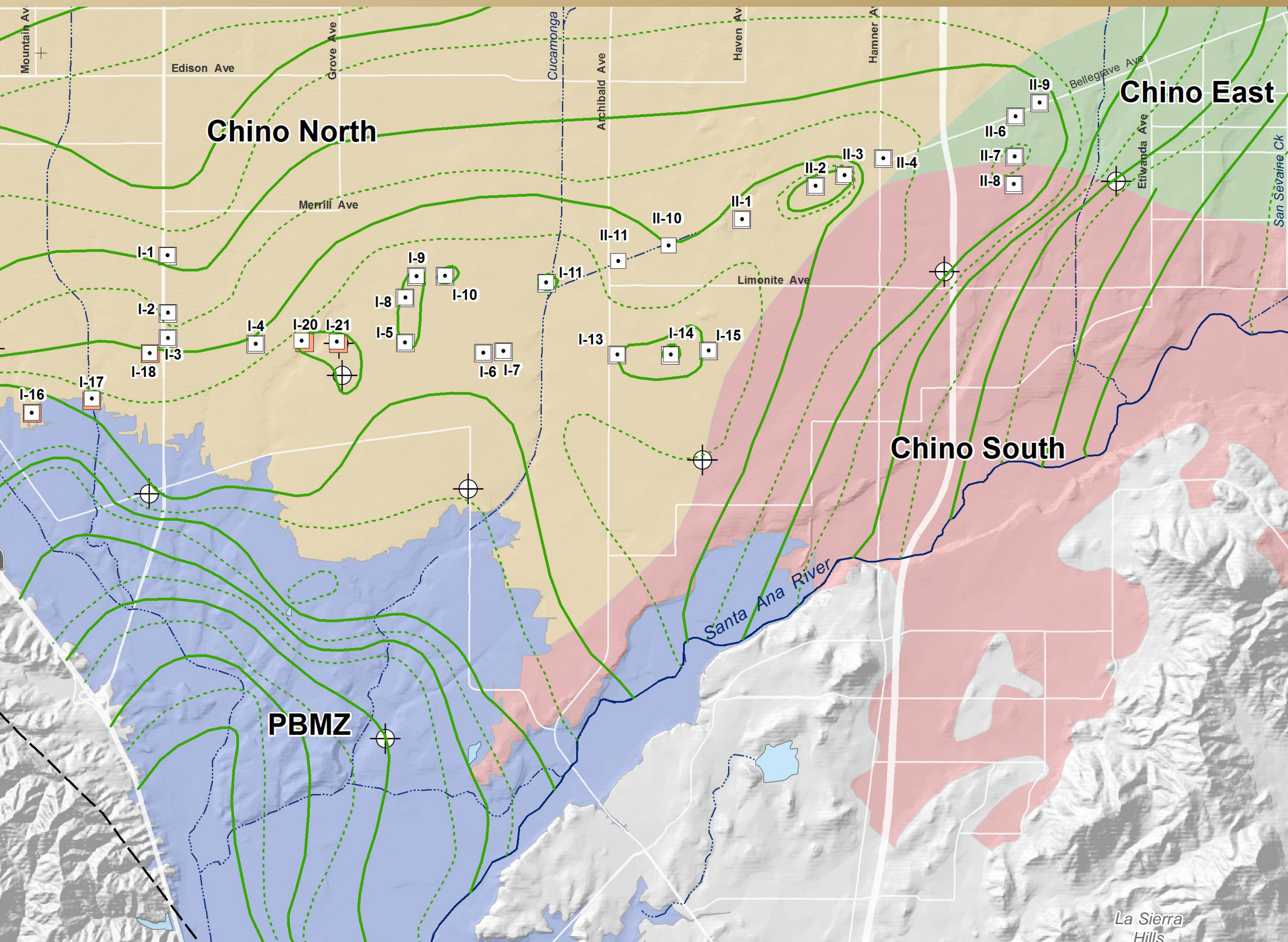
Optimum Basin Management Program

Chino Basin Maximum Benefit Annual Report 2019



prepared for

Chino Basin Watermaster and Inland Empire Utilities Agency

April 2020

WEI

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April 15, 2020

Regional Water Quality Control Board, Santa Ana Region
Attention: Ms. Hope Smythe
3737 Main Street, Suite 500
Riverside, California 92501-3348

Subject: Transmittal of the Chino Basin 2019 Maximum Benefit Annual Report

Dear Ms. Smythe,

The Chino Basin Watermaster (Watermaster) and Inland Empire Utilities Agency (IEUA) hereby submit the Chino Basin Maximum Benefit Annual Report for 2019. This Annual Report is in partial fulfillment of the maximum benefit commitments made by Watermaster and the IEUA as discussed in Resolution No. R8-2004-0001 and its attachment: *Resolution Amending the Water Quality Control Plan for the Santa Ana River Basin to Incorporate an Updated Total Dissolved Solids (TDS) and Nitrogen Management Plan for the Santa Ana Region Including Revised Groundwater Subbasin Boundaries, Revised TDS and Nitrate-Nitrogen Quality Objectives for Groundwater, Revised TDS and Nitrogen Wasteload Allocations, and Revised Reach Designations, TDS and Nitrogen Objectives and Beneficial Uses for Specific Surface Waters*. Table 5-8a in the attachment to the Resolution identifies the Chino Basin Maximum Benefit Commitments which are specific projects and requirements that must be implemented to demonstrate that water quality consistent with maximum benefit to the people of the state will be maintained. This Annual Report describes the status of compliance with each commitment and the work performed during 2019.

If you have any questions, please do not hesitate to call.

Sincerely,

Chino Basin Watermaster

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Acronyms, Abbreviations, and Initialisms

afy	acre-feet per year
Basin Plan	Water Quality Control Plan for the Santa Ana River Basin
CK	Chino Creek
CCWF	Chino Creek Well Field
CDA	Chino Desalter Authority
Chino-North	Chino-North Groundwater Management Zone
DTSC	California Department of Toxic Substance Control
ET	evapotranspiration
GMZ	groundwater management zone
GWQMP	Groundwater Quality Monitoring Program
HCMP	Hydraulic Control Monitoring Program
IEUA	Inland Empire Utilities Agency
MCL	Maximum contaminant level
mgd	million gallons per day
mgl	milligrams per liter
NAWQA	National Water Quality Assessment
OBMP	Optimum Basin Management Program
OCWD	Orange County Water District
PBHSP	Prado Basin Habitat Sustainability Program
PBMZ	Prado Basin Management Zone
Regional Board	Regional Water Quality Control Board, Santa Ana Region
SAR	Santa Ana River
SARWC	Santa Ana River Water Company
SARWM	Santa Ana River Watermaster
SOB Report	State of the Basin Report
SWP	State Water Project
TCE	trichloroethene
TDS	total dissolved solids
TIN	total inorganic nitrogen
USGS	United States Geological Survey
VOC	volatile organic compound
Watermaster	Chino Basin Watermaster
WEI	Wildermuth Environmental, Inc.

Section 1 – Introduction

This 2019 Maximum Benefit Annual Report was prepared by the Chino Basin Watermaster (Watermaster) and the Inland Empire Utilities Agency (IEUA) pursuant to their maximum-benefit commitments, as described in the Water Quality Control Plan for the Santa Ana River Basin (Basin Plan; California Regional Water Quality Control Board, Santa Ana Region [Regional Board], 2008).

This introductory section provides background on: the Chino Basin Optimum Basin Management Program (OBMP) and Implementation Plan; the Regional Board's recognition of the Chino Basin OBMP Implementation Plan; the establishment of alternative, maximum-benefit groundwater-quality objectives for the Chino Basin; and the commitments made by Watermaster and the IEUA when the Regional Board granted them access to the assimilative capacity created by the application of the maximum-benefit objectives for regulatory purposes. This Annual Report describes the status of compliance with each commitment and the work performed during calendar year 2019.

1.1 Investigations of the Relationship between Groundwater Production and Santa Ana River Discharge

Figure 1-1 is a map of the Chino Basin. Groundwater generally flows from the forebay regions in the north and east toward the Prado Basin, where rising groundwater becomes surface water in the Santa Ana River and its tributaries. Recent and past studies have provided insight into the influence of groundwater pumping in the southern end of the Chino Basin on the Safe Yield of the Basin and the groundwater pumping ability in this part of the Basin to control the discharge of rising groundwater to the Prado Basin and the Santa Ana River. Several studies, as discussed below, quantify the impacts of pumping at Chino Basin Desalter well field[1] in the southern Chino Basin on groundwater discharge to the Prado Basin and the Santa Ana River.

Desalter well fields were first described in *Nitrogen and TDS Studies, Upper Santa Ana Watershed* (James M. Montgomery, Consulting Engineers, Inc., 1991). This study matched desalter production to meet future potable demands in the lower Chino Basin through 2015. Well fields were sited to maximize the interception of rising groundwater discharge from the north and to induce streambed percolation in the Santa Ana River. The decrease in rising groundwater and increase in streambed infiltration were projected to account for 45 to 65 percent of total desalter pumping.

A design study for the Chino Basin Desalter well fields provided estimates of the volume of rising groundwater discharge intercepted by desalter production (Wildermuth, 1993). This study used a detailed model of the lower Chino Basin (a rectangular grid with 400-foot by 400-foot cells, covering the southern Chino Basin) to evaluate the hydraulic impacts of desalter production on rising groundwater discharge and groundwater levels at nearby wells. This study

[1] Chino Basin Desalter well field pumping is intended to the replace lost agricultural pumping in the southern Chino Basin to maintain the yield of the basin and prevent rising groundwater from the basin to the Santa Ana River. The 2000 OBMP indicated that agricultural pumping is projected to decrease 40,000 afy as land use transitioned to urban uses.

showed the relationship of intercepting rising groundwater discharge to well field locations and well pumping capacity. The fraction of total desalter well pumping composed of decreased rising groundwater discharge and increased streambed infiltration was estimated to range from 40 to 50 percent.

A subsequent analysis, consistent with the OBMP Implementation Plan and the Peace II Agreement, projected the increase in streambed infiltration to be about 20 percent of desalter pumping due to Watermaster's basin re-operation[2] plan alone (Wildermuth Environmental, Inc. [WEI], 2009d). This projection resulted from evaluating the Peace II Agreement project description through 2060 with the 2007 Chino Basin Model using then current and projected groundwater pumping at the Chino Basin Desalter wells.

In 2011, the Chino Basin Watermaster initiated the process to recalculate the safe yield, which included an update and recalibration of its groundwater model. The 2013 Chino Basin Model was used to conduct a detailed investigation on the state of the hydraulic control of rising groundwater discharge from the north, including: an estimation of the historical amounts of rising groundwater discharge to the Santa Ana River and Santa Ana River recharge for the period 1961 through 2011, and to project the discharge and recharge through 2050 (WEI, 2015c). The New Yield[3] from Santa Ana River recharge as estimated by the 2013 Chino Basin Model is 61 percent of desalter well production in fiscal year 2011 and levels off to about 49 percent of total future desalter well pumping through fiscal year 2030. This new yield induced by pumping at the desalter wells and basin re-operation is consistent with the planning estimates described in the previous studies.

These studies demonstrate that the yield of the Chino Basin is enhanced by increasing groundwater pumping in the southern portion of the Basin. These studies also indicated that the Chino Basin Desalter and re-operation, authorized in the Peace II Agreement and approved by the Court, will (i) capture groundwater flowing south from the forebay regions of the Chino Basin and (ii) reduce the outflow of high-salinity groundwater to the Santa Ana River, thereby providing greater protection of downstream beneficial uses.

1.2 The OBMP and the 2004 Basin Plan Amendment

The Chino Basin OBMP (WEI, 1999) was developed by Watermaster and the parties to the 1978 Chino Basin Judgment (Chino Basin Municipal Water District v. City of Chino et al.) pursuant to a February 19, 1998 court ruling. The OBMP maps a strategy that provides for the

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[2] Re-operation as defined in Peace II Agreement "means the controlled overdraft of the Basin by the managed withdrawal of groundwater Production for the Desalters and the potential increase in the cumulative un-replenished Production from 200,000 acre-feet authorized by paragraph 3 of the Engineering Appendix Exhibit I to the Judgement, to 600,000 acre-feet for the express purpose of securing and maintaining Hydraulic Control as a component of the Physical Solution."

[3] New Yield as defined in the Peace Agreement "means proven increases in yield in quantities greater than historical amounts from sources of supply including, but not limited to, […] operations of the Desalters […] and other management activities implemented and operational after June 1, 2000." The net Santa Ana River recharge in fiscal year 2000 is the baseline from which to measure New Yield from Santa Ana River recharge in all subsequent years.

enhanced yield of the Chino Basin and reliable water supplies for the development expected to occur within the Basin. The goals of the OBMP are to: enhance basin water supplies, protect and enhance water quality, enhance the management of the Basin, and equitably finance the OBMP. The OBMP Implementation Plan is the court-ordered governing document for achieving the goals defined in the OBMP. The OBMP Implementation Plan is a comprehensive, long-range water management plan for the Chino Basin and includes the use of recycled water for direct reuse and artificial recharge. It also includes the capture of increased quantities of high-quality storm water, the recharge of imported water when its total dissolved solids (TDS) concentrations are low, improving the water supply by desalting poor-quality groundwater, supporting regulatory efforts to improve water quality in the Basin, and the implementation of management activities that will result in the reduced outflow of high-TDS/high-nitrate groundwater to the Santa Ana River and the Orange County Basin, thus ensuring the protection of downstream beneficial uses and water quality.

The 1995 Basin Plan contained restrictions on the use of recycled water for irrigation and groundwater recharge. In particular, it contained TDS objectives ranging from 220 to 330 milligrams per liter (mgl) over a significant portion of the Basin. The ambient TDS concentrations in these areas exceeded the objectives, which meant that no assimilative capacity existed for the discharge or recharge of high-TDS water sources over the Basin. Therefore, the use of the IEUA's recycled water (which had a TDS concentration of about 490 mgl at the time) for irrigation and groundwater recharge—one of the key elements of the OBMP Implementation Plan—would require mitigation even though recycled water reuse would not materially impact future TDS concentrations or impair the beneficial uses of Chino Basin groundwater.

In 1995, in part because of these considerations, the Regional Board initiated a collaborative study with 22 water supply and wastewater agencies, including Watermaster and the IEUA, to devise a new TDS and nitrogen management plan for the Santa Ana Watershed. This study culminated in the Regional Board's adoption of a Basin Plan amendment in January 2004 (Regional Board, 2004). This amendment included revised groundwater subbasin boundaries, termed "groundwater management zones" (GMZs), revised TDS and nitrate (as nitrogen, hereafter referred to as nitrate) objectives for groundwater, revised TDS and nitrogen wasteload allocations, revised surface water reach designations, and revised TDS and nitrogen objectives and beneficial uses for specific surface waters. The technical work supporting the 2004 Basin Plan amendment was directed by the TIN/TDS Task Force and is summarized in *TIN/TDS Phase 2A: Tasks 1 through 5, TIN/TDS Study of the Santa Ana Watershed* (WEI, 2000).

The new TDS and nitrate objectives for the GMZs in the Santa Ana River Basin were established to ensure that water quality is maintained pursuant to the State's antidegradation policy (State Board Resolution No. 68-16). These objectives were termed "antidegradation" objectives. Figure 1-1 shows the antidegradation objectives for the five Chino Basin GMZs[4]: Chino-1, Chino-2, Chino-3, Chino-East, and Chino-South. Note that the antidegradation TDS objectives for Chino-1, Chino-2, and Chino-3 are low (250 to 280 mgl) and would restrict recycled water reuse and artificial recharge, as well as the recharge of imported water when its TDS concentration is above the objectives, without mitigation. Figure 1-2 is a cumulative distribution plot that shows the percent of time that the TDS concentration of State Water

[4] Note that the Prado Basin Management Zone is regulated by the Regional Board as a surface water management zone and does not have groundwater objectives assigned.

Project (SWP) water at Silverwood Lake[5] has been less than or equal to the TDS antidegradation objectives for these three GMZs based on the observed TDS concentrations from 1980 through 2019, a period of 40 years. The TDS concentrations of SWP water were less than the antidegradation objectives in the Chino-1, -2, and -3 GMZs about 67, 53, and 58 percent of the time, respectively.

To address this issue, Watermaster and the IEUA proposed, and the Regional Board accepted, alternative "maximum benefit" objectives for a new GMZ, the Chino-North GMZ (Chino-North), that combined Chino-1, Chino-2 and Chino-3 into one single management unit, as shown in Figure 1-1. All of the recharge activities that would occur as part of the OBMP Implementation Plan are within Chino-North. The TDS and nitrate maximum-benefit objectives established for Chino-North are 420 and 5 mgl, respectively. The maximum-benefit TDS objective was higher than the then-current ambient TDS concentration of 300 mgl, thus creating 120 mgl of assimilative capacity for TDS and allowing for recycled water reuse and recharge, and imported water recharge, without mitigation. Under the maximum benefit program, the TDS concentration of SWP water is projected be less than the 420 mgl maximum-benefit objective 99 percent of the time, as shown in Figure 1-2.

The maximum-benefit objectives were established based on demonstrations by Watermaster and the IEUA that the antidegradation requirements were satisfied. First, they demonstrated that beneficial uses would continue to be protected. Second, they showed that water quality consistent with maximum benefit to the people of the State of California would be maintained. Other factors—such as economics, the need to use recycled water, and the need to develop housing in the area—were also taken into account in establishing the maximum-benefit objectives.

1.3 Maximum Benefit Implementation Plan for Salt Management: Maximum-Benefit Commitments

The application of the maximum-benefit objectives is contingent upon the implementation of specific projects and programs by Watermaster and the IEUA. These projects and programs, termed the "Chino Basin maximum-benefit commitments," are described in the Maximum Benefit Implementation Plan for Salt Management in Chapter 5 of the Basin Plan and are listed in Table 5-8a therein (Regional Board, 2008). These commitments include:

1. The implementation of a surface-water monitoring program.
2. The implementation of a groundwater monitoring program.
3. The expansion of the Chino-I Desalter to 10 million gallons per day (mgd) and the construction of the Chino-II Desalter with a design capacity of 10 mgd.
4. The additional expansion of desalter capacity (20 mgd) pursuant to the OBMP and the Peace Agreement (tied to the IEUA's agency-wide effluent concentration).

[5] Silverwood Lake in the San Bernardino Mountains is a reservoir on the east branch of the SWP that supplies the IEUA region with SWP water deliveries from the Metropolitan Water District of Southern California (MWD) via the Devil Canyon Power Plant Afterbay and Upper Feeder Pipeline.

5. The completion of the recharge facilities included in the Chino Basin Facilities Improvement Program.
6. The management of recycled water quality to ensure that the IEUA agency-wide, 12-month running average wastewater effluent quality does not exceed 550 mgl and 8 mgl for TDS and total inorganic nitrogen (TIN), respectively.
7. The management of basin-wide, volume-weighted TDS and nitrogen concentrations in artificial recharge to less than or equal to the maximum-benefit objectives.
8. The achievement and maintenance of the "hydraulic control" of groundwater outflow from the Chino Basin, specifically from Chino-North, to protect Santa Ana River water quality and downstream beneficial uses.
9. The determination of ambient TDS and nitrate concentrations of Chino Basin groundwater every three years.

If these maximum-benefit commitments are not met, the antidegradation objectives would apply for regulatory purposes. The application of the antidegradation objectives would result in no assimilative capacity for TDS and nitrate in the Chino-1, Chino-2, and Chino-3 GMZs, and the Regional Board would require mitigation for both recycled water and imported SWP water discharges to Chino-North that exceed the antidegradation objectives. Furthermore, the Regional Board would require that Watermaster and the IEUA mitigate the effects of discharges of recycled and imported SWP water that took place in excess of the antidegradation objectives under the maximum-benefit objectives retroactively to January 2004. The mitigation for past discharges would be required to be completed within a ten-year period following the Regional Board's finding that the maximum-benefit commitments were not met.

1.4 Purpose and Report Organization

This report describes the status of compliance with the maximum-benefit commitments listed above and is organized as follows:

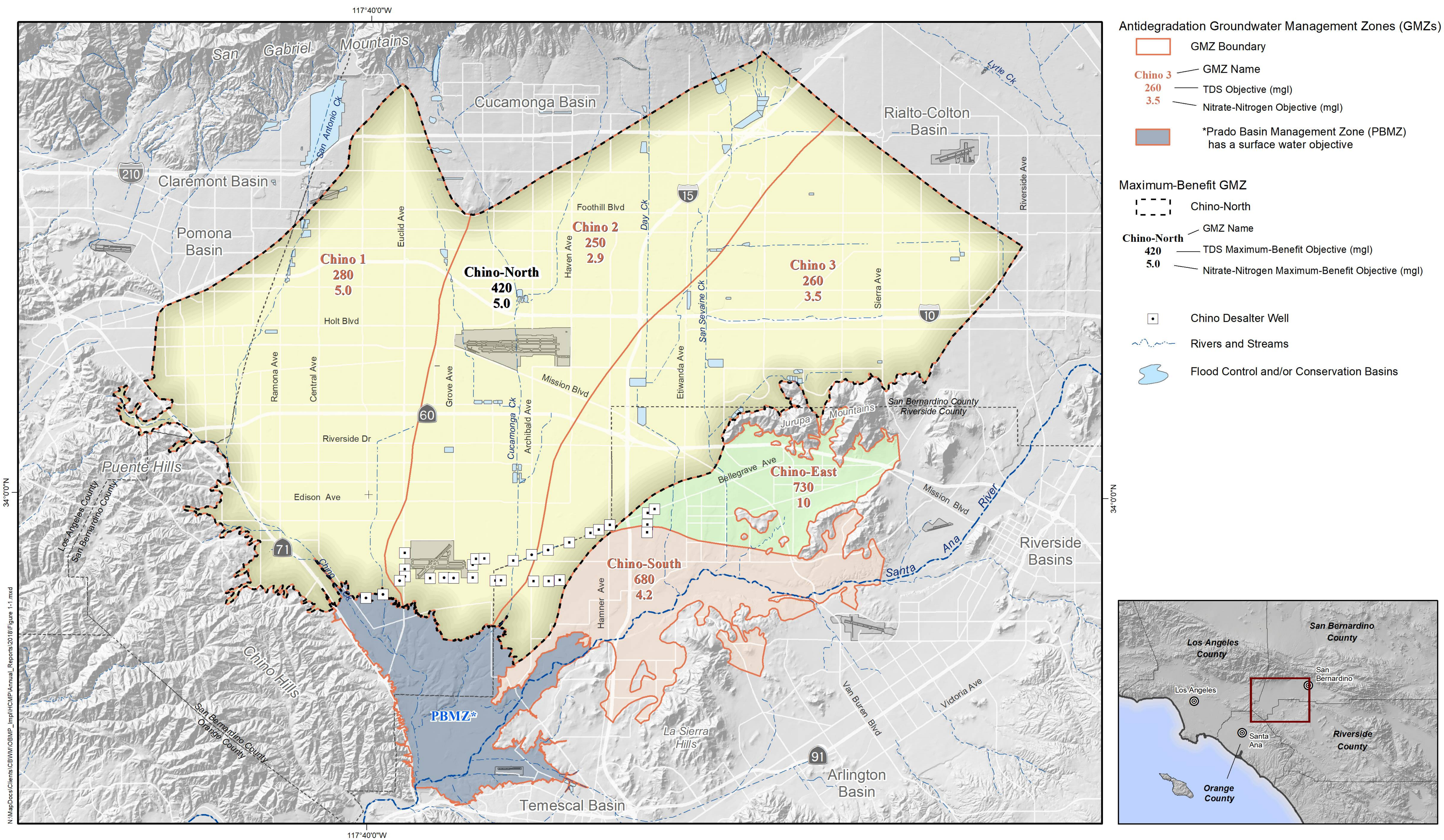
Section 1 – Introduction: This section provides context and background regarding the development of the maximum-benefit objectives and the associated maximum-benefit commitments for the Chino Basin.

Section 2 – Maximum-Benefit Commitment Compliance: Section 2 describes the status of compliance with each of the maximum-benefit commitments.

Section 3 – Data Collected in 2019: Section 3 describes the data collected in 2019 as part of the maximum benefit monitoring program.

Section 4 – The Influence of Rising Groundwater on the Santa Ana River: Section 4 characterizes the influence of rising groundwater on the flow and quality of the Santa Ana River between the Riverside Narrows and Prado Dam.

Section 5 – References: Section 5 provides the references consulted in performing the analyses described herein and in writing this report.



