SANTA ANA RIVER WATERMASTER

FOR

ORANGE COUNTY WATER DISTRICT

VS. CITY OF CHINO et al.

CASE NO. 117628 - COUNTY OF ORANGE

TWENTY-SIXTH

ANNUAL REPORT

OF THE

SANTA ANA RIVER WATERMASTER

FOR WATER YEAR

OCTOBER 1, 1995 - SEPTEMBER 30, 1996

APRIL 30, 1997

SANTA ANA RIVER WATERMASTER

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

WATERMASTER
William J. Carroll
Bill B. Dendy
Donald L. Harriger
William R. Mills, Jr.
Robert L. Reiter

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April 30, 1997

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

Re: Watermaster Report for Water Year October 1, 1995 - September 30, 1996

Gentlemen:

We have the honor of submitting herewith the Twenty-sixth Annual Report of the Santa Ana River Watermaster. We wish to point out that the supporting basic data heretofore presented as Appendices are bound separately and are available upon request from the office of the Secretary of the Watermaster.

The principal findings of the Watermaster for the water year 1995-96 are as follows:

At Prado

1	Base Flow at Prado	131,861 acre-feet
2	Annual Weighted TDS in Base and Storm Flows	514 mg/L
3	Annual Adjusted Base Flow	152,299 acre-feet
4	Cumulative Adjusted Base Flow	2,660,693 acre-feet
5	Cumulative Entitlement of OCWD	1,092,000 acre-feet
6	Cumulative Credit	1,568,693 acre-feet
7	One-third of Cumulative Debit	0 acre-feet
8	Minimum Required Base Flow in 1996-97	34,000 acre-feet

At Riverside Narrows

1	Base Flow at Riverside Narrows	54,548 acre-feet
2	Annual Weighted TDS in Base Flow	625 mg/L
3	Annual Adjusted Base Flow	54,548 acre-feet
4	Cumulative Adjusted Base Flow	974,185 acre-feet
5	Cumulative Entitlement of CBMWD and WMWD	396,500 acre-feet
6	Cumulative Credit	577,685 acre-feet
7	One-third of Cumulative Debit	0 acre-feet
8	Minimum Required Base Flow in 1996-97	12,420 acre-feet

The above findings show that at the end of the 1995-96 water year, Chino Basin Municipal Water District and Western Municipal Water District have a cumulative credit of 1,568,693 acre-feet to their Base Flow obligation at Prado Dam. San Bernardino Valley Municipal Water District has a cumulative credit of 577,685 acre-feet to its Base Flow obligation at Riverside Narrows.

Based on these findings, the Watermaster concludes that there was full compliance with the provisions of the Stipulated Judgment in 1995-96.

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

Sincerely yours,

Santa Ana River Watermaster

By: William J. Carroll
William J. Carroll

Donald L. Harriger

Bill B. Dendy
Bill B. Dendy

William R. Mills Jr.
William R. Mills Jr.

Robert L. Reiter
Robert L. Reiter

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B Daily Precipitation Data at San Bernardino County Hospital

C Santa Ana River Watermaster Financial Statements with Report on Examination by Orange County Water District Controller

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CHAPTER I

WATERMASTER ACTIVITIES AND WATER CONDITIONS

This is the Twenty-fifth Annual Report of the Santa Ana River Watermaster and it covers water year 1995-96. The annual report is 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 (Case No. 117628-County of Orange). The 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 Upper 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 in the case were dismissed except for the four major public water districts within the Santa Ana River Basin, namely, San Bernardino Valley Municipal Water District (SBVMWD), Western Municipal Water District of Riverside County (WMWD), Chino Basin Municipal Water District (CBMWD), and Orange County Water District (OCWD). The boundaries of these districts are shown on Plate 1. The judgment 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. Beginning at the Twentieth Annual Report, it was decided to include a short history of the litigation and summary of judgment in the report at 5-year intervals. Since this is the Twenty-fifth Annual Report, this history is included in the subsequent sections.

In order to administer the provisions of the Judgment, the court appointed a Watermaster composed of five persons. Between August 15, 1985 and January 15, 1997, the Santa Ana River Watermaster Committee consisted of Harvey O. Banks, William J. Carroll, William R. Mills, Jr., Donald L. Harriger, and Robert L. Reiter. On January 15, 1997, Mr. Banks, deceased, was replaced by Bill B. Dendy. In 1995-96, Mr. Carroll served as chairman and Mr. Reiter continued to serve as secretary/treasurer.

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.

History of Litigation

The complaint in the case was filed by Orange County Water District on October 18, 1963 seeking an adjudication of water rights against more than 2,500 water users in the area tributary to Prado Dam within the Santa Ana River watershed. Thirteen cross-complaints were filed in 1968 extending the adjudication to include an additional 1,500 water users in the area downstream from Prado Dam. With some 4,000 parties involved in the case, it became obvious that every effort should be made to arrive at a settlement and physical solution in order to avoid enormous and unwieldy litigation.

Efforts to arrive at a settlement and physical solution were pursued by public officials, individuals, attorneys, and engineers. Attorneys for the parties organized in order to facilitate settlement discussions and, among other things, provided guidance for the formation and activities of an engineering committee to provide information on the physical facts.

An initial meeting of the engineers representing the parties was held on January 10, 1964. Agreement was reached that it would be beneficial to undertake jointly the compilation of basic data. Liaison was established with the Department of Water Resources, State of California, to expedite the acquisition of data. Engineers representing the parties were divided into subcommittees which were given the responsibility of investigating such things as the boundary of the Santa Ana River watershed and its subareas, standardization of the terminology, the location and description of wells and diversion facilities, waste disposal and transfer of water between subareas.

In response to a request from the attorneys' committee at a meeting held April 17, 1964, on April 30, 1964, the joint engineering committee prepared a list of preliminary engineering studies directed toward settlement of the Santa Ana River water rights litigation. Special assignments were made to individual engineers on selected items requested by the attorneys' committee.

The attorneys and engineers for the defendants then commenced a series of meetings separate from the representatives of the plaintiffs in order to consolidate their positions and to determine a course of action. On October 7, 1964, engineers for the defendants presented the results of the studies made by the joint engineering committee. The defendants' attorneys requested that additional information be provided on the methods of measuring flow at Prado Dam, the historical supply and disposal of water passing Prado Dam, segregation of flow into components, and determination of the amount of supply which was usable by the downstream area. On December 11, 1964, the supplemental information was presented to the defendants' attorneys.

During 1965, engineers and attorneys for the defendants held numerous conferences and conducted additional studies in an attempt to determine their respective positions in the case. Early in 1966, the plaintiff and defendants exchanged drafts of possible principles of settlement. Commencing March 22 and ending April 13, 1966, four meetings were held by the engineers to discuss the draft of principles for settlement.

On February 25, 1968, the defendants submitted a request to the Court that the Order of Reference be issued requesting the State Department of Water Resources to determine the physical facts. On May 9, 1968, the plaintiffs' attorney submitted motions opposing the Order of Reference and requested that a preliminary injunction be issued. In the meantime, every effort was being made to come to an agreement on the Stipulated Judgment. Commencing on February 28, 1968 and extending until May 14,

1968, six meetings were held to determine the scope of physical facts on which agreement could be reached so that if an Order of Reference were to be approved by the Court, the work under the proposed reference would not repeat the extensive basic data collection and compilation which had already been completed and on which engineers for both plaintiffs and defendants had reached substantial agreement. Such basic data were compiled and published in two volumes under date of May 14, 1968 entitled "Appendix A, Basic Data."

On May 21, 1968, an outline of a proposal for settlement of the case was prepared and a committee of attorneys and engineers for the parties commenced preparation of the settlement documents. On June 16, 1968, the Court held a hearing on the motions it had received requesting a preliminary injunction and an Order of Reference. The parties requested that the Court delay the preliminary hearings on these motions in view of the efforts toward settlement that were underway. The plaintiff, however, was concerned regarding the necessity of bringing the case to trial within the statutory limitation and, accordingly, on July 15, 1968, submitted a motion to set the complaint in the case for trial. On October 15, 1968, the trial was commenced and was adjourned after one-half day of testimony on behalf of the plaintiff. Thereafter, the parties filed with the Court the necessary Settlement Documents including a Stipulation for Judgment. The Court entered the Judgment on April 17, 1969.

Summary of Judgment

Provisions of the Judgment became effective on October 1, 1970. The Judgment does not define water rights of the individual claimants. Instead, it provides for a regional allocation of water supply of the Santa Ana River system and established entitlements and obligations among the four existing major public water districts overlying the aggregate of substantially all of the major areas of water use in the watershed. The districts, the locations of which are shown on Plate 1, "Santa Ana River Watershed", are as follows:

(1) Orange County Water District (OCWD), representing all lower basin entities located within Orange County downstream of Prado Dam.

(2) Western Municipal Water District (WMWD), representing middle basin entities located within Riverside County on both sides of the Santa Ana River primarily upstream from Prado Dam.

(3) Chino Basin Municipal Water District (CBMWD), located in the San Bernardino County Chino Basin area, representing middle basin entities within its boundaries and located primarily upstream from Prado Dam.

(4) San Bernardino Valley Municipal Water District (SBVMWD), representing all entities within its boundaries, and embraced within the upper portion of the Riverside Basin area, the Colton Basin area (being an upstream

portion of the middle basin) and the San Bernardino Basin area, being essentially the upper basin.

The physical solution under the Stipulated Judgment provides, in general, that SBVMWD shall be responsible for assuring an average annual amount of Adjusted Base Flow at Riverside Narrows and CBMWD and WMWD shall jointly be responsible for assuring an average annual amount of Adjusted Base Flow at Prado Dam. Essential to the understanding of the provisions of the Judgment is the definition of certain important terms. The total surface flow passing a point of measurement is divided into components, which are generally defined in the Judgment as follows:

(1) Storm Flow - That portion of the total surface flow passing a point of measurement, which originates from precipitation and runoff without having first percolated to ground water storage in the zone of saturation, calculated in accordance with procedures referred to in the Judgment.

(2) Base Flow - That portion of the total surface flow passing a point of measurement which remains after deduction of storm flow, nontributary flows, exchange water purchased by OCWD, and certain other flows as determined by the Watermaster.

(3) Adjusted Base Flow - Actual base flow in each year adjusted for quality.

The Judgment sets forth a declaration of rights. Briefly stated, the Judgment provides that the water users in the area downstream from Prado Dam have rights, as against the upstream users, to receive an average annual supply of 42,000 acre-feet of Adjusted Base Flow at Prado Dam, together with the right to all Storm Flow reaching Prado Dam. Water users in the area upstream of Prado Dam, as against the downstream users, have the right to divert, pump, extract, conserve, store and use all surface and ground water supplies originating within the upper area, so long as the lower area receives the water to which it is entitled.

The physical solution set forth in the Judgment requires that SBVMWD shall be responsible for an average annual Adjusted Base Flow of 15,250 acre-feet at Riverside Narrows subject each year to the following:

(1) A minimum Base Flow of 13,420 acre-feet plus one-third of any cumulative debit.

(2) After October 1, 1986, if no cumulative debit exists, the minimum quantity shall be 12,420 acre-feet.

(3) Prior to 1986, if the cumulative credits exceed 10,000 acre-feet, the minimum quantity shall be 12,420 acre-feet.

(4) All cumulative debits shall be removed by the discharge of a sufficient Base Flow at Riverside Narrows at least once in any ten consecutive years following October 1, 1976. Any cumulative credits shall remain on the books of account until used to offset any subsequent debits or until otherwise disposed of by SBVMWD.

(5) The Base Flow at Riverside Narrows shall be adjusted using weighted average annual TDS in such Base Flow in accordance with the formula set forth in the Judgment.

The obligations under the physical solution for meeting the Adjusted Base Flow of 42,000 acre-feet at Prado Dam for the benefit of the downstream users as shared by CBMWD and WMWD are as follows:

(1) Minimum Adjusted Base Flow at Prado shall not be less than 37,000 acre-feet plus one-third of any cumulative debit.

(2) After October 1, 1986, if no cumulative debit exists, the minimum Adjusted Base Flow quantity shall be 34,000 acre-feet.

(3) Prior to 1986, if the cumulative credit exceeds 30,000 acre-feet, the minimum Adjusted Base Flow shall be 34,000 acre-feet.

(4) Sufficient quantities of Base Flow shall be provided at Prado to discharge completely any cumulative debits at least once in any ten consecutive years following October 1, 1976. Any cumulative credits shall remain on the books of account until used to offset any debits, or until otherwise disposed of by CBMWD and WMWD.

(5) The Base Flow at Prado during any year shall be adjusted using the weighted average annual TDS in the total flow at Prado (Base Flow plus Storm Flow) in accordance with the formula set forth in the Judgment.

The accounting provided for under the Judgment allows for credits to be earned when the average annual Adjusted Base Flow exceeds 15,250 acre-feet at Riverside Narrows and 42,000 acre-feet at Prado Dam. Debits accrue when the average annual Adjusted Base Flow falls below the above quantities at the respective locations. The adjustment of Base Flow for water quality is to provide an incentive to maintain a better quality of water as a result of implementation of the physical solution. That is, when the water quality is improved over a certain amount, the quantitative amount of the obligation is decreased; but when that water quality is impaired beyond a specified limit, the quantity of the obligation is increased. This is one of the first comprehensive adjudications in Southern California which includes provisions applicable to the quality of water in addition to the determination of quantitative rights.

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 discharges of the Santa Ana River below Prado Dam and at The Metropolitan Water District of Southern California (MWDSC) Upper Feeder Crossing (Riverside Narrows). Discharge data have also been provided for the Santa Ana River at E Street in San Bernardino and for several smaller streams tributary to Prado Reservoir; namely, Chino Creek at Schaefer Avenue, Cucamonga Creek near Mira Loma, and Temescal Wash in the City of Corona (Appendix A).

The 1995-96 daily mean discharge record for the USGS gaging station, "Santa Ana River below Prado," is considered by the USGS to be an "excellent" record. Extremes for this period saw a maximum daily mean discharge of 5,690 cfs on March 8, 1995 and a minimum daily mean discharge of 128 cfs on September 4, 1995. Maximum daily mean discharges are mitigated by the utilization of storage in the reservoir behind Prado Dam, upstream of the USGS gaging station.

The 1995-96 daily mean discharge record for the USGS gaging station, "Santa Ana River at MWD Crossing", is considered by the USGS to be "fair" below 900 cfs and "poor" above 900 cfs. Extremes for this period were a maximum daily mean discharge of 2,970 cfs on February 21, 1996 and a minimum daily mean discharge of 50 cfs on October 11, 1995.

As discussed in Chapter II, Nontributary Flow due to release of State Water Project water from the OC-59 turnout into San Antonio Creek totaled 21,233 acre-feet. In addition, the Arlington Desalter operated during the 1995-96 water year and discharged 4,244 acre-feet of product water into a channel tributary to the Santa Ana River.

Precipitation during 1995-96 totaled 11.92 inches as measured at the San Bernardino County Hospital and reported by the National Oceanic and Atmospheric Administration (Appendix B). The rainfall total was 66% of the 26-year base period (1934-35 through 1959-60) average of 17.98 inches. Plate 2 shows annual precipitation from 1934-35 through 1995-96.

Change in Point of Wastewater Discharge from San Bernardino and Colton

On April 1, 1996, the cities of San Bernardino and Colton began discharging their municipal wastewater effluent at a point several miles farther downstream of their historical discharge points and through the Rapid Infiltration and Extraction System (RIX). RIX is a 50-acre groundwater recharge and extraction system specifically

TABLE 1
COSTS TO THE PARTIES AND USGS FOR MEASUREMENTS WHICH PROVIDE DATA USED BY THE SANTA ANA RIVER WATERMASTER

October 1, 1995 to September 30, 1996

USGS GAGING STATION NAME	Total Cost	USGS Share	Parties Share
Santa Ana River at MWD Crossing (Riverside Narrows			
Surface Water Gage	$16,700	$8,350	$8,350
Water Quality Monitoring/TDS Sampling	$6,500	$3,250	$3,250
Chino Creek at Schaefer	$11,900	$5,950	$5,950
Cucamonga Creek at Mira Loma	$11,900	$5,950	$5,950
Santa Ana River belowPrado Dam			
Surface Water Gage	$11,900	$5,950	$5,950
Water Quality Monitoring/TDS Samples	$14,450	$7,225	$7,225
Water Quality Conductance Program	$1,350	$0	$1,350
TOTAL COST	$74,700		
TOTAL USGS SHARE OF COST		$36,675	
TOTAL PARTIES SHARE OF COST			$38,025
COST DISTRIBUTION AMONG PARTIES			
Chino Basin Municipal Water District	20%		$7,605
Orange County Water District	40%		$15,210
San Bernardino Valley Municipal Water District	20%		$7,605
Western Municipal Water District	20%		$7,605
TOTAL COST SHARED BY PARTIES			$38,025

designed to meet the filtration and disinfection requirements *of California Code of Regulations, Title 22*, for discharge in Reach Four of the Santa Ana River.

The Regional Water Quality Control Board had ordered the two cities to provide Title 22 treatment levels of their discharge prior to its entrance into the Santa Ana River. An evaluation indicated that a system for groundwater recharge and immediate extraction would accomplish the required treatment levels and would be more cost effective than a conventional tertiary treatment system. The RIX system, located adjacent to the Santa Ana River, was constructed by the two cities with the Santa Ana Watershed Project Authority acting as construction manager.

In order to ensure that the secondary effluent recharged to the groundwater system would be fully recovered, it is necessary that the amount of RIX extractions exceed the amount of recharged water. Although it has been projected that the over-extraction rates would, in the long term, be about ten percent more than that recharged, it was necessary during the initial months of operation of the facility to over-extract at a much higher rate. Initially the over-extraction rate was about 30%.

The over-extraction, combined with the fact that the RIX discharge point is located several miles downstream from the prior discharge points of the two cities, had an immediate impact upon the flows at both Riverside Narrows and Prado as can be seen on the hydrographs for those locations. The extracted amounts are considered as Base Flow since they are not Storm Flow related.

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 Stipulated Judgment. 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 II and III.

Administration Costs

In accordance with Paragraph 7(d) of the Stipulated 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% of the cost and WMWD, SBVMWD, and CBMWD each paying 20% of the cost. The Stipulated Judgment further provides that the Watermaster may from time to time, at its discretion, require advances of operating funds from the parties.

At its meeting on April 10, 1995, the Watermaster adopted a budget for the fiscal year 1995-96 in the amount of $14,000. Table 2 shows the items and amount included in said budget. The expenses for the fiscal year 1995-96 are also shown. The budget for

fiscal year 1996-97 was adopted on April 5, 1996. A financial review was performed by OCWD and is contained in Appendix C.

