SANTA ANA RIVER WATERMASTER

FOR

ORANGE COUNTY WATER DISTRICT

VS. CITY OF CHINO, et al

CASE NO. 117628-COUNTY OF ORANGE

SEVENTEENTH

ANNUAL REPORT

OF THE

SANTA ANA RIVER WATERMASTER

1986-1987

APRIL 30, 1988

SANTA ANA RIVER WATERMASTER

ORANGE COUNTY WATER DISTRICT VS. CITY OF CHINO ET AL
CASE NO. 117628--COUNTY OF ORANGE

WATERMASTER
Harvey O. Banks
William J. Carroll
Donald L. Harriger
William R. Mills, Jr.
Robert L. Reiter

MAILING ADDRESS
P.O. Box 8300
Fountain Valley, CA
92728-8300
Telephone:
(714) 963-5661

April 30, 1988

To: Clerk of Superior Court of Orange County
and all Parties

Re: Watermaster Report for 1986-87

Gentlemen:

We have the honor of submitting herewith the Seventeenth Annual Report of the Santa Ana River Watermaster.

The principal findings of the Watermaster for the water year 1986-87 are as follows:

<u>At Prado</u>

(1)	Base Flow at Prado	119,848 acre-feet
(2)	Annual Weighted TDS of Base and Storm Flows	622 mg/L
(3)	Annual Adjusted Base Flow	127,638 acre-feet
(4)	Cumulative Adjusted Base Flow	1,422,137 acre-feet
(5)	Cumulative Entitlement of OCWD	714,000 acre-feet
(6)	Cumulative Credit	708,137 acre-feet
(7)	One-third of Cumulative Debit	0 acre-feet
(8)	Minimum Required Base Flow in 1987-88	34,000 acre-feet

<u>At Riverside Narrows</u>

(1)	Base Flow at Riverside Narrows	59,808 acre-feet
(2)	Annual Weighted TDS of Base Flow	649 mg/L
(3)	Annual Adjusted Base Flow	59,808 acre-feet
(4)	Cumulative Adjusted Base Flow	554,850 acre-feet
(5)	Cumulative Entitlement of CBMWD and WMWD	259,250 acre-feet
(6)	Cumulative Credit	295,600 acre-feet
(7)	One-third of Cumulative Debit	0 acre-feet
(8)	Minimum Required Base Flow in 1987-88	12,420 acre-feet

The above findings show that at the end of the 1986-87 water year, Chino Basin Municipal Water District and Western Municipal Water district have a cumulative credit of 708,137 acre-feet to their Base Flow obligation at Prado Dam. San Bernardino Valley Municipal Water District has a cumulative credit of 295,600 acre-feet to its Base Flow obligation at Riverside Narrows.

The Watermaster continued to exercise surveillance over the many projects within the watershed for their potential effect on Base Flow.

Sincerely yours,

SANTA ANA RIVER WATERMASTER

BY: Harvey O. Banks Donald L. Harriger

William J. Carroll William R. Mills, Jr.

Robert L. Reiter

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF PLATES
(Located at Back of Report)

APPENDICES
(Located at Back of Report)

CHAPTER I
WATERMASTER ACTIVITIES

This is the Seventeenth Annual Report of the Santa Ana River Watermaster required by the stipulated Judgment in the case of Orange County Water District vs. City of Chino, et al, entered by the court on April 17, 1969. This stipulated Judgment became effective on October 1, 1970 and contains a declaration of rights of the entities in the lower area of the Santa Ana River Basin downstream of Prado Dam as against those in the upstream area, and provides a physical solution to implement the provisions of the Judgment. The physical solution accomplishes, in general, a regional intrabasin allocation of the surface flow of the Santa Ana River System. All defendants and cross-defendants were dismissed except the four major public water districts within the Santa Ana River Basin; namely, the San Bernardino Valley Municipal Water District (SBVMWD), Western Municipal Water District (WMWD), Chino Basin Municipal Water District (CBMWD), and Orange County Water District (OCWD). The boundaries of these districts are shown on Plate 1. This arrangement leaves to each of the major hydrologic units in the watershed the determination and regulation of individual rights therein and the development and implementation of its own basin management plan. The History of Litigation and the Summary of Judgment are included as Appendices F and G in the Fifteenth Annual Report.

In order to administer the provisions of the Judgment, the court appointed a Watermaster composed of five persons. Since August 15, 1985, the Santa Ana River Watermaster Committee has consisted of Harvey O. Banks, William J. Carroll, William R. Mills, Jr., Donald L. Harriger and Robert L. Reiter. In 1986-87 Mr. Banks continued to serve as Chairman, and Mr. Mills continued to serve as Secretary. During the year the office of the Santa Ana River Watermaster Committee was relocated to the offices of the Orange County Water District at 10500 Ellis Avenue, P.O. Box 8300, Fountain Valley, California, 92728-8300.

The time for submission of the annual report is seven months after the end of the water year. The items to be reported upon are listed in the letter of transmittal of this report.

Stream Flow and Water Quality Measurements

Stream flow measurements and water quality data required by the Watermaster are, for the most part, furnished by the U.S. Geological Survey (USGS). The financing of the cooperative monitoring program with the USGS is shared by the parties to the Judgment. These costs are set forth in Table 1.

The USGS measured and computed the mean daily discharge of the Santa Ana River at MWD Crossing and below Prado. Runoff data have also been provided for several smaller streams tributary to Prado Reservoir; namely, Chino Creek at Schaefer Avenue, Cucamonga Creek near Mira Loma and Temescal Wash at Corona, and for the Santa Ana River at E Street in San Bernardino and at Mission Boulevard in Riverside.

Precipitation during 1986-87 was below normal and totaled 8.08 inches at San Bernardino County Hospital. Only 0.37 inches were recorded after April 3. In December, January, February, and March a total of 6.42 inches were measured. Significant amounts of storm runoff were recorded during the last two weeks of November and ten days in December at both Riverside Narrows and Prado. Storm runoff continued intermittently from about November 17 through April 8 at Prado and through April 5 at Riverside Narrows. A small amount of storm runoff occurred during the last week of September at Prado and during the last three weeks of September at Riverside Narrows.

The 1986-87 discharge record for the USGS gaging station, "Santa Ana River below Prado" is considered by the USGS to be a "good" record. Nine (9) direct discharge measurements, which ranged from about 4 to 251 cubic feet per second, were made during the year. Beginning January 4, 1987, to May 7, 1987, and intermittently both before and after that period, the discharge was regulated by Prado Reservoir with a maximum of 7,522 acre-feet in storage at noon on March 24, 1987. Flow was also regulated by Prado Reservoir October 1-2 and 7-12, and November 6-7 and November 18-December 23, inclusive, 1986, and June 15-July 12, and September 10-30, inclusive, 1987. The maximum average daily discharge after regulation by Prado Reservoir occurred on January 6, 1987, and amounted to 675 cubic feet per second. The mean annual discharge was approximately 195 cubic feet per second.

The overall 1986-87 discharge record for the USGS gaging station "Santa Ana River at MWD Crossing" is considered by the USGS to be a "poor" record at both low and high stages because of the shifting channel. The station was located at the MWD pipeline crossing for the entire year. The continuous downstream

TABLE 1

COSTS TO THE PARTIES AND USGS FOR MEASUREMENTS WHICH PROVIDE DATA USED BY THE SANTA ANA RIVER WATERMASTER

October 1, 1986 to September 30, 1987

SAN BERNARDINO VALLEY MUNICIPAL WATER DISTRICT		
At Riverside Narrows (MWD Crossing)		
Water Quality Monitor/TDS Samples	$ 637	
Dozer	333	
At Mission Boulevard		
Surface Water Gage	468	$ 1,438
WESTERN MUNICIPAL WATER DISTRICT		
Same as SBVMWD	$ 1,438	
Cucamonga Creek Discharge	1,750	
Chino Creek Discharge	1,167	$ 4,355
CHINO BASIN MUNICIPAL WATER DISTRICT		
Same as WMWD		$ 4,354
ORANGE COUNTY WATER DISTRICT		
At Prado		
Water Quality Monitor/TDS Samples, Water Quality Sampling and Conductivity Programs	$ 5,290	
At Mission Boulevard		
Surface Water Gage	936	
Chino Creek		
Surface Water Gage	1,167	$ 7,393
TOTAL FOR PARTIES		$ 17,540
UNITED STATES GEOLOGICAL SURVEY		$ 14,360
GRAND TOTAL		$ 31,900

movement of sand deposits affected the stage discharge relationship for the station. Control of the channel by bulldozing was not attempted. Nineteen (19) direct discharge measurements, which ranged from 57 to 474 cubic feet per second, were made during the year.

Data related to the operation of Prado Reservoir were obtained from the Corps of Engineers. Water quality data were supplied to the Watermaster by the Orange County Water District, City of Riverside, City of Corona, Chino Basin Municipal Water District, Department of Water Resources (DWR), and the USGS.

Compilation and Analysis of Basic Data

The Watermaster has established procedures for compiling and analyzing the basic data necessary to carry out the provisions of the Judgment. The records maintained by the Watermaster have been listed in prior annual reports. Based on these data, determinations were made of the Base Flow, Storm Flow, Nontributary Flow, and relationships between electrical conductivity (EC) and total dissolved solids (TDS). These determinations are explained in detail in Chapters III and IV.

Administration Costs

In accordance with Paragraph 7(d) of the Judgment, the fees and expenses of each of the members of the Watermaster are borne by the district which nominated such member. All other Watermaster administrative costs and expenses are borne by the parties, with OCWD paying 40 percent of the cost and WMWD, SBVMWD, and CBMWD each paying 20 percent of the cost. The Judgment further provides that the Watermaster may from time to time, at its discretion, require advances of operating capital from the parties.

At its meeting on May 6, 1986, the Watermaster adopted a budget for the fiscal year 1986-87 in the amount of $16,000. Table 2 shows the items and amount included in said budgets together with actual expenses for the fiscal year 1986-87. At its meeting on May 11, 1987, the Watermaster adopted a budget for the fiscal year 1987-88 in the amount of $16,000.

An audit prepared by Diehl, Evans and Company showing the details of income and expenses of the Santa Ana River Watermaster for the fiscal year 1986-87 is included herein as Appendix E.

TABLE 2

SANTA ANA RIVER WATERMASTER BUDGET AND EXPENSES

	July 1, 1986 to June 30, 1987 Budget	July 1, 1986 to June 30, 1987 Expenses	July 1, 1987 to June 30, 1988 Budget
Administration	$ 5,000.00	$ 5,088.00	$ 5,000.00
Support Engineering Services	8,000.00	8,299.00	8,000.00
Reproduction of Annual Report	3,000.00	2,635.00	3,000.00
Total	$ 16,000.00	$ 16,022.00	$ 16,000.00

Summary of Findings

A summary of findings by the Watermaster for the period 1970-71 through 1986-87 is presented in Table 3. The Base Flow obligations at both Riverside Narrows and Prado Dam provided for in the Judgment have been met and cumulative credits have been established.

TABLE 3

SUMMARY OF FINDINGS

AT PRADO

Water Year	Rainfall (in)[1]	Total Flow (ac-ft)[2]	Base Flow (ac-ft)	Weighted TDS (mg/L)[3]	Adjusted Base Flow (ac-ft)	Cumulative Credit (ac-ft)
1970-71	11.97	51,864	38,402	727	38,402	(3,598)
1971-72	9.62	51,743	40,416	707	40,416	(5,182)
1972-73	18.46	77,484	48,999	638	51,531	4,349
1973-74	12.72	63,620	43,106	633	45,513	7,862
1974-75	13.49	61,855	50,176	694	51,263	17,125
1975-76	15.86	59,209	45,627	635	48,098	23,223
1976-77	11.95	62,953	48,387	660	50,000	31,223
1977-78	30.47	252,837	58,501	383	73,955	63,178
1978-79	17.51	134,486	71,863	580	79,049	100,227
1979-80	30.93	527,760	82,509	351	106,505	164,732
1980-81	10.45	117,888[4]	74,875[5]	728	74,875[5]	205,652[6]
1981-82	18.34	143,702	81,548	584	89,431	253,083
1982-83	32.36	426,273[4]	111,692[5]	411	138,591[5]	353,036[6]
1983-84	10.81	178,395[4]	109,231[5]	627	115,876[5]	431,514[6]
1984-85	12.86	162,912	125,023[8]	617	133,670	523,184
1985-86	17.86	196,565	127,215[8]	567	141,315	622,499
1986-87	8.08	140,872	119,848	622	127,638	708,137

AT RIVERSIDE NARROWS

Water Year	Rainfall (in)[1]	Total Flow (ac-ft)[2]	Base Flow (ac-ft)	Weighted TDS (mg/L)[3]	Adjusted Base Flow (ac-ft)	Cumulative Credit (ac-ft)
1970-71	11.97	24,112	17,061	704	17,012	1,762
1971-72	9.62	22,253	16,157	712	16,017	2,529
1972-73	18.46	32,571	17,105	700	17,105	4,384
1973-74	12.72	24,494	16,203	700	16,203	5,337
1974-75	13.49	19,644	15,445	731	15,100	5,187
1975-76	15.86	26,540	17,263	723	16,977	6,914
1976-77	11.95	23,978	18,581	722	18,286	9,950
1977-78	30.47	181,760	22,360	726	21,941	16,641
1978-79	17.51	47,298	26,590	707	26,456	27,847
1979-80	30.93	254,077	25,549[7]	676	25,549	38,146
1980-81	10.45	34,278	19,764	715	19,550	42,446
1981-82	18.34	83,050	32,778	678	32,778	59,974
1982-83	32.36	279,987	57,128	610	57,128	101,852
1983-84	10.81	82,745	56,948	647	56,948	143,550
1984-85	12.86	78,771	69,772[8]	633	69,772	198,072
1985-86	17.86	99,258	68,220[8]	624	68,220	251,042
1986-87	8.08	78,093	59,808	649	59,808	295,600

(1) Measured at San Bernardino County Hospital.

