DROUGHT

CONTINGENCY PLANNING GUIDELINES FOR 1989

JANUARY 1989

State of California
The Resources Agency
DEPARTMENT OF WATER RESOURCES

DROUGHT

CONTINGENCY PLANNING GUIDELINES FOR 1989

JANUARY 1989

State of California
The Resources Agency
DEPARTMENT OF WATER RESOURCES

Gordon K. Van Vleck
Secretary for Resources
The Resources
Agency

George Deukmejian
Governor
State of
California

David N. Kennedy
Director
Department of
Water Resources

FOREWORD

In 1987 and 1988, California experienced its third severe drought this century. People, agriculture, industry, fish, wildlife, and the economy all suffered. Our last severe drought occurred in 1976 and 1977, when Californians and their environment sustained a $2.4 billion drought loss.

If 1989 should prove to be a third critically dry year, or even just a dry year, the impacts of this drought would be far-reaching.

Consequently, the State Legislature passed and the Governor signed, in September 1988, Senate Bill 32, which directs the Department of Water Resources to take the lead in preparing for the possibility of a third dry year. The legislation requires the Department to report to the Legislature by January 2l, 1989, with recommendations for State-level drought response. That report is entitled *Drought Assistance: A Report to the Legislature in Response to Senate Bill 32.*

In response to SB 32, the Department of Water Resources developed drought guidelines to coordinate the actions of the California water community in the event the drought continues in 1989. The guidelines were established in coordination with over 300 federal, State, and local agencies and others, with broad public review at five conferences held throughout the State. We appreciate the wide interest and helpful assistance of the many people who have contributed to this task.

The guidelines, as presented in this report, identify drought impacts and actions taken during 1988 by water agencies throughout the State to cope with the drought. The report describes alternative 1989 water supply scenarios and options for minimizing possible water supply shortages and for protecting fish and wildlife. In addition, the report discusses available federal and State technical and financial assistance, as well as regulatory actions specifically applicable during droughts. This includes a description of new drought assistance authorized by federal and State statutes enacted during 1988.

The report has been prepared to help water officials and others identify actions they can take and assistance that is available to minimize adverse drought impacts. It is intended to be a helpful reference document.

We all hope that the drought will end soon. However, as a result of our collective efforts in preparing and coordinating this report, California water agencies are now more aware of and knowledgeable about drought response planning and better able to take effective action than during our last serious drought in 1977.

David N. Kennedy
Director of Water Resources

CONTENTS

Foreword iii
Department of Water Resources' Organization ix
California Water Commission x

1. OVERVIEW 1

Assessment of 1988 Water Supply 2
Surface Supplies 2
Ground Water Supplies 7
Assessment of 1989 Water Year Possibilities 9
The Purpose of this Report 9

2. DROUGHT IMPACTS IN 1988 AND POTENTIAL PROBLEMS IN 1989 11

Agricultural and Urban Impacts 11
Assessment of 1989 Water Supply Adequacy:
Northwestern California 11
North Bay 15
South Bay 17
North Central Coast 19
South Central Coast 21
South Coast 23
Sacramento Valley Floor 25
San Joaquin Valley Floor 27
Sierra Nevada Foothills 29
Northeastern California 31
Tahoe-Truckee 32
South Lahontan 34
Colorado Desert 35
Water Quality Problems 36
Water Supplies of the Sacramento–San Joaquin Delta 36
Drinking Water 36
Agriculture 36
Industrial Uses 37
Water Quality Monitoring 37
Fish and Wildlife 37
Recreation 40
Electrical Energy 41

3. RESPONDING TO A DRY 1989 43

The Federal Central Valley Project and the State Water Project 43
The Central Valley Project 43
The State Water Project 44
Possible Delta Drought Facilities 46
Sherman Island Overland Supply 46
Rock Barriers at Quimby Island 46
Rock Barriers in the South Delta 46
Weather Modification 47
Water Transfers 48
Water Transfers in 1977 48
U.S. Bureau of Reclamation's 1977 Water Bank 49
Water Transfers and Wheeling Agreements in 1988 49
The Federal Disaster Assistance Act of 1988 (Aid to Water Transfers) 51
California Administrative and Legislative Provisions 52
System Interconnections 52
Role of the Department of Water Resources in Water Transfers 53
Water Conservation and Public Information 53
Water Rationing Guidelines for Urban Areas 55
Trucking Water 58
Contingency Plans of Selected Urban Water Suppliers 58
San Francisco Water Department 59
East Bay Municipal Utility District 60
Los Angeles Department of Water and Power 61
The Metropolitan Water District of Southern California 62
Marin Municipal Water District 63
Agriculture — Allocation of Limited Surface Supply and Increased Use of Ground Water 64
Allocating Limited Agricultural Surface Supplies 64
Plans for Special Allocations to Permanent Crops 64
Examples of District Water Deliveries Plans 65
Increasing Ground Water Use by Agriculture 66
Ground Water Levels 66
The Availability of Increased Pumping Capacity 66
Possible Shortages and Backlogs in Well Services 67

4. FINANCIAL AND TECHNICAL ASSISTANCE 69

Federal Drought Assistance Programs 69
U.S. Department of the Interior 70
U.S. Department of Agriculture 70
Farmers Home Administration 70
Emergency Loan Program 70
Agricultural Stabilization and Conservation Service 71
Emergency Feed Program 71
Emergency Feed Assistance Program 71
Forage Assistance Program 71
Tree Assistance Program 71
Conservation Reserve Program 72
Emergency Conservation Program 72
Emergency Crop Loss Assistance 72
Agricultural Conservation Program 72
U.S. Small Business Administration 72
Economic Injury Disaster Loan 72
Federal Emergency Management Agency 73
Federal Disaster Assistance 73
U.S. Army Corps of Engineers 73
Emergency Water Supplies and Drought Assistance Programs 73
State Drought Assistance Programs 73
Senate Bill 32 73
Emergency Clean Water Grant Fund 73
Office of Emergency Services 74
Department of Water Resources' Drought Center 74
Interagency Drought Task Force 74

5. REGULATORY ACTIONS 75

The State Water Resources Control Board 75
The Regional Water Quality Control Boards 76
Department of Health Services 76
Department of Fish and Game 77
Public Utilities Commission 78
Federal Energy Regulatory Commission 78
U.S. Army Corps of Engineers 78
Local Government 79

APPENDIXES

A Senate Bill 32 83
B Survey of Water Purveyors 87
C State/Federal Interagency Drought Task Force 129
D Planning for Well Drilling or Rehabilitation 131

Figures

1 Seasonal Precipitation in Percent of Average: October l, 1986, to September 30, 1987; October 1, 1987, to September 30, 1988 3

2 Cumulative Unimpaired Runoff for Worst Two-Year Droughts; Selected Central Valley Rivers 4

3 Sacramento River Basin Flows 5

4 Water Year Runoff in Percent of Average, by Hydrologic Regions, October 1 – September 30 6

5 Ground Water Level Change in San Joaquin Valley by County 8

6 Drought Analysis Regions 12

State of California
GEORGE DEUKMEJIAN, Governor

The Resources Agency
GORDON K. VAN VLECK, Secretary for Resources

Department of Water Resources
DAVID N. KENNEDY, Director

ROBERT G. POTTER
Deputy Director

JOHN P. CAFFREY
Chief Deputy Director

LAWRENCE A. MULLNIX
Deputy Director

SALLE S. JANTZ
Assistant Director

SUSAN N. WEBER
Chief Counsel

This report was prepared under the direction of

SUZANNE BUTTERFIELD
Drought Response Coordinator

by

DIVISION OF PLANNING

Warren Cole ..... Supervising Engineer, Water Resources
Glenn Sawyer ..... Supervising Land and Water Use Analyst

DIVISION OF FLOOD MANAGEMENT

Maurice Roos ..... Chief, Hydrology Branch

DROUGHT CENTER

Robert Fingado ..... Senior Engineer, Water Resources
Arthur L. Winslow ..... Senior Engineer, Water Resources

Department Retirees

George Deatherage
James C. Mosley
R. Dean Thompson

Consultant to the Department

Robert Hagan

Editorial and Graphic Arts Service

Travis Latham ..... Research Writer
William L. Wilson ..... Art Director

State of California
The Resources Agency
Department of Water Resources

CALIFORNIA WATER COMMISSION

Clair A. Hill, Chairman, Redding,
Stanley M. Barnes. Vice Chairman, Visalia

Harold W. Ball ..... La Mesa
Katherine B. Dunlap ..... Los Angeles
Leon E. Henry ..... Victorville
James J. Lenihan ..... Mountain View
Martin A. Matich ..... San Bernardino
Audrey Z. Tennis ..... Chico
Jack G. Thomson ..... Bakersfield

Orville L. Abbott
Executive Officer and Chief Engineer

Tom Y. Fujimoto
Assistant Executive Officer

The California Water Commission serves as a policy advisory body to the Director of Water Resources on all California water resources matters. The nine-member citizen commission provides a water resources forum for the people of the State, acts as a liaison between the legislative and executive branches of State Government, and coordinates federal, state, and local water resources efforts.

1. OVERVIEW

Northern and Central California have once again experienced two consecutive critically dry years. This is the second time in 11 years, and the third time this century that two such years have hit Northern California. Economic loss, environmental damage, and human hardship go hand-in-hand with drought. In 1977, forty-seven counties in California declared drought emergencies, and Californians endured a $2.4 billion drought loss.* In 1988, water shortages occurred in 45 California counties, adversely affecting 45 percent of irrigated agriculture and 26 percent of the population. By mid-September, 14 counties and the city of Willits declared drought emergencies. Fish and wildlife resources and recreation all suffered.

The responsibility of local, State, and federal water managers during a drought is to take action to minimize the adverse impacts. This report is intended to assist in that effort. More broadly, the report is meant to serve as a reference document for any person interested in drought actions likely to be taken by local, State, and federal agencies in a dry 1989.

Further guidance for dealing with a possibly dry 1989 has been provided by Governor Deukmejian and the California Legislature. In September, the Governor signed Senate Bill 32, which provides direction to the Department of Water Resources for drought contingency planning. DWR is to report by January 21, 1989, on recommended legislation and other possible actions that could lessen 1989 drought damage.

An exact blueprint for coping with a possible third consecutive dry year cannot be prepared because the characteristics of the 1988–89 winter cannot be foreseen. However, drawing upon the knowledge gained in 1976–77, including broad local support and willingness at the local level to conserve water, as well as recent experience with the 1987–88 drought, we can identify additional drought-coping mechanisms to be put to use as needed.

The knowledge gained in the drought of 1976–77 will be especially important if California must face a dry 1989. Among the lessons taught by that experience are these:

- Ground water dependency increased more dramatically than had been expected. For example, in 1977 in the San Joaquin Valley, ground water provided 76 percent of the supply. In 1975, a near-normal year, the amount was 52 percent.
- Communities and individual users in upland and coastal areas who relied on wells in shallow alluvial basins or fractured rock saw their wells go dry. This required

* "Executive Summary" of *Drought — Alternative Strategies for 1978,* Governor's Drought Emergency Task Force, January 1978.

2new wells to be drilled or, in the worst case, domestic water to be brought in by truck.

- Cities, counties, and State and federal agencies worked together on water transfer agreements and temporary exchange facilities. Transfers also occurred between individuals, usually when the supplier could use ground water to replace surface water.
- Much of the precipitation during the drought percolated directly into the ground, reducing expected river flows. Heavy irrigation pumping lowered ground water levels. Water from the rivers flowed to the lowered water tables, reducing still further the expected surface water supply.
- Temporary rock barriers were placed at various locations in the Delta to control ocean salinity intrusion, and to increase water circulation in certain channels in the southern Delta. Most of these barriers proved effective in aiding water conveyance and protecting water quality.
- Urban water use was reduced 25 percent and more in many areas of the State through conservation measures and rationing.
- In nearly every instance where mandatory rationing was implemented in 1977, consumers responded by cutting water use more than requested.

Assessment of 1988 Water Supply

Surface Supplies

Low rainfall, snowpack, runoff, and carryover storage have produced conditions that do not meet the current water needs of many urban and agricultural areas. Both 1987 and 1988 were well below average in precipitation, especially in the mountainous regions that provide most of the runoff (Figure 1). Although 1988's drought effects were not as severe as those in 1977, California's water supply is significantly below normal in most areas and critical in a few.

No two years have the same amounts and patterns of precipitation, and 1987 and 1988 were no exception. Surprisingly, the Central Valley floor had near-normal precipitation in 1988, while the Sierra Nevada again was far below normal. Runoff of Northern California rivers was much the same in 1987 and 1988, with the lesser 1988 runoff, in relation to precipitation, due largely to depleted soil moisture. Figure 2 compares runoff for these two years for selected Sierra Nevada rivers. It shows that drought impact was greatest in the central Sierra Nevada, with the American River and Mokelumne River basins the most severely affected. Runoff from the American River watershed for 1987 and 1988 combined was only 60 percent of normal for one year. Also severely affected was the Tahoe-Truckee region, where Lake Tahoe fell below its natural rim elevation in October 1988. Figure 3 shows Sacramento River Basin Flows* for the past 82 years. Runoff in 1988 in this basin was 48 percent of normal, compared to 27 percent of normal in 1977. Figure 4 shows water year runoff by hydrologic regions in percent of average.

---

* Total in millions of acre-feet of the unimpaired runoff of (1) the Sacramento River above Bend Bridge near Red Bluff, (2) the Feather River inflow to Oroville Reservoir, (3) the Yuba River at Smartsville, and (4) the American River inflow to Folsom Reservoir. Water year classifications in Figure 3 are as established for water rights decision D-1485.

Figure 1

SEASONAL PRECIPITATION IN PERCENT OF AVERAGE

OCTOBER 1, 1986 TO SEPTEMBER 30, 1987

OCTOBER 1, 1987 TO SEPTEMBER 30, 1988*

*Estimated mid-September 1988

Figure 2

CUMULATIVE UNIMPAIRED RUNOFF FOR WORST TWO-YEAR DROUGHTS
Selected Central Valley Rivers
(Water Years in percent of normal)

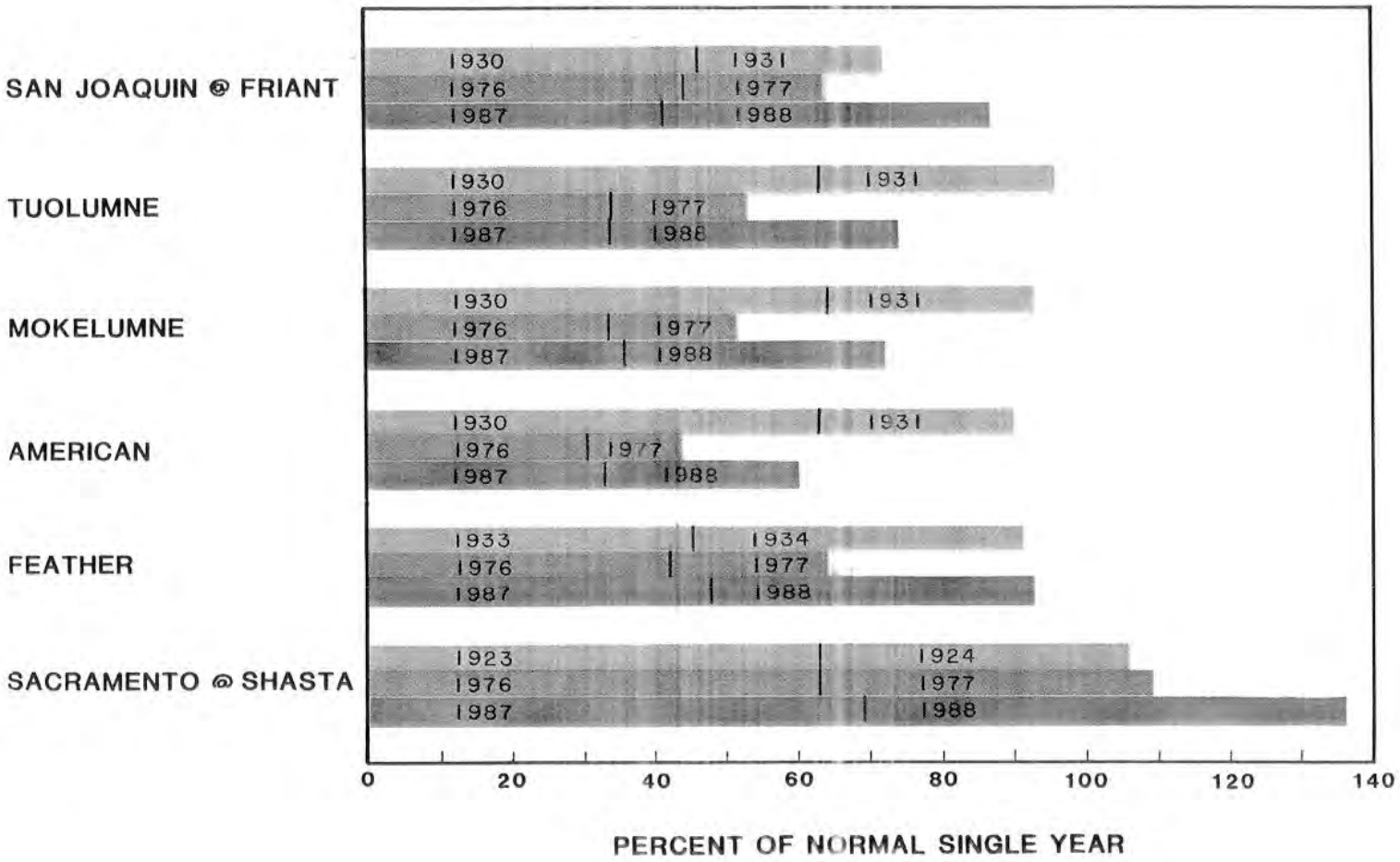
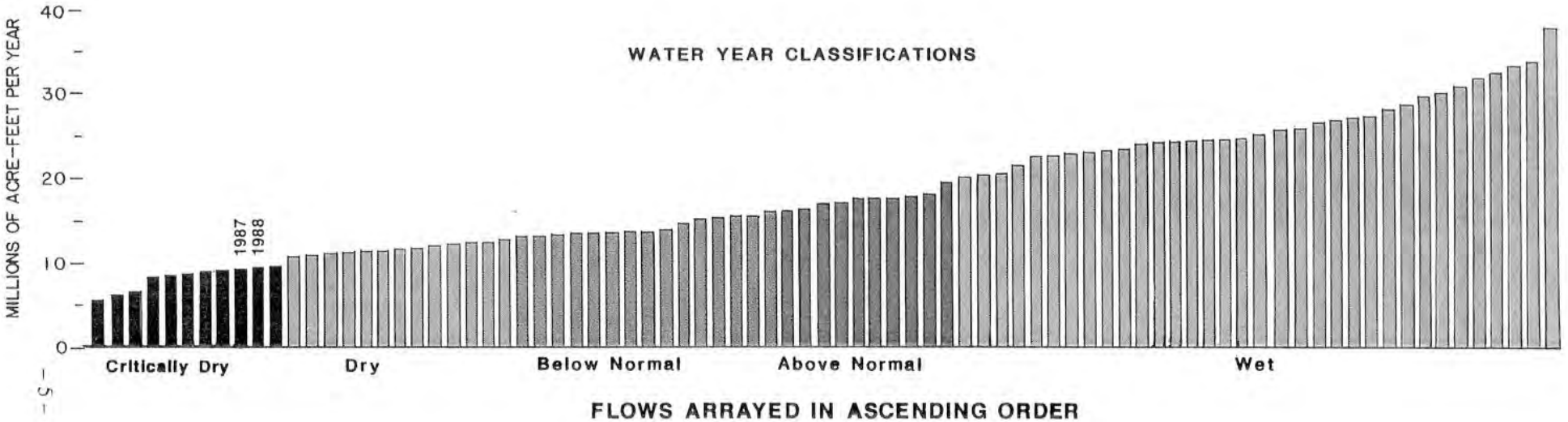


Figure 3

SACRAMENTO RIVER BASIN FLOWS



FLOWS ARRAYED IN ASCENDING ORDER

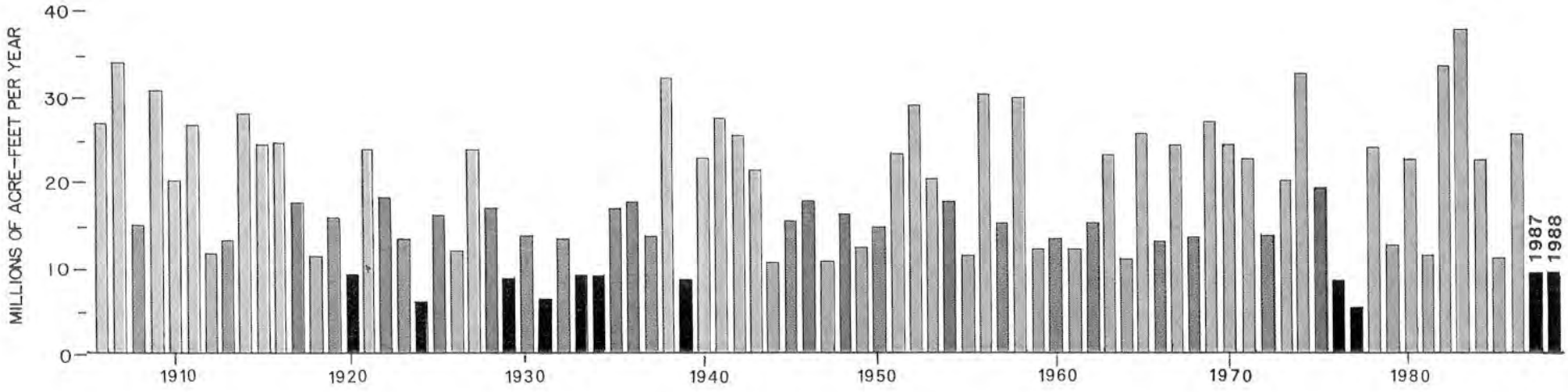
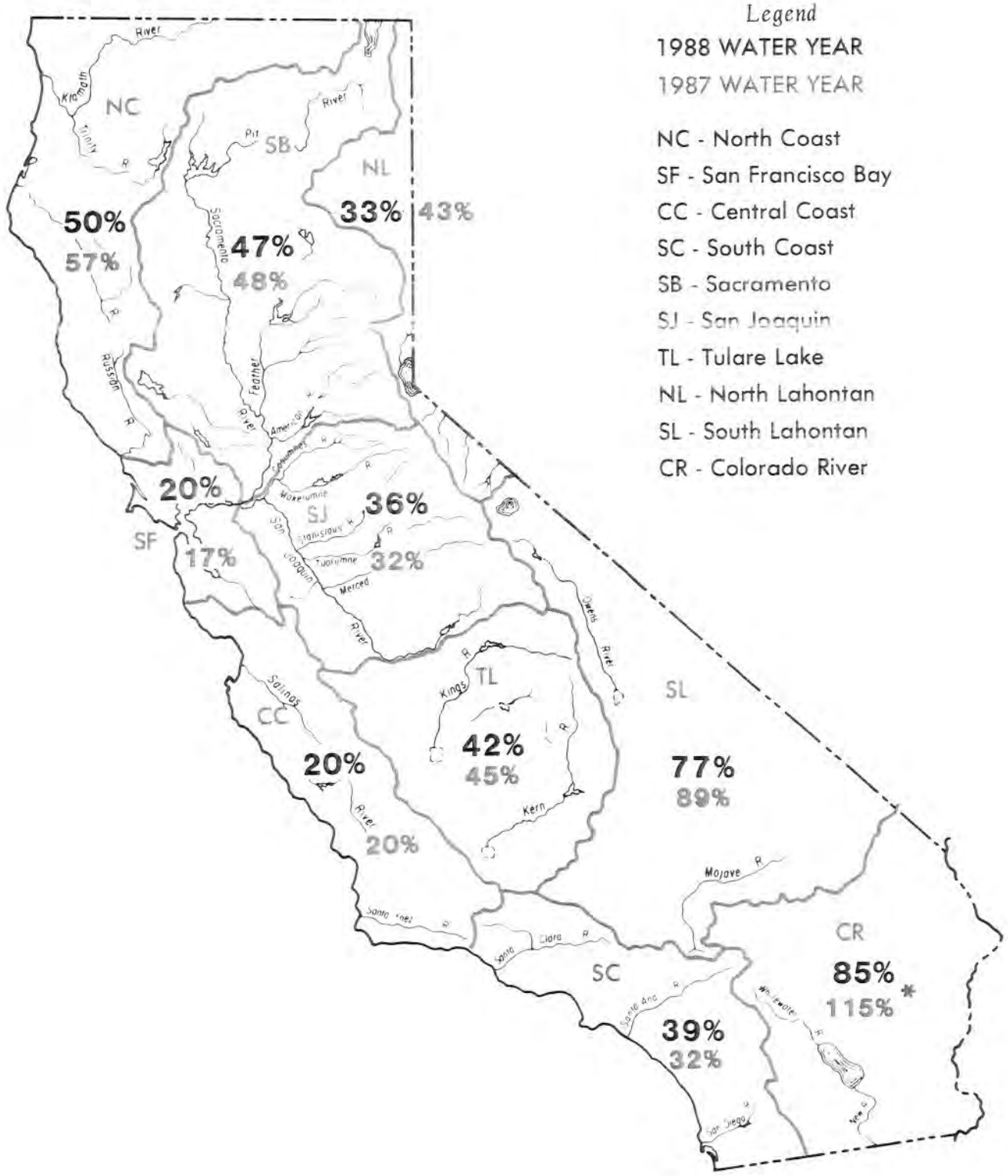


Figure 4

WATER YEAR RUNOFF IN PERCENT OF AVERAGE BY HYDROLOGIC REGIONS

October 1 to September 30



*Values for Colorado River

California's water storage facilities have again proved their worth during the past two years. At the end of September 1986, storage was well above normal — about 119 percent. By the end of September 1987, it was about 85 percent of the long-term average. This year, end-of-September storage was about 66 percent of normal, down some 4 million acre-feet from last year but nearly 1 million acre-feet more than on September 30, 1976, and much better (by 7 million acre-feet) than in 1977. Still, some reservoirs, particularly those in the central Sierra Nevada, are close to 1977 levels.

Surplus Colorado River water, so important in alleviating crisis conditions in 1977, is again available to California, due to above-normal storage in lakes Mead and Powell. Interstate storage on the Colorado River, although down almost 2 million acre-feet from last year, is still almost 6 million acre-feet above 1976 levels. The Metropolitan Water District of Southern California plans to use the full capacity of the Colorado River Aqueduct by diverting about 1.2 million acre-feet of Colorado River water in 1988 and again in 1989. MWD's basic apportionment is less than 550,000 acre-feet per year.

Ground Water Supplies

In an average year, ground water provides about 40 percent of the State's water for irrigation and urban uses. In severe drought years, ground water dependency increases dramatically. For example, in 1977, in the San Joaquin Valley, ground water provided 76 percent of the supply. In 1975, a near-normal water supply year, this amount was 52 percent.

Ground water, which was the salvation for agriculture in the Central Valley during the last drought, is again as accessible as before. Pump lifts in some areas are even less than they were in 1977 because of several years of above-normal rainfall, and in some locations, increased surface water imports. Some local problems have been caused by excessive drawdown. An example is the city of Turlock, where increased agricultural pumping affected the city's wells.

Figure 5 shows changes in average ground water elevations since 1970 for seven San Joaquin Valley counties. In the Tulare Lake basin, which includes all or part of Kings, Tulare, Kern, and Fresno counties, water levels have shown generally a continuing rise since the end of the 1976–77 drought. In the San Joaquin River basin, the situation is more variable, with levels in both Stanislaus and Merced counties about the same as at the end of the earlier drought.

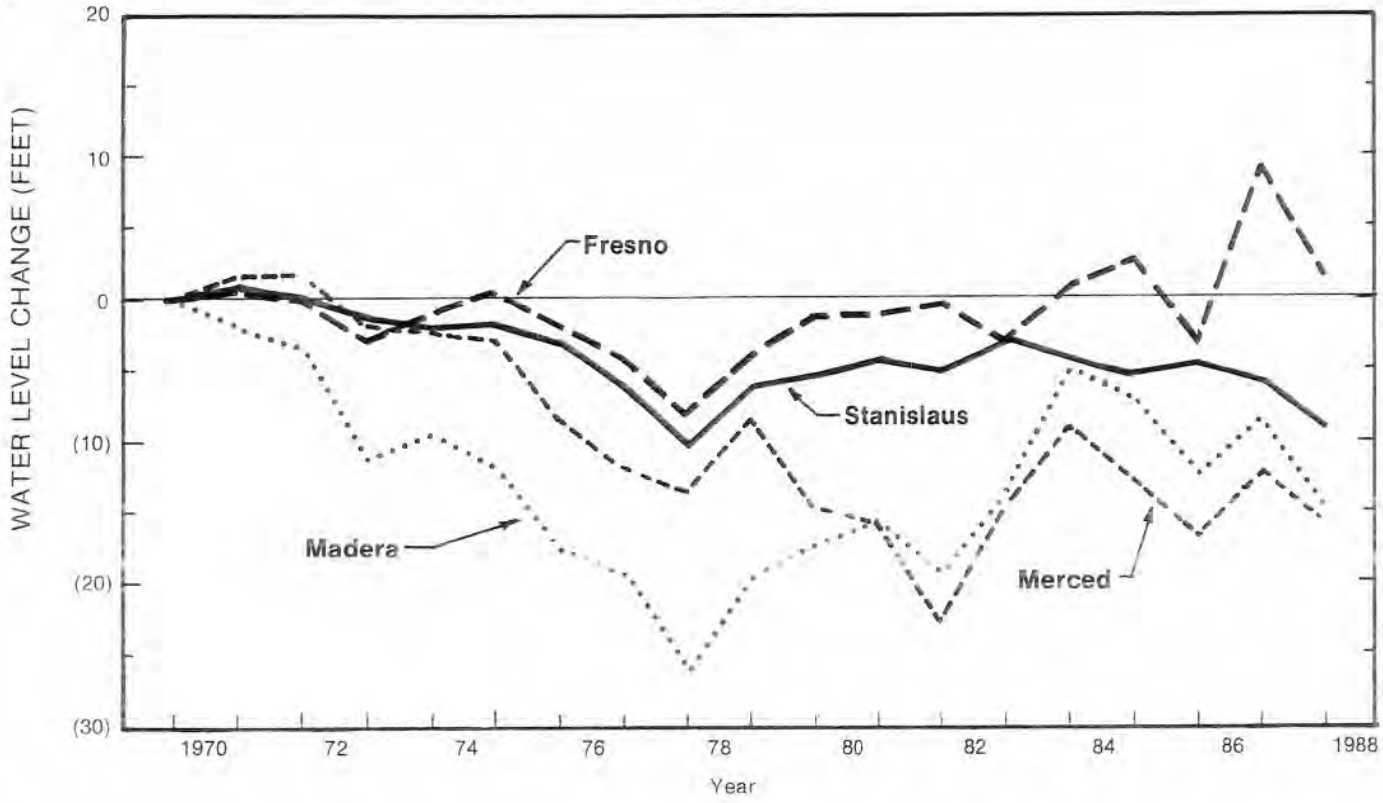
It is estimated that 17,800 irrigation wells have been drilled since 1976. This greatly increases the capability of farmers to turn to ground water where surface supplies are short. Well reactivation, including equipment replacement, is necessary in many cases, but overall the situation is considerably improved over 1976 capabilities. Most users overlying ground water basins should be able to make up for a shortage in surface supplies because of the relative ease of pumping from the large supply available.

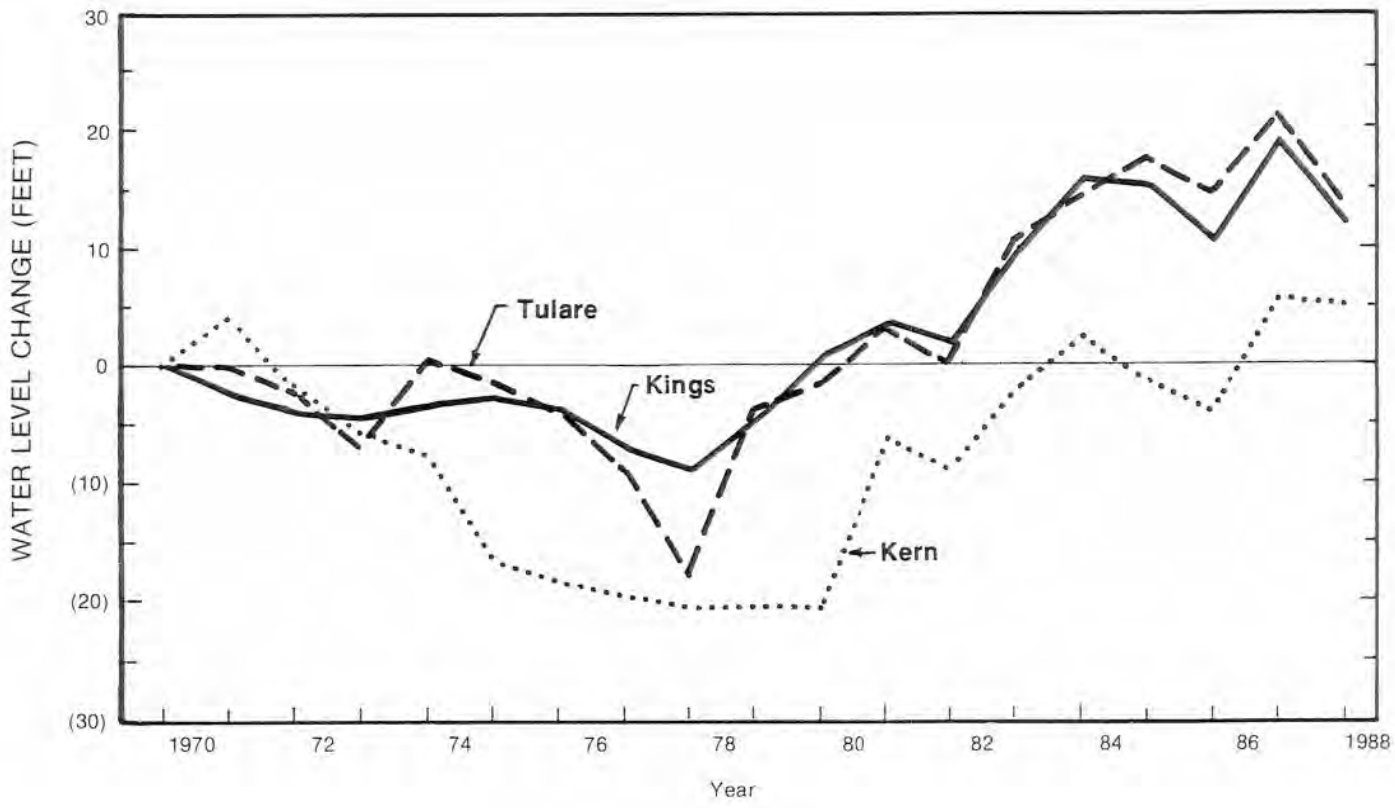
By contrast, communities and individual users in many upland and coastal areas relying on wells in shallow alluvial basins or fractured rock have seen their wells go dry, or nearly so. The yield of wells in fractured rock is influenced by the amount of annual precipitation seeping into fissures, and little carryover storage occurs from one year to the next.

Figure 5

GROUND WATER LEVEL CHANGE IN SAN JOAQUIN VALLEY BY COUNTY

1970 - 1988





Assessment of 1989 Water Year Possibilities

No one wants to go through another record dry year like 1977, and the odds of that happening in 1989 are remote. Unfortunately, there is no reliable method of forecasting precipitation a year or even a season in advance. The conventional wisdom is to assume that each year is random. If so, the chances of 1989 being as dry as either 1987 or 1988 are about one in ten. With the needs of 6 million more Californians to satisfy than in 1977, a year as dry as 1988 would pose serious problems for some water purveyors (see Chapters 2 and 3.)