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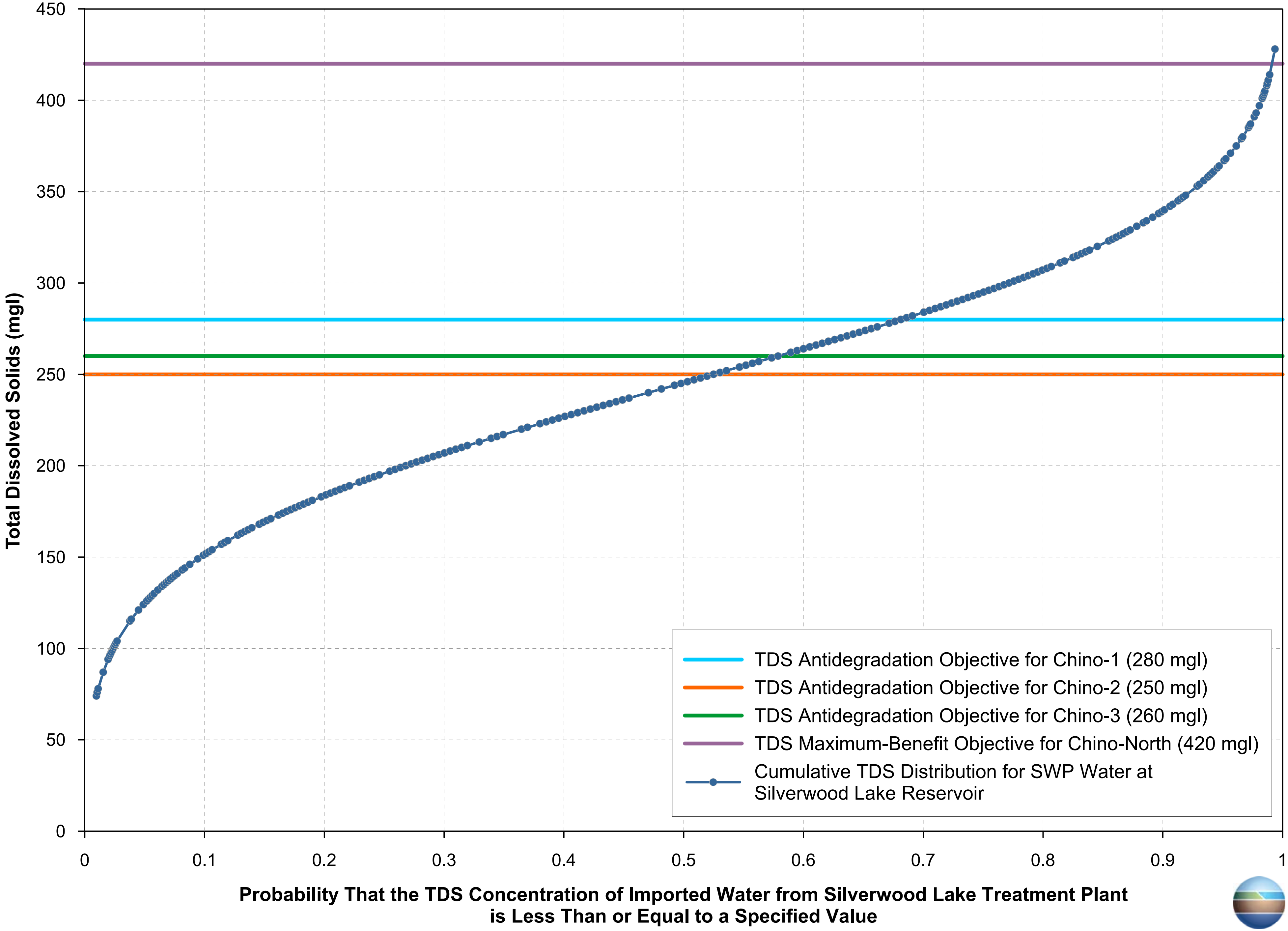
2019 Maximum Benefit Annual Report

Chino Basin Management Zones

Antidegradation & Maximum-Benefit Objectives for TDS and Nitrate-Nitrogen

Figure 1-1

Figure 1-2
Cumulative Distribution of State Water Project TDS Concentrations at Silverwood Lake Reservior
1980 to 2019



Section 2 – Maximum-Benefit Commitment Compliance

Table 2-1 lists the status of compliance for each of the nine maximum-benefit commitments outlined in the Maximum Benefit Implementation Plan for Salt Management in Chapter 5 of the Basin Plan (Regional Board, 2008) as of December 31, 2019. A discussion of ongoing activities related to commitment compliance is provided below. For this discussion, the commitments are grouped together into four main topics: hydraulic control, Chino Basin Desalters, recycled water recharge, and the recomputation of ambient groundwater quality.

2.1 Hydraulic Control

The Regional Board requires that Watermaster and the IEUA achieve and maintain "hydraulic control" of groundwater outflow from Chino-North (Commitment number 8). The Basin Plan defines hydraulic control as: "[…] eliminating groundwater discharge from the Chino Basin to the Santa Ana River, or controlling the discharge to *de minimis* levels […]." In practice, Watermaster and the IEUA use a more measurable definition of hydraulic control: eliminating groundwater discharge from Chino-North to the Prado Basin Management Zone (PBMZ) or controlling the discharge to *de minimis* levels. In a letter from the Regional Board to Watermaster and the IEUA, dated October 12, 2011, the Regional Board defined the *de minimis* discharge of groundwater from Chino-North to the PBMZ as less than 1,000 acre-feet per year (afy). (Regional Board, 2011).

2.1.1 Hydraulic Control Monitoring Program

The surface-water and groundwater monitoring programs (Commitments number 1 and number 2) were required, in part[6], to collect the data necessary to determine the state of hydraulic control and were thus referred to collectively as the Hydraulic Control Monitoring Program (HCMP). In May 2004, Watermaster and the IEUA submitted a surface-water and groundwater monitoring program work plan to the Regional Board entitled: *Final Hydraulic Control Monitoring Program Work Plan for the Optimum Basin Management Program* (Work Plan [WEI, 2004b]). The Regional Board adopted Resolution R8-2005-0064, approving the Work Plan, and required Watermaster and the IEUA to implement the HCMP.

The concept of using multiple lines of evidence was included in the initial design of the HCMP because it was unclear whether one line of evidence would clearly demonstrate hydraulic control. The multiple lines of evidence were:

- Collect and analyze groundwater-elevation data to determine the direction of groundwater flow in the southern part of the Chino Basin and whether pumping at the Chino Basin Desalter well fields is completely capturing all groundwater that would otherwise discharge out of Chino-North and into the PBMZ.
- Collect and analyze the chemistry of basin-wide groundwater and the Santa Ana River to (i) track the migration, or lack thereof, of the South Archibald volatile organic compound (VOC) plume beyond the Chino Basin Desalter well fields, and

[6] The groundwater monitoring program also supports the recomputation of ambient water quality and a number of Watermaster's OBMP activities.

(ii) identify the source of groundwater in the area of the Chino Basin between the Santa Ana River and the Chino Basin Desalter well fields.

- Collect and analyze surface-water quality data and surface-water discharge measurements to determine if groundwater from the Chino Basin is rising as surface water and contributing to flow in the Santa Ana River or if the River is recharging the Basin.
- Use Watermaster's numerical groundwater-flow model to corroborate the results and interpretations of the first three lines of evidence.

Watermaster and the IEUA executed this surface-water and groundwater-monitoring program pursuant to the Work Plan from 2004 through 2011 and concluded that (i) hydraulic control had been achieved to the east of Chino-I Desalter Well 5, (ii) hydraulic control had not been achieved to the west of Chino-I Desalter Well 5, and (iii) the impact of rising groundwater discharge from Chino-North on surface-water quality in the Santa Ana River at Prado Dam has been *de minimis* (WEI, 2007b; 2008b; 2009a; 2010; 2011a; and 2012b). In 2010, the Chino Basin Desalter Authority[7] (CDA) began construction of the Chino Creek Well Field (CCWF), which was designed to achieve hydraulic control to the west of Chino-I Desalter Well 5 (see also: Section 2.1.3 and Figure 2-1).Watermaster and the IEUA also concluded that the data collected as part of the surface-water monitoring program were not necessary to determine the state of hydraulic control and began the process of modifying the surface-water and groundwater-monitoring program and maximum-benefit commitments accordingly (WEI 2011a and 2012b).

On February 10, 2012, the Regional Board adopted an amendment to the Basin Plan to remove all references to specific monitoring locations and sampling frequencies for the groundwater and surface-water monitoring programs and, in their place, required that Watermaster and the IEUA submit (i) an updated surface-water monitoring program by February 25, 2012 and (ii) a revised groundwater monitoring program and schedule for achieving hydraulic control by December 31, 2013. Pursuant to (i), Watermaster and the IEUA submitted the *2012 Hydraulic Control Monitoring Program Work Plan* (2012 Work Plan) to the Regional Board on February 25, 2012 (WEI, 2012a). The 2012 Work Plan was adopted by the Regional Board on March 16, 2012 (Regional Board, 2012).[8] Pursuant to (ii), Watermaster and the IEUA submitted the *2014 Maximum Benefit Monitoring Work Plan* (2014 Work Plan) to the Regional Board on December 23, 2013 (WEI, 2013c).[9] The 2014 Work Plan was approved by the Regional Board on April 25, 2014 (Regional Board, 2014b).

Each year, the data collected pursuant to the 2014 Work Plan is summarized and included in the Chino Basin Maximum Benefit Annual Report (see Section 3 of this report).

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[7] www.chinodesalter.org

[8] The 2012 Basin Plan amendment was approved by the Office of Administrative Law on December 6, 2012, and at that time, the revised surface-water monitoring program (2012 Work Plan) was implemented.

[9] The name was changed from the Hydraulic Control Monitoring Program Work Plan to the Maximum Benefit Monitoring Program Work Plan to clarify that the 2014 Work Plan (and its predecessor) contains the monitoring and data collection strategy for complying with both the maximum-benefit monitoring directives of demonstrating hydraulic control and computing ambient water quality.

2.1.2 Hydraulic Control Monitoring Program Objectives and Methods

Based on the data collection and analyses performed to date, the ongoing questions to be answered by the HCMP are:

1. Will hydraulic control of groundwater from Chino-North be maintained east of Chino-I Desalter Well 5?
2. Will the CCWF continue to reduce groundwater discharge from Chino-North to the PBMZ past the desalter well field west of Chino-I Desalter Well 5 to the *de minimis* threshold of 1,000 afy or less?
3. Will the impact of groundwater discharge from Chino-North to the PBMZ that becomes rising groundwater on the surface-water quality in the Santa Ana River remain *de minimis*?

Watermaster and the IEUA use the following methods to answer these questions:

Method to Address Question 1. The groundwater level monitoring program and periodic groundwater modeling will continue to be used to define the capture zone created by the Chino Basin Desalter well field east of Chino-I Desalter Well 5. These methods will be sufficient to demonstrate hydraulic control in this area in the future.

Watermaster prepares a State of the Basin (SOB) Report every two years (see WEI, 2019a for example). The SOB Report includes a spring groundwater-elevation contour map of the southern portion of Chino Basin, showing the capture zone of the Chino Basin Desalter well field, and a characterization of the state of hydraulic control based on the groundwater-elevation contours. The most up-to-date hydraulic control findings in the SOB Report will be referenced each year in the Chino Basin Maximum Benefit Annual Report (see Section 2.1.3 of this report).

Watermaster recalibrates and runs its groundwater-flow model at least every five years to assess the physical impacts of the implementation of the OBMP and Peace II Agreement, the state of hydraulic control, the balance of recharge and discharge, the cumulative impact of water rights transfers among the parties, and to recalculate safe yield. The most up-to-date modeling assessment of the then-current and projected state of hydraulic control will be referenced each year in the Maximum Benefit Annual Report (see Section 2.1.3 of this report).

Method to Address Question 2. The 2013 Chino Basin Model estimated that the amount of groundwater discharge from Chino-North to the PBMZ in the absence of the CCWF has been about 2,400 afy (WEI, 2014a). The model was used to estimate the discharge once the CCWF wells are in operation. The results indicated that with planned production at the CCWF (1,529 afy), the groundwater discharge from Chino-North to the PBMZ would decrease to about 900 afy by 2016, which is less than the *de minimis* threshold.

At least every five years, historical production and groundwater-level data for the CCWF and other wells will be used to recalibrate the Chino Basin Model. The model will be used to calculate annual groundwater discharge past the CCWF since the start of CCWF operations and to estimate future groundwater discharge past the CCWF based on projected groundwater pumping in the Basin. The most up-to-date modeling assessment of the then-current and projected groundwater discharge past the CCWF will be referenced each year in the Maximum Benefit Annual Report (see Section 2.1.4 of this report).

Method to Address Question 3. The HCMP has shown that the historical and current impacts of groundwater discharge from Chino-North to the PBMZ that becomes rising groundwater on the surface-water quality of the Santa Ana River at Prado Dam is *de minimis*. Groundwater modeling shows that pumping at the CCWF will further decrease the volume of groundwater discharge from Chino-North that becomes rising groundwater in the PBMZ and thereby further reduces the impact on Santa Ana River water quality.

A 2015 mass-balance analysis estimated the impact of groundwater discharge from Chino-North to the PBMZ through the CCWF on the volume-weighted TDS concentration of the Santa Ana River at Prado Dam. The mass-balance analysis estimated that rising groundwater from Chino-North on the TDS concentration of the Santa Ana River at Prado Dam without the CCWF would increase the TDS concentration of the River by approximately 8 mgl (one and a half percent increase) relative to full hydraulic control in this area. The operation of the CCWF to the *de minimis* threshold reduces the impact to a 4 mgl increase (a half percent increase) relative to full hydraulic control (WEI, 2016).

Continued analysis of Santa Ana River flow and quality at Below Prado Dam will help determine the nature of the impact of groundwater discharge from Chino-North that becomes rising groundwater in the PBMZ. The impact of groundwater discharge from Chino-North to the PBMZ on Reach 2 of the Santa Ana River will be characterized each year in the Chino Basin Maximum Benefit Annual Report (see Section 4 of this report).

2.1.3 Current Status of Hydraulic Control

Watermaster and the IEUA demonstrated in previous Annual Reports (WEI, 2007b; 2008b; 2009a; 2010; 2011a; 2012b; 2013a; 2014b; 2015a; and 2016) that complete hydraulic control has been achieved at and east of Chino-I Desalter Well 5. For the area west of Chino-I Desalter Well 5, the operation of the CCWF is intended to achieve hydraulic control to *de minimis* levels (<1,000 afy). In February 2016, the CCWF commenced full-scale operation with production at wells I-16, I-17, I-20, and I-21 and, by definition, hydraulic control was determined to have been achieved in this area. In 2019, the CCWF wells produced a total of about 1,227 af. Production at the CCWF has decreased as a result of the new maximum contaminant level (MCL) for 1,2,3-TCP, resulting in the CDA temporarily shutting the down operation of CCWF Well I-17.

Figure 2-1 shows the most current characterization of the state of hydraulic control based on groundwater-elevation contours for spring 2018 from the 2018 SOB Report (WEI, 2019a). The spring 2018 groundwater-elevation contours show a regional depression in groundwater elevation at and east of Chino-I Desalter well I-20, demonstrating that groundwater flowing from Chino-North to the PBMZ is being captured by the desalter wells in this area.

2.1.4 Future Projection of Hydraulic Control

In a letter dated January 23, 2014, the Regional Board required that Watermaster and the IEUA submit a plan detailing how hydraulic control will be sustained in the future as agricultural pumping in the southern region of Chino-North continues to decrease and how the Chino Basin Desalters will achieve the required total groundwater production level of 40,000 afy. Watermaster and the IEUA coordinated with the CDA to develop a plan to achieve 40,000 afy of desalter well pumping and submitted a final plan to the Regional Board on June 30, 2015 (Watermaster & IEUA, 2015). The plan includes the construction and operation of three new wells (II-10, II-11, and II-12) for the Chino-II Desalter. Two of the three wells began operation in the second half of 2018, and the third is anticipated to begin operating in 2021 (refer to Figure 2-4 and Section 2.2 of this Report for more details).

In 2019, Watermaster began its five-year update and recalibration of the Chino Basin Model to recalculate Safe Yield of the Chino Basin. As part of the 2020 Safe Yield recalculation, the future state of hydraulic control was estimated using the updated Chino Basin Model. A planning scenario was developed to recalculate Safe Yield based on the recent planning work reported in the *2018 Storage Framework Investigation* (WEI, 2019b) and the *2020 Storage Management Plan* (WEI, 2020). This scenario, referred to herein as 2020 SYR1 is based on the water demands and water supply plans provided by the Watermaster Parties, planning hydrology that incorporates climate change impacts on precipitation and evapotranspiration (ET), and assumptions regarding cultural conditions and future groundwater replenishment. The projected state of hydraulic control was estimated with the Chino Basin Model by simulating the Chino Basin's response to the 2020 SYR1 scenario. The attainment of hydraulic control is assessed using model-predicted groundwater elevation data to evaluate whether all groundwater north of the desalter well fields is captured by the Chino Basin Desalter well fields (total hydraulic containment standard) or that groundwater discharge through the Chino Basin Desalter well fields is, in aggregate, less than 1,000 afy (*de minimis* standard).

Figure 2-2 shows the model-projected state of hydraulic control in 2030 for the 2020 SYR1 scenario. The figure includes groundwater-elevation contours for model layer 1 and groundwater flow vectors projected for July 2030. The groundwater elevations and directional flow vectors show full hydraulic containment of the Chino-North groundwater at and east of Chino-I Well I-20, and groundwater discharge from the Chino-North to the PBMZ and Santa Ana River is projected to not be fully contained by the Chino Basin Desalter well field west of Well I-20.

The volume of groundwater discharge to the west of Well I-20 was estimated through the analysis of model projected discharges across a "line of control" approximately perpendicular to the groundwater flow direction past the CCWF well field area. Figure 2-2 shows the location of the line of control. Figure 2-3 is a time-history chart that shows the historical and projected volume of groundwater discharge across the line of control (2004 to 2050). Over this period, the groundwater discharge across the line of control ranges 380 to 740 afy, averages 490 afy, and is always less than the *de minimis* discharge threshold of 1,000 afy. The groundwater discharge in 2019 was approximately 520 af. Additionally, as shown in Figure 2-2, there are several private pumping wells downgradient of the line of control that further reduce rising groundwater outflow to the PBMZ.

2.2 Chino Basin Desalters

The operation of the Chino Basin Desalters is fundamental to the maximum benefit requirement of achieving hydraulic control to protect the water quality of the Santa Ana River as well as maximizing the yield of the Chino Basin and minimizing the loss of stored water. The first Chino Basin Desalter, Chino-I, began operation in late 2000 and had an original design capacity of 8 mgd (8,960 afy). Commitment number 3 required the expansion of Chino-I Desalter and the construction of Chino-II Desalter. In 2005, the Chino-I Desalter was expanded to a capacity of 14 mgd (15,680 afy), and a contract was awarded for the construction of the Chino-II Desalter. The Chino-II Desalter came online in June 2006 with a capacity of 15 mgd (16,800 afy), bringing the total Chino Basin Desalter capacity to 29 mgd (32,480 afy). As articulated in the OBMP Implementation Plan, the Peace Agreement, and the 2007 Peace II Agreement, Watermaster and the IEUA are required to expand desalter well pumping to about 40,000 afy. Commitment number 4 requires the submittal of plans to construct additional wells and facilities as needed to achieve hydraulic control and ultimately to achieve the ultimate capacity defined in the OBMP Implementation Plan.

The CCWF wells (I-16, I-17, I-18, I-20, and I-21) were constructed between September 2011 and May 2012[10] in the southwestern portion of the Chino Basin to achieve hydraulic control to the west of Well I-5 (see Section 2.1.1). The well locations are shown in Figure 2-4. Pumping at CCWF Wells I-16 and I-17 commenced in mid-2014. Pumping at CCWF Wells I-20 and I-21 commenced in February 2016. The combined pumping capacity of these four wells is about 1,529 afy (1.4 mgd). Due to the presence of VOCs, the CDA does not have plans to produce at Well I-18 for the Chino-I Desalter system.

The final expansion plan to achieve the 40,000 afy of production is to construct and operate three new wells for the Chino-II Desalter (Wells II-10, II-11, and II-12)—the locations[11] for which are shown in Figure 2-4. Due to the proximity of these wells to the South Archibald trichloroethene (TCE) plume, the CDA is collaborating with identified parties to integrate these wells into a remedial solution to address groundwater cleanup while maintaining hydraulic control[12]. The plan and schedule to construct the final three wells was submitted to the Regional Board on June 30, 2015 (Watermaster & IEUA, 2015). The plan includes the construction of a dedicated pipeline to convey groundwater produced from these wells to the Desalter II treatment facility which will remove VOCs via air stripping.

The construction of Wells II-10 and II-11 was completed in September 2015. In 2018, equipping of these wells was completed, and pumping initiated in July 2018 and September 2018 at Wells II-11 and II-10, respectively. The land acquisition process for Well II-12 and the construction of a nearby monitoring well were completed in 2019. The construction of the dedicated raw water pipeline to deliver the water from the three wells to the Chino-II Desalter is underway, and construction of Well II-12 is expected to begin in mid-2020. Pumping at the final well is anticipated to begin in 2021.

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[10] Proposed CCWF Well I-19 was not constructed because the projected pumping estimates during borehole testing were too low to warrant construction.

[11] Note that the Well II-12 location is a proposed location.

[12] In June 2013, the CDA entered into a Memorandum of Understanding with CDA Sponsor Agencies (Western Municipal Water District, City of Ontario, and Jurupa Community Service District), the IEUA, and the City of Upland, regarding the South Archibald TCE Plume cleanup. The CDA is working with this group and the "Airport Parties" (former industrial companies on the Ontario Airport property and the United States Army and Air Force) to find a mutually agreeable and beneficial solution to mitigate the TCE contamination.

Figure 2-4 shows the location of the existing and planned Chino Basin Desalter wells and the total annual pumping at the Desalter wells since 2000. In 2019, total pumping by the Chino Basin Desalter wells was 32,332 af. Over the last 19 years, the Chino Basin Desalters have treated about 457,553 af of high-TDS/nitrate water averaging about 22,900 afy. Also shown in the time history chart in Figure 2-4 is the cumulative export of TDS and nitrate mass to the brine line (in tons) that has resulted from pumping and treatment at the Chino Basin Desalter facilities. From 2001 to 2019, the Desalters have exported about 298,000 tons of TDS and 17,600 tons of nitrate from the Chino Basin.

As previously noted in Section 2.1.3, CCWF Well I-17 is temporarily offline due to the detection of 1,2,3-TCP at levels that exceed the new CA Primary MCL. Additionally, Chino-I Desalter Wells I-1, I-2 and I-3 were also taken out of service from 2018 through 2019 due to the detection of 1,2,3-TCP at levels that exceed the MCL.

2.3 Recycled Water Recharge and Quality

2.3.1 Recycled Water Recharge

The recharge of recycled water, imported water, and storm water is an integral part of the OBMP Implementation Plan, and is necessary to maximize the use of the water resources of the Chino Basin. The IEUA, Watermaster, Chino Basin Water Conservation District, and San Bernardino County Flood Control District are partners in the implementation of the Chino Basin Recycled Water Groundwater Recharge Program. The IEUA manages the recharge program and performs recycled water recharge operations pursuant to Regional Board Orders R8-2007-0039 and R8-2009-0057. As required by these orders, the IEUA and Watermaster submit quarterly and annual reports to the Regional Board on the Chino Basin recycled water recharge activities. Figure 2-5 is a map of existing facilities in the Chino Basin used for imported water, storm water, and recycled water recharge. Table 2-2 summarizes the total annual recharge, by water type, from July 2005 (commencement of recycled water recharge activities) through 2019. Since July 2005, about 181,500 af of imported water, 145,300 af of storm water, and 127,400 af of recycled water have been recharged to the Chino Basin.

Commitment number 7 requires that the use of recycled water for artificial recharge be limited to the amount that can be blended on a volume-weighted basis with other sources of recharge to achieve five-year running-average concentrations of no more than the maximum-benefit objectives (420 mgl for TDS and 5 mgl for nitrate). Recycled water recharge began in July 2005; thus, the first five-year period for which the metric was computed was July 2005 through June 2010. This metric is computed on a monthly basis. Table 2-3 summarizes the five-year running-average volume-weighted TDS and nitrate concentrations of the combined recharge sources. The monthly recharge and water-quality data used to compute the five-year running-average TDS and nitrate metrics are plotted in Figures 2-6a and 2-6b, respectively. A table of the monthly data used to compute these metrics, by recharge source, has been included as Appendix A to this report.

The five-year running-average, volume-weighted TDS and nitrate concentrations have not exceeded the maximum-benefit objectives for TDS or nitrate. Since June 2010, the five-year running average, volume-weighted TDS concentrations ranged from 203 mgl to 354 mgl and averaged around 264 mgl and is 262 mgl as of December 2019. Nitrate ranged from 1 mgl to about 3 mgl and averaged around 1.9 mgl, and 1.7 mgl as of December 2019. The maximum TDS and nitrate concentrations were observed in September 2016 when the preceding five-year period had almost no imported water recharge.

Prior to 2016, the TDS concentration metric was increasing monotonically at a rate of about 1.3 mgl per month, primarily driven by the increasing proportion of recycled water recharge relative to imported and storm waters. Between May and September 2016, that rate increased to about 12 mgl per month, reflecting the loss of the last significant period of imported water recharge (May and September of 2011) from the 5-year period used for the metric calculation. The TDS concentration metric began to decrease and stabilize due to imported water recharge that occurred from October 2016 through January 2018. Additionally, imported water recharge that occurred from March 2019 through December 2019 decreased and stabilized the TDS concentration metric throughout 2019. A similar trend was observed for the nitrate concentration metric, as shown in Figure 2-6b. These observations demonstrate the importance of imported water recharge to complying with the long-term TDS metric contained in the maximum benefit commitments.