(2) Does not include Nontributary Flow.
(3) For Base and Storm Flow at Prado and Base Flow only at Riverside Narrows.
(4) Includes 16,090 acre-feet of water pumped from Lake Elsinore which passed Prado Dam in 1980-81; 7,720 acre-feet in 1982-83 and 12,550 acre-feet in 1983-84.
(5) Excludes water pumped from Lake Elsinore.
(6) Includes 8,045 acre-feet in 1979-80, 3,362 acre-feet in 1982-83, and 4,602 acre-feet in 1983-84 of Lake Elsinore discharge.
(7) Includes Rubidoux Wastewater in 1979-80 and subsequent years.
(8) The values shown include groundwater pumped from San Bernardino Basin and released to the river in accordance with Court Orders approving agreement and allowing temporary additional extractions of water from the San Bernardino Basin Area.

Note: For the years 1973-74 through 1979-80, a correction has been made for different losses of State water than assumed in reports published for these years. The values changed are Base Flow, weighted TDS, and adjusted Base Flow. These changes, in turn, have changed the cumulative credit for these years. See Appendix C in the Twelth Annual Report, 1981-1982.

CHAPTER II
WATER SUPPLY CONDITIONS

The precipitation in the Santa Ana River Watershed during 1986-87, as represented by rainfall measured at San Bernardino County Hospital, was about 45 percent of normal in terms of the Base Period average. The total flow of the Santa Ana River below Prado during the 1986-87 water year was about 140,900 acre-feet as compared to a total flow of 196,900 acre-feet which occurred in the previous year. The subnormal rainfall in the Santa Ana River Watershed during 1986-87 resulted in decreased Base Flow amounts at both Riverside Narrows and Prado, 59,808 acre-feet and 119,848 acre-feet, respectively, or 88 percent and 94 percent, respectively, of 1985-86 Base Flows.

Chino Basin Groundwater Storage Program

This program was described and its implications with respect to Watermaster responsibilities and activities were described in the Sixteenth Annual Report. No water was stored underground in 1986-87 or previously. Metropolitan Water District of Southern California (MWD) is negotiating agreements with the concerned agencies and is making the necessary environmental studies and preparing the required environmental documentation and environmental impact report.

Discharge of Groundwater From San Bernardino Basin Area To Santa Ana River

This program also was described in the Sixteenth Annual Report. No groundwater was pumped from San Bernardino Basin to the Santa Ana River in 1986-87.

Proposed Discharge of State Project Water Above Prado Ontario/MWD Exchange Program

The Sixteenth Annual Report presents a description of this program and its implications with respect to the responsibilities and activities of the Watermaster. During 1986-87 Metropolitan Water District of Southern California (MWD) delivered 228 acre-feet of Colorado River water to the City of Ontario

during September under the Program. No State Project water was released to San Antonio Creek.

The Watermaster has made some further field studies of the hydrologic and hydraulic conditions along Chino Creek as such conditions may affect quantity and quality of Base Flow at Prado due to the State Water Project dilution water that will be released to San Antonio Creek from OC-59. The Watermaster is developing a methodology and procedures to determine such effects. The USGS has offered to work with the Watermaster to obtain the necessary field information. The Watermaster has accepted the offer.

MWD has agreed to reimburse the Watermaster for the increase in costs due to the Watermaster's involvement with the Program in determining the Base Flow effects.

Santa Ana Watershed Project Authority

Projects Affecting Base Flow in the Santa Ana River

Santa Ana Watershed Project Authority (SAWPA), a joint exercise of powers agency, was formed in 1968 to plan, finance, construct, and operate projects which relate to water quality/quantity management in the Santa Ana basin. Member agencies of SAWPA are:

Chino Basin Municipal Water District (CBMWD)

Eastern Municipal Water District (EMWD)

Orange County Water District (OCWD)

San Bernardino Valley Municipal Water District (SBVMWD)

Western Municipal Water District (WMWD)

SAWPA is actively engaged in the planning and construction of several projects that could affect the quantity and quality of flow in the Santa Ana River at Riverside Narrows and below Prado Dam. Some of these projects will decrease the quantity of Base Flow at Prado by bypassing water around Prado but will improve quality by removing poor quality wastewaters and poor quality groundwater from the upper area with final disposal to the ocean within the restrictions imposed by the Regional Water Quality Control Board.

SAWPA has completed construction of and is currently operating the Santa Ana Regional Interceptor (SARI) from Fillmore Street in Riverside and Carbon Canyon Road in Chino to the Orange County Sanitation District's wastewater treatment facilities. Here the SARI flows are treated for final disposal to the

ocean through a diffuser located 5 miles from the shoreline. SAWPA plans to extend the SARI line to San Bernardino.

The sources of wastewater discharged to the SARI system include industries with direct connections, the California Rehabilitation Center at Norco, effluent from the Stringfellow Treatment Plant, industrial and commercial wastewater hauled to a truck station, and untreated domestic sewage. During water year 1986-87, 5,043 acre-feet of wastewater from the area above Prado was discharged to the ocean via the SARI system.

Other SAWPA projects which may affect the quantity and quality of river flow include:

Woodcrest State Project Water Pipeline

Arlington Desalter

Western Riverside County Regional Wastewater System

San Bernardino Regional Tertiary Wastewater System

Lake Elsinore Stabilization Program

Precipitation During 1986-87

During the 1986-87 water year, the precipitation at the San Bernardino County Hospital amounted to 8.08 inches, which is 45 percent of the Base Period average. Most of the precipitation, 79 percent, occurred during the months of December through March. The maximum monthly precipitation of 2.01 inches occurred during March.

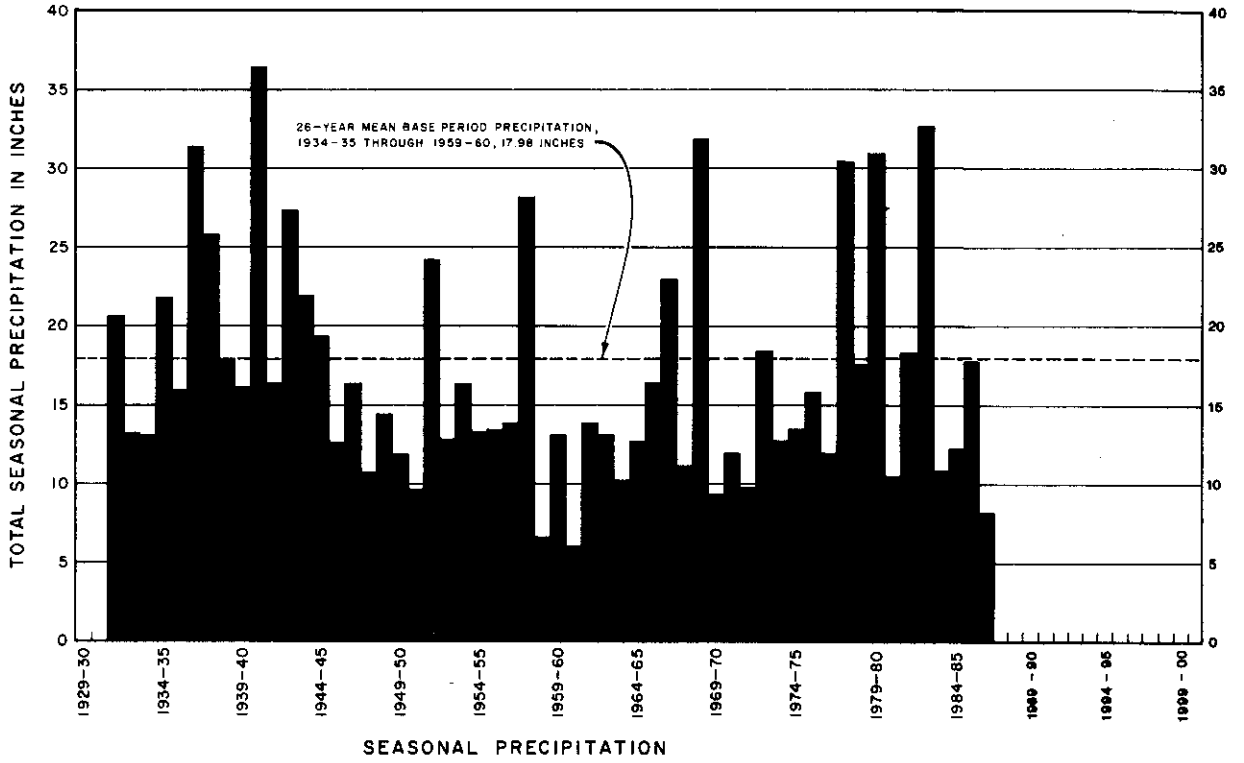
Figure 1 shows the seasonal precipitation from 1931-32 through 1986-87 and the accumulated departure from the 1934-35 through 1959-60 Base Period average.

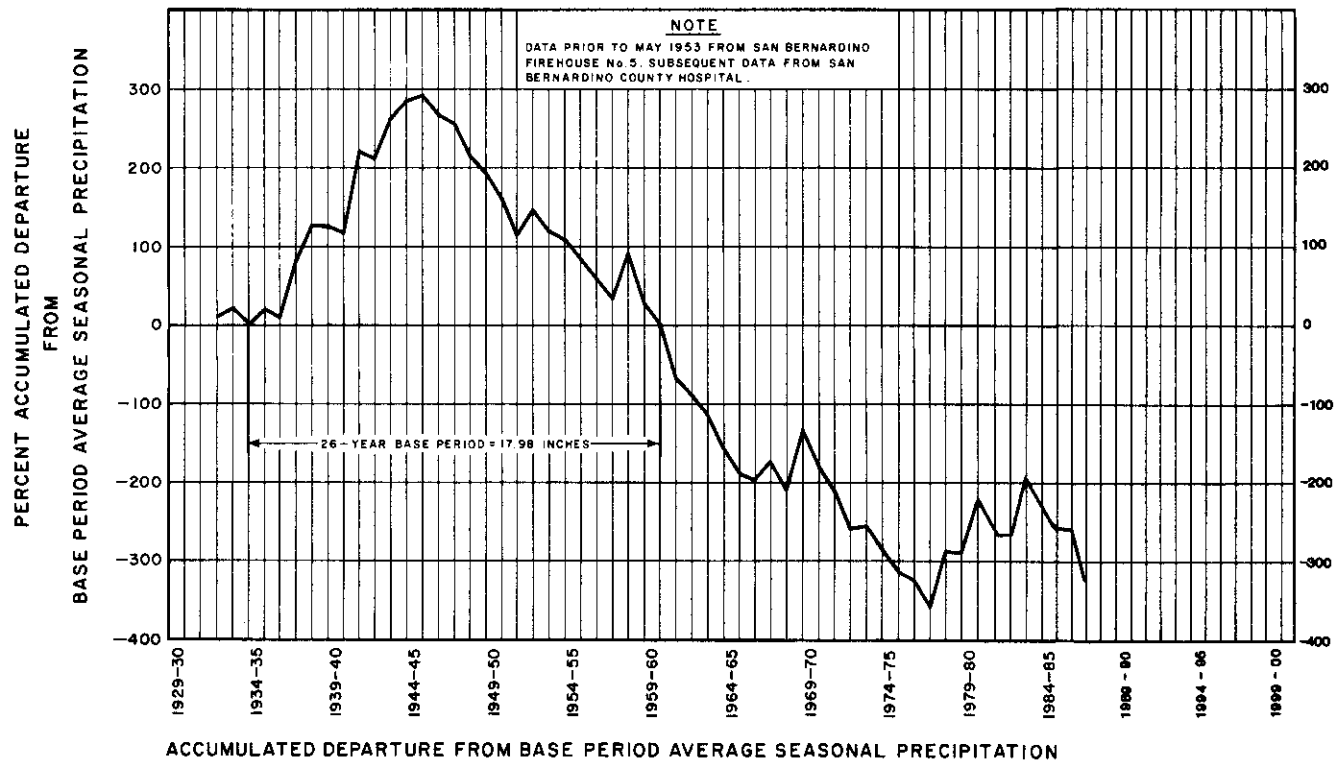
Runoff During 1986-87

Below Prado

The total seasonal flow at Prado for the 1986-87 water year was about 140,900 acre-feet, well above the Base Period (1934-35 through 1959-60) average of 78,780 acre-feet per year.