If next year is as dry as 1977 (a one percent chance), obviously, shortages will be severe over a wide area. If 1989 equates to 1987 or 1988, the shortages will be severe in specific areas. Some shortages in the State Water Project and again in the Friant area of the Central Valley Project will be expected. They will, however, vary from watershed to watershed. The needs in some basins would be satisfied with the repeat of a 1988 water year.

The Purpose of this Report

It will be incumbent upon local and regional water managers to assess needs, system capabilities, and available supplies. This report is intended to help. It covers expected drought-caused problems in 1989, based on extensive surveys and interviews conducted in the summer and fall of 1988; a number of possible actions at the local, State, and federal levels for coping with a dry 1989; and current financial and technical drought assistance.

Chapter 2 identifies potential 1989 water-short areas and discusses natural resource problems, based on the results of summer and fall interviews.

Chapter 3 looks to planning for a third dry year. It assesses the delivery potential of the Central Valley Project and the State Water Project and notes local water contingency plans. Water transfers and water exchanges, ground water use, cloud seeding, and water conservation are reviewed.

Chapter 4 sets forth State and federal assistance programs and identifies the agencies involved in drought assistance. It describes federal drought legislation and California's drought legislation signed by the Governor in September 1988.

Chapter 5 identifies those State and federal agencies that have regulatory authority in responding to the drought.

2. DROUGHT IMPACTS IN 1988 AND POTENTIAL PROBLEMS IN 1989

Although 1987 was critically dry, negative impacts on water users were minimal. When 1988 also turned out to be critically dry, some agencies still had sufficient water in reservoirs, but many others were facing shortages. In general, the larger projects are designed for droughts extending over several years, while smaller systems, especially in Northern California, are designed to deal with only one very dry year. Designers of the these projects count on annual refilling by winter rains.

If 1989 is also dry, many more areas will be affected, some with much more serious problems than they encountered this year — inadequate supplies for urban and agricultural users, poorer water quality, impacts on fish and wildlife, fewer recreational opportunities, and reduction of hydroelectric power.

Agricultural and Urban Impacts

Beginning in March 1988, the Department of Water Resources each month surveyed water purveyors to monitor and update information on their drought-related problems. The first survey included about 70 purveyors and, by August, this number had grown to more than 300 purveyors. From these surveys, DWR selected 112 water agencies to be interviewed to learn how they planned to deal with water supply shortages in a dry 1989. The survey results, tabulated by county and agency, are presented in Appendix B.

Summary analyses were made for each of 13 regions of the State shown on Figure 6, delineated on the basis of similarity of likely problems and potential water supply solutions. These regional assessments, presented on the following pages, provide a means of comparing the severity of the present drought to the drought of 1976 and 1977 and highlight potential problem situations in each of these areas.

Since 1977, irrigated cropland statewide has increased only a small amount. Earlier it was noted that ground water conditions are, in most instances, more favorable than in 1977. The ready availability of ground water enabled irrigated agriculture to come through the 1976–1977 drought relatively unscathed. Agriculture again appears to be favorably situated where ground water is an alternative water source. On the other hand, the State's population has increased 20 percent since 1977, ranging from 13 percent growth in the South Bay region to 67 percent in the Sierra Nevada Foothills region. Some localities have been hard-pressed to keep up with growing water needs, and the drought has placed an additional burden on local water managers.

Figure 6
DROUGHT ANALYSIS REGIONS

Assessment of 1989 Water Supply Adequacy

Northwestern California

Population

1977 – 171,000
1988 – 196,000
Increase – 15 %

Net Water Use

1975 – 175,000 acre-feet
1985 – 166,000 acre-feet
Decrease – 9,000 acre-feet (5%)

Normal Year Water Sources

(In percent)

Surface Water:	
Local	62
Imported	0
Reclaimed Water	1
Ground Water:	
Safe Yield	37
Overdraft	0
	100%

SELECTED RESERVOIRS SUPPLYING THE AREA

Storage on September 30 – *in 1,000s of acre-feet*

Reservoir	Historical Average	1986	1987	1988	1976	1977
Ruth	32	28	25	32	36	14

SUMMARY EVALUATION

A few localities reported problems in 1988 due to reduced surface water supplies. Ground water provides 37 percent of the normal-year water supply in this area, mostly in the coastal basins of the Mad and Eel rivers and the Eureka plain. Spring ground water levels throughout the area were generally higher than they were in the spring of 1977.

The hardest hit community is the city of Willits. Water was trucked in and a temporary pipeline was installed and used late in 1988 to transfer water from Scout Lake, which is owned by the Oakland area Boy Scouts.

If 1989 is dry:

Supplies should be adequate if ground water pumping is increased along the Coastal basin. However, too large an increase could cause sea-water intrusion.

Wells in shallow terrace formations are generally low-yielding and sensitive to annual recharge from precipitation and streamflow. Communities relying on wells in these formations will again see reduced production if 1989 is dry. Deepening of wells is usually not beneficial in these shallow formations.

Other local agencies such as Humboldt Bay Municipal Utility District, the city of Trinidad, and the Hornbrook Community Services District will require conservation and rationing to survive another dry year like 1988. Also, Hornbrook will attempt to move its Rancheria Creek diversions upstream to reduce losses to streambed percolation.

Purveyors Contacted in this Region

Hussey Ranch Corporation Community Service District
Humboldt Bay Municipal Water District
City of Trinidad
City of Fort Bragg
City of Willits
Redwood Valley County Water District
Hornbrook Community Service District
Weaverville Community Service District
Laytonville County Water District

Assessment of 1989 Water Supply Adequacy

North Bay

Population
1977 – 755,000
1988 – 945,000
Increase – 25 %

Net Water Use
1975 – 345,000 acre-feet
1985 – 429,000 acre-feet
Increase – 84,000 acre-feet (24%)

Normal Year Water Sources

	(In percent)
Surface Water:	
Local	52
Imported	21
Reclaimed Water	3
Ground Water:	
Safe Yield	24
Overdraft	0
	100%

SELECTED RESERVOIRS SUPPLYING THE AREA *

Storage on September 30 – *in 1,000s of acre-feet*

Reservoir	Historical Average	1986	1987	1988	1976	1977
Pillsbury	42	41	32	22	51	10
Mendocino	50	43	42	51	34	13
Sonoma (Warm Springs)	104	213	133	148	**	**
Hennessey	24	23	15	14	17	13
Nicasio	14	21	12	10	1	0
Kent	12	19	12	11	5	1
TOTAL	**246**	**360**	**246**	**256**	**108**	**37**

* *The SWP also supplies portions of this region through the North Bay Aqueduct, which was completed in 1988.*
** *Project completed in 1984.*

SUMMARY EVALUATION

Surface water provides three-quarters of the region's normal needs. One-half of these needs is supplied from local surface water sources, with the remaining surface supply imported from outside the region.

This region's overall water supply situation is much better than in 1977. In 1977, for example, Marin County's reservoirs almost dried up and water was pumped in through a temporary pipeline across the Richmond-San Rafael Bridge. In 1988, however, there were no significant drought related shortages in the region, except in some of the smaller communities. These improved conditions can be attributed primarily to the construction of Warm Springs Dam (Lake Sonoma), which added 380,000 acre-feet of storage capacity and augmented supplies for Sonoma County Water Agency and North Marin County Water District. Also, Marin Municipal Water District,

hardest hit in 1977, has since completed Soulajule Reservoir and enlarged Kent Lake, increasing system storage capacity from 50,000 acre-feet to 76,000 acre-feet.. MMWD can also purchase some water from Sonoma County Water Agency. (A more detailed discussion of MMWD's drought activities and plans is presented in Chapter 3.)

If 1989 is dry:

Coastal communities that are not served by SCWA, such as Jenner and Camp Meeker, will have problems in 1989, as is typical for this area, because of limited storage, reduced ground water recharge, and insufficient runoff from small watersheds. Jenner Water Works is negotiating with the county to take over its water system. The county should be able to provide the financial strength to develop a firmer supply. For 1989, Jenner and Camp Meeker may truck water from other purveyors.

The city of Napa will encourage conservation and, if necessary, invoke mandatory rationing if 1989 is dry. No major economic impacts are anticipated unless severe conditions exist.

Strict rationing will be necessary in many of the communities with smaller water systems.

Purveyors Contacted in this Region

Marin Municipal Water District
City of Napa
Camp Meeker Water Company
Jenner Water Works

Assessment of 1989 Water Supply Adequacy

South Bay

Population

1977 – 4,111,000
1988 – 4,652,000
Increase –13 %

Net Water Use

1975 – 942,000 acre-feet
1985 – 1,025,000 acre-feet
Increase – 83,000 acre-feet (9%)

Normal Year Water Sources

(In percent)

Surface Water:	
Local	7
Imported	72
Reclaimed Water	1
Ground Water:	
Safe Yield	20
Overdraft	0
	100%

SELECTED RESERVOIRS SUPPLYING THE AREA *

Storage on September 30 – *in 1,000s of acre-feet*

Reservoir	Historical Average	1986	1987	1988	1976	1977
Calaveras	56	74	54	50	30	27
Crystal Springs	40	44	19	42	25	44
Pardee	149	190	206	194	83	46
Camanche**	278	336	118	10	186	55
Hetch Hetchy	247	277	232	236	122	113
Lloyd (Cherry Valley)	138	216	189	36	119	104
San Antonio	39	39	5	18	16	30
Anderson	49	52	0	0	36	13
TOTAL	**996**	**1,228**	**823**	**586**	**617**	**432**

* *The SWP and CVP also supply this region through the South Bay Aqueduct, the Contra Costa Canal, and the recently completed San Felipe Division.*

** *East Bay MUD reservoir used to satisfy prior local rights to Mokelumne River flows.*

SUMMARY EVALUATION

This area depends to a great extent on surface water imported from the Sierra Nevada. In 1977, storage in the region's reservoirs, listed above, dropped to 43 percent of the historical average on September 30. In 1988, reservoir storage was somewhat better but still very low. At the same time, system demands are higher now due to increased population. Storage for San Francisco Water Department and East Bay Municipal Utility District, when major system reservoirs are included, was less than 50 percent of average on September 30, 1988. To provide safe carryover for a possible third dry year, both the SFWD and EBMUD, which draw water from Sierra Nevada reservoirs, instituted water rationing. (Detailed descriptions of these two agencies' drought activi-

ties and plans are presented in Chapter 3). The State Water Project, through its South Bay Aqueduct, delivers water to Alameda and Santa Clara counties. Full deliveries were made in 1988. The federal Central Valley Project also made full deliveries to Contra Costa County from the Delta and in Santa Clara County by way of the recently completed San Felipe Division.

Because of inadequate local runoff, several small water purveyors in the Santa Cruz mountains are buying supplemental water from the San Jose Water Company. This water is expensive because of the high pumping lift needed for delivery.

If 1989 is dry:

Santa Clara Valley Water District, which relies on water supplies from local surface reservoirs, the Hetch Hetchy system, the State Water Project, the federal San Felipe Project, and ground water, will require voluntary rationing of 15 percent if 1989 is as dry as 1988. If conditions are drier than in 1988, then mandatory rationing will be invoked to achieve between 25 percent and 40 percent reduction in use. Alameda County Water District, which uses slightly more ground water than it does surface water, will replace its current voluntary conservation program with mandatory rationing, if shortages reach 25 percent or more. Small water purveyors will continue to experience shortages. Both the San Francisco Water Department and East Bay MUD would continue water rationing programs implemented in 1988. (Details of the San Francisco Water Department and East Bay Municipal Utility District plans are discussed in Chapter 3).

Purveyors Contacted in this Region

Alameda County Water District
East Bay Municipal Utility District
Contra Costa Water District
San Francisco Water Department
Aldercroft County Water District
Chemiketa Water Company
Santa Clara Valley Water District

Assessment of 1989 Water Supply Adequacy

North Central Coast

Population

1977 – 503,000

1988 – 664,000

Increase – 32 %

Net Water Use

1975 – 670,000 acre-feet

1985 – 708,000 acre-feet

Increase – 38,000 acre-feet (6%)

Normal Year Water Sources

(In percent)

Surface Water:	
Local	3
Imported	0
Ground Water:	*
Safe Yield	85
Overdraft	12
	100%

SELECTED RESERVOIRS SUPPLYING THE AREA **

Storage on September 30 – *in 1,000s of acre-feet*

Reservoir	Historical Average	1986	1987	1988	1976	1977
San Antonio	219	278	217	164	243	52
Nacimiento	137	232	142	34	58	23
TOTAL	**356**	**510**	**359**	**198**	**301**	**75**

* *Releases from San Antonio and Nacimiento reservoirs are used for ground water recharge in the Salinas Valley and supply is shown as ground water.*

** *The CVP also supplies this region through its San Felipe Division.*

SUMMARY EVALUATION

Ground water recharged from surface sources is the primary supply in this region. In 1977, the region suffered severe water shortages, with mandatory rationing and other conservation measures implemented. Supplies in 1988 have come much closer to meeting normal demands. Many entities have drilled new wells or are planning to do so. However, some coastal agencies must limit new well construction and pumping because of the threat of sea–water intrusion or because of fear they might draw down the pool now used by residents pumping from shallow wells. Water conservation efforts are widespread in the region. In 1988, the Monterey Peninsula Water Management District used voluntary conservation to achieve a 10 percent reduction in water use.

Suppliers using surface water are concerned about carryover storage for 1989. Most of San Benito County and the southern part of Santa Clara County are served in part by surface water from the federal San Felipe Project. The supply was adequate in 1988, but algae caused some taste and odor problems.

If 1989 is dry:

The city of Santa Cruz may purchase and convey water through interties with Soquel Creek Water District and Scotts Valley Water District. Mandatory rationing will probably be imposed in a number of areas.

If rainfall is 25 percent or more below average by January 1989, Santa Cruz will seek relief to reduce fish flow requirements in the San Lorenzo River to conserve its supply. Also, the city wants help from DWR in developing radio and TV drought messages for use as needed throughout their area. Lompico County Water District will drill a new well to firm up supplies.

The Monterey Peninsula Water Management District may enact a mandatory water rationing ordinance requiring reductions of 25 to 40 percent to meet 1989 operation needs.

Purveyors Contacted in this Region

Monterey Peninsula Water Management District
Lompico County Water District
San Lorenzo Valley Water District
City of Santa Cruz

Assessment of 1989 Water Supply Adequacy

South Central Coast

Population

1977 – 427,000
1988 – 550,000
Increase – 29 %

Net Water Use

1975 – 338,000 acre-feet
1985 – 407,000 acre-feet
Increase – 69,000 acre-feet (20%)

Normal Year Water Sources

(In percent)

Surface Water:	
Local	18
Imported	0
Reclaimed Water	1
Ground Water:	
Safe Yield	45
Overdraft	36
	100%

SELECTED RESERVOIRS SUPPLYING THE AREA

Storage on September 30 – *in 1,000s of acre-feet*

Reservoir	Historical Average	1986	1987	1988	1976	1977
Salinas (Santa Margarita)	18	18	11	6	13	8
Gibraltar	7	7	3	3	5	4
Cachuma	169	172	128	99	145	112
Whale Rock	30	36	31	26	34	28
TOTAL	**224**	**233**	**173**	**134**	**197**	**152**

SUMMARY EVALUATION

Sources of supply are local surface and ground water. The larger water purveyors such as the city of Santa Barbara, the city of San Luis Obispo, the county of San Luis Obispo, and the Goleta Water District rely mostly on surface water, while the remaining portion of the region uses ground water. In both 1977 and 1988, the region's water supplies were generally adequate for normal demands. However, the city of Morro Bay, which relies entirely on ground water, experienced a 30 percent shortage in 1988 and instituted stringent water conservation restrictions. Because of reduced surface supplies in 1988, San Luis Obispo County used ground water to meet 85 percent of its demand. This may cause problems if continued in critically overdrafted basins.

If 1989 is dry:

Ground water use is expected to increase to help meet the surface water deficiency; however, the Goleta Water District is faced with severe overdraft conditions, and an increase in use would intensify the overdraft problems. The district expects to cut demand by 20 percent through a mandatory rationing program. Also, the San Simeon Acres Community Services District faces seawater intrusion if greatly increased amounts of ground water are pumped.

The city of Morro Bay will continue its mandatory conservation program, and the Santa Ynez Improvement District No. 1 will impose mandatory rationing if its supply is reduced significantly.

Carryover surface supplies in Salinas and Whale Rock reservoirs will be adequate to meet the demands of the city of San Luis Obispo, but conservation will be necessary. The reservoirs will also help meet the county's needs when combined with increased ground water pumping, as in 1988.

Purveyors Contacted in this Region

City of San Luis Obispo
San Simeon Acres Community Service District
County of San Luis Obispo
Goleta Water District
City of Santa Barbara
City of Morro Bay
Santa Ynez Improvement District No. 1

Assessment of 1989 Water Supply Adequacy

South Coast

Population

1977 – 12,090,000

1988 – 15,286,000

Increase – 26 %

Net Water Use

1975 – 3,240,000 acre-feet

1985 – 3,761,000 acre-feet

Increase – 521,000 acre-feet (16%)

Normal Year Water Sources

(In percent)

Surface Water:	
Local	5
Imported	64
Reclaimed Water	2
Ground Water:	
Safe Yield	26
Overdraft	3
	100%

SELECTED RESERVOIRS SUPPLYING THE AREA

Storage on September 30 – *in 1,000s of acre-feet*

Reservoir	Historical Average	1986	1987	1988	1976	1977
Oroville*	2,428	2,661	1,979	1,529	1,828	915
San Luis*	601	993	445	399	469	196
Mead**	19,895	24,416	23,826	22,795	20,062	20,205
Powell**	17,021	24,200	24,738	22,753	19,640	16,140
Casitas	202	242	214	199	204	182
Piru	32	49	21	24	12	14
Castaic	214	256	248	205	237	58
Henshaw	10	8	2	2	2	1
Crowley	142	153	158	94	53	52
Mathews	115	137	133	146	91	109
TOTAL	**40,660**	**53,115**	**51,764**	**48,146**	**42,598**	**37,872**

* *State Water Project supply shared with other areas.*

** *Interstate water used jointly.*

SUMMARY EVALUATION

Primary sources are the Colorado River, the State Water Project and the Los Angeles Aqueduct from Owens Valley. Reservoir storage on September 30, 1988, was ten million acre-feet more than was in storage on September 30, 1977. The Colorado River storage at lakes Mead and Powell accounted for nine million of the increase. The above-normal Colorado River storage in 1988 helped offset shortages from other sources.

The drought in this region was not as severe as in other areas of the State. Precipitation was near normal, but local surface water provides only about 5 percent of total supplies. Imported supplies

were adequate from the Colorado River where supplies are above normal. Also, the SWP made full deliveries to Southern California because of adequate storage in Oroville and San Luis reservoirs. In Ventura County, however, the United Water Conservation District, whose normal supply is almost two-thirds ground water, had a shortage of about 25 percent. The district instituted a voluntary water conservation program and took other steps to reduce its demand or increase its supply. Although its supply was near normal, the Casitas Municipal Water District also called for voluntary water conservation.

While supplies to the region are plentiful, compared to other regions, almost all water purveyors, including the Los Angeles Department of Water and Power and The Metropolitan Water District of Southern California, called for voluntary conservation to reserve water in storage for a possible third dry year. Although its supply was normal, the San Diego County Water Authority called for voluntary conservation to attain a 10-percent reduction in demands and launched other water conservation measures, including a media public information campaign and promotion of water reclamation and reuse projects.

If 1989 is dry:

For 1989, the Secretary of the Interior has again determined there is surplus water available in the Colorado River, and MWD plans to divert 1.2 million acre-feet, which is the full capacity of the Colorado River Aqueduct.

In addition to direct diversion of Colorado River water, MWD exchanges a portion of its Colorado River water with the Coachella Valley Water District and the Desert Water Agency for their SWP supply. MWD provides the agencies water for underground storage in return for the ability to interrupt deliveries of entitlements. From 1983 to April 1987, MWD delivered more than 550,000 acre-feet of water to those agencies. Since that time, through May 1988, 55,000 acre-feet has been withdrawn from this account by the overlying agencies.

Because of Colorado River supplies, this region should have fewer problems than any other. Even so, because of the situation statewide, the three major agencies — the Los Angeles Department of Water and Power, The Metropolitan Water District of Southern California, and the San Diego County Water Authority — would impose mandatory rationing and adopt other emergency water conservation measures. The drought activities and contingency plans for the LADWP and MWD are discussed more fully in Chapter 3. The San Diego County Water Authority, whose supply is 99 percent surface water (largely imported from MWD), would consider a shortage of 25 percent an extreme emergency, calling for severe restrictions on many domestic water uses.

Although its supply was adequate in 1988, the city of Ventura plans to invoke mandatory rationing if shortages occur in 1989. The United Water Conservation District and the Casitas Municipal Water District will continue their voluntary conservation programs.

Purveyors Contacted in this Region

Los Angeles Department of Water and Power
Metropolitan Water District of Southern California
San Diego County Water Authority
City of Ventura
Casitas Municipal Water District
United Water Conservation District

Assessment of 1989 Water Supply Adequacy

Sacramento Valley Floor

Population

1977 – 1,308,000
1988 – 1,775,000
Increase – 36 %

Net Water Use

1975 – 6,066,000 acre-feet
1985 – 6,723,000 acre-feet
Increase – 657,000 acre-feet (11%)

Normal Year Water Sources

(In percent)

Surface Water:	
Local	72
Imported	*
Ground Water:	
Safe Yield	26
Overdraft	2
	100%

SELECTED RESERVOIRS SUPPLYING THE AREA

Storage on September 30 – *in 1,000s of acre-feet*

Reservoir	Historical Average	1986	1987	1988	1976	1977
Clare Engle (Trinity)**	1,788	1,901	1,813	1,479	1,503	242
Shasta**	3,005	3,211	2,108	1,586	1,295	631
Black Butte	30	28	32	34	21	1
Stony Gorge	11	27	13	20	9	4
East Park	16	29	18	18	2	0
Bullards Bar	540	706	615	542	344	258
Clear Lake***	226	76	42	54	0	0
Camp Far West	41	38	7	4	4	3
Berryessa	1,281	1,382	1,135	986	1,038	759
Indian Valley	158	249	111	52	—	—
Folsom **	651	653	430	218	416	147
TOTAL	**7,623**	**8,300**	**6,324**	**4,993**	**4,632**	**2,045**

* *Included in "Local Surface Water."*
** *Supply shared with other areas.*
*** *Above natural outlet.*

SUMMARY EVALUATION

Surface water makes up 72 percent of net water use in this region. With water stored in the major reservoirs at the beginning of the year and available runoff from the major rivers, most 1987 and 1988 demands were met. In some cases, additional ground water was used. In 1977, surface water deliveries were down as much as 50 percent. Ground water was heavily pumped to make up the deficiency.

Indian Valley Reservoir on the North Fork of Cache Creek, constructed since the 1976-77 drought, has proven to be a very important source of water for Yolo County.

The smaller communities that rely on supplies from local reservoirs have had to use voluntary conservation or rationing as a primary means of coping in 1988.

If 1989 is dry:

Total reservoir storage at the end of September 1988 was 65 percent of average. This should be sufficient carryover storage to meet most needs in 1989, unless we experience a critically dry year like 1977. Because storage in Indian Valley Reservoir will start the 1989 water year with only 30 percent of average, shortages will be experienced if conditions are dry.

Most farmers in the Yolo County Flood Control and Water Conservation District will pump more ground water to help offset possible shortages in their surface supplies.

The city of Lakeport and other areas in Lake County may experience a shortage of ground water due to lack of natural recharge. Also, again in 1989, as in 1988, the smaller agencies such as Lime Saddle Community Services District in Butte County and Paskenta Community Services District in Tehama County will need to ration water or attempt to acquire a substitute supply.

Purveyors Contacted in this Region

Lime Saddle Community Service District
Magalia County Water District
Glenn-Colusa Irrigation District
Orland Unit Water Users Association
City of Lakeport
Lake County Special District
Lower Lake County Water Works
Upper Lake County Water District
Stonehouse Mutual Water Company
Centerville Community Service District
Shasta County Service Area #6
Shasta Dam Public Utility District
Sutter Mutual Water Company
South Sutter Water District
Paskenta Community Service District
Paradise Irrigation District
Yolo County Flood Control and Water Conservation District

Assessment of 1989 Water Supply Adequacy

San Joaquin Valley Floor

Population

1977 – 1,856,000
1988 – 2,517,000
Increase – 36 %

Net Water Use

1975 – 14,023,000 acre-feet
1985 – 14,416,000 acre-feet
Increase – 393,000 acre-feet (3%)

Normal Year Water Sources

(In percent)

Surface Water:	
Local	48
Imported	31
Reclaimed Water	1
Ground Water:	
Safe Yield	11
Overdraft	9
	100%

SELECTED RESERVOIRS SUPPLYING THE AREA***

Storage on September 30 – *in 1,000s of acre-feet*

Reservoir	Historical Average	1986	1987	1988	1976	1977
New Hogan	143	136	59	16	70	11
Donnells	32	49	8	10	5	11
Beardsley	74	77	28	23	2	4
New Melones	1,683	1,948	1,443	989	4*	3*
Tullock	42	63	60	36	8	11
Don Pedro	1,228	1,672	934	930	687	307
McClure	603	696	314	148	244	95
Millerton	212	159	168	146	224	197
Oroville**	2,428	2,661	1,978	1,529	1,828	915
Pine Flat	455	561	126	63	208	68
Isabella	217	327	151	75	70	36
Terminus	17	12	5	6	17	10
Success	15	21	5	7	7	5
San Luis****	1,166	1,481	688	492	678	274
TOTAL	**8,315**	**9,862**	**5,969**	**4,470**	**4,740**	**2,226**

* *Original Melones.*
** *Supply shared with other areas. See Chapter 3.*
*** *The CVP's northern system also supplies this region.*
**** *Total of CVP and SWP storage.*

SUMMARY EVALUATION

For the reservoirs listed above, water in storage on September 30, 1988, was only 54 percent of average. This is about 2 million acre-feet more than at the end of 1977, due in part to storage of 989,000 acre-feet in New Melones Reservoir, which was completed since 1977. The short storage supply carried over from 1987, coupled with 35 percent of normal runoff and a greater demand

for irrigation water to make up for lack of rainfall, has caused many growers to increase their use of ground water. Use of ground water jumped nearly 100 percent in 1988. About 2.5 to 3 million acre-feet of additional ground water was pumped to make up the deficiency of surface water.

Permanent crops are being adequately irrigated, but in some cases, more than the usual areas are being left fallow. Also, some annual crops have been changed to lower water-using types.

If 1989 is dry:

The Stockton East Water District is planning to take Stanislaus River water through the Farmington tunnel project in 1989 to help make up deficiencies that will occur in their primary source, New Hogan Reservoir on the Calaveras River. In addition to this supply, the district will pump more ground water to meet a demand reduced by conservation and strict rationing.

With another year as dry as 1988, the Oakdale Irrigation District will receive an additional 50,000 acre-feet from the U.S. Bureau of Reclamation's New Melones Reservoir, but the district will still be required to ration water. Supplies to the district would be about 70 percent of normal.

Water purveyors relying on local reservoir storage on the Mokelumne, Calaveras, Stanislaus, Kings, Kaweah, Tule, and Kern rivers will suffer major shortages in surface water if 1989 is as dry as 1988. Most of these purveyors have facilities to use ground water; however, some will have to increase the number of wells.

Purveyors Contacted in this Region

City of Brentwood
Alta Irrigation District
Laguna Irrigation District
Westlands Water District
Fresno Irrigation District
James Irrigation District
Consolidated Irrigation District
Orange Cove Irrigation District
Arden Water Company
Arvin-Edison Water Storage District
Belridge Water Storage District
Berrenda Mesa Water District
Buena Vista Water Storage District
Kern Delta Water District
Lost Hills Water District
North Kern Water Storage District
Semitropic Water Storage District
Shafter-Wasco Irrigation District
Southern San Joaquin Irrigation District
Wheeler Ridge Maricopa Water Storage District
Dudley Ridge Water District.
City of Corcoran
Madera Irrigation District
Chowchilla Water District
Merced Irrigation District
Stockton East Water District
North San Joaquin Water Conservation District
South San Joaquin Irrigation District
City of Ceres
Modesto Irrigation District
Oakdale Irrigation District
Oak Flat Water District
Orestimba Water District
Patterson Water District
City of Turlock
Turlock Irrigation District
Lower Tule River Irrigation District
Lindsay-Strathmore Irrigation District
Terra Bella Irrigation District
Delano-Earlimart Irrigation District
Porterville Irrigation District
Tulare Lake Basin Water Storage District
Kings County Water District (including Lakeside Irrigation Water District)

Assessment of 1989 Water Supply Adequacy

Sierra Nevada Foothills

Population

1977 – 264,000
1988 – 442,000
Increase – 67 %

Net Water Use

1975 – 378,000 acre-feet
1985 – 485,000 acre-feet
Increase – 107,000 acre-feet (28%)

Normal Year Water Sources

(In percent)

Surface Water:	
Local	87
Imported	3
Ground Water:	
Safe Yield	9
Overdraft	1
	100%

SELECTED RESERVOIRS SUPPLYING THE AREA

Storage on September 30 – *in 1,000s of acre-feet*

Reservoir	Historical Average	1986	1987	1988	1976	1977
Frenchman	34	40	31	23	15	8
Little Grass Valley	55	61	60	59	48	31
Sly Creek	15	41	36	25	24	14
Jackson Meadows	47	50	22	22	3	5
Bowman	41	56	29	31	41	16
Spaulding	61	61	56	53	47	62
Scotts Flat	29	35	24	22	17	2
Rollins	45	64	50	39	23	6
Jenkinson (Sly Park)	25	26	14	14	11	5
Lower Bear	24	24	17	11	17	7
Salt Springs	77	96	28	33	28	4
Strawberry	12	12	10	12	12	13
TOTAL	**465**	**566**	**371**	**344**	**286**	**173**

SUMMARY EVALUATION

As indicated above, there has been tremendous population growth in this region since the last drought. Available supplies are being stressed to their limits. Surface water is the primary source in this region. Ground water meets only 10 percent of the demand. In times of low surface runoff, little flexibility is possible to augment the deficiency. Some districts, such as the El Dorado Irrigation District and the small community of Grizzly Flat, have experienced severe water shortages. Mandatory rationing, trucking in water, or laying emergency pipeline are methods used to cope with the shortages.

If 1989 is dry:

This area has limited ability to cope with another dry year, even though 12 reservoirs were storing 170,000 acre-feet more at the end of 1988 than was available at the end of 1977. In El Dorado County, the El Dorado Irrigation District will use a new tunnel to transport 5,000 acre-feet of Pacific Gas and Electric Co.'s water from the American River and store it in Sly Park Reservoir. This will help offset the effects of future droughts. The district will enforce mandatory rationing.

The Tuolumne County Water System will require its full entitlement of 9,000 acre-feet from New Melones Reservoir to meet the demand reduced by mandatory rationing.

The Mariposa Public Utility District is negotiating with a private water system within its boundary. Connections to the private system are already in, and surplus supplies from the system will help meet the district's needs. Widespread rationing in this region will be required.

Purveyors Contacted in this Region

Jackson Valley Irrigation District
City of Angels Camp
El Dorado Irrigation District
Mariposa Public Utility District
Nevada Irrigation District
Placer County Water Agency
Bidwell Water Company
Plumas County Service Area #8 (Plumas Eureka Estates)
Plumas County Community Development Commission (formerly Quincy Water Company)
Tuolumne County Water System

Assessment of 1989 Water Supply Adequacy

Northeastern California

Population

1977 – 65,000
1988 – 82,000
Increase – 26 %

Net Water Use

1975 – 1,420,000 acre-feet
1985 – 1,448,000 acre-feet
Increase – 28,000 acre-feet (2%)

Normal Year Water Sources

(In percent)

Surface Water:	
Local	83
Imported	0
Ground Water:	
Safe Yield	17
Overdraft	36
	100%

SELECTED RESERVOIRS SUPPLYING THE AREA

Storage on September 30 – *in 1,000s of acre-feet*

Reservoir	Historical Average	1986	1987	1988	1976	1977
Clear Lake (Modoc County)	224	334	250	185	228	147
Dwinnell (Shastina)	14	12	4	2	9	1
TOTAL	**238**	**346**	**254**	**187**	**237**	**148**

SUMMARY EVALUATION

This area depends entirely on local supplies. Much of the area's surface water supply is under watermaster service. Users adapt to the supply available, which was about 40 percent of normal in 1988. Some areas will run out of water.

If 1989 is dry:

If the 1989 water year is much below normal, many farms under watermaster service in the valleys of Modoc, Lassen, and Siskiyou counties will be able to divert only about one–half of the water they need. The McCloud Community Service District, which serves 1,160 people, will attempt to improve its system, including detection and repair of leaks and purchase of the existing water line from springs.

Purveyor Contacted in this Region

McCloud Community Service District

Assessment of 1989 Water Supply Adequacy

Tahoe – Truckee

Population

1977 – 36,000

1988 – 49,000

Increase – 36 %

Net Water Use

1975 – 183,000 acre-feet

1985 – 163,000 acre-feet

Decrease – 20,000 acre-feet (11%)

Normal Year Water Sources

(In percent)

Surface Water:	
Local	93
Imported	0
Reclaimed Water	3
Ground Water:	
Safe Yield	4
Overdraft	0
	100%

SELECTED RESERVOIRS SUPPLYING THE AREA

Storage on September 30 – *in 1,000s of acre-feet*

Reservoir	Historical Average	1986	1987	1988	1976	1977
Stampede*	126	182	88	61	58	31
Boca	21	34	33	12	30	5
Prosser Creek	15	19	13	4	0	0
Lake Tahoe**	416	588	311	12	308	0
Bridgeport	15	17	2	0	4	0
TOTAL	**593**	**840**	**447**	**89**	**400**	**36**

* *Water supply is allocated to uses in Nevada.*

** *Above natural outlet.*

SUMMARY EVALUATION

Lake Tahoe ceased flowing into the Truckee River in October 1988, Bridgeport Reservoir was empty, and other reservoirs in the region were well below normal supply on September 30, 1988. Voluntary conservation is practiced, but the area's chronic local supply problems are worsened by dry years. Heavy weekend and vacation populations swell demands. Agencies could require mandatory rationing and possible pumping from lakes.

Markleeville, the seat of Alpine County, experienced a severe water shortage. The stream that normally supplies the community went dry, and water had to be piped four miles from another creek to the treatment plant. Before the change was made, water was rationed.

If 1989 is dry:

If the water level in Lake Tahoe remains below the natural rim, the water supply for the Reno area will be greatly diminished. Water can be drawn from other sources, such as Donner Lake,

and if the drought continues into 1989, other supplies will be investigated. During the 1929–34 drought, water was pumped from Lake Tahoe to the Truckee River.

Markleeville Water Company's old system needs more dependable supplies and upgrading, including additional storage tank capacity. They will investigate three supply alternatives: 1) drilling a well in the volcanics; 2) laying four miles of pipeline to obtain 30 gallons per minute of well water from Turtle Creek Park; and 3) pumping from Markleeville Creek through a 3- to 4-mile pipeline. Rationing will be in effect.

Purveyors Contacted in this Region

Markleeville Water Company
Donner Lake Utility Company

Assessment of 1989 Water Supply Adequacy

South Lahontan

Population

1977 – 280,000
1988 – 442,000
Increase – 58 %

Net Water Use

1975 – 332,000 acre-feet
1985 – 428,000 acre-feet
Increase – 96,000 acre-feet (29%)

Normal Year Water Sources

(In percent)

Surface Water:	
Local	10
Imported	10
Reclamation	2
Ground Water:	
Safe Yield	42
Overdraft	36
	100%

SUMMARY EVALUATION

This area relies primarily on ground water, a condition that has led to considerable overdrafting in some areas. No drought-related problems have been reported. Antelope Valley–East Kern Water Agency, Littlerock Creek Irrigation District, and Palmdale Water District receive imported supplies from the State Water Project.