TABLE 2

SANTA ANA RIVER WATERMASTER BUDGET AND EXPENSES

Budget Item	July 1, 1995 to June 30, 1996 Budget	July 1, 1995 to June 30, 1996 Expenses	July 1, 1996 to June 30, 1997 Budget
Administration	$ 0.00	$ 0.00	$ 0.00
Support Engineering Services	11,500.00	0.00[1]	9,500.00
Reproduction of Annual Report	2,500.00	2,231.42[1]	2,500.00
TOTAL	$16,000.00	$2,231.42	$12,000.00

(1) Expenses appear low because they were paid after June 30, 1996 and will be expensed in 1996-97

Summary of Findings

A summary of findings by the Watermaster for the period 1970-71 through 1995-96 is presented in Table 3. Note that the Base Flow obligations at both Prado Dam and Riverside Narrows as provided for in the Stipulated 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	76,375	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	143,367	81,548	584	89,431	253,083
1982-83	32.36	425,938[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	140,538	119,848	622	127,638	708,137
1987-88	13.78	170,279[9]	124,104[9]	582	136,308	802,445
1988-89	12.64	152,743[9]	119,572[9]	583	131,230	891,675
1989-90	8.53	144,483	119,149[10]	611	127,986	977,611
1990-91	15.48	191,321	111,151[11]	514	128,379	1,064,040
1991-92	16.54	193,225	106,948[11]	499	124,869	1,146,909
1992-93	30.92	568,677	128,068[11]	368	163,499	1,268,408
1993-94	11.62	158,241	111,186[11]	611	119,432	1,345,840
1994-95	25.14	424,017[4]	123,468[11]	415	152,792[5]	1,458,394[6]
1995-96	11.92	194,797	131,861[11]	514	152,299	1,568,693

TABLE 3 (Continued)

SUMMARY OF FINDINGS
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	17,021	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	253,817	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	82,708	32,778	678	32,778	59,974
1982-83	32.36	279,645	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	69,722[8]	633	69,772	198,072
1985-86	17.86	99,258	68,220[8]	624	68,220	251,042
1986-87	8.08	77,752	59,808	649	59,808	295,600
1987-88	13.78	79,706	55,324	620	55,324	335,674
1988-89	12.64	62,376	52,259	607	52,259	372,683
1989-90	8.53	58,159	53,199	590	53,583	411,016
1990-91	15.48	73,790	45,041[11]	616	45,041	440,807
1991-92	16.54	71,427	40,306	620	40,306	465,863
1992-93	30.92	267,043	41,434	634	41,434	492,047
1993-94	11.62	45,006	31,278[11]	677	31,278	508,075
1994-95	25.14	243,411	45,562[11]	646	45,562	538,387
1993-94	11.92	81,786	54,548[11]	625	54,548	577,685

TABLE 3 (Continued)

(1) Measured at San Bernardino County Hospital.
(2) Excludes Nontributary Flow and Exchange Waters.
(3) For Base and Storm Flow at Prado and Base Flow only at Riverside Narrows.
(4) Includes Lake Elsinore discharges which passed Prado Dam totaling 16,090 acre-feet in 1980-81; 7,720 acre-feet in 1982-83; 12,550 acre-feet in 1983-84 and 14,697 acre-feet in 1994-95.
(5) Excludes water discharged from Lake Elsinore.
(6) Includes a credit for a portion of Lake Elsinore discharges totaling 8,045 acre-feet in 1980-81; 3,362 acre-feet in 1982-83; 4,602 acre-feet in 1983-84; and 1,762 acre-feet in 1994-95.
(7) Includes Rubidoux Wastewater in 1979-80 and subsequent years.
(8) Includes 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.
(9) Excludes Nontributary Flow released to San Antonio Creek by MWDSC under the Ontario/MWDSC Exchange Program.
(10) Excludes water discharged to Santa Ana River from Arlington Desalter in 1989-90 and subsequent years in accordance with an agreement between OCWD, WMWD, and Santa Ana Watershed Project Authority.
(11) Excludes groundwater pumped from San Bernardino, Colton, and Riverside Basins and discharged to the Santa Ana River to flow to OCWD under the Exchange Water agreements.

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 Twelfth Annual Report (1981-82).

CHAPTER II

BASE FLOW AT PRADO

This chapter deals with determinations of 1) the components of flow at Prado, which include Nontributary Flow, Arlington Desalter discharge, Exchange Water, Storm Flow and Base Flow and 2) the Adjusted Base Flow at Prado credited to CBMWD and WMWD.

Flow at Prado

During the 1995-96 water year, the flow of the Santa Ana River as measured at the USGS gaging station below Prado Dam amounted to 217,160 acre-feet. There was no storage behind the dam at the beginning or end of the water year. Inflow to the reservoir included 131,861 acre-feet of Base Flow and 58,692 acre-feet of Storm Flow, based on an adjusted Prado Reservoir storage-elevation curve described in the following section. Of the nontributary flow due to State Water Project water released to San Antonio Creek at turnout OC-59, 20,893 acre-feet were determined to have reached Prado Reservoir during 1995-96. Nontributary flows due to the Arlington Desalter and Exchange programs totaled 4,244 acre-feet and 1,470 acre-feet, respectively. The monthly components of flow of the Santa Ana River at Prado Dam for 1995-96 are listed in Table 4 and are shown graphically on Plate 3. Historical Base and Storm Flows of the Santa Ana River below Prado during the period 1934-35 through 1995-96 are presented on Plate 4.

Prado Reservoir Storage-Elevation Curve Adjustment

The Watermaster calculates inflow to Prado Reservoir by adjusting outflow data using change in reservoir storage. Reservoir storage is based on a storage-elevation curve last updated by the U.S. Army Corps of Engineers (ACOE) in 1988. The ACOE reports that sedimentation averaged about 200 acre-feet per year between 1969 and 1979. Such sedimentation affects the accuracy of the storage-elevation curve when the storage in the reservoir is low. This inaccuracy results in anomalies in the calculated inflow near the end of each period of reservoir.

For 1995-96, the Watermaster adjusted the Prado Reservoir storage-elevation curve to improve the calculated Santa Ana River inflow hydrograph from which Base Flow and Storm Flow are determined. Assuming an average sedimentation rate of 200 acre-feet per year from 1988 to 1996, the portion of the ACOE storage-elevation curve below elevation 520 feet was adjusted to include a 1,600 acre-feet reservoir storage loss. Elevation 520 feet represents the approximate maximum flood storage elevation attained behind Prado Dam in the last several years where most sedimentation would likely have occurred. The new storage-elevation curve was developed by distributing the 1,600 acre-feet storage loss until the curve produced inflow values without significant anomalies.

TABLE 4

COMPONENTS OF FLOW AT PRADO DAM

FOR WATER YEAR 1995-96
(acre-feet)

	USGS Measured Outflow	Storage Change (1)	Computed Inflow	Lake Elsinore Flows at Prado Dam (2)	Exchange Water (3)	San Antonio Creek (4)	Arlington Desalter	Storm Flow	Base Flow
1995									
October	9,741	0	9,741	0	0	0	0	0	9,741
November	10,810	0	10,810	0	0	0	0	0	10,810
December	13,726	0	13,726	0	167	0	379	1,350	11,829
1996									
January	15,671	1,779	17,450	0	0	0	446	4,376	12,629
February	46,066	6,060	52,126	0	0	0	285	39,007	12,834
March	27,443	-3,774	23,669	0	0	0	80	11,120	12,470
April	21,859	-3,867	17,992	0	0	3,376	526	2,839	11,251
May	18,954	30	18,984	0	323	6,039	549	0	12,072
June	16,731	-228	16,503	0	407	5,626	506	0	9,964
July	15,487	0	15,487	0	194	5,768	517	0	9,007
August	10,294	0	10,294	0	145	84	409	0	9,657
September	10,378	0	10,378	0	234	0	547	0	9,596
Total	217,160	0	217,160	0	1,470	20,893	4,244	58,692	131,861

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

(2) Because Lake Elsinore discharge was not envisioned during the formulation of the Final Judgment, it is removed from Santa Ana River flows at Prado Dam for the purpose of calculating Base and Storm flow.

(3) Exchange Water pumped from the San Bernardino, Colton, and Riverside groundwater basins and discharged into the Santa Ana River less an estimated loss of 5% for evapotranspiration.

(4) State Water Project water released into San Antonio Creek from turnout OC-59 during 1995-96 and calculated to have reached Prado Dam in the 1995-96 water year.

Exchange Programs

On two occasions, WMWD and OCWD have agreed to exchange imported water from MWDSC for pumped groundwater. The pumped groundwater, hereafter referred to as Exchange Water, is delivered via the Santa Ana River, and since it is exchanged for imported water, it is accounted for as Nontributary Water. Because these exchanges are delivered upstream of Prado Dam and are effectively Nontributary Water, the amount of Exchange Water reaching Prado Dam is excluded from the computation of Base Flow and Base Flow quality. This section describes past and current exchange programs. A monthly summary of the 1995-96 Exchange Water deliveries is contained in Appendix D.

Releases of Exchange Water from Riverside Canal

In 1993, OCWD and WMWD entered into an agreement to participate in MWDSC's Demonstration Local Storage (DLS) Program. The agreement provides for delivery of MWDSC water to WMWD with WMWD causing a like amount of groundwater, pumped from the basins above the Riverside Narrows, to be delivered to OCWD via the Riverside Canal and into the Santa Ana River. Because the mechanism is identical to the Drought Emergency Exchange Program, waters discharged to the river under these two programs are combined and termed Exchange Waters.

The Drought Emergency Exchange Program is more fully described in Chapter II of the Twenty-first Annual Report (1990-91). No water under the Drought Emergency Exchange Program was delivered during 1995-96.

During the 1995-96 water year, WMWD delivered 1,470 acre-feet to the Santa Ana River upstream of Prado Dam under the DLS Program. This amount reflects an agreed upon 5% evapotranspiration loss between the point of delivery and Prado Dam.

Nontributary Flow

Since May 1973, OCWD has from time to time purchased State Water Project water for the replenishment of the groundwater basin 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 the City of Upland.

Releases to San Antonio Creek

During the 1995-96 water year, 21,233 acre-feet of State Water Project water were released into San Antonio Creek from the Foothill Feeder at turnout OC-59 near Upland. Total monthly deliveries and daily flow rates were provided by OCWD Forebay Operations. Water losses between OC-59 and Prado Dam were calculated per the procedures set forth in the Twelfth Annual Report (1981-82), Appendix C. Using these procedures, 20,893 acre-feet of the water released from OC-59 reached Prado Dam

and 340 acre-feet (1.6%) were lost to evapotranspiration. A monthly summary of Nontributary Flow released from OC-59 into San Antonio Creek is contained in Appendix E.

Arlington Desalter

The underflow from the Arlington groundwater sub-basin has historically been a component of the Santa Ana River flow. These groundwaters have increasingly been degraded through agricultural and other uses. Two parties to the Stipulated Judgment, WMWD and OCWD, as members of the Santa Ana Watershed Project Authority, constructed a groundwater cleanup project which is designed to reduce the poor quality underflow from the sub-basin. This project is known as the Arlington Desalter and consists of five extraction wells and a treatment facility which reduces salinity. The capacity of the facility is approximately 6 mgd. The facility began operations in July 1990, with OCWD buying the product water delivered through the Santa Ana River. All parties to the Stipulated Judgment agreed that the product water from this facility would be excluded from the computation of Santa Ana River Base Flow and Base Flow quality. During the 1995-96 water year, 4,244 acre-feet of water discharged from the Arlington Desalter was determined to have reached Prado Dam. Daily discharge rates and electrical conductance of product water were provided by OCWD Operations. A summary of Arlington Desalter discharges is contained in Appendix F.

Lake Elsinore Discharge

There were no discharges from Lake Elsinore during the 1995-96 water year.

Storm Flow

Portions of storm flows are retained behind Prado Dam for regulation of downstream flows and for water conservation purposes. The ACOE owns Prado Dam and operates it according to a release schedule utilizing a debris pool elevation of 494 feet until March 1 of each year. In 1994 an agreement was signed by OCWD, ACOE, and the U.S. Fish and Wildlife Service, which provides that between March 1 and August 30 the pool would be raised, given sufficient flows, to elevation 497 feet. This elevation would be increased year by year, as additional biological habitat mitigation by OCWD comes on line, to a maximum elevation of 505 feet. On April 12, 1995, the ACOE, the U.S. Fish and Wildlife Service, and OCWD reached an agreement to accelerate immediately the raising of the seasonal water conservation pool to elevation 505 feet, in exchange for a $1 million contribution by OCWD to U.S. Fish and Wildlife Service to be used to develop Least Bell's vireo habitat by the removal of a non-native plant, *Arundo donax*. Storm flows captured within the reservoir are released following the storm to downstream groundwater recharge facilities. Monthly and annual quantities of Storm Flow are shown in Table 4. The abrupt increase in base flow in late March is attributed to the start of the RIX Project.

During the 1995-96 water year, the maximum volume of water stored in Prado Reservoir reached 12,690 acre-feet on February 21, 1996. The maximum daily mean flow released from Prado Dam to the Santa Ana River was 6,950 cfs on the same day.

During the year, construction continued on elements of the Santa Ana River Mainstem flood control project, including the Seven Oaks Dam, located on the Santa Ana River above the community of Mentone.

Base Flow

The Base Flow is affected by Nontributary Flow releases to San Antonio Creek, discharges from the Arlington Desalter, deliveries of Exchange Water, and discharges from Lake Elsinore. The general procedure used by the Watermaster to separate the 1995-96 flow components was the same as used for previous years and is fully described in the Fifth (1974-75) and the Twelfth (1981-82) Annual Reports. The monthly and annual quantities of Base Flow are shown in Table 4.

Wastewater Effluent Discharges

A portion of the Base Flow at Prado is made up of treated wastewater effluent discharged from a number of municipal wastewater treatment plants located above Prado Dam. During the 1995-96 water year, about 145,480 acre-feet of effluent were discharged above Prado Dam by major agencies as shown in Table 5. This amount includes over-extraction of groundwater from the RIX Project, as described in Chapter I.

Water Quality Adjustments

The flow-weighted average total dissolved solids (TDS) for the total flow passing Prado Dam, including Nontributary Flow released above Riverside Narrows, Exchange Water and Arlington Desalter discharge, was found to be 494 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 flow below Prado Dam. This record was supplemented by twenty-two (22) and seventeen (17) grab samples for EC collected by the USGS and OCWD, respectively, and analyzed for TDS.

A correlation between TDS and EC yields the following best fit equation:

$$TDS = EC \times 0.612762$$

(where the units of TDS and EC are mg/L and microsiemens/cm, respectively)

Using the daily EC data, flow-weighted average daily values for TDS were calculated using the above equation. The plot of TDS on Plate 5 shows the daily average TDS concentration of the Santa Ana River flow passing Prado Dam. A summary of daily

TABLE 5

MUNICIPAL WASTEWATER EFFLUENT DISCHARGED ABOVE PRADO (acre-feet)

Year	Redlands	San Bernardino	Colton	Rialto	RIX[1]	Riverside	Corona	CBMWD #1	CBMWD #2	CBMWD CCWRF[2]	Total
1970-71	2,650	17,860	2,520	2,270	--	18,620	3,190	--	--	--	47,110
1971-72	2,830	16,020	2,230	2,400	--	19,010	3,230	6,740	--	--	52,460
1972-73	2,810	18,670	2,530	2,260	--	19,060	3,340	10,380	--	--	59,050
1973-74	2,770	17,680	2,530	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
1987-88	6,060	27,880	5,240	6,040	--	34,660	6,050	31,290	5,500	--	122,720
1988-89	5,250	27,640	5,550	6,280	--	35,490	8,080	35,510	6,180	--	129,980
1990-91	6,690	27,570	5,670	6,290	--	32,180	9,110	36,840	6,100	--	130,450
1991-92	6,230	25,060	5,660	6,360	--	32,660	9,010	40,360	5,780	1,550	132,670
1992-93	6,880	25,550	6,210	6,460	--	34,100	9,600	41,510	5,640	4,720	140,670
1993-94	6,440	23,800	5,830	6,540	--	32,640	7,790	37,310	5,430	7,010	132,790
1994-95	6,720	26,330	5,500	6,820	--	33,950	7,340	39,680	5,360	8,690	140,390
1995-96	6,550	13,240	2,770	6,890	20,760	33,960	7,850	39,590	4,810	9,060	145,480

[1]RIX = Rapid Infiltration and Extraction Facility, including over-extraction of groundwater

[2]CCWRF = Carbon Canyon Water Reclamation Facility

The amounts shown in this table were determined from data provided by the agencies.

TDS and EC of the Santa Ana River below Prado Dam is contained in Appendix H.

At Prado Dam, the flow-weighted average annual TDS value of 494 mg/L represents the quality of the total flow including releases to San Antonio Creek, Exchange Water, and Arlington Desalter. The Stipulated Judgment requires that Base Flow shall be subject to adjustment based on the TDS of Base Flow and Storm Flow only. Hence a determination of the TDS of Base Flow plus Storm Flow only, is detailed in the following paragraphs.

Adjustment for Exchange Water

The City of Riverside continued to pump groundwater which was discharged into the Riverside Canal for delivery to OCWD. The amount of water discharged to the Santa Ana River during the 1995-96 water year was 1,470 acre-feet. Using monthly TDS grab samples collected from Riverside Canal at the Tava Lanes turnout and monthly flow values, a flow-weighted average TDS of 588 mg/L was calculated. A summary of Exchange Water quality is contained in Appendix D.

Adjustment for Flow to San Antonio Creek

During the 1995-96 water year, 20,893 acre-feet of the water released from OC-59 was calculated to have reached Prado Dam. A flow-weighted average TDS of 240 mg/L was calculated for State Water Project water delivered from OC-59 to San Antonio Creek. As discussed in the Twelfth Annual Report, studies have indicated that leaching of salts from soils to the OC-59 water occurred as it flowed along Chino Creek to Prado Dam. Therefore, the TDS of the OC-59 water reaching Prado Dam was recalculated as described in Appendix E.

Adjustment for Arlington Desalter

During the 1989-90 water year, Arlington Desalter began to discharge product water into a storm channel tributary to the Santa Ana River. The amount of product water discharged to the Santa Ana River during the 1995-96 water year totaled 4,244 acre-feet. Using daily EC, a 0.63 conversion factor, and daily flow values, a flow-weighted average TDS of 427 mg/L was calculated. A summary of these calculations is contained in Appendix F.

Adjustment for Lake Elsinore Discharges

During the 1995-96 water year, no discharge from Lake Elsinore occurred. Therefore, no water quality adjustment was necessary.

Flow Component	Annual Flow (acre-feet)	Average TDS (mg/L)	Annual Flow x Average TDS (acre-feet x mg/L)
1. Measured Outflow	217,160	494	107,277,040
2. Less Exchange Water	1,470	588	864,360
3. Less Nontributary Flow			
San Antonio Creek	20,893	321	6,706,653
4. Less Arlington Desalter	4,244	427	1,812,188
5. Measured Outflow less lines 2, 3, and 4	190,553		97,893,839
Average TDS in total Base and Storm Flow		97,893,839 ÷ 190,553 = 514 mg/L	

After adjusting for Exchange Water, Nontributary Flow, and Arlington Desalter discharges, the weighted average annual TDS of Storm Flow and Base Flow for 1995-96 is 514 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 514 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:

$$(131{,}861 \text{ ac-ft}) + \frac{35}{42{,}000} (131{,}861 \text{ ac-ft}) (700 - 514) = 152{,}299 \text{ ac-ft}$$

Entitlement and Credit or Debit

Paragraph 5(c) of the Stipulated Judgment states that "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 no 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 1995-96 required under the Stipulated Judgment are as follows:

1.	Measured Outflow at Prado	217,160 acre-feet
2.	Base Flow at Prado	131,861 acre-feet
3.	Annual Weighted TDS of Base and Storm Flow	514 mg/L
4.	Annual Adjusted Base Flow	152,299 acre-feet
5.	Cumulative Adjusted Base Flow	2,660,693 acre-feet
6.	Cumulative Entitlement of OCWD	1,092,000 acre-feet
7.	Cumulative Credit	1,568,693 acre-feet
8.	One-Third of Cumulative Debit	0 acre-feet
9.	Minimum Required Base Flow in 1996-97	34,000 acre-feet

CHAPTER III

BASE FLOW AT RIVERSIDE NARROWS

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

Flow at Riverside Narrows

The flow of the Santa Ana River at Riverside Narrows amounted to 83,256 acre-feet, measured at the USGS gaging station near the MWDSC Upper Feeder Crossing. Separated into its components, Base Flow was 54,548 acre-feet, Storm Flow was 29,321 acre-feet, and Nontributary Flow of 1,470 acre-feet was in the form of Exchange Water. Included in Base Flow are 2,082 acre-feet of wastewater from Rubidoux Community Services District which now by-passes the USGS gaging station. The Storm and Base Flow components of the flow of the Santa Ana River at Riverside Narrows for each month in the 1995-96 water year are listed in Table 6 and graphically shown on Plate 6. The components of flow of the Santa Ana River at Riverside Narrows during the period 1934-35 through 1995-96 are presented on Plate 7.

Release of Exchange Water

During water year 1995-96, 1,470 acre-feet of Exchange Water were delivered to the Santa Ana River upstream of the Riverside Narrows.

Base Flow

Based on the hydrograph shown on Plate 6 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. The abrupt increase in base flow in late March is attributed to the startup of the RIX Project.

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 1995-96, in the amount of 2,082 acre-feet, has been added to the stream flow as measured at the gaging station.