After 1943-44, the Base Flow at Prado progressively decreased and reached a low in 1960-61 of 26,190 acre-feet. Since that year, the Base Flow has substantially increased. During the 17-year period (1970-71 through 1986-87) since the Judgment went into effect, the Base Flow, unadjusted for quality, has averaged 75,142 acre-feet per year. This compares to the 26-year Base Period





VARIATION IN PRECIPITATION AT SAN BERNARDINO

FIGURE 1

average of 47,470 acre-feet and the Base Flow requirements under the Judgment of 42,000 acre-feet. The 1986-87 unadjusted Base Flow amounted to 119,848 acre-feet, an increase of 44,706 acre-feet over the 17-year average.

The calculated inflow to Prado Reservoir in 1986-87 was about 143,500 acre-feet. During the month of January, inflow amounted to about 19,200 acre-feet, or 13 percent of the seasonal total. The recorded maximum storage in Prado Reservoir occurred at noon March 24, 1987, when 7,522 acre-feet (about 3 percent of the reservoir capacity at spillway level) was in storage. The maximum release of 675 cfs from Prado Reservoir occurred January 6, 1987.

Figure 2 shows the Storm and Base Flow components of the Total Flow in the Santa Ana River below Prado during the period 1934-35 through 1986-87.

At Riverside Narrows

The Total Flow of the Santa Ana River at Riverside Narrows for the 1986-87 water year was about 78,090 acre-feet.

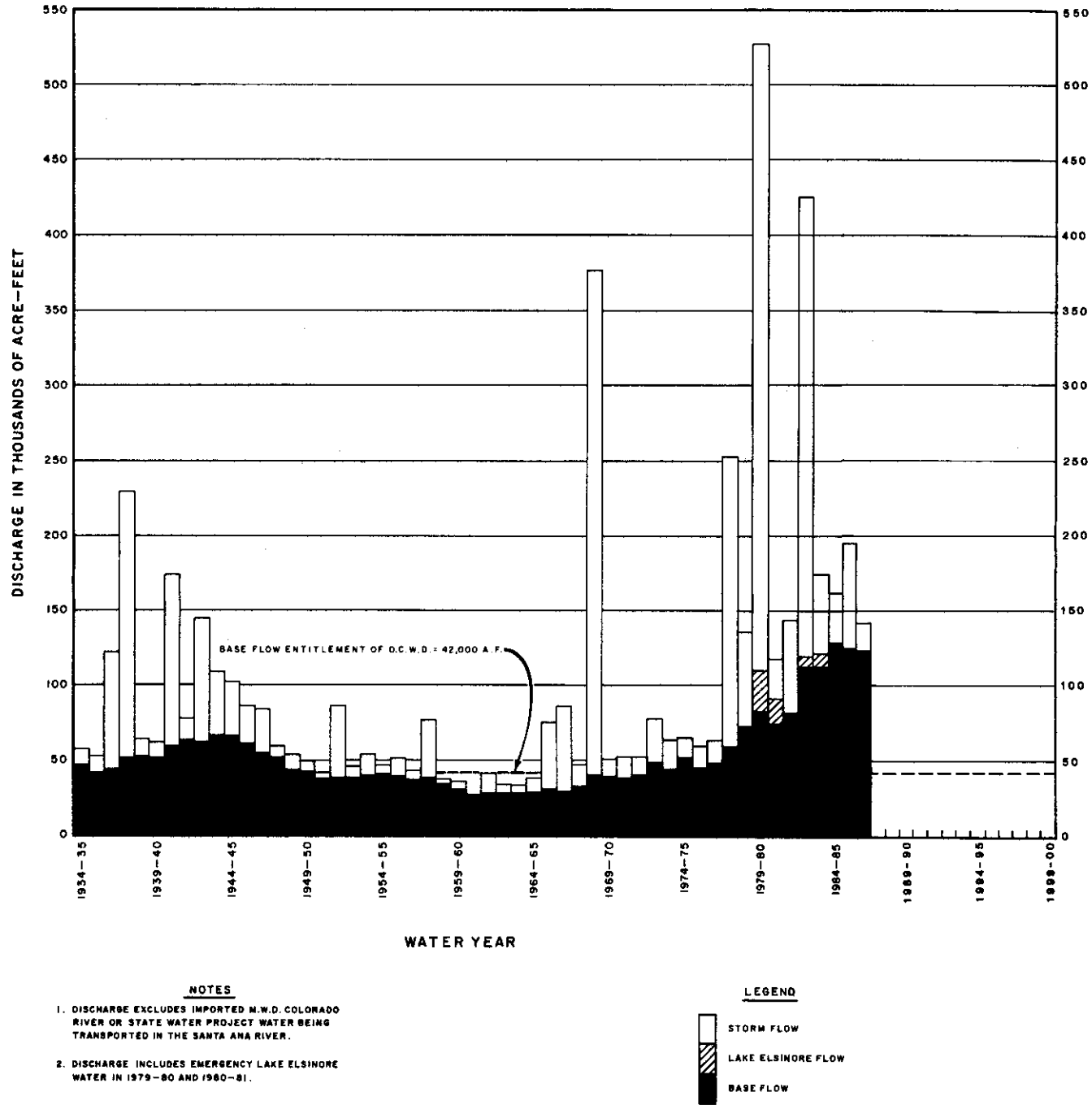
The unadjusted Base Flow at Riverside Narrows decreased from 27,120 acre-feet in 1943-44 to an all-time low of 13,450 acre-feet in 1965-66. Since that time, the Base Flow at Riverside Narrows has generally increased. During the 17-year period 1970-71 through 1986-87, the Base Flow has averaged 32,749 acre-feet per year. The 1986-87 unadjusted Base Flow amounted to 59,808 acre-feet, an increase of about 27,000 acre-feet over the 17-year average.

Figure 3 shows the components of Total Flow in the Santa Ana River at Riverside Narrows for the period from 1934-35 through 1986-87.

Wastewater Effluent Discharges

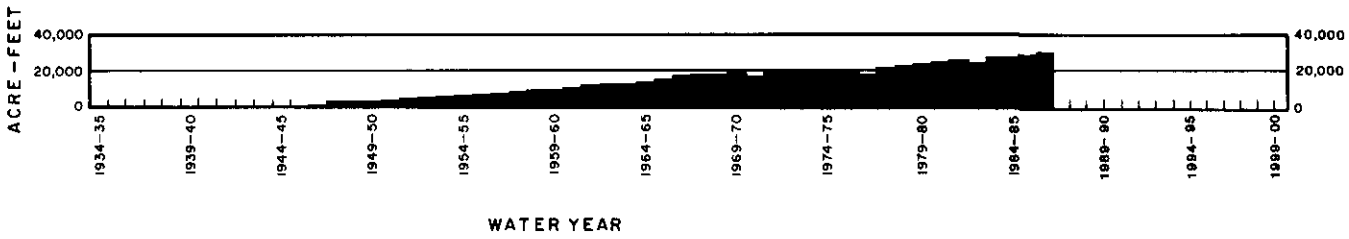
A portion of the Base Flow at Prado is made up of treated wastewater effluent discharged from a number of wastewater treatment plants located above Prado.

The quantities discharged by the major agencies are shown in Table No. 4. For the year 1985-86, about 111,000 acre-feet were discharged to the river above Prado.

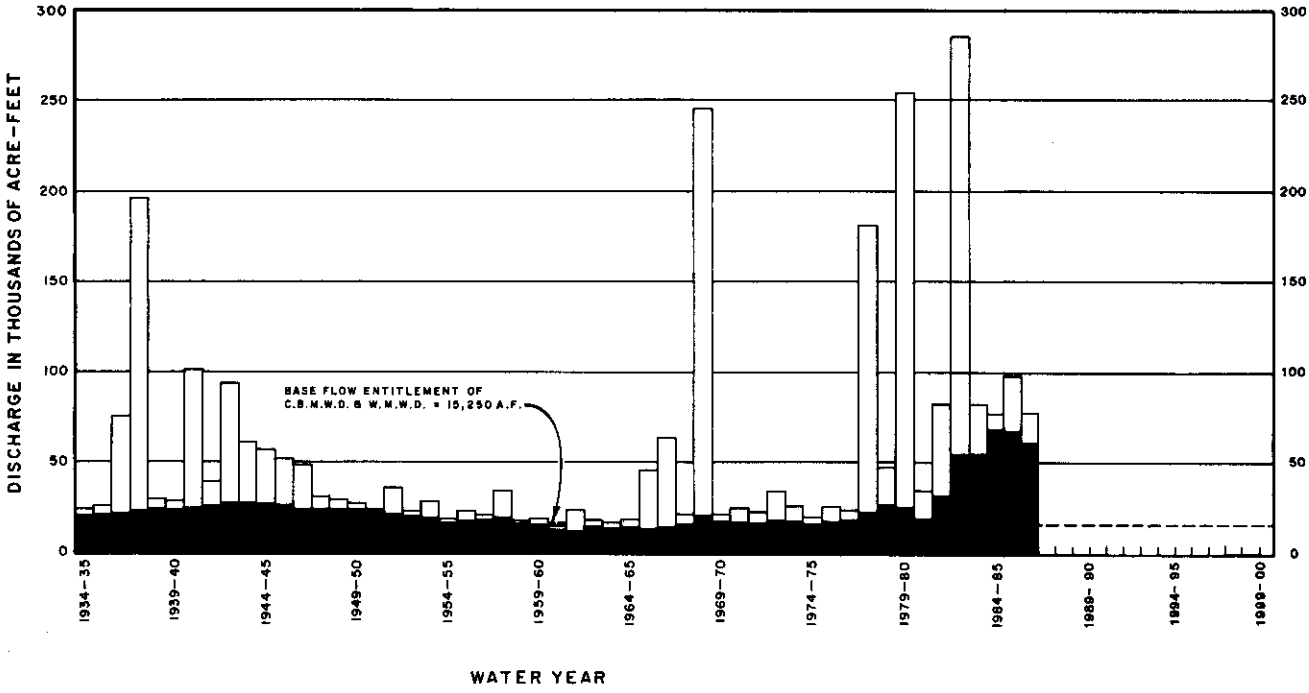


DISCHARGE OF SANTA ANA RIVER BELOW PRADO DAM

FIGURE 2



SEWAGE EFFLUENT FROM RIVERSIDE WATER QUALITY CONTROL PLANTS



NOTES

1. DISCHARGE EXCLUDES SEWAGE EFFLUENT FROM THE RIVERSIDE WATER QUALITY CONTROL PLANTS AND IMPORTED M.W.D. COLORADO RIVER OR STATE WATER PROJECT WATER BEING TRANSPORTED IN THE SANTA ANA RIVER.
2. DISCHARGE OF RUBIDOUX WASTEWATER PLANT INCLUDED IN BASE FLOW COMMENCING IN 1979-80.

LEGEND

STORM FLOW

BASE FLOW

DISCHARGE OF SANTA ANA RIVER AT RIVERSIDE NARROWS

FIGURE 3

TABLE 4

WASTEWATER EFFLUENT DISCHARGED ABOVE PRADO BY MAJOR AGENCIES
(Acre-Feet)

Year	Red-lands	San Bernardino	Colton	Rialto	River-side	Corona	CBMWD #1	CBMWD #2	Total
1970-71	2,650	17,860	2,520	2,270	18,620	3,190	0	0	47,110
1971-72	2,830	16,020	2,230	2,400	19,010	3,230	6,740	0	52,460
1972-73	2,810	18,670	2,530	2,260	19,060	3,340	10,380	0	59,050
1973-74	2,770	17,680	2,350	2,320	19,560	3,510	11,440	2,320	61,950
1974-75	2,540	16,750	1,980	2,320	19,340	4,020	14,960	2,280	64,190
1975-76	2,450	17,250	2,540	2,240	19,580	4,700	15,450	2,950	67,160
1976-77	3,170	17,650	3,260	2,330	18,770	5,010	14,640	3,380	68,210
1977-78	3,280	18,590	3,810	2,380	20,310	5,200	14,650	4,060	72,280
1978-79	3,740	19,040	3,850	3,050	21,070	5,390	15,040	5,070	76,250
1979-80	4,190	20,360	4,190	2,990	22,910	5,360	14,410	5,520	79,930
1980-81	4,410	20,550	3,930	3,370	24,180	5,590	17,270	5,260	84,560
1981-82	4,420	23,340	3,780	3,470	25,640	5,410	19,580	5,360	91,000
1982-83	4,530	24,160	3,600	3,620	25,020	5,860	20,790	4,290	91,870
1983-84	5,150	22,080	3,700	3,830	26,090	6,200	20,950	3,950	91,950
1984-85	4,990	23,270	3,830	4,070	27,750	6,250	25,160	4,280	99,600
1985-86	5,200	24,720	4,010	4,720	28,820	5,900	28,240	2,660	104,270
1986-87	5,780	26,810	4,170	5,350	30,340	6,170	27,160	5,000	110,780

The amounts shown in Table 4 were determined from data provided by the agencies.

CHAPTER III
BASE FLOW AT PRADO

This chapter deals with determinations of: 1) the components of flow at Prado, which include Nontributary Flow, Storm Flow, and Base Flow; and 2) the adjusted Base Flow at Prado credited to CBMWD and WMWD.

