2013 Amendment to the 2010 Recharge Master Plan Update

Prepared for:

Chino Basin Watermaster
Inland Empire Utilities Agency

September 2013

WILDERMUTH™
ENVIRONMENTAL INC.

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Prepared by

Wildermuth Environmental, Inc.

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Table of Contents

List of Tables

List of Tables

List of Figures

List of Figures

Acronyms, Abbreviations, and Initialisms

acre-ft/yr	acre-feet per year
ASR	Aquifer Storage and Recovery
Basin Plan	Santa Ana Regional Water Quality Control Plan
BMP	Best Management Practice
CDPH	California Department of Public Health
CEQA	California Environmental Quality Act
CBFIP	Chino Basin Facilities Improvement Program
CBWCD	Chino Basin Water Conservation District
CDA	Chino Desalter Authority
CDFM	cumulative departure from mean
cfs	cubic feet per second
CRA	Colorado River Aqueduct
CVWD	Cucamonga Valley Water District
DYYP	Dry Year Yield Program
DWR	CA Department of Water Resources
EPA	US Environmental Protection Agency
ft-bgs	Feet below ground surface
FWC	Fontana Water Company
GE	General Electric
HCMP	Hydraulic Control Monitoring Program
IEUA	Inland Empire Utilities Agency
JCSD	Jurupa Community Services District
MCL	maximum contaminant level
Metropolitan	Metropolitan Water District of Southern California

Acronyms, Abbreviations, and Initialisms

MWDSC	Metropolitan Water District of Southern California
MPI	Material Physical Injury
MEP	maximum extent possible
MS4	Municipal Separate Storm Sewer System
msl	mean sea level
MVWD	Monte Vista Water District
MZ1	Management Zone 1
MZ2	Management Zone 2
MZ3	Management Zone 3
MZ4	Management Zone 4 – Chino East
MZ5	Management Zone 5 – Chino South
NPDES	National Pollutant Discharge Elimination System
ORGP	Ontario Groundwater Recovery Project
OBMP	Optimum Basin Management Plan
O&M	operations and maintenance
PRPs	Potentially Responsible Parties
PID	Project Identification Number
PEIR	Programmatic Environmental Impact Report
R4	Rainfall, Runoff, Router, and Rootzone Model
RWC	Recycled Water Contribution
RWQCB	Regional Water Quality Control Board
RIX	Rapid Infiltration Extraction Treatment Plant
RMPU	2010 Recharge Master Plan Update
SARWC	Santa Ana River Water Company

Acronyms, Abbreviations, and Initialisms

SBCFCD	San Bernardino County Flood Control District
SCADA	Supervisory Control and Data Acquisition
SWP	State Water Project
TYCIP	Ten-Year Capital Improvement Program
TVMWD	Three Valleys Municipal Water District
TDS	total dissolved solids
UWMP	Urban Water Management Plan
USGS	United States Geological Survey
VOC	Volatile Organic Compound
Watermaster	Chino Basin Watermaster
WLAM	WasteLoad Allocation Model
WEI	Wildermuth Environmental, Inc.
WMWD	Western Municipal Water District
WQMP	Water Quality Management Plan
WRCRWAP	Western Riverside County Regional Wastewater Authority Plant

Section 1 – Introduction

This report documents the investigation that was conducted pursuant to the direction of the Court and the Chino Basin Watermaster (Watermaster) to amend its 2010 Recharge Master Plan Update (RMPU) (WEI, et al, 2010). The 2010 RMPU was prepared consistent with the requirements of the Peace II Agreement and the December 2007 Court Order[1] that approved and directed Watermaster to implement the Peace II Agreement. The 2010 RMPU was a condition subsequent to the December 2007 Court order that mandated completion of the 2010 RMPU and submittal to the Court by July 1, 2010. The 2010 RMPU was completed on time and submitted to the Court in June 2010.

1.1 Scope and Content of the 2010 RMPU

The minimum scope and content of the 2010 RMPU work was contained in the December 2007 Court Order and included the following.

1.1.1 Peace Agreement

Section 5.1 (e) of the Peace Agreement contains Watermaster's commitments regarding the recharge of supplemental water in the Chino Basin. The 2010 RMPU focused on Watermaster's implementation of Peace Agreement Section 5.1 (e) items (i), (iii), (v), (vii), and (viii), which are stated as follows (see Peace Agreement, pages 20 and 21):

"Watermaster shall exercise Best Efforts to:

(i) protect and enhance the safe yield of the Chino Basin through Replenishment and Recharge; […]

(iii) direct Recharge relative to Production in each area and sub-area of the Basin to achieve long term balance and to promote the goal of equal access to groundwater in all areas and sub-areas of the Chino Basin; […]

(v) establish and periodically update criteria for the use of water from different sources for Replenishment purposes; […]

(vii) recharge the Chino Basin with water in any area where groundwater levels have declined to such an extent that there is an imminent threat of Material Physical Injury to any party to the Judgment;

(viii) maintain long-term hydrologic balance between total Recharge and discharge in all areas and sub-areas; […]."

[1] The Court orders discussed in this section are available on Watermaster's ftp site.

The OBMP Implementation Plan (Exhibit B of the Peace Agreement) contains language identical to that in Peace Agreement Section 5.1 (e), but it is mostly silent as to the schedule for implementing the specific commitments listed above (see OBMP Exhibit B, paragraph 11 on page 20 and the implementation schedule on pages 22 and 23). Paragraph 9 of page 20 of the Implementation Plan includes additional recharge guidelines that Watermaster must consider:

> “9. When locating and directing physical recharge, Watermaster shall consider the following guidelines:
>
> (i) provide long-term hydrologic balance within the areas and sub-areas of the basin
>
> (ii) protect and enhance water quality
>
> (iii) improve water levels
>
> (iv) the cost of recharge water
>
> (v) any other relevant factors”

Section 7 of the Rules and Regulations repeats the commitments of Section 5.1 (e) of the Peace Agreement and adds (see Rules and Regulations, page 37, 7.1 [b] [iv]):

> “(b) Watermaster shall exercise Best Efforts to: […]
>
> (iv) Make its initial report on the then existing state of Hydrologic Balance by July 1, 2003, including any recommendations on Recharge actions which may be necessary under the OBMP. Thereafter, Watermaster shall make written reports on the long term Balance in the Chino Basin every two years; […].”

1.1.2 Peace II Agreement

The Peace II Agreement states that Watermaster will update the Recharge Master Plan and obtain Court approval of that update to address how the Chino Basin will be managed to secure and maintain hydraulic control and operated at a new equilibrium at the conclusion of the period of reoperation. This plan must reflect an appropriate schedule for planning, design, and physical improvements—as required—to provide reasonable assurance that, following the full beneficial use of groundwater withdrawn in accordance with basin reoperation and authorized controlled overdraft, sufficient replenishment capability exists to meet the reasonable projections of the Desalter replenishment obligations. With the concurrence of the IEUA and Watermaster, the Recharge Master Plan is to be updated and amended as frequently as necessary with Court approval and no less than every five (5) years.

Peace II Article 8.4 summarizes recharge in Management Zone 1 (MZ1)—specifically the 6,500 acre-ft/yr supplemental recharge to MZ1. Moreover, the Parties make the following acknowledgments regarding the 6,500 acre-ft/yr supplemental recharge:

(a) A fundamental premise of the Physical Solution is that all water users dependent upon Chino Basin will be allowed to pump sufficient waters from the Basin to meet their requirements. To promote the goal of equal access to groundwater within all areas and sub-areas of the Chino Basin, Watermaster has committed to use its best efforts to direct recharge relative to production in each area and subarea of the Basin and to achieve long-term balance between total recharge and discharge. The Parties acknowledge that to assist Watermaster in providing for recharge, the Peace Agreement sets forth a requirement for Appropriative Pool purchase of 6,500 acre-ft/yr of Supplemental Water for recharge in Management Zone 1 (MZ1). The purchases have been credited as an addition to Appropriative Pool storage accounts. The water recharged under this program has not been accounted for as Replenishment water.

(b) Watermaster was required to evaluate the continuance of this requirement in 2005 by taking into account provisions of the Judgment, Peace Agreement and OBMP, among all other relevant factors. It has been determined that other obligations in the Judgment and Peace Agreement, including the requirement of hydrologic balance and projected replenishment obligations, will provide for sufficient wet water recharge to make the separate commitment of Appropriative Pool purchase of 6,500 acre-ft unnecessary. Therefore, because the recharge target as described in the Peace Agreement has been achieved, further purchases under the program will cease and Watermaster will proceed with operations in accordance with the provisions of paragraphs (c), (d) and (e) below.

(c) The parties acknowledge that, regardless of Replenishment obligations, Watermaster will independently determine whether to require wet-water recharge within MZ1 to maintain hydrologic balance and to provide equal access to groundwater in accordance with the provisions of this Section 8.4 and in a manner consistent with the Peace Agreement, OBMP and the Long Term Plan for Subsidence." Watermaster will conduct its recharge in a manner to provide hydrologic balance within, and will emphasize recharge in MZ1. Accordingly, the Parties acknowledge and agree that each year Watermaster shall continue to be guided in the exercise of its discretion concerning recharge by the principles of hydrologic balance. (d) Consistent with its overall obligations to manage the Chino Basin to ensure hydrologic balance within each management zone, for the duration of the Peace Agreement (until June of 2030), Watermaster will ensure that a minimum of 6,500 acre-ft of wet water recharge occurs within MZ1 on an annual basis. However, to the extent that water is unavailable for recharge or there is no replenishment obligation in any year, the obligation to recharge 6,500 acre-ft will accrue and be satisfied in subsequent years.

1. Watermaster will implement this measure in a coordinated manner so as to facilitate compliance with other agreements among the parties, including but not limited to the Dry-Year Yield Agreements.

2. In preparation of the Recharge Master Plan, Watermaster will consider whether existing groundwater production facilities owned or controlled by

producers within MZ1 may be used in connection with an aquifer storage and recovery ("ASR") project so as to enhance recharge in specific locations and to otherwise meet the objectives of the Recharge Master Plan.

(d) Five years from the effective date of the Peace II Measures, Watermaster will cause an evaluation of the minimum recharge quantity for MZ1. After consideration of the information developed in accordance with the studies conducted pursuant to paragraph 3 below, the observed experiences in complying with the Dry Year Yield Agreements as well as any other pertinent information, Watermaster may increase the minimum requirement for MZ1 to quantities greater than 6,500 acre-ft/yr. In no circumstance will the commitment to recharge 6,500 acre-ft be reduced for the duration of the Peace Agreement."

1.1.3 Special Referee's December 2007 Report, Sections VI (Assurances Regarding Recharge), VII (Declining Safe Yield), and VIII (New Equilibrium)

In the Final Report and Recommendations on Motion for Approval of Peace II Documents, the Special Referee stated that "A key element of the proposed Peace II Measures is that Watermaster must develop recharge capability throughout the Basin Reoperation period, to ensure that sufficient recharge capability exists at the end of the period" (Final Report, page 25, [Schneider, 2007]). The Special Referee recommended and the Court ultimately ordered that several elements be included within the updated Plan (Motion to Approve Watermaster's Filing in Satisfaction of Condition Subsequent 5; Watermaster Compliance with Condition Subsequent 6, August 21, 2008):

1. Baseline conditions must be clearly defined and supported by technical analysis. The baseline definition should encompass factors such as pumping, demand, recharge capacity, total Basin water demand, and availability of replenishment water.

2. Safe Yield should be estimated annually, though it is recognized that it is not to be formally recalculated until 2011. Watermaster should develop a technically defensible approach to estimating Safe Yield annually.

3. Measures should be evaluated to lessen or stop the projected Safe Yield decline. All practical measures should be evaluated in terms of their potential benefits and feasibility.

4. Evaluations and reporting of the impact of Basin Re-Operation on groundwater storage and water levels should be done on an annual basis.