TABLE 6

COMPONENTS OF FLOW AT RIVERSIDE NARROWS

FOR WATER YEAR 1995-96
(acre-feet)

	Month	USGS Measured Flow	Storm Flow	Exchange Water (1)	Rubidoux Waste-water	Base Flow (2)
1994	October	3,495	0	0	178	3,673
	November	3,539	0	0	169	3,708
	December	3,786	60	167	168	3,728
1995	January	7,952	3,921	0	158	4,188
	February	22,072	18,421	0	148	3,799
	March	11,291	6,278	0	169	5,183
	April	5,921	641	0	168	5,448
	May	5,839	0	323	179	5,695
	June	5,435	0	407	177	5,205
	July	4,925	0	194	190	4,921
	August	4,324	0	145	191	4,370
	September	4,677	0	234	187	4,630
Total		83,256	29,321	1,470	2,082	54,548

(1) Exchange Water pumped from the San Bernardino, Colton, and Riverside groundwater basin and discharged into the Santa Ana River, less an estimated loss of 5% for evapotranspiration

(2) Baseflow equals USGS measured flow, minus storm flow, minus Exchange Water, plus Ribidoux Wastewater.

Water Quality

The determination of water quality at the Riverside Narrows Gaging Station was made using periodic grab samples taken and analyzed for TDS by the USGS and the City of Riverside. Water quality data based on samples taken during storm flow periods were not used in the calculations.

The flow-weighted quality of wastewater from Rubidoux was 652 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 625 mg/L.

Flow Component	Annual Flow (acre-feet)	Average TDS (mg/L)	Annual Flow x Average TDS (acre-feet x mg/L)
1. Base Flow including Nontributary Flow	53,936	623	33,601,505
2. Less Nontributary Flow MWD Exchange Water	1,470	588	864,360
3. Plus Rubidoux Wastewater	2,082	652	1,357,464
4. Base Flow less line 2 plus line 3	54,548		34,093,139
Average TDS of Base Flow	34,093,139 ÷ 54,548 = 625 mg/L		

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 subjected to adjustment based on weighted average annual TDS in the Base Flow as follows:

If the Weighted Average TDS in Base Flow at Riverside Narrows 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.

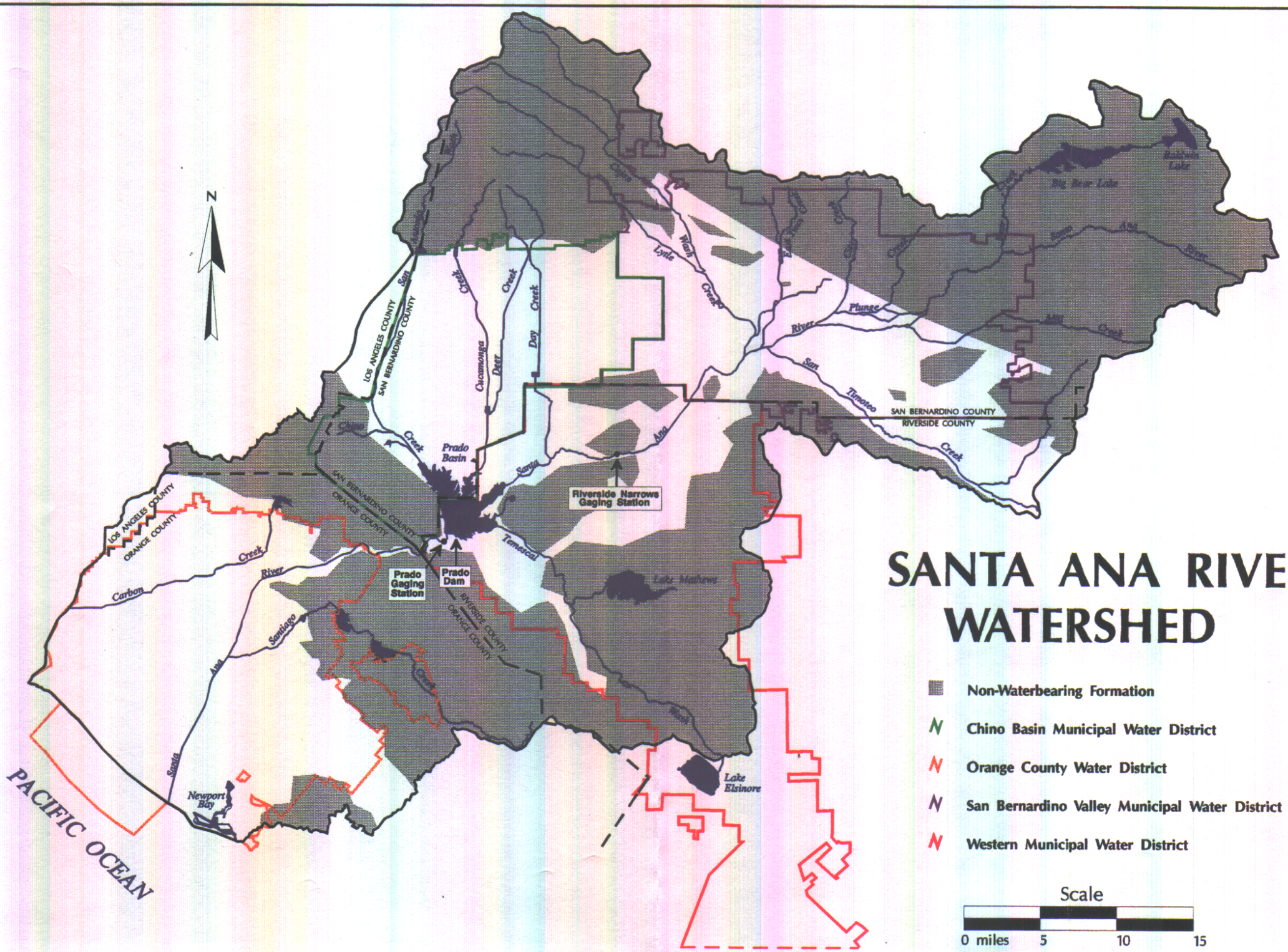
From the previous subsection, the weighted average annual TDS in the Base Flow at Riverside Narrows for the water year 1995-96 was 625 mg/L. Therefore, no adjustment is necessary, and the Adjusted Base Flow for 1995-96 is 54,548 acre-feet.

Entitlement and Credit or Debit

Paragraph 5(b) of the Stipulated 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 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 concerning flow at Riverside Narrows for 1995-96 required under the Stipulated Judgment are as follows:

1.	Base Flow at Riverside Narrows	54,548 acre-feet
2.	Annual Weighted TDS of Base Flow	625 mg/L
3.	Annual Adjusted Base Flow	54,548 acre-feet
4.	Cumulative Adjusted Base Flow	974,185 acre-feet
5.	Cumulative Entitlement of CBMWD and WMWD	396,500 acre-feet
6.	Cumulative Credit	577,685 acre-feet
7.	One-Third of Cumulative Debit	0 acre-feet
8.	Minimum Required Base Flow in 1996-97	12,420 acre-feet



SANTA ANA RIVER WATERSHED

- Non-Waterbearing Formation
- N Chino Basin Municipal Water District
- N Orange County Water District
- N San Bernardino Valley Municipal Water District
- N Western Municipal Water District

Scale

0 miles 5 10 15

PRECIPITATION AT SAN BERNARDINO SINCE 1934-35

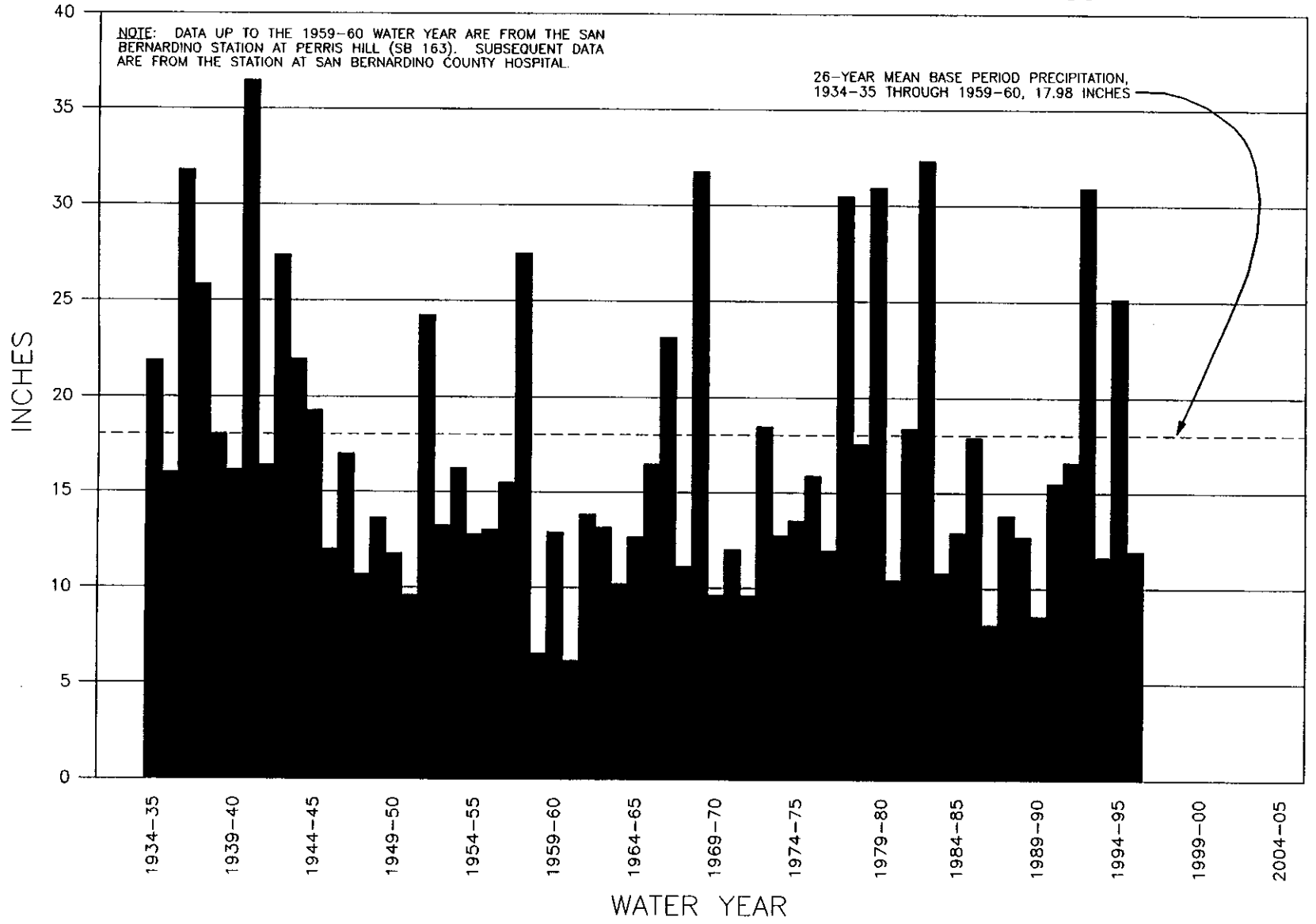
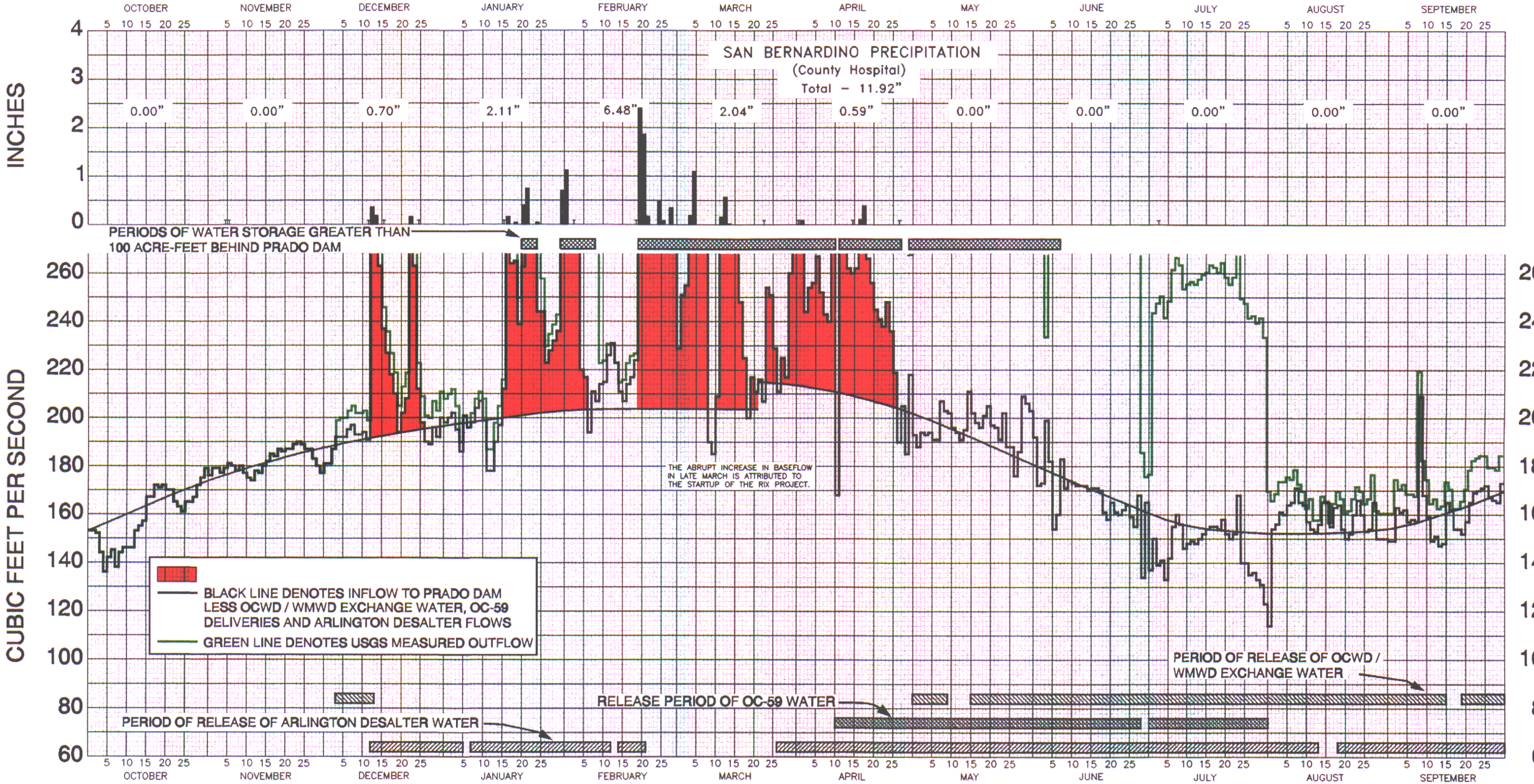


