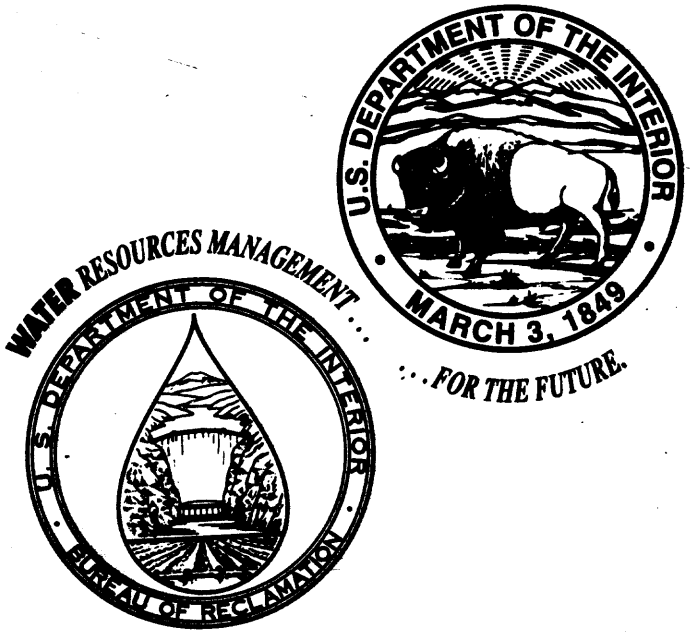
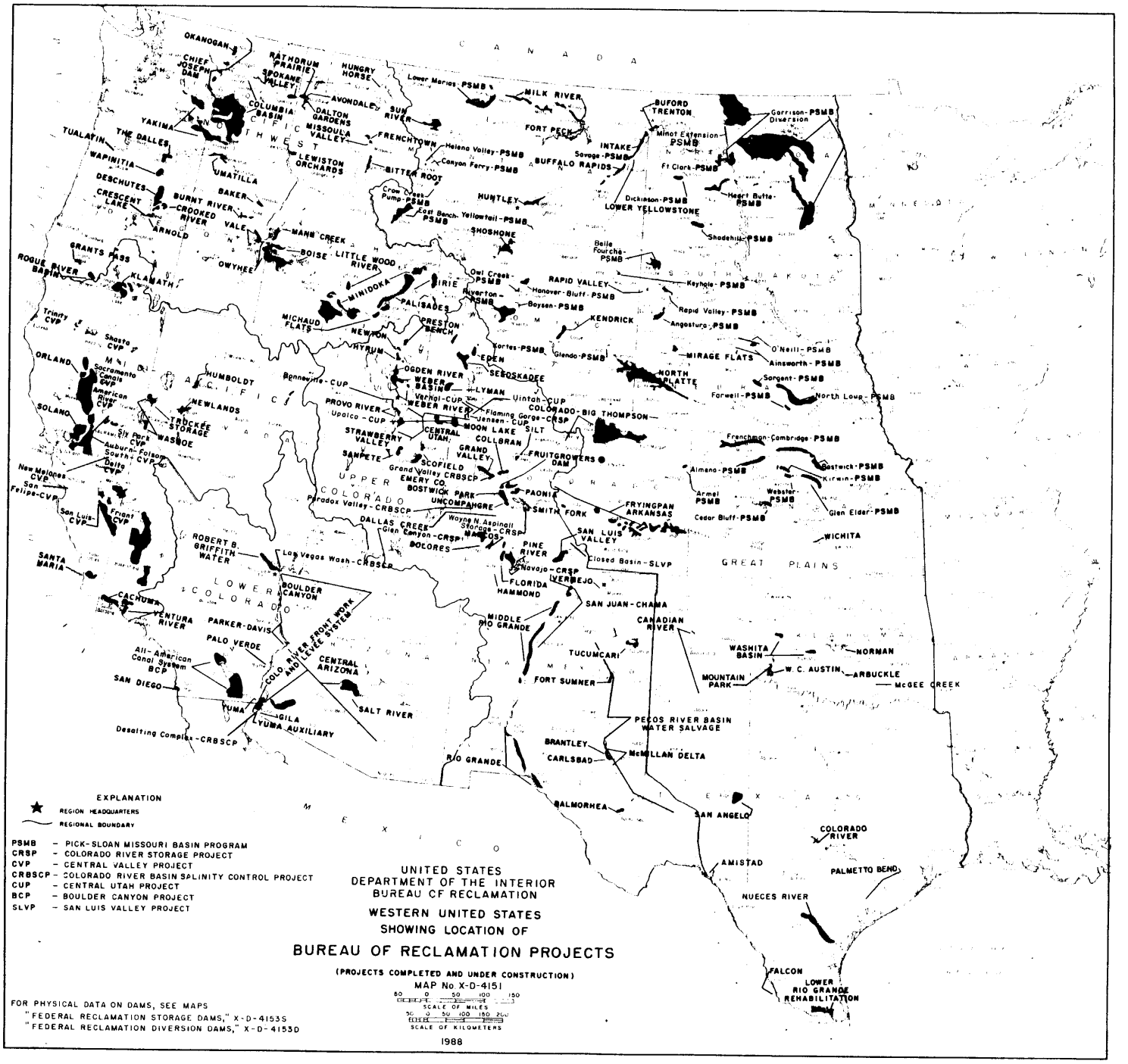
WATER SUPPLY CONDITIONS FOR THE WESTERN STATES

MAY 1993



UNITED STATES DEPARTMENT OF THE INTERIOR

BUREAU OF RECLAMATION


CANADA
MEXICO
OKANOGAN
CHIEF JOSEPH DAM
COLUMBIA BASIN
RATHDRUM PRAIRIE
SPOKANE VALLEY
HUNGRY HORSE
AVONDALE
DALTON GARDENS
SUN RIVER
Lower Marias PSMB
MILK RIVER
FORT PECK
BUFORD TRENTON
Garrison-PSMB Diversion
Minot Extension PSMB
INTAKE
Savage-PSMB
BUFFALO RAPIDS
Ft Clark-PSMB
Dickinson-PSMB
LOWER YELLOWSTONE
Heart Butte-PSMB
Shadehill-PSMB
MISSOULA VALLEY
FRENCHTOWN
Helena Valley-PSMB
Canyon Ferry-PSMB
LEWISTON ORCHARDS
BITTER ROOT
Crow Creek Pump-PSMB
East Bench-PSMB
Yellowtail-PSMB
HUNTLEY
SHOSHONE
Belle Fourche-PSMB
TUALATIN
THE DALLES
YAKIMA
WAPINITIA
UMATILLA
DESCHUTES
CRESCENT LAKE
BURNT RIVER
CROOKED RIVER
BAKER
VALE
ARNOLD
MANN CREEK
OWYHEE
BOISE
LITTLE WOOD RIVER
MINIDOKA
IRRIGON
Owl Creek-PSMB
Riverton-PSMB
RAPID VALLEY
Hanover-Bluff-PSMB
Boysen-PSMB
Keyhole-PSMB
Rapid Valley-PSMB
Angostura-PSMB
KENDRICK
GRANTS PASS
ROGUE RIVER BASIN
KLAMATH
Trinity CVP
Shasta CVP
MICHAUD FLATS
PALISADES
PRESTON BENCH
NEWTON
HYRUM
Cortez-PSMB
Glendo-PSMB
EDEN
SEEDSKADEE
MIRAGE FLATS
O'Neill-PSMB
Ainsworth-PSMB
ORLAND
Sacramento Canals CVP
American River CVP
HUMBOLDT
Bonneville-CUP
OGDEN RIVER
WEBER BASIN
Vernal-CUP
WEBER RIVER
LYMAN
Uintah-CUP
NORTH PLATTE
Sargent-PSMB
Farwell-PSMB
North Loup-PSMB
SOLANO
NEWLANDS
TRUCKEE STORAGE
WASHOE
PROVO RIVER
Upalco-CUP
Flaming Gorge-CRSP
Jensen-CUP
COLORADO-BIG THOMPSON
Six Park CVP
Auburn-Folsom South-CVP
Delta CVP
STRAWBERRY VALLEY
CENTRAL UTAH
MOON LAKE
SILT
COLLBRAN
GRAND VALLEY
FRUITGROWERS DAM
Frenchman-Cambridge-PSMB
SANPETE
SCOFIELD
Grand Valley CRBSCP
EMERY CO.
Almena-PSMB
Kirwin-PSMB
Webster-PSMB
Armel PSMB
Cedar Bluff-PSMB
Glen Elder-PSMB
New Melones CVP
San Felipe-CVP
San Luis-CVP
Friant CVP
UPPER COLORADO
Paradox Valley-CRBSCP
BOSTWICK PARK
UNCOMPAHGRE
PAONIA
SMITH FORK
FRYINGPAN ARKANSAS
DALLAS CREEK
Glen Canyon-CRSP
Wayne N. Aspinall Storage-CRSP
MANCOS
DOLORES
PINE RIVER
SAN LUIS VALLEY
WICHITA
GREAT PLAINS
ROBERT B. GRIFFITH WATER
Las Vegas Wash-CRBSCP
Closed Basin-SLVP
SANTA MARIA
Navajo-CRSP
FLORIDA
HAMMOND
VERBEJO
LOWER COLORADO
BOULDER CANYON
SAN JUAN-CHAMA
CACHUMA
VENTURA RIVER
PARKER-DAVIS
COLO. RIVER FRONT WORK AND LEVEE SYSTEM
MIDDLE RIO GRANDE
CANADIAN RIVER
PALO VERDE
All-American Canal System BCP
CENTRAL ARIZONA
TUCUMCARI
WASHITA BASIN
NORMAN
W. C. AUSTIN
ARBUCKLE
McGEE CREEK
MOUNTAIN PARK
SAN DIEGO
FORT SUMNER
SALT RIVER
GILA
YUMA
YUMA AUXILIARY
Desalting Complex-CRBSCP
PECOS RIVER BASIN WATER SALVAGE
BRANTLEY
CARLSBAD
McMILLAN DELTA
RIO GRANDE
BALMORHEA
SAN ANGELO
COLORADO RIVER
AMISTAD
PALMETTO BEND
NUECES RIVER
FALCON
LOWER RIO GRANDE REHABILITATION
EXPLANATION
REGION HEADQUARTERS
REGIONAL BOUNDARY
PSMB – PICK-SLOAN MISSOURI BASIN PROGRAM
CRSP – COLORADO RIVER STORAGE PROJECT
CVP – CENTRAL VALLEY PROJECT
CRBSCP – COLORADO RIVER BASIN SALINITY CONTROL PROJECT
CUP – CENTRAL UTAH PROJECT
BCP – BOULDER CANYON PROJECT
SLVP – SAN LUIS VALLEY PROJECT
FOR PHYSICAL DATA ON DAMS, SEE MAPS
"FEDERAL RECLAMATION STORAGE DAMS," X-D-4153S
"FEDERAL RECLAMATION DIVERSION DAMS," X-D-4153D
UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
WESTERN UNITED STATES
SHOWING LOCATION OF
BUREAU OF RECLAMATION PROJECTS
(PROJECTS COMPLETED AND UNDER CONSTRUCTION)
MAP No. X-D-4151
SCALE OF MILES
SCALE OF KILOMETERS
1988

INTRODUCTION

The Bureau of Reclamation (Reclamation) is the West's primary water resources management agency. Reclamation operates more than 350 storage dams, delivering about 30 million acre-feet of water each year. It serves the needs of approximately 25 million people, provides irrigation water to about 10 million acres of land, and generates about 45 billion kilowatthours of hydroelectric energy each year. In addition, Reclamation provides flood control, river regulation, recreation, fish and wildlife, water quality, and other water-related benefits to the citizens of the West.

The amount of water available to meet these purposes varies from year to year. The volume of winter snowfall usually determines the water supply conditions in the West. During winters with average or above average snow accumulation, spring runoff is typically sufficient to fill reservoirs for the season's demands. However, when winter weather is too dry to accumulate a sufficient mountain snowpack, reservoirs may not fill.

Typically, Reclamation reservoirs were designed to provide carryover storage from one year to the next to ensure a dependable water supply even during one or more years of below normal inflow. However, most reservoirs do not have sufficient storage capacity to continue to meet needs when drought conditions extend for several years.

This report summarizes water supply conditions at selected Reclamation projects and river basins as of May 1, 1993. Projects were included in this document based upon the availability of data and the severity of potential impacts from drought. This report does not provide project demands. However, water supply conditions must be examined in context of demand from each project, and comparisons between projects are not always appropriate. Each project should be compared to its own historical record to determine the severity of water supply shortages.

The data presented in this report are the latest that were available at the time of publication and are often provisional. Typically, the reporting agencies review these data at the end of the water year and do not publish official data until up to a year after the end of the water year.

For copies of this report, please contact Sylvia Duncan at 303-236-3800; for inquiries, please contact Dave King at 303-236-8322.

More detailed information about specific projects is available from Reclamation's regional offices listed on the following page.

Pacific Northwest Regional Office
1150 North Curtis Road
Boise, Idaho 83706-1234

Mid-Pacific Regional Office
2800 Cottage Way
Sacramento, California 95825-1898

Lower Colorado Regional Office
P.O. Box 61470
Boulder City, Nevada 89006-1470

Upper Colorado Regional Office
P.O. Box 11568
Salt Lake City, Utah 84147

Great Plains Regional Office
P.O. Box 36900
Billings, Montana 59107-36900

CONTENTS

TABLES

FIGURES

Overview

Pacific Northwest Region

Mid-Pacific Region

Lower Colorado Region

Upper Colorado Region

Great Plains Region

OVERVIEW

This document summarizes water supply conditions in the 17 Western States as of May 1, 1993. Water supply can be described by several parameters, including soil moisture, streamflow forecasts, snow water equivalents, accumulated precipitation, accumulated inflow, and reservoir storage. Although reservoir storage is probably the best indicator, no single parameter can reflect the total water supply picture.

Reclamation comprises five regions: Pacific Northwest, Mid-Pacific, Lower Colorado, Upper Colorado, and Great Plains (see frontispiece map.) The following discussion describes water supply conditions in the Western States in general. A more complete discussion of water supply conditions by Reclamation region is provided in the summaries at the end of this document.

The **Palmer Drought Severity Index** ratings for May 1, 1993 (shown on figure 1) show that most of the West is about the same as last month. The notable exception is California and Nevada where soil moisture decreased. Most of California and Nevada show mild drought conditions with respect to soil moisture. Unusually to extremely above average moisture conditions exist in Kansas, Nebraska, Oklahoma, western New Mexico, and Arizona. Most of Texas has good soil moisture except the southwestern corner which is in a mild drought. Near average to unusually moist conditions exist in Colorado, Utah, southeastern Idaho, and southern Oregon. However, a band of drought covers parts of Oregon, Idaho, Washington, and South Dakota, as well as most of Montana, Wyoming, and North Dakota.

Accumulated precipitation and **snow water equivalent** data show that the northern portion of the West had above average precipitation during April, which improved water year totals. Although isolated dry areas persist, most of the northern half of the West had near average seasonal precipitation. Most of the southern half of the West has experienced above average seasonal precipitation. Isolated cases of dryness persist—the Humboldt River basin of Nevada had a below average snowpack after several years of drought. The Flathead and Bitterroot River basins of Montana and the Yakima River Basin of Washington (Pacific Northwest Region) had below average seasonal precipitation. The Sun and Milk River basins of Montana remain quite dry.

Accumulated inflow data continue to show that the northern half of the West has experienced below average runoff for the water year. This reflects the dry conditions in many areas in 1992. This also reflects dry conditions in a band across the northern part of the West through the winter. However, a number of reservoirs in this region should improve as snowpacks melt. In warmer parts of the West, melting has begun or even finished, and reservoir inflow data reflects this as well as seasonal precipitation. During March, inflow was heavy in southern Idaho, eastern and central Oregon (Pacific Northwest Region), the Central Valley Project

(Mid-Pacific Region), Kansas and Nebraska (Great Plains Region), Arizona (Lower Colorado Region), New Mexico (Upper Colorado Region), and other isolated areas.

Reservoir storage conditions, shown on the figure 2 color map, improved again during April with additional precipitation and the start of snowmelt. In general, reservoirs in the southern half of the West have good to excellent storage and the northern half are near average. Snowmelt has not peaked in most areas and reservoirs have not yet refilled. The northern half of the West also improved, (e.g., storage in Columbia River basin improved 137 percent). However, Flathead Lake, on an upper tributary of the Columbia River in Montana (Pacific Northwest Region), only improved by 14 percent to have 28 percent of average storage. In addition to Flathead Lake, a few other areas remain critically low in storage—Rye Patch Reservoir in Nevada (Mid-Pacific Region) is only at 29 percent of average, Pathfinder Dam in Wyoming (Great Plains Region) is at 32 percent of average, Keyhole Reservoir in Wyoming (Great Plains Region) is at 37 percent of average, and Jamestown Reservoir in North Dakota (Great Plains Region) is at 58 percent of average. On the other side of the coin, some reservoirs have been drawn down in anticipation of a large runoff—for instance, Blue Mesa Reservoir on the Gunnison River in Colorado (Upper Colorado Region).

Streamflow forecasts, as shown on figure 3 and in table 2, predict that runoff in 1993 will be from near average to much above average in most of the West. If melting occurs rapidly, some areas may experience flooding during 1993. Forecasts for the Central Valley Project in California (Mid-Pacific Region) range from 121 to 151 percent of average. Inflow to Elephant Butte Reservoir on the Rio Grande (Upper Colorado Region) is predicted to be 169 percent of average. The forecast is for 150 percent of average for the Colorado River basin in Colorado (Upper Colorado Region), and some areas could experienced flooding. Areas with alarmingly low forecasts are the Yakima River basin (Pacific Northwest Region) at 61 percent of average and the Flathead River (Pacific Northwest Region) at 75 percent. These figures are troubling because they follow previously dry seasons.

