APPENDIX 10b

Chino Basin OBMP,
2020 Maximum Benefit Annual Report

FINAL REPORT | APRIL 2021

Chino Basin Optimum Basin Management Program 2020 Maximum Benefit Annual Report

PREPARED FOR

Chino Basin Watermaster and the
Inland Empire Utilities Agency

PREPARED BY

WEST YOST
Water. Engineered.

PETER KAVOUNAS, P.E.
General Manager

SHIVAJI DESHMUKH, P.E.
General Manager

April 15, 2021

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 2020 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 2020. 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 2020.

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

Sincerely,

Chino Basin Watermaster

Peter Kavounas, P.E.
General Manager

Inland Empire Utilities Agency

Shivaji Deshmukh, P.E.
General Manager

Chino Basin Optimum Basin Management Program
2020 Maximum Benefit Annual Report

Prepared for

Chino Basin Watermaster and the Inland Empire Utilities Agency

Project No. 941-80-20-32

Project Manager: Veva Weamer	4/15/2021 Date
QA/QC Review: Samantha Adams	4/15/2021 Date

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FINAL REPORT | APRIL 2021

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LIST OF ACRONYMS AND ABBREVIATIONS

afy	acre-feet per year
Basin Plan	Water Quality Control Plan for the Santa Ana River Basin
CCWF	Chino Creek Well Field
CDA	Chino Basin 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
MWD	Metropolitan Water District of Southern California
NAWQA	National Water Quality Assessment
OBMP	Optimum Basin Management Program
PBHSP	Prado Basin Habitat Sustainability Program
PBMZ	Prado Basin Management Zone
Regional Board	Regional Water Quality Control Board, Santa Ana Region
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
TKN	Total Kjeldahl Nitrogen
USGS	United States Geological Survey
VOC	volatile organic compound
Watermaster	Chino Basin Watermaster
WEI	Wildermuth Environmental, Inc.

1.0 INTRODUCTION

This 2020 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: 1) the Chino Basin Optimum Basin Management Program (OBMP) and Implementation Plan; 2) the Regional Board's recognition of the Chino Basin OBMP Implementation Plan; 3) the establishment of alternative, maximum-benefit groundwater-quality objectives for the Chino Basin; and 4) 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 2020.

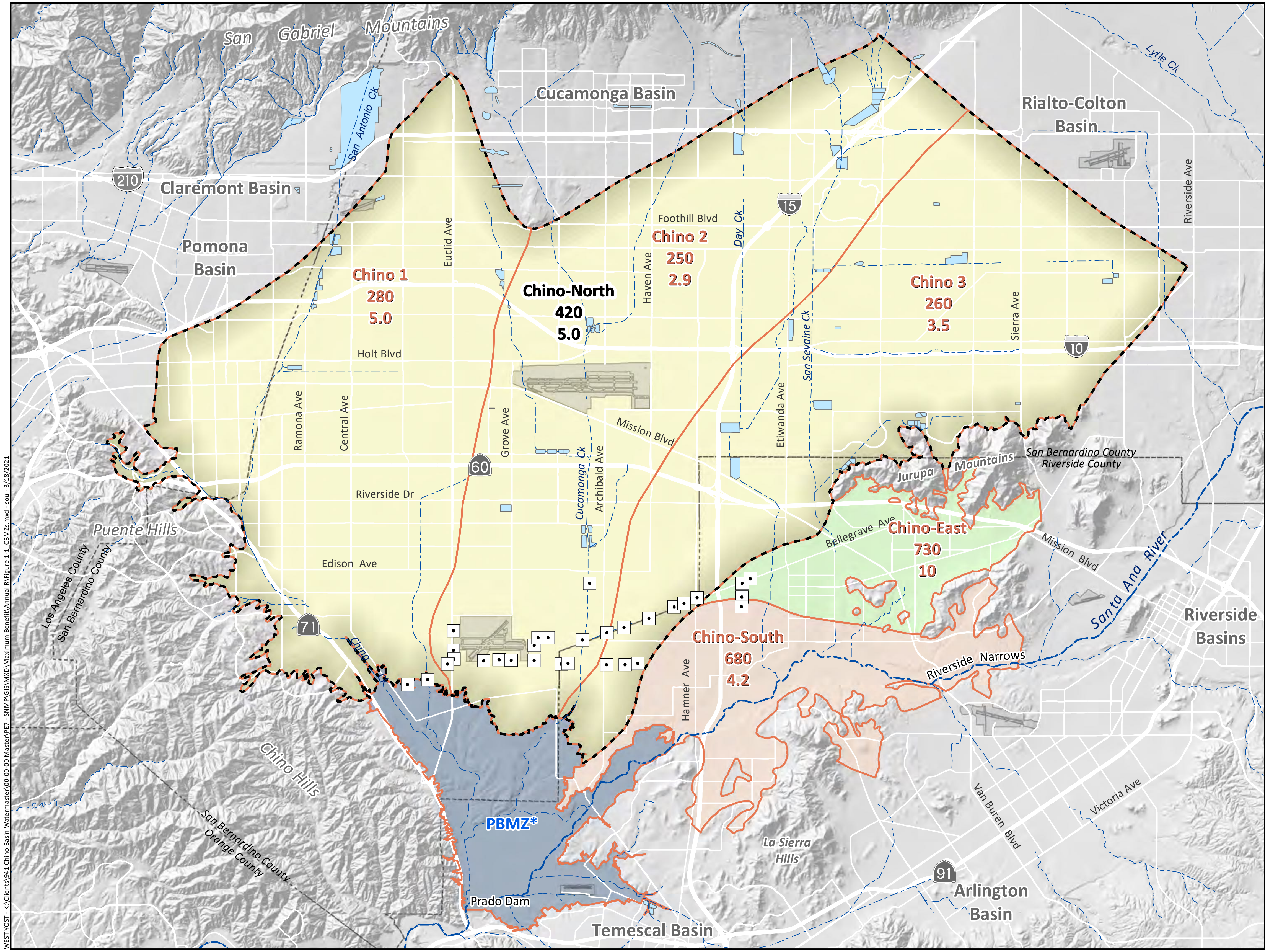
1.1 Investigations of the Relationship between Groundwater Production and Santa Ana River Discharge

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 Chino Basin on the Safe Yield of the Basin, and on the discharge of rising groundwater to the Prado Basin and the Santa Ana River. Several studies, as discussed below, quantify the impacts of Chino Basin Desalter well field[1] pumping on groundwater discharge to the Prado Basin and the Santa Ana River.

The 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 southern 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 Environmental, Inc. [WEI], 1993). This study used a detailed model of the southern Chino Basin to evaluate the hydraulic impacts of desalter pumping on rising groundwater discharge and groundwater levels at nearby wells. This study 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.

[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.



Antidegradation Groundwater Management Zones (GMZs)

- GMZ Boundary
- Chino 3 — GMZ Name
- 260 — TDS Objective (mgl)
- 3.5 — Nitrate Objective (mgl)
- Prado Basin Management Zone (PBMZ)

Maximum-Benefit GMZ

- Chino-North
- Chino-North — GMZ Name
- 420 — TDS Maximum-Benefit Objective (mgl)
- 5.0 — Nitrate Maximum-Benefit Objective (mgl)

- Chino Basin Desalter Well
- Rivers and Streams
- Flood Control and/or Conservation Basins

*PBMZ has a surface water objective.

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Author: SO

Date: 3/18/2021

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Chino Basin Management Zones

Antidegradation and Maximum-Benefit Objectives for TDS and Nitrate

Figure 1-1

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., 2009d). This projection was made using the 2007 Chino Basin Model to evaluate then-current and projected groundwater pumping at the Chino Basin Desalter wells through 2060 as envisioned in the Peace II Agreement project description.

In 2011, the 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 1) estimate the historical volumes of rising groundwater discharge to the Santa Ana River and the recharge of the Santa Ana River for the period 1961 through 2011; and 2) project the discharge and recharge volumes through 2050 (WEI, 2015c). The projected New Yield[3] from Santa Ana River recharge estimated by the 2013 Chino Basin Model was 61 percent of desalter well pumping in fiscal year 2011 and decreases 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 1) capture groundwater flowing south from the forebay regions of the Chino Basin; and 2) 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 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.

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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.

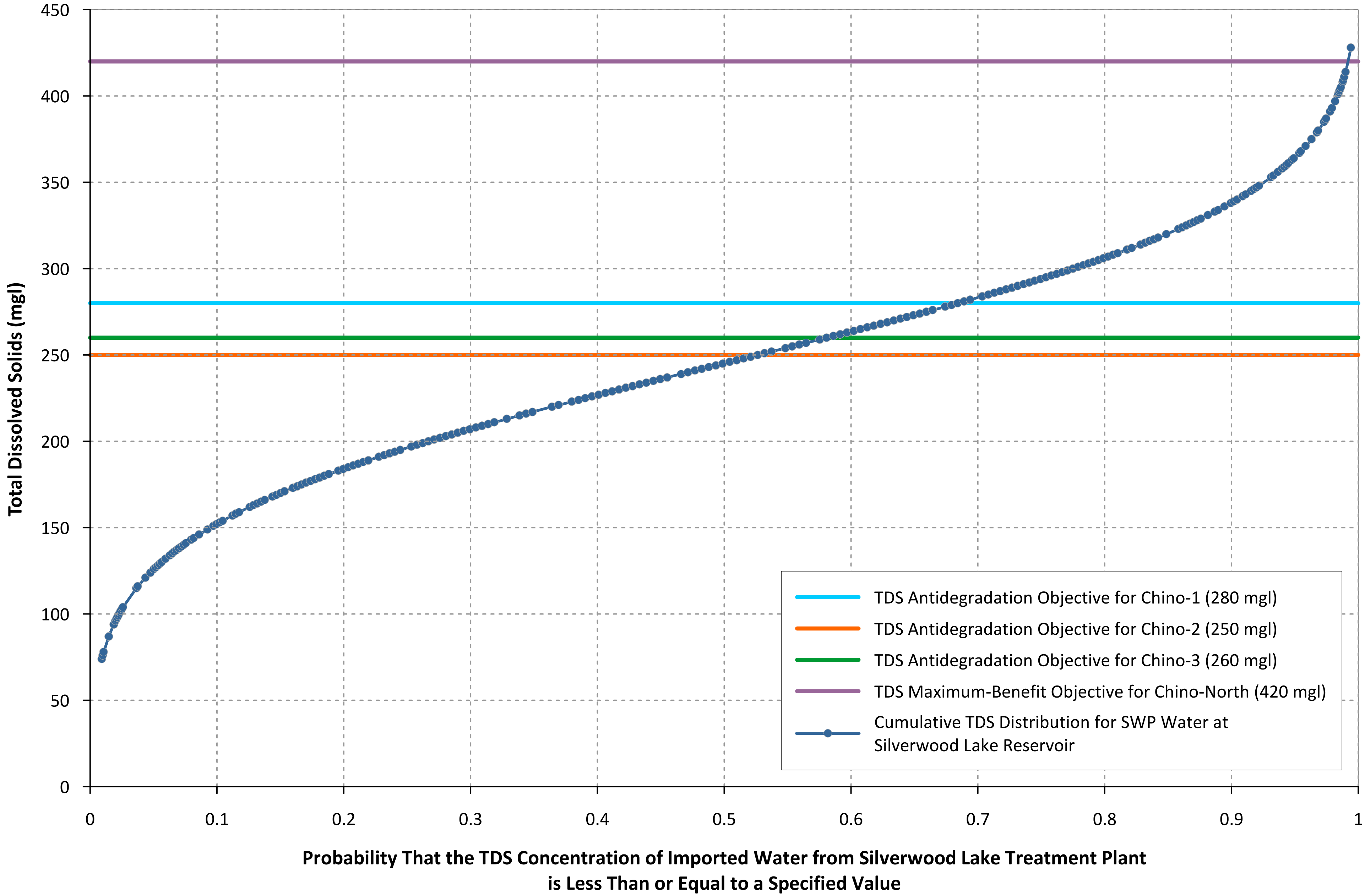
The 1995 Basin Plan contained restrictions on the use of recycled water for irrigation and groundwater recharge. In particular, it contained TDS objectives ranging from 220 to 330 milligrams per liter (mgl) over a significant portion of the Chino Basin. The ambient TDS concentrations in these areas exceeded 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 nitrate objectives and beneficial uses for specific surface waters. The technical work supporting the 2004 Basin Plan amendment was directed by the total inorganic nitrogen (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 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 2020, 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.

[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.

[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.



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Cumulative Distribution of
State Water Project TDS Concentrations
Silverwood Lake Reservoir - 1980 to 2020

Figure 1-2

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 consistent with California Water Code Section 13241—such as economics, the need to use recycled water, and the need to develop housing in the area—were also considered 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:

- The implementation of a surface-water monitoring program.
- The implementation of a groundwater monitoring program.
- The expansion of the Chino-I Desalter to a capacity of 10 million gallons per day (mgd) and the construction of the Chino-II Desalter with a design capacity of 10 mgd.
- 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).[6]
- The completion of the recharge facilities included in the Chino Basin Facilities Improvement Program.
- 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 TIN, respectively.
- The management of basin-wide, volume-weighted TDS and nitrogen concentrations in artificial recharge to less than or equal to the maximum-benefit objectives.

[6] The desalter expansion of an additional 20 mgd was initially required to occur when the 12-month running average for IEUA agency-wide effluent TDS concentration exceeded 545 mgl for three consecutive months. The expansion of the desalters of an additional 20 mgd has occurred without triggering this exceedance and been driven by the implementation of the Peace II Agreement and achieving hydraulic control.

- 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.
- 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 1.0 – 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 2.0 – Maximum-Benefit Commitment Compliance. Section 2.0 describes the status of compliance with each of the maximum-benefit commitments.
- Section 3.0 – Data Collected in 2020. Section 3.0 describes the data collected in 2020 as part of the maximum-benefit monitoring program.
- Section 4.0 –Influence of Rising Groundwater on the Santa Ana River. Section 4.0 characterizes the influence of rising groundwater on the flow and quality of the Santa Ana River between the Riverside Narrows and Prado Dam.
- Section 5.0 – References. Section 5.0 provides the references consulted in performing the analyses described herein and in writing this report.

2.0 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, 2020. 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 quality, 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 implemented for Commitments number 1 and number 2 are designed, in part[7], to collect the data necessary to determine the state of hydraulic control and are 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.