Total Flow at Prado

The total flow of the Santa Ana River at Prado amounted to 140,872 acre-feet, measured at the USGS gaging station below Prado. This included 808 acre-feet that was in storage at the beginning of the year. Also 3,461 acre-feet were in storage at the end of the water year. The inflow into the reservoir, comprised 119,848 acre-feet of Base Flow and 23,343 acre-feet of Storm Flow. Nontributary Flow during 1986-87 due to the release of State Project water above Riverside Narrows during 1972-73 was 334 acre-feet. The components of flow of the Santa Ana River at Prado for each month in the 1986-87 water year are listed in Table 5, and are shown graphically on Plate 2.

Nontributary Flow

Since May 1973, OCWD has from time to time purchased State Project water for the replenishment of the groundwater basins in Orange County. The water has been released at two locations: Santa Ana River above Riverside Narrows (1972-73 only) and San Antonio Creek near Upland.

Releases Above Riverside Narrows

As fully discussed in Appendix F of the Fifth Annual Report, the Watermaster Committee determined a schedule of credits to OCWD for State Project water which was released above Riverside Narrows during 1972-73; for 1986-87 the credit is 334 acre-feet, assumed to be distributed uniformly throughout the year, as shown in Table 5. A portion of this water, because it percolated in the basin above the Narrows, did not reach the Narrows in 1972-73, and the schedule as developed in the fifth annual report, is the best estimate of the amount that reaches Riverside Narrows each year.

TABLE 5

COMPONENTS OF FLOW AT PRADO FOR WATER YEAR 1986-87

(acre-feet)

Month	Prado Outflow	Storage Change (1)	Computed Inflow	Storm Flow	Nontrib. Flow (2)	Base Flow
October	11,571	-807	10,764	1,813	28	8,923
November	11,456	+40	11,496	1,446	28	10,022
December	13,728	-38	13,690	2,216	28	11,446
January	16,606	+2,592	19,198	7,049	28	12,121
February	12,775	+2,010	14,785	3,539	28	11,218
March	15,630	+2,564	18,194	5,712	28	12,454
April	18,643	-6,323	12,320	1,393	28	10,899
May	11,341	-846	10,495	0	28	10,467
June	8,021	+105	8,126	0	28	8,098
July	8,563	-105	8,458	0	28	8,430
August	7,819	0	7,819	0	27	7,792
September	4,719	+3,461	8,180	175	27	7,978
Total	140,872	2,653	143,525	23,343	334	119,848

(1) The monthly change in storage is included in the monthly components of flow.

(2) That portion of State Project water released during 1972-73 upstream of Riverside Narrows, determined to have reached Prado in 1986-87.

Releases to San Antonio Creek

During water year 1986-87, OCWD did not purchase State Project water to be released from the Rialto Reach of the Foothill Feeder at OC-59 into San Antonio Creek near Upland. Therefore, there was no Nontributary Flow of State Project water through Prado from this source during 1986-87.

Storm Flow

Generally during storms, the U.S. Army Corps of Engineers operates the Prado gates so that some of the storm runoff is temporarily held in storage behind the dam. As the storm ends, Prado Reservoir storage is generally reduced by the controlled releases to the downstream water conservation facilities operated by OCWD. Monthly and annual quantities of Storm Flow are shown in Table 5.

The Orange County Water District and the U.S. Army Corps of Engineers continued their cooperative study on water conservation at Prado. The study which is being funded by the District and conducted by the Corps was originally to be finalized in October of 1987. The study, however, is continuing due to uncertain factors related to the habitat of the least Bell's vireo, the Santa Ana River Mainstem Project and relocation studies for Prado Petroleum. The study is now expected to be completed in May of 1988. Alternative studies by the Corps are for water conservation pools at elevation 514 or below. The 514 elevation was used as the upper limit as that is the elevation referred to in the stipulated Judgment which allows water conservation by the District up to that level. All of the impacts which water conservation could affect are evaluated in the study including the agricultural leases, recreational leases, airport, sewerage and oil facilities. The study also has an indepth evaluation of the environmental effects focused primarily on the least Bell's vireo. The vireo was designated as an endangered species in 1986, however, as of the first of February, 1988 a decision had not been made as to the designation of critical habitat for this species.

In regard to the least Bell's vireo, the OCWD in cooperation with the Flood Control District's of Orange, Riverside and San Bernardino counties and other parties are conducting a study which will develop a Habitat Conservation Plan for the vireo in the entire Santa Ana River. That study is scheduled to be completed in June of 1988. The Habitat Conservation Plan lays out a possible plan in which the least Bell's vireo may be protected and/or enhanced in the environment as it relates to other projects on the river system.

In November of 1986, President Reagan signed the Water Resources Development Act (P.L. 99-662) which authorized the Santa Ana River Mainstem Project. The next major step is the preparation of a design memorandum which is scheduled to be delivered to Washington, D.C. in August of 1988. The design memorandum includes the initial design concepts for the entire Santa Ana River Project including Seven Oaks Dam, Prado Dam, facilities on the Santa Ana River as well as the Oak Street Drain and Santiago Creek.

During the 1986-87 water year, more than 100 acre-feet of water was stored behind Prado during the periods October 1 and 2, and 7 to 12, 1986, November 18 to 25, 1986, December 6 to 21, 1986, January 4 to May 5, 1987, June 17 to 30, 1987, and September 11 to 30, 1987. During those periods, the water stored in Prado Reservoir varied up to a maximum of 7,522 acre-feet and the maximum mean daily flow released to the Santa Ana River was 675 cfs.

Base Flow

The determination of Base Flow was affected by Nontributary Flow which had been released above Riverside Narrows. The general procedure used by the members of the Watermaster to separate the 1986-87 flow components was the same as used for previous years and is fully described in the Fifth Annual Report. The monthly and annual amounts are shown in Table 5.

Water Quality

The weighted average total dissolved solids (TDS) for the total flow passing Prado Dam, including Nontributary Flow released above Riverside Narrows was found to be 621 mg/L. This determination was based on records from a continuous monitoring device, operated by the USGS, for electrical conductivity (EC) of the Santa Ana River below Prado, supplemented by grab samples for EC and TDS determination, and a statistical correlation of EC and TDS.

The EC of the outflow at Prado was recorded hourly on a punched tape by the USGS. The USGS collected a total of 19 grab samples and performed laboratory analyses for TDS. A correlation between TDS and EC was developed using the TDS data from the grab samples and the field EC recorded by the technician at the times when the samples were collected. Data used for the statistical analysis are listed in Table B-1, Appendix B. The statistical analysis yields the best fit equation shown below:

$$TDS = EC/[1.5188 + (9.1409 \times 10^{-5}) \times EC)]$$

where: TDS = mg/L

EC = micromhos/cm

Application of the equation relating EC to TDS provided hourly TDS values. Using hourly data, flow weighted average daily values for TDS were computed and are listed in Table B-2, Appendix B.

The plot of TDS on Plate 3 shows the daily average TDS concentration of the Santa Ana River flow passing Prado Dam. The daily average TDS concentration was calculated from the hourly EC measurements and the correlation of EC and TDS. As daily TDS concentration could not be determined during the period when continuous EC data were not available, TDS was approximated by using best available data. Laboratory values of TDS from grab samples taken during the malfunction period aided in approximation.

Water Quality Adjustment for Nontributary Flow

The weighted average annual TDS of State Project water value of 621 mg/L, shown in Table B-3, Appendix B, represents the quality of Total Flow which includes Nontributary Flow from release of State Project water to Santa Ana River above Riverside Narrows. The stipulated Judgment requires that Base Flow shall be subject to adjustment based on the TDS of Base Flow and Storm Flow only. Hence, the following determination of Base Flow plus Storm Flow TDS has been made.

The flow weighted average TDS of State water released above Riverside Narrows during 1972-73 was 235 mg/L and was adjusted to 242 mg/L to reflect a 3 percent evapotranspiration loss of the water released.

		Annual Flow (acre-feet)	Average TDS (mg/L)	Annual Flow x Average TDS (acre-feet x mg/L)
1.	Total Flow	140,872	621	87,481,512
2.	Nontributary Flow Riverside Narrows	334	242	80,828
3.	Total Base and Storm Flows	140,538		87,400,684
4.	Average TDS of Total Base and Storm Flows	87,400,684	÷ 140,538 = 622 mg/L	

After adjusting for Nontributary Flows of State Project water from above Riverside Narrows, the weighted average annual TDS of Storm Flow and Base Flow for 1986-87 was 622 mg/L, as shown above.

Adjusted Base Flow at Prado

The stipulated Judgment provides that the amount of Base Flow at Prado received during any year shall be subjected to adjustment based on weighted average annual TDS of the Base Flow and Storm Flow at Prado as follows:

If the Weighted Average TDS in Base Flow and Storm Flow at Prado is:	Then the Adjusted Base Flow shall be determined by the formula:
Greater than 800 mg/L	$Q - \frac{35}{42,000} Q\ (TDS-800)$
700 mg/L to 800 mg/L	Q
Less than 700 mg/L	$Q + \frac{35}{42,000} Q\ (700-TDS)$

Where: Q = Base Flow actually received.

The weighted average annual TDS of 622 mg/L is less than 700 mg/L. Therefore, the Base Flow must be adjusted by the above equation for TDS less than 700 mg/L. Thus the Adjusted Base Flow is as follows:

$$(119,848 \text{ ac-ft}) + \frac{35}{42,000} (119,848 \text{ ac-ft})(700 - 622) = 127,638 \text{ ac-ft}$$

Entitlement and Credit or Debit

From pages 12 and 13 of the stipulated Judgment, the following obligation of the CBMWD and WMWD is given: "CBMWD and WMWD shall be responsible for an average annual Adjusted Base Flow of 42,000 acre-feet at Prado..... CBMWD and WMWD each year shall be responsible for not less than 37,000 acre-feet of Base Flow at Prado, plus one-third of any cumulative debit; provided, however, that for any year commencing on or after October 1, 1986, when there is not cumulative debit, or for any year prior to 1986 whenever the cumulative credit exceeds 30,000 acre-feet, said minimum shall be 34,000 acre-feet."

The Watermaster's findings concerning flow at Prado for 1986-87 required under the stipulated Judgment are as follows:

1.	Total Flow at Prado	140,872	acre-feet
2.	Base Flow at Prado	119,848	acre-feet
3.	Annual Weighted TDS of Base and Storm Flows	622	mg/L
4.	Annual Adjusted Base Flow	127,638	acre-feet
5.	Cumulative Adjusted Base Flow	1,422,137	acre-feet
6.	Cumulative Entitlement of OCWD	714,000	acre-feet
7.	Cumulative Credit	708,137	acre-feet
8.	One-Third of Cumulative Debit	0	acre-feet
9.	Minimum Required Base Flow in 1987-88	34,000	acre-feet

CHAPTER IV
BASE FLOW AT RIVERSIDE NARROWS

This chapter deals with determination of 1) the components of flow at Riverside Narrows, which include Nontributary Flow, Storm Flow, and Base Flow; and 2) the adjusted Base Flow at Riverside Narrows credited to SBVMWD.

Total Flow at Riverside Narrows

The total flow of the Santa Ana River at Riverside Narrows amounted to 78,093 acre-feet, measured at the USGS gaging station near the MWD Upper Feeder Crossing. Separated into its components, Base Flow was 59,808 acre-feet, Storm Flow was 20,128 acre-feet, and Nontributary Flow due to a prior release of State Project water above Riverside Narrows was 341 acre-feet. Included in Base Flow are 2,184 acre-feet of wastewater from Rubidoux Community Services District which now bypasses the USGS gaging station. The components of flow of the Santa Ana River at Riverside Narrows for each month in the 1986-87 water year are listed in Table 6 and graphically shown on Plate 4.

Nontributary Flow

During the period May through September, 1973, 11,617 acre-feet of State Project water from the East Branch of the California Aqueduct was purchased by the Orange County Water District and released into the Santa Ana River in the vicinity of Colton.

The Watermaster's determination of the effect of these releases has been discussed in the Fifth Annual Report of the Watermaster. For the water year 1986-87 the amount of State Project water reaching Riverside Narrows has been agreed upon as 341 acre-feet.

Base Flow

Based on the hydrograph shown on Plate 4 and utilizing in general the procedures reflected in the Work Papers of the engineers (as referenced in Paragraph 2 of the Engineering Appendix of the stipulated Judgment), a separation was made between Storm Flow and the sum of Base Flow and Nontributary Flow.

TABLE 6

COMPONENTS OF FLOW AT RIVERSIDE NARROWS FOR WATER YEAR 1986-87

(acre-feet)

		Total Flow USGS Measurement	Storm Flow	Non-tributary Flow	Rubidoux Waste-water	Base Flow (1)
1986	October	4,794	286	29	173	4,652
	November	6,000	1,117	29	177	5,031
	December	6,246	1,379	29	182	5,020
1987	January	12,704	7,164	29	187	5,698
	February	7,948	2,863	29	167	5,223
	March	11,879	6,222	28	190	5,819
	April	6,030	778	28	178	5,402
	May	4,955	0	28	185	5,112
	June	4,982	0	28	181	5,135
	July	4,421	0	28	183	4,576
	August	3,632	0	28	192	3,796
	September	4,502	319	28	189	4,344
Total		78,093	20,128	341	2,184	59,808

(1) Base Flow includes Rubidoux wastewater discharged below Riverside Narrows.