5. Total demand for groundwater should be forecast for 2015, 2020, 2025, and 2030. The availability of imported water for supply and replenishment, and the availability of recycled water should be forecast on the same schedule. The schedules should be

refined in each Recharge Master Plan update. Projections should be supported by thorough technical analysis.

6. The Recharge Master Plan must include a detailed technical comparison of current and projected groundwater recharge capabilities and current and projected demands for groundwater. The Recharge Master Plan should provide guidance as to what should be done if recharge capacity cannot meet or is projected not to be able to meet replenishment needs. This guidance should detail how Watermaster will provide sufficient recharge capacity or undertake alternative measures so that Basin operation in accordance with the Judgment and the Physical Solution can be resumed at any time.

These recommendations are a reflection of the requirements described in the Peace II Measures. Peace Agreement II section 8.1 and the Amendment to Judgment Exhibit "I" section 2(b)(5) require that the updated Recharge Master Plan must:

- Address how the Basin will be contemporaneously managed to secure and maintain Hydraulic Control and subsequently operated at a new equilibrium at the conclusion of the period of Re-Operation.
- Contain recharge estimations and summaries of the projected water supply availability as well as the physical means to accomplish the recharge projections.
- Reflect an appropriate schedule for planning, design, and physical improvements as may be required to provide reasonable assurance that sufficient Replenishment capacity exists to meet the reasonable projections of Desalter Replenishment obligations following the implementation of Basin Re-Operation."

Peace Agreement II section 8.4(d)(2) further requires that the Recharge Master Plan:

> "Consider whether existing groundwater production facilities owned or controlled by producers within MZ1 may be used in connection with an aquifer storage and recovery ("ASR") project so as to further enhance recharge in specific locations and to otherwise meet the objectives of the Recharge Master Plan."

The Outline of the 2010 Recharge Master Plan Update report and the scope of work were designed to respond to the Special Referee's report, as ordered by the Court on December 21, 2007. The Court subsequently approved the outline, and the stakeholders reviewed and approved the scope of work.

1.2 2010 RMPU Implementation

In its October 2010 Court order, the Court accepted the 2010 RMPU as satisfying Condition Subsequent Number 8 and ordered that certain recommendations of the 2010 RMPU be implemented. Specifically, the Court ordered:

> "(3) Watermaster is hereby ordered to convene the committee described in item 3 of section 7.1 of the updated RMP to develop the monitoring, reporting, and accounting practices that will be required to estimate local project stormwater recharge and new yield.
>
> (4) Watermaster is hereby ordered to conduct further analyses as described in section 7.2 of the updated RMP of the Phase I through III projects to refine the projects, to develop a financing plan, and to develop an implementation plan.
>
> (5) By December 17, 2011, six months following completion of the parties UWMPs, Watermaster will report to the Court on any changes to the 2010 RMP necessitated by information received through the UWMPs. In this report Watermaster will also report on progress made under items (3) and (4) above, and will report on the status of IEUA's approval of the RMP."

Item 3 of Section 7.1 of the 2010 RMPU reads as follows:

> "3. In implementing the above, Watermaster should form a committee—consisting of itself, the landuse control entities, the County Flood Control Districts, the CBWCD, the IEUA, and others—to develop the monitoring, reporting, and accounting practices that will be required to estimate local project stormwater recharge and new yield. This committee should be formed immediately, and the monitoring, reporting, and accounting practices should be developed as soon as possible."

The operable section of Section 7.2 of the 2010 RMPU reads as follows:

> "Watermaster should conduct further analyses of the Phase I through III projects to refine the projects, to develop a financing plan, and to develop an implementation plan. This planning work should begin as soon as practical and could be accomplished within three years. The schedule to implement the Phase I through III projects would be developed during the proposed planning work, and the construction of these projects could be completed within five years of completing the proposed planning work."

Interpreted literally, the Court currently expects that the Planning for the Phase I through III projects to be done by October 2013 and that construction be completed by October 2018. This does not mean that all the projects contained within the 2010 RMPU will be constructed by October 2018. Watermaster needs to determine which of the recharge projects identified in the 2010 RMPU, and perhaps other recharge projects, need to be implemented based on current projected needs and have the planning for these projects done at an appropriate level that they may be constructed by October 2018.

In November 2011, Watermaster reported its progress pursuant to the October 2010 Court Order; after which, in December 2011, the Court issued an order directing Watermaster to continue with its implementation of the 2010 RMPU per its October 2010 order but with a revised schedule.

And, on December 15, 2011, the Watermaster Board:

> "Moved to approve that within the next year there will be the completion of Recharge Master Plan Update, there will be the development of an Implementation Plan to address balance issues within the Chino Basin subzones, and the development of a Funding Plan, as presented."[2]

This report is in response to the October 2010 and December 2011 Court Orders and the December 2011 Board direction. An update was filed with the court in May 2012 and in December 2012 a new schedule was adopted.

1.3 Production Sustainability

The term sustainability is used throughout this report and refers specifically to the ability to produce water from a specific well at a desired production rate, given the groundwater level at that well and its specific well construction and equipment details. It has no nexus to the Judgment or Peace Agreements. Groundwater production at a well is presumed to be sustainable if the groundwater level at that well is greater than the sustainability metric. Sustainability metrics are defined for each well by well owner. If the groundwater level falls below the sustainability metric, the owner will either lower their pumping equipment in their well or have to reduce production.

1.4 Organization of this Report

This report is organized around a set of questions that were developed to respond to the Court, the Watermaster Board, and the Parties. The table below lists these questions, the order in which they are answered, and the sections in which the answers are provided.

Section	Questions Addressed
Section 2 – Changed Conditions	1. What are the regulatory and institutional issues that have occurred since the 2010 RMPU was prepared? 2. How have groundwater levels changed since the OBMP was approved in 2000? 3. How have groundwater and replenishment projections changed since the 2010 RMPU was prepared? 4. How much water has been stored by the Parties and what is the potential for additional storage in the future? 5. What are the replenishment sources available to the Watermaster and what are their reliability and cost?

[2] From the minutes of the December 15, 2011 Watermaster Board meeting.

Section	Questions Addressed
Section 3 – Impacts of Revised Groundwater Production and Replenishment Projections	1. How are groundwater levels projected to change with the revised projections? 2. What areas in the basin are facing sustainability challenges?
Section 4 – Inventory of Existing Recharge Facilities and Their Capabilities	1. What are the existing recharge facilities and what is their ability to recharge storm and supplemental waters? 2. What physically/institutionally limits the ability to recharge storm water at existing facilities and what improvements could be made to these facilities to capture more stormwater? 3. What physically/institutionally limits the supplemental water recharge capacity of the existing recharge facilities? 4. What are the implications of the most recent draft recycled water recharge regulations for the Chino Basin? 5. What is the recharge capacity of existing ASR facilities in the Chino Basin? 6. What is the projected in-lieu recharge capacity in the Basin and what limits it?
Section 5 – Monitoring, Reporting, and Accounting Practices to Estimate Long-Term Average Annual Net New Stormwater Recharge	1. What policies and accounting procedures need to be developed to account for the New Yield created by MS4 compliance?
Section 6 – Recharge Options to Improve Yield and Assure Sustainability	1. What areas in the basin are likely to have future sustainability issues that can be addressed by increasing physical recharge? 2. What operational changes should be implemented to increase the recharge of storm and supplemental waters at existing basins to increase yield or to assure production sustainability? What are the costs and impediments to implementations? 3. What new recharge facilities should be constructed to increase yield or to assure production sustainability? What are the costs and impediments to implementation? 4. What changes in production patterns (location and magnitude) could be implemented to increase yield or to assure production sustainability? What are the costs and impediments to implementations?
Section 7 – Evaluation Criteria	1. What criteria should be used to evaluate the recharge options identified in Section 6?

Section	Questions Addressed
	2. What are the criteria for ranking the options?
Section 8 – Recommended 2013 Recharge Master Plan Update	1. Applying the criteria and ranking scheme from Section 7, what operational and facilities improvements (projects) should be implemented to increase yield and assure sustainable production? 2. What is the recommended implementation and financing plan?

The objectives of this section are to describe changed conditions from what was assumed in the 2010 RMPU and to update information that was included in the 2010 RMPU. Specifically this section answers the following questions:

- What are the regulatory and institutional issues that have occurred since the 2010 RMPU was prepared?
- How have groundwater levels changed since the OBMP was approved in 2000?
- How have groundwater and replenishment projections changed since the 2010 RMPU was prepared?
- How much water has been stored by the Parties and what is the potential for additional storage in the future?
- What are the replenishment sources available to the Watermaster and what is their reliability and cost?

2.1 Legislative and Regulatory

There has been one significant legislative change and one regulatory change since the 2010 RMPU. The legislative change is the implementation of SBX7-7, the so-called "20 percent by 2020 law." Under this legislation, potable water demands are to be reduced by 10 percent by 2015 and 20 percent by 2020.[3] The municipal water suppliers have incorporated this requirement into their 2010 Urban Water Management Plans. This information was not available during the preparation of the 2010 RMPU. The implications of the implementation of this law on groundwater production and replenishment are discussed in further detail in the section below entitled Revised Groundwater Production and Replenishment Projections.

Currently, Watermaster and the IEUA recharge recycled water in the Chino Basin under a permit issued by the Regional Water Quality Control Board (Regional Board). The California Department of Public Health (DPH) has draft regulations for the planned recharge of recycled water into a potable water supply aquifer. The DPH recently updated its draft regulations. The DPH uses the draft regulations as guidance in the regulation of recycled water recharge and issues permit conditions that are incorporated by the Regional Board into permits for planned recycled water recharge projects. The implications of the new draft regulations on recycled water are discussed in Section 4 of this report.

[3] The actual law and implementation are more complicated than just the stated reductions in potable water demand. The law also has an agricultural water demand reduction mandate. For more information, go to http://www.water.ca.gov/wateruseefficiency/sb7/docs/20x2020plan.pdf.

2.2 Groundwater Level Changes

This section analyzes groundwater level changes in the Basin and groundwater level changes at representative wells since the implementation of the OBMP in 2000. Groundwater level changes are characterized in groundwater level contour maps, a groundwater level change contour map, cross-sections that illustrate changes in saturated thickness, and time histories of groundwater levels at selected wells through 2011. The data used in the subsequent figures are contained in a relational database and were accessed through HydroDaVE™.

2.2.1 Groundwater Level Changes Across the Basin

Figures 2-1a and 2-1b are groundwater elevation contour maps for spring of 2000 and the spring of 2010. These maps were included in the recent 2010 State of the Basin Report (WEI, 2012). The following procedures were used in the creation of these maps:

- Extract the entire time history of groundwater level data from Watermaster's groundwater level database for all wells in the Chino Basin.
- Plot and explore groundwater elevation time histories for all wells.
- Choose one "static" groundwater level elevation data point per well that is representative of the spring 2000 and spring 2010 periods.
- Plot groundwater level elevation data on maps with background geologic/hydrologic features.
- Contour and digitize groundwater elevation data.

The direction of groundwater flow is perpendicular to these contours in the direction of decreasing elevation. These maps show that groundwater generally flows in a south-southwest direction from the primary areas of recharge in the northern parts of the basin toward the Prado Flood Control Basin in the south. There are notable pumping depressions in the groundwater level surface that interrupt the general flow patterns in the northern portion of MZ1 (Montclair and Pomona areas) and directly southwest of the Jurupa Hills. There is an extensive groundwater level depression surrounding the Chino I and Chino II Desalter well fields in the spring of 2010.[4]

Figure 2-2 shows the difference in groundwater elevation between the spring of 2010 and the spring of 2000. This map was composed by subtracting the groundwater elevations for the year 2000 from the groundwater elevations for 2010. The change in groundwater elevation is

[4] The Chino I desalter started producing groundwater in 2001, and the groundwater depression surrounding wells CDA I-5 through CDA I-12 quickly developed. The Chino I desalter expansion and the Chino Desalter II started up in 2007, and the groundwater depression surrounding CDA I-13 through CDA I-15 and the Chino Desalter II wells quickly developed.

shown by contours of equal change and by a color ramp of yellow-to-green for increasing groundwater elevations and yellow-to-red for decreasing groundwater elevations. These groundwater-level changes are for the shallow unconfined aquifer, where most of the storage change occurs.