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

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[(a)]		
a. Submit draft Monitoring Program to Regional Board	a. January 23, 2005	a. Draft work plan submitted to the Regional Board on January 23, 2005
b. Implement Monitoring Program	b. Within 30 days from the date of Regional Board approval of the monitoring plan	b. Monitoring plan initiated prior to Regional Board approval
c. Submit Draft Revised Monitoring Program to Regional Board	c. 15 days from 2012 Basin Plan Amendment (BPA) approval	c. Draft work plan submitted to the Regional Board on February 16, 2012, six days after 2012 BPA approval
d. Implement Revised Monitoring Program	d. Upon Regional Board 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. Submit Draft Revised Monitoring Program(s) (subsequent to that required in "c", above) to Regional Board	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	e. No revisions requested by the Regional Board
f. Implement Revised Monitoring Program(s)	f. Upon Regional Board approval	f. N/A
g. Annual data report submittal	g. April 15th	g. All annual reports submitted by April 15 of each year since 2006
2. Groundwater Monitoring Program[(a)]		
a. Submit Draft Monitoring Program to Regional Board	a. January 23, 2005	a. Draft monitoring plan submitted to Regional Board on January 23, 2005
b. Implement Monitoring Program	b. Within 30 days from the date of Regional Board approval of the monitoring plan	b. Monitoring program initiated prior to Regional Board approval
c. Plan and schedule for demonstrating hydraulic control	c. By December 31, 2013	c. Plan and schedule for demonstrating hydraulic control submitted in the 2014 Work Plan to the Regional Board on December 23, 2013

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	d. Upon Regional Board approval	d. Hydraulic control demonstration reported in all annual reports
e. Submit Draft Revised Monitoring Program(s) (subsequent to that required in "a", above) to Regional Board	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	e. No revisions requested by Regional Board
f. Implement revised monitoring plans (s)	f. Upon Regional Board approval	f. N/A
g. Annual data report submittal	g. April 15th	g. All annual reports submitted by April 15 of each year
3. Chino Desalters		
a. Chino-I Desalter expansion to 10 mgd	a. Prior to the recharge of recycled water	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. Chino-II Desalter construction to 10 mgd capacity	b. Recharge of recycled water allowed once award of contract and notice to proceed issued for construction of desalter treatment plant	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

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
4. Submittal of future desalters plan and schedule		
	Plan due: October 1, 2005 Trigger for construction: when the IEUA agency-wide 12-month running average effluent TDS concentration exceeds 545 mgl for three consecutive months. Implement plan and schedule upon Regional Board approval	Several plans for desalter expansion have been submitted to the Regional Board since 2005. The expansions have proceed to achieve hydraulic control and to meet the pumping capacity pursuant to Peace II Agreement. Watermaster and the IEUA submitted the most recent desalter expansion plan to the Regional Board on June 30, 2015 . The plan included the construction of three additional wells to achieve the ultimate pumping capacity of 36 mgd (40,000 afy). Two wells were constructed and began operation in 2018. One well was constructed in 2020 and operation will begin in 2021. As of June 2020, the CDA facilities have a pumping capacity of 40,000 afy.
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.

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
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.		
	Compliance must be achieved by the end of the 5th year after initiation of recycled water recharge operations.	
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.	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.
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).

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
8. Hydraulic Control Failure		
a. Plan and schedule to correct loss of hydraulic control	a. 60 days from Regional Board finding that hydraulic control is not being maintained	a. No mitigation plan and schedule for the loss of hydraulic control has been requested.
b. Achievement and maintenance of hydraulic control	b. In accordance with plan and schedule approved by the Regional Board	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. Two wells were constructed and began operation in 2018. One well was constructed in 2020 and operation will begin in 2021.
c. Mitigation plan for temporary failure to achieve/maintain hydraulic control	c. By January 23, 2005	c. Plan submitted to the Regional Board on March 3, 2005. No mitigation action has been triggered.
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.

(a) 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.

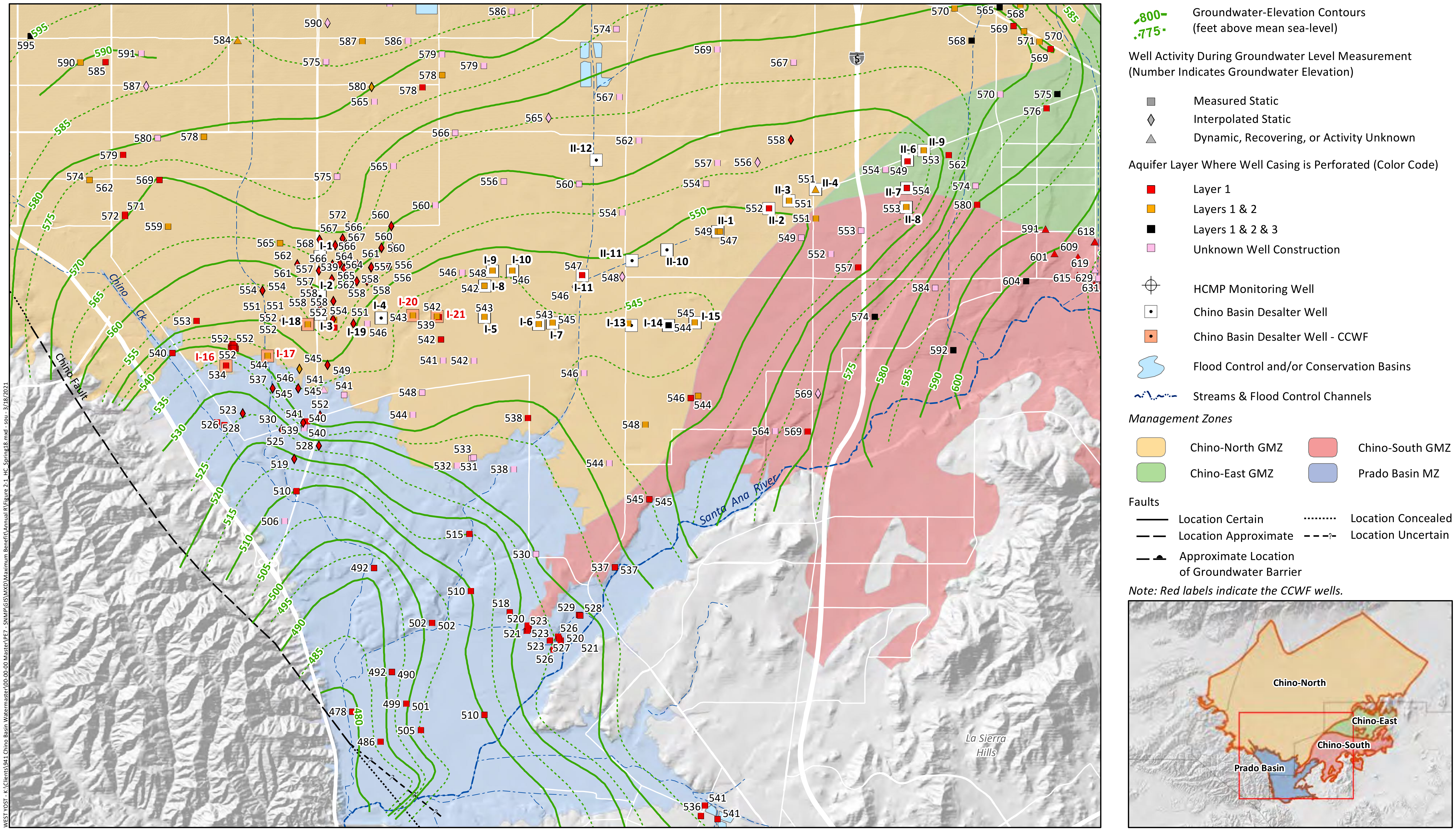
afy = acre-feet per year
mgd = million gallons per day
mgl = milligrams per liter
TDS = Total Dissolved Solids

The initial design of the HCMP included multiple lines of evidence 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 1) track the migration, or lack thereof, of the South Archibald volatile organic compound (VOC) plume beyond the Chino Basin Desalter well fields; and 2) 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 1) hydraulic control had been achieved to the east of Chino-I Desalter Well 5; 2) hydraulic control had not been achieved to the west of Chino-I Desalter Well 5; and 3) 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[8] (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).

[8] https://www.chinodesalter.org/



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2020 Maximum Benefit
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State of Hydraulic Control
Spring 2018

Figure 2-1

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 1) an updated surface-water monitoring program by February 25, 2012; and 2) a revised groundwater monitoring program and schedule for achieving hydraulic control by December 31, 2013. Pursuant to 1), 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).[9] Pursuant to 2), 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).[10] 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 3.0 of this report).

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

[9] 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.

[10] 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.

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 without the CCWF, rising groundwater from Chino-North would increase the TDS concentration of the Santa Ana River at Prado Dam 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 in this area (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 4.0 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 2020, the CCWF wells produced a total of about 1,325 af which is less than the amount previously understood to be necessary to ensure *de minimis* outflows. Production at the CCWF has decreased since 2017 as a result of the new maximum contaminant level (MCL) for 1,2,3-TCP, which required the CDA to temporarily shut down operation of CCWF Well I-17. In 2020, Watermaster's groundwater model was used to estimate the historical (2004-2018) and projected (2019-2050) volume of groundwater discharge past the CCWF (WEI, 2020) under revised pumping conditions at the CCWF. The model-results indicate that both the estimated historical and projected discharge past the CCWF area is always below the *de minimis* threshold level of 1,000 afy (see Section 2.1.4). The model assumes an annual average pumping volume at the CCWF of 992 af from fiscal year 2019 through the remainder of the planning period. In 2021, Watermaster plans to work with the Regional Board to formally update the definition of the minimum pumping required at the CCWF to maintain hydraulic control.

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 included 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 June 2021 (refer to Figure 2-4 and Section 2.2 of this Report for more details).

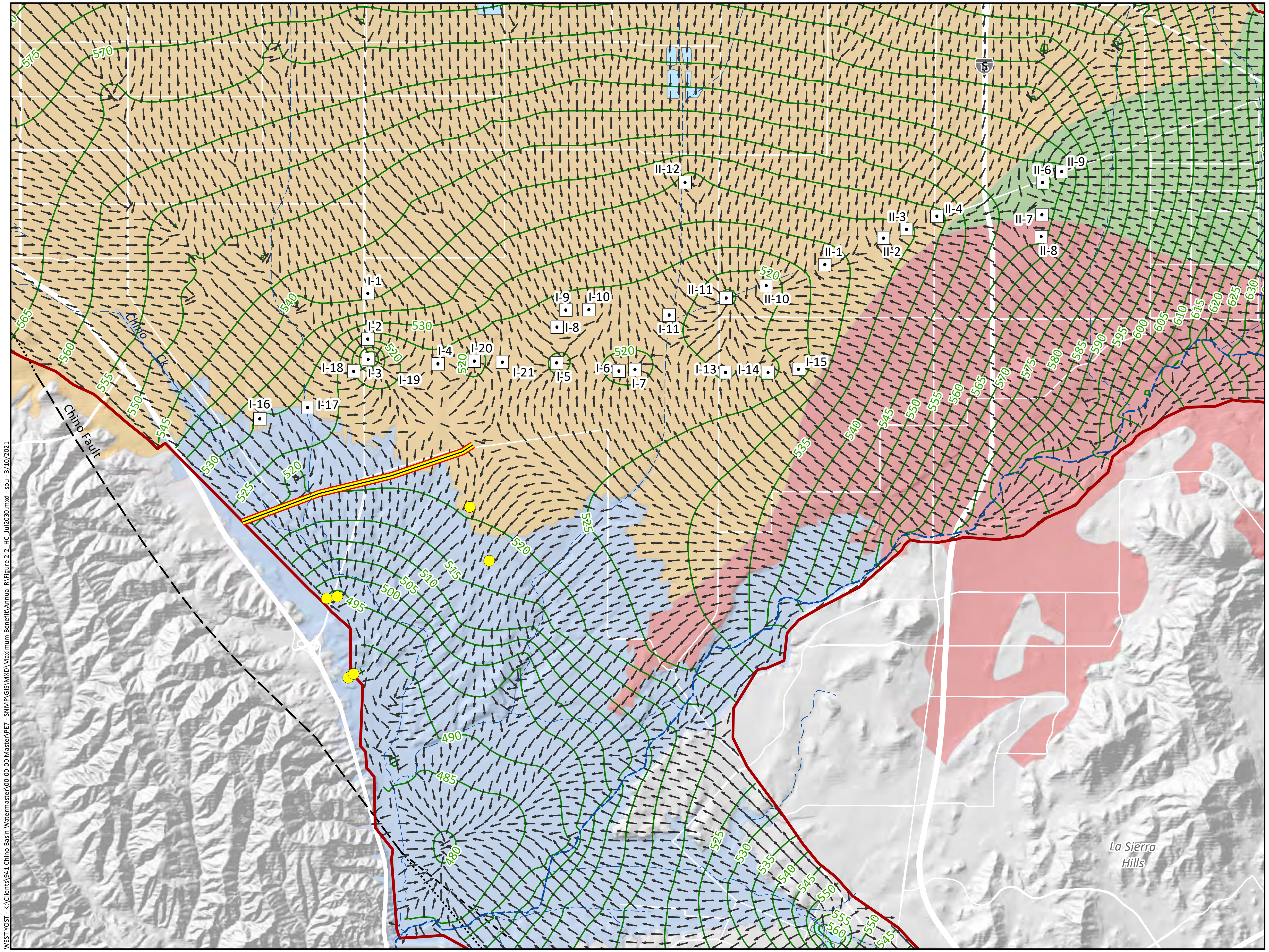
In 2020, Watermaster completed its five-year update and recalibration of the Chino Basin Model to recalculate Safe Yield of the Chino Basin (WEI, 2020). As part of the 2020 Safe Yield recalculation, the future state of hydraulic control was estimated using the updated Chino Basin Model. A planning scenario 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 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 (WEI, 2020). 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 from 380 to 740 afy, averages 490 afy, and is always less than the *de minimis* discharge threshold of 1,000 afy. Additionally, as shown in Figure 2-2, there are several active private pumping wells downgradient of the line of control that further reduce rising groundwater outflow to the PBMZ. As describe above in Section 2.1.3, Watermaster plans to work with the Regional Board to formally update the definition of the minimum pumping required at the CCWF to maintain outflow from the Chino-North to *de minimis* levels.

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 and managing TDS and nitrate loading from. The operations are essential for 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 the additional wells and facilities needed to achieve the ultimate capacity defined in the OBMP Implementation Plan, maintain hydraulic control once agricultural pumping ceases in the southern end of the Basin, and to ensure the offset of TDS and nitrate consistent with the maximum benefit proposal. The Basin Plan requires that the construction of the desalter expansion begin once the 12-month running average of the IEUA's agency-wide effluent TDS concentration reaches 545 mgl for three consecutive months.



