State of California The Resources Agency

Memorandum

Date : September 23,1988

To : Ed Huntley

Bob Zettlemoyer

From : **Department of Water Resources**

Subject: Memorandum Report - Additional Information for Bulletin 160-87

This report was prepared to provide greater detail than Bulletin 160-87 on population, land use, water use, water supply; and water management issues. These items are summarized in convenient tables and short discussions of issues and actions.

Details provided in this report which are not contained in Bulletin 160-87 nor the Statistical Appendix are as follows: population data by planning subareas (PSA) and county; 1985 crop acreages by PSA; net water use and supplies by PSA; and a description of additional water issues in each District that were not included in Bulletin 160-87.

This report should be considered as a model for more frequent updates of California land use, water use, and water supplies. With current computer capability in the epartment it should be possible to update this data on an annual basis.

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PART IV ADDITIONAL WATER MANAGEMENT ISSUES (CONTINUED)

PART I

POPULATION

POPULATION BY COUNTY

	APR 1960	APR 1970	APR 1980	JAN 1985	JUL 2000	JUL 2010
Alameda	908,209	1,071,446	1,105,379	1,186,400	1,361,200	1,427,300
Alpine	397	484	1,097	1,070	1,600	2,100
Amador	9,990	11,821	19,314	22,850	36,800	43,800
Butte	82,030	101,969	143,851	161,500	221,900	258,700
Calaveras	10,289	13,585	20,710	26,250	42,800	52,500
Colusa	12,075	12,430	12,791	14,450	19,400	21,100
Contra Costa	409,030	556,116	656,380	711,100	870,600	950,200
Del Norte	17,771	14,580	18,217	18,600	20,800	21,200
El Dorado	29,390	43,833	85,812	102,100	158,500	193,900
Fresno	365,945	413,329	514,229	571,600	734,000	843,700
Glenn	17,245	17,521	21,350	22,950	28,000	30,100
Humboldt	104,892	99,692	108,514	112,400	120,000	120,200
Imperial	72,105	74,492	92,110	104,500	143,000	164,400
Inyo	11,684	15,571	17,895	18,350	18,800	19,000
Kern	291,984	330,234	403,089	472,500	662,600	766,000
Kings	49,954	66,717	73,738	83,800	116,200	128,700
Lake	13,786	19,548	36,366	47,050	80,900	101,000
Lassen	13,597	16,796	21,661	24,350	29,500	32,800
Los Angeles	6,038,771	7,041,980	7,477,503	8,030,800	9,132,600	9,621,700
Madera	40,468	41,519	63,116	75,100	115,500	140,500
Marin	146,820	208,652	222,592	225,700	236,500	235,700
Mariposa	5,064	6,015	11,108	13,050	20,300	24,700
Mendocino	51,059	51,101	66,738	73,000	92,200	103,400
Merced	90,446	104,629	134,558	157,800	238,200	287,900
Modoc	8,308	7,469	8,610	9,600	11,700	13,400
Mono	2,213	4,016	8,577	9,250	10,600	11,700
Monterey	198,351	247,450	290,444	325,300	424,300	471,400
Napa	65,890	79,140	99,199	103,400	123,200	134,900
Nevada	20,911	26,346	51,645	66,700	113,800	141,000
Orange	703,925	1,421,233	1,932,709	2,110,200	2,599,200	2,833,800
Placer	56,998	77,632	117,247	136,300	203,700	245,800
Plumas	11,620	11,707	17,340	18,900	23,800	25,900
Riverside	306,191	456,916	663,199	801,100	1,350,000	1,646,300
Sacramento	502,778	634,373	783,381	883,500	1,184,000	1,351,200
San Benito	15,396	18,226	25,005	29,800	48,700	57,200
San Bernadino	503,591	682,233	895,016	1,063,100	1,661,000	1,978,900
San Diego	1,033,011	1,357,854	1,861,846	2,102,000	2,852,500	3,254,300
San Francisco	740,316	715,674	678,974	724,700	763,800	721,600
San Joaquin	249,989	291,073	347,342	408,000	612,000	723,800
San Luis Obispo	81,044	105,690	155,435	184,500	302,200	362,900
San Mateo	444,387	557,361	587,329	613,500	656,900	659,700
Santa Barbara	168,962	264,324	298,694	329,500	407,400	435,700
Santa Clara	642,315	1,065,313	1,295,071	1,391,000	1,640,000	1,761,200
Santa Cruz	84,219	123,790	188,141	210,500	286,100	329,800
Shasta	59,468	77,640	115,715	129,500	179,699	204,000
Sierra	2,247	2,365	3,073	3,430	4,100	4,500
Siskiyou	32,885	33,225	39,732	42,500	47,100	49,200
Solano	134,597	171,989	235,203	271,100	391,400	457,900
Sonoma	147,375	304,885	299,681	331,700	429,100	481,300
Stanislaus	157,294	194,506	265,900	300,900	418,200	491,200
Sutter	33,380	41,935	52,246	57,800	72,000	79,100
Tehama	25,305	29,517	38,888	43,750	59,600	68,300
Trinity	9,706	7,615	11,858	13,500	16,900	19,100
Tulare	168,403	188,322	245,738	277,000	393,400	470,300
Tuolumne	14,404	22,169	33,928	39,600	64,600	75,200
Ventura	199,138	378,497	529,174	594,400	784,500	891,000
Yolo	65,727	91,788	113,374	122,400	152,200	168,100
Yuba	33,859	44,736	49,733	53,500	63,200	66,600
STATE TOTAL	**15,717,204**	**19,971,069**	**23,667,565**	**26,079,000**	**32,853,000**	**36,277,000**

NORTH COAST HSA
1985 Irrigated Lands in Thousand Acres

	Upper Klamath	Lower Klamath	Coastal	Russian River	Total
Grain	80.4	0.1	0.8	0.2	81.5
Corn	0.6	0.1	0.3	0.0	1.0
Other Field	0.9	0.1	0.2	0.3	1.5
Alfalfa	50.5	0.6	0.6	0.4	52.1
Pasture	79.7	9.8	24.6	10.0	124.1
Other Truck	16.2	0.7	1.2	0.3	18.4
Other Deciduous	0.0	0.0	0.7	7.9	8.6
Grapes	0.0	0.0	0.7	29.4	30.1
Total Crop Acreage	228.3	11.4	29.1	48.5	317.3
Double Crop	0.0	0.0	0.0	0.0	0.0
Total Land Area	228.3	11.4	29.1	48.5	317.3

SAN FRANCISCO BAY HSA
1985 Irrigated Lands in Thousand Acres

	North Bay	South Bay	Total
Grain	6.8	3.6	10.4
Corn	0.5	1.2	1.7
Other Field	1.0	0.0	1.0
Alfalfa	0.0	0.4	0.4
Pasture	4.1	0.7	4.8
Tomatoes	0.1	0.0	0.1
Other Truck	0.7	8.4	9.1
Other Deciduous	5.5	3.6	9.1
Grapes	24.2	2.0	26.2
Total Crop Acreage	42.9	19.9	62.8
Double Crop	0.1	1.2	1.3
Total Land Area	42.8	18.7	61.5

CENTRAL COAST HSA
1985 Irrigated Lands in Thousand Acres

	Northern	Southern	Total
Grain	15.1	2.5	17.6
Sugar Beets	10.5	1.9	12.4
Corn	3.4	0.8	4.2
Other Field	22.4	14.8	37.2
Alfalfa	18.2	22.7	40.9
Pasture	12.3	13.5	25.8
Tomatoes	18.2	2.1	20.3
Other Truck	202.1	89.4	291.5
Other Deciduous	27.3	2.3	29.6
Citrus-Olive	0.2	16.1	16.3
Grapes	39.1	17.2	56.3
Total Crop Acreage	368.8	183.3	552.1
Double Crop	68.3	37.7	106.0
Total Land Area	300.5	145.6	446.1

SOUTH COAST HSA
1985 Irrigated Lands in Thousand Acres

	Metro LA	Santa Clara	Santa Ana	San Diego	Total
Grain	1.3	2.0	12.0	3.4	18.7
Sugar Beets	0.0	0.1	0.0	0.0	0.1
Corn	0.0	1.2	4.3	0.8	6.3
Other Field	0.2	1.8	6.4	0.5	8.9
Alfalfa	0.0	0.6	10.3	0.1	11.0
Pasture	0.6	2.5	14.0	2.6	19.7
Tomatoes	0.0	4.8	0.8	2.4	8.0
Other Truck	5.0	57.1	26.2	13.2	101.5
Other Deciduous	0.0	1.0	1.4	0.7	3.1
Citrus-Olive	2.8	51.0	43.2	61.7	158.7
Grapes	0.0	0.0	8.4	3.1	11.5
Total Crop Acreage	9.9	122.1	127.0	88.5	347.5
Double Crop	0.0	23.9	13.0	2.1	39.0
Total Land Area	9.9	98.2	114.0	86.4	308.5

SACRAMENTO VALLEY HSA
1985 Irrigated Lands in Thousand Acres

	Shasta Pit	Sacto Valley NW	Sacto Valley NE	Central Basin West	Central Basin East	South West	South East	Delta	Total
Grain	13.2	15.9	11.3	174.2	77.7	0.2	1.3	43.6	337.4
Rice	0.0	2.8	0.0	180.3	239.7	1.1	0.6	1.4	425.9
Sugar Beets	0.0	3.2	1.7	40.1	10.8	0.0	0.0	15.7	71.5
Corn	0.0	3.9	2.1	85.3	23.0	0.1	0.0	52.4	166.8
Other Field	1.4	8.9	7.2	83.4	51.6	0.2	0.0	21.0	173.7
Alfalfa	27.9	8.2	1.3	53.4	9.0	1.0	7.0	9.3	117.1
Pasture	91.0	45.1	29.2	29.2	58.9	7.1	86.8	21.0	368.3
Tomatoes	0.0	0.2	0.0	61.0	22.0	0.0	0.0	13.6	96.8
Other Truck	0.6	1.0	2.2	18.7	14.7	0.1	1.0	3.4	41.7
Almond-Pistachio	0.0	12.0	21.9	38.2	32.9	0.0	0.0	0.0	105.0
Deciduous Orchard	0.1	15.7	23.8	31.5	109.1	8.7	4.4	7.1	200.4
Citrus-Olive	0.0	8.0	0.1	0.7	2.3	0.0	5.0	0.0	16.1
Grapes	0.0	0.1	0.8	2.1	0.4	3.3	0.5	3.1	10.3
Total Crop Acrage	134.2	125.0	101.6	798.1	652.1	21.8	106.6	191.6	2,131.0
Double Crop	0.0	4.0	4.0	43.0	35.5	0.0	0.0	4.4	90.9
Total Land Area	134.2	121.0	97.6	755.1	616.6	21.8	106.6	187.2	2,040.1

SAN JOAQUIN HSA
1985 Irrigated Lands in Thousand Acres

	Delta	Eastern Valley Floor	Vly East Side	Vly West Side	West Side Uplnds	Foothill and Uplnds	Sierra Uplnds	Westrn Uplnds	Total
Grain	36.9	20.8	78.8	14.7	0.0	0.0	0.0	1.6	152.8
Rice	0.1	6.2	15.5	10.8	0.0	0.0	0.0	0.0	32.6
Cotton	0.0	0.0	69.4	111.1	0.0	0.0	0.0	0.0	180.5
Sugar Beets	9.8	24.9	11.2	17.9	0.0	0.0	0.0	0.3	64.1
Corn	70.8	31.0	118.0	18.7	0.0	0.0	0.0	0.1	238.6
Other Field	25.2	19.8	43.7	52.3	0.0	0.0	0.0	2.8	143.8
Alfalfa	39.5	16.6	93.2	57.5	0.0	0.0	0.0	1.2	208.0
Pasture	13.4	50.8	156.2	19.0	0.0	0.9	0.2	0.4	240.9
Tomatoes	25.1	8.4	6.6	30.0	0.0	0.0	0.0	0.6	70.7
Other Truck	34.2	7.9	20.8	64.1	0.0	0.1	0.0	0.4	127.5
Almond-Pistachio	0.0	19.5	191.3	12.8	0.0	0.0	0.0	1.3	224.9
Other Deciduous	14.6	20.9	88.4	26.0	0.0	0.4	0.1	2.2	152.6
Citrus-Olive	0.0	0.3	6.3	0.6	0.0	0.0	0.0	0.0	7.2
Grapes	4.4	54.9	134.6	0.8	0.0	1.0	0.0	0.0	195.7
Total Crop Acreage	274.0	282.0	1,034.0	436.3	0.0	2.4	0.3	10.9	2,039.9
Double Crop	14.9	13.0	34.9	13.4	0.0	0.0	0.0	1.3	77.5
Total Land Area	259.1	269.0	999.1	422.9	0.0	2.4	0.3	9.6	1,962.4

TULARE LAKE BASIN HSA
1985 Irrigated Lands in Thousand Acres

	Kings Kaweah Tule	Kern Valley	San Luis Westside	Uplands	Western Uplands	Total
Grain	158.2	80.1	92.8	0.0	0.0	331.1
Rice	0.7	1.1	0.4	0.0	0.0	2.2
Cotton	451.5	320.4	334.1	0.0	0.0	1,106.0
Sugar Beets	9.6	10.4	5.7	0.0	0.0	25.7
Corn	92.7	5.9	8.0	0.0	0.0	106.6
Other Field	49.1	37.7	20.8	0.2	0.0	107.8
Alfalfa	257.9	87.9	30.6	0.9	0.2	377.5
Pasture	51.7	8.0	1.0	4.0	0.0	64.7
Tomatoes	2.8	4.5	61.3	0.0	0.0	68.6
Other Truck	12.3	75.6	54.0	0.2	0.0	142.1
Almond-Pistachio	34.2	104.1	15.3	0.0	0.0	153.6
Other Deciduous	153.5	23.2	0.6	1.6	0.0	178.9
Citrus-Olive	118.6	38.2	1.3	1.7	0.0	159.8
Grapes	300.2	99.2	7.0	0.0	0.0	406.4
Total Crop Acreage	1,693.0	896.3	632.9	8.6	0.2	3,231.0
Double Crop	38.0	7.0	13.0	0.0	0.0	58.0
Total Land Area	1,655.0	889.3	619.9	8.6	0.2	3,173.0

NORTH LAHONTAN HSA
1985 Irrigated Lands in Thousand Acres

	Lassen Group	Alpine Group	Total
Grain	12.9	0.0	12.9
Rice	0.1	0.0	0.1
Corn	0.3	0.0	0.3
Alfalfa	39.9	3.6	43.5
Pasture	55.1	37.5	92.6
Other Truck	1.5	0.0	1.5
Total Crop Acreage	109.8	41.1	150.9
Double Crop	0.0	0.0	0.0
Total Land Area	109.8	41.1	150.9