Groundwater levels have declined across the central and eastern portions of the Basin. This decline is attributed to groundwater production in MZ2 and MZ3 during the period and the implementation of "basin re-operation." Groundwater levels declined significantly in most of the areas around the Chino Desalter well fields. Pumping began in 2001 and progressively increased as the well field and the desalter facilities expanded. The drawdown associated with the desalter well field has achieved hydraulic control in most of this area and has increased the hydraulic gradient from the Santa Ana River toward the desalter well field. Hydraulic Control is one of several commitments made by the IEUA and Watermaster to the Regional Board (RWQCB) as part of the maximum benefit commitments incorporated in the Santa Ana Regional Water Quality Control Plan (Basin Plan) in 2004 and the Peace II Agreement in 2007. Watermaster conducts monitoring and prepares an annual report to the RWQCB to document the state of hydraulic control.

Groundwater levels have risen in the western part of the Basin. In the northwest part of the Basin this is attributed to a decrease in production associated with in-lieu and wet water recharge for the MWDSC Dry-Year Yield Program (DYYP). In the southwest, water levels have increased where there is decreased pumping associated with the land subsidence investigation and the resulting MZ1 Subsidence Management Plan (WEI, 2007b). In the south near Prado Basin, water levels have risen due to decreased agricultural pumping and, more recently, the agricultural use of recycled water in lieu of groundwater production.

Figure 2-3 illustrates the groundwater production time history for fiscal years 1999-2000 through 2010-11[5] by pool, DYYP take, and for the Chino Desalter Authority (CDA). During this period total groundwater production oscillated between 160,000 to 180,000 acre-ft/yr except for 2006 and 2011. Aggregate production by the Overlying Agricultural and Overlying Non-agricultural pools declined from about 50,000 acre-ft/yr to about 22,000 acre-ft/yr. These declines were offset by production from the appropriative pool, DYYP takes in 2008, 2009, and 2010, and by increases in production from the Chino Basin desalters. Production by the Appropriative pool generally increased through 2007 and then declined to less than 100,000 acre-ft/yr after 2007.

2.2.2 Changes in Saturated Thickness

Figure 2-4 shows the locations of flow-lined based cross-section profiles through each of the management zones, through a part of the Chino II Desalter well field, and through part of the Jurupa Community Services District (JCSD) well field. These flow-line based cross-sections are shown in figures 2-5a through 2-5f. The intent of these cross-sections is to show the

[5] Hereafter, all years in which production, replenishment, and recharge are discussed will be fiscal years, and they will be referred to as the trail year. For example, fiscal 1999-2000 will be referred to as 2000.

saturated thickness through these cross-sections for 2000 and 2010 and wells located on or near these cross-sections. The horizontal red bar shown at most wells are sustainability metrics that have been provided by the well owners. Groundwater production at wells is presumed to be sustainable if the groundwater level at the well is greater than the sustainability metric. If the groundwater level falls below the sustainability metric, the owner will either lower their pumping equipment in their well or will have to reduce production. These metrics will be described in more detail in Section 3.

Cross-sections A-A’ (Figure 2-5a), B-B’ (Figure 2-5b), and C-C’ (Figure 2-5c) are laid out in a generally north to south alignment through MZ1, MZ2, and MZ3, respectively. The saturated thickness through most of these cross-sections ranges from about 400 feet to over 1,000 feet with two notable exceptions: the northern end of A-A’ and the JCSD well field in cross-section C-C’. Groundwater levels are seen to be slightly higher in MZ1 in 2010 relative to 2000, and this increase is relatively small compared the saturated thickness and the depth of wells. Groundwater levels are generally 20 to 50 feet lower in MZ2 and MZ3 in 2010 relative to 2000; as with MZ1, this change is relatively small compared to the saturated thickness and depth of wells except where cross-section C-C’ passes through the JCSD well field and the Chino desalter wells, where the saturated thickness is much smaller due to an increase in the elevation of the effective base of the aquifer.

Cross-sections D-D’ (Figure 2-4d) and E-E’ (Figure 2-4e) are laid out in a generally east to west alignment through MZ4 and MZ5, respectively. The saturated thickness throughout most of these cross-sections ranges from about 100 feet to 300 feet and in some places less. The saturated thickness near JCSD well 24 appears to be slightly greater than 100 feet in 2010. Groundwater levels are generally 0 to 30 feet lower in MZ4 and MZ5 in 2010 relative to 2000 with the decrease in MZ5 less than MZ4.

2.2.3 Historical Groundwater Level Trends

Figure 2-1a shows the locations of wells with groundwater level time histories discussed herein and the Chino Basin management zone boundaries. Wells were selected based on length of record, density of data points, quality of data, geographical distribution, and aquifer system. Wells are identified by their local name (usually owner abbreviation and well number) or their Watermaster identification number (Watermaster ID) if privately owned.

Figures 2-6a through 2-6e are groundwater level time history charts for the wells shown in Figure 2-1a, for MZ1 through MZ5, respectively. Some of the short-term groundwater level fluctuations shown in these figures result from the inclusion of static and dynamic observations. Below, by management zone, the behavior of groundwater levels at specific wells is compared to climate, groundwater production, wet water recharge activities, and other factors as appropriate.

To compare groundwater levels to climate, a cumulative departure from mean precipitation (CDFM) curve has been plotted on the groundwater level time history charts. Positive sloping lines on the CDFM curve show wet years or wet periods, whereas negatively sloping lines show dry years or dry periods. For example, the period from 1978 to 1983 was an extremely wet period, and it is represented by a positively sloping line. To compare groundwater levels to pumping and recharge activities, bar charts that show groundwater production and wet water recharge by management zone have been superimposed on the groundwater level time history charts. These charts are detailed and somewhat complicated tools that provide insight into the complicated response of groundwater levels to several stressors.

2.2.3.1 Management Zone 1

MZ1 is an elongate region, running generally north-south, and comprises the westernmost area of the Chino Basin. It is bounded by MZ2 to the east, various basin-boundary faults to the north, and sedimentary bedrock outcrops to the west and south.

Figure 2-6a shows groundwater level time histories for the following wells: Monte Vista Water District Well 10 (MVWD-10), City of Pomona Well 11 (P-11), City of Chino Well 10 (C-10), and Chino Hills Wells 15A and 16 (CH-15A and CH-16). The Montclair, College Heights, Upland, and Brooks Street Basins are located in the northern portion of MZ1 and are the primary sites for artificial recharge. Careful inspection of Figure 2-6a indicates that the groundwater level response to precipitation is minimal, as evidenced by comparison of the CDFM to groundwater level time series, and that groundwater levels are most significantly influenced by groundwater production and artificial recharge.

Wells MVWD-10 and P-11 exhibit representative groundwater levels for the northern portion of MZ1. An analysis of static groundwater levels at these wells shows a decline from 1995 to 2001, a period of increased groundwater production in MZ1. Since 2001, water levels have risen by about 100 feet at MVWD-10 and by about 45 feet at P-11. This increase is attributed to a decrease in local production and an increase in wet water recharge in MZ1 since 2001.

Well C-10 is located in central MZ1. Water levels at C-10 peaked in the mid-1990s and declined by about 20 feet from 1995 to 2000. Unlike other wells in MZ1 that experienced significant water level recovery from 2000 to 2006, the water levels at C-10 remained essentially unchanged. Since 2006, water levels have risen by approximately 20 feet. This increase is due to a decrease in local production and an increase in wet water recharge.

Water levels measured at CH-15A are representative of the shallow aquifer system in the southern portion of MZ1. The recent land subsidence investigation has shown that in southern MZ1, the aquifer system is hydrologically stratified. The shallow aquifer system is unconfined to semi-confined while the deep aquifer system is confined. Water levels in CH-15A have historically been stable at around 80-90 ft-bgs and have experienced small variations in response to nearby pumping. Since 2000, water levels have risen by about 10 feet. This is primarily due to the decrease in local production associated with the MZ1 Interim Management Plan.

CH-16 is perforated in the confined deep aquifer system, which is characterized by large changes in piezometric pressure due to nearby pumping. In 2003 and 2004, during a series of pumping tests conducted by Watermaster in southern MZ1, water levels in CH-16 dropped by approximately 100 feet, and the period of recovery lasted several months. These tests demonstrated that piezometric levels in CH-16 (and the deep aquifer system in general) are heavily influenced by changes in pumping from local wells screened within the deep aquifer system. The static water levels at CH-16 declined by about 100 feet from 1995 to 2000 and subsequently recovered by about 140 feet from 2000 to 2006. At the end of 2008, static water levels had declined by about 30 feet from the 2006 highs with a maximum drawdown of about 60 feet observed in the summer of 2008.

2.2.3.2 Management Zone 2

Management Zone 2 (MZ2) is a large, central, elongate area of the Chino Basin. Figure 2-6b shows groundwater level time histories for Cucamonga Valley Water District (CVWD) Wells CB-3 and CB-5 (CVWD CB-3 and CVWD CB-5), City of Ontario Well 16 (O-16), Watermaster ID 600394, and Hydraulic Control Monitoring Program Wells 2/1 and 2/2 (HCMP-2/1, and HCMP-2/2). These wells are aligned north to south, approximately along a groundwater flow line. The San Sevaine, Etiwanda, Lower Day, Victoria, Turner, and Ely Basins are located in the northern and central regions of MZ2 and are the primary sites for artificial recharge. Careful inspection of Figure 2-6b indicates that the groundwater level response to precipitation and artificial recharge is minimal, as evidenced by comparison of the CDFM and artificial recharge time history to groundwater level time histories, and that groundwater level time histories are most significantly influenced by groundwater production.

The groundwater level time histories for the northernmost wells—CVWD CB-3 and CB-5 and O-16—show a general water level increase following 1978, which is likely due to a combination of the 1978 to 1983 wet period, the reduction in overdraft following the implementation of the Chino Basin Judgment, and the start of artificial replenishment with imported water in the San Sevaine and Etiwanda Basins. Following the early 1990s, water levels at these wells began to decrease and have continued to decrease to present. The static water levels at CB-3 and CB-5 decreased by approximately 30 feet between 2003 and 2006. Long-term water level decreases in this area of MZ2 are likely due to decreased wet water recharge from 1996 to 2003 and increased groundwater production from 1995 to present.

Well Watermaster ID X-Ref 404 is located in the central portion of MZ2, north of the Chino I Desalter well field. Water levels at this well have decreased by about 15 feet since 2000.

Wells HCMP 2/1 and HCMP 2/2 are located at the southern end of MZ2 near the Chino I Desalter well field. These wells were completed and the first measurements were recorded in early 2005. HCMP 2/1 is perforated in the shallow aquifer system, and HCMP 2/2 is perforated in the deep aquifer system. Contrary to that of MZ1, the deeper aquifer in this MZ behaves much more like the shallow, unconfined aquifer, which is indicative of a greater degree of hydraulic communication between the two aquifer systems. Both wells exhibited similar groundwater level increases (15-20 feet) from 2005 to 2006. It is likely that this was due to changes in local production—especially at some of the nearby Chino I Desalter wells, which experienced production decreases in 2005 and 2006. Since 2006, water levels have decreased by 5-10 feet in both wells.

2.2.3.3 Management Zone 3

Management Zone 3 (MZ3) consists of the area along the eastern boundary of the Chino Basin. It is bounded by MZ2 to the west, Chino-East (MZ4) and Chino-South (MZ5) to the south, and the Rialto-Colton Fault to the east. Figure 2-6c shows water level time histories for Fontana Water Company Wells F30A and F35A (F30A and F35A), Milliken Landfill Well M-3 (M-3), County of San Bernardino MIL M-06B, Watermaster ID 3602468, and HCMP Well 7/1 (HCMP 7/1). These wells are aligned northeast to southwest, approximately along a groundwater flow line. The RP-3 and Declez Basins are located in the central region of MZ3 and are the primary sites for artificial recharge. Careful inspection of Figure 2-6c indicates that, like MZ2, the groundwater level response to precipitation and artificial recharge is minimal, as evidenced by comparison of the CDFM and artificial recharge time history to groundwater level time histories, and that groundwater level time histories are most significantly influenced by groundwater production.