2030 Groundwater Flow Vectors
Model Layer 1

2030 Groundwater Elevation Contours
(feet above mean sea-level) - Model Layer 1

Line of Control for Assessment of
Hydraulic Control

Private Wells Assumed Active Downgradient
of the Line of Control

Chino Basin Desalter Well

Groundwater Flow Model Boundary

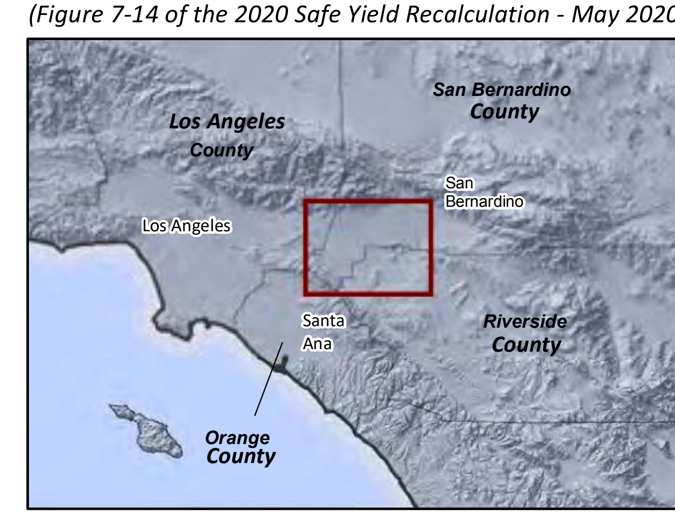
Flood Control and/or Conservation Basins

Streams & Flood Control Channels

Management Zones

- Chino-North GMZ
- Chino-East GMZ
- Chino-South GMZ
- Prado Basin MZ

(Figure 7-14 of the 2020 Safe Yield Recalculation - May 2020)



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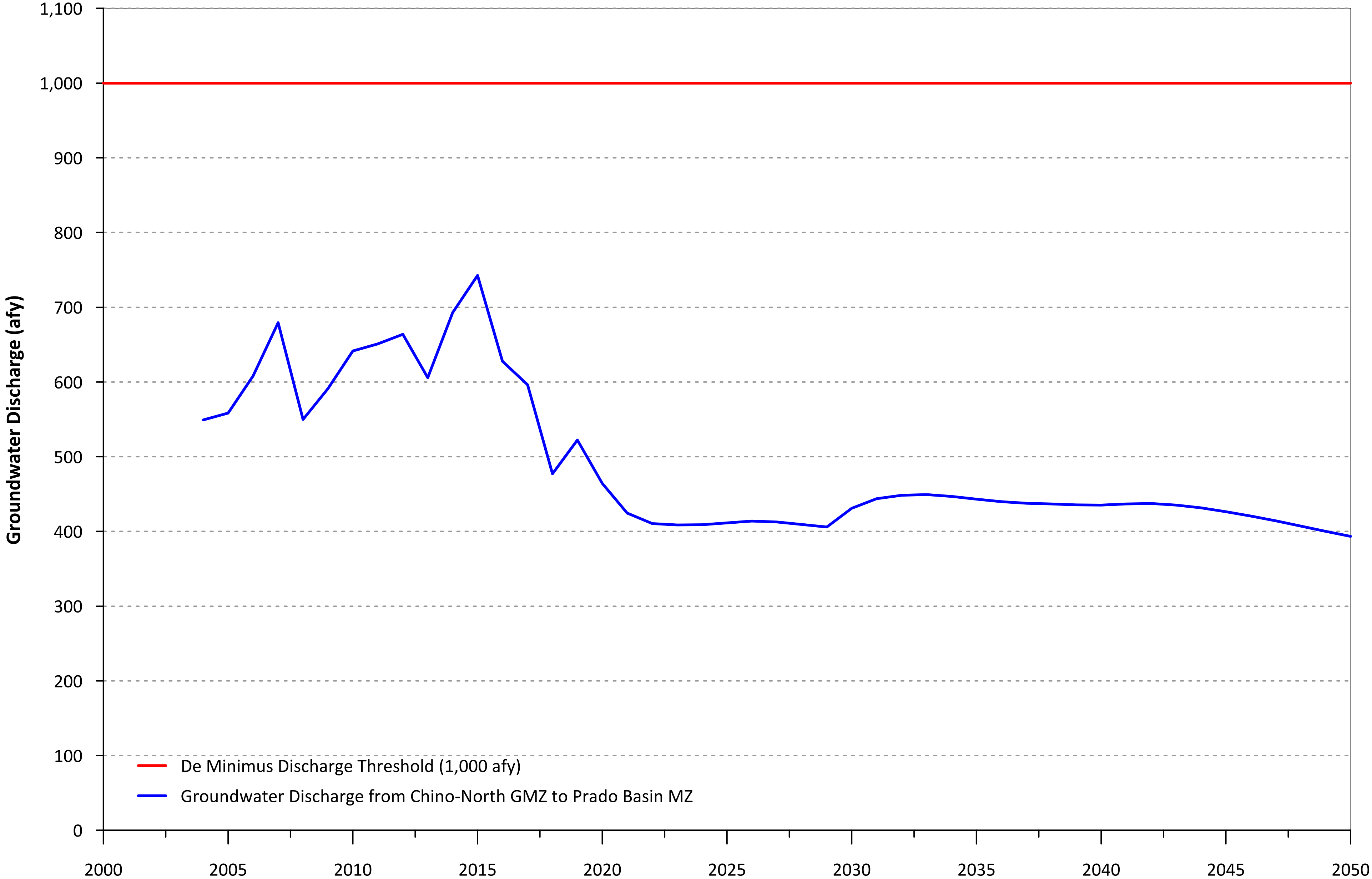
State of Hydraulic Control
July 2030

Figure 2-2



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

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Historical and Projected Groundwater Discharge from the Chino-North GMZ to Prado Basin MZ 2005 to 2050

Figure 2-3

Although the IEUA recycled water effluent has never reached 545 mgl as a 12-month average, the Chino Desalter Authority proceeded to expand the capacity of the desalters to ensure the attainment of hydraulic control. The CCWF wells (I-16, I-17, I-18, I-20, and I-21) were constructed between September 2011 and May 2012[11] 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 at Well I-18, the CDA has not produced groundwater at this well since its construction. And as previously noted in Section 2.1.3, Well I-17 has been offline since 2017 due to the detection of 1,2,3-TCP concentrations above the new CA Primary MCL. The VOC concentrations (including 1,2,3-TCP) at CCWF Well I-17 and I-18 are associated with the Chino Airport plume. Additionally, Chino-I Desalter Wells I-1, I-2 I-3, and I-4 in the vicinity of the CCWF were also taken out of service starting in 2018 due to the presence of 1,2,3-TCP and trichloroethene (TCE) associated with the Chino Airport plume, and other contaminants. Implementation of a remedial action plan for cleanup of the Chino Airport plume is underway that includes the utilization of CCWF Wells I-16, I-17, I-18, and potentially I-20 and I-21, and Chino-I Desalter Wells I-1, I-2, I-3, and I-4, as part of a pump-and-treat system, along with ten extraction well clusters constructed by the County of San Bernardino who is the identified responsible party for the plume. Groundwater pumped from the CCWF, Chino-I Desalter wells, and County wells will be treated at the Chino-I treatment facility using new and existing treatment infrastructure. It is anticipated that pumping at CCWF Wells I-17 and I-18 will commence in July 2022 as part of this pump and treat system.

The final expansion plan to achieve the 40,000 afy of production was to construct and operate three new wells for the Chino-II Desalter (Wells II-10, II-11, and II-12)—the locations for which are shown in Figure 2-4. Due to the proximity of these wells to the South Archibald TCE plume, the CDA has been collaborating with the responsible parties of the plume to integrate these wells into a remedial solution to address groundwater cleanup of the plume 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 included 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 construction of Well II-12 was completed in November 2020. Equipping of Well II-12, and construction of the dedicated raw water pipeline to deliver the water from the three wells to the Chino-II Desalter is currently underway and is estimated for completion and operation by June 2021.

Figure 2-4 shows the location of the existing Chino Basin Desalter wells and the total annual pumping at the Desalter wells since 2000. In 2020, total pumping by the Chino Basin Desalter wells was 39,600 af. In

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

[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.

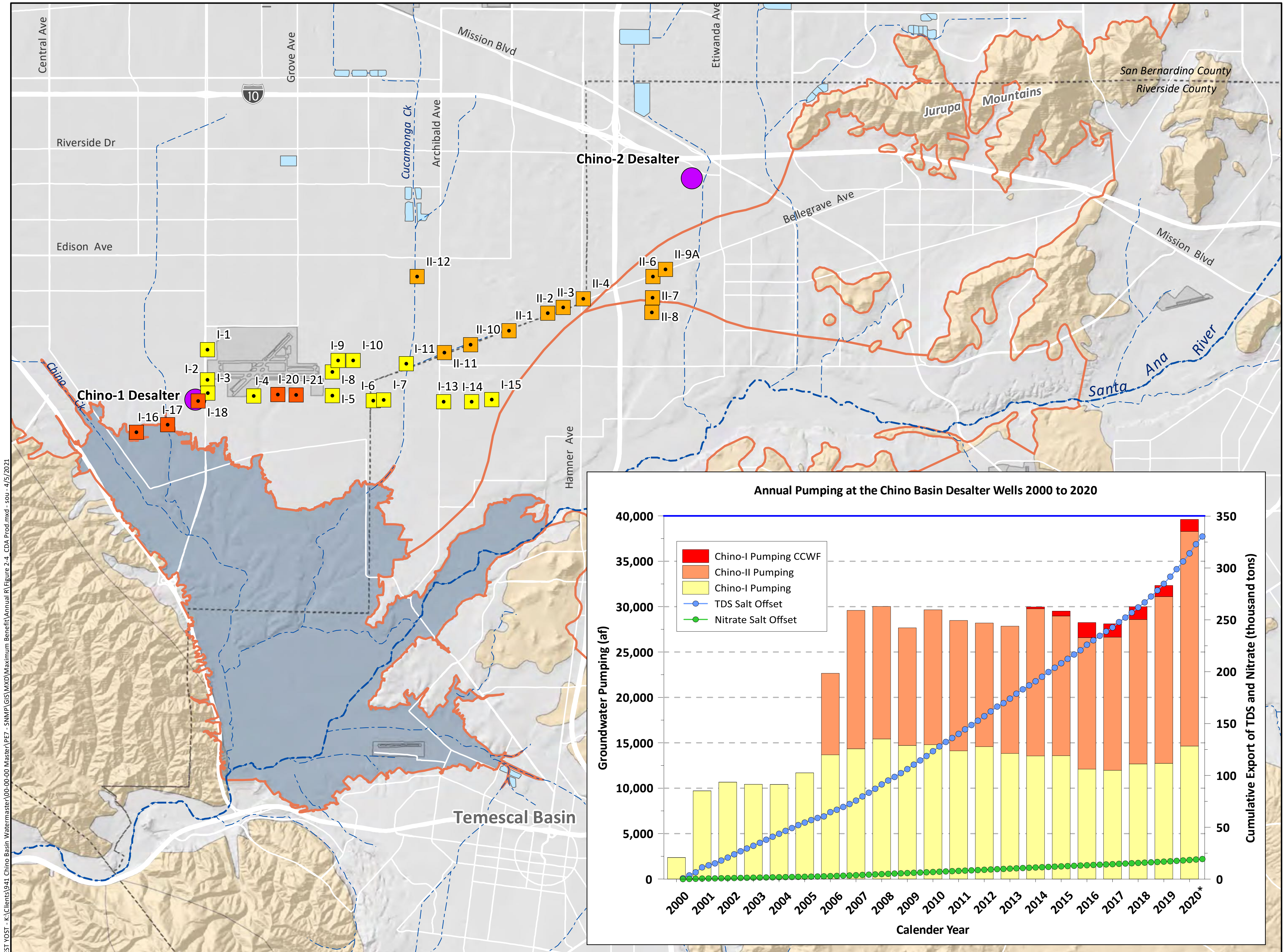
June 2020, the CDA facilities officially reached the pumping capacity necessary to meet the 40,000 afy required for hydraulic control. This pumping capacity was achieved without the inclusion of Well II-12, which was part of the final expansion plan designed to meet the 40,000 afy. As noted above, Well II-12 is still planned for operation as part of the South Archibald TCE plume remedial solution.

Since 2000, the Chino Basin Desalters have treated about 497,200 af of high-TDS/nitrate water, averaging about 23,700 afy. 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 is also shown in Figure 2-4. From 2000 to 2020, the Desalters exported about 330,400 tons of TDS and 19,400 tons of nitrate from the Chino Basin.

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 December 2020. Since July 2005, about 185,200 af of imported water, 153,800 af of storm water, and 143,400 af of recycled water have been recharged to the Chino Basin.



Chino Basin Desalter Wells

- Chino-I Desalter Well
- Chino-I Desalter Well 5
- Chino-I CCWF Well
- Chino-II Desalter Well
- Desalter Treatment Facility
- Groundwater Management Zone Boundaries
- Prado Basin Management Zone
- Rivers and Streams
- Flood Control and/or Conservation Basins
- Airport

Geology

Water-Bearing Sediments

- Quaternary Alluvium
- 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

**Note: In June 2020, the CDA reached the pumping capacity at the desalter well fields to meet the 40,000 afy required for hydraulic control.*

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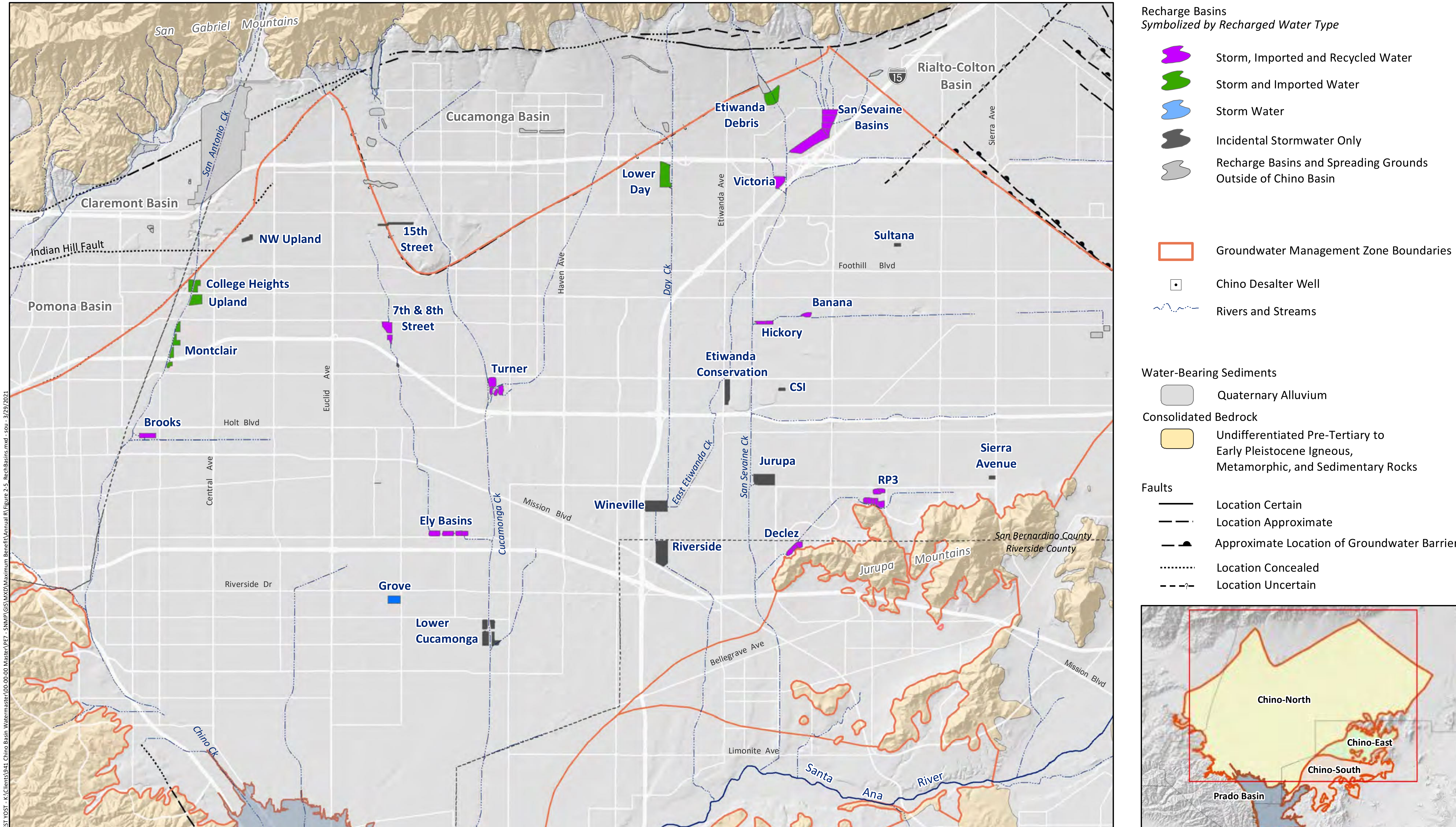
Chino Basin Desalter Wells
Annual Pumping 2000 to 2020

Figure 2-4



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Chino Basin Recharge Basins
Existing Facilities by Recharge Type as of 2020

Figure 2-5

Table 2-2. Annual Groundwater Recharge at Chino Basin Facilities - 2005 to 2020

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	8,220	4,516	12,756
2010	4,980	19,390	8,304	32,674
2011	32,913	10,762	6,914	50,589
2012	0	9,372	7,823	17,195
2013	0	3,429	14,394	17,823
2014	795	8,166	10,997	19,958
2015	0	6,769	12,056	18,825
2016	4,260	9,812	14,310	28,382
2017	39,502	7,447	14,362	61,310
2018	5,990	6,751	12,510	25,251
2019	25,700	14,460	11,160	49,977
2020	3,638	7,167	15,509	26,313
Total	**191,193**	**152,270**	**140,821**	**482,941**

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 monthly. 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, is included as Appendix A to this report.