If 1989 is dry:

Delivery of less than requested amounts could occur if 1989 is another critically dry year. Additional ground water could be pumped to make up any shortage in surface deliveries. The community of June Lake would use more water from June Lake to offset shortages in its secondary Snow Creek supply.

Purveyor Contacted in this Region

Mammoth County Water District
June Lake Public Utility District

Assessment of 1989 Water Supply Adequacy

Colorado Desert

Population
1977 – 281,000
1988 – 419,000
Increase – 49 %

Net Water Use
1975 – 4,029,000 acre-feet
1985 – 4,024,000 acre-feet
Decrease – 5,000 acre-feet (0%)

Normal Year Water Sources

	(In percent)
Surface Water:	
Local	—
Imported	97
Ground Water:	
Safe Yield	2
Overdraft	1
	100%

SUMMARY EVALUATION

Because rainfall here averages less than five inches per year, this region relies almost entirely on imported water, primarily from the Colorado River. With the lower Colorado River reservoirs now at above-average storage levels, full allocations to area users were made in 1988. (See South Coast region for Colorado River reservoir storages.) The region received full deliveries in 1977.

If 1989 is dry:

Deliveries from the Colorado River and SWP should be adequate. The State Water Project has contracts with four agencies that lie partly or entirely within the area -- the Coachella Valley Water District, the Desert Water Agency, the San Gorgonio Pass Water Agency, and the Mojave Water Agency. Mojave is requesting no deliveries at present. The other agencies would take water from the MWD water bank if the SWP is forced by the drought to reduce municipal and industrial water deliveries.

Purveyors Contacted in this Region

No agencies were interviewed.

Water Quality Problems

Apart from creating water shortages, droughts also degrade water quality. Not only is there less water, but the water that is available is less suitable for its intended uses. Most drought-related water quality problems result from lack of dilution. Salt is concentrated in agricultural drainage by evaporation and uptake by vegetation. When drainage is returned to a low-flowing stream channel, the resultant salinity in the channel is higher than during normal years. Specific water quality impacts were evident in 1988 and can be expected to become a greater problem, if the drought continues in 1989.

Water Supplies of the Sacramento–San Joaquin Delta

One of California's drought-related water quality problems occurs in the Sacramento–San Joaquin Delta, a source of supplemental water for about 16 million Californians and 1½ million acres of agricultural lands. Reservoir releases, natural runoff, and irrigation return flows normally repel saline water that enters the Delta from San Francisco Bay. When streamflows are low, salt water penetrates farther than normal, making the water used in the Delta and exported from it saltier than usual. Temporary barriers constructed in Delta channels can help to control salinity intrusion.

Drinking Water

One of the more significant water quality problems related to the Delta and drought conditions is the formation of trihalomethane (THM) in drinking water supplies. THMs are potential cancer-causing chemicals formed when water containing certain precursors is chlorinated during the process of disinfecting drinking water. To protect the health of consumers, the U.S. Environmental Protection Agency has set the allowable limit of THMs in drinking water at 100 parts per billion.

Water supplies can contain two types of chemicals that promote the formation of THMs. One type is derived from organic substances produced by decaying vegetation; the other is bromides, which are salts of seawater origin. During a drought, reduced fresh-water dilution can increase the concentration of organic substances in the water. Also, because of the intrusion of salt water into the Delta, bromide concentrations increase. The result is a water supply that has a greater capacity to form THMs and is, therefore, more difficult to treat to meet the established drinking water limit. Some municipal users of Delta water supplies are encountering treatment problems due to elevated bromide levels.

Agriculture

When irrigation water is saline, more water must be applied to adequately leach salt from the soils. When agricultural users do not get enough rain or cannot get enough water for leaching, salt accumulates in the soil. In some cases, salt accumulation can be tolerated during several years of severe drought. However, at some point, the salt must be leached, either by precipitation or applied water, or the soil becomes infertile.

Industrial Uses

Many industries use water in the manufacturing process or in the product. Some of the industrial processes requiring water of specific quality are disrupted when water of acceptable quality cannot be supplied. One example is the paper container manufacturing industry. When the process water used to make paper cartons is too salty, cans stored in them will corrode.

Water Quality Monitoring

Local water service agencies may need to increase monitoring to identify problems and assess their extent. Where problems are suspected or known to exist, the local agency should assume responsibility for communicating with appropriate regulatory agencies. Users of domestic wells should monitor quality closely, if past sampling indicates a potential problem.

DWR will provide technical advice and assistance, where possible, to help local agencies in identifying and developing solutions to their water quality problems.

Fish and Wildlife

The current drought is already severely affecting California's fish and wildlife resources. Low streamflows and reservoir levels, high water temperatures, and poor water quality are resulting in serious fishery losses. Recent fish counts are showing reductions of young striped bass, shad, salmon, and several other species. The number and size of fish being reared at hatcheries is decreasing. Fish production at the Feather River hatchery at Oroville is a notable exception. The places and times that fish can be planted are becoming fewer, and fishing access and opportunities for angling are becoming more limited.

Dry forage conditions, fire losses, and short water supplies are constricting habitat and causing wildlife to occupy more confined areas, thus increasing the likelihood of disease and making them more vulnerable to predation and poaching.

Lack of water, changes in agricultural acreage and drainage, reduction of food and habitat, and salt water intrusion have caused serious problems for waterfowl. These conditions had increased crop depredation on private agricultural fields, reduced nesting success, and concentrated waterfowl into more confined wetland areas, thereby increasing the potential for major outbreaks of deadly botulism and cholera. The November rains eased some of these stresses.

Some specific examples of drought-caused fishery problems this year are:

- Low reservoir levels in the CVP and high ambient air temperatures are resulting in significantly elevated water temperatures in the Sacramento-San Joaquin River systems. Only close cooperation between federal and State water and fish and wildlife agencies have to date prevented catastrophic losses of the State's valuable Central Valley chinook salmon runs. Temperatures have been maintained virtually all summer by utilizing the cold water behind Shasta Dam at the expense of bypassing hydroelectric facilities.
- Fish losses are occurring on the Truckee River and Little Truckee River Systems, due to rapid fluctuations of river flow and the dewatering of some river sections, resulting in the stranding of fish.

- Some coastal streams are drying up due to lack of precipitation, increased diversions, and ground water pumping.

- The dewatering of Bridgeport Reservoir on the East Walker River has resulted in the major loss of one of the "top 10" trophy trout fisheries in the western United States.

To aid State and federal fish and wildlife agencies in their efforts to mitigate the effects of the drought on fish and wildlife, Congress has passed the Federal Disaster Assistance Act of 1988. Under this act, the U. S. Bureau of Reclamation is authorized to make water available to protect fish and wildlife resources and to mitigate losses that occur as a result of the drought. The act also authorized the Bureau to construct a temperature control curtain at Shasta Dam. The purpose of the curtain is to give the Bureau some control of the temperature of water released through the Shasta powerplant as part of the overall effort to protect anadromous fisheries.

The Modesto Irrigation District and the Turlock Irrigation District are cooperatively funding an experimental hatchery in Modesto's old Main Canal near LaGrange Dam. About 1 million salmon fry will be raised in the old canal channel during early 1989 and released downstream later in the year. This program is an effort to mitigate drought effects on the San Joaquin River system. Fish water requirements from Don Pedro Reservoir will continue to be met, even if a third dry year should occur. Those release schedules are being modified on a month-to-month basis by request of the Department of Fish and Game to provide more flows during certain months of the year.

If 1989 is dry, there will be increased demands for water diversions and requests for relaxation of minimum flow requirements. If implemented, these will result in even further adverse impacts on fish and wildlife. To reduce these impacts, fish and wildlife agencies will be increasing mitigation and management efforts in several areas. The Department of Fish and Game will:

- Work with the Environmental Protection Agency and the State Water Resources Control Board and Regional Water Quality Control Boards to take emergency actions to prevent loss of fish in the upper Sacramento River. This will involve the control and treatment of acid mine waste derived from the Iron Mountain Mine in Shasta County.

- Work with USBR to cool summer temperature in the upper Sacramento River. This will focus on the winter-run chinook salmon and will involve cold-water releases from the bottom of Shasta Dam.

- Work with USBR to accelerate installation of a temperature control device at Shasta Dam.

- Transfer hatchery production from Nimbus Hatchery on the American River (where temperatures would be too high in the fall) to the Feather River Hatchery below Oroville Dam where cooler water is available. Water can be drawn from Lake Oroville at different levels to control the temperature of releases.

- Purchase water on a cost-shared basis to maintain wetlands at the Grasslands Water District.

- Explore specific opportunities to buy or trade water to meet fall and spring outflow needs on anadromous fishery streams.
- Work with SWRCB and various water agencies to move the location of diversions downstream in areas where additional streamflow can be obtained without sacrifice to the quality of the water supply.
- Work with water agencies to modify project operation so that rapid fluctuations of streamflow are reduced, eliminating the stranding of fish.
- Encourage water agencies to maximize conjunctive uses in a manner that will maintain surface flows when they are critically needed for fisheries.

In addition:

- If water supplies to spring-fed fish hatcheries fall too low, catchable-size and subcatchable-size fish will be tranferred to hatcheries with sufficient water and space. They also may be planted earlier than usual at high-elevation lakes or in large reservoirs. The number of late-season hatchery trout reared to catchable size may be reduced.
- Because low flows and higher water temperatures will preclude normal late-season fish planting in some locations, trout will only be stocked early in the season in these waters. Late-season trout allotments will be diverted to other, more suitable sites.
- Fishery agencies will continue to work actively with water storage agencies to obtain releases of colder water from large reservoirs.
- To benefit anglers, the Department of Fish and Game will notify them of lower reservoir levels and difficult access to fishing sites.
- Some reservoirs with low water levels may be treated to improve conditions for resident game fish in the future.
- Stream habitat improvements may be undertaken that would not be possible without low streamflows.
- Fish and Game will advise SWRCB of the impacts of possible discharges of heavily treated wastewater effluent, increased diversions, and relaxation of fish protection standards.
- Additional emergency water supplies for big game species may be obtained, including springs and guzzlers, water trucked to dry locations, and water obtained from other sources, such as ranches and utility companies.
- Additional deep well pumping at waterfowl management areas will be considered to help ease the impact on wintering waterfowl.
- Additional sources of water and improved water conservation practices such as staged flooding of ponds to stretch supplies, will be considered for management

and wetland areas. Dead birds will be picked up promptly to cut the spread of avian botulism and cholera.

- Measures will be taken to protect threatened, endangered, and sensitive species.

Recreation

Droughts adversely affect both recreation and certain natural and cultural resources in many of California's parks. Low water conditions in many reservoirs, lakes, rivers, and streams decrease recreation opportunties and quality and lower park attendance. In 1988, water shortages and a greater potential for fire existed at about two-thirds of the State's 300 park units.

The drought has also increased the costs of maintaining some park units. Expensive supplemental water supplies are required to keep several parks operating. Upgrading of sewage treatment facilities may be needed if water quality problems develop. Costly navigational hazard work will be required because of falling reservoir levels at other units. Fire danger and suppression costs also have increased. Trees and other vegetation in the Coast Range and Sierra Nevada are expected to be stressed by the lack of water and become more susceptible to insect attacks.

If California experiences a third consecutive dry year, recreation use, quality, revenues and costs, and natural resources all will also be impacted. Coastal and Delta park units, however, should not be significantly affected by a continuation of the drought.

If the drought extends into 1989, many of the drought-related actions taken during 1976–77 and those initiated in 1988 will be used and expanded, as appropriate. Possible actions include:

- Beginning in May 1989, the Department of Parks and Recreation plans to promote water conservation as an interpretive theme at all parks located in drought-affected areas.
- Water conservation patrols may be increased to check for leaks and water waste, and water service to outlying areas where patrolling is difficult could be cut off to eliminate "water-pirating."
- Natural resources will be closely monitored to identify drought stress-related impacts.
- Prescribed burns for vegetative management may be curtailed.
- The public will be encouraged to use coastal, Delta, and other recreation units not affected by the drought.
- The Department of Boating and Waterways will extend existing boat ramps, improving public access to waterways.
- Boating and Waterways will inform the public of low-water navigation hazards, overcrowded boat traffic on the more accessible lakes and rivers, and whitewater river conditions.
- Some parks may be closed because of a lack of water or high fire danger.

Electrical Energy

Nearly 16 percent of California's electrical generating capacity comes from hydropower. In developing their power supplies, the State's electric utilities plan for periodic drought conditions — reduced hydroelectric production due to lowered streamflow and reservoir levels. Thus, even in very dry years, utilities are able to meet electricity demand by securing output from alternative sources. Present projections by the California Energy Commission for 1989 affirm this outlook.

However, the gas-fired electrical power that is substituted for in-State hydrogeneration and Pacific Northwest energy purchases is more expensive. For this reason, if the drought continues, some Californians can expect their 1989 electric bills to increase. Customers may also, under certain circumstances, be asked to help manage peak demand by rescheduling and reducing demand. These effects would be magnified if the Pacific Northwest is affected by a 1989 drought.

3. RESPONDING TO A DRY 1989

If 1989 is dry, most water agencies and many individuals will be faced with the need to take special actions in response to water shortages. This chapter gives examples of what is being planned and presents suggestions that may be useful for those who must find means to cope with critical water shortages. Plans for dealing with fish and wildlife problems and recreation impacts, as well as special concerns related to water quality are presented in Chapter 2 .

The Federal Central Valley Project and the State Water Project

The question is sometimes asked: "Why do the government officials responsible for managing our water continue to make normal or near-normal water deliveries during droughts?"

The answer to this very important question is that water officials must weigh the possibility that a drought will continue against the economic loss the State might incur if water deliveries were curtailed while supplies were still available. Therefore, delivery decisions are based on necessary carryover storage for the following year and a water supply that has a very high probability of being exceeded. What occurs in drought management is the postponement of economic loss to eventually minimize it or avoid it altogether.

The Central Valley Project of the U.S. Bureau of Reclamation and the State Water Project both follow established procedures to determine the amounts of water they may deliver in a given year. From October to January, CVP delivery plans are based on current reservoir storage, combined with various runoff scenarios during the remainder of the water year. By mid–January, half the rainy season is past, and more reliable assessments of the year's available supply are made. Commitments are made to CVP water customers in February. SWP delivery commitments are initially made in December and then updated in January and February. The SWP procedure is based upon achieving a target carryover storage at the end of September.

In early 1988, at the time commitments for delivery in 1988 were made, snowpack in the Sierra Nevada was near normal and reservoir storage just short of average. Based on these conditions and conservative forecasts of future runoff, full requested deliveries under long-term contracts were approved by both the CVP and the SWP in February. Precipitation and runoff occurring after January was very low, and delivery commitments were met by drawing on reservoir storage during 1988.

The Central Valley Project

Operational alternatives for the CVP for 1989 have been developed for a range of possible water supplies. The actual operation will be dictated by the precipitation which occurs during the win-

ter of 1988–89. CVP reservoir storage at the end of the 1988 water year (September 30, 1988) was 4.6 million acre-feet. (The desirable level of carryover storage is 8.0 million acre-feet.)

Water supply forecasts used in developing operations plans are based on the Sacramento River Basin Flows, defined in Chapter 1.

Four operational alternatives for 1989, developed in June, have been considered for the CVP. They are based upon hydrologies ranging from the driest year of record (1977) to normal, shown in the following table.

SUMMARY OF OPERATIONAL ALTERNATIVES
CENTRAL VALLEY PROJECT
In millions of acre-feet

Hydrology	Sacramento River Basin Flows, 1988-1989	Projected Water Deliveries 1989	Projected Storage Sep. 30, 1989
Driest year of record	5.1	50% reductions	1.2
Supply that should be exceeded 9 years out of 10	9.2	No reductions	2.4
Supply that should be exceeded 3 years out of 4	12.5	No reductions	4.4
Normal supply year	17.3	No reductions	7.4

These alternatives do not address the low runoff from the San Joaquin River basin above Millerton Reservoir. In a normal year in the Friant area, all the firm (Class I) deliveries should be met, and about 50 percent of the less dependable (Class II) deliveries would be made. In 1988, the low runoff (46 percent) resulted in no Class II deliveries and a 22 percent reduction in Class I deliveries. Continuation of the drought into 1989 will again result in large reductions in the Friant area.

The State Water Project

The SWP uses a Delivery Risk Analysis to determine the amount of water deliveries that can be approved each year. The DRA procedure was developed over a number of years through extensive hydrologic probability analyses and discussions among the water contractors. It is a procedure that defines the relationship between forecasted water supply at a certain level of probability for the current water year, current carryover storage, target end-of-year carryover storage, and total approvable SWP deliveries for the calendar year. The DRA objective is to ensure that enough carryover storage will be maintained to meet next year's water quality protection requirements in the Delta and to supply at least an emergency level of deliveries next year, without the need for extraordinary measures. Very conservative water supply forecasts are used to ensure that two-year delivery commitments and carryover storage can be met, even in the event of very dry hydrol-

ogy. Use of the DRA has enabled the SWP to meet full contractual obligations during 1987 and 1988, event though these were the third driest two consecutive years since 1906.

Operation of the SWP in 1989 has been analyzed under varied water supply conditions. That analysis is summarized in the following table.

SUMMARY OF OPERATIONAL ALTERNATIVES

STATE WATER PROJECT

In millions of acre-feet

Hydrology	Sacramento River Basin Index	Projected Deliveries	Projected Carryover Storage
Driest year of record	5.1	Large agricultural and municipal reductions; amount depends on special drought measure implementation.	1.0
Supply that should be exceeded 9 years out of 10	9.2	40% agricultural reductions	1.5
Supply that should be exceeded 3 years out of 4	12.5	No reductions	1.7
Normal year	17.3	No reductions	2.3

The SWP Contingency Plan for 1989 at this time consists of the following phased evaluations and decisions.

Flag Date	Action
11/30/88	Established the Delivery Risk Analysis for 1989 and made initial delivery com mitments.
12/15/88	Initiated monthly updates of water supply and delivery commitments based on the forecasted project water supply that has a 90 percent probability of being exceeded. (If the forcasted water supply indicated less than a 90 percent chance of receiving a 1988 water supply during 1989, preliminary design of temporary barriers will have begun.)
1/15/89	Second monthly water supply and delivery commitment update.
2/15/89	Third monthly update of water supply and deliveries. If drought conditions are indicated and 10-day forecasts do not indicate any change in weather for Northern California, consider proposing that special drought measures be implemented.

3/15/89 Fourth monthly update of water supply and deliveries. Establish official monthly delivery schedules of SWP water for the remainder of 1989 with any special drought measures that appear appropriate at that time. (These schedules may be established at one of the earlier monthly updates, if those forecasts can be fully satisfied, commensurate with the 1989 DRA.) This and subsequent updates are based on a hydrology that has a 99% chance of being exceeded.

4/14/89 Fifth monthly update of water supply and deliveries, if full deliveries have not yet been approved.

5/15/89 Final monthly update of water supply and deliveries, if full deliveries have not yet been approved.

Possible Delta Drought Facilities

If conditions continue to be dry, temporary facilities could be built in the Delta that could save water and improve water quality and water circulation conditions, as was done in 1976–77. The facilities described below will help to make the most use of inflows by altering existing flow patterns and points of diversion, and will make the Delta's fresh-water barrier more efficient.

Sherman Island Overland Supply

The farmers on Sherman Island get their water from various locations on the perimeter of the island. In general, the water quality standard at Emmaton (a midpoint on the northwestern side of the island) on the Sacramento River protects quality at all locations. The purpose of this project is to provide Sherman Island's western end a water supply from an intake on the eastern end of the island where water quality will still be adequate and allow conservation of Delta outflow. Facilities were constructed in late 1988 and are being used for winter leaching. If 1989 continues the drought, the project will be used for irrigation.

Rock Barriers at Quimby Island

This facility would consist of two barriers: one in the channel between Quimby Island and Holland Tract, and one in the channel between Quimby Island and Mandeville Island. The barriers would block ocean salts from moving into the Contra Costa Canal intake channel at Rock Slough and into other South Delta channels. This facility's purpose is the same as that of the facilities in the Rock Slough area constructed in 1977; however, placing the barriers at the Quimby Island locations should prove to be more effective. The amount of water conserved by these barriers would depend on when they were installed while meeting existing standards or the degree to which the Delta water quality standards were relaxed.

Rock Barriers in the South Delta

Barriers placed at several locations in the South Delta would be designed to improve water quality, water levels, and circulation. A determination of which barrier should be constructed and barrier location depends somewhat on actual conditions that prevail, so each will need to be evaluated as the year progresses. Two barriers definitely planned for installation in 1989 are the Middle River barrier and the Old River barrier.

The Middle River barrier has been placed for the last two years during the irrigation season and then partially removed during the winter. It has successfully improved water levels in the stretch of Middle River from the junction of Old River to where the barrier is located, west of Tracy Boulevard. This barrier will be installed in 1989 unless conditions are extremely wet.

The Old River barrier has been installed for many years in the fall months to alter the flow pattern to increase the flow in the San Joaquin River past Stockton. This has been at the request of the Department of Fish and Game to help the salmon migrate upstream. This barrier will also be installed in 1989, unless conditions are wetter than normal.

A facility that was installed in 1977, a rock barrier in Old River southeast of the Delta-Mendota Canal intake, could be placed in 1989, if conditions continue to be dry. This barrier improved conditions in Old River south of Grant Line Canal.

Which of these or other facilities will be built depends upon actual conditions that prevail in 1989, and so each will be evaluated in the spring and as the year progresses.

Weather Modification

About a dozen different weather modification programs are conducted each year in the mountain watersheds in California. Results from some of these long-term programs and from several recent multi-year winter cloud seeding research projects in the western United States indicate that seeding can increase the winter snowpack. Although results cannot be guaranteed, there is justification enough to make a special cloud seeding program this coming winter worthwhile.

The best results can be expected during below-normal to normal winter conditions when a reasonable number of seeding opportunities are available and the threat of flooding is reduced. This will help the drought recovery process. If a third critically dry year develops, the effects of cloud seeding will not be as great because seeding opportunities would probably be few, but they would still add useful amounts of valuable water within the treated watersheds. A recent study by North American Weather Consultants on the Feather River indicated a maximum potential of a 10-percent increase in the 1977 level of runoff from seeding, assuming use of all opportunities that occurred that year.

The best results from additional cloud seeding would be expected in the unseeded wetter regions around the northern rim of the Central Valley. The most productive region appears to be an arc from the northern Sierra Nevada extending into the Trinity River watershed above Trinity Dam. DWR is evaluating a special drought relief weather modification program for use this coming season to aerially seed the western slope of the Feather River watershed with silver iodide, beginning in December. The program would extend into May, unless terminated earlier by wet conditions. Operating under radar control, the seeder air fleet would be based in the Sacramento Valley. Estimated water yield for the five-month period has been calculated to be about 35,000 acre-feet of additional runoff per seeder airplane. Suspension criteria will be developed to guard against causing flood conditions in the target areas to be seeded.

Assuming a reasonable number of opportunities, a fleet of two seeder aircraft should be able to generate 70,000 acre-feet of additional runoff during the season at a cost under $10 per acre-foot. The increase would be distributed over the targeted watershed. Hydroelectric power benefits alone should be worth at least $12 per acre-foot of runoff.

Water Transfers

Water transfers and exchanges are playing an increasingly important role in western water management and, during a drought, there is particular interest in these measures. Over the last few years, State and federal governments have passed a number of laws aimed at facilitating water transfers. Government action to promote transfers has focused on establishing a legal and institutional framework flexible enough to allow all plausible incentives to be pursued. Transfers are not exempt from such essential considerations as economic and environmental impact assessment. Each transfer proposal must be evaluated individually. Because of the various physical, economic, environmental, and institutional factors that are involved, a single set of criteria applicable to all cases is essentially impossible to develop.

Water Transfers in 1977

Among the many efforts to offset the severe water shortages of the 1976–1977 drought, water exchanges and transfers stand out as some of the most creative. Despite some constraints imposed by water rights law and institutional requirements, many exchanges and transfers took place. State Water Project contractors with alternative sources agreed to forego part of their project water for use in areas of greater need. A number of local districts exchanged smaller amounts of water, as did individuals. What is most important, cities, counties, and State and federal agencies worked together on agreements and temporary exchange facilities so that transfers took place quickly.

The first major water exchange of 1976–1977 occurred in mid-1976 between The Metropolitan Water District of Southern California and the Dudley Ridge Water District, an agricultural contractor in the San Joaquin Valley. MWD increased its Colorado River diversions by 10,500 acre-feet and released an equal amount of its State Project water to Dudley Ridge.

As the drought continued, the Department of Water Resources began negotiations in January 1977 with MWD for more water exchanges. By mid-March 1977, MWD signed an agreement whereby it would relinquish up to 400,000 acre-feet of its State Project water and use lower quality Colorado River water instead. (Surplus flows were available at that time because of favorable storage conditions in the lower Colorado River reservoirs.) This exchange water was then redistributed to water-short agricultural and urban users.

One outstanding example of how agencies and water districts worked together is the Marin Agreement. Through a cooperative effort by the city and county of San Francisco, the city of Hayward, the East Bay Municipal Utility District, and the Marin Municipal Water District, a temporary pipeline was installed on the deck of the Richmond–San Rafael Bridge to convey 10,800 acre-feet of MWD's exchange water. DWR acted as coordinator and intermediary. The Marin Agreement provided for wheeling water from the Delta by way of the South Bay Aqueduct to the city of San Francisco's San Antonio Reservoir. Then, by a series of exchanges, the water travelled through the facilities of the city of Hayward and East Bay Municipal Utility District to the pipeline on the bridge and then into Marin's system.

U.S. Bureau of Reclamation's 1977 Water Bank

One of the primary functions of the 1977 Federal Emergency Drought Act was to establish a water bank to assist water users in purchasing water from willing sellers. Responsibility for administration of the water bank was placed with the Bureau of Reclamation.

Early in 1977, after evaluating needs of its CVP water contractors, USBR determined that water bank supplies, as they became available, were first to be allocated for survival of permanent crops; second, to maintain crops needed to support foundation dairy and cattle herds and other breeding stock; and third, in maturing other crops. After securing firm commitments from San Joaquin Valley entities to purchase from the water bank, USBR looked for prospective sellers.

The first source of water was the State Water Project, which made about 8,000 acre-feet available through the exchange agreement with The Metropolitan Water District of Southern California.

Additional water was needed for the water bank, but USBR was constrained by legal restrictions, including the requirement that any water transferred must be legally identified as Central Valley Project water. Once water was so identified, the permit process allowed its transfer to other areas within USBR's permitted place of use.

During the negotiations for purchase of CVP water, several important factors surfaced. They included:

1. The need to identify CVP water available for transfer;
2. The ability of buyers to pay willing sellers;
3. How to deal with credit for return flow; and
4. The capability of wheeling and the availability of conveyance facilities.

By the end of the drought, the water bank's brief but successful history saw more than 46,000 acre-feet of water purchased. After deducting 4,000 acre-feet of return flow and wheeling losses, over 42,000 acre-feet of water was delivered to qualified Emergency Drought Act recipients. The program succeeded in satisfying all requests for water used for survival of permanent crops and maintaining crops to support dairy and cattle herds; some water was left over for use in maturing other crops.

Water Transfers and Wheeling Agreements in 1988

In 1988, a number of water transfers and exchanges were implemented or considered by water supply agencies throughout California. The following tabulation summarizes a number of these, most of which were directly related to alleviating current drought-induced shortages. While some of the transfers are small from a statewide perspective, they have significance to the local water users.

1988 Transfers and Exchanges

1 Yuba County Water Agency/State Water Project (SWP) — Surface Water Transfer

The SWP purchased 122,000 acre-feet from Bullards Bar Reservoir in a "trial transfer" approved by the State Water Resources Control Board. This transfer resulted in reduced releases from Oroville Reservoir and an improvement in SWP storage to be carried over for next year. The actual carryover benefit to the SWP may be adjusted later, if it is determined that the transfer has an adverse impact on the CVP.

2 El Dorado Irrigation District/PG&E — Surface Water Transfer

EID received a Temporary Urgency Permit to obtain 5,000 acre-feet of additional supply from PG&E's El Dorado Ditch. The new supply will be diverted from the ditch near Pacific House, conveyed through the recently completed Hazel Creek Tunnel, and stored in Sly Park Reservoir. In approving the permit, SWRCB required EID to enter into agreements with PG&E and the Bureau of Reclamation to compensate them for any loss caused by the diversion.

3 Lime Saddle Community Services District/Del Oro Water District — Ground Water Transfer

Del Oro WD agreed to pump as much as 200 additional acre-feet from its abandoned gold mine for use by Lime Saddle CSD. The water was wheeled through an interconnection with Paradise Irrigation District.

4 City of Willits/Boy Scouts USA — Surface Water Transfer

Boy Scouts USA agreed to provide water from its lake to the city of Willits. Pipe from the Office of Emergency Service's stock was laid to convey the water and water was transferred in the fall of 1988.

5 South San Joaquin Irrigation District/Private Wells — Ground Water Transfer

South San Joaquin ID is purchasing about 28,000 acre-feet of ground water produced by 70 wells located near existing SSJID canals.

6 Kern County Water Agency/Several Water Districts — Surface Water Transfer

Several water districts bought 71,000 acre-feet of SWP water from other water districts through Kern County WA's 1988 agricultural pool. An additional 11,970 acre-feet was transferred between several districts with Kern County WA's approval. All exchanges were made by way of existing facilities.

7 Mid Valley Water Authority/Tulare Lake Basin Water Storage District — Surface Water Exchange

Mid Valley WA contracted for 30,000 acre-feet of CVP water: (1) 10,000 acre-feet was wheeled to Cawelo Water District via the California Aqueduct and the Cross Valley Canal; (2) 20,000 acre-feet was wheeled to the Tulare Lake Basin WSD via the California Aqueduct. This was exchanged for 20,000 acre-feet of Kings River water, of which 10,000 acre-feet was delivered to Lakeside IWD and 10,000 acre-feet to Kings County Water District via their existing facilities.

8 Delano Earlimart Water District/Arvin–Edison Water Storage District — Surface Water Transfer

Delano Earlimart WD purchased 8,000 acre-feet from Arvin–Edison, by way of Kern County WA's Cross Valley Canal.

9 Orange Cove Irrigation District/Kern–Tulare Water District — Surface Water Transfer

Orange Cove ID purchased 400 acre-feet of Kern–Tulare WD's USBR entitlements. The water was conveyed in existing systems.

10 Tulare Lake Basin Water Storage District/Empire West Side Irrigation District — Surface Water Exchange

Tulare obtained 450 acre-feet of Empire's Kings River water during June, July, and August in exchange for releasing a like amount of Tulare's SWP entitlement water to Empire during October through December 1988.

The Federal Disaster Assistance Act of 1988 (Aid to Water Transfers)

Among its many provisions, this act authorizes the Secretary of the Interior to again assist water exchanges and transfers. It authorized the Secretary, by contract, to assist willing buyers to purchase available water supplies from willing sellers, and to redistribute the exchanged water. The temporary exchanges are authorized under federal reclamation laws to mitigate losses and damage resulting from drought conditions in 1987, 1988, and 1989. The exchanges must be consistent with existing contracts or agreements and State law and must terminate by December 31, 1989. Exchanges can be made to protect fish and wildlife resources and to mitigate losses resulting from the drought.

To facilitate the water exchange program, regional directors of the Bureau of Reclamation will compile and maintain a list of buyers and sellers. Interested buyers and sellers are encouraged to submit specified information to the appropriate regional director, each of whom is to review proposals submitted by sellers and buyers to match potential exchanges. Where available supplies equal or exceed requests from buyers, and no other apparent conflicts exist, buyers and sellers will be brought together to negotiate an exchange agreement, consistent with State law.

If requests from buyers exceed water available from willing sellers, priorities will be established. Where State law establishes priorities, such priorities will be followed in allocating the water. Where State law is silent in setting priorities, the regional director will consult with State and local water resource agencies to establish allocation priorities.

The Secretary may also make water or conveyance capacity available temporarily to mitigate losses and damage from the drought, provided that these contracts do not adversely impact existing contracts, State law, or interstate compacts governing the use of such water.

California Administrative and Legislative Provisions

During the 1980s, a number of new laws have been passed, aimed at facilitating water transfers and temporary urgency permits and changes. As a result, the California Water Code has clarified some concerns associated with transfers and has identified State policy and agency roles in carrying out water transfers and emergency water right actions.

The following summary highlights present administrative provisions related to water transfers during droughts.

- SWRCB may issue a conditional temporary permit to divert and use water (or change an existing permit or license) for as long as six months, if it finds that there is an urgent though temporary need; that such diversion and use can be made without injury to vested rights and without unreasonable effects on fish, wildlife, or other beneficial instream uses; and that it is in the public interest.

- Cessation or reduction in use of appropriated water due to conservation efforts is a reasonable beneficial use, and no forfeiture of rights shall occur as a result.

- Under specified conditions, State and local agencies are prohibited from denying a transfer of water through unused capacity in a water conveyance facility.

- Any local or regional public agency authorized by law to serve water to the customers of the agency may sell, lease, exchange, or otherwise transfer water that is surplus to the needs of the agency's users for use outside the agency.

In addition, AB 982, which became effective January 1989, establishes new, expedited procedures for temporary water transfers. The bill allows the SWRCB to exempt temporary transfers from the California Environmental Quality Act, but it still requires a finding by the State Water Resources Control Board about unreasonable effects on the environment, other legal users of water, and third parties.

System Interconnections

A vast system of aqueducts and water distribution facilities exists in California. Increasingly, interconnections are being built to facilitate water transfers and exchanges. While there are, no doubt, others, many of these could again play an important role if the drought continues. They include the connection of the Putah South Canal to the SWP's North Bay Aqueduct; the SWP's South Bay Aqueduct to the Hetch Hetchy system at San Antonio Reservoir; East Bay MUD's Mokelumne River Aqueduct to the Contra Costa Canal; and the Kern County Water Agency's Cross Valley Canal between the California Aqueduct and the CVP's Friant-Kern Canal. Also, the potential still exists to connect supplies in the southern and eastern San Francisco Bay areas with Marin County by again laying pipe on the Richmond-San Rafael Bridge.

Role of the Department of Water Resources in Water Transfers

DWR has been an active party to water transfers for a number of years. During the 1976–77 drought, water transfers involving SWP reservoirs, pumping plants, aqueducts, and canals helped satisfy the urgent needs of urban and agricultural water users. Moreover, coordination of water transfer activities and facilities during that drought demonstrated that interconnections exist in California to provide capability to move water from areas of abundance to most areas of need in times of crisis.

In 1980, a State law was adopted that directed water officials to ". . . facilitate the voluntary transfer of water and water rights where it is consistent with the public welfare of the place of export and place of import." The Costa–Isenberg Act of 1986 directs DWR to facilitate the voluntary exchange or transfer of water and implement existing State laws that pertain to water transfers. Also, pursuant to 1986 legislation, the Department is prepared to make unused capacity in the SWP available for water transfers under specific conditions.

DWR facilitates water transfers by (1) functioning as a water wholesaler through its management of the SWP, (2) conveying water from sources of supply to areas of need through the SWP and interconnection with other water delivery systems, and (3) serving as a water transfer facilitator.

In March 1986, DWR established an in–house Water Transfers Committee to help:

- Evaluate and implement transfers
- Review proposed water transfer legislation
- Identify currently active transfer proposals
- Clarify DWR's role in water transfers

Since the committee was formed, DWR has published *A Catalog of Water Transfer Proposals*, which evaluates proposals under consideration by various parties at that time, and a document titled *Questions to be Asked in the Case–by–Case Review of Water Transfer Proposals*. In November, the Department distributed copies of the draft *A Guide to Water Transfers in California* for review.