The water supply situation in most of the West in 1993 is optimistic. This is the last long-term forecast (seasonal volume estimation) of the season. Although additional precipitation will affect the final water supply, the May 1 snowpack is the dominant factor in the May 1 forecast. Additional perspectives on these indicators are shown in figures 4-29 in the regional summaries found later in this report.

Reclamation works with the National Weather Service, the Corps of Engineers, and other agencies to provide the most up-to-date streamflow forecasts (short-term flow rate estimates).

PALMER DROUGHT SEVERITY INDEX

The Palmer Drought Severity Index (PDSI) is a measurement tool for relative dryness or wetness, indicating prolonged and abnormal deficiencies or excesses of soil moisture. PDSI calculations are made from such indices as weekly precipitation totals, weekly average temperatures, moisture content of the soil, evapotranspiration rates, and previous indexes. The PDSI is based upon a scale of relative values, with values greater than +4 and less than -4 representing extreme conditions.

The PDSI is an important climatological tool for evaluating the scope, severity, and frequency of prolonged periods of abnormally dry or wet weather. The index does not consider availability of snowmelt runoff, reservoir storage, or the availability of ground-water resources which can significantly influence current water supply conditions and projections for a given area. However, the PDSI can provide important information about the following questions: Will irrigated crops require more than the usual amount of water? Will precipitation run off into water channels or be absorbed into the soil? What is the degree of fire danger?

The following map (figure 1) shows the PDSI for each climate division as reported by the Climate Analysis Center of the National Weather Service on May 1, 1993.

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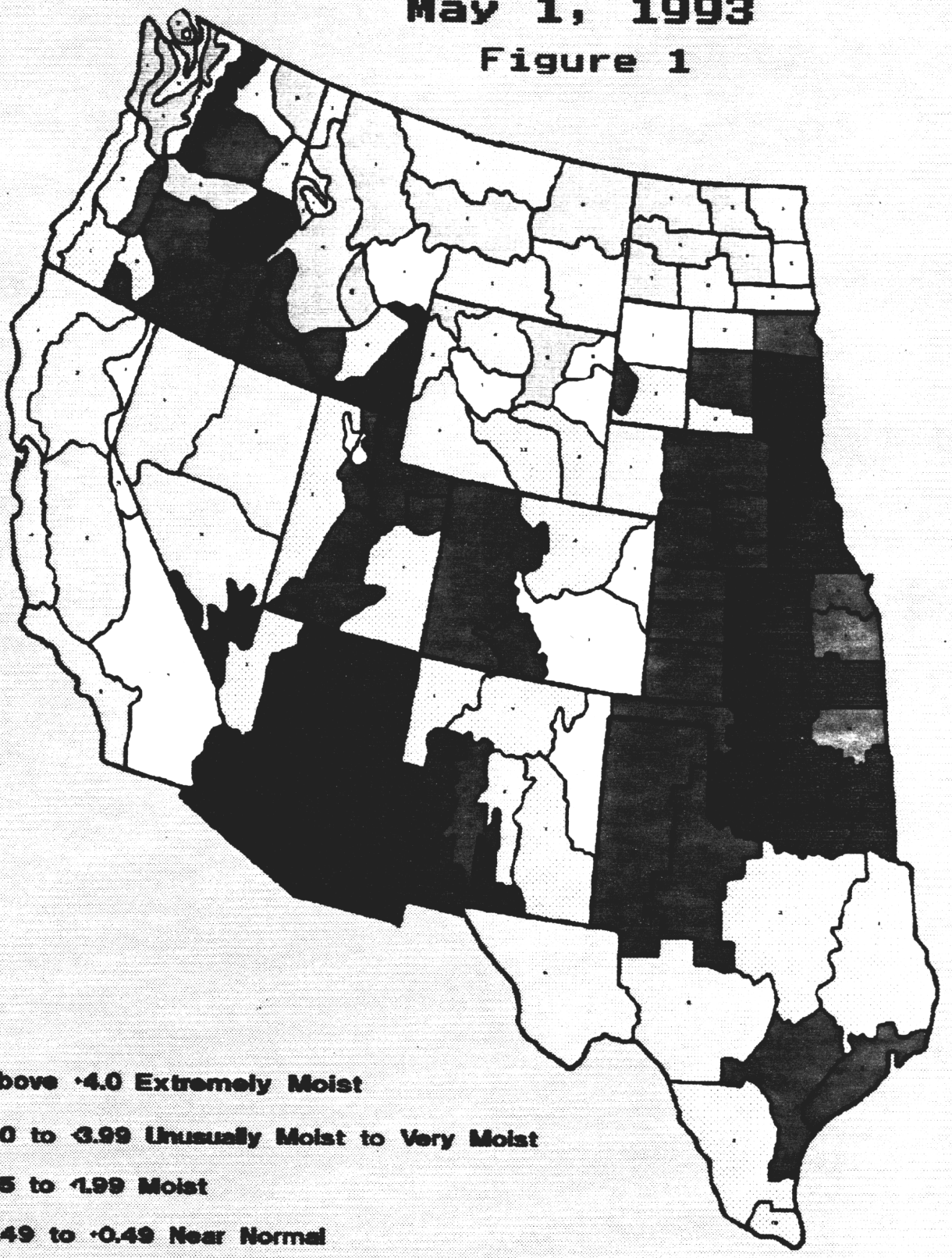
PALMER DROUGHT SEVERITY INDEX RATINGS

May 1, 1993

Figure 1



- Above +4.0 Extremely Moist
- +2.0 to +3.99 Unusually Moist to Very Moist
- +0.5 to +1.99 Moist
- -0.49 to +0.49 Near Normal
- -0.5 to -1.99 Mild Drought
- -2.0 to -3.99 Moderate to Severe Drought
- Below -4.0 Extreme Drought

Data Provided by :
Climate Analysis Center
National Weather Service
Some Data are Preliminary

RESERVOIR STORAGE

Reservoir storage, for many projects, is the key to an adequate water supply. The central task of Reclamation's reservoirs is to capture the spring runoff for release during the dry season. But, even under the best of conditions, many factors must be considered to balance reservoir storage with downstream water uses.

Many Reclamation reservoirs were authorized by the Congress to meet multiple water uses, and the requirements for each water use are balanced under the reservoir's operating plan. As pertinent, the operating plans answer the following questions: If carryover levels are high, how much reservoir drawdown will be required in the winter to capture possible spring floods? How much water will be needed to provide for irrigation and for municipal and industrial water use? How much water needs to be released into streamflow to meet the requirements for fish and wildlife, water quality, and rafting? How much water will be released and at what rate to generate needed hydroelectricity? How will release requirements be balanced with the reservoir water levels needed for recreation? How does the volume of water released from the reservoir compare to the volume of water flowing into it? If the winter snowpack is low, will there be enough water left in the reservoir pool at the end of the summer season to provide for next year's water requirements?

Table 1 and the following map (figure 2) show reservoir storage conditions as of April 30, 1993, in most of the river basins where Reclamation has reservoirs. The numbered basins on the table provide a key to the numbered basins on the map. Additional information on reservoir storage is provided in the regional summaries found later in this report.

Table 1.—Bureau of Reclamation reservoir storage
(April 30, 1993)

River basin number	Region/selected river basin[1]	End-of-month storage	Percent of average
	Pacific Northwest Region		
1	Flathead	454	28
2	Yakima	508	67
3	Columbia	5,581	299
4	Upper Snake	2,580	84
5	Boise	678	84
6	Payette	473	98
7	Owyhee	752	115
8	Malheur	270	122
9	Umatilla	101	95
10	Deschutes	399	83
11	Rogue	84	70
12	Tualatin	54	104
	Mid-Pacific Region		
13	Upper Sacramento	4,263	123
14	Trinity	1,393	80
15	Feather	3,274	119
16	American	861	117
17	San Joaquin	365	105
18	Stanislaus	582	48
37	Klamath	788	95
38	Humboldt	25	29
39	Truckee[2]	168	99
40	Carson	170	88
41	Santa Ynez	191	133
42	Ventura	255	120
	Lower Colorado Region		
19	Lower Colorado	24,064	[3]85

See footnotes at end of table.

Table 1.—Bureau of Reclamation reservoir storage—Continued
(April 30, 1991)

River basins number	Region/selected river basin[1]	End-of-month storage	Percent of average
	Upper Colorado Region		
21	Rio Grande	2,336	[3]88
28	Upper Green[4]	3,116	[3]83
29	Gunnison[5]	413	[3]50
30	San Juan[6]	1,417	[3]84
36	Upper Colorado[7]	14,160	[3]58
	Great Plains Region		
22	Upper Missouri	2,419	100
23	Bighorn	1,786	103
24	North Platte	1,082	63
25	Cheyenne	298	76
26	South Platte[8]	550	94
27	Arkansas[9]	391	92
43	Republican	599	100
44	Solomon	379	133
45	Niobrara	92	102
46	Lower Platte	179	108
47	Washita	256	129

[1] Storage is expressed in thousands of acre-feet of water. One acre-foot is equivalent to about 326,000 gallons. The percent of average storage refers to the average storage on that date over a historic period of record which varies by reservoir.
[2] Truckee River basin excludes Lake Tahoe.
[3] Percent of storage capacity rather than percent of average storage.
[4] Flaming Gorge Dam storage water.
[5] Blue Mesa Dam storage water.
[6] Navajo Reservoir storage water.
[7] Lake Powell storage only.
[8] Includes Colorado River storage water for the Colorado-Big Thompson Project.
[9] Includes Fryingpan-Arkansas Project storage water.

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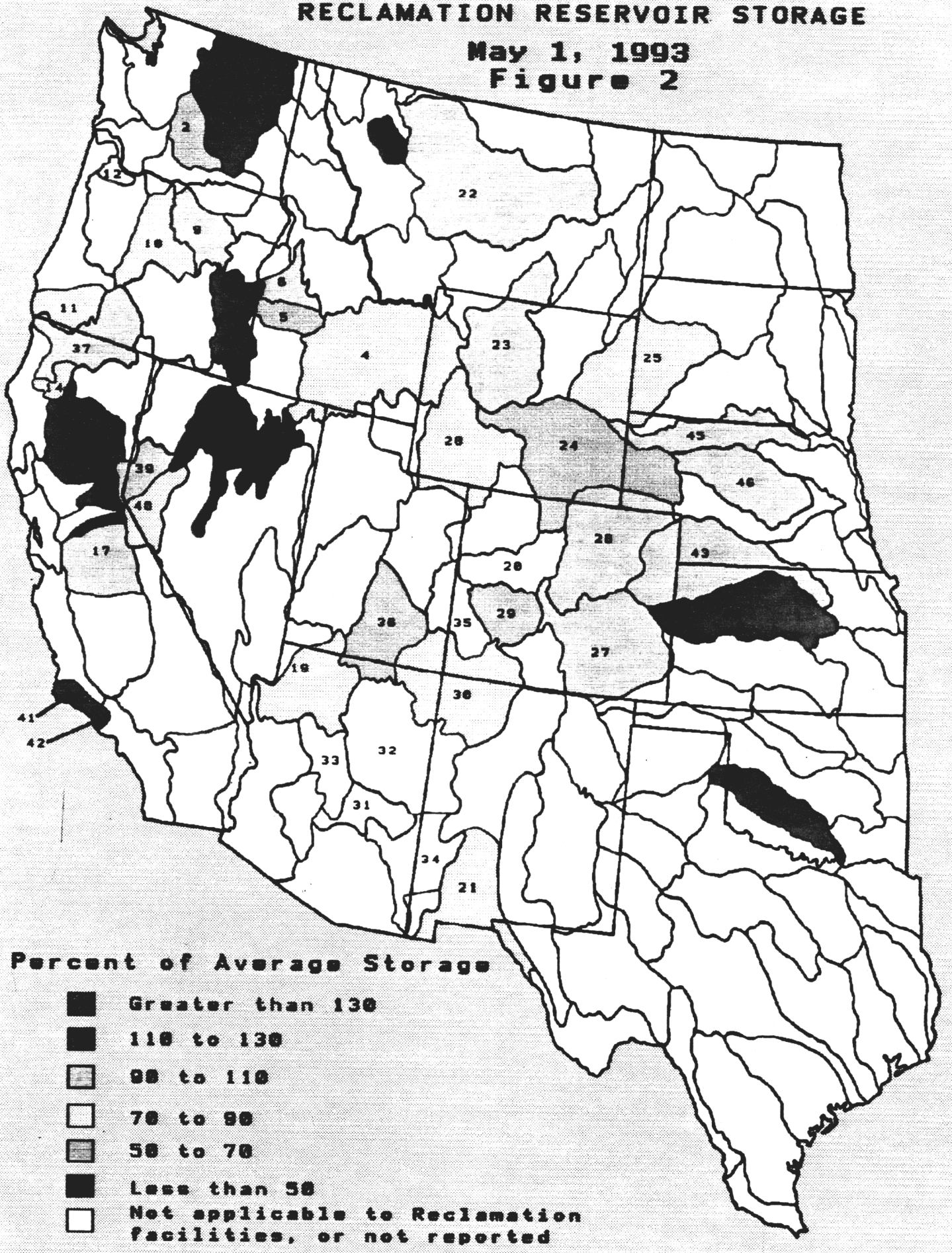
RECLAMATION RESERVOIR STORAGE

May 1, 1993
Figure 2



Percent of Average Storage

- Greater than 130
- 110 to 130
- 90 to 110
- 70 to 90
- 50 to 70
- Less than 50
- Not applicable to Reclamation facilities, or not reported

NOTE: Selected River Basins.

STREAMFLOW FORECASTS

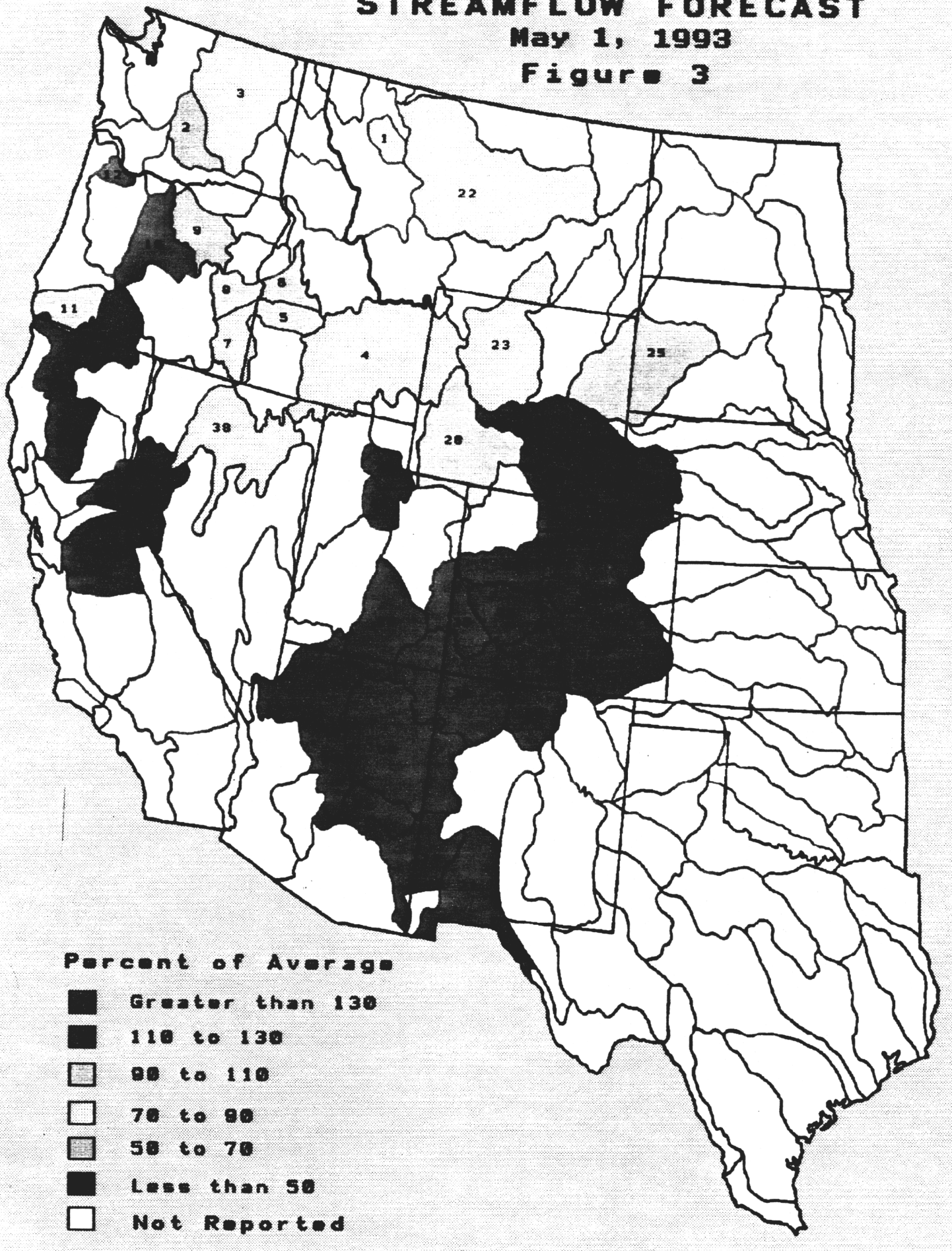
Streamflow forecast data are prepared in most areas by the Soil Conservation Service and the National Weather Service. Forecasts are important to reservoir operators because they provide an indicator of reservoir inflow to be used in determining how the spring runoff is likely to occur and how reservoirs should be operated. Forecast data are compiled as of the first day of each month during the late winter and spring months. Table 2 and the following map (figure 3) summarize the streamflow forecast information for selected river basins. The map is generated with data from table 2 and supplemented with data from the Soil Conservation Service and the National Weather Service. It shows forecasts as of May 1, 1993. Also, graphs displaying streamflow forecast information are included with the regional summaries found later in this report.