Table 2-3. Monthly Calculation of the Five-Year, Volume-Weighted TDS and Nitrate Concentrations of Recharge Water Sources to the Chino Basin[a] - 2005 to 2020

Five-Year Period	TDS, mgl	Nitrate, mgl
Jul 2005 - Jun 2010	203	1.1
Aug 2005 - Jul 2010	205	1.1
Sep 2005 - Aug 2010	207	1.1
Oct 2005 - Sep 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
Mar 2006 - Feb 2011	214	1.2
Apr 2006 - Mar 2011	216	1.2
May 2006 - Apr 2011	221	1.3
Jun 2006 - May 2011	222	1.3
Jul 2006 - Jun 2011	222	1.3
Aug 2005 - Jul 2011	218	1.2
Sep 2006 - Aug 2011	215	1.2
Oct 2006 - Sep 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
Mar 2007 - Feb 2012	218	1.4
Apr 2007 - Mar 2012	216	1.4
May 2007 - Apr 2012	215	1.4
Jun 2007 - May 2012	217	1.4
Jul 2007 - Jun 2012	220	1.4
Aug 2007 - Jul 2012	221	1.4
Sep 2007 - Aug 2012	221	1.4
Oct 2007 - Sep 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
Mar 2008 - Feb 2013	233	1.6
Apr 2008 - Mar 2013	235	1.6
May 2008 - Apr 2013	236	1.6
Jun 2008 - May 2013	237	1.6

Table 2-3. Monthly Calculation of the Five-Year, Volume-Weighted TDS and Nitrate Concentrations of Recharge Water Sources to the Chino Basin[(a)] - 2005 to 2020

Five-Year Period	TDS, mgl	Nitrate, mgl
Jul 2008 - Jun 2013	239	1.7
Aug 2008 - Jul 2013	240	1.7
Sep 2008 - Aug 2013	241	1.7
Oct 2008 - Sep 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
Feb 2009 - Jan 2014	253	1.8
Mar 2009 - Feb 2014	257	1.8
Apr 2009 - Mar 2014	259	1.9
May 2009 - Apr 2014	261	1.9
Jun 2009 - May 2014	263	1.9
Jul 2009 - Jun 2014	264	1.9
Aug 2009 - Jul 2014	265	1.9
Sep 2009 - Aug 2014	266	1.9
Oct 2009 - Sep 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
Mar 2010 - Feb 2015	279	2.0
Apr 2010 - Mar 2015	280	2.0
May 2010 - Apr 2015	283	2.0
Jun 2010 - May 2015	283	2.1
Jul 2010 - Jun 2015	285	2.1
Aug 2010 - Jul 2015	286	2.1
Sep 2010 - Aug 2015	286	2.1
Oct 2010 - Sep 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
Mar 2011 - Feb 2016	290	2.2
Apr 2011 - Mar 2016	292	2.2
May 2011 - Apr 2016	293	2.2
Jun 2011 - May 2016	300	2.3

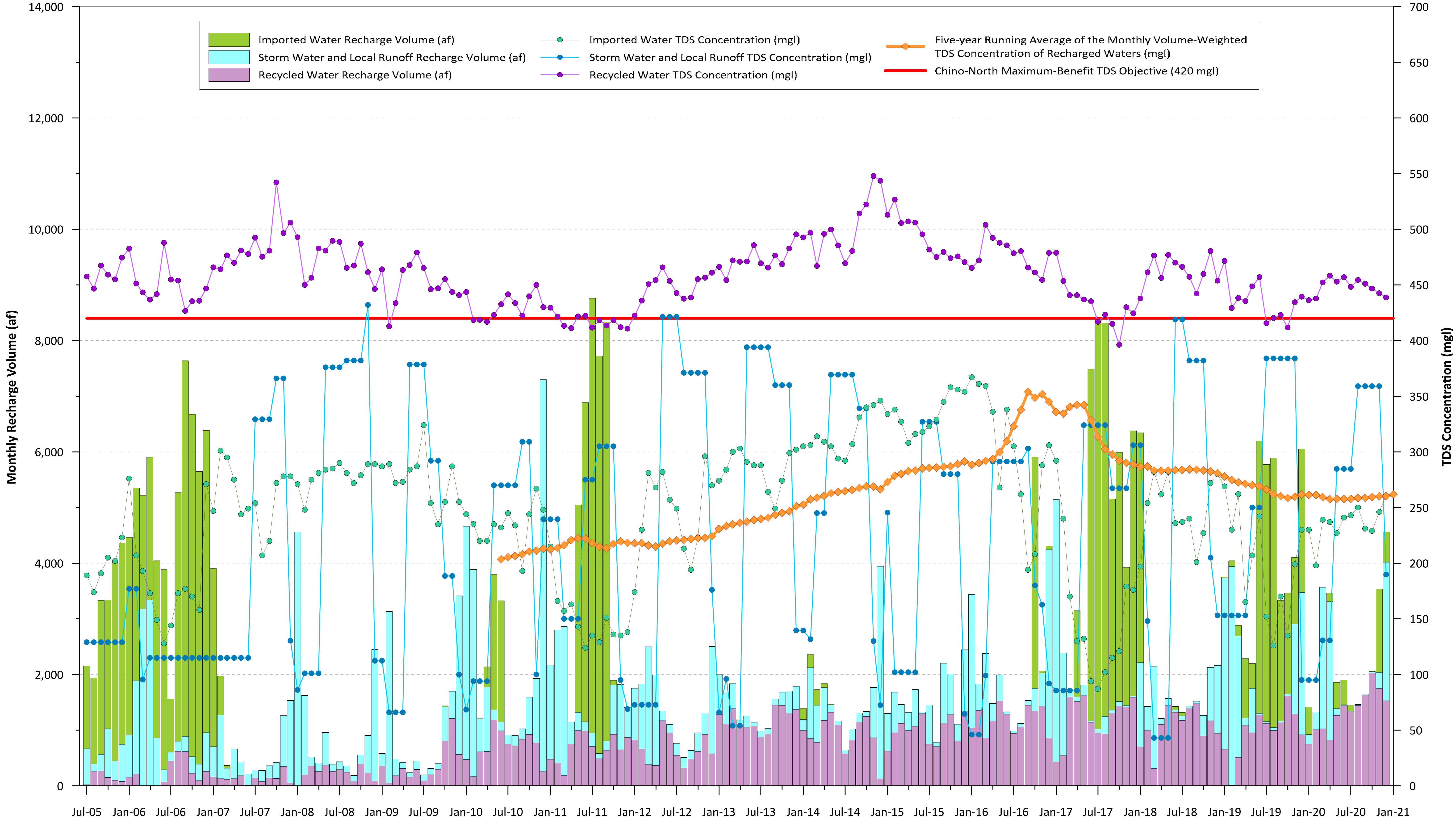
Table 2-3. Monthly Calculation of the Five-Year, Volume-Weighted TDS and Nitrate Concentrations of Recharge Water Sources to the Chino Basin[(a)] - 2005 to 2020

Five-Year Period	TDS, mgl	Nitrate, mgl
Jul 2011 - Jun 2016	310	2.4
Aug 2011 - Jul 2016	323	2.6
Sep 2011 - Aug 2016	338	2.8
Oct 2011 - Sep 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
Mar 2012 - Feb 2017	334	2.7
Apr 2012 - Mar 2017	340	2.8
May 2012 - Apr 2017	342	2.8
Jun 2012 - May 2017	342	2.8
Jul 2012 - Jun 2017	328	2.6
Aug 2012 - Jul 2017	314	2.5
Sep 2012 - Aug 2017	302	2.4
Oct 2012 - Sep 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
Mar 2013 - Feb 2018	287	2.1
Apr 2013 - Mar 2018	283	2.1
May 2013 - Apr 2018	283	2.1
Jun 2013 - May 2018	283	2.1
Jul 2013 - Jun 2018	283	2.1
Aug 2013 - Jul 2018	284	2.1
Sep 2013 - Aug 2018	284	2.1
Oct 2013 - Sep 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
Mar 2014 - Feb 2019	275	1.9
Apr 2014 - Mar 2019	273	1.9
May 2014 - Apr 2019	271	1.9
Jun 2014 - May 2019	270	1.8

Table 2-3. Monthly Calculation of the Five-Year, Volume-Weighted TDS and Nitrate Concentrations of Recharge Water Sources to the Chino Basin[(a)] - 2005 to 2020

Five-Year Period	TDS, mgl	Nitrate, mgl
Jul 2014 - Jun 2019	269	1.8
Aug 2014 - Jul 2019	266	1.8
Sep 2014 - Aug 2019	262	1.7
Oct 2014 - Sep 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
Feb 2015 - Jan 2020	261	1.7
Mar 2015 - Feb 2020	261	1.7
Apr 2015 - Mar 2020	259	1.6
May 2015 - Apr 2020	257	1.6
Jun 2015 - May 2020	258	1.6
Jul 2015 - Jun 2020	258	1.6
Aug 2015 - Jul 2020	258	1.6
Sep 2015 - Aug 2020	258	1.6
Oct 2015 - Sep 2020	259	1.6
Nov 2015 - Oct 2020	259	1.6
Dec 2015 - Nov 2020	260	1.6
Jan 2016 - Dec 2020	260	1.6

(a) See Appendix A for more details.



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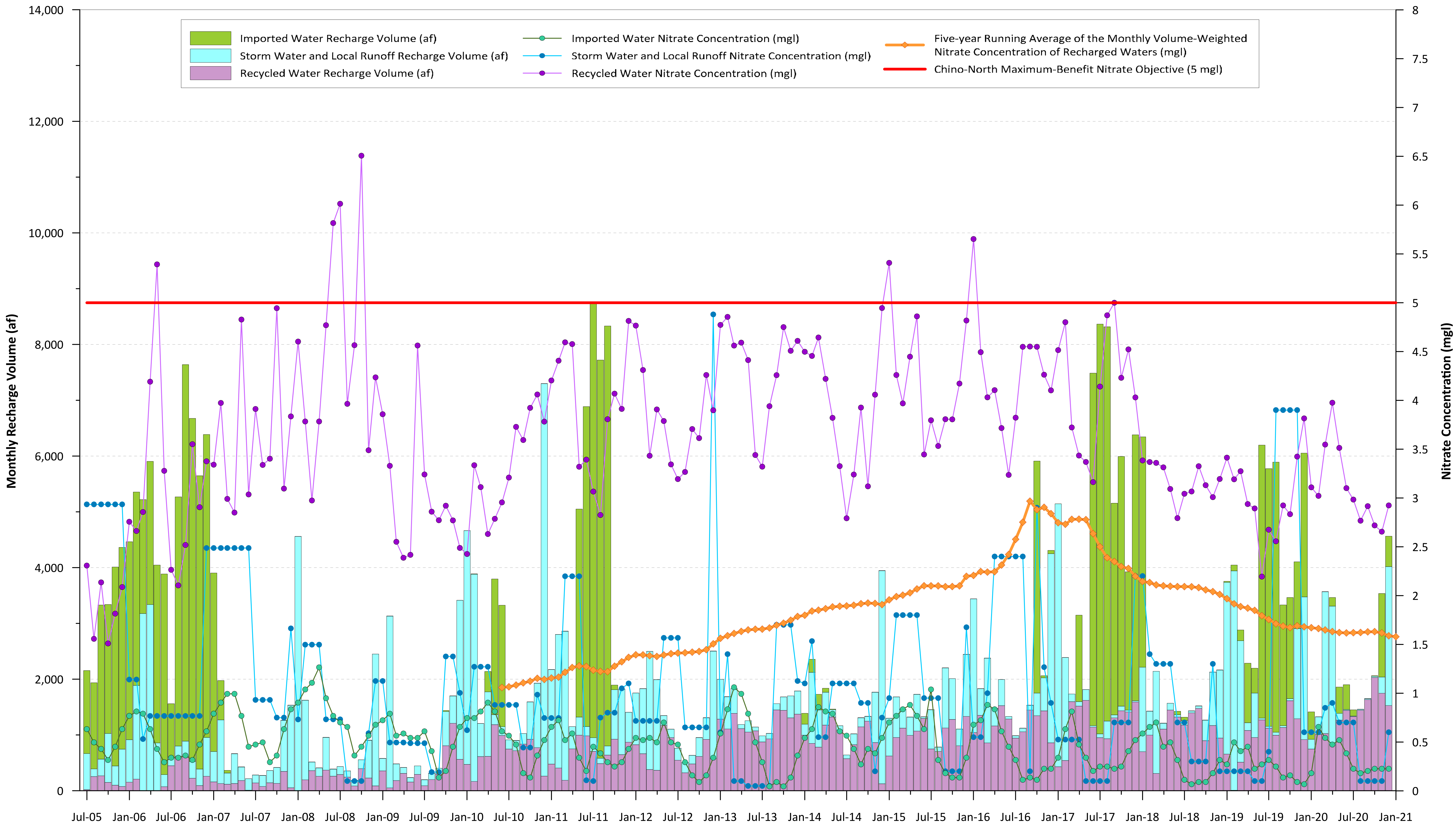
Volume and TDS Concentrations of Recharge Water Sources in Chino Basin
2005 to 2020

Figure 2-6a



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Volume and Nitrate Concentrations of Recharge Water Sources in Chino Basin
2005 to 2020

Figure 2-6b

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, averaged about 264 mgl, and was 260 mgl as of December 2020. Nitrate ranged from 1 mgl to about 3 mgl, averaged about 1.8 mgl, and was 1.6 mgl as of December 2020. The maximum five-year running average, volume-weighted 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 decreased from September 2016 through April 2020 and stabilized through 2020. This trend is due to the increase in imported water recharge that occurred from October 2016 through January 2018, March 2019 through December 2019, and November 2020 through December 2020; and the increase in storm water recharge during water year 2019. A similar trend was observed for the nitrate concentration metric, as shown in Figure 2-6b. These observations demonstrate the importance of periodic 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 are 550 mgl and 8 mgl, respectively. Compliance with these limits is based on the volume-weighted, 12-month running average of the agency-wide effluent for all IEUA wastewater treatment facilities. The volume-weighted, 12-month running average of the IEUA agency-wide effluent is referred to as the “effluent compliance metric”. 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 effluent compliance metric does not exceed the permit limits when the TDS effluent compliance metric exceeds 545 mgl for three consecutive months or the TIN effluent compliance metric exceeds 8 mgl in any one month. The plan must be submitted within 60 days of a finding that one of these “action limits” has been exceeded. The plan and schedule must be implemented upon Regional Board approval. The effluent compliance metric is calculated and reported by the IEUA in the Groundwater Recharge Program Quarterly Monitoring Reports.

