Santa Ana River Projected Flow Impacts Report

March 2004

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I. INTRODUCTION

This report characterizes 2001-02 flow conditions and updates projected 2010 and 2025 municipal wastewater discharges to the Santa Ana River (SAR) above Prado Dam, as described in SAWPA's Integrated Water Resources Plan (IWRP). Interest in this report was prompted by downstream agencies due to the development of water recycling, planned facility up-grades, as well as, contributions from water resource projects by agencies in the upper Santa Ana Watershed. The planning horizon for this update matches the SAWPA IWRP using the years of 2010 and 2025. Water resource projects examined include those projects that may impact river flow which were identified in the IWRP and have been constructed or are anticipated to be constructed from State Water Bond Prop 13 funding. Additionally, there are several other water resource projects that have arisen since the IWRP development that may have an impact on SAR flows have also been included in this update. The update provides various scenarios of flow dependent on alternative rainfall and storm runoff contributions to the SAR preformed through the analysis of historical rainfall and storm runoff data.

II. 1969 PRADO SETTLEMENT MINIMUM SAR MUNICIPAL DISCHARGES

The Prado 1969 Judgment set forth a comprehensive "physical solution" to assure that a certain average and minimum annual amount of non-storm flow (base flow) at Prado Dam. Through this settlement specific quantities of wastewater from wastewater treatments plants that discharge to the SAR are required to be maintained within the SAR. This includes the obligation of SBVMWD to assure an average annual adjusted base flow of 15,240 AFY at Riverside Narrows and IEUA and WMWD have a joint obligation to assure an average annual adjusted base flow of 42,000 AFY at Prado dam

III. CHARACTERIZATION OF 2001-02 SANTA ANA RIVER FLOW

One of the primary sources of information on the make up of SAR flows is the Santa Ana River Watermaster Report. Current flow conditions were summarized from data available from the Thirty-Second Annual report of the Santa Ana River Watermaster for the Water Year 2001-02 (Watermaster Report). This report provided documentation of historical storm runoff data, current effluent discharge from municipal wastewater treatment facilities, and other nontributary flows, see Figure 1.

The Watermaster Report includes historical records of annual rainfall and estimated storm flow runoff for the Upper Santa Ana River Watershed (down to Prado Dam) for the period of 1970 through 2002. Average annual precipitation for the upper watershed was reported to be approximately 18 inches, which was estimated to contribute roughly 65,400 acre feet of storm flow through Prado Dam annually. During the period of record annual rainfall in the upper watershed varied from 5.1 inches in 2001-02 to 33.4 inches in 1997-98. Over this same period annual storm flow runoff recorded at Prado Dam ranged from 10,600 acre feet in 2001-02 to 445,300 acre feet in 1979-80.

Annual total flow records for Prado Dam included in the Watermaster Report were provided by the USGS from its gauging station located on the SAR below Prado Dam. This flow was then

allocated by the Watermaster to storm flow, base flow and other nontributary flow contributions including estimated water losses, using methods which are explained in detail in their report. Based on discussion with Watermaster committee members, irrigation return flow is not assumed to be a significant contribution to flow at Prado Dam, due to the overall water loss to evaporation and infiltration in the Santa Ana River Channel. Consequently, irrigation return flow is included in base flow estimates.

As defined in the Watermaster Report, base flow is "that portion of the total surface flow passing a point of measurement (either Riverside Narrows or Prado Dam) which remains after deduction of storm flow, nontributary flows, exchange water purchased by OCWD, and certain other flows as determined by the Watermaster." A major contributor to the base flow is the effluent discharge from municipal wastewater treatment facilities, which showed a general upward trend for the period of record. This upward trend depicted an increase from approximately 38,400 AFY in 1970-01 to 146,000 AFY in 2001-02. Included in the report were all municipal discharges to the SAR system, listed in Table 1. However, due to the percolation of flow prior to reaching the Santa Ana River channel at E Street in San Bernardino, effluent discharged from the Beaumont, Redlands and Yucaipa treatment facilities were not considered to contribute to the surface flows at Riverside Narrows and Prado Dam during the reporting period.

Table 1 – 2001-02 Upper Santa Ana Municipal Wastewater Dischargers

FACILITY NAME	Design capacity (AFY)	Total production (AFY)	Discharge to Santa Ana River (AFY)
Beaumont WWTP #1	1,700	1,400	--
Redlands WWTP	10,100	7,400	--
YVWD H.N. Wochholz WWTP	5,000	3,300	--
City of Corona WWTP #1& #2	16,200	12,400	12,400
IEUA Regional Water Recycling Plant #1 & #4	57,100	40,400	40,400
IEUA Carbon Canyon Water Recycling Facility	11,400	10,700	10,700
IEUA Regional Water Recycling Plant #2	5,600	4,100	4,100
San Bernardino/Colton RIX Facility	44,800	44,500	44,500
City of Rialto WWTP	13,100	8,000	8,000
Riverside Regional Water Quality Control Plant	44,800	35,600	35,600
Western Riverside County Regional WWTP	9,000	2,400	2,400
Eastern Municipal Water District*	56,000	42,600	--
Elsinore Valley Municipal Water District*	6,400	6,200	--
Total	**281,200**	**219,000**	**158,100**

* Reported from individual agencies

Although excluded from the base flow, further adding to the total flow of the SAR are "non-tributary" flows that are accounted for and reported in the Watermaster Report. These consisted of purchases by OCWD including State Water Project water released at the OC-59 connection to San Antonio Creek, treated water discharged to the river from the Arlington Desalter, WMWD Transfer Program water, and SBVMWD High Groundwater Mitigation Project water.