Table 2.—Streamflow forecasts
(May 1, 1993)

River basin number	Region/selected river basin[1]	Forecast period	Forecast 1,000 acre-feet	Forecast Percent of average
	Pacific Northwest Region			
1	Flathead River (Hungry Horse)	May-Sept.	1,426	75
2	Yakima River	May-July	903	61
4	Upper Snake River	May-July	2,620	85
5	Boise River (Lucky Peak)	May-July	1,257	107
6	Payette River	May-July	1,352	96
	Mid-Pacific Region			
13	Upper Sacramento River	Oct.-Sept.	6,600	121
14	Trinity River	Oct.-Sept.	1,470	122
16	American River	Oct.-Sept.	3,500	132
17	San Joaquin River	Oct.-Sept.	2,650	151
18	Stanislaus River	Oct.-Sept.	1,690	148
37	Klamath River	May-Sept.	420	125
38	Humboldt River	May-July	106	82
39	Truckee River	May-July	252	130
40	Carson River	May-July	52	124
	Lower Colorado Region			
36	Inflow to Lake Powell	April-July	11,000	136
	Upper Colorado Region			
28	Green River (Flaming Gorge)	April-July	1,150	91
29	Gunnison River (Blue Mesa)	April-July	1,020	146
30	San Juan River (Navajo)	April-July	1,080	141
36	Inflow to Lake Powell	April-July	11,000	136
48	Provo River (Deer Creek)	April-July	153	120
49	Weber River (Pine View)	April-July	136	110
50	Rio Grande at Otowi Bridge	Mar.-July	1,020	149
21	Inflow to Elephant Butte	Mar.-July	845	169
	Great Plains Region			
22	Upper Missouri River	May-Sept.	3,100	85
23	Big Horn River	May-Sept.	920	89
24	North Platte River (Seminoe Reservoir inflow)	April-July	925	121
26	Colorado-Big Thompson Project (Lake Granby inflow)	April-July	259	130
27	Fryingpan-Arkansas Project (Pueblo Reservoir inflow)	April-Sept.	370	131

[1] When the forecast corresponds to a reservoir, the reservoir name is provided in parentheses.

STREAMFLOW FORECAST
May 1, 1993
Figure 3



PACIFIC NORTHWEST REGION

General Summary

April brought record precipitation to several areas, more than making up for the winter's meager precipitation. Heavy rains caused flooding in the Weiser River near Weiser, Idaho.

Water Supply Outlook

Boise River Basin

Total end-of-April storage in the Boise River basin of southwest Idaho (including Lake Lowell) was 676,500 acre-feet, 59 percent of capacity, or 84 percent of average. April precipitation in the watershed was about 200 percent of average, bringing the total precipitation from October through April to 124 percent of average. First of May snowpack in the basin was 120 percent of average. Reclamation predicts that the May through July runoff above Lucky Peak will be 1.26 million acre-feet, or 108 percent of average, assuming that average precipitation continues through June. Reclamation expects the three upper system reservoirs (Anderson Ranch, Arrowrock, and Lucky Peak) to fill completely this season. To maintain space in the reservoirs for flood protection for the Boise Valley, Reclamation began releasing water in late April. We are watching the storage and inflows closely and may need to adjust releases during May and June.

Payette River Basin

The combined active storage in Cascade and Deadwood Reservoirs in the Payette River basin at the end of April was 473,490 acre-feet, 58 percent of capacity, or 98 percent of average. April precipitation was about 230 percent of average, and first of May snowpack in the watershed was 112 percent of average. Reclamation predicts May through July runoff will be 1.35 million acre-feet at Horseshoe Bend (103 percent of average), assuming average precipitation through June. We presently estimate that the storage system will fill this season.

Eastern Oregon

After very large March inflows, Owyhee Reservoir in eastern Oregon filled to capacity on April 6 and remained full through the month. Precipitation in the upper watershed was about 170 percent of average during April. All three reservoirs in the Malheur basin should fill this year (Bully Creek and Agency Valley Reservoirs are already full), and Reclamation's Vale Project

should receive an average water supply. Other full reservoirs in eastern Oregon include McKay in the Umatilla basin, Unity in the Burnt River basin, and Thief Valley in the Powder River basin.

Crooked River Basin

End-of-April storage in the Crooked River basin of central Oregon was 99 percent of capacity. Both the Ochoco[1] and Prineville reservoirs filled during March from above average precipitation and runoff from the low-elevation snowpack. Flood control operations continued into April with nearly bank-full releases from both reservoirs. The release from Bowman Dam was reduced late in April as the inflows receded.

Upper Snake River Basin

Total end-of-April storage in eight upper Snake River basin reservoirs was 63 percent of capacity, or 84 percent of average. Precipitation in the upper Snake watershed during April was 145 percent of average, bringing the October-April seasonal precipitation to 103 percent of average. First of May snowpack in the upper basin was also 103 percent of average. Reclamation predicts that May through July runoff of the Snake River at Heise will be 2.62 million acre-feet, 85 percent of average, assuming average precipitation through June. The continued wet weather has resulted in more snowpack accumulation and delayed irrigation demand, indicating an improved water supply outlook compared with earlier projections. Generally, the irrigation supply should be adequate this year.

Yakima River Basin

Total end-of-April storage in the Yakima River basin of central Washington was 48 percent of capacity, or 67 percent of average. Although April precipitation in the upper watershed was 152 percent of average, the October-April precipitation is still only 72 percent of average. Assuming average precipitation for the rest of the season, Reclamation predicts that May-July runoff will be 65 percent of average for the Yakima River near Parker. Water deliveries to junior "proratable" right holders, which account for roughly half of the project rights, will be reduced. Reclamation now estimates that those users will receive about 60 percent of their full entitlement.

[1] Ochoco filled to its restricted capacity.

Table 3.– Pacific Northwest Region reservoir storage
(April 30, 1993)

Reservoir name	Capacity	End-of-month storage	Average storage	Percent of average
	(Unit: 1,000 acre-feet)			
Flathead River basin				
Hungry Horse	2,981	454	1,596	28
Yakima River basin				
Cle Elum Lake	437	176	296	59
Kachess Lake	239	109	194	56
Keechelus Lake	158	97	114	85
Tieton Dam & Rimrock	198	103	137	75
Bumping Lake	34	23	12	192
Total	1,065	508	753	67
Columbia River basin				
Grand Coulee	5,185	4,617	1,109	416
Banks Lake	715	648	498	130
Sullivan Dam	332	316	261	121
Total	6,233	5,581	1,868	299
Okanogan River basin				
Conconully Dam	13	7	8	88
Salmon Lake Dam	11	8	9	89
Total	24	15	17	88
Upper Snake River basin				
Jackson Lake	847	203	456	45
Palisades Reservoir	1,200	498	750	66
Island Park	135	103	126	82
Grassy Lake	15	14	12	117
Ririe	81	39	53	74
American Falls	1,673	1,613	1,546	104
Minidoka Dam	95	84	94	89
Little Wood	30	26	25	104
Total	4,076	2,580	3,062	84
Boise River basin				
Anderson Ranch	423	91	286	32
Arrowrock Reservoir	287	258	204	126
Lucky Peak	264	218	164	133
Lake Lowell	169	111	151	74
Total	1,143	678	805	84

Table 3.—Pacific Northwest Region reservoir storage -- Continued
(April 30, 1993)

Reservoir name	Capacity	End-of-month storage	Average storage	Percent of average
	(Unit: 1,000 acre-feet)			
Payette River basin				
Cascade Reservoir	653	398	381	104
Deadwood Reservoir	162	75	103	73
Total	815	473	484	98
Weiser River basin				
Mann Dam	11	11	10	110
Owyhee River basin				
Lake Owyhee	715	716	607	118
Wildhorse	72	36	47	77
Total	787	752	654	115
Malheur River basin				
Agency Valley Dam	60	60	50	120
Bully Creek	30	31	25	124
Warm Springs	191	179	146	123
Total	281	270	221	122
Powder River basin				
Mason Dam & Phillips	74	43	59	73
Thief Valley Reservoir	17	18	17	106
Total	91	61	76	80
Burnt River basin				
Unity Reservoir	25	24	25	96
Umatilla River basin				
McKay Reservoir	68	66	59	112
Cold Springs Reservoir	45	35	47	74
Total	113	101	106	95

Table 3.—Pacific Northwest Region reservoir storage -- Continued
(April 30, 1993)

Reservoir name	Capacity	End-of-month storage	Average storage	Percent of average
	(Unit: 1,000 acre-feet)			
Deschutes River basin				
Crane Prairie Dam	55	31	44	70
Crescent Lake Dam	87	13	57	23
Wickiup Dam	200	175	190	92
Ochoco Dam	47	24	39	62
Arthur Bowman Dam	153	151	147	103
Haystack Dam	6	5	5	100
Wasco Dam	12	NA	NA	NA
Total	559	399	482	83
Rogue River basin				
Agate Dam	5	NA	NA	NA
Emigrant Dam	39	35	37	95
Fish Lake	8	4	6	67
Fourmile Lake	16	8	11	73
Howard Prairie	61	28	52	54
Hyatt Dam	16	9	14	64
Total	145	84	120	70
Tualatin River basin				
Scoggins Dam	54	54	52	104

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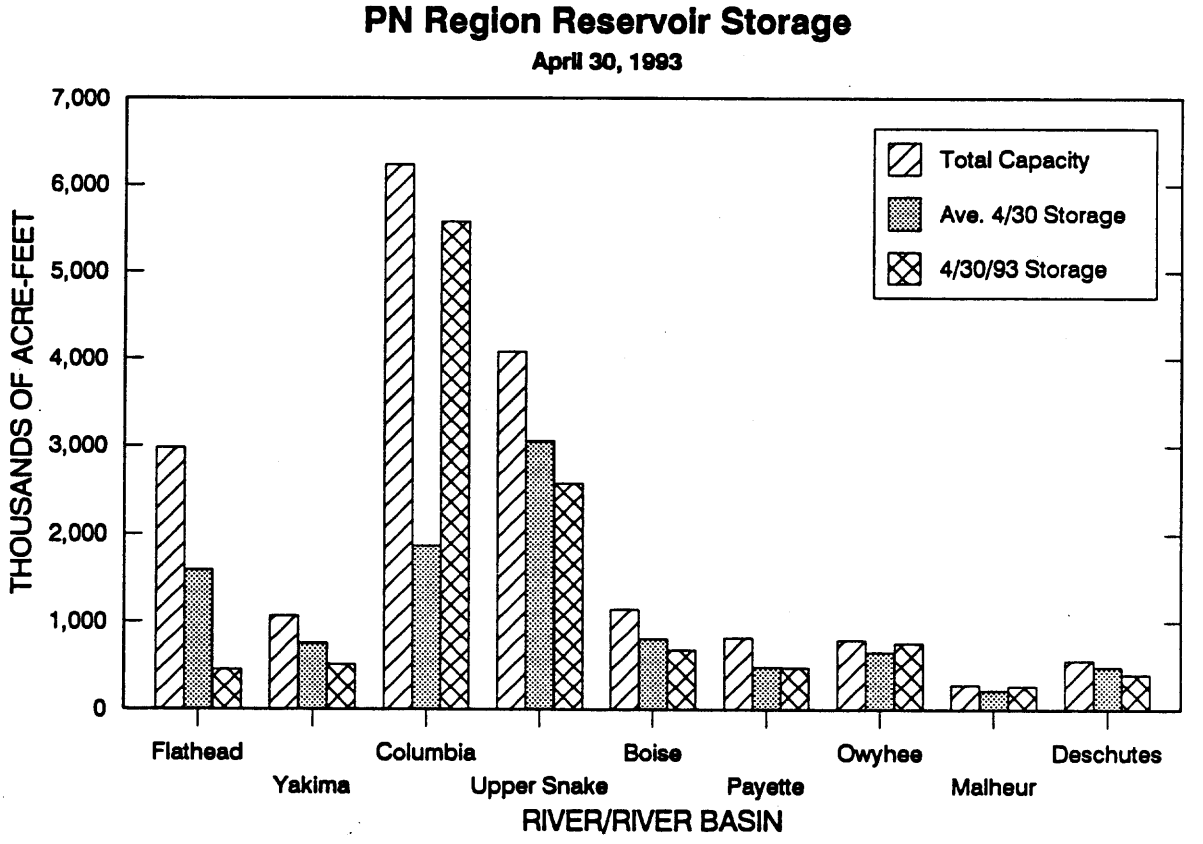
PN Region Reservoir Storage
April 30, 1993
THOUSANDS OF ACRE-FEET
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
Total Capacity
Ave. 4/30 Storage
4/30/93 Storage
Flathead
Yakima
Columbia
Upper Snake
Boise
Payette
Owyhee
Malheur
Deschutes
RIVER/RIVER BASIN

Figure 4

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PN Region May-Jul Streamflow Forecasts

May 1, 1993

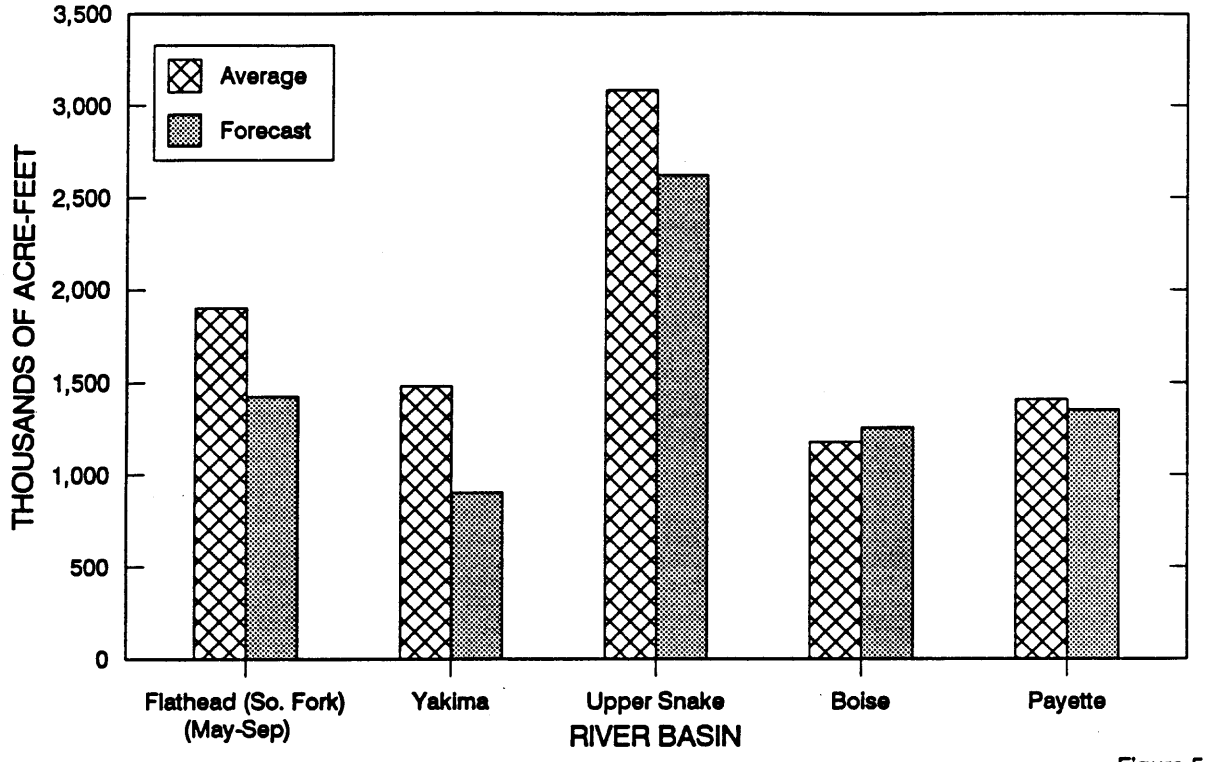

Figure 5

PN Region WY 1993 Accumulated Inflow

April 30, 1993

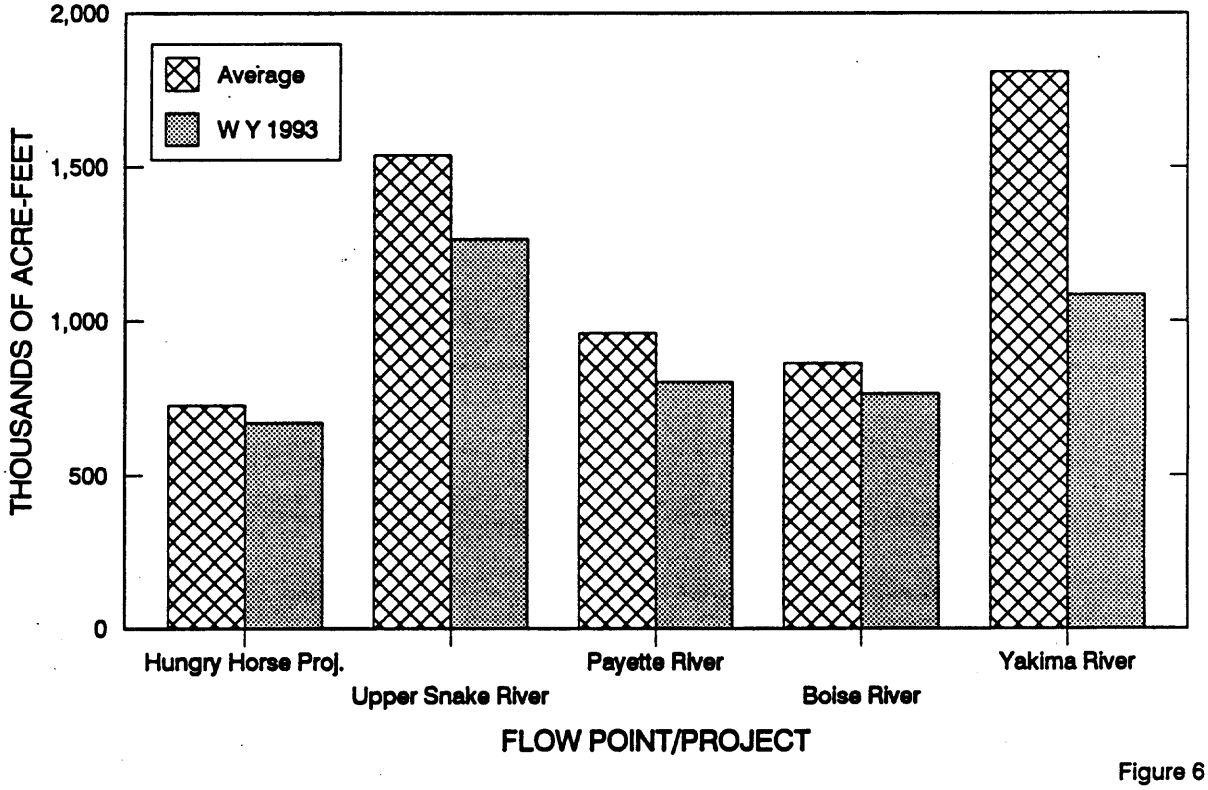

Figure 6

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PN Region WY 1993 Snow Water Equivalent