PLATE 2



DISCHARGE OF SANTA ANA RIVER AT PRADO DAM & SAN BERNARDINO PRECIPITATION
WATER YEAR 1995-96

DISCHARGE OF SANTA ANA RIVER AT PRADO SINCE 1934-35

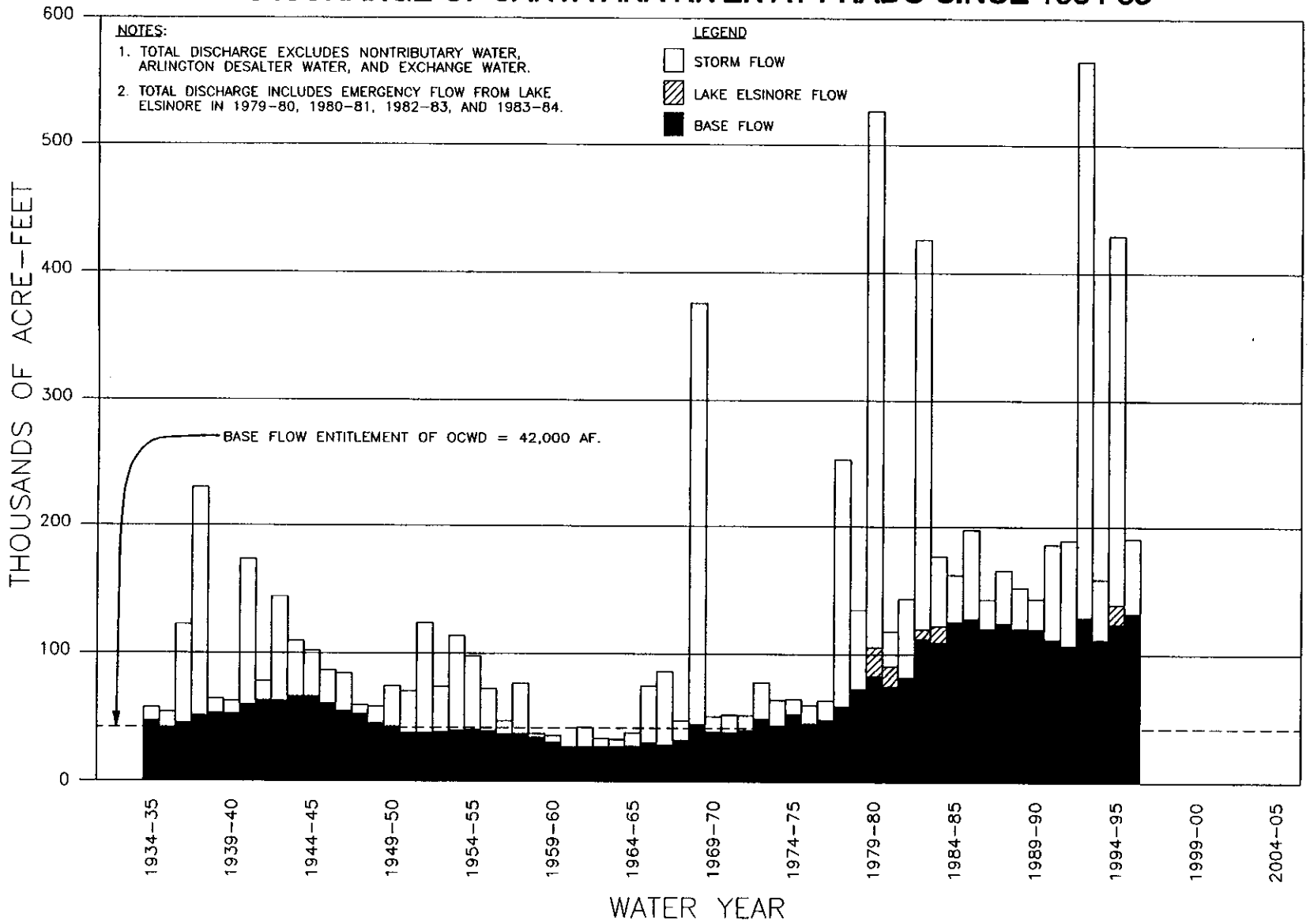
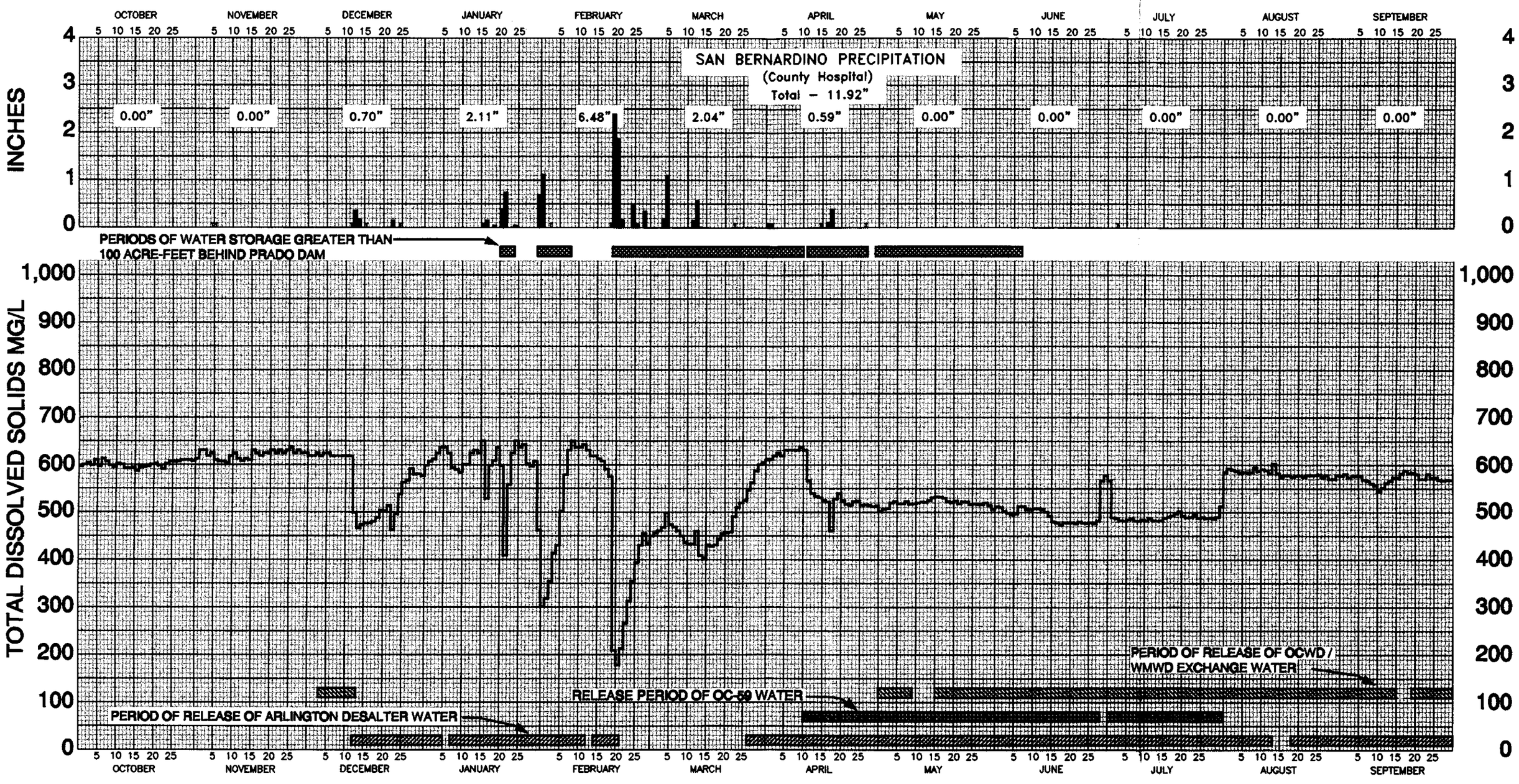
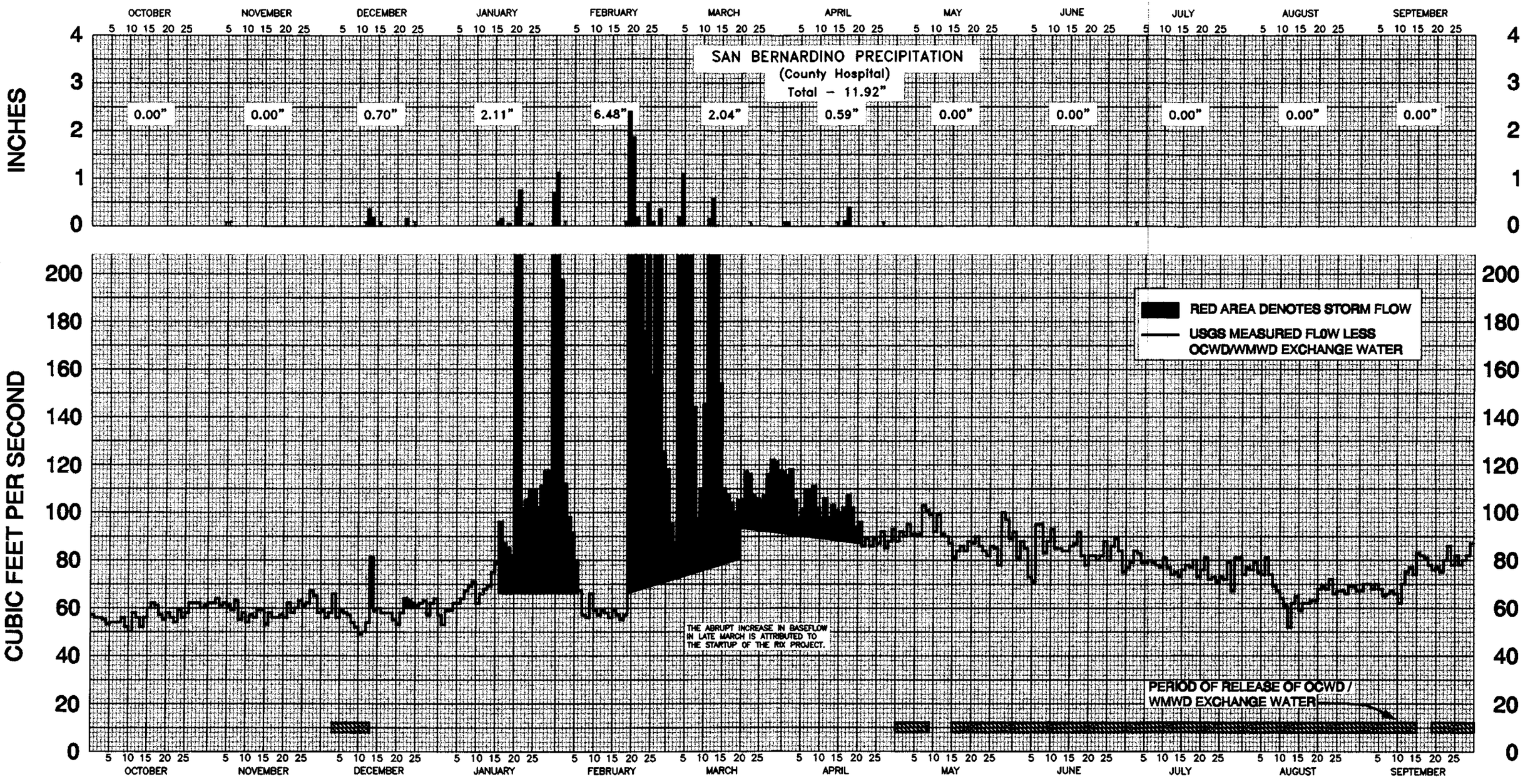


PLATE 4



DISSOLVED SOLIDS IN SANTA ANA RIVER BELOW PRADO DAM
WATER YEAR 1995-96

Plate 5



DISCHARGE OF SANTA ANA RIVER AT RIVERSIDE NARROWS & SAN BERNARDINO PRECIPITATION
WATER YEAR 1995-96

Plate 6

DISCHARGE OF SANTA ANA RIVER AT RIVERSIDE NARROWS SINCE 1934-35

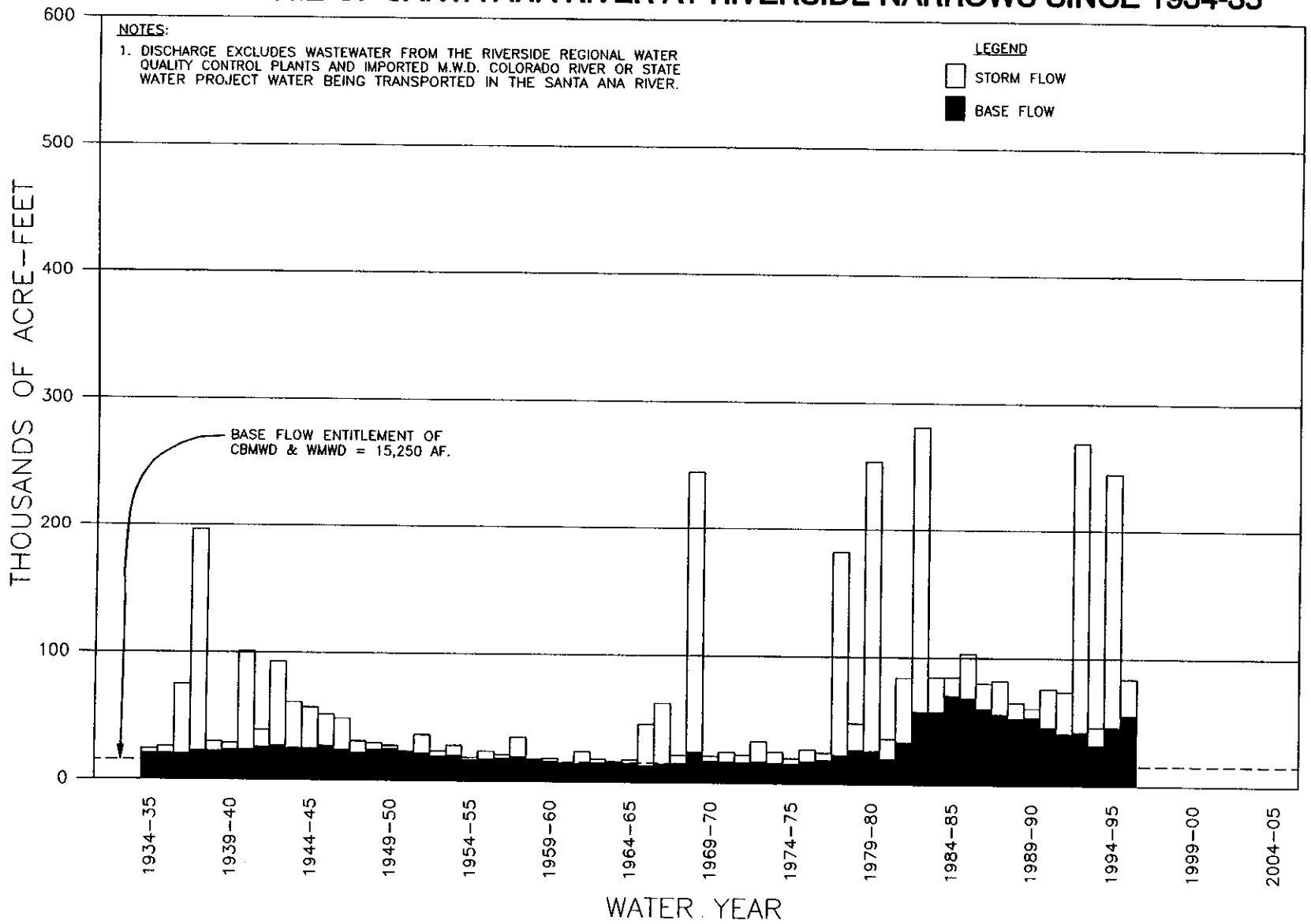


PLATE 7

SANTA ANA RIVER WATERMASTER

FOR

ORANGE COUNTY WATER DISTRICT

VS. CITY OF CHINO et al.

CASE NO. 117628 - COUNTY OF ORANGE

BASIC DATA

FOR THE

TWENTY-SIXTH ANNUAL REPORT

OF THE

SANTA ANA RIVER WATERMASTER

FOR WATER YEAR

OCTOBER 1, 1995 - SEPTEMBER 30, 1996

APRIL 30, 1997

TABLE OF CONTENTS

Appendix

Note: Totals at the bottom of appendix tables may not appear to add arithmetically because of the hidden rounding of data values to zero decimal places.

APPENDIX A

USGS FLOW MEASUREMENTS OF THE SANTA ANA RIVER BELOW PRADO, AT MWD CROSSING, AND E STREET, AND OF TEMESCAL CREEK ABOVE MAIN STREET (AT CORONA)

WATER YEAR 1995-96

11059300 SANTA ANA RIVER AT E STREET, NEAR SAN BERNARDINO, CA

LOCATION.--Lat 34°03'54", long 117°17'58", in San Bernardino Grant, San Bernardino County, Hydrologic Unit 18070203, on left bank, 0.4 mi downstream from E Street Bridge, 0.4 mi upstream from Warm Creek, 1.2 mi downstream from San Timoteo Creek, 2.8 mi south of San Bernardino, and 26 mi downstream from Big Bear Lake.
DRAINAGE AREA.--541 mi^2.

WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--March 1939 to September 1954, October 1966 to current year.
GAGE.--Water-stage recorder. Elevation of gage is 940 ft above sea level, from topographic map. Prior to Nov. 10, 1950, water-stage recorder on right bank 0.4 mi upstream at datum 964.50 ft above sea level. Nov. 11, 1950, to Sept. 30, 1954, water-stage recorder on both banks 0.4 mi upstream at datum 964.50 ft above sea level. Oct. 1, 1966, to Sept. 30, 1976, water-stage recorder on right bank 0.4 mi upstream at datum 954.50 ft above sea level. Oct. 1, 1976, to Sept. 30, 1977, gage was removed for channel construction. Oct. 1, 1977, to Jan. 28, 1981, water-stage recorder on right bank 0.5 mi upstream at elevation 950 ft above sea level, from topographic map.
REMARKS.--Records fair through January and poor thereafter. Flow partly regulated by Big Bear Lake (station 11049000). Natural flow of stream affected by ground-water withdrawals and diversion for domestic use and irrigation upstream from station. Effluent from sewage reclamation plant 1.0 mi upstream caused sustained flow past gage from 1967 to Mar. 21, 1996. See schematic diagram of Santa Ana River basin.
EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 28,000 ft^3/s, Feb. 25, 1969, gage height, 11.9 ft, site and datum then in use; no flow for many days many years prior to 1967 and since Mar. 21, 1996.
EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 1,000 ft^3/s, from rating curve extended above 5,930 ft^3/s on basis of critical-depth computations:

Date	Time	Discharge (ft^3/s)	Gage height (ft)	Date	Time	Discharge (ft^3/s)	Gage height (ft)
Jan. 21	1945	1,840	4.94	Feb. 27	2200	1,460	4.70
Jan. 31	2130	3,990	5.39	Mar. 4	2115	2,000	4.93
Feb. 20	2030	4,510	5.51	Mar. 14	1915	1,720	4.81
Feb. 25	1145	1,280	4.62				

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1995 TO SEPTEMBER 1996
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	42	52	40	31	904	e52	.00	.00	.00	.00	.00	.00
2	39	57	35	32	69	e50	.00	.00	.00	.00	.00	.00
3	34	49	34	32	44	e49	.00	.00	.00	.00	.00	.00
4	37	45	32	32	42	237	.00	.00	.00	.00	.00	.00
5	37	43	32	31	46	691	.00	.00	.00	.00	.00	.00
6	37	44	36	32	49	161	.00	.00	.00	.00	.00	.00
7	35	40	39	34	43	67	.00	.00	.00	.00	.00	.00
8	34	40	36	34	41	e50	.00	.00	.00	.00	.00	.00
9	37	39	34	33	45	e47	.00	.00	.00	.00	.00	.00
10	37	40	35	36	43	e45	.00	.00	.00	.00	.00	.00
11	35	38	26	33	44	e45	.00	.00	.00	.00	.00	.00
12	34	39	26	33	46	e50	.00	.00	.00	.00	.00	.00
13	35	39	45	32	54	254	.00	.00	.00	.00	.00	.00
14	38	38	33	32	53	162	.00	.00	.00	.00	.00	.00
15	34	38	33	40	56	39	.00	.00	.00	.00	.00	.00
16	35	38	32	34	53	e38	.00	.00	.00	.00	.00	.00
17	40	38	28	49	52	e38	.00	.00	.00	.00	.00	.00
18	36	38	30	35	53	e37	.39	.00	.00	.00	.00	.00
19	35	38	29	32	96	e38	.00	.00	.00	.00	.00	.00
20	41	38	29	37	2370	e37	.00	.00	.00	.00	.00	.00
21	40	39	30	311	1990	2.8	.00	.00	.00	.00	.00	.00
22	40	38	29	74	436	.00	.00	.00	.00	.00	.00	.00
23	42	38	33	35	104	.00	.00	.00	.00	.00	.00	.00
24	40	35	31	32	48	.00	.00	.00	.00	.00	.00	.00
25	40	36	27	30	186	.00	.00	.00	.00	.00	.00	.00
26	39	37	32	32	48	.00	.00	.00	.00	.00	.00	.00
27	39	36	32	32	124	.00	.00	.00	.00	.00	.00	.00
28	39	38	32	33	72	.00	.00	.00	.00	.00	.00	.00
29	39	35	31	31	e55	.00	.00	.00	.00	.00	.00	.00
30	43	35	31	37	---	.00	.00	.00	.00	.00	.00	.00
31	48	---	32	839	---	.00	---	.00	---	.00	.00	---
TOTAL	1181	1198	1004	2170	7266	2189.80	0.39	0.00	0.00	0.00	0.00	0.00
MEAN	38.1	39.9	32.4	70.0	251	70.6	.013	.000	.000	.000	.000	.000
MAX	48	57	45	839	2370	691	.39	.00	.00	.00	.00	.00
MIN	34	35	26	30	41	.00	.00	.00	.00	.00	.00	.00
AC-FT	2340	2380	1990	4300	14410	4340	.8	.00	.00	.00	.00	.00

e Estimated.

11066460 SANTA ANA RIVER AT MWD CROSSING, NEAR ARLINGTON, CA

LOCATION.--Lat 33°58'07", long 117°26'51", in NE 1/4 SW 1/4 sec.30, T.2 S., R.5 W., Riverside County, Hydrologic Unit 18070203, on left bank at MWD pipeline crossing, 0.8 mi downstream from Union Pacific Railroad Bridge, 1.1 mi upstream from bridge on Van Buren Boulevard, and 3.3 mi north of Arlington.
DRAINAGE AREA.--852 mi^2.

WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--March 1970 to current year.
REVISED RECORDS.--WDR CA-83-1: Drainage area.
GAGE.--Water-stage recorder. Elevation of gage is 685 ft above sea level, from topographic map. Gage moved to left bank at present datum on June 17, 1993 (formerly on right bank). Prior to Oct. 1, 1984, water-stage recorder at site 300 ft upstream on left bank at different datum.
REMARKS.--Records fair below 900 ft^3/s and poor above. Flow partly regulated by Big Bear Lake (station 11049000). Natural streamflow affected by ground-water withdrawals, diversions for irrigation, and return flows from irrigated areas. The records at this station are equivalent to those collected at Santa Ana River at Riverside Narrows, near Arlington minus the flow at Riverside Water-Quality Control Plant at Riverside Narrows, near Arlington. See schematic diagram of Santa Ana River basin.
EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 30,700 ft^3/s, Mar. 6, 1995, gage height, 14.47 ft, on basis of area-velocity study; maximum gage height, 20.23 ft, Mar. 4, 1978; minimum daily, 15 ft^3/s, Sept. 7, 8, 1980.
EXTREMES OUTSIDE PERIOD OF RECORD.--Maximum discharge since at least 1927, 100,000 ft^3/s, Mar. 2, 1938, on basis of slope-area measurement at site 1.1 mi downstream. Flood of Jan. 22, 1862, 320,000 ft^3/s, on basis of slope-conveyance study at site 8.2 mi upstream. Stage at that site was 5 ft higher than that of Mar. 2, 1938.
EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 1,500 ft^3/s:

Date	Time	Discharge (ft^3/s)	Gage height (ft)	Date	Time	Discharge (ft^3/s)	Gage height (ft)
Jan. 22	0045	2,440	8.27	Feb. 27	2330	1,520	7.68
Jan. 31	2345	4,820	9.94	Mar. 5	0630	2,290	8.14
Feb. 20	2200	4,950	10.02				

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1995 TO SEPTEMBER 1996
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	57	62	59	57	1380	118	117	94	100	84	79	70
2	56	62	56	53	197	95	115	101	90	86	80	73
3	56	64	58	59	112	87	118	99	95	88	80	73
4	55	61	73	59	98	242	105	104	92	87	83	69
5	53	62	64	62	91	971	97	100	79	82	80	72
6	54	61	67	62	80	521	101	100	77	81	77	71
7	54	59	66	64	67	253	109	100	102	82	83	67
8	54	63	65	67	57	144	109	106	102	81	74	68
9	56	55	63	69	56	97	111	102	90	81	69	69
10	52	58	61	71	66	110	102	99	94	80	67	72
11	50	54	58	62	59	145	97	92	100	84	67	69
12	58	57	58	66	57	209	106	99	92	80	65	77
13	56	56	63	68	59	555	98	91	92	77	54	82
14	52	59	81	69	58	227	103	90	91	78	64	84
15	56	59	59	75	56	154	101	87	90	75	68	81
16	60	53	60	79	59	110	100	86	92	79	60	83
17	62	58	58	96	57	107	102	90	93	81	64	82
18	61	56	58	87	55	104	107	92	99	80	64	81
19	57	56	58	85	57	100	102	89	89	82	64	78
20	55	57	55	82	2720	105	94	92	85	75	67	81
21	58	56	53	424	2970	105	96	92	88	78	70	82
22	56	62	58	547	973	117	86	95	89	82	70	80
23	54	58	64	101	292	116	89	91	87	74	69	85
24	59	60	63	105	176	107	86	90	89	76	73	91
25	56	63	62	109	401	106	89	88	95	76	67	83
26	58	61	61	109	157	105	87	92	87	76	70	87
27	62	62	62	102	236	107	92	91	93	74	71	83
28	62	67	63	111	357	116	85	83	95	81	69	86
29	62	65	57	117	125	122	88	106	91	69	72	88
30	60	58	62	117	---	121	93	105	82	87	71	91
31	61	---	64	775	---	117	---	98	---	87	69	---
TOTAL	1762	1784	1909	4009	11128	5693	2985	2944	2740	2483	2180	2358
MEAN	56.8	59.5	61.6	129	384	184	99.5	95.0	91.3	80.1	70.3	78.6
MAX	62	67	81	775	2970	971	118	106	102	88	83	91
MIN	50	53	53	53	55	87	85	83	77	69	54	67
AC-FT	3490	3540	3790	7950	22070	11290	5920	5840	5430	4930	4320	4680

11072100 TEMESCAL CREEK ABOVE MAIN STREET, AT CORONA, CA

LOCATION.--Lat 33°53'21", long 117°33'43", in La Sierra Grant, Riverside County, Hydrologic Unit 18070203, on right bank 500 ft upstream from Main Street Bridge in Corona and 1.5 mi upstream from topographic boundary of Prado Flood Control basin.

