR, CA
PERIOD OF RECORD 1928-86

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT-SEP
AVERAGE	360	1196	2368	2926	3013	2913	3011	3145	1872	608	258	200	1823
MINIMUM	118	130	175	190	255	448	710	786	427	146	82	83	
1977	191	219	187	218	255	448	710	786	603	152	98	206	
1987	412	430	631	1349	2163	2429	2299	1731	572	239	144	125	1044
1987 (PERCENT OF AVG)	114	36	27	46	72	83	76	55	31	39	56	63	57

STATION 12134500 SKYKOMISH RIVER NR GOLD BAR, WA
PERIOD OF RECORD 1929-86

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT-SEP
AVERAGE	2737	4405	4925	4037	3554	3139	4298	6778	6938	3687	1424	1430	3946
MINIMUM	488	534	1263	945	791	1469	1908	3425	2169	971	612	515	
1977	1026	2545	3448	3599	2555	2388	4437	4025	4152	1279	1321	1779	
1987	1313	7491	2464	2351	3084	4394	4952	6760	3523	1278	647	511	3231
1987 (PERCENT OF AVG)	48	170	50	58	87	140	115	100	51	35	45	36	82

Table 3.--Comparison of 1987 monthly mean flows with historic monthly mean flows, historic minimum monthly mean flows, and 1977 monthly mean flows--Continued

[Units are cubic feet per second, except as noted]

STATION 12306500 MOYIE RIVER AT EASTPORT, ID
PERIOD OF RECORD 1930-86

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT-SEP
AVERAGE	152	214	211	167	179	274	1286	3202	2003	473	134	102	700
MINIMUM	43	42	53	42	55	69	317	1174	526	127	58	44	
1977	109	97	77	76	83	79	457	1205	575	131	70	72	
1987	120	232	218	138	125	524	1412	2216	576	195	104	51	493
1987 (PERCENT OF AVG)	79	108	103	83	70	191	110	69	29	41	78	50	70

STATION 12354500 CLARK FORK AT ST REGIS, MT
PERIOD OF RECORD 1912-86

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT-SEP
AVERAGE	3621	3668	3526	3254	3457	4319	9358	21411	23343	8388	3379	3140	7572
MINIMUM	1854	1942	1909	1450	1592	2199	3333	7190	6395	1998	1454	1351	
1977	3907	3345	2838	2387	2584	2502	4262	7456	6758	2398	1690	2198	
1987	3356	3290	2527	2220	2467	3496	7927	12293	6270	2848	1972	1729	4200
1987 (PERCENT OF AVG)	93	90	72	68	71	81	85	57	27	34	58	55	55

STATION 12358500 MF FLATHEAD RIVER NR WEST GLACIER, MT
PERIOD OF RECORD 1940-86

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT-SEP
AVERAGE	1083	1040	896	710	700	811	3039	9812	10451	4043	1368	992	2912
MINIMUM	367	279	262	319	300	307	664	5259	3576	1249	576	551	
1977	614	458	406	337	378	412	2352	5849	4163	1504	1073	1152	
1987	935	1180	852	478	432	1122	5202	8817	4068	1892	1176	679	2236
1987 (PERCENT OF AVG)	86	113	95	67	62	138	171	90	39	47	86	68	77

STATION 12404500 KETTLE RIVER NR LAURIER, WA
PERIOD OF RECORD 1930-86

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT-SEP
AVERAGE	724	773	624	533	580	1034	4901	12232	9336	2740	841	693	2918
MINIMUM	184	202	154	77	98	212	1478	4246	3783	759	250	157	
1977	962	610	429	341	396	454	2893	8147	6116	1099	337	326	
1987	819	726	350	480	413	1925	4776	9159	2876	979	409	189	1925
1987 (PERCENT OF AVG)	113	94	56	90	71	186	97	75	31	36	49	27	66