May 3, 1993

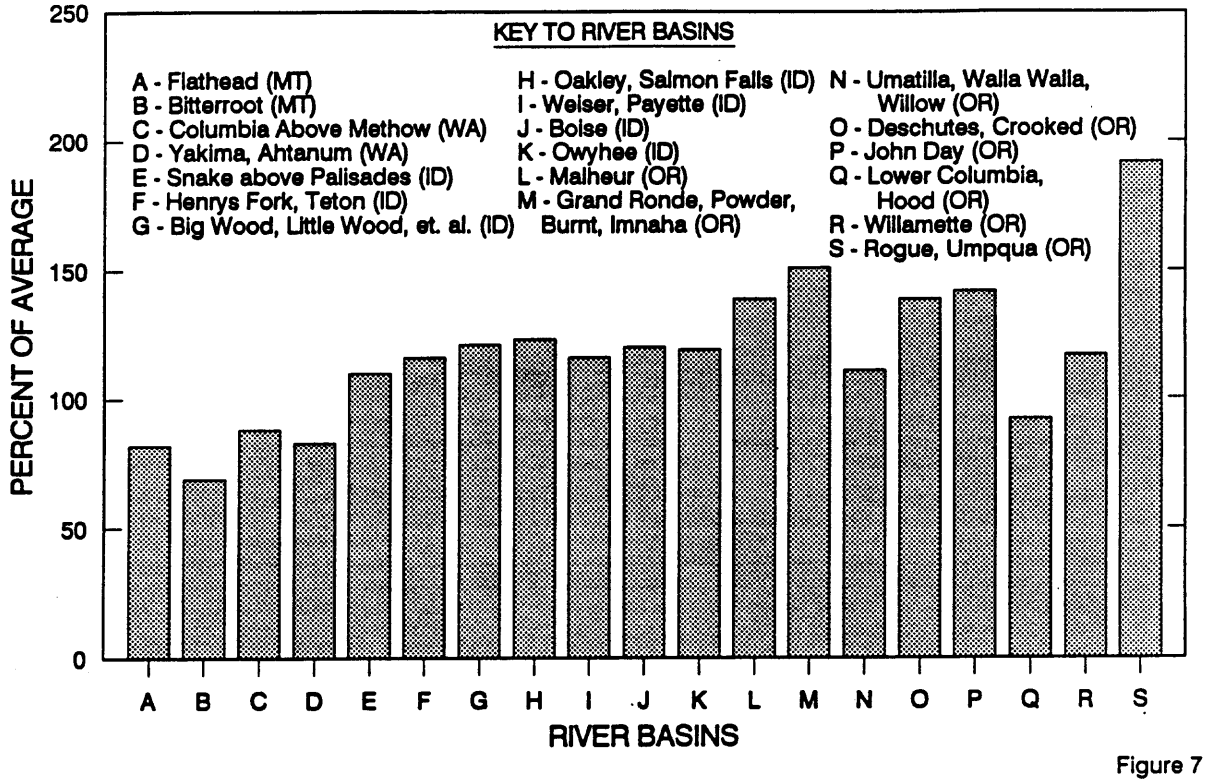

Figure 7

PN Region WY 1993 Accumulated Precipitation

May 3, 1993

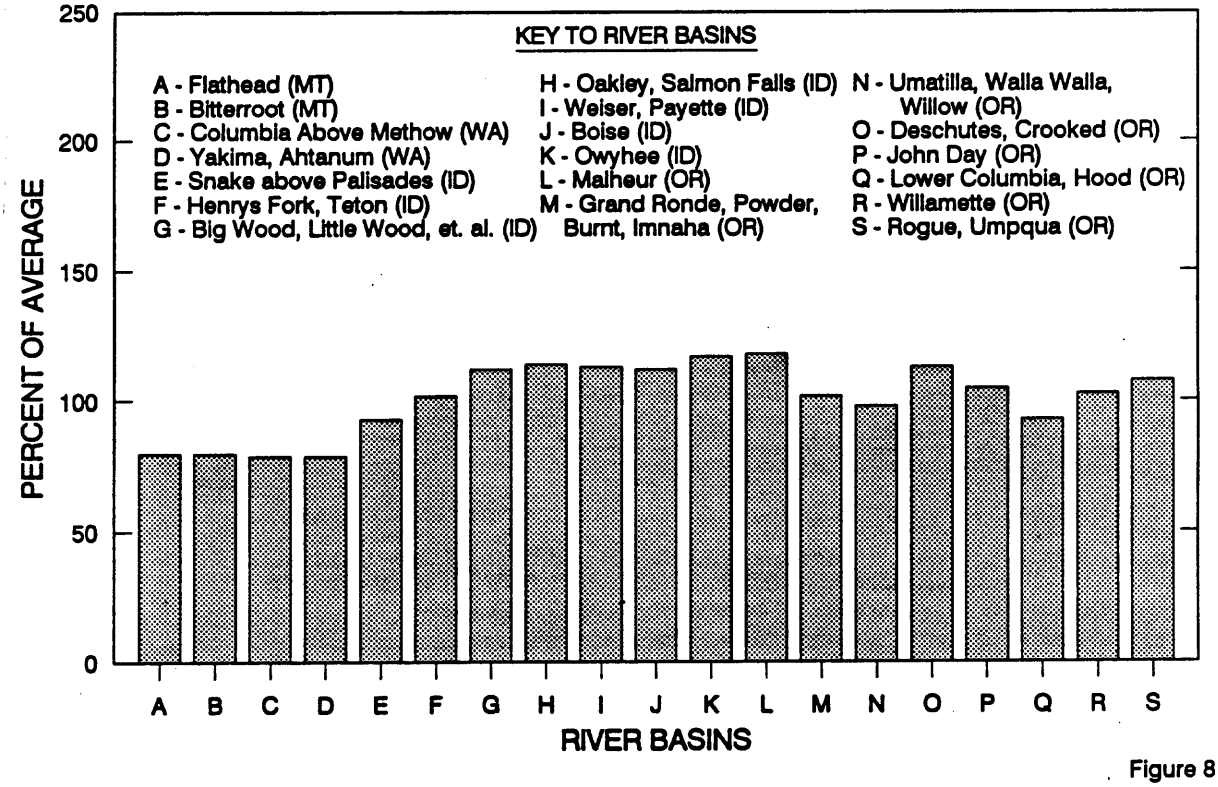

Figure 8

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MID-PACIFIC REGION

Central Valley Project

Central Valley Project end-of-April storage was 8.0 million acre-feet, compared to last year's end-of-April storage of 5.7 million acre-feet. Storage in these reservoirs is 100 percent of the 10-year average.

The Sacramento River index is predicted to be 21.4 million acre-feet with a 50-percent exceedance level.

May 1993 forecasts for runoff are:

Reservoir and basin	Runoff forecast (percent of average) (October - September)	Runoff forecast (thousands of acre-feet) (October - September)
Clair Engle (Trinity River)	122	1,470
Shasta (Sacramento River)	121	6,600
Folsom (American River)	132	3,500
New Melones (Stanislaus)	148	1,690
Millerton (San Joaquin River)	151	2,650

Other Projects

Casitas Reservoir in Ventura River basin has had 343 percent of average inflow, improving reservoir storage to 120 percent of average. No shortages are expected in other central and western California projects.

Water supply in the Klamath River basin in northern California and southwestern Oregon has improved so dramatically from last year that normal conditions are expected for 1993.

The Lahontan Reservoir in the Carson River basin in Nevada is at 87 percent of average.

Rye Patch Reservoir in the Humboldt River basin remains very low at 29 percent of average storage. Given the current forecast, this reservoir will remain very low.

Reservoirs in the Truckee River basin of Nevada and California remain below average and expect some shortages during 1993.

Table 4.—Mid-Pacific Region reservoir storage
(April 30, 1993)

Reservoir name	Capacity	End-of-month storage	Average storage	Percent of average
	(Unit: 1,000 acre-feet)			
Sacramento basin				
Shasta	4,552	4,263	3,461	123
Trinity River basin				
Clair Engle	2,448	1,393	1,752	80
Feather River basin				
Oroville (State Water Project)	3,538	3,274	2,749	119
American River basin				
Folsom	974	861	734	117
San Joaquin River basin				
Millerton	520	365	346	105
Stanislaus River basin				
New Melones	2,420	582	1,216	48
Klamath River basin				
Gerber	94	81	60	135
Clear Lake	527	207	299	69
Upper Klamath	873	500	473	106
Total	1,494	788	832	95
Carson River basin				
Lahontan	317	170	194	88
Humboldt River basin				
Rye Patch	190	25	87	29
Truckee River basin				
Boca	41	38	26	146
Prosser Creek	30	16	14	114
Stampede	227	114	130	88
Total	298	168	170	99
Putah Creek basin				
Lake Berryessa	1,602	941	1,129	83

Table 4.—Mid-Pacific Region reservoir storage -- Continued
(April 30, 1993)

Reservoir name	Capacity	End-of-month storage	Average storage	Percent of average
	(Unit: 1,000 acre-feet)			
Stony Creek basin				
Black Butte	144	137	90	152
East Park	51	51	50	102
Stony Gorge	50	49	49	100
Total	245	237	189	125
Santa Ynez River basin				
Cachuma	190	191	144	133
Ventura River basin				
Lake Casitas	252	255	212	120

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MP Region Reservoir Storage

Central Valley Project

April 30, 1993

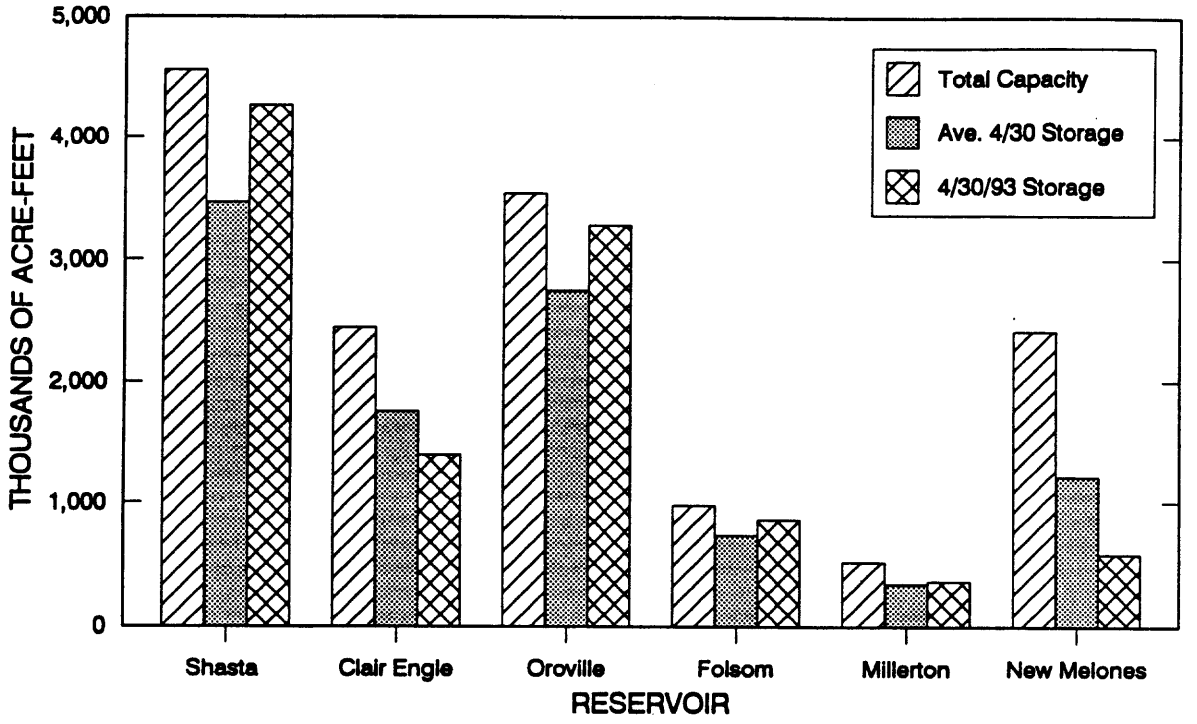

Figure 9

MP Region Reservoir Storage

Other River Basins

April 30, 1993

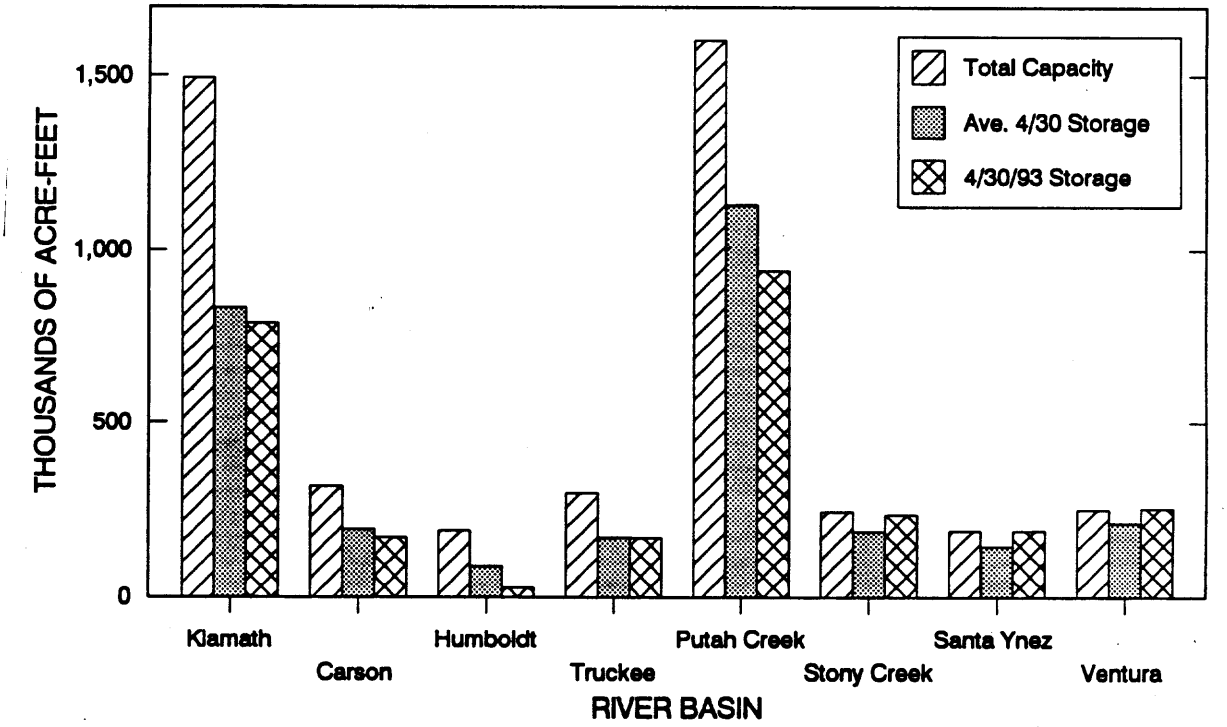

Figure 10

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MP Region Oct-Sep Streamflow Forecasts

