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**ORANGE COUNTY WATER DISTRICT**

February 10, 1993

Mr. William R. Mills Jr, P.E.  
General Manager  
Orange County Water District  
Post Office Box 8300  
Fountain Valley, CA 92728-8300

Dear Mr. Mills:

In accordance with Section 26 of the District Act, the 1991-92 Engineer's Report is hereby submitted.

Precipitation for the July 1, 1991 through June 30, 1992 period was 119% of normal following a year of 84% of long-term average. Santa Ana River flow at Prado during the water year totaled 197,732 acre-feet, of which 33,400 acre-feet passed the District's spreading grounds and wasted to the ocean. Imported water purchased for replenishment purposes for the year ending June 30, 1991 totaled 53,740 acre-feet. This year's total water usage for the District was 511,689 acre-feet, which is 8.4% more than last year's use. The groundwater pumped from the basin was 271,224 acre-feet, with 39,789 acre-feet of imported water purchased for direct use through the In-Lieu program.

The Santa Ana River flow past Prado Dam in 1991-92 was 63% higher than the 30-year average, and is due to the increase in discharges of highly treated sewage to the River in upstream areas, in addition to above average rainfall.

TITLE: 1991 & 1992 ENGINEER'S REPORT ON  
GROUNDWATER CONDITIONS, WATER  
SUPPLY & BASIN UTILIZATION IN OC  
WATER DISTRICT  
AUTHOR: OCWD BOARD OF DIRECTORS  
DATE: 2/1/93  
CATEGORY: 1.1

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The accumulated overdraft decreased from 409,350 acre-feet in 1991 to 394,350 acre-feet in 1992, a decrease of 15,000 acre-feet. The basin's accumulated overdraft, however, is only 56% of the overdraft in the 1950's. As a result of the findings of the basin groundwater conditions, the Replenishment Assessment levied in 1993-1994 for the purchase of water could equal the amount of money necessary to purchase 120,523 acre-feet for replenishment of the District's groundwater supplies.

Very truly yours,

Craig D. Miller  
Engineer I

Steven R. Conklin, P.E.  
Engineering Manager

SRC:CDM:rda

Enclosure

**1991-92**

**ENGINEER'S REPORT ON**

**GROUNDWATER CONDITIONS,**

**WATER SUPPLY AND BASIN UTILIZATION**

**IN THE ORANGE COUNTY WATER DISTRICT**

**FEBRUARY 1993**

**ORANGE COUNTY WATER DISTRICT  
BOARD OF DIRECTORS**

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**William R. Mills Jr., P.E., General Manager**

## EXECUTIVE SUMMARY

The amount of groundwater extracted from the basin during the year beginning July 1, 1991 was 271,224 acre-feet, which is the third highest amount in the history of the District. Total water use in the District increased 8% from the previous year due to an aggressive groundwater replenishment program, which increased the amount of import water purchased for replenishment by 333% over the previous year. A total of 93,529 acre-feet was purchased in the year beginning July 1, 1991 for groundwater replenishment purposes, of which 39,789 acre-feet was purchased through the In-Lieu Program.

As in previous years, District staff calculated the change in basin storage based on the change in measured groundwater levels from November 1991 to November 1992. A change in water level contour map (Figure 2) was created from the 1991 and 1992 November water level elevation maps. Rainfall was about 119% of normal during the water year, and the average groundwater level in the basin was about 11.7 feet below sea level as of November 1992, a decrease of 4.3 feet from the prior year. A change in storage calculation resulted in a net change in basin storage of approximately -27,000 acre-feet for the year ending November 1992.

The District Act requires that the change in volume of groundwater in storage be calculated on the last day of the water year, June 30, 1992. By using monthly hydrologic data, the November 1992 change in storage calculation can be estimated at year end, June 1992. For the year ending June 30, 1992, the change in storage is approximately +15,000 acre-feet. Therefore, based on the basin conditions for the water year ending June 30, 1992, OCWD could purchase up to 120,523 acre-feet for replenishment of the groundwater basin during the next year, beginning July 1, 1993, pursuant to the OCWD Act.

## ACKNOWLEDGMENTS

A number of public and private agencies contributed data used in this report, including the following:

City of Anaheim  
City of Buena Park  
Coastal Municipal Water District  
County Sanitation Districts of Orange County  
City of Fountain Valley  
City of Fullerton  
City of Garden Grove  
City of Huntington Beach  
The Irvine Company  
Irvine Ranch Water District  
City of La Palma  
Mesa Consolidated Water District  
The Metropolitan Water District of Southern California  
Municipal Water District of Orange County  
City of Orange  
Orange County Environmental Management Agency  
City of Santa Ana  
Santa Ana Watershed Project Authority  
City of Seal Beach  
Serrano Irrigation District  
Southern California Water Company  
Tri-Cities Municipal Water District  
City of Tustin  
United States Geological Survey  
City of Westminster  
Yorba Linda Water District

The cooperation received from all agencies is gratefully acknowledged.

The basic data report is made a part of this report and is placed on file in the District office.

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# **PART I: GROUNDWATER CONDITIONS**

Groundwater conditions in the Orange County basin are influenced by the natural hydrologic conditions of rainfall, seepage from the underground reservoir to the ocean and other basins, and natural stream inflow. The basin is also influenced by the artificial conditions created by groundwater extraction through wells, use of imported waters for replenishment of groundwater supplies, and water conservation practices throughout OCWD. Groundwater quality is affected by both natural and artificial conditions.

The 1991-92 year starting July 1 yielded rainfall of 16.01 inches, 119% of the long-term average rainfall of 13.4 inches. Stream flow in the Santa Ana River for the water year was above normal, with a total of 197,732 acre-feet of natural stream flow through Prado Dam (about 76,387 acre-feet more than the 30-year average of 121,345 acre-feet). Stream flow at Prado Dam was high, compared with the 30-year average, partially because of increased treated wastewater discharges to the Santa Ana River upstream of Prado Dam which now exceed 135,000 acre-feet per year. Increased upstream development increases treated wastewater discharges, and storm runoff flows are increased due to construction of impervious surfaces.

## **NON-LOCAL WATER SUPPLY**

During the year July 1, 1991 to June 30, 1992, the total water use in the OCWD service area was 496,608 acre-feet. Of this, a total of 206,482 acre-feet was Colorado River and State Project water received through the facilities of MWD; the remainder was ground water production, reclaimed water or natural water. Thus, approximately 42% of the total non-local water supply to the OCWD area was purchased Colorado River or State Project water, of which 52,117 acre-feet was water delivered to OCWD's Forebay facilities area for groundwater replenishment; 1,623 acre-feet was water injected underground near Seal Beach in the Orange County portion of the Alamitos Barrier to halt seawater intrusion; 39,786 acre-feet was in-lieu water; and 112,954 acre-feet was direct service water received by cities and other entities in Orange County. The non-local water supplies for the period 1955-56 through 1991-92 are shown on Figure 4.

Table 1 shows the imported Colorado River and State Project water purchased for groundwater replenishment at the Forebay and Alamitos Barrier and water purchased by local purveyors for direct use during the year ending June 30, 1992. All of the imported Forebay recharge water was Colorado River water.

**TABLE 1****IMPORTED WATER DELIVERIES JULY 1991 TO JUNE 1992**

	Acre-Feet
Direct Use (Includes In-Lieu)	152,743
Forebay Recharge	52,117
Alamitos Barrier	1,623
<b>Total</b>	<b>206,483</b>

In April 1991, the OCWD Board of Directors approved a temporary In-Lieu Program for the period of October 1991 through January 1992. The In-Lieu Program was approved earlier by MWD. The cost of the in-lieu water to OCWD was computed using the difference between the MWD rate and the cost to produce groundwater. OCWD paid this difference to only those agencies which reduced pumping below their assigned groundwater basin production percentage. For the duration of the program, purveyors purchased a total of 39,789 acre-feet of in-lieu water, in quantities shown in Table 2.

**TABLE 2****IN-LIEU PROGRAM WATER DELIVERIES  
OCTOBER 1991 - MAY 1992**

	Acre-Feet
Anaheim	8710.7
Fountain Valley	780.9
Garden Grove	4,531.1
Huntington Beach	3,497.9
IRWD	3,283.7
Mesa Consolidated Water District	3,719.1
Orange	4,173.7
Santa Ana	9,463.7
Tustin	1,627.8
<b>Total</b>	<b>39,788.9</b>

The MWD Interruptible Program, which began July 1, 1981, was continued in 1991-92. The Interruptible Program is a formal procedure implementing a conjunctive use concept which has long been supported by OCWD. MWD adopted amendments to its Administrative Code and the Municipal Water District of Orange County (MWDOC) adopted an ordinance effective July 1, 1981 which established non-interruptible, interruptible and emergency service classes for imported water. The prices established for 1991-92 were \$222 and \$169 per acre-foot, respectively, for treated and untreated import water. An additional \$2.00/acre-foot surcharge was imposed by MWDOC. On April 1, 1991 the MWD Board of Directors took an action to eliminate the Interruptible rate differential, the Interruptible Program is to be discontinued for the year beginning July 1, 1992. Table 3 shows the amount of interruptible water certified and delivered for 1991-92.

**TABLE 3**

**INTERRUPTIBLE PROGRAM WATER DELIVERIES  
(Acre-Foot/Year Beginning July 1)**

Agency	OCWD Certified 1991-92	Delivered 1991-92
Anaheim	700.0	700.0
Buena Park	520.0	352.8
La Palma	820.0	0.0
Orange	3,900.0	2,709.0
Westminster	2,202.0	1,506.2
<b>Total</b>	<b>8,142.0</b>	<b>5,268.0</b>

**GROUNDWATER LEVELS**

The extraction of water from the basin for the year beginning July 1, 1991 was 271,224 acre-feet. An additional 1,690.6 acre-feet of water was pumped, but was exempt from assessments. The majority of the exempted water - 81.2% - was contaminated groundwater pumped by Mobil Oil Corporation, decontaminated and returned for recharge to the basin.

A map of groundwater elevations in the Orange County groundwater basin as of November 1, 1992 is shown as Figure 1 (following Page 9). Figure 2 is a contour map showing the change in water levels for the period November 1, 1991 through November 1, 1992.

Shown on Figure 3 are the water level hydrographs for four monitoring wells located in different areas of the basin for the years between 1969 (full basin) and 1992.

**GROUNDWATER QUALITY**

During 1991-92, the imported and local water served by the major agencies within the OCWD service area was determined to have an average of 527 milligrams per liter (mg/l) total dissolved solids (TDS). The average TDS concentration of water produced from the groundwater basin was 509 mg/l TDS. Table 4 shows the weighted average of both groundwater and supplemental supplies for TDS, nitrates and hardness in the water supplied by the major agencies within the OCWD service area during 1991-92. These averages were determined from analyses of well water, supplemental water and production figures submitted to and filed with OCWD by each agency.