Table 2-4 and Figure 2-7 show the monthly, volume-weighted IEUA agency-wide effluent TDS and TIN concentrations and the compliance metric for 2005 through 2020. Since the initiation of recycled water recharge in July 2005, the TDS and TIN effluent compliance metrics have ranged between 456 and 534 mgl and 3.8 and 7.6 mgl, respectively, and have never exceeded the permit limits[13]. During 2020, the TDS and TIN effluent compliance metrics ranged between 468 and 484 mgl and 3.8 and 4.2 mgl, respectively.

[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.

Table 2-4. Monthly and 12-Month Running Average of the IEUA Agency-Wide Effluent TIN and TDS Concentrations - 2005 to 2020

Month	TIN, mgl		TDS, mgl	
	Monthly	12-Month Running Average[a]	Monthly	12-Month Running Average
Jan 2005	7.3	8.4	492	486
Feb 2005	8.4	8.4	496	487
Mar 2005	7.5	8.4	516	488
Apr 2005	6.9	8.2	534	491
May 2005	6.7	8.0	513	492
Jun 2005	7.0	8.0	507	492
Jul 2005	5.4	7.8	466	492
Aug 2005	5.9	7.7	452	490
Sep 2005	5.4	7.4	469	491
Oct 2005	5.5	7.1	468	491
Nov 2005	5.5	6.7	467	490
Dec 2005	8.4	6.7	481	488
Jan 2006	9.9	6.9	491	488
Feb 2006	9.0	6.9	467	486
Mar 2006	8.8	7.1	471	482
Apr 2006	7.8	7.1	464	476
May 2006	8.3	7.2	454	471
Jun 2006	6.5	7.2	466	468
Jul 2006	6.8	7.3	472	469
Aug 2006	5.9	7.3	475	470
Sep 2006	6.5	7.4	465	470
Oct 2006	6.4	7.6	457	469
Nov 2006	6.9	7.6	456	468
Dec 2006	7.1	7.5	470	467
Jan 2007	7.7	7.3	488	467
Feb 2007	6.2	7.1	481	468
Mar 2007	6.7	6.9	490	470
Apr 2007	5.6	6.7	491	472
May 2007	5.6	6.5	489	475
Jun 2007	6.0	6.5	495	477
Jul 2007	5.1	6.3	492	479
Aug 2007	5.2	6.3	478	479
Sep 2007	5.9	6.2	478	480
Oct 2007	6.0	6.2	517	485

Table 2-4. Monthly and 12-Month Running Average of the IEUA Agency-Wide Effluent TIN and TDS Concentrations - 2005 to 2020

Month	TIN, mgl		TDS, mgl	
	Monthly	12-Month Running Average[(a)]	Monthly	12-Month Running Average
Nov 2007	7.6	6.2	514	490
Dec 2007	7.4	6.3	522	495
Jan 2008	6.8	6.2	511	481
Feb 2008	6.4	6.2	492	483
Mar 2008	6.6	6.2	515	484
Apr 2008	6.7	6.3	519	487
May 2008	7.2	6.4	502	489
Jun 2008	6.8	6.5	490	490
Jul 2008	6.1	6.6	499	491
Aug 2008	5.8	6.6	514	492
Sep 2008	8.3	6.8	510	494
Oct 2008	7.0	6.9	503	496
Nov 2008	5.7	6.7	496	498
Dec 2008	6.3	6.7	494	504
Jan 2009	6.5	6.6	497	503
Feb 2009	7.8	6.7	463	500
Mar 2009	6.9	6.8	496	499
Apr 2009	6.6	6.8	509	498
May 2009	5.8	6.6	501	498
Jun 2009	5.4	6.5	505	499
Jul 2009	5.0	6.4	512	499
Aug 2009	4.5	6.3	499	497
Sep 2009	4.0	6.0	498	497
Oct 2009	4.6	5.8	500	497
Nov 2009	4.8	5.7	489	497
Dec 2009	5.5	5.6	494	497
Jan 2010	5.7	5.6	493	496
Feb 2010	6.2	5.4	489	498
Mar 2010	6.4	5.4	482	497
Apr 2010	5.7	5.3	473	494
May 2010	5.2	5.3	471	492
Jun 2010	5.0	5.2	478	490
Jul 2010	5.1	5.2	477	487
Aug 2010	4.6	5.2	477	485

Table 2-4. Monthly and 12-Month Running Average of the IEUA Agency-Wide Effluent TIN and TDS Concentrations - 2005 to 2020

Month	TIN, mgl		TDS, mgl	
	Monthly	12-Month Running Average[(a)]	Monthly	12-Month Running Average
Sep 2010	3.7	5.2	476	483
Oct 2010	5.5	5.3	478	481
Nov 2010	5.7	5.3	479	481
Dec 2010	5.0	5.3	472	479
Jan 2011	6.4	5.4	474	477
Feb 2011	6.9	5.4	455	474
Mar 2011	6.4	5.4	468	473
Apr 2011	6.5	5.5	460	472
May 2011	6.0	5.6	462	471
Jun 2011	5.7	5.6	464	470
Jul 2011	4.3	5.5	454	468
Aug 2011	4.4	5.5	457	467
Sep 2011	5.8	5.7	457	465
Oct 2011	5.2	5.7	457	463
Nov 2011	5.9	5.7	453	461
Dec 2011	6.3	5.8	454	460
Jan 2012	6.4	5.8	465	459
Feb 2012	6.7	5.8	476	461
Mar 2012	6.7	5.8	497	463
Apr 2012	7.4	5.9	496	466
May 2012	6.4	5.9	493	469
Jun 2012	5.8	5.9	482	470
Jul 2012	5.4	6.0	477	472
Aug 2012	4.8	6.1	463	473
Sep 2012	5.1	6.0	472	474
Oct 2012	4.9	6.0	486	476
Nov 2012	6.1	6.0	485	479
Dec 2012	6.0	6.0	492	482
Jan 2013	6.1	5.9	495	484
Feb 2013	6.8	5.9	490	486
Mar 2013	6.1	5.9	493	485
Apr 2013	6.4	5.8	501	486
May 2013	6.4	5.8	503	487
Jun 2013	5.8	5.8	502	488

Table 2-4. Monthly and 12-Month Running Average of the IEUA Agency-Wide Effluent TIN and TDS Concentrations - 2005 to 2020

Month	TIN, mgl		TDS, mgl	
	Monthly	12-Month Running Average[(a)]	Monthly	12-Month Running Average
Jul 2013	5.6	5.8	496	490
Aug 2013	6.9	6.0	496	493
Sep 2013	7.3	6.2	499	495
Oct 2013	7.4	6.4	496	496
Nov 2013	6.7	6.4	507	497
Dec 2013	7.6	6.6	511	499
Jan 2014	5.9	6.6	510	500
Feb 2014	6.1	6.5	509	502
Mar 2014	5.5	6.5	497	502
Apr 2014	5.2	6.4	517	504
May 2014	5.2	6.3	524	505
Jun 2014	4.4	6.1	506	506
Jul 2014	3.5	6.0	494	505
Aug 2014	3.5	5.7	508	506
Sep 2014	4.1	5.4	524	508
Oct 2014	4.9	5.2	541	512
Nov 2014	5.9	5.1	571	518
Dec 2014	6.2	5.0	565	522
Jan 2015	7.9	5.2	546	525
Feb 2015	7.4	5.3	560	529
Mar 2015	6.2	5.4	528	532
Apr 2015	5.2	5.4	531	533
May 2015	6.1	5.4	520	533
Jun 2015	4.6	5.4	515	534
Jul 2015	5.2	5.6	500	534
Aug 2015	4.7	5.7	503	534
Sep 2015	4.8	5.7	508	532
Oct 2015	5.2	5.8	506	529
Nov 2015	5.4	5.7	505	524
Dec 2015	6.2	5.7	503	519
Jan 2016	7.3	5.7	504	515
Feb 2016	6.5	5.6	495	510
Mar 2016	5.9	5.6	521	509
Apr 2016	5.8	5.6	514	508

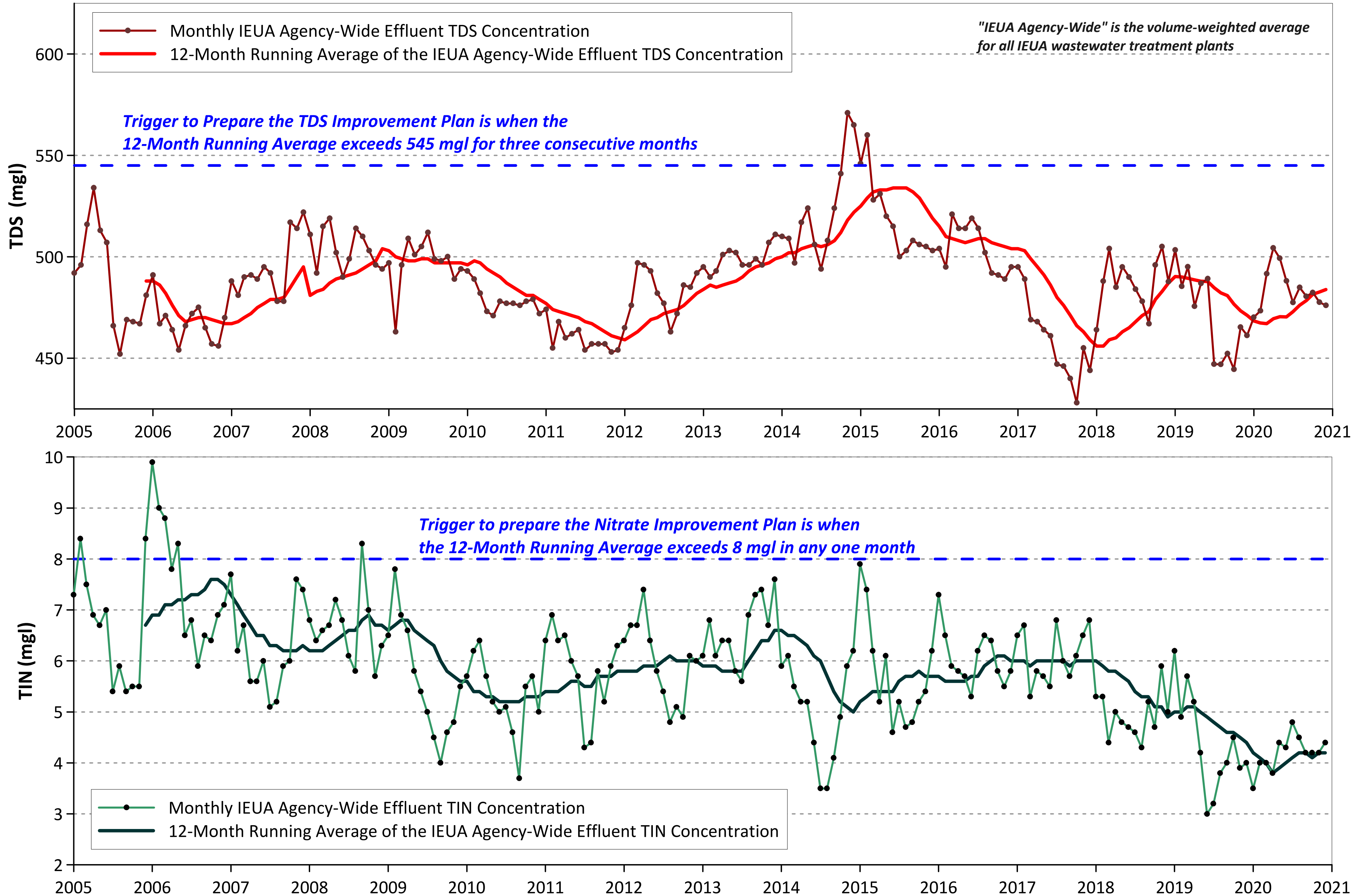
Table 2-4. Monthly and 12-Month Running Average of the IEUA Agency-Wide Effluent TIN and TDS Concentrations - 2005 to 2020

Month	TIN, mgl		TDS, mgl	
	Monthly	12-Month Running Average[a]	Monthly	12-Month Running Average
May 2016	5.7	5.6	514	507
Jun 2016	5.3	5.7	519	508
Jul 2016	6.2	5.7	514	509
Aug 2016	6.5	5.9	502	509
Sep 2016	6.4	6.0	492	507
Oct 2016	5.8	6.1	491	506
Nov 2016	5.5	6.1	489	505
Dec 2016	5.8	6.0	495	504
Jan 2017	6.5	6.0	495	504
Feb 2017	6.7	6.0	489	503
Mar 2017	5.3	5.9	469	499
Apr 2017	5.8	6.0	468	495
May 2017	5.7	6.0	464	491
Jun 2017	5.5	6.0	461	486
Jul 2017	6.8	6.0	447	480
Aug 2017	6.0	6.0	446	476
Sep 2017	5.7	5.9	440	471
Oct 2017	6.1	6.0	428	466
Nov 2017	6.5	6.0	455	463
Dec 2017	6.8	6.0	444	459
Jan 2018	5.3	6.0	464	456
Feb 2018	5.3	5.9	488	456
Mar 2018	4.4	5.8	504	459
Apr 2018	5	5.8	485	460
May 2018	4.8	5.7	495	463
Jun 2018	4.7	5.6	490	465
Jul 2018	4.6	5.4	484	468
Aug 2018	4.3	5.3	478	471
Sep 2018	5.2	5.3	467	473
Oct 2018	4.7	5.1	496	479
Nov 2018	5.9	5.1	505	483
Dec 2018	5	4.9	488	487
Jan 2019	6.2	5.0	503	490
Feb 2019	4.9	5.0	485	490

Table 2-4. Monthly and 12-Month Running Average of the IEUA Agency-Wide Effluent TIN and TDS Concentrations - 2005 to 2020

Month	TIN, mgl		TDS, mgl	
	Monthly	12-Month Running Average[a]	Monthly	12-Month Running Average
Mar 2019	5.7	5.1	495	489
Apr 2019	5.2	5.1	476	489
May 2019	4.2	5.0	487	488
Jun 2019	3	4.9	489	488
Jul 2019	3.2	4.8	447	485
Aug 2019	3.8	4.7	447	482
Sep 2019	4	4.6	452	481
Oct 2019	4.5	4.6	445	477
Nov 2019	3.9	4.5	465	473
Dec 2019	4	4.4	461	471
Jan 2020	3.5	4.2	470	468
Feb 2020	4	4.1	473	467
Mar 2020	4	4.0	492	467
Apr 2020	3.8	3.8	504	469
May 2020	4.4	3.9	499	470
Jun 2020	4.3	4.0	488	470
Jul 2020	4.8	4.1	477	473
Aug 2020	4.5	4.2	485	476
Sep 2020	4.2	4.2	481	478
Oct 2020	4.2	4.1	482	482
Nov 2020	4.2	4.2	478	483
Dec 2020	4.4	4.2	476	484

(a) 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.