Wells F30A and F35A are located in the northeastern portion of MZ3. The groundwater level time histories of these two wells show relatively stable water levels from 1978 until the late 1990s. From 2000 to 2006, the wells experienced a progressive decline in water levels of about 25 feet. This decline is due to increased production in MZ3. Since 2006, water levels at F35A have remained relatively unchanged, and water levels at F30A have fluctuated ±5 to 10 feet.

Wells M-3, M-06B, and Watermaster ID Xref 425 are located in the central portion of MZ3. From 2000 to 2006, a groundwater decline of about 30 feet was observed at these wells.

The southernmost well, HCMP-7/1, experienced a groundwater level decline of about 20 feet from 2005 to the end of 2008. Similar water level declines can be observed in most wells throughout MZ3. This regional drawdown in MZ3 is due to the steady increase in production within MZ3 over the past 20 years and a lack of artificial recharge.

2.2.3.4 Management Zone 4

MZ4, also known as Chino-East, is bounded by the Jurupa Hills to the north, the Pedley Hills to the east, MZ5 to the south, and MZ3 to the west. Figure 2-6d shows groundwater level time histories for HCMP Well 9/1 (HCMP-9/1), Jurupa Community Services District Well 10 (JCSD-10), Watermaster ID 4503, and FC932A2. There are no recharge basins in MZ4, and very little groundwater production occurs in this area.

Groundwater levels at these wells decreased by about 20 to 40 feet between 2000 and 2008. These declines are due to groundwater production at wells in the management zone and at nearby wells in MZ3, including the Chino II desalter well field, which is located near the western boundary of the MZ4.

2.2.3.5 Management Zone 5

MZ5, also known as Chino-South, is bounded by MZ4 to the north, MZ3 to the west, the Riverside Narrows to the east, and various unnamed hills to the south. Figure 2-6e shows groundwater level time histories for USGS Well Archibald-1, HCMP Well 8/1 (HCMP 8/1), and Santa Ana River Water Company Well 07 (SARWC-07). There are no groundwater recharge basins in MZ5, but the Santa Ana River is a major source of groundwater recharge. In place of artificial recharge, Figure 2-6e shows the total Santa Ana River discharge measured at the MWD crossing where the Santa Ana River enters the Chino Basin. Santa Ana River discharge in the lower Chino Basin is the source of recharge to wells producing in that area, including the Chino desalters.

These wells exhibit very little groundwater level variation due to the stabilizing effects of Santa Ana River discharge and, more particularly, dry-weather discharge that consists of recycled water and rising water discharge, originating above the MWD crossing and the City of Riverside recycled water discharge just downstream of the MWD crossing. Production in MZ5 decreased steadily from 1978 to 2008 due to a reduction in agricultural production, as the overlying land was converted from agricultural to urban uses. Groundwater levels in HCMP-8/1 and SARWC-07 have declined about 10 to 15 feet since 2006. This decline is due to the onset of pumping at nearby Chino II Desalter wells.

2.2.4 Focused Groundwater Level Time Histories in the Southern End of MZ3

The discussion of Figures 2-5a through 2-5g indicated that groundwater levels were close or had fallen below sustainability metrics for the some wells in the southern end of MZ3. In this section, we examine the time history of selected wells in this part of the Basin. Figures 2-7a and 2-7b are groundwater level time history charts for the wells shown in Figure 2-1a: for the eastern Desalter II well field and for selected JCSD wells in the JCSD well field, respectively. Static and dynamic water level observations have been included to show the trend in groundwater levels in these areas and the amount of drawdown incurred at these wells when operating. Below, the behavior of groundwater levels at specific wells is compared to climate, groundwater production, wet water recharge activities, and other factors as appropriate.

Figure 2-7a illustrates the groundwater level time histories and stressors for the eastern wells of the Desalter II well field. The water level time history starts in 2007 and continues into 2012, a period of just under five years. These data are collected at high frequency using integrated pressure transducers with data loggers. The static and dynamic levels are easily identifiable. Static groundwater levels at wells CDA II-7 and CDA II-8 decreased about 20 feet by mid-2009 and have remained steady since that time. Static groundwater levels at wells CDA II-6 and CDA II-9a decreased about 30 feet by mid-2009 and have remained steady since that time. Desalter II production declined after 2009, and artificial recharge in MZ3 at the RP3 and Declez Basins increased. Based on the groundwater modeling work discussed in Section 3, it is likely that the reduction in Desalter II production contributed to the stabilization of groundwater levels at these wells.

Figure 2-7b illustrates the groundwater level time histories and stressors for selected JCSD wells. The locations of these wells are shown in Figure 2-1a. The water level time histories for JCSD 12 and JCSD 17 start before 2000. The irregularity of the data makes the interpretation of the water level time histories less clear than that of the desalter wells discussed above. Water levels at JCSD 12 appear to decline about 10 feet through 2005, decrease another 30 feet after Desalter II started up in 2007, and stabilize in 2009. The water level time history for JCSD 17 is more difficult to interpret, but the trend in the data suggests that the static level may have decreased 10 feet.

The water level record at JCSD 22 starts in 2004 with irregular observations through 2008 and more frequent observations thereafter. Static groundwater levels at JCSD 22 vary somewhat between 2004 and 2007 with no discernible trend. After the startup of Desalter II, groundwater levels appear to decrease about 20 feet by mid-2009, remaining steady since that time. Static groundwater levels at wells CDA II-6 and CDA II-9a appear to decrease about 30 feet by mid-2009, remaining steady since that time. Desalter II production declined after 2009 and artificial recharge in MZ3 at the RP3 and Declez Basins increased. Based on the groundwater modeling work discussed in Section 3, it is likely that the reduction in Desalter II production contributed to the stabilization of groundwater levels at these wells.

2.3 Water Stored in the Basin

Members of the Overlying Non-agricultural and appropriative pools can store water in the Chino Basin for subsequent use and transfer among parties to Judgment. Storage is regulated pursuant to the Judgment and Watermaster rules and regulations. Classifications of water in storage include:

- Carryover water – unproduced water in any year that may accrue to a member of the Overlying Non-agricultural and appropriative pools and that is produced first each subsequent fiscal year or accounted for as excess carryover water;

- Excess carryover water – carryover water which in aggregate quantities exceeds a party's share of the safe yield in the case of the Overlying Non-agricultural pool or the assigned share of operating safe yield in the case of the appropriative pool in any year; and

- Supplemental water – water imported to the Chino Basin from outside of the Chino Basin watershed and recycled water.

Table 2-1 shows the time history of the aggregate water in storage for all parties in the Overlying Non-agricultural and Appropriative pools by storage type for the period July 1, 2001 through June 30, 2011. This time history is shown graphically in Figure 2-8. Aggregate storage by the Overlying Non-agricultural pool increased from about 38,000 acre-ft in July of 2001 to about 56,000 acre-ft in July of 2011. Aggregate storage by the Appropriative pool increased from about 154,000 acre-ft in July of 2001 to about 286,000 acre-ft in July of 2011. In total, storage increased from about 192,000 acre-ft in 2001 to about 342,000 acre-ft by July 2011, with most of the increase occurring after 2004. Table 2-2 shows the distribution of storage by individual members of the Overlying Non-agricultural and Appropriative pools.

2.4 Revised Groundwater Production and Replenishment Projections

The 2010 RMPU (WEI, et al., 2010) contained a recommendation to update the groundwater production and replenishment obligations to reflect the water purveyor plans being developed to comply with SBX7-7 (20 percent reduction in per capita potable demands by 2020) and the

2010 Urban Water Management Plans (UWMPs) that were due in June 2011. Some stakeholders in the 2010 RMPU process noted that water purveyors may have overestimated groundwater production projections, which would lead to an overestimate of future replenishment obligations and potentially investments in new recharge facilities that may not be required if more recent future groundwater production estimates were used.

The Court accepted this recommendation and included it in its October 8, 2010 Court Order, directing Watermaster and the IEUA to prepare updated groundwater production and replenishment obligation projections and to submit them to the Court by December 17, 2011. This section complies with the October 8, 2010 Court Order and to support the ongoing Watermaster planning process, wherein Watermaster is updating and using its groundwater models to predict basin responses to future planning scenarios. One of the goals of modeling the future planning scenarios is to estimate the safe yield of the Chino Basin.

It is important to note that this report is focused on production and replenishment. The term replenishment, as used herein, refers to the mitigation of overproduction pursuant to the physical solution specified in the Judgment through either wet-water or in-lieu means. Recharge and replenishment water are defined in the Peace Agreement as: "[…] the introduction of water into the Basin, directly or indirectly, through injection, percolation, delivering water for use in–lieu of Production or other method. Recharge references the physical act of introducing water into the Basin. Recharge includes Replenishment Water but not all Recharge is Replenishment Water."

The distinction between recharge and replenishment is important. There may be reasons to recharge other than replenishment, such as mitigating excessive groundwater level declines. Watermaster's recharge obligations related to excessive groundwater level decline and/or the need to balance recharge and discharge are contained in 5.1 (e) of the Peace Agreement.

2.4.1 Groundwater Production Projections

WEI collected available UWMPs from the Chino Basin Parties, including the Cities of Chino, Ontario, Pomona, and Upland; the Golden State Water Company; the San Antonio Water Company; the Monte Vista Water District; the Cucamonga Valley Water District; the Fontana Water Company; the Jurupa Community Services District; the Chino Desalter Authority; the Inland Empire Utilities Agency; the Three Valleys Municipal Water District; the Western Municipal Water District; and the Metropolitan Water District of Southern California. In addition to these plans, WEI contacted the City of Chino Hills to informally obtain their water demands and supply plans. For those retail water agencies that are not required to prepare UWMPs, WEI conducted interviews or reviewed other planning information to estimate water demands and to establish water supply plans.

WEI reviewed this planning information, and where parties' water supply plans showed more water supply than demand, WEI conducted additional discussions to distinguish their Chino Basin groundwater production projections and was able to establish priorities of the various supplies and adjust their water supply plans.

The Metropolitan Water District of Southern California (Metropolitan) has indicated that it will discontinue Replenishment Service water deliveries and replace those deliveries with some other program that will be developed in the future. Seemingly, Watermaster will likely be required to purchase untreated water from Metropolitan at Tier 1, Tier 2, or melded Tier 1/Tier 2 rates for future replenishment. Several Appropriators have demonstrated that, given increased replenishment, power, and assessment costs, it is currently or will soon be more economical to purchase Metropolitan water directly than to produce groundwater in excess of their production rights.

The production projection for agricultural producers has not changed in concept from the 2010 RMPU. Agricultural groundwater production was assumed to decrease linearly from about 21,000 acre-ft/yr in 2009-10 to about 5,000 acre-ft/yr by 2019-20. The sensitivity of this assumption on projected production and replenishment will be described later in this report. In the last few years, recycled water has been supplied for agricultural uses and has resulted in a decline in agricultural groundwater use. The land remaining in agricultural land use is mostly within the sphere of influence of the Cities of Chino and Ontario. The decline in agricultural groundwater use, as shown in Table 2-3, is consistent with the growth in water demand by the Cities of Chino and Ontario.

The production projections for individual Overlying Non-agricultural producers were based on the following:

- For active producers where planning information was unavailable, production was assumed to be their maximum annual production from the five prior years (2006-07 through 2010-11).
- For General Electric (GE), production was assumed to be zero; GE now injects all of its produced groundwater back into the Chino Basin.
- For all other producers, planning estimates were provided.