SOUTH LAHONTAN HSA
1985 Irrigated Lands in Thousand Acres

	Antelope Valley	Death Valley	Indian Wells	Mojave River	Mono Owens	Total
Grain	1.2	0.0	0.2	0.2	0.1	1.7
Other Field	0.1	0.0	0.4	0.3	0.1	0.9
Alfalfa	13.1	0.1	2.9	18.7	6.0	40.8
Pasture	5.6	0.0	0.9	1.1	11.3	18.9
Other Truck	2.6	0.0	0.2	0.1	0.0	2.9
Other Deciduous	1.2	0.0	0.4	0.3	0.0	1.9
Total Crop Acreage	23.8	0.1	5.0	20.7	17.5	67.1
Double Crop	0.0	0.0	0.0	0.0	0.0	0.0
Total Land Area	23.8	0.1	5.0	20.7	17.5	67.1

COLORADO RIVER HSA
1985 Irrigated Lands in Thousand Acres

	Colorado River	Imperial	Anza Borrego	Coachella	29Palms Lanfair	Chuckwalla	Total
Grain	16.0	77.9	0.1	1.2	0.1	0.0	95.3
Cotton	23.6	20.7	0.0	2.5	0.0	0.0	46.8
Sugar Beets	0.0	37.3	0.0	0.0	0.0	0.0	37.3
Corn	3.4	2.5	0.0	3.6	0.0	0.0	9.5
Other Field	6.0	19.3	0.7	0.4	3.6	4.2	34.2
Alfalfa	37.5	212.2	4.2	4.6	2.2	0.0	260.7
Pasture	2.2	23.3	0.1	1.8	0.1	0.0	27.5
Tomatoes	0.7	4.4	0.0	0.2	0.0	0.0	5.3
Other Truck	27.1	97.9	1.0	12.1	0.0	1.0	139.1
Other Deciduous	0.0	0.3	0.1	0.3	0.0	0.0	0.7
Citrus-Olive	3.7	2.1	1.0	21.1	0.0	0.1	28.0
Grapes	0.0	0.0	0.0	18.9	0.0	0.2	19.1
Total Crop Acreage	120.2	497.9	7.2	66.7	6.0	5.5	703.5
Double Crop	17.4	50.8	0.0	6.4	0.0	0.0	74.6
Total Land Area	102.8	447.1	7.2	60.3	6.0	5.5	628.9

CALIFORNIA STATE TOTALS
1985 Irrigated Lands in Thousand Acres

	North Coast	SF Bay	Central Coast	South Coast	Sacto Valley	San Joaquin	Tulare Lake	North Lahontan	South Lahontan	Colorado River	Total
Grain	81.5	10.4	17.6	18.7	337.4	152.8	331.1	12.9	1.7	95.3	1,059.4
Rice	0.0	0.0	0.0	0.0	425.9	32.6	2.2	0.1	0.0	0.0	460.8
Cotton	0.0	0.0	0.0	0.0	0.0	180.5	1106.0	0.0	0.0	46.8	1,333.3
Sugar Beets	0.0	0.0	12.4	0.1	71.5	64.1	25.7	0.0	0.0	37.3	211.1
Corn	1.0	1.7	4.2	6.3	166.8	238.6	106.6	0.3	0.0	9.5	535.0
Other Field	1.5	1.0	37.2	8.9	173.7	143.8	107.8	0.0	0.9	34.2	509.0
Alfalfa	52.1	0.4	40.9	11.0	117.1	208	377.5	43.5	40.8	260.7	1,152.0
Pasture	124.1	4.8	25.8	19.7	368.3	240.9	64.7	92.6	18.9	27.5	987.3
Tomatoes	0.0	0.1	20.3	8.0	96.8	70.7	68.6	0.0	0.0	5.3	269.8
Other Truck	18.4	9.1	291.5	101.5	41.7	127.5	142.1	1.5	2.9	139.1	875.3
Almonds-Pistachio	0.0	0.0	0.0	0.0	105.0	224.9	153.6	0.0	0.0	0.0	483.5
Other Deciduous	8.6	9.1	29.6	3.1	200.4	152.6	178.9	0.0	1.9	0.7	584.9
Citrus-Olive	0.0	0.0	16.3	158.7	16.1	7.2	159.8	0.0	0.0	28.0	386.1
Grapes	30.1	26.2	56.3	11.5	10.3	195.7	406.4	0.0	0.0	19.1	755.6
Subtotal	317.3	62.8	552.1	347.5	2,131.0	2039.9	3231.0	150.9	67.1	703.5	9,603.1
Double Crop	0.0	1.3	106.0	39.0	90.9	77.5	58.0	0.0	0.0	74.6	447.3
Total Land	317.3	61.5	446.1	308.5	2,040.1	1962.4	3173.0	150.9	67.1	628.9	9,155.8

PART III

COMPARISON OF WATER USE AND WATER SUPPLIES

Comparison of Supplies & Demands
Thousand Acre-Feet

North Coast HSA - Coastal PSA

DEMANDS	1980	1985	2010
Agriculture	55	51	52
M & I	78	79	83
Wildlife	0	0	2
Recreation	0	0	0
Cooling	0	0	0
HWUI			
Total	133	130	137
Est. Net H2O demd	130	132	139
SUPPLIES			
Local Surface	85	80	85
Imports by local	0	0	0
Colorado river	0	0	0
Ground water	44	50	52
CVP	0	0	0
Surface M & I	0	0	0
Other federal	0	0	0
SWP	0	0	0
Waste water recl	0	2	2
Total Supply	129	132	139
SUPPLMNTL DEMAND			
G W overdraft	0	0	0
Shortage	1	0	0
Total supp dmnd	1	0	0
Reserves	0	0	0

North Coast HSA - Upper Klamath PSA

DEMANDS	1980	1985	2010
Agriculture	663	672	690
M & I	10	9	9
Wildlife	260	337	337
Recreation	0	0	0
Cooling	0	0	0
HWUI			
Total	933	1018	1036
Est. Net H2O demd	751	762	781
SUPPLIES			
Local Surface	239	239	239
Imports by local	2	2	2
Colorado river	0	0	0
Ground water	87	98	117
CVP	0	0	0
Surface M & I	0	0	0
Other federal	422	422	422
SWP	0	0	0
Waste water recl	1	1	1
Total Supply	751	762	781
SUPPLMNTL DEMAND			
G W overdraft	0	0	0
Shortage	0	0	0
Total supp dmnd	0	0	0
Reserves	45	31	28

North Coast HSA- Lower Klamath PSA

DEMANDS	1980	1985	2010
Agriculture	30	26	28
M & I	7	8	9
Wildlife	0	0	0
Recreation	0	0	0
Cooling	0	0	0
HWUI			
Total	37	34	37
Est. Net H2O demd	37	34	37
SUPPLIES			
Local Surface	20	23	24
Imports by local	0	0	0
Colorado river	0	0	0
Ground water	17	11	13
CVP	0	0	0
Surface M & I	0	0	0
Other federal	0	0	0
SWP	0	0	0
Waste water recl	0	0	0
Total Supply	37	34	37
SUPPLMNTL DEMAND			
G W overdraft	0	0	0
Shortage	0	0	0
Total supp dmnd	0	0	0
Indcted reserves			
Total reserves	0	0	0

North Coast HSA - Russian River PSA

DEMANDS	1980	1985	2010
Agriculture	73	83	100
M & I	58	64	80
Wildlife	0	0	0
Recreation	1	1	2
Cooling	0	0	0
HWUI			
Total	132	148	182
Est. Net H2O demd	118	135	166
SUPPLIES			
Local Surface	8	8	8
Imports by local	16	16	16
Colorado river	0	0	0
Ground water	50	67	52
CVP	0	0	0
Surface M & I	0	0	0
Other federal	36	36	81
SWP	0	0	0
Waste water recl	8	8	9
Total Supply	118	135	166
SUPPLMNTL DEMAND			
G W overdraft	0	0	0
Shortage	0	0	0
Total supp dmnd	0	0	0
Indcted reserves			
Total reserves	0	0	72

San Francisco Bay HSA - South Bay PSA

DEMANDS	1980	1985	2010
Agriculture	65	61	42
M & I	852	950	1062
Wildlife	0	0	0
Recreation	1	1	1
Cooling	6	2	2
HWUI			
Total	924	1014	1107
Est. Net H2O demd	934	1025	1123
SUPPLIES			
Local Surface	68	70	70
Imports by local	440	484	514
Colorado river	0	0	0
Ground water	181	198	190
CVP	81	95	155
Surface M & I	0	0	0
Other federal	0	0	0
SWP	150	140	167
Waste water recl	7	7	21
Total Supply	927	994	1117
SUPPLMNTL DEMAND			
G W overdraft	0	31	0
Shortage	7	0	6
Total supp dmnd	7	31	6
Indcted reserves			
Total reserves	137	121	139

San Francisco Bay HSA - North Bay PSA

DEMANDS	1980	1985	2010
Agriculture	56	57	52
M & I	115	138	160
Wildlife	100	100	100
Recreation	1	1	1
Cooling	0	0	0
HWUI			
Total	272	296	313
Est. Net H2O demd	270	294	309
SUPPLIES			
Local Surface	160	160	158
Imports by local	32	33	35
Colorado river	0	0	0
Ground water	30	35	34
CVP	0	0	0
Surface M & I	0	0	0
Other federal	38	54	18
SWP	7	4	54
Waste water recl	3	3	9
Total Supply	270	289	308
SUPPLMNTL DEMAND			
G W overdraft	0	0	0
Shortage	0	5	1
Total supp dmnd	0	5	1
Indcted reserves			
Total reserves	0	0	0

Central Coast HSA - Southern PSA

DEMANDS	1980	1985	2010
Agriculture	399	436	396
M & I	108	129	168
Wildlife	0	0	0
Recreation	1	1	3
Cooling	0	0	0
HWUI			
Total	508	566	567
Est. Net H2O demd	378	407	431
SUPPLIES			
Local Surface	18	18	18
Imports by local	0	0	0
Colorado river	0	0	0
Ground water	178	178	178
CVP	0	0	0
Surface M & I	0	0	0
Other federal	54	54	54
SWP	0	0	63
Waste water recl	5	5	5
Total Supply	255	255	318
SUPPLMNTL DEMAND			
G W overdraft	116	139	105
Shortage	7	13	8
Total supp dmnd	123	152	113
Indcted reserves			
Total reserves	15	15	15

Central Coast HSA - San Luis Obispo County

DEMANDS	1980	1985	2010
Agriculture	155	170	160
M & I	31	38	63
Wildlife	0	0	0
Recreation	1	1	2
Cooling	0	0	0
HWUI			
Total	187	209	225
Est. Net H2O demd	140	148	168
SUPPLIES			
Local Surface	13	13	13
Imports by local	0	0	0
Colorado river	0	0	0
Ground water	66	66	66
CVP	0	0	0
Surface M & I	0	0	0
Other federal	5	5	5
SWP	0	0	22
Waste water recl	2	2	2
Total Supply	86	86	108
SUPPLMNTL DEMAND			
G W overdraft	53	55	57
Shortage	1	7	3
Total supp dmnd	54	62	60
Indcted reserves			
Total reserves	15	15	15

Central Coast HSA - Santa Barbara County

DEMANDS	1980	1985	2010
Agriculture	244	266	236
M & I	77	91	105
Wildlife	0	0	0
Recreation	0	0	1
Cooling	0	0	0
HWUI			
Total	321	357	342
Est. Net H2O demd	238	259	263
SUPPLIES			
Local Surface	5	5	5
Imports by local	0	0	0
Colorado river	0	0	0
Ground water	112	112	112
CVP	0	0	0
Surface M & I	0	0	0
Other federal	49	49	49
SWP	0	0	41
Waste water recl	3	3	3
Total Supply	169	169	210
SUPPLMNTL DEMAND			
G W overdraft	63	84	48
Shortage	6	6	5
Total supp dmnd	69	90	53
Indcted reserves			
Total reserves	0	0	0

Central Coast HSA - Northern PSA

DEMANDS	1980	1985	2010
Agriculture	790	768	776
M & I	130	140	211
Wildlife	0	0	0
Recreation	1	1	2
Cooling	0	0	0
HWUI			
Total	921	909	989
Est. Net H2O demd	721	708	783
SUPPLIES			
Local Surface	21	21	21
Imports by local	0	0	0
Colorado river	0	0	0
Ground water	590	604	568
CVP	0	0	82
Surface M & I	0	0	0
Other federal	0	0	0
SWP	0	0	0
Waste water recl	0	1	1
Total Supply	611	626	672
SUPPLMNTL DEMAND			
G W overdraft	110	82	111
Shortage	0	0	0
Total supp dmnd	110	82	111
Indcted reserves			
Total reserves	0	0	36

Los Angeles HSA - Santa Clara PSA

DEMANDS	1980	1985	2010
Agriculture	321	313	254
M & I	145	166	258
Wildlife	7	0	7
Recreation	1	0	7
Cooling	0	0	0
HWUI			
Total	474	479	526
Est. Net H2O demd	383	397	438
SUPPLIES			
Local Surface	7	7	7
Imports by local	0	0	0
Colorado river	6	0	14
Ground water	170	171	171
CVP	0	0	0
Surface M & I	0	0	0
Other federal	20	20	20
SWP	88	68	171
Waste water recl	10	10	37
Total Supply	301	276	420
SUPPLMNTL DEMAND			
G W overdraft	82	121	0
Shortage	0	0	18
Total supp dmnd	82	121	18
Indcted reserves			
Total reserves	48	0	0

Los Angeles HSA - Metro Los Angeles PSA

DEMANDS	1980	1985	2010
Agriculture	27	22	12
M & I	1511	1658	1827
Wildlife	0	0	0
Recreation	0	0	0
Cooling	5	3	2
HWUI			
Total	1543	1683	1841
Est. Net H2O demd	1523	1652	1802
SUPPLIES			
Local Surface	22	22	22
Imports by local	482	485	485
Colorado river	264	397	206
Ground water	313	313	313
CVP	0	0	0
Surface M & I	0	0	0
Other federal	0	0	0
SWP	393	397	614
Waste water recl	35	38	72
Total Supply	1509	1652	1712
SUPPLMNTL DEMAND			
G W overdraft	14	0	0
Shortage	0	0	90
Total supp dmnd	14	0	90
Indcted reserves			
Total reserves	116	0	0

Santa Ana HSA

DEMANDS	1980	1985	2010
Agriculture	412	367	189
M & I	735	834	1202
Wildlife	0	0	0
Recreation	2	4	8
Cooling	1	5	0
HWUI			
Total	1150	1210	1399
Est. Net H2O demd	962	1044	1192
SUPPLIES			
Local Surface	93	93	93
Imports by local	0	0	0
Colorado river	290	401	195
Ground water	402	402	402
CVP	0	0	0
Surface M & I	0	0	0
Other federal	0	0	0
SWP	138	113	393
Waste water recl	29	35	79
Total Supply	952	1044	1162
SUPPLMNTL DEMAND			
G W overdraft	10	0	0
Shortage	0	0	30
Total supp dmnd	10	0	30
Indcted reserves			
Total reserves	203	0	0

San Diego HSA

DEMANDS	1980	1985	2010
Agriculture	228	193	196
M & I	389	460	734
Wildlife	5	5	5
Recreation	2	3	4
Cooling	0	0	0
HWUI			
Total	624	661	939
Est. Net H2O demd	634	668	933
SUPPLIES			
Local Surface	37	37	37
Imports by local	0	0	0
Colorado river	290	337	356
Ground water	77	77	77
CVP	0	0	0
Surface M & I	0	0	0
Other federal	0	0	0
SWP	221	207	328
Waste water recl	9	10	37
Total Supply	634	668	835
SUPPLMNTL DEMAND			
G W overdraft	0	0	0
Shortage	0	0	98
Total supp dmnd	0	0	98
Indcted reserves			
Total reserves	46	0	0