DRAINAGE AREA.--224 mi^2, excludes 768 mi^2 above Lake Elsinore.

PERIOD OF RECORD.--October 1980 to July 1983, February 1984 to current year. December 1967 to September 1974, water-stage recorder at site 1.2 mi downstream at different datum (published as Station 11072200, Temescal Creek at Corona, CA).

GAGE.--Water-stage recorder and concrete-lined flood control channel. Elevation of gage is 600 ft above sea level, from topographic map. October 1980 to July 1983 at site 500 ft downstream at different datum.

REMARKS.--Records fair except for estimated daily discharges, which are poor. Flow regulated by several small storage reservoirs. Many diversions upstream from station for irrigation. Water discharged to channel from Arlington Desalter at times since September 1990; records for water years 1981 to 1990 and 1991 to current year are not equivalent.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 4,720 ft^3/s, Mar. 1, 1983, gage height, 11.67 ft, site and datum then in use, on basis of slope-conveyance study; minimum daily, 0.27 ft^3/s, Sept. 25, 1981.

EXTREMES OUTSIDE PERIOD OF RECORD.--Maximum discharge, 8,850 ft^3/s, Feb. 25, 1969, gage height, 8.17 ft, from floodmark, at old site (Station 11072200) 1.2 mi downstream on basis of slope-area measurement of peak flow.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1995 TO SEPTEMBER 1996
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	8.7	5.4	5.1	15	54	22	e46	14	12	8.5	12	11
2	9.8	5.5	5.8	16	24	24	e41	14	12	25	14	12
3	8.8	5.8	6.5	16	27	25	e36	14	13	25	14	13
4	7.4	6.6	7.4	17	20	42	e31	14	13	27	14	14
5	5.6	5.7	11	11	19	52	e29	14	13	24	14	14
6	6.2	5.3	8.5	4.3	19	27	e28	14	13	21	15	14
7	6.4	5.4	7.1	5.1	18	27	e25	14	13	20	15	14
8	5.6	4.8	7.5	9.2	21	26	e24	13	14	17	16	14
9	5.2	5.6	8.2	13	23	26	e22	13	13	13	15	13
10	5.0	5.1	8.2	11	24	26	e20	13	13	14	12	13
11	5.7	5.3	7.9	18	26	24	e19	13	13	14	4.7	13
12	5.6	4.5	6.9	16	26	32	e19	13	14	13	14	12
13	5.8	5.0	42	17	14	188	e17	13	13	13	7.6	13
14	5.9	5.3	21	19	16	43	e16	13	13	13	2.5	13
15	5.8	5.8	14	18	25	32	e15	15	14	13	2.9	13
16	6.3	6.1	14	43	40	29	e15	17	14	11	3.3	13
17	6.0	6.8	14	22	36	27	e22	15	14	13	3.6	13
18	5.8	5.6	14	21	32	26	e50	16	14	12	4.0	13
19	6.6	5.8	14	26	30	24	e31	16	15	13	8.7	13
20	6.3	6.1	13	23	409	24	e29	12	17	13	15	14
21	7.2	6.6	14	126	223	24	e26	13	18	14	15	16
22	7.6	5.8	15	24	57	24	e24	13	18	13	15	14
23	4.5	4.5	38	20	33	25	e23	13	21	14	23	14
24	3.9	5.2	15	19	25	25	e21	13	23	14	5.7	15
25	6.7	5.6	14	23	104	25	e20	13	25	13	11	15
26	7.4	5.6	14	19	33	25	e20	14	26	14	11	16
27	6.3	6.1	14	20	59	32	e19	13	26	13	11	16
28	5.3	5.3	15	26	29	47	e17	12	26	13	11	17
29	5.0	4.9	16	22	22	47	17	12	26	13	12	18
30	5.4	5.3	15	24	---	48	16	13	18	13	12	19
31	4.9	---	15	196	---	47	---	13	---	12	11	---
TOTAL	192.7	166.4	421.1	859.6	1488	1115	738	422	497	468.5	345.0	422
MEAN	6.22	5.55	13.6	27.7	51.3	36.0	24.6	13.6	16.6	15.1	11.1	14.1
MAX	9.8	6.8	42	196	409	188	50	17	26	27	23	19
MIN	3.9	4.5	5.1	4.3	14	22	15	12	12	8.5	2.5	11
AC-FT	382	330	835	1710	2950	2210	1460	837	986	929	684	837

e Estimated.

APPENDIX B

DAILY PRECIPITATION DATA
AT SAN BERNARDINO COUNTY HOSPITAL

WATER YEAR 1995-96

Table B-1

DAILY PRECIPITATION AT SAN BERNARDINO COUNTY HOSPITAL

1995			1996									
Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	0	TR	0	0	1.12	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0.09	0	0	0	0	0
3	0	0	0	0	TR	0	0	0	0	TR	0	0
4	0	0	0	0	0	0.19	0	0	0	0	0	0
5	0	0	0	0	0	1.1	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0.16	0	0	0	0	0	0
13	0	0	0.36	0	0	0.57	0	0	0	0	0	0
14	0	0	0.18	0	0	0.02	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	TR	TR	0	0	0	0	0	0	0	0
17	0	0	0	0.16	0	0	0.11	0	0	0	0	0
18	0	0	0	0	0	0	0.39	0	0	0	0	0
19	0	0	0	0.05	0	0	0	0	0	0	0	0
20	0	0	0	0	2.4	0	0	0	0	0	0	0
21	0	0	0	0.4	1.86	0	0	0	0	0	0	0
22	0	0	0	0.75	0.17	0	0	0	0	0	0	0
23	0	0	0.16	0	0	TR	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	TR	0.5	0	0	0	0	0	0	0
26	0	0	0	0	0.08	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0	0	0.05	0.35	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0		0	0	0	0	0	0	0
31	TR		0	0.7		0		0		0	0	
Total	0	0	0.7	2.11	6.48	2.04	0.59	0	0	0	0	0

TR = Trace

APPENDIX C

SANTA ANA RIVER WATERMASTER
FINANCIAL STATEMENTS WITH REPORT
ON EXAMINATION BY
ORANGE COUNTY WATER DISTRICT CONTROLLER

WATER YEAR 1995-96

ORANGE COUNTY WATER DISTRICT

April 26, 1997

Santa Ana River Watermaster
c/o SBVMWD
P.O. Box 5906
San Bernardino, CA 92412-5906

Gentlemen:

I have reviewed the attached summary of transactions for the checking and savings accounts of the Santa Ana River Watermaster. As part of this review, I have compared the transactions on the attached summary with those shown on the original Bank of America Checking and Savings Account statements.

The transactions on the summary also match those found on original documents. The Checking and Savings Accounts balances as of June 30, 1996, are as shown.

Very truly yours,

ORANGE COUNTY WATER DISTRICT

Barbara Heatherly
Controller

BH

P.O. BOX 8300, FOUNTAIN VALLEY, CA 92728-8300 • 10500 ELLIS AVENUE, FOUNTAIN VALLEY, CA 92708
TELEPHONE (714) 378-3200 FAX (714) 378-3373

SANTA ANA RIVER WATERMASTER

FINANCIAL STATEMENTS

JUNE 30, 1996

SANTA ANA RIVER WATER MASTER

STATEMENT OF ASSETS AND LIABILITIES
ARISING FROM CASH TRANSACTIONS

June 30, 1996

ASSETS

Cash in checking account (Note 3)	$	11,556
Cash in savings account (Note 3)		2,255
TOTAL ASSETS	$	13,811

FUND BALANCE

Fund balance	$	13,811

See independent reviewer's reports and notes to financial statements.

SANTA ANA RIVER WATERMASTER

STATEMENT OF ASSETS AND LIABILITIES
ARISING FROM CASH TRANSACTIONS

June 30, 1996

	Actual	Budget	Over (Under) Budget
REVENUE COLLECTED:			
Water district contributions (Note 2):			
Orange County Water District	$ 2,000	$2,000	$ -0-
Chino Basin Municipal Water District	-0-	1,000	(1,000)
San Bernardino Valley Municipal Water District	1,000	1,000	-0-
Western Municipal Water District	-0-	1,000	(1,000)
Interest from Savings Account	44	-0-	44
TOTAL REVENUE COLLECTED	3,044	5,000	(1,956)
EXPENSES PAID:			
Professional Engineering Service	4,321	11,500	(7,179)
Administrative Expenses:			
Office and Bank Service Charges	-0-	-0-	-0-
Auditing Services	-0-	-0-	-0-
Annual Reports	-0-	2,500	(2,500)
TOTAL EXPENSES PAID	4,321	14,000	(9,679)
EXCESS OF REVENUE COLLECTED OVER EXPENSES PAID	(1,277)	(9,000)	7,723
FUND BALANCE AT JULY 1, 1995	15,088		
FUND BALANCE AT JUNE 30, 1996	13,811		

See independent reviewer's report and notes to financial statements.

SANTA ANA RIVER WATERMASTER

NOTES TO FINANCIAL STATEMENTS

June 30, 1996

1. SIGNIFICANT ACCOUNTING POLICIES:

Basis of Accounting:

The Santa Ana River Watermaster's ("Watermaster") policy is to prepare its financial statements on the cash basis of accounting; consequently, certain revenues are recognized when received rather than when earned, and certain expenses are recognized when cash is disbursed rather than when the obligation is incurred.

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 judgment 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 Districts	20%
Total	100%

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

See Independent reviewer's report.

SANTA ANA RIVER WATERMASTER

NOTES TO FINANCIAL STATEMENTS
(CONTINUED)

June 30, 1996

3. CASH IN BANK:

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

Cash at June 30, 1996 consisted of the following:

Bank of America:	
Checking account	$ 11,556
Savings account	2,255
	$ 13,811

All cash is fully insured by the FDIC.

APPENDIX D

WATER QUALITY AND FLOW OF EXCHANGE GROUNDWATER DISCHARGED TO THE SANTA ANA RIVER ABOVE PRADO

WATER YEAR 1995-96

PREPARED BY

DONALD L. HARRIGER

TABLE D-1
MWDSC DEMONSTRATION PROGRAM
DISCHARGED TO THE SANTA ANA RIVER
ABOVE PRADO DAM

WATER YEAR 1994-95
(acre-feet)

Month	Discharged Below Riverside Narrows	Discharged Above Riverside Narrows (1)
1995		
October	0	0
November	0	0
December	0	167
1996		
January	0	0
February	0	0
March	0	0
April	0	0
May	0	323
June	0	407
July	0	194
August	0	145
September	0	234
Subtotal	0	1,470
Total		1,470

(1) Adjusted for a 5% transportation loss.

TABLE D-2
MWDSC DEMONSTRATION PROGRAM
DISCHARGED TO THE SANTA ANA RIVER
ABOVE PRADO DAM

WATER YEAR 1994-95

October 1995

Day	Discharged Above Riverside Narrows (1) (cfs)
1	0
2	0
3	0
4	0
5	0
6	0
7	0
8	0
9	0
10	0
11	0
12	0
13	0
14	0
15	0
16	0
17	0
18	0
19	0
20	0
21	0
22	0
23	0
24	0
25	0
26	0
27	0
28	0
29	0
30	0
31	0
Total in CFS-DAYS	0
Total in AF	0

(1) Adjusted for 5% transportation loss

TABLE D-2 (continued)
MWDSC DEMONSTRATION PROGRAM
DISCHARGED TO THE SANTA ANA RIVER
ABOVE PRADO DAM

WATER YEAR 1994-95

November 1996

Day	Discharged Above Riverside Narrows (1) (cfs)
1	0
2	0
3	0
4	0
5	0
6	0
7	0
8	0
9	0
10	0
11	0
12	0
13	0
14	0
15	0
16	0
17	0
18	0
19	0
20	0
21	0
22	0
23	0
24	0
25	0
26	0
27	0
28	0
29	0
30	0
Total in CFS-DAYS	0
Total in AF	0

(1) Adjusted for 5% transportation loss

TABLE D-2 (continued)
MWDSC DEMONSTRATION PROGRAM
DISCHARGED TO THE SANTA ANA RIVER
ABOVE PRADO DAM

WATER YEAR 1994-95

December 1995

Day	Discharged Above Riverside Narrows (1) (cfs)
1	0
2	0
3	0
4	7
5	8
6	8
7	8
8	8
9	9
10	9
11	9
12	8
13	10
14	0
15	0
16	0
17	0
18	0
19	0
20	0
21	0
22	0
23	0
24	0
25	0
26	0
27	0
28	0
29	0
30	0
31	0
Total in CFS-DAYS	84
Total in AF	167

(1) Adjusted for 5% transportation loss

TABLE D-2 (continued)
MWDSC DEMONSTRATION PROGRAM
DISCHARGED TO THE SANTA ANA RIVER
ABOVE PRADO DAM

WATER YEAR 1994-95

January 1996

Day	Discharged Above Riverside Narrows (1) (cfs)
1	0
2	0
3	0
4	0
5	0
6	0
7	0
8	0
9	0
10	0
11	0
12	0
13	0
14	0
15	0
16	0
17	0
18	0
19	0
20	0
21	0
22	0
23	0
24	0
25	0
26	0
27	0
28	0
29	0
30	0
31	0
Total in CFS-DAYS	0
Total in AF	0

(1) Adjusted for 5% transportation loss

TABLE D-2 (continued)
MWDSC DEMONSTRATION PROGRAM
DISCHARGED TO THE SANTA ANA RIVER
ABOVE PRADO DAM

WATER YEAR 1994-95

February 1996

Day	Discharged Above Riverside Narrows (1) (cfs)
1	0
2	0
3	0
4	0
5	0
6	0
7	0
8	0
9	0
10	0
11	0
12	0
13	0
14	0
15	0
16	0
17	0
18	0
19	0
20	0
21	0
22	0
23	0
24	0
25	0
26	0
27	0
28	0
29	0
Total in CFS-DAYS	0
Total in AF	0

(1) Adjusted for 5% transportation loss

TABLE D-2 (continued)
MWDSC DEMONSTRATION PROGRAM
DISCHARGED TO THE SANTA ANA RIVER
ABOVE PRADO DAM

WATER YEAR 1994-95

March 1996

Day	Discharged Above Riverside Narrows (1) (cfs)
1	0
2	0
3	0
4	0
5	0
6	0
7	0
8	0
9	0
10	0
11	0
12	0
13	0
14	0
15	0
16	0
17	0
18	0
19	0
20	0
21	0
22	0
23	0
24	0
25	0
26	0
27	0
28	0
29	0
30	0
31	0
Total in CFS-DAYS	0
Total in AF	0

(1) Adjusted for 5% transportation loss

TABLE D-2 (continued)
MWDSC DEMONSTRATION PROGRAM
DISCHARGED TO THE SANTA ANA RIVER
ABOVE PRADO DAM

WATER YEAR 1994-95

April 1996

Day	Discharged Above Riverside Narrows (1) (cfs)
1	0
2	0
3	0
4	0
5	0
6	0
7	0
8	0
9	0
10	0
11	0
12	0
13	0
14	0
15	0
16	0
17	0
18	0
19	0
20	0
21	0
22	0
23	0
24	0
25	0
26	0
27	0
28	0
29	0
30	0
Total in CFS-DAYS	0
Total in AF	0

(1) Adjusted for 5% transportation loss

TABLE D-2 (continued)
MWDSC DEMONSTRATION PROGRAM
DISCHARGED TO THE SANTA ANA RIVER
ABOVE PRADO DAM

WATER YEAR 1994-95

May 1996

Day	Discharged Above Riverside Narrows (1) (cfs)
1	6
2	10
3	9
4	10
5	10
6	10
7	10
8	3
9	1
10	0
11	0
12	0
13	0
14	0
15	0
16	5
17	6
18	6
19	5
20	4
21	5
22	5
23	5
24	6
25	6
26	6
27	6
28	5
29	6
30	8
31	10
Total in CFS-DAYS	163
Total in AF	323

(1) Adjusted for 5% transportation loss

TABLE D-2 (continued)
MWDSC DEMONSTRATION PROGRAM
DISCHARGED TO THE SANTA ANA RIVER
ABOVE PRADO DAM

WATER YEAR 1994-95

June 1996

Day	Discharged Above Riverside Narrows (1) (cfs)
1	8
2	9
3	7
4	7
5	6
6	6
7	7
8	7
9	7
10	6
11	7
12	7
13	7
14	7
15	6
16	6
17	6
18	7
19	7
20	7
21	6
22	7
23	7
24	7
25	7
26	7
27	7
28	6
29	7
30	7
Total in CFS-DAYS	205
Total in AF	407

(1) Adjusted for 5% transportation loss

TABLE D-2 (continued)
MWDSC DEMONSTRATION PROGRAM
DISCHARGED TO THE SANTA ANA RIVER
ABOVE PRADO DAM

WATER YEAR 1994-95

July 1996

Day	Discharged Above Riverside Narrows (1) (cfs)
1	7
2	7
3	4
4	4
5	3
6	2
7	2
8	2
9	3
10	3
11	3
12	3
13	3
14	3
15	2
16	3
17	3
18	3
19	2
20	2
21	2
22	1
23	2
24	3
25	5
26	3
27	2
28	2
29	2
30	6
31	6
Total in CFS-DAYS	98
Total in AF	194

(1) Adjusted for 5% transportation loss

TABLE D-2 (continued)
MWDSC DEMONSTRATION PROGRAM
DISCHARGED TO THE SANTA ANA RIVER
ABOVE PRADO DAM

WATER YEAR 1994-95

August 1996

Day	Discharged Above Riverside Narrows (1) (cfs)
1	5
2	3
3	4
4	4
5	5
6	3
7	2
8	0
9	0
10	0
11	3
12	4
13	2
14	2
15	3
16	1
17	2
18	2
19	1
20	4
21	2
22	1
23	1
24	1
25	1
26	3
27	4
28	3
29	3
30	2
31	2
Total in CFS-DAYS	73
Total in AF	145

(1) Adjusted for 5% transportation loss

TABLE D-2 (continued)
MWDSC DEMONSTRATION PROGRAM
DISCHARGED TO THE SANTA ANA RIVER
ABOVE PRADO DAM

WATER YEAR 1994-95

September 1996

Day	Discharged Above Riverside Narrows (1) (cfs)
1	3
2	3
3	3
4	1
5	2
6	3
7	2
8	2
9	2
10	6
11	7
12	7
13	7
14	7
15	7
16	0
17	0
18	0
19	0
20	5
21	5
22	5
23	5
24	5
25	5
26	5
27	5
28	6
29	6
30	4
Total in CFS-DAYS	118
Total in AF	234

(1) Adjusted for 5% transportation loss

TABLE D-3
MWDSC DEMONSTRATION PROGRAM
DISCHARGED TO THE SANTA ANA RIVER
ABOVE PRADO DAM

WATER YEAR 1994-95

Month	Discharge (1) (acre-feet)	TDS (mg/L)	Discharge x TDS
1995			
October	0	--	0
November	0	--	0
December	167	595	99,134
1996			
January	0	--	0
February	0	--	0
March	0	--	0
April	0	--	0
May	323	595	192,367
June	407	578	235,021
July	194	594	115,462
August	145	589	85,283
September	234	589	137,855
Total	1,470		865,122

$$\frac{865,122}{1,470} = 589 \text{ mg/L}$$

Flow weighted TDS of pumped groundwater releases to the River = 589 mg/L.