Table 2-3 shows the projected time history of groundwater production for the 2010 through 2035 period, based on the information collected from the water supply agencies. "Normal" water supply conditions were used when the 2010 UWMPs were available. Under normal supply conditions, total annual groundwater production is projected to decrease from about 162,000 acre-ft/yr in 2010 to about 159,000 acre-ft/yr by 2020 and then gradually increase to about 191,000 acre-ft/yr by 2035. Projected annual groundwater production (in acre-ft/yr) is shown below.

Summary of Groundwater Production by Pool and the CDA

(acre-ft/yr)

Planning Year	Agricultural Pool Production	Overlying Non-Agricultural Pool Production	Appropriative Pool and CDA Projection	Total Production
2010	21,000	2,343	138,320	161,662
2015	13,000	3,387	142,987	159,374
2020	5,000	3,667	150,356	159,023
2025	5,000	3,667	161,356	170,023
2030	5,000	3,667	171,969	180,636
2035	5,000	3,667	181,875	190,542

Municipal and private water purveyors as well as private users in the Chino Basin area depend in part or completely on Chino Basin groundwater. The table below contains aggregate water supply projections (in acre-ft/yr), based on the UWMPs and other information obtained for this investigation.

Macro Water Supply Plan for Watermaster Parties and the CDA

(acre-ft/yr)

Water Source	2010	2015	2020	2025	2030	2035
Chino Basin Groundwater	161,662	159,374	159,023	170,023	180,636	190,542
Non-Chino Basin Groundwater	49,718	57,463	57,463	57,463	57,463	57,463
Local Surface Water	26,017	18,869	18,869	18,869	18,869	18,869
Imported Water From Metropolitan	57,434	87,558	95,521	98,448	101,327	105,768
Other Imported Water	766	3,500	3,500	3,500	3,500	3,500
Recycled Water for Direct Reuse	13,516	21,393	26,393	30,993	35,593	40,694
Total	309,113	348,157	360,769	379,296	397,388	416,836

The total water demand is projected to grow from about 309,000 acre-ft/yr in 2010 to about 417,000 acre-ft/yr by 2035. As stated above, Chino Basin groundwater production is projected to decrease from about 162,000 acre-ft/yr in 2010 to about 159,000 acre-ft/yr by 2020 and then increase gradually to about 191,000 acre-ft/yr in 2035. Recycled water for direct reuse is projected to increase from about 14,000 acre-ft/yr in 2010 to about 41,000 acre-ft/yr by 2035. The amount of imported water supplied by Metropolitan is projected to increase from about 57,000 acre-ft/yr in 2010 to about 106,000 acre-ft/yr by 2035, an increase of 86 percent.

2.4.2 Replenishment Obligation Projections

Watermaster recharges supplemental water into the Chino Basin pursuant to the Judgment and the Peace Agreement. Total annual replenishment is calculated herein based on projected groundwater production and production rights. Production rights are based on the following assumptions:

- The safe yield is 140,000 acre-ft/yr through 2011 and, thereafter, the safe yield estimate presented in 2009 Production Optimization and Evaluation of the Peace II Project Description (WEI, 2009). The safe yield is projected to decline to about 129,000 acre-ft/yr by 2035.

- The Judgment allows 5,000 acre-ft/yr of controlled overdraft of the Chino Basin through 2017.

- Reoperation water is allocated to the replenishment of CDA desalter production, as provided for in the Peace II Agreement, updated in the report prepared to satisfy Condition Subsequent No. 7 (WEI, 2008), and updated thereafter based on actual CDA production. Reoperation water is completely used up by 2030.

- The 6,500 acre-ft/yr supplemental water recharge commitment to Management Zone 1 (MZ1) pursuant to the Peace II Agreement.

- Recycled water recharge was assumed to occur as projected by the IEUA in its February 10, 2012 email to Ken Jeske.

Recycled water recharge is used in MZ1 to partially meet the 6,500 acre-ft/yr supplemental water recharge obligation. Therefore, some of the recycled water recharge that has historically occurred in MZ1 and is planned to occur in the future is credited to meet the 6,500 acre-ft/yr supplemental water recharge obligation.

2.4.3 Groundwater Production and Replenishment Scenarios

Four groundwater production and replenishment scenarios were developed in this investigation.

2.4.3.1 Scenario 1 – Baseline Scenario – Projected Groundwater Production and Production Rights and Efficient Market Assumption

Table 2-4 contains the projected groundwater production from Table 2-3, the various components of production rights and total production rights, the projected replenishment obligation, and the cumulative replenishment obligation (the baseline projection). The sudden decrease in production rights in 2014 is caused by the exhaustion of the first tranche of reoperation water by the existing desalters. The increase in production rights in 2015 is caused by the startup in use of the second tranche of reoperation water by the CDA expansion and the projected increase in recycled water recharge. The decrease in production rights over the period of 2019 through 2030 is due to the elimination of 5,000 acre-ft/yr of controlled overdraft after 2017 and the gradual decrease of safe yield. The sudden decrease in production rights that occurs in 2031 is due to the assumed ending of the 6,500 acre-ft/yr recharge obligation in MZ1 and the exhaustion of the second tranche of reoperation water.

Watermaster's replenishment obligation was estimated using the following assumptions:

- The water in storage accounts at the start of fiscal year 2010 is not used to meet future replenishment obligations. This is a conservative assumption that reserves discretion regarding the use of this water to individual storing parties.

- On a go-forward basis, under-producers will transfer un-pumped rights to overproducers each year; that is, there is an efficient market that moves unused production rights from under-producers to overproducers (hereafter, the efficient market assumption).

For this investigation, the net annual replenishment obligation was assumed to be equal to the greater of zero and the difference between actual production and production rights. The net replenishment obligation—assuming normal water supply years and the adjusted groundwater production projection from the UWMPs scenario—is projected to be zero in 2010 through 2023 (with a one-year exception in 2014), increase to about 1,600 acre-ft/yr in 2024, increase gradually to about 25,000 acre-ft/yr in 2030, jump to about 34,000 acre-ft/yr by 2031, and increase gradually thereafter to 43,000 acre-ft/yr in 2035. As noted above, this assumes that under-producers will transfer un-used production rights to overproducers each year; that is, there is an efficient market that moves unexercised rights from under-producers to overproducers. This assumption may underestimate the replenishment obligation for some years if water cannot be acquired in those years. Though, over the long term, this assumption is valid because the Appropriator parties cannot store unused production rights indefinitely, and the demand for replenishment water will provide financial incentives for unused production rights to be sold to overproducers. The efficient market assumption has been vetted with the Watermaster and the Judgment parties throughout the post Peace Agreement period and more recently in the RMPU Steering Committee process in 2012.

The last column in Table 2-4 shows the cumulative replenishment obligation from July 1, 2009 forward. Negative values indicate that cumulative production rights through that year exceed the cumulative production and that the volume of water in storage accounts will have increased by the negative of that value. For example, by the end of 2023, the cumulative replenishment obligation is estimated to be about -144,000 acre-ft. During the period of 2010 through 2023, the cumulative production rights are about 144,000 acre-ft greater than the cumulative production, and the volume of water in storage accounts will have increased by about 144,000 acre-ft.

After 2023, the net replenishment obligation becomes positive and grows as the annual production rights are less than the annual production. That said, the volume of water accumulating in storage accounts through 2023 is greater than the cumulative positive net replenishment obligation projected to occur from 2024 through 2032. In theory, this means that Watermaster may not have to purchase water from Metropolitan for replenishment until 2033. Though, Watermaster will still need to acquire and recharge supplemental water to meet its 6,500 acre-ft/yr MZ1 recharge obligation through 2030. There may also be a need to recharge imported water to dilute recycled water recharge. The maximum replenishment obligation would reach about 43,000 acre-ft/yr in 2035 which is substantially less than the projected supplemental recharge capacity available to Watermaster.

2.4.3.2 Scenario 2 – Projected Groundwater Production and Production Rights per Table 2-4 with a Delay in the Decline of Agricultural Pool Production, and Efficient Market Assumption

Table 2-5 is identical to Table 2-4 except that the projected decline in Agricultural pool production is deferred until after 2020 and is assumed to decline to 5,000 acre-ft/yr by 2025 (hereafter Scenario 2). This was done to test the sensitivity of the projected replenishment obligation to the projected Overlying Agricultural pool production shown in Table 2-3. This results in greater projected groundwater production through 2024 than the production projection used in Scenario 1, the Baseline Scenario. The resulting net replenishment obligation projection with this assumed, delayed decline in Agricultural pool production looks similar to the prior projection with the cumulative replenishment obligation being negative through 2026, reaching a value of about -65,000 acre-ft in 2016, and gradually increasing thereafter to about +240,000 by 2035. The maximum replenishment obligation would reach about 43,000 acre-ft/yr in 2035 which is substantially less than the projected supplemental recharge capacity available to Watermaster.

2.4.3.3 Scenario 3 – Projected Groundwater Production and Production Rights per Table 2-4 with Appropriative Pool Production Increased by 10 Percent, and Efficient Market Assumption

Table 2-6 is identical to Table 2-4 except that the Appropriative pool contribution to groundwater production was increased by ten percent (hereafter Scenario 3). This was done to test the sensitivity of the projected replenishment obligation to the projected Appropriative pool production shown in Tables 2-3 and 2-4. This results in greater projected groundwater production throughout the planning period than was seen in Scenarios 1 and 2. The resulting net replenishment obligation projection with this assumed increase in Appropriative pool production looks similar to the prior projections with the cumulative replenishment obligation being negative through 2022, reaching a value of -39,000 acre-ft in 2013 and gradually increasing thereafter to about +430,000 by 2035. The maximum replenishment obligation would reach about 57,000 acre-ft/yr in 2035, which is substantially less than the projected supplemental recharge capacity available to Watermaster.

2.4.3.4 Scenario 4 – Projected Groundwater Production and Production Rights per Table 2-4 with Appropriative Pool Production Increased by 10 Percent, with a Delay in the Decline of Agricultural Pool Production, and Efficient Market Assumption

Table 2-7 is identical to Table 2-4 except that the Appropriative pool contribution to groundwater production was increased by ten percent, and the projected decline in agricultural pool production is deferred until after 2020 and is assumed to decline to 5,000 acre-ft/yr by 2024-25 (hereafter Scenario 4). This was done to test the sensitivity of the projected replenishment obligation to the projected Overlying Agricultural and Appropriative pools production shown in Table 2-3. This results in greater projected groundwater production throughout the planning period than was seen in Scenarios 1, 2, and 3. The resulting net replenishment obligation projection with this assumed increase in Appropriative pool production looks similar to the prior projections with the cumulative replenishment obligation being negative for most of the planning period, reaching a value of -78,000 acre-ft in 2021-22 and gradually increasing thereafter to about +228,000 by 2034-35. The maximum replenishment obligation would reach about 46,000 acre-ft/yr in 2034-35, which is substantially less than the projected supplemental recharge capacity available to Watermaster.

2.4.4 Projected Time History of Water in Storage

Figure 2-9 shows the projected time history of water in storage accounts and, more specifically, the buildup in storage due to production rights exceeding groundwater production throughout most of the planning period for the four planning scenarios shown in Tables 2-4, 2-5, 2-6, and 2-7. The amount of water in storage includes 283,000 acre-ft of water, which is in storage as of July 1, 2009, plus the projected increase in storage for each planning scenario. The projected time history shown in Figure 2-9 assumes that replenishment will come from storage when the production exceeds production rights. The intent of this figure is to illustrate the impact of the groundwater production projections on storage and to illustrate the amount of water in storage that could be available to offset future replenishment obligations. For Scenario 1, the volume of water in storage is projected to reach about 427,000 acre-ft in 2023 and declines thereafter but never reaches zero. This means that in theory, Watermaster could purchase replenishment water from storing parties (provided that there are willing sellers) and never have to purchase water from Metropolitan for replenishment. This holds true for Scenario 2. Watermaster would have to purchase replenishment water from Metropolitan for replenishment by 2033 for Scenario 3 and 2030 for Scenario 4.