Sacramento HSA - Shasta Lake Pit River PSA

DEMANDS	1980	1985	2010
Agriculture	398	401	342
M & I	12	11	14
Wildlife	15	15	15
Recreation	0	0	0
Cooling	0	0	0
HWUI			
Total	425	427	371
Est. Net H2O demd	384	389	401
SUPPLIES			
Local Surface	328	329	329
Imports by local	0	0	0
Colorado river	0	0	0
Ground water	56	60	72
CVP	0	0	0
Surface M & I	0	0	0
Other federal	0	0	0
SWP	0	0	0
Waste water recl	0	0	0
Total Supply	384	389	401
SUPPLMNTL DEMAND			
G W overdraft	0	0	0
Shortage	0	0	0
Total supp dmnd	0	0	0
Indcted reserves			
Total reserves	28	0	0

Sacramento HSA - Northeast Valley PSA

DEMANDS	1980	1985	2010
Agriculture	376	366	323
M & I	36	48	72
Wildlife	0	12	12
Recreation	0	0	0
Cooling	0	0	0
HWUI			
Total	412	426	407
Est. Net H2O demd	407	410	424
SUPPLIES			
Local Surface	201	201	201
Imports by local	0	0	0
Colorado river	0	0	0
Ground water	163	166	180
CVP	43	43	43
Surface M & I	0	0	0
Other federal	0	0	0
SWP	0	0	0
Waste water recl	0	0	0
Total Supply	407	410	424
SUPPLMNTL DEMAND			
G W overdraft	0	0	0
Shortage	0	0	0
Total supp dmnd	0	0	0
Indcted reserves			
Total reserves	0	0	0

Sacramento HSA - Northwest Valley PSA

DEMANDS	1980	1985	2010
Agriculture	538	480	463
M & I	50	57	69
Wildlife	0	9	9
Recreation	0	0	0
Cooling	0	0	0
HWUI			
Total	588	546	541
Est. Net H2O demd	534	501	542
SUPPLIES			
Local Surface	20	20	20
Imports by local	0	0	0
Colorado river	0	0	0
Ground water	201	168	202
CVP	199	199	206
Surface M & I	0	0	0
Other federal	108	108	108
SWP	0	0	0
Waste water recl	6	6	6
Total Supply	534	501	542
SUPPLMNTL DEMAND			
G W overdraft	0	0	0
Shortage	0	0	0
Total supp dmnd	0	0	0
Indcted reserves			
Total reserves	80	80	72

Sacramento HSA - Central Basin West PSA

DEMANDS	1980	1985	2010
Agriculture	3595	2811	3522
M & I	47	57	71
Wildlife	106	106	106
Recreation	1	1	1
Cooling	0	0	2
HWUI			
Total	3749	2975	3702
Est. Net H2O demd	2497	2433	2571
SUPPLIES			
Local Surface	200	200	200
Imports by local	0	0	0
Colorado river	0	0	0
Ground water	647	696	696
CVP	1373	1249	1392
Surface M & I	0	0	0
Other federal	271	271	261
SWP	0	0	0
Waste water recl	6	6	11
Total Supply	2497	2422	2560
SUPPLMNTL DEMAND			
G W overdraft	0	11	11
Shortage	0	0	0
Total supp dmnd	0	11	11
Indcted reserves			
Total reserves	66	130	36

Sacramento HSA - Central Basin East PSA

DEMANDS	1980	1985	2010
Agriculture	3749	2809	3425
M & I	304	367	478
Wildlife	122	122	122
Recreation	1	1	1
Cooling	0	0	0
HWUI			
Total	4176	3299	4026
Est. Net H2O demd	2940	2881	2971
SUPPLIES			
Local Surface	1404	1378	1385
Imports by local	2	2	2
Colorado river	0	0	0
Ground water	712	697	764
CVP	697	699	773
Surface M & I	0	0	0
Other federal	0	0	0
SWP	7	5	9
Waste water recl	3	3	3
Total Supply	2825	2784	2936
SUPPLMNTL DEMAND			
G W overdraft	115	97	35
Shortage	0	0	0
Total supp dmnd	115	97	35
Indcted reserves			
Total reserves	162	243	329

Sacramento HSA - Southwest PSA

DEMANDS	1980	1985	2010
Agriculture	50	53	50
M & I	7	9	16
Wildlife	0	0	0
Recreation	0	0	0
Cooling	0	0	0
HWUI			
Total	57	62	66
Est. Net H2O demd	49	54	59
SUPPLIES			
Local Surface	9	13	19
Imports by local	0	0	0
Colorado river	0	0	0
Ground water	32	39	37
CVP	0	1	1
Surface M & I	0	0	0
Other federal	1	0	0
SWP	0	0	0
Waste water recl	1	1	2
Total Supply	43	54	59
SUPPLMNTL DEMAND			
G W overdraft	0	0	0
Shortage	6	0	0
Total supp dmnd	6	0	0
Indcted reserves			
Total reserves	7	7	7

Sacramento HSA - Southeast PSA

DEMANDS	1980	1985	2010
Agriculture	342	373	372
M & I	76	57	92
Wildlife	0	0	0
Recreation	0	1	1
Cooling	0	0	0
HWUI			
Total	418	431	465
Est. Net H2O demd	358	371	405
SUPPLIES			
Local Surface	290	298	307
Imports by local	9	9	9
Colorado river	0	0	0
Ground water	30	30	36
CVP	27	29	33
Surface M & I	0	0	0
Other federal	0	0	0
SWP	0	1	1
Waste water recl	0	0	0
Total Supply	356	367	386
SUPPLMNTL DEMAND			
G W overdraft	2	4	19
Shortage	0	0	0
Total supp dmnd	2	4	19
Indcted reserves			
Total reserves	125	124	105

Sacramento HSA - Delta PSA

DEMANDS	1980	1985	2010
Agriculture	555	510	504
M & I	28	19	23
Wildlife	0	0	0
Recreation	1	1	1
Cooling	0	0	0
HWUI			
Total	584	530	528
Est. Net H2O demd	453	444	458
SUPPLIES			
Local Surface	425	425	435
Imports by local	0	0	0
Colorado river	0	0	0
Ground water	28	19	23
CVP	0	0	0
Surface M & I	0	0	0
Other federal	0	0	0
SWP	0	0	0
Waste water recl	0	0	0
Total Supply	453	444	458
SUPPLMNTL DEMAND			
G W overdraft	0	0	0
Shortage	0	0	0
Total supp dmnd	0	0	0
Indcted reserves			
Total reserves	7	4	0

San Joaquin HSA - Delta PSA

DEMANDS	1980	1985	2010
Agriculture	807	793	703
M & I	25	36	52
Wildlife	5	5	5
Recreation	0	0	0
Cooling	0	0	0
HWUI			
Total	837	834	760
Est. Net H2O demd	655	691	655
SUPPLIES			
Local Surface	574	605	554
Imports by local	0	0	0
Colorado river	0	0	0
Ground water	26	30	43
CVP	40	41	43
Surface M & I	0	0	0
Other federal	15	15	15
SWP	0	0	0
Waste water recl	0	0	0
Total Supply	655	691	655
SUPPLMNTL DEMAND			
G W overdraft	0	0	0
Shortage	0	0	0
Total supp dmnd	0	0	0
Indcted reserves			
Total reserves	19	15	0

San Joaquin HSA - Western Uplands PSA

DEMANDS	1980	1985	2010
Agriculture	47	48	45
M & I	22	20	21
Wildlife	0	0	0
Recreation	0	0	0
Cooling	0	0	0
HWUI			
Total	69	68	66
Est. Net H2O demd	70	69	67
SUPPLIES			
Local Surface	0	0	0
Imports by local	0	0	0
Colorado river	0	0	0
Ground water	14	6	6
CVP	56	63	61
Surface M & I	0	0	0
Other federal	0	0	0
SWP	0	0	0
Waste water recl	0	0	0
Total Supply	70	69	67
SUPPLMNTL DEMAND			
G W overdraft	0	0	0
Shortage	0	0	0
Total supp dmnd	0	0	0
Indcted reserves			
Total reserves	16	0	28

San Joaquin HSA - Foothill & Upland PSA

DEMANDS	1980	1985	2010
Agriculture	10	11	18
M & I	15	16	25
Wildlife	0	0	0
Recreation	0	1	1
Cooling	0	0	0
HWUI			
Total	25	28	44
Est. Net H2O demd	32	35	51
SUPPLIES			
Local Surface	26	29	31
Imports by local	0	0	0
Colorado river	0	0	0
Ground water	2	2	2
CVP	4	4	6
Surface M & I	0	0	0
Other federal	0	0	0
SWP	0	0	0
Waste water recl	0	0	0
Total Supply	32	35	39
SUPPLMNTL DEMAND			
G W overdraft	0	0	0
Shortage	0	0	12
Total supp dmnd	0	0	12
Indcted reserves			
Total reserves	12	9	5

San Joaquin HSA - Eastern Valley Floor PSA

DEMANDS	1980	1985	2010
Agriculture	964	847	1009
M & I	78	62	91
Wildlife	0	0	0
Recreation	0	0	0
Cooling	15	25	25
HWUI			
Total	1057	934	1125
Est. Net H2O demd	842	752	909
SUPPLIES			
Local Surface	161	166	143
Imports by local	0	0	0
Colorado river	0	0	0
Ground water	473	479	479
CVP	18	32	32
Surface M & I	0	0	0
Other federal	40	40	40
SWP	0	0	0
Waste water recl	5	5	5
Total Supply	697	722	699
SUPPLMNTL DEMAND			
G W overdraft	145	30	210
Shortage	0	0	0
Total supp dmnd	145	30	210
Indcted reserves			
Total reserves	82	0	0

San Joaquin HSA - Sierra Uplands PSA

DEMANDS	1980	1985	2010
Agriculture	20	20	30
M & I	18	22	36
Wildlife	0	0	0
Recreation	9	9	9
Cooling	0	0	0
HWUI			
Total	47	51	75
Est. Net H2O demd	43	47	68
SUPPLIES			
Local Surface	40	40	40
Imports by local	0	0	0
Colorado river	0	0	0
Ground water	0	0	0
CVP	0	4	12
Surface M & I	0	0	0
Other federal	0	0	0
SWP	0	0	0
Waste water recl	2	2	4
Total Supply	42	46	56
SUPPLMNTL DEMAND			
G W overdraft		0	0
Shortage	1	1	12
Total supp dmnd	1	1	12
Indcted reserves			
Total reserves	0	0	0

San Joaquin HSA - Valley East Side PSA

DEMANDS	1980	1985	2010
Agriculture	4033	3653	3627
M & I	232	267	428
Wildlife	14	14	14
Recreation	0	0	0
Cooling	0	0	0
HWUI			
Total	4279	3934	4069
Est. Net H2O demd	3285	3264	3330
SUPPLIES			
Local Surface	2254	2186	2132
Imports by local	0	0	0
Colorado river	0	0	0
Ground water	432	432	432
CVP	352	352	415
Surface M & I	0	0	0
Other federal	0	0	0
SWP	0	0	0
Waste water recl	13	15	24
Total Supply	3051	2985	3003
SUPPLMNTL DEMAND			
G W overdraft	234	279	327
Shortage	0	0	0
Total supp dmnd	234	279	327
Indcted reserves			
Total reserves	0	68	59

San Joaquin HSA - Valley West Side PSA

DEMANDS	1980	1985	2010
Agriculture	1593	1551	1463
M & I	13	13	17
Wildlife	67	67	67
Recreation	1	2	4
Cooling	0	0	0
HWUI			
Total	1674	1633	1551
Est. Net H2O demd	1457	1477	1451
SUPPLIES			
Local Surface	0	0	0
Imports by local	0	0	0
Colorado river	0	0	0
Ground water	28	28	28
CVP	1375	1386	1417
Surface M & I	0	0	0
Other federal	0	0	0
SWP	8	7	5
Waste water recl	1	1	1
Total Supply	1412	1422	1451
SUPPLMNTL DEMAND			
G W overdraft	45	55	0
Shortage		0	0
Total supp dmnd	45	55	0
Indcted reserves			
Total reserves	78	65	36

Tulare Lake HSA - Uplands PSA

DEMANDS	1980	1985	2010
Agriculture	24	30	30
M & I	6	8	15
Wildlife	0	0	0
Recreation	6	6	8
Cooling	0	0	0
HWUI			
Total	36	44	53
Est. Net H2O demd	30	32	37
SUPPLIES			
Local Surface	16	16	16
Imports by local	0	0	0
Colorado river	0	0	0
Ground water	10	10	10
CVP	0	0	0
Surface M & I	0	0	0
Other federal	0	0	0
SWP	3	5	9
Waste water recl	1	1	1
Total Supply	30	32	36
SUPPLMNTL DEMAND			
G W overdraft	0	0	0
Shortage	0	0	1
Total supp dmnd	0	0	1
Indcted reserves			
Total reserves	0	0	0

Tulare Lake HSA - Western Uplands PSA

DEMANDS	1980	1985	2010
Agriculture	0	0	0
M & I	0	1	2
Wildlife	0	0	0
Recreation	0	0	0
Cooling	0	0	0
HWUI			
Total	0	1	2
Est. Net H2O demd	0	1	1
SUPPLIES			
Local Surface	0	0	0
Imports by local	0	0	0
Colorado river	0	0	0
Ground water	0	1	1
CVP	0	0	0
Surface M & I	0	0	0
Other federal	0	0	0
SWP	0	0	0
Waste water recl	0	0	0
Total Supply	0	1	1
SUPPLMNTL DEMAND			
G W overdraft	0	0	0
Shortage	0	0	0
Total supp dmnd	0	0	0
Indcted reserves			
Total reserves	0	0	0

Tulare Lake HSA - Kings Kaweah Tule PSA

DEMANDS	1980	1985	2010
Agriculture	6300	6000	6003
M & I	277	301	441
Wildlife	30	30	30
Recreation	1	1	1
Cooling	0	0	0
HWUI			
Total	6608	6332	6475
Est. Net H2O demd	4223	4142	4294
SUPPLIES			
Local Surface	1719	1719	1719
Imports by local	0	0	0
Colorado river	0	0	0
Ground water	279	296	360
CVP	1027	1027	1335
Surface M & I	0	0	0
Other federal	193	193	193
SWP	212	127	110
Waste water recl	33	36	53
Total Supply	3463	3398	3770
SUPPLMNTL DEMAND			
G W overdraft	760	744	506
Shortage	0	0	18
Total supp dmnd	760	744	524
Indcted reserves			
Total reserves	0	0	0