2.3.2 Recycled Water Quality

As described in the Basin Plan, the IEUA wastewater effluent TDS and TIN permit limits are an important component of the maximum benefit demonstration and provide a controlling point for the management of TDS and nitrate concentrations in the Chino Basin. The TDS and TIN permit limits for the IEUA agency-wide effluent (a volume-weighted average for all IEUA wastewater treatment facilities) are 550 mgl and 8 mgl, respectively, based on a 12-month running average. Commitment number 6 requires that the IEUA submit a plan and schedule to the Regional Board for the implementation of measures to ensure that the 12-month running-average of the IEUA agency-wide effluent concentration does not exceed these permit limits when either the 12-month running-average IEUA agency-wide effluent TDS concentration exceeds 545 mgl for three consecutive months, or the TIN concentration exceeds 8 mgl in any one month. The plan must be submitted within 60 days of a finding that one of these trigger limits has been exceeded. The plan and schedule must be implemented upon Regional Board approval. The 12-month running-average IEUA agency-wide effluent water quality is reported by the IEUA in the Groundwater Recharge Program Quarterly Monitoring Reports.

Table 2-4 and Figure 2-7 show the monthly and 12-month running-average IEUA agency-wide effluent TDS and TIN concentrations for 2005 through 2019. Since the initiation of recycled water recharge in July 2005, the 12-month running average IEUA agency-wide TDS and TIN[13] concentrations have never exceeded the triggers and have ranged between 456 and 534 mgl and 4.4 and 7.6 mgl, respectively. During 2019, the 12-month running average IEUA agency-wide

[13] The Agency-wide 12-month running average TIN limit in the NPDES permit was decreased from 10 mgl to 8 mgl, effective July 8, 2006. This decreased limit was anticipated; therefore, secondary treatment at all facilities was optimized to attain lower TIN. The 12-Month Running Average TIN has not been above the limit of 8 mgl since the recycled water recharge program began in July 2005.

TDS and TIN concentrations ranged between 471 and 490 mgl and 4.4 and 5.1 mgl, respectively.

During 2015, a historical-high 12-month running-average IEUA agency-wide effluent TDS concentration of 534 mgl was calculated for three consecutive months in June, July and August. This 12-month running-average IEUA agency-wide effluent TDS concentration of 534 mgl was only 11 mgl below the trigger threshold in Commitment number 6 to prepare a plan and schedule to ensure that the 12-month running-average IEUA agency-wide wastewater effluent TDS concentration does not exceed the permit limit of 550 mgl.

The TDS concentration of the effluent is influenced by the volume and TDS concentration of the water supplies served tributary to the IEUA's treatment plants. To demonstrate this, Figure 2-8 shows the monthly and 12-month, running-average IEUA agency-wide effluent TDS concentration plotted with: the monthly TDS concentrations of SWP water from Silverwood Lake,[14] the monthly volume-weighted TDS concentrations of the combined water supplies served in the area tributary to the IEUA's treatment plants (including SWP water), the volume of water supply served in the area tributary to IEUA's treatment plants that is SWP water, and the volume of water supply served in the area tributary to IEUA's treatment plants that is from local sources (groundwater and surface water). Note that:

- From 2012 through early 2016, the SWP water seasonal-high TDS concentrations continuously increased due to the statewide drought conditions that began in 2012. This increase correlates to the increase of the monthly combined water supply's TDS concentration and the monthly and 12-month, running-average IEUA agency-wide effluent TDS concentrations.

- The increase in the combined monthly water supply's TDS concentration is less than the increase in monthly SWP water TDS concentrations because it also includes local water supplies with lower-TDS concentrations.

- In 2015, the proportion of the total water supply that is SWP water decreased, reducing the effect of the increasing TDS concentration of SWP water on the volume-weighted TDS concentration of the total water supply.

- In 2016 and 2017, the TDS concentration of SWP water decreased due to wet-winter conditions in northern California. This also increased the availability of the SWP water supply, which resulted in a decreasing trend of the 12-month running-average IEUA agency-wide effluent TDS concentration through mid-2017.

- In 2019, the wet-winter condition in California decreased both the TDS concentrations of SWP water and the combined water supply, which resulted in a decreasing trend of the 12-month running-average IEUA agency-wide effluent TDS concentration through 2019.

The relationships of the TDS concentrations plotted in Figure 2-8 indicate that the increase in the TDS concentration of SWP water during the drought contributed in part to the increase in

[14] Source of imported SWP water to IEUA agencies.

the TDS concentration of the IEUA's agency-wide effluent. The increasing trend in the TDS concentrations of effluent is not solely explained by the TDS concentrations plotted in Figure 2-8, and there are likely other factors contributing to the increase, as suggested by the difference in the magnitude of increase between the monthly water supply TDS concentrations (about 70 mgl) and monthly IEUA agency-wide effluent TDS concentrations (about 120 mgl) for the 2012 to 2016 period.

Another likely cause of the increase in the effluent TDS concentration is the incorporation of the water conservation practices required by the State of California during the drought. Water conservation practices in 2015 and 2016 are evident in the decreased volume of total water supply plotted in Figure 2-8. The observed water quality and water use trends suggest that drought conditions have a meaningful impact on the TDS concentrations of the water supply and recycled water and that future droughts similar to the 2012 to 2016 period could lead to short-term exceedances of the 12-month running-average IEUA agency-wide effluent TDS concentration. For this reason, Watermaster and the IEUA petitioned the Regional Board to modify the TDS compliance metric for recycled water to a longer-term averaging period. The Regional Board agreed that an evaluation of the compliance metric is warranted and directed Watermaster and the IEUA to develop a technical scope of work to support the adoption of a longer-term averaging period. This scope of work was submitted to the Regional Board in 2017 and includes the following tasks:

- Develop numerical modeling tools (R4, Hydrus 2D, MODFLOW, MT3D) to evaluate the projected future TDS and nitrate concentrations of the Chino Basin.
- Define a baseline (status-quo) scenario and evaluate it with the new modeling tools.
- Define salinity management planning scenarios and evaluate them with the new modeling tools to compare the projected TDS and nitrate concentrations against the baseline scenario.
- Use the results to develop a draft regulatory compliance strategy that includes a longer-term average period for recycled water TDS concentrations.
- Collaborate with the Regional Board to review and finalize the regulatory strategy.
- Support the Regional Board in the preparation of a Basin Plan amendment upon approval of the regulatory strategy.

Watermaster and the IEUA began implementing the scope of work in July 2017 and have been working collaboratively with Regional Board staff to review interim work products and address new technical questions that have arisen. As of this writing, the draft regulatory compliance strategy is scheduled to be complete by August 2020.

2.4 Ambient Groundwater Quality

Commitment number 9 requires that Watermaster and the IEUA recompute the ambient TDS and nitrate concentrations for the Chino Basin and Cucamonga GMZs every three years, beginning in July 2005. The method used to compute ambient TDS and nitrate concentrations was consistent with the method used by the TIN/TDS Task Force to determine the antidegradation objectives for the GMZs of the Santa Ana River Watershed. The most recent recomputation, covering the 20-year period from 1999 to 2018, is currently underway. Table 2-5 shows the results of the current[15] and all historical ambient TDS and nitrate concentration determinations. As of 2018, the ambient TDS concentration of Chino-North is 350 mgl and thus, there remains 70 mgl of assimilative capacity. Prior to the 2018 recomputation, the ambient TDS concentration had been increasing at a rate of about 10 mgl per three-year period since 2003. The current ambient nitrate concentration of Chino-North is 10.3 mgl and there is no assimilative capacity, which has been the case since the adoption of the maximum benefit objectives in 2004. Prior to 2018, the ambient nitrate concentration had been increasing at a rate of about 0.4 mgl per three-year period since 2003. The final report documenting the recomputation covering the 20-year period from 1999 to 2018, is due to be completed by June 2020.

[15] The current results for 2018 is considered final, although the technical report documenting the results is pending completion by the project consultant.

Table 2-1
Status of Compliance with the Chino Basin Maximum-Benefit Commitments

Description of Commitment	Compliance Date – as soon as possible, but no later than	Status of Compliance
1. Surface Water Monitoring Program[1] a. Submit draft Monitoring Program to Regional Board b. Implement Monitoring Program c. Submit Draft Revised Monitoring Program to Regional Board d. Implement Revised Monitoring Program e. Submit Draft Revised Monitoring Program(s) (subsequent to that required in “c”, above) to Regional Board f. Implement Revised Monitoring Program(s) g. Annual data report submittal	a. January 23, 2005 b. Within 30 days from the date of Regional Board approval of the monitoring plan c. 15 days from 2012 Basin Plan Amendment (BPA) approval d. Upon Regional Board approval e. Upon notification of the need to do so from the Regional Board Executive Officer and in accordance with the schedule prescribed by the Executive Officer f. Upon Regional Board approval g. April 15th	a. Draft work plan submitted to the Regional Board on January 23, 2005 b. Monitoring plan initiated prior to Regional Board approval c. Draft work plan submitted to the Regional Board on February 16, 2012, six days after 2012 BPA approval d. Revised monitoring program began in December 2012 after the BPA was approved by the Office of Administrative Law on December 6, 2012 e. No revisions requested by the Regional Board f. n/a g. All annual reports submitted by April 15 of each year since 2006
2. Groundwater Monitoring Program[1] a. Submit Draft Monitoring Program to Regional Board b. Implement Monitoring Program c. Plan and schedule for demonstrating hydraulic control	a. January 23, 2005 b. Within 30 days from the date of Regional Board approval of the monitoring plan c. By December 31, 2013	a. Draft monitoring plan submitted to Regional Board on January 23, 2005 b. Monitoring program initiated prior to Regional Board approval c. Plan and schedule for demonstrating hydraulic control submitted in the 2014 Work Plan to the Regional Board on December 23, 2013

[1] The commitments related to surface water and groundwater monitoring were revised by a Basin Plan amendment approved by the Regional Board on February 10, 2012. The commitments and status of compliance shown in this table reflect the amended commitments for surface water and groundwater monitoring.

Table 2-1
Status of Compliance with the Chino Basin Maximum-Benefit Commitments

Description of Commitment	Compliance Date – as soon as possible, but no later than	Status of Compliance
d. Implement hydraulic control demonstration e. Submit Draft Revised Monitoring Program(s) (subsequent to that required in "a", above) to Regional Board f. Implement revised monitoring plans (s) g. Annual data report submittal	d. Upon Regional Board approval e. Upon notification of the need to do so from the Regional Board Executive Officer and in accordance with the schedule prescribed by the Executive Officer f. Upon Regional Board approval g. April 15th	d. Hydraulic control demonstration reported in all annual reports e. No revisions requested by Regional Board f. n/a g. All annual reports submitted by April 15 of each year
3. Chino Desalters a. Chino-I Desalter expansion to 10 mgd b. Chino-II Desalter construction to 10 mgd capacity	a. Prior to the recharge of recycled water b. Recharge of recycled water allowed once award of contract and notice to proceed issued for construction of desalter treatment plant	a. Chino-I Desalter expansion to a pumping capacity of 14 mgd (15,700 afy) was completed in April 2005 and operation began in October 2005; recycled water recharge began in July 2005. b. Contract for Chino-II Desalter awarded in early 2005; construction was completed to a pumping capacity of 10 mgd (11,00 afy), and the facility went online in June 2006.
4. Submittal of future desalters plan and schedule	October 1, 2005 Implement plan and schedule upon Regional Board approval	Several plans for desalter expansion have been submitted to the Regional Board since 2005. The pumping capacity of the constructed desalter wells in 2015 was about 30 mgd (33,500 afy). Watermaster and the IEUA submitted a plan to the Regional Board on June 30, 2015 to construct three additional wells to achieve the ultimate pumping capacity of 36 mgd (40,000 afy), per the Peace and Peace II Agreements. The first two wells are constructed and began operating in 2018. The construction of the third well will begin in 2020 and is anticipated to become operational in 2021.

Table 2-1
Status of Compliance with the Chino Basin Maximum-Benefit Commitments

Description of Commitment	Compliance Date – as soon as possible, but no later than	Status of Compliance
5. Recharge facilities (17) built and in operation	June 30, 2005	Watermaster and the IEUA partnered with the San Bernardino County Flood Control District and the Chino Basin Water Conservation District for completion of the Chino Basin Facilities Improvement Program to construct and/or improve eighteen recharge sites. There are currently 17 basins in the Chino Basin Groundwater Recharge Program.
6. Submittal of IEUA wastewater quality improvement plan and schedule	60 days after agency-wide, 12-month running average effluent TDS quality equals or exceeds 545 mgl for 3 consecutive months, or after agency-wide, 12-month running average TIN equals or exceeds 8 mgl in any month Implement plan and schedule upon approval by Regional Board	These threshold events have not occurred; therefore, a wastewater quality improvement plan has not been submitted (See Table 2-6, and Figures 2-6 and 2-7 of this report).
7. Recycled water will be blended with other recharge sources such that the volume-weighted, 5-year running average TDS and nitrate-nitrogen concentrations of recharge are equal to or less than the maximum benefit water quality objectives. a. Submit a report that documents the location, amount of recharge, and TDS and nitrogen quality of storm water recharge before the OBMP recharge improvements were constructed and what is projected to occur after the recharge improvements are completed.	Compliance must be achieved by the end of the 5th year after initiation of recycled water recharge operations. a. Prior to initiation of recycled water recharge	a. No documentation of water quality data or quantity for storm water prior to OBMP initiation exists. Storm water has been monitored for flow, TDS, and nitrogen since 2005.

Table 2-1
Status of Compliance with the Chino Basin Maximum-Benefit Commitments

Description of Commitment	Compliance Date – as soon as possible, but no later than	Status of Compliance
b. Submit documentation of the amount and TDS and nitrogen quality of all sources of recharge and recharge locations. For storm water recharge used for blending, submit documentation that the recharge is the result of OBMP enhanced recharge facilities.	b. Annually, by April 15th, after initiation of construction of basins/other facilities to support enhanced storm water recharge	b. The volume-weighted, 5-year running average TDS and nitrate-nitrogen concentrations of Chino Basin recharge are less than the maximum-benefit water quality objectives (See Table 2-5, and Figures 2-5a and 2-5b of this report).
8. Hydraulic Control Failure a. Plan and schedule to correct loss of hydraulic control b. Achievement and maintenance of hydraulic control c. Mitigation plan for temporary failure to achieve/maintain hydraulic control	a. 60 days from Regional Board finding that hydraulic control is not being maintained b. In accordance with plan and schedule approved by the Regional Board c. By January 23, 2005	a. No mitigation plan and schedule for the loss of hydraulic control has been requested. b. Hydraulic control has been achieved to the east of Chino-I Desalter Well 20. Groundwater model estimates published in 2015 indicate that production at the CCWF will achieve hydraulic control in the west to *de minimis* levels (<1,000 afy of groundwater flow past the CCWF well field to the PBMZ). Full production at the CCWF was achieved in 2016. Watermaster and the IEUA submitted a plan on June 30, 2015 to the Regional Board to construct three additional wells to achieve the ultimate Desalter capacity of 40,000 afy. Construction of two wells is completed and they began operating in 2018. Construction of the third well will begin in 2020 and is anticipated to become operational in 2021. c. Plan submitted to the Regional Board on March 3, 2005. No mitigation action has been triggered.

Table 2-1
Status of Compliance with the Chino Basin Maximum-Benefit Commitments

Description of Commitment	Compliance Date – as soon as possible, but no later than	Status of Compliance
9. Ambient groundwater quality determination	July 1, 2005 and every three years thereafter	Watermaster and the IEUA have participated in the regional triennial ambient water quality determination as requested by SAWPA. Watermaster and the IEUA provide their fair share of funds and substantial groundwater data for this effort.

Table 2-2

Annual Groundwater Recharge at Chino Basin Facilities - 2005 to 2019

Calendar Year	Imported water (af)	Storm water (af)	Recycled Water (af)	Total (af)
2005	22,015	11,932	868	34,815
2006	47,422	11,932	2,695	62,049
2007	3,959	6,103	1,622	11,684
2008	0	10,559	2,781	13,340
2009	20	8,223	4,516	12,759
2010	4,980	19,391	8,304	32,675
2011	32,025	10,756	8,078	50,859
2012	0	9,372	7,823	17,195
2013	0	3,456	14,394	17,850
2014	795	8,166	10,997	19,958
2015	0	6,764	12,056	18,820
2016	4,260	9,804	14,310	28,374
2017	37,802	7,571	14,477	59,850
2018	4,252	6,751	12,942	23,945
2019	23,940	14,482	11,556	49,977
Total	**181,470**	**145,261**	**127,419**	**454,150**

Table 2-3

Monthly Calculation of the Five-Year, Volume-Weighted Total Dissolved Solids (TDS) and Nitrate-Nitrogen Concentrations of Recharge Water Sources to the Chino Basin [1]

Five-Year Period	TDS (mgl)	Nitrate-N (mgl)
July 2005 - June 2010	203	1.1
Aug 2005 - July 2010	205	1.1
Sept 2005 - Aug 2010	207	1.1
Oct 2005 - Sept 2010	208	1.1
Nov 2005 - Oct 2010	210	1.1
Dec 2005 - Nov 2010	211	1.2
Jan 2006 - Dec 2010	213	1.1
Feb 2006 - Jan 2011	212	1.2
March 2006 - Feb 2011	214	1.2
April 2006 - March 2011	216	1.2
May 2006 - April 2011	221	1.3
June 2006 - May 2011	222	1.3
July 2006 - June 2011	222	1.3
Aug 2005 - July 2011	218	1.2
Sept 2006 - Aug 2011	215	1.2
Oct 2006 - Sept 2011	213	1.2
Nov 2006 - Oct 2011	217	1.3
Dec 2006 - Nov 2011	220	1.3
Jan 2007 - Dec 2011	218	1.4
Feb 2007 - Jan 2012	218	1.4
March 2007 - Feb 2012	218	1.4
April 2007 - March 2012	216	1.4
May 2007 - April 2012	215	1.4
June 2007 - May 2012	217	1.4
July 2007 - June 2012	220	1.4
Aug 2007 - July 2012	221	1.4
Sept 2007 - Aug 2012	221	1.4
Oct 2007 - Sept 2012	222	1.4
Nov 2007 - Oct 2012	222	1.4
Dec 2007 - Nov 2012	223	1.4
Jan 2008 - Dec 2012	224	1.5
Feb 2008 - Jan 2013	231	1.6
March 2008 - Feb 2013	233	1.6
April 2008 - March 2013	235	1.6
May 2008 - April 2013	236	1.6
June 2008 - May 2013	237	1.6
July 2008 - June 2013	239	1.7
Aug 2008 - July 2013	240	1.7
Sept 2008 - Aug 2013	241	1.7
Oct 2008 - Sept 2013	243	1.7
Nov 2008 - Oct 2013	245	1.7
Dec 2008 - Nov 2013	247	1.7
Jan 2009 - Dec 2013	251	1.8

Table 2-3

Monthly Calculation of the Five-Year, Volume-Weighted Total Dissolved Solids (TDS) and Nitrate-Nitrogen Concentrations of Recharge Water Sources to the Chino Basin [1]

Five-Year Period	TDS (mgl)	Nitrate-N (mgl)
Feb 2009 - Jan 2014	253	1.8
March 2009 - Feb 2014	257	1.8
April 2009 - March 2014	259	1.9
May 2009 - April 2014	261	1.9
June 2009 - May 2014	263	1.9
July 2009 - June 2014	264	1.9
Aug 2009 - July 2014	265	1.9
Sept 2009 - Aug 2014	266	1.9
Oct 2009 - Sept 2014	268	1.9
Nov 2009 - Oct 2014	269	1.9
Dec 2009 - Nov 2014	269	1.9
Jan 2010 - Dec 2014	266	1.9
Feb 2010 - Jan 2015	273	2.0
March 2010 - Feb 2015	279	2.0
April 2010 - March 2015	280	2.0
May 2010 - April 2015	283	2.0
June 2010 - May 2015	283	2.1
July 2010 - June 2015	285	2.1
Aug 2010 - July 2015	286	2.1
Sept 2010 - Aug 2015	286	2.1
Oct 2010 - Sept 2015	287	2.1
Nov 2010 - Oct 2015	287	2.1
Dec 2010 - Nov 2015	289	2.1
Jan 2011 - Dec 2015	291	2.2
Feb 2011 - Jan 2016	288	2.2
March 2011 - Feb 2016	290	2.2
April 2011 - March 2016	292	2.2
May 2011 - April 2016	293	2.2
June 2011 - May 2016	300	2.3
July 2011 - June 2016	310	2.4
Aug 2011 - July 2016	323	2.6
Sept 2011 - Aug 2016	338	2.8
Oct 2011 - Sept 2016	354	3.0
Nov 2011 - Oct 2016	349	2.9
Dec 2011 - Nov 2016	352	2.9
Jan 2012 - Dec 2016	345	2.8
Feb 2012 - Jan 2017	336	2.7
March 2012 - Feb 2017	334	2.7
April 2012 - March 2017	340	2.8
May 2012 - April 2017	342	2.8
June 2012 - May 2017	342	2.8
July 2012 - June 2017	328	2.6
Aug 2012 - July 2017	314	2.5

Table 2-3

Monthly Calculation of the Five-Year, Volume-Weighted Total Dissolved Solids (TDS) and Nitrate-Nitrogen Concentrations of Recharge Water Sources to the Chino Basin [1]

Five-Year Period	TDS (mgl)	Nitrate-N (mgl)
Sept 2012 - Aug 2017	302	2.4
Oct 2012 - Sept 2017	298	2.3
Nov 2012 - Oct 2017	292	2.3
Dec 2012 - Nov 2017	290	2.3
Jan 2013 - Dec 2017	289	2.2
Feb 2013 - Jan 2018	287	2.1
March 2013 - Feb 2018	287	2.1
April 2013 - March 2018	283	2.1
May 2013 - April 2018	283	2.1
June 2013 - May 2018	283	2.1
July 2013 - June 2018	283	2.1
Aug 2013 - July 2018	284	2.1
Sept 2013 - Aug 2018	284	2.1
Oct 2013 - Sept 2018	284	2.1
Nov 2013 - Oct 2018	283	2.1
Dec 2013 - Nov 2018	282	2.0
Jan 2014 - Dec 2018	281	2.0
Feb 2014 - Jan 2019	278	2.0
March 2014 - Feb 2019	275	1.9
April 2014 - March 2019	273	1.9
May 2014 - April 2019	271	1.9
June 2014 - May 2019	270	1.8
July 2014 - June 2019	269	1.8
Aug 2014 - July 2019	266	1.8
Sept 2014 - Aug 2019	262	1.7
Oct 2014 - Sept 2019	260	1.7
Nov 2014 - Oct 2019	258	1.7
Dec 2014 - Nov 2019	260	1.7
Jan 2015 - Dec 2019	262	1.7

1 - See Appendix A for more details.