May 1, 1993

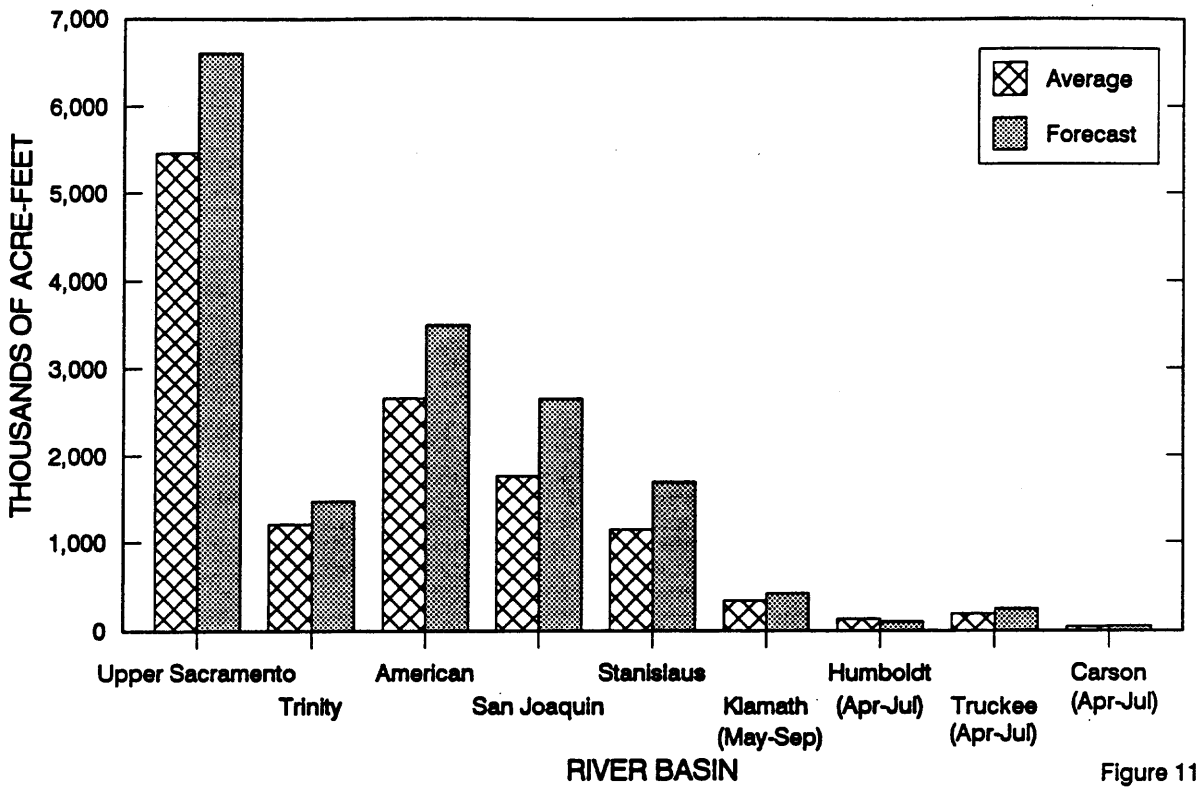

Figure 11

MP Region WY 1993 Accumulated Inflow

April 30, 1993

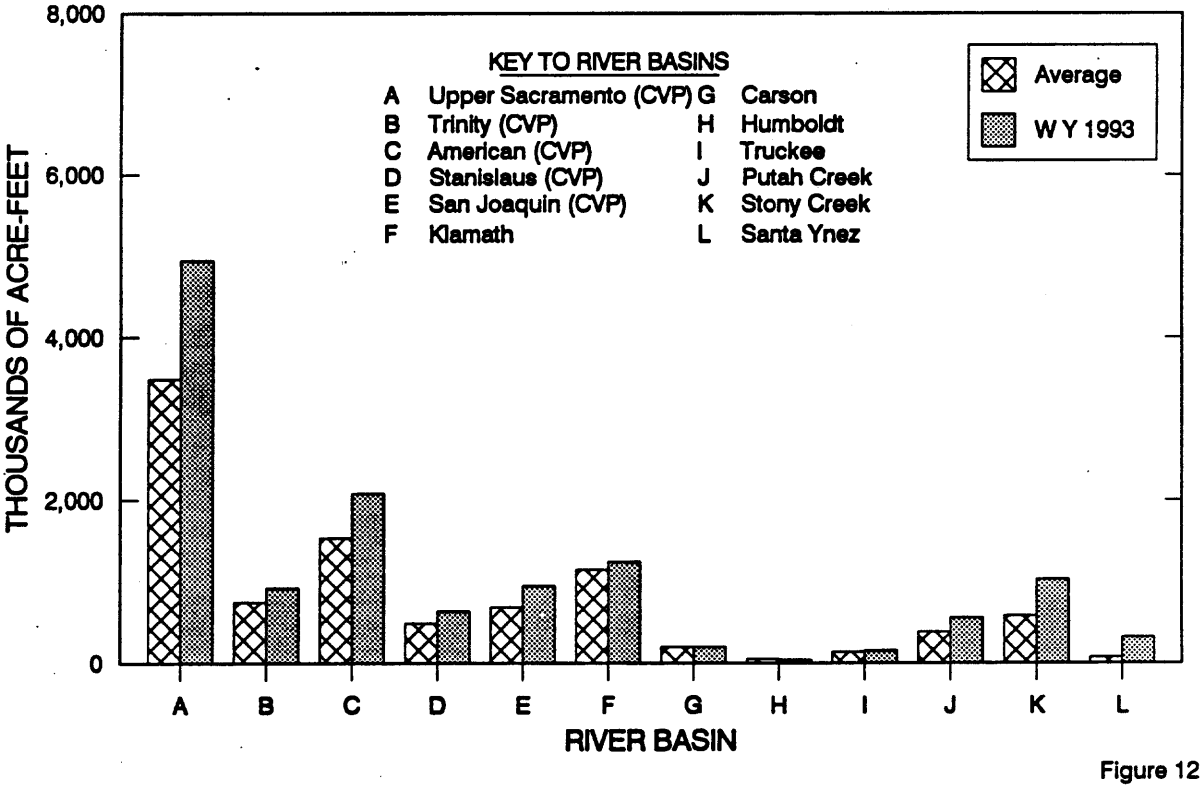

Figure 12

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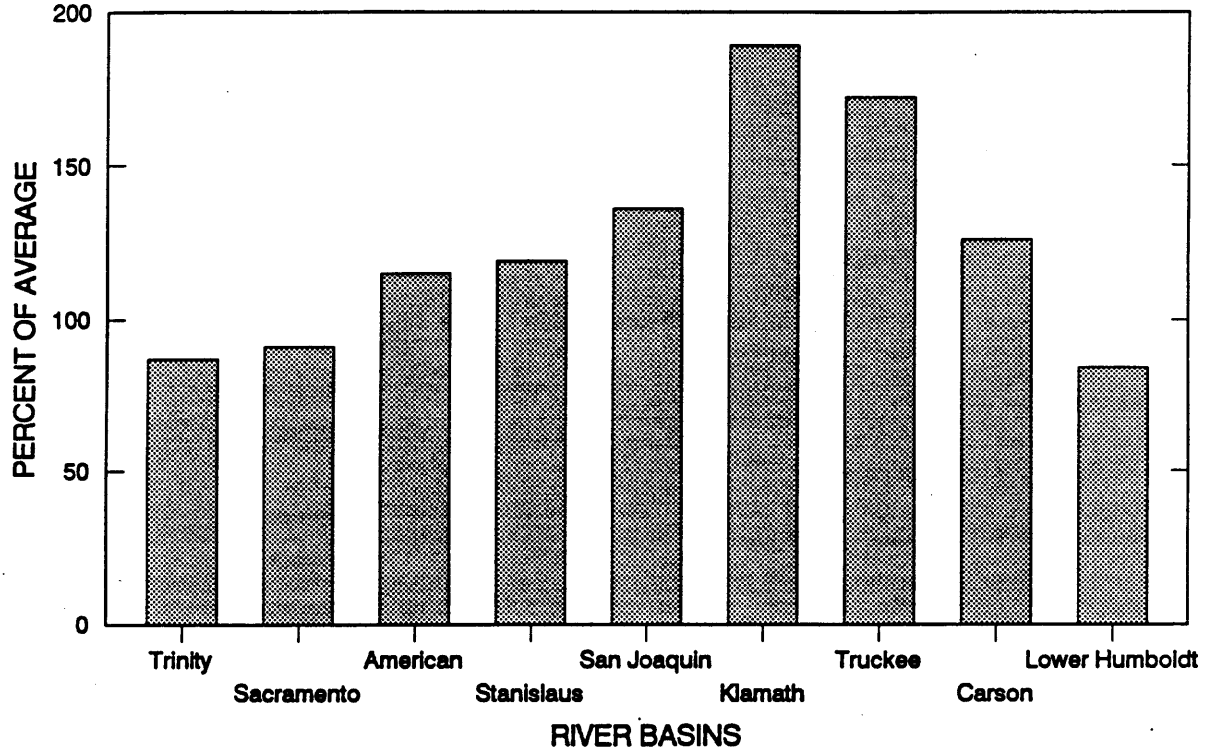
MP Region WY 1993 Snow Water Equivalent

May 3, 1993

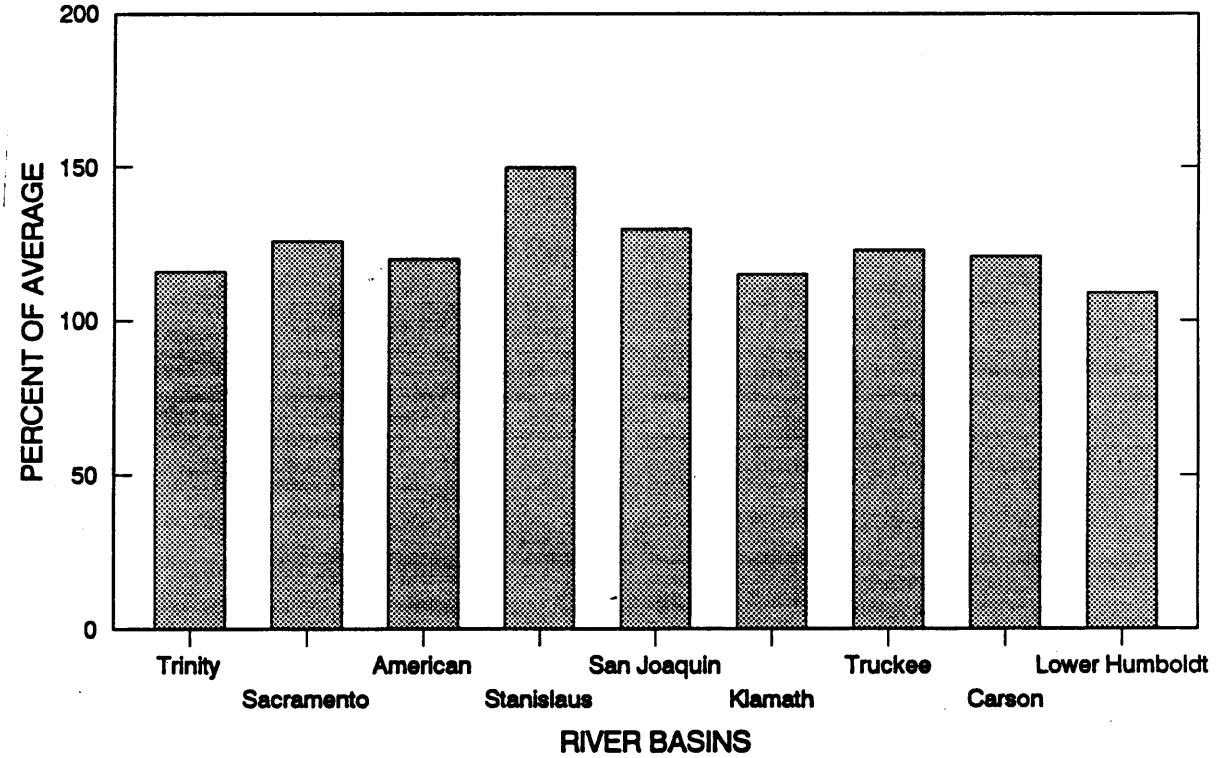


Note: Trinity, Sacramento, American, Stanislaus, and San Joaquin data as of May 1, 1993

Figure 13

MP Region WY 1993 Accumulated Precipitation

May 3, 1993



Note: Trinity, Sacramento, American, Stanislaus, and San Joaquin data as of May 1, 1993

Figure 14

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LOWER COLORADO REGION

Total end-of-April reservoir storage in the Lower Colorado River Basin mainstem reservoirs was 43.4 million acre-feet, or 73 percent of capacity.

The April 1 forecast for March-May inflow into central Arizona reservoirs was 0.58 million acre-feet, or 410 percent of median.

Releases from Painted Rock Reservoir on the Gila River continue to meet Mexico's water needs. Normal Colorado River water deliveries to Mexico are being retained in Lake Mead.

Because no rainfall fell during March, water use by agricultural districts rose to about the highest on record. The current forecast for 1993 Lower Basin water use is 7.0 million acre-feet, which falls within the compact requirement of 7.5 million acre-feet that the 1993 Colorado River Operating Plan makes available.

Table 5. —Lower Colorado Region reservoir storage
(April 30, 1993)

Reservoir name	Capacity	End-of-month storage	Average storage[1]	Percent of capacity
	(Unit: 1,000 acre-feet)			
Colorado River basin				
Lake Mead	25,877	21,922		85
Lake Mojave	1,810	1,547		85
Lake Havasu	619	595		96
Total	28,306	24,064		85

[1] The Lower Colorado Region reports storage as a percentage of capacity.

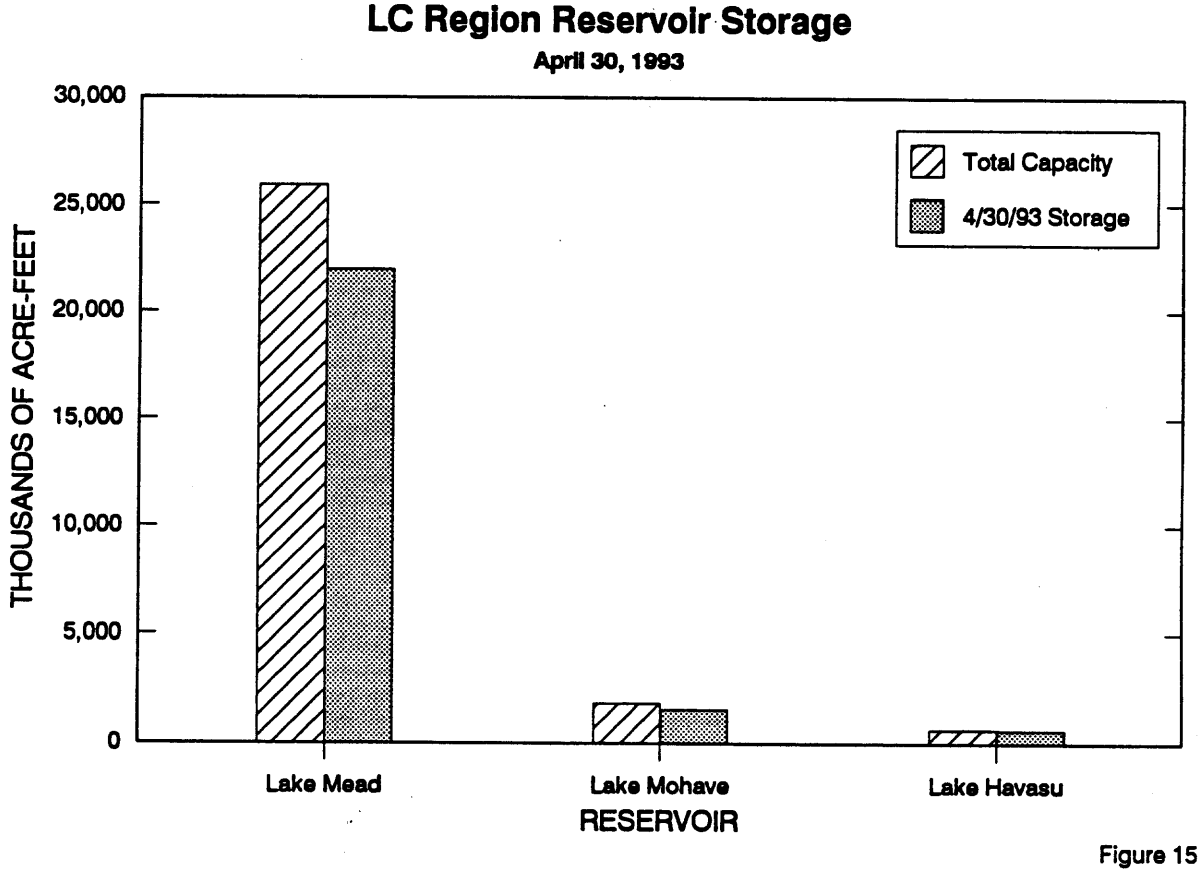
LC Region Reservoir Storage
April 30, 1993
30,000
25,000
20,000
15,000
10,000
5,000
0
THOUSANDS OF ACRE-FEET
Total Capacity
4/30/93 Storage
Lake Mead
Lake Mohave
Lake Havasu
RESERVOIR

Figure 15

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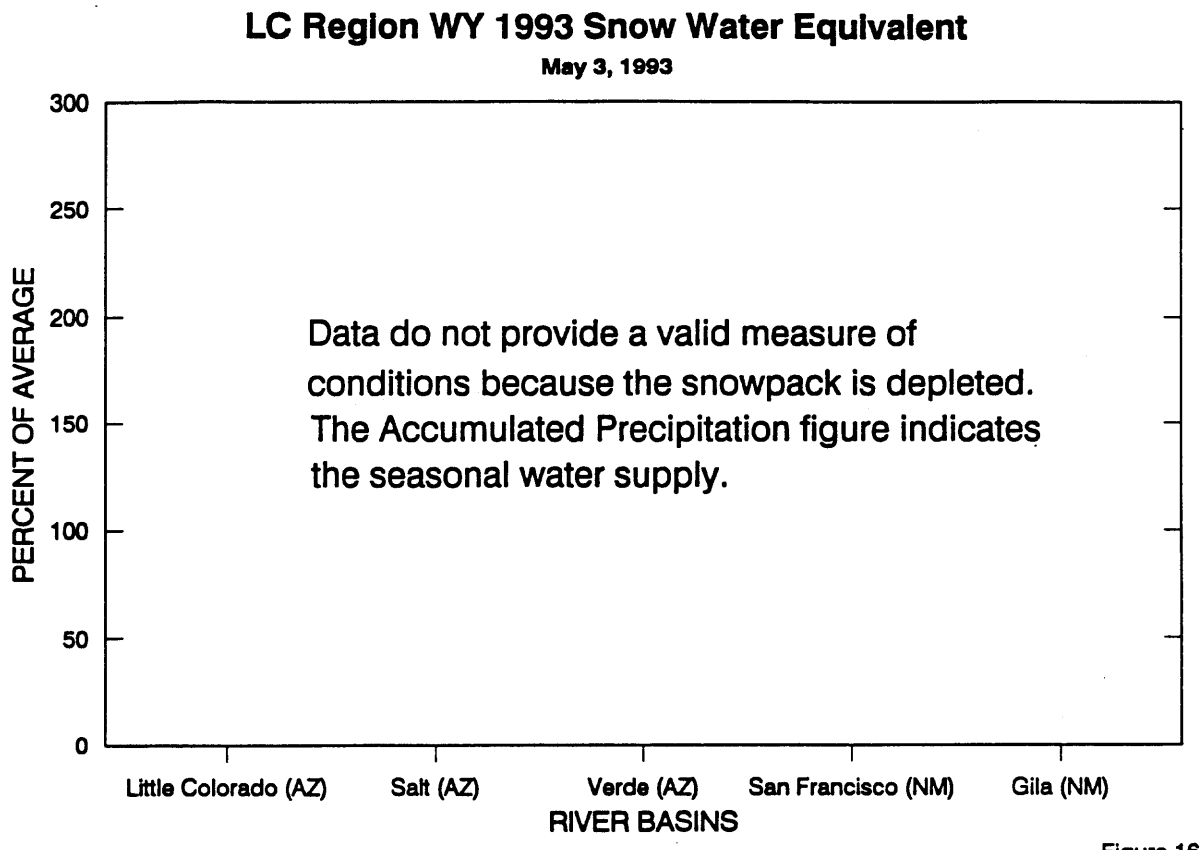