Table 3.--Comparison of 1987 monthly mean flows with historic monthly mean flows, historic minimum monthly mean flows, and 1977 monthly mean flows--Continued

[Units are cubic feet per second, except as noted]

STATION 12459000 WENATCHEE RIVER AT PESHASTIN, WA
PERIOD OF RECORD 1930-86

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT-SEP
AVERAGE	1148	1737	1840	1536	1536	1792	3620	8018	9074	4625	1532	862	3110
MINIMUM	336	329	421	421	476	839	1583	3506	3191	1164	572	426	
1977	781	1043	1056	1575	1356	1115	2786	3506	4566	1255	943	855	
1987	620	2182	1287	845	783	2343	4600	9281	5537	1866	699	467	2543
1987 (PERCENT OF AVG)	54	126	70	55	51	131	127	116	61	40	46	54	82

STATION 13047500 FALLS RIVER NR SQUIRREL, ID
PERIOD OF RECORD 1919-86

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT-SEP
AVERAGE	509	497	454	412	403	406	677	1926	2176	903	577	538	790
MINIMUM	259	276	283	219	287	293	404	1086	589	298	316	315	
1977	550	471	440	400	383	372	738	1201	917	325	316	365	
1987	595	689	474	461	420	425	959	1627	671	405	301	289	610
1987 (PERCENT OF AVG)	117	139	104	112	104	105	142	84	31	45	52	54	77

STATION 13168500 BRUNEAU RIVER NR HOT SPRING, ID
PERIOD OF RECORD 1944-86

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT-SEP
AVERAGE	104	124	136	171	228	360	817	1333	1062	306	106	86	403
MINIMUM	54	71	73	81	99	119	196	362	179	62	38	35	
1977	146	123	98	95	116	136	395	397	645	129	69	64	
1987	121	129	96	101	129	216	361	569	236	78	42	39	176
1987 (PERCENT OF AVG)	116	104	71	59	57	60	44	43	22	25	40	45	44

STATION 13185000 BOISE RIVER NR TWIN SPRINGS, ID
PERIOD OF RECORD 1912-86

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT-SEP
AVERAGE	396	446	484	455	518	827	2150	3838	3432	1238	473	375	1219
MINIMUM	267	263	265	265	283	326	717	782	723	321	224	223	
1977	422	352	325	297	305	326	717	782	923	351	250	263	
1987	538	475	331	349	381	695	1466	1707	735	305	184	180	603
1987 (PERCENT OF AVG)	136	107	68	77	74	84	68	44	21	25	39	48	49

Table 3.--Comparison of 1987 monthly mean flows with historic monthly mean flows, historic minimum monthly mean flows, and 1977 monthly mean flows--Continued

[Units are cubic feet per second, except as noted]

STATION 13333000 GRANDE RONDE RIVER AT TROY, OR
PERIOD OF RECORD 1945-86

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT-SEP
AVERAGE	922	1247	2073	2251	3151	4145	6364	7574	6046	2298	883	810	3147
MINIMUM	603	688	685	702	769	888	2257	2368	2159	520	448	574	
1977	831	836	720	766	769	888	2541	2368	2267	520	448	706	
1987	816	1155	1032	900	1887	4463	4187	4143	1959	831	538	467	1865
1987 (PERCENT OF AVG)	89	93	50	40	60	108	66	55	32	36	61	58	59

STATION 13340000 CLEARWATER RIVER AT OROFINO, ID
PERIOD OF RECORD 1965-86

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT-SEP
AVERAGE	2443	3300	4308	4839	5839	8220	14484	29944	28646	7958	2378	2200	9547
MINIMUM	1230	1332	1438	1543	1830	2673	6390	17110	10210	2818	1250	1086	
1977	2086	2094	1706	1663	1984	2673	10760	17110	10210	2818	1548	2168	
1987	1910	3236	2279	1912	3112	7191	15014	18468	6746	2553	1329	889	5387
1987 (PERCENT OF AVG)	78	98	53	40	53	87	104	62	24	32	56	40	56