The flow-weighted average quality of water extracted from the groundwater basin by major water purveyors within OCWD ranged from a high quality of about 272 mg/l in TDS, from wells located in the coastal area, to a TDS concentration of about 800 mg/l from wells in the eastern portion of the basin (see Table 4). The cumulative, weighted average quality of water served, which represents a blend of groundwater, imported Colorado River water, and imported State Project water, was 527 mg/l TDS.

**TABLE 4**  
**AVERAGE QUALITY OF WATER DELIVERED (1991-92)**

City/Agency	Water Quality Constituents (mg/l) <sup>1</sup>		
	TDS <sup>2</sup>	NO <sub>3</sub> <sup>3</sup>	Hardness <sup>4</sup>
Anaheim	640	12.3	320
Buena Park	467	1.0	232
East Orange County WD	509	0.8	214
Fountain Valley	349	1.9	202
Fullerton	645	14.1	303
Garden Grove	491	7.5	300
Huntington Beach	416	1.5	200
Irvine Ranch WD	430	0.7	166
La Palma	291	0.0	138
Mesa Consolidated WD	494	1.4	291
Orange	548	8.3	288
Santa Ana	518	11.9	491
Seal Beach	272	0.1	76
Serrano Irrigation District	800	33.2	492
Southern Calif WC	488	5.3	266
Tustin	585	39.3	260
Westminster	378	3.7	218
Yorba Linda WD	657	12.4	321

<sup>1</sup> Weighted average for groundwater and supplemental water served.

<sup>2</sup> Secondary drinking water standard for total dissolved solids (TDS), 500 mg/l (lower limit) and 1,000 mg/l (upper limit).

<sup>3</sup> The primary drinking water standard for nitrates as NO<sub>3</sub> is 45 mg/l.

<sup>4</sup> Hardness as CaCO<sub>3</sub>:  
     0-75 mg/l = soft  
     75-150 mg/l = moderately hard  
     150-300 mg/l = hard  
     300-up mg/l = very hard

**NOTE: Primary Drinking Water Standards must be met, while Secondary Standards relate to odor and esthetics, and must be met to the extent practical.**

## PRODUCTION OF WATER FROM WELLS WITHIN DISTRICT

The groundwater production quantities within OCWD for the period 1955-56 through 1991-92 are presented in Table 5 and Figure 5. Groundwater production would have been much higher in recent years, however, the In-Lieu Program has served as an efficient recharge method allowing producers to reduce the amount of water pumped from the basin. If the In-Lieu water was not purchased in 1991-92, the groundwater production would have been 311,013 acre-feet.

For the current water year (1992-93), assuming above average rainfall and an estimated groundwater production of 295,000 acre-feet, the projected annual recharge (no overdraft) is estimated at 20,000 acre-feet. For the ensuing year (1993-94), with an anticipated basin production of 320,000 acre-feet and assuming normal rainfall, the basin annual overdraft is estimated at 50,000 acre-feet.

**TABLE 5**

### HISTORICAL GROUNDWATER PRODUCTION WITHIN THE ORANGE COUNTY WATER DISTRICT

July 1 - June 30	Production in Acre-feet*	July 1 - June 30	Production in Acre-feet*
1954-55	148,224	1973-74	218,863
1955-56	154,677	1974-75	225,597
1956-57	186,032	1975-76	245,456
1957-58	160,258	1976-77	243,511
1958-59	208,571	1977-78	188,407
1959-60	207,448	1978-79	216,290
1960-61	226,025	1979-80	221,453
1961-62	177,172	1980-81	228,943
1962-63	186,093	1981-82	244,184
1963-64	188,603	1982-83	249,548
1964-65	179,798	1983-84	223,207
1965-66	182,172	1984-85	252,070
1966-67	169,375	1985-86	270,932
1967-68	193,656	1986-87	276,354
1968-69	178,798	1987-88	265,226
1969-70	194,379	1988-89	275,077
1970-71	203,923	1989-90	261,190
1971-72	229,048	1990-91	266,745
1972-73	214,983	1991-92	271,224

\* Does not include in-lieu water

Section 25 of the OCWD Act requires that OCWD annually order an investigation and report on the groundwater conditions within its boundaries to include, among other information which OCWD may desire, the following:

**SUMMARY OF FINDINGS ON 1991-92 GROUNDWATER  
CONDITIONS AND RECOMMENDATIONS**

<b>Findings</b>	<b>Acre-Feet</b>
1. Annual overdraft for water year 1991-92 .....	88,710
2. Accumulated overdraft on the last day of the preceding water year (1991-92)* .....	394,350
3. Total production of water from the groundwater supplies of said District for the preceding water year (1991-92) .....	271,224
4. Estimate of annual recharge (no overdraft) for the current water year (1992-93) .....	20,000
5. Estimate of annual overdraft for the ensuing water year (1993-94) .....	50,000
6. Average annual overdraft for the immediate past five water years (1987-88 to 1991-92) .....	81,088
7. Under the provisions of Section 27 of the District Act, a portion or all of the 1993-94 Replenishment Assessment could be equal to an amount of money necessary to purchase 120,523 acre-feet of replenishment water.	

*\* Previous Engineer's Reports have used November groundwater conditions to determine accumulated overdraft. This reports findings estimate accumulated overdraft as of the last day of June 1992.*

**DATA CONCERNING GROUNDWATER CONDITIONS 1991-92**

A summary of the data concerning the 1990-91 and 1991-92 groundwater conditions within OCWD are shown in Table 6. The table also shows the change in the water figures for the two years.

**TABLE 6**

**COMPARISON OF WATER CONDITIONS  
FROM WATER YEARS 1991 TO 1992**

	WATER YEAR*		CHANGE
	1990-91	1991-92	
<b>I. GROUNDWATER LEVELS (Feet)</b>			
Average Water Elevation of Wells on Nov. 1, Reference Elevation Sea Level	(7.4)	(11.7)	(4.3)
Accumulated Overdraft (Acre-feet)	409,350	394,350	(15,000)
<b>II. NON-LOCAL WATER SUPPLY (Acre-Feet)</b>			
Santa Ana River at Prado Dam Imported Water	195,000	197,732	2,732
Alamitos Barrier	1,933	1,623	(310)
Forebay Conservation Facility	15,619	52,117	36,498
State Water Project	0	0	0
Direct Use	149,837	112,954	(36,883)
In-Lieu Replenishment Water	44,588	39,789	(4,799)
Other Sources	240.9	1,659	1,418
Total	406,977	412,717	5,740
<b>III. RECLAIMED WASTEWATER SUPPLY (Acre-feet)</b>			
Water Factory 21	6,634	6,843	209
Irrigation Use	2,257	2,042	(215)
Other Use	8,227	8,357	130
Total	17,188	17,242	124
<b>IV. PRODUCTION OF GROUNDWATER (Acre-feet)</b>			
Irrigation Use	15,588	11,036	(4,552)
Other Use	251,126	260,188	9,062
Total	266,744	271,224	4,480
<b>V. TOTAL WATER DEMAND (Acre-feet)</b>	471,653	444,491	(27,162)
<b>VI. RAINFALL (Inches)</b>	11.3	16.0	4.7
<b>VII. BASIN DISCHARGES (Acre-Feet)</b>			
Sewage Discharge to Ocean**	293,915	247,757	(46,158)
Loss to Ocean from Santa Ana River	37,750	33,400	(4,350)
Total	331,665	281,157	(50,508)
<b>VIII. WATER QUALITY (mg/l TDS)</b>			
Santa Ana River at Prado Dam	606	496	(110)
Imported Colorado River Water	555	620	65
Imported State Project Water	323	392	69
Average Water Pumped	472	484	12

\* Water year starts July 1.

\*\* Includes areas beyond the Forebay and Pressure areas.

( ) Negative

## **OVERDRAFT OF DISTRICT BASIN**

The annual overdraft, as defined in the OCWD Act is the quantity by which the production of water from the groundwater supplies during the water year exceeds the natural replenishment of such groundwater supplies during the same water year. This difference between extractions and replenishment can be estimated by computing the change in volume of groundwater in storage which would have occurred had not imported water been used for recharge, and all artificial groundwater recharge activities such as the In-Lieu Program, as well as using reclaimed and imported water to maintain seawater intrusion barriers.

It is estimated that the volume of groundwater in storage increased as of June 30, 1992 by 15,000 acre-feet. During 1991-92, about 60,582 acre-feet of imported Colorado River, State Project water, Water Factory 21 (excluding deep well water), Arlington Desalter and Alamitos Barrier water was percolated or injected to replenish the groundwater supplies. Therefore, the annual overdraft that occurred during 1991-92 was approximately 88,710 acre-feet.

During the five years from 1988 to 1992, an annual average of 35,161 acre-feet of Colorado River (including Alamitos Barrier), State Project, Bunker Hill Basin and Water Factory 21 water was percolated or injected into the underground basin for replenishment. During this same five-year period, the water levels in the Forebay (intake) area of the basin fell 3.9 feet and water levels in the Pressure (coastal) area fell 3.7 feet, resulting in a net decrease in basin storage of about 85,450 acre-feet, or an average decrease of about 17,090 acre-feet per year. The average overdraft in the basin during these five years is estimated to be about 81,088 acre-feet per year. Average seasonal rainfall in the OCWD service area during this five-year period was 10.4 inches, or 78% of the historical average of 13.4 inches.

The accumulated overdraft as defined in the OCWD Act is the quantity of water necessary to be placed in OCWD's intake area of the groundwater basin in order to prevent the landward movement of ocean water into the fresh groundwater body. The landward movement of ocean water can only be prevented if pressure levels near the coast are several feet above sea level. Pressure levels along the coast are related to the volume of water stored in the intake area, water pumped from the entire basin, and the pattern or location of pumping. The coastal water levels are also affected by the seawater intrusion control projects that may be in operation.

For the purpose of estimating the accumulated overdraft, the groundwater levels, as measured on November 1, 1969, were assumed to represent the full basin conditions, under which seawater intrusion would not occur. Using this 1969 reference year, the groundwater levels as of November 1, 1992, show an accumulated loss in storage of about 436,350 acre-feet, as shown on Figure 6.

## RECOMMENDATION FOR PURCHASE OF REPLENISHMENT WATER FOR 1993-94

The OCWD Act provides for the determination by the Board of Directors of a Replenishment Assessment which would provide the funds necessary to purchase sufficient water to replenish the average annual overdraft for the immediate past five years plus an additional amount of water sufficient to mitigate the accumulated overdraft which has occurred over a period of not less than 10 years nor more than 20 years.

The five-year average annual overdraft is 81,088 acre-feet/year as of June 30, 1992 and one-tenth of the accumulated overdraft is 39,435 acre-feet. Therefore, in accordance with Section 27 of the OCWD Act, the Replenishment Assessment levied in 1993-94 could equal the amount of money necessary to purchase 120,523 acre-feet of replenishment water.

The determination of the total Replenishment Assessment to be collected in 1993-94 corresponds to the purchase of 120,523 acre-feet of imported supplies. This would reflect the purchase of 3,000 acre-feet for basin replenishment at the Alamitos Barrier along the coastal zone; 106,523 acre-feet of Colorado River and State Project water for recharge at the Santa Ana River conservation facilities and off-channel recharge reservoirs; and 11,000 acre-feet from Water Factory 21 for replenishment at the Talbert Barrier.