Table 2-4

Monthly and 12-Month Running Average of the IEUA Agency-Wide Effluent Total Inorganic Nitrogen (TIN) and Total Dissolved Solids (TDS) Concentrations - 2005 to 2019

Month	TIN (mgl)		TDS (mgl)	
	Monthly	12-Month Running Average[1]	Monthly	12-Month Running Average
Jan-05	7.3	8.4	492	486
Feb-05	8.4	8.4	496	487
Mar-05	7.5	8.4	516	488
Apr-05	6.9	8.2	534	491
May-05	6.7	8.0	513	492
Jun-05	7.0	8.0	507	492
Jul-05	5.4	7.8	466	492
Aug-05	5.9	7.7	452	490
Sep-05	5.4	7.4	469	491
Oct-05	5.5	7.1	468	491
Nov-05	5.5	6.7	467	490
Dec-05	8.4	6.7	481	488
Jan-06	9.9	6.9	491	488
Feb-06	9.0	6.9	467	486
Mar-06	8.8	7.1	471	482
Apr-06	7.8	7.1	464	476
May-06	8.3	7.2	454	471
Jun-06	6.5	7.2	466	468
Jul-06	6.8	7.3	472	469
Aug-06	5.9	7.3	475	470
Sep-06	6.5	7.4	465	470
Oct-06	6.4	7.6	457	469
Nov-06	6.9	7.6	456	468
Dec-06	7.1	7.5	470	467
Jan-07	7.7	7.3	488	467
Feb-07	6.2	7.1	481	468
Mar-07	6.7	6.9	490	470
Apr-07	5.6	6.7	491	472
May-07	5.6	6.5	489	475
Jun-07	6.0	6.5	495	477
Jul-07	5.1	6.3	492	479
Aug-07	5.2	6.3	478	479
Sep-07	5.9	6.2	478	480
Oct-07	6.0	6.2	517	485
Nov-07	7.6	6.2	514	490
Dec-07	7.4	6.3	522	495
Jan-08	6.8	6.2	511	481
Feb-08	6.4	6.2	492	483
Mar-08	6.6	6.2	515	484
Apr-08	6.7	6.3	519	487
May-08	7.2	6.4	502	489
Jun-08	6.8	6.5	490	490

Table 2-4

Monthly and 12-Month Running Average of the IEUA Agency-Wide Effluent
Total Inorganic Nitrogen (TIN) and Total Dissolved Solids (TDS) Concentrations - 2005 to 2019

Month	TIN (mgl)		TDS (mgl)	
	Monthly	12-Month Running Average[1]	Monthly	12-Month Running Average
Jul-08	6.1	6.6	499	491
Aug-08	5.8	6.6	514	492
Sep-08	8.3	6.8	510	494
Oct-08	7.0	6.9	503	496
Nov-08	5.7	6.7	496	498
Dec-08	6.3	6.7	494	504
Jan-09	6.5	6.6	497	503
Feb-09	7.8	6.7	463	500
Mar-09	6.9	6.8	496	499
Apr-09	6.6	6.8	509	498
May-09	5.8	6.6	501	498
Jun-09	5.4	6.5	505	499
Jul-09	5.0	6.4	512	499
Aug-09	4.5	6.3	499	497
Sep-09	4.0	6.0	498	497
Oct-09	4.6	5.8	500	497
Nov-09	4.8	5.7	489	497
Dec-09	5.5	5.6	494	497
Jan-10	5.7	5.6	493	496
Feb-10	6.2	5.4	489	498
Mar-10	6.4	5.4	482	497
Apr-10	5.7	5.3	473	494
May-10	5.2	5.3	471	492
Jun-10	5.0	5.2	478	490
Jul-10	5.1	5.2	477	487
Aug-10	4.6	5.2	477	485
Sep-10	3.7	5.2	476	483
Oct-10	5.5	5.3	478	481
Nov-10	5.7	5.3	479	481
Dec-10	5.0	5.3	472	479
Jan-11	6.4	5.4	474	477
Feb-11	6.9	5.4	455	474
Mar-11	6.4	5.4	468	473
Apr-11	6.5	5.5	460	472
May-11	6.0	5.6	462	471
Jun-11	5.7	5.6	464	470
Jul-11	4.3	5.5	454	468
Aug-11	4.4	5.5	457	467
Sep-11	5.8	5.7	457	465
Oct-11	5.2	5.7	457	463
Nov-11	5.9	5.7	453	461
Dec-11	6.3	5.8	454	460

Table 2-4

Monthly and 12-Month Running Average of the IEUA Agency-Wide Effluent
Total Inorganic Nitrogen (TIN) and Total Dissolved Solids (TDS) Concentrations - 2005 to 2019

Month	TIN (mgl)		TDS (mgl)	
	Monthly	12-Month Running Average[1]	Monthly	12-Month Running Average
Jan-12	6.4	5.8	465	459
Feb-12	6.7	5.8	476	461
Mar-12	6.7	5.8	497	463
Apr-12	7.4	5.9	496	466
May-12	6.4	5.9	493	469
Jun-12	5.8	5.9	482	470
Jul-12	5.4	6.0	477	472
Aug-12	4.8	6.1	463	473
Sep-12	5.1	6.0	472	474
Oct-12	4.9	6.0	486	476
Nov-12	6.1	6.0	485	479
Dec-12	6.0	6.0	492	482
Jan-13	6.1	5.9	495	484
Feb-13	6.8	5.9	490	486
Mar-13	6.1	5.9	493	485
Apr-13	6.4	5.8	501	486
May-13	6.4	5.8	503	487
Jun-13	5.8	5.8	502	488
Jul-13	5.6	5.8	496	490
Aug-13	6.9	6.0	496	493
Sep-13	7.3	6.2	499	495
Oct-13	7.4	6.4	496	496
Nov-13	6.7	6.4	507	497
Dec-13	7.6	6.6	511	499
Jan-14	5.9	6.6	510	500
Feb-14	6.1	6.5	509	502
Mar-14	5.5	6.5	497	502
Apr-14	5.2	6.4	517	504
May-14	5.2	6.3	524	505
Jun-14	4.4	6.1	506	506
Jul-14	3.5	6.0	494	505
Aug-14	3.5	5.7	508	506
Sep-14	4.1	5.4	524	508
Oct-14	4.9	5.2	541	512
Nov-14	5.9	5.1	571	518
Dec-14	6.2	5.0	565	522
Jan-15	7.9	5.2	546	525
Feb-15	7.4	5.3	560	529
Mar-15	6.2	5.4	528	532
Apr-15	5.2	5.4	531	533
May-15	6.1	5.4	520	533
Jun-15	4.6	5.4	515	534

Table 2-4

Monthly and 12-Month Running Average of the IEUA Agency-Wide Effluent
Total Inorganic Nitrogen (TIN) and Total Dissolved Solids (TDS) Concentrations - 2005 to 2019

Month	TIN (mgl)		TDS (mgl)	
	Monthly	12-Month Running Average[1]	Monthly	12-Month Running Average
Jul-15	5.2	5.6	500	534
Aug-15	4.7	5.7	503	534
Sep-15	4.8	5.7	508	532
Oct-15	5.2	5.8	506	529
Nov-15	5.4	5.7	505	524
Dec-15	6.2	5.7	503	519
Jan-16	7.3	5.7	504	515
Feb-16	6.5	5.6	495	510
Mar-16	5.9	5.6	521	509
Apr-16	5.8	5.6	514	508
May-16	5.7	5.6	514	507
Jun-16	5.3	5.7	519	508
Jul-16	6.2	5.7	514	509
Aug-16	6.5	5.9	502	509
Sep-16	6.4	6.0	492	507
Oct-16	5.8	6.1	491	506
Nov-16	5.5	6.1	489	505
Dec-16	5.8	6.0	495	504
Jan-17	6.5	6.0	495	504
Feb-17	6.7	6.0	489	503
Mar-17	5.3	5.9	469	499
Apr-17	5.8	6.0	468	495
May-17	5.7	6.0	464	491
Jun-17	5.5	6.0	461	486
Jul-17	6.8	6.0	447	480
Aug-17	6.0	6.0	446	476
Sep-17	5.7	5.9	440	471
Oct-17	6.1	6.0	428	466
Nov-17	6.5	6.0	455	463
Dec-17	6.8	6.0	444	459
Jan-18	5.3	6.0	464	456
Feb-18	5.3	5.9	488	456
Mar-18	4.4	5.8	504	459
Apr-18	5	5.8	485	460
May-18	4.8	5.7	495	463
Jun-18	4.7	5.6	490	465
Jul-18	4.6	5.4	484	468
Aug-18	4.3	5.3	478	471
Sep-18	5.2	5.3	467	473
Oct-18	4.7	5.1	496	479
Nov-18	5.9	5.1	505	483
Dec-18	5	4.9	488	487
Jan-19	6.2	5.0	503	490

Table 2-4

Monthly and 12-Month Running Average of the IEUA Agency-Wide Effluent
Total Inorganic Nitrogen (TIN) and Total Dissolved Solids (TDS) Concentrations - 2005 to 2019

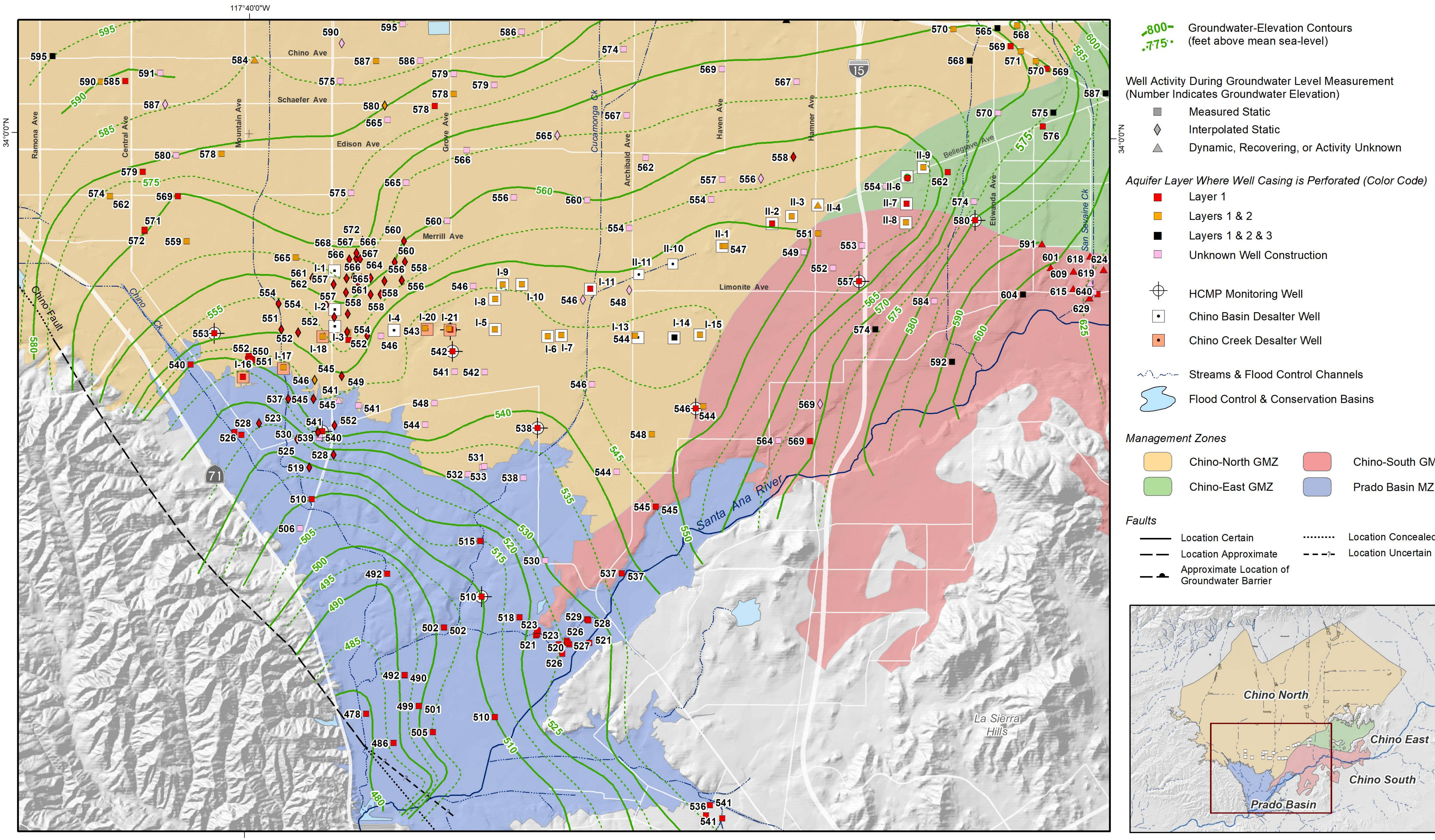
Month	TIN (mgl)		TDS (mgl)	
	Monthly	12-Month Running Average[1]	Monthly	12-Month Running Average
Feb-19	4.9	5.0	485	490
Mar-19	5.7	5.1	495	489
Apr-19	5.2	5.1	476	489
May-19	4.2	5.0	487	488
Jun-19	3	4.9	489	488
Jul-19	3.2	4.8	447	485
Aug-19	3.8	4.7	447	482
Sep-19	4	4.6	452	481
Oct-19	4.5	4.6	445	477
Nov-19	3.9	4.5	465	473
Dec-19	4.0	4.4	461	471

1- The Agency-wide 12-month running average TIN limit in the NPDES permit was decreased from 10 mg/L to 8 mg/L, effective July 8, 2006. This decreased limit was anticipated; therefore, secondary treatment at all facilities was optimized to attain lower TIN. The 12-Month Running Average TIN has not been above the limit of 8 mg/L since the recycled water recharge program began in July 2005.

Table 2-5
Water Quality Objectives and Ambient Water Quality Determinations for the Chino Basin and Cucamonga Groundwater Management Zones

Groundwater Management Zone	Water Quality Objectives mgl				Ambient Water Quality Determination mgl													
	Antidegradation		Maximum Benefit		1997		2003		2006		2009		2012		2015		2018 [1]	
	TDS	NO_3-N	TDS	NO_3-N	TDS	NO_3-N	TDS	NO_3-N	TDS	NO_3-N	TDS	NO_3-N	TDS	NO_3-N	TDS	NO3-N	TDS	NO_3-N
Chino Basin Maximum-Benefit Groundwater Management Zone																		
Chino-North	--	--	420	5	300	7.4	320	8.7	340	9.7	340	9.5	350	10	360	10.3	350	10.3
Chino Basin Antidegradation Groundwater Management Zones																		
Chino 1	280	5	--	--	310	8.4	330	8.9	340	9.3	340	9.1	350	10	350	10.5		
Chino 2	250	2.9	--	--	300	7.2	340	9.5	360	10.7	360	10.3	380	10.7	380	10.9		
Chino 3	260	3.5	--	--	280	6.3	280	6.8	310	8.2	320	8.4	320	8.5	320	8.9		
Chino-South	680	4.2	--	--	720	8.8	790	15.3	940	25.7	980	26.8	990	28	940	27.8	920	27.8
Chino-East	730	10	--	--	760	29.1	620	9.6	650	12.7	770	15.7	770	21	840	22	840	22
Cucamonga	210	2.4	380	5	260	4.4	250	4.3	250	4.0	250	4.1	260	4.1	260	4.3	260	4.7

1. The recomputation of the ambient water quality for Chino-1, Chino-2, and Chino-3 is currently underway and the results will be reported in the *Recomputation of the Ambient Water Quality In the Santa Ana River Watershed for the Period of 1999 to 2018* that will be finalized by June 2020.



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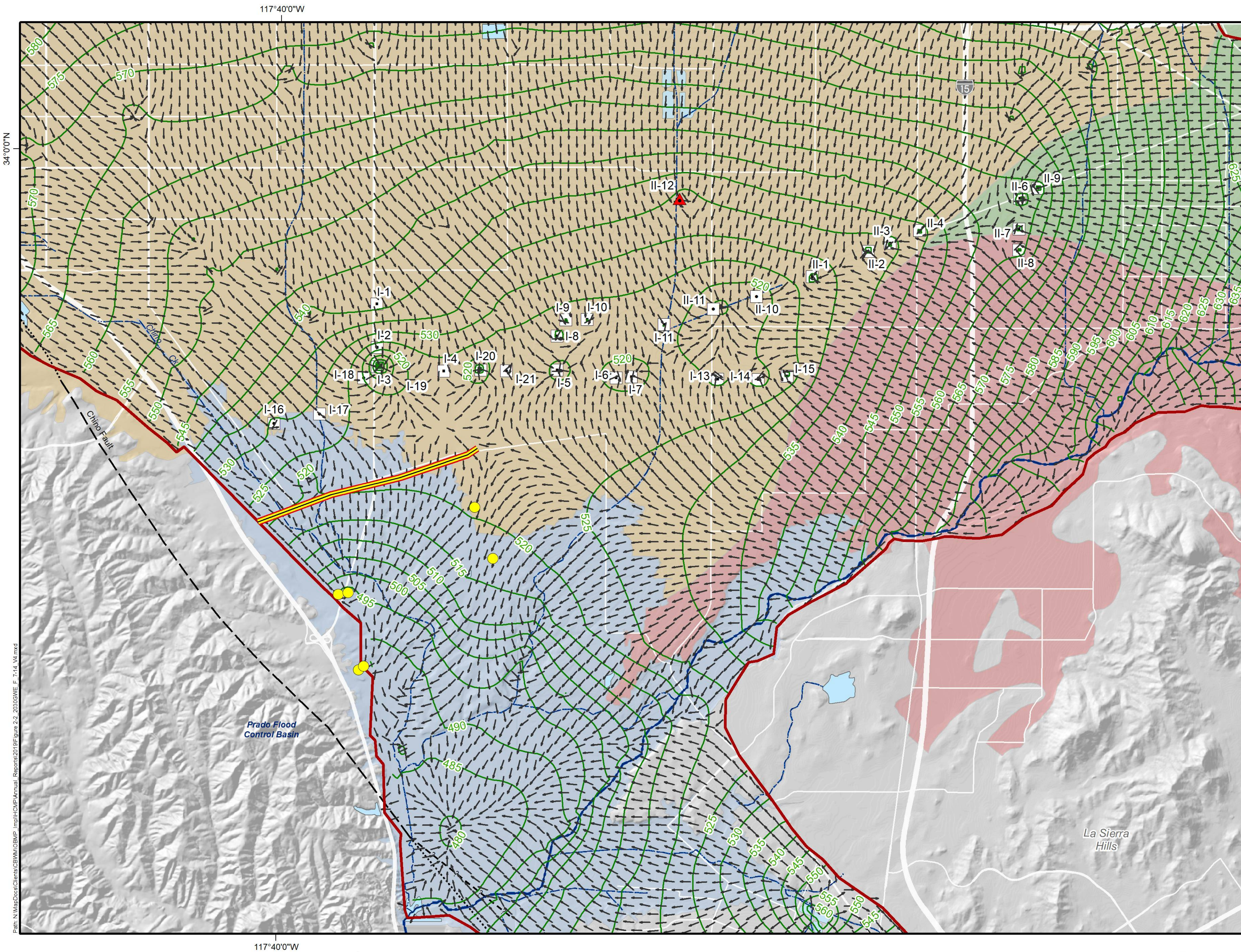
(Exhibit 4-8 from the 2018 Chino Basin State of the Basin Report - June 2019)

2019 Maximum Benefit Annual Report

State of Hydraulic Control in Spring 2018

Shallow Aquifer System

Figure 2-1



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File: Figure_7-5_GWE 2030

0 1 2 Miles

Kilometers 0 0.5 1 1.5

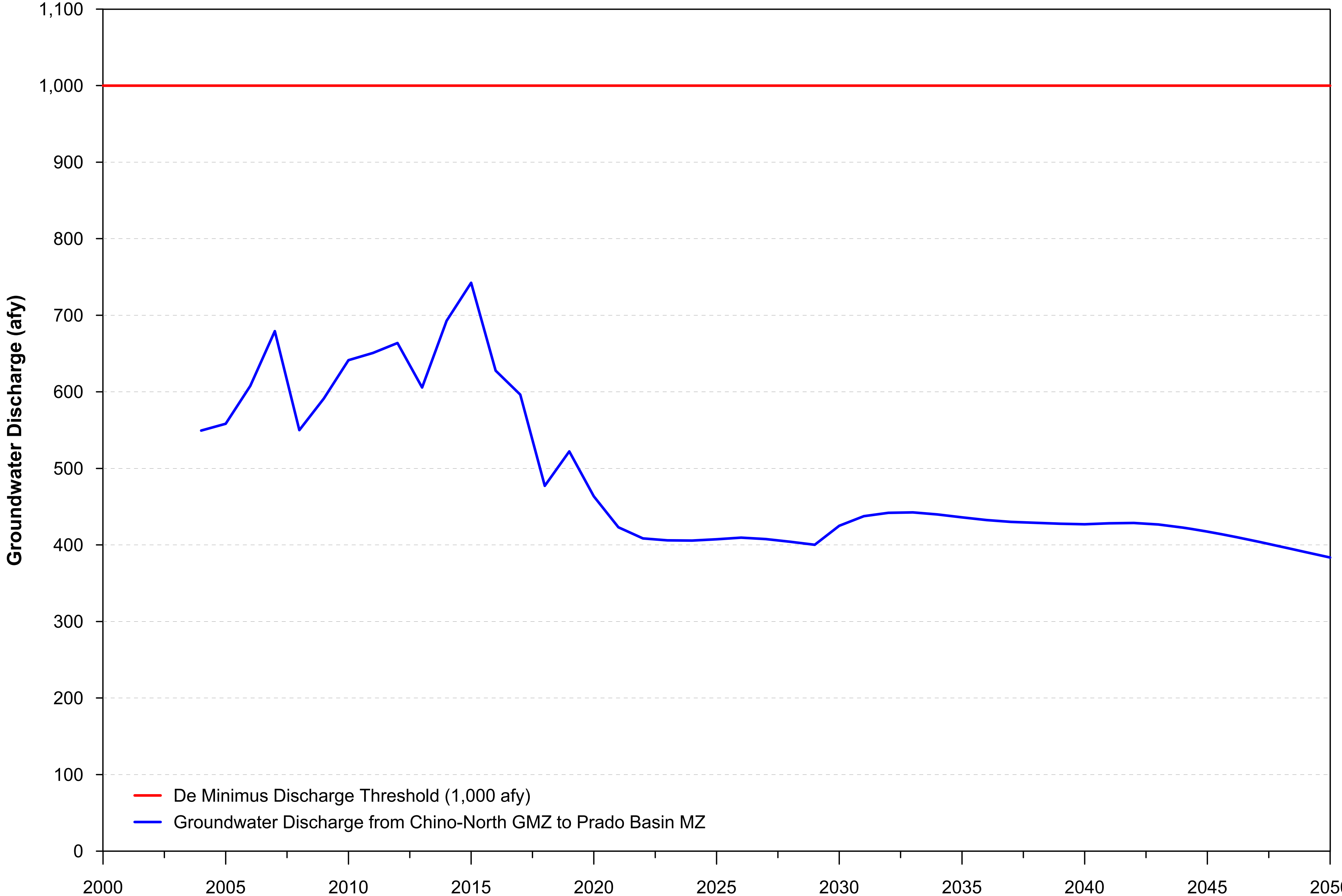
(From Figure 7-14 of the Draft 2020 Safe Yield Recalculation - April 2020)

2019 Maximum Benefit Annual Report

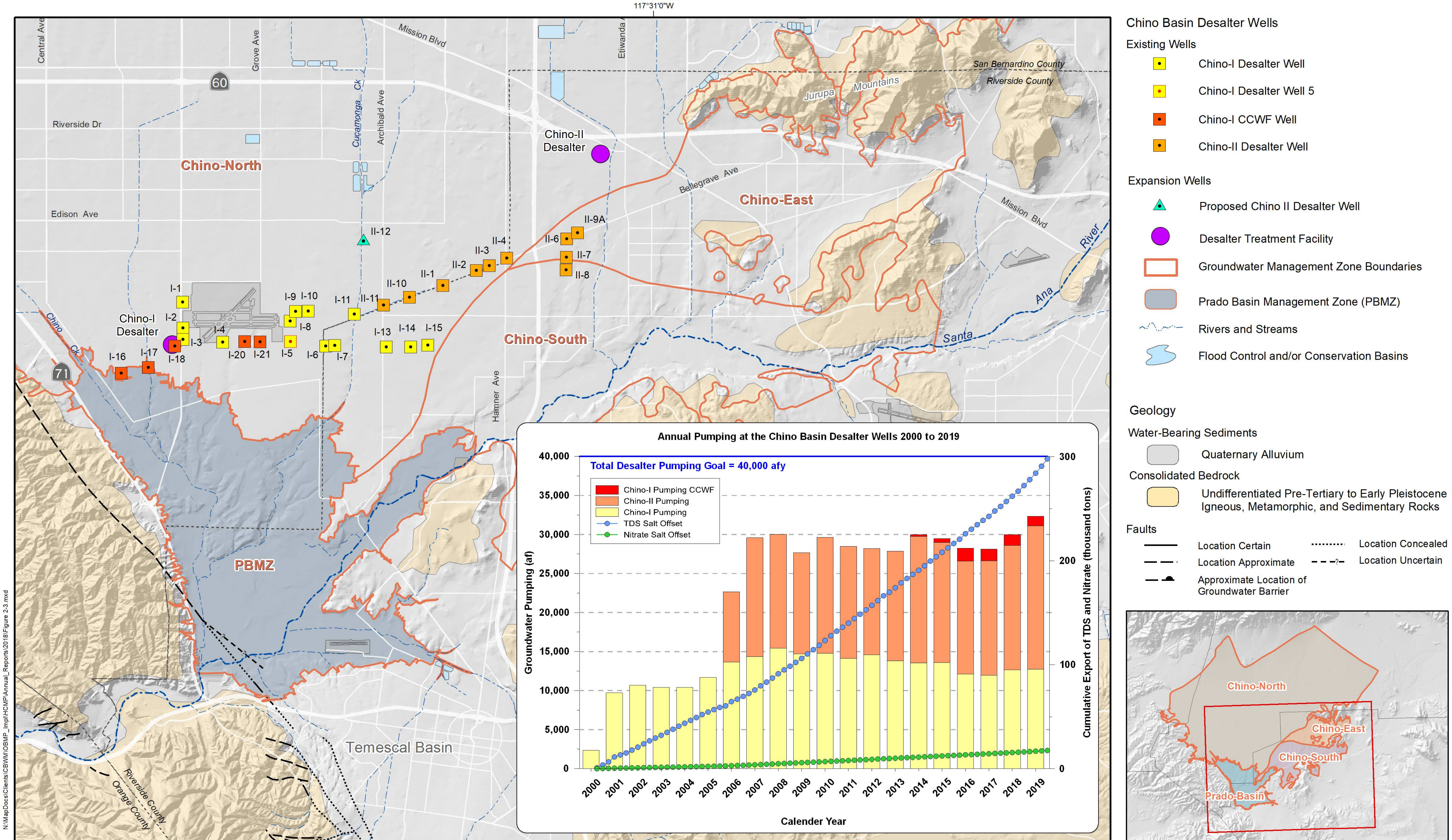
State of Hydraulic Control
July 2030

Figure 2-2

Figure 2-3
Historical and Projected Groundwater Discharge from the Chino-North GMZ to Prado Basin MZ



(Figure 7-15 from the Draft
Safe Yield Recalculation Report - April 2020)