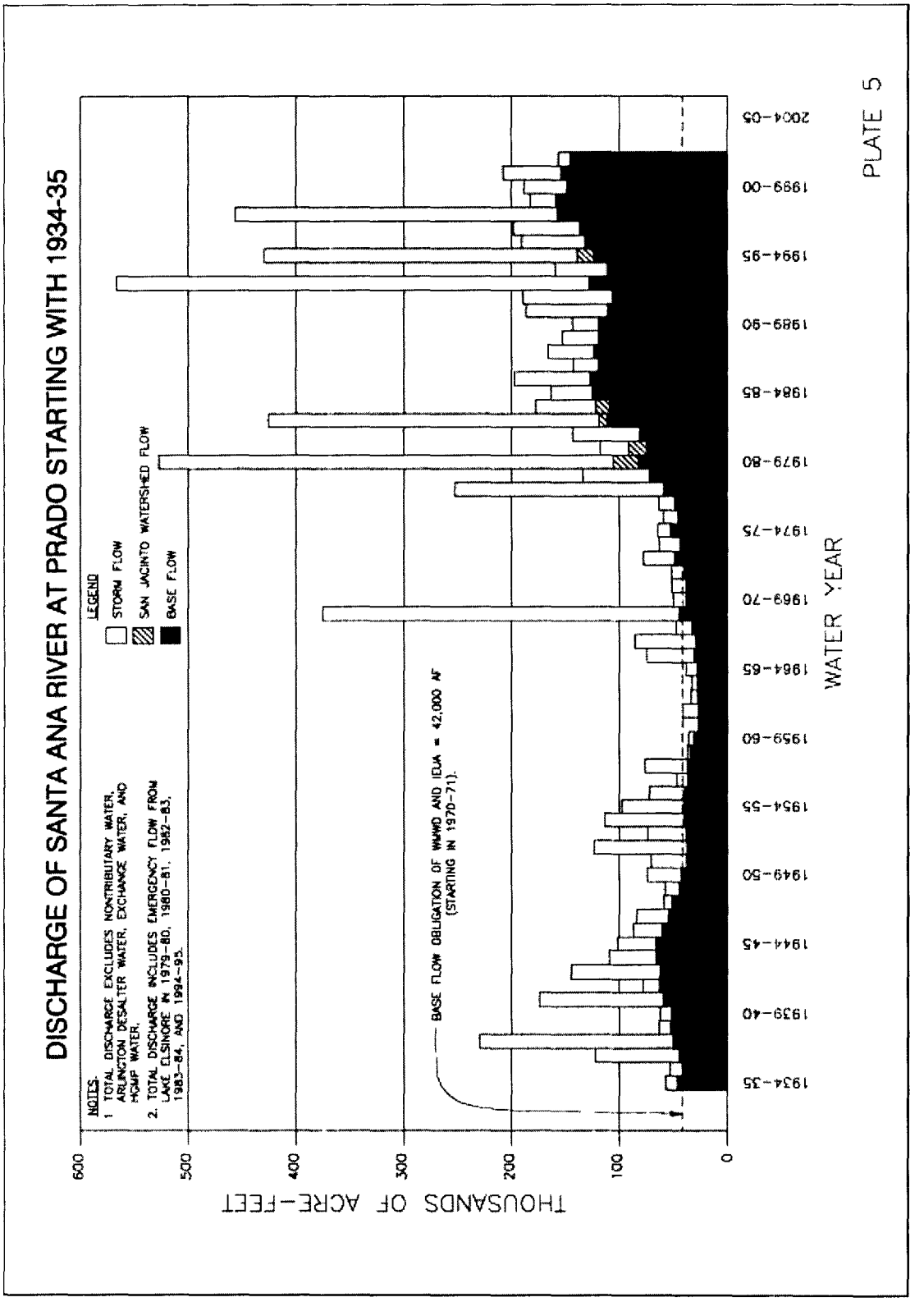
IV. 2001-02 WATERSHED FLOW AT PRADO DAM

In 2001-02 SAR flows as measured at the USGS gaging station, located below Prado Dam totaled 174,500 acre-feet. This included inflows of 10,600 acre-feet of storm flow, the lowest volume on record since the institution of the SAR Watermaster. Base flow from municipal dischargers and other sources including water losses from evaporation and infiltration was estimated at 145,500 acre-feet. Adding to total SAR flows are 2,900 acre-feet of State Water Project water released to San Antonio Creek, 6,200 acre-feet of Arlington Desalter discharge, 4,400 acre-feet of SBVMWD High Groundwater Mitigation Project (HGMP) water and 4,900 acre-feet of WMWD Transfer Program water, listed in Table 2.