Tulare Lake HSA - San Luis West Side PSA

DEMANDS	1980	1985	2010
Agriculture	1817	1707	1692
M & I	11	10	13
Wildlife	0	0	0
Recreation	0	0	0
Cooling	0	0	0
HWUI			
Total	1828	1717	1705
Est. Net H2O demd	1536	1612	1530
SUPPLIES			
Local Surface	0	0	0
Imports by local	0	0	0
Colorado river	0	0	0
Ground water	128	110	47
CVP	1274	1296	1330
Surface M & I	0	0	0
Other federal	0	0	0
SWP	101	72	63
Waste water recl	1	1	1
Total Supply	1504	1479	1441
SUPPLMNTL DEMAND			
G W overdraft	32	133	78
Shortage	0	0	11
Total supp dmnd	32	133	89
Indcted reserves			
Total reserves	56	0	0

Tulare Lake HSA - Kern Valley Floor PSA

DEMANDS	1980	1985	2010
Agriculture	3283	2943	3056
M & I	138	161	258
Wildlife	15	15	15
Recreation	0	1	2
Cooling	3	0	0
HWUI			
Total	3439	3120	3331
Est. Net H2O demd	2532	2408	2610
SUPPLIES			
Local Surface	464	464	464
Imports by local	0	0	0
Colorado river	0	0	0
Ground water	134	134	134
CVP	435	435	464
Surface M & I	0	0	0
Other federal	50	50	50
SWP	1220	1190	1022
Waste water recl	32	35	52
Total Supply	2335	2308	2186
SUPPLMNTL DEMAND			
G W overdraft	197	100	274
Shortage	0	0	150
Total supp dmnd	197	100	424
Indcted reserves			
Total reserves	0	0	0

North Lahontan HSA - Lassen Group PSA

DEMANDS	1980	1985	2010
Agriculture	288	295	304
M & I	6	7	9
Wildlife	10	10	10
Recreation	0	0	0
Cooling	0	0	0
HWUI			
Total	304	312	323
Est. Net H2O demd	290	297	304
SUPPLIES			
Local Surface	186	190	192
Imports by local	3	3	3
Colorado river	0	0	0
Ground water	89	92	97
CVP	0	0	0
Surface M & I	0	0	0
Other federal	10	10	10
SWP	0	0	0
Waste water recl	2	2	2
Total Supply	290	297	304
SUPPLMNTL DEMAND			
G W overdraft	0	0	0
Shortage	0	0	0
Total supp dmnd	0	0	0
Indcted reserves			
Total reserves	0	0	0

North Lahontan HSA - Alpine Group PSA

DEMANDS	1980	1985	2010
Agriculture	154	154	156
M & I	17	20	31
Wildlife	0	0	0
Recreation	1	1	1
Cooling	0	0	0
HWUI			
Total	172	175	188
Est. Net H2O demd	160	163	176
SUPPLIES			
Local Surface	146	152	163
Imports by local	0	0	0
Colorado river	0	0	0
Ground water	10	6	6
CVP	0	0	0
Surface M & I	0	0	0
Other federal	0	0	0
SWP	0	0	0
Waste water recl	4	5	7
Total Supply	160	163	176
SUPPLMNTL DEMAND			
G W overdraft	0	0	0
Shortage	0	0	0
Total supp dmnd	0	0	0
Indcted reserves			

South Lahontan HSA - Mono Owens PSA

DEMANDS	1980	1985	2010
Agriculture	124	96	94
M & I	12	13	15
Wildlife	3	3	3
Recreation	6	6	6
Cooling	0	0	0
HWUI			
Total	145	118	118
Est. Net H2O demd	101	104	104
SUPPLIES			
Local Surface	40	40	42
Imports by local	0	0	0
Colorado river	0	0	0
Ground water	60	63	61
CVP	0	0	0
Surface M & I	0	0	0
Other federal	0	0	0
SWP	0	0	0
Waste water recl	1	1	1
Total Supply	101	104	104
SUPPLMNTL DEMAND			
G W overdraft	0	0	0
Shortage	0	0	0
Total supp dmnd	0	0	0
Indcted reserves			
Total reserves	0	0	0

South Lahontan HSA - Death Valley PSA

DEMANDS	1980	1985	2010
Agriculture	1	1	1
M & I	1	1	1
Wildlife	0	0	0
Recreation	1	1	2
Cooling	0	0	0
HWUI			
Total	3	3	4
Est. Net H2O demd	2	2	3
SUPPLIES			
Local Surface	0	0	0
Imports by local	0	0	0
Colorado river	0	0	0
Ground water	2	2	3
CVP	0	0	0
Surface M & I	0	0	0
Other federal	0	0	0
SWP	0	0	0
Waste water recl	0	0	0
Total Supply	2	2	3
SUPPLMNTL DEMAND			
G W overdraft	0	0	0
Shortage	0	0	0
Total supp dmnd	0	0	0
Indcted reserves			
Total reserves	0	0	0

South Lahontan HSA - Indian Wells PSA

DEMANDS	1980	1985	2010
Agriculture	55	25	24
M & I	10	11	18
Wildlife	0	0	0
Recreation	0	0	1
Cooling	0	0	0
HWUI			
Total	65	36	43
Est. Net H2O demd	52	29	32
SUPPLIES			
Local Surface	0	0	0
Imports by local	0	0	0
Colorado river	0	0	0
Ground water	28	27	28
CVP	0	0	0
Surface M & I	0	0	0
Other federal	0	0	0
SWP	0	0	0
Waste water recl	2	2	2
Total Supply	30	29	30
SUPPLMNTL DEMAND			
G W overdraft	22	0	2
Shortage	0	0	0
Total supp dmnd	22	0	2
Indcted reserves			
Total reserves	0	0	0

South Lahontan HSA - Mojave River PSA

DEMANDS	1980	1985	2010
Agriculture	108	112	110
M & I	32	48	85
Wildlife	0	0	0
Recreation	1	6	8
Cooling	2	4	26
HWUI			
Total	143	170	229
Est. Net H2O demd	96	141	190
SUPPLIES			
Local Surface	0	0	0
Imports by local	0	0	0
Colorado river	0	0	0
Ground water	30	30	30
CVP	0	0	0
Surface M & I	0	0	0
Other federal	0	0	0
SWP	7	1	51
Waste water recl	2	3	5
Total Supply	39	34	86
SUPPLMNTL DEMAND			
G W overdraft	57	107	93
Shortage	0	0	11
Total supp dmnd	57	107	104
Indcted reserves			

South Lahontan HSA - Antelope Valley PSA

DEMANDS	1980	1985	2010
Agriculture	205	115	64
M & I	40	47	104
Wildlife	0	0	0
Recreation	1	5	7
Cooling	0	0	0
HWUI			
Total	246	167	175
Est. Net H2O demd	168	152	145
SUPPLIES			
Local Surface	4	4	4
Imports by local	0	0	0
Colorado river	0	0	0
Ground water	58	58	47
CVP	0	0	0
Surface M & I	0	0	0
Other federal	0	0	0
SWP	78	41	87
Waste water recl	4	4	7
Total Supply	144	107	145
SUPPLMNTL DEMAND			
G W overdraft	24	45	0
Shortage	0	0	0
Total supp dmnd	24	45	0
Indcted reserves			

Colorado River HSA - Coachella PSA

DEMANDS	1980	1985	2010
Agriculture	375	384	335
M & I	156	188	315
Wildlife	0	0	0
Recreation	1	1	1
Cooling	0	0	0
HWUI			
Total	532	573	651
Est. Net H2O demd	622	541	584
SUPPLIES			
Local Surface	4	4	4
Colorado River	492	421	415
Ground water	33	33	33
CVP	0	0	0
Surface M & I	0	0	0
Other federal	0	0	0
SWP	30	47	62
Waste water recl	2	2	20
Total Supply	561	507	534
SUPPLMNTL DEMAND			
G W overdraft	61	34	42
Shortage	0	0	8
Total supp dmnd	61	34	50
Indcted reserves			
Total reserves	0	0	0

Colorado River HSA - Borrego PSA

DEMANDS	1980	1985	2010
Agriculture	48	44	40
M & I	1	2	2
Wildlife	0	0	0
Recreation	0	0	0
Cooling	0	0	0
HWUI			
Total	49	46	42
Est. Net H2O demd	49	45	41
SUPPLIES			
Local Surface	0	0	0
Colorado River	40	40	40
Ground water	7	2	1
CVP	0	0	0
Surface M & I	0	0	0
Other federal	0	0	0
SWP	0	0	0
Waste water recl	0	0	0
Total Supply	47	42	41
SUPPLMNTL DEMAND			
G W overdraft	2	3	0
Shortage	0	0	0
Total supp dmnd	2	3	0
Indcted reserves			
Total reserves	0	0	0

Colorado River HSA - 29 Palms Lanfair PSA

DEMANDS	1980	1985	2010
Agriculture	13	31	35
M & I	13	15	25
Wildlife	0	0	0
Recreation	0	1	1
Cooling	0	0	0
HWUI			
Total	26	47	61
Est. Net H2O demd	20	39	48
SUPPLIES			
Local Surface	0	0	0
Imports by local	0	0	0
Colorado river	0	0	0
Ground water	18	25	25
CVP	0	0	0
Surface M & I	0	0	0
Other federal	0	0	0
SWP	0	0	0
Waste water recl	1	1	1
Total Supply	19	26	26
SUPPLMNTL DEMAND			
G W overdraft	1	13	22
Shortage	0	0	0
Total supp dmnd	1	13	22
Indcted reserves			
Total reserves	0	0	0

Colorado River HSA - Imperial Valley PSA

DEMANDS	1980	1985	2010
Agriculture	2473	2549	2191
M & I	27	32	49
Wildlife	17	17	17
Recreation	0	0	0
Cooling	3	0	0
HWUI			
Total	2520	2598	2257
Est. Net H2O demd	2860	2860	2448
SUPPLIES			
Local Surface	0	0	0
Colorado River	2860	2860	2408
Ground water	0	0	0
CVP	0	0	0
Surface M & I	0	0	0
Other federal	0	0	0
SWP	0	0	0
Waste water recl	0	0	40
Total Supply	2860	2860	2448
SUPPLMNTL DEMAND			
G W overdraft	0	0	0
Shortage	0	0	0
Total supp dmnd	0	0	0
Indcted reserves			
Total reserves	0	0	200

Colorado River HSA - Colorado River PSA

DEMANDS	1980	1985	2010
Agriculture	675	650	676
M & I	11	12	18
Wildlife	0	0	0
Recreation	2	3	4
Cooling	0	0	0
HWUI			
Total	688	665	698
Est. Net H2O demd	550	539	576
SUPPLIES			
Local Surface	0	0	0
Colorado River	540	529	566
Ground water	10	10	10
CVP	0	0	0
Surface M & I	0	0	0
Other federal	0	0	0
SWP	0	0	0
Waste water recl	0	0	0
Total Supply	550	539	576
SUPPLMNTL DEMAND			
G W overdraft	0	0	0
Shortage	0	0	0
Total supp dmnd	0	0	0
Indcted reserves			
Total reserves	0	0	0

STATE WATER PROJECT ALLOCATION OF 2010 SUPPLIES

AGENCY	REQUEST	PRO RATA	REGION	REGION PRO RATA	REGION SHORTAGE
Oak Flat WD	5,700	5,086	San Joaquin	5,086	614
Empire West Side ID	3,000	2,677	Tulare	1,203,918	145,382
Tulare Lake Basin WSD	118,500	105,732			
Dudley Ridge WD	57,700	51,483			
Kern County WA	1,153,400	1,029,126			
Devil's Den WD	12,700	11,332			
County of Kings	4,000	3,569			
Coachella Valley WD	23,100	20,611	Colorado R	62,324	7,526
Desert WA	38,100	33,995			
Littlerock Creek ID	0	0	S Lahontan	138,199	16,688
Crestline Lake Arrowhead WA	4,287	3,825			
Antelope Valley-East Kern WA	82,500	73,611			
Mojave WA	50,800	45,326			
Palmdale WD	17,300	15,436			
San Bernadino Valley MWD	66,000	58,889	S Coast	1,506,169	181,881
San Gabriel Valley MWD	16,400	14,633			
San Gorgonio Pass WA *	17,300	15,436			
Ventura County FCD	20,000	17,845			
Castaic Lake WA	41,500	37,029			
Metropolitan WD	1,535,500	1,370,056			
Santa Barbara County FC&WCD	45,486	40,585	C Coast	62,891	7,595
San Luis Obispo County FC&WCD	25,000	22,306			
Alameda County FC&WCD	46,000	41,044	San Francisco	221,413	26,737
Alameda County WD	42,000	37,475			
Santa Clara Valley WD	100,000	89,225			
Solano County FC&WCD	41,750	37,252			
Napa County FC&WCD	18,400	16,417			
TOTALS	3,586,423	3,200,000	**	3,200,000	386,423

* San Gorgonio split 50/50 between South Coast and Colorado River Regions
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PART IV

ADDITIONAL

WATER MANAGEMENT ISSUES

CVP WATER MARKETING

The Bureau program to sell additional water from the Central Valley Project has sparked protests from environmental organizations concerned about impacts of new transfers on fish and wildlife. The Coordinated Operation Agreement between the USBR and the DWR had paved the way for such marketing, but now the Bureau is preparing environmental impact statements to analyze the impacts from resumption of contracting in each of the major river basins of the Central Valley. The Bureau estimates one million acre-feet of water is available, although requests for four million acre-feet have been received. The Bureau has released its analysis of the areas which need water. This analysis provides information for the environmental impact statements which will be written for the Sacramento River area, American River area, and Delta export areas. The draft environmental impact statements are scheduled for completion in September 1988 and for finalization in December 1988.

SACRAMENTO RIVER FISHERY

The salmon and steelhead fishery in the upper Sacramento River has been greatly depleted since the 1940's, largely attributed to the construction of Shasta Dam, Keswick Dam, and the Red Bluff Diversion Dam. SB 1086 (Nielsen), enacted by the 1986 legislature, calls for preparation of a Riparian Habitat Inventory and an upper Sacramento River Fisheries and Riparian Habitat Management Plan to be submitted to the legislature by January 1, 1989. The Wildlife Conservation Council was assigned to prepare the inventory, and an Advisory Council and an Action Team were assigned the management plan. The inventory has been completed. The Action Team has identified a list of fishery and riparian habitat problems and potential solutions. Among the problems listed on the main stem are: limited spawning gravels, an outdated Coleman Hatchery, Red Bluff Diversion Dam, Tehama-Colusa Fish Facility, habitat loss from Sacramento River bank protection, and the Glenn-Colusa Irrigation District Diversion Dam. Problems were also listed on tributaries, including Clear, Cow, Battle, Cottonwood, Mill, Deer, and Butte Creeks. The final management plan will describe proposed restoration actions, indicate priorities, and provide

estimated costs, benefits, and potential funding sources. Proposed implementing legislation will be provided if possible.

COLUSA BASIN DRAINAGE

The Colusa Basin, including parts of Glenn, Colusa, and Yolo Counties, is a leading agricultural area as well as one of the most notable waterfowl hunting areas in the State. It has been long plagued with local problems of shallow flooding of large areas from runoff of tributary drainages. Similar problems occur during the late spring due to return flows from irrigation.

The Department studied this problem in the early 1960's and reported on it in Bulletin 109 in 1962. That report recommended that an improved drainage channel and levee system be reevaluated in the future when increased land use and potential flood damages make flood protection justified.

DWR began a new investigation in 1985 to develop a basin plan for drainage and flood control, taking into account seepage, subsidence, and water quality problems. This study is scheduled for completion in 1989. A bill was passed in 1987 which enabled the formation of a basin-wide drainage district. The Department is assisting in the formation of the new district.