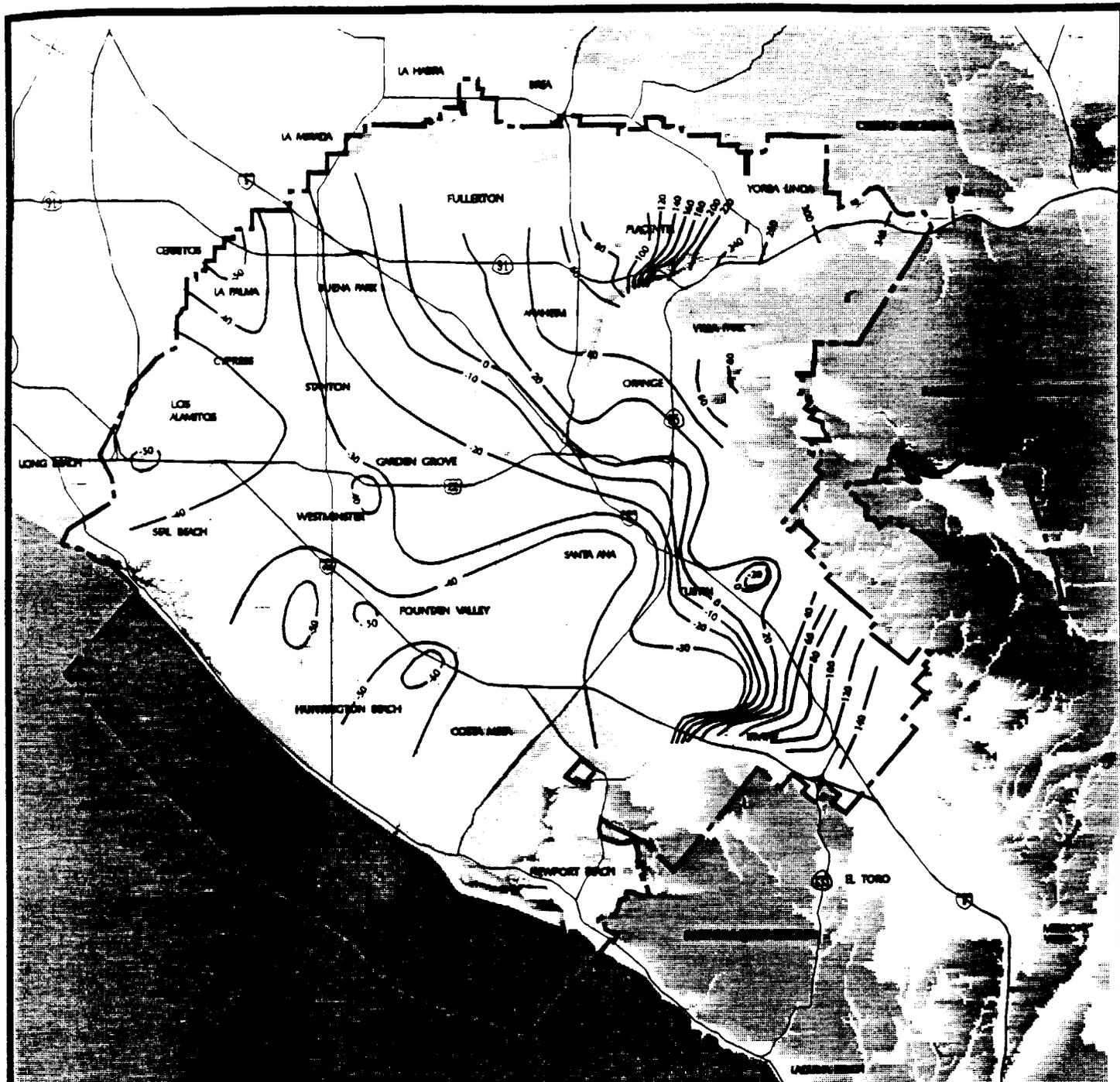
The 1993-94 upper limit for the purchase of water shown in Table 7 is equal to \$28,283,922. A Replenishment Assessment of \$47/acre-foot for irrigation use and \$94/acre-foot for all other uses would correspond to this total. These assessments are based on the assumption that 10,000 acre-feet will be pumped for irrigation use and 310,000 acre-feet for all other uses as shown in Table 8.

**TABLE 7**

### LIMIT OF THE REPLENISHMENT ASSESSMENT FOR THE PURCHASE OF WATER 1993-94

Water Source	Acre-foot	Cost \$/AF	Amount
Alamitos Barrier	3,000	\$392	\$1,176,000
Water Factory 21	11,000	\$392*	\$4,312,000
Groundwater Replenishment	106,523	\$214	\$22,795,922
<b>TOTALS</b>	<b>120,523</b>		<b>\$28,283,922</b>

\* avoided MWD rate.