Nontributary Flow was assumed to be equally distributed throughout the year (341 acre-feet divided by 12 months) and subtracted from the sum of the Base Flow and Nontributary Flow as shown on Table 6.

In April 1980, Rubidoux Community Services District made the first delivery of wastewater to the regional treatment plant at Riverside. Prior to that time, Rubidoux had discharged to the river upstream of the Riverside Narrows Gaging Station. Wastewater from Rubidoux during water year 1986-87, in the amount of 2,184 acre-feet as shown in Appendix D, has been added to the streamflow as measured at the gaging station.

Water Quality

The determination of quality of water at the Riverside Narrows Gaging Station was made using periodic grab samples taken and analyzed for TDS by the

USGS, DWR and the City of Riverside. The results are summarized in Appendix C, Table C-1. Table C-2 shows the flow weighted quality of streamflow passing the gaging station which includes the nontributary flow.

The flow weighted quality of wastewater from Rubidoux is shown in Appendix D, Table D-1 as 738 mg/L. The Base Flow quality resulting from exclusion of the Nontributary Flow and inclusion of the Rubidoux wastewater is shown in the following table as 649 mg/L.

		Annual Flow (acre-feet)	Avg. TDS (mg/L)	(Annual Flow) x (Avg. TDS) (acre-feet x mg/L)
1.	Base Flow including Nontributary Flow	57,965	643	37,294,312
2.	Less Nontributary Flow	341	237	80,817
3.	Plus Rubidoux Wastewater	2,184	738	1,610,716
4.	Base Flow	59,808	649	38,824,211

Adjusted Base Flow at Riverside Narrows

The stipulated Judgment provides that the amount of Base Flow at Riverside Narrows received during any year shall be subject to adjustment based on the weighted average annual TDS of the Base Flow as follows:

If the Weighted Average TDS in Base Flow at Riverside Narrow is:	Then the Adjusted Base Flow shall be determined by the formula:
Greater than 700 mg/L	$Q - \frac{11}{15,250} Q\,(TDS-700)$
600 mg/L to 700 mg/L	Q
Less than 600 mg/L	$Q + \frac{11}{15,250} Q\,(600-TDS)$

Where: Q = Base Flow actually received.

From the previous subsection, the weighted average annual TDS in the Base Flow at Riverside Narrows for the water year 1986-87 was 649 mg/L. Therefore, no adjustment is necessary, and the Adjusted Base Flow for 1986-87 is 59,808.

Entitlement and Credit or Debit

Paragraph 5(b) of the Judgment states that "SBVMWD shall be responsible for an average annual Adjusted Base Flow of 15,250 acre-feet at Riverside Narrows... SBVMWD each year shall be responsible at Riverside Narrows for not less than 13,420 acre-feet of Base Flow plus one-third of any cumulative debit, provided, however, that for any year commencing on or after October 1, 1986, when there is no cumulative debit, or for any year prior to 1986 whenever the cumulative credit exceeds 10,000 acre-feet, said minimum shall be 12,420 acre-feet."

The Watermaster's findings at Riverside Narrows for 1986-87 required under the Judgment are as follows:

1.	Base Flow at Riverside Narrows	59,808	acre-feet
2.	Annual Weighted TDS of Base Flow	649	mg/L
3.	Annual Adjusted Base Flow	59,808	acre-feet
4.	Cumulative Adjusted Base Flow	554,850	acre-feet
5.	Cumulative Entitlement of CBMWD and WMWD	259,250	acre-feet
6.	Cumulative Credit	295,600	acre-feet
7.	One-Third of Cumulative Debit	0	acre-feet
8.	Minimum Required Base Flow in 1987-88	12,420	acre-feet

APPENDIX A

NONTRIBUTARY WATER RELEASED BY MWD TO SAN ANTONIO CREEK NEAR UPLAND

CONNECTION OC-59

1986-87

PREPARED BY

DONALD L. HARRIGER

TABLE A-1

NONTRIBUTARY WATER FROM OC-59
MONTHLY TOTALS
(Acre-Feet)

WATER YEAR 1986-87

No Water was released in Water Year 1986-87 from OC-59 for the Orange County Water District

APPENDIX B

WATER QUALITY-
SANTA ANA RIVER BELOW PRADO

1986-87

PREPARED BY

WILLIAM R. MILLS, JR.

METHOD OF ANALYZING WATER QUALITY DATA

Utilizing the USGS water quality records, the following analyses were performed by the Watermaster to determine the annual weighted TDS:

1. Mean daily flow weighted specific conductivity (EC) was calculated using the punched tape from the Prado water quality recorder, processed by a computer program designed by USGS. Input to the program included hourly EC data from the recorder tape, which was flow weighted using hourly discharge stage data from the water stage recorder. However, due to recorder malfunction, hourly EC data was not available for the periods from October 1 and 2 and 7 to 10, 1986, November 6 and 7, 1986, January 29 and 30, 1987, June 15 to August 14, 1987, and September 10 to 22, 1987.

2. Laboratory analyses of the 19 grab samples taken by the USGS below Prado Dam during the 1986-87 season were run to determine both EC and TDS. Data from the grab samples are given in Table B-1. Results of these analyses were used to prepare a correlation between EC recorded on punched tape of the USGS at the times when the grab samples were collected and the corresponding TDS. A detailed discussion of this statistical analysis is presented in the Fifth Annual Watermaster Report.

3. The equation from the curve fitting operation was then used to determine the mean daily TDS corresponding to the mean daily EC values for each day of the year except for the period when the recorder was not functioning.

4. The TDS for the period when EC data were not available was approximated using best available data. For the period June 15 to August 14, 1987, the interpolation was performed using laboratory values of TDS determined from grab samples.

5. The mean daily TDS values were then multiplied by the mean daily flow as shown in Table B-2. These products were then summed and divided by the total flow for the year to determine the weighted average TDS value for the water year. This value for TDS for the total flow including nontributary water was 621 mg/L of TDS for the 1986-87 water year. The weighted TDS calculation for the water year 1986-87 is shown in Table B-3.

TABLE B-1

USGS WATER QUALITY SAMPLES BELOW PRADO DAM FOR WATER YEAR 1986-87

DATE	EC (1) (micromhos/cm)	TDS (2) (mg/l)	SOURCE
10/02	1080	655	USGS
11/04	1080	685	USGS
11/25	1070	694	USGS
12/02	1070	671	USGS
1/08	636	407	USGS
1/14	980	611	USGS
2/04	1080	669	USGS
3/02	876	535	USGS
3/18	967	589	USGS
4/01	910	570	USGS
4/17	953	583	USGS
5/05	1110	678	USGS
5/13	1070	654	USGS
6/03	1050	670	USGS
6/30	1050	636	USGS
7/20	1090	672	USGS
7/28	1050	643	USGS
8/14	1040	645	USGS
9/22	1070	669	USGS

(1) Field EC recorded at time of sampling.

(2) Based on analysis of grab samples.

TABLE B-2

SUMMARY OF WEIGHTED TDS BELOW PRADO DAM

WATER YEAR 1986-87

OCTOBER 1986

DAY		PRADO OUTFLOW (cfs-day)	DAILY MEAN EC (micromhos)	COMPUTED TDS (1) (3) (mg/l)	OUTFLOW x TDS
OCT	1	322	(2)	636	204792
	2	333	(2) (4)	655	218115
	3	360	1060	656	236182
	4	246	1120	691	169949
	5	159	1120	691	109845
	6	179	1040	644	115349
	7	44	(2)	635	27940
	8	4	(2)	620	2480
	9	5	(2)	610	3050
	10	173	(2)	600	103800
	11	364	954	594	216222
	12	342	942	587	200735
	13	270	1010	627	169259
	14	202	1010	627	126631
	15	181	991	616	111452
	16	177	981	610	107951
	17	176	973	605	106514
	18	174	971	604	105099
	19	178	969	603	107306
	20	177	975	606	107327
	21	172	986	613	105406
	22	159	1020	633	100605
	23	155	1040	644	99884
	24	157	1050	650	102087
	25	160	1060	656	104970
	26	156	1080	668	104159
	27	158	1090	673	106411
	28	162	1110	685	110981
	29	151	1140	702	106062
	30	158	1140	702	110978
	31	163	1140	702	114490
TOTAL		5817			3716030
MONTHLY FLOW WEIGHTED TDS				639	

1. TDS = EC/(1.5188+9.1409E-5*EC)
2. Recorder Malfunction
3. TDS values for non-record days are approximated using best available data.
4. TDS value from laboratory analysis.

TABLE B-2 (continued)

SUMMARY OF WEIGHTED TDS BELOW PRADO DAM

WATER YEAR 1986-87

NOVEMBER 1986

	DAY	PRADO OUTFLOW (cfs-day)	DAILY MEAN EC (micromhos)	COMPUTED TDS (1) (3) (mg/l)	OUTFLOW x TDS
NOV	1	171	1120	691	118135
	2	173	1100	679	117515
	3	175	1090	673	117860
	4	176	1080	668	117512
	5	176	1060	656	115467
	6	98	(2)	662	64876
	7	196	(2)	662	129752
	8	214	1070	662	141641
	9	177	1050	650	115092
	10	169	1050	650	109890
	11	164	1050	650	106639
	12	167	1050	650	108590
	13	167	1060	656	109562
	14	169	1060	656	110874
	15	166	1070	662	109871
	16	168	1060	656	110218
	17	170	1060	656	111530
	18	324	794	499	161655
	19	283	853	534	151178
	20	286	932	581	166179
	21	260	1030	639	166030
	22	260	1050	650	169062
	23	170	1060	656	111530
	24	157	1080	668	104826
	25	182	1080	668	121518
	26	204	1080	668	136207
	27	199	1070	662	131713
	28	191	1070	662	126418
	29	184	1070	662	121785
	30	180	1070	662	119137
TOTAL		5776			3702264
MONTHLY FLOW WEIGHTED TDS				641	

1. TDS = EC/(1.5188+9.1409E-5*EC)
2. Recorder Malfunction
3. TDS values for non-record days are approximated using best available data.

TABLE B-2 (continued)

SUMMARY OF WEIGHTED TDS BELOW PRADO DAM

WATER YEAR 1986-87

DECEMBER 1986

DAY		PRADO OUTFLOW (cfs-day)	DAILY MEAN EC (micromhos)	COMPUTED TDS (1) (mg/l)	OUTFLOW x TDS
DEC	1	177	1090	673	119207
	2	181	1070	662	119799
	3	183	1060	656	120059
	4	246	1050	650	159959
	5	188	1080	668	125524
	6	190	981	610	115879
	7	230	826	518	119161
	8	240	791	497	119312
	9	210	835	523	109928
	10	194	907	566	109856
	11	230	921	575	132146
	12	260	979	609	158266
	13	257	1010	627	161110
	14	254	1030	639	162198
	15	251	1050	650	163210
	16	249	1050	650	161909
	17	255	1060	656	167295
	18	257	1070	662	170102
	19	263	1080	668	175601
	20	264	1080	668	176268
	21	252	1080	668	168256
	22	234	1080	668	156238
	23	216	1080	668	144219
	24	242	1090	673	162983
	25	211	1090	673	142105
	26	192	1080	668	128195
	27	198	1060	656	129900
	28	198	1060	656	129900
	29	197	1060	656	129244
	30	197	1050	650	128097
	31	205	1050	650	133299
TOTAL		6921			4399225
MONTHLY FLOW WEIGHTED TDS				636	

1. TDS = EC/(1.5188+9.1409E-5*EC)

TABLE B-2 (continued)

SUMMARY OF WEIGHTED TDS BELOW PRADO DAM

WATER YEAR 1986-87

JANUARY 1987

DAY		PRADO OUTFLOW (cfs-day)	DAILY MEAN EC (micromhos)	COMPUTED TDS (1) (3) (mg/l)	OUTFLOW x TDS
JAN	1	207	1050	650	134599
	2	199	1040	644	128238
	3	205	1030	639	130908
	4	293	769	484	141788
	5	650	474	303	197229
	6	675	514	328	221580
	7	525	645	409	214622
	8	439	658	417	182944
	9	203	784	493	100066
	10	199	839	526	104645
	11	196	902	563	110408
	12	196	902	563	110408
	13	196	952	593	116196
	14	220	957	596	131072
	15	232	931	580	134666
	16	227	992	616	139910
	17	223	1010	627	139796
	18	223	1020	633	141100
	19	221	998	620	136989
	20	233	1040	644	150148
	21	253	1010	627	158602
	22	253	1030	639	161560
	23	254	1040	644	163680
	24	253	1060	656	165983
	25	250	1060	656	164015
	26	246	1060	656	161391
	27	244	1040	644	157236
	28	242	1050	650	157358
	29	164	(2)	662	108568
	30	187	(2)	662	123794
	31	264	1070	662	174735
TOTAL		8372			4564234
MONTHLY FLOW WEIGHTED TDS				545	

1. TDS = EC/(1.5188+9.1409E-5*EC)
2. Recorder Malfunction
3. TDS values for non-record days are approximated using best available data.