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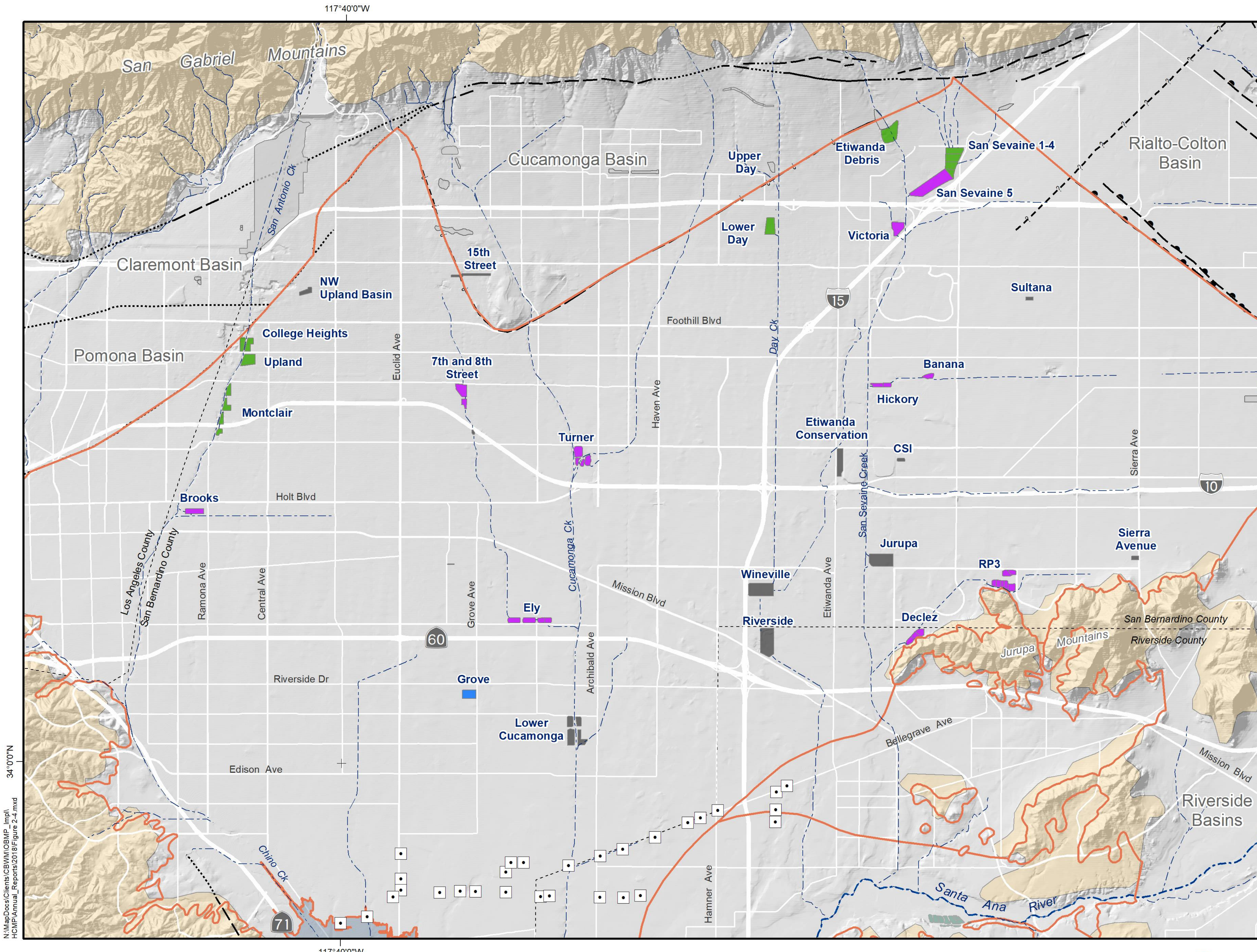
0 1 2 3 4 Miles
0 2 4 6 Kilometers

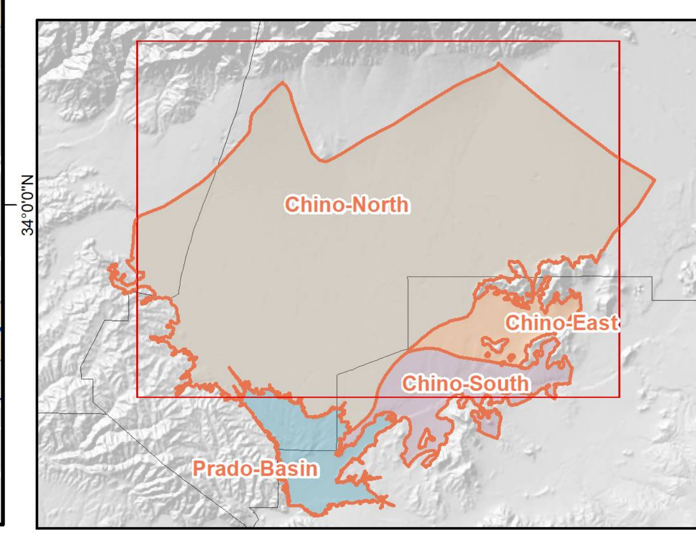
2019 Maximum Benefit Annual Report

Chino Basin Desalter Wells

Annual Pumping 2000 to 2019

Figure 2-4





Recharge Basins
Symbolized by Recharged Water Type

- Storm, Imported and Recycled Water
- Storm and Imported Water
- Storm Water
- Incidental Stormwater Only
- Recharge Basins and Spreading Grounds Outside of Chino Basin

- Groundwater Management Zone Boundaries
- Chino Desalter Well
- Rivers and Streams

Geology

Water-Bearing Sediments

- Quaternary Alluvium

Consolidated Bedrock

- Undifferentiated Pre-Tertiary to Early Pleistocene Igneous, Metamorphic, and Sedimentary Rocks

Faults

- Location Certain
- Location Approximate
- Approximate Location of Groundwater Barrier
- Location Concealed
- Location Uncertain

N:\MapDocs\Clients\CBWM\OBMP_Impl\HCMP\Annual_Reports\2018\Figure 2-4.mxd

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File: Figure 2-5

0 1 2 3 4 Miles
0 2 4 6 Kilometers

Chino Basin Watermaster — Partners in Basin Management

2019 Maximum Benefit Annual Report

Chino Basin Recharge Basins

Existing Facilities by Recharge Type as of 2019

Figure 2-5

Figure 2-6a

Volume and Total Dissolved Solids (TDS) Concentrations of Recharge Water Sources in the Chino Basin - 2005 to 2019

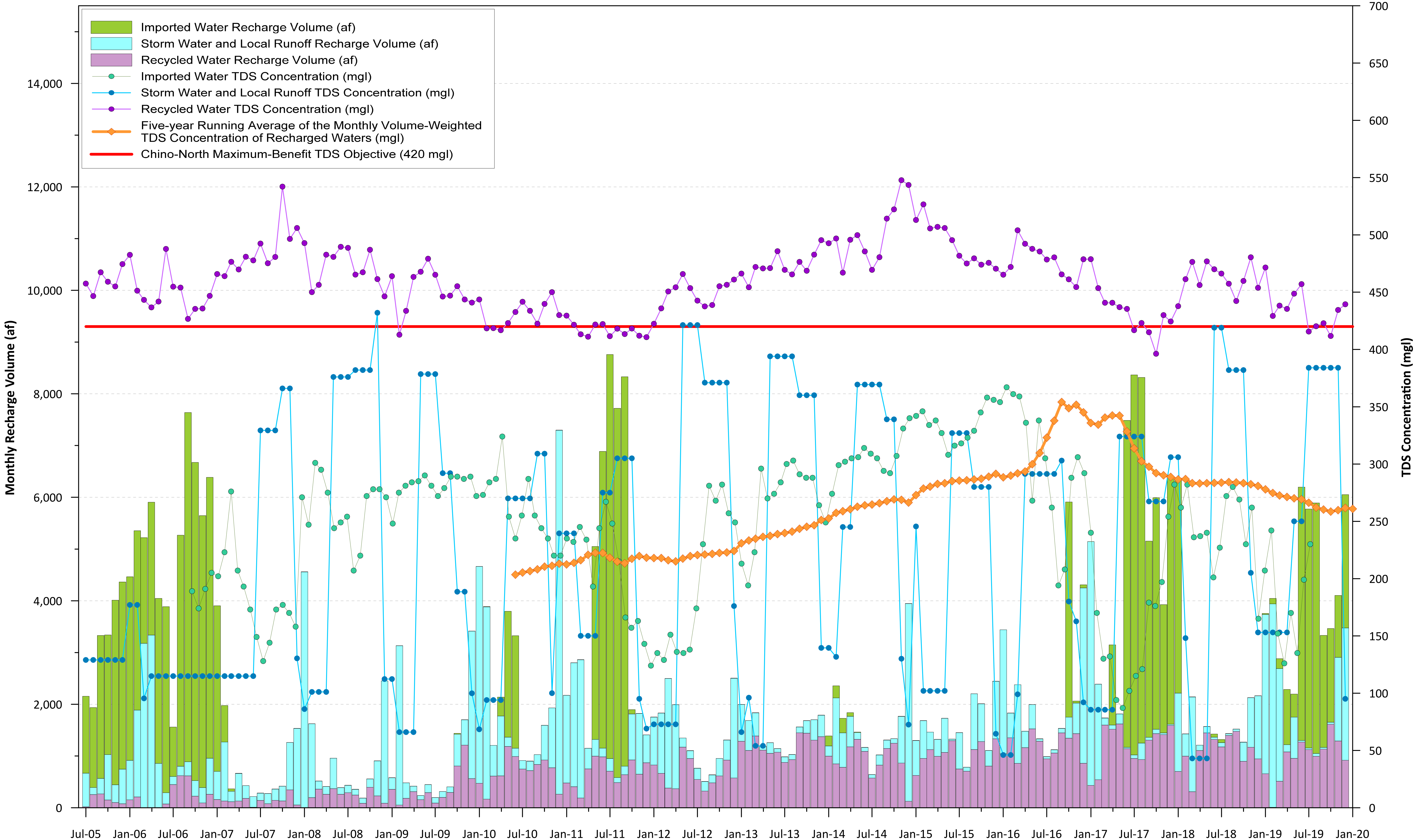


Figure 2-6b
Volume and Nitrate-Nitrogen Concentrations of Recharge Water Sources in the Chino Basin - 2005 to 2019

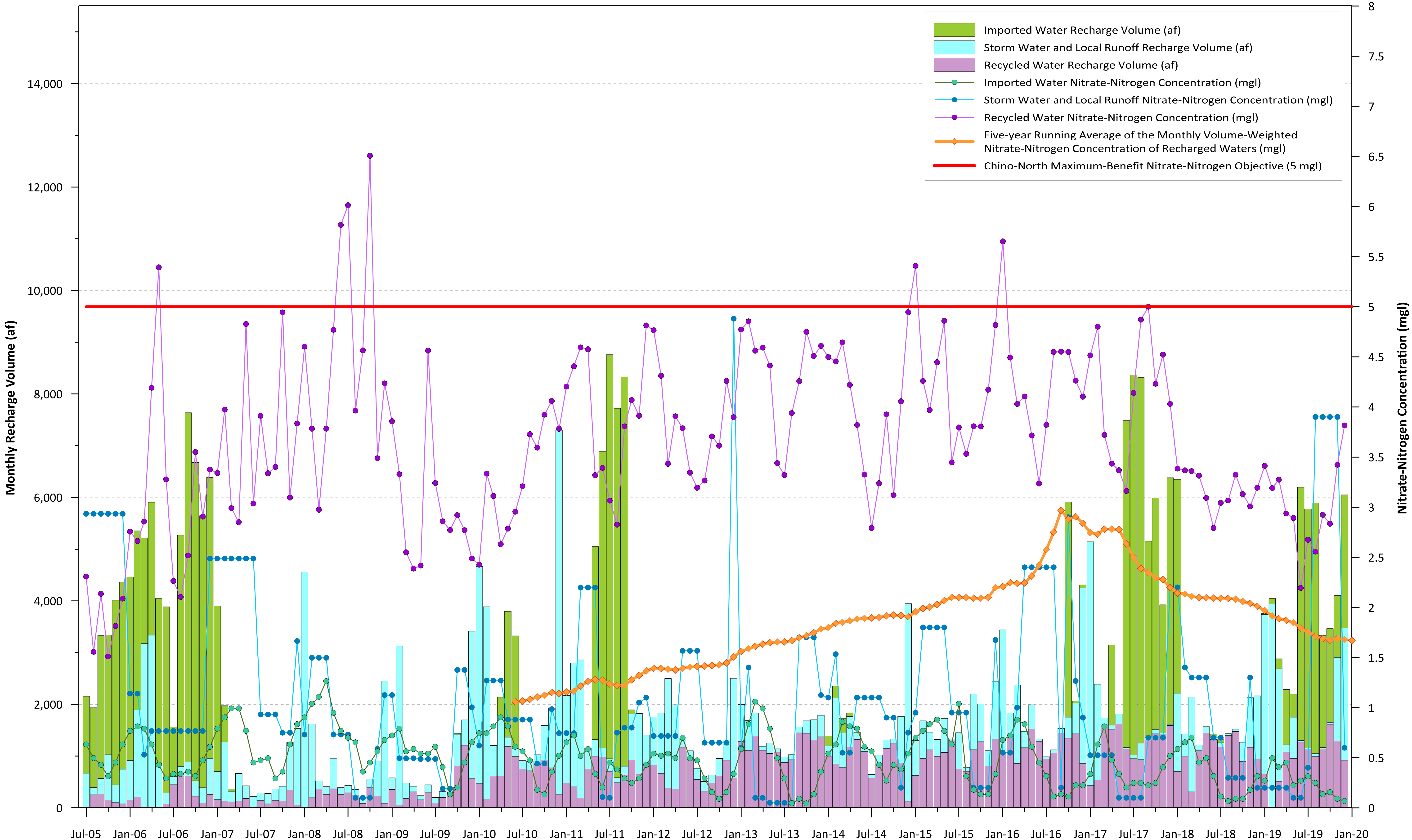


Figure 2-7
Monthly and 12-Month Running Average of IEUA Agency-Wide Effluent
Total Dissolved Solids (TDS) and Total Inorganic Nitrogen (TIN) Concentrations - 2005 to 2019

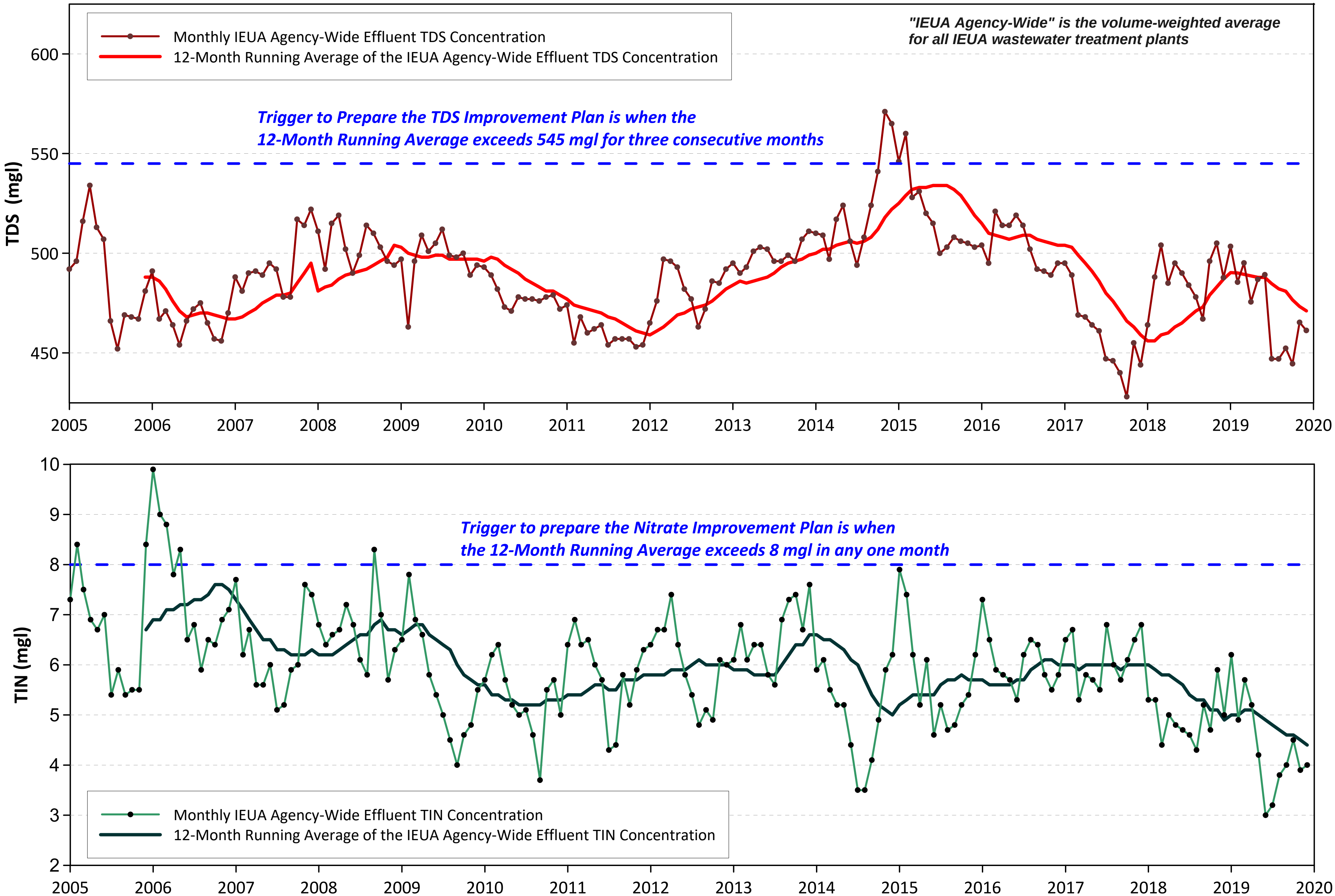
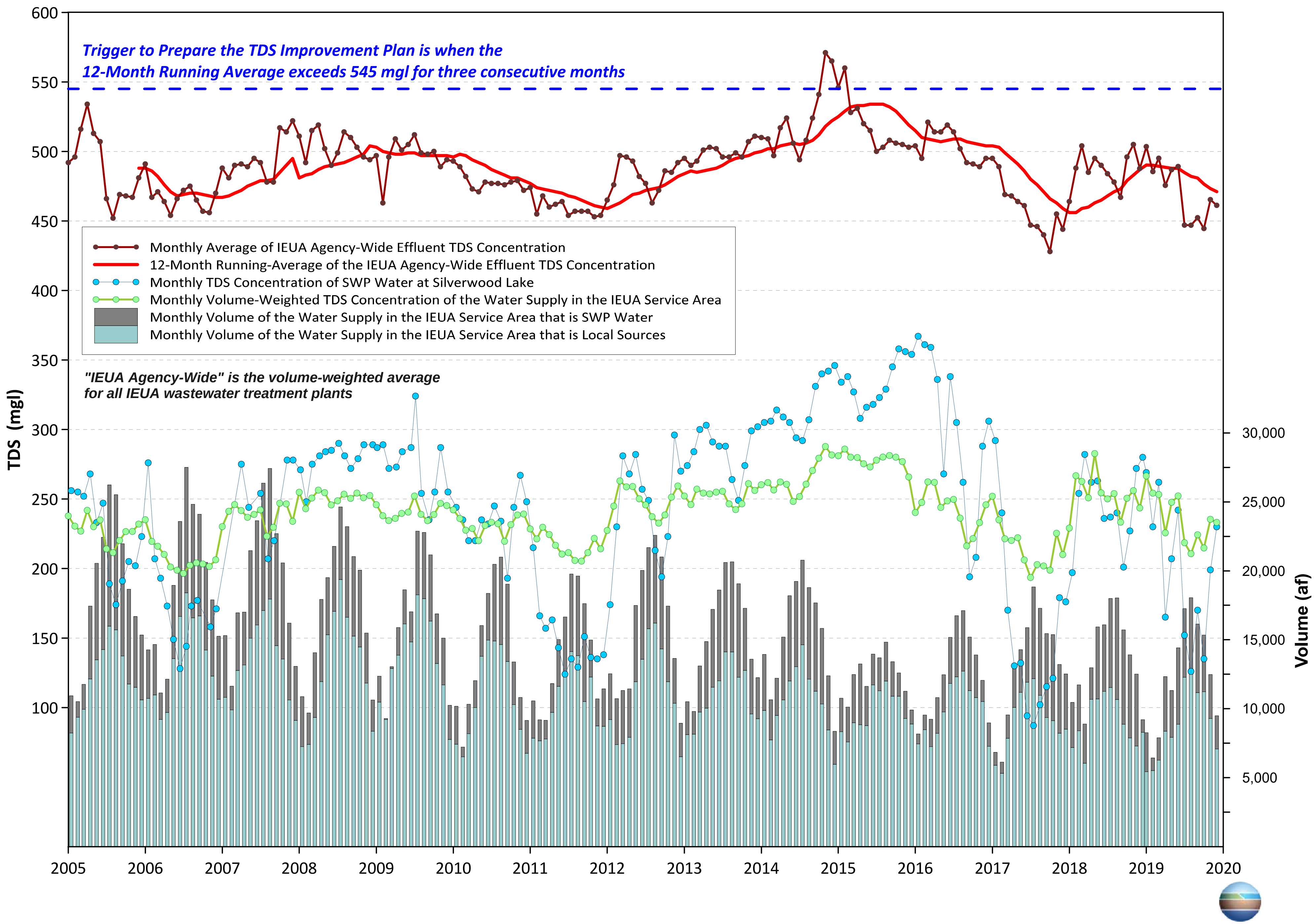


Figure 2-8

Monthly and 12-Month Running Average of the IEUA Agency-Wide Effluent Total Dissolved Solids (TDS) Concentrations, versus Monthly TDS Concentrations of the State Water Project (SWP) Water and the Monthly IEUA Volume-Weighted Water Supply - 2005 to 2019



Section 3 – Data Collected in 2019

Groundwater and surface-water data collected for the Maximum-Benefit Monitoring Program pursuant to the 2014 Work Plan are used for both the maximum benefit monitoring directives of demonstrating hydraulic control and computing ambient water quality every three years. The data collected in 2019 for the Maximum-Benefit Monitoring Program include groundwater elevation, groundwater quality, and surface-water quality. The 2019 data collection efforts are described below.

3.1 Groundwater Monitoring Program

Watermaster's Groundwater Monitoring Program consists of two main components: a groundwater-level monitoring program and a groundwater-quality monitoring program. These monitoring programs were designed and implemented to support the OBMP Implementation Plan and the other regulatory requirements of Watermaster and the IEUA. Watermaster's Groundwater Monitoring Program is summarized below with specific reference to the monitoring requirements of the maximum-benefit commitments.

3.1.1 Groundwater-Level Monitoring Program

Figure 3-1 shows the locations of the wells that are included in Watermaster's groundwater-level monitoring program. In total, there are about 1,100 wells in the groundwater-level monitoring program. The groundwater-level monitoring program supports many Watermaster management functions, including: the periodic assessment of Safe Yield, groundwater model development and recalibration, cumulative impacts of transfers, balance of recharge and discharge, subsidence management, material physical injury assessments, estimation of storage change, other scientific demonstrations required for groundwater management, and many regulatory requirements, such as the demonstration of hydraulic control and the triennial ambient water quality recomputation. The wells within the southern portion of the Basin were selected for inclusion in the monitoring program to assist in Watermaster's analyses of hydraulic control, land subsidence, and desalter impacts to private well owners and riparian vegetation in the PBMZ. The density of groundwater-level monitoring near the desalter well fields is greater than in outlying areas because hydraulic gradients are expected to be steeper near the desalter well fields, and these data are needed to assess the state of hydraulic control.

Figure 3-1 shows the wells where groundwater-level data were collected in 2019, symbolized by measurement frequency. At about 900 of these wells, water levels are measured by well owners, including municipal water agencies, the California Department of Toxic Substance Control (DTSC), the County of San Bernardino, and various consulting firms on behalf of their clients. The measurement frequency by municipal water agencies is typically about once per month, and Watermaster compiles the data quarterly. The measurement frequency by other well owners varies, and Watermaster compiles these data twice per year. The remaining 200 wells shown in Figure 3-1 are mainly privately-owned wells or dedicated monitoring wells that are primarily located in the southern portion of the Chino Basin. Watermaster staff measures water levels at these wells using manual methods once per month or with pressure transducers with on-board data loggers that record water levels once every 15 minutes. All water-level data are reviewed by Watermaster staff and uploaded to a centralized database management system that can be accessed online through HydroDaVE[SM]. All water-level data collected in 2019 are contained in the Microsoft (MS) Access database that has been included with this report as Appendix B. The well location information for private wells with water-level data is excluded from the database in this report for confidentiality reasons.

3.1.2 Groundwater-Quality Monitoring Program

Figure 3-2 shows the locations of the wells that are included in Watermaster's groundwater-quality monitoring program. In total, there are about 830 wells in the groundwater-quality monitoring program. Watermaster obtains groundwater-quality data, in part, to comply with two maximum-benefit commitments: the triennial ambient water quality recomputation and the analysis of hydraulic control. These data are also used for Watermaster's biennial SOB report, to support ground-water modeling, to characterize non-point source contamination and plumes associated with point-source discharges, and to characterize present trends in groundwater quality.