(1) Flow adjusted for a 5% transportation loss (1,547 x 0.95 = 1,470).

APPENDIX E

WATER QUALITY AND DISCHARGE OF WATER RELEASED BY MWDSC TO SAN ANTONIO CREEK NEAR UPLAND

CONNECTION OC-59

WATER YEAR 1995-96

PREPARED BY

WILLIAM R. MILLS, JR.

TABLE E-1

NONTRIBUTARY WATER FROM OC-59

MONTHLY TOTALS

(acre-feet)

WATER YEAR 1995-96

Month	Released at OC-59	12-Hour Delay (1)	Evaporation Losses (2)	Calculated Flow at Prado
1995				
October	0	0	-	0
November	0	0	-	0
December	0	0	-	0
1996				
January	0	0	-	0
February	0	0	-	0
March	0	0	-	0
April	3,538	3,448	73	3,376
May	6,132	6,122	83	6,039
June	5,608	5,707	81	5,626
July	5,954	5,857	89	5,768
August	0	97	13	84
September	0	0	0	0
Total	21,232	21,232	340	20,893

(1) Released nontributary water is delayed 12 hours to reflect the estimated travel time between OC-59 and Prado Dam.

(2) Monthly evapotranspiration losses calculated per the procedures referenced in the Twelfth Annual Watermaster Report, Appendix C and shown in Table E-3.

TABLE E-2

NONTRIBUTARY WATER FROM OC-59
APRIL 1996
(cfs)

Day	Released at OC-59	12 Hour Delay	Calculated Flow at Prado Dam(1)
1	0	0	0
2	0	0	0
3	0	0	0
4	0	0	0
5	0	0	0
6	0	0	0
7	0	0	0
8	0	0	0
9	0	0	0
10	60	30	29
11	90	75	73
12	90	90	88
13	90	90	88
14	90	90	88
15	90	90	88
16	72	81	79
17	50	61	60
18	72	61	60
19	90	81	79
20	90	90	88
21	90	90	88
22	90	90	88
23	90	90	88
24	90	90	88
25	90	90	88
26	90	90	88
27	90	90	88
28	90	90	88
29	90	90	88
30	90	90	88
Total (cfs-days)	1,784	1,739	1,702
(AF)	3,538	3,448	3,376

(1) Includes the monthly evapotranspiration loss listed in Table E-1.

TABLE E-2 (continued)

NONTRIBUTARY WATER FROM OC-59
MAY 1996
(cfs)

Day	Released at OC-59	12 Hour Delay	Calculated Flow at Prado Dam(1)
1	92	91	90
2	100	96	94
3	100	100	99
4	100	100	99
5	100	100	99
6	100	100	99
7	100	100	99
8	100	100	99
9	100	100	99
10	100	100	99
11	100	100	99
12	100	100	99
13	100	100	99
14	100	100	99
15	100	100	99
16	100	100	99
17	100	100	99
18	100	100	99
19	100	100	99
20	100	100	99
21	100	100	99
22	100	100	99
23	100	100	99
24	100	100	99
25	100	100	99
26	100	100	99
27	100	100	99
28	100	100	99
29	100	100	99
30	100	100	99
31	100	100	99
Total (cfs-days)	3,092	3,087	3,045
(AF)	6,132	6,122	6,039

(1) Includes the monthly evapotranspiration loss listed in Table E-1.

TABLE E-2 (continued)

NONTRIBUTARY WATER FROM OC-59
JUNE 1996
(cfs)

Day	Released at OC-59	12 Hour Delay	Calculated Flow at Prado Dam(1)
1	102	101	100
2	102	102	101
3	102	102	101
4	102	102	101
5	102	102	101
6	102	102	101
7	102	102	101
8	102	102	101
9	102	102	101
10	102	102	101
11	102	102	101
12	102	102	101
13	102	102	101
14	102	102	101
15	102	102	101
16	102	102	101
17	102	102	101
18	102	102	101
19	102	102	101
20	102	102	101
21	102	102	101
22	102	102	101
23	102	102	101
24	102	102	101
25	102	102	101
26	102	102	101
27	102	102	101
28	74	88	87
29	0	37	36
30	0	0	0
Total (cfs-days)	2,828	2,878	2,837
(AF)	5,608	5,707	5626

(1) Includes the monthly evapotranspiration loss listed in Table E-1.

TABLE E-2 (continued)

NONTRIBUTARY WATER FROM OC-59
JULY 1996
(cfs)

Day	Released at OC-59	12 Hour Delay	Calculated Flow at Prado Dam(1)
1	62	31	31
2	98	80	79
3	98	98	97
4	98	98	97
5	98	98	97
6	98	98	97
7	98	98	97
8	98	98	97
9	98	98	97
10	98	98	97
11	98	98	97
12	98	98	97
13	98	98	97
14	98	98	97
15	98	98	97
16	98	98	97
17	98	98	97
18	98	98	97
19	98	98	97
20	98	98	97
21	98	98	97
22	98	98	97
23	98	98	97
24	98	98	97
25	98	98	97
26	98	98	97
27	98	98	97
28	98	98	97
29	98	98	97
30	98	98	97
31	98	98	97
Total (cfs-days)	3,002	2,953	2,908
(AF)	5,954	5,857	5,768

(1) Includes the monthly evapotranspiration loss listed in Table E-1.

TABLE E-2 (continued)

NONTRIBUTARY WATER FROM OC-59
AUGUST 1996
(cfs)

Day	Released at OC-59	12 Hour Delay	Calculated Flow at Prado Dam(1)
1	0	49	42
2	0	0	0
3	0	0	0
4	0	0	0
5	0	0	0
6	0	0	0
7	0	0	0
8	0	0	0
9	0	0	0
10	0	0	0
11	0	0	0
12	0	0	0
13	0	0	0
14	0	0	0
15	0	0	0
16	0	0	0
17	0	0	0
18	0	0	0
19	0	0	0
20	0	0	0
21	0	0	0
22	0	0	0
23	0	0	0
24	0	0	0
25	0	0	0
26	0	0	0
27	0	0	0
28	0	0	0
29	0	0	0
30	0	0	0
31	0	0	0
Total (cfs-days)	0	49	42
(AF)	0	97	84

(1) Includes the monthly evapotranspiration loss listed in Table E-1.

TABLE E-3

EVAPOTRANSPIRATION LOSSES OF STATE WATER FROM OC-59
WATER YEAR 1995-96
SUM OF ALL CHANNEL REACHES
(acre-feet)

Month	State Water Released with 12-hour delay	Rialto Pipeline to Los Serranos Road	Los Serranos to Prado Dam w/o vegetation	Los Serranos to Prado Dam w/ vegetation	Total Evapo-transpiration	Percent of Monthly Release
1996						
April	3,448.3	21.63	37.02	14.06	72.70	2.11%
May	6,122.1	31.56	40.50	11.10	83.16	1.36%
June	5,707.4	30.76	42.30	8.10	81.16	1.42%
July	5,857.2	35.76	45.90	7.50	89.16	1.52%
August	97.2	1.07	10.99	1.39	13.46	13.85%
Total	21,232.2	120.78	176.7	42.1	339.6	
				Percent of Annual Releases =		1.60%

TABLE E-3.1

EVAPOTRANSPIRATION LOSSES OF STATE WATER FROM OC-59
WATER YEAR 1995-96
RIALTO PIPELINE TO LOS SERRANOS ROAD

Month	State Water Released with 12-hour delay (AF)	Days of Evaporation	Evapo-transpiration (in) (a)	Computed Evaporation Losses (b)	
				(AF)	(% of release)
[1]	[2]	[3]	[4]	[5]	[6]
1996					
April	3,448.3	21	6.61	21.63	0.63%
May	6,122.1	31	6.75	31.56	0.52%
June	5,707.4	28	7.05	30.76	0.54%
July	5,857.2	31	7.65	35.76	0.61%
August	97.2	1	7.10	1.07	1.10%

(a) At UCR Evapotranspiration Station #44
(b) Evaporation losses=[4]/(days/month)x[3]x(Pan Factor of 1.0)x(area of 56.1 acres)x(1 foot/12 inches)

TABLE E-3.2

EVAPOTRANSPIRATION LOSSES OF STATE WATER FROM OC-59
WATER YEAR 1995-96
LOS SERRANOS ROAD TO PRADO DAM (WITHOUT VEGETATION COVER)

Month	State Water Released with 12-hour delay (AF)	Days of Evaporation (+7 days)(a)	Evapo-transpiration (in) (b)	Average Wetted Area (AF) (c)	Computed Evaporation Losses (d)	
					(AF)	(% of release)
[1]	[2]	[3]	[4]	[5]	[6]	[7]
1996						
April	3,448.3	28	6.61	72	37.02	1.07%
May	6,122.1	31	6.75	72	40.50	0.66%
June	5,707.4	30	7.05	72	42.30	0.74%
July	5,857.2	31	7.65	72	45.90	0.78%
August	97.2	8	7.10	72	10.99	11.31%

(a) Period of delivery plus 7 days after stoppage of delivery.
(b) At UCR Evapotranspiration Station #44
(c) Equals 1/2 of 144 acres if the maximum flow rate of the month is less than 200 cfs and 1/2 of 369 acres if the maximum flow rate is greater or equal to 200 cfs.
(d) Evaporation losses=[3]x[4]/(days/month)x[5]x(1 foot/12 inches)

TABLE E-3.3

EVAPOTRANSPIRATION LOSSES OF STATE WATER FROM OC-59
WATER YEAR 1995-96
LOS SERRANOS ROAD TO PRADO DAM (WITH VEGETATION COVER)

Month	State Water Released with 12-hour delay (AF)	Days of Evaporation (a)	Evapo-transpiration (in) (b)	Normal Evaporation (in) (c)	Average Wetted Area (AF) (d)	Computed Evaporation Losses (e)	
						(AF)	(% of release)
[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
1996							
April	3,448.3	28	6.61	4.10	72	14.06	0.41%
May	6,122.1	31	6.75	4.90	72	11.10	0.18%
June	5,707.4	30	7.05	5.70	72	8.10	0.14%
July	5,857.2	31	7.65	6.40	72	7.50	0.13%
August	97.2	8	7.10	6.20	72	1.39	1.43%

(a) Period of delivery plus 7 days after stoppage of delivery.
(b) At UCR Evapotranspiration Station #44
(c) Referenced in the 1983 report "Nontributary Losses of State Water Released at OC-59 and Final Adjustments to Base Flows".
(d) Equals 1/2 of 144 acres if the maximum flow rate of the month is less than 200 cfs and 1/2 of 369 acres if the maximum flow rate is greater or equal to 200 cfs.
(e) Evaporation losses=[3]x([4]-[5])/(days/month)x[6]x(1 foot/12 inches)

TABLE E-4

CALCULATION OF WEIGHTED TDS FOR
STATE WATER PROJECT WATER ARRIVING AT
PRADO DAM FROM RELEASES AT OC-59
WATER YEAR 1995-96

Month	Total Flow (acre-feet)	Weighted Average TDS (Mg/L)(1)	Flow x TDS
1995			
October	0	-	0
November	0	-	0
December	0	-	0
1996			
January	0	-	0
February	0	-	0
March	0	-	0
April	3,376	234	789,881
May	6,039	224	1,352,719
June	5,626	255	1,434,700
July	5,768	244	1,407,398
August	84	244	20,431
September	0	-	0
Total	20,893		5,005,128
Yearly Flow Weighted TDS =		240	

Notes:

(1) Monthly TDS values for State Water Project water arriving at Prado were calculate based on mass balance using known flow and quality components.

APPENDIX F

WATER QUALITY AND DISCHARGE FROM THE ARLINGTON DESALTER TO THE ARLINGTON VALLEY DRAIN

WATER YEAR 1995-96

PREPARED BY

WILLIAM R. MILLS, JR.

TABLE F-1

SUMMARY OF DISCHARGE AND WEIGHTED TDS
FROM THE ARLINGTON DESALTER
TO THE ARLINGTON VALLEY DRAIN
WATER YEAR 1995-96

OCTOBER 1995

Day	Arlington Discharge (cfs)	Arlington Discharge (acre-feet)	Daily Mean EC (microsiemens/cm)	Computed TDS (mg/L)(1)	Outflow X TDS
1	0	0	0	0	0
2	0	0	0	0	0
3	0	0	0	0	0
4	0	0	0	0	0
5	0	0	0	0	0
6	0	0	0	0	0
7	0	0	0	0	0
8	0	0	0	0	0
9	0	0	0	0	0
10	0	0	0	0	0
11	0	0	0	0	0
12	0	0	0	0	0
13	0	0	0	0	0
14	0	0	0	0	0
15	0	0	0	0	0
16	0	0	0	0	0
17	0	0	0	0	0
18	0	0	0	0	0
19	0	0	0	0	0
20	0	0	0	0	0
21	0	0	0	0	0
22	0	0	0	0	0
23	0	0	0	0	0
24	0	0	0	0	0
25	0	0	0	0	0
26	0	0	0	0	0
27	0	0	0	0	0
28	0	0	0	0	0
29	0	0	0	0	0
30	0	0	0	0	0
31	0	0	0	0	0
Total	0	0			0
Monthly Flow Weighted TDS				0	

1. TDS = EC x 0.634955

TABLE F-1 (continued)

SUMMARY OF DISCHARGE AND WEIGHTED TDS
FROM THE ARLINGTON DESALTER
TO THE ARLINGTON VALLEY DRAIN
WATER YEAR 1995-96

NOVEMBER 1995

Day	Arlington Discharge (cfs)	Arlington Discharge (acre-feet)	Daily Mean EC (microsiemens/cm)	Computed TDS (mg/L)(1)	Outflow X TDS
1	0	0	0	0	0
2	0	0	0	0	0
3	0	0	0	0	0
4	0	0	0	0	0
5	0	0	0	0	0
6	0	0	0	0	0
7	0	0	0	0	0
8	0	0	0	0	0
9	0	0	0	0	0
10	0	0	0	0	0
11	0	0	0	0	0
12	0	0	0	0	0
13	0	0	0	0	0
14	0	0	0	0	0
15	0	0	0	0	0
16	0	0	0	0	0
17	0	0	0	0	0
18	0	0	0	0	0
19	0	0	0	0	0
20	0	0	0	0	0
21	0	0	0	0	0
22	0	0	0	0	0
23	0	0	0	0	0
24	0	0	0	0	0
25	0	0	0	0	0
26	0	0	0	0	0
27	0	0	0	0	0
28	0	0	0	0	0
29	0	0	0	0	0
30	0	0	0	0	0
Total Monthly Flow Weighted TDS	0	0		0	0

1. TDS = EC x 0.634955

TABLE F-1 (continued)

SUMMARY OF DISCHARGE AND WEIGHTED TDS
FROM THE ARLINGTON DESALTER
TO THE ARLINGTON VALLEY DRAIN
WATER YEAR 1995-96

DECEMBER 1995

Day	Arlington Discharge (cfs)	Arlington Discharge (acre-feet)	Daily Mean EC (microsiemens/cm)	Computed TDS (mg/L)(1)	Outflow X TDS
1	0	0	0	0	0
2	0	0	0	0	0
3	0	0	0	0	0
4	0	0	0	0	0
5	0	0	0	0	0
6	0	0	0	0	0
7	0	0	0	0	0
8	0	0	0	0	0
9	0	0	0	0	0
10	0	0	0	0	0
11	0	0	0	0	0
12	0	0	0	0	0
13	5	11	666	423	2,258
14	9	17	666	423	3,685
15	9	17	655	416	3,611
16	9	17	654	415	3,586
17	9	17	652	414	3,576
18	9	17	645	410	3,588
19	9	17	653	415	3,555
20	11	22	647	411	4,597
21	11	22	778	494	5,528
22	11	22	775	492	5,499
23	11	22	768	488	5,442
24	11	22	766	486	5,428
25	11	22	771	490	5,456
26	11	22	763	484	5,399
27	11	22	767	487	5,435
28	11	22	748	475	5,300
29	11	22	752	477	5,321
30	11	22	755	479	5,342
31	11	22	753	478	5,328
Total	191	379			87,935
Monthly Flow Weighted TDS				460	

1. TDS = EC x 0.634955

TABLE F-1 (continued)

SUMMARY OF DISCHARGE AND WEIGHTED TDS
FROM THE ARLINGTON DESALTER
TO THE ARLINGTON VALLEY DRAIN
WATER YEAR 1995-96

JANUARY 1996

Day	Arlington Discharge (cfs)	Arlington Discharge (acre-feet)	Daily Mean EC (microsiemens/cm)	Computed TDS (mg/L)(1)	Outflow X TDS
1	10	21	815	517	5,350
2	10	20	850	540	5,547
3	10	20	831	528	5,333
4	10	20	832	528	5,331
5	4	8	830	527	2,023
6	0	0	0	0	0
7	0	0	0	0	0
8	4	8	674	428	1,696
9	4	8	674	428	1,802
10	4	7	674	428	1,616
11	9	17	674	428	3,670
12	9	17	679	431	3,690
13	9	17	681	432	3,694
14	8	17	688	437	3,712
15	8	17	681	432	3,661
16	8	17	695	441	3,716
17	8	16	649	412	3,387
18	8	16	649	412	3,387
19	8	16	653	415	3,408
20	8	16	650	413	3,386
21	9	17	711	451	3,843
22	9	17	673	427	3,724
23	9	18	702	446	3,967
24	9	17	693	440	3,882
25	6	12	690	438	2,685
26	7	13	640	406	2,755
27	7	14	886	563	4,101
28	7	14	888	564	4,102
29	7	14	888	564	4,102
30	7	14	889	564	4,098
31	7	14	890	565	4,102
Total	225	446			105,769
Monthly Flow Weighted TDS				471	

1. TDS = EC x 0.634955

TABLE F-1 (continued)

SUMMARY OF DISCHARGE AND WEIGHTED TDS
FROM THE ARLINGTON DESALTER
TO THE ARLINGTON VALLEY DRAIN
WATER YEAR 1995-96

FEBRUARY 1996

Day	Arlington Discharge (cfs)	Arlington Discharge (acre-feet)	Daily Mean EC (microsiemens/cm)	Computed TDS (mg/L)(1)	Outflow X TDS
1	7	14	891	566	4,107
2	7	14	880	559	4,056
3	7	14	880	559	4,082
4	7	14	879	558	4,077
5	7	14	879	558	4,077
6	7	14	879	558	4,077
7	7	14	878	557	4,056
8	8	16	874	555	4,570
9	9	18	868	551	4,914
10	9	18	867	551	4,976
11	9	18	867	551	4,976
12	5	10	867	551	2,812
13	0	0	0	0	0
14	0	0	0	0	0
15	4	8	882	560	2,280
16	9	18	882	560	5,149
17	9	18	848	538	4,934
18	9	18	733	465	4,185
19	9	18	719	457	4,162
20	9	18	720	457	4,161
21	2	5	720	457	1,139
22	0	0	0	0	0
23	0	0	0	0	0
24	0	0	0	0	0
25	0	0	0	0	0
26	0	0	0	0	0
27	0	0	0	0	0
28	0	0	0	0	0
29	0	0	0	0	0
Total Monthly Flow Weighted TDS	143	285		535	76,790

1. TDS = EC x 0.634955

TABLE F-1 (continued)