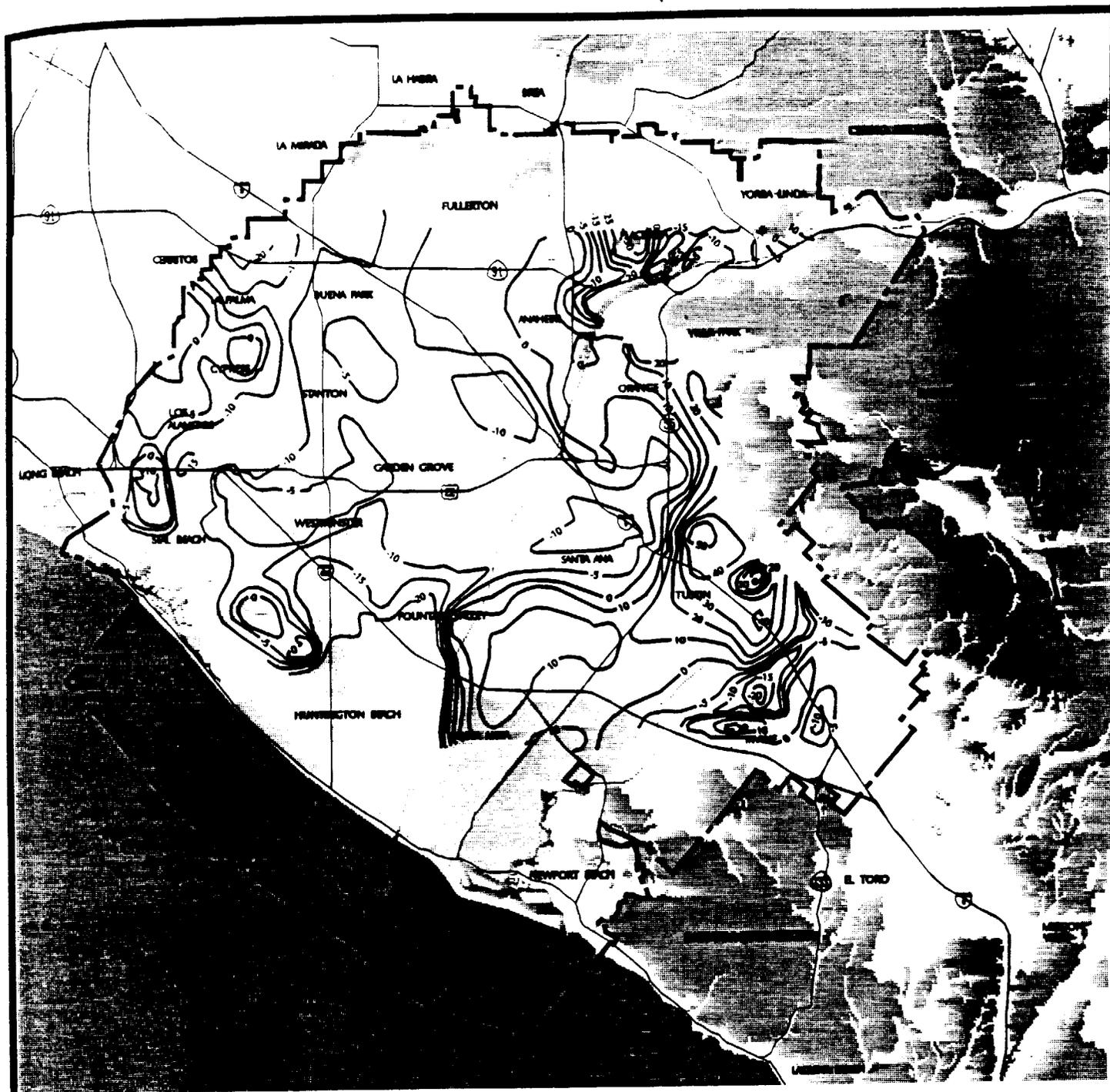
**EXPLANATION**

-  GROUNDWATER ELEVATION CONTOURS  
IN FEET ABOVE MEAN SEA LEVEL
-  OCWD BOUNDARY
-  NON-WATERBEARING FORMATION
-  MESAS



November 1992  
Groundwater Contour Map





**EXPLANATION**

- ~ CHANGE IN GROUNDWATER ELEVATION IN FEET
- ~ OCWD BOUNDARY
- ▭ NON-WATERBEARING FORMATION
- ▭ MESAS

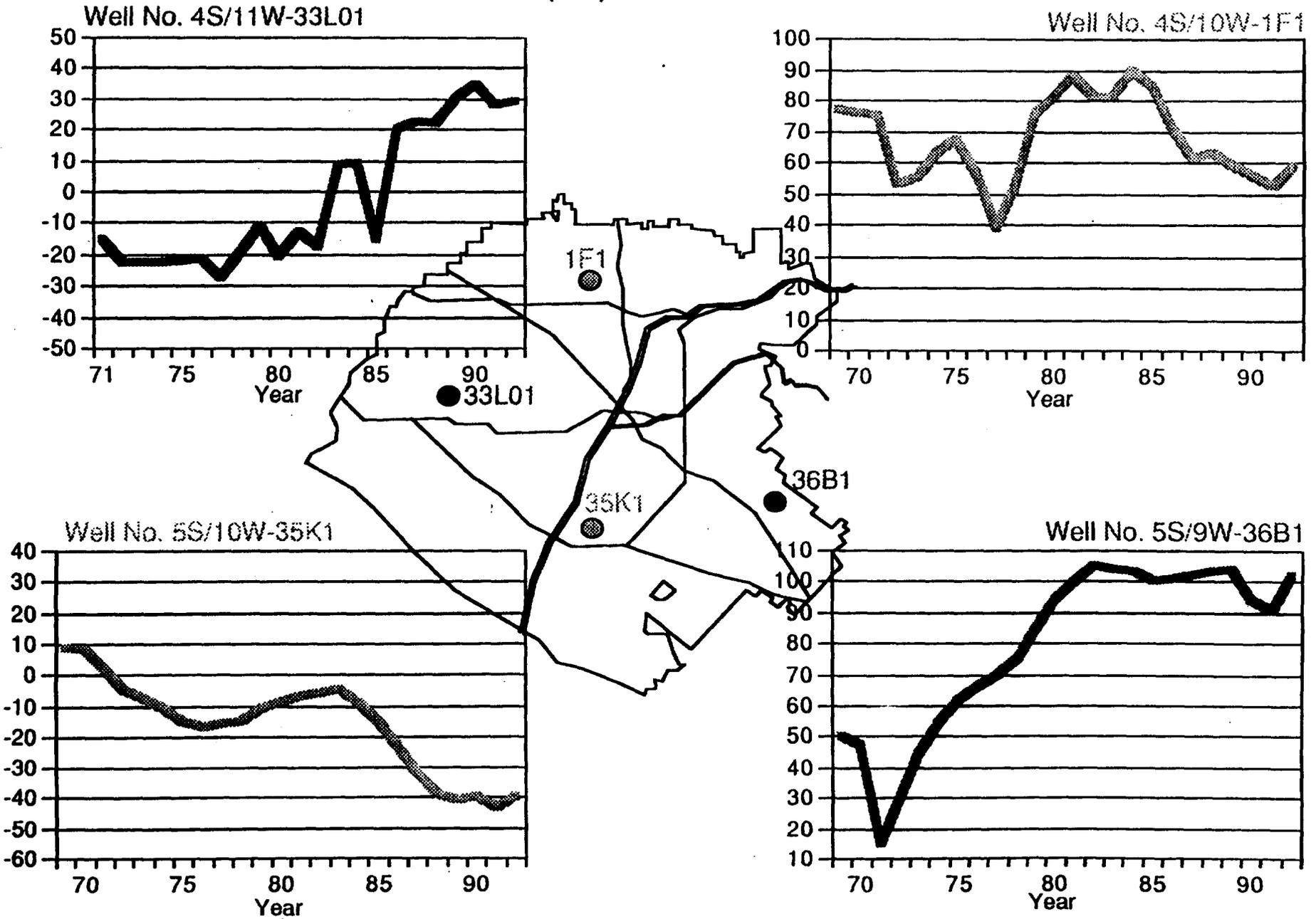


**Change In Water Level  
Nov. 1991 to Nov. 1992**



# MONITORING WELL HYDROGRAPH TRENDS

Elevation (feet) = 0 Sea Level



12

FIGURE 3

### NON-LOCAL WATER SUPPLY TO OCWD

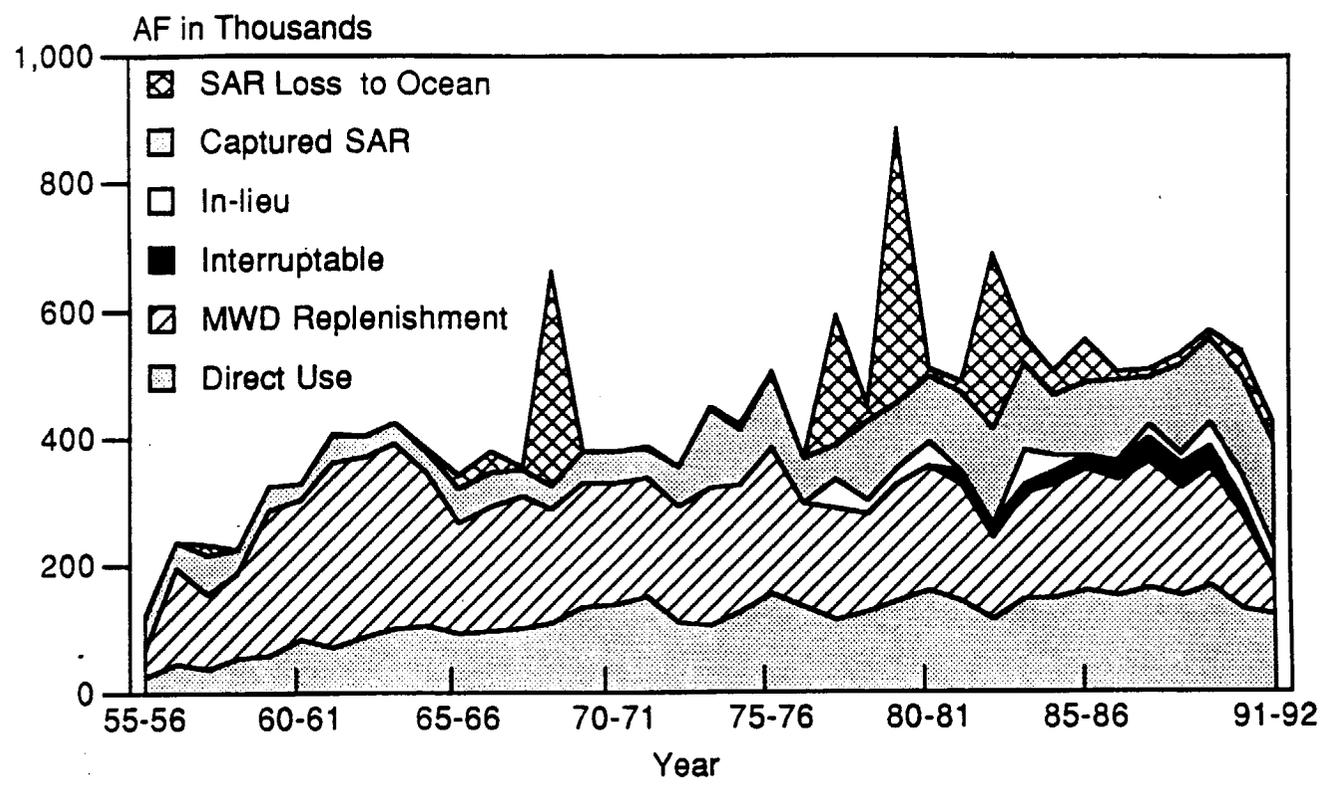
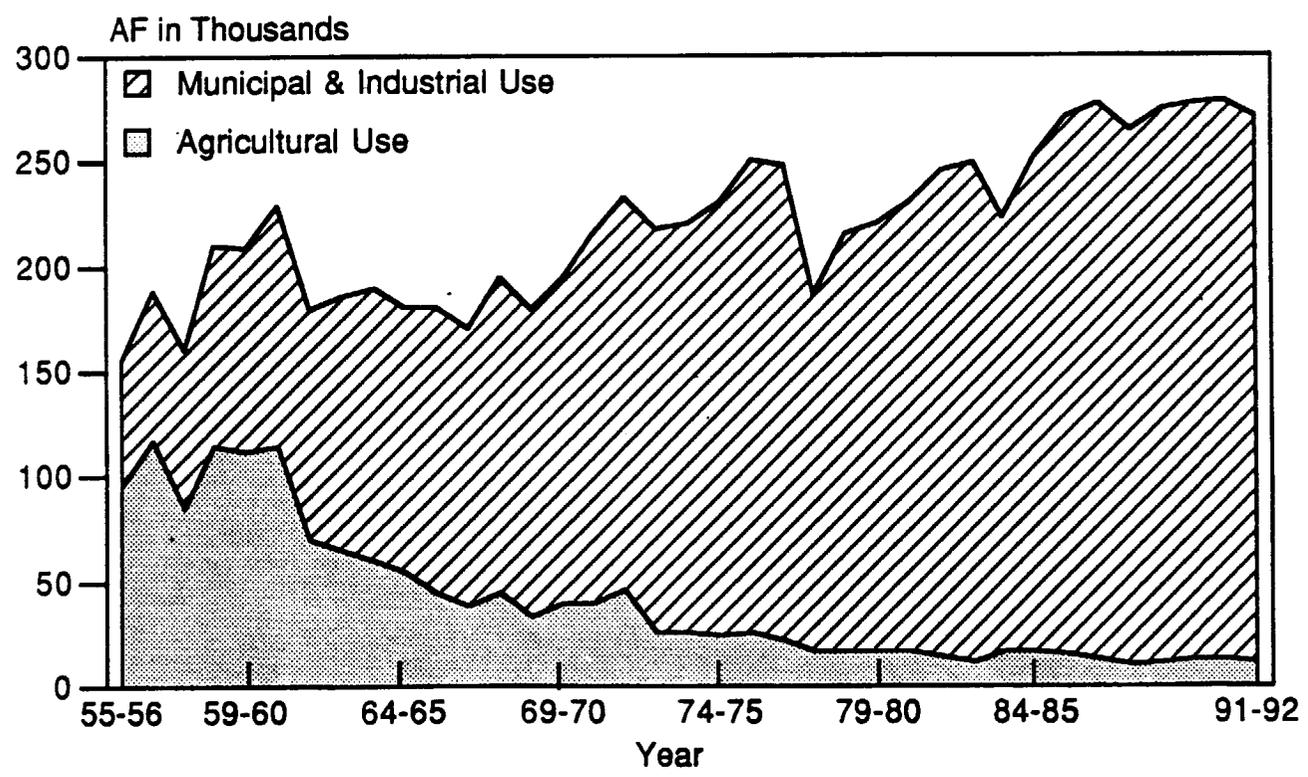
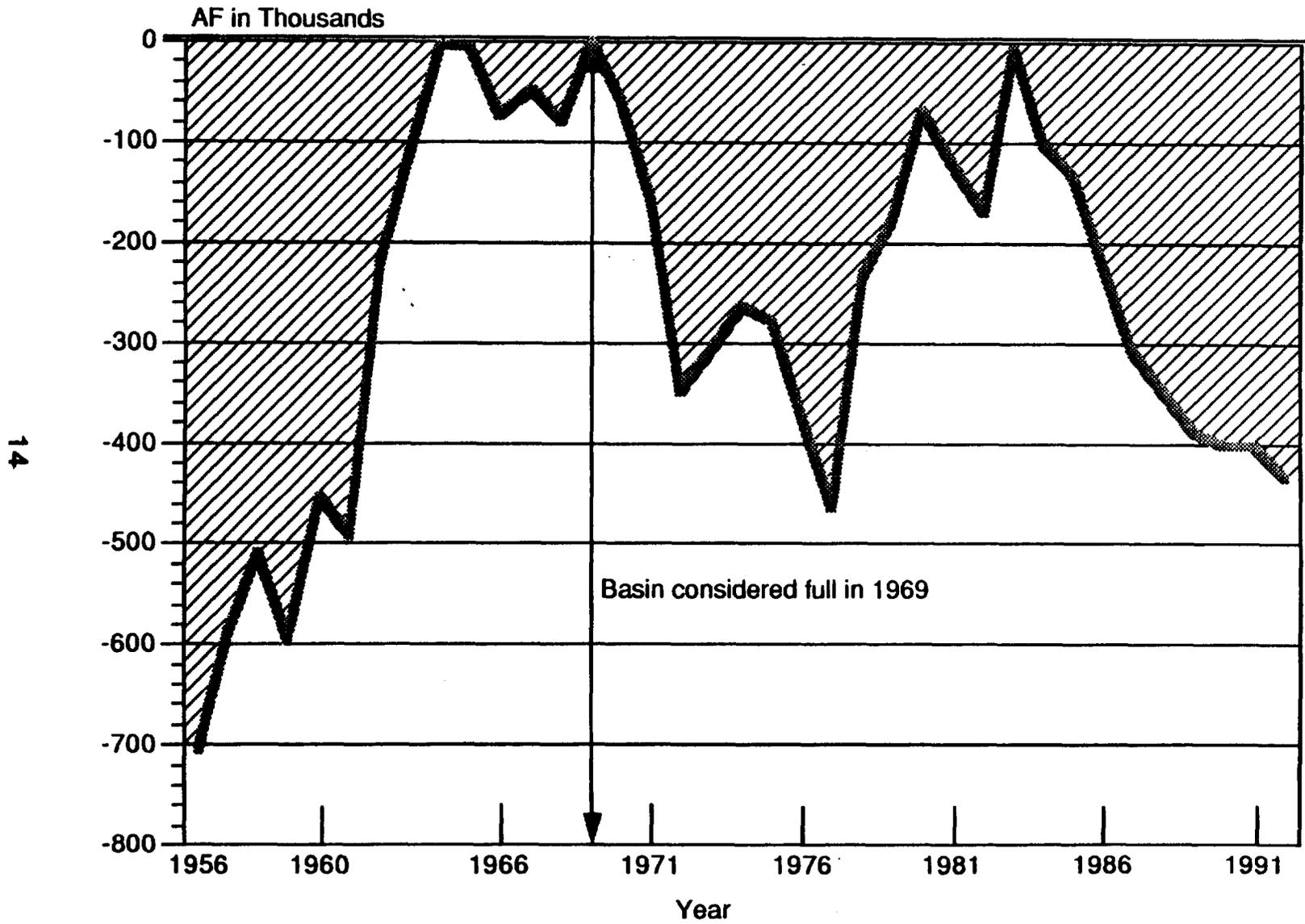