BUTTE BASIN PROBLEMS

Among the many water-related problems of the Butte Basin are fish passage and habitat degradation, herbicide contamination, flooding and drainage problems, and water rights problems. The issues are complex because of the large number of diversions and types of uses and the maze-like pattern of water flow in the wetland and irrigated areas. Salmon runs in the watershed have decreased from around 20,000 in 1960 to less than 500 at present. The work being done under SB 1086 toward a Sacramento River Fisheries Management Plan has identified Butte Creek as a watershed with an urgent need for fishery mitigation work. The Department proposes to start a three-year study of the basin in 1989 with emphasis on developing solutions to the identified problems.

FOOTHILL WATER SUPPLIES

The foothill communities on both sides of the Sacramento Valley which do not have ready access to either ground water or dependable surface water supplies have water supply problems during dry periods. The Butte County communities of Paradise, Magalia, Forest Ranch, and Cohasset are particularly notable because of the significant populations involved. Paradise is the largest by far and has managed to meet its water demands to date by staged development of Little Butte Creek with two dams and reservoirs. However, strict rationing was required in 1977 and the first stage of rationing has started in the current drought. The smaller communities rely mainly on individual wells and many citizens resorted to hauling water in 1977. They face the same prospect in the current drought. Across the valley, Stonyford, Elk Creek, and Century Ranch have similar problems.

The Department is studying the ground water in the Butte County foothills. The possibility of finding dependable supplies with deep wells is under study.

CLEAR LAKE FLOODING

The major water resource related problem in the upper Cache Creek Basin is flooding on the Clear Lake rim, caused primarily by inadequate discharge capacity of the Lake's 5-mile-long outlet channel. In 1979 the Corps recommended enlargement of the outlet channel and a one-mile bypass around the highly developed portion. Yolo County interests objected, claiming that this plan could aggravate the flooding and erosion problems downstream in the Capay Valley. The Corps is now studying the Capay problem.

GROUND WATER CONTAMINATION

Several ground water contamination problems exist in the Northern District. In the Chico area, high nitrate levels have been found in the developing area around the city. The Department studied the problem in 1983 and concluded that septic tanks and urban runoff drainage wells are the most widespread sources. It was

recommended that unsewered areas be encouraged to connect to the existing sewerage system as soon as feasible and that all drainage wells be eliminated as soon as possible.

In the Red Bluff area, county officials have long been concerned about high bacterial counts and nitrate levels in the Antelope area just east of Red Bluff. In 1985-87, the Department studied the problem and concluded that it was related to septic tanks and agricultural practices. It was recommended that the minimum depth for surface seals on domestic wells be increased from 20 to 50 feet. It was also recommended that the feasibility of extending the public water and/or sewer system into the Antelope area be determined.

In the Oroville area, the Koppers Company, Inc., and predecessors contaminated the ground water with pentachlorophenol (PCB) and other hazardous compounds from 1948 to 1973. DWR studied the problem for the Regional Board in 1973 to verify the existence of the problem and its approximate extent. The Environmental Protection Agency started a Superfund Investigation in 1986. In the meantime, Koppers has agreed to furnish the residents directly affected with domestic water at Koppers expense. This was first done with bottled water (to 45 households) and is now done by connection with Oroville-Wyandotte Irrigation District water lines.

BIG VALLEY

The Big Valley problems include flooding, inadequate drainage, irrigation supply shortages, wildlife refuge supply shortages, and a depressed economy. The Bureau of Reclamation studied the Allen Camp project for many years as a possible solution but finally concluded that it was not economically justified. Local interests are now urging studies of two smaller projects -- the Ostram Point project and raising Roberts Reservoir. The Department is proposing to start a Big Valley study next year, while the Soil Conservation Service proposes to study raising Roberts Reservoir.

LAKE COUNTY WATER SUPPLY

Growth in Lakeport and other areas around Clear Lake is beginning to reach the limit of inexpensively developable water supplies. The City of Lakeport previously relied on Scott Valley ground water supplies but has now turned to the lake itself and the additional treatment costs involved. County officials are considering ground water management districts for the Scott Valley and Big Valley areas and have sought advice from the Department.

SACRAMENTO RIVER SEEPAGE AND EROSION

The importance of seepage and erosion along the Sacramento River was indicated by numerous letters and phone calls received by legislators, public officials and agencies; critical press coverage; and frequent complaints at public meetings. The State has previously been sued for over $30 million regarding seepage problems, although these suits were eventually dismissed.

The Department is conducting continuing studies of these problems, with long-range objectives of development and implementation of proposals to stabilize erosion and sediment deposition and reduce or eliminate damage due to seepage along the Sacramento River. Any water storage projects north of the Delta could change the flow regime and mitigation could be required. The short-range goal is to evaluate erosion, deposition, and seepage sites to determine the relationship between river stages, erosion, deposition, seepage, and site characteristics.

WATER RIGHTS AND NEVADA

The limited surface water resources in arid northeastern California along the Nevada border have been extensively developed. In many instances, water rights have been adjudicated and watermaster service areas established. Recent development has been and future development will be dependent on limited ground water resources.

Recent growth and increased water demands in Reno and adjacent areas of Washoe County, Nevada, have led to a search for additional water. One of the alternatives

under consideration is the importation of ground water from basins along the California border in northern Washoe County. Where these ground water basins extend across the border, there is fear that ground water extractions in Nevada will induce movement of ground water from California into Nevada.

As Honey Lake, Long Valley, and Surprise Valley ground water basins all have limited water supplies, their residents have been opposing any large scale development and exportation from the Nevada portions of their basins. A ground water management district has been formed in Long Valley, and Lassen County has requested that one be formed for Honey Lake. California and Nevada are jointly supporting a ground water study by the U.S. Geological Survey in Honey Lake Basin to determine what impact would be caused by increased extraction of ground water in the Nevada portion of Honey Lake Basin.

In Surprise Valley, ground water use has resulted in lowering water levels and some wells have dried up. Ground water management may also be required in this basin.

SUSANVILLE FLOODING

Susanville has a long history of flooding from both the Susan River and Piute Creek. The only feasible structural protection measures are bank protection and repair work at various locations. The city is now relying on proper floodplain management to assure safe community development in the future.

SIERRA VALLEY GROUND WATER

Increasing summer water shortages in Sierra Valley and the concern that out-of-state interests would tap the water resources of the valley for export prompted Plumas and Sierra Counties to ask for protective legislation in 1980. SB 1391, the Sierra Basin Ground Water Act, was passed that year. During an overdraft or when significant water quality problems occur, the Sierra Valley Ground Water Management District has the power to use a permit system for ground water management. The Department made an initial ground water study in 1980-83 and has been preparing an

annual update ever since. It is concluded that overdraft has started in the eastern half of the basin.

TRINITY RIVER FISHERY

Since 1965, the Northern District has been actively involved in helping to solve the Trinity River fishery problems occurring since construction of the federal Trinity and Lewiston Dams. The Department was a major participant in constructing fishery restoration projects, planning the Buckhorn Mountain Sediment Control Dam, preparing the management program, and formulating federal legislation authorizing both the sediment control dam and the management program. DWR provided the chairman for the Trinity River Task Force Action Group for approximately 8 years and now chairs the Task Force Technical Coordinating Committee (TCC). Presently, DWR is responsible for constructing sediment control pools on State property around the mouth of Grass Valley Creek. DWR is providing 7-1/2 percent of the 10-year management program funding, which will total around $70 million over its authorized life. The Department will continue to play a major role in this program by funding a portion of it, by constructing restoration projects, and by serving on the TCC.

KLAMATH RIVER FISHERY

The large Klamath River chinook salmon and steelhead trout fisheries have decreased in recent years due to diversions, dam construction, timber harvest activities, and overfishing. Recent fishing closures and restoration work on the Trinity River have resulted in increases which can be augmented with additional restoration work on the Klamath River.

Starting in 1984, the Northern District became active in helping prepare a Klamath River Basin Fisheries resource plan patterned after the Trinity River Management Plan. This plan was authorized by Congress in 1986 and funded at a level of $21 million over 20 years. Funding is to be provided equally by the Federal and State governments. A Klamath River Basin Fisheries Task Force was established by the implementing legislation, HR 4712. Although the Department is not a designated member of this task force, we expect to participate in an advisory capacity on

various restoration projects. We may also perform some planning and construction work as we are presently doing on the Trinity River. Initial funding for this program has not yet been appropriated, but is expected to become available next fiscal year.

SMITH RIVER GROUND WATER

In 1983, the Regional Water Quality Control Board found pesticide residues from the lily bulb industry in the ground water near the town of Smith river. In 1986, the Board provided the Department with funds to study the geohydrology of the area. The Department reported to the Board in February of this year on the geologic and hydrologic conditions that influence the occurrence, movement, and recharge of ground water in the area. The Board will use this report to help model contaminant movement and predict the rate of aquifer recovery.

HUMBOLDT BAY WATER SUPPLIES

Humboldt Bay Municipal Water District (HBMWD) is the largest water supplier in the North Coast area and supplies an average of 75 million gallons per day in the Humboldt Bay area, including Eureka, Arcata, McKinleyville, and the Louisiana Pacific and Simpson lumber mills. All of HBMWD's yield from Ruth Reservoir on the Mad River is contracted for, and no additional firm supply is available to meet future demands or allow for mitigation measures in periods of drought. HBMWD has been considering enlarging Ruth Reservoir for about 10 years. In the meantime, during drought periods all users (and particularly the lumber mills) are requested to conserve water. The mill deliveries had to be cut back somewhat in 1977.

EEL RIVER FLOODING

The Eel River has a long history of flood problems. The tremendous flood of 1964 caused widespread damage and loss of lives. The Corps of Engineers has studied this problem for many years without finding a feasible solution other than the Sandy Prairie levee which now protects Fortuna. In 1968, the Corps recommended inclusion of flood control storage reservation in both Dos Rios and English Ridge Reservoirs in combination with delta levees, but these reservoirs will not be built in the foreseeable future. Local officials are now relying on an advance warning system for existing development and floodplain management to control future development. The Department plays a key role in both the warning system and in floodplain management.

NORTH COAST WATER SUPPLIES

Although water supply problems are not common in the north coast area, they do occur in various areas, largely because of a limited economic base to support development costs. The most acute problem in Siskiyou county is Hornbrook, where in 1977 most people had to either haul water or share well water with those who still had operable wells. Hayfork, Trinity County, is served mainly from Ewing Reservoir and diversion from Big Creek. However, the local district has barely escaped shortage twice because of low reservoir levels. In the long range, they will have to raise Ewing Dam and increase the diversion capacity. Trinidad, Humboldt County, relies on Luffenholz Creek and had to ration water in 1977. The community has had a moratorium on new hookups for several years because of inadequate supplies.

The City of Willits has had a problem with turbidity, taste, and odor in its Morris Reservoir supply and high arsenic, iron, and manganese levels in its well supply. The Department completed studies of these problems last year. In the short range, the city was advised to experiment with mixing these supplies to reduce the problem of each. In the longer range, the City should study the feasibility of a well field in Little Lake Valley. Also, watershed management measures should be taken in the reservoir's watershed and changes made in the reservoir treatment methods.

RUSSIAN RIVER

With the availability of water from Warm Springs Dam (Lake Sonoma) and the State Water Resources Control Board Decision 1610 defining the instream requirements and operating criteria, the major water supply problems in the Russian River system have been solved beyond 2010. However, there is a growing concern over the extent of the sedimentation occurring in Lake Pillsbury on the Eel River and Lake Mendocino on the Russian River. Indications are that these lakes are filling with sediment at a greater rate than anticipated. The operating criteria developed for the Russian River system is based on the storages of Lake Mendocino and Lake Pillsbury and a reduction in storage capacity will effect the water supply in dry or critical years. A task force has been formed by the Eel-Russian River Commission to determine the source of the sediment and what can be done to reduce the problem.

Also, Mendocino County has expressed concern over the recent Decision 1610. They are concerned that the County will be prevented from acquiring additional water supply. Mendocino County has filed an appeal with the Board requesting changes in the amount of water allocated to Mendocino County.

Over the next two or three decades, water agencies will need to learn more about ground water availability in order to conjunctively use this water with their surface water and extend their water supplies to meet future demands.

YOLO-SOLANO COUNTIES

Completion of Indian Valley Dam and Reservoir on North Fork Cache Creek has virtually eliminated ground water overdraft in Yolo County, except in local areas, such as the Yolo-Zamora area, where Indian Valley water is not available. Both Yolo and Solano Counties will need additional water after 2000. The proposed West Sacramento Canal Unit of the CVP is the most likely source of supplemental water supplies for the area.

NORTH BAY

With Phase II of the North Bay Aqueduct (NBA) now in operation, the total water supply of the North Bay area should be more than adequate to meet projected needs beyond 2010. A problem of water supply distribution would have existed in Napa County; however, through an exchange with the City of Napa for NBA water, the cities of Calistoga and Yountville will receive other water developed by Napa and the problem will be alleviated.

SOUTH BAY

In the late 1970's DWR conducted planning studies to determine when supplemental water is needed in this area and to evaluate the potential for increasing the effectiveness of existing and future supplies through pooling or exchanges by interconnections of delivery systems and adjustments of service areas.

Although the South Bay may have sufficient water supplies on a regional basis beyond 2010, certain areas have been identified that will have supplemental water needs in excess of current reserve supplies. However, if local water agencies cooperate in improvement of the areawide delivery systems, these supplemental needs could probably be met, and new water supply projects would not be required until after 2010.

Alameda County Water District (ACWD) will have supplemental water needs in excess of current reserve supplies, beginning about 2000, but is presently analyzing alternative sources of water supplies.

To improve the quality of its water supply and to improve the reliability of its supply in the event of supply disruptions, the Contra Costa Water District is considering the construction of a reservoir on Kellogg Creek (Los Vaqueros).

The East Bay Municipal Utility District (EBMUD) has a contract with the Bureau for delivery of up to 150,000 acre-feet of water annually from the American River via the Folsom South Canal. The diversion of this water is under litigation. The

complainants, Environmental Defense Fund, Save the American River Association, and the County of Sacramento, et al., contend that greater beneficial uses could be made of water in the lower American River if EBMUD would divert the water below the confluence of the American and Sacramento Rivers EBMUD maintains it has a right and responsibility to meet its water supply need with the best quality water available.

With completion of the San Felipe Division of the CVP, water management problems - especially ground water overdraft and land subsidence in Santa Clara County - should be alleviated. However, in the northern area of the county, leaking underground storage tanks have contaminated some wells. Studies to determine the extent of contamination and decontamination operations are being performed.

The San Francisco Water Department (SFWD) water demand projections indicate that water supplemental to that presently being provided by the Hetch Hetchy Aqueduct will be required in the late 1990s, while the Department's projections indicate that present supplies will be adequate to past 2010. SFWD is initiating a two-year resource plan study to analyze water needs and water management alternatives. Phase I of the study will include an analysis of various models for projecting future water needs.