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Monthly and 12-Month Running Average of the IEUA Agency-Wide Effluent
TDS and TIN Concentrations - 2005 to 2020

Figure 2-7

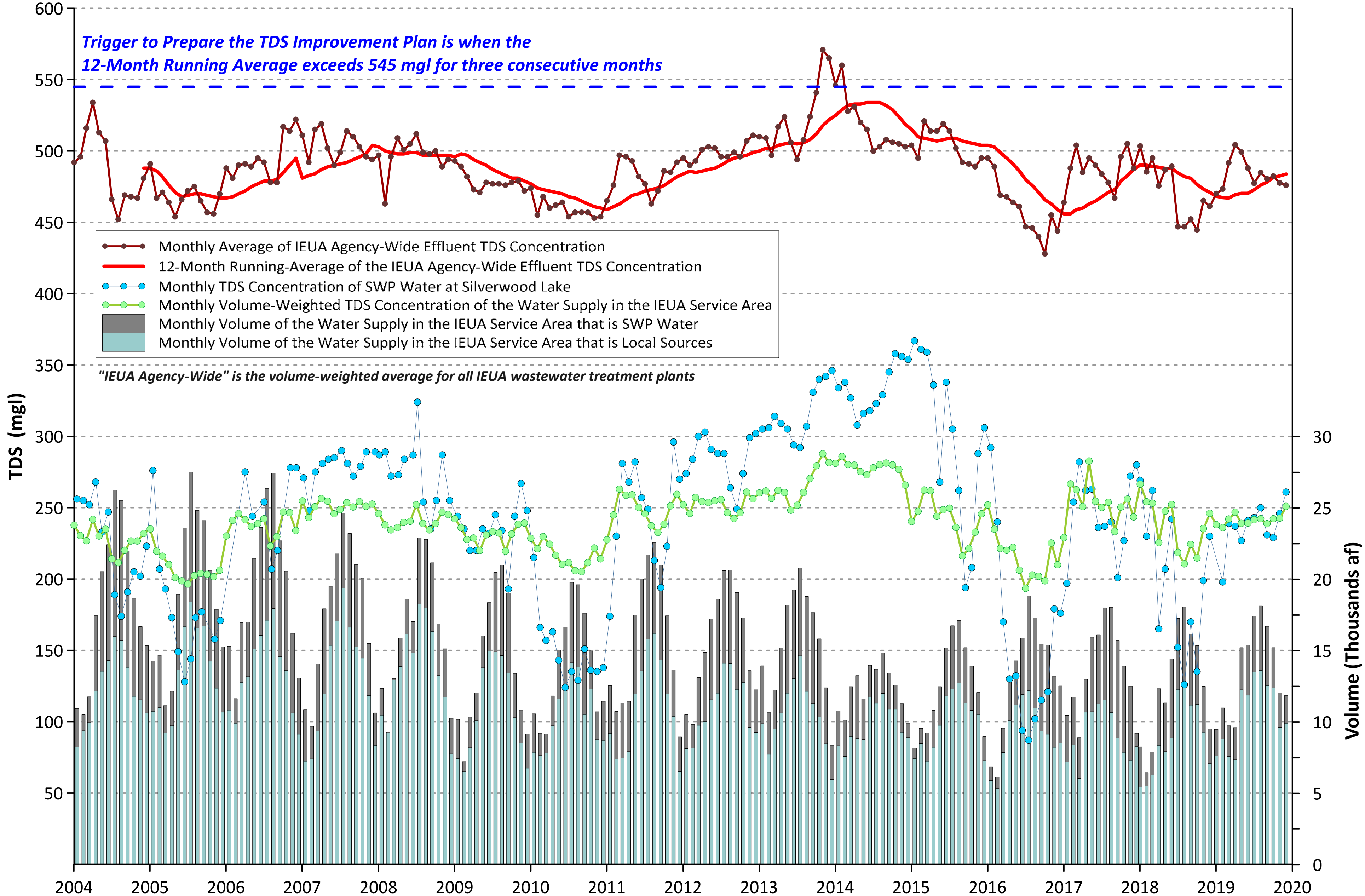
During 2015, the TDS effluent compliance metric reached a historical-high value of 534 mgl for three consecutive months in June, July, and August. This was only 11 mgl below the action limit defined in Commitment number 6.

The TDS concentration of the effluent is influenced by the volume and TDS concentration of the water supplies served in the service areas tributary to the IEUA's treatment plants. To demonstrate this, Figure 2-8 shows the monthly, volume-weighted IEUA agency-wide effluent TDS concentration and compliance metric 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 (e.g. total water supply, including SWP water); the volume of water supply served in the area tributary to the IEUA's treatment plants that is SWP water; and the volume of water supply served in the area tributary to the 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 total water supply TDS concentration, the monthly volume-weighted TDS, and the effluent compliance metric.
- The increase in the TDS concentration of the total water supply is less than the increase in TDS concentrations of the SWP supply because it 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 effluent compliance metric through mid-2017.
- In 2019, the wet-winter condition in California decreased both the TDS concentrations of SWP water and the total water supply, which resulted in a decreasing trend of the effluent compliance metric through 2019.
- In 2020, the proportion of the total water supply that is low-TDS SWP water decreased, which resulted in a slight increasing trend of the effluent compliance metric through 2020.

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 the TDS concentration of the IEUA's effluent. 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 through 2016 are evident in the decreased volume of total water supply plotted in Figure 2-8.

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



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Monthly and 12-Month Running Average of the IEUA Agency-Wide Effluent, versus Monthly SWP
TDS Concentrations - 2005 to 2020

Figure 2-8

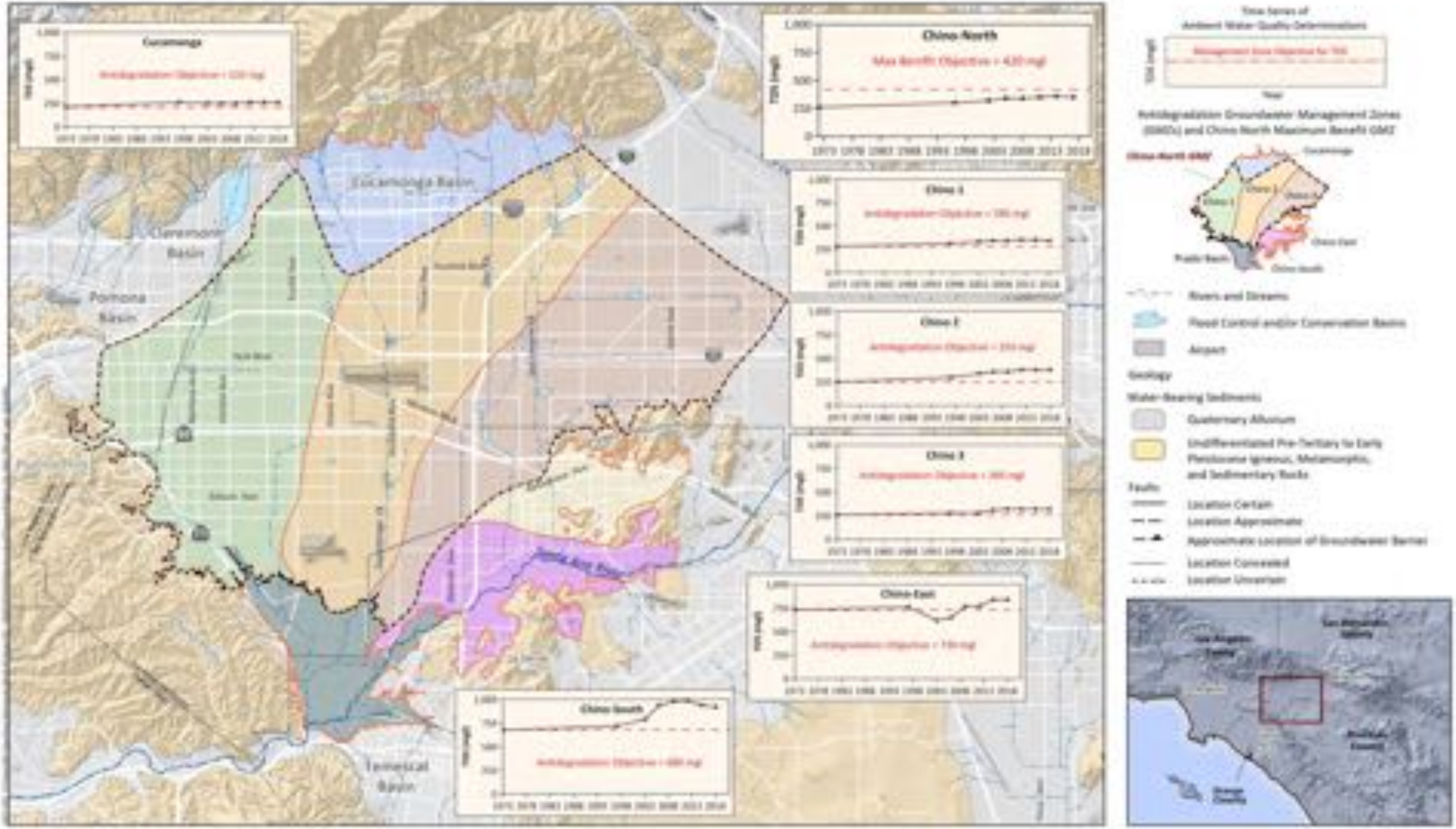
These observed water quality and water use trends suggest that drought conditions have a meaningful impact on the TDS concentrations of the water supply and recycled water and that future droughts similar to the 2012 to 2016 period could lead to short-term exceedances of the effluent compliance metric that is based on a short-term averaging period of 12-months. 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 analyze the impacts of the proposed change. The 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 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. In 2020, Watermaster and the IEUA completed the evaluation of the baseline planning scenario, including detailed sensitivity analyses and conducted two project status and technical review meetings with the Regional Board in October and November. The draft regulatory compliance strategy is anticipated to be submitted to the Regional Board for review in 2021.

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 was completed in July 2020 (WSC, 2020). Figures 2-9a and Figure 2-9b show trends of the current and all historical ambient TDS and nitrate concentration determinations. As of 2018, the ambient TDS concentration of Chino-North is 350 mgl, which is 10 mgl less than the 2015 ambient TDS concentration. There remains 70 mgl of assimilative capacity. 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.



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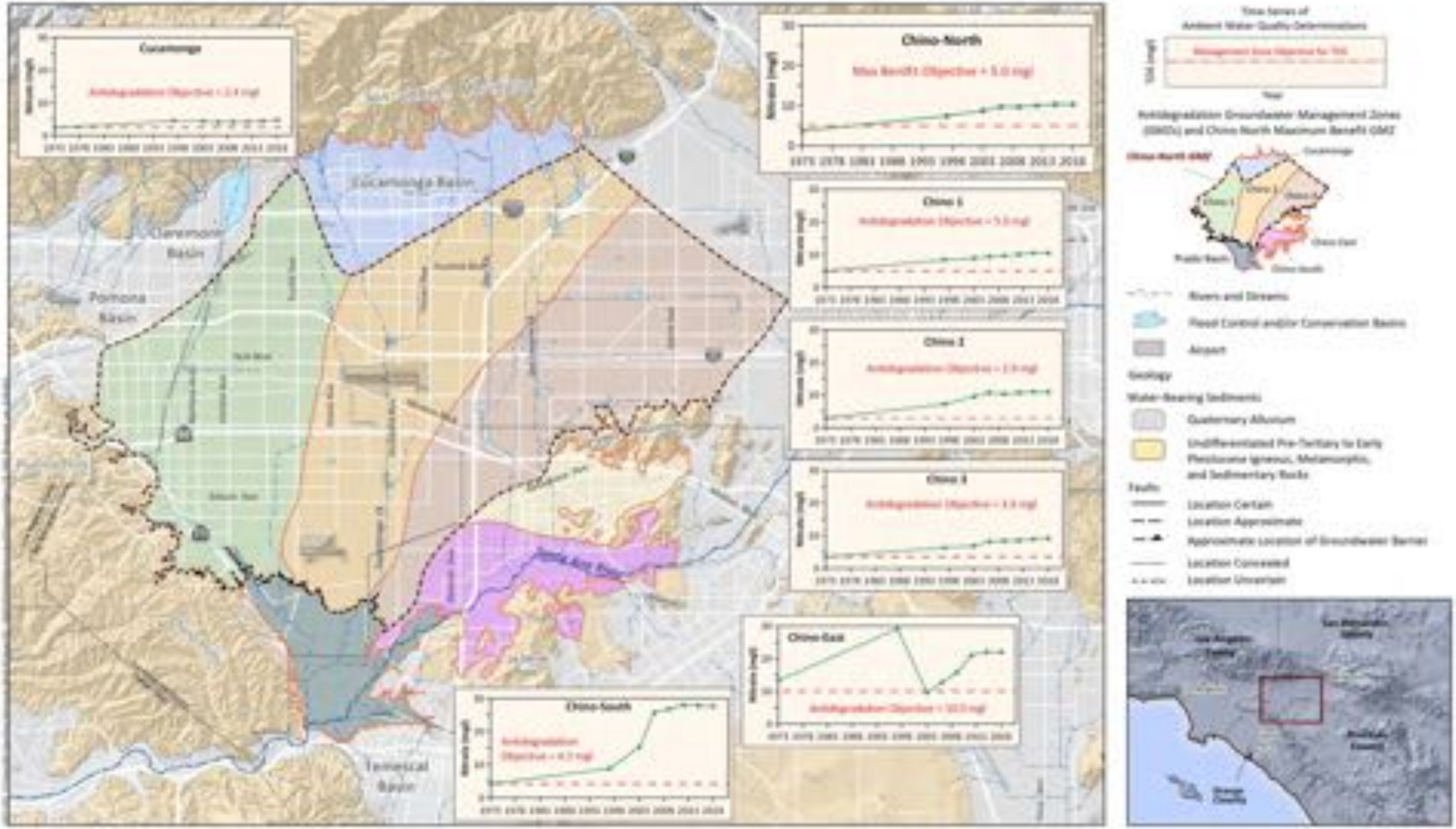
Trends in Ambient Water Quality
Determinations for Total Dissolved Solids By Groundwater Management Zone

Figure 2-9a



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Trends in Ambient Water Quality
Determinations for Nitrate
By Groundwater Management Zone

Figure 2-9b

3.0 DATA COLLECTED IN 2020

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 2020 for the Maximum-Benefit Monitoring Program include groundwater elevation, groundwater quality, and surface-water quality. The 2020 data collection efforts are described below.