FIGURE 5

### GROUNDWATER PRODUCTION AND USE WITHIN OCWD



# STORAGE IN ORANGE COUNTY GROUNDWATER BASIN\*

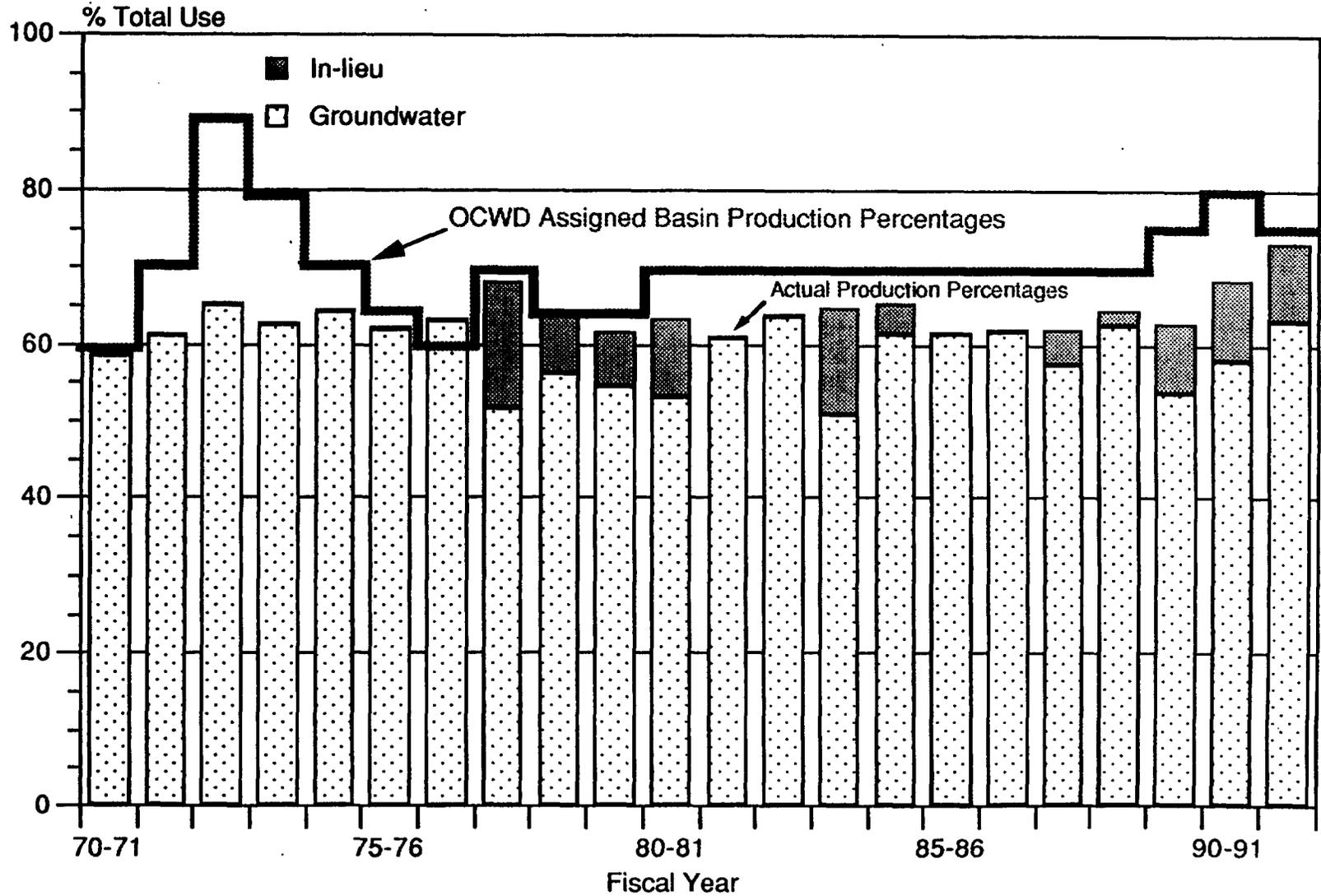


\* Accumulated overdraft determined using November groundwater levels.