FOLSOM SOUTH CANAL SERVICE AREA

The Folsom South Canal service area of the CVP, which includes portions of Sacramento and San Joaquin counties in the Sacramento and San Joaquin HSA's, is one of the areas experiencing ground water overdraft. The problem is most evident near the City of Stockton, an area that presently depends on ground water as a major supply for irrigated agriculture and urban development. Water agencies are planning to eliminate ground water overdraft by importing surface water for conjunctive use with ground water. The alternative looked to first for additional surface water was the Auburn-Folsom South Unit and completion of the Folsom South Canal.

With the controversy and uncertainty involved in the construction of Auburn Dam and completion of the Folsom South Canal, both Stockton East Water District and Central San Joaquin Water Conservation District, two water agencies in the service area,

have signed contracts with the USBR for water from New Melones Reservoir on the Stanislaus River. Stockton East WD has contracted for 75,000 acre-feet of annual interim supply and Central has contracted for 49,000 acre-feet of firm and 31,000 acre-feet of interim water. Both districts are in the process of applying for PL984 loans to construct conveyance and storage facilities for diversion of the New Melones water. This water would be used to overcome the ground water overdraft that both agencies experience.

The two water agencies have also contacted DWR with a proposal of releasing their contracted New Melones water to the Delta in dry and critical years for pumping by the SWP, in exchange for financing of their diversion, storage, and conveyance facilities. A memorandum of understanding is about to be signed (involving approximately 20 agencies) for the Bureau and DWR to do a joint study on the proposal.

WILDLIFE REFUGES

Waterfowl migrating through or wintering in California comprise over 60 percent of the Pacific flyway population and 18 percent of the entire continental wintering waterfowl population. The National Wildlife Refuges and State Wildlife management Areas in the Central Valley provide approximately one-third of the California critical wetland habitat for waterfowl.

These wildlife areas have relied on surplus water, ground water, and agricultural return water to meet their needs. As demands for fresh water for other purposes have increased in California, the quantity and quality of water available for wildlife areas have been diminishing, especially during below normal rainfall years. The wildlife areas are in need of firm water supplies.

The Bureau recently initiated a two-year study to investigate alternative sources of water supply for the ten Central Valley National Wildlife Refuges, four Central Valley State Wildlife Management Areas, and lands served by Grasslands Water District. Estimated water requirements for these areas at full development are over 500,000 acre-feet while existing water supplies are estimated to be only about

100,000 acre-feet. DWR is a participating agency in the study along with the U.S. Fish and Wildlife Service, the State Department of Fish and Game, and the California Waterfowl Association.

SAN JOAQUIN DISTRICT

KESTERSON RESERVOIR

In 1983 and again in 1984, the discovery of a higher than normal incidence of death and deformity in waterfowl at Kesterson National Wildlife Refuge in western Merced County focused attention on the agricultural drainage problem in the western San Joaquin Valley. The waterfowl problems were caused by selenium, an element transported into the refuge by agricultural drainage water used to create the wildlife habitat. Selenium concentrations are known to increase as a result of evaporation and bioaccumulation.

Drainage water flowing into Kesterson Refuge originates on farms where underground water levels encroach into crop root zones. The crop roots intake the water but leave much of the salts in the soil, resulting in salt accumulation, which, if left unchecked, can eventually render soil useless for agricultural purposes. Underground drain pipes are commonly used to remove salt-laden agricultural drainage water. Selenium, found naturally in the soil, is dissolved in the drainage water which is pumped into canals and exported from the area to Kesterson or the San Joaquin River.

In 1960, Federal legislation not only provided for the importing of water into the San Joaquin Valley but also for the exporting of agricultural drainage water. In 1968, construction began on the San Luis Drain, designed to export agricultural drainage water. Due to a lack of funds, drain construction ended at Kesterson Reservoir in 1975. The reservoir was subsequently operated as a wildlife refuge.

The discovery of dead and deformed waterfowl at the refuge, which lies within the Pacific Flyway (a corridor for migratory birds, extending from Canada to Mexico, a portion of which includes Central California), led the Secretary of the Interior to

order a halt to the inflow of agricultural drainage water into Kesterson. The Secretary issued the order to comply with the International Migratory Bird Treaty Act.

On July 5, 1988, the Water Resources Control Board approved a cleanup plan consisting of filling in 590 acres of ephemeral pools in order to eliminate wetland habitat. A contract for $3.4 million has been awarded to Dutra Construction to move 740,000 cubic yards of material by January 1, 1989. The Bureau will continue to monitor the site after construction is completed.

GRASSLAND WATER DISTRICT

One agency significantly affected by the Kesterson Reservoir waterfowl issue was Grassland Water District, which distributes water to its 52,000 acres to support waterfowl habitat. One portion of the District lies southeast of Los Banos; another lies between Los Banos and Kesterson National Wildlife Refuge.

The District has an annual entitlement of 53,500 acre-feet of Bureau water, delivered through the Delta-Mendota Canal. It is estimated that, in addition to this Bureau water, 90,000 acre-feet of drainage water passed through the District annually, some of which was used to supplement the federal water supplies.

As the Kesterson issue expanded, the District incurred unanticipated expenses for legal representation, increased liability insurance, and selenium-control studies. Consequently, the District found it necessary to increase standby water charges from $3 an acre to $5 an acre in 1986.

An estimated 150,000 acre-feet of water is needed annually to provide waterfowl habitat and grow waterfowl feed on a year-round basis. Therefore, the District is attempting to secure an additional, reliable, long-term annual water supply of 100,000 acre-feet.

AGRICULTURAL DRAINAGE RESEARCH CENTER

The DWR Los Banos demonstration Desalting Facility ceased operations in December 1986 except for solar pond activities which will continue until 1989. Desalting demonstration activities, primarily pretreatment research, is planned to continue at a new test site near Mendota which will be established in cooperation with Westlands Water District. The new facility is expected to be operational in late 1988 or early 1989. the purpose of the new facility (much smaller than Los Banos) is to complete the demonstration and development work begun at Los Banos.

In late 1986, Westlands Water District, which had been sponsoring small scale selenium removal research, made the decision to construct a 1-mgd prototype anaerobic biological selenium removal plant and a 1-mgd deep well injection disposal system to determine the technical and economic feasibility of disposal methods. Due to performance difficulties and cost uncertainties only the deep well injection program will actually be constructed. Westlands Water District has purchased a 300+ acre site south of Mendota for this demonstration. The appropriate permits have been received and design is under way.

The Treatment and Disposal Subcommittee of the San Joaquin Valley Drainage Program (SJVDP) a cooperative federal and state investigation of agricultural drainage problems, has proposed a test program to continue the development of the anaerobic biological selenium removal process which Westlands Water District originally considered constructing at its Mendota test site. The SJVDP will be a small scale test program with the objective of improving the process and demonstrating its ability to meet the original objective of reducing selenium concentrations in the effluent so it can be safely disposed of in evaporation ponds.

In addition to these activities there are efforts being made by a group of agencies to establish an agricultural drainage research center upon the Westlands site. This center, to be sponsored by local, state, and federal agencies, will conduct (if approved) a wide range of investigations on evaporation ponds, selenium removal

techniques, and other drainage related issues. Conceptual approval by the various agencies has been given. Negotiations on funding and organization are under way. The DWR desalination, WWD deep well injection, and proposed anaerobic biological selenium removal studies described above would form the nucleus for the center.

PANOCHE-SILVER CREEK FLOODING

The Panoche-Silver Creek watershed is located west of the City of Mendota in western Fresno County and extends into eastern San Benito County. The principal stream is Panoche Creek; Silver Creek is the only major tributary. The only urban area within the watershed is the City of Mendota with a population of approximately 4,200.

Substantial flood damage occurred from runoff of the Panoche-Silver Creek watershed in 1958 ($460,000 in damages), in 1969 ($1.8 million in damages), and in 1975 (90,000 in damages). Extensive flood fighting during these floods and during more recent floods has prevented greater damages to agricultural lands.

According to Fresno County representatives, flood discharges during earlier years were allowed to flow over agricultural lands for periods of time with the beneficial effect of raising lands with silt deposits. As these upstream lands reached a desired height, more flood flows were diverted to downstream areas.

Prior to 1973, the City of Mendota suffered relatively minor damages; however, levee construction and other flood-fighting methods to prevent agricultural damage apparently diverted floodwaters along Belmont Avenue and through the City. This resulted in legal action by the City against the farmers. The courts ruled in favor of the City, and the levees along Belmont Avenue were removed. However, there is now concern that the potential for flooding has reappeared.

A watershed investigation report by the U.S. Soil Conservation Service, dated April 1976, formulated several plans to resolve the problem. Other alternatives have been identified for consideration by local interests. The selection of a solution has

been hampered by legal and economic considerations. The problem could be further complicated by the discovery that Silver Creek flood flows are high in selenium concentrations.

LOWER SAN JOAQUIN RIVER WATER QUALITY

Water quality problems have been noticed in the lower stretches of the San Joaquin River for several decades and were first studied by DWR in its Bulletin 89, "Lower San Joaquin Valley Water Quality Investigation", dated December 1960. The fundamental source of this problem is the widespread development of irrigated agriculture throughout the San Joaquin drainage basin. This development has resulted in the diversion of the majority of the natural streamflow of the San Joaquin river and its tributaries during the irrigation seasons. Under current conditions, river flow in the lower reaches during the irrigation season is maintained only through irrigation return flows and ground water accretions. The water quality of much of these irrigation return flows and ground water accretions is poor, especially return flows derived from the west side of the San Joaquin Valley.

In recognition of water quality problems in the lower San Joaquin river, and the potential environmental impacts of selenium, the Central Valley Regional Water Quality Control Board recently conducted an investigation of the lower San Joaquin River in coordination with the State Water Resources Control Board. This investigation resulted in a May 1987 report, "Regulation of Agricultural Drainage to the San Joaquin River", that reviewed the nature and source of water quality problems in the river. This report also examined the scientific basis for various concentration standards for selenium and other elements. The report concluded that the primary source of selenium and salinity in the San Joaquin River is agricultural return flows from the west side of the Valley. In response to this report, the Regional Board has enacted standards for the San Joaquin River and directed west side agricultural users to improve their irrigation practices and thereby reduce the quantity of their drainage flows into the San Joaquin River.

CALIENTE CREEK

Caliente Creek, located in the extreme southeast corner of the San Joaquin Valley in Kern County, carries rainfall runoff from the Tehachipi mountains. Flood control problems on this unregulated stream were highlighted in the 1982-83 winter floods. These floods had the highest peak flow in Caliente Creek since 1932 and caused considerable flood damage. From where Caliente Creek enters the San Joaquin Valley southeast of Bakersfield, the creek separated into two channels, inundating portions of the towns of Lamont and Arvin and flooding several square miles of farmland. In the 1982-83 flooding, several county roads and railroads were washed away, Arvin-Edison Water storage District canals were damaged, and total Caliente Creek flooding damages were estimated to exceed $40 million.

Since the 1982-83 flooding, local efforts to achieve flood control protection have been accelerated. Kern County Water Agency has been the lead local agency in this effort, coordinating planning studies through the efforts of the Caliente Creek Flood Control Task Force. The Agency provided local cost sharing to fund a Caliente Creek Creek flood control feasibility report that was prepared by the U.S. Corps of Engineers. The Corps' draft report, released in July 1987, indicated a beneficial benefit-cost ratio for construction of the selected alternative - a 16,000 acre-foot dam costing a total of $58.7 million. Federal funds for preliminary project design are included in the President's 1988-89 fiscal year budget, and the Corps is enthusiastically supporting the Caliente Creek flood control project as a cost sharing example

TRANSFER OF STATE WATER PROJECT ENTITLEMENT

Reductions in crop prices have combined with escalating power costs in the last few years to make irrigation unprofitable in some areas of the San Joaquin Valley. Portions of the State Water Project service areas in Kern County have been especially affected. The cost of energy, when combined with the high cost of SWP supplies and the debt obligation incurred by improvement districts in constructing pipeline distribution systems, has caused some farmers to default on their water district bills.

As a result of these high water costs, two Kern County Water Agency member units - Wheeler Ridge-Maricopa Water Storage District and Berrenda Mesa Water District - have requested a reduction in their entitlement amounts. the reduction in their entitlement, amounting to about 90,000 acre-feet for both districts combined, would be sold to other SWP contractors. The two involved districts would like to sell their entitlement to Southern California municipal and industrial SWP contractors for a price that would pay off indebtedness incurred by farmers in constructing pressure pipeline delivery systems that are now too expensive to use. Because the two districts are member units of Kern County Water Agency, they must obtain approval for the entitlement sale from the Agency. Kern County Water Agency, recognizing the long-term overdraft conditions in Kern County, has a policy of reassigning unused entitlement within Kern County. Because of uncertainty over possible sale of excess entitlement, the status of this entitlement reduction has not been resolved.

KINGS RIVER CONSERVATION DISTRICT

In 1986, Kings River Conservation District put out to bid the Dinkey Creek Dam and hydroelectric project. Dinkey Creek is a tributary to the north fork of the Kings River in eastern Fresno County. The low bid for the construction of the dam and reservoir was $57 million, and the low bid for the tunnels and powerplants was reported at $101 million. The question of the need for additional environmental studies arose due to design changes. This question delayed the awarding of construction contracts. The design changes included the relocation of the powerplant, elimination or modification of access roads, and realignment of the diversion tunnels. Under the proposed operation of the hydroelectric plant, Pacific Gas and Electric Company (PGandE) would have purchased the energy produced. Prior to committing to purchase the power, PGandE sought assurance from the California Public Utilities Commission that PGandE would be allowed to sell the power produced by the project at rates sufficient to cover costs. PGandE received no assurance, and subsequent drops in oil costs have essentially postponed the Dinkey Creek project.

In 1986, Kings River Conservation District continued studies for a damsite at Rodgers Crossing. Rodgers Crossing is on the main stem of the Kings River just upstream from the existing Pine Flat Reservoir. Subsequently, Congressman Richard Lehman proposed that areas along the Kings River, including Rodgers Crossing, be included in the National Wild and Scenic River System. Such status would prevent development in these areas. Currently, the plans to pursue the Rodgers Crossing project have been postponed. However, Congress has appropriated funds which will be used by the U. S. Army Corps of Engineers to perform a reconnaissance-level study concerning the raising of Pine Flat dam.

ARROYO PASAJERO

Since 1980, DWR has been studying a serious problem threatening the California Aqueduct in the vicinity of its intersection with a natural drainage channel called Arroyo Pasajero near Huron in western Fresno County. The aqueduct, completed in 1967, formed a barrier to water and sediment flowing from the arroyo. By design, this runoff from the arroyo was retained in a ponding basin and periodically discharged into the aqueduct. Presently, this basin is more than half filled with sediment, a condition which has significantly reduced its storage capacity. As a consequence, floodwaters from even minor storms raise the basin's water level to a point where the aqueduct is threatened by overtopping and failure.

After a 1980 investigation determined that arroyo runoff was also raising asbestos levels in aqueduct water, concerns were voiced over possible health risks associated with consuming water containing high levels of asbestos. Responding to these concerns, the Department began investigating methods of managing arroyo runoff without discharging it into the aqueduct. These investigations are continuing.

TULARE BASIN WHITE BASS

In the early 1960's the DFG studied the prospect of introducing non-native species of fish into California waters for recreational fishing purposes. Between 1964 and 1968 several attempts were made to establish white bass in Lake Nacimiento in northwestern San Luis Obispo County, and in 1970 fishermen caught some of the first adult white bass.