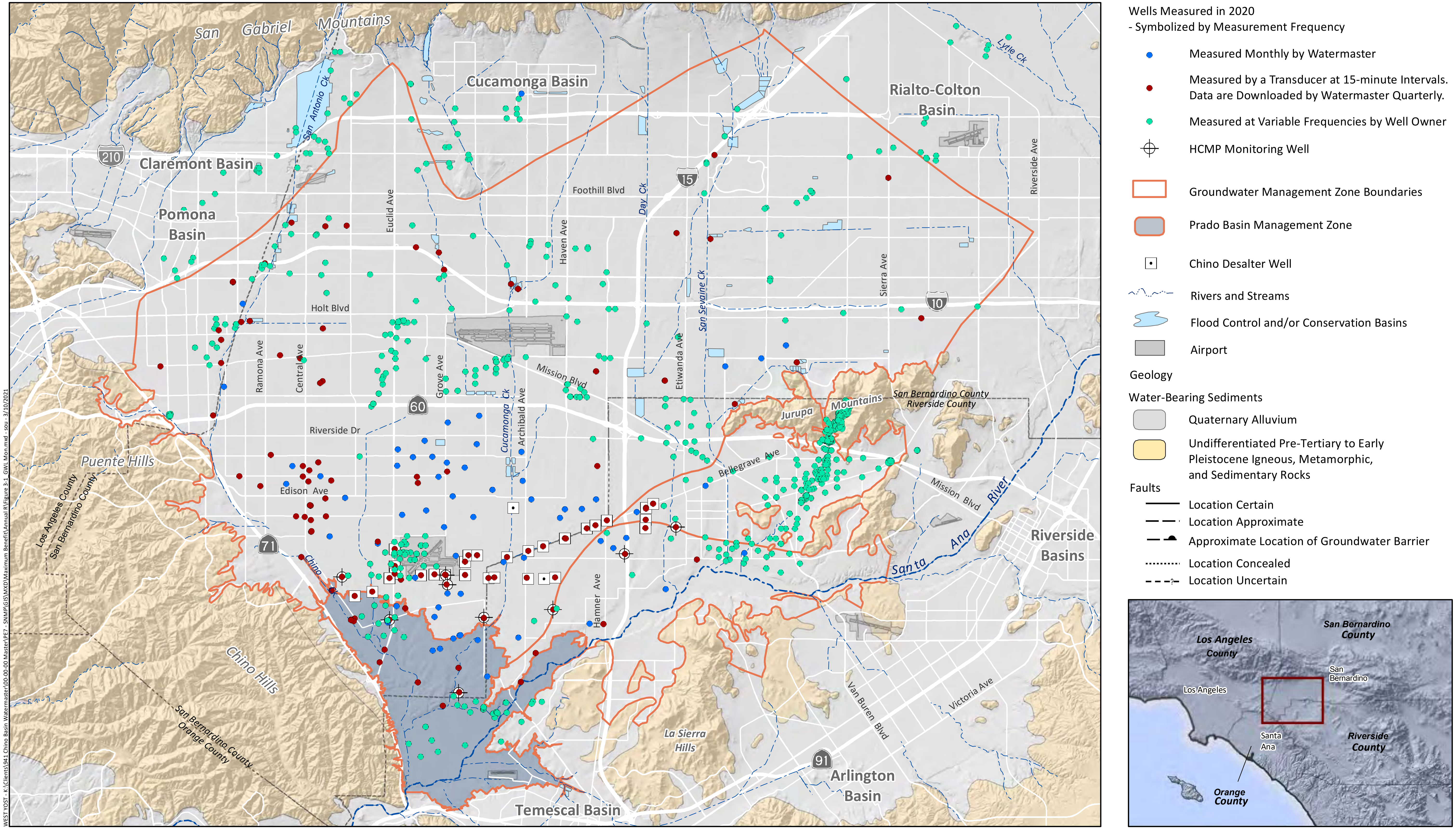
3.1 Groundwater Monitoring Program

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 1,160wells that are included in Watermaster's groundwater-level monitoring program. The groundwater-level monitoring program supports many Watermaster management functions which include: 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 pumping 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 2020, symbolized by measurement frequency. At 945 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 215 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 2020 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.



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2020 Maximum Benefit
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Groundwater-Level Monitoring Program
Wells Monitored in 2020

Figure 3-1

3.1.2 Groundwater-Quality Monitoring Program

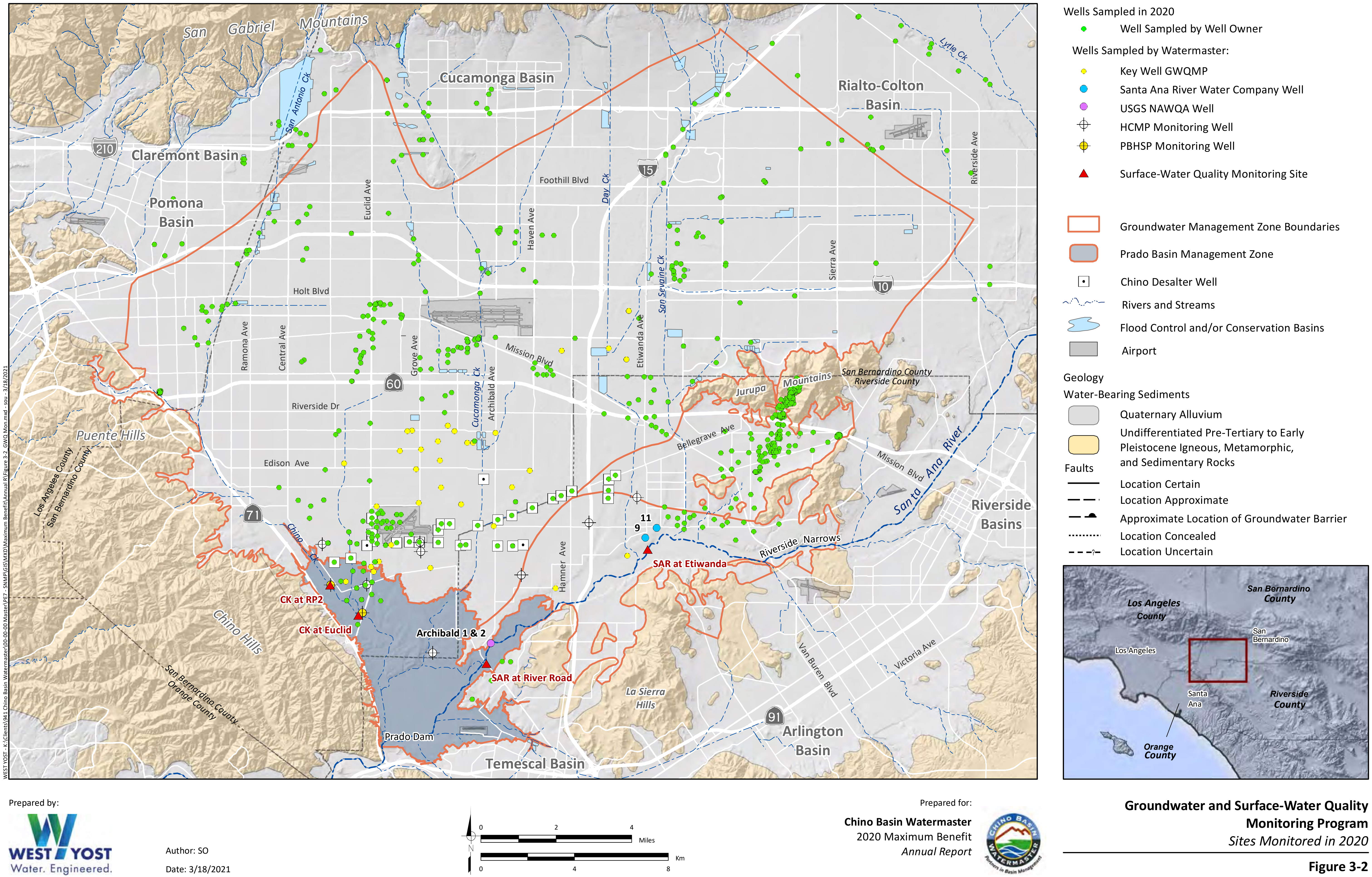
Figure 3-2 shows the locations of the 890 wells that are included in Watermaster's groundwater-quality monitoring program. Watermaster obtains groundwater-quality data, in part, to comply with two maximum-benefit commitments: the triennial ambient water quality recomputation and the analysis of hydraulic control. These data are also used to: prepare Watermaster's biennial SOB report, support ground-water modeling, characterize non-point source contamination and plumes associated with point-source discharges, and characterize present trends in groundwater quality.

Figure 3-2 shows the wells where groundwater-quality data were collected by Watermaster or well owners in 2020. At 830 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 60 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.

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
Major Trace Elements Al, As, Ba, Cr, Mn	EPA 200.8
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
Gross Alpha/Beta	EPA 900.0
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
Total Phosphorus	SM4500-PE/EPA 365.1
Turbidity	EPA 180.1
VOCs[a]	EPA 524.2
1,2,3 -Trichloropropane (Low Detection)	CASRL 524M-TCP

(a) 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)



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WEST YOST Water. Engineered.

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Prepared for:

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2020 Maximum Benefit
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Groundwater and Surface-Water Quality Monitoring Program
Sites Monitored in 2020

Figure 3-2

During 2020, 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 in proximity to contaminant plumes 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 2020, 28 private wells and 10 monitoring wells were sampled from July through December 2020.
- Annual samples were collected from eight[15] of the nine multi-nested HCMP monitoring wells (18 well casings) in the southern portion of Chino Basin in August 2020.
- 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 2020.
- Quarterly or semi-annual samples were collected at one single-nested and one multi-nested Prado Basin Habitat Sustainability Program (PBHSP) monitoring wells (three well casings), and one monitoring well utilized for the PBHSP, in April, June, and September 2020.

All groundwater-quality data are reviewed by Watermaster staff and uploaded to a centralized database management system that can be accessed online through HydroDaVE℠. All publicly available water-quality data collected in 2020 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 quarterly or semi-annual samples[16] at two sites along Chino Creek, *CK at RP2* and *CK at Euclid,* for the PBHSP. Figure 3-2 shows the locations of these sites.

For surface water sites along the Santa Ana River, 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 2020. Surface-water quality samples are tested for the analytes listed in Table 3-2. For the surface water sites along Chino Creek, the samples are collected on the same day as the semi-annual groundwater-quality samples at the nearby PBHSP monitoring wells. Samples were collected in April, June, and September 2020. All surface-water quality data are reviewed by Watermaster and uploaded to a centralized database management system that can be accessed online through

[15] Due to high turbidity, one well was not sampled. This well was redeveloped and sampled in early 2021.

[16] The frequency of the sampling for the PBHSP was changed from quarterly to semi-annually in 2020. Quarterly samples were collected in fiscal year 2020 (ending June 2020) and semi-annual samples were collected in fiscal year 2021 (starting July 2020).

HydroDaVE^SM. All surface-water quality data collected in 2020 are contained in the MS Access database included with this report as Appendix B.

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

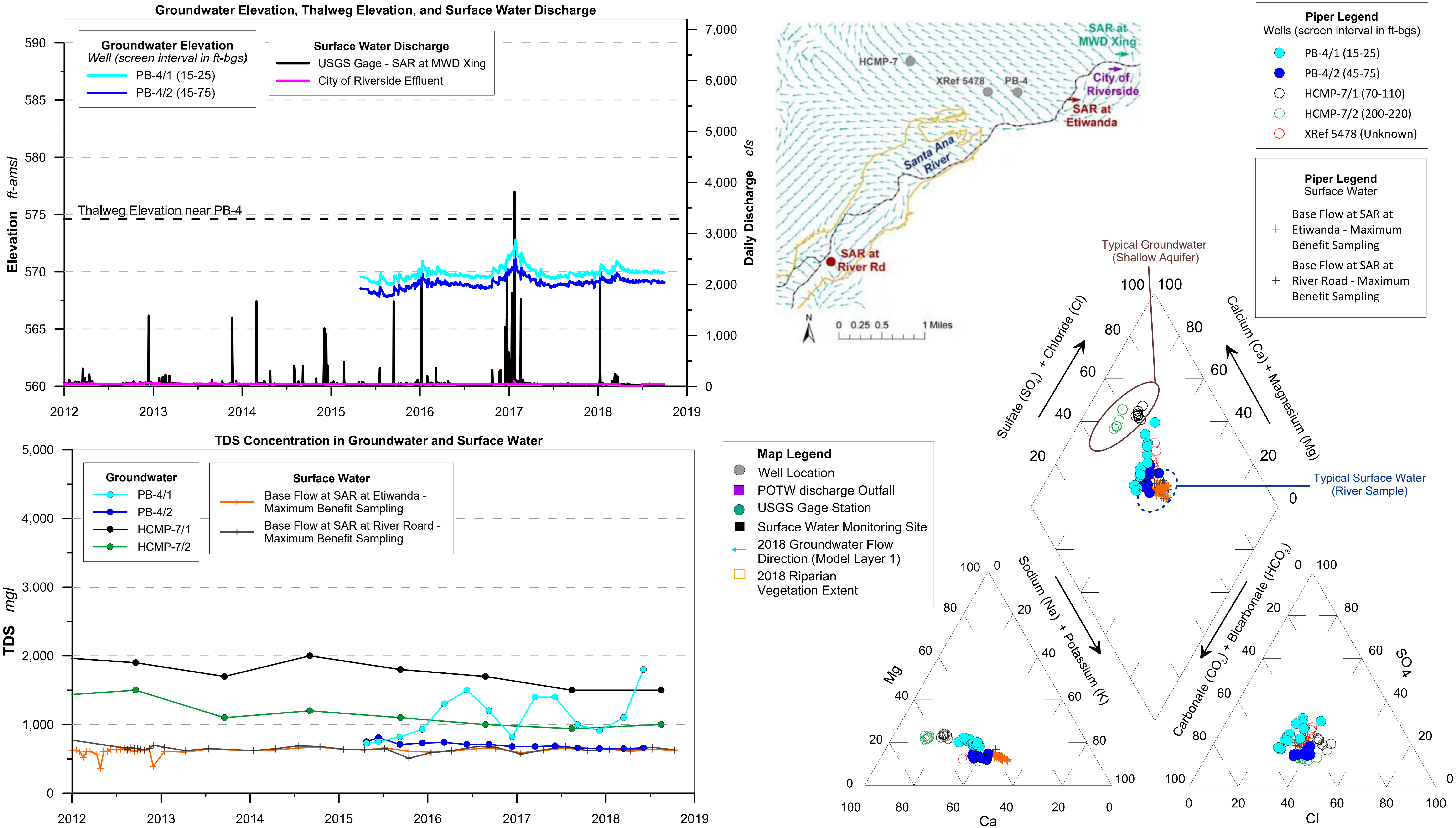
Figure 3-3 is an exhibit from the 2018 PBHSP Annual Report (WEI, 2019c) that shows the analysis of the groundwater and surface water interactions in the Santa Ana River using the surface water quality data collected at the two sites in the Santa Ana River (*SAR at Etiwanda* and *SAR at River Road*). 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. Note that:

- The simulated groundwater-flow directions (arrow symbols on the map) diverge from the Santa Ana River, indicating that this is an area of streambed recharge.
- Groundwater elevations at both PB-4 wells are below the thalweg elevation of the Santa Ana River near PB-4, indicating that this is an area of streambed recharge from mid-2015 to late 2019.
- Groundwater elevations at both PB-4 wells increase slightly during and immediately after periods of stormwater discharge as measured by the USGS gage located upstream of PB-4 wells in the Santa Ana River, suggesting that stormwater discharge is a source of recharge to the shallow groundwater.
- The TDS concentrations at PB-4/1 (shallow well) fluctuate between 730-1,500 mgl; the lower TDS concentrations within this range are similar to the TDS concentrations of the baseflow in the Santa Ana River as sampled at *SAR at Etiwanda* and *SAR at River Road*, while the higher TDS concentrations are similar to the TDS concentrations of shallow groundwater at a nearby well (HCMP-7/1). This suggests that the source of groundwater sampled at PB-4/1 is influenced by streambed recharge of the Santa Ana River, the shallow regional aquifer system, and/or local return flows of precipitation and applied water. TDS concentrations at PB-4/2 (deeper well) range from 650-810 mgl which are similar to the TDS concentrations of

the baseflow in the Santa Ana River, suggesting that the source of groundwater samples at PB-4/2 is streambed recharge.