Figure 3-2 shows the wells where groundwater-quality data were collected in 2019. At about 760 of these wells, water-quality samples were collected by well owners, including municipal water agencies, the DTSC, the County of San Bernardino, and various private companies and consulting firms. The sampling frequency and constituents tested vary by well and owner. These water quality data are compiled by Watermaster twice per year. The remaining approximately 70 wells shown in Figure 3-2 are privately owned agricultural wells or dedicated monitoring wells that were sampled by Watermaster for various purposes. All groundwater samples collected by Watermaster are tested for the analytes listed in Table 3-1. Note that VOCs are sampled only at wells within or adjacent to known contamination plumes.

During 2019, Watermaster performed the following groundwater-quality sampling:

- Annual and triennial samples were collected for the Key Well Groundwater Quality Monitoring Program (GWQMP). The Key Well GWQMP consists of a network of about 85 private wells predominantly in the southern portion of the Chino Basin and 11 monitoring wells, which include two multi-nested MZ-3 monitoring wells (six well casings), and two multi-nested former Kaiser Steel monitoring wells (five well casings). About nine of the private wells are sampled every year; the remaining private wells are sampled every three years. All of the monitoring wells are sampled every year. Watermaster is constantly evaluating and revising the private wells in the Key Well GWQMP as wells are abandoned or destroyed due to urban development. During 2019, 32 private wells and 10 monitoring wells were sampled from July through December 2019.

- Annual samples were collected from the nine multi-nested HCMP monitoring wells (21 well casings) in the southern portion of Chino Basin in September 2019.

- Quarterly samples were collected at four shallow monitoring wells along the Santa Ana River, which consist of two former United States Geological Survey (USGS) National

Water Quality Assessment (NAWQA) Program wells (Archibald 1 and Archibald 2) and two Santa Ana River Water Company (SARWC) wells (Wells 9 and 11). Samples were collected in January, April, July, and October 2019.

- Quarterly samples were collected at the two multi-nested Prado Basin Habitat Sustainability Program (PBHSP) monitoring wells (four well casings) in March, June, September, and December 2019.

All groundwater-quality data are reviewed by Watermaster staff and uploaded to a centralized database management system that can be accessed online through HydroDaVE^{SM}. All publicly available water-quality data collected in 2019 are contained in the MS Access database included with this report as Appendix B. Groundwater-quality data collected at private wells in the Basin are excluded from the database in this report for confidentiality reasons.

3.2 Surface-Water Quality Monitoring Program

Watermaster collects quarterly surface-water quality samples from two sites along the Santa Ana River, *SAR at Etiwanda* and *SAR at River Road*, and two sites along Chino Creek for the PBHSP, *Chino Creek at RP2* and *Chino Creek at Euclid*. Figure 3-2 shows the locations of these sites.

For surface water sites along the Santa Ana River, surface water samples are collected on the same day as the quarterly groundwater-quality samples at the near-river NAWQA and SARWC wells. Samples were collected in January, April, July, and October 2019. Surface-water quality samples are tested for the analytes listed in Table 3-2. For the surface water sites along Chino Creek, the surface water samples are collected on the same day as the quarterly groundwater-quality samples at the nearby PBHSP monitoring wells. Samples were collected in March, June, September, and December 2019. All surface-water quality data are reviewed by Watermaster and uploaded to a centralized database management system that can be accessed online through HydroDaVE^{SM}. All surface-water quality data collected in 2019 are contained in the MS Access database included with this report as Appendix B.

Figure 3-3 is an exhibit from the most recent PBHSP Annual Report (WEI, 2019c) that shows the analysis of the groundwater and surface water interactions in the Santa Ana River using the surface water quality data collected at the two sites in the Santa Ana River (*SAR at Etiwanda* and *SAR at River Road*). The surface-water quality data is used along with the surface water discharge data, groundwater elevation and quality data, and model-simulated groundwater-flow directions to analyze the groundwater and surface water interactions. The analysis concludes that this area of the Santa Ana River is a losing reach, characterized by streambed recharge to the Chino Basin; further demonstrating hydraulic control.

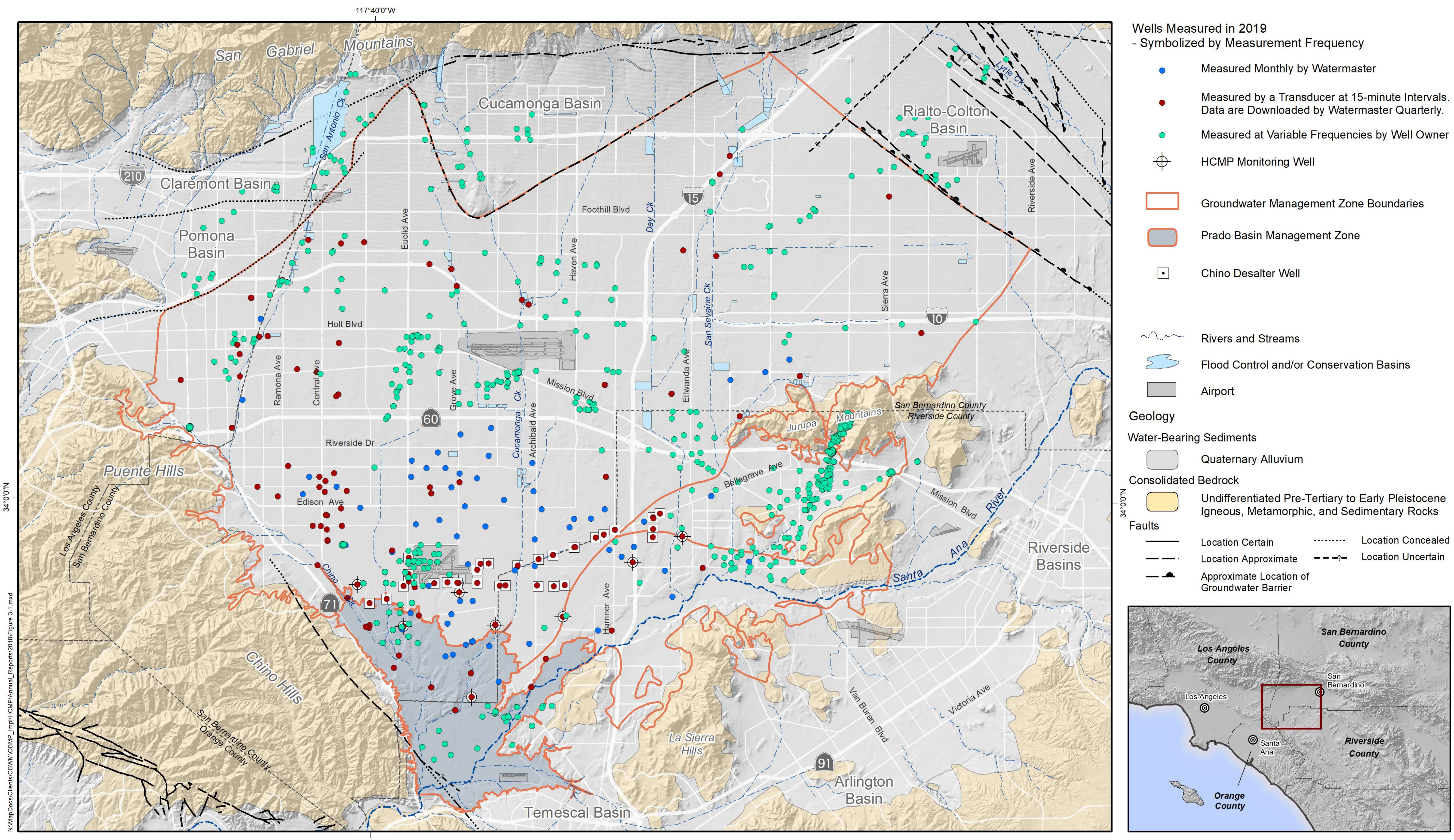
Table 3-1
Analyte List for the Groundwater-Quality Monitoring Program

Analyte	Laboratory Analysis Method
Major cations: Ca, Mg, K, Si, Na	EPA 200.7
Major anions: Cl, SO_4, NO_2, NO_3	EPA 300.0
Total Hardness	SM 2340B
Total Alkalinity (incl. Carbonate, Bicarbonate, Hydroxide)	SM 2320B
Ammonia Nitrogen	EPA 350.1
Arsenic	EPA 200.8
Boron	EPA 200.7
Chromium, Total	EPA 200.8
Hexavalent Chromium	EPA 218.6
Fluoride	SM 4500F-C
Perchlorate	EPA 314.0
pH	SM2330B/SM 4500-HB
Specific Conductance	SM 2510B
Total Dissolved Solids	EPA 160.1/SM 2540C
Total Kjeldahl Nitrogen (TKN)	EPA 351.2
Organic Nitrogen	EPA 351.2
Total Organic Carbon	SM5310C/E415.3
Turbidity	EPA 180.1
VOCs[1]	EPA 524.2
1,2,3 -Trichloropropane (Low Detection)	CASRL 524M-TCP

1 - Only at wells within or near known VOC plumes (Chino Airport, South Archibald, Pomona, GE Flatiron, GE Testcell, Former Crown Coach Facility, Alger Manufacturing Inc., Chino Institution for Men, Milliken Landfill, Stringfellow)

Table 3-2
Analyte List for the Surface-Water Quality Monitoring Program

Analytes	Laboratory Analysis Method
Major cations: K, Na, Ca, Mg	EPA 200.7
Major anions: Cl, SO_4, NO_2, NO_3	EPA 300.0
Total Hardness	SM 2340B
Total Alkalinity (incl. Carbonate, Bicarbonate, Hydroxide)	SM 2320B
Boron	EPA 200.7
Ammonia-Nitrogen	EPA 350.1
pH	SM 4500-HB
Specific Conductance	SM 2510B
Total Dissolved Solids	E160.1/SM2540C
Total Kjeldahl Nitrogen (TKN)	EPA 351.2
Organic Nitrogen	EPA 351.2
Turbidity	EPA 180.1
Total Organic Carbon	SM5310C/E415.3



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Date: 3/12/2020
File: Figure 3-1

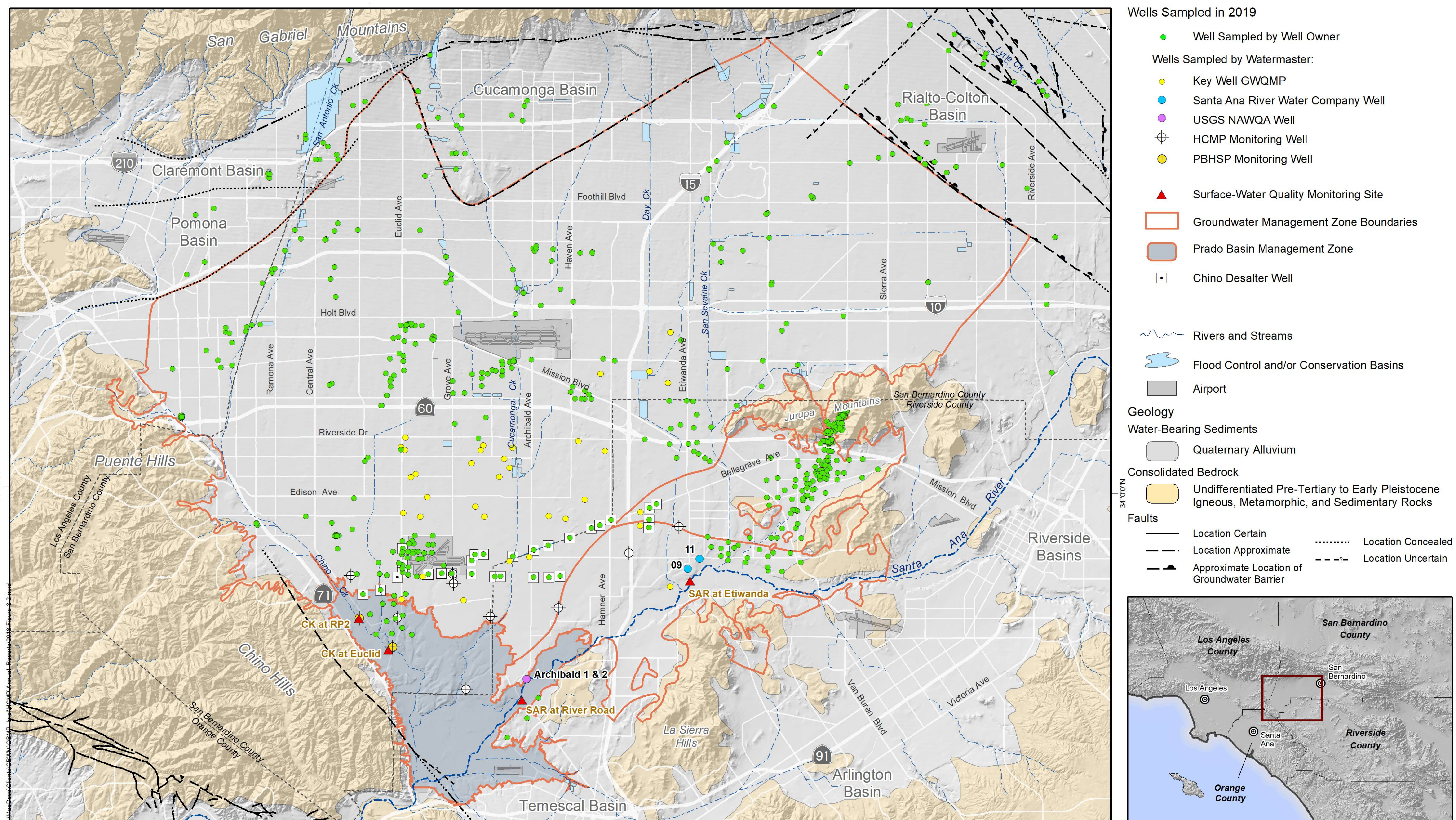
0 1 2 3 4 Miles
0 2 4 6 Kilometers

Chino Basin Watermaster — Partners in Basin Management

2019 Maximum Benefit Annual Report

Groundwater-Level Monitoring Program
Wells Monitored in 2019

Figure 3-1



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Author: SO
Date: 4/7/2020
File: Figure 3-2

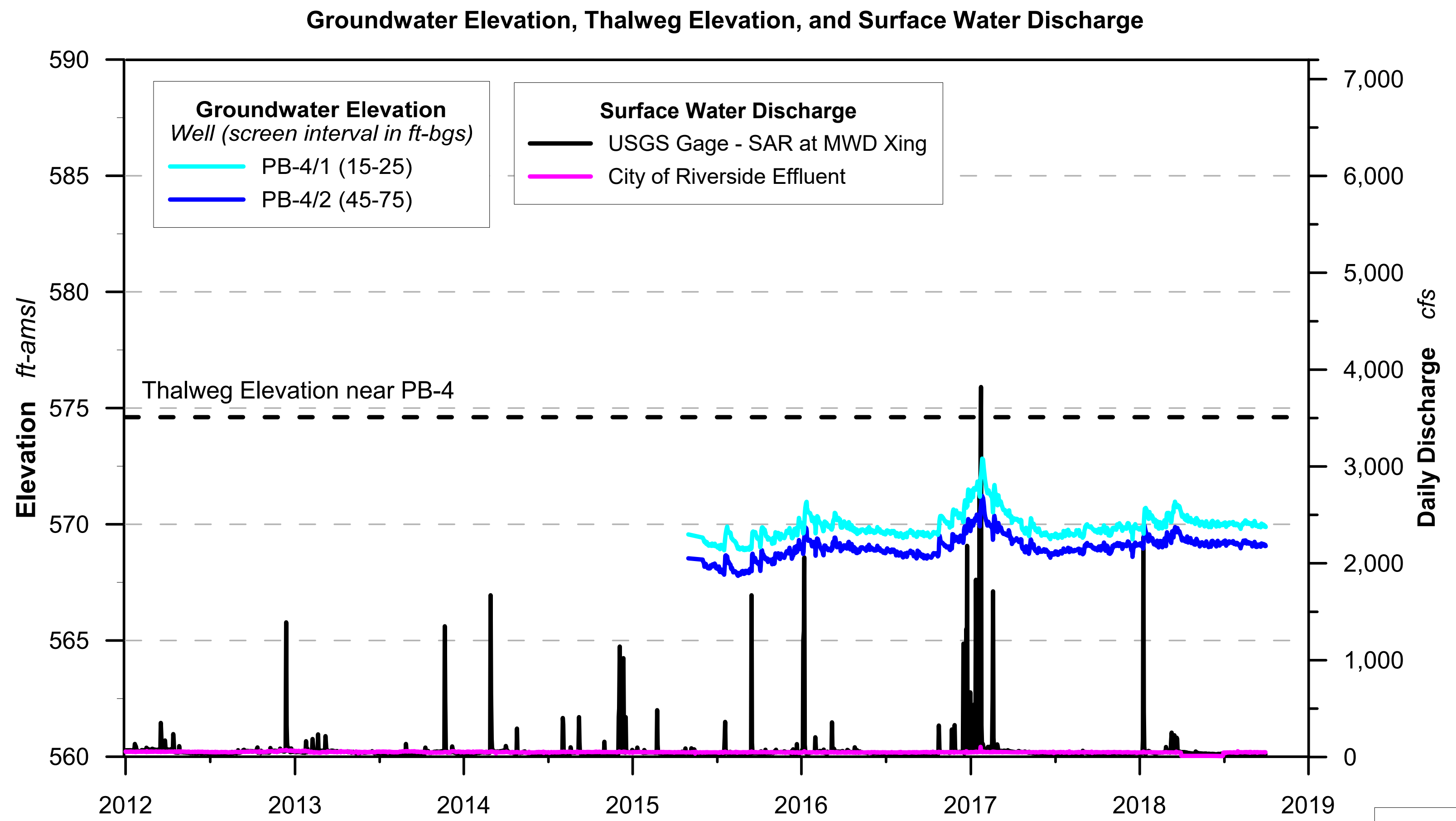
0 1 2 3 4 Miles
0 2 4 6 Kilometers

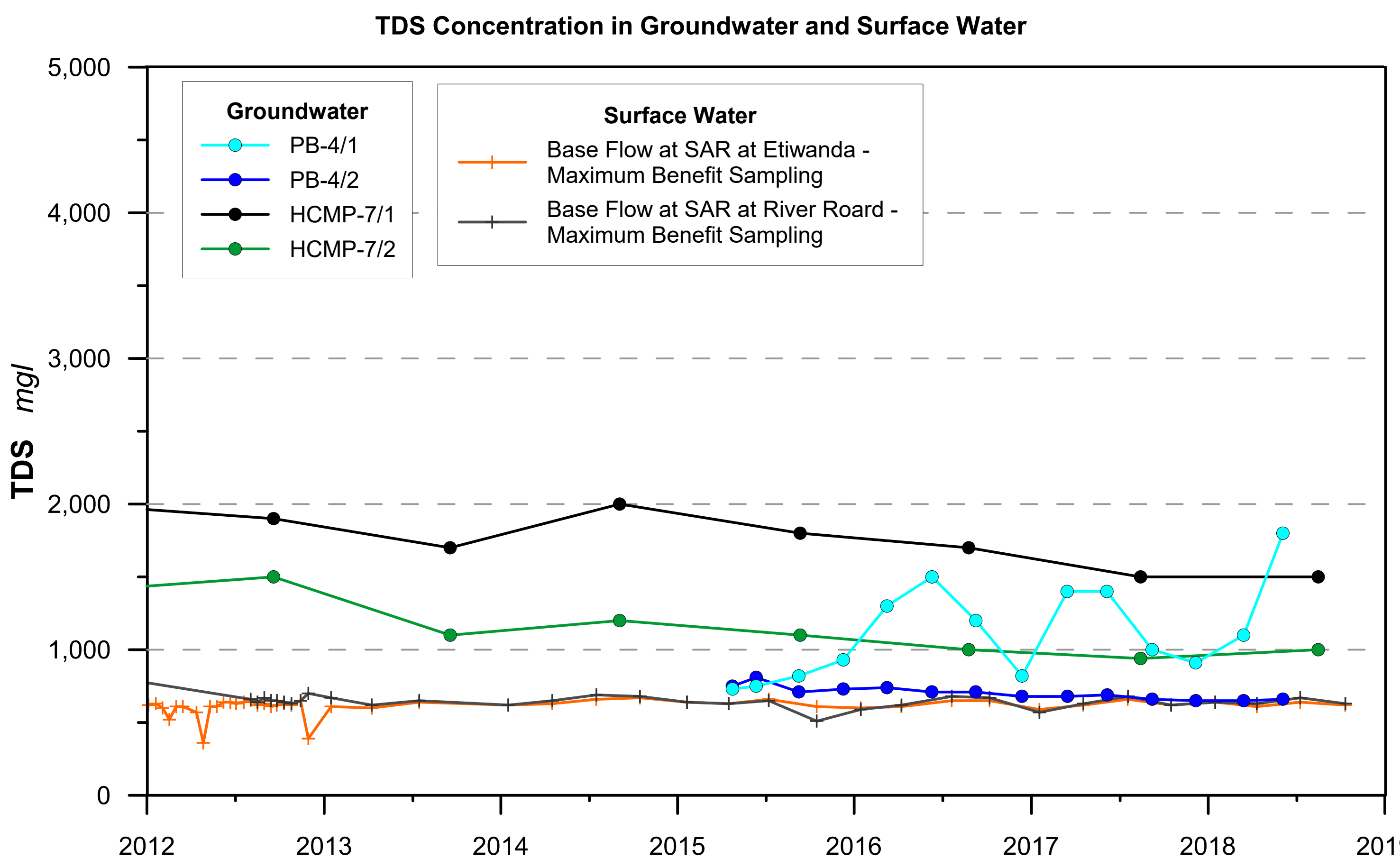
Chino Basin Watermaster
Partners in Basin Management

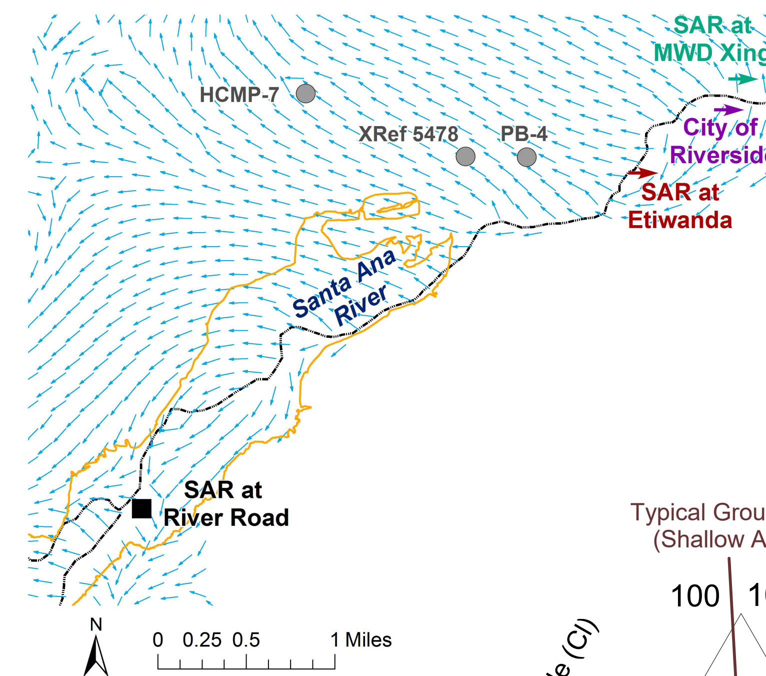
2019 Maximum Benefit Annual Report

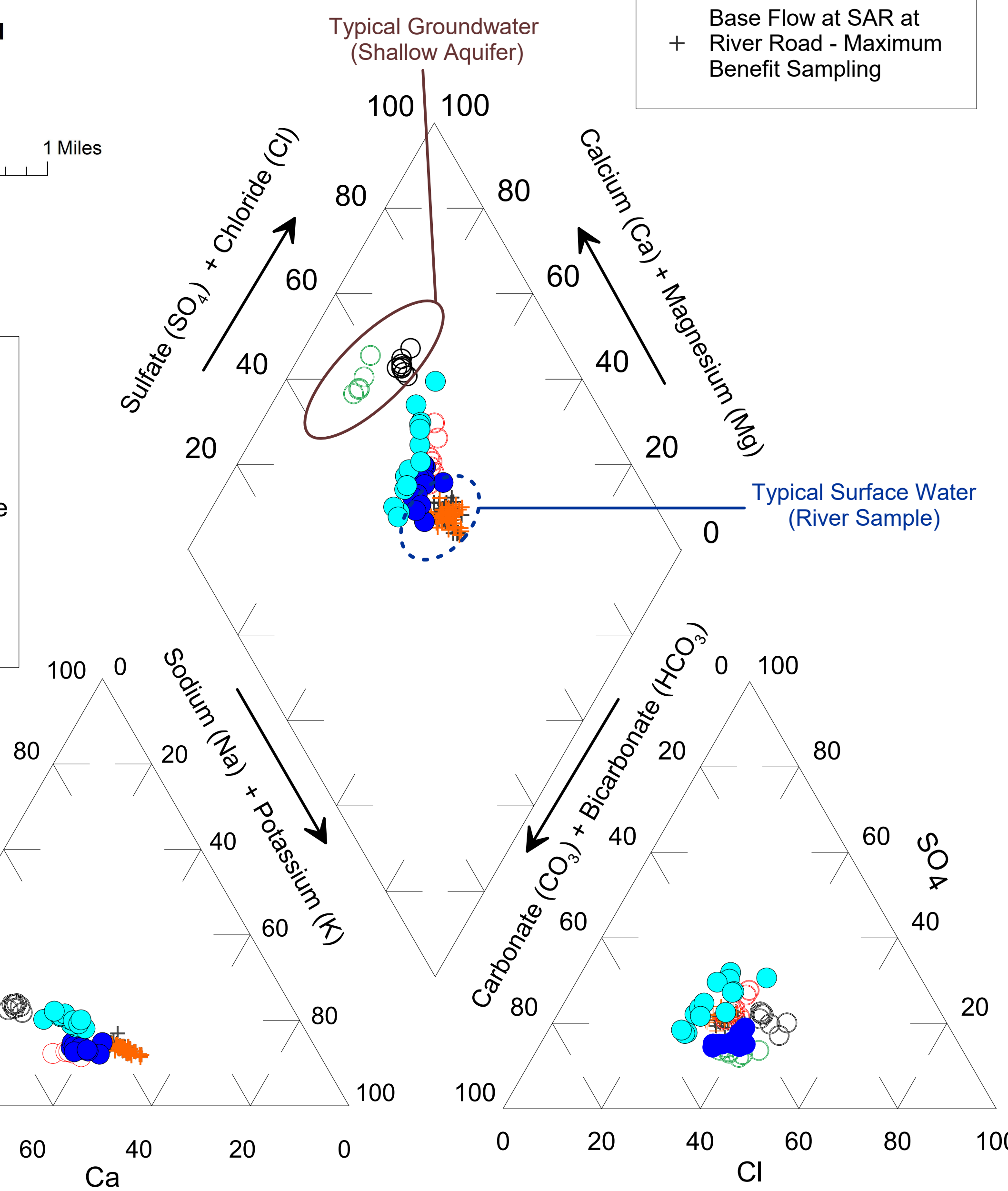
Groundwater and Surface-Water Quality Monitoring Program
Sites Sampled in 2019

Figure 3-2









(Figure 3-15h from the 2018 PBHSP Annual Report June 2019)

Groundwater and Surface Water Interactions
Santa Ana River Near PB-4

Figure 3-3

Section 4 - The Influence of Rising Groundwater on the Santa Ana River

This section characterizes the influence of rising groundwater on the flow and quality of the Santa Ana River between the Riverside Narrows and Prado Dam. Rising groundwater from the Chino Basin to the Santa Ana River consists of groundwater from Chino-North that flows past the CCWF well field and unpumped groundwater south of and outside the influence of the Chino Basin Desalter well fields.[16]

4.1 Surface-Water Discharge Accounting

Annual estimates of the Chino Basin recharge and discharges (computational results from Watermaster's Chino Basin groundwater model) are used to evaluate the annual net contribution of rising groundwater to the Santa Ana River between the Riverside Narrows and Prado Dam. The purpose of this analysis is to estimate the magnitude of net rising groundwater in the Santa Ana River between Riverside Narrows and Prado Dam. Net rising groundwater is the combined losses and gains in Santa Ana River flow due to rising groundwater, streambed infiltration, and evapotranspiration (ET). Achieving hydraulic control should decrease net rising groundwater.