FIGURE 6

# ASSIGNED AND ACTUAL GROUNDWATER BASIN PRODUCTION PERCENTAGE MAJOR PRODUCERS\*

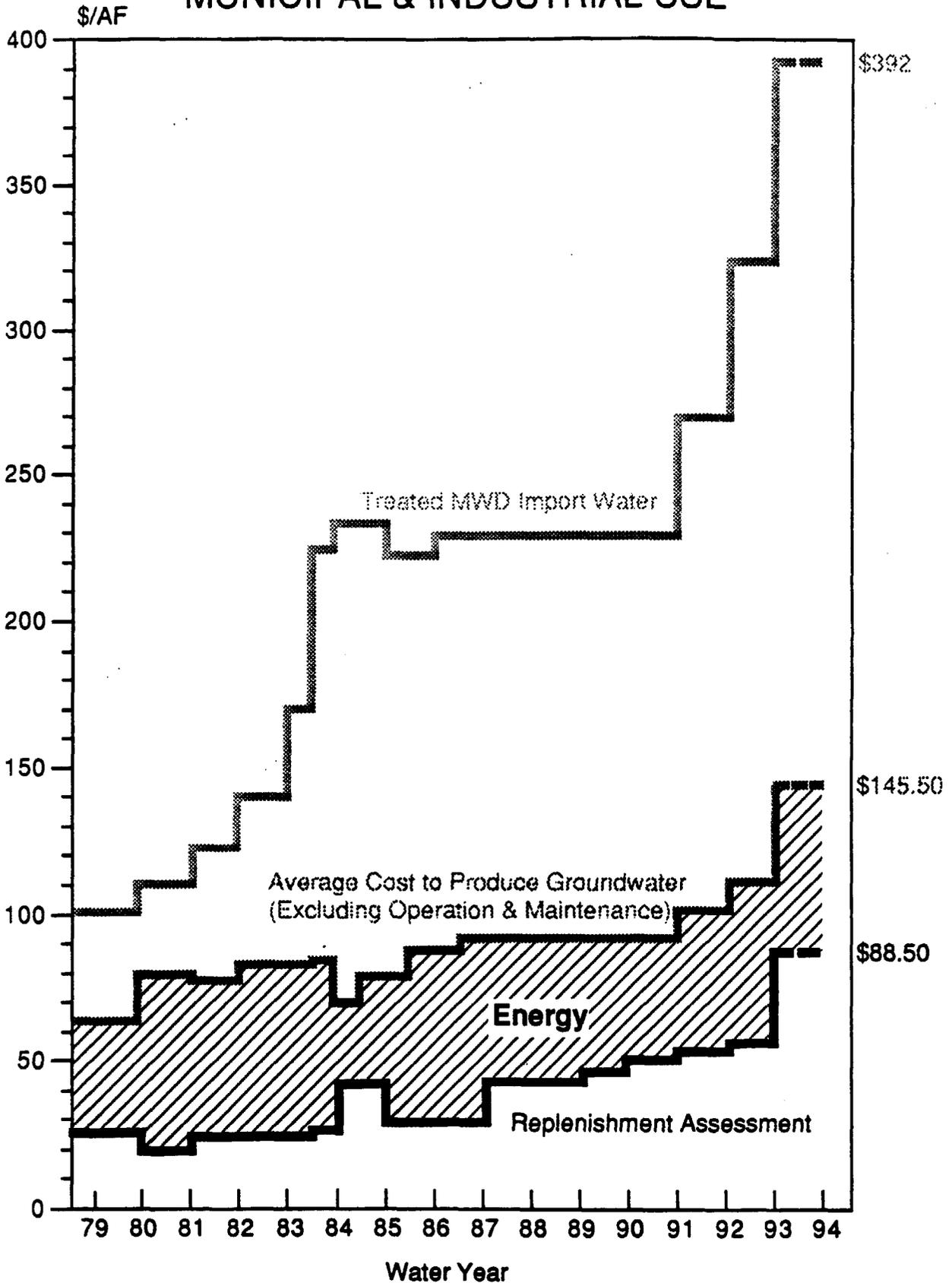
15



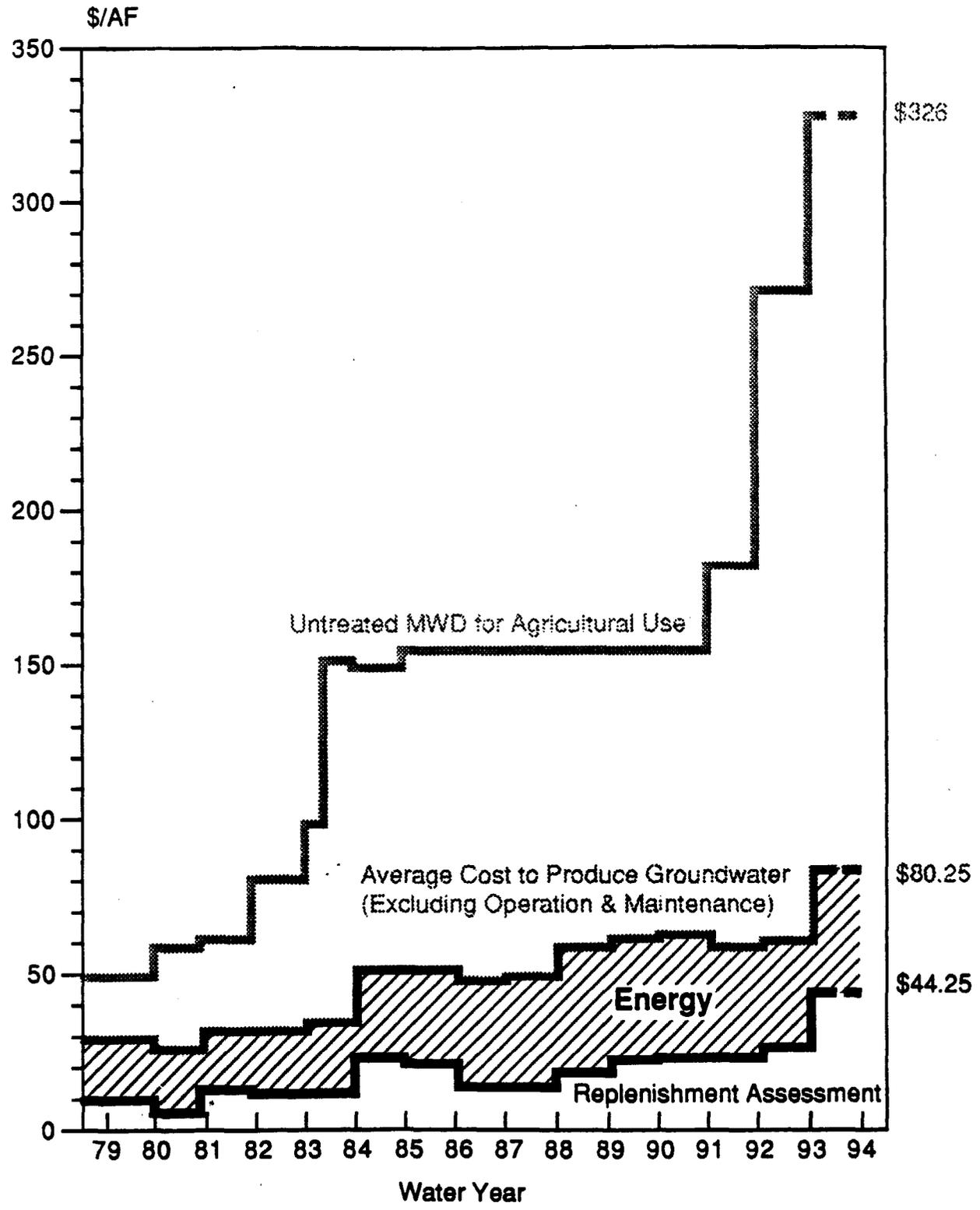
\* Newport Beach not included in years 1988-92, no wellfield constructed.

FIGURE 8

# ADOPTED AND PROJECTED WATER RATES MUNICIPAL & INDUSTRIAL USE



## ADOPTED AND PROJECTED WATER RATES AGRICULTURAL USE



## **PART II: WATER SUPPLY AND BASIN UTILIZATION**

Section 31.5 of the OCWD Act requires an investigation and annual report setting forth the following information relating to water supply and basin utilization within the OCWD service area, together with such other information as OCWD may desire:

### **FINDINGS FOR THE JULY 1 THROUGH JUNE 30 1991-92 WATER YEAR**

1. The amount of water produced by persons and operators from the OCWD groundwater basin service area during the water year was 271,224 acre-feet.
2. The amount of water produced by persons and operators from supplemental sources during the water year was 166,693 acre-feet.
3. The amount of water produced by persons and operators from all other sources during the water year was 1,659.0 acre-feet.
4. The amount of water served to agencies from the In-Lieu Program during the water year was 39,789 acre-feet.
5. The amount of groundwater in storage in OCWD's basin has increased by 15,000 acre-feet from the 1990-91 conditions as of June 30, 1992.
6. The estimated 1993-94 demand for direct use of MWD water within the OCWD service area is about 171,000 acre-feet, including interruptible water. The quantity of water available for groundwater replenishment during 1993-94 if the drought ends is estimated at 120,523 acre-feet.
7. The sum of the variable cost of energy and the Replenishment Assessment for producing groundwater in the ensuing year (1993-94) for other than irrigation use is about \$145.50/acre-foot.
8. The sum of the variable cost of energy and the Replenishment Assessment for producing groundwater in the ensuing year (1993-94) for irrigation use is about \$80.25/acre-foot.
9. The estimated cost of MWD water for other than irrigation use (treated non-interruptible) during the ensuing year 1993-94 is \$392.00/acre-foot. The estimated cost of MWD water for irrigation use (untreated non-interruptible) during the ensuing year 1993-94 is \$326.00/acre-foot. Neither of these costs include the cost of feeder pipeline deliveries or distribution.

**WATER SUPPLY AND BASIN UTILIZATION DURING  
THE PRECEDING YEAR BEGINNING JULY 1, 1991**

During the year ending June 30, 1992 a total of 444,491 acre-feet of water was produced or obtained by persons and operators in the OCWD service area. This quantity was made up of (1) groundwater, (2) supplemental water, and (3) water from other sources. A summary of the amounts taken from each of these sources is shown in Table 8.

**TABLE 8**

**WATER SUPPLY AND BASIN UTILIZATION  
WITHIN THE ORANGE COUNTY WATER DISTRICT**

	Ground Water	Imported Water	In-lieu	Other	Reclaimed Water*	Total
<b>1991-92 (Preceding Year)</b>						
Other than Irrigation	260,188	112,585	39,789	1,642	15,200	429,404
Irrigation	11,036	1,992	0	17	2,042	15,087
<b>Total</b>	<b>271,224</b>	<b>114,577</b>	<b>39,789</b>	<b>1,659</b>	<b>17,242</b>	<b>444,491</b>
<b>1992-93 (Current Year)**</b>						
Other than Irrigation	285,000	120,000	20,500	3,000	11,000	439,500
Irrigation	10,000	1,500	0	0	2,500	14,000
<b>Total</b>	<b>295,000</b>	<b>121,500</b>	<b>20,500</b>	<b>3,000</b>	<b>13,500</b>	<b>453,500</b>
<b>1993-94 (Ensuing Year)**</b>						
Other Than Irrigation	310,000	140,000	10,000	1,000	20,000	481,000
Irrigation	10,000	1,000	0	0	3,000	14,000
<b>Total</b>	<b>320,000</b>	<b>141,000</b>	<b>10,000</b>	<b>1,000</b>	<b>23,000</b>	<b>495,000</b>

\* Includes OCWD's Green Acres Project and IRWD's reclaimed water production

\*\* Estimated

## **AMOUNT OF WATER PRODUCED FROM OTHER SOURCES**

Other sources of water supply refers to the diversions from Santiago Creek. Of the total 1,658 acre-feet diverted from Santiago Creek, 17 acre-feet were used for irrigation and 1,641 acre-feet were used for other than irrigation purposes. The names of all persons and operators obtaining water from these sources and the quantities received are listed in Appendices A-5 and A-6.

## **AMOUNT OF WATER PRODUCED FROM SUPPLEMENTAL SOURCES**

Sources of supplemental water consisted of direct deliveries from MWD through Municipal Water District of Orange County, Anaheim, Fullerton and Santa Ana and deliveries from Coastal Municipal Water District and Tri-Cities Municipal Water District, as well as reclaimed water from OCWD and IRWD. During the year beginning July 1991, deliveries from those sources totaled 123,354 acre-feet, of which 119,320 acre-feet was for municipal and industrial use and 4,034 acre-feet for agricultural purposes. In addition to domestic and agricultural deliveries, 52,117 acre-feet of imported water was recharged in the Forebay area. The names of the major operators producing supplemental water for local deliveries are listed in the appendices. Appendix A-3 lists OCWD's major water agencies that produce water for purposes other than irrigation and Appendix A-4 lists those that produce water for irrigation use.

## **BASIN PRODUCTION PERCENTAGE DURING WATER YEAR (July 1, 1991 - June 30, 1992)**

The Basin Production Percentage for uses other than irrigation for water year 1991-92 was established at 80% by the OCWD Board of Directors in April 1991. The Basin Production Percentage is defined in the OCWD Act as "the ratio that all water to be produced from groundwater supplies within the District bears to all water to be produced by persons and operators within the District from supplemental sources as well as from groundwater within the District." The Basin Production Percentage is based on the activities of those persons and operators that utilize water from both supplemental sources and groundwater. Persons and operators who produced 25 acre-feet or less of water from the groundwater basin, were excluded from the production limitations. The 1991-92 Basin Production Percentage achieved was 71.4%, (if Newport Beach is excluded from the calculation, because of their lack of groundwater production, the BPP becomes 74.5%) by the 23 major OCWD producers.

Individual groundwater and supplemental water production percentages (excluding water for irrigation purposes) achieved by OCWD's major water agencies during the year beginning July 1, 1991 are presented in Appendix A-7. Historical assigned and actual groundwater basin production percentages are presented on Figure 6.

## **WATER SUPPLY AND BASIN UTILIZATION DURING THE CURRENT YEAR (1992-93)**

The total water requirement within the OCWD service area was 444,491 acre-feet during last year which was 5.8 % less than the 471,894 acre-feet used during 1990-91. The water requirements for the current year, 1992-93, are estimated at about 453,500 acre-feet, the components of this total are shown in Table 8.

## **PROBABLE AVAILABILITY OF WATER FROM SUPPLEMENTAL SOURCES DURING WATER YEAR 1993-94**

During 1993-94 supplemental water is anticipated from six sources: (1) Colorado River water imported by MWD, (2) MWD's State Water Project, (3) OCWD's Water Factory 21 facilities, (4) Arlington Desalter, (5) OCWD's Green Acres Project, and (6) IRWD's Michelson Plant. The drought has restricted the availability of imported water and during the remainder of 1992-93, MWD may not have the capability to meet OCWD's replenishment demands. In years after 1992-93, the availability of water for replenishment is uncertain until supply reservoirs have recovered from the drought. MWD's dependence on State Project water will gradually increase between now and 1994 while its Colorado River supplies decrease as a result of greater river water diversions by the Central Arizona Project. Additionally, the limited capacity of the State Water Project and capacity constraints within MWD's distribution system may restrict the amount of project water that can be delivered to MWD's member agencies. The water supply estimates for 1993-94 in Table 8 are based on full utilization of imported supplies with no deficiencies.

Water Factory 21 began operations in the fall of 1976. Deep well water blended with a combination of tertiary treated wastewater effluent and desalted wastewater is expected to supply about 17,000 acre-feet of high quality water during the 1993-94 year as a result of the completion of the current renovation program. In addition, construction is continuing on the Green Acres Project, which will ultimately reclaim 7,500 acre-feet per year of secondary effluent for landscape irrigation. Work continues on the Alamitos Barrier to switch the water supply from imported water to reclaimed water.