Figure 16

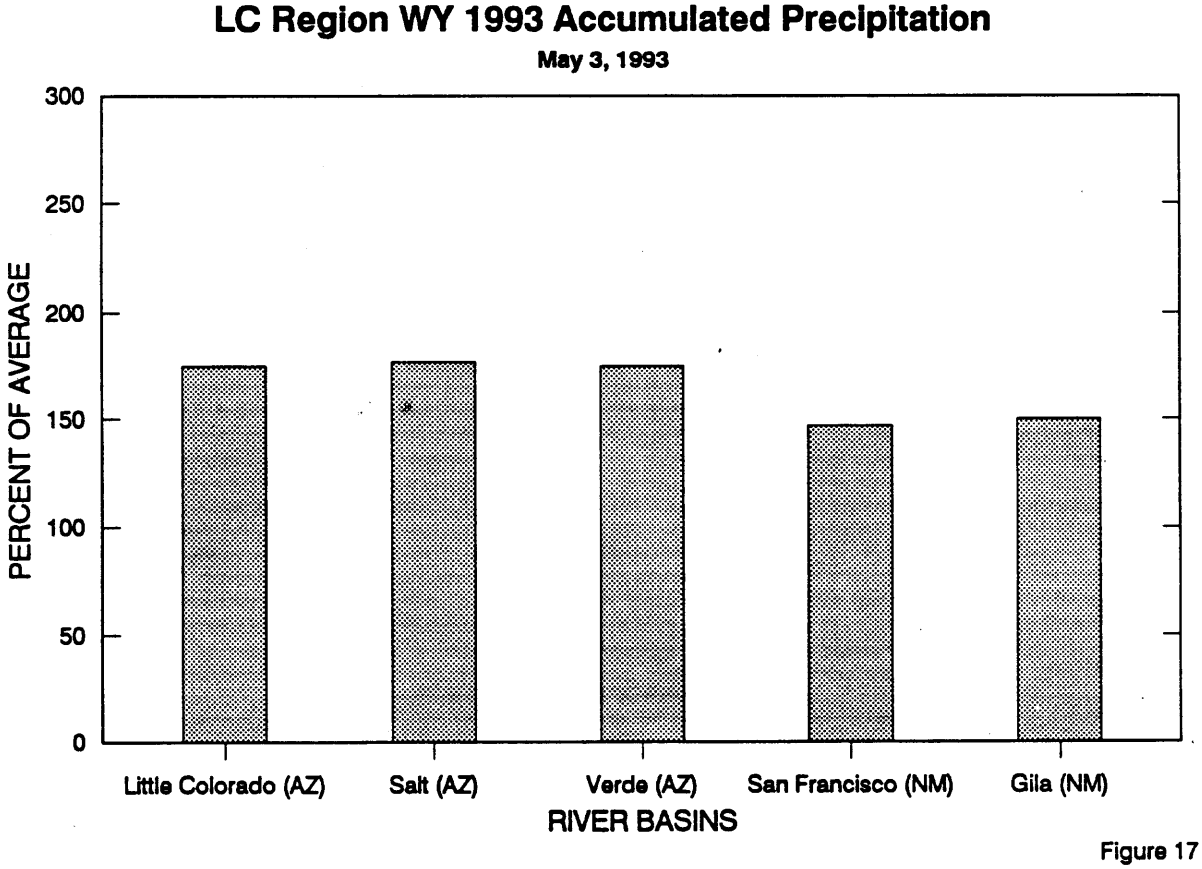

Figure 17

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UPPER COLORADO REGION

Colorado River Basin

At 95 percent of average precipitation, the Green River drainage is the lowest in the Colorado Basin. The Colorado River drainage above Cisco, Utah, is at 135 percent of average, and the San Juan basin is at 122 percent of average. The Gunnison River basin is about 126 percent of average.

Reservoir storage figures show Lake Powell at 58 percent of capacity, San Juan basin reservoirs at 58 percent of capacity, Gunnison River basin reservoirs at 50 percent of capacity, and the Green River mainstem reservoirs at 57 percent of capacity. The reservoir storage in eastern Utah ranges wildly from 19 percent at Scofield Reservoir to 92 percent of capacity at Starvation Reservoir.

Wasatch Front/Great Basin

Both the Weber-Ogden River basin and the Great Basin area have 114 percent of average precipitation. The Provo River basin has 121 percent of average precipitation.

Storage in reservoirs in the Wasatch Front ranges from 37 percent of capacity at Causey Reservoir to 77 percent at Deer Creek Reservoir. Most reservoirs are between 50 to 80 percent of capacity.

Rio Grande Basin

Rio Grande and Pecos River basins in eastern New Mexico have an excellent snowpack—over 130 percent of average.

Streamflow Forecasts

The Colorado Basin streamflow forecasts range from 90 to 192 percent of average, as does the Great Basin area of western Utah. Forecasts for major dams are:

	Streamflow forecast (thousands of acre-feet)	Streamflow forecast (percent of average)
Flaming Gorge	1,150	91
Blue Mesa	1,020	146
Navajo	1,080	141
Powell	11,000	136

Given the present forecasts, most reservoirs in the Colorado/Great Basin should fill or almost fill. Due to very low carry-over conditions in Scofield Reservoir, the Price River basin of eastern Utah faces the poorest water supply situation.

Table 6.—Upper Colorado Region reservoir storage
(April 30, 1993)

Reservoir name	Capacity	End-of-month storage	Average storage[1]	Percent of capacity
	(Unit: 1,000 acre-feet)			
Colorado River basin				
Flaming Gorge	3,749	3,116		83
Blue Mesa	830	413		50
Navajo	1,696	1,417		84
Lake Powell	24,322	14,160		58
Total	30,597	19,106		62
Wasatch Front basins				
Deer Creek	150	115		77
Pineview	110	84		76
Total	260	199		77
Rio Grande basin				
Heron Reservoir	401	319		80
El Vado	186	123		66
Elephant Butte	2,065	1,894		92
Total	2,652	2,336		88

[1] The Upper Colorado Region reports reservoir storage as a percentage of capacity.

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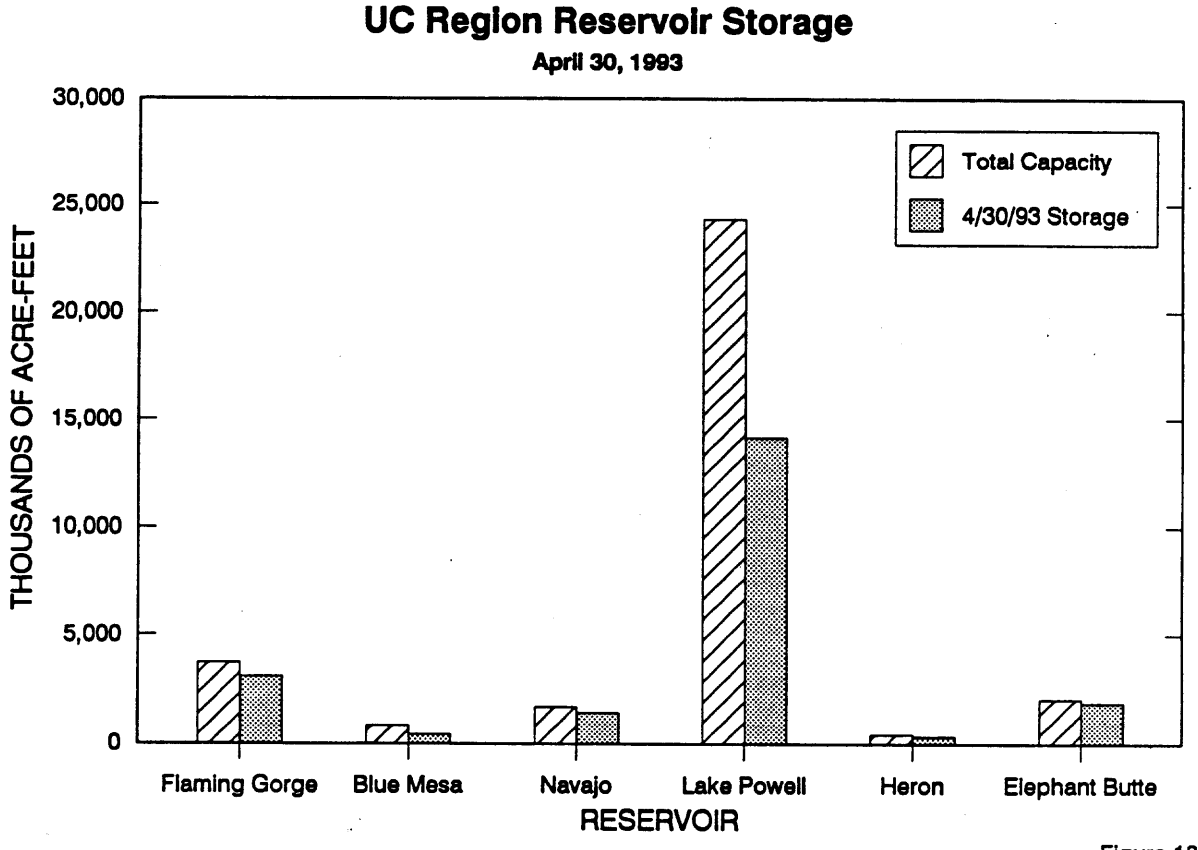
UC Region Reservoir Storage
April 30, 1993
30,000
25,000
20,000
15,000
10,000
5,000
0
THOUSANDS OF ACRE-FEET
Total Capacity
4/30/93 Storage
Flaming Gorge
Blue Mesa
Navajo
Lake Powell
Heron
Elephant Butte
RESERVOIR

Figure 18

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UC Region Apr-Jul Streamflow Forecasts

May 1, 1993

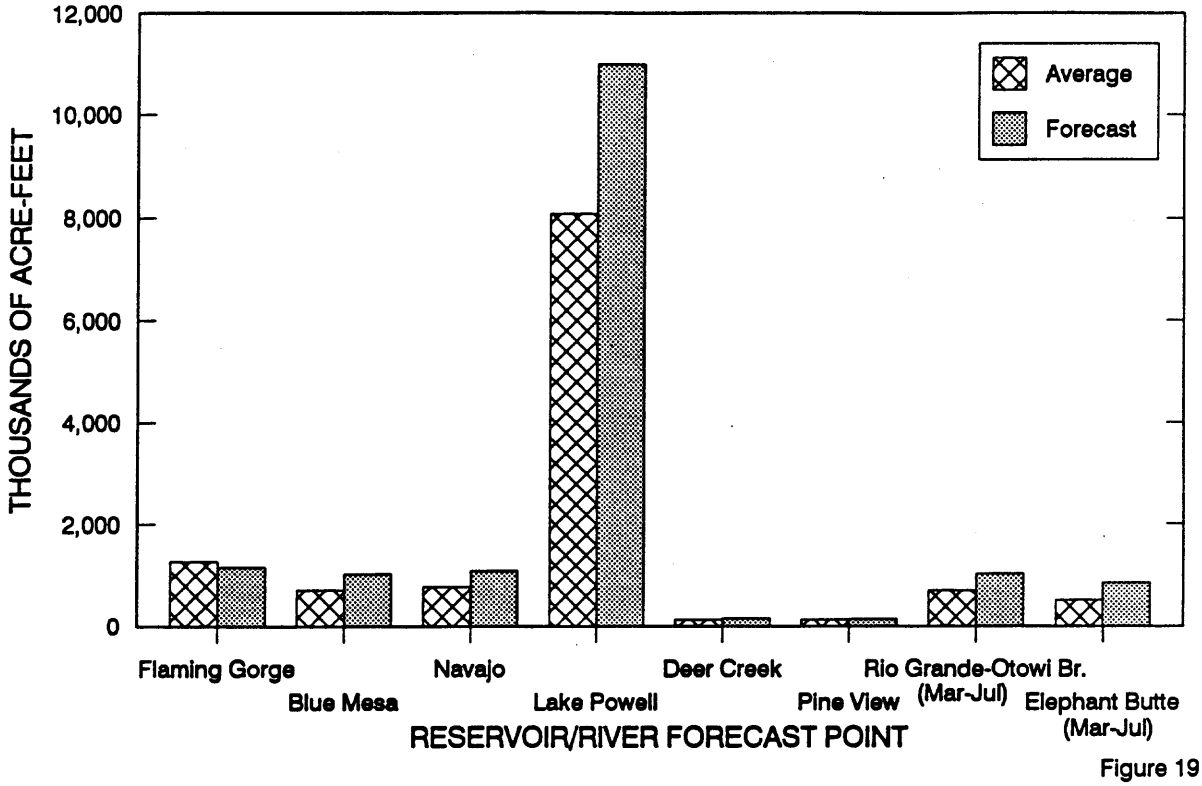

Figure 19

UC Region WY 1993 Accumulated Inflow

April 30, 1993

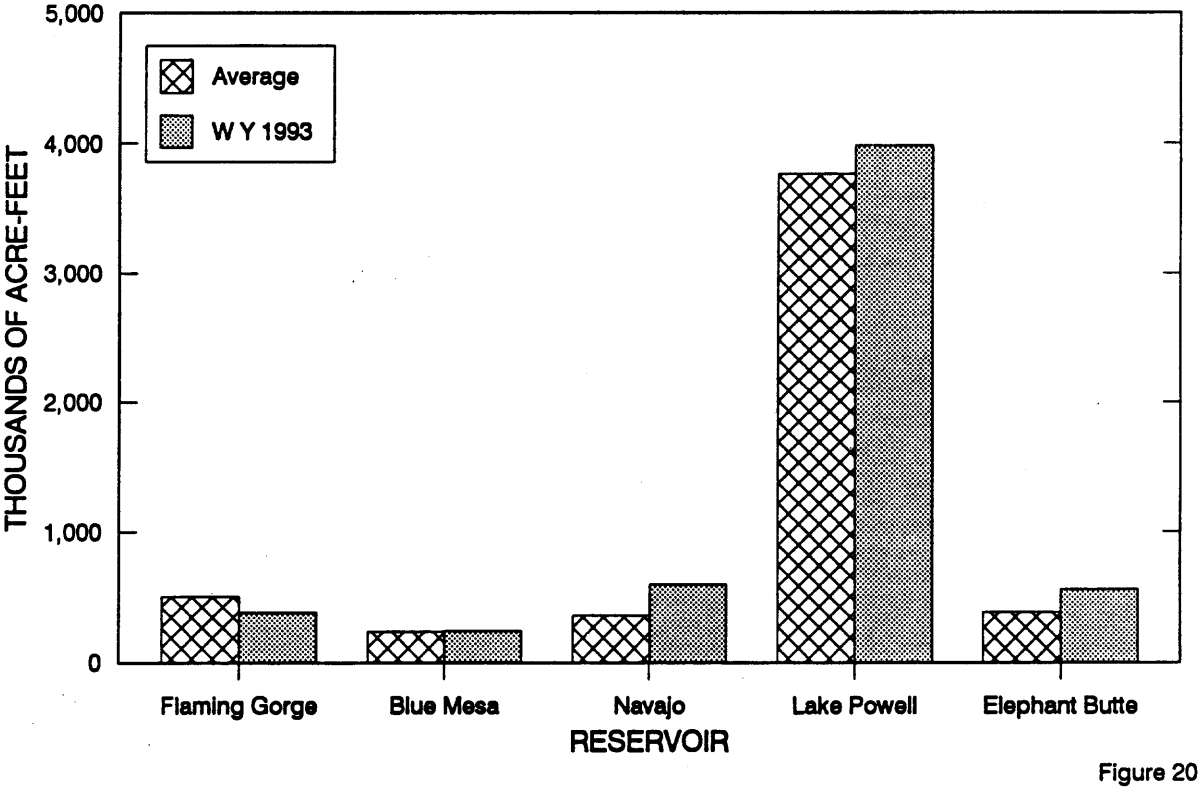

Figure 20

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UC Region WY 1993 Snow Water Equivalent