2.4.5 Supplemental Water Recharge Capacity and Requirements to Meet Replenishment Obligations

The 2010 RMPU stated that: "The supplemental water recharge capacity of the spreading basins available to Watermaster and the existing ASR wells is about 88,700 acre-ft/yr. With in-lieu recharge, the supplemental water recharge capacity ranges from 113,700 to 128,700 acre-ft/yr." The supplemental water recharge capacity dedicated to recycled water recharge and the 6,500 acre-ft/yr MZ1 obligation is about 25,200 acre-ft//yr. This leaves about 89,000 to

103,000 acre-ft/yr of supplemental water recharge capacity for replenishment purposes.[6] The maximum supplemental water recharge requirement estimated in the production scenarios described above was 46,000 acre-ft/yr and assumes that the replenishment obligation will be met with imported water recharge and not storage. Given what is known today and anticipated groundwater production, there is no need to construct additional supplemental water recharge capacity to meet future replenishment obligations through 2035.

2.4.6 Conclusions Regarding Groundwater Production and Replenishment Projections

The following conclusions are evident from the discussion above:

- The groundwater production projections for 2012 are substantially less than assumed in the 2010 RMPU. The groundwater production projections presented herein are based, in part, on the 2010 UWMPs and a projected decline in agricultural water use. The reduction in projected groundwater production has been largely offset by an increase in the direct use of imported water, which appears to be driven, in part, by the changing economics of groundwater production. The Watermaster parties participating in the RMPU Steering Committee have reviewed the production projections and have accepted them as the best current estimates

- No new recharge facilities or new sources of replenishment water will be required to meet future replenishment obligations, as required by the Judgment. There may be other reasons to construct new recharge facilities, such as to mitigate excessive groundwater level declines. Watermaster's recharge obligations related to excessive groundwater level decline and/or the need to balance recharge and discharge are contained in Section 5.1 (e) of the Peace Agreement.

- Watermaster and the parties should consider reviewing the storage management plan currently in use to determine if changes should be made to improve storage management in general and more specifically to accommodate the probable increases in storage that will occur in the future.

2.5 Replenishment Sources, Availability and Cost

Watermaster has historically met its replenishment obligations through the purchase of State Water Project (SWP) water from the IEUA who in turn obtains this water from the Metropolitan Water District of Southern California (Metropolitan) and through the purchase of water from members of the Appropriative pool. The 2010 RMPU contains a detailed

[6] As part of the current RMPU steering committee process, the supplemental water recharge capacity was reduced about 2,000 acre-ft/yr (see Section 4) however there is more than adequate supplemental water recharge capacity to meet future replenishment obligations.

description of sources of supplemental water that could be used for replenishment or other recharge programs. These sources include:

- Metropolitan's SWP and Colorado River Aqueduct supplies delivered through Metropolitan facilities;
- groundwater and surface water supplies in the Santa Ana Watershed that can be supplied to the Chino Basin directly through existing or new conveyance facilities or by exchange;
- surplus groundwater from the Six Basins area;
- recycled water from the Western Riverside County Regional Wastewater Authority Plant located in the Chino Basin;
- recycled water from the Rapid Infiltration Extraction Treatment Plant (RIX) in Colton, from the City of Rialto, from the City of Riverside, and from others;
- groundwater and surface water supplies from the Central Valley, conveyed to the Chino Basin through SWP and Metropolitan facilities, San Bernardino Valley Municipal Water District facilities, and San Gabriel Municipal Water District facilities; and
- groundwater and surface water supplies from the Colorado River Basin conveyed to the Chino Basin through Metropolitan facilities.

The 2010 RMPU report documents the availability of these sources and includes cost estimates for some. With the exception of the Metropolitan's SWP water, the availability and cost of all other supplemental water sources are unknown at this time.

2.5.1 SWP Water Supplied by Metropolitan

The 2010 RMPU contained an analysis of the availability of Metropolitan's SWP water. Since the 2010 RMPU was completed, Metropolitan has completed its 2010 Integrated Resources Plan (IRP) Update (Metropolitan, 2010). Metropolitan's core resources strategy, if implemented, will result in Metropolitan being able to meet all its demands at all times with the exceptions of potential shortages as the strategy is being implemented in the current decade.[7] Metropolitan is currently implementing its core resource strategy. Based on this finding, it is assumed herein that Watermaster will be able to purchase SWP water from Metropolitan when needed.

[7] Based on the 2010 Update, Integrated Regional Plan (Metropolitan, 2010) and personal discussion with Brandon Goshi of Metropolitan.

Historically, Watermaster has purchased almost all of its replenishment water at rates that were discounted relative to water served by Metropolitan for direct use. Metropolitan has eliminated its replenishment service for 2013 and likely thereafter, which means that Watermaster will be required to purchase more expensive untreated Tier 1 and Tier 2 water for replenishment purposes. Table 2-8a shows the historical recharge of Metropolitan SWP water in the Chino Basin. Figure 2-10 shows the location of Metropolitans pipelines and turnouts and the recharge basins used to recharge imported water.

Since 2002, Metropolitan's average water rates have increased about 6 percent per year, and during the period 2007 through 2012, rates have increased about 11 percent per year. The Metropolitan Board recently approved its fiscal 2012/13 and 2013/14 budgets and water sales rates. Metropolitan's average water rates will increase 5 percent in 2012/13 and 5 percent in 2013/14 and are projected to increase between 3 and 5 percent for the following five years (Metropolitan, 2012). Table 2-9 lists the historical water rates for replenishment, untreated Tier 1 and untreated Tier 2 services, and a range of future rate projections based on sustained rate increases of 4 percent (Metropolitan's five-year average rate), 6.18 percent (low rate based on the observed compound rate 2003 through 2012), and 10.92 percent (high rate based on the observed compound rate 2007 through 2012). The current cost of imported water from Metropolitan for replenishment purposes is about $593 per acre-ft and is projected to rise by 2020 to somewhere in the range of $750 to $1,100 per acre-ft.

2.5.2 Recycled Water for Recharge and Its Availability and Cost

In the last decade IEUA has constructed improvements at its treatment plants and conveyance facilities that have made recycled water available for direct reuse and groundwater recharge. The conveyance improvements and recharge basins use to recharge recycled water are shown in Figure 2-11. IEUA has conducted planning investigations to project the amount of recycled water available for recharge[8]. The key factors used to develop the recycled water recharge projections below are: basin/turnout capacities, infiltration rates, basin maintenance, recycled water contribution limitations, dry vs. wet year, capital projects and annual O&M. The specific assumptions for the recycled water recharge projections are listed below. The projections are included in Table 2-10.

- Mid-Range (Average Year) Recycled Water Recharge Assumptions:

  1. Recycled water recharge occurs 7 months of the year for Basins with infiltration rates $\geq$ 0.5 ft/day.

  2. Recycled water recharge occurs 5 months of the year for Basins with infiltration rates $\leq$ 0.5 ft/day.

  3. Recycled water turnout capacity limitations were considered.

[8] IEUA Memorandum, Groundwater Recharge Master Plan Update, Recycled Water Assumptions, February 14, 2012.

4. Recycled water contribution (RWC) limitations were considered.

5. Basin maintenance is assumed to be at a frequency that would ensure that 50percent of post cleaning infiltration rate[9] at all times.

6. Basin maintenance occurs every two-to three years for each basin.

7. Includes approved projects from the 2012/13 Ten-Year Capital Improvement Program (TYCIP):

   a. Turner Basin – Recycled water conveyance enhancements completed by October 2013, and beneficial use is realized in FY 2013/14. Assumes permitting of Turner Basin 5 and 8 are completed and operational to maximize use.

   b. RP-3 & Declez Basin – Recycled water conveyance enhancements completed by December 2013, and beneficial use is realized in FY 2014/15.

   c. Lower Day, Etiwanda Debris Basin & Etiwanda Conservation Basin – Currently, these projects are not in in the TYCIP; however, Lower Day can be implemented by FY 2017/18 and Etiwanda Debris Basin by FY 2021/22.

   d. Infiltration rates based on historical storm flow and imported water flow to these basins. Actual infiltration rates may be lower when the basin is used on a long term basis.

   e. No RWC limitations, since there is no history of underflow/storm flow diluent calculations or basin performance history.

- Low-Range (Wet Year) Recycled Water Recharge Assumptions, same as Mid-Range except:

  1. Recycled water recharge occurs 4 months of the year for Basins with infiltration rates ≥ 0.5 ft/day.

  2. Recycled water recharge occurs 2 months of the year for Basins with infiltration rates ≤ 0.5 ft/day.

  3. Imported water is not competing with recycled water for groundwater recharge.

- High-Range (Dry Year) Recycled Water Recharge Assumptions, same as Mid-Range except:

  1. Recycled water recharge occurs 10 months of the year due to limited storm water recharge for Basins with infiltration rates ≥ 0.5 ft/day.

[9] The "post-cleaning infiltration rate" is the maximum infiltration rate achievable in the basin.

2. Recycled water recharge occurs 7 months of the year due to limited storm water recharge for Basins with infiltration rates ≤ 0.5 ft/day.

The IEUA has also prepared cost projections for recycled water recharge. These go through 2015 and included in Table 2-9. The historical and projected recycled water recharge rate ranges about $300 to $400 per acre-ft less than the cost of imported water from Metropolitan over the 2010 through 2015 period.

Table 2-1
Time History of Water in Storage in the Chino Basin Exclusive of the Dry-Year Yield Activities
(acre-ft)

Account Balance July 1	Appropriative Pool (Pool 3)				Overlying Non-Ag (Pool 2)			Total
	Carryover	Excess Carryover (ECO)	Supplemental	Total	Carryover	Excess Carryover (ECO)	Total	
2001	15,940	45,281	92,813	154,034	5,301	32,330	37,631	191,665
2002	13,521	42,205	87,801	143,527	5,285	34,767	40,052	183,579
2003	18,656	48,651	81,180	148,487	6,743	36,850	43,593	192,080
2004	19,676	53,127	80,963	153,766	7,177	40,881	48,058	201,824
2005	54,834	63,631	88,849	207,314	7,227	45,888	53,115	260,429
2006	32,062	55,442	86,170	173,674	7,227	49,178	56,405	230,079
2007	34,552	50,895	83,184	168,631	7,084	51,476	58,560	227,191
2008	41,625	83,962	81,520	207,107	6,819	45,248	52,067	259,174
2009	42,795	101,907	84,867	229,569	6,672	46,600	53,272	282,841
2010	41,263	120,897	90,133	252,293	6,934	47,731	54,665	306,958
2011	41,412	146,074	98,079	285,565	6,959	49,343	56,302	341,867

Table 2-2
Groundwater in Storage in the Chino Basin by Party as of July 1, 2011
(acre-ft)

Producer	Carryover[1,4]	Excess Carryover[2,5]	Supplemental[3]	Total
Overlying Non-Agricultural Pool				
Ameron	98	2,110	na	2,208
Angelica Textile Service[3]	-	-	na	0
Agua Capital Management	948	11,309	na	12,257
Auto Club Speedway[3]	1,000	2,731	na	3,731
California Steel Industries Inc.[5]	1,154	2,916	na	4,070
CCG Ontario, LLC	-	-	na	0
General Electric Company[6]	-	-	na	0
GenOn West, LP (Formerly RRI Etiwanda)[7]	955	7,238	na	8,193
Kaiser Ventures Inc.	-	-	na	0
KCO, LLC/ The Koll Company (City of Ontario)	-	-	na	0
Loving Savior of the Hills	-	-	na	0
Ontario City Non-Ag	2,328	15,067	na	17,395
Praxair Inc. (City of Ontario)	1	4,375	na	4,376
San Antonio Winery[3]	-	-	na	0
San Bernardino County (Chino Airport)	11	170	na	181
Southern California Edison Company (City of Ontario)	-	196	na	196
Space Center Mira Loma Inc.	0.003	-	na	0
Sunkist Growers Inc. (City of Ontario)	-	-	na	0
Swan Lake Mobile Home Park	464	3,226	na	3,690
Vulcan Materials Company	-	5	na	5
West Venture Development	-	-	na	0
Subtotal Overlying Non-Agricultural Pool Production	*6,959*	*49,343*		56,302
Appropriative Pool				
Arrowhead Mountain Spring Water Company	-	-	-	0
City of Chino	4,034	29,840	5,271	39,145
City of Chino Hills	2,111	8,934	7,022	18,067
City of Norco	202	2,212	106	2,520
City of Ontario	11,374	18,542	22,147	52,063
City of Pomona	11,216	13,046	13,724	37,986
City of Upland	1,183	6,325	8,331	15,839
Cucamonga Valley Water District	294	42,002	18,673	60,969
Fontana Union Water Company	-	-	-	0
Fontana Water Company	-	-	0.031	0
Jurupa Community Services District	2,061	6,704	2,093	10,858
Inland Empire Utilities Agency				0
Marygold Mutual Water Company	567	657	1,785	3,009
Metropolitan Water District of Southern California				0
Monte Vista Irrigation Company	677	1,964	6,570	9,211
Monte Vista Water District	4,590	652	6,886	12,128
Niagara	-	-	1,422	1,422
San Antonio Water Company	929	8,109	1,092	10,130
San Bernardino County (Olympic Facility)	-	-	-	0
Santa Ana River Water Company	170	210	529	909
Golden State Water Company	411	1,053	1,591	3,055
West End Consolidated Water Company	948	1,876	498	3,322
West Valley Water District	644	3,948	339	4,931
Subtotal Appropriative Pool Production	*41,411*	*146,074*	*98,079*	285,565
Total in Storage	48,370	195,417	98,079	341,867

na = Not Applicable

[1] Pool 3 data from CBWM FY 2011-2012 Assessment Package page 2A, Under Production Balances, Carryover: Next Year Beginning Balance column.