Since the availability of imported replenishment supplies is expected to decrease in the future, OCWD has numerous programs under way, as previously mentioned, to increase local replenishment supply. These supplies are a result of OCWD's accelerated activities in water reclamation, seawater intrusion control, desalination and water quality improvement projects.

## **RECOMMENDED BASIN PRODUCTION PERCENTAGE FOR 1992-93**

During 1992-93, the Basin Production Percentage was established by the OCWD Board of Directors at 75% on all groundwater. The OCWD Board of Directors requested production limitations of about 5,000 acre-feet to achieve basin management objectives by requesting the City of Fullerton and Irvine Ranch Water District to produce 10% less than their production limitation in 1991-92. OCWD and these agencies have completed this successful program, and

have no present or future production limitations requested of them. In 1993-94, a Basin Production Percentage of 75% is recommended based on the projected availability of non local water supplies.

To achieve basin management objectives during 1991-92, three agencies (Anaheim, Orange, Santa Ana) were assigned a production requirement by OCWD. The pumping requirement was established for these producers to pump in excess of their Basin Production Percentage (BPP). The OCWD Board of Directors provided exceptions from the Basin Equity Assessment for production of poor quality well water, treated to domestic standards, in excess of the basin percentage for Anaheim, Garden Grove and Orange in 1991-92.

### **COST OF WATER PRODUCTION FOR THE ENSUING YEAR (1993-94)**

The OCWD Act requires that costs of producing groundwater and of obtaining supplemental water be evaluated annually. The cost of producing groundwater and/or supplemental water varies for each producer, depending on many factors. Although these variations in cost are recognized, it was necessary for the purpose of this report to arrive at figures representative of the average cost of producing groundwater, and of purchasing supplemental water for irrigation use and for uses other than irrigation.

### **COST OF GROUNDWATER PRODUCTION FOR USES OTHER THAN IRRIGATION**

The variable cost of energy and the Replenishment Assessment for groundwater production for uses other than irrigation within the OCWD service area during the ensuing year is about \$145.50/acre-foot. A survey of the major water producers was conducted to determine the characteristics of a representative extraction facility and the associated production costs. The findings of the survey are presented in Appendix A-8.

Two significant factors influencing the cost of groundwater production are energy prices and operation and maintenance costs. Based on the responses of the October 1992 agency survey, the energy cost ranged from \$19.00/AF to \$159.00/AF, with an O&M cost of \$5.35/AF to \$47.33/AF. Other factors which influence these costs include varying load factors and different groundwater levels. Recently drilled wells are generally deeper (1,100 foot depth for a typical well) than those drilled a couple of decades ago. The average load factor, which indicates the percent of use of an extraction facility, was 61% for the major water agencies subject to the Basin Equity Assessment.

Electrical energy accounts for approximately 30% of the total groundwater production cost for uses other than irrigation in 1993-94. A major factor influencing the cost of electrical energy is the lift, i.e., the vertical distance water must be lifted from pumping level to land surface. The estimated production costs during the ensuing year for a representative well are presented in Table 9.

**TABLE 9**

**COMPUTATION OF 1993-94 WATER PRODUCTION COSTS**

Item	Non-irrigation		Irrigation	
	Annual Amount	\$/AF	Annual Amount	\$/AF
<b>Fixed Costs:</b>				
Capital Costs	\$42,504	37.35	26,873	64.91
Land	1,491	1.31	625	1.51
Insurance and Taxes	2,470	2.17	625	1.51
<b>Total Fixed Costs</b>	<b>\$46,465</b>	<b>40.83</b>	<b>28,123</b>	<b>67.94</b>
<b>Variable Costs:</b>				
Oper. & Maint.	\$41,617	6.57	11,807	28.52
Electric Energy	64,866 <sup>1</sup>	57.00 <sup>1</sup>	14,916 <sup>2</sup>	36.00 <sup>2</sup>
Replen. Assess.	100,713	88.50 <sup>3</sup>	18,320	44.25 <sup>3</sup>
<b>Total Variable Costs:</b>	<b>\$207,196</b>	<b>152.07</b>	<b>45,043</b>	<b>108.77</b>
<b>Total Production Costs:</b>	<b>\$253,661</b>	<b>192.90</b>	<b>\$73,166</b>	<b>176.71</b>

<sup>1</sup> Based on an assumed 61 percent load factor, 1,138 acre-feet/year and average lift of 280 feet.

<sup>2</sup> Based on an estimated 30 percent load factor, 414 acre-feet/year and average lift of 123 feet.

<sup>3</sup> Proposed for adoption in the 1993-94 budget.

**COST OF GROUNDWATER PRODUCTION FOR IRRIGATION USE**

The cost of groundwater production for irrigation use within the OCWD service area during the ensuing year is estimated to be \$176.71/acre-foot, including a Replenishment Assessment of \$44.25/acre-foot. The characteristics of a representative extraction facility for irrigation use are presented in Appendix A-8.

Investigation reveals that a typical production facility for irrigation use produces about 205 acre-feet per year at a load factor of about 30%. Electrical energy will account for about 20% of the total groundwater production cost for irrigation use in 1993-94. The estimated production costs in the ensuing year for a representative irrigation facility are presented in Table 9.

## COST OF SUPPLEMENTAL WATER

The cost of supplemental water from the Colorado River and the State Water Project during 1993-94 is estimated at \$239.06/acre-foot for irrigation use (untreated interruptible) and at \$406.91/acre-foot for other than irrigation use (treated non-interruptible). In addition, imported water has a penalty of \$652 per acre-foot additional charge for overuse during periods when imported water use is restricted.

The component costs of supplemental water that were considered include: (1) MWD's direct charge, (2) cost of the connection to the MWD system, (3) cost of pressure regulation and flow control, (4) cost of feeder pipelines, and (5) cost of annual operation and maintenance of the regulation and control facilities.

Projected MWD water prices for the year beginning July 1, 1993 are shown in Table 10. Adopted and projected water rates for years 1970-71 through 1993-94 are shown on Figures 8 and 9. As previously stated, the estimated MWD rates presented in Table 10 are based on the best information available at the time of this report. The projected rates shown in Table 10 do not include the additional \$2.85/acre-foot fee by MWDOC for its general operating fund.

**TABLE 10**

### **ESTIMATED PRICE OF MWD WATER PER ACRE-FOOT DURING THE ENSUING YEAR 1993-94**

	Treated (\$/AF)	Untreated (\$/AF)
Non-interruptible	392	326*
Seasonal Storage**	273	214
Emergency	1,044	978

*Note: These estimates are based on the best information available at the time of this report. This does not include MWDOC's \$2.85/acre-foot general operating charge.*

*\*MWD's disincentive charge would be twice \$326/AF or \$652/AF, if delivery limitations are in effect.*

*\*\* Normally not available May 1 - September 30*

Treated water is used primarily for municipal and industrial purposes. The water quality of treated MWD water is comparable to water obtained from the groundwater basin. Untreated MWD water is normally purchased for agriculture and replenishment purposes.

The amortized initial costs of the connection and flow regulation system, the annual operation and maintenance costs, and MWDOC's operating expenses were determined to be low compared to the purchase price of MWD water. Total costs of these factors are projected to average about \$13.79/acre-foot for irrigation use and about \$14.60/acre-foot for uses other than irrigation in 1993-94.

The amortized initial costs of feeder pipelines were determined and found to vary over a wide range between producers. The costs for some producers are minimal, while for other producers the costs amount to several dollars per acre-foot. Because of these variables, no unit costs are given in this report; however, it should be kept in mind that this component may be substantial for some producers.

A comparison of the estimated costs of pumped water versus imported supplemental water during the ensuing year (1993-94) is shown in Table 11 and Figures 8 and 9.

**TABLE 11**

**SUMMARY OF ESTIMATED COST OF WATER PRODUCTION  
FOR THE ENSUING WATER YEAR 1993-94**

	Groundwater (\$/AF)	Supplemental Water (\$/AF)
<b>Irrigation Use:</b>		
Fixed Cost	\$67.94	\$13.79
Variable Cost**	108.77*	214.00
<b>Total</b>	<b>\$176.71</b>	<b>\$227.79</b>
<b>Other than Irrigation Use:</b>		
Fixed Cost	\$40.83	\$14.60
Variable Cost	152.07*	392.00
<b>Total</b>	<b>\$192.90</b>	<b>\$406.60</b>

\* Includes Replenishment Assessment of \$44.25/acre-foot & \$88.50/acre-foot for purchase of water for irrigation use and other than irrigation use, respectively.

\*\* Including Operations and Maintenance

## **DELIVERY OF RECYCLED WASTEWATER**

Historically, only groundwater, imported water and local surface waters have been accounted for in the District. It is expected that recycled wastewater will be a significant additional source in the near future. The District Act was changed as of July 1, 1991 to account for reclaimed water as "Supplemental Water." Recycled wastewater is currently used in the Irvine Ranch Water District service area, at OCWD's Talbert Seawater Intrusion Barrier, (i.e., Water Factory 21 water) and in OCWD's Green Acres Project service area.

The District's Green Acres Project commenced operation in November 1991 serving recycled wastewater to landscaped areas in Fountain Valley, Santa Ana, and Costa Mesa. Plans are underway for Phase II of the Green Acres Project, extending service to portions of Newport Beach and Huntington Beach. In addition, the District has completed a Master Wastewater Plan for use of recycled wastewater throughout the District, which identifies a potential demand of 13,800 acre-feet per year for irrigation use on areas larger than five acres in the northern part of the District. The southern part of the District will be served by reclaimed wastewater from the Green Acres Project and future extensions or by Irvine Ranch Water District. Annual totals for the amount of recycled wastewater served are shown in Appendix A-8.