Water Conservation and Public Information

Promotion of conservation actions to cope with emergency water shortages is usually well received with widespread response by the general public. The public's willingness to cooperate under these circumstances was clearly demonstrated during the 1976–77 drought and in 1988. The public perception that there is a need for extraordinary measures, some of which entail personal financial costs and/or inconveniences, and an understanding of the effectiveness of the prescribed actions is essential to gaining wide public support and ready participation. It's extremely important, therefore, to carefully plan the public information program and emergency conservation actions. The following discussion summarizes key points made both by members of the media and water managers.

A local public information program should be aimed at the following five basic groups: local decision-makers; governmental bodies; industries, schools, businesses, and other groups which are asked to comply with specific use restrictions; news media; and the general public. The first objective should be providing information accurately and promptly.

When appealing to these groups for water use reductions, the utility must act credibly and consistently. It is important that utilities demonstrate to the public that they are doing everything possible to minimize the shortage. Accurate information concerning supply status (reservoir and ground water levels), conservation efforts, remaining supply, and other pertinent information should be provided to all personnel involved with public information, especially to those briefing the media.

In dealing with the media, if the utility does not have a well-coordinated internal information sharing program, it is advisable to have one person speak for the utility (preferably the manager or someone in management). Responses to media inquiries must be immediate to maintain communication links and prevent media representatives from having to seek alternative information sources that may be less well informed. Good communication fosters opportunities for a water agency to tell its story and ensures that knowledgeable people will be called on to speak on the issues. Establishing, and aggressively using, a well-schooled speakers' bureau is an excellent communication technique.

Before developing drought-related public information strategies, there are several important issues to keep in mind about program focus and content. First, it should be emphasized that the situation is unpredictable and may change from month to month. Even if precipitation increases, the effect on the water supply is not immediate.

The public should be made aware of the impact of the drought on water system costs as early as possible. Reduced demand will obviously reduce revenue. Most water utilities have fixed costs on the order of 75 to 80 percent of their total budget and this needs to be communicated to the public. There may be additional costs incurred for purchasing water; conservation programs; purchasing emergency pumps, pipes, and other equipment; increased water quality testing; and other drought-related activities. These costs ultimately will be borne by the system users.

Finally, the utility should avoid being placed in an adversarial position. The focus should be on the emergency at hand, without blame implied towards any customer class.

The Department is prepared to assist any agency or individual with their water conservation efforts. In late October 1988, the Department cosponsored a series of public information workshops in various parts of the State to assist local agencies in developing public information programs.

Many actions that will conserve water are well tested and documented. These include installing shower flow restrictors and toilet reservoir inserts, restricting landscape irrigation, using greywater, detecting system leaks, and evaluating irrigation systems. The Department has published

the following water conservation guidebooks to assist local agencies in tailoring their actions to best fit their specific situations:

Urban Drought Guidebook
Agricultural Drought Guidebook
Landscape Water Conservation Guidebook
Water Audit and Leak Detection Guidebook
How To Do An In School Education Program
How To Do A Residential Retrofit Program
How to Produce A Lawn Watering Guide
Designing A Public Information Program for Water Conservation

Water Rationing Guidelines for Urban Areas

Consumer response to rationing programs is more predictable than to other conservation measures, and these are generally the most effective programs to achieve significant demand reduction. In nearly every instance where mandatory rationing was implemented in 1977, consumers responded by reducing water use further than was requested. In fact, one of the inherent problems with a rationing system is in accurately designing the program to achieve the desired reduction in demand without greatly exceeding this amount. Although midcourse corrections can be made to lessen the impact of a program proving to be too severe, changing programs once they are in place tends to send a message to the customers that the utility lacks resolve or understanding.

Key elements of a successful rationing program are that the resource is shared as equitably as possible, and that customers are kept informed about the status of the shortage. However, allocation disagreements are to be expected, and procedures to handle valid exceptions and variances need to be part of every rationing program.

A good public information program facilitates administration and enforcement of a rationing plan. Pertinent information regarding water use and supply must be published and disseminated at least weekly to continually reaffirm customer commitment.

Rationing programs are generally patterned after one of the following basic allocations schemes:

- percentage reduction
- seasonal allotment
- fixed allotment
- specific use bans

A *percentage reduction* assigns each customer class a consumption reduction goal as a percentage of the consumption level used in a similar billing period during a normal season. The *seasonal allotment* is similar to the percentage reduction except that the consumption reduction goal is varied, depending on the time of year. Required percent reductions can be constant, stepped, or variable.

Fixed percentage reductions were widely implemented during the 1977 California drought. The fixed percentage system was easy to coordinate because water allocations were quickly determined from the previous year's water bills. However, the percentage reduction method was widely perceived as inequitable because it had the effect of penalizing former water conservers, while rewarding those who had previously used large water quantities. Identical houses could therefore receive different water allotments. Also, this program did not distinguish between indoor and outdoor water use.

Fixed allotment rationing establishes a customer's water consumption goal on a unit basis (such as per capita or per connection), calculated from an estimate of essential uses. A per connection allotment is easier to implement, but may introduce unfair allocations where a wide range of uses are covered by a single customer classification or where many people reside at a single residence. Also, per household rationing does not adequately distinguish between families with large outdoor water use requirements and those with none. Despite these shortcomings, surveys show customers generally prefer a fixed allocation within which they can determine their own water use priorities.

The type of rationing method selected depends on three factors:

- The amount of water available for sanitary and/or process purposes, convenience uses, and outside irrigation.
- The seasonal variation in water consumption (usually a function of irrigation demand).
- The degree of homogeneity among consumer types.

Where water is in extremely short supply and only small amounts can be made available for irrigation, the fixed allotment approach usually works best. Where some water is available for landscape irrigation, a plan that permits the customer more water in the dry season, either on a percentage reduction or a seasonal allotment basis, is preferable. In general, restrictions prohibiting specific consumer actions (such as a total ban on sprinkler usage or car washing) are less popular than those restricting use to an allocated amount.

The California Public Utilities Commission is preparing generic conservation rationing plans applicable to any water service agency. The plan selected would depend on the amount of water use reduction being sought.

For more information on conservation methods, refer to the Department's *Urban Drought Guidebook.*

DWR Public Information Assistance to Water Districts in a Dry 1989

- DWR cosponsored five workshops in late fall, 1988, to assist water districts in planning public information programs targeted to a third dry year.
- DWR will coordinate a statewide Water Awareness Week, May 1–7, 1989, to help enhance local water district public information programs. Cosponsors include the Water Education Foundation and the Association of California Water Agencies.

Suggested Steps for Local Agencies in Developing A Public Information Program on Drought

- Set specific goals and objectives.

  What does your agency want the public to know or do?

- Write a Fact Sheet on impact of drought on service area for distribution to the media and the public.

  Include specific information on how the drought could affect your community. What is the level of area water supplies? What are the potential problems? What is your outlook?

- Select your audience and determine their information needs so that you can take action.

  Who do you want to reach? What specific information does your audience need?

- Develop a message and slogan to attract and maintain media and public attention. Make personal contacts with the media.

- Make sure your organization is conserving water and publicize your actions.

- Plan continuous activities to reach your audience, especially during Water Awareness Week, May 1 – 7.

  Involve local residents in your conservation efforts. Plan activities that are visual and interesting. Show, don't just discuss, what your community is doing to conserve water.

- Schedule appearances by local officials or water experts on community radio and television talk shows.

  Consider having the media interview water patrol personnel about water-wasting practices and unusual situations they have encountered.

- Review newspapers and suggest ideas for stories that will fit their formats.

  Many newspaper sections lend themselves to articles on conservation — such as the garden and home improvement sections.

- Combine resources with other water agencies.

  Coordinating with other water agencies can help you plan an effective public information and education program. Consider sharing ideas, materials, responsibilities, and personnel.

- Use volunteers. They can be a valuable asset. Journalism or communication studies students can be offered paid internships or course credit. Public relations experts can be asked to volunteer their services. Consider also using retired citizen groups, youth groups, local and volunteer fire depart ments, employees, and family members.

Trucking Water

Although it is inconvenient, hauling water by truck when local supplies have run out may be the simplest expedient for individual residences and small communities and for stock watering. Water quality must be considered, especially where public health is involved. For instance, tank trucks or containers that have been used for pesticides or other toxic materials clearly should not be considered for hauling water.

There are a number of possible water haulers. In most cases, local commercial water haulers probably would be the lowest cost alternative. If water purveyors expect to run out of water and have water hauled, it may be advisable for them to pre-arrange with local haulers. This is important because there are other high priority seasonal needs, such as fire fighting, that may preempt hauling equipment. Other haulers that possibly could be used in an emergency if equipment is available include the National Guard, which has 250 "water buffaloes" for emergency use. Local or State highway or recreation agencies may have tank trucks available. Tankers and railroad cars that are used to transport beer, milk, syrup, and other potable liquids also are possible resources. County health departments should be consulted before using containers not normally used for water.

When all State and local resources are exhausted, the U.S. Corps of Engineers is authorized under Public Law 84-99 to provide emergency supplies of drinking water by transporting water to communities or constructing wells where there is a substantial threat to public health and welfare. All such work will be done on a cost-reimbursable basis. The Corps also has authority under Public Law 95-51 to transport water to farmers, ranchers, and political subdivisions in drought-distressed areas. Assistance can be requested through the nearest region of the State Office of Emergency Services.

The Federal Disaster Assistance Act of 1988 allows emergency loans to be made to water users for the acquistion and transportation of water. Applications can be submitted to the Regional Director of the U.S. Bureau of Reclamation in Sacramento.

If water which does not meet drinking water standards is available, water purification equipment may be obtained from commercial or civil defense sources in lieu of hauling. Bottled or canned water may be used for drinking, but this is too expensive for other uses.

As a planning guide for estimating needs, in 1977 several communities with severe water rationing were able to get by with 35-50 gallons per person per day for all domestic purposes, excluding landscape irrigation.

Contingency Plans of Selected Urban Water Suppliers

Four of the State's largest metropolitan water service agencies were contacted by the Department of Water Resources for detailed information on plans for dealing with water shortages, in case 1989 is dry. These are San Francisco's Water Department; the East Bay Municipal Utility District, which serves most of Alameda and Contra Costa counties and part of Santa Clara County; the Los Angeles Department of Water and Power; and The Metropolitan Water District of Southern California, which provides water to 27 member agencies. The Department also interviewed

the Marin Municipal Water District, which was the focus of extraordinary coordinated action by several agencies to provide the district much-needed water in 1977.

San Francisco Water Department

The San Francisco Water Department serves 2.2 million people in the South Bay area. It delivers retail water to the 750,000 people in the county of San Francisco and wholesales water to 33 South Bay water purveyors, which serve 1.45 million people in the counties of Alameda, San Mateo, and Santa Clara.

The water supply for the SFWD's service area comes from reservoirs in the Sierra Nevada, in Alameda County, and on the San Franciso peninsula. The Hetch Hetchy system in the Sierras has a storage capacity of 636,000 acre-feet (active storage, 586,000 acre-feet). There is 147,000 acre-feet of storage in Alameda County and 91,000 acre-feet in peninsula reservoirs (totalling 209,000 acre-feet of active storage). The total system capacity is 894,000 acre-feet, with 795,000 acre-feet of active storage. San Francisco also has 560,000 acre-feet of storage entitlement in New Don Pedro Reservoir that is used to satisfy senior water rights of Modesto and Turlock Irrigation Districts. Also, the reservoir normally provides some storage to be used by the San Francisco Water Department, but in September 1988, it contained no water for that purpose.

In an average year, SFWD delivers 330,000 acre-feet (290 million gallons per day) of which 56,000 acre-feet (50 mgd) comes from local watersheds. The maximum capacity of the Hetch Hetchy system to deliver water to the Bay area is limited to 340,000 acre-feet (300 mgd). The city of San Franciso initiated special water conservation practices when the 1986–87 season provided low runoff in the Tuolumne River watershed. In the spring of 1987, the San Francisco Public Utility Commission reduced hydropower generation in the Hetch Hetchy system and instituted a voluntary 10-percent conservation program.

In 1988, Tuolumne River runoff was about 50 percent of normal, or about 950,000 acre-feet; however, only 17,000 acre-feet was available for use by the Hetch Hetchy system due to downstream rights. There is an overall 25-percent mandatory systemwide rationing in effect. Inside water use has been reduced by 10 percent and outside use by 60 percent. Rationing is enforced through the rate structure, with use over allocated amounts being charged at up to ten times the usual rate.

Hetch Hetchy system storage in mid-September 1988 was about 42 percent of normal for that time of year. Water availability to meet SFWD's water needs depends on the 1988–89 runoff in the watershed and water available in storage. Based on 220,000 acre-feet of carryover storage, possible scenarios of water availability with differing percents of normal 1988–89 runoff are:

- 100 percent of normal; SFWD will meet 1987 levels of use (300,000 acre-feet) and refill most storage.
- 75 percent of normal; SFWD will meet 1987 levels of use while maintaining reserve storage equal to 75 percent of 1987 levels of use (220,000 acre-feet).
- 65–70 percent of normal; SFWD will meet current levels of rationed water use (220,000 acre-feet), while maintaining target storage reserve (220,000 acre-feet). Alternatively, it will meet the 1987 level of water use by reducing reserve storage to 50 percent of 1987 usage and counting on 1989–90 at near normal runoff.

- At 50 percent or less of normal, probably all Tuolumne River inflow would need to be released to meet downstream users' water entitlements (Modesto and Turlock Irrigation Districts). The service area would be forced to rely on reserve storage and/or purchase other supplies, relying on 1989–90 to be a normal year. An alternative scenario would be to restrict water use to current 1987–88 rationing level (75 percent of 1987 use or 225,000 acre-feet), purchase 80,000 acre-feet (25 percent of 1987 use), and deplete reservoir storage to a level equal to 50 percent of 1987 usage.

Next spring's predicted runoff will determine action to be taken to meet the service areas' needs. SFWD has investigated payment to Modesto and Turlock Irrigation Districts for some of their Tuolumne River entitlement water. SFWD is also exploring the purchase of contracted or uncommitted State or federal water.

East Bay Municipal Utility District

East Bay MUD serves parts of Alameda and Contra Costa counties. Service area populations are about 755,000 in Alameda County and 356,000 in Contra Costa County. The district also serves surplus water to the city of Brentwood, which is outside the district's service area in eastern Contra Costa County. Service to Brentwood was cut off in 1988 because of the drought. (Brentwood used lower quality ground water, adding two new wells.)

Normal water supply is surface water taken from the Mokelumne River at Pardee and Camanche reservoirs. Camanche Reservoir is operated for flood control and to meet downstream water rights. The district has rights to deliver up to 365,000 acre–feet per year to its East Bay service area through the Mokelumne Aqueduct.

In 1987, demand was 244,500 acre–feet. After the 1976–77 drought, safe yield of the system was reduced to 203 million gallons per day, or 227,000 acre–feet per year.

The EBMUD board of directors issued a water emergency declaration on March 22, 1988. The district began its Water Conservation Rate Structure Program and Mandatory Water Use Restrictions on June 1, 1988, and achieved a 26-percent reduction in use. The mandatory program was driven by a rate schedule intended to reduce use while maintaining level revenues. EBMUD intensified its year-round conservation program, which included public education, water audits, additional water-waste patrols, and leak detection. The district tightly managed its reservoir levels since 1987 by keeping Pardee Reservoir as full as possible and releasing only the minimum required flows to Camanche Reservoir. During 1988, EBMUD also installed a wastewater reclamation facility at the Orinda Treatment Plant and expanded its water reclamation program.

The district believes that, if 1989 is a moderately dry year, it can meet a shortage by increased conservation measures and rationing. If 1989 is a critically dry year, storage at the end of September 1989 would range from 34 percent to 10 percent of capacity, with a significant portion of the supply unavailable because the water level would have dropped below the lowest reservoir outlets. The district's most critical alternative for increasing the 1989 supply is to blend Delta water with Mokelumne River water; this process is already under way, with the objective of pumping Delta water by March 1, 1989, if the drought continues.

Water quality in Camanche Reservoir deteriorated in 1988 because of the greatly reduced storage pool. The high water temperature destroyed the reservoir's cold-water fishery and virtually elimi-

nated salmon spawning downstream of the dam. Continuation of the drought through 1989 would spread the problem to the Pardee Reservoir fishery and eliminate another year of salmon spawning.

Alternatives to either reduce demand or increase the 1989 supply:

- Increase mandatory rationing.
- Implement more restrictive conservation measures.
- Buy agricultural water from farmers on the lower Mokelumne River. This water would be retained in the district's reservoirs for later use.
- Pump water from the Sacramento-San Joaquin Delta (Indian Slough), blend it with Mokelumne River water, and treat it for use in the service area.
- Pump water from the Sacramento-San Joaquin Delta (Indian Slough) through the Mokelumne Aqueduct back to Camanche Reservoir and release this water downstream to maintain a flow of 90 cubic feet per second. Irrigation needs above 90 cfs would come from Camanche storage. Pardee Reservoir storage would be used within the district's service area. This alternative was turned down by the State Water Resources Control Board on August 18, 1988.

EBMUD says its course of action for 1989 depends on how much rain is received this winter. If it appears that 1989 will be dry, the current water demand reduction measures will be continued and more stringent rationing measures may become necessary.

Los Angeles Department of Water and Power

The Los Angeles Department of Water and Power provides municipal and industrial water for the city of Los Angeles. About 3.4 million people are served through 658,000 connections. Agricultural demands are insignificant.

The primary supply is surface water delivered through the Los Angeles Aqueduct from the Owens Valley and the Mono Basin, normally amounting to 470,000 acre-feet per year. Secondary sources are local ground water and purchases from The Metropolitan Water District of Southern California. Ground water normally provides about 103,000 acre-feet per year, and MWD provides 50,000 to 117,000 acre-feet per year.

In fiscal year 1987–88, the supply available in the Los Angeles Aqueduct was 416,000 acre-feet. For calendar year 1988, this supply was 70 to 80 percent of normal, despite the fact that runoff from the eastern Sierra Nevada was only about 50 percent of normal. Shortages were offset by ground water from the Owens Valley pumped at a relatively high rate, and water was taken from the Los Angeles Aqueduct's reservoir storage. LADWP also increased its purchases from MWD to 150,000 acre-feet, bringing the total 1988 supply for Los Angeles to 688,000 acre-feet.

Because of diminished water supplies, the city of Los Angeles implemented Phase I of its Emergency Water Conservation Ordinance in April 1988, restricting water uses by residents. Phase I prohibits restaurants from serving drinking water, unless requested; hosing of sidewalks and driveways; and operation of decorative fountains. Residents also are required to repair all water leaks on their property and were asked to voluntarily reduce their water use by 10 percent.

60In addition, in a timely action not drought-related, the city adopted a water conservation ordinance intended to reduce sewage flows and corresponding water use by 10 percent over the next five years. This ordinance was aimed primarily at retrofitting water conservation devices on all commercial, industrial and residential properties. LADWP also provides all residential customers, free of charge upon request, with low-flow shower heads, toilet tank displacement bags, and leak-detection dye tablets. Failure to install retrofit devices by July 1989 will result in surcharges of 10 to 100 percent for all users except single-family dwellings, duplexes, and condominium units. The ordinance further sets xeriscape landscaping requirements for all new construction and requires owners of large turf areas to reduce their water use by 10 percent. Turf owners failing to meet the 10-percent reduction face a surcharge of 10 to 100 percent.

LADWP is also promoting conservation through an extensive television advertising campaign, making public speakers available, and distributing brochures and other educational materials free of charge.

If 1989 is also dry, the supply for the Los Angeles Aqueduct will probably be less than 70 percent of normal because Los Angeles Aqueduct reservoir storage will be depleted. Moreover, high rates of ground water pumping over a prolonged period in Owens Valley could have adverse environmental impacts. Consequently, the city of Los Angeles may implement additional phases of its Emergency Water Conservation Ordinance. Phases II through V require mandatory reductions of 10, 15, 20, and 25 percent, respectively. The total water conservation budget for 1988 is $5 million.

The Metropolitan Water District of Southern California

The Metropolitan Water District provides about 50 percent of the water needs for about 14.5 million people through about 340 service connections to 27 member agencies. MWD imports water from the Colorado River and the State Water Project. The objective is to maximize deliveries of Colorado River water and to provide the remainder from the SWP. System demands for 1988 are about 2.0 million acre-feet, including 185,000 acre-feet for agriculture. MWD also provides about 50,000 acre-feet per year for sea-water intrusion barriers.

Combined deliveries from the Colorado River and the State Water Project are expected to be adequate for 1988. However, some member agencies, such as the Los Angeles Department of Water and Power, have experienced supply deficiencies in 1988, increasing their demands for supplemental water from MWD.

Beginning in 1987, MWD took steps to reduce demands on the SWP in the event of a protracted drought. These steps included suspension of water deliveries to the water banking acounts of the Desert Water Agency and the Coachella Water District, as well as various conservation efforts. It is anticipated, however, that these steps will be almost offset by increased supplemental demands resulting from reduced local supplies and growth in MWD's service area.

Total MWD delivery demands in 1989 are projected to be about 2.1 million acre feet. If locally developed supplies are low, including Los Angeles Aqueduct supplies, total MWD demands could be 2.2 million acre-feet in 1989.

In the event of a shortage in 1989, possible actions would include: increased conservation through public education and possible pricing incentives; reducing ground water replenishment deliveries;

providing incentives for member agencies to pump additional ground water; reducing or eliminating interruptible deliveries for municipal, industrial and agricultural uses; and continued coordination with the Department of Water Resources to maximize capture of any excess water in the Delta.

Additional actions that might be taken this year to prepare for a possible third dry year include: development of financial incentive programs for conservation by member agencies; providing additional incentives to member agencies to produce more local water; predelivery of water to member agency storage accounts for use in early 1989; and development of a procedure to reduce or eliminate interruptible deliveries.

MWD's drought water conservation budget for 1988 is $1.25 million, primarily for public information programs and distribution of water conservation kits. More than $12 million will be spent this year within MWD's service area on programs designed to reduce water consumption. Costs for implementing the actions described above have not been estimated. MWD supports and encourages DWR to pursue water purchases, such as that from the Yuba County Water Agency.

Marin Municipal Water District

The Marin Municipal Water District provides municipal and industrial water to some 167,000 people or about 75 percent of the Marin County population. Water is served in 10 cities through 55,400 connections that are in use and another 2,000 that currently are not. The district does not provide agricultural water.

MMWD's supply is derived entirely from surface water sources. Its seven reservoirs have a total storage capacity of about 80,000 acre-feet. Average annual runoff is 74,200 acre-feet. In 1977, runoff totaled only 7,000 acre-feet. The district also can obtain 4,300 acre-feet per year from the Sonoma County Water Agency. This supply is delivered by contract during the winter when aqueduct capacity is available. In practice, the district has been obtaining about half the contract amount each year, but this year it had taken 3,900 acre-feet by early August.

MMWD's facilities have an annual operational yield of 35,000 acre-feet. The district can supply that amount in 95 percent of all years. Water supply during the remaining 5 percent of all years requires a 15-percent reduction in use in the first year of a two-year drought and up to 33 percent in the second.

During 1987-88, the district supplied about 33,000 acre-feet, plus 60 acre-feet of reclaimed wastewater that was used for parks, golf courses, and other turf areas. Expansion of reclaimed wastewater facilities is currently under way to serve a market demand of 1,000 acre-feet per year.

In calendar year 1987, consumption of 32,800 acre-feet exceeded the system's drought period yield of 30,000 acre-feet and approached the operational yield of 35,000 acre-feet. Because voluntary restrictions had not achieved the required goal of 15-percent reduction in use, MMWD adopted a mandatory water conservation and dry-year water use reduction program that went into effect on August 8. The program requires every customer to limit use to 1987 levels and to cease wasting water. The goal is a 15-percent reduction below the 1987 level of use. Use through new connections is to be limited to 85 percent of the average use per connection. Irrigation runoff is to be minimized, certain nonessential uses are prohibited, and breaks or leaks in the customer's

plumb62ing systems are to be corrected within 48 hours. Since adoption of the ordinance, the district has 62realized an overall 16 percent reduction in use over 1987.

As of September 1, storage in the district's reservoirs totaled about 39,500 acre-feet, which is 77 percent of normal for that date. Minor taste, odor, and turbidity problems are being experienced due to lower reservoir levels.

MMWD has developed response plans, including staged responses and trigger points, in the event next year is dry. More restrictive limitations than are now in effect are being considered. The district also hopes that water will continue to be available from the Sonoma County Water Agency on the same schedule and in the same amount as it was this year. The district is upgrading its reclaimed water facility. As part of its contingency planning for 1989, the district is evaluating the extent of demand reduction needed under various intensities of a continuing drought.

Agriculture -- Allocation of Limited Surface Supply and Increased Use of Ground Water

Several agricultural water suppliers who indicated in the survey reported in Chapter 2 that they would likely experience water shortage problems if 1989 were dry were interviewed to obtain more information on specific measures being planned; in particular, how they plan to allocate limited surface water supplies and how they intend to increase use of ground water. Most of the agencies interviewed are in the San Joaquin Valley, where the impact of reduced streamflow was most widely felt by agriculture and where a dry 1989 would most likely create the greatest hardships on this industry.

Allocating Limited Agricultural Surface Supplies

Most districts have formulas and regulations for allocating surface water on the basis of acreage served. In some, special considerations for permanent crops may apply.

Water allocations, choice of program for delivery of district water, and possible supplemental water supplies are critical, especially in districts largely planted to permanent crops. Districts that do not overlie usable ground water and that cannot arrange for water transfers from other districts face the most serious allocation problems.

Plans for Special Allocations to Permanent Crops

Some type of emergency supplemental water purchase or exchange, if somehow possible in an extended drought, may be the only realistic way to save permanent crops in such areas if 1989 is dry. In 1977, the U.S. Bureau of Reclamation made a special allocation of water to permanent crops in the Kings River service area.

In some districts, arrangements will be made to allocate water preferentially for permanent crops to ensure survival. Berrenda Mesa Water District, as the result of 1977 experience, has a formula for such allocation. Westlands Water District expects surface water shortages will lead to a district emergency declaration, allowing purchase or exchange among users, especially to save perennials. The Lindsay-Strathmore Irrigation District on the eastern edge of the San Joaquin Valley,

where depth to bedrock is shallow, has very limited ground water. The district operates six wells, but water quality is poor for citrus trees, which are planted throughout its service area. Its 1989 plan seeks to contract with neighboring districts for water under an exchange program whereby the LSID would provide excess water in wet years for spreading in districts able to recharge ground water.

Most districts appear to expect growers of permanent crops to make their own arrangements for obtaining of additional water from other growers. The district staffs do not participate in the arrangements, except to help transport the water when district facilities are needed.

Examples of District Water Deliveries Plans

District plans for distributing limited water supplies vary. Those with unlined canals usually seek to restrict wetting of canals and to reduce delivery times to cut seepage.

Delivery plans include:

- Delivering on a normal schedule and in usual amounts until supply runs out.
- Restricting the duration of the irrigation season.

  Fresno Irrigation District would deliver early (March to May) and then canals will be dry.

  Madera Irrigation District would limit delivery to peak period (June to August 15). Similarly, Chowchilla Irrigation District will shorten delivery period to reduce losses.

  North Kern Water Service District would hold water in reservoir for delivery in peak season, with wells carrying crops in early and late season.

- Delivering at extended intervals.

  South San Joaquin Irrigation District in 1988 reduced number of deliveries from a normal of eleven to seven, with the irrigation interval increased from 20 to 24 days.

  Oakdale Irrigation District in 1988 cut delivery from 10 days with 3 inches to 12 days with 2 inches.

- Holding water in a reservoir for use in 1990 or for transfer.

  Laguna Irrigation District, if faced with an allocation too small for efficient delivery, would hold supply in reservoir or transfer to another district for 1990 entitlement.

  With the exception of plans such as Laguna Irrigation District, none of the districts interviewed expect to plan allocations and deliveries so as to have appreciable carryover for 1990.

Each of these approaches to water delivery may influence differently the cropping decisions farmers will make. Growing season, length of time required for crop maturity, sensitivity to soil moisture stress, as well as crop marketing potentials must be considered when a farmer is faced with

making decision regarding what crop to raise and how much land can be planted, considering the water delivery plans of his district. The choice of crop is further constrained because of climate conditions, soil type, drainage and salinity, weeds and diseases, availability of special machinery, marketing contracts, and grower experience.

Increasing Ground Water Use by Agriculture

If 1989 is dry, districts overlying usable ground water expect that much of their surface supply deficiency will be replaced by increased pumping. Some districts expect ground water pumping to increase as much as tenfold. However, this will entail significant efforts and costs, and, in some cases, major problems will be encountered.

Ground Water Levels

In the early 1970s, most areas of the San Joaquin Valley were undergoing overdraft. This was greatly accelerated by the increased pumping done in response to the 1976–77 drought. In fact, total overdraft from 1970 to the end of 1977 amounted to nearly 8 million acre-feet in the valley south of San Joaquin County. However, by 1988, after the wet years that followed 1977, ground water in storage had increased over 6 million acre-feet to just 1.5 million acre-feet less than it had been in 1970 (Figure 5). Thus, due to the good fortune of a series of wet years, San Joaquin Valley ground water reservoirs generally are in good condition.

However, water levels in some areas, principally in Stanislaus and Merced counties, remain about the same as in 1977.

Increased agricultural pumping may dry up some urban wells, some domestic wells in rural areas, and even some irrigation wells. In 1988, the city of Turlock's wells were affected by reduced recharge and increased pumping by Turlock Irrigation District. Prompt response by Turlock ID to reduce irrigation pumping near the city and the deepening of city wells relieved the problem. With increased use of ground water, significant water table lowering will likely be faced in other districts, adversely impacting both urban and rural wells in terms of both water yield and quality. In some areas there are concerns that increased pumping in 1989 will lead to poorer water quality as the water table drops and new wells are drilled into more saline aquifers.

The Availability of Increased Pumping Capacity

A few water districts operate district-owned wells, which allows them to continue much of their deliveries, even during times of major surface supply shortages. For example, in 1988, the Turlock Irrigation District supplemented its 75-percent deficiency in surface water by increased pumping from district wells into its canals. Turlock ID is fortunate in that it had previously developed, largely for drainage, a network of wells that allow the district to readily draw on ground water. In addition, this and other districts, including the South San Joaquin Irrigation District, have contracted with some farmers to purchase farm well water for delivery in the districts' canal system. Other farmers with serviceable wells are pumping ground water for use on their own fields and releasing their allocation of district water for delivery to others.

Fortunately, in some districts, many farmers have operating wells that can be used as needed to offset even extreme surface water shortages. In normal water years, these wells have been used

during peak periods and/or in late season as surface water was depleted. However, at the other extreme, in some other districts that overlie ground water, few wells, for various reasons, have been developed. Some farm wells of limited capacity may have been developed for frost protection and occasional use to meet peak demands, but such wells will likely be inadequate to supply full irrigation needs.

Many wells were drilled in 1977 to deal with the emergency created by the drought. Some not used since may have casing problems and cannot be rehabilitated. Most old wells will require some rehabilitation services, replacement of meters, and possibly reconnection to power lines.

Possible Shortages and Backlogs in Well Services

Because of the great dependence being placed on increased ground water pumping in 1989, contingency plans of all districts overlying ground water or having indirect access to ground water, discussions have been held with the California Groundwater Association to explore the potential of shortages in well supplies and backlogs in well servicing and drilling.

Most drillers now have backlogs of one or more months, with backlogs for larger wells approaching six months. Some drillers are presently operating with two shifts, a few with three shifts. Where possible, some drillers are operating seven days per week.

Drillers point out that new drilling rigs are costly, require substantial manufacturing time, and will likely not be ordered. The industry cannot afford costly capital outlays for extra or standby equipment not likely to find much use except in drought years. Lack of qualified and experienced well-drillers also now limits drilling. The California well-drilling industry cautions against engaging out-of-state drillers who are said to have inadequate equipment and lack expertise with conditions encountered in this state.

Supplies needed for new wells and for well rehabilitation are presently tight. The availability of Monterey sand, required for good wells under most conditions, is limited. The only other source of quality sand is Colorado. Domestic manufacturers of well casing and pumps are now limited and quick expansion is unlikely. Electric motors, especially large sizes, are in short supply, and this could lead to important backlogs. Shifts to internal combustion engines will be limited by short supplies of gear heads. The supply of electric power, even in the face of greatly reduced hydroelectric generation, is expected to be adequate. However, problems may arise (as they did in 1977) in procuring transformers and in extending power lines to locations distant from existing service.

The California Groundwater Association is optimistic about the State's drillers' ability to meet 1989 needs. However, it would not take much of an increase in orders for well rehabilitation or new wells to produce backlogs of many months. The understandable desire of farmers and other well owners to await information on 1989 surface water supplies before placing orders could aggravate the backlog problems and restrict ground water pumping increases.

To reduce delays in well rehabilitation or drilling new wells, the Groundwater Association has prepared two checklists (see Appendix D).

4. FINANCIAL AND TECHNICAL ASSISTANCE

Both the federal and State governments provide drought assistance. Financial assistance is largely provided by federal agencies. The role of State agencies is primarily to provide technical assistance, guidance, coordination and mutual aid, and only limited direct financial aid. A review of 1977 drought aid to California provides an insight into the degree of federal aid that could be made available in a dry 1989.

California's economy suffered an estimated $2.4 billion loss from the 1976–77 drought. More than 40 federal programs administered by 16 agencies offered drought relief in the form of loans, grants, indemnity payments, and other types of aid to State and local government, households, farms, and private businesses. In California, more than 2,700 requests for assistance totaling more than $260 million were approved. The financial assistance generally fell into two categories: (1) short-term monies to prevent damage before it occurred by augmenting water supplies and to make loans to farmers for production losses and (2) working capital to farmers and other businesses until conditions returned to normal.

By the end of 1977, more than 50 proposals for drought-related legislation had been introduced in the California Legislature, and about one-third of these became law. Two measures were enacted that provided loans to public agencies for water supply facilities. The Davis-Grunsky drought emergency loan program made about $4.5 million available. Although not specifically designed as drought legislation, the Safe Drinking Water Bond Act, passed by the electorate in June 1976, provided 11 loans in 1977 totaling about $4.8 million to upgrade existing water systems, thus helping alleviate drought conditions.

Assistance programs have been amended since 1977, and new federal and State drought assistance legislation was passed and enacted into law in 1988. Additional assistance may be needed if the drought continues in 1989.

FEDERAL DROUGHT ASSISTANCE PROGRAMS

The Federal Disaster Assistance Act of 1988 was signed into law on August 11, 1988. This act provides a broad range of drought assistance and benefits for people and businesses impacted by the drought throughout the country. The act authorizes emergency livestock feed assistance, emergency crop loss assistance, and migrant or seasonal farm worker assistance. It also includes a broad array of assistance and benefits to ranchers, dairy farmers, rural businesses, Indians, and migrant and seasonal farm workers. Several of these provide assistance for water facilities and new conservation measures. Included are a maximum of 50 percent reimbursement of the costs of

providing livestock water, including installing pipelines, tanks and troughs; constructing or deepening wells; and developing springs or seeps. Hay producers who participate in authorized federal conservation reserve programs may obtain benefits for carrying out certain additional approved conservation practices, including restoring wetlands and establishing wildlife food plots and trees. The livestock and agricultural assistance are provided through the U.S. Department of Agriculture and are described by program below.

The act also provides two types of water-related assistance -- assistance for drought-impacted rural areas throughout the United States and emergency assistance in California and other states with federal reclamation projects.

Assistance for rural areas includes research, demonstration projects, grants, loans, loan guarantees and other technical assistance to improve water management and alleviate drought problems. Necessary funds can be appropriated annually for this assistance. Assistance for rural areas as well as livestock and crop assistance is administered by the U.S. Department of Agriculture, as described below.