Table 4-1 is a water budget table from Watermaster's groundwater model that was updated and recalibrated to recalculate the safe yield in 2020 (WEI, 2020). The water budget table lists the annual recharge and discharge components for the Chino Basin input to, or computed by the model for the calibration period of fiscal year 1978 to 2018, and fiscal year 2019 of the planning simulation (scenario *2020 SYR1*) to update the projections of net recharge and Safe Yield. Column 10, *Streambed Infiltration from the Santa Ana River*, is the annual estimate of streambed infiltration in the Santa Ana River downstream of the Riverside Narrows and the lower reaches of Chino Creek and Mill Creek. Column 20, *Rising Groundwater*, is the annual estimate of the combined groundwater discharge from Chino-North to the Santa Ana River, Chino Creek, and Mill Creek. The net rising groundwater from Chino-North to the Santa Ana River between Riverside Narrows and Prado Dam is calculated in Column 24 as the difference between groundwater discharge to and streambed infiltration (Column 20 minus Column 10). Figure 4-1 shows the time history of this net rising groundwater calculation. With three exceptions, in 2001, 2003, and 2004, the net rising groundwater estimate is negative over the 42-year period. Negative values for net rising groundwater indicate that the volume of rising groundwater in this reach of the Santa Ana River is less than the combined volume of losses from the river due to streambed infiltration. Net rising groundwater decreased (larger negative values) as the Chino-I and Chino-II Desalters ramped up production in the southern Chino Basin starting in FY 2005. These observations are consistent with conclusions from the monitoring data and demonstrate that hydraulic control is being achieved.

[16] See groundwater flow vectors in Figure 2-2.

4.2 Surface-Water Quality at Prado Dam

Rising groundwater from the Chino Basin to the Santa Ana River consists of groundwater from Chino-North that flows past the CCWF well field and unpumped groundwater south of and outside the influence of the Chino Basin Desalter well fields. Groundwater discharge from Chino-North to the PBMZ is either pumped by wells, consumed by riparian vegetation in the PBMZ, or becomes rising groundwater and contributes to Santa Ana River discharge at Prado Dam. Calibration of the 2008 Wasteload Allocation Model (1994-2006) estimated that rising groundwater in the PBMZ had an average TDS concentration of about 850 mgl (WEI, 2009b). This estimate is consistent with a 2015 TDS mass-balance characterization of the Santa Ana River (WEI, 2015d) and recent sampling at PBMZ monitoring wells (WEI, 2019c).

The Santa Ana River Watermaster (SARWM) has compiled annual reports pursuant to the 1969 stipulated judgment[17] that contain annual estimates of: significant discharges to the Santa Ana River, estimates of the storm flow and base flow discharge, and the volume-weighted TDS concentration of discharge at the Riverside Narrows and at Prado Dam (see SARWM, 2019). These estimates are used herein to demonstrate the impact of rising groundwater outflow on the TDS concentration of the Santa Ana River at Prado Dam. Figure 4-2 is a time-history chart of the annual discharge components in the Santa Ana River at Prado Dam and the associated annual volume-weighted TDS concentrations as reported by the SARWM. The base flow discharge is represented by two bars: (i) the SARWM estimate of base flow discharge at Prado Dam minus the rising groundwater from the Chino Basin component, and (ii) the total rising groundwater discharge from the Chino Basin to the Santa Ana River estimated with the Watermaster's 2020 groundwater model update as shown in column 20 of Table 4-1 — the sum of these two terms equal the SARWM estimate of base flow discharge at Prado Dam. Figure 4-2 also shows the five-year moving average of the SARWM's estimate of the annual flow-weighted TDS concentration of the Santa Ana River at Prado Dam. This five-year moving average is the metric the Regional Board uses to determine compliance with the Basin Plan TDS concentration objective of 650 mgl for Reach 2 of the Santa Ana River (Reach 2 TDS metric) (Regional Board, 2008). Note that:

- Since about 1980, annual estimates of rising groundwater discharge from the Chino Basin to the Santa Ana River, which ranged from about 13,000 to 30,000 afy, have been a small percentage of total annual flow at Prado Dam, ranging from about three percent during wet years to about 17 percent during dry years.
- From 2005 to 2015, the model-estimated groundwater discharge from Chino-North to the PBMZ ranged from 550 afy to 750 afy without CCWF operation[18], which represents a small fraction of the total rising groundwater from the Chino Basin to the Santa Ana River. It represents about four percent of rising

[17] The Santa Ana River was adjudicated in the 1960s, and a stipulated judgment was filed in 1969 (OCWD v. City of Chino et al., Case No. 117628, County of Orange). Since the Judgment was filed, the SARWM has compiled annual reports

[18] See Figure 2-3 of this report for modeling projections of groundwater discharge from Chino-North to the PBMZ past the CCWF using historical data

groundwater discharge from the Chino Basin to the Santa Ana River, and about less than one percent of the total flow in the Santa Ana River at Prado Dam.

- In 2016, the CCWF commenced operation, further reducing the groundwater discharge from the Chino-North to the PBMZ to the de *minimis* threshold levels (less than 1,000 afy). The model projected groundwater discharge past the CCWF ranges from about 400 to 600 afy in 2016 through 2050.[19] This represents about three percent of the total rising groundwater discharge to the Santa Ana River from the Chino Basin, and less than one percent of the total flow in the Santa Ana River at Prado Dam.
- Since about 1980, the Reach 2 TDS metric has ranged between 481 and 603 mgl and has not exceeded the TDS objective of 650 mg/L—even during extended dry periods when storm water dilution of the Santa Ana River is relatively little (e.g. water years 1984 through 1992, 1999 through 2004, and 2012 through 2016).
- The Reach 2 TDS metric increased continuously from water year 2006 to water year 2016, which coincides with a dry climatic period and a steady decrease in the volume of base flow discharge. The decrease in baseflow is mostly attributable to the decrease wastewater discharges to the Santa Ana River.
- In water year 2019, the Reach 2 TDS metric decreased to 500 mgl.

These observations suggest that the rising groundwater discharge from the Chino Basin to the Santa Ana River has had a *de minimis* impact on the flow and TDS concentration of the Santa Ana River since about 1980 and has never contributed to an exceedance of the TDS objective for Reach 2. The groundwater discharge from the Chino-North to the PBMZ that becomes rising groundwater discharge in the Santa Ana River has historically been small compared to total discharge in the Santa Ana River and has further decreased with CCWF operation. Based on the trends observed since 2005, the Reach 2 TDS metric will likely continue to increase as other conditions that affect the flow and quality of the Santa Ana River change over time, such as the continued reduction of wastewater effluent discharges to the River, and/or an increase in the duration and frequency of dry periods due to climate change. Given that wastewater effluent discharges are projected to decline further, the maintenance of hydraulic control of Chino-North will become increasingly important to protecting the water quality of the Santa Ana River at Prado Dam and downstream beneficial uses.

[19] See Figure 2-3 of this report for modeling projections of groundwater discharge from Chino-North to the PBMZ past the CCWF.

Table 4-1

Water Budget for the Chino Basin for the Calibration and Planning Periods and Estimated Net Santa Ana River Rising Groundwater

Fiscal Year	Recharge														Discharge						Change in Storage		Net Rising Groundwater Contribution to Surface Discharge
	Subsurface Inflow							Deep Infiltration of Precipitation and Applied Water	Santa Ana River Streambed Infiltration[1]	Streambed Infiltration from the Santa Ana River Tributaries	Managed Aquifer Recharge			Total Recharge	Groundwater Pumping			Riparian Veg ET	Rising Groundwater[2]	Total Discharge	Annual	Cumulative	
	Bloomington Divide	Chino/Puente Hills, Jurupa Hills, and Rialto Basin	Net Temescal Basin	Pomona Basin	Claremont Basin	Cucamonga Basin	Spadra Basin				Storm Water	Recycled Water	Imported Water		CDA Pumping	Overlying Non Ag and Appropriative Pools	Overlying Agricultural Pool						
	(1)	(2)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24) = (20) - (10)
1978	11,404	8,811	2,502	2,278	2,277	12,032	961	117,423	37,046	24,456	5,183	3,175	6,952	234,499	0	64,771	120,072	16,951	14,495	216,289	18,210	18,210	(22,552)
1979	11,002	9,659	3,101	2,867	2,574	11,628	576	122,211	33,871	15,620	2,951	3,049	28,347	247,456	0	65,008	118,922	17,257	12,619	213,805	33,651	51,861	(21,253)
1980	12,497	10,790	3,420	2,922	2,578	11,567	498	126,236	38,002	20,253	4,662	3,232	16,537	253,195	0	69,503	110,885	16,404	14,897	211,689	41,505	93,366	(23,105)
1981	13,071	10,955	4,216	3,024	2,585	11,537	476	126,479	30,545	7,647	1,219	3,451	20,850	236,055	0	72,927	116,470	17,194	13,035	219,626	16,429	109,795	(17,510)
1982	13,337	11,289	4,987	2,892	2,470	11,401	480	126,714	33,792	11,112	3,096	3,726	21,641	246,937	0	68,404	101,624	16,868	13,389	200,284	46,652	156,447	(20,403)
1983	13,316	10,685	5,161	3,008	2,597	11,552	496	132,273	35,436	18,011	6,703	3,873	27,590	270,704	0	67,259	94,508	16,139	17,899	195,805	74,898	231,346	(17,537)
1984	14,378	9,829	6,112	3,222	2,752	11,871	511	133,497	29,048	8,724	2,472	982	22,400	245,799	0	74,726	107,238	16,642	17,412	216,018	29,782	261,127	(11,636)
1985	13,577	8,729	6,343	3,085	2,561	11,887	526	128,408	30,446	6,257	2,032	0	20,782	234,631	0	79,626	105,444	16,810	14,364	216,243	18,388	279,515	(16,082)
1986	12,428	9,439	6,192	3,007	2,456	11,668	549	127,728	33,461	6,062	2,903	0	18,327	234,221	0	83,822	105,254	16,877	15,805	221,757	12,463	291,979	(17,656)
1987	11,951	8,844	6,493	2,944	2,379	11,309	553	121,909	32,772	2,874	1,789	0	19,938	223,754	0	88,675	104,829	17,090	14,383	224,976	(1,222)	290,756	(18,389)
1988	11,385	7,674	5,839	2,790	2,274	10,771	538	122,069	34,246	2,925	2,641	0	2,485	205,637	0	94,222	95,264	17,187	15,603	222,276	(16,640)	274,117	(18,643)
1989	11,408	7,528	5,339	2,681	2,214	10,364	529	120,836	31,310	1,422	2,393	0	7,332	203,357	0	97,218	89,511	17,407	14,798	218,935	(15,578)	258,539	(16,513)
1990	11,788	7,121	4,579	2,536	2,124	10,448	509	115,495	31,487	433	1,430	0	0	187,950	0	98,914	83,775	17,482	13,942	214,113	(26,163)	232,376	(17,545)
1991	12,630	6,656	4,009	2,421	2,092	10,335	474	113,633	33,477	712	2,198	0	3,634	192,271	0	88,986	83,073	17,525	14,171	203,756	(11,484)	220,891	(19,306)
1992	13,286	7,250	3,737	2,438	2,136	10,393	442	112,979	34,141	1,028	3,598	0	5,568	196,997	0	102,664	77,336	17,736	14,905	212,640	(15,643)	205,248	(19,237)
1993	13,611	8,300	2,863	2,725	2,434	10,588	423	116,794	37,980	2,239	6,619	0	14,224	218,800	0	88,040	83,284	17,404	17,162	205,889	12,910	218,159	(20,817)
1994	13,637	8,223	3,621	2,994	2,560	10,871	425	117,935	30,748	650	1,486	0	16,448	209,597	0	93,564	72,115	18,155	15,589	199,423	10,174	228,333	(15,159)
1995	13,478	9,217	2,488	2,899	2,507	10,967	428	119,075	35,361	1,538	4,662	0	10,375	212,995	0	98,173	62,171	17,711	19,136	197,191	15,803	244,136	(16,225)
1996	13,289	9,146	3,546	3,017	2,560	11,015	455	117,398	29,441	709	2,425	0	82	193,085	0	109,609	71,220	18,429	18,553	217,811	(24,726)	219,410	(10,888)
1997	13,292	9,072	3,290	2,829	2,430	10,883	481	116,836	30,483	1,007	3,305	0	16	193,925	0	112,998	68,968	18,564	18,917	219,448	(25,523)	193,887	(11,565)
1998	13,650	8,754	2,402	2,803	2,417	10,727	503	117,046	33,821	1,637	5,780	0	8,352	207,895	0	104,141	45,302	18,238	22,456	190,138	17,757	211,644	(11,365)
1999	13,956	8,514	3,516	2,936	2,489	10,756	494	115,042	26,381	519	1,007	0	5,839	191,449	0	118,738	46,730	19,035	22,794	207,298	(15,849)	195,795	(3,587)
2000	14,451	7,890	2,858	2,707	2,341	10,563	508	109,843	27,081	499	1,985	507	997	182,232	523	133,086	46,538	18,938	23,315	222,400	(40,168)	155,628	(3,767)
2001	14,556	7,970	3,132	2,532	2,254	10,223	525	107,823	25,419	598	3,162	500	6,538	185,230	9,470	120,396	41,429	18,717	26,464	216,476	(31,245)	124,382	1,045
2002	15,177	7,242	3,565	2,467	2,206	10,028	517	102,792	25,922	230	1,148	505	6,493	178,292	10,173	129,760	38,650	18,472	26,544	223,599	(45,307)	79,075	621
2003	15,747	6,518	2,932	2,377	2,145	9,868	504	102,305	28,672	859	6,284	185	6,548	184,945	10,322	123,471	36,507	18,157	26,630	215,087	(30,142)	48,934	(2,042)
2004	16,088	6,780	1,994	2,407	2,123	9,860	492	99,010	27,465	536	3,357	49	7,607	177,768	10,480	128,548	36,809	18,069	27,669	221,574	(43,807)	5,127	204
2005	14,346	7,918	721	2,643	2,336	9,816	481	99,647	30,922	5,917	17,648	158	12,259	204,813	10,595	112,943	34,503	17,178	29,844	205,064	(251)	4,876	(1,078)
2006	14,568	7,648	1,891	3,152	2,571	9,897	467	99,823	30,439	1,806	12,940	1,303	34,567	221,073	19,819	113,553	30,812	17,561	24,576	206,321	14,752	19,627	(5,862)
2007	15,150	7,607	1,268	2,911	2,413	9,826	412	96,008	29,276	79	4,745	2,993	32,960	205,647	28,529	123,695	29,919	18,276	21,441	221,859	(16,212)	3,415	(7,835)
2008	15,044	7,346	1,173	2,627	2,240	9,842	384	93,275	31,703	1,530	10,205	2,340	0	177,709	30,116	127,696	26,280	18,358	20,003	222,453	(44,744)	-41,329	(11,700)
2009	15,271	7,363	696	2,509	2,178	9,950	414	91,489	33,318	839	7,512	2,684	0	174,220	28,456	137,345	23,386	18,561	18,475	226,223	(52,003)	-93,331	(14,843)
2010	15,584	6,402	562	2,448	2,167	9,809	441	88,512	35,285	1,939	14,273	7,210	5,000	189,632	28,964	108,983	22,038	18,686	18,067	196,739	(7,107)	-100,438	(17,218)
2011	15,960	6,889	557	2,601	2,299	9,891	452	88,763	36,213	3,358	17,052	8,065	9,465	201,564	28,941	94,413	18,042	18,739	18,765	178,901	22,663	-77,775	(17,447)
2012	15,577	6,971	1,397	2,713	2,317	9,820	441	84,009	34,463	463	9,271	8,634	22,560	198,637	28,230	108,501	22,412	19,282	15,649	194,074	4,563	-73,212	(18,814)
2013	15,144	6,651	1,516	2,676	2,203	9,748	426	80,130	33,536	243	5,271	10,479	0	168,023	27,380	111,748	24,074	17,348	13,871	194,421	(26,398)	-99,610	(19,665)
2014	15,067	6,355	1,371	2,645	2,144	9,548	440	78,395	34,301	241	4,299	13,593	795	169,195	29,626	118,849	22,131	17,426	13,348	201,380	(32,185)	-131,795	(20,953)
2015	15,230	5,760	1,217	2,547	2,096	8,721	458	75,817	34,907	421	8,001	10,840	0	166,014	30,022	104,317	17,552	17,580	13,585	183,056	(17,042)	-148,837	(21,322)
2016	15,716	5,015	1,057	2,498	2,062	7,809	449	73,547	36,134	476	9,236	13,222	0	167,221	28,191	101,301	16,908	17,824	14,147	178,371	(11,150)	-159,988	(21,987)
2017	15,967	5,587	1,529	2,462	2,056	8,311	423	72,874	35,805	1,920	11,575	13,934	13,150	185,593	28,284	98,960	16,191	17,869	15,261	176,565	9,028	-150,960	(20,544)
2018	15,711	5,385	2,306	2,510	2,072	8,041	388	69,532	32,664	2,165	4,494	13,212	35,621	194,101	30,088	93,904	16,776	18,147	13,914	172,828	21,272	-129,687	(18,750)
2019	15,538	7,694	365	2,644	2,060	6,914	343	68,414	36,230	550	10,472	13,504	0	164,728	31,748	82,530	20,362	18,066	14,113	166,819	(2,092)	-131,779	(22,117)

Source: Water Budget from the Chino Basin goundwater model that was updated and recalibrated to calculate Safe Yield in 2020. The period includes the calibration period of fiscal year 1978 to 2018 and fiscal year 2019 of the planning simulation period for Scenario 2020 SYR1.

1. Streambed infiltration from Santa Ana River includes infiltration at Santa Ana River below Riverside Narrows and at lower reaches of Chino and Mill Creeks

2. Groundwater discharge to streams includes groundwater from Chino-North discharge to Santa Ana River and Chino and Mill Creeks.

(Red Text) Indicates negative values.

Figure 4-1
Net Annual Rising Groundwater Contribution to Surface Discharge in Santa Ana River between Riverside Narrows and Prado Dam, 1978 to 2019

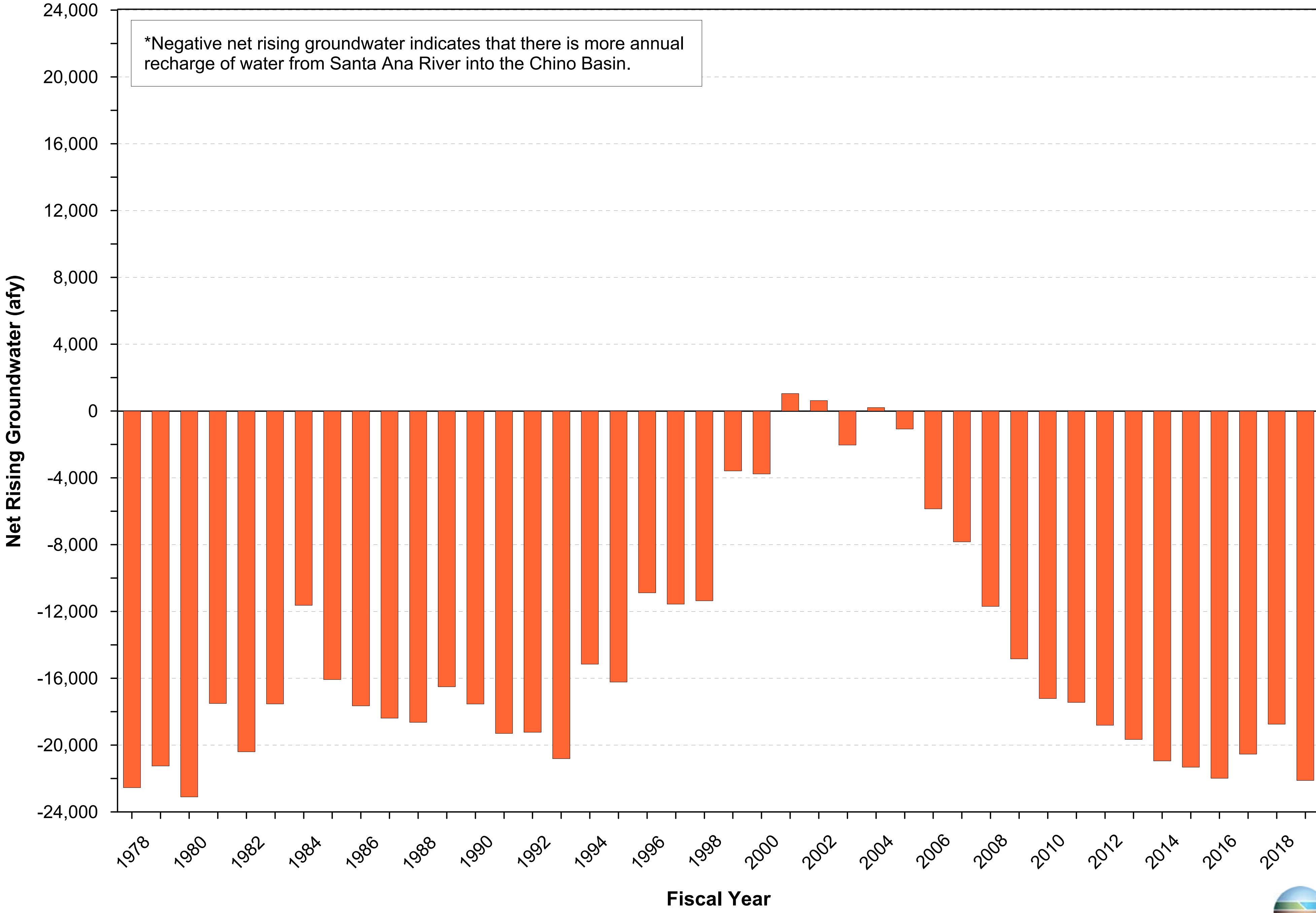
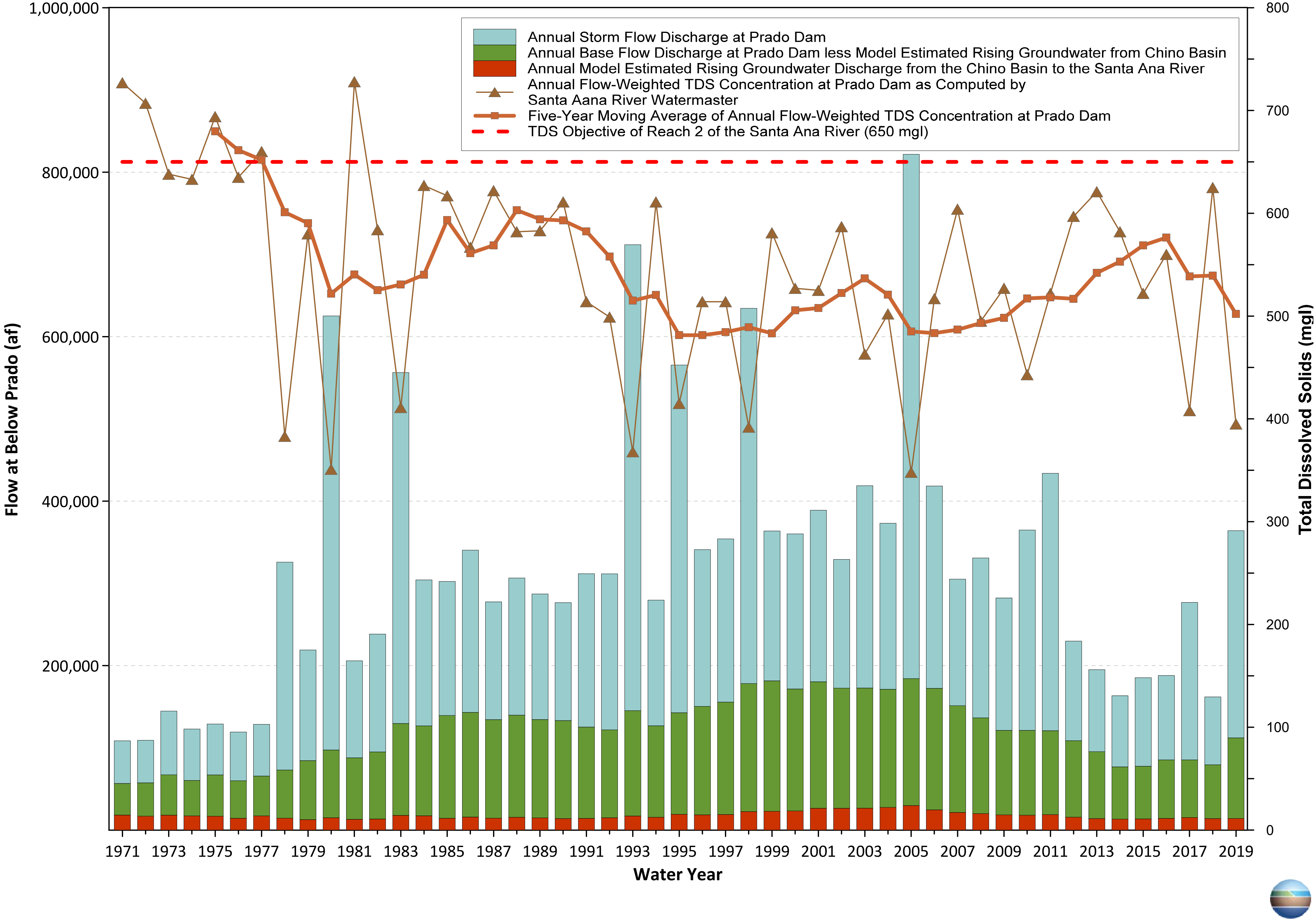