Table 2 – Components of 2001-02 Santa Ana River Flow at Prado Dam

Components of Santa Ana River Flow	Contribution at Prado Dam (AFY)	Percent Contribution
Storm Flow	10,600	6.1
Base Flow	145,500	83.4
Releases to San Antonio Creek	2,900	1.7
Arlington Desalter	6,200	3.6
High Groundwater Mitigation Project	4,400	2.5
WMWD Transfer Program	4,900	2.8
Total	**174,500**	

Figure 1 – Discharge of Santa Ana River at Prado Dam 1934 – 2002



V. PROJECTED 2010 AND 2025 SANTA ANA RIVER FLOW IMPACTS

Future impacts to SAR flows were estimated using projections of 2010 and 2025 flows from municipal wastewater effluent dischargers and flow estimates from anticipated water resource projects in the upper Santa Ana River Watershed. This information was compiled from components of SAWPA's 2002 Integrated Watershed Plan (IWP), Integrated Water Resources Plan (IWRP), and municipal discharging agencies water recycling planning documents and updated through personal communication with numerous local water agency staff. The following section describes the various components of the projected impacts to SAR flow for 2010 and 2025.

Santa Ana River - Storm Flow

Storm runoff is determined from annual rainfall and snowmelt in the watershed. In the upper Santa Ana Watershed, annual runoff may vary greatly from year to year. Considering the extreme range of conditions that may exist in the watershed, annual rainfall records were examined for the period of record, 1970-2002 as a means of developing alternative rainfall vs. runoff scenarios to represent drought, average and heavy rainfall conditions. This was performed by identifying the five driest, most typical (based upon the long term average 18 in.) and wettest rainfall years, then estimating the average annual storm runoff during those periods. The results of the analysis were as follows:

- The driest rainfall period averaged 7.9 in. contributing 18,300 AFY of runoff
- The most typical rainfall period averaged 18.1 in. contributing 65,400 AFY of runoff
- The wettest rainfall period averaged 31.6 in. contributing 340,300 AFY of runoff

These data will be used to provide theoretical storm flow estimates for future 2010 and 2025 Santa Ana River flow scenarios.

Santa Ana River - Municipal Discharges

Projected 2010 and 2025 effluent discharges from municipal wastewater treatment facilities contributing to Santa Ana River flows at Prado Dam were estimated based upon the projected plant expansion, upgrades and water recycling goals of local agencies, as reported in SAWPA's IWRP and updated by agency staff. Updated agency projections show effluent discharges increasing for the 2010 and 2025 planning period. This is attributed to increasing demand for water treatment based upon population projections, as well as planned facility expansion. For this report, water loss attributed to evaporation and infiltration from municipal effluent discharged into the Santa Ana River channel was assumed to be four percent annually using estimates provided in the Watermaster Report.

An important factor to consider when evaluating the impacts of facility expansion on SAR flow is water recycling. The emphasis to "water-proof" the Santa Ana Watershed has many agencies planning for greater recycling and water recharge, which will have a direct impact on SAR flows. Initial planning projections, as reported in the IWRP, showed a decrease in municipal discharge to the SAR for 2010, based upon the ambitious water recycling goals of agencies in the

upper watershed. The demand for recycled water, however, has not increased at the rate first anticipated and large capital costs, as well as the availability of funding have slowed the development of recycled water scheduled for 2010. Water recycling is still considered tremendously important by agencies in the watershed and for this report much of the planned increases for water recycling have been pushed out to the 2025 planning period.

Some important notes in regard to specific agency/facility upgrades or expansion are as follows:

Upstream Dischargers (Beaumont, Redlands & Yucaipa)

The Beaumont, Redlands and Yucaipa treatment facilities, as reported in the Watermaster Report are not projected to contribute surface flows to the SAR at Prado Dam. Discharge from these facilities is recharged in the higher reaches of the upper Santa Ana River watershed. Future water management plans for these up-stream dischargers include expansion for both the City of Beaumont and Yucaipa Valley Water District facilities. However, the greater part of these discharges are expected to be recharged in the upper watershed following the long-term water management goals to recycling as much water as feasible for local use or groundwater recharge.

City of Rialto – Wastewater Treatment Plant

The City of Rialto Wastewater treatment plant capacity is approximately 13,100 AFY. In 2001-2002, this facility produced approximately 8,000 AFY of tertiary treated effluent of which 70 AFY was recycled water.

The water management plans for the City of Rialto include both the expansion of its existing WWTP system and increased water recycling. Facility expansion includes construction up-grades to increase current treatment capacity by 4,500 AFY and the development of approximately 2,200 AFY of recycled water. The City is currently only in the preliminary discussion stages of developing these projects and it is not anticipated that these expansion projects will be underway by 2010. For the purposes of this report, all projected facility up-grades and expansion will be assumed to be completed by the 2025 planning horizon.

City of San Bernardino/Colton - RIX Facility

The Rapid Infiltration and Extraction System (RIX) was developed as a cost effective method for the cities of San Bernardino and Colton to meet the filtration and disinfection requirements of California Code of Regulations, Title 22, for discharge into the Santa Ana River. The facility is a 50-acre groundwater recharge and extraction system located adjacent to the Santa Ana River. RIX currently receives inflows of approximately 40,000 AFY; this is blended by the over-extraction of groundwater, estimated to be 10 percent, to ensure that secondary effluent recharged to the groundwater system is fully recovered. In 2001-2002 discharge to the Santa Ana River including over-extraction was approximately 44,500 AFY. Projected discharges from the RIX facility to the Santa Ana River based upon growth estimates for 2010 and 2025 are roughly 55,700 and 79,600 AFY respectively.