SUMMARY OF DISCHARGE AND WEIGHTED TDS
FROM THE ARLINGTON DESALTER
TO THE ARLINGTON VALLEY DRAIN
WATER YEAR 1995-96

MARCH 1996

Day	Arlington Discharge (cfs)	Arlington Discharge (acre-feet)	Daily Mean EC (microsiemens/cm)	Computed TDS (mg/L)(1)	Outflow X TDS
1	0	0	0	0	0
2	0	0	0	0	0
3	0	0	0	0	0
4	0	0	0	0	0
5	0	0	0	0	0
6	0	0	0	0	0
7	0	0	0	0	0
8	0	0	0	0	0
9	0	0	0	0	0
10	0	0	0	0	0
11	0	0	0	0	0
12	0	0	0	0	0
13	0	0	0	0	0
14	0	0	0	0	0
15	0	0	0	0	0
16	0	0	0	0	0
17	0	0	0	0	0
18	0	0	0	0	0
19	0	0	0	0	0
20	0	0	0	0	0
21	0	0	0	0	0
22	0	0	0	0	0
23	0	0	0	0	0
24	0	0	0	0	0
25	0	0	0	0	0
26	0	0	0	0	0
27	3	6	759	482	1,432
28	9	19	759	482	4,543
29	9	19	730	464	4,326
30	9	18	728	462	4,286
31	9	18	727	462	4,265
Total	40	80			18,852
Monthly Flow Weighted TDS				468	

1. TDS = EC x 0.634955

TABLE F-1 (continued)

SUMMARY OF DISCHARGE AND WEIGHTED TDS
FROM THE ARLINGTON DESALTER
TO THE ARLINGTON VALLEY DRAIN
WATER YEAR 1995-96

APRIL 1996

Day	Arlington Discharge (cfs)	Arlington Discharge (acre-feet)	Daily Mean EC (microsiemens/cm)	Computed TDS (mg/L)(1)	Outflow X TDS
1	9	18	724	460	4,248
2	9	18	725	460	4,239
3	9	18	725	460	4,232
4	9	18	707	449	4,051
5	9	18	690	438	3,872
6	9	17	689	437	3,860
7	9	17	688	437	3,854
8	9	17	691	439	3,871
9	9	17	685	435	3,824
10	8	16	751	477	3,912
11	9	18	674	428	3,849
12	9	18	676	429	3,860
13	9	18	673	427	3,836
14	9	18	672	427	3,837
15	7	14	702	446	3,222
16	8	17	619	393	3,297
17	8	16	570	362	2,891
18	9	17	657	417	3,635
19	9	18	636	404	3,657
20	9	18	635	403	3,645
21	9	18	634	403	3,645
22	9	18	636	404	3,650
23	9	18	634	403	3,639
24	9	18	635	403	3,645
25	9	18	634	403	3,639
26	9	18	634	403	3,639
27	9	18	635	403	3,645
28	9	17	632	401	3,540
29	9	18	627	398	3,586
30	9	18	620	394	3,534
Total	265	526			111,852
Monthly Flow Weighted TDS				421	

1. TDS = EC x 0.634955

TABLE F-1 (continued)

SUMMARY OF DISCHARGE AND WEIGHTED TDS
FROM THE ARLINGTON DESALTER
TO THE ARLINGTON VALLEY DRAIN
WATER YEAR 1995-96

MAY 1996

Day	Arlington Discharge (cfs)	Arlington Discharge (acre-feet)	Daily Mean EC (microsiemens/cm)	Computed TDS (mg/L)(1)	Outflow X TDS
1	9	18	615	390	3,475
2	9	18	615	390	3,475
3	9	18	615	390	3,475
4	9	18	614	390	3,470
5	9	18	614	390	3,470
6	9	18	614	390	3,470
7	9	18	614	390	3,470
8	9	18	614	390	3,470
9	9	18	614	390	3,470
10	9	18	614	390	3,470
11	9	18	614	390	3,470
12	9	18	613	389	3,458
13	9	18	614	390	3,464
14	9	18	614	390	3,464
15	9	18	713	453	4,022
16	10	19	816	518	5,092
17	10	19	816	518	5,092
18	10	19	815	517	5,086
19	9	18	754	479	4,261
20	9	17	616	391	3,402
21	9	17	599	380	3,332
22	9	17	599	380	3,332
23	9	17	599	380	3,332
24	9	17	598	380	3,321
25	9	17	598	380	3,321
26	9	17	598	380	3,321
27	9	17	598	380	3,321
28	9	17	598	380	3,321
29	9	17	598	380	3,321
30	9	17	598	380	3,321
31	9	17	598	380	3,321
Total	277	549			112,085
Monthly Flow Weighted TDS				405	

1. TDS = EC x 0.634955

TABLE F-1 (continued)

SUMMARY OF DISCHARGE AND WEIGHTED TDS
FROM THE ARLINGTON DESALTER
TO THE ARLINGTON VALLEY DRAIN
WATER YEAR 1995-96

JUNE 1996

Day	Arlington Discharge (cfs)	Arlington Discharge (acre-feet)	Daily Mean EC (microsiemens/cm)	Computed TDS (mg/L)(1)	Outflow X TDS
1	9	17	599	380	3,320
2	9	17	599	380	3,320
3	9	17	599	380	3,320
4	9	17	608	386	3,388
5	9	18	622	395	3,503
6	9	18	622	395	3,503
7	9	18	622	395	3,497
8	9	18	623	396	3,502
9	9	18	622	395	3,497
10	9	18	622	395	3,497
11	9	18	621	394	3,491
12	9	18	621	394	3,491
13	9	17	589	374	3,230
14	9	17	589	374	3,230
15	9	17	589	374	3,218
16	9	17	589	374	3,218
17	9	17	589	374	3,218
18	9	17	600	381	3,249
19	9	17	591	375	3,218
20	9	17	591	375	3,218
21	8	16	477	303	2,410
22	9	17	590	375	3,230
23	9	17	590	375	3,230
24	8	17	590	375	3,160
25	9	17	600	381	3,267
26	9	17	580	368	3,141
27	9	17	580	368	3,135
28	9	17	580	368	3,135
29	9	17	580	368	3,135
30	4	8	587	373	1,488
Total	255	506			96,458
Monthly Flow Weighted TDS				378	

1. TDS = EC x 0.634955

TABLE F-1 (continued)

SUMMARY OF DISCHARGE AND WEIGHTED TDS
FROM THE ARLINGTON DESALTER
TO THE ARLINGTON VALLEY DRAIN
WATER YEAR 1995-96

JULY 1996

Day	Arlington Discharge (cfs)	Arlington Discharge (acre-feet)	Daily Mean EC (microsiemens/cm)	Computed TDS (mg/L)(1)	Outflow X TDS
1	3	5	621	394	1,044
2	9	17	621	394	3,473
3	9	17	616	391	3,433
4	9	17	615	390	3,421
5	9	17	615	390	3,421
6	9	17	615	390	3,421
7	9	17	614	390	3,415
8	9	17	613	389	3,410
9	8	16	624	396	3,177
10	9	17	627	398	3,434
11	9	18	626	397	3,519
12	9	18	625	397	3,507
13	9	17	625	397	3,501
14	9	18	625	397	3,507
15	9	18	626	397	3,513
16	8	15	626	397	3,088
17	9	17	591	375	3,212
18	9	17	589	374	3,195
19	9	17	590	375	3,201
20	9	17	590	375	3,201
21	9	17	590	375	3,201
22	9	17	590	375	3,201
23	9	17	590	375	3,201
24	9	17	591	375	3,200
25	9	17	592	376	3,206
26	9	17	592	376	3,206
27	9	17	592	376	3,206
28	9	17	592	376	3,206
29	9	17	591	375	3,200
30	9	17	592	376	3,206
31	9	17	592	376	3,206
Total	261	517			100,330
Monthly Flow Weighted TDS				385	

1. TDS = EC x 0.634955

TABLE F-1 (continued)

SUMMARY OF DISCHARGE AND WEIGHTED TDS
FROM THE ARLINGTON DESALTER
TO THE ARLINGTON VALLEY DRAIN
WATER YEAR 1995-96

AUGUST 1996

Day	Arlington Discharge (cfs)	Arlington Discharge (acre-feet)	Daily Mean EC (microsiemens/cm)	Computed TDS (mg/L)(1)	Outflow X TDS
1	9	17	592	376	3,200
2	9	17	592	376	3,200
3	9	17	592	376	3,200
4	9	17	591	375	3,195
5	9	17	591	375	3,195
6	9	17	592	376	3,200
7	8	17	592	376	3,194
8	8	17	592	376	3,194
9	8	17	593	377	3,200
10	6	11	593	377	2,121
11	3	5	593	377	1,032
12	9	17	604	384	3,271
13	3	5	604	384	1,009
14	0	0	0	0	0
15	0	0	0	0	0
16	0	0	0	0	0
17	0	0	0	0	0
18	0	0	0	0	0
19	5	10	691	439	2,309
20	9	19	691	439	4,129
21	9	19	691	439	4,129
22	9	19	692	439	4,128
23	6	12	692	439	2,680
24	5	9	698	443	2,079
25	9	19	692	439	4,128
26	9	19	693	440	4,134
27	9	19	692	439	4,121
28	9	19	691	439	4,115
29	9	19	692	439	4,121
30	9	19	692	439	4,121
31	9	19	691	439	4,115
Total	206	409			84,519
Monthly Flow Weighted TDS				410	

1. TDS = EC x 0.634955

TABLE F-1 (continued)

SUMMARY OF DISCHARGE AND WEIGHTED TDS
FROM THE ARLINGTON DESALTER
TO THE ARLINGTON VALLEY DRAIN
WATER YEAR 1995-96

SEPTEMBER 1996

Day	Arlington Discharge (cfs)	Arlington Discharge (acre-feet)	Daily Mean EC (microsiemens/cm)	Computed TDS (mg/L)(1)	Outflow X TDS
1	9	19	692	439	4,115
2	9	19	692	439	4,115
3	9	19	692	439	4,115
4	9	19	691	439	4,109
5	9	19	691	439	4,109
6	9	19	692	439	4,115
7	9	19	692	439	4,108
8	9	19	692	439	4,108
9	9	19	692	439	4,108
10	9	19	693	440	4,114
11	9	19	691	439	4,102
12	9	19	691	439	4,102
13	9	19	691	439	4,095
14	9	19	691	439	4,095
15	9	18	691	439	4,088
16	9	18	692	439	4,094
17	9	18	692	439	4,094
18	9	18	692	439	4,094
19	9	18	692	439	4,094
20	9	18	692	439	4,094
21	9	18	693	440	4,100
22	9	18	692	439	4,094
23	9	18	693	440	4,100
24	9	18	693	440	4,100
25	9	18	693	440	4,100
26	8	17	680	432	3,622
27	8	17	602	382	3,248
28	8	17	601	382	3,243
29	8	17	603	383	3,253
30	8	17	602	382	3,248
Total	276	547			119,173
Monthly Flow Weighted TDS				432	

1. TDS = EC x 0.634955

TABLE F-2

QUALITY OF WATER DISCHARGED
FROM THE ARLINGTON DESALTER
TO THE ARLINGTON VALLEY DRAIN
WATER YEAR 1995-96

Month	Discharge (acre-feet)	Weighted TDS (mg/L)	Discharge X TDS
1995			
October	0	0	0
November	0	0	0
December	379	460	174,417
1995			
January	446	471	209,789
February	285	535	152,310
March	80	468	37,392
April	526	421	221,855
May	549	405	222,317
June	506	378	191,321
July	517	385	199,001
August	409	410	167,641
September	547	432	236,375
Total	4,243		1,812,419
	Yearly Flow Weighted TDS =	427	

TABLE F-3
TDS ADJUSTMENT OF OC-59 DISCHARGE
WATER YEAR 1995-96

The TDS of the OC-59 water reaching Prado Dam was estimated using the two methods described below. The second method provided a more representative estimate.

Method 1 (Based on Annualized Values)

Method 1 is essentially the same as that described in Appendix C of the Twelfth Annual Report. It uses the following equation which depends on assumed *annual average* TDS concentrations of Base Flow and Storm Flow at Prado, which are not measured values:

$$Q_p q_p = Q_{bf} q_{bf} + Q_{sf} q_{sf} + Q_{ex} q_{ex} + Q_{ad} q_{ad} + Q_{59} q_{59}$$

where:			
Q_p	= total flow at Prado	= 217,160 af
q_p	= total flow TDS at Prado	= 494 mg/L
Q_{bf}	= base flow at Prado	= 131,861 af
q_{bf}	= base flow TDS at Prado	= 600 mg/L*
Q_{sf}	= storm flow at Prado	= 58,692 af
q_{sf}	= storm flow TDS at Prado	= 350 mg/L*
Q_{ex}	= exchange flow	= 1,470 af
q_{ex}	= exchange flow TDS	= 588 mg/L
Q_{ad}	= Arlington Desalter flow	= 4,244 af
q_{ad}	= Arlington Desalter TDS	= 427 mg/L
Q_{59}	= OC-59 flow reaching Prado	= 20,893 af
q_{59}	= OC-59 flow TDS reaching Prado	

Note: All values are annualized.

*Assumed value

Solving for q_{59}:

$$q_{59} = \frac{Q_p q_p - Q_{bf} q_{bf} - Q_{sf} q_{sf} - Q_{ex} q_{ex} - Q_{ad} q_{ad}}{Q_{59}}$$

$$= \mathbf{237\ mg/L}$$

The value of q_{59} is very sensitive to the assumed value of Prado storm flow TDS. For example, when the Prado storm flow TDS was assumed to be 300 mg/L, the resultant q_{59} equaled 377 mg/L. Therefore, since very small changes in assumed figures cause significant differences in estimated q_{59} values, the following method was developed to reduce this uncertainty.

Method 2 (Based on data from July, 1996)

Method 2 uses essentially the same equation as Method 1, except the time period of flow measurements is based on one "representative month" (July) which eliminates the storm flow terms (Q_{sf} and q_{sf}). It also uses TDS concentrations at Prado observed before and during purchases of OC-59 water, as graphed on Plate 5. A reduction of TDS of approximately 100 mg/L is clearly shown in mid-April when OC-59 releases began followed by a similar magnitude increase on August 1 when releases ended. Using the month of July as a representative period of relatively stable TDS concentrations, the following equation was used to estimate the TDS of OC-59 water reaching Prado Dam:

$$Q_p q_p = Q_{bf} q_{bf} + Q_{ex} q_{ex} + Q_{ad} q_{ad} + Q_{59} q_{59}$$

where:

Q_p	= total flow at Prado[1]	= 15,487 af
q_p	= total flow TDS at Prado[2]	= 490 mg/L
Q_{bf}	= base flow at Prado[1]	= 9,007 af
q_{bf}	= base flow TDS at Prado[3]	= 600 mg/L
Q_{ex}	= exchange flow[1]	= 194 af
q_{ex}	= exchange flow TDS	= 588 mg/L
Q_{ad}	= Arlington Desalter flow[1]	= 518 af
q_{ad}	= Arlington Desalter TDS	= 427 mg/L
Q_{59}	= OC-59 flow reaching Prado[1]	= 5,768 af
q_{59}	= OC-59 flow TDS reaching Prado	

[1]For July 1996.
[2]Visually estimated from Plate 5 (July 1996).
[3]Visually estimated from Plate 5 during period with only base flow (Oct. 1995).

Solving for q_{59}:

$$q_{59} = \frac{Q_p q_p - Q_{bf} q_{bf} - Q_{ex} q_{ex} - Q_{ad} q_{ad}}{Q_{59}}$$

$$= \mathbf{321\ mg/L}$$

By eliminating the uncertainty of assumed storm flow TDS concentrations, this method more accurately reflects the TDS concentration of the OC-59 water reaching Prado Dam. *Because the measured TDS of the OC-59 water remained essentially constant during the 4-month release period, the 321 mg/L value would similarly not be expected to fluctuate. Therefore, this value was used to calculate annual base and storm flow TDS at Prado in the report.*

APPENDIX G

WATER QUALITY AND DISCHARGE FROM LAKE ELSINORE

WATER YEAR 1995-96

PREPARED BY

WILLIAM R. MILLS, JR.

No discharges into the Santa Ana River watershed from Lake Elsinore occurred during the 1995-96 water year.

APPENDIX H

WATER QUALITY AND DISCHARGE OF THE SANTA ANA RIVER BELOW PRADO DAM

WATER YEAR 1995-96

PREPARED BY

WILLIAM R. MILLS, JR.

TABLE H-1

WATER QUALITY SAMPLES BELOW PRADO DAM
FOR WATER YEAR 1995-96

Date	EC (microsiemens/cm)	TDS (mg/L)	Source
10/04/95	588	970	USGS
10/17/95	648	1000	OCWD
10/18/95	610	985	USGS
11/02/95	644	1000	USGS
11/14/95	644	1040	OCWD
11/29/95	614	1030	USGS
12/07/95	614	993	USGS
12/12/95	616	1030	OCWD
01/04/96	650	1020	USGS
01/16/96	636	1030	OCWD
01/24/96	634	1020	USGS
02/06/96	470	780	USGS
02/20/96	268	427	OCWD
02/28/96	458	755	USGS
03/14/96	390	640	USGS
03/19/96	436	696	OCWD
03/28/96	506	833	USGS
04/04/96	600	1000	USGS
04/16/96	492	822	OCWD
04/22/96	518	845	USGS
05/14/96	494	827	OCWD
05/22/96	510	840	USGS
05/31/96	508	834	USGS
06/14/96	498	811	USGS
06/18/96	460	792	OCWD
07/02/96	472	800	USGS
07/16/96	466	766	OCWD
07/17/96	478	778	USGS
08/01/96	550	941	USGS
08/06/96	610	935	OCWD
08/13/96	600	941	OCWD
08/16/96	554	949	USGS
08/20/96	536	949	OCWD
08/27/96	564	946	OCWD
09/04/96	590	908	OCWD
09/05/96	580	958	USGS
09/10/96	564	926	OCWD
09/17/96	618	957	OCWD
09/19/96	588	966	USGS

TABLE H-2

SUMMARY OF FLOW WEIGHTED TDS BELOW PRADO DAM

WATER YEAR 1995-96

OCTOBER 1995

Day	Prado Outflow (cfs)	Daily Mean EC (microsiemens/cm)	Computed TDS(1)	Outflow X TDS
1	153	974	597	91,315
2	153	979	600	91,784
3	152	986	604	91,836
4	144	978	599	86,296
5	136	996	610	83,002
6	142	974	597	84,750
7	145	1,000	613	88,850
8	138	991	607	83,800
9	144	977	599	86,208
10	146	971	595	86,869
11	146	982	602	87,853
12	146	981	601	87,763
13	153	966	592	90,565
14	155	966	592	91,749
15	157	969	594	93,221
16	167	958	587	98,033
17	167	971	595	99,364
18	172	971	595	102,339
19	171	974	597	102,058
20	172	981	601	103,393
21	170	984	603	102,503
22	170	976	598	101,669
23	165	965	591	97,567
24	163	983	602	98,182
25	161	990	607	97,668
26	165	989	606	99,994
27	165	991	607	100,196
28	167	995	610	101,820
29	172	996	610	104,973
30	175	996	610	106,804
31	179	993	608	108,917
Total Monthly Flow Weighted TDS	4,911		601	2,951,342

1. TDS = EC x 0.612762

TABLE H-2 (continued)

SUMMARY OF FLOW WEIGHTED TDS BELOW PRADO DAM

WATER YEAR 1995-96

NOVEMBER 1995

Day	Prado Outflow (cfs)	Daily Mean EC (microsiemens/cm)	Computed TDS(1)	Outflow X TDS
1	176	1,000	613	107,846
2	179	1,030	631	112,975
3	179	1,030	631	112,975
4	177	1,010	619	109,543
5	179	1,020	625	111,878
6	181	995	610	110,355
7	180	990	607	109,194
8	178	991	607	108,090
9	180	986	604	108,753
10	177	1,010	619	109,543
11	175	1,020	625	109,378
12	174	1,000	613	106,621
13	178	992	608	108,199
14	177	1,000	613	108,459
15	180	995	610	109,746
16	182	1,030	631	114,868
17	185	1,020	625	115,628
18	184	1,010	619	113,876
19	187	1,020	625	116,878
20	186	1,020	625	116,253
21	187	1,030	631	118,024
22	187	1,020	625	116,878
23	189	1,030	631	119,286
24	190	1,020	625	118,753
25	189	1,030	631	119,286
26	187	1,040	637	119,170
27	187	1,020	625	116,878
28	183	1,030	631	115,500
29	180	1,020	625	112,503
30	177	1,020	625	110,628
Total	5,450			3,387,967
Monthly Flow Weighted TDS			622	