[2] Pool 3 data from CBWM FY 2011-2012 Assessment Package page 3A, Ending Balance column.

[3] Pool 3 data from CBWM FY 2011-2012 Assessment Package page 4A, total of Ending Balance column of recharge, quantified, and new accounts.

[4] Pool 2 data from CBWM FY 2011-12 Assessment Package page 14A, Carryover: Next Year Begin Bal column.

[5] From CBWM FY 2011-2012 Assessment Package page 15A, Ending Balance column.

Table 2-3
Projected Groundwater Production for the Chino Basin
Normal Year Projection
(acre-ft)

Producer	Historical Production by Fiscal Year							Production Projection[1]					
	2006-07	2007-08	2008-09	2009-10	2010-11	Maximum	Average	2009-10	2014-15	2019-20	2024-25	2029-30	2034-35
Overlying Agricultural Pool													
Aggregate Agricultural Pool Production[2]	*29,649*	*23,530*	*23,277*	*21,043*	*21,030*	*29,649*	*23,706*	*21,000*	*13,000*	*5,000*	*5,000*	*5,000*	*5,000*
Overlying Non-Agricultural Pool													
Ameron	-	-	-	5	28	28	7	28	28	28	28	28	28
Angelica Textile Service[3]	29	23	31	41	54	54	36	54	54	54	54	54	54
Agua Capital Management	-	-	-	-	-	-	-	-	-	-	-	-	-
Auto Club Speedway[3]	621	601	505	496	449	621	534	621	621	621	621	621	621
California Steel Industries Inc.[5]	1,284	1,331	1,126	1,059	1,085	1,331	1,177	1,126	2,170	2,450	2,450	2,450	2,450
CCG Ontario, LLC	-	-	-	-	-	-	-	-	-	-	-	-	-
General Electric Company[6]	461	538	344	287	31	538	332	-	-	-	-	-	-
GenOn West, LP (Formerly RRI Etiwanda)[7]	705	793	536	138	328	793	500	500	500	500	500	500	500
Kaiser Ventures Inc.	-	-	-	-	-	-	-	-	-	-	-	-	-
KCO, LLC/ The Koll Company (City of Ontario)	-	-	-	-	-	-	-	-	-	-	-	-	-
Loving Savior of the Hills	-	-	-	-	-	-	-	-	-	-	-	-	-
Ontario City Non-Ag	-	-	-	-	-	-	-	-	-	-	-	-	-
Praxair Inc. (City of Ontario)	-	-	-	-	-	-	-	-	-	-	-	-	-
San Antonio Winery[3]	-	-	1	13	11	13	5	13	13	13	13	13	13
San Bernardino County (Chino Airport)	-	-	-	-	-	-	-	-	-	-	-	-	-
Southern California Edison Company (City of Ontario)	-	-	-	-	-	-	-	-	-	-	-	-	-
Space Center Mira Loma Inc.	-	-	-	-	-	-	-	-	-	-	-	-	-
Sunkist Growers Inc. (City of Ontario)	147	130	29	-	-	147	61	-	-	-	-	-	-
Swan Lake Mobile Home Park	-	-	-	-	-	-	-	-	-	-	-	-	-
Vulcan Materials Company	5	5	4	0	-	5	3	-	-	-	-	-	-
West Venture Development	-	-	-	-	-	-	-	-	-	-	-	-	-
Subtotal Overlying Non-Agricultural Pool Production	*3,251*	*3,421*	*2,575*	*2,039*	*1,987*	na	*2,655*	2,343	3,387	3,667	3,667	3,667	3,667
Appropriative Pool													
Arrowhead Mountain Spring Water Company	392	366	350	374	408	408	378	374	378	378	378	378	378
City of Chino	8,877	7,608	8,939	7,808	7,304	8,939	8,107	7,441	8,574	9,526	11,278	12,563	13,796
City of Chino Hills	2,057	2,535	1,953	1,446	1,986	2,535	1,995	2,900	2,900	2,900	2,900	2,900	2,900
City of Norco	-	-	-	-	-	-	-	-	-	-	-	-	-
City of Ontario	28,010	26,027	30,080	25,269	19,010	30,080	25,679	20,955	20,373	24,242	29,631	35,049	39,383
City of Pomona	10,894	13,188	13,731	11,404	10,528	13,731	11,949	10,279	13,103	14,300	14,300	14,300	15,000
City of Upland[4]	1,521	3,064	3,724	3,410	734	3,724	2,490	3,342	250	250	250	250	250
Cucamonga Valley Water District	18,786	15,294	23,748	19,263	20,318	23,748	19,482	19,831	17,931	16,331	17,931	19,631	21,231
Fontana Union Water Company	-	-	-	-	-	-	-	-	-	-	-	-	-
Fontana Water Company	16,218	19,199	13,315	13,557	8,348	19,199	14,128	9,921	5,319	6,413	8,372	10,332	12,041
Jurupa Community Services District	18,213	17,160	20,096	15,979	14,642	20,096	17,218	15,000	16,900	18,800	18,800	18,800	18,800
Inland Empire Utilities Agency	-	-	-	-	-	-	-	-	-	-	-	-	-
Marygold Mutual Water Company	184	544	142	346	1,107	1,107	465	346	2,200	2,200	2,200	2,200	2,200
Metropolitan Water District of Southern California	-	-	-	-	-	-	-	-	-	-	-	-	-
Monte Vista Irrigation Company	-	-	-	-	-	-	-	-	-	-	-	-	-
Monte Vista Water District	11,621	14,250	15,574	15,803	12,264	15,803	13,902	15,774	12,191	11,231	11,531	11,781	12,111
Niagara	1,106	1,153	1,210	1,298	1,345	1,345	1,223	1,210	1,210	1,210	1,210	1,210	1,210
San Antonio Water Company	544	416	1,187	966	716	1,187	766	1,552	1,507	1,507	1,507	1,507	1,507
San Bernardino County (Olympic Facility)	16	16	22	16	18	22	18	22	22	22	22	22	22
Santa Ana River Water Company	-	-	-	-	-	-	-	160	318	335	335	335	335
Golden State Water Company	881	599	748	359	444	881	606	273	411	411	411	411	411
West End Consolidated Water Company	-	-	-	-	-	-	-	-	-	-	-	-	-
West Valley Water District	-	-	-	-	-	-	-	-	-	900	900	900	900
Subtotal Appropriative Pool Production	*119,321*	*121,418*	*134,817*	*117,299*	*99,172*	*na*	*118,405*	*109,380*	*103,587*	*110,956*	*121,956*	*132,569*	*142,475*
Chino Desalter Authority													
Total Desalter Production	*27,077*	*30,121*	*28,985*	*28,823*	*29,013*	*30,121*	*17,824*	*28,940*	*39,400*	*39,400*	*39,400*	*39,400*	*39,400*
Total Basin Production	179,298	178,491	189,654	169,204	151,201	na	162,590	161,662	159,374	159,023	170,023	180,636	190,542

1 -- The production projection for Overlying Ag Pool based on prior OBMP planning investigations. The production projection for the Appropriative Pool Parties is based on their UWMP's and may have been refined based on subsequent discussions. The production projection for the Overlying Non-ag Pool was estimated based on discussions with individual Parties or from historical data.

2 -- Ramp down in projected Overlying Ag Pool production mirrors the increase in total water demand projected by the Cities of Chino and Ontario.

3 -- Projected production is based on maximum annual production for the period 2006-07 through 2010-11. Brian Geye confirmed for the Auto Club Speedway.

4 -- Updated on February 1, 2012 by Rosemary Hoerning.

5 -- Projection provided by Ken Jeske via email on October 21, 2011.

6 -- Projection provided by Ken Jeske via email on October 21, 2011.

7 -- Confirmed by Len Moore at Genon.

Table 2-4

Scenario 1 -- Baseline Scenario -- Projected Groundwater Production and Production Rights and Efficient Market Assumption

(acre-ft)

Fiscal Year	Projected Groundwater Production per 2010 UWMP for Normal Year[1]	Production Rights: Safe Yield[2]	Production Rights: Controlled Overdraft Pursuant to Judgment	Production Rights: Reoperation Water Offset to Desalter Production	Production Rights: 6,500 acre-ft/yr Supplemental Water Recharge in MZ1 per Peace II	Production Rights: Mid-Range Recycled Water Recharge[3]	Production Rights: Credit Against 6,500 acre-ft/yr Obligation from Recycled Water Recharged in MZ1[4]	Production Rights: Total	Net Replenishment Obligation[5]	Cumulative Replenishment Obligation from July 1, 2009
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9) = (3)+(4)+(5)+(6)+(7)+(8)	(10) = min{0,(2)-(9)}	$(11)_t = [(2)_t-(9)_t] + (11)_{t-1}$
2009 - 2010	161,662	140,000	5,000	28,857	6,500	7,210	-2,762	184,805	0	-23,143
2010 - 2011	161,205	140,000	5,000	29,043	6,500	8,028	-3,244	185,327	0	-47,265
2011 - 2012	160,747	134,545	5,000	29,025	6,500	8,200	-3,200	180,071	0	-66,589
2012 - 2013	160,289	134,844	5,000	24,124	6,500	8,200	-3,200	175,468	0	-81,768
2013 - 2014	159,831	135,211	5,000	5,000	6,500	9,300	-3,200	157,811	2,021	-79,747
2014 - 2015	159,374	135,593	5,000	10,000	6,500	14,500	-3,200	168,393	0	-88,767
2015 - 2016	159,303	136,418	5,000	10,000	6,500	14,500	-3,200	169,218	0	-98,681
2016 - 2017	159,233	137,123	5,000	10,000	6,500	14,500	-3,200	169,923	0	-109,372
2017 - 2018	159,163	137,332	0	10,000	6,500	16,900	-3,200	167,532	0	-117,741
2018 - 2019	159,093	137,170	0	10,000	6,500	16,900	-3,200	167,370	0	-126,018
2019 - 2020	159,023	136,695	0	10,000	6,500	16,900	-3,200	166,895	0	-133,890
2020 - 2021	161,223	136,055	0	10,000	6,500	16,900	-3,200	166,255	0	-138,922
2021 - 2022	163,423	135,529	0	10,000	6,500	18,700	-3,200	167,529	0	-143,028
2022 - 2023	165,623	134,947	0	10,000	6,500	18,700	-3,200	166,947	0	-144,352
2023 - 2024	167,823	134,188	0	10,000	6,500	18,700	-3,200	166,188	1,635	-142,717
2024 - 2025	170,023	133,281	0	10,000	6,500	18,700	-3,200	165,281	4,742	-137,975
2025 - 2026	172,145	132,413	0	10,000	6,500	18,700	-3,200	164,413	7,733	-130,242
2026 - 2027	174,268	131,603	0	10,000	6,500	18,700	-3,200	163,603	10,665	-119,577
2027 - 2028	176,391	130,964	0	10,000	6,500	18,700	-3,200	162,964	13,427	-106,150
2028 - 2029	178,513	130,485	0	10,000	6,500	18,700	-3,200	162,485	16,029	-90,122
2029 - 2030	180,636	130,210	0	10,000	6,500	18,700	-3,200	162,210	18,426	-71,696
2030 - 2031	182,617	130,010	0	0	0	18,700	0	148,710	33,907	-37,788
2031 - 2032	184,598	129,810	0	0	0	18,700	0	148,510	36,088	-1,700
2032 - 2033	186,579	129,610	0	0	0	18,700	0	148,310	38,270	36,570
2033 - 2034	188,561	129,410	0	0	0	18,700	0	148,110	40,451	77,021
2034 - 2035	190,542	129,210	0	0	0	18,700	0	147,910	42,632	119,653
Total	4,401,886	3,482,652	40,000	276,049	136,500	413,838	-66,806	4,282,233	266,025	
Average	169,303	133,948	1,538	10,617	5,250	15,917	-2,569	164,701	10,232	