TABLE B-2 (continued)

SUMMARY OF WEIGHTED TDS BELOW PRADO DAM

WATER YEAR 1986-87

FEBUARY 1987

DAY		PRADO OUTFLOW (cfs-day)	DAILY MEAN EC (micromhos)	COMPUTED TDS (1) (mg/l)	OUTFLOW x TDS
FEB	1	263	1060	656	172544
	2	261	1050	650	169712
	3	259	1050	650	168412
	4	245	1070	662	162159
	5	225	1080	668	150229
	6	226	1070	662	149584
	7	226	1060	656	148270
	8	227	1040	644	146281
	9	228	1050	650	148254
	10	175	1070	662	115828
	11	185	1060	656	121371
	12	243	1060	656	159423
	13	192	1090	673	129309
	14	117	1070	662	77439
	15	118	1060	656	77415
	16	118	1070	662	78101
	17	219	1030	639	139848
	18	281	1050	650	182717
	19	279	1070	662	184663
	20	277	1040	644	178502
	21	276	1030	639	176247
	22	277	1020	633	175268
	23	206	1030	639	131547
	24	162	1010	627	101556
	25	271	1030	639	173054
	26	339	941	586	198774
	27	288	924	576	165980
	28	258	905	565	145791
TOTAL		6441			4128277
MONTHLY FLOW WEIGHTED TDS				641	

1. TDS = EC/(1.5188+9.1409E-5*EC)

TABLE B-2 (continued)

SUMMARY OF WEIGHTED TDS BELOW PRADO DAM

WATER YEAR 1986-87

MARCH 1987

DAY		PRADO OUTFLOW (cfs-day)	DAILY MEAN EC (micromhos)	COMPUTED TDS (1) (mg/l)	OUTFLOW x TDS
MAR	1	257	902	563	144769
	2	256	879	550	140714
	3	254	904	564	143380
	4	254	941	586	148934
	5	191	918	573	109400
	6	185	956	595	110111
	7	255	977	608	154923
	8	254	966	601	152674
	9	253	958	596	150882
	10	252	941	586	147762
	11	251	938	585	146731
	12	250	937	584	145999
	13	250	921	575	143637
	14	251	927	578	145101
	15	254	931	580	147436
	16	256	960	598	152972
	17	256	978	608	155681
	18	257	968	602	154779
	19	258	957	596	153712
	20	259	970	603	156288
	21	262	966	601	157482
	22	264	969	603	159150
	23	266	983	611	162543
	24	266	947	590	156911
	25	266	942	587	156127
	26	267	916	572	152615
	27	268	898	561	150331
	28	268	900	562	150648
	29	267	915	571	152457
	30	266	934	582	154872
	31	267	940	586	156399
TOTAL		7880			4615421
MONTHLY FLOW WEIGHTED TDS				586	

1. TDS = EC/(1.5188+9.1409E-5*EC)

TABLE B-2 (continued)

SUMMARY OF WEIGHTED TDS BELOW PRADO DAM

WATER YEAR 1986-87

APRIL 1987

DAY		PRADO OUTFLOW (cfs-day)	DAILY MEAN EC (micromhos)	COMPUTED TDS (1) (mg/l)	OUTFLOW x TDS
APR	1	269	929	579	155825
	2	271	947	590	159861
	3	310	963	599	185787
	4	328	946	589	193291
	5	328	950	592	194065
	6	327	963	599	195975
	7	326	962	599	195184
	8	327	956	595	194628
	9	327	946	589	192702
	10	327	940	586	191545
	11	327	938	585	191160
	12	326	957	596	194225
	13	322	964	600	193168
	14	320	978	608	194601
	15	316	986	613	193653
	16	327	984	612	200010
	17	342	971	604	206574
	18	336	976	607	203937
	19	330	998	620	204554
	20	319	1040	644	205567
	21	312	1040	644	201056
	22	309	1010	627	193708
	23	304	1010	627	190574
	24	300	1020	633	189820
	25	294	1020	633	186024
	26	288	1030	639	183910
	27	294	1040	644	189457
	28	304	1050	650	197672
	29	297	1060	656	194850
	30	292	1070	662	193267
TOTAL		9399			5766651
MONTHLY FLOW WEIGHTED TDS				614	

1. TDS = EC/(1.5188+9.1409E-5*EC)

TABLE B-2 (continued)

SUMMARY OF WEIGHTED TDS BELOW PRADO DAM

WATER YEAR 1986-87

MAY 1987

DAY		PRADO OUTFLOW (cfs-day)	DAILY MEAN EC (micromhos)	COMPUTED TDS (1) (mg/l)	OUTFLOW x TDS
MAY	1	285	1080	668	190290
	2	279	1080	668	186283
	3	272	1080	668	181610
	4	262	1100	679	177971
	5	249	1100	679	169141
	6	230	1100	679	156234
	7	197	1070	662	130389
	8	202	1080	668	134872
	9	190	1040	644	122438
	10	183	1050	650	118994
	11	171	1050	650	111191
	12	168	1060	656	110218
	13	165	1060	656	108250
	14	165	1040	644	106328
	15	162	1020	633	102503
	16	165	1010	627	103436
	17	167	995	618	103223
	18	159	990	615	97812
	19	159	986	613	97439
	20	162	985	612	99183
	21	166	986	613	101729
	22	164	990	615	100888
	23	161	988	614	98854
	24	155	987	613	95079
	25	150	994	618	92627
	26	152	1000	621	94397
	27	155	1020	633	98074
	28	155	1040	644	99884
	29	154	1050	650	100137
	30	157	1040	644	101172
	31	157	1050	650	102087
TOTAL		5718			3692733
MONTHLY FLOW WEIGHTED TDS				646	

1. TDS = EC/(1.5188+9.1409E-5*EC)

TABLE B-2 (continued)

SUMMARY OF WEIGHTED TDS BELOW PRADO DAM

WATER YEAR 1986-87

JUNE 1987

DAY	PRADO OUTFLOW (cfs-day)	DAILY MEAN EC (micromhos)	COMPUTED TDS (1) (3) (mg/l)	OUTFLOW x TDS
JUNE 1	143	1060	656	93817
2	128	1050	650	83231
3	129	1050	650	83881
4	129	1050	650	83881
5	135	1040	644	86995
6	135	1040	644	86995
7	150	1030	639	95786
8	150	1010	627	94033
9	166	990	615	102118
10	161	992	616	99231
11	153	994	618	94480
12	146	996	619	90329
13	136	996	619	84142
14	131	992	616	80741
15	110	(2)	625	68750
16	99	(2)	635	62865
17	60	(2)	645	38700
18	27	(2)	655	17685
19	104	(2)	665	69160
20	168	(2)	675	113400
21	171	(2)	685	117135
22	73	(2)	698	50954
23	87	(2) (4)	710	61770
24	164	(2)	698	114472
25	172	(2)	690	118680
26	168	(2)	680	114240
27	167	(2)	670	111890
28	165	(2)	660	108900
29	161	(2)	648	104328
30	156	(2) (4)	636	99216
TOTAL	4044			2631805
MONTHLY FLOW WEIGHTED TDS			651	

1. TDS = EC/(1.5188+9.1409E-5*EC)
2. Recorder Malfunction
3. TDS values for non-record days are approximated using best available data.
4. TDS value from laboratory analysis.

TABLE B-2 (continued)

SUMMARY OF WEIGHTED TDS BELOW PRADO DAM

WATER YEAR 1986-87

JULY 1987

DAY	PRADO OUTFLOW (cfs-day)	DAILY MEAN EC (micromhos)	COMPUTED TDS (1) (3) (mg/l)	OUTFLOW x TDS
JULY 1	153	(2)	635	97155
2	151	(2)	635	95885
3	145	(2)	634	91930
4	140	(2)	634	88760
5	135	(2)	633	85455
6	133	(2)	632	84056
7	152	(2)	632	96064
8	167	(2)	631	105377
9	158	(2) (4)	630	99540
10	143	(2)	632	90376
11	147	(2)	638	93786
12	151	(2)	641	96791
13	149	(2)	644	95956
14	133	(2)	648	86184
15	130	(2)	652	84760
16	130	(2)	656	85280
17	121	(2)	660	79860
18	119	(2)	664	79016
19	115	(2)	668	76820
20	134	(2) (4)	672	90048
21	149	(2)	668	99532
22	145	(2)	664	96280
23	145	(2)	662	95990
24	141	(2)	656	92496
25	138	(2)	652	89976
26	133	(2)	650	86450
27	131	(2)	645	84495
28	130	(2) (4)	643	83590
29	134	(2)	645	86430
30	134	(2)	647	86698
31	131	(2)	649	85019
TOTAL	4317			2790055
MONTHLY FLOW WEIGHTED TDS			646	

1. TDS = EC/(1.5188+9.1409E-5*EC)
2. Recorder Malfunction
3. TDS values for non-record days are approximated using best available data.
4. TDS value from laboratory analysis.

TABLE B-2 (continued)

SUMMARY OF WEIGHTED TDS BELOW PRADO DAM

WATER YEAR 1986-87

AUGUST 1987

DAY		PRADO OUTFLOW (cfs-day)	DAILY MEAN EC (micromhos)	COMPUTED TDS (1) (3) (mg/l)	OUTFLOW x TDS
AUG	1	126	(2)	650	81900
	2	123	(2)	650	79950
	3	117	(2)	650	76050
	4	118	(2)	652	76936
	5	116	(2)	652	75632
	6	121	(2)	655	79255
	7	122	(2)	655	79910
	8	124	(2)	658	81592
	9	122	(2)	658	80276
	10	121	(2)	660	79860
	11	123	(2) (4)	660	81180
	12	123	(2)	655	80565
	13	125	(2)	650	81250
	14	133	(2) (4)	645	85785
	15	133	1030	639	84931
	16	134	1010	627	84003
	17	135	994	618	83365
	18	134	999	620	83140
	19	131	1020	633	82888
	20	122	1030	639	77906
	21	128	1020	633	80990
	22	135	1020	633	85419
	23	131	1030	639	83653
	24	129	1040	644	83129
	25	131	1040	644	84418
	26	130	1050	650	84531
	27	130	1050	650	84531
	28	128	1060	656	83976
	29	133	1060	656	87256
	30	135	1050	650	87782
	31	129	1050	650	83881
TOTAL		3942			2545939
MONTHLY FLOW WEIGHTED TDS				646	

1. TDS = EC/(1.5188+9.1409E-5*EC)
2. Recorder Malfunction
3. TDS values for non-record days are approximated using best available data.
4. TDS value from laboratory analysis.

TABLE B-2 (continued)

SUMMARY OF WEIGHTED TDS BELOW PRADO DAM

WATER YEAR 1986-87

SEPTEMBER 1987

DAY	PRADO OUTFLOW (cfs-day)	DAILY MEAN EC (micromhos)	COMPUTED TDS (1) (3) (mg/l)	OUTFLOW x TDS
SEPT 1	133	1040	644	85707
2	137	1040	644	88284
3	138	1040	644	88929
4	138	1040	644	88929
5	129	1060	656	84632
6	134	1050	650	87132
7	135	1050	650	87782
8	140	1060	656	91848
9	146	1030	639	93232
10	96	(2)	641	61536
11	46	(2)	643	29578
12	56	(2)	645	36120
13	58	(2)	647	37526
14	56	(2)	649	36344
15	52	(2)	651	33852
16	52	(2)	653	33956
17	51	(2)	655	33405
18	51	(2)	657	33507
19	52	(2)	660	34320
20	52	(2)	663	34476
21	52	(2)	666	34632
22	52	(2) (4)	669	34788
23	52	1050	650	33812
24	52	1040	644	33509
25	52	1030	639	33206
26	53	1050	650	34463
27	53	1090	673	35695
28	53	1110	685	36309
29	54	1100	679	36681
30	54	1090	673	36368
TOTAL	2379			1550557
MONTHLY FLOW WEIGHTED TDS			652	

1. TDS = EC/(1.5188+9.1409E-5*EC)
2. Recorder Malfunction
3. TDS values for non-record days are approximated using best available data.
4. TDS value from laboratory analysis.