The City of San Bernardino is proposing the sale of 18,000 AFY of recycled water from the RIX facility. In accordance with the Stipulated Judgment of 1970 the City of San Bernardino is contractually obligated to deliver 16,000 AFY to the river. Over the past five years of operation, 1996-2002, discharge from the RIX facility, which is comprised of flows from both San Bernardino and Colton treatment plants including over-extraction, averaged approximately 47,250 AFY. The sale of 18,000 AFY of recycled water from the RIX facility will reduce surface flows into the river at the point of the RIX discharge which could directly affect recharge in those aquifers directly or indirectly receiving water downstream of the RIX outfall. However, the residual flow, currently estimated to be 31,000 AFY, is substantially more than required by the Stipulated Judgment. Additionally, with the projected increase in RIX discharge in the future the City of San Bernardino will not have a problem meeting the requirements of the Stipulated Judgment in the future. Based on discussions with City of San Bernardino staff and other parties, it is likely that the sale of RIX product water would be limited to the Santa Ana River Watershed and not impact flows in the Santa Ana River since any major water transfer or sale will likely result in the recycled water remaining in the river system for discharge.

City of Riverside – Regional Water Quality Control Plant

The City of Riverside operates the Riverside Regional Water Quality Control Plant, a 44,800 AFY capacity facility. In 2001-2002, this facility discharged approximately 35,600 AFY of tertiary treated effluent of which 130 AFY was recycled water.

The City's water management plans include the expansion of its water recycling capabilities to meet future demand projections. This calls for the development of approximately 9,800 AFY of recycled water by 2025. Currently the City is in the design phase for construction of a new pump station to develop 2,000 AFY of recycled water. This project is on schedule to be completed by 2005, and is anticipated to meet the City's demand expectations for 2010. To date, no further expansion of the City's water recycling capabilities is being explored. For the purposes of this report, all projected facility upgrades and expansion will be assumed to be completed by the 2025 planning horizon.

Additionally, the City of Riverside is exploring the option of expanding groundwater production in the Riverside South Basin to meet future demand expectations. This includes a potential increase in well production in the Riverside South Basin of 10,000 AFY by 2010 and 27,000 AFY by 2025. To achieve these goals, it is estimated that the increase of groundwater production could require the additional recharge of roughly 23,500 AFY in the basin. This report assumes that the additional water pumped will remain in the basin and not impact long-term flows in the SAR.

Inland Empire Utilities Agency (IEUA) – Regional Water Recycling Plants

Inland Empire Utilities Agency (IEUA) operates five wastewater water reclamation plants with a combined treatment capacity of 74,100 AFY, some of which discharges to the Santa Ana River. In 2001-2002 these facilities produced approximately 55,100 AFY of tertiary treated effluent of which approximately 5,700 AFY was recycled water.

IEUA's Wastewater Facilities Master Plan, August 2002 calls for the expansion of the existing WWTP system and increased water recycling. This work will be completed in multiple phases and include plans to interconnect IEUA tertiary wastewater water reclamation plants RP – No. 1, No. 2, No. 4, No. 5, and Carbon Canyon Water Recycling Facility (CC-WRF). Facility expansion includes construction up-grades to increase current treatment capacity by 60,300 AFY and the development of approximately 56,400 AFY of recycled water by 2025.

Phases I and II of this work anticipated to be completed by 2010 will develop approximately 19,000 AFY (5,600 AFY will be lost with the phasing out of RP No. 2) of new plant capacity and an additional 13,300 AFY of tertiary treated water. This includes the expansion of RP No. 4 to produce an additional 7,800 AFY of tertiary treated water and the construction of RP No. 5 (completed in 2002) with a capacity to produce 16,800 AFY of tertiary treated effluent.

Phase I of the plan is currently under construction with some segments completed and is expected to be completed by late 2004. Design for Phase II was initiated in January 2004 with completion scheduled for early 2006. Funding for the construction of Phase II estimated at $28 million has been applied for under the State's Proposition 50.

Phases III, IV and V of the plan are scheduled for 2005-06, 2006-08 and 2008-10 respectively. These phases of IEUA's plan call for the further development of approximately 41,200 AFY of new plant capacity and an additional 43,100 AFY of recycled water from all IEUA treatment plants. Funding for these phases of the plan estimated at $65 million has not yet been finalized, therefore this work in anticipated to be completed by 2025.

The projected increase in water recycling is significantly lower than what was reported to SAWPA for SAWPA's IWRP. This reduction is based on updated recycling information from IEUA which reveal that the initial estimates for water recycling for 2010 from IEUA may have been high due to the need to meet DHS requirements for blending of discharge water and the concern of availability of imported water for blending. Latest projections estimate an increase of IEUA recycling of less than 60 percent of the original values reported for 2010 in the IWRP.

Western Municipal Water District – Wastewater Treatment Plants

Western Municipal Water District (WMWD) operates the March Air Reserve Base WWTP (MARB-WWTP), an 840 AFY facility, which supplies non-potable water for irrigation and the Western Riverside Regional Wastewater Treatment Plant (WRR-WWTP), a 9,000 AFY facility, which discharges treated effluent to the Santa Ana River.

The MARB-WWTP currently discharges approximately 370 AFY of secondary treated effluent which is used locally for irrigation. This facility does not operate in the vicinity of the Santa Ana River nor does it contribute surface flows to the Santa Ana River under any flow scenarios. Therefore, this facility was excluded from the analysis.