APPENDIX A-1

PERSONS AND OPERATORS PRODUCING OVER 25 ACRE-FEET  
OF GROUNDWATER FOR OTHER THAN IRRIGATION USE IN  
ORANGE COUNTY WATER DISTRICT DURING WATER YEAR\* 1991-92

Operator	Acre-feet	Operator	Acre-feet
Abbey Funeral Center	42.6	Magic Lamp Mobilehome Park	26.9
Anaheim Cemetery	39.4	Mesa Consolidated Water District	11,476.4
Anaheim, City of	42,313.3	Mesa Verde Country Club	287.1
Angelica Healthcare	337.1	Midway City Mutual Water Co.	130.3
Appleman and Goldman	52.6	Mile Square Golf Course	355.1
Armed Forces Reserve Center	109.8		
		Navy Golf Course	463.4
Buena Park, City of	7,475.0	Newport Beach Golf Course	137.5
		Noble, R.J. Co.	40.3
Catalina Street Pump Owners	35.9		
Chapman, Irvin C.	351.5	Oasis Drinking Waters	77.1
Chevron U.S.A.	102.4	Old Ranch Country Club	311.6
Chevron U.S.A.	32.7	Orange, City of	16,984.4
Coca-Cola Foods	87.8	Orange County Water District	8,592.6
Community College District	30.1	Orange Park Acres Mutual Water Company	495.8
Diamond Park Mutual Water Co.	75.3	Page Avenue Mutual Water Company	33.7
Donovan Golf Course Mgmt. Inc.	369.3		
		River View Golf	329.2
East Orange County Water District	165.8	Rockwell International	122.2
Eastside Water Association	247.8		
Environmental Mgmt. Agency of OC	330.4	Santa Ana, City of	25,426.1
		Santa Ana Country Club	191.0
Fairhaven Memorial Park	112.0	Seal Beach, City of	3,269.8
FJC U.S.A., Inc.	213.7	Serrano Irrigation District	1,104.3
Forest Lawn Memorial Park	179.0	Shell Western E&P, Inc.	209.7
Fountain Valley, City of	7,765.2	South Midway City Water Co.	82.2
Fullerton, City of	22,256.6	Southern California Water Co.	17,225.9
		Sparkletts Drinking Water Corp.	174.4
Garden Grove Acres Mut. Wtr. Co.	86.3		
Garden Grove, City of	20,214.2	Texaco, Inc.	120.5
Good Shepherd Cemetery	35.3	Tustin, City of	6,759.9
Hinckley & Schmitt Co. of Calif.	41.1	Villa Capri Mobilehome Park	27.7
Huntington Beach Unified High School	41.8		
Huntington Beach, City of	21,484.0	Walt Disney Prod. Maint. Div.	85.9
Hynes Estates, Inc.	68.5	Westminster Memorial Park	263.7
		Westminster, City of	10,177.5
Irvine Ranch Water District	16,973.7	Woodbridge Village Homeowners Assoc.	457.2
Irvine Company, The	384.2		
		Yorba Linda Country Club (Calif. Golf)	373.2
Knott's Berry Farm	252.8	Yorba Linda Water District	9,007.9
Kraemer II Partners	27.0	Yosemite Water Company	58.6
La Palma, City of	2,168.3		
Liberty Park Water Association	28.1		
Los Alamitos Race Course	289.6		
		<b>TOTAL</b>	<b>259,699.3</b>

\*Water year begins July 1

APPENDIX A-2

PERSONS AND OPERATORS PRODUCING OVER 25 ACRE-FEET  
OF GROUNDWATER FOR IRRIGATION USE IN  
ORANGE COUNTY WATER DISTRICT DURING WATER YEAR\* 1991-92

Operator	Acre-feet	Operator	Acre-feet
Anaheim, City of	247.0	Old Ranch Country Club	112.1
Etchandy, Gary	118.6	Orange, City of Water Dept.	267.8
Fairhaven Memorial Park	28.4	Osumi Farms, Inc.	983.2
Fujishige, Hiroshi	167.5	Sakahara, Frank	29.0
Fullerton, City of	161.2	Sakioka Farms	315.8
Huntington Beach, City of	162.4	Segerstrom, C. J. & Sons	237.9
Irvine Company, The	5,032.7	Shozi Brothers	55.5
Irvine Ranch Water District	1,211.9	Stanley Ruiz Farms	597.8
Ito-Ozawa Farms	258.1	Village Nurseries	118.9
Kraemer II Partners	41.7	Walt Disney Productions, Maint. Division	95.9
Laguna Farms #4	41.0	Yorba Linda Water District	98.4
Louis de Martini Farms	288.5		
Mesa Consolidated Water Dist.	77.6		
		<b>TOTAL</b>	<b>10,748.9</b>

\*Water year begins July 1

APPENDIX A-3

PERSONS AND OPERATORS RECEIVING WATER  
FROM SUPPLEMENTAL SOURCES FOR  
OTHER THAN IRRIGATION USE IN  
ORANGE COUNTY WATER DISTRICT  
DURING WATER YEAR \* 1991-92  
(EXCLUDING IN-LIEU REPLENISHMENT WATER)

Operator	Acre-Feet
Anaheim, City of	14,092.7
Buena Park, City of	6,035.6
Fountain Valley, City of	2,139.9
Fullerton, City of	7,046.1
Garden Grove, City of	1,756.6
Huntington Beach, City of	6,875.1
Irvine Company, The	0.0
Irvine Ranch Water District	13,229.7
La Palma, City of	0.0
Mesa Consolidated Water District	4,666.4
Newport Beach	16,901.5
Orange, City of	5,230.4
East Orange County Water District	758.6
Orange Park Acres Mutual Water Company	255.5
Santa Ana, City of	9,284.0
Santiago County Water District	0.0
Santa Ana Heights Water Company	1,826.3
Seal Beach, City of	292.9
Southern California Water Company	7,738.0
Tustin, City of	3,005.0
Westminster, City of	2,492.0
Yorba Linda Water District	7,331.9
<b>Total</b>	<b>110,962.2</b>

APPENDIX A-4

PERSONS AND OPERATORS RECEIVING WATER  
FROM SUPPLEMENTAL SOURCES FOR IRRIGATION USE  
IN ORANGE COUNTY WATER DISTRICT  
DURING WATER YEAR\*1991-92

Operator	Acre-Feet
Anaheim, City of	88.4
Fullerton, City of	54.6
Irvine Ranch Water District	1,702.7
Orange, City of	63.5
Yorba Linda Water District	82.5
<b>Total</b>	<b>1,991.7</b>

\* Water Year begins July 1.

APPENDIX A-5

PERSONS AND OPERATORS RECEIVING WATER FROM ALL  
OTHER SOURCES FOR OTHER THAN IRRIGATION USE  
IN ORANGE COUNTY WATER DISTRICT  
DURING WATER YEAR\* 1991-92

Operator	Acre-Feet	Source
Serrano Irrigation District	1,641.6	Santiago Creek
<b>Total</b>	<b>1,641.6</b>	

APPENDIX A-6

PERSONS AND OPERATORS RECEIVING WATER FROM ALL  
OTHER SOURCES FOR IRRIGATION USE  
WITHIN ORANGE COUNTY WATER DISTRICT  
DURING WATER YEAR\* 1991-92

Operator	Acre-Feet	Source
Serrano Irrigation District	16.6	Santiago Creek
<b>Total</b>	<b>16.6</b>	

\* Water Year begins July 1.

**APPENDIX A-7**

**PERSONS AND OPERATORS RECEIVING IN-LIEU  
REPLENISHMENT WATER FROM SUPPLEMENTAL SOURCES  
IN ORANGE COUNTY WATER DISTRICT  
DURING WATER YEAR\*1991-92**

Operator	Acre-Feet
Anaheim, City of	
Fountain Valley, City of	8,710.7
Garden Grove, City of	780.9
Huntington Beach, City of	4,531.1
Irvine Ranch Water District	3,497.9
Mesa Consolidated Water District	3,283.7
Orange, City of	3,719.1
Santa Ana, City of	4,173.7
Tustin, City of	9,463.7
<b>Total</b>	<b>39,788.9</b>

**APPENDIX A-8**

**PERSONS AND OPERATORS RECEIVING  
RECLAIMED WASTEWATER IN  
ORANGE COUNTY WATER DISTRICT  
DURING WATER YEAR\* 1991-92**

OTHER THAN IRRIGATION		IRRIGATION	
Operator	Acre-feet	Operator	Acre-feet
County Sanitation Districts	716.9**	Irvine Company, The	2,042.3
Fountain Valley, City of	110.6		
Irvine Ranch Water District	8,247.2		
OCWD (Water Factory 21)	6,843.0		
<b>TOTAL</b>	<b>15,917.7</b>	<b>TOTAL</b>	<b>2,042.3</b>

\*\* County Sanitation Districts not included in supplemental water calculations.

\*Water year July 1

APPENDIX A-9

PRODUCTION PERCENTAGES ACHIEVED DURING  
1991-92 BY PERSONS AND OPERATORS WITH THE  
CAPABILITY TO TAKE BOTH SUPPLEMENTAL  
WATER AND GROUNDWATER

Operator	In-Lieu Replenishment	Ground- water	In-Lieu & Ground- water	Supple- mental*
Anaheim, City of				
Buena Park, City of	13.3%	65.0%	78.3%	21.7%
Fountain Valley, City of	0.0%	55.3%	55.3%	44.7%
Fullerton, City of	7.2%	71.9%	79.1%	20.9%
Garden Grove, City of	0.0%	75.9%	75.9%	24.1%
Huntington Beach, City of	17.1%	76.3%	93.4%	6.6%
Irvine Company, The	10.9%	67.6%	78.5%	21.5%
Irvine Ranch Water District	0.0%	72.6%	72.6%	27.4%
La Palma, City of	7.4%	40.7%	48.7%	53.3%
Mesa Cons. Water District	0.0%	100.0%	100.0%	0.0%
Newport Beach	18.7%	57.9%	78.6%	23.4%
Orange, City of	0.0%	0.0%	0.0%	100.0%
East O.C. Water District	15.6%	64.6%	80.2%	19.8%
Orange Park Acres Mutual Water Company	0.0%	17.9%	17.9%	82.1%
Santa Ana, City of	0.0%	68.0%	68.0%	34.0%
Santa Ana Heights Water Company	21.4%	57.6%	79.0%	21.0%
Santa Ana Heights Water Company	0.0%	0.0%	0.0%	100.0%
Santiago County Water District	0.0%	0.0%	0.0%	100.0%
Seal Beach, City of	0.0%	91.8%	91.8%	8.2%
Serrano Irrigation District	0.0%	39.7%	39.7%	60.3%
Southern Calif. Water Co.	0.0%	69.0%	69.0%	31.0%
Tustin, City of	14.3%	59.3%	73.6%	26.4%
Westminster, City of	0.0%	80.3%	80.3%	19.7%
Yorba Linda Water District	0.0%	55.1%	55.1%	44.9%
<b>Overall Weighted Percentage</b>	<b>9.6%</b>	<b>60.3%</b>	<b>69.9%</b>	<b>30.1%</b>

\* Supplemental water includes recycled wastewater.

APPENDIX A-10

CHARACTERISTICS OF REPRESENTATIVE  
EXTRACTION FACILITY FOR 1993-94

Operation:

	Other than irrigation	Irrigation
	Pumps into Pressure System @ 70 psi	Pumps into Gravity Irrigation System @ 9-22 psi
Load (Use) Factor:	61 percent	30 percent
Efficiency:	65 percent	65 percent
Design Flow Rate:	2,000 gpm	1,000 gpm
Motor Horsepower:	200 hp	60 hp
Type Motor:	Electric	Electric
Well Casting Diameter:	20 inches	12 inches
Depth of Well:	1,100 feet	700 feet
Type of Pump:	Vertical Turbine	Vertical Turbine
Depth of Bowls:	300 feet	140 feet
Average Lift:	280 feet	123 feet
System Discharge Pressure:	161 feet	20 to 50 feet
Total Pumping Lift:	441 feet	153 feet
Estimated Life:	30 years	30 years
Annual Cost of Facilities*	\$39,268	\$17,850
Annual Cost of Land*	\$1,490	\$625

\* Based on an interest rate of 6% amortized over a 30 year period.