APPENDIX C

WATER QUALITY
SANTA ANA RIVER AT RIVERSIDE NARROWS

1986-87

PREPARED BY

DONALD L. HARRIGER

TABLE C-1

WATER QUALITY ANALYSES
SANTA ANA RIVER AT RIVERSIDE NARROWS

WATER YEAR 1986-87

DATE SAMPLED	EC Micromhos/cm	TDS mg/l	Source
1986			
10-02	1080	655	USGS
10-09	950	652	C OF R
10-14	930	630	C OR R
10-14	972	621	DWR
10-23	980	645	C OF R
10-28	970	612	C OF R
11-04	1080	685	USGS
11-06	960	616	C OF R
11-11	990	632	C OF R
11-14	1060	-	USGS
11-20	920	610	C OF R
11-25	990	648	C OF R
11-25	1070	694	USGS
12-02	1070	671	USGS
12-04	930	618	C OF R
12-04	980	623	DWR
12-09	960	621	C OF R
12-18	940	579	C OF R
12-23	960	624	C OF R
1987			
1-01	1000	630*	C OF R
1-06	860	550*	C OF R
1-08	636	407*	USGS
1-14	980	611*	USGS
1-15	1000	618*	C OF R
1-20	1070	662*	DWR
1-20	1000	645*	C OF R
1-29	920	591*	C OF R

* Storm flow, not used in determining monthly averages

C OF R - City of Riverside
USGS - United States Geological Survey
DWR - Department of Water Resources

DATE SAMPLED	EC Micromhos/cm	TDS mg/l	Source
2-03	890	639*	C OF R
2-04	1080	669*	USGS
2-12	950	622*	C OF R
2-17	900	642*	C OF R
2-19	989	685*	DWR
2-26	765	497*	C OF R
3-02	876	535*	USGS
3-03	940	612*	C OF R
3-12	960	622*	C OF R
3-17	940	601*	C OF R
3-18	967	589*	USGS
3-23	913	579*	DWR
3-26	930	604*	C OF R
3-31	1000	632*	C OF R
4-01	910	570*	USGS
4-09	1000	624*	C OF R
4-14	1020	656*	C OF R
4-17	953	583*	USGS
4-20	1000	667	DWR
4-23	1040	680	C OF R
4-28	1030	669	C OF R
5-05	1110	678	USGS
5-07	1080	652	C OF R
5-11	999	665	DWR
5-13	1070	654	USGS
5-21	1020	659	C OF R
5-26	950	653	C OF R
6-03	1050	670	USGS
6-04	960	625	C OF R
6-08	983	656	DWR
6-09	1000	501*	C OF R
6-16	980	505*	C OF R
6-23	970	634	C OF R
6-30	1050	636	USGS

* Storm flow, not used in determining monthly averages

C OF R - City of Riverside
USGS - United States Geological Survey
DWR - Department of Water Resources

DATE SAMPLED	EC Micromhos/cm	TDS mg/l	Source
7-02	990	636	C OF R
7-07	900	628	C OF R
7-09	-	628	DWR
7-16	980	628	C OF R
7-20	1090	672	USGS
7-21	980	635	C OF R
7-28	1050	643	USGS
7-30	970	614	C OF R
8-04	970	656	C OF R
8-11	957	621	DWR
8-13	940	625	C OF R
8-14	1040	645	USGS
8-18	960	619	C OF R
8-27	960	640	C OF R
9-01	920	613	C OF R
9-02	-	646	USGS
9-10	900	576	C OF R
9-15	900	591	C OF R
9-22	1070	669	USGS
9-24	930	602	C OF R
9-29	940	605	C OF R

* Storm flow, not used in determining monthly averages

C OF R - City of Riverside
USGS - United States Geological Survey
DWR - Department of Water Resources

TABLE C-2

FLOW WEIGHTED TDS OF BASE FLOW AT RIVERSIDE NARROWS
(Including Nontributary Flow
Discharged Above the Narrows)

WATER YEAR 1986-87

	Month	Acre Feet(1)	TDS (2) (mg/l)	Acre Feet Times TDS
1986	October	4,508	636	2,867,088
	November	4,883	648	3,164,184
	December	4,867	623	3,032,141
1987	January	5,540	635	3,517,900
	February	5,085	647	3,289,995
	March	5,657	659	3,727,963
	April	5,252	672	3,529,344
	May	4,955	660	3,270,300
	June	4,982	644	3,208,408
	July	4,421	636	2,811,756
	August	3,632	634	2,302,688
	September	4,183	615	2,572,545
	Total	57,965		37,294,312

Flow weight TDS $= \frac{37,294,312}{57,965} = 643$ mg/l

(1) Total Flow minus Storm Flow from Table 6
(2) Estimated average TDS based on water quality data from Table C-1

APPENDIX D

QUANTITY AND QUALITY OF WASTEWATER FROM RUBIDOUX COMMUNITY SERVICES DISTRICT

1986-87

PREPARED BY

DONALD L. HARRIGER

TABLE D-1

QUANTITY AND QUALITY OF WASTEWATER FROM RUBIDOUX
DISCHARGED BELOW THE
RIVERSIDE NARROWS GAGING STATION

WATER YEAR 1986-87

Month	Acre-Feet	TDS mg/l	Acre-Feet Times TDS
October 1986	173	737	127,501
November	177	734	129,918
December	182	776	141,232
January 1987	187	713	133,331
February	167	728	121,576
March	190	720	136,800
April	178	757	134,746
May	185	719	133,015
June	181	744	134,664
July	183	748	136,884
August	192	758	145,536
September	189	717	135,513
	2,184		1,610,716

$$\frac{1{,}610{,}716}{2{,}184} = 738 \text{ mg/l}$$

Average Flow Weighted Quality of Wastewater = 738 mg/l

APPENDIX E

SANTA ANA RIVER WATERMASTER
FINANCIAL STATEMENTS WITH REPORT
ON
EXAMINATION BY CERTIFIED PUBLIC ACCOUNTANTS

SANTA ANA RIVER WATERMASTER

FINANCIAL STATEMENTS

WITH REPORT ON EXAMINATION BY CERTIFIED PUBLIC ACCOUNTANTS

JUNE 30, 1987

DIEHL, EVANS, GIFFORD & COMPANY
CERTIFIED PUBLIC ACCOUNTANTS

A PARTNERSHIP INCLUDING ACCOUNTANCY CORPORATIONS
ONE CIVIC PLAZA • SUITE 265
NEWPORT BEACH • CALIFORNIA 92660-5915
PHONE (714) 644-6156

RODNEY K. McDANIEL, CPA
WIN G. PETERS, CPA
DONALD H. PETERSON, CPA
DONALD E. CALLAHAN, CPA
L. PETER SCHERER, CPA
RALPH H. WEINTRAUB, CPA
MICHAEL R. LUDIN, CPA
PHILIP H. HOLTKAMP, CPA
THOMAS M. PERLOWSKI, CPA

DON GIFFORD, CPA
(RETIRED)

September 29, 1987

ACCOUNTANTS' REPORT

Santa Ana River Watermaster
Fountain Valley, California

We have examined the statement of assets and liabilities arising from cash transactions of the Santa Ana River Watermaster as of June 30, 1987 and the related statement of revenue collected, expenses paid and changes in fund balance for the year then ended. Our examination was made in accordance with generally accepted auditing standards and, accordingly, included such tests of the accounting records and such other auditing procedures as we considered necessary in the circumstances.

As described in Note 1, the Watermaster's policy is to prepare its financial statements on the basis of cash receipts and disbursements; consequently, certain revenue and the related assets are recognized when received rather than when earned and certain expenses are recognized when paid rather than when the obligation is incurred. Accordingly, the accompanying financial statements are not intended to present financial position and results of operations in conformity with generally accepted accounting principles for governmental units.

In our opinion, the aforementioned financial statements present fairly the assets and liabilities arising from cash transactions of the Santa Ana River Watermaster at June 30, 1987, and the revenue collected and expenses paid for the year then ended, on the basis of accounting described in Note 1, which basis has been applied in a manner consistent with that of the preceding year.

Diehl, Evans, Gifford and Company

OTHER OFFICES AT:
1910 NORTH BUSH ST.
SANTA ANA, CA 92706-2894
(714) 542-4453

2965 ROOSEVELT ST.
CARLSBAD, CA 92008-2389
(619) 729-2343

120 WEST WOODWARD AVE.
ESCONDIDO, CA 92025-9990
(619) 741-3141

SANTA ANA RIVER WATERMASTER

STATEMENT OF ASSETS AND LIABILITIES
ARISING FROM CASH TRANSACTIONS

June 30, 1987

ASSETS

Cash in checking account (Note 3)	$ 501
Cash in savings account (Note 3)	7,583
TOTAL ASSETS	$ 8,084

LIABILITIES AND FUND BALANCE

Liabilities	$ -
Fund balance	8,084
TOTAL LIABILITIES AND FUND BALANCE	$ 8,084

See accountants' report and notes to financial statements.

SANTA ANA RIVER WATERMASTER

STATEMENT OF REVENUE COLLECTED, EXPENSES
PAID AND CHANGES IN FUND BALANCE

For the year ended June 30, 1987

		Actual	Budget	Over (Under) Budget
REVENUE COLLECTED:				
Water district contributions (Note 2):				
Orange County Water District		$ 6,400	$ 6,400	$ -
Chino Basin Municipal Water District		3,200	3,200	-
San Bernardino Valley Municipal Water District		3,200	3,200	-
Western Municipal Water District		3,200	3,200	-
Interest from savings account		579	-	579
TOTAL REVENUE COLLECTED		16,579	16,000	579
EXPENSES PAID:				
Professional engineering services		8,299	8,000	299
Administrative expenses:				
Office and secretarial expense	$ 4,363			
Auditing services	725	5,088	5,000	88
Annual reports		2,635	3,000	(365)
TOTAL EXPENSES PAID		16,022	16,000	22
EXCESS OF REVENUE COLLECTED OVER EXPENSES PAID		557	$ -	$ 557
FUND BALANCE AT JULY 1, 1986		7,527		
FUND BALANCE AT JUNE 30, 1987		$ 8,084		

See accountants' report and notes to financial statements.

SANTA ANA RIVER WATERMASTER

NOTES TO FINANCIAL STATEMENTS

June 30, 1987

1. SIGNIFICANT ACCOUNTING POLICIES:

The Watermaster uses the cash receipts and disbursements method of accounting for all of its financial activity.

2. ORGANIZATION AND HISTORY:

The Santa Ana River Watermaster is composed of a committee of five representatives from four water districts. Two representatives serve from Orange County Water District and one representative each serves from Chino Basin Municipal Water District, Western Municipal Water District and San Bernardino Valley Municipal Water District. The committee was established on April 23, 1969 by order of the Superior Court of California in Orange County as part of a judgement resulting from a lawsuit by the Orange County Water District as plaintiff vs. City of Chino, et al, as defendants.

Costs and expenses incurred by the individual representatives are reimbursed directly from the water districts. Collective Watermaster costs and expenses are budgeted and paid for by the Watermaster after receiving contributions from the water districts. Water district contributions are made in the following ratios:

Orange County Water District	40%
Chino Basin Municipal Water District	20
Western Municipal Water District	20
San Bernardino Valley Municipal Water District	20
Total	100%

The Watermaster issues a report each year to satisfy its obligation to monitor and test water flows from the Upper Area to the Lower Area of the Santa Ana River.

3. CASH IN BANK:

The following disclosures are made in accordance with Statement No. 3 of the Governmental Accounting Standards Board (GASB 3):

Cash at June 30, 1987 consisted of the following:

	1987
Security Pacific National Bank:	
Demand account	$ 501
Savings account	7,583
Total Cash	$ 8,084

Cash is stated on a cost basis, which is the same as market.

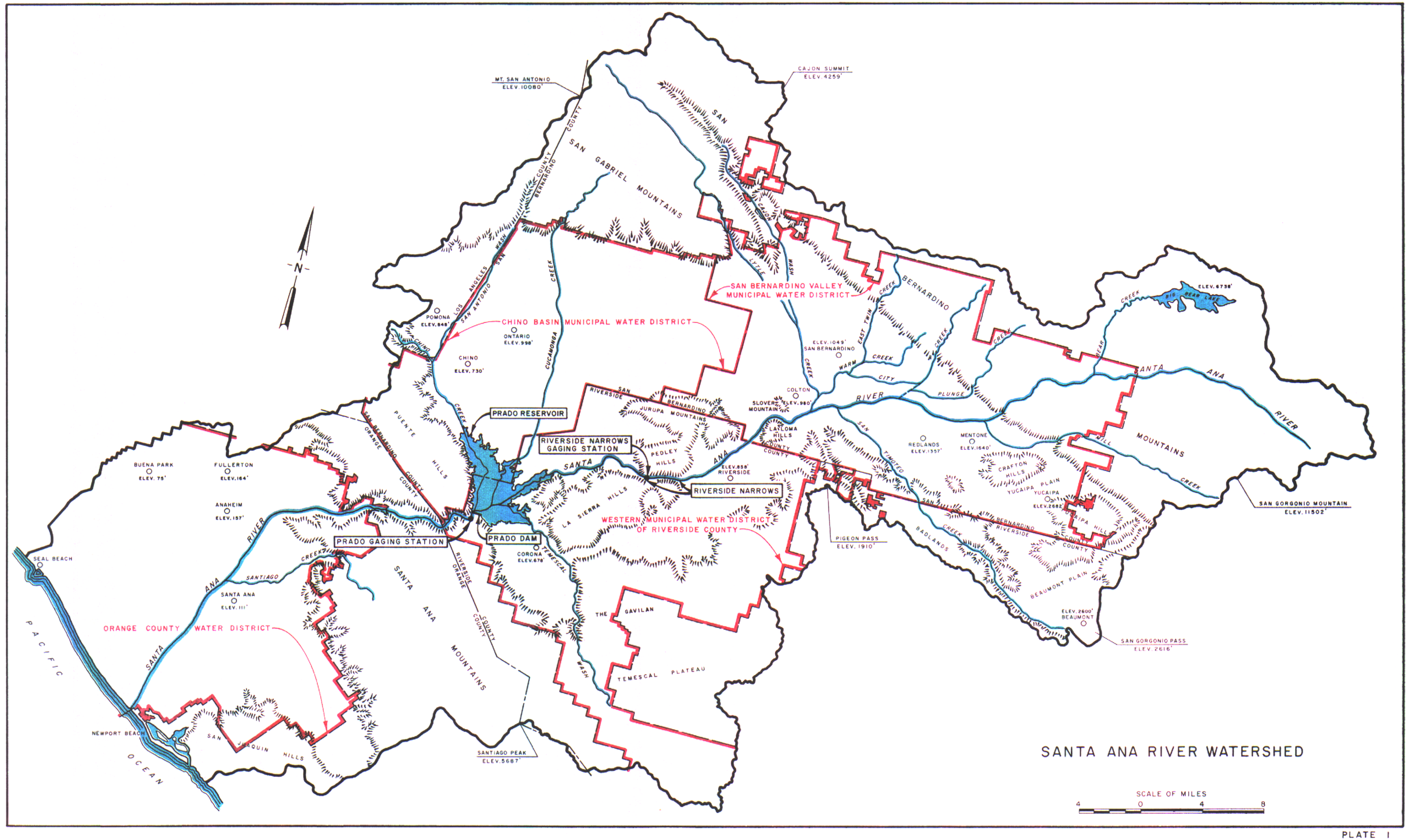
See accountants' report.