In 2001-2002 WRR-WWTP discharged approximately 2,400 AFY of tertiary treated effluent to the Santa Ana River none of which were recycled. WMWD's water management plans for WRR-WWTP expansion include increasing plant capacity from 9,000 to 17,900 AFY along with

the development of 5,200 AFY of recycled water by 2025. These plans, however, are only in the preliminary discussion stage and it is not anticipated that any expansion will be completed by 2010.

Additionally, agricultural customers in portions of the WMWD's service area are currently supplied imported Metropolitan Water District water due to the lack of an alternate non-potable water supply and/or lack of a separate conveyance system for agricultural deliveries. One WMWD project described in the SAWPA IWRP and funded by Water Bond Prop 13 funds would shift agricultural use from imported water supplies to a non-potable local water supply, which would free potable water supplies for other uses. This would be accomplished by extracting non-potable water from either the Riverside Canal or the Gage Canal.

The capacity to transfer water for this project is 6,000 acre-feet per year. This is based upon an anticipated reduction in the area devoted to agriculture in the future and conveyance restrictions presented by the existing March Air Force Base pipeline (non-potable conveyance facility). Additionally, in the future, should agricultural demand decrease below this level, it is expected that non-potable water service would be shifted to meet irrigation requirements at the Riverside National Cemetery, March Air Force Base Golf Course and future open space areas. The transfer of groundwater under this project is not expected to impact long term flows in the Santa Ana River because this water will eventually percolate back into the River system and remain in the river watershed.

City of Corona – Wastewater Treatment Plants

The City of Corona operates three wastewater treatment facilities WWTP Plant No.1, a 12,900 AFY facility, which discharges treated effluent to the Santa Ana River, WWTP No. 2, a 3,400 AFY facility which supplies non-potable water to treatment ponds and WWTP No. 3, a 1,100 AFY facility which supplies non-potable water for irrigation.

WWTP No. 3 currently discharges approximately 330 AFY of secondary treated effluent which is used locally for irrigation. This facility does not operate in the vicinity of the Santa Ana River nor does it contribute surface flows to the Santa Ana River under any flow scenarios. Therefore, this facility was excluded from the analysis.

In 2001-2002 WWTP Plant No.1 discharged approximately 10,100 AFY of tertiary treated effluent to the Santa Ana River of which approximately 330 AFY were recycled. WWTP Plant No.2 discharged approximately 2,200 AFY to treatment ponds which were assumed to infiltrate into the SAR.

The water management plans for the City of Corona include both the expansion of existing plant capacity and increased water recycling. The proposed expansion of the system includes upgrades to WWTP Plant No.1 and WWTP No. 2. These up-grades include an increase of the City's treatment capacity by 6,200 AFY and development of approximately 13,100 AFY of recycled water by 2025.

Work anticipated to be completed by 2010 includes the expansion of WWTP No. 1 treatment capacity by 3,400 AFY and the development of infrastructure to enable the recycling of all tertiary treated effluent, which is currently discharged to the Santa Ana River. Based upon the projected increase in production for 2010, WWTP No. 1 will be producing approximately 12,900 AFY of recycled water. The plan also calls for the expansion of WWTP No. 2, which produces secondary treated effluent discharged to local recharge ponds by 560 AFY.

The City is currently completing the design phase of this project and is expected to begin construction in 2005. Questions still remain in regard to the City's ability to achieve its recycling goals due to water quality concerns with its Title 22 permit and available demand for recycled water. However, the City remains committed to its goals to complete the project. Based upon current construction and permitting schedules, SAWPA staff projects that approximately 70% of the City's recycled water goal will be met by 2010 with the remainder of the project completed by the long term planning horizon of Year 2025.

EMWD & EVMWD – San Jacinto Watershed Discharge

Flow or other effluent discharges from the San Jacinto Watershed reaching Prado Dam are infrequent. Typically, past discharges have been the result of extremely heavy rainfall in the San Jacinto Watershed causing the overflow of Lake Elsinore into Temescal Wash. Since 1970, there have been only five years in which recorded flow at Prado Dam has included contributions form Temescal Wash. These include discharges which reached Prado Dam totaling approximately 16,100 acre-feet in 1980-81; 7,700 acre-feet in 1982-83; 12,600 acre-feet in 1983-84; 4,700 acre-feet in 1994-95; and 1,700 acre-feet in 1997-98.

Planned improvements and expansion by EMWD and EVMWD will have a significant impact on the discharge of flow from the San Jacinto Watershed. Projected expansion by EVMWD will supply an additional 12,000 AFY of tertiary treated effluent to the District, in excess to the 560 AFY required to be discharged to Temescal Wash. This discharge is projected to be used by the City of Lake Elsinore to maintain Lake Elsinore at a minimum elevation of 1,240 ft above sea level, the defined standard operation water level for Lake Elsinore. The maximum amount of water required to maintain this level for Lake Elsinore is estimated to be 14,500 AFY.

Excess effluent, if no other market has been established, will be available for discharge to Temescal Wash. Currently, to supply needed water to the Lake, water is purchased from EMWD and EVMWD through a pilot project to deliver tertiary treated effluent to the Lake when it is available. Over the first two years of the pilot study, EMWD and EVMWD have delivered roughly 4500 AFY of water to Lake Elsinore. As EVMWD recycled water supply increases due to increased growth, the need to purchase future EMWD surplus recycled water will diminish. The availability of this constant supply of water from EVMWD in the future will make purchases of EMWD water unnecessary.