U.S. Department of the Interior

In reclamation states, the act authorizes certain actions by the U.S. Department of the Interior. It authorizes studies to identify opportunities to obtain federal project water, management and construction to mitigate drought losses and assistance so that willing buyers can temporarily purchase available water from willing sellers. Water or canal capacity may temporarily be made available. Emergency loans may be made to water users for acquisition, management, conservation, and transportation of project water. Finally, project water may be made available to protect fish and wildlife and to mitigate for drought-related fish and wildlife losses. A maximum of $25 million is authorized for emergency loans and management and also for construction activities by the Bureau of Reclamation to mitigate losses in reclamation states. Each USBR region has been allocated $4 million of this total, with $5 million for the Denver, Colorado, office. Additional funds can be appropriated for other Bureau activities specified in the act in reclamation states. Reclamation assistance in California is provided by the Bureau, and applications are to be submitted to the regional office in Sacramento.

The act authorizes the Secretary of the Interior to make available to the Oakdale and South San Joaquin irrigation districts unallocated storage and water for those districts in New Melones Reservoir carried over from the previous year. It also authorizes up to $5.5 million to install a curtain to control the temperature of water released from Shasta Reservoir to protect and enhance the anadromous fishery.

U.S. Department of Agriculture

FARMERS HOME ADMINISTRATION

Emergency Loan Program

This program makes low-interest loans available to applicants having qualifying physical and/or production losses in counties eligible for federal assistance. The assistance requires a disaster or emergency declaration by the President, or a natural disaster determination by the Secretary of

Agriculture, upon request by the Governor. Loan funds may be used to restore or replace damaged property; to pay all or part of the production costs associated with the disaster year and/or the year following the disaster year; to pay delinquent debt installments; to pay family living expenses; to construct, buy, or improve buildings; to purchase machinery, equipment, and foundation livestock; to pay costs to reorganize a farming system, when justified; and to refinance short-term, intermediate, and/or long-term debts, when justified. Prior to action by the President or the Secretary, the FmHA administrator may make physical loss loans available to qualified applicants if it is determined that such losses have occurred as the result of a natural disaster. The FmHA loans are available to family-sized operators and cannot exceed $500,000 for each disaster. Farmers and ranchers should contact their local FmHA office.

AGRICULTURAL STABILIZATION AND CONSERVATION SERVICE

Emergency Feed Program (Feed Cost Sharing Program)

Under this program, Commodity Credit Corporation shares with eligible livestock owners up to one-half of the cost of feed, including hay, purchased to cover farmers' abnormal feed needs or their feed loss, whichever is smaller, on farms with a 40 percent or larger feed loss.

To be eligible for assistance, a livestock owner must have suffered a 40 percent loss of feed production on the farm because of a natural disaster which requires him to buy abnormal amounts of feed for eligible livestock. Eligible livestock are cattle, sheep, horses, mules, swine, goats, lambs, fish and poultry owned at least six months; or, if owned less than six months, are either offspring of eligible livestock or were purchased as part of the farm's normal operation.

Emergency Feed Assistance Program

This program provides for the sale of CCC-owned grain at 75 percent of the basic county loan rate to livestock producers in drought-designated counties whose feed production has suffered a 40 percent or greater loss because of drought. Eligible livestock producers must have insufficient feed available to carry their eligible livestock to the next normal feed availability period -- such as a grain harvest or spring or fall pasture. Producers must pay for grain to be received by certified check, cashier's check, or money order payable to CCC at the county office where their application is filed.

Forage Assistance Program

This program authorizes aid to re-establish permanent pasture and rangeland lost due to the 1988 drought. Maximum cost-sharing is limited to 50 percent of the actual or average cost incurred to re-establish the acreage. Seed, minerals, seeding, and seed bed preparations are included.

Tree Assistance Program

This program authorizes cost share assistance to small and medium-scale commercial tree producers who experienced significant seedling losses due to the 1988 drought. Cost sharing is limited to 65 percent of the actual or average cost of reestablishing seedlings on the portions of qualifying stands that are eligible for payment.

Conservation Reserve Program

This program provides cost share assistance for new conservation practices on CRP acreage with eligible owners or operators on existing CRP contracts. Producers who had the fiscal year 1988 CRP annual rental payment reduced for the emergency use of their CRP acreage will be eligible for cost share assistance up to 50 percent of the cost on specific conservation practices.

Emergency Conservation Program

This program provides emergency funds to share with farmers and ranchers the cost of restoring to productive use farmland seriously damaged by natural disasters or carrying out emergency water conservation measures during severe droughts. ECP assistance is available only to help solve conservation problems caused by natural disasters that impair and endanger the land or materially affect its productive capacity. The damage must be unusual (except for wind erosion) and not likely to occur frequently in the same area. Conservation problems that existed before a disaster are not eligible for ECP assistance. Rehabilitation of farmland damaged by wind erosion and other disasters, including drought, may include removing debris, providing water for livestock, restoring fencing, grading and shaping farmland, restoring structures, and carrying out water conservation measures.

Emergency Crop Loss Assistance

This program aids farmers who suffered 1988 crop losses as a result of drought, excessive moisture, and hail damage. Disaster payments are available to eligible producers whose production losses exceed 35 percent of normal. These payments apply to losses for all commercially grown crops. Maximum benefits under all ASCS disaster programs for 1988, including Emergency Feed Program and Emergency Feed Assistance Program, are $100,000 per person, as defined under ASCS regulations. Disaster applications must be filed no later than March 31, 1989, at the ASCS office in the county where the loss occurred.

Agricultural Conservation Program

This cost-sharing program is available in drought-affected counties for various livestock practices, such as pasture reseeding, livestock wells, and other livestock watering facilities. Applicants can obtain details from a local ASCS office. The California State ASCS Committee is placing special emphasis on water conservation.

U.S. Small Business Administration

Economic Injury Disaster Loan

This program provides low-interest working capital loans to small non-farm businesses to meet financial obligations arising from a natural disaster. Drought-related difficulties are recognized only when the Secretary of Agriculture makes a disaster designation for the Emergency Loan Program of the Farmers Home Administration and asks the Small Business Administration to implement the Economic Injury Disaster Loan program. This program provides the only federal drought assistance such businesses can receive.

Federal Emergency Management Agency

Federal Disaster Assistance

FEMA disaster assistance is provided under the authority of the Disaster Relief of 1974. FEMA provides assistance to save lives and protect property and preserve public health and safety. FEMA makes grants to local and state governments to repair or restore publicly owned real property and facilities. Typically, FEMA drought assistance is significantly less than during natural catastrophes when physical destruction occurs.

U.S. Army Corps of Engineers

Emergency Water Supplies and Drought Assistance Programs

If the Corps determines that an area is drought distressed, it has the authority to initiate well drilling, truck in potable water supplies, and transport water by small-diameter emergency water lines to distressed areas. The Corps can require that the user of the emergency source pay for the construction of the emergency system. Before the Corps will drill an emergency well, it requires the user to obtain all necessary State and local permits. During the 1976-77 drought, the Corps' assistance was not sought.

STATE DROUGHT ASSISTANCE PROGRAMS

Senate Bill 32

In September 1988, Governor Deukmejian signed Senate Bill 32. This legislation directs the Department of Water Resources to carry out 1989 drought contingency planning and to report to the Legislature by January 21, 1989, with recommendations for drought response actions the Legislature and others should take.

The legislation directs DWR to be of technical assistance to local agencies with emergency water supply needs, to work with the Department of Fish and Game to identify and develop responses to fish and wildlife problems caused by the drought, to develop an emergency financial assistance program, and to determine if any regulatory relief would be needed so as not to impede construction of emergency water supply projects. The legislation is reproduced as Appendix A.

Emergency Clean Water Grant Fund

The Department of Health Services administers the Emergency Clean Water Grant Fund, which can be used by the Department to respond to any emergency situation affecting a public water system, including providing for additional water during an outage. These funds can be used, for example, for emergency interties with another water system, for payment for use of bottled water by consumers, for installation of emergency treatment, or for payment for hauling water by tanker truck. While not intended to substitute for other available drought disaster funding, these funds can be used during emergency drought conditions for water utilities having limited funding capability.

Office of Emergency Services

During a drought, the main objective of OES is to provide support to local government to help minimize the drought impact. In this context, OES serves to coordinate resources, assist with development of drought-related legislation, and provide information on financial aid and assistance programs. OES also assesses and tabulates drought damage and impacts from data provided by local, State, and federal sources.

Local requests for federal disaster relief assistance are made to the Governor through OES, which reviews and analyzes the requests and, when appropriate, recommends action by the Governor.

Requests for State disaster resources also are made through OES. The request originates from individuals or local government and is made to the county emergency services director. It is forwarded to the regional OES office, and, if necessary, to OES headquarters in Sacramento.

Department of Water Resources' Drought Center

The Drought Center was opened in Sacramento in April 1988. The small staff that operates the Center is responsible for responding to drought-related inquiries, for coordinating State drought assistance actions, and for assisting water purveyors with water supply problems. The Center also documents problem areas within the State and produces drought publications. Computerized drought information was added to the California Data Exchange Center data bank, making this information immediately available to water agencies, the news media, and others.

Interagency Drought Task Force

In the fall of 1987, DWR established an Interagency Drought Task Force made up of eleven State agencies and nine federal agencies. The members exchange information on drought impacts and agency roles at regularly scheduled meetings in Sacramento. In a third dry year, the group will serve as a mutual aid network for quickly getting assistance to areas of need. Appendix C lists the agencies and members of the task force.

5. REGULATORY ACTIONS

Certain federal, State, and local agencies have regulatory authority that is exercised during periods of drought. To understand the extent of their authority and responsibility and how they overlap and coordinate, it is instructive to review the roles of the agencies individually.

The State Water Resources Control Board

Issuance and enforcement of water rights is the responsibility of the State Water Resources Control Board. The Board's primary objective during a drought is to assure that the available water supply is used in accordance with established rights. This is accomplished by (1) informing water right holders when water is not available under the holders priority; (2) taking enforcement action against violators of permit and license conditions, and for illegal diversions and waste or unreasonable use of water; and (3) conducting investigations of complaints regarding illegal diversions and waste or unreasonable use of water.

In 1977, under its Dry Year Program, the Board notified groups of permittees when water availability under their rights would cease. The Board took similar action this year. On April 18, 1988, its Division of Water Rights issued a warning to over 5,000 riparian diverters in the Sacramento–San Joaquin Delta and over 1,350 diverters holding permits or licenses under jurisdiction of the Board in the Sacramento–San Joaquin watershed and Delta channels. The Board warned that natural flows would not be sufficient to fully satisfy all users of water in the Sacramento-San Joaquin watershed and Delta channels and that curtailment of use might be required. A notice of curtailment had previously been issued to about 55 permittees and licensees on the San Joaquin River.

On June 13 and 14, the Board held a public hearing on the statewide impact of the drought. The Board was concerned that there be adequate planning, should drought conditions continue into 1989. Several State agencies, USBR, and a selected group of water agencies presented testimony. Among the issues addressed were these:

- What was the current estimate of the amount of water that will be in storage by the end of summer?
- How much water will be available to supply 1989 demands?
- What was the status of planning for 1989, in the event there is another dry or critically dry year?

The Board is considering a drought resolution, which it prepared in case it should be needed in 1989.

Contingency plans for the Water Rights Program will be formulated for 1989. These will include:

- Providing information on water shortage or availability to diverters.
- Assuring that the available water supply is used in accordance with established rights.
- Conducting investigation of complaints regarding illegal diversions and waste or unreasonable use of water.
- Taking enforcement action against violators of permit and license conditions, illegal diversions, and waste or unreasonable use of water.

As in 1988, the Division of Water Rights would field additional enforcement staff during the irrigation season. Data would be collected on permittees and licensees not in compliance with water use in accordance with their established rights. Diversions by major appropriators would be closely monitored, and complaints regarding illegal diversions and waste or unreasonable use of water would be investigated. Information on the number of additional complaints regarding illegal diversions and waste or unreasonable use of water would be monitored.

The Regional Water Quality Control Boards

The Regional Water Quality Control Boards administer federal and State Clean Water Acts to regulate water quality in specific regions of the State, subject to the State Board's appeal process. The Regional Boards issue permits to those discharging wastewater. Regional Board permits incorporate requirements established by the State Board and the Department of Health Services. In drought years, such as in 1976 and 1977, the Regional Boards have considered reducing the requirements for obtaining waste discharge permits. Even these requirements are not allowed to fall below minimum standards established by the Department of Health Services. The Regional Boards also seek out violators of discharge permits and enforce water quality standards through the issuance of fines, cease and desist orders, and other appropriate enforcement actions.

Department of Health Services

The Department of Health Services regulates all public water systems serving drinking water to five or more service connections. Local health departments enforce the Department's regulations in the case of water systems having five to 200 service connections. DOHS carries out its responsibilities through the adoption of drinking water standards and regulations, the issuance of domestic water supply permits, and a program of surveillance and enforcement. DOHS also enforces the Federal Safe Drinking Water Act through a delegation agreement with the federal Environmental Protection Agency.

In addition, DOHS establishes standards and criteria for wastewater reclamation that are implemented by the Regional Water Quality Control Boards. These requirements are spelled out in Ti-

tle 22 of the California Code of Regulations and may vary, depending on the type of reuse. DOHS also establishes guidelines for ground water recharge with reclaimed wastewater and for consumer use of "graywater" (wastewater from sinks, showers, washing machines, and other sources not containing sewage).

Both DOHS regulations and permits contain requirements regarding adequate quantities and pressures to be maintained by public water systems. If DOHS determines that adequate quantities of water are not available to prevent water outages or to meet consumer demands, the agency is empowered to impose a moratorium on new service connections. These requirements and regulatory actions generally apply to normal water system operations. Situations involving unforeseen emergency drought conditions are usually dealt with on a case-by-case basis with considerably more flexibility.

During periods of emergency drought situations, DOHS has the flexibility to approve the use of alternative sources of water on a temporary basis. Sources of water of marginal quality can sometimes be used with approval of the Department, depending on the situation. Where there are no alternatives, sources that may not meet drinking water standards may be approved by DOHS during the emergency. In such cases, the Department may impose temporary requirements such as emergency disinfection or consumer notification. Approval of an alternative temporary source depends on the quality of that source, the availability of mitigation measures, and the degree of risk to the consumer.

Similarly, restrictions that may be required for use of reclaimed wastewater or graywater may be relaxed during drought emergencies, depending on the specific situation. In such cases, additional public warnings or other temporary measures may be required. Before any such use, however, DOHS must be contacted.

Department of Fish and Game

The Department of Fish and Game has been established to preserve, protect, and enhance California's fish and wildlife and their habitats. DFG has standing to appear in any water right proceeding before the State Water Resources Control Board. DFG advises the Board of the instream flows required for fisheries. The State Board considers these recommendations in determining whether it is in the public's interest to reject the application or impose terms and conditions that require a specific amount of water to be released to maintain fish and wildlife populations. DFG also advises the State and Regional Boards on possible water quality problems that adversely affect fish and wildlife.

Water used for fish and wildlife areas is generally obtained through a water rights permit issued by the State Water Resources Control Board. DFG would be subject to the State Board's drought actions, in addition to the limitations of its permit.

DFG administers Alteration of Streambed Agreements that would be required in a drought when the natural flow of the bed, channel, or bank of any river, stream, or lake is diverted, obstructed, or changed.

Public Utilities Commission

The Public Utilities Commission has the authority to regulate any person, firm, or corporation owning, controlling, operating, or managing any nonpublic water system in the State that sells, leases, or delivers water for compensation. The PUC regulates the rates, rules, and conditions of service of these water systems and establishes rates in accordance with the principle that the water systems' owners are entitled to rates that cover a reasonable level of expense, plus a fair return on investment.

During the 1976-77 drought, the PUC issued various orders implementing water conservation measures. Water suppliers who incurred expenses in implementing Commission-ordered water conservation measures were allowed to petition the PUC to recoup those increases in rates. In the event of a third dry year in 1989, the PUC may elect to implement similar measures.

Federal Energy Regulatory Commission

The Federal Energy Regulatory Commission issues licenses for the construction, operation and maintenance of dams, water conduits, reservoirs, and powerhouses across, along, or from navigable waters, that occupy federal lands or that use surplus water from federal dams, and are associated with hydroelectric power. It also issues permits to study the feasibility of such projects.

In dealing with both wet years and droughts, FERC establishes minimum flow articles in most licenses it issues for projects at nongovernment dams. During critically dry periods, FERC has authority retained in each license to implement emergency requirements. During the 1976-77 drought, FERC used this authority to reduce the amount of discharge from various hydroelectric projects so that the available reservoir storage would be conserved.

U.S. Army Corps of Engineers

The U.S. Army Corps of Engineers regulates activities that affect and obstruct navigable waters. Consequently, a permit must be obtained from the Corps before construction of any obstacle, canal, or conduit on or affecting a navigable body of water.

The Corps is responsible for regulating the discharge of dredge or fill material into navigable waters under the Federal Clean Water Act. This authority is subject to the veto power of the Environmental Protectection Agency, a power seldom used. Using standards established by EPA, the Corps is authorized to deny or revoke a permit, if it determines that the discharge is or will have an unacceptable effect on municipal water supplies, fisheries, wildlife, or recreation areas. The most common use of this is to protect wetland and marsh areas from filling.

The Corps also has various flood control responsibilities. The Corps owns and operates reservoirs in California and regulates the flood storage capacities within other reservoirs in the State.

During a drought, the Corps has authority to lower the discharge permit requirements to emergency levels for discharge of fill within navigable waters and to impose requirements for construction of temporary and/or permanent structures on or affecting navigable waterways.

Local Government

Local government bodies have the authority to establish various land use requirements in their jurisdiction. When emergency well construction or water transfer is necessary during a drought, local permits may be required. Before drilling a well or constructing a means of transferring or diverting water, a private party must comply with all applicable land use regulations, if no exemption is provided for in the local regulations.

During a drought, local governments may establish and enforce water conservation measures. Examples are restricting car washing, landscape irrigation, and pool refilling; installating water meters; and establishing maximum allowable daily use of water per person or connection. Penalties provided under drought emergency ordinances can include such actions as civil fines, installing flow restrictors, or terminating water service.

Local water agencies have the authority to declare a water shortage emergency when they determine that the ordinary demands of water users cannot be met without depleting the water supply to a level insufficient to supply human consumption needs. The local agency has the authority to adopt regulations and restrictions to conserve water for domestic, sanitation, and fire protection use.

APPENDIXES

Appendix A

Senate Bill No. 32

CHAPTER 957

An act relating to drought assistance, and declaring the urgency thereof, to take effect immediately.

[Approved by Governor September 16, 1988. Filed with Secretary of State September 19, 1988.]

LEGISLATIVE COUNSEL'S DIGEST

SB 32, Ayala. Water resources: drought assistance.

Under existing law, the Department of Water Resources has various powers and duties relating to ensuring adequate supplies of water within the state.

This bill would direct the department to identify the areas of the state in which a 3rd year of drought could impose severe health, economic, and environmental hardship and to develop options for addressing those water supply shortages and for protection of fish and wildlife. The bill would require the department to report its findings to the Legislature by January 21, 1989.

The bill would direct the department to assist, as prescribed, local representatives in the areas identified in implementing the emergency water supply options which are currently authorized.

The bill would become inoperative upon specified determinations or findings by the department.

The bill would make legislative findings and declarations.

The bill would declare that it is to take effect immediately as an urgency statute.

The people of the State of California do enact as follows:

SECTION 1. The Legislature hereby finds and declares as follows:

(a) 1987 and 1988 have been successive critically dry years and water shortages are now occurring in some areas of the state.

(b) If 1989 is also dry, there will be widespread areas of water shortage. These shortages, especially shortages affecting urban areas, agricultural areas with permanent crops, and fisheries would have a serious impact on California's economy.

(c) The Department of Water Resources is taking action to assist areas of water shortage this year. The department has established a statewide Drought Center as a clearinghouse of the technical and financial assistance information which is available to address and lessen drought impacts and has formed an Interagency Drought Task Force to identify and coordinate existing drought assistance measures. The department is now beginning to concentrate on actions that may be needed in 1989 should the current drought

continue.

SEC. 2. The Legislature directs the Department of Water Resources to identify the areas of the state in which a third year of drought could impose severe health, economic, and environmental hardship. The department, in coordination with local representatives and other state and federal agencies, including the Department of Fish and Game, shall develop options for addressing the water supply shortages in the identified areas of potential need, and for protection of fish and wildlife. In its consideration of water supply options, the department shall consider, among other things, water conservation, expanded use of local groundwater supplies, emergency and temporary water quality protection facilities such as temporary barriers in the Sacramento-San Joaquin Delta, water transfers of developed supplies, and temporary interconnections that facilitate exchanges between surface water distribution systems. The department shall also identify the need for legislative or regulatory actions that may be needed to implement the emergency water supply options in a timely manner. The department should consider, in consultation with appropriate local, state, and federal agencies, regulatory or legislative actions including, but not limited to, reevaluating existing drinking water standards where those standards hamper implementation of emergency water supply options; accelerating regulatory processes; implementation of the California Environmental Quality Act; the processing of applications by existing water rights permit holders or licensees for temporary changes; and establishing an emergency financial assistance program that could include loans, loan guarantees, or grants to assist drought-stricken areas. The financial assistance could be used to finance the construction of temporary distribution system interconnections, the drilling of new wells, or other temporary drought related programs. The department shall report to the Legislature on its findings by January 21, 1989.

SEC. 3. The Legislature directs the Department of Water Resources to assist local representatives in the areas identified as potentially having severe shortages next year in implementing the emergency water supply options developed pursuant to Section 2 which are currently authorized. The department shall provide assistance through the department's Drought Center to any water user needing help implementing an emergency drought related action. The department shall provide technical and financial expertise and shall assist water users through the state's regulatory system so necessary drought emergency actions are not unreasonably slowed by that system. All state agencies shall cooperate fully with the department in this effort.

SEC. 4. This act shall become inoperative if the May 1, 1989, forecast in the Department of Water Resources' Bulletin 120 indicates that the 1988–89 hydrologic year in the Sacramento River Basin is an above normal or wet year or upon a subsequent finding

by the Director of Water Resources that the drought is over.

SEC. 5. This act is an urgency statute necessary for the immediate preservation of the public peace, health, or safety within the meaning of Article IV of the Constitution and shall go into immediate effect. The facts constituting the necessity are:

In order to provide effective drought relief at the earliest possible time, it is necessary that this act take effect immediately.

O

90 90

Appendix B

SURVEY OF WATER PURVEYORS

Periodically, during 1988, the Department of Water Resources interviewed California water service agencies to identify water-short communities and the actions they are taking to resolve their drought-caused problems. The following table summarizes what 112 agencies did to cope with the drought in 1988 and what actions they would take if they experience water supply deficiencies in 1989. The most prevalent action reported is voluntary conservation by users or mandatory rationing by agencies, such as volume restrictions. In 1988, 27 agencies required conservation, and another 27 mandated rationing.

If the drought continues in 1989, mandatory rationing will increase sharply, rising to 60 agencies at 25 percent deficiency or to 76 agencies at 50 percent deficiency. Other actions, such as educating users on ways to save water, making more efficient use of water, and changing to crops that take less water or taking land out of production, will also increase substantially in 1989. Changes in crop patterns, for example, will more than double at 25 percent deficiency and triple at 50 percent deficiency.

To increase their water supplies, 38 agencies increased ground water pumping or development in 1988, and 23 more said they would do so in 1989, if necessary. Many agencies will also purchase more water, exchange water with other agencies, or look for replacement supplies.

The table is arranged to readily provide information useful in planning or evaluating drought impacts, such as the number of agencies calling for rationing, correcting system leaks or seepage, drilling or rehabilitating wells, increasing ground water pumping, purchasing or exchanging water, or reclaiming and reusing water. It may become important to examine more closely the limitations and thus the reality of coping mechanisms that depend on certain actions, such as expecting to increase ground water pumping substantially or to buy additional surface water.

Entries under "1988 Coping Actions" indicate actions already taken. Those under "1989 Coping Actions" list actions contemplated or emergency measures to be followed. Coping actions can take either or both of two approaches: (1) reduce demand and/or (2) increase supply directly or indirectly. The symbols in the table indicate the primary types of coping actions. The numbers in the columns under the letter symbols refer to explanations in the "Notes" column. An "X" indicates that some other type of action was taken in 1988 or is planned for 1989.

SURVEY OF

COUNTY / AGENCY	NORMAL WATER SUPPLY	1988 WATER SUPPLY	NORMAL DEMAND	1988 COPING ACTIONS								
				REDUCE DEMAND					INCREASE SUPPLY			
1/	2/	3/	4/	5/					6/			
	SURFACE WATER GROUND WATER TOTAL (ACRE FEET)	SURFACE WATER GROUND WATER TOTAL (ACRE FEET)	POPULATION - POP ACRES - AC ACRE FEET - AF	RATION OR CONSERVE	EDUCATION	EFFICIENCY IN USE	CHANGE PLANTING OR AREA	OTHER	GROUND WATER	PURCHASE OR EXCHANGE	DEVELOP NEW WATER	OTHER
ALAMEDA												
ALAMEDA COUNTY WATER DIST.	24,000 25,000 49,000	20,000 25,000 45,000	255,000 POP 63,000 AC 49,000 AF	V 1	X							
ALAMEDA-CONTRA COSTA												
EAST BAY MUD	244,500 0 244,500	209,000 0 209,000	1,100,000 POP AC 244,500 AF	M 1	X	L				P 2		
ALPINE												
MARKLEEVILLE W.C.	60 0 60	60 0 60	150 CONNEC POP AC 60 AF	V	X	L 1						O 2
AMADOR												
JACKSON VALLEY I.D.	11,630 0 11,630	7,000 0 7,000	385 POP 3,500 AC 11,630 AF	V			A,C					
BUTTE												
LIMESADDLE C.S.D.	0 130 130	24 100 124	600 POP AC 130 AF	M	X					P 1		
BUTTE												
MAGALIA C.W.D.	0 75 75	20 60 80	650 POP AC 82 AF	M		L				P 1		
BUTTE												
PARADISE I.D.	8,150 0 8,150	8,150 0 8,150	25,000 POP 202 AC 7,200 AF	M		W 1			X 2			

WATER PURVEYORS

1989 COPING ACTIONS

IF DEFICIENCY EQUALS

25%										50%									
REDUCE DEMAND					INCREASE SUPPLY					REDUCE DEMAND					INCREASE SUPPLY				
7/					8/					9/					10/				
RATION OR CONSERVE	EDUCATION	EFFICIENCY IN USE	CHANGE PLANTING OR AREA	OTHER	GROUND WATER	PURCHASE OR EXCHANGE	DEVELOP NEW WATER	OTHER		RATION OR CONSERVE	EDUCATION	EFFICIENCY IN USE	CHANGE PLANTING OR AREA	OTHER	GROUND WATER	PURCHASE OR EXCHANGE	DEVELOP NEW WATER	OTHER	
M	X							O		M	X								
M	X	L					P 3			M	X	L				P 3		O 4	
M	X						X 3	X 4		M	X						X 3	X 4	
V	X		A, C			P 1		X 2		V	X		A, C			P 1		X 2	
M						P 1				M						P 1			
M		L			D	P 1				M		L			D	P 1			
M	X	W 1			X 2	P 3				M	X	W 1			X 2	P 3			

LEGEND

REDUCE DEMAND	INCREASE SUPPLY
M. MANDATORY RATIONING	D. DRILL AND/OR REHABILITATE WELLS
V. VOLUNTARY CONSERVATION	G. INCREASE PUMPING
L. LEAK OR SEEPAGE CORRECTION	P. PURCHASE ADDITIONAL WATER
W. WATER MANAGEMENT PRACTICES	E. EXCHANGE WITH OTHER AGENCYS
A. AREA PLANTED REDUCED	R. RECLAMATION OR REUSE
C. CHANGE TO LOWER WATER USE CROP	O. WATER QUALITY CONSIDERATIONS
X. SOME ACTION TAKEN OR PLANNED	X. SOME ACTION TAKEN OR PLANNED

11/ NOTES

1. WITH WATER WASTE RESTRICTIONS.

1. MANDATORY RATIONING. ACHIEVED 30% IN 1989
2. OFFER TO PURCHASE DOWNSTREAM AGRICULTURAL WATER WAS REFUSED. BUT REMAINS OPEN.
3. PURCHASE DELTA WATER FROM USBR AND STORE IT IN TERMINAL RESERVOIRS.
4. WATER QUALITY PROBLEMS MAY OCCUR IN 1989.

1. REPAIRED 20 GPM LEAK. EASIER TO MEET DEMAND
2. AS PRESENT SUPPLY (MUSSER & JARVIS CREEK) DIMINISHES. QUALITY DEGRADES DUE TO HOT SPRINGS UPSTREAM.
3. DIVERT FROM MARKLEEVILLE CREEK.
4. SYSTEM IS OLD. NEEDS UPGRADING WITH STORAGE ADDED FOR FIRE PROTECTION. NEED LOW COST LOAN.

1. LOOK FOR WATER TO PURCHASE FROM MOKELUMNE RIVER.
2. FEDERAL OR STATE FINANCIAL AID WOULD BE SOUGHT.

1. PURCHASE FROM DEL ORO W.C.

1. PURCHASE FROM PARADISE I.D.

1. EMPHASIS ON REDUCED GUTTER FLOODING.
2. PURSUING GROUND WATER DEVELOPMENT.
3. POSSIBLE PURCHASE FROM PG&E IF DISTRICT IS NEARLY OUT OF WATER.

SURVEY OF

COUNTY / AGENCY	NORMAL WATER SUPPLY	1988 WATER SUPPLY	NORMAL DEMAND	1988 COPING ACTIONS								
				REDUCE DEMAND					INCREASE SUPPLY			
1/	2/	3/	4/	5/					6/			
	SURFACE WATER GROUND WATER TOTAL (ACRE FEET)	SURFACE WATER GROUND WATER TOTAL (ACRE FEET)	POPULATION - POP ACRES - AC ACRE FEET - AF	RATION OR CONSERVE	EDUCATION	EFFICIENCY IN USE	CHANGE PLANTING OR AREA	OTHER	GROUND WATER	PURCHASE OR EXCHANGE	DEVELOP NEW WATER	OTHER
CALAVERAS												
ANGELS CAMP. CITY	800 0 800	800 0 800	2,400 POP 0 AC 800 AF		X							
CONTRA COSTA												
BRENTWOOD. CITY	1,400 0 1,400	700 700 1,400	6,700 POP AC 1,400 AF	V	X	L			G 1			O 2
CONTRA COSTA												
CONTRA COSTA W.D.	122,500 0 122,500	122,500 0 122,500	350,000 POP EST. 400 AC 122,500 AF		X	W						O 1
DEL NORTE												
HUSSEY RANCH CORP. C.S.D.	EST. 4 0 4	EST. 4 0 4	44 POP AC EST. 4 AF	M		X						
EL DORADO												
EL DORADO I.D.	38,000 0 38,000	32,000 0 32,000	52,000 POP 7,000 AC 36,000 AF	M	X		X			P 1		
FRESNO-KINGS-TULARE												
ALTA I.D.	175,000 205,000 380,000	60,000 320,000 380,000	POP 111,730 AC 380,000 AF	M	X	X 1			G 2			
FRESNO												
FRESNO I.D.	510,200 54,800 565,000	(a)416,700 148,300 565,000	POP 170,000 AC 565,000 AF						G 1			

WATER PURVEYORS

1989 COPING ACTIONS
IF DEFICIENCY EQUALS

25%										50%									
REDUCE DEMAND					INCREASE SUPPLY					REDUCE DEMAND					INCREASE SUPPLY				
7/					8/					9/					10/				
RATION OR CONSERVE	EDUCATION	EFFICIENCY IN USE	CHANGE PLANTING OR AREA	OTHER	GROUND WATER	PURCHASE OR EXCHANGE	DEVELOP NEW WATER	OTHER		RATION OR CONSERVE	EDUCATION	EFFICIENCY IN USE	CHANGE PLANTING OR AREA	OTHER	GROUND WATER	PURCHASE OR EXCHANGE	DEVELOP NEW WATER	OTHER	11/ NOTES
	X										X								
V	X	L			G 1			O 2		V	X	L			G 1			O 2	1. GROUND WATER USE WOULD INCREASE COMMENSURATE WITH SURFACE WATER DECREASE. 2. GROUND WATER IS NOT AS HIGH A QUALITY AS SURFACE WATER BUT STILL WITHIN PUBLIC HEALTH STANDARDS.
	X	W						O 1			X	W						O 1	1. SOME INCREASE IN SODIUM, CHLORIDES, AND THM'S. THE INCREASE IN COSTS OF TREATMENT ARE UNKNOWN AT THIS TIME
M	X				D 1					M	X				D 1				1. NEED STATE SUPPORT FOR CONSTRUCTION OF A NEW WELL. DWR HAS APPLICATION FOR LOAN TO CONSTRUCT.
M	X		X 2							M	X		X 2			P			1. DISTRICT IS PURCHASING UP TO 5,000 AF FROM PG&E TO STORE IN SLY PARK RESERVOIR FOR 1989. 2. PERENNIAL CROPS MAY GET PRIORITY OVER ANNUAL CROPS.
M	X	R			G 2					M	X	R	C 3		G 2	P E			1. MONITORS PENALIZE FOR MISUSE & WASTE. 2. LOCAL GROWERS PUMP GW TO COVER ANY DIFFERENCES BETWEEN DELIVERY AND NEED. 3. KEEP USERS ADVISED SO THEY CAN CHANGE CROPS IF NEEDED.
					G 1			X 2							G 1			X 2	0. WATER SUPPLY INCLUDES FRESNO TREATED SEWAGE SEEPAGE: (NORMAL, 19.2 TAF; 1988, 9.6 TAF) AND EXCLUDES WATER NORMALLY WHEELED BY F.I.D. FOR CITY OF FRESNO: (NORMAL, 60 TAF; 1988, 46.8 TAF). 1. LOCAL GROWERS PUMP GW TO COVER ANY DIFFERENCES BETWEEN DELIVERY AND NEED. 2. PRE-SEASON WEATHER MODIFICATION.