3. CASH IN BANK (CONTINUED):

Collateral for Deposits

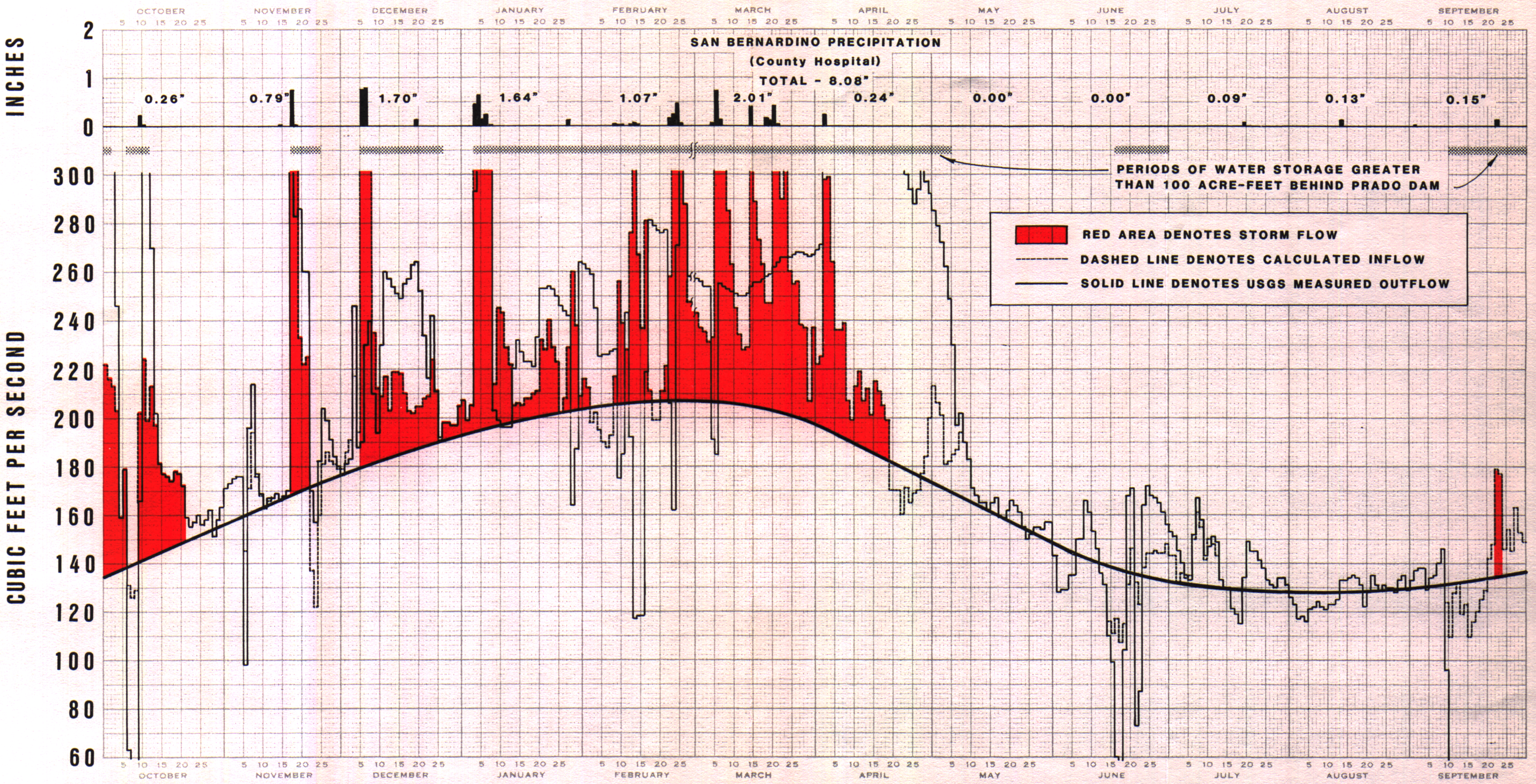
Under the provisions of the California Government Code, California banks and savings and loan associations are required to secure a District's deposits by pledging government securities as collateral. Deposits up to $100,000 are insured by the FDIC or FSLIC.

See accountants' report.

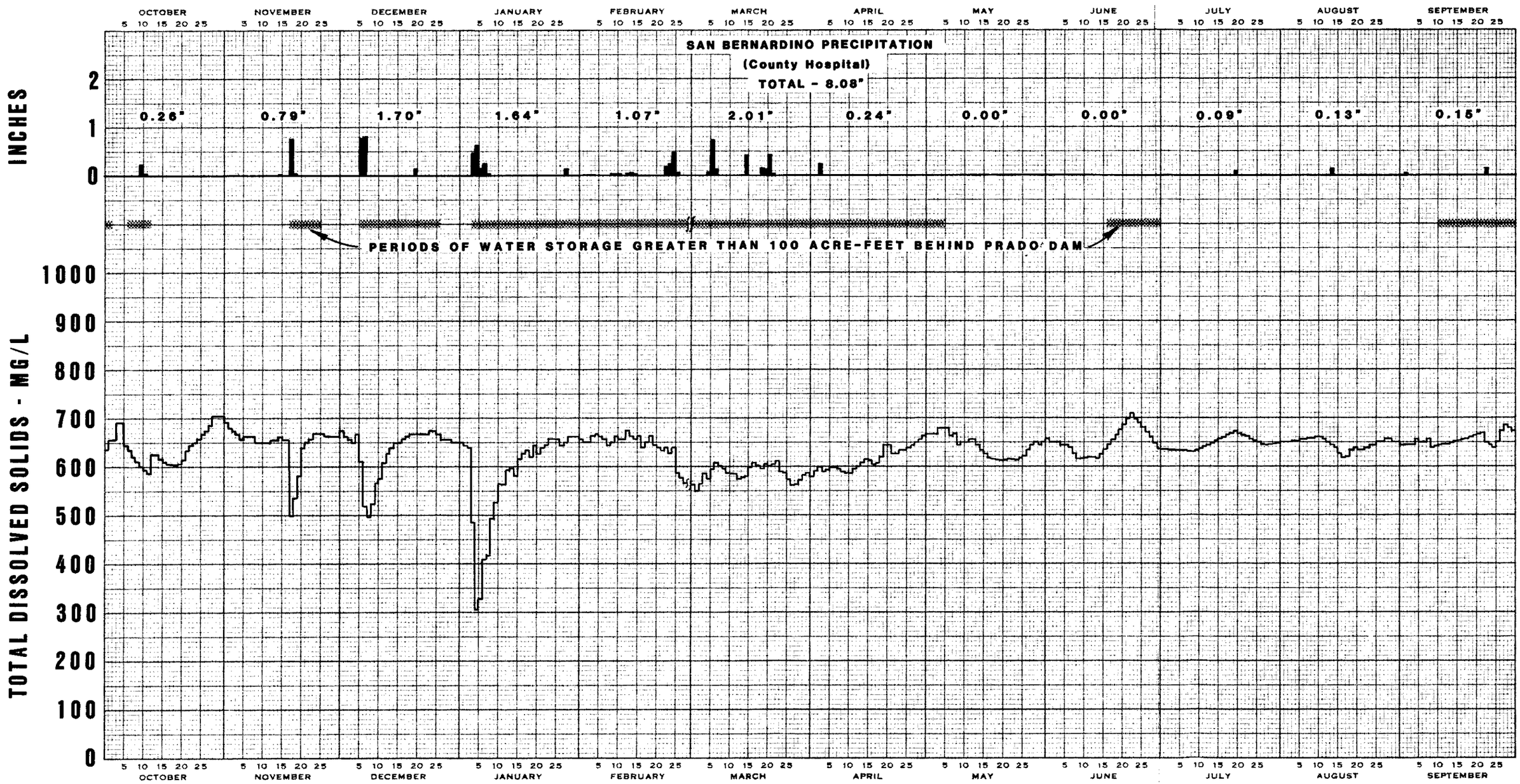


SANTA ANA RIVER WATERSHED

PLATE I

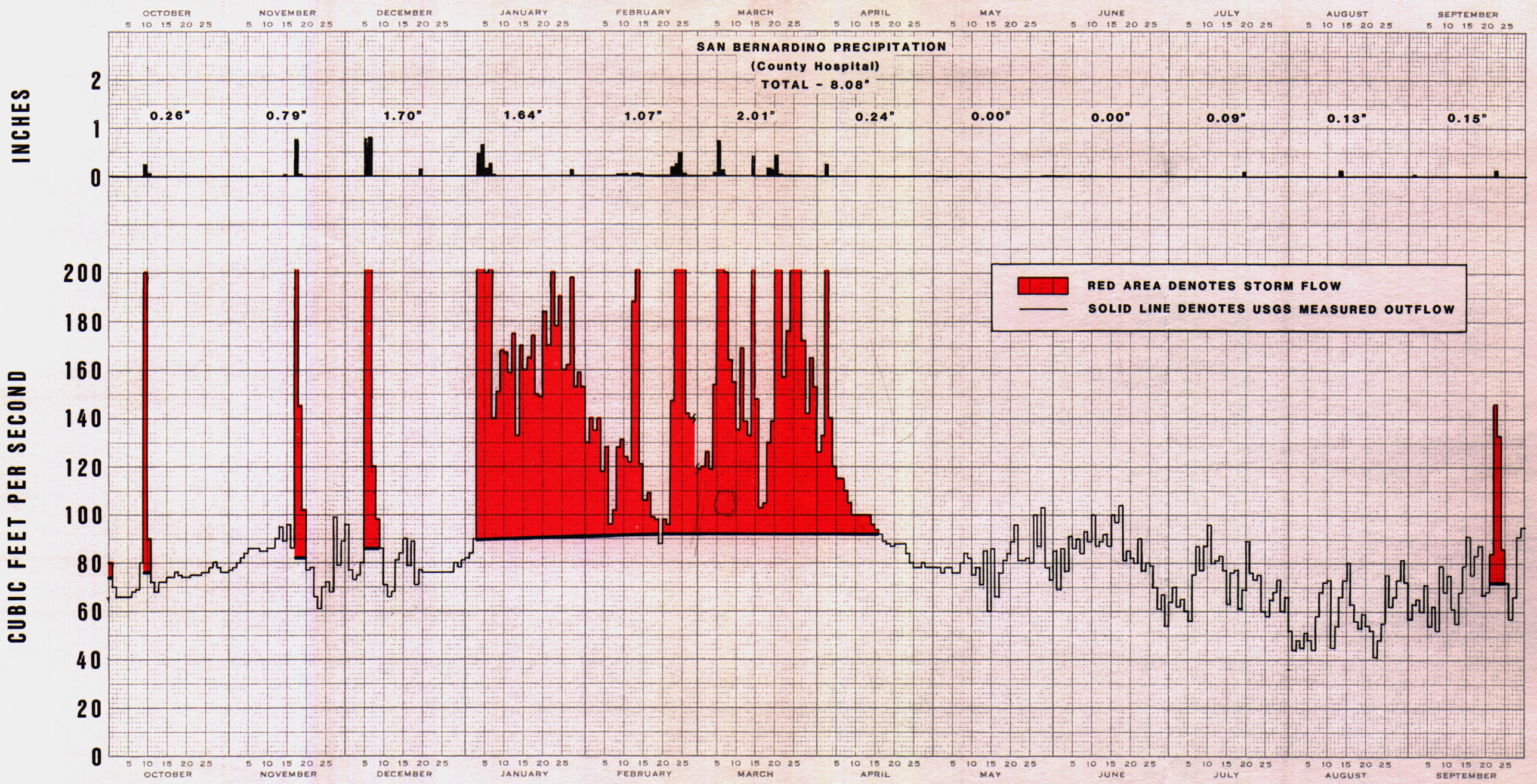


DISCHARGE OF SANTA ANA RIVER BELOW PRADO DAM & SAN BERNARDINO PRECIPITATION
WATER YEAR 1986-87



DISSOLVED SOLIDS IN SANTA ANA RIVER BELOW PRADO DAM
WATER YEAR 1986-87

PLATE 3



DISCHARGE OF SANTA ANA RIVER AT RIVERSIDE NARROWS & SAN BERNARDINO PRECIPITATION

WATER YEAR 1986-87

PLATE 4