Projected expansion by EMWD may result in an increased flow to the SAR, if no market for the water has been established, of as much as 7,100 AFY by 2010 and 12,000 by 2025 of water discharged into Temescal Wash. However, since the demand for the excess reclaimed water from EMWD to Lake Elsinore is expected to continue until EVMWD reclaimed water supply

increases sufficiently to make up for the total Lake evaporation demand, no SAR flows are shown from EMWD reaching the SAR through the Year 2010. By 2025, the demand for lake makeup water is expected to be fully made up by reclaimed water delivered by EVMWD.

SBVMWD - High Groundwater Mitigation Project

The High Groundwater Mitigation Project developed and implemented by San Bernardino Valley Municipal Water District (SBVMWD) goal is to lower the groundwater within the Area of Historic High Groundwater while minimizing the effects of the dewatering on other parts of the Bunker Hill Basin. Lowering groundwater levels within the Bunker Hill Groundwater Basin reduces the threat to overlying development, particularly during earthquake when soil liquefaction may occur and increases the ability to control water levels of the entire basin for water banking and conjunctive use. Initially, the project called for the lowering of the groundwater to a minimum level of 15 feet within the active high groundwater area, this was achieved in 2003. Currently, this is being rethought, based upon the safety of lowering groundwater to a minimum level of 50 feet, as reported by SBVMWD staff. Product water produced from the high groundwater area is currently conveyed to the Santa Ana River (via the Rice-Thorne Pipeline and the Riverside Canal) where it flows to the Orange County Water District.

The ultimate goal, as stated by SBVMWD staff for the project includes the development of a pipeline system to convey water produced from dewatering program wells, as well as other existing City of Riverside and City of San Bernardino wells to locations throughout the watershed. This will enable product water to be used to serve the needs for conjunctive use, as well as during periods of drought. Water produced in excess of local capacity for conjunctive use will be delivered to points within the Bunker Hill Basin for use or discharge into the Santa Ana River via the Riverside Canal. As part of the plan to develop this pipeline system and maintain flows in the Santa Ana River, SBVMWD has projected a rolling maximum of 25,000 acre-feet of water, which can be discharged to the River within any 12-month period. Projected discharges to Santa Ana River flow for 2010 and 2025 can be assumed to vary based upon annual precipitation and storm runoff. The values used to represent water releases for these various conditions are 25,000 AFY for a wet year, 2,500 for an average rainfall year and 0 AFY for a dry year. Water loss between the release point and Prado Dam of two percent is calculated per the procedures described in the Watermaster Report to account for evaporation and infiltration.

Santa Ana River - Arundo Removal

SAWPA and other local agencies are working to remove Arundo dorax, a non-native bamboo-like plant species in the Santa Ana Watershed. This invasive species is a problem for numerous reasons, it uses large quantities of water, it is a fire hazard, it is a hazard to bridges and other facilities along to waterways, it exacerbates flood potential by choking waterways, and it destroys native habitats for threatened and endangered species. Arundo was introduced to the Santa Ana River basin after Europeans arrived in California and has been used extensively in recent times for bank stabilization. The plant grows along the washes and tributaries of the Santa Ana River, and in the year 2001, it was estimated that there were 10,000 acres of Arundo in the

watershed. It is estimated that the Arundo in the watershed consumes 30,000 acre-feet (9.8 billion gallons) of water every year, three times the amount of native species.

The first round of the arundo removal program is expected to be complete by 2010. This round is estimated to remove approximately 3,000 acres of Arundo from the watershed, providing roughly 10,000 AFY of additional flow in the SAR watershed. This is to be followed by a second round of removal estimated to eradicate another 3,000 acres of Arundo by 2025. Based upon the current plan for Arundo removal, an estimated 60 percent of the Arundo removed in the initial effort and only an additional 25 percent of the Arundo removed by 2025 will actually impact SAR flow at Prado Dam. This is due to the location of most of the Arundo removal occurring in the upper reaches of the SAR watershed where SAR flows quickly percolate before reaching Prado Dam. Therefore, for the 2010 and 2025 report analyses new water additions to SAR flows at Prado dam from Arundo removal only amounted to 6,000 and 8,500 AFY respectively. These analyses assumed a 2 percent water loss due to evaporation and infiltration based upon the assumptions previously described for the High Groundwater Mitigation Project.

VI. PROJECTED 2010 WATERSHED FLOW AT PRADO DAM

Projected 2010 Santa Ana River flows were estimated to range from 205,300 and 551,800 AFY based upon the three storm runoff scenarios. This included inflows of 18,300 to 340,300 AFY of storm flow, and base flow from municipal dischargers (see breakdown in Table 3). Adding to these flows are base flow contributions from the High Groundwater Mitigation Project (HGMP) and the removal of Arundo from the SAR channel listed in Table 4.