May 3, 1993

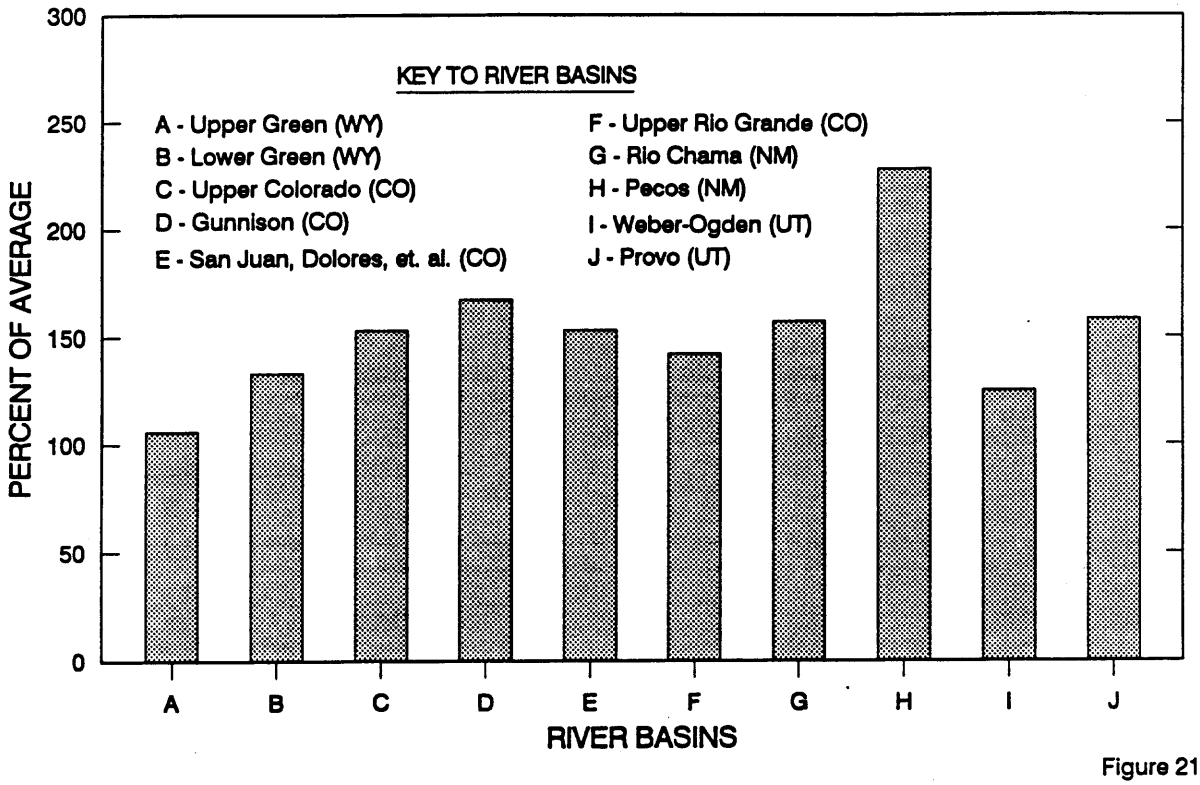

Figure 21

UC Region WY 1993 Accumulated Precipitation

May 3, 1993

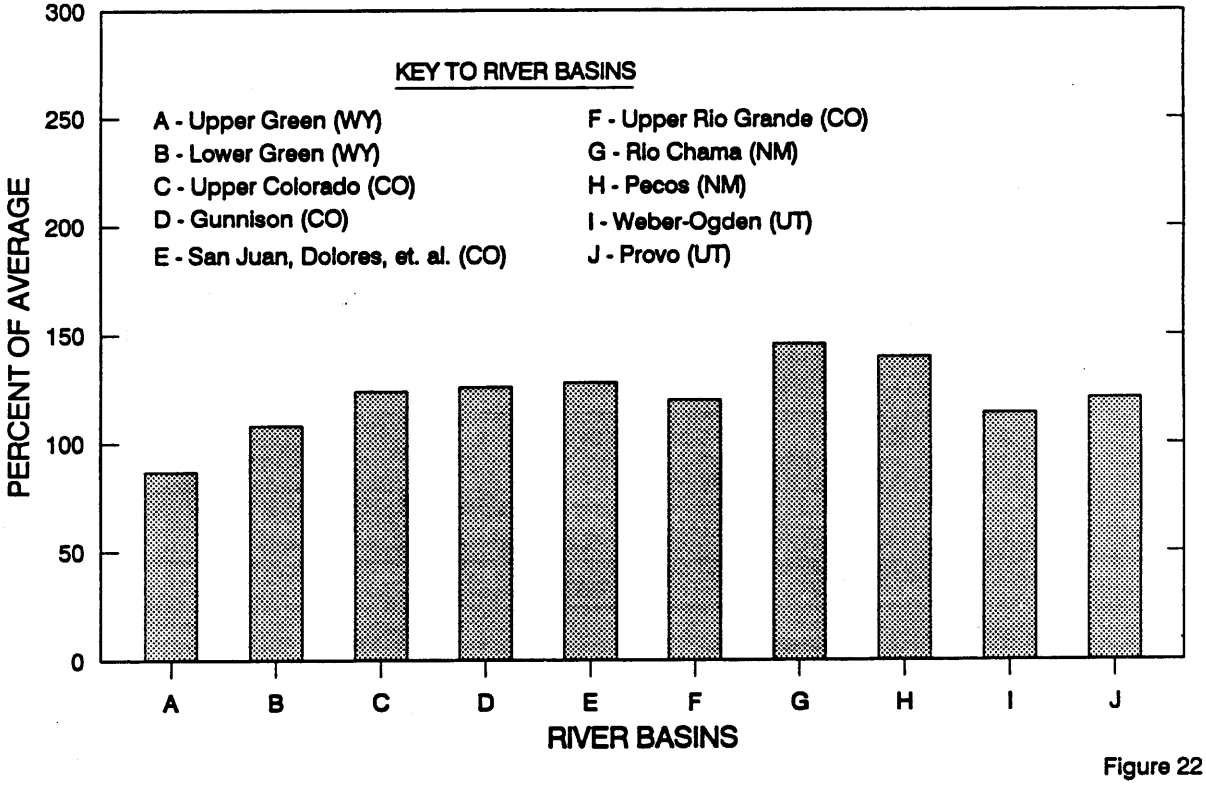

Figure 22

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GREAT PLAINS REGION

Weather Summary

Precipitation, mostly rainfall, was plentiful in the North Platte River Basin, the Colorado-Big Thompson Project area, and in certain locations in the Nebraska-Kansas project area. Several isolated snowstorms in South Dakota and Wyoming broke some snow accumulation records.

Storage

Although end-of-April storage at many of the reservoirs is below average, precipitation throughout the winter provided considerable inflow to many reservoirs. Generous precipitation also helped most of the reservoirs in the Nebraska-Kansas project area. Total end-of-April storage in the project area is approximately 352,000 acre-feet greater than last year.

Several areas still have problems, including Keyhole Reservoir in Wyoming, Clark Canyon Reservoir in Montana, Belle Fourche Reservoir in South Dakota, and Reclamation reservoirs in North Dakota. Reservoir storage in the Nebraska-Kansas project area is approaching near average levels for May 1, except for Enders Dam at 77 percent of average and Cedar Bluff Reservoir at 61 percent of average.

Weather Forecast

The 30-day forecast for the Great Plains Region by State is shown below:

	30-day temperature	30-day precipitation
Montana	Average	Above/average
Wyoming	Average	Average
North Dakota	Average/below	Average
South Dakota	Average	Below/average
Nebraska	Average	Below
Colorado	Above/average	Below/average
Kansas	Average	Below
Oklahoma	Average	Below
Texas	Average/above	Below

Possible Project Shortages

Clark Canyon, Montana

Although Clark Canyon reservoir has gained reservoir storage over the past several months, the reservoir is at 65 percent of average. Without significant runoff, the irrigation districts will face shortages again in 1993.

Nebraska-Kansas Project Area

Reservoir storage at Reclamation facilities in this area continues to improve with the above average precipitation. Although storage is approaching near average conditions for May 1, most of the reservoirs are still below useable capacity. Some irrigation shortages can be expected during 1993. Lovewell Reservoir will be allowed to store 3 feet into the flood control pool again this spring to allow the Bostwick Units in Nebraska and Kansas to maximize their available water supply.

Keyhole Reservoir, Wyoming

Although the reservoir did gain about 7,000 acre-feet of storage in April, reservoir storage is at its second lowest end-of-April level since the early 1960's and remains at only 34 percent of average. Reservoir inflows would have to be much greater than average for the reservoir to recover to average conditions in 1993. Irrigators will experience shortages in 1993

Belle Fourche Reservoir, South Dakota

Reservoir storage gained 15,000 acre-feet in April. This is the highest end-of-April storage in 3 years. The reservoir has gained 37,300 acre-feet in the last 2 months and 75,000 acre-feet since October 1. The reservoir is 50 percent of useable capacity, or 71 percent of average. Since Belle Fourche Reservoir receives part of its water supply from Keyhole Reservoir and reservoir storage is well below average, irrigation shortages in 1993 are expected.

Jamestown, E.A. Patterson, and Heart Butte Reservoirs, North Dakota

Reservoir storage did improve slightly during April due to increased precipitation. E.A. Patterson Lake gained only 300 acre-feet and is 74 percent of average. Heart Butte gained 1,600 acre-feet of storage in April. The reservoir is 74 percent of average and 70 percent of useable capacity. Jamestown Reservoir only gained 4,000 acre-feet during April and is 58 percent of average and 73 percent of useable capacity. The continued drought in the area has caused significant impacts. Irrigation will probably be limited to a partial water supply in 1993.

Platte River Basin, Wyoming

Seminoe and Pathfinder Reservoirs are at their lowest end-of-April content since 1982 and 1965, respectively. Since filling, the only lower end-of-April contents were in the recent drought years of 1990, 1991, 1992. Ownership accounts in the Kendrick and North Platte Projects remain at near record lows. Although above average inflow is predicted, irrigation water users need significant precipitation before they can receive a full service supply.

Table 7.—Great Plains Region reservoir storage
(April 30, 1993)

Reservoir name	Capacity	End-of-month storage	Average storage	Percent of average
	(Unit: 1,000 acre-feet)			
Upper Missouri River basin				
Clark Canyon	178	106	163	65
Canyon Ferry	1,952	1,542	1,522	101
Lake Elwell	965	771	735	105
Total	3,095	2,419	2,420	100
Sun River Project				
Gibson	99	66	54	122
Willow Creek	33	23	24	96
Pishkun	47	35	26	135
Total	179	124	104	119
Milk River basin				
Fresno	105	88	81	109
Nelson	80	58	61	95
Sherburne	69	21	21	100
Total	254	167	163	102
Bighorn River basin				
Bighorn Lake	1,070	816	821	99
Boysen	802	609	473	129
Buffalo Bill	399	271	335	81
Bull Lake	150	56	70	80
Pilot Butte	37	34	28	121
Total	2,458	1,786	1,727	103
Heart River basin				
E. A. Patterson	10	5	7	71
Lake Tshida	75	54	74	73
Total	85	59	81	73
North Platte River basin				
Alcova	184	179	180	99
Pathfinder	1,017	211	654	32
Seminoe	1,017	302	425	71
Glendo	518	390	465	84
Total	2,736	1,082	1,724	63

Table 7.—Great Plains Region reservoir storage -- Continued
(April 30, 1993)

Reservoir name	Capacity	End-of-month storage	Average storage	Percent of average
	(Unit: 1,000 acre-feet)			
Cheyenne River basin				
Angostura	131	115	117	98
Belle Fourche	192	93	131	71
Deerfield	16	15	14	107
Keyhole	194	32	86	37
Pactola	99	43	45	96
Total	632	298	393	76
Grand River basin				
Shadehill	140	140	126	111
James River basin				
Jamestown	36	20	35	57
Colorado - Big Thompson Project				
Carter Lake	112	106	106	100
Green Mountain	154	67	57	118
Horsetooth	157	129	128	101
Lake Granby	540	248	295	84
Total	963	550	586	94
Fryingpan - Arkansas Project				
Pueblo	265	177	185	96
Reudi	102	53	59	90
Turquoise Lake	129	55	70	79
Twin Lakes	140	106	111	95
Total	636	391	425	92
Republican River basin				
Frenchman - Cambridge Division				
Trenton	112	105	104	101
Enders	45	26	34	76
Red Willow	38	33	32	103
Medicine Creek	36	36	37	97
Bonny	41	40	40	100
Norton	36	19	10	190
Harlan County	328	291	304	96
Lovewell	42	49	41	120
Total	678	599	602	100

Table 7.—Great Plains Region reservoir storage -- Continued
(April 30, 1993)

Reservoir name	Capacity	End-of-month storage	Average storage	Percent of average
	(Unit: 1,000 acre-feet)			
Solomon River basin				
Kirwin	99	46	49	94
Webster	77	31	31	100
Glen Elder	242	302	204	148
Total	418	379	284	133
Niobrara River basin				
Box Butte	31	18	17	106
Merrit	75	74	73	101
Total	106	92	90	102
Lower Platte River basin				
Sherman	69	51	55	93
Calamus	127	128	111	115
Total	196	179	166	108
Washita River basin				
Foss	437	175	124	141
Fort Cobb	144	81	74	109
Total	581	256	198	129
Arkansas River basin				
Cheney	248	169	144	117
Norman	196	108	92	117
Sanford	1,383	310	324	96
Total	1,827	587	560	105
Red River basin				
Altus	154	136	83	164
Arbuckle	109	63	64	98
McGee Creek	199	118	125	94
Mountain Park	118	99	68	146
Total	580	416	340	122

Table 7.—Great Plains Region reservoir storage -- Continued
(April 30, 1993)

Reservoir name	Capacity	End-of-month storage	Average storage	Percent of average
	(Unit: 1,000 acre-feet)			
Nueces River basin				
Choke Canyon	691	673	374	180
Colorado River basin				
Marshall Ford	1,954	NA	NA	NA
Twin Buttes	641	146	73	200
Nastworthy	11	10	9	111
Total	2,606	156	82	190
Lavaca-Navidad River basin				
Palmetto Bend	166	NA	NA	NA