The white bass is an aggressive feeder which consumes young fry as part of its diet. This aggressive nature, although pleasing to fishermen, was a concern to DFG. The possibility existed of adversely affecting the striped bass and salmon fisheries if the white bass became established in the Sacramento-San Joaquin Delta. For this reason the white bass were placed in Lake Nacimiento, the waters of which flow into the Salinas River, then out to Monterey Bay.

Then in 1977 a biologist for DFG confirmed that white bass were present in Lake Kaweah, Tulare County, northeast of Visalia. It is presumed that someone unlawfully moved white bass from Lake Nacimiento to Lake Kaweah. Efforts to control the white bass in Lake Kaweah were under way when heavy rainfall in the winter of 1982-83 caused water to flood over the spillway at Lake Kaweah. Along with the floodwaters came the white bass, who flourished in the lake created by the flooding.

Since the flooding prevented planting and production on the inundated lands, the agricultural interests devised a plan to pump the floodwaters out of Tulare Lake to resume agricultural production. The plan called for the construction of several pumping plants which would cause the water to flow northward in the South Fork Kings River into the North Fork Kings River, then into the San Joaquin River.

This plan made it possible for white bass to eventually migrate to the Delta if left unchecked. DFG therefore required a fish screen at a point where the floodwaters would enter the river channel and began a monitoring program downstream of the fish

screen. The monitoring process discovered several white bass downstream of the fish screen, and the pumping was halted in October 1983.

DFG immediately began a chemical spraying program on the South Fork Kings River in order to kill any other undetected white bass. Pumping resumed until January 1984, when biologists discovered the white bass were spawning early, and fears arose that fertilized eggs might be transported into the Kings River during pumping. In October 1984 DFG erected numerous fish barriers in the channels, canals, and waterways in Kings and Tulare Counties in an attempt to limit the movement of white bass.

Between 1985 and 1987 DFG prepared an environmental impact report outlining a plan to control and eradicate white bass. The white bass control plan began in September 1987, while the water level of Lake Kaweah was low. DFG employees began electro-fishing and netting fish in the lake. In October 1987 the spraying of Lake Kaweah began. In the subsequent weeks Lake Bravo near Woodlake, various ponds, and nearly 200 miles of canals and sloughs were sprayed with a chemical containing rotenone. DFG originally estimated that it would require two to six weeks before the remaining traces of rotenone would deteriorate and the water would be safe for fish. DFG began enhancing Lake Kaweah for fish habitation by placing trees in and around the lake and placing pipes and barrels in the lake as fish spawning shelters.

DFG also started a water monitoring program to test wells for any trace of the chemicals used in the program. In early 1988 DFG began planting catchable trout, Florida bass, spotted bass, bluegills, channel catfish, and black crappie. It is estimated that the lake will be a fine fishing area within two years with the elimination of the trash fish.

MADERA AND FRIANT-KERN CANALS

Recently, to reduce its operating expenses, the Bureau entered into agreements with three water agencies for the operation and maintenance of Madera and Friant-Kern

Canals. Madera Irrigation District and Chowchilla Water District agreed to operate and maintain the Madera Canal, which transports water from Friant Dam (Millerton Lake) across Madera County toward Merced County. The districts assumed these duties on October 1, 1985

On October 1, 1986, a new agency, the Friant Water Users Authority (FWUA), accepted the duties of operating and maintaining the Friant-Kern Canal, which transports water from Friant Dam along the east side of the San Joaquin Valley to the Kern River in Kern County. Not all federal water contractors who obtain water from the Friant-Kern Canal have chosen to participate in the FWUA, but each who has is represented by a member on the FWUA's Board of Directors.

Water contracts held by federal water contractors along the Madera Canal will be renewed by 1992; contracts held by federal contractors along the Friant-Kern Canal will be renewed by 1995. Of concern to all these contractors are the effects of the Coordinated Operations Agreement and the Delta water rights hearing being conducted by the State Water Resources Control Board. With water contract renewals pending, federal contractors foresee a possibility that their water rights and contracts may be adversely affected.

PAJARO VALLEY WATER MANAGEMENT AGENCY

A general election in November 1984 resulted in approval of the creation of the Pajaro Valley Water Management Agency (PVWMA). The purpose of PVWMA is to manage existing water supplies and secure future supplies where necessary in order to reduce long-term overdraft and provide water for future needs within its jurisdictional boundaries which surround the City of Watsonville.

In 1986, PVWMA initiated its Phase I studies, the purpose of which was to review as much data as possible in order to reach a conclusion about existing water conditions. This study and subsequent review concluded that ground water overdraft and seawater intrusion are in existence and that pumpage exceeds that which was

previously reported. PVWMA has subsequently initiated further studies and has implemented a well monitoring program in order to formulate a water management plan.

In late 1987, PVWMA voted to send a letter of intent to the U. S. Bureau of Reclamation to contract for deliveries of water from the San Felipe Project. Although the letter of intent does not bind PVWMA to contract with the Bureau of Reclamation, the notification of intent makes possible the initiation of feasibility and environmental studies and discussion of contract provisions.

MONTEREY PENINSULA AND BAY AREA

In the Monterey Peninsula area, below average rainfall in the winter of 1987-88 following a previous winter of below-average rainfall, brought remembrance of the dry years a decade earlier in 1976 and 1977. Although water quality is constantly under consideration, water quantity concerns were again brought to the attention of the public as California American Water Company (Cal-Am) began distributing water conservation kits to its customers. Cal-Am provides and delivers water to the Monterey Peninsula. Cal-Am obtains a portion of its water supply from the Carmel River at San Clemente Dam. Carmel River is regulated by San Clemente Dam, built in 1921, and further upstream by the dam at Los Padres Reservoir, which was built in 1949. When originally built, the capacity of the reservoirs behind San Clemente and Los Padres Dams were approximately 2,150 and 3,200 acre-feet, respectively. Sedimentation has subsequently reduced the combined storage capacity of the reservoirs to less than 3,000 acre-feet.

Following the dry years of 1976 and 1977, the California Legislature created the Monterey Peninsula Water Management District (MPWMD). The purpose of MPWMD was to develop a plan to meet Monterey Peninsula's water needs as well as enhance the natural resources of the Carmel River. Approximately 95 percent of the water customers within the jurisdiction of MPWMD are served by Cal-Am.

In the early 1980's, MPWMD became the lead agency in the effort to determine the feasible alternatives which would meet the needs of the Monterey Peninsula and Carmel Valley. After evaluating numerous alternatives, MPWMD released a draft environmental impact statement/environmental impact report (EIS/EIR) in late 1987 entitled "New San Clemente Project". The report addressed factors concerning a new dam downstream from the existing San Clemente Dam site which would be conjunctively operated to enhance fisheries and provide ground water recharge in downstream areas so that additional ground water would be available where pumping is taking place. Discussed in the report are dam sizes varying from 16,000 to 29,000 acre-feet as well as the no-project alternative. The Environmental Protection Agency (EPA) has issued an opinion that the EIS/EIR is inadequate. MPWMD is working with EPA to resolve the conflict.

Along Monterey Bay where the Salinas River enters the bay, sea water intrusion continues to be a problem. Due to ground water pumping and less-than-adequate ground water recharge, sea water migrates inland through the aquifers. The Monterey County Flood Control and Water Conservation District is conducting several activities in order to devise a workable plan for the varied uses of water and the needs of the area. A ground water model is being used to analyze various plans to hold back sea water intrusion. In an effort to form a ground water management and protection strategy, conjunctive use studies are being conducted concerning the operations of Nacimiento and San Antonio Dams which control the flow of water in the Salinas River. The studies attempt to optimize the water available for use, recharge, retarding of seawater intrusion, and enhancement of environmental resources.

SOUTHERN DISTRICT

SAN LUIS REY INDIANS WATER SETTLEMENT

In December 1985, a preliminary agreement was reached between the City of Escondido and the Vista Irrigation District, on the one hand, and the five Mission Indian bands, on the other, aimed at resolving their long-standing conflict over water rights in the San Luis Rey River Valley.

The roots of this conflict date back to before the turn of the century. While the Indian reservations in the San Luis Rey River Valley were being established, Escondido's predecessor was appropriating water rights under State law and building a 13-mile canal, known as the Escondido Canal, across portions of four of the Indian reservations to Lake Wohlford. Thirty years later, Vista's predecessor purchased the Warner Ranch and built a dam and reservoir at its eastern boundary. These two entities combined their resources and, since 1922, have controlled about 90 percent of the water in the San Luis Rey watershed. To protect their water rights, they obtained federal licenses and permits and entered into contracts with the Secretary of the Interior, acting on behalf of the Indians. The Indians filed suit to have these agreements nullified and to seek adjudication of the water rights they claimed under the Winters doctrine. Under that doctrine, so named after the 1908 ruling of the U.S. Supreme Court in Winters vs. United States, Indian reservations have a right to all the water they needed as of the time they were created, regardless of when or whether the water was first put to use.

On December 19, 1987, the United States Senate passed S795, the San Luis Rey Indian Water Rights Settlement Act, which incorporated the agreement. Among its provisions, it would make available 22,700 acre-feet of water per year from the CVP to all parties.

The water supply that would be available to the Indians under this agreement would be about 7,700 acre-feet greater than the maximum they could obtain if they were allocated 100 percent of the total river water supply.

The California Water Commission has been concerned that the agreement could deprive CVP users in the Sacramento and San Joaquin Valleys of the water they will need in the future, and it raises questions about the protection afforded to counties of origin under existing statutes. Users and potential users of CVP water are also concerned about the precedent of delivering CVP water for use on non-Indian lands in Southern California.

Proponents contend that the agreement would put an end to costly litigation, avoid disruption of services to non-Indian users of water, and ensure the viability of Indian communities.

The bill is now being amended and concurrent legislation (H.R. 1699) has been introduced in the House of Representatives.

UNTREATED SEWAGE FROM MEXICO

The City of San Diego has been plagued by Tijuana's sewage since 1965 when the city agreed to treat Tijuana's waste on an emergency basis. Millions of gallons of raw sewage have flowed across the border during frequent failure of Tijuana's antiquated system. During these failures, water in the Tijuana River carries raw sewage to the Tijuana River Estuary in San Diego County and onto South Bay beaches via the ocean.

To correct this damaging problem, Mexico agreed to modernize and expand Tijuana's sewage and water supply system and to build a 34-million-gallon per day (mgd) sewage treatment plant. The decision was an outgrowth of a decision reached by President Reagan and Mexican President Miguel de la Madrid in 1983. Pursuant to that

agreement, Mexico has received a $46.4 million grant from the Inter-American Development Bank to help finance expansion of Tijuana's sewage and water supply system and will spend an additional $11 million to build the waste water treatment plant, which will include six aeration ponds about 5 miles south of Tijuana. Construction of the plant has started; it will be built in two 17-mgd increments to stop chronic 13-mgd discharges toward San Diego's Point Loma Sewage Treatment Plant and periodic uncontrolled discharges from Tijuana's dilapidated sewers.

Mexico also proposes to build a 40-mgd upstream secondary treatment plant, below the Rodriguez Dam in Tijuana. However, U.S. officials oppose Mexico's construction plan because, they argue, the new plant would not treat the water to meet the desired standards, resulting in substandard water quality for the Tijuana River and eventually San Diego's coast.

SANTA ANA RIVER FLOOD CONTROL PROJECT

An omnibus water resources bill, which includes the Santa Ana River Flood Control Project, received Presidential approval on November 17, 1986. Supporters of the Santa Ana River project, called the All-River Plan, say it is necessary to avoid an estimated $12 billion worth of damages from a severe flood in the region and to provide better protection to about two million residents along the river.

Upstream storage is part of the Corps' overall plan to reduce major flooding along the Santa Ana River from its source in the San Bernardino Mountains to the Pacific Ocean. The All-River Plan, which includes increasing the height of Prado Dam and improving the 3.1-mile Oak Street Drain in Corona, originally called for construction of a dam across the river at the community of Mentone, near Redlands. However, in response to protests from residents that the dam was too close to an earthquake fault and would damage their property and the environment, Congress ordered the Corps in November of 1983 to study alternatives to the proposed Mentone Plan.

The new plan eliminates the controversial Mentone Dam. Instead, a 550-foot-high dam, the Seven Oaks Dam, would be built in a fairly remote and sparsely populated area four miles upstream from the community of Mentone. A three-mile area upstream of the dam site would be flooded.

The Corps plans to accelerate the design of Seven Oaks Dam in Upper Santa Ana Canyon so it can be put on the same completion schedule as the enlargement of Prado Dam.

SAN BERNARDINO GROUND WATER

Although the Bunker Hill Basin in the San Bernardino Valley was considered solely a recreational area, composed mainly of springs and marshlands as late as the 1940s, it now boasts a thriving urban complex and industrial center. Yet studies show that the ground water level remains dangerously high.

In the 1870s, test drilling revealed that the aquifer underlying the basin was under artesian pressure and that, in some places, wellhead pressure was sufficient to pressurize a household water distribution system. In several areas, shallow wells of 50 to 100 feet in depth yielded flowing water. However, by the mid-1950's, extractions exceeded the natural recharge and ground water levels began to decrease. Water levels dropped more than 100 feet.

In 1954, the San Bernardino Valley Municipal Water District (SBVMWD) was established under the Municipal Water District Act of 1911 to plan for a long-range water supply for the approximately 325 square miles within its boundaries. With the importation of SWP water by SBVMWD, ground water levels in the basin reversed their downward trend and began recovering in the early 1970s. The resulting rise in the ground water levels has caused several problems in the Bunker Hill Pressure Subarea, including a potential for soil liquefaction caused by seismic shaking.

Compounding the situation is the judgement rendered in 1969 to a suit filed by the Western Municipal Water District of Riverside County (WMWD) against the East San

Bernadino County Water District in the Superior Court of Riverside County. It limits the amount of water that can be exported from the San Bernardino (Bunker Hill) basin. In addition, the judgment requires SBVMWD to incur replenishment obligations of imported water when the Bunker Hill Basin's extractions exceed a stipulated amount.

Approximately 170,000 acre-feet of water is pumped from the basin annually. The largest group of pumpers is those agencies named as defendants in the Western judgment (Riverside, Meeks & Daly, Gage Canal, and others). Combined, they pump approximately 65,000 acre-feet per year. The Cities of San Bernardino, Loma Linda, and Redlands and the various mutual water agencies and private wells account for the rest. (Data supplied by SBVMWD). A major concern of all pumping agencies is power costs. Therefore, a high ground water table is beneficial to these agencies in terms of lower pumping charges.

Water agencies have identified possible solutions to alleviate these problems by diversion, pumping, or some combination of the two. However, many water agencies have an interest in the basin and there is no single basin management plan in effect. Further, the objectives and interests of the various agencies sometimes conflict.

One such solution considered was to pump additional water to the City of Riverside. In December of 1981, agreements were reached among SBVMWD, WMWD, the City of San Bernardino, and the City of Riverside, whereby the City of Riverside could take up to an additional 10,000 acre-feet of water per year. The extractions permitted under these agreements are in addition to those allowed in the Western judgment.