Table 3 – 2010 Projected Municipal Discharges to the Santa Ana River

FACILITY NAME	Design capacity (AFY)	Total production (AFY)	Discharge to Santa Ana River (AFY)
Beaumont WWTP #1	2,800	2,800	--
Redlands WWTP	10,100	6,700	--
YVWD H.N. Wochholz WWTP	9,000	7,100	--
City of Corona WWTP #1	16,200	12,900	3,900
City of Corona WWTP #2**	3,900	3,400	3,400
IEUA Regional Water Recycling Plant #1 & #4	65,000	56,600	40,000
IEUA Carbon Canyon Water Recycling Facility & Plant #5	28,200	26,300	24,000
San Bernardino/Colton RIX Facility	55,700	55,700	55,700
City of Rialto WWTP	13,100	10,100	10,000
Riverside Regional Water Quality Control Plant	44,800	39,200	37,100
Western Riverside County Regional WWTP	9,000	7,400	7,400
Eastern Municipal Water District	84,000	49,600	7,100
Elsinore Valley Municipal Water District	18,100	16,400	--
Total	**359,900**	**294,200**	**188,600**

** Discharge to spreading basin or pond

Table 4 – Components of 2010 Santa Ana River Flow

Components of Santa Ana River Flow	Contribution at Prado Dam (AFY)		
	Dry	Avg	Wet
Municipal Discharges (with evap. and infiltration losses)	181,100	181,100	181,100
SBVMWD - High Groundwater Mitigation Project	--	2,500	24,500
Arundo Removal	5,900	5,900	5,900
Total Base Flow Projection	**187,000**	**189,500**	**211,500**
Storm Flow	18,300	65,400	340,300
Total Base Flow and Storm Flow	**205,300**	**254,900**	**551,800**

VII. PROJECTED 2025 WATERSHED FLOW AT PRADO DAM

Projected 2025 Santa Ana River flows were estimated to range from 215,800 and 562,300 AFY based upon the three storm runoff scenarios. This included inflows of 18,300 to 340,300 AFY of storm flow, and base flow from municipal dischargers (see breakdown in Table 5). Adding to these flows are base flow contributions from the High Groundwater Mitigation Project (HGMP) and the removal of Arundo from the SAR channel listed in Table 6.

Table 5 – 2025 Projected Municipal Discharges to the Santa Ana River

FACILITY NAME	Design capacity (AFY)	Total production (AFY)	Discharge to Santa Ana River (AFY)
Beaumont WWTP #1	4,500	4,500	--
Redlands WWTP	10,100	6,700	--
YVWD H.N. Wochholz & Oak Valley WWTPs	14,600	9,200	--
City of Corona WWTP #1	16,200	13,600	100
City of Corona WWTP #2**	3,900	3,900	3,900
IEUA Regional Water Recycling Plant #1, #4 & Satellite Facilities	84,000	75,000	25,000
IEUA Regional Water Recycling Plant #5 & Carbon Canyon Water Recycling Facility	50,400	45,900	33,900
San Bernardino/Colton RIX Facility	79,600	79,600	79,600
City of Rialto WWTP	17,600	10,600	8,400
Riverside Regional Water Quality Control Plant	44,800	39,200	29,200
Western Riverside County Regional WWTP	17,900	10,200	5,000
Eastern Municipal Water District	99,700	62,700	12,000
Elsinore Valley Municipal Water District	33,800	28,500	--
Total	**477,100**	**376,600**	**197,100**

** Discharge to spreading basin or pond

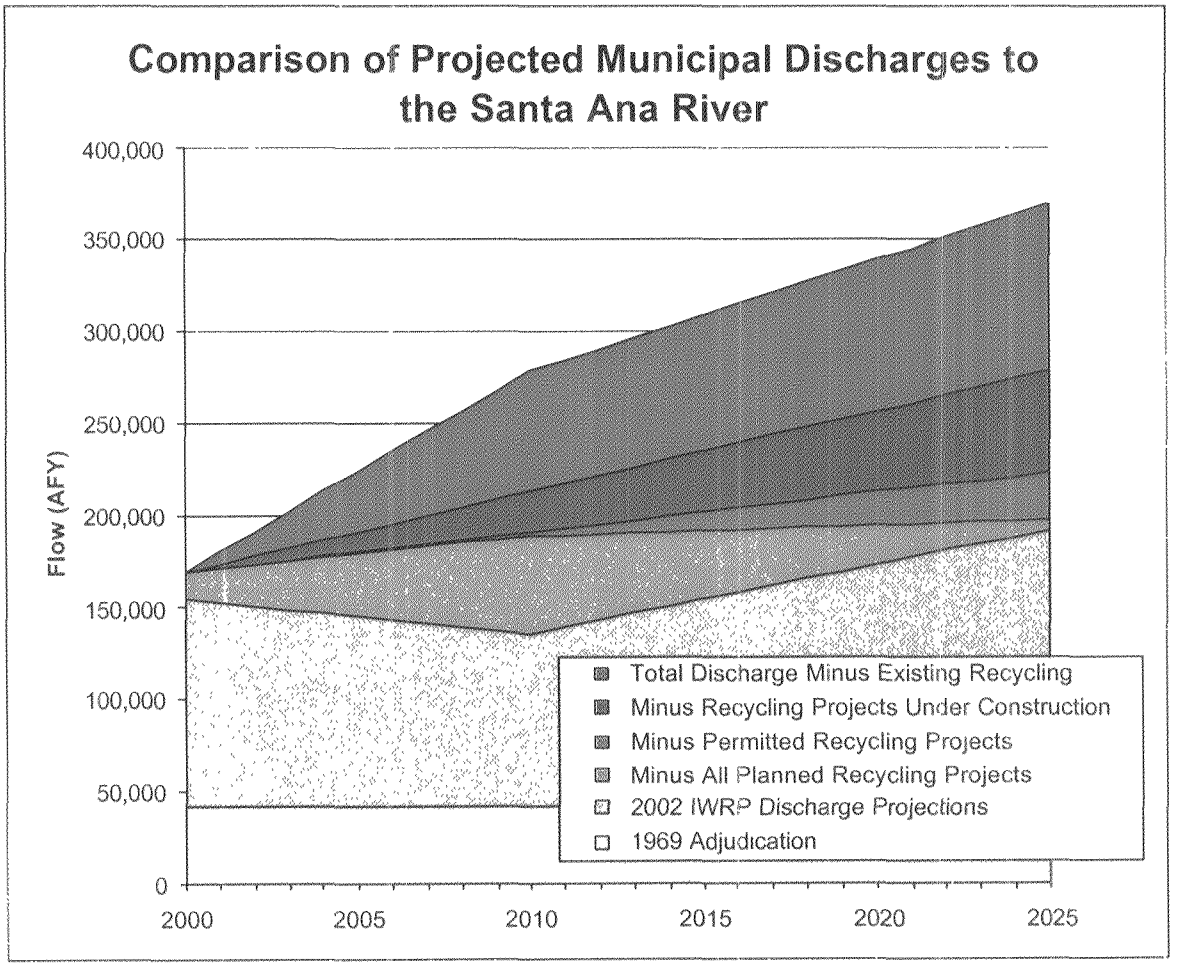
Table 6 – Components of 2025 Santa Ana River Flow