- The general-mineral chemistry for both PB-4 wells plots very close to the chemistry of surface water for *SAR at Etiwanda* and *SAR at River Road* on the Piper diagram, indicating that the source of the shallow groundwater at PB-4 is streambed recharge of the Santa Ana River, the shallow regional aquifer system, and/or local return flows of precipitation and applied water.

The analysis detailed in the 2018 PBHSP Annual Report 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.



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Author: SO
Date:2/25/20

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

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

Figure 3-3

4.0 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 (see locations in Figure 3-2). 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.[17]

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, which is the extent of the Santa Ana River flowing through Chino Basin (see Figure 1-1). 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 as an input to, or computed by, the model for the calibration period of fiscal year 1978 to 2018, plus fiscal year 2019 and 2020 from the planning period for scenario *2020 SYR1*. Column 9, *Streambed Infiltration from the Santa Ana River*, is the annual estimate of streambed infiltration to the Chino Basin in the Santa Ana River downstream of the Riverside Narrows and the lower reaches of Chino Creek and Mill Creek. Column 19, *Rising Groundwater*, is the annual estimate of the combined groundwater discharge from Chino Basin to the Santa Ana River, Chino Creek, and Mill Creek. The net rising groundwater from Chino Basin to the Santa Ana River between Riverside Narrows and Prado Dam is calculated in Column 23 as the difference between groundwater discharge and streambed infiltration (Column 19 minus Column 9). 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 43-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 increased production in the southern Chino Basin starting in fiscal year 2005. These observations are consistent with conclusions from the monitoring data and demonstrate that hydraulic control is being achieved.

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

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

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[18] 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 (SARWM, 2020). 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: 1) the SARWM estimate of base flow discharge at Prado Dam minus the rising groundwater from the Chino Basin component; and 2) 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 19 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 740 afy without the operation of the CCWF[19], which represents a small fraction of the total rising groundwater from the Chino Basin to the Santa Ana River. It represents, on average, about four percent of rising 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 630 afy in 2016 through 2050.[20] 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 mgl—even during extended dry periods when storm

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

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

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

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 with a decrease in low-TDS stormwater flow and a steady decrease in the volume of base flow discharge. The decrease in baseflow is mostly attributable to the decrease in wastewater discharges to the Santa Ana River.
- In water year 2020, the Reach 2 TDS metric was 490 mgl, a decrease of 12 mgl from the previous year.

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 1978 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 the operation of the CCWF. 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 further decline, 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.

Table 4-1. Water Budget for the Chino Basin for the Calibration and Planning Periods and Estimated Net 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[a]	Streambed Infiltration from the Santa Ana River Tributaries	Managed Aquifer Recharge			Total Recharge	Groundwater Pumping			Riparian Veg ET	Rising Groundwater[d]	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[b,c]	Overlying Agricultural Pool						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23) = (19) - (9)
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	7,731	364	2,634	2,055	6,909	363	68,367	35,862	602	12,861	11,145	6,510	164,728	31,233	84,668	15,478	18,099	14,234	166,819	(2,092)	-131,779	(22,117)
2020	15,538	7,709	754	2,664	2,132	6,867	355	70,799	35,317	602	9,966	12,952	18,103	183,757	35,630	96,570	15,722	18,268	14,844	181,033	2,725	-126,963	(20,473)

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 and 2020 of the planning simulation period for Scenario 2020 SYR1 with updated historical managed aquifer recharge and pumping.

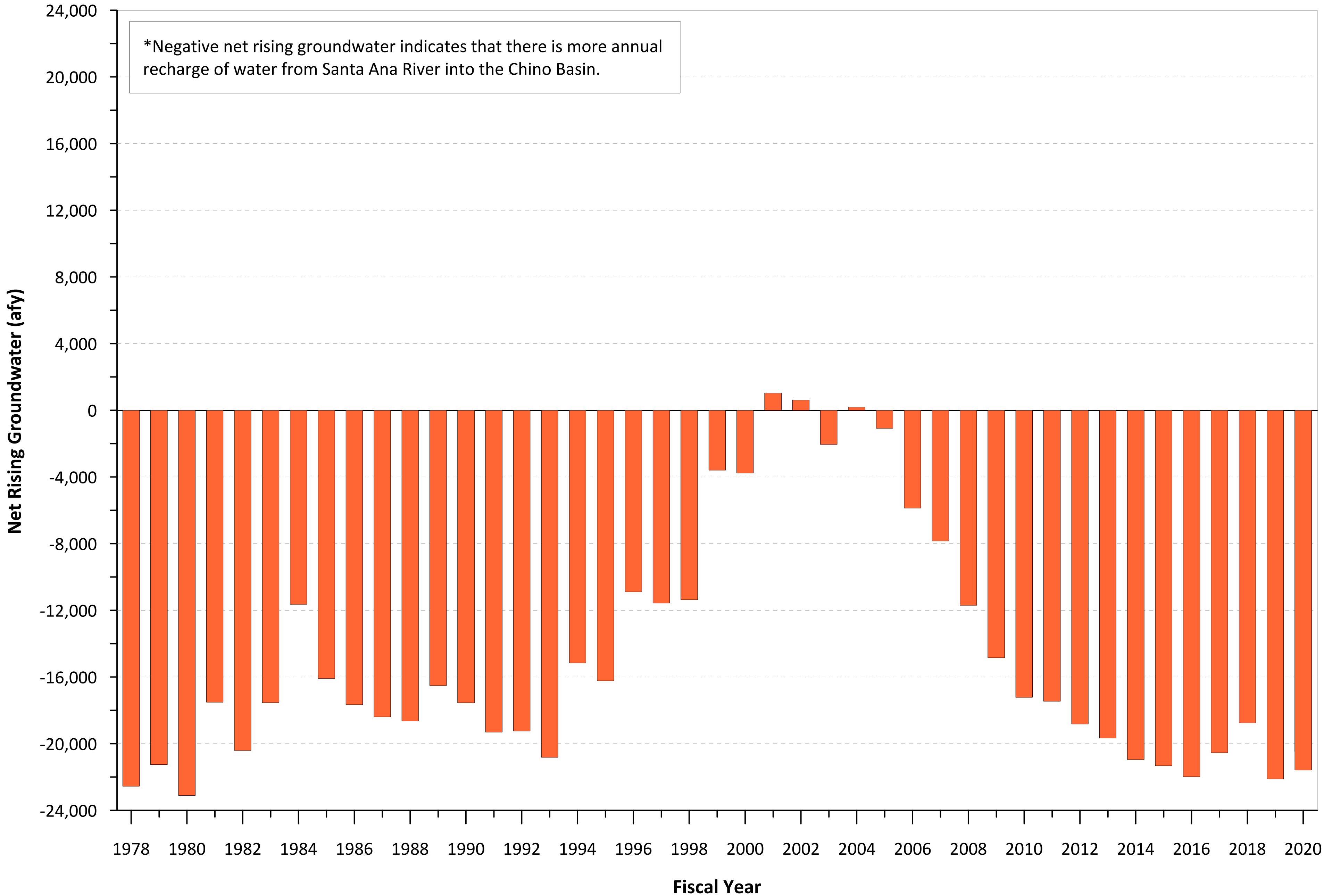
(a) Streambed infiltration from Santa Ana River includes infiltration at Santa Ana River below Riverside Narrows and at lower reaches of Chino and Mill Creeks

(b) Does not include San Antonio Water Company Wells 15 and 16, and Santa Ana River Water Company Well 9.

(c) Less injection in wells by General Electric.

(d) Rising groundwater discharge to Santa Ana River and Chino and Mill Creeks.

(Red Text) Indicates negative values.



Prepared by:

WEST YOST
Water. Engineered.

Author: SO
Date:2/25/20

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\GR\MaxBen\AnnualR\Figure4-1

Prepared for:

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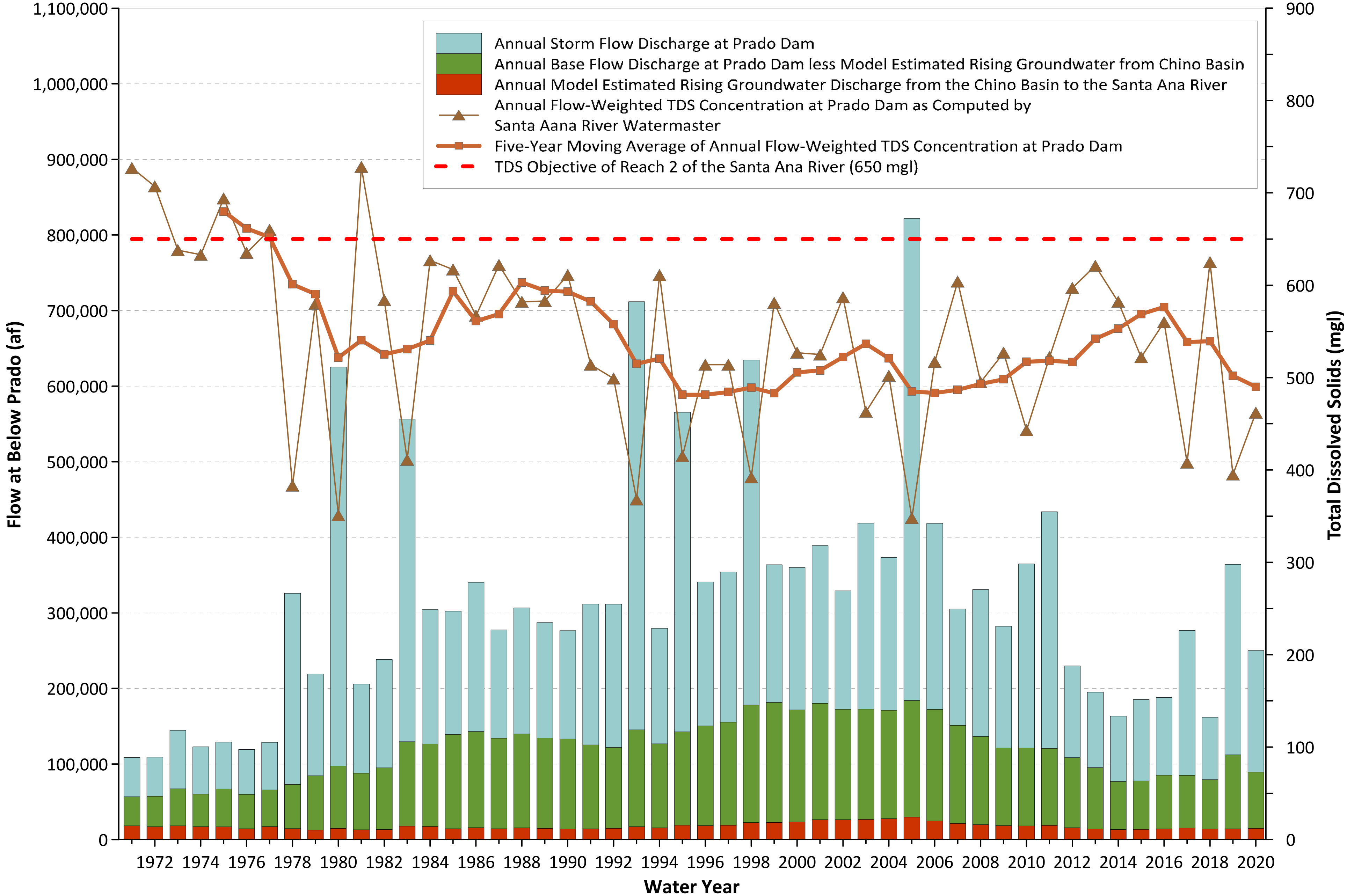
2020 Maximum Benefit
Annual Report

Net Annual Rising Groundwater Contribution to Surface Discharge in Sana Ana River between Riverside Narrows and Prado Dam - 1978 to 2020

Figure 4-1



Prepared by:

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Prepared for:

Chino Basin Watermaster
2020 Maximum Benefit
Annual Report

TDS and Components of Discharge of the Santa Ana River at Prado Dam
Water Year 1971 to 2020

Figure 4-2

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Appendix A

The IEUA Five-Year, Volume-Weighted TDS and TIN Computation for Managed Aquifer Recharge

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
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
Jan-20	174	492	748	1,414	95	230	436	455946	261	0.6	0.2	3.1	2518	1.7
Feb-20	316	0	1008	1,324	95	198	438	471329	261	0.6	0.7	3.0	3235	1.7
Mar-20	2543	0	1025	3,568	131	239	452	795874	259	0.9	0.5	3.5	5797	1.6
Apr-20	2490	155	820	3,464	131	237	458	737484	257	0.9	0.5	4.0	5571	1.6
May-20	121	473	1266	1,860	285	227	453	715037	258	0.7	0.5	3.5	4777	1.6
Jun-20	17	444	1440	1,901	285	241	457	769942	258	0.7	0.4	3.1	4648	1.6
Jul-20	11	110	1330	1,451	285	243	448	625797	258	0.7	0.2	3.0	3998	1.6
Aug-20	18	0	1442	1,460	359	250	454	661647	258	<0.1	0.2	2.8	3992	1.6
Sep-20	18	0	1634	1,652	359	231	451	743306	259	<0.1	0.2	2.9	4765	1.6
Oct-20	24	9	2030	2,063	359	229	447	917518	259	<0.1	0.2	2.7	5522	1.6
Nov-20	290	1498	1749	3,536	359	246	443	1246288	260	<0.1	0.2	2.7	5008	1.6
Dec-20	2490	545	1528	4,563	190	246	439	1277043	260	0.6	0.2	2.9	6083	1.6

SW/LR (Mean): Stormwater / Local Runoff (Mean) is a monthly average value of all SW/LR data collected during the month. For months without data available, previous month's data is carried down

SW/LR (Max): Stormwater / Local Runoff (Max) is a monthly maximum value of all SW/LR data collected during the month. For months without data available, previous month's data is carried down

IW: Imported Water based on monthly Table D data received from the Metropolitan Water District. For months without data available, previous month's data is carried down

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

2020 Maximum Benefit Database

Concord

1001 Galaxy Way, Suite 310
Concord CA 95420
925-949-5800

Davis

2020 Research Park Drive, Suite 100
Davis CA 95618
530-756-5905

Eugene

1650 W 11th Avenue, Suite 1-A
Eugene OR 97402
541-431-1280

Lake Forest

23692 Birtcher Drive
Lake Forest CA 92630
949-420-3030

Lake Oswego

5 Centerpointe Drive, Suite 130
Lake Oswego OR 97035
503-451-4500

Oceanside

804 Pier View Way, Suite 100
Oceanside CA 92054
760-795-0365

Phoenix

4505 E Chandler Boulevard, Suite 230
Phoenix AZ 85048
602-337-6110

Pleasanton

6800 Koll Center Parkway, Suite 150
Pleasanton CA 94566
925-426-2580

Sacramento

8950 Cal Center Drive, Bldg. 1, Suite 363
Sacramento CA 95826
916-306-2250

San Diego

11939 Rancho Bernardo Road, Suite 100
San Diego CA 92128
858-505-0075

Santa Rosa

2235 Mercury Way, Suite 105
Santa Rosa CA 95407
707-543-8506