LEGEND

REDUCE DEMAND	INCREASE SUPPLY
M. MANDATORY RATIONING	D. DRILL AND/OR REHABILITATE WELLS
V. VOLUNTARY CONSERVATION	G. INCREASE PUMPING
L. LEAK OR SEEPAGE CORRECTION	P. PURCHASE ADDITIONAL WATER
W. WATER MANAGEMENT PRACTICES	E. EXCHANGE WITH OTHER AGENCYS
A. AREA PLANTED REDUCED	R. RECLAMATION OR REUSE
C. CHANGE TO LOWER WATER USE CROP	Q. WATER QUALITY CONSIDERATIONS
X. SOME ACTION TAKEN OR PLANNED	X. SOME ACTION TAKEN OR PLANNED

SURVEY OF

COUNTY / AGENCY	NORMAL WATER SUPPLY	1988 WATER SUPPLY	NORMAL DEMAND	1988 COPING ACTIONS									
				REDUCE DEMAND					INCREASE SUPPLY				
1/	2/ SURFACE WATER / GROUND WATER / TOTAL (ACRE FEET)	3/ SURFACE WATER / GROUND WATER / TOTAL (ACRE FEET)	4/ POPULATION - POP; ACRES - AC; ACRE FEET - AF	5/ RATION OR CONSERVE	EDUCATION	EFFICIENCY IN USE	CHANGE PLANTING OR AREA	OTHER	6/ GROUND WATER	PURCHASE OR EXCHANGE	DEVELOP NEW WATER	OTHER
FRESNO JAMES I.D.	47,500 25,000 72,500	56,500 25,500 82,000	POP 21,630 AC 55,602 AF									X 2
FRESNO-KINGS LAGUNA I.D.	60,000 30,000 95,000	(a) 27,000 68,000 95,000	POP 31,605 AC 95,000 AF			L 1			G 2			
FRESNO-TULARE ORANGE COVE I.D.	40,600 36,900 77,500	31,976 45,520 77,496	(a) 4,000 POP 26,100 AC 77,500 AF	M	X	W			G	P		
FRESNO-KINGS WESTLANDS W.D.	1,350,000 50,000 1,400,000	1,300,000 150,000 1,450,000	(EST) 750 POP 570,000 AC 1,406,000 AF						G			
FRESNO CONSOLIDATED I.D.	293,000 207,000 500,000	73,000 427,000 500,000	(a) 77,000 POP (b) 140,000 AC 500,000 AF						G 1			
GLENN & COLUSA GLENN-COLUSA I.D.	825,000 0 825,000	825,000 0 825,000	POP 120,000 AC 825,000 AF									
GLENN ORLAND UNIT WATER USERS A.	125,000 0 125,000	125,000 0 125,000	POP 19,000 AC 100,000 AF									

WATER PURVEYORS

1989 COPING ACTIONS
IF DEFICIENCY EQUALS

25%

REDUCE DEMAND					INCREASE SUPPLY				
7/					8/				
RATION OR CONSERVE	EDUCATION	EFFICIENCY IN USE	CHANGE PLANTING OR AREA	OTHER	GROUND WATER	PURCHASE OR EXCHANGE	DEVELOP NEW WATER	OTHER
M		L	C 1		G			X 2
		L 1			G 2			
M	X	W	X		G	P		X 1
		X			G 1	E 2		C
					G 1			X 2
M			C	X 1	G 2			
M	X		C			P 1	D 2	

50%

REDUCE DEMAND					INCREASE SUPPLY			
9/					10/			
RATION OR CONSERVE	EDUCATION	EFFICIENCY IN USE	CHANGE PLANTING OR AREA	OTHER	GROUND WATER	PURCHASE OR EXCHANGE	DEVELOP NEW WATER	OTHER
M		L	C 1		G			X 2
		L 1						
M	X	W	X		G	P		
M			X		G 1	E 2		
					G 1			X 2
M			C	X 1	G 2			
M	X		C			P 1	D 2	

LEGEND

REDUCE DEMAND	INCREASE SUPPLY
M. MANDATORY RATIONING V. VOLUNTARY CONSERVATION L. LEAK OR SEEPAGE CORRECTION W. WATER MANAGEMENT PRACTICES A. AREA PLANTED REDUCED C. CHANGE TO LOWER WATER USE CROP X. SOME ACTION TAKEN OR PLANNED	D. DRILL AND/OR REHABILITATE WELLS G. INCREASE PUMPING P. PURCHASE ADDITIONAL WATER E. EXCHANGE WITH OTHER AGENCYS R. RECLAMATION OR REUSE O. WATER QUALITY CONSIDERATIONS X. SOME ACTION TAKEN OR PLANNED

NOTES

11/

1. INFORM GROWERS OF PENDING SHORTAGE ALLOWING SWITCH TO LOW WATER CROPS.
2. DWR CAN: ENLARGE DELTA MENDOTA CANAL. PROVIDE FINANCING.

o. LEFT 12,000 AF IN PINE FLAT TO AVOID CHANNEL DEPLETIONS. AVAILABLE IN 1989.
1. COULD INSTALL METERS. LINE OR PIPE LEAKY DITCHES IF STATE WOULD SPEED UP LOAN PROCESS.
2. INDIVIDUAL GROWERS USE GROUND WATER TO MAKE UP DEFICIENCY.

o. THE POPULATION OF THE CITY OF ORANGE COVE (14000) LIES WITHIN AND IS INCLUDED IN ORANGE COVE I.D.
1. NEED ASSISTANCE IN WATER TRANSFERS. PUBLISHED DROUGHT TIPS, WORKSHOPS FOR WATER MANAGEMENT PRACTICES AND FINANCIAL HELP TO IMPLEMENT ALL OF THE ABOVE.

1. INDIVIDUAL GROWERS WOULD DEVELOP AND USE GW TO MAKE UP FOR SHORTAGE, PROBABLY POOR QUALITY.
2. DWR SHOULD: FACILITATE EXCHANGE BETWEEN SWP + CVP CONTRACTORS, ALLOW TRANSPORT OF ADEQUATE QUALITY GW IN CALIF. AQUE.

a. INCLUDES POPULATION OF EXCLUDED CITIES -50,000.
b. ONLY 60% CAN RECEIVE SURFACE WATER.
1. INDIVIDUAL GROWERS USE PRIVATE WELLS TO SUPPLY DEMAND NOT MET BY SURFACE SUPPLY
2. DWR CAN: ADD STORAGE ON KINGS RIVER, PROVIDE GRANTS TO LINE CANALS AND TO BUILD ADDITIONAL RECHARGE PONDS.

1. THE CALIFORNIA IRRIGATION MANAGEMENT INFORMATION SYSTEM CAN HELP REDUCE WATER USE ON CROPS BUT IS NOT TOO EFFECTIVE ON REDUCING RICE WATER USE ON 80,000 ACRES.
2. COMINGLE SURFACE SUPPLIES WITH INDIVIDUAL OWNER'S WELL WATER.

1. PURCHASE WATER FROM CVP IF AVAILABLE.
2. DWR FINANCIAL HELP TO DRILL WELLS.

SURVEY OF

COUNTY / AGENCY	NORMAL WATER SUPPLY	1988 WATER SUPPLY	NORMAL DEMAND	1988 COPING ACTIONS									
				REDUCE DEMAND					INCREASE SUPPLY				
1/	2/ SURFACE WATER / GROUND WATER / TOTAL (ACRE FEET)	3/ SURFACE WATER / GROUND WATER / TOTAL (ACRE FEET)	4/ POPULATION - POP; ACRES - AC; ACRE FEET - AF	5/ RATION OR CONSERVE	EDUCATION	EFFICIENCY IN USE	CHANGE PLANTING OR AREA	OTHER	6/ GROUND WATER	PURCHASE OR EXCHANGE	DEVELOP NEW WATER	OTHER
HUMBOLDT HUMBOLDT BAY M.W.D.	55,850 0 55,850	55,850 0 55,850	62,000 POP AC 55,850 AF									
HUMBOLDT CITY OF TRINIDAD	90 0 90	(a) 0 (a)	850 POP AC 90 AF	V	X	W 1						
KERN ARDEN WATER CO.	0 320 320	0 275 275	EST 2,300 POP AC 300-450 AF			X 1			D 2			
KERN ARVIN-EDISON W.S.D.	318,300 (a) 31,700 350,000	40,300 (a)209,700 350,000	UNKNOWN POP 112,000 AC 350,000 AF						G			
KERN BELRIDGE W.S.D.	(a)150,000 0 150,000	(a)150,000 0 150,000	POP 49,000 AC 150,000 AF									
KERN BERRENDA MESA W.D.	(a)161,900 400 162,300	(a)148,800 400 149,200	UNKNOWN POP (b) AC 110,000 AF				X 1					

WATER PURVEYORS

1989 COPING ACTIONS
IF DEFICIENCY EQUALS

25%

REDUCE DEMAND					INCREASE SUPPLY				
7/					8/				
RATION OR CONSERVE	EDUCATION	EFFICIENCY IN USE	CHANGE PLANTING OR AREA	OTHER	GROUND WATER	PURCHASE OR EXCHANGE	DEVELOP NEW WATER	OTHER	NOTES
				X 1					1. DROUGHT AWARENESS MATERIAL HAS BEEN HELPFUL. WANT RETROFIT KITS AT REASONABLE COST. 2. AMEND WATER RIGHTS PERMITS TO REDUCE FISH RELEASES IN DRY PERIODS.
V	X	W						X 2	o. LESS THAN THE HISTORICAL DRY YEAR RECORD. 1. STARTED A PROGRAM OF WATERSHED MANAGEMENT. 2. EXPECT TO VIOLATE OUR MINIMUM WATER WILDLIFE BYPASS REQUIREMENT. 3. PROVIDE STATE ASSISTANCE ON LITTLE RIVER PROJECT
		X 1				P 3			1. FLOW RESTRICTORS & TOILET RESERVOIR INSERTS IN USE. 2. CONNECTING TO NEIGHBORING WELL OF 80 GPM AND DEEPENING EXISTING WELLS. 3. INVESTIGATING: PURCHASE OF KERN RIVER WATER OR DRILLING ADDITIONAL WELLS ON USCE PROPERTY.
						P 1		X 2	o. RECOVERY OF GW USED EQUAL TO SURFACE DEFICIENCY. 1. PURCHASE RIGHT TO SURFACE WATER BEFORE SEASON, SELLER PUMPS GW, BUYER SELLS TO CUSTOMER WITHOUT GW SOURCE. 2. DWR COULD: GET PERIPHERAL CANAL AND AUBURN DAM.
			X 1	X 2				X 3	o. SWP ENTITLEMENT 161,000 AF 1. OF THE 49,000 ACRES, 5,900 ACRES ARE IN PERMANENT CROPS. 2. CAN SUSTAIN 20% SHORTAGE WITH GREATER CARE. NO SERIOUS PLANS FOR 50% LOSS. 3. DWR COULD HELP BY EXTENDING PAYMENTS.
M			X 1			E 2		X 3	o. ENTITLEMENT EXCEEDS DEMAND. b. GROSS AREA: 55,000 AC, SERVICE AREA: 49,000 AC. IRRIGATED AREA: 32,300 AC 1. OF THE 32,300 IRRIGATED ACRES, 30,300 AC ARE IN PERMANENT CROPS. 2. ARRANGE FOR EXTRACTION AND EXCHANGE OF GW FROM NEIGHBORING DISTRICTS. 3. EXTEND DRY YEAR WATER COST OVER YEARS WITH FULL SUPPLIES.

50%

REDUCE DEMAND					INCREASE SUPPLY				
9/					10/				
RATION OR CONSERVE	EDUCATION	EFFICIENCY IN USE	CHANGE PLANTING OR AREA	OTHER	GROUND WATER	PURCHASE OR EXCHANGE	DEVELOP NEW WATER	OTHER	NOTES
M	X			X 1				X 2	1. DROUGHT AWARENESS MATERIAL HAS BEEN HELPFUL. WANT RETROFIT KITS AT REASONABLE COST. 2. AMEND WATER RIGHTS PERMITS TO REDUCE FISH RELEASES IN DRY PERIODS.
V	X	W				P		X 3	o. LESS THAN THE HISTORICAL DRY YEAR RECORD. 1. STARTED A PROGRAM OF WATERSHED MANAGEMENT. 2. EXPECT TO VIOLATE OUR MINIMUM WATER WILDLIFE BYPASS REQUIREMENT. 3. PROVIDE STATE ASSISTANCE ON LITTLE RIVER PROJECT
		X 1				P 3			1. FLOW RESTRICTORS & TOILET RESERVOIR INSERTS IN USE. 2. CONNECTING TO NEIGHBORING WELL OF 80 GPM AND DEEPENING EXISTING WELLS. 3. INVESTIGATING: PURCHASE OF KERN RIVER WATER OR DRILLING ADDITIONAL WELLS ON USCE PROPERTY.
						P 1		X 2	o. RECOVERY OF GW USED EQUAL TO SURFACE DEFICIENCY. 1. PURCHASE RIGHT TO SURFACE WATER BEFORE SEASON, SELLER PUMPS GW, BUYER SELLS TO CUSTOMER WITHOUT GW SOURCE. 2. DWR COULD: GET PERIPHERAL CANAL AND AUBURN DAM.
			X 1	X 2				X 3	o. SWP ENTITLEMENT 161,000 AF 1. OF THE 49,000 ACRES, 5,900 ACRES ARE IN PERMANENT CROPS. 2. CAN SUSTAIN 20% SHORTAGE WITH GREATER CARE. NO SERIOUS PLANS FOR 50% LOSS. 3. DWR COULD HELP BY EXTENDING PAYMENTS.
M			X 1			E 2		X 3	o. ENTITLEMENT EXCEEDS DEMAND. b. GROSS AREA: 55,000 AC, SERVICE AREA: 49,000 AC. IRRIGATED AREA: 32,300 AC 1. OF THE 32,300 IRRIGATED ACRES, 30,300 AC ARE IN PERMANENT CROPS. 2. ARRANGE FOR EXTRACTION AND EXCHANGE OF GW FROM NEIGHBORING DISTRICTS. 3. EXTEND DRY YEAR WATER COST OVER YEARS WITH FULL SUPPLIES.

LEGEND

REDUCE DEMAND	INCREASE SUPPLY
M. MANDATORY RATIONING V. VOLUNTARY CONSERVATION L. LEAK OR SEEPAGE CORRECTION W. WATER MANAGEMENT PRACTICES A. AREA PLANTED REDUCED C. CHANGE TO LOWER WATER USE CROP X. SOME ACTION TAKEN OR PLANNED	D. DRILL AND/OR REHABILITATE WELLS G. INCREASE PUMPING P. PURCHASE ADDITIONAL WATER E. EXCHANGE WITH OTHER AGENCYS R. RECLAMATION OR REUSE Q. WATER QUALITY CONSIDERATIONS X. SOME ACTION TAKEN OR PLANNED

11/ NOTES

SURVEY OF

COUNTY / AGENCY	NORMAL WATER SUPPLY	1988 WATER SUPPLY	NORMAL DEMAND	1988 COPING ACTIONS								
				REDUCE DEMAND					INCREASE SUPPLY			
1/	2/	3/	4/	5/					6/			
	SURFACE WATER GROUND WATER TOTAL (ACRE FEET)	SURFACE WATER GROUND WATER TOTAL (ACRE FEET)	POPULATION - POP ACRES - AC ACRE FEET - AF	RATION OR CONSERVE	EDUCATION	EFFICIENCY IN USE	CHANGE PLANTING OR AREA	OTHER	GROUND WATER	PURCHASE OR EXCHANGE	DEVELOP NEW WATER	OTHER
KERN BUENA VISTA W.S.D.	145,000 25,000 (a)170,000	80,000 65,000 (a)145,000	POP 40,000 AC (a)130,000 AF	M		R 1	X 2		G 3	E		
KERN KERN DELTA W.D.	186,400 205,600 392,000	169,200 222,800 392,000	POP 107,930 AC 408,500 AF						G	P		X 1
KERN LOST HILLS W.D.	138,800 0 138,800	138,800 0 138,800	POP (a) 42,500 AC 138,800 AF									
KERN NORTH KERN W.S.D.	190,000 75,000 265,000	35,000 160,000 195,000	POP 56,000 AC 206,250 AF						G	E 1		X 2
KERN SEMITROPIC W.S.D.	206,600 297,400 504,000	164,000 336,000 500,000	POP 120,400 AC 500,000 AF			L			G			
KERN SHAFTER-WASCO I.D.	89,600 37,500 127,100	42,200 55,300 97,500	POP 34,400 AC 97,500 AF	M					G	P		

WATER PURVEYORS

1989 COPING ACTIONS
IF DEFICIENCY EQUALS

25%

REDUCE DEMAND					INCREASE SUPPLY				
7/					8/				
RATION OR CONSERVE	EDUCATION	EFFICIENCY IN USE	CHANGE PLANTING OR AREA	OTHER	GROUND WATER	PURCHASE OR EXCHANGE	DEVELOP NEW WATER	OTHER
M		R 1	X 2		G 3	E		
								X 1
M					G	E 1	R 3	X 4
M		W			G		R	X 1
M	X 1	X			G	E	X 2	X 3

50%

REDUCE DEMAND					INCREASE SUPPLY			
9/					10/			
RATION OR CONSERVE	EDUCATION	EFFICIENCY IN USE	CHANGE PLANTING OR AREA	OTHER	GROUND WATER	PURCHASE OR EXCHANGE	DEVELOP NEW WATER	OTHER
M		R 1	X 2		G 3	E	X 4	
								X 1
M					G	E 1	R 3	X 4
M		W			G		R	X 1
M	X	X 1	C		G	E	X 2	X 3

LEGEND

REDUCE DEMAND	INCREASE SUPPLY
M. MANDATORY RATIONING V. VOLUNTARY CONSERVATION L. LEAK OR SEEPAGE CORRECTION W. WATER MANAGEMENT PRACTICES A. AREA PLANTED REDUCED C. CHANGE TO LOWER WATER USE CROP X. SOME ACTION TAKEN OR PLANNED	D. DRILL AND/OR REHABILITATE WELLS G. INCREASE PUMPING P. PURCHASE ADDITIONAL WATER E. EXCHANGE WITH OTHER AGENCYS R. RECLAMATION OR REUSE O. WATER QUALITY CONSIDERATIONS X. SOME ACTION TAKEN OR PLANNED

NOTES

11/

o. SUPPLY IS AT SOURCE. DEMAND IS AT FARM.
1. TAIL WATER RECOVERY SYSTEMS.
2. CROPS ADJUSTED TO FIT SUPPLY.
3. GW PUMPING INCREASES AS SURFACE SUPPLY DECREASES.
4. DWR COULD: IMPLEMENT KERN WATER BANK. UNDERSTAND DISTRICT PROBLEMS AND FACILITATE ANNUAL ENTITLEMENT EXCHANGES.

1. LOOKING FORWARD TO KERN WATER BANK.

o. 66,000 AC CAPABLE OF RECEIVING SWP WATER. 42,500 FARMED IN 1988. 16,200 IDLE. TAKEN OVER BY CREDITORS.
1. DWR SHOULD DEVELOP GW EXCHANGE AND RECHARGE PROGRAMS WITH K.C.W.A.

1. USE GROUND WATER EARLY IN YEAR AND LET SURFACE WATER ACCUMULATE IN STORAGE RESERVOIR FOR USE LATER IN YEAR WHEN PEAKING DEMAND IS HIGHER.
2. WITHDRAW PREVIOUSLY STORED WATER FROM RESERVOIR.
3. RECLAIM OIL FIELD WATER BY BLENDING TO ACCEPTABLE LEVELS.
4. NEED MORE RECHARGE VIA PONDS. ON FARM RECHARGE CARRIES TOO MUCH FERTILIZERS TO GW.

1. PREDROUGHT ACTION. CONNECT WELLS TO DISTRICT DISTRIBUTION SYSTEM. DWR COULD FINANCE SYSTEM AND USE FOR FUTURE CONJUNCTIVE USE.

1. PREDROUGHT ACTION-DEVELOP WELLS & INFORM GROWERS TO FACILITATE CROP SELECTION.
2. IMPROVE FRIANT-KERN/CROSS VALLEY INTERTIE.
3. DWR CAN HELP-CONTINUE DROUGHT CENTER-INCREASE SWP SUPPLY.

SURVEY OF

COUNTY / AGENCY	NORMAL WATER SUPPLY	1988 WATER SUPPLY	NORMAL DEMAND	1988 COPING ACTIONS								
				REDUCE DEMAND					INCREASE SUPPLY			
1/	2/	3/	4/	5/					6/			
	SURFACE WATER GROUND WATER TOTAL (ACRE FEET)	SURFACE WATER GROUND WATER TOTAL (ACRE FEET)	POPULATION - POP ACRES - AC ACRE FEET - AF	RATION OR CONSERVE	EDUCATION	EFFICIENCY IN USE	CHANGE PLANTING OR AREA	OTHER	GROUND WATER	PURCHASE OR EXCHANGE	DEVELOP NEW WATER	OTHER
KERN												
SOUTHERN SAN JOAQUIN M.U.D.	147,000 60,000 207,000	122,000 80,000 202,000	POP 61,300 AC 180,000 AF			W			G	P		
KERN												
WHEELER RIDGE MARICOPA WSD	252,840 60,000 312,840	242,840 7,160 250,000	POP 84,000 AC 250,000 AF			X 1						
KINGS												
DUDLEY RIDGE W.D.	58,000 0 58,000	58,000 0 58,000	POP 15,170 AC 52,000 AF									
KINGS												
KINGS COUNTY W.D. (INC. LAKESIDE IRR. W.D.)	156,700 216,900 373,600	93,800 279,800 373,600	POP 129,700 AC 373,600 AF	V		X			G			X 1
KINGS												
CORCORAN. CITY	0 30,000 30,000	0 37,000 37,000	9,150 POP AC 30,000 AF									
LAKE												
LAKE COUNTY SPEC. DIST.	0 28 28	8 20 28	70 POP NA AC 28 AF								X 1	
LAKE												
LAKEPORT. CITY	100 750 850	175 675 850	4,500 POP AC 850 AF	M								

WATER PURVEYORS

1989 COPING ACTIONS
IF DEFICIENCY EQUALS

25%

REDUCE DEMAND					INCREASE SUPPLY				
7/					8/				
RATION OR CONSERVE	EDUCATION	EFFICIENCY IN USE	CHANGE PLANTING OR AREA	OTHER	GROUND WATER	PURCHASE OR EXCHANGE	DEVELOP NEW WATER	OTHER
M	X	W			G	P,E		
		X 1	A,C 2					X 4
M		X 1	A 2					X 3
M	X	X	C		G	E		X 1
V	X 1							X 2
							X 1	
M						P 1		

50%

REDUCE DEMAND					INCREASE SUPPLY			
9/					10/			
RATION OR CONSERVE	EDUCATION	EFFICIENCY IN USE	CHANGE PLANTING OR AREA	OTHER	GROUND WATER	PURCHASE OR EXCHANGE	DEVELOP NEW WATER	OTHER
M	X	W			G	P,E		
M		X 1	A,C 2			P 3		X 4
M		X 1	A 2					X 3
M	X	X	C		X	X 2		X 1
M				X 3				X 2
							X 1	
M						P 1		

LEGEND

REDUCE DEMAND	INCREASE SUPPLY
M. MANDATORY RATIONING V. VOLUNTARY CONSERVATION L. LEAK OR SEEPAGE CORRECTION W. WATER MANAGEMENT PRACTICES A. AREA PLANTED REDUCED C. CHANGE TO LOWER WATER USE CROP X. SOME ACTION TAKEN OR PLANNED	D. DRILL AND/OR REHABILITATE WELLS G. INCREASE PUMPING P. PURCHASE ADDITIONAL WATER E. EXCHANGE WITH OTHER AGENCYS R. RECLAMATION OR REUSE O. WATER QUALITY CONSIDERATIONS X. SOME ACTION TAKEN OR PLANNED

11/ NOTES

1. WATER WASTERS HAVE WATER SHUT OFF.
2. CURTAIL ROW CROPS. ONLY ABOUT ONE HALF OF THE DISTRICT WOULD BE FARMED.
3. PURCHASE DEPENDS ON PRICE.
4. DWR SHOULD: ALLOW SWP ENTITLEMENT CARRY OVER TO JAN & FEB FOR MORE EFFICIENT USE - PROVIDE WAY TO FUND DRY YEAR PAYMENTS OVER NORMAL YEARS.

1. PIPING & LINING CANALS, INSTALLING MIST SPRINKLERS ON PERMANENT CROPS. EXPERIMENTING WITH DRIP ON COTTON.
2. LAND WILL GO OUT OF PRODUCTION IN PROPORTION TO REDUCTION OF SUPPLY. NEED 3AF/AC OR NO PROFIT.
3. DWR SOULD PROVIDE SWP PAYMENT CARRY OVER FROM DEFICIENT YEARS TO NORMAL YEARS.

1. DWR COULD MAKE MORE WATER AVAILABLE AND LOWER WHEELING COST.
2. PROBABLY NONE AVAILABLE.

1. BEGIN EDUCATION EARLY.
2. DWR SHOULD PROVIDE SURFACE WATER AT REASONABLE COST TO TREAT.
3. REDUCE PRESSURE, HENCE VOLUME.

1. PUMP LAKE WATER THROUGH SEPARATE DISTRIBUTION SYSTEM FOR YARD WATERING.

1. PURCHASE LAKE WATER FROM YOLO COUNTY FLOOD CONTROL & W.C.D. TO RECHARGE WELL FIELD.

SURVEY OF

COUNTY / AGENCY	NORMAL WATER SUPPLY	1988 WATER SUPPLY	NORMAL DEMAND	1988 COPING ACTIONS									
				REDUCE DEMAND					INCREASE SUPPLY				
1/	2/	3/	4/	5/					6/				
	SURFACE WATER GROUND WATER TOTAL (ACRE FEET)	SURFACE WATER GROUND WATER TOTAL (ACRE FEET)	POPULATION - POP ACRES - AC ACRE FEET - AF	RATION OR CONSERVE	EDUCATION	EFFICIENCY IN USE	CHANGE PLANTINGS OR AREA	OTHER	GROUND WATER	PURCHASE OR EXCHANGE	DEVELOP NEW WATER	OTHER
LAKE LOWER LAKE COUNTY W.D.	0 250 250	0 (EST) 150 (EST) 150	2,600 POP AC 250 AF	M	X				D			
LAKE UPPER LAKE COUNTY W.D.	0 129 129	0 129 129	1,200 POP AC 129 AF		X							
LAKE STONEHOUSE M.W.C.	0 448 448	0 448 448	2,340 POP AC 448 AF									
LOS ANGELES LA DEPT OF WATER & PWR	587,000 103,000 690,000	567,000 121,100 (a)688,100	3,388,000 POP AC 690,000 AF	V	X 1	X 2		X 3	G			
LOS ANGELES METROPOLITAN W.D. OF SO. CAL	2,050,000 0 2,050,000	2,050,000 0 2,050,000	14,500,000 POP ↑(a) ↓(c)(b)→AC 2,050,000 AF		X	W		X 1				

WATER PURVEYORS

1989 COPING ACTIONS
IF DEFICIENCY EQUALS

25%										50%									
REDUCE DEMAND					INCREASE SUPPLY					REDUCE DEMAND					INCREASE SUPPLY				
7/					8/					9/					10/				
RATION OR CONSERVE	EDUCATION	EFFICIENCY IN USE	CHANGE PLANTING OR AREA	OTHER	GROUND WATER	PURCHASE OR EXCHANGE	DEVELOP NEW WATER	OTHER		RATION OR CONSERVE	EDUCATION	EFFICIENCY IN USE	CHANGE PLANTING OR AREA	OTHER	GROUND WATER	PURCHASE OR EXCHANGE	DEVELOP NEW WATER	OTHER	
M	X				X			X 1		M	X				X	P 2		X 1	
	X				D	-		X 1			X				D			X 1	
M	X				D -					M	X				D				
M 4		X 2		X 3	G		X 5			M 4		X 2		X 3	G				
M	X	W			G	E				M	X	W		X 2	G	E		X 3	

LEGEND

REDUCE DEMAND	INCREASE SUPPLY
M. MANDATORY RATIONING	D. DRILL AND/OR REHABILITATE WELLS
V. VOLUNTARY CONSERVATION	G. INCREASE PUMPING
L. LEAK OR SEEPAGE CORRECTION	P. PURCHASE ADDITIONAL WATER
W. WATER MANAGEMENT PRACTICES	E. EXCHANGE WITH OTHER AGENCYS
A. AREA PLANTED REDUCED	R. RECLAMATION OR REUSE
C. CHANGE TO LOWER WATER USE CROP	Q. WATER QUALITY CONSIDERATIONS
X. SOME ACTION TAKEN OR PLANNED	X. SOME ACTION TAKEN OR PLANNED

11/ NOTES

1. NEED FINANCIAL HELP TO IMPROVE SYSTEM.
2. AGREEMENT WITH YOLO COUNTY TO PURCHASE 300 AF/YR FROM CACHE CREEK.

1. LOOK FOR LOW COST LOAN FOR ADDITIONAL WELLS.

o. ABSENT ADDITIONAL 1987-88 CONSERVATION MEASURES, DEMAND WOULD BE 5% GREATER IN A DROUGHT YEAR.

1. 1988 COSTS FOR WATER CONSERVATION WORK. $5M.
2. REDUCE SEWER FLOWS BY REQUIRING LOW FLOW DEVICES ON BOTH NEW & EXISTING BUILDINGS.
3. PROHIBITED USES.
4. 10% TO 25% MANDATORY REDUCTION. ORDINANCE AVAILABLE FOR USE.
5. DWR COULD PROVIDE INCENTIVE FOR AGRICULTURE TO USE MORE GW IN LIEU OF SWP WATER.

o. MWD SUPPLIES ABOUT 50% OF WATER NEEDS FOR THIS POPULATION FROM THE COLORADO RIVER AND STATE WATER PROJECT
D. ABOUT 185,000 AF OF AGRICULTURAL WATER IS DELIVERED ANNUALLY.
c. THIS INCLUDES 50,000 AF FOR SEAWATER INTRUSION BARRIERS. PROJECTED 1989 DEMAND 2.1 MAF. COULD RISE TO 2.2 MAF.
1. SUSPENDED DELIVERIES TO THE DESERT/COACHELLA ACCOUNT AND REDUCED DEMANDS THROUGH CONSERVATION EFFORTS. REDUCED CONSUMPTION MAY BE NEARLY OFFSET BY INCREASED SUPPLEMENTAL DEMANDS RESULTING FROM REDUCED LOCAL SUPPLIES AND GROWTH IN MWD SERVICE AREA.
2. POSSIBLY NO DELIVERIES TO AGRICULTURE.
3. DWR SHOULD PETITION THE SWRCB TO RELAX DELTA OUTFLOW STANDARDS SO THAT LESS FRESH WATER FLOWS TO THE OCEAN.

SURVEY OF

COUNTY / AGENCY	NORMAL WATER SUPPLY	1988 WATER SUPPLY	NORMAL DEMAND	1988 COPING ACTIONS									
				REDUCE DEMAND					INCREASE SUPPLY				
1/	2/	3/	4/	5/					6/				
	SURFACE WATER GROUND WATER TOTAL (ACRE FEET)	SURFACE WATER GROUND WATER TOTAL (ACRE FEET)	POPULATION - POP ACRES - AC ACRE FEET - AF	RATION OR CONSERVE	EDUCATION	EFFICIENCY IN USE	CHANGE PLANTING OR AREA	OTHER	GROUND WATER	PURCHASE OR EXCHANGE	DEVELOP NEW WATER	OTHER
MADERA												
MADERA I.D.	220,880 115,000 335,880	85,000 225,000 310,000	POP 95,000 AC 285,000 AF	M		W 1				P.E 2		
MADERA												
CHOWCHILLA W.D.	159,000 44,000 203,000	64,000 116,000 180,000	POP 65,000 AC 164,000 AF						G			
MARIN												
MARIN M.W.D.	35,200 0 35,200	33,900 0 33,900	167,000 POP AC 33,000 AF	V	X					P 1		X 2
MARIPOSA												
MARIPOSA P.U.D.	280 25 305	200 100 300	1,500 POP AC 305 AF	M	X	L					X 2	X 1
MENDOCINO												
FORT BRAGG, CITY	1,000 (a) 360 1,360	1,000 (a) 290 1,290	5,860 POP AC 1,300 AF	V	X							
MENDOCINO												
LAYTONVILLE COUNTY W.D.	0 134 134	0 134 134	1,100 POP 0 AC 134 AF	V	X							

WATER PURVEYORS

1989 COPING ACTIONS
IF DEFICIENCY EQUALS

25%										50%									
REDUCE DEMAND					INCREASE SUPPLY					REDUCE DEMAND					INCREASE SUPPLY				
7/					8/					9/					10/				
RATION OR CONSERVE	EDUCATION	EFFICIENCY IN USE	CHANGE PLANTING OR AREA	OTHER	GROUND WATER	PURCHASE OR EXCHANGE	DEVELOP NEW WATER	OTHER		RATION OR CONSERVE	EDUCATION	EFFICIENCY IN USE	CHANGE PLANTING OR AREA	OTHER	GROUND WATER	PURCHASE OR EXCHANGE	DEVELOP NEW WATER	OTHER	11/ NOTES
M					D 3	P.E				M					D 3	P.E			1. LIMITED USE OF SURFACE WATER TO JUNE, JULY & 2 WKS OF AUG TO MINIMIZE CONVEYANCE LOSS. OPERATED TO REDUCE SPILLS. 2. PURCHASED WATER FOR USE BY GROWERS WITH WELL PROBLEMS. ALLOWED GROWERS TO MOVE PUMPED WATER AND TO EXCHANGE WATER VIA DISTRICT CANALS. 3. NEW & ADDITIONAL WELLS TO MAKE INCREASED AMOUNTS OF GROUND WATER AVAILABLE.
		W 1	X 2		G							W 1	X 2		G				1. SURFACE WATER DELIVERY MADE AS RAPIDLY AS POSSIBLE TO MINIMIZE CONVEYANCE LOSSES. 2. DWR COULD INCREASE LONG RANGE WEATHER FORCASTING. GROWERS COULD PLANT FOR WATER SUPPLY IF THE FORCAST IS ACCURATE.
X 3	X					P 1		X 2		X 3	X					P 1		Q 4	1. DISTRICT HAS CONTRACT WITH SONOMA CWA FOR 4300 AF; NORMAL USE 2200 AF. 1988 USE TO 8/3 - 3900 AF. 2. NO MAJOR PROBLEMS. 3. DISTRICT DEVELOPING USE LIMITS TO GUIDE 1989 ACTION IF NEEDED. 4. LOW RESERVOIR LEVELS HAVE CAUSED TASTE. ODOR, AND TURBIDITY PROBLEMS.
		L 2			D 3	P 4				M 5		L 2			D 3	P 4			1. DECIDED TO DRAIN STOCKTON CREEK RES TO DO NEEDED REPAIR. RECINDED RATIONING. 2. LEAK DETECTION PLUS USE OF GREY WATER. 3. DEVELOP NEW WELLS, BUT ACTUAL DRILLING WILL BE DONE AT LAST MINUTE. 4. PURCHASED LOCAL WATER SYSTEM LOCATED WITHIN SERVICE AREA. GAINED ADDITIONAL WATER SUPPLY. 5. RATION AT 100 GPDP.
M	X	X		X 1			X 2	X 1		M	X	X		X 1			X 2	X 1	0. SUPPLY FROM SPRINGS. 1. DWR COULD: HELP CHOOSE A CONSERVATION KIT FOR DISTRIBUTION; HELP SETUP LANDSCAPE DEMO, PROVIDE EDUCATIONAL AIDS (FILMS, STUDY GUIDES, ETC.). 2. INVESTIGATING BACK UP SUPPLY FROM COVINGTON GULCH.
V	X				G		X 1			V	X				G		X 1		1. PUMP SURFACE WATER FROM TEN-MILE CREEK.