Components of Santa Ana River Flow	Contribution at Prado Dam (AFY)		
	Dry	Avg	Wet
Municipal Discharges (with evap. and infiltration losses)	189,200	189,200	189,200
SBVMWD - High Groundwater Mitigation Project	--	2,500	24,500
Arundo Removal	8,300	8,300	8,300
Total Base Flow Projection	**197,500**	**200,000**	**222,000**
Storm Flow	18,300	65,400	340,300
Total Base Flow and Storm Flow	**215,800**	**265,400**	**562,300**

VIII. PROJECTED SAR MUNICIPAL DISCHARGES

An evaluation of projected flow based upon municipal discharges and upper watershed water resource project discharges to the SAR for 2010 and 2025 was performed to show the contributions to SAR flow at Prado Dam. Figure 2 shows the range of possible flow contributions from municipal discharge based upon varying levels of water recycling planned by agencies in the watershed. Data shown in this figure includes the baseline minimum wastewater flows in accordance with the 1969 Prado Judgment, the original SAR wastewater flows projected in SAWPA's 2002 Integrated Watershed Plan (IWP), Integrated Water Resources Plan component, as well as, total projected municipal discharge to the SAR excluding existing water recycling projects. Additionally, the figure includes the resulting municipal discharges to the SAR after (a) recycling projects which are already under construction or completed as of 2004, (b) recycling projects which have only advanced to the permitted stage and (c) recycling projects only in the planning stage have been subtracted from the total projected municipal discharge to the SAR.

Figure 2 – Comparison of Projected Municipal Discharges to the Santa Ana River



IX. SUMMARY

The evaluation of projected flows in the SAR includes a variety of parameters which are not fully understood. Past modeling studies such as the Basin Planning Procedure Model prepared for the Santa Ana Regional Water Quality Control Board attempted to account for the interrelationship of groundwater to surface flows in the river through groundwater modeling. However, upon detailed review by the TIN TDS Task Force, many early assumptions used in this model were considered flawed which resulted in a reevaluation of groundwater basin boundaries and flow conditions. As part of the TIN TDS Study, the Task Force elected not to develop a new integrated groundwater and surface water model for the watershed due to its significant expense. Real time monitoring was recommended and accepted by the Task Force agencies to account for flow quality. Without the availability of an integrated model, projections of SAR flows that account for the groundwater rising into or percolating out of the SAR are unavailable. Basic assumptions have been made by the Watermaster Report to account for irrigation return or nuisance flows water loss evaporation, infiltration and plant uptake which have also been used by SAWPA in this analysis.

Natural surface runoff available to river flow and groundwater recharge is highly variable from year to year, due to the extreme range of precipitation that falls in the watershed. Annual rainfall can vary greatly from year to year, therefore the supply of natural surface flow for the river is considered intermittent at best. Base flow in the Santa Ana River, for the most part of the year, is comprised of discharge from municipal wastewater treatment facilities and output from various water resource projects in the watershed. Discharge from municipal wastewater treatment facilities, and therefore base flow has generally increased from year to year and is expected to continue this trend into the future. Projections of municipal discharge into the SAR show a gradual increase from 158,100 AFY in 2001-02 to 197,100 AFY by 2025. Impacting the availability of future discharge to the SAR from municipal wastewater treatment facilities is water recycling. In the future, agencies confronted with limited water resources and ever greater demands on these resources will be required to begin or expand water recycling capabilities.

Finally, an important component of SAR base flow projections are water resource projects planned in the watershed by various agencies. These projects include additions to base flow through expanded groundwater pumping and the removal of evasive plant species, each of which can have some impact on SAR base flow from year to year. Water resource projects in the upper watershed are expected on average to contribute by 2010, 14,900 AFY and by 2025 17,300 AFY of base flow to the SAR. An important consideration impacting the operation of these projects, regardless of the project objective is annual storm flow. The variation in annual storm runoff from extreme drought to heavy rainfall and depending on the length of these extreme periods can alter project operation from one year to the next. The result is a continued need to monitor these future water resource impacts and municipal discharges and regularly update the SAR flow projections over time.

X. REFERENCES

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