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GP Region Reservoir Storage

Missouri River Basin
April 30, 1993

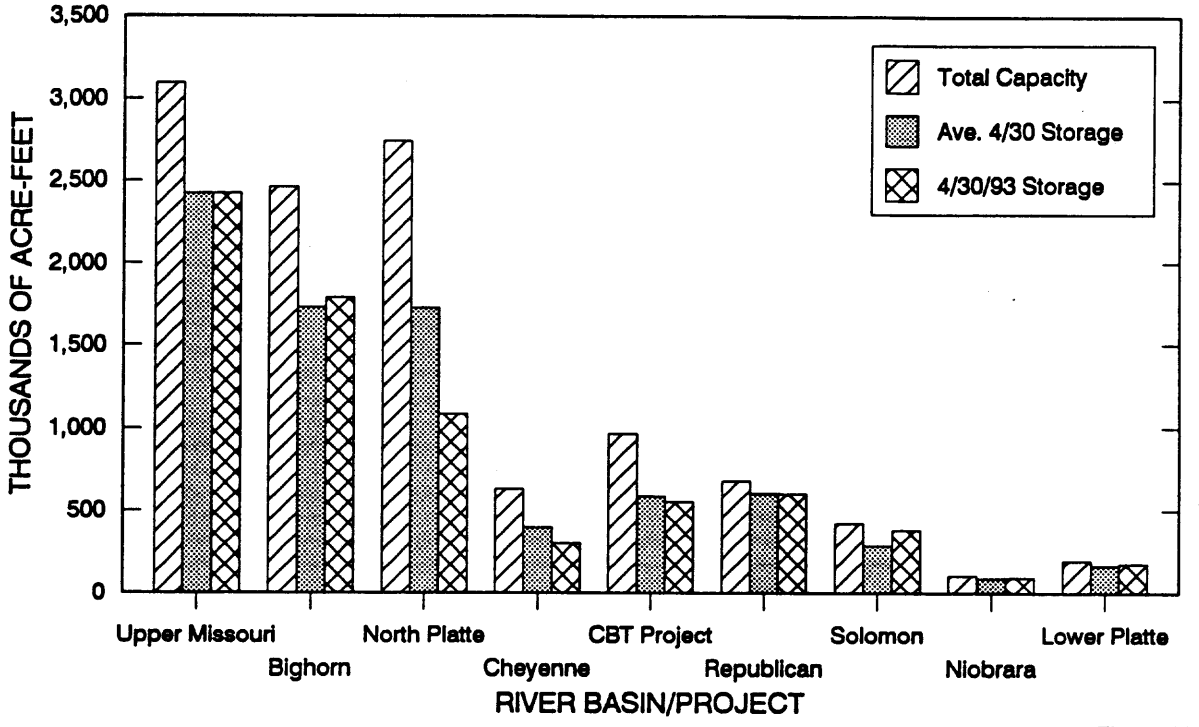

Figure 23

GP Region Reservoir Storage

Other River Basins
March 31, 1993

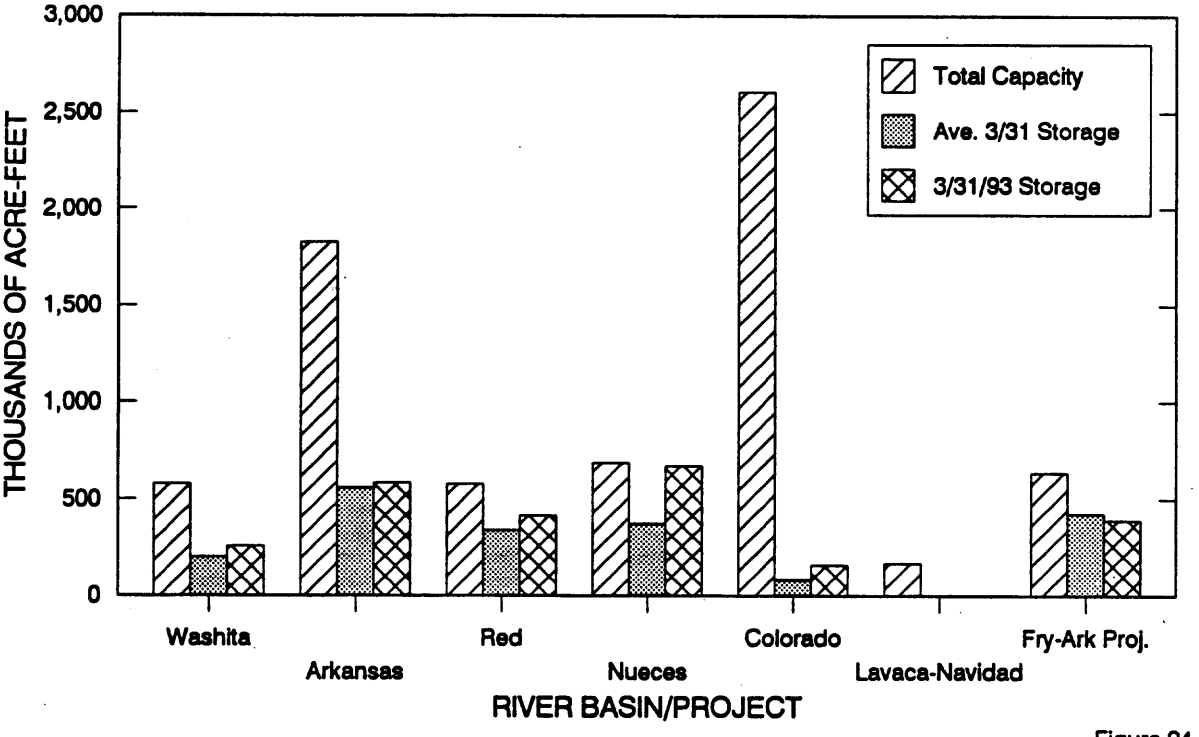

Figure 24

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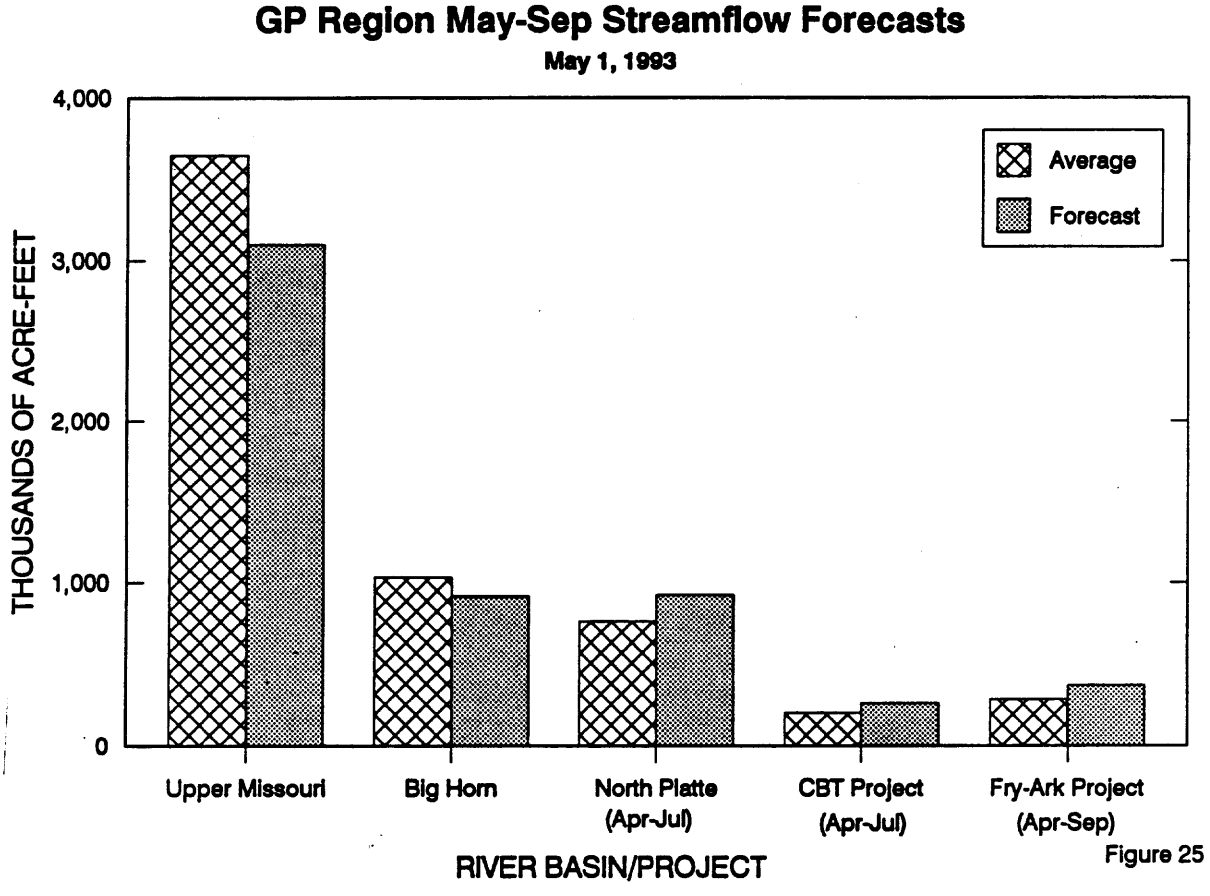
GP Region May-Sep Streamflow Forecasts
May 1, 1993
4,000
3,000
2,000
1,000
0
THOUSANDS OF ACRE-FEET
Average
Forecast
Upper Missouri
Big Horn
North Platte (Apr-Jul)
CBT Project (Apr-Jul)
Fry-Ark Project (Apr-Sep)
RIVER BASIN/PROJECT

Figure 25

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GP Region WY 1993 Accumulated Inflow

Missouri River Basin

April 30, 1993

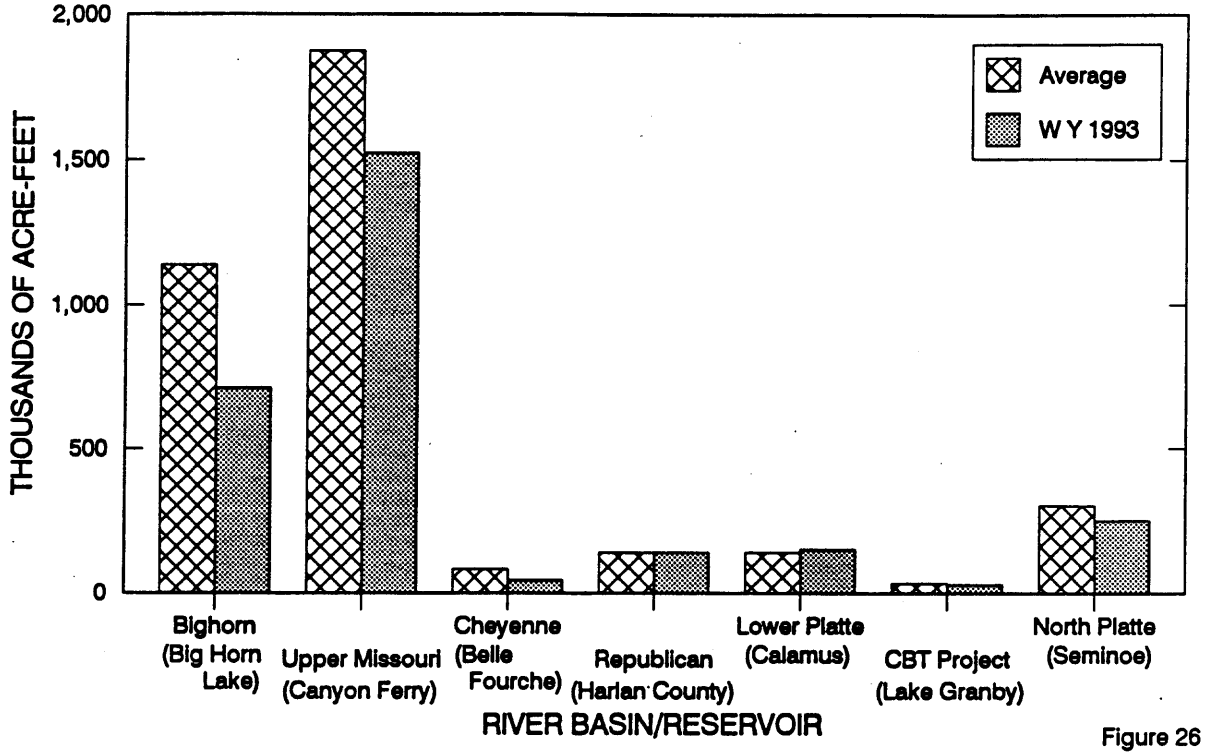
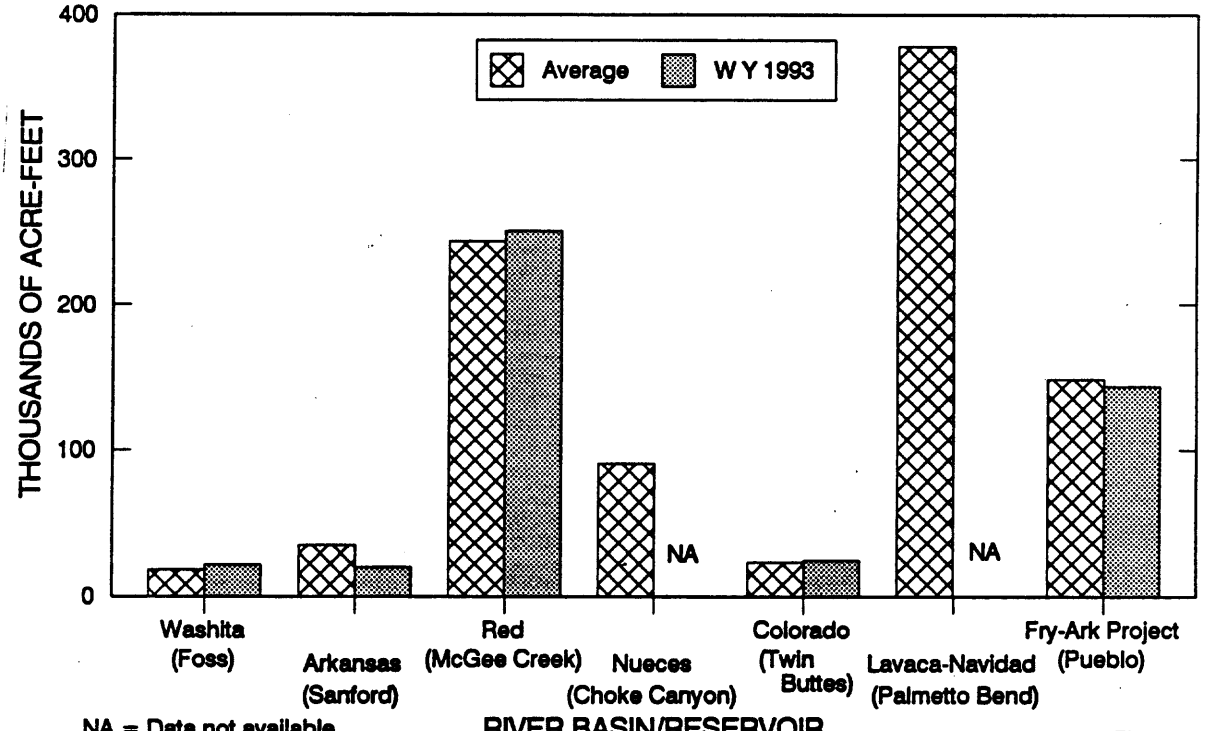


Figure 26

GP Region WY 1993 Accumulated Inflow

Other River Basins

April 30, 1993



NA = Data not available

Figure 27

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GP Region WY 1993 Snow Water Equivalent

May 3, 1993

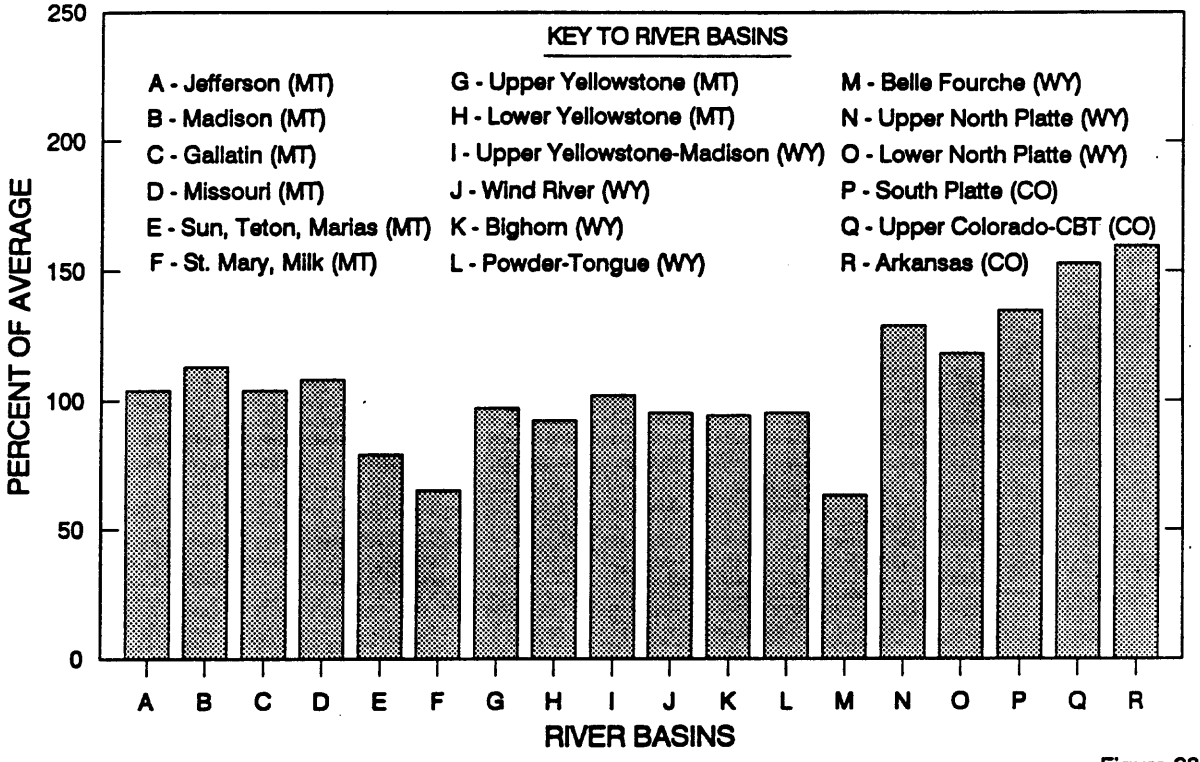

Figure 28

GP Region WY 1993 Accumulated Precipitation

May 3, 1993

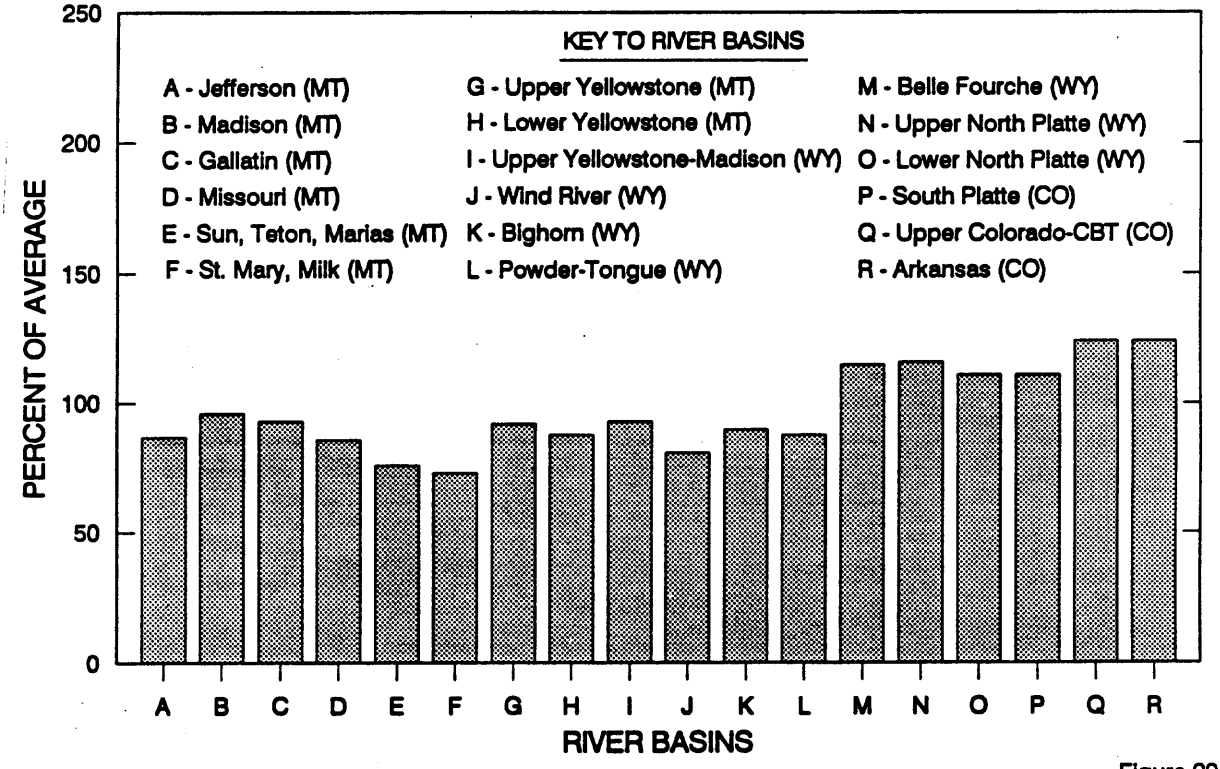

Figure 29

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