LEGEND

REDUCE DEMAND	INCREASE SUPPLY
M. MANDATORY RATIONING V. VOLUNTARY CONSERVATION L. LEAK OR SEEPAGE CORRECTION W. WATER MANAGEMENT PRACTICES A. AREA PLANTED REDUCED C. CHANGE TO LOWER WATER USE CROP X. SOME ACTION TAKEN OR PLANNED	D. DRILL AND/OR REHABILITATE WELLS G. INCREASE PUMPING P. PURCHASE ADDITIONAL WATER E. EXCHANGE WITH OTHER AGENCYS R. RECLAMATION OR REUSE Q. WATER QUALITY CONSIDERATIONS X. SOME ACTION TAKEN OR PLANNED

SURVEY OF

COUNTY / AGENCY	NORMAL WATER SUPPLY	1988 WATER SUPPLY	NORMAL DEMAND	1988 COPING ACTIONS									
				REDUCE DEMAND					INCREASE SUPPLY				
1/	2/	3/	4/	5/					6/				
	SURFACE WATER GROUND WATER TOTAL (ACRE FEET)	SURFACE WATER GROUND WATER TOTAL (ACRE FEET)	POPULATION - POP ACRES - AC ACRE FEET - AF	RATION OR CONSERVE	EDUCATION	EFFICIENCY IN USE	CHANGE PLANTING OF AREA	OTHER	GROUND WATER	PURCHASE OR EXCHANGE	DEVELOP NEW WATER	OTHER
MENDOCINO												
REDWOOD V. COUNTY W.D.	2,000 0 2,000	2,000 0 2,000	4,500 POP 3,300 AC (a) 2,000 AF	V								
MENDOCINO												
WILLITS CITY	1,300 (a) 1,300	1,040 (a) 1,040	4,500 POP AC 1,300 AF	V		X 1				P 2	X 3	
MERCED												
MERCED I.D.	550,000 20,000 570,000	285,000 202,000 487,000	POP 91,400 AC (a)352,100 AF	M				X 1	G			
MONO												
JUNE LAKE	250 0 250	(a) 250 0 250	700 POP AC 250 AF	V	X				D			
MONO												
MAMMOUTH C.W.D.	2,200 0 2,200	1,500 565 2,065	5,000 POP AC 2,000 AF	M	X							
MONTEREY												
MONTEREY PENINSULA MWD	7,000 16,000 23,000	5,000 16,000 21,000	105,000 POP AC 21,000 AF	V 1								

WATER PURVEYORS

1989 COPING ACTIONS
IF DEFICIENCY EQUALS

25%

REDUCE DEMAND					INCREASE SUPPLY				
7/					8/				
RATION OR CONSERVE	EDUCATION	EFFICIENCY IN USE	CHANGE PLANTING OR AREA	OTHER	GROUND WATER	PURCHASE OR EXCHANGE	DEVELOP NEW WATER	OTHER
V								
V						X	X 3	
	X	L			G			X 2
V	X							X 1
M		L 1			D			
M 2					D 3			

50%

REDUCE DEMAND					INCREASE SUPPLY				
9/					10/				
RATION OR CONSERVE	EDUCATION	EFFICIENCY IN USE	CHANGE PLANTING OR AREA	OTHER	GROUND WATER	PURCHASE OR EXCHANGE	DEVELOP NEW WATER	OTHER
M			X 1					
M						X	X 3	
M	X	W	X		G			X 3
V	X							X 1
M		L 1			D			
M								

LEGEND

REDUCE DEMAND	INCREASE SUPPLY
M. MANDATORY RATIONING	D. DRILL AND/OR REHABILITATE WELLS
V. VOLUNTARY CONSERVATION	G. INCREASE PUMPING
L. LEAK OR SEEPAGE CORRECTION	P. PURCHASE ADDITIONAL WATER
W. WATER MANAGEMENT PRACTICES	E. EXCHANGE WITH OTHER AGENCYS
A. AREA PLANTED REDUCED	R. RECLAMATION OR REUSE
C. CHANGE TO LOWER WATER USE CROP	Q. WATER QUALITY CONSIDERATIONS
X. SOME ACTION TAKEN OR PLANNED	X. SOME ACTION TAKEN OR PLANNED

11/ NOTES

- o. ABOUT 40% OF DEMAND IS URBAN AND 60% IS AGRICULTURE.
  1. AGRICULTURAL DELIVERIES WOULD BE CURTAILED.
- o. GW IS USED ONLY AT TIMES OF PEAK DEMAND FOR NON-POTABLE PURPOSES BECAUSE OF HIGH IRON, MANGANESE, AND ARSENIC.
  1. CITY HAS REPLACED SOME DELIVERY LINES TO CONSERVE WATER.
  2. AN UNKNOWN PORTION OF THE 1988 SUPPLY WAS TRUCKED IN.
  3. TEMPORARY PIPELINE IN PLACE IF NEEDED TO BRING FINNEY CREEK WATER TO CITY. WOULD BE USED IF 1989 IS DRY.
- o. INCLUDES CONTRACT DELIVERIES OUT OF DIST 40,000 AF.
  1. REDUCED OUT OF DIST DELIVERIES, INCREASED $/AF FOR OVER ALLOTMENT USE.
  2. PRE DROUGHT ACTION IMPROVE WELLS. CONSERVE STORED WATER. WEED CONTROL & INCREASE PUBLIC AWARENESS.
  3. DWR COULD PROVIDE DOLLARS FOR PUMPING AND DISTRIBUTION SYSTEM UPGRADE.
- o. SNOW CREEK SUPPLY BELOW NORMAL.
  1. USE MORE WATER FROM JUNE LAKE.
- 1. DWR COULD HELP WITH THE LEAK DETECTION PROGRAM.
- 1. 10% VOLUNTARY CONSERVATION
  2. DISTRICT BOARD WILL BE ADOPTING RATIONING ORDINANCES FOR 1989 IN JAN 1989.
  3. ABOUT THE ONLY POSSIBILITY TO INCREASE SUPPLY IS TO DRILL WELLS NEAR THE COASTLINE. THIS COULD CAUSE SEAWATER INTRUSION.

SURVEY OF

COUNTY / AGENCY	NORMAL WATER SUPPLY	1988 WATER SUPPLY	NORMAL DEMAND	1988 COPING ACTIONS								
				REDUCE DEMAND					INCREASE SUPPLY			
1/	2/	3/	4/	5/					6/			
	SURFACE WATER GROUND WATER TOTAL (ACRE FEET)	SURFACE WATER GROUND WATER TOTAL (ACRE FEET)	POPULATION - POP ACRES - AC ACRE FEET - AF	RATION OR CONSERVE	EDUCATION	EFFICIENCY IN USE	CHANGE PLANTING OR AREA	OTHER	GROUND WATER	PURCHASE OR EXCHANGE	DEVELOP NEW WATER	OTHER
NAPA												
NAPA, CITY	15,800 0 15,800	15,000 0 15,000	60,000 POP 1,000 AC 15,500 AF	V	X		A 1					O 2
NEVADA/PLACER												
DONNER LAKE UTILITY CO.	375 120 495	375 120 495	1500-8000 POP AC 495 AF							E 1		
NEVADA												
NEVADA I.D.	250,000 0 250,000	171,000 0 171,000	40,000 POP 25,570 AC 134,000 AF	V						P 1		
PLACER												
PLACER COUNTY W.A.	115,000 0 115,000	102,500 0 102,500	(a) 83,000 POP UNKNOWN AC 104,000 AF	V						P 1		X 2
PLUMAS												
BIDWELL WATER CO.	5,000 0 5,000	2,200 0 2,200	2,200 POP AC 5,000 AF								X 1	

WATER PURVEYORS

1989 COPING ACTIONS
IF DEFICIENCY EQUALS

25%										50%									
REDUCE DEMAND					INCREASE SUPPLY					REDUCE DEMAND					INCREASE SUPPLY				
7/					8/					9/					10/				
RATION OR CONSERVE	EDUCATION	EFFICIENCY IN USE	CHANGE PLANTING OR AREA	OTHER	GROUND WATER	PURCHASE OR EXCHANGE	DEVELOP NEW WATER	OTHER		RATION OR CONSERVE	EDUCATION	EFFICIENCY IN USE	CHANGE PLANTING OR AREA	OTHER	GROUND WATER	PURCHASE OR EXCHANGE	DEVELOP NEW WATER	OTHER	11/ NOTES
V	X									M	X					E 3			o. 3,800AF IS FROM SWP. NORTH BAY AQUEDUCT THE REST IS LOCAL. 1. THE CITY DID NOT SUPPLY WATER TO AROUND 2,000 ACRES OF GRAPES. 2. TURBIDITY, TASTE AND ODOR PROBLEMS AS RESERVOIR GETS LOW. 3. CITY MAY PROVIDE WATER TO TWO OTHER AGENCIES IF CONDITIONS WARRANT.
																			1. THE SPRING WHICH SUPPLIES 200 AF PER YEAR PRODUCED ONLY 100 AF IN 1988. AND THE SHORTAGE WAS MADE UP FROM DONNER LAKE
V						P 1				M						P 1		X 2	1. PURCHASE FROM PG&E. 2. WOULD REQUEST FINANCIAL AID.
M										M			A 3			P 4		X 5	o. 12,000 SERVED BY SAN JUAN SUBURBAN W.D. IN PCWA AREA. 1. PURCHASE FROM PG&E 2. PUMPING FROM THE N.F. OF THE AMERICAN R. UP TO 25,000 AF TO MEET THE DEFICIENCY IN NORMAL SUPPLIES. 3. REDUCE AREA OF ANNUAL CROPS AND PERMANENT PASTURE. 4. POSSIBLE PURCHASE FROM ANOTHER IRRIGATION DIST. 5. FINANCIAL ASSISTANCE WOULD BE NEEDED TO PURCHASE & PUMP MORE THAN 25,000 AF FROM THE AMERICAN RIVER.
M		L			D					M		L			D				1. CLEANED OUT INTAKE AT RESERVOIR.

LEGEND

REDUCE DEMAND	INCREASE SUPPLY
M. MANDATORY RATIONING V. VOLUNTARY CONSERVATION L. LEAK OR SEEPAGE CORRECTION W. WATER MANAGEMENT PRACTICES A. AREA PLANTED REDUCED C. CHANGE TO LOWER WATER USE CROP X. SOME ACTION TAKEN OR PLANNED	D. DRILL AND/OR REHABILITATE WELLS G. INCREASE PUMPING P. PURCHASE ADDITIONAL WATER E. EXCHANGE WITH OTHER AGENCYS R. RECLAMATION OR REUSE O. WATER QUALITY CONSIDERATIONS X. SOME ACTION TAKEN OR PLANNED

SURVEY OF

COUNTY / AGENCY	NORMAL WATER SUPPLY	1988 WATER SUPPLY	NORMAL DEMAND	1988 COPING ACTIONS									
				REDUCE DEMAND					INCREASE SUPPLY				
1/	2/	3/	4/	5/					6/				
	SURFACE WATER GROUND WATER TOTAL (ACRE FEET)	SURFACE WATER GROUND WATER TOTAL (ACRE FEET)	POPULATION - POP ACRES - AC ACRE FEET - AF	RATION OR CONSERVE	EDUCATION	EFFICIENCY IN USE	CHANGE PLANTING OR AREA	OTHER	GROUND WATER	PURCHASE OR EXCHANGE	DEVELOP NEW WATER	OTHER	
PLUMAS													
PLUMAS CO. SERV AREA #8 (PLUMAS EUREKA ESTATES)	0 141 141	0 141 141	200-600 POP AC 141 AF										
PLUMAS													
QUINCY WATER COMPANY (NOW: PLUMAS COUNTY COMMUNITY DEVELOPMENT COMMISSION)	81 952 1,033	40 952 992	2,800 POP AC 1,033 AF	M	X								
SAN DIEGO													
SAN DIEGO CO. WATER AUTH.	590,000 590,000	579,000 0 579,000	2,253,000 POP 0 AC 590,000 AF	V	X	W	X 1						
SAN FRANCISCO-ALAMEDA-SANTA CLARA-SAN MATEO													
SAN FRANCISCO WATER DEPT.	396,000 0 396,000	(a)297,000 0 (a)297,000	2,200,000 POP AC 330,000 AF	M	X								
SAN JOAQUIN													
N. SAN JOA. W.C.D.	8,000 (a)	0 (b)	POP (c) 2,750 AC 8,000 AF						G				

WATER PURVEYORS

1989 COPING ACTIONS
IF DEFICIENCY EQUALS

25%										50%									
REDUCE DEMAND					INCREASE SUPPLY					REDUCE DEMAND					INCREASE SUPPLY				
7/					8/					9/					10/				
RATION OR CONSERVE	EDUCATION	EFFICIENCY IN USE	CHANGE PLANTING OR AREA	OTHER	GROUND WATER	PURCHASE OR EXCHANGE	DEVELOP NEW WATER	OTHER		RATION OR CONSERVE	EDUCATION	EFFICIENCY IN USE	CHANGE PLANTING OR AREA	OTHER	GROUND WATER	PURCHASE OR EXCHANGE	DEVELOP NEW WATER	OTHER	11/ NOTES
V					D					M					D				
M	X	L 1			D		X 2			M	X	L 1			D		X 2		1. REQUEST DWR HELP WITH LEAK DETECTION. 2. BOYLE CREEK SUPPLY AVAILABLE FOR EMERGENCY USE.
M	X	W	X 1	R				X 4		M 2	X	W 2	X 3	R				X 4	a. AGRICULTURAL DEMAND IS 115,000AF 1. ENCOURAGE XERISCAPE PLANTINGS. 2. IF SUCH SHORTAGES WERE TO OCCUR, THE GOVERNOR WOULD HAVE TO DECLARE A STATE OF EMERGENCY, ALL OUTSIDE IRRIGATION WOULD HAVE TO BE ILLEGAL EXCEPT IRRIGATION WITH RECLAIMED WATER. CAR WASHES AND WATER INTENSIVE INDUSTRIES WOULD HAVE TO BE SHUT DOWN. 3. LANDSCAPE IRRIGATION ILLEGAL EXCEPT WITH RECLAIMED WATER. 4. DWR SHOULD PLAN FOR DEVELOPMENT OF VARIOUS FACILITIES TO DEAL WITH FUTURE DROUGHTS.
M	X				D 1					M	X				D 1	P 2		X 3	a. THIS NUMBER EQUALS 75% OF NORMAL SUPPLY OF 396,000 AF. 1. WITH USGS, STUDYING GROUND WATER POTENTIAL UNDER CITY FOR NON-POTABLE WATER USES. 2. LOOKING AT PURCHASES FROM DOWNSTREAM DIVERTERS ON THE TUOLUMNE RIVER AND FROM THE STATE AND FEDERAL GOVERNMENTS. 3. 1988-89 RUNOFF WOULD NOT MEET ANY REQUIREMENTS OF SFWD. BUT ONLY ENTITLEMENTS OF DOWNSTREAM USERS. SFWD MUST DEPLETE RESERVOIR STORAGE AND PURCHASE OTHER SUPPLIES.
																			a. AN UNKNOWN AMOUNT OF GW IS USED FOR CROPS IN ADDITION TO THE 2750 ACRES LISTED. b. 8,000 AF MORE GW WAS PUMPED TO MAKE UP THE DEFICIENCY. c. TOTAL ACRES IRRIGATED IS UNKNOWN.

LEGEND

REDUCE DEMAND	INCREASE SUPPLY
M. MANDATORY RATIONING V. VOLUNTARY CONSERVATION L. LEAK OR SEEPAGE CORRECTION W. WATER MANAGEMENT PRACTICES A. AREA PLANTED REDUCED C. CHANGE TO LOWER WATER USE CROP X. SOME ACTION TAKEN OR PLANNED	D. DRILL AND/OR REHABILITATE WELLS G. INCREASE PUMPING P. PURCHASE ADDITIONAL WATER E. EXCHANGE WITH OTHER AGENCYS R. RECLAMATION OR REUSE Q. WATER QUALITY CONSIDERATIONS X. SOME ACTION TAKEN OR PLANNED

SURVEY OF

COUNTY / AGENCY	NORMAL WATER SUPPLY	1988 WATER SUPPLY	NORMAL DEMAND	1988 COPING ACTIONS									
				REDUCE DEMAND						INCREASE SUPPLY			
1/	2/ SURFACE WATER / GROUND WATER / TOTAL (ACRE FEET)	3/ SURFACE WATER / GROUND WATER / TOTAL (ACRE FEET)	4/ POPULATION - POP; ACRES - AC; ACRE FEET - AF	5/ RATION OR CONSERVE	EDUCATION	EFFICIENCY IN USE	CHANGE PLANTING OR AREA	OTHER		6/ GROUND WATER	PURCHASE OR EXCHANGE	DEVELOP NEW WATER	OTHER
SAN JOAQUIN													
S. SAN JOA. IRR. DIST.	280,000 (a) / 280,000	(b) 134,700 / 28,000 / 162,700	POP / 64,000 AC / 253,000 AF	M		W	A, C 1			G 2			
SAN JOAQUIN													
STOCKTON EAST WATER DIST.	100,000 / 142,000 / 242,000	40,000 / 172,000 / 212,000	250,000 POP / 54,000 AC / 242,000 AF								P 1	X 1	
SAN L. OBISPO													
SAN L. OBISPO CITY	7,680 / 0 / 7,680	8,467 / 0 / 8,467	39,850 POP / AC / 8,467 AF	V 1	X	W							
SAN L. OBISPO													
SAN SIMEON AC C.S.D.	(a)	(b)	(c) POP / AC / 123 AF										

WATER PURVEYORS

1989 COPING ACTIONS
IF DEFICIENCY EQUALS

25%

REDUCE DEMAND					INCREASE SUPPLY					NOTES
7/					8/					
RATION OR CONSERVE	EDUCATION	EFFICIENCY IN USE	CHANGE PLANTING OR AREA	OTHER	GROUND WATER	PURCHASE OR EXCHANGE	DEVELOP NEW WATER	OTHER		
M			A, C	R 3	G 4					a. IN YEARS WHEN SURFACE SUPPLY IS LESS THAN 280,000 AF. GROUND WATER IS USED TO MAKE UP DEFICIENCY. b. ABOUT 25,000 AF OF THE SURFACE SUPPLY IS FROM STORAGE FROM DONNELL AND BEARDSLEY RESERVOIRS. 1. CHANGED TYPE OF CORN FROM 120 DAY TO 90 DAY; DID NOT DOUBLE CROP. AND ABOUT 2,500 ACRES WERE NOT PLANTED. 2. PUMPED 9,700 AF USING DISTRICT WELLS AND 28,000 AF USING RENTED PRIVATE WELLS. 3. 2,500 ACRES NOT PLANTED. 4. WITH ADDITIONAL PUMPING, SALINE INTRUSTION POSSIBLE. DWR COULD PROVIDE FINANCIAL ASSISTANCE TO HELP WITH ADDITIONAL PUMPING COSTS.
M					D 2	P 3				1. THE SEWD HAS REQUESTED THE USCE TO FURNISH THEM 3,000 AF FROM MINIMUM POOL STORAGE IN NEW HOGAN RES. 2. WELLS ON WESTERN EDGE OF STOCKTON COULD BECOME UNUSABLE, WELLS ON THE SOUTHERN EDGE ARE CURRENTLY UNUSABLE. 3. TUNNEL TO BRING STANISLAUS RIVER WATER INTO SEWD. 4. COMPLETE FARMINGTON PROJECT INCLUDING AGREEMENT WITH OAKDALE AND SOUTH SJID'S.
M	X	W	C	X 2	D 3		X 4			1. VOLUNTARY CUTBACK OF 25% WITH INCREASED RATES FOR USAGE ABOVE A LIFELINE ALLOW. 2. ESTABLISH GROWTH CONTROL MEASURES IN ACCORDANCE WITH PROPOSED WATER ALLOCATION REGULATIONS. 3. ADDITIONAL ENERGY COSTS ESTIMATED AT $300,000 OR HIGHER. 4. DWR SHOULD PROVIDE FINANCIAL AND ADMINISTRATIVE ASSISTANCE FOR DEVELOPING NEW WATER SOURCES.
M	X			X 1				O 2		a. DO NOT KNOW. DURING HIGH TIDE GET SEAWATER INTRUSION. b. GROUNDWATER LEVEL 3FT BELOW NORMAL. c. 250-300 PERMANENT POPULATION, UP TO 2,500 SEASONAL. 1. CONTINUE MORATORIUM ON BUILDING. 2. DWR CAN HELP DISTRICT CONVINCE THE REGIONAL WATER QUALITY CONTROL BOARD TO USE EFFLUENT WATER FOR LANDSCAPE IRRIGATION.

50%

REDUCE DEMAND					INCREASE SUPPLY				
9/					10/				
RATION OR CONSERVE	EDUCATION	EFFICIENCY IN USE	CHANGE PLANTING OR AREA	OTHER	GROUND WATER	PURCHASE OR EXCHANGE	DEVELOP NEW WATER	OTHER	
M			A, C	R 3	G 4				
M					D 2	P 3	X 4	O	
M	X	W	C	X 1	D 3		X 4		
M	X			X 1					

LEGEND

REDUCE DEMAND	INCREASE SUPPLY
M. MANDATORY RATIONING V. VOLUNTARY CONSERVATION L. LEAK OR SEEPAGE CORRECTION W. WATER MANAGEMENT PRACTICES A. AREA PLANTED REDUCED C. CHANGE TO LOWER WATER USE CROP X. SOME ACTION TAKEN OR PLANNED	D. DRILL AND/OR REHABILITATE WELLS G. INCREASE PUMPING P. PURCHASE ADDITIONAL WATER E. EXCHANGE WITH OTHER AGENCYS R. RECLAMATION OR REUSE O. WATER QUALITY CONSIDERATIONS X. SOME ACTION TAKEN OR PLANNED

SURVEY OF

COUNTY / AGENCY	NORMAL WATER SUPPLY	1988 WATER SUPPLY	NORMAL DEMAND	1988 COPING ACTIONS								
				REDUCE DEMAND					INCREASE SUPPLY			
1/	2/	3/	4/	5/					6/			
	SURFACE WATER GROUND WATER TOTAL (ACRE FEET)	SURFACE WATER GROUND WATER TOTAL (ACRE FEET)	POPULATION - POP ACRES - AC ACRE FEET - AF	RATION OR CONSERVE	EDUCATION	EFFICIENCY IN USE	CHANGE PLANTINGS OR AREA	OTHER	GROUND WATER	PURCHASE OR EXCHANGE	DEVELOP NEW WATER	OTHER
SAN L. OBISPO CITY OF MORRO BAY	0 1,724 1,724	0 1,203 1,203	10,000 POP 0 AC 1,724 AF	M 1								
SAN L. OBISPO COUNTY OF SAN L. OBISPO	187,000 21,000 208,000	31,000 177,000 208,000	80,000 POP (a) AC 208,000 AF						G			
SANTA BARBARA GOLETA W.D.	10,200 5,000 15,200	10,000 5,200 15,200	70,000 POP 5,000 AC 15,000 AF						G 1			
SANTA BARBARA CITY OF SANTA BARBARA	15,100 1,400 16,500	15,533 1,400 16,933	80,000 POP AC 16,933 AF									
SANTA BARBARA SANTA YNEZ IMPROVEMENT DIST	3,000 3,700 6,700	3,000 3,700 6,700	7,000 POP AC 6,700 AF									

WATER PURVEYORS

1989 COPING ACTIONS
IF DEFICIENCY EQUALS

25%

7/ REDUCE DEMAND					8/ INCREASE SUPPLY				
RATION OR CONSERVE	EDUCATION	EFFICIENCY IN USE	CHANGE PLANTING OR AREA	OTHER	GROUND WATER	PURCHASE OR EXCHANGE	DEVELOP NEW WATER	OTHER	11/ NOTES
M						P 2		X 3	1. INSTITUTED STRINGENT WATER CONSERVATION RESTRICTIONS IN SEPT. 1988 2. PURCHASE WATER FROM WHALE ROCK RESERVOIR AND FROM LOCAL FARMERS. 3. DWR CAN: PROVIDE SWP WATER, PROVIDE WATER CONSERVATION MATERIALS.
M		X		X 1					o. AG DEMAND = 174,000 AF. 1. BUILDING MORATORIUM.
M	X	W 2	C		D 3	P 4		X 5	1. GROUNDWATER OVERDRAFT APPROXIMATELY 5FT/YR. 2. DWR COULD PROVIDE LOW INTEREST LOAN ($2.5 MILLION). PROVIDE 50,000 LOW FLOW SHOWER HEADS. 3. BECAUSE OF GW OVERDRAFT PUMPING MUST BE REDUCED IN 1989 TO AVOID DAMAGING WELLS. 4. WHILE UNLIKELY, IT IS POSSIBLE TO PURCHASE LAKE CACHUMA ALLOTMENT AT AROUND $350/AF FROM OTHER LOCAL WATER DISTRICTS WHILE THEY PUMP UNUSED GW. 5. BECAUSE OF PROJECTED STORAGE IN LAKE CACHUMA SUPPLY WILL BE CUT ONLY 10% IN 1989, HOWEVER, SUPPLY COULD BE REDUCED UP TO 75% IN 1990.
M	X	W		X 1	G		R 2	X 3	1. DWR COULD PROVIDE ACCURATE, UP-TO-DATE INFORMATION ON WATER CONSERVATION TECHNOLOGY AND SHARE DATA ON NEW WATER SUPPLY TECHNOLOGIES. 2. ACTIVATE DROUGHT SURCHARGE. INCREASE PROMOTION OF RECLAIMED WATER USE. 3. BECAUSE OF PROJECTED STORAGE IN LAKE CACHUMA, AND LAKE GIBRALTAR, NORMAL SUPPLY FOR 1989, IS AVAILABLE. HOWEVER, LARGE REDUCTIONS CAN BE MADE IN 1990
M									

50%

9/ REDUCE DEMAND					10/ INCREASE SUPPLY				
RATION OR CONSERVE	EDUCATION	EFFICIENCY IN USE	CHANGE PLANTING OR AREA	OTHER	GROUND WATER	PURCHASE OR EXCHANGE	DEVELOP NEW WATER	OTHER	
M						P 2		X 3	
M		X		X 1					
M	X	W 2	C		D 3	P 4		X 5	
M		W		X 1	G		R 2	X 3	
M									

LEGEND

REDUCE DEMAND	INCREASE SUPPLY
M. MANDATORY RATIONING	D. DRILL AND/OR REHABILITATE WELLS
V. VOLUNTARY CONSERVATION	G. INCREASE PUMPING
L. LEAK OR SEEPAGE CORRECTION	P. PURCHASE ADDITIONAL WATER
W. WATER MANAGEMENT PRACTICES	E. EXCHANGE WITH OTHER AGENCYS
A. AREA PLANTED REDUCED	R. RECLAMATION OR REUSE
C. CHANGE TO LOWER WATER USE CROP	O. WATER QUALITY CONSIDERATIONS
X. SOME ACTION TAKEN OR PLANNED	X. SOME ACTION TAKEN OR PLANNED

SURVEY OF

COUNTY / AGENCY	NORMAL WATER SUPPLY	1988 WATER SUPPLY	NORMAL DEMAND	1988 COPING ACTIONS									
				REDUCE DEMAND					INCREASE SUPPLY				
1/	2/ SURFACE WATER / GROUND WATER / TOTAL (ACRE FEET)	3/ SURFACE WATER / GROUND WATER / TOTAL (ACRE FEET)	4/ POPULATION - POP; ACRES - AC; ACRE FEET - AF	5/ RATION OR CONSERVE	EDUCATION	EFFICIENCY IN USE	CHANGE PLANTING OR AREA	OTHER	6/ GROUND WATER	PURCHASE OR EXCHANGE	DEVELOP NEW WATER	OTHER
SANTA CLARA												
SANTA CLARA VALLEY W.D.	(a)312,000 108,000 420,000	(b)225,000 (c)162,000 387,000	1,400,000 POP N/A AC EST378,000 AF	V					G	P		
SANTA CLARA												
ALDERCROFT CO. W.D.	105 0 105	(a) 102 0 102	400 POP AC 105 AF	V	X					P 1		
SANTA CLARA												
CHEMIKETA WATER CO.	140 0 140	(a) 140 0 140	400 POP AC 140 AF		X 1				X 2			
SANTA CRUZ												
LOMPICO CO. W.D.	81 110 191	40 94 134	1,400 POP AC 81 AF	M					D			X 2
SANTA CRUZ												
SAN LORENZO VALLEY W.D.	804-1,043 890-1,135 1,694-2178	562 1,135 1,697	15-25,000 POP N/A AC 1,688 AF			L, W			G			
SANTA CRUZ												
SANTA CRUZ. CITY	10,161 1,234 11,395	7,875 1,197 9,072	75,000 POP AC 12,867 AF	V	X	W 1						
SHASTA												
CENTERVILLE C.S.D.	1,560 0 1,560	1,560 0 1,560	2,100+ POP N/A AC 1,560 AF									

WATER PURVEYORS

1989 COPING ACTIONS
IF DEFICIENCY EQUALS

25%

REDUCE DEMAND					INCREASE SUPPLY				
7/					8/				
RATION OR CONSERVE	EDUCATION	EFFICIENCY IN USE	CHANGE PLANTING OR AREA	OTHER	GROUND WATER	PURCHASE OR EXCHANGE	DEVELOP NEW WATER	OTHER
V	X				G 1	P		
M	X					P 1		
	X 1				X 2			
M 1					D			X 2
		L, W			G		X 1	X 2
M	X	W 1	C		D	P 2		X 3
M	X	W				P 1	X 2	X 3

50%

REDUCE DEMAND					INCREASE SUPPLY			
9/					10/			
RATION OR CONSERVE	EDUCATION	EFFICIENCY IN USE	CHANGE PLANTING OR AREA	OTHER	GROUND WATER	PURCHASE OR EXCHANGE	DEVELOP NEW WATER	OTHER
M	X				G 1	P		Q 2
M	X					P 1		
	X 1				X 2	P 3		
M				X 3	D	P		X 2
M		L, W			D		X 1	X 2
M	X	W 1	C		D	P 2		X 3
M	X	W				P	X 2	X 3

LEGEND

REDUCE DEMAND	INCREASE SUPPLY
M. MANDATORY RATIONING	D. DRILL AND/OR REHABILITATE WELLS
V. VOLUNTARY CONSERVATION	G. INCREASE PUMPING
L. LEAK OR SEEPAGE CORRECTION	P. PURCHASE ADDITIONAL WATER
W. WATER MANAGEMENT PRACTICES	E. EXCHANGE WITH OTHER AGENCYS
A. AREA PLANTED REDUCED	R. RECLAMATION OR REUSE
C. CHANGE TO LOWER WATER USE CROP	O. WATER QUALITY CONSIDERATIONS
X. SOME ACTION TAKEN OR PLANNED	X. SOME ACTION TAKEN OR PLANNED

11/ NOTES

- a. IF 1989 WERE A NORMAL YEAR.
- b. INCLUDES ADDITIONAL PURCHASE.
- c. OVERDRAFTING.
- 1. WILL PUMP TO MEET DEFICIENCY BUT NOT MORE THAN BASIN CAN SAFELY SUPPLY. WOULD LIKE MORE AUTHORITY TO CONTROL GW PUMPING BY SUBCONTRACTORS.
- 2. WATER FROM THE DELTA WILL BE POORER QUALITY.

- a. ONLY ABOUT 12 AF ARE SUPPLIED BY THE SIX SPRINGS. THE REST IS PURCHASED FROM SAN JOSE WATER CO.
- 1. WILL TRUCK WATER AT 4 CENTS/GAL.

- a. SINCE 6/28/88 EARTHQUAKE, SUPPLY OK.
- 1. WARNED RESIDENCES OF WATER SHORTAGE AND SUGGESTED THEY INSTALL CHEMICAL TOILETS.
- 2. NOT FEASIBLE TO PUMP GROUND WATER.
- 3. TRUCK WATER

- 1. ADOPTED STEEP PRICING SCHEDULE.
- 2. DWR COULD PROVIDE GRANTS, MONEY, WELL-DRILLING ASSISTANCE, CONSERVATION LITERATURE, WATER CONSERVATION KITS.
- 3. DISTRIBUTE WATER CONSERVATION KITS.

- 1. DISTRICT MAY CONSTRUCT A PIPELINE BETWEEN ITS NORTHERN AND SOUTHERN SECTIONS.
- 2. DWR COULD HELP IMPROVE RELATIONS BETWEEN LOCAL WATER AGENCIES.

- 1. RESTRICTED WATER USE AND MANY OTHER ACTIONS. DWR COULD PROVIDE GENERIC CONSERVATION MATERIAL FOR TV & RADIO.
- 2. POSSIBLE PURCHASE FROM SOQUEL CR. W.D. THROUGH EXISTING INTERTIE.
- 3. PETITION FOR REDUCTION OF FISH FLOWS BELOW SAN LORENZO DIVERSION. DWR COULD SUPPORT THIS ACTION.

- 1. CLEAR CREEK CSD MAY HAVE SURPLUS WATER. ALSO POSSIBLE INTERTIE WITH CITY OF REDDING.
- 2. INVESTIGATING OLD MINE SHAFT AS SOURCE.
- 3. DWR COULD PROVIDE FINANCIAL AID.

SURVEY OF

COUNTY / AGENCY	NORMAL WATER SUPPLY	1988 WATER SUPPLY	NORMAL DEMAND	1988 COPING ACTIONS								
				REDUCE DEMAND					INCREASE SUPPLY			
1/	2/ SURFACE WATER / GROUND WATER / TOTAL (ACRE FEET)	3/ SURFACE WATER / GROUND WATER / TOTAL (ACRE FEET)	4/ POPULATION - POP; ACRES - AC; ACRE FEET - AF	5/ RATION OR CONSERVE	EDUCATION	EFFICIENCY IN USE	CHANGE PLANTING OR AREA	OTHER	6/ GROUND WATER	PURCHASE OR EXCHANGE	DEVELOP NEW WATER	OTHER
SHASTA												
SHASTA CO. SERV AREA #6	100 0 100	100 0 100	500 POP AC 100 AF									
SHASTA												
SHASTA DAM AREA P.U.D.	1,927 0 1,927	1,927 0 1,927	10,500 POP AC 1,876 AF			L						
SISKIYOU												
HORNBROOK C.S.D.	62 7 69	37 14 51	350 POP AC 69 AF	M								
SISKIYOU												
MCCLOUD C.S.D.	(a) 1,120 0 1,120	(a) 1,120 0 1,120	1,160 POP AC 1,120 AF									
SONOMA												
CAMP MEEKER WATER CO.	56 50 106	41 20 61	600 POP N/A AC 74 AF	M		L, W		X 1	D	P 2	X 3	X 4
SONOMA												
JENNER WATER WORKS	(a)	(a)	(b) 300 POP AC AF	V		W						
STANISLAUS												
CITY OF CERES	0 5,350 5,350	0 5,400 5,400	18,631 POP AC 5,400 AF			W 1			D 2			

WATER PURVEYORS

1989 COPING ACTIONS

IF DEFICIENCY EQUALS

25%										50%									
REDUCE DEMAND					INCREASE SUPPLY					REDUCE DEMAND					INCREASE SUPPLY				
7/					8/					9/					10/				
RATION OR CONSERVE	EDUCATION	EFFICIENCY IN USE	CHANGE PLANTING OR AREA	OTHER	GROUND WATER	PURCHASE OR EXCHANGE	DEVELOP NEW WATER	OTHER		RATION OR CONSERVE	EDUCATION	EFFICIENCY IN USE	CHANGE PLANTING OR AREA	OTHER	GROUND WATER	PURCHASE OR EXCHANGE	DEVELOP NEW WATER	OTHER	11/ NOTES
		X 1					X 2	X 3				X 1					X 2	X 3	1. REDUCE AGRICULTURAL DELIVERIES FROM CVP TO AREAS WHICH HAVE AN ALTERNATIVE SOURCE. 2. EXTEND PUMPS DEEPER INTO SHASTA LAKE- WOULD NEED LOW INTEREST LOAN. 3. PRESENTLY USING RESERVES AND LIQUIDATING PROPERTY FOR IMPROVEMENTS. NEED LOAN INFORMATION.
	X	L				P	X 1	X 2			X	L				P	X 1	X 2	1. PUMP FROM BELOW SHASTA DAM. 2. DWR CAN ASSIST WITH EMERGENCY INTERTIE TO USBR AFTERBAY- WATER RIGHTS.
M				X 1	G, Q		X 2			M				X 1	G, Q		X 2		1. DWR PROVIDE CLASSES AND BROCHURES FOR COPING WITH DROUGHT. 2. MOVE DIVERSION UP STREAM TO ELEMINATE DEPLETION TO TERRACE DEPOSITS.
		L			D 1		X 2					L			D 1		X 2		o. SPRINGS 1. POSSIBLE GROUNDWATER POTENTIAL. 2. DWR COULD PROVIDE FINANCE ASSISTANCE TO IMPROVE SYSTEM AND PURCHASE PRESENT TRANSMISSTION LINES.
M		L, W		X 1	D	P 2	X 3	X 4		M		L, W		X 1	D	P 2	X 3	X 4	1. BUILDING MORATORIUM SINCE 1960. 2. WATER TRUCKED IN. 3. CONSIDERING A PIPELINE FROM THE RUSSIAN RIVER AND BUILDING A RESERVOIR. 4. PUC HAS NOT PERMITTED RATE INCREASE IN ORDER TO BREAK EVEN WITH EXPENSES.
M 1						P 2				M						P 2			o. NO METERS, SO COULD NOT ESTIMATE. b. BASED ON 100 CONNECTIONS. 1. RATIONING HAS BEEN USED IN THE PAST. 2. POSSIBLY TRUCK IN WATER FROM SPRINGS.
V		W 1			D 2					V		W 3			D 2				1. PROVIDE INFORMATION ON WATER CONSERVATION AND HOW MUCH WATER VARIOUS PLANTS NEED. 2. MUST LOWER EXISTING WELLS. NEED DWR'S HELP WITH LOANS AND GRANTS TO CONSTRUCT NEW WELLS. DEVELOP REGULATIONS ON GW PUMPING IN A DRY YEAR. 3. RESTRICT WATER USE FOR CONSTRUCTION.