STATION 14018500 WALLA WALLA RIVER NR TOUCHET, WA
PERIOD OF RECORD 1952-86

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT-SEP
AVERAGE	94	286	859	1187	1350	1213	1141	716	260	44	20	46	601
MINIMUM	20	61	257	306	286	339	243	61	21	6	3	9	
1977	72	152	283	348	286	339	308	84	35	10	17	69	
1987	53	474	436	516	978	937	415	184	43	15	4	6	338
1987 (PERCENT OF AVG)	56	166	51	43	72	77	36	26	17	34	20	13	56

STATION 14046500 JOHN DAY RIVER AT SERVICE CREEK, OR
PERIOD OF RECORD 1930-86

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT-SEP
AVERAGE	327	602	1246	1616	2382	3640	5302	5020	2536	582	181	189	1969
MINIMUM	71	152	216	195	358	597	1010	491	416	91	15	31	
1977	337	403	360	341	427	597	1850	1780	1036	137	44	132	
1987	465	894	700	985	2367	4600	4786	2338	846	372	132	102	1549
1987 (PERCENT OF AVG)	142	149	56	61	99	126	90	47	33	64	73	54	79

Table 3.--Comparison of 1987 monthly mean flows with historic monthly mean flows, historic minimum monthly mean flows, and 1977 monthly mean flows--Continued

[Units are cubic feet per second, except as noted]

STATION 14178000 N SANTIAM RIVER BLW BOULDER CR NR DETROIT, OR
PERIOD OF RECORD 1929-86

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT-SEP
AVERAGE	526	986	1407	1311	1297	1165	1342	1470	1140	641	480	446	1018
MINIMUM	312	336	432	383	404	616	610	701	441	375	326	319	
1977	461	476	432	414	404	639	1048	1050	743	411	371	381	
1987	443	1428	915	956	1406	1152	1030	875	670	494	413	364	846
1987 (PERCENT OF AVG)	84	145	65	73	108	99	77	60	59	77	86	82	83

STATION 14232500 CISPUS RIVER NR RANDLE, WA
PERIOD OF RECORD 1930-86

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT-SEP
AVERAGE	587	1220	1678	1451	1412	1279	1713	2529	2168	1063	568	450	1343
MINIMUM	266	251	350	396	328	586	794	1331	784	499	374	306	
1977	381	386	392	441	445	586	1534	1615	1515	499	399	456	
1987	408	1500	924	962	1780	2130	1600	1950	922	512	379	277	1112
1987 (PERCENT OF AVG)	70	123	55	66	126	167	93	77	43	48	67	62	83

STATION 14301500 WILSON RIVER NR TILLAMOOK, OR
PERIOD OF RECORD 1932-1986

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT-SEP
AVERAGE	612	1906	2733	2515	2239	1802	1170	628	334	171	109	169	1199
MINIMUM	58	87	378	344	642	595	426	202	164	79	44	40	
1977	97	271	378	344	673	2135	639	556	490	130	127	455	
1987	245	2234	1164	1784	2022	2400	553	308	289	128	81	65	939
1987 (PERCENT OF AVG)	40	117	43	71	90	133	47	49	87	75	74	38	78

STATION 14321000 UMPQUA RIVER NR ELKTON, OR
PERIOD OF RECORD 1906-86

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT-SEP
AVERAGE	1936	7239	13644	16006	15511	12427	9663	6534	3786	1749	1180	1207	7574
MINIMUM	857	832	1238	1440	1365	3462	2432	1934	1053	742	703	740	
1977	1329	1385	1238	1440	1365	5653	4097	5917	2181	986	879	1271	
1987	2047	10460	5506	12740	14860	8654	4325	2495	1611	1747	1201	1122	5564
1987 (PERCENT OF AVG)	106	144	40	80	96	70	45	38	43	100	102	93	73

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