Figure 4-2
TDS and Components of Discharge of the Santa Ana River at Prado Dam - 1971 to 2019



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Appendices

Appendix A - IEUA Five-Year Volume-Weighted TDS and TIN Computation

Appendix B - Database

Appendix A

IEUA Five-Year Volume-Weighted TDS and TIN Computation

Appendix A: TDS and NO_3-N Data Table

Month	Volume (acre-feet) SW/LR	Volume IW	Volume RW	Volume Total	TDS (mg/L) SW/LR (Mean)	TDS IW	TDS RW	TDS Σ (Vol x TDS)	TDS 5-yr Avg	NO_3-N (mg/L) SW/LR (Mean)	NO_3-N IW	NO_3-N RW*	NO_3-N Σ (Vol x TDS)	NO_3-N 5-yr Avg
Jul-05	647	1,488	20	2,155	129	189	458	373806		2.9	0.6	2.3	2885	
Aug-05	137	1,545	254	1,936	129	174	447	399909		2.9	0.5	1.6	1564	
Sep-05	299	2,763	268	3,329	129	191	467	691278		2.9	0.4	2.1	2634	
Oct-05	876	2,313	150	3,340	129	205	459	656175		2.9	0.3	1.5	3529	
Nov-05	344	3,567	100	4,010	129	202	455	810393		2.9	0.5	1.8	2800	
Dec-05	669	3,617	77	4,362	129	223	475	929286		2.9	0.6	2.1	4408	
Jan-06	762	3,548	154	4,463	177	276	483	1188208		1.1	0.8	2.8	4015	
Feb-06	1,679	3,467	209	5,355	177	207	451	1109014		1.1	0.8	2.7	5287	
Mar-06	3,177	2,043	0	5,219	95	193	443	697408		0.5	0.8	2.9	3297	
Apr-06	3,337	2,568	0	5,905	115	173	437	827652		0.8	0.6	4.2	4182	
May-06	857	3,190	0	4,046	115	149	442	573690		0.8	0.4	5.4	2025	
Jun-06	216	3,597	73	3,886	115	128	488	520838		0.8	0.3	3.3	1460	
Jul-06	156	956	449	1,561	115	144	455	359551		0.8	0.3	2.3	1459	
Aug-06	182	4,467	619	5,269	115	173	454	1074838		0.8	0.3	2.1	2955	
Sep-06	273	6,749	616	7,638	115	177	427	1488730		0.8	0.4	2.5	4197	
Oct-06	300	6,150	224	6,675	115	170	435	1177526		0.8	0.3	3.6	2969	
Nov-06	296	5,257	93	5,646	115	158	436	905165		0.8	0.5	2.9	2989	
Dec-06	697	5,429	260	6,386	115	271	447	1667416		2.5	0.6	3.4	5918	
Jan-07	543	3,201	160	3,904	115	247	466	927308		2.5	0.8	3.3	4413	
Feb-07	1,140	706	130	1,976	115	301	464	403809		2.5	0.9	4.0	3989	
Mar-07	200	48	117	365	115	295	477	93031		2.5	1.0	3.0	895	
Apr-07	532	4	130	666	115	275	470	123292		2.5	1.0	2.8	1698	
May-07	245	0	182	427	115	244	481	115621		2.5	0.8	4.8	1487	
Jun-07	206	0	10	216	115	249	478	28445		2.5	0.5	3.0	543	
Jul-07	141	0	141	282	329	254	492	115864		0.9	0.5	3.9	683	
Aug-07	197	0	78	275	329	207	475	101948		0.9	0.5	3.3	444	
Sep-07	218	0	143	361	329	220	481	140613		0.9	0.3	3.4	690	
Oct-07	285	0	132	417	366	272	542	175777		0.7	0.4	4.9	865	
Nov-07	915	0	346	1,261	366	278	497	506679		0.7	0.6	3.1	1757	
Dec-07	1,481	0	53	1,534	130	278	506	219871		1.7	0.8	3.8	2667	
Jan-08	4,558	0	1	4,559	86	271	493	392987		0.7	0.9	4.6	3337	
Feb-08	1,427	0	196	1,623	101	248	450	232422		1.5	1.0	3.8	2878	
Mar-08	155	0	360	515	101	275	456	179969		1.5	1.1	3.0	1303	
Apr-08	150	0	260	410	101	281	483	140669		1.5	1.3	3.8	1208	
May-08	588	0	369	957	376	284	481	398503		0.7	0.9	4.8	2190	
Jun-08	128	0	261	389	376	285	490	175914		0.7	0.8	5.8	1612	
Jul-08	142	0	291	433	376	290	489	195594		0.7	0.7	6.0	1854	
Aug-08	111	0	245	356	382	281	465	156409		<0.1	0.7	4.0	982	
Sep-08	99	0	86	185	382	272	467	78001		<0.1	0.4	4.6	402	
Oct-08	161	0	395	556	382	279	487	253867		<0.1	0.5	6.5	2586	
Nov-08	677	0	229	906	432	289	461	398131		0.6	0.6	3.5	1198	
Dec-08	2,363	0	88	2,451	112	289	446	304660		1.1	0.7	4.2	3031	
Jan-09	224	0	356	580	112	287	464	190341		1.1	0.7	3.9	1625	
Feb-09	3,080	0	52	3,132	66	289	413	224746		0.5	0.8	3.3	1698	
Mar-09	299	0	182	481	66	272	434	98661		0.5	0.6	2.6	612	
Apr-09	106	0	311	417	66	273	463	151093		0.5	0.6	2.4	795	
May-09	79	0	156	235	379	284	468	102878		0.5	0.5	2.4	416	
Jun-09	153	0	293	446	379	287	479	198306		0.5	0.5	4.6	1411	
Jul-09	107	0	90	197	379	324	465	82368		0.5	0.6	3.2	344	
Aug-09	113	0	200	313	292	254	446	122229		0.2	0.4	2.9	594	
Sep-09	108	0	296	404	292	235	447	163848		0.2	0.1	2.8	841	
Oct-09	614	17	807	1,438	189	255	455	487420		1.4	0.2	2.9	3205	
Nov-09	489	3	1,210	1,702	189	287	444	629794		1.4	0.5	2.8	4026	
Dec-09	2,851	0	563	3,414	100	255	441	532946		1.0	0.7	2.5	4262	

Appendix A: TDS and NO_3-N Data Table

	Volume (acre-feet)				TDS (mg/L)					NO_3-N (mg/L)				
Month	SW/LR	IW	RW	Total	SW/LR (Mean)	IW	RW	Σ (Vol x TDS)	5-yr Avg	SW/LR (Mean)	IW	RW*	Σ (Vol x TDS)	5-yr Avg
Jan-10	4,190	0	473	4,663	68	244	444	496489		0.6	0.7	2.4	3751	
Feb-10	3,715	6	167	3,888	94	235	418	420493		1.3	0.7	3.3	5281	
Mar-10	593	0	612	1,205	94	220	419	311908		1.3	0.8	3.1	2658	
Apr-10	1,156	365	617	2,138	94	220	417	446130		1.3	0.9	2.6	3421	
May-10	179	2,433	1,185	3,797	270	235	423	1121340		0.9	0.8	2.8	5436	
Jun-10	159	2,176	990	3,325	270	232	433	976102	203	0.9	0.6	3.0	4391	1.1
Jul-10	164	0	748	912	270	245	442	374597	205	0.9	0.6	3.2	2544	1.1
Aug-10	183	0	718	901	270	234	434	360817	207	0.9	0.5	3.7	2838	1.1
Sep-10	190	0	836	1,026	309	193	423	411920	208	0.4	0.2	3.6	3088	1.1
Oct-10	670	0	923	1,593	309	244	440	612919	210	0.4	0.1	3.9	3917	1.1
Nov-10	1,156	0	773	1,929	100	267	450	463450	211	1.0	0.4	4.1	4277	1.2
Dec-10	7,036	0	262	7,298	240	248	430	1797782	213	0.7	0.5	3.8	6238	1.1
Jan-11	1,695	0	478	2,173	240	215	430	611254	212	0.7	0.7	4.2	3273	1.2
Feb-11	2,395	0	407	2,802	240	166	422	745176	214	0.7	0.7	4.4	3579	1.2
Mar-11	2,673	0	188	2,861	150	157	413	478632	216	2.2	0.5	4.6	6738	1.2
Apr-11	399	0	751	1,150	150	163	411	368605	221	2.2	0.6	4.6	4313	1.3
May-11	323	3,729	997	5,049	150	143	422	1002210	222	2.2	0.3	3.3	5282	1.3
Jun-11	167	5,736	984	6,887	275	124	422	1172590	222	0.1	0.2	3.4	4521	1.3
Jul-11	244	7,810	706	8,760	275	135	412	1412035	218	0.1	0.5	3.1	5715	1.2
Aug-11	97	7,138	486	7,721	305	129	418	1153623	215	0.8	0.4	2.8	4185	1.2
Sep-11	163	7,529	639	8,331	305	151	413	1450791	213	0.8	0.3	3.8	4772	1.2
Oct-11	888	83	924	1,895	305	136	418	668564	217	0.8	0.2	4.1	4490	1.3
Nov-11	1,174	0	648	1,822	95	135	412	378506	220	1.1	0.3	3.9	3767	1.3
Dec-11	538	0	870	1,408	69	138	411	394455	218	1.1	0.4	4.8	4779	1.4
Jan-12	926	0	826	1,752	73	174	422	416352	218	0.7	0.5	4.8	4600	1.4
Feb-12	1,166	0	664	1,830	73	230	436	374306	218	0.7	0.5	4.3	3698	1.4
Mar-12	2,117	0	381	2,498	73	281	451	325796	216	0.7	0.5	3.4	2825	1.4
Apr-12	1,625	0	367	1,992	73	268	454	285010	215	0.7	0.5	3.9	2598	1.4
May-12	177	0	1,171	1,348	421	282	466	620049	217	1.6	0.7	3.8	4712	1.4
Jun-12	151	0	952	1,103	421	257	454	495353	220	1.6	0.5	3.3	3420	1.4
Jul-12	216	0	547	763	421	249	443	333110	221	1.6	0.5	3.2	2085	1.4
Aug-12	186	0	322	508	371	213	438	209899	221	0.7	0.3	3.3	1173	1.4
Sep-12	154	0	481	635	371	194	439	268173	222	0.7	0.2	3.7	1883	1.4
Oct-12	338	0	615	953	371	223	455	405346	222	0.7	0.1	3.6	2441	1.4
Nov-12	388	0	921	1,309	371	296	456	564333	223	0.7	0.2	4.3	4175	1.4
Dec-12	1928	0	576	2,504	176	270	461	604864	224	4.9	0.3	3.9	11654	1.5
Jan-13	713	0	1,284	1,997	66	274	466	645687	231	0.6	0.6	4.8	6556	1.6
Feb-13	579	0	1,107	1,686	96	284	454	558439	233	1.4	0.8	4.9	6185	1.6
Mar-13	449	0	1,387	1,836	54	300	472	678910	235	0.1	1.1	4.6	6370	1.6
Apr-13	75	0	1,113	1,188	54	303	471	527969	236	0.1	1.0	4.6	5117	1.6
May-13	204	0	1,052	1,256	394	291	471	575868	237	0.1	0.8	4.4	4652	1.6
Jun-13	68	0	1,074	1,142	394	288	486	548488	239	0.1	0.5	3.4	3698	1.7
Jul-13	108	0	876	984	394	288	469	453794	240	0.1	0.3	3.3	2914	1.7
Aug-13	98	0	930	1,028	394	264	466	471527	241	0.1	0.0	3.9	3669	1.7
Sep-13	112.1	0	1449	1,561	360	249	476	730660	243	1.7	0.1	4.3	6359	1.7
Oct-13	242	0	1441	1,683	360	274	469	762469	245	1.7	0.0	4.7	7255	1.7
Nov-13	394	0	1307	1,701	360	299	483	772794	247	1.7	0.1	4.5	6561	1.7
Dec-13	414	0	1374	1,788	140	302	495	738433	251	1.1	0.4	4.6	6798	1.8

Appendix A: TDS and NO_3-N Data Table

	Volume (acre-feet)				TDS (mg/L)					NO_3-N (mg/L)				
Month	SW/LR	IW	RW	Total	SW/LR (Mean)	IW	RW	Σ (Vol x TDS)	5-yr Avg	SW/LR (Mean)	IW	RW*	Σ (Vol x TDS)	5-yr Avg
Jan-14	196	195	997	1,388	140	305	493	578128	253	1.1	0.5	4.5	4805	1.8
Feb-14	1,274	235	848	2,357	132	306	497	661107	257	1.5	0.6	4.5	5879	1.8
Mar-14	665	282	782	1,729	245	314	467	616698	259	0.6	0.9	4.6	4239	1.9
Apr-14	589	72	1,177	1,838	245	309	496	749989	261	0.6	0.8	4.2	5349	1.9
May-14	131	11	1,322	1,464	369	305	500	712383	263	1.1	0.8	3.8	5203	1.9
Jun-14	76	0	1,090	1,166	369	294	486	557325	264	1.1	0.6	3.3	3708	1.9
Jul-14	67	0	574	641	369	292	470	294238	265	1.1	0.6	2.8	1676	1.9
Aug-14	195	0	825	1,020	369	307	481	468433	266	1.1	0.4	3.2	2887	1.9
Sep-14	163	0	1145	1,308	339	331	514	643986	268	0.9	0.3	3.9	4641	1.9
Oct-14	87	0	1247	1,334	339	340	522	680739	269	0.9	0.4	3.1	3968	1.9
Nov-14	903	0	864	1,767	130	342	548	590670	269	0.2	0.4	4.1	3686	1.9
Dec-14	3820	0	126	3,946	73	346	544	345444	266	0.8	0.5	4.9	3488	1.9
Jan-15	676	0	623	1,299	246	334	513	485557	273	1.0	0.7	5.4	4011	2.0
Feb-15	729	0	954	1,683	102	338	527	576798	279	1.8	0.8	4.3	5375	2.0
Mar-15	339	0	1,123	1,462	102	327	506	602367	280	1.8	0.8	4.0	5067	2.0
Apr-15	327	0	994	1,321	102	308	507	537312	283	1.8	0.9	4.4	5008	2.0
May-15	660	0	1,069	1,729	102	316	506	608234	283	1.8	0.8	4.9	6383	2.1
Jun-15	30	0	1,296	1,326	327	318	495	651848	285	1.0	0.6	3.4	4494	2.1
Jul-15	702	0	750	1,452	327	323	482	590867	286	1.0	1.0	3.8	3514	2.1
Aug-15	79	0	705	784	327	329	475	360708	286	1.0	0.3	3.5	2565	2.1
Sep-15	1,078	0	1,125	2,203	280	345	480	841340	287	0.2	0.2	3.8	4498	2.1
Oct-15	732	0	1,278	2,010	280	358	474	810732	287	0.2	0.1	3.8	5009	2.1
Nov-15	300	0	806	1,106	280	356	476	467334	289	0.2	0.1	4.2	3422	2.1
Dec-15	1,112	0	1,333	2,445	65	354	470	698826	291	1.7	0.3	4.8	8283	2.2
Jan-16	2,398	0	1,042	3,440	46	367	465	595099	288	0.6	0.7	5.7	7209	2.2
Feb-16	478	0	1,352	1,830	46	361	472	660132	290	0.6	0.7	4.5	6337	2.2
Mar-16	1,519	0	858	2,377	99	359	504	582813	292	1.0	0.9	4.0	4977	2.2
Apr-16	317	0	1,162	1,479	291	336	492	664347	293	2.4	0.8	4.1	5529	2.2
May-16	468	0	1,525	1,993	291	268	488	880267	300	2.4	0.6	3.7	6789	2.3
Jun-16	45	0	1,286	1,331	291	338	486	637463	310	2.4	0.5	3.2	4269	2.4
Jul-16	43	0	944	987	291	305	479	464231	323	2.4	0.3	3.8	3711	2.6
Aug-16	64	0	1,057	1,121	291	262	480	526390	338	2.4	0.1	4.5	4961	2.8
Sep-16	87	0	1,447	1,534	303	194	466	699940	354	0.2	0.1	4.6	6602	3.0
Oct-16	405	4160	1,345	5,910	180	208	461	1558536	349	2.9	0.1	4.5	7761	2.9
Nov-16	591	40	1,432	2,063	163	288	454	758363	352	1.3	0.2	4.3	6861	2.9
Dec-16	3,389	60	860	4,309	92	306	479	741934	345	0.9	0.2	4.1	6591	2.8
Jan-17	4712	0	431	5,143	86	292	479	609244	336	0.5	0.3	4.5	4419	2.7
Feb-17	1846	0	542	2,388	86	240	454	403660	334	0.5	0.6	4.8	3571	2.7
Mar-17	136	0	1598	1,734	86	170	441	715947	340	0.5	0.8	3.7	6018	2.8
Apr-17	81	1551	1517	3,149	86	130	441	877108	342	0.5	0.5	3.4	5987	2.8
May-17	194	0	1620	1,814	324	132	437	770616	342	<0.1	0.3	3.4	5477	2.8
Jun-17	26	6319	1141	7,486	324	94	435	1099173	328	<0.1	0.2	3.2	4895	2.6
Jul-17	68	7346	952	8,366	324	87	417	1057919	314	<0.1	0.2	4.1	5772	2.5
Aug-17	317	7068	932	8,317	324	102	423	1217994	302	<0.1	0.2	4.9	6326	2.4
Sep-17	53	3794	1307	5,154	267	115	415	992861	298	0.7	0.2	5.0	7428	2.3
Oct-17	83	4477	1433	5,993	267	121	396	1131570	292	0.7	0.2	4.2	7231	2.3
Nov-17	32	2480	1413	3,926	267	179	430	1060282	290	0.7	0.4	4.5	7422	2.3
Dec-17	23	4768	1591	6,381	306	176	424	1521360	289	2.2	0.5	4.0	8937	2.2

Appendix A: TDS and NO_3-N Data Table

	Volume (acre-feet)				TDS (mg/L)					NO_3-N (mg/L)				
Month	SW/LR	IW	RW	Total	SW/LR (Mean)	IW	RW	Σ (Vol x TDS)	5-yr Avg	SW/LR (Mean)	IW	RW*	Σ (Vol x TDS)	5-yr Avg
Jan-18	1514	4130	701	6,344	306	197	438	1583606	287	2.2	0.6	3.4	8126	2.1
Feb-18	428	0	998	1,426	148	254	461	523722	287	1.4	0.7	3.4	3960	2.1
Mar-18	1832	0	310	2,142	43	282	476	226292	283	1.3	0.7	3.4	3422	2.1
Apr-18	105	0	1105	1,210	43	262	456	508798	283	1.3	0.5	3.3	3799	2.1
May-18	122	0	1447	1,569	43	282	477	695296	283	1.3	0.5	3.1	4632	2.1
Jun-18	42	62	1321	1,425	419	236	470	653092	283	0.7	0.3	2.8	3739	2.1
Jul-18	82	60	1176	1,318	419	237	466	596863	284	0.7	0.1	3.0	3642	2.1
Aug-18	36	0	1397	1,432	382	240	457	652387	284	0.3	0.1	3.1	4293	2.1
Sep-18	43	0	1477	1,520	382	201	442	669458	284	0.3	0.1	3.3	4923	2.1
Oct-18	369	0	898	1,267	382	227	460	553690	283	0.3	0.1	3.1	2921	2.1
Nov-18	959	0	1168	2,128	205	272	480	757967	282	1.3	0.2	3.0	4761	2.0
Dec-18	1219	0	945	2,164	153	280	454	615408	281	0.2	0.3	3.2	3263	2.0
Jan-19	3079	19	657	3,754	153	269	472	785796	278	0.2	0.3	3.4	2862	2.0
Feb-19	3932	106	9	4,047	153	230	429	629649	275	0.2	0.5	3.2	867	1.9
Mar-19	2177	192	512	2,881	153	262	438	607781	273	0.2	0.4	3.3	2189	1.9
Apr-19	139	1068	1080	2,286	153	165	435	667610	271	0.2	0.5	2.9	3682	1.9
May-19	796	447	955	2,197	250	207	449	719663	270	<0.1	0.2	2.9	2941	1.8
Jun-19	31	4896	1270	6,197	250	242	457	1772872	269	<0.1	0.3	2.2	4115	1.8
Jul-19	31	4620	1123	5,774	384	152	416	1180771	266	0.4	0.3	2.7	4476	1.8
Aug-19	54	4841	995	5,890	384	126	420	1048907	262	3.9	0.2	2.6	3957	1.7
Sep-19	32	2165	1134	3,331	384	170	423	859840	260	3.9	0.1	2.9	3732	1.7
Oct-19	38	1813	1614	3,465	384	135	412	923797	258	3.9	0.2	2.8	5008	1.7
Nov-19	1616	1198	1290	4,104	384	199	434	1419377	260	3.9	0.1	3.4	10827	1.7
Dec-19	2557	2577	918	6,052	95	230	439	1239023	262	0.6	0.1	3.8	5211	1.7

IW: Imported Water based on monthly Table D data received from the Metropolitan Water District

RW: Recycled Water based on a monthly average of all available RP-1 & RP-4 effluent data and RP-1/RP-4 RW Blend at NRG Turnout data

* 25% nitrogen loss coefficient has been applied to calculate recycled water nitrate-nitrogen quality per Basin Plan Amendment

Maximum Benefit Water Quality Objectives in Chino North Management Zone for TDS is 420 mg/L and nitrate-nitrogen is 5 mg/L, based on a 5-year running average

Appendix B

Database