LEGEND

REDUCE DEMAND	INCREASE SUPPLY
M. MANDATORY RATIONING V. VOLUNTARY CONSERVATION L. LEAK OR SEEPAGE CORRECTION W. WATER MANAGEMENT PRACTICES A. AREA PLANTED REDUCED C. CHANGE TO LOWER WATER USE CROP X. SOME ACTION TAKEN OR PLANNED	D. DRILL AND/OR REHABILITATE WELLS G. INCREASE PUMPING P. PURCHASE ADDITIONAL WATER E. EXCHANGE WITH OTHER AGENCYS R. RECLAMATION OR REUSE Q. WATER QUALITY CONSIDERATIONS X. SOME ACTION TAKEN OR PLANNED

SURVEY OF

COUNTY / AGENCY	NORMAL WATER SUPPLY	1988 WATER SUPPLY	NORMAL DEMAND	1988 COPING ACTIONS									
				REDUCE DEMAND					INCREASE SUPPLY				
1/	2/	3/	4/	5/					6/				
	SURFACE WATER GROUND WATER TOTAL (ACRE FEET)	SURFACE WATER GROUND WATER TOTAL (ACRE FEET)	POPULATION - POP ACRES - AC ACRE FEET - AF	RATION OR CONSERVE	EDUCATION	EFFICIENCY IN USE	CHANGE PLANTING OR AREA	OTHER	GROUND WATER	PURCHASE OR EXCHANGE	DEVELOP NEW WATER	OTHER
STANISLAUS MODESTO I.D.	250,000 0 250,000	180,000 33,000 213,000	POP 60,000 AC 250,000 AF						D	P I		
STANISLAUS OAKDALE I.D.	(a)297,900 19,400 (a)317,300	(b)234,000 18,000 252,000	1,000 POP 58,000 AC 253,000 AF	M	P	W I	A		G			
STANISLAUS OAK FLAT W.D.	6,100 0 6,100	5,400 0 5,400	POP 2,400 AC 6,100 AF			W	A I					
STANISLAUS ORESTIMBA W.D.	15,860 0 15,860	15,860 0 15,860	POP 5,600 AC 17,900 AF									
STANISLAUS PATTERSON W.D.	55,000 800 55,800	41,000 775 41,775	POP 13,500 AC 40,476 AF									
STANISLAUS TURLOCK CITY OF	0 15,500 15,500	0 14,500 14,500	42,000 POP AC 15-16,000 AF						D			

WATER PURVEYORS

1989 COPING ACTIONS

IF DEFICIENCY EQUALS

25%										50%									
REDUCE DEMAND					INCREASE SUPPLY					REDUCE DEMAND					INCREASE SUPPLY				
7/					8/					9/					10/				
RATION OR CONSERVE	EDUCATION	EFFICIENCY IN USE	CHANGE PLANTING OR AREA	OTHER	GROUND WATER	PURCHASE OR EXCHANGE	DEVELOP NEW WATER	OTHER		RATION OR CONSERVE	EDUCATION	EFFICIENCY IN USE	CHANGE PLANTING OR AREA	OTHER	GROUND WATER	PURCHASE OR EXCHANGE	DEVELOP NEW WATER	OTHER	11/ NOTES
		W 2			D	P				M		W 3	X 4		D	P			1. PURCHASED GW FROM FARMERS. 2. LIMIT OPPERATIONAL SPILLS. 3. POSSIBLY INSTALL SPILL RETURN SYSTEMK AT END OF DISTRICT. 4. MAY LOOK AT PAYING FARMERS NOT TO IRRIGATE.
M		W	C 2		X	P 3				M			C 2			P 3			a. INCLUDES 12,900 AF FROM RECLAIMED SURFACE DRAINAGE. b. INCLUDES 16,000 AF OF RECLAIMED SURFACE DRAINAGE PLUS 50,000 AF FROM USBR. 1. CUT FREQUENCY AND AMOUNT OF IRRIGATION DELIVERIES. 2. INFORM USERS OF CONDITIONS SO THEY COULD CHANGE CROPS. DISTRICT HAS NO AUTHORITY TO TO REQUIRE CROP CHANGES. 3. FROM USBR, BUT DISTRICT IS NOT WILLING TO COME UNDER FEDERAL ACREAGE LIMITATION.
M	X	W	A 2							M	X	W	A 3						1. SOME GROUND LEFT OUT OF PRODUCTION. 2. 60-70% OF OPEN GROUND TAKEN OUT OF PRODUCTION. 3. ALL OPEN GROUND TAKEN OUT OF PRODUCTION.
M	X		A 1		P 2	E 2				M	X		A 3		D 2	E 2			1. CROP CHANGES INVOLVE TAKING 60-70% OPEN LAND OUT OF PRODUCTION. 2. IN 1977 PRIVATE WELLS OF GOOD QUALITY ALLOWED TO PUMP INTO DELTA MENDOTA CANAL FOR TRANSPORT AND BANKING. 3. ALL OPEN GROUND TAKEN OUT OF PRODUCTION.
V		W			G 1					M		W	C		G				1. PRIVATE WELLS.
X 1		X			D					X 2					D				1. METER ALL SERVICES. 2. INCREASE METERED RATES.

LEGEND

REDUCE DEMAND	INCREASE SUPPLY
M. MANDATORY RATIONING V. VOLUNTARY CONSERVATION L. LEAK OR SEEPAGE CORRECTION W. WATER MANAGEMENT PRACTICES A. AREA PLANTED REDUCED C. CHANGE TO LOWER WATER USE CROP X. SOME ACTION TAKEN OR PLANNED	D. DRILL AND/OR REHABILITATE WELLS G. INCREASE PUMPING P. PURCHASE ADDITIONAL WATER E. EXCHANGE WITH OTHER AGENCYS R. RECLAMATION OR REUSE Q. WATER QUALITY CONSIDERATIONS X. SOME ACTION TAKEN OR PLANNED

SURVEY OF

COUNTY / AGENCY	NORMAL WATER SUPPLY	1988 WATER SUPPLY	NORMAL DEMAND	1988 COPING ACTIONS								
				REDUCE DEMAND					INCREASE SUPPLY			
1/	2/ SURFACE WATER / GROUND WATER / TOTAL (ACRE FEET)	3/ SURFACE WATER / GROUND WATER / TOTAL (ACRE FEET)	4/ POPULATION - POP; ACRES - AC; ACRE FEET - AF	5/ RATION OR CONSERVE	EDUCATION	EFFICIENCY IN USE	CHANGE PLANTING OR AREA	OTHER	6/ GROUND WATER	PURCHASE OR EXCHANGE	DEVELOP NEW WATER	OTHER
STANISLAUS												
TURLOCK I.D.	578,664 120,000 698,664	216,216 210,000 426,216	POP 160,000 AC 575,000 AF	M 1	X				G	P 2		
SUTTER												
SUTTER MUTUAL WATER CO.	267,900 0 267,900	(a)280,000 0 (a)280,000	POP 40,000 AC 267,900 AF									R 1
SUTTER												
S. SUTTER W.D.	110,000 0 110,000	35,000 75,000 110,000	POP 35,000 AC 110,000 AF				A 1		G			
TEHAMA												
PASKENTA C.S.D.	71 0 71	70 0 70	150-200 POP AC 71 AF									
TRINITY												
WEAVERVILLE COMM. S.D.	835 2 837	(a) (a) (a)	3,600 POP N/A AC 837 AF									

WATER PURVEYORS

1989 COPING ACTIONS
IF DEFICIENCY EQUALS

25%										50%									
REDUCE DEMAND					INCREASE SUPPLY					REDUCE DEMAND					INCREASE SUPPLY				
7/					8/					9/					10/				
RATION OR CONSERVE	EDUCATION	EFFICIENCY IN USE	CHANGE PLANTING OR AREA	OTHER	GROUND WATER	PURCHASE OR EXCHANGE	DEVELOP NEW WATER	OTHER		RATION OR CONSERVE	EDUCATION	EFFICIENCY IN USE	CHANGE PLANTING OR AREA	OTHER	GROUND WATER	PURCHASE OR EXCHANGE	DEVELOP NEW WATER	OTHER	
M	X	X	A 5		G 3, 4						X		A 5		G 3, 4				
			A, C 2	X 4						X 3		X 3	A, C	X 4					
					G		X 2								G				
X 1	X						X 2	X 3		X 1	X						X 2	X 3	
M 1	X 2	X								M 1	X 2	X							

LEGEND

REDUCE DEMAND

- M. MANDATORY RATIONING
- V. VOLUNTARY CONSERVATION
- L. LEAK OR SEEPAGE CORRECTION
- W. WATER MANAGEMENT PRACTICES
- A. AREA PLANTED REDUCED
- C. CHANGE TO LOWER WATER USE CROP
- X. SOME ACTION TAKEN OR PLANNED

INCREASE SUPPLY

- D. DRILL AND/OR REHABILITATE WELLS
- G. INCREASE PUMPING
- P. PURCHASE ADDITIONAL WATER
- E. EXCHANGE WITH OTHER AGENCYS
- R. RECLAMATION OR REUSE
- O. WATER QUALITY CONSIDERATIONS
- X. SOME ACTION TAKEN OR PLANNED

11/ NOTES

1. CHANGED NORMAL ALLOTMENT OF 48" TO 12" WITH FARMERS ABLE TO BUY ADDITIONAL WATER AT $10/AF.
2. SUPPLEMENTED DON PEDRO WATER WITH T.I.D. DRAINAGE PUMPS AND CONTRACTED WITH PRIVATE AND IMPROVEMENT DISTRICT PUMP OWNERS FOR WATER THEY COULD PUMP INTO THE SYSTEM.
3. GROUNDWATER WILL PROBABLY NOT MEET THE DEMAND IN 1989 BECAUSE OF LOWER WATER LEVELS.
4. GROUND WATER QUALITY IN SOME AREAS IS MARGINAL OR NOT ACCEPTABLE FOR ALL CROPS.
5. EXPECT SOME FARMERS TO REDUCE SECOND CROPPING OR CORN ACREAGE.

0. INCLUDES 80,000 AF OF DRAIN WATER.
1. INSTALLED BOOSTER SYSTEM TO REUSE 80,000 AF OF DRAIN WATER
2. WOULD SET UP A FIRM CROP PATTERN.
3. DEEP TROUBLE. WE DON'T KNOW WHAT WE WOULD DO.
4. DWR DROUGHT GUIDEBOOK IS HELPFUL TO CONSERVE WATER.

1. 15-20% REDUCTION IN RICE PLANTINGS.
2. STATE COULD EXTEND DAVIS-GRUNSKY LOANS FOR ANOTHER TWO YEARS.

1. COULD CUT LARGEST WATER USER (CRANE MILL) IN EMERGENCY.
2. ADD MORE PIPE IN THOMES CREEK BED.
3. DWR CAN PROVIDE CONSERVATION INFORMATION GEOLOGIC ADVICE. FINANCIAL AID.

0. 1988 SUPPLY BELOW NORMAL. AMOUNT UNKNOWN.
1. RATIONING IS POSSIBLE.
2. DWR COULD PROVIDE WATER CONSERVATION INFORMATION.

SURVEY OF

COUNTY / AGENCY	NORMAL WATER SUPPLY	1988 WATER SUPPLY	NORMAL DEMAND	1988 COPING ACTIONS								
				REDUCE DEMAND					INCREASE SUPPLY			
1/	2/	3/	4/	5/					6/			
	SURFACE WATER GROUND WATER TOTAL (ACRE FEET)	SURFACE WATER GROUND WATER TOTAL (ACRE FEET)	POPULATION - POP ACRES - AC ACRE FEET - AF	RATION OR CONSERVE	EDUCATION	EFFICIENCY IN USE	CHANGE PLANTING OR AREA	OTHER	GROUND WATER	PURCHASE OR EXCHANGE	DEVELOP NEW WATER	OTHER
TULARE LOWER TULE RIVER I.D.	301,858 35,000 336,858	52,900 230,000 282,900	POP 79,000 AC 272,000 AF		X	X			G			
TULARE LINDSAY-STRATHMORE I.D.	32,500 2,000 34,500	26,450 2,000 28,450	4,500 POP (a) 14,000 AC 28,200 AF	M						E I		
TULARE TERRA BELLA I.D.	29,000 2,500 31,500	22,620 1,000 23,620	3,200 POP 11,000 AC 27,000 AF			W I						

WATER PURVEYORS

1989 COPING ACTIONS
IF DEFICIENCY EQUALS

25%										50%									
REDUCE DEMAND					INCREASE SUPPLY					REDUCE DEMAND					INCREASE SUPPLY				
7/					8/					9/					10/				
RATION OR CONSERVE	EDUCATION	EFFICIENCY IN USE	CHANGE PLANTING OR AREA	OTHER	GROUND WATER	PURCHASE OR EXCHANGE	DEVELOP NEW WATER	OTHER		RATION OR CONSERVE	EDUCATION	EFFICIENCY IN USE	CHANGE PLANTING OR AREA	OTHER	GROUND WATER	PURCHASE OR EXCHANGE	DEVELOP NEW WATER	OTHER	
V 1					G 2	P 3	X 4			M 5		W 6			G 2	P 3	X 4		
M					X 2	E 1		X 3		M					X 2	E 1			
M	X	W 2	C 3	X 6	G	P 4				M	X 5		C 3		G	P 4			

LEGEND

REDUCE DEMAND	INCREASE SUPPLY
M. MANDATORY RATIONING V. VOLUNTARY CONSERVATION L. LEAK OR SEEPAGE CORRECTION W. WATER MANAGEMENT PRACTICES A. AREA PLANTED REDUCED C. CHANGE TO LOWER WATER USE CROP X. SOME ACTION TAKEN OR PLANNED	D. DRILL AND/OR REHABILITATE WELLS G. INCREASE PUMPING P. PURCHASE ADDITIONAL WATER E. EXCHANGE WITH OTHER AGENCYS R. RECLAMATION OR REUSE Q. WATER QUALITY CONSIDERATIONS X. SOME ACTION TAKEN OR PLANNED

11/ NOTES

1. NO CHANGE FROM NORMAL OPERATION. POSSIBLY USE PRICING TO ENCOURAGE GW PUMPING.
2. ALL GROWERS WILL BE REQUIRED TO PUMP GW.
3. WILL PURCHASE WATER FROM OTHER CVP CONTRACTORS IF AVAILABLE.
4. INTERCONNECT FRIANT-KERN CANAL WITH CROSS VALLEY CANAL AND PUMP WATER. UPSTREAM. DWR COULD ASSIST IN GETTING POINT OF DIVERSION & WATER USE CHANGES SO THAT BETTER USE OF GROUND & SURFACE WATER COULD BE MADE THROUGH EXCHANGES.
5. OFF/ON SCHEDULING. PRICE INCREASES. VOLUME ALLOCATION IN RELATION TO CANAL CAPACITY.
6. ALL GROWERS ENCOURAGED TO USE TAILWATER RETURN SYSTEMS. ON/OFF OPERATION REDUCES WATER LOSSES.

0. NEARLY ENTIRE DISTRICT IS PLANTED TO PERMANENT CROPS.
1. CONTRACTED WITH OTHER DISTRICTS FOR WATER THIS YEAR, FOR RETURN WATER NEXT YEAR.
2. GW PRACTICALLY NON-EXISTENT AND SUCH POOR QUALITY IT CANNOT SUPPORT CITRUS.
3. LSID IS A FEDERAL CONTRACTOR, THEREFORE MAY NOT BE ELIGIBLE FOR DWR ASSISTANCE.

1. SYSTEM IS ALL PIPED-LOSSES LESS THAN 2%.
2. ADD MONITORS TO STOP ANY OVER IRRIGATION.
3. ALL PERMANENT CROPS, CHANGES IN CROPS NOT FEASIBLE.
4. WILL SEEK TO PURCHASE GW FROM THOSE WITH GW OR FROM OTHER DISTRICTS. DWR COULD HELP LOCATE AND TRANSPORT WATER.
5. WILL IMPLEMENT A TREE MAINTENANCE PROGRAM THAT WILL ALLOW TREE SURVIVAL BUT LOSS OF CROPS.
6. DWR COULD ASSIST: IN LOCATING AND TRANSPORTING EXTRA WATER; SOLVING WATER PROBLEMS LIKE MORE STORAGE; EXPAND WATER SUPPLY FORECASTS; CONTINUE CONTACTS WITH LOCAL DISTRICTS, IT SHOWS AN AWARENESS AND ALLOWS LOCAL INPUT.

SURVEY OF

COUNTY / AGENCY	NORMAL WATER SUPPLY	1988 WATER SUPPLY	NORMAL DEMAND	1988 COPING ACTIONS								
				REDUCE DEMAND					INCREASE SUPPLY			
1/	2/	3/	4/	5/					6/			
	SURFACE WATER GROUND WATER TOTAL (ACRE FEET)	SURFACE WATER GROUND WATER TOTAL (ACRE FEET)	POPULATION : POP ACRES - AC ACRE FEET - AF	RATION OR CONSERVE	EDUCATION	EFFICIENCY IN USE	CHANGE PLANTING OR AREA	OTHER	GROUND WATER	PURCHASE OR EXCHANGE	DEVELOP NEW WATER	OTHER
TULARE DELANO-EARLIMART I.D.	182,500 10,000 192,500	81,000 65,000 146,000	POP 50,000 AC 146,000 AF							E 1		
TULARE PORTERVILLE I.D.	43,000 (a) 43,000	16,000 (a) 16,000	POP 14,800 AC AF	X 1					G 2			
TULARE/KINGS TULARE LAKE BASIN W.S.D.	206,700 42,000 248,700	(a)118,500 175,000 (a)293,500	POP 170,000 AC 391,000 AF									
TUOLUMNE TUOLUMNE CO. WATER SYSTEM	19,000 N/A 19,000	19,000 N/A 19,000	9,000 POP AC 19,000 AF	M 1	X		C 2			P 3		

WATER PURVEYORS

1989 COPING ACTIONS
IF DEFICIENCY EQUALS

25%									50%								
REDUCE DEMAND					INCREASE SUPPLY				REDUCE DEMAND					INCREASE SUPPLY			
7/					8/				9/					10/			
RATION OR CONSERVE	EDUCATION	EFFICIENCY IN USE	CHANGE PLANTING OR AREA	OTHER	GROUND WATER	PURCHASE OR EXCHANGE	DEVELOP NEW WATER	OTHER	RATION OR CONSERVE	EDUCATION	EFFICIENCY IN USE	CHANGE PLANTING OR AREA	OTHER	GROUND WATER	PURCHASE OR EXCHANGE	DEVELOP NEW WATER	OTHER
M	X				G 2	E 1		X 3	M	X				G 2	P 4		
X 3					G 2				X 3					G 2			
			A 1					X 2				A 1					
M	X		C 4			P 5	X 6		M	X		C 4			P 5	X 6	

LEGEND

REDUCE DEMAND	INCREASE SUPPLY
M. MANDATORY RATIONING	D. DRILL AND/OR REHABILITATE WELLS
V. VOLUNTARY CONSERVATION	G. INCREASE PUMPING
L. LEAK OR SEEPAGE CORRECTION	P. PURCHASE ADDITIONAL WATER
W. WATER MANAGEMENT PRACTICES	E. EXCHANGE WITH OTHER AGENCYS
A. AREA PLANTED REDUCED	R. RECLAMATION OR REUSE
C. CHANGE TO LOWER WATER USE CROP	Q. WATER QUALITY CONSIDERATIONS
X. SOME ACTION TAKEN OR PLANNED	X. SOME ACTION TAKEN OR PLANNED

NOTES

11/

1. EXCHANGE AGREEMENT FOR CROSS VALLEY CANAL PROVIDES 8,000 AF.
2. INDIVIDUAL FARMERS WILL INCREASE PUMPING.
3. LOOK FOR RELIEF FROM RESTRICTIVE REGULATION ON WATER EXPORT FROM THE DELTA. DWR COULD: LOWER SOME OF ITS CHARGES FOR TRANSPORTING WATER THROUGH THE STATE SYSTEM, SPEED UP THE PROCESS OF MAKING MORE WATER AVAILABLE, ASSIST SWRCB ON RELAXATION OF DELTA REGULATIONS, LOOK VERY CLOSE AT ITS COST STRUCTURE AND REDUCE COST TO THE USER AS MUCH AS POSSIBLE.
4. WOULD ATTEMPT TO PURCHASE FROM OTHER AGENCIES WITH GOOD GW SUPPLY.

a. UNKNOWN AMOUNT OF GW WAS PUMPED BY INDIVIDUALS.

1. ALTERNATING ON/OFF SCHEDULE.
2. INDIVIDUAL FARMERS WOULD RELY ON GW. GW TABLE IS VERY HIGH.
3. PRORATE OR PRICE INCREASE.

a. AN ADDITIONAL UNKNOWN AMOUNT WAS FROM 1986 CARRY OVER.

1. LANDS WILL BE TAKEN OUT OF PRODUCTION.
2. DWR CAN ASSIST (1) BY EXTENDING PAYMENT FOR CAPITAL AND MINIMUM CHARGES ON SWP WATER-5 YEARS FOR EXAMPLE AND (2) WITH PERMANENT PROVISIONS TO CARRY OVER SWP TABLE A WATER TO JANUARY & FEBRUARY IN THE FOLLOWING YEARS.

1. MANDATORY RATIONING UNTIL MAY, THEN LATE RAINS CAUSED ONLY VOLUNTARY CONSERVATION WITH A GOAL OF 25% SAVINGS.
2. VOLUNTARY CROP CHANGES.
3. PURCHASED NEW MELONES WATER AT CONSIDERABLE ADDITIONAL COST.
4. MANDATORY CROP CHANGES.
5. PURCHASING ADDITIIONAL WATER WILL FURTHER INCREASE PUMPING COSTS.
6. DESIRE FINANCIAL ASSISTANCE TO MEET COSTS OF ADDITIONAL PUMPING.

SURVEY OF

COUNTY / AGENCY	NORMAL WATER SUPPLY	1988 WATER SUPPLY	NORMAL DEMAND	1988 COPING ACTIONS									
				REDUCE DEMAND					INCREASE SUPPLY				
1/	2/ SURFACE WATER / GROUND WATER / TOTAL (ACRE FEET)	3/ SURFACE WATER / GROUND WATER / TOTAL (ACRE FEET)	4/ POPULATION - POP; ACRES - AC; ACRE FEET - AF	5/ RATION OR CONSERVE	EDUCATION	EFFICIENCY IN USE	CHANGE PLANTING OR AREA	OTHER	6/ GROUND WATER	PURCHASE OR EXCHANGE	DEVELOP NEW WATER	OTHER
VENTURA CASITAS MUN. W.D.	(a) 20,350 0 (a) 20,350	20,350 0 20,350	55,000 POP AC 19,100 AF	V	X	W						
VENTURA CITY OF VENTURA	15,000 8,000 23,000	15,000 8,000 23,000	92,000 POP AC 23,000 AF		X	X 1		X 2	X 3			
VENTURA UNITED WATER CONS. DIST.	12,000 20,000 32,000	8,700 15,700 24,400	150,000 POP 16,000 AC 32,000 AF	V	X	X 1			G		X 2	
YOLO YOLO CO. FLOOD CONTROL & W.C.D.	180,000 175,000 355,000	178,000 200,000 378,000	10,000 POP UNKNOWN AC (a) 430,000 AF		X	W 1		X 2				

WATER PURVEYORS

1989 COPING ACTIONS
IF DEFICIENCY EQUALS

25%

REDUCE DEMAND					INCREASE SUPPLY				
7/					8/				
RATION OR CONSERVE	EDUCATION	EFFICIENCY IN USE	CHANGE PLANTING OR AREA	OTHER	GROUND WATER	PURCHASE OR EXCHANGE	DEVELOP NEW WATER	OTHER
V 1	X	W			G 2			
M	X				G 4			
V	X	X 1			G		X 3	
M 3	X				G 4			

50%

REDUCE DEMAND					INCREASE SUPPLY				
9/					10/				
RATION OR CONSERVE	EDUCATION	EFFICIENCY IN USE	CHANGE PLANTING OR AREA	OTHER	GROUND WATER	PURCHASE OR EXCHANGE	DEVELOP NEW WATER	OTHER
V 1	X	W			G 2			
M	X				G 4			
V	X	X 1			G		X 3	
M 3	X				G 4	P 5	X 6	

LEGEND

REDUCE DEMAND	INCREASE SUPPLY
M. MANDATORY RATIONING	D. DRILL AND/OR REHABILITATE WELLS
V. VOLUNTARY CONSERVATION	G. INCREASE PUMPING
L. LEAK OR SEEPAGE CORRECTION	P. PURCHASE ADDITIONAL WATER
W. WATER MANAGEMENT PRACTICES	E. EXCHANGE WITH OTHER AGENCYS
A. AREA PLANTED REDUCED	R. RECLAMATION OR REUSE
C. CHANGE TO LOWER WATER USE CROP	O. WATER QUALITY CONSIDERATIONS
X. SOME ACTION TAKEN OR PLANNED	X. SOME ACTION TAKEN OR PLANNED

11/ NOTES

- NORMAL WATER SUPPLY OF 20,350 AF IS SAFE ANNUAL YIELD FROM LAKE CASITAS WHICH HAS A TOTAL STORAGE CAPACITY OF 254,000 AF AND IT IS ESTIMATED THAT STORAGE ON DECEMBER 31, 1988, WILL BE 190,000 AF. BECAUSE OF THIS STORAGE, NO DEFICIENCY IS ANTICIPATED FOR 1989.
1. WILL CONTINUE WITH MAJOR CONSERVATION EFFORT.
2. WILL ENCOURAGE INCREASED PUMPING FROM OJAI GW BASIN BY THOSE WHO RECEIVE LAKE CASITAS WATER AS A SUPPLEMENTAL SUPPLY, AND WORK TOWARD CONJUNCTIVE USE OF LAKE CASITAS AND GW SUPPLIES.

1. WATER CONSERVATION PROGRAM HAS BEEN IN EFFECT SINCE 1975.
2. A WASTE WATER ORDINANCE IS CURRENTLY BEING DEVELOPED.
3. NEW GW SOURCE NOW BEING DEVELOPED.
4. AN INCREASED USE OF GW MAY BE REQUIRED DURING DROUGHT PERIODS.

1. SUPPORT OF MOBILE IRRIGATION LAB TO INCREASE IRRIGATION EFFICIENCY.
2. PUMPING THROUGH PIPELINE TO INCREASE DELIVERY OF SURFACE WATER TO IRRIGATION.
3. VERN FREEMAN DIVERSION UNDER CONSTRUCTION TO INCREASE DIVERSION OF SURFACE WATER.

- INCLUDES WATER OBTAINED FROM RAINFALL AND SOIL MOISTURE.
1. IMPROVED DISTRIBUTION SYSTEM TO REDUCE CONVEYANCE LOSSES. ARRANGED TO COLLECT RETURN FLOWS AND REDISTRIBUTE TO OTHER USERS.
2. NO LATE APPLICATIONS FOR WATER ACCEPTED UNLESS OFFSET WATER SUPPLY MADE AVAILABLE.
3. WILL ALLOCATE AVAILABLE SURFACE WATER.
4. MOST GROWERS WILL BE ABLE TO AUGMENT SURFACE SUPPLIES IN 1989 BY INCREASED PUMPING.
5. WOULD LIKE TO PURCHASE WATER FROM OTHER AGENCIES BUT LACK NEEDED INTERCONNECTIONS.
6. DISTRICT SEEKING ADDITIONAL WATER SUPPLIES ON A LONG-TERM BASIS.

Appendix C

STATE/FEDERAL INTERAGENCY DROUGHT TASK FORCE

State Agencies

Department of Water Resources
Suzanne G. Butterfield (916) 323-0859
Chairman, Interagency Drought Task Force
1416 - 9th Street, 16th floor
Sacramento CA 95814

Jack Eaton (916) 445-1295
State Water Project
1416 - 9th Street, 6th floor
Sacramento CA 95814

Department of Boating and Waterways
Jack Williams (916) 322-1810
1629 S Street
Sacramento CA 95814-7291

Department of Fish and Game
John Turner (916) 322-4922
1416 - 9th Street, 12th floor
Sacramento CA 95814

Department of Food and Agriculture
Emil Loe (916) 445-5141
1229 N Street
Sacramento CA 95814

Department of Forestry and Fire Protection
Gary Brittner (916) 445-9445
1416 - 9th Street, 15th floor
Sacramento CA 95814

Office of Emergency Services
John Passerello (916) 427-4201
2800 Meadowview Road
Sacramento CA 95814

Department of Health Services
Public Water Supply Branch
Nadine Feletto (916) 323-6111
714 P Street, Room 692
Sacramento CA 95814

State Water Resources Control Board
Murt Lininger (916) 324-5703
901 P Street
Sacramento CA 95814

Public Utilities Commission
Jim McVicar (415) 557-2234
505 Van Ness Avenue
San Francisco CA 94102-3298

Department of Transportation
Office of Landscape Architecture
Lewis B. Koe (916) 445-8868
1120 N Street
Sacramento CA 95814

Office of Highway Maintenance
Phillip Olivares (916) 445-3579
1120 N Street
Sacramento CA 95814

Department of Parks and Recreation
Ronald D. Rawlings (916) 324-8399
1416 - 9th Street, 14th floor
Sacramento CA 95814

Federal Agencies

Small Business Administration
William Leggiero (916) 978-4578
Disaster Assistance, Area 4
1825 Bell Street
Sacramento CA 95825

Farmers Home Administration
Darrel Zerger (916) 666-3382
194 West Main Street, Suite F
Woodland CA 95695

National Weather Service
R. Larry Ferral (916) 442-1201
1416 - 9th Street, 16th floor
Sacramento CA 95814

U.S. Army Corps of Engineers
Mark Verke (916) 551-2539
650 Capitol Mall
Sacramento CA 95814-4794

U.S. Bureau of Land Management
Mark Blakeslee (916) 978-4725
2800 Cottage Way
Sacramento CA 95825

U.S. Bureau of Reclamation
Donald L. Paff (916) 978-5221
2800 Cottage Way
Sacramento CA 95825

U.S. Forest Service
Andrew Leven (415) 556-1564
630 Sansome Street
San Francisco CA 94111

Federal Emergency Management Agency
Tommie Hamner (415) 923-7250
Region 9, Disaster Assistance Program Div.
Building 105, Presidio
San Francisco CA 94129

Agricultural Stabilization and Conservation Service
Kenneth Frick (916) 551-801
1303 J Street, Suite 300
Sacramento CA 95814

Appendix D

PLANNING FOR WELL DRILLING OR REHABILITATION

The State of California has established standards for the construction, major reconstruction, and destruction of water wells throughout the State. These standards are published in DWR Bulletin 74-81, copies of which are available at no charge from the Department of Water Resources at P.O. Box 942836, Sacramento CA 94236-0001. In addition, many cities and most counties have ordinances based on these standards.

The following check lists were prepared by the California Groundwater Association. They are intended to assist farmers and others in planning new well construction and rehabilitating existing wells. Additional information about the association can be obtained from Ron Foster, Executive Director, at (707) 578-4408.

PLANNING TO DRILL A NEW WELL

This check list is designed to assist in the planning for construction of a new well. It is basic and does not address all details in the preparation and construction of a new well. In all cases, it is important to hire an experienced, well-qualified drilling contractor. In the State of California, a C–57 license is required to drill water wells and install pumping systems. A C–61 license is required for work on well pumping systems.

I. CALCULATE YOUR WATER NEEDS. The well drilling contractor needs to be aware of all the water needs, present and future. The contractor can help calculate immediate and long–term water needs.

II. PICK A DRILLING SITE. Pick an appropriate site with adequate working area for construction and future servicing. Remember that overhead power lines require a safe distance for the operation of drilling equipment. It is important to locate all septic tanks and sewage lines and all other underground obstructions before picking the exact site and to obtain standards from the county health department. Bulletin 74–81 (*Water Well Standards: State of California*, Department of Water Resources) requires water wells to be 100 feet from septic tanks and leach lines. The health department can identify variations in this regulation.

III. DRILLING WATER AVAILABILITY. The contractor will need water to drill. He can specify quantities needed.

IV. HANDLING SURPLUS. It is illegal to discharge into most rivers or creeks, except when approval has been granted. Water or other material must be transported or pumped off some sites. In all cases, site clean-up is required, and there will be a need to dispose of some water and material after the well is drilled. Planning will save time and money.

V. PERMIT TO DRILL A WELL. Obtaining well permits is complicated in some areas. It may be appropriate and time-saving for the owner to get the permit, rather than to make it the obligation of the contractor.

VI. SURFACE SEALS. It is recommended that standards from DWR Bulletin 74–81 be used to ensure a proper well seal. Most counties require these minimum standards.

VII. WELL CONSTRUCTION AND COMPLETION. The California Ground Water Association recommends that the owner:

A. Use properly licensed drilling or pump contractors.

B. Obtain a contractor who is experienced in the type of well to be drilled.

C. Discuss future well maintenance with your driller. Some wells run for years without a problem, but intelligent maintenance decisions require periodic inspections and record-keeping by the owner/operator. These checks include pumping rate (gallons per minute) and, where possible, static water level and pumping water level. If only the pumping rate (gpm) is recorded and proper comparison noted, there could be advance notice of possible well problems. This can be done by the well owner/operator or the contractor.

D. Water quality should be checked often if the well water is to be used for drinking. If contamination is suspected nearby, monthly or more frequent checks should be planned. This can be discussed with the contractor. Even if the well is not used to supply drinking water, quality plays an important part in the life of the well.

VIII. IMPROPER WELL OPERATION. Most wells cycle on and off by means of automatic devices. Maintenance program checks should be made to ensure that all these systems are operating properly. Damage could result if they are left to run without proper and normal care.

SUMMARY

These are basic comments. Planning a new well includes more than can be included in this list. Plan to hire and work with a licensed drilling or pump contractor.

(The California Groundwater Association does not assume any responsibility for any well construction undertaken using this check list.)

REHABILITATION OF WATER WELLS

This check list is intended for anyone considering rehabilitation of a water well. It is designed to assist in maintaining and rehabilitating existing wells. It provides basic information needed to know where to begin and how to proceed. In all cases, the recommended procedure is to hire a properly licensed well drilling or pump contractor. A well driller requires a C-57 license, and a pump contractor requires a C-61 license.

I. EVALUATION OF LARGE-DIAMETER WELLS. No set rules exist for determining when a well or pump will require rehabilitation work. It may be necessary every six months or many years in the future. If records have been kept on a well, they may provide a head start. Accurate records can help to determine if and when a well needs rehabilitation. Periodic evaluation is recommended, even if a well does not appear to have a problem.

For a simple assessment of well problems, the drilling or pump contractor will evaluate the physical condition of the pump, pump motor, and power supply. The contractor may then suggest a

well and pump performance test. Many power companies do this at little or no cost, or a licensed contractor can perform this task.

Larger well installations require a more detailed well inspection. Sometimes a downhole camera inspection indicates well problems that might otherwise take longer to locate. A well owner should check with a contractor for help in determining how best to proceed with rehabilitation. It is important to remember that some well and pump problems are unique to the area in which the well is located, and they are best handled by a contractor in that area or one who has had experience in the area.

II. EVALUATION OF SMALL DOMESTIC WELLS. For domestic and other small-yield wells, it is impractical to try to thoroughly diagnose the problem in a given well before undertaking maintenance. Records of any type are often incomplete, and the cost of evaluation may quickly exceed the homeowner's budget. On the other hand, maintenance is not usually complex and even modest improvements will often last for years.

The California Groundwater Association will assist in locating a licensed contractor. (The association does not assume any responsibility for any well maintenance undertaken with this list.)