Then in October of 1983, SBVMWD and WMWD entered into another agreement, relating only to the natural water supply of the basin area and the alleviation of the high ground water problem by allowing the parties additional extractions of water from the pressure zone. The additional water may be extracted during a six-year period beginning in 1983 in annual amounts determined jointly by the parties, not to exceed

40,000 acre-feet in any calendar year; it is in addition to that allowed in the Western judgment.

VENTURA COUNTY GROUND WATER

Ground water has been the principal water supply for irrigation and urban uses over much of the Oxnard Plain in Ventura County. However, due to increasing developments in the Oxnard Plain, the ground water aquifers underlying the plain have been overdrafted. The overdraft within the United Water Conservation District has averaged 18,900 acre-feet per year during 1976-85. The estimated annual overdraft for 1985-86 and 1986-87 was 25,000 acre-feet and 30,000 acre-feet, respectively. The continuous overdraft of the basin has resulted in the loss of ground water storage to intruding sea water and the loss of fresh water by an increase in salinity. The area affected by sea water intrusion in the Oxnard Plain has increased from 17.9 square miles in 1974 to 22.7 square miles in 1985.

As a result of pressure from the State Water Resources Control Board, the County of Ventura and United developed a water management plan to alleviate this problem. The plan was for United to construct a pipeline, called the Pumping Trough Line, and a permanent Freeman Diversion structure near the community of Saticoy. These two projects will allow increased diversion from the Santa Clara River and delivery of water to a wellfield where pumping has created a trough that causes sea water intrusion. The Pumping Trough Line is essentially complete, but the plan will not be fully implemented until the permanent Freeman Diversion structure is completed. Construction of these facilities is being financed by a PL 84-984 loan from the Bureau of Reclamation, an $8-million grant from the Board and local funding through an assessment district. United hopes to replace part of the Bureau of Reclamation loan with a lower interest loan obtained under the State Water Conservation and Water Quality (Bond) Law of 1986.

In addition, a Fox Canyon Ground Water Management Agency was formed to manage the ground water resources which underlie the geographical boundary of the Fox Canyon

Aquifer. The Fox Canyon Aquifer is one of the deeper aquifers underlying the Oxnard Plain and extends from offshore to and beyond the Oxnard Plain. Although the Fox Canyon Aquifer is in an overdraft condition, sea water has not yet intruded on shore. To minimize the overdraft, the agency has proposed ordinances to install meters on all wells pumping more than 100 acre-feet per year, to limit the amount of ground water that can be pumped, and to restrict the drilling of new wells in the Las Posas Basin.

COLORADO RIVER WATER RIGHTS

As a result of the 1964 U.S. Supreme Court decree in Arizona v. California, California's apportionment to Colorado River water was reduced and the five lower Colorado Indian tribes were awarded either 905,496 acre-feet of diversions annually or the water necessary to supply the consumptive use required for irrigation of 136,636 acres, whichever is less.

In 1978, the tribes asked the Court to grant them additional water rights, alleging that the United States failed to claim a sufficient amount of irrigable acreage (the so-called "omitted" lands) in the earlier litigation. The tribes also raised claims for more water because the Department of the Interior and favorable court decrees had enlarged the boundaries of the Indian reservations after 1964 ("boundary" lands).

In 1978, the Special Master appointed by the Supreme Court to hear these claims recommended that additional water rights be granted to the Indian tribes. In 1983, however, the Court rejected the claims for omitted lands from further consideration but ruled that the claims for boundary lands could be the subject of future considerations. Litigation now pending before the U.S. District Court in San Diego could resolve this issue. Any claims granted would probably be charged against the fourth priority of MWD under the Seven Party Agreement, which established priorities for California's entitlement, because this is the lowest priority that would fall within California's basic apportionment of 4.4 million acre-feet.

The City of Needles, the community of Winterhaven, the U.S. Bureau of Land Management, and others have also been attempting to obtain a secure supply of additional water for municipal, industrial, and recreational purposes. On November 14, 1986, the President signed legislation authorizing the Secretary of the Interior to operate and maintain a project consisting of a series of wells capable of providing up to 10,000 acre-feet of water annually from a bank of ground water created by leakage from the All-American Canal. Under this legislation, P.L. 99-655, the Lower Colorado River Water Supply Act, the Imperial Irrigation District (IID) and the Coachella Valley Water District (CVWD) would exchange a portion of their rights to divert water from the Colorado River in return for an equivalent quantity and quality of ground water to be pumped from the wellfield into the canal. Before implementation, the plan would require concurrence of the members of the 1931 Seven Party Agreement. Pending development of a long-term supply, MWD and CVWD entered into an agreement in 1985 to provide the City of Needles with an interim supply over the next five years.

The reduction in California's Colorado River water apportionment would have become effective in 1985 following the start of operation of the Central Arizona Project, if surplus flows had not been available. In years without surplus flows, all the loss will probably have to be borne by MWD because it has a lower priority than agricultural agencies with rights to Colorado River water. To compensate for that loss and for probable deficiencies in the yield of the SWP, MWD is pursuing a number of programs to augment its supplies. Measures designed to increase its Colorado River supplies include: (1) the banking of surplus supplies of Colorado River water in Lake Mead for use in dry years; (2) the use of unused water to which agricultural agencies are entitled; (3) the use of Arizona's and Nevada's unused apportionment: and (4) the transfer of salvaged agricultural water.

COLORADO RIVER SALINITY

In the past several years, releases from reservoir storage in the lower Colorado River as a result of above normal water supply have been two to three times greater

than releases required for beneficial uses. These high flows have reduced salinity in the lower Colorado River to historic lows. However, with the return to normal water supply and increased water use within the upper basin, salinity levels are predicted to increase in the coming years.

The long-term average annual salinity of the Colorado River ranges from about 50 mg/L in its headwaters in Colorado and Wyoming to 850 mg/L at Imperial Dam. This increase is a result of salt loading and salt concentration. Prior to man's development of the water supply, the Colorado River's salinity is estimated to have been approximately 250 mg/L at Lees Ferry, Arizona; in 1978, the last year of nonexcess flow, the salinity averaged 578 mg/L.

Irrigated agriculture is the major source of increasing salinity in the river. Salts dissolved from the underlying saline soils and geologic formations by deep percolation are transported to the river by irrigation return flows. Further increases of the salt load to the river will come in part from the development of future irrigation projects. Proposed out-of-basin exports and projected development of the vast energy resources in the Upper Colorado River Basin will add to the river's salinity problem.

With development and pollution increases, nutrient loading to the main stem reservoirs could become a problem. Compounds such as phosphorus and nitrogen, which are essential to the growth of algae, are causing some portions of the reservoirs to become overly productive. This can result in taste and odor problems within the reservoir, the formation of toxins, and a reduction in the dissolved oxygen available for fish. These problems can then lead to adverse effects on municipal, industrial, and recreational use. Thus far, most of the nutrient loading problems have been confined to Las Vegas Bay in Lake Mead, but efforts are being made to minimize their impact.

In 1972, the seven basin states adopted a policy of maintaining the salinity concentrations in the lower mainstem of the Colorado River system at or below the

flow-weighted averages of 1972, while the basin states continue to develop their compact-apportioned waters. The Federal Water Pollution Control Act Amendments of 1972 required the establishment of numerical standards for salinity in the Colorado River. In 1973, the seven basin states created the Colorado River Basin Salinity Control Forum to establish numerical salinity criteria and to develop a plan of implementation for salinity control.

In 1975, all the basin states adopted the salinity standards set forth in the report "Water Quality Standards for Salinity, Including Numeric Criteria, and Plan of Implementation for Salinity Control, Colorado River System", as recommended by the Forum. The State adopted- and EPA-approved standards call for maintenance of the average annual flow-weighted salinity (TDS) concentrations of 723 mg/L below Hoover Dam, of 747 mg/L below Parker Dam, and of 879 mg/L at Imperial Dam.

The basin states also have an active role in the plan of implementation for salinity control. The Forum has adopted policies which place salt effluent limitations on industrial and municipal discharges, and it recommends the industrial use of saline water whenever possible. The Forum is also exploring the possibility of a range of future salinity control methods.

HIGH FLOWS AND HIGH GROUND WATER ALONG THE COLORADO RIVER

A combination of four major weather events in May and June of 1983 caused the Colorado River Basin reservoirs to spill, even though 6.6 million acre-feet of empty reservoir space had been available in the Colorado River system at the beginning of the year. These weather events were: (1) cool weather suppressing snowmelt in April and May, (2) heavy snowfall during May, (3) rapid snow melting near the end of May due to unusually hot weather, and (4) an intense rainstorm in the Upper Basin in June. This created runoff flows ranging from 117 percent of normal on May 1 to 210 percent of normal in late June.

Lake Powell rose to its maximum reservoir storage level of 3708.34 feet on July 14, 1983. Storage in Lake Mead reached the top of the spillway gates on July 13, 1983. causing spillage for the first time in over 40 years. Storage continued to increase until July 25 when the water level reached 4.43 feet above the spillway gates.

The average release rate from Hoover Dam is normally around 15,000 cfs during high irrigation months. However, because of the large increases in runoff, the release rate from Hoover Dam averaged in excess of 33,500 cfs for the remainder of 1983. These high release rates from Hoover Dam caused bank erosion and flooding of low-lying areas downstream. The greatest flood damage occurred downstream of Davis Dam. High ground water was a problem for residential and agricultural lands along the lower Colorado River. Businesses also suffered as a result of reduced recreational use of the river.

WATER DIVERSIONS TO THE CITY OF LOS ANGELES

In normal years, the City of Los Angeles derives about 80 percent of its water supply from the Owens Valley and Mono Basin; it also gets low-cost energy generated by the falling water along its gravity system. The city's right to divert this water is under legal challenge. If these supplies are reduced, the city will have to rely more heavily on water from MWD, thus placing additional demands upon its already constrained State Water Project and Colorado River water entitlements.

OWENS VALLEY

After completion of the Second Los Angeles Aqueduct, LADWP announced its intention to increase ground water pumping in the Owens Valley to improve the aqueduct's delivery capability during dry years. Following a suit filed by Inyo County in 1972, the courts ruled that LADWP must prepare an Environmental Impact Report (EIR) on the project. Two EIRs have been prepared, but both were successfully challenged by the County. The City is under a court mandate to prepare a third EIR for the project, which the court has defined as the entire Second Aqueduct.

Subsequently, the county's voters approved a pumping ordinance to prevent ground water overdraft, and the county levied a separate and higher tax on city-owned property, actions which also became the subject of litigation.

In 1985, seeking to end these controversies, the city and county approved an agreement, which provides, among other things, for: (1) development of a pumping program for each runoff year to be determined jointly by the city and the county; if they cannot agree, the city may not pump in excess of the amounts set forth in a table included in the agreement; (2) implementation by the city of measures to increase the amount of water conservation in Los Angeles and the Owens Valley and to use water from MWD and certain Los Angeles ground water basins if the pumping table is used; (3) implementation of certain enhancement/mitigation projects to compensate for the adverse impacts of ground water extractions; (4) suspension of litigation involving the county's challenge to the city's EIR on increased ground water pumping and the county's plan to appeal the ruling that declared its ground water ordinance unconstitutional; (5) termination of litigation challenging the county's imposition of a separate and higher tax on city-owned lands; and (6) financing by the city of certain studies that are being conducted jointly by the U. S. Geological Survey, the county, and the city on the effects of pumping in Owens Valley. The results of these studies could form the basis of a long-term ground water management plan for the valley.

The 3rd District Court of Appeals has approved extension of the agreement for 16 months - from February 28, 1989, to June 30, 1990. The extension will allow time to complete the studies, develop a long-term pumping program, and prepare an EIR.

MWD WATER SUPPLY INITIATIVES

Voter and legislative rejection of measures needed to augment the yield of the SWP, combined with the loss of 650,000 acre-feet of MWD'S annual Colorado River water entitlement following the startup of the Central Arizona Project, have forced MWD to

explore other means of obtaining the supplies it needs to meet the requirements of an expanding population (from around 13 million in 1985 to over 16 million by the turn of the century). To respond to this challenge, MWD is pursuing a number of programs which may be grouped into two categories, demand management programs and supply enhancement programs.

On the demand side, MWD has initiated a number of programs to encourage conservation and reduce demands, including an interruptible water supply program and a local projects program. Under the interruptible water supply program, contractors have agreed to reduce demands for imported water during water shortage periods in return for lower water rates. Under the local projects program, MWD has agreed to contribute to the costs of local development which would not be undertaken in the absence of the contribution.

Most of the programs in the supply enhancement category call for innovative water exchange and transfer and storage agreements with other agencies. Some of the most promising of these involve the transfer of water from agricultural to urban areas.

One example of such a program is the proposed water exchange plan between MWD and IID. Because IID is under pressure from both Federal and State agencies to conserve its irrigation water from the Colorado River, MWD offered to partially finance a conservation program for IID in exchange for the salvaged water. MWD hoped to acquire an additional 100,000 acre-feet of Colorado River water per year that would be saved and offered $100 per acre-foot a year, for a total of $350 million over the 35-year life of the proposed agreement.

IID, however, is holding to a price of $175 per acre-foot a year for conserved water. As of February 1988, negotiations between the two districts have again reached an impasse. In the meantime, legislation has been introduced into the Congress under which MWD would pay the full cost of lining portions of the All-American and Coachella Canals, which deliver water to IID and the neighboring Coachella Valley Water District, in return for the water saved.

MWD is also involved in discussions with the Palo Verde Irrigation District (PVID), the highest priority California user of Colorado River water. The plan under discussion would permit MWD to contract with farmers in PVID to reduce their planted acreage or plant lower water-using crops to the extent necessary to generate the water needed by MWD. The program could provide MWD with up to 100,000 acre-feet of water in dry years.

Through its participation on a task force that includes the SWP contractors and DWR, MWD is also investigating possibilities in the San Joaquin Valley. In Kern County, agricultural agencies and farmers in economic difficulty are considering transferring SWP entitlements to urban areas. MWD is also discussing a storage plan with the Kern County Water Agency and its member agencies that would allow MWD to put water into their ground water basins during wet periods in return for some of their SWP during dry periods.

One of the more recent proposals involves a cooperative initiative with the Arvin-Edison Water District, a CVP contractor in southeastern Kern County that has its CVP water delivered through the California Aqueduct by an arrangement with the State. MWD would assist Arvin-Edison in constructing its partially completed distribution system and would deliver a portion of its SWP water in wet years to the CVP contractor. In return, MWD would receive some of Arvin-Edison's CVP water in dry years.

One ongoing program involves a cooperative agreement among MWD, CVWD, and Desert Water Agency (DWA). The program helps recharge the ground water basin in the Coachella Valley and, at the same time, will provide water for MWD for use during droughts. The program will help protect Southern California's coastal plain against droughts by banking as much as 600,000 acre-feet of Colorado River water in Coachella Valley now when excess flows are available in the river. During dry years, CVWD and DWA will relinquish their deliveries of SWP water to MWD to the extent that MWD has provided advance delivery of Colorado River water to the two

desert agencies. Neither desert agency, although both are contractors for SWP water, has direct access to it.

These programs offer some promise of easing future shortages and of making optimum use of available water supplies.