1. TDS = EC x 0.612762

TABLE H-2 (continued)

SUMMARY OF FLOW WEIGHTED TDS BELOW PRADO DAM

WATER YEAR 1995-96

DECEMBER 1995

Day	Prado Outflow (cfs)	Daily Mean EC (microsiemens/cm)	Computed TDS(1)	Outflow X TDS
1	181	1,010	619	112,019
2	181	1,010	619	112,019
3	187	1,020	625	116,878
4	199	1,010	619	123,159
5	200	1,020	625	125,003
6	200	1,020	625	125,003
7	203	1,010	619	125,635
8	205	1,010	619	126,872
9	202	1,010	619	125,016
10	202	1,010	619	125,016
11	203	1,010	619	125,635
12	199	1,010	619	123,159
13	321	815	499	160,308
14	374	761	466	174,401
15	281	773	474	133,100
16	246	778	477	117,275
17	236	778	477	112,508
18	227	784	480	109,052
19	219	797	488	106,953
20	205	822	504	103,257
21	213	820	502	107,025
22	219	839	514	112,590
23	277	756	463	128,320
24	286	810	496	141,952
25	223	878	538	119,975
26	209	919	563	117,694
27	201	925	567	113,928
28	200	966	592	118,386
29	207	946	580	119,992
30	203	948	581	117,922
31	211	942	577	121,794
Total	6,920			3,801,845
Monthly Flow Weighted TDS			549	

1. TDS = EC x 0.612762

TABLE H-2 (continued)

SUMMARY OF FLOW WEIGHTED TDS BELOW PRADO DAM

WATER YEAR 1995-96

JANUARY 1996

Day	Prado Outflow (cfs)	Daily Mean EC (microsiemens/cm)	Computed TDS(1)	Outflow X TDS
1	208	977	599	124,523
2	210	990	607	127,393
3	212	998	612	129,646
4	205	1,020	625	128,129
5	190	1,040	637	121,082
6	201	1,040	637	128,092
7	196	1,020	625	122,503
8	202	970	594	120,065
9	208	963	590	122,739
10	211	955	585	123,475
11	208	980	601	124,905
12	187	981	601	112,409
13	187	1,020	625	116,878
14	198	1,030	631	124,967
15	205	1,020	625	128,129
16	216	1,060	650	140,298
17	344	863	529	181,912
18	280	978	599	167,799
19	270	994	609	164,453
20	250	1,040	637	159,318
21	263	976	598	157,289
22	462	668	409	189,108
23	465	911	558	259,575
24	441	1,020	625	275,633
25	377	1,060	650	244,872
26	258	1,040	637	164,416
27	230	1,050	643	147,982
28	235	983	602	141,551
29	239	974	597	142,642
30	243	991	607	147,561
31	300	754	462	138,607
Total	7,901			4,677,949
Monthly Flow Weighted TDS			592	

1. TDS = EC x 0.612762

TABLE H-2 (continued)

SUMMARY OF FLOW WEIGHTED TDS BELOW PRADO DAM

WATER YEAR 1995-96

FEBRUARY 1996

Day	Prado Outflow (cfs)	Daily Mean EC (microsiemens/cm)	Computed TDS(1)	Outflow X TDS
1	505	491	301	151,937
2	577	519	318	183,500
3	552	578	354	195,505
4	545	675	414	225,420
5	591	702	430	254,224
6	610	819	502	306,130
7	653	945	579	378,126
8	533	1,030	631	336,400
9	324	1,060	650	210,447
10	223	1,040	637	142,112
11	224	1,040	637	142,749
12	231	1,050	643	148,625
13	231	1,030	631	145,794
14	223	1,010	619	138,012
15	215	1,010	619	133,061
16	216	1,000	613	132,357
17	223	992	608	135,553
18	226	964	591	133,499
19	227	938	575	130,473
20	1,010	341	209	211,041
21	5,800	291	178	1,034,220
22	5,140	348	213	1,096,060
23	1,120	434	266	297,851
24	632	510	313	197,505
25	565	579	355	200,456
26	525	643	394	206,853
27	461	701	430	198,021
28	403	743	455	183,479
29	440	708	434	190,888
Total	23,225			7,440,298
Monthly Flow Weighted TDS			320	

1. TDS = EC x 0.612762

TABLE H-2 (continued)

SUMMARY OF FLOW WEIGHTED TDS BELOW PRADO DAM

WATER YEAR 1995-96

MARCH 1996

Day	Prado Outflow (cfs)	Daily Mean EC (microsiemens/cm)	Computed TDS(1)	Outflow X TDS
1	431	734	450	193,850
2	423	744	456	192,844
3	423	752	461	194,917
4	367	764	468	171,811
5	341	814	499	170,087
6	419	774	474	198,722
7	443	766	469	207,933
8	450	753	461	207,634
9	449	734	450	201,946
10	446	712	436	194,584
11	447	706	433	193,377
12	419	706	433	181,264
13	381	750	460	175,097
14	467	668	409	191,155
15	509	660	404	205,851
16	506	704	431	218,281
17	504	698	428	215,565
18	487	704	431	210,084
19	475	724	444	210,729
20	472	742	455	214,604
21	469	744	456	213,815
22	466	747	458	213,304
23	463	802	491	227,534
24	460	832	510	234,516
25	457	848	520	237,467
26	450	856	525	236,036
27	446	893	547	244,050
28	443	917	562	248,923
29	441	958	587	258,878
30	443	979	600	265,753
31	439	988	605	265,774
Total	13,836			6,596,384
Monthly Flow Weighted TDS			477	

1. TDS = EC x 0.612762

TABLE H-2 (continued)

SUMMARY OF FLOW WEIGHTED TDS BELOW PRADO DAM

WATER YEAR 1995-96

APRIL 1996

Day	Prado Outflow (cfs)	Daily Mean EC (microsiemens/cm)	Computed TDS(1)	Outflow X TDS
1	444	996	610	270,978
2	447	998	612	273,357
3	443	1,010	619	274,168
4	439	1,020	625	274,383
5	428	1,010	619	264,885
6	420	1,030	631	265,081
7	412	1,030	631	260,032
8	407	1,030	631	256,876
9	392	1,030	631	247,409
10	369	1,040	637	235,154
11	333	1,030	631	210,171
12	330	924	566	186,843
13	346	882	540	186,998
14	348	871	534	185,733
15	358	867	531	190,193
16	356	857	525	186,949
17	348	852	522	181,681
18	383	753	461	176,720
19	380	861	528	200,483
20	345	882	540	186,457
21	344	857	525	180,647
22	347	843	517	179,246
23	345	841	515	177,790
24	345	853	523	180,327
25	344	855	524	180,226
26	342	840	515	176,034
27	332	842	516	171,294
28	318	841	515	163,876
29	308	836	512	157,779
30	268	839	514	137,781
Total	11,021			6,219,549
Monthly Flow Weighted TDS			564	

1. TDS = EC x 0.612762

TABLE H-2 (continued)

SUMMARY OF FLOW WEIGHTED TDS BELOW PRADO DAM

WATER YEAR 1995-96

MAY 1996

Day	Prado Outflow (cfs)	Daily Mean EC (microsiemens/cm)	Computed TDS(1)	Outflow X TDS
1	282	820	502	141,695
2	294	827	507	148,986
3	296	829	508	150,362
4	300	848	520	155,887
5	303	853	523	158,374
6	304	846	518	157,593
7	306	846	518	158,629
8	313	853	523	163,601
9	318	844	517	164,460
10	316	846	518	163,813
11	314	848	520	163,161
12	312	852	522	162,887
13	308	850	521	160,421
14	303	856	525	158,931
15	305	866	531	161,849
16	307	870	533	163,663
17	306	869	532	162,942
18	310	865	530	164,312
19	313	854	523	163,793
20	314	850	521	163,546
21	320	855	524	167,652
22	321	846	518	166,405
23	317	854	523	165,886
24	315	852	522	164,453
25	315	842	516	162,523
26	313	845	518	162,066
27	306	844	517	158,254
28	304	842	516	156,847
29	304	849	520	158,151
30	308	841	515	158,723
31	309	825	506	156,208
Total	9,556			4,966,073
Monthly Flow Weighted TDS			520	

1. TDS = EC x 0.612762

TABLE H-2 (continued)

SUMMARY OF FLOW WEIGHTED TDS BELOW PRADO DAM

WATER YEAR 1995-96

JUNE 1996

Day	Prado Outflow (cfs)	Daily Mean EC (microsiemens/cm)	Computed TDS(1)	Outflow X TDS
1	308	836	512	157,779
2	308	834	511	157,401
3	303	820	502	152,247
4	234	815	499	116,860
5	312	808	495	154,475
6	308	811	497	153,061
7	310	838	513	159,183
8	311	838	513	159,697
9	307	826	506	155,385
10	299	825	506	151,153
11	291	829	508	147,822
12	288	829	508	146,298
13	290	825	506	146,603
14	289	817	501	144,681
15	285	803	492	140,234
16	286	784	480	137,396
17	287	780	478	137,173
18	288	774	474	136,592
19	280	781	479	133,999
20	280	780	478	133,827
21	280	782	479	134,170
22	277	776	476	131,714
23	277	783	480	132,903
24	279	780	478	133,349
25	281	778	477	133,961
26	275	781	479	131,606
27	271	777	476	129,027
28	269	786	482	129,559
29	186	924	566	105,312
30	176	943	578	101,699
Total	8,435			4,185,166
Monthly Flow Weighted TDS			496	

1. TDS = EC x 0.612762

TABLE H-2 (continued)

SUMMARY OF FLOW WEIGHTED TDS BELOW PRADO DAM

WATER YEAR 1995-96

JULY 1996

Day	Prado Outflow (cfs)	Daily Mean EC (microsiemens/cm)	Computed TDS(1)	Outflow X TDS
1	177	925	567	100,324
2	244	798	489	119,312
3	248	795	487	120,812
4	251	788	483	121,197
5	242	787	482	116,703
6	249	791	485	120,689
7	262	793	486	127,311
8	267	786	482	128,595
9	264	787	482	127,312
10	254	791	485	123,112
11	256	786	482	123,298
12	257	794	487	125,039
13	256	789	483	123,768
14	258	786	482	124,261
15	260	789	483	125,702
16	261	797	488	127,465
17	264	800	490	129,415
18	263	804	493	129,570
19	261	811	497	129,704
20	265	819	502	132,991
21	259	804	493	127,599
22	256	798	489	125,180
23	259	800	490	126,964
24	276	808	495	136,651
25	250	796	488	121,940
26	248	800	490	121,572
27	242	794	487	117,741
28	243	798	489	118,823
29	240	793	486	116,621
30	242	800	490	118,631
31	234	837	513	120,014
Total	7,808			3,828,317
Monthly Flow Weighted TDS			490	

1. TDS = EC x 0.612762

TABLE H-2 (continued)

SUMMARY OF FLOW WEIGHTED TDS BELOW PRADO DAM

WATER YEAR 1995-96

AUGUST 1996

Day	Prado Outflow (cfs)	Daily Mean EC (microsiemens/cm)	Computed TDS(1)	Outflow X TDS
1	170	955	585	99,482
2	166	967	593	98,362
3	169	963	590	99,725
4	174	958	587	102,143
5	174	953	584	101,609
6	176	954	585	102,885
7	175	955	585	102,408
8	179	954	585	104,639
9	173	969	594	102,722
10	170	958	587	99,794
11	163	964	591	96,285
12	167	961	589	98,340
13	158	950	582	91,976
14	158	984	603	95,267
15	168	949	582	97,694
16	166	939	575	95,514
17	157	943	578	90,720
18	165	944	578	95,444
19	170	939	575	97,815
20	167	942	577	96,396
21	161	944	578	93,130
22	162	938	575	93,113
23	167	945	579	96,703
24	172	943	578	99,388
25	170	945	579	98,440
26	165	947	580	95,747
27	167	936	574	95,782
28	177	943	578	102,277
29	162	930	570	92,319
30	161	931	570	91,848
31	161	945	579	93,229
Total	5,190			3,021,194
Monthly Flow Weighted TDS			582	

1. TDS = EC x 0.612762

TABLE H-2 (continued)

SUMMARY OF FLOW WEIGHTED TDS BELOW PRADO DAM

WATER YEAR 1995-96

SEPTEMBER 1996

Day	Prado Outflow (cfs)	Daily Mean EC (microsiemens/cm)	Computed TDS(1)	Outflow X TDS
1	161	941	577	92,834
2	161	948	581	93,525
3	175	936	574	100,370
4	171	940	576	98,495
5	173	943	578	99,965
6	169	940	576	97,343
7	169	928	569	96,101
8	168	924	566	95,120
9	220	915	561	123,349
10	183	909	557	101,931
11	175	887	544	95,116
12	165	901	552	91,096
13	167	917	562	93,838
14	163	924	566	92,289
15	164	937	574	94,162
16	174	935	573	99,690
17	171	949	582	99,438
18	163	960	588	95,885
19	163	952	583	95,086
20	166	953	584	96,938
21	171	948	581	99,334
22	179	931	570	102,116
23	183	931	570	104,398
24	184	948	581	106,885
25	185	935	573	105,993
26	185	936	574	106,106
27	180	929	569	102,466
28	180	925	567	102,025
29	179	929	569	101,897
30	185	927	568	105,086
Total	5,232			2,988,878
Monthly Flow Weighted TDS			571	

1. TDS = EC x 0.612762

TABLE H-3

ANNUAL SUMMARY OF FLOW WEIGHTED TDS BELOW PRADO DAM

WATER YEAR 1995-96

Month	Monthly Flow (cfs-days)	Monthly Weighted TDS (mg/L)	Monthly Flow x TDS
1995			
OCTOBER	4,911	601	2,951,342
NOVEMBER	5,450	622	3,387,967
DECEMBER	6,920	549	3,801,845
1996			
JANUARY	7,901	592	4,677,949
FEBRUARY	23,225	320	7,440,298
MARCH	13,836	477	6,596,384
APRIL	11,021	564	6,219,549
MAY	9,556	520	4,966,073
JUNE	8,435	496	4,185,166
JULY	7,808	490	3,828,317
AUGUST	5,190	582	3,021,194
SEPTEMBER	5,232	571	2,988,878
Total	109,485		54,064,962
Yearly Flow Weighted TDS =		494	

APPENDIX I

WATER QUALITY AND FLOW OF WASTEWATER FROM RUBIDOUX COMMUNITY SERVICES DISTRICT DISCHARGED BELOW THE RIVERSIDE NARROWS GAGING STATION

WATER YEAR 1995-96

PREPARED BY

DONALD L. HARRIGER

TABLE I-1

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

WATER YEAR 1995-96

MONTH	Discharge (acre -feet)	TDS (mg/L)	Discharge xTDS
1995			
October	178	633	112,692
November	169	579	98,085
December	168	667	112,317
1996			
January	158	683	107,863
February	148	667	98,582
March	169	638	108,040
April	168	683	114,445
May	179	647	115,720
June	177	673	118,966
July	190	667	126,912
August	191	643	122,957
September	187	647	120,922
Total	2,082		1,357,499

Flow weighted TDS = 652 mg/L

APPENDIX J

WATER QUALITY AND FLOW OF THE SANTA ANA RIVER AT RIVERSIDE NARROWS

WATER YEAR 1995-96

PREPARED BY

DONALD L. HARRIGER

TABLE J-1

SANTA ANA RIVER AT RIVERSIDE NARROWS

WATER YEAR 1995-96

Date Sampled	E.C. (microsiemens/cm)	TDS (mg/L)	Source of data
1995			
10/02/95	1,030	688	C of R
10/03/95	1,026	661	C of R
10/04/95	893	574	USGS
10/12/95	1,092	740	C of R
10/17/95	1,087	688	C of R
10/18/95	958	610	USGS
10/26/95	1,000	684	C of R
11/03/95	984	662	USGS
11/09/95	1,059	702	C of R
11/14/95	1,046	657	C of R
11/21/95	1,020	624	USGS
11/23/95	1,010	711	C of R
11/28/95	1,054	667	C of R
12/05/95	938	598	USGS
12/07/95	1,096	668	C of R
12/12/95	962	597	C of R
12/21/95	968	596	C of R
12/26/95	1,098	657	C of R
1996			
01/03/96	998	624	USGS
01/04/96	985	325 *	C of R
01/09/96	990	649 *	C of R
01/18/96	895	629 *	C of R
01/19/96	962	594 *	USGS
01/22/96	736	446 *	USGS
01/23/96	841	579 *	C of R
02/01/96	342	256 *	C of R
02/01/96	367	216 *	USGS
02/06/96	949	604	C of R
02/15/96	970	639	C of R

* Data not used in determining monthly averages, storm flow.

C of R City of Riverside
USGS U.S. Geological Survey
DWR Dept. of Water Resources

TABLE J-1

SANTA ANA RIVER AT RIVERSIDE NARROWS

WATER YEAR 1995-96

Date Sampled	E.C. (microsiemens/cm)	TDS (mg/L)	Source of data
02/20/96	128	128 *	C of R
02/29/96	894	574 *	C of R
03/04/96	921	556 *	USGS
03/05/96	250	205 *	C of R
03/13/96	697	516 *	C of R
03/13/96	494	312 *	USGS
03/19/96	943	619	C of R
03/28/96	930	593	C of R
04/02/96	968	598	C of R
04/03/96	814	520	USGS
04/11/96	997	642	C of R
04/12/96	856	532	USGS
04/16/96	1,004	620	C of R
04/25/96	1,051	627	C of R
05/01/96	846	544	USGS
05/02/96	986	628	C of R
05/09/96	820	644	C of R
05/16/96	995	658	C of R
05/21/96	1,010	685	C of R
05/22/96	988	634	USGS
05/30/96	943	620	C of R
06/04/96	903	564	USGS
06/06/96	1,030	717	C of R
06/11/96	982	634	C of R
06/20/96	983	648	C of R
06/25/96	984	652	C of R
07/02/96	1,030	636	USGS
07/04/96	990	671	C of R
07/15/96	916	558	USGS
07/18/96	964	669	C of R
07/23/96	967	665	C of R

* Data not used in determining monthly averages, storm flow.

C of R City of Riverside
USGS U.S. Geological Survey
DWR Dept. of Water Resources

TABLE J-1

SANTA ANA RIVER AT RIVERSIDE NARROWS

WATER YEAR 1995-96

Date Sampled	E.C. (microsiemens/cm)	TDS (mg/L)	Source of data
08/01/96	949	552	USGS
08/06/96	888	659	C of R
08/13/96	1,010	-	USGS
08/14/96	1,000	617	DWR
08/20/96	969	598	C of R
08/29/96	944	623	C of R
09/03/96	945	646	C of R
09/03/96	906	552	USGS
09/12/96	952	645	C of R
09/12/96	881	532	USGS
09/17/96	934	607	C of R
09/26/96	834	454	C of R

* Data not used in determining monthly averages, storm flow.

C of R City of Riverside

USGS U.S. Geological Survey

DWR Dept. of Water Resources

TABLE J-2

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

WATER YEAR 1994-95

Month	Flow [1] (acre-feet)	TDS [2] (mg/L)	Flow x TDS
1995			
October	3,495	664	2,319,099
November	3,539	671	2,372,571
December	3,726	623	2,322,320
1996			
January	4,031	624	2,515,176
February	3,651	622	2,269,130
March	5,014	606	3,038,420
April	5,280	590	3,114,118
May	5,839	630	3,681,284
June	5,435	643	3,494,517
July	4,925	640	3,150,987
August	4,324	610	2,636,754
September	4,677	573	2,678,375
Total	53,935		33,592,751

$$\text{Flow weighted TDS} = \frac{33{,}592{,}751}{53{,}935} = 623 \text{ mg/L}$$

(1) Total Flow minus Storm Flow from Table 6

(2) TDS based on water quality data from Table J - 1

* Data are straight line estimates during storm flow periods