1 --Linearly interpolated between planning years.
2 -- Safe yield estimate from the 2009 Production Optimization and Evaluation of the Peace II Project Description (WEI, 2009). Estimate includes new stormwater recharge from the
3 -- Based on Actual through 2010-11, IEUA 2010 Urban Water Management Plan starting in 2014-15 and thereafter, and linearly interpolated between 2010-11 and 2014-15.
4 -- Recycled water recharged in the Brooks Street Basin and the Seventh and Eighth Street Basins are actual through 2010-11 and planning estimates thereafter.
5 -- This is the net replenishment obligation based on the assumptions described in the text, negative values reported as zeros.

20120501 Figure 2-9 Tables 2-3 through 2-7.xlsx -- Table 2-4
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Table 2-5
Scenario 2 -- Projected Groundwater Production and Production Rights per Table 2-3 with a Delay in the Decline of Agricultural Pool Production, and Efficient Market Assumption

(acre-ft)

Fiscal Year	Projected Groundwater Production per 2010 UWMP for Normal Year[1]	Production Rights							Net Replenishment Obligation[5]	Cumulative Replenishment Obligation from July 1, 2009
		Safe Yield[2]	Controlled Overdraft Pursuant to Judgment	Reoperation Water Offset to Desalter Production	6,500 acre-ft/yr Supplemental Water Recharge in MZ1 per Peace II	Mid-Range Recycled Water Recharge[3]	Credit Against 6,500 acre-ft/yr Obligation from Recycled Water Recharged in MZ1[4]	Total		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9) = (3)+(4)+(5)+(6)+(7)+(8)	(10) = min{0,(2)-(9)}	$(11)_t = [(2)_t-(9)_t] + (11)_{t-1}$
2009 - 2010	161,662	140,000	5,000	28,857	6,500	7,210	-2,762	184,805	0	-23,143
2010 - 2011	162,805	140,000	5,000	29,043	6,500	8,028	-3,244	185,327	0	-45,665
2011 - 2012	163,947	134,545	5,000	29,025	6,500	8,200	-3,200	180,071	0	-61,789
2012 - 2013	165,089	134,844	5,000	24,124	6,500	8,200	-3,200	175,468	0	-72,168
2013 - 2014	166,231	135,211	5,000	5,000	6,500	9,300	-3,200	157,811	8,421	-63,747
2014 - 2015	167,374	135,593	5,000	10,000	6,500	14,500	-3,200	168,393	0	-64,767
2015 - 2016	168,903	136,418	5,000	10,000	6,500	14,500	-3,200	169,218	0	-65,081
2016 - 2017	170,433	137,123	5,000	10,000	6,500	14,500	-3,200	169,923	510	-64,572
2017 - 2018	171,963	137,332	0	10,000	6,500	16,900	-3,200	167,532	4,431	-60,141
2018 - 2019	173,493	137,170	0	10,000	6,500	16,900	-3,200	167,370	6,123	-54,018
2019 - 2020	175,023	136,695	0	10,000	6,500	16,900	-3,200	166,895	8,128	-45,890
2020 - 2021	174,023	136,055	0	10,000	6,500	16,900	-3,200	166,255	7,768	-38,122
2021 - 2022	173,023	135,529	0	10,000	6,500	18,700	-3,200	167,529	5,494	-32,628
2022 - 2023	172,023	134,947	0	10,000	6,500	18,700	-3,200	166,947	5,076	-27,552
2023 - 2024	171,023	134,188	0	10,000	6,500	18,700	-3,200	166,188	4,835	-22,717
2024 - 2025	170,023	133,281	0	10,000	6,500	18,700	-3,200	165,281	4,742	-17,975
2025 - 2026	172,145	132,413	0	10,000	6,500	18,700	-3,200	164,413	7,733	-10,242
2026 - 2027	174,268	131,603	0	10,000	6,500	18,700	-3,200	163,603	10,665	423
2027 - 2028	176,391	130,964	0	10,000	6,500	18,700	-3,200	162,964	13,427	13,850
2028 - 2029	178,513	130,485	0	10,000	6,500	18,700	-3,200	162,485	16,029	29,878
2029 - 2030	180,636	130,210	0	10,000	6,500	18,700	-3,200	162,210	18,426	48,304
2030 - 2031	182,617	130,010	0	0	0	18,700	0	148,710	33,907	82,212
2031 - 2032	184,598	129,810	0	0	0	18,700	0	148,510	36,088	118,300
2032 - 2033	186,579	129,610	0	0	0	18,700	0	148,310	38,270	156,570
2033 - 2034	188,561	129,410	0	0	0	18,700	0	148,110	40,451	197,021
2034 - 2035	190,542	129,210	0	0	0	18,700	0	147,910	42,632	239,653
Total	4,521,886	3,482,652	40,000	276,049	136,500	413,838	-66,806	4,282,233	313,155	
Average	173,919	133,948	1,538	10,617	5,250	15,917	-2,569	164,701	12,044	

1 --Linearly interpolated between planning years. No adjustment was made in Appropriate Pool production to account for increase ag production.
2 -- Safe yield estimate from the 2009 Production Optimization and Evaluation of the Peace II Project Description (WEI, 2009). Estimate includes new stormwater recharge from the
3 -- Based on Actual through 2010-11, IEUA 2010 Urban Water Management Plan starting in 2014-15 and thereafter, and linearly interpolated between 2010-11 and 2014-15.
4 -- Recycled water recharged in the Brooks Street Basin and the Seventh and Eighth Street Basins are actual through 2010-11 and planning estimates thereafter.
5 -- This is the net replenishment obligation based on the assumptions described in the text, negative values reported as zeros.
Values in **red** indicate a change from the December 14, 2011 Draft Report

20120501 Figure 2-9 Tables 2-3 through 2-7.xlsx -- Table 2-5
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WILDERMUTH ENVIRONMENTAL INC.

Table 2-6
Scenario 3 -- Projected Groundwater Production and Production Rights per Table 2-4 with Appropriative Pool Production Increased by 10 Percent, and Efficient Market Assumption

(acre-ft)

Fiscal Year	Projected Groundwater Production per 2010 UWMP for Normal Year[1]	Production Rights							Net Replenishment Obligation[5]	Cumulative Replenishment Obligation from July 1, 2009
		Safe Yield[2]	Controlled Overdraft Pursuant to Judgment	Reoperation Water Offset to Desalter Production	6,500 acre-ft/yr Supplemental Water Recharge in MZ1 per Peace II	Mid-Range Recycled Water Recharge[3]	Credit Against 6,500 acre-ft/yr Obligation from Recycled Water Recharged in MZ1[4]	Total		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9) = (3)+(4)+(5)+(6)+(7)+(8)	(10) = min{0,(2)-(9)}	$(11)_t = [(2)_t-(9)_t] + (11)_{t-1}$
2009 - 2010	172,600	140,000	5,000	28,857	6,500	7,210	-2,762	184,805	0	-12,205
2010 - 2011	172,027	140,000	5,000	29,043	6,500	8,028	-3,244	185,327	0	-25,505
2011 - 2012	171,453	134,545	5,000	29,025	6,500	8,200	-3,200	180,071	0	-34,123
2012 - 2013	170,879	134,844	5,000	24,124	6,500	8,200	-3,200	175,468	0	-38,711
2013 - 2014	170,306	135,211	5,000	5,000	6,500	9,300	-3,200	157,811	12,495	-26,216
2014 - 2015	169,732	135,593	5,000	10,000	6,500	14,500	-3,200	168,393	1,339	-24,877
2015 - 2016	169,809	136,418	5,000	10,000	6,500	14,500	-3,200	169,218	592	-24,285
2016 - 2017	169,887	137,123	5,000	10,000	6,500	14,500	-3,200	169,923	0	-24,322
2017 - 2018	169,964	137,332	0	10,000	6,500	16,900	-3,200	167,532	2,432	-21,890
2018 - 2019	170,041	137,170	0	10,000	6,500	16,900	-3,200	167,370	2,671	-19,219
2019 - 2020	170,118	136,695	0	10,000	6,500	16,900	-3,200	166,895	3,223	-15,996
2020 - 2021	172,538	136,055	0	10,000	6,500	16,900	-3,200	166,255	6,284	-9,712
2021 - 2022	174,958	135,529	0	10,000	6,500	18,700	-3,200	167,529	7,429	-2,283
2022 - 2023	177,378	134,947	0	10,000	6,500	18,700	-3,200	166,947	10,432	8,149
2023 - 2024	179,798	134,188	0	10,000	6,500	18,700	-3,200	166,188	13,611	21,760
2024 - 2025	182,218	133,281	0	10,000	6,500	18,700	-3,200	165,281	16,938	38,697
2025 - 2026	184,553	132,413	0	10,000	6,500	18,700	-3,200	164,413	20,141	58,838
2026 - 2027	186,888	131,603	0	10,000	6,500	18,700	-3,200	163,603	23,285	82,123
2027 - 2028	189,223	130,964	0	10,000	6,500	18,700	-3,200	162,964	26,259	108,382
2028 - 2029	191,558	130,485	0	10,000	6,500	18,700	-3,200	162,485	29,073	137,456
2029 - 2030	193,893	130,210	0	10,000	6,500	18,700	-3,200	162,210	31,683	169,139
2030 - 2031	196,072	130,010	0	0	0	18,700	0	148,710	47,362	216,501
2031 - 2032	198,251	129,810	0	0	0	18,700	0	148,510	49,742	266,243
2032 - 2033	200,431	129,610	0	0	0	18,700	0	148,310	52,121	318,364
2033 - 2034	202,610	129,410	0	0	0	18,700	0	148,110	54,500	372,864
2034 - 2035	204,789	129,210	0	0	0	18,700	0	147,910	56,880	429,744
Total	4,711,976	3,482,652	40,000	276,049	136,500	413,838	-66,806	4,282,233	468,492	
Average	181,230	133,948	1,538	10,617	5,250	15,917	-2,569	164,701	18,019	

1 --Linearly interpolated between planning years.

2 -- Safe yield estimate from the 2009 Production Optimization and Evaluation of the Peace II Project Description (WEI, 2009). Estimate includes new stormwater recharge from the

3 -- Based on Actual through 2010-11, IEUA 2010 Urban Water Management Plan starting in 2014-15 and thereafter, and linearly interpolated between 2010-11 and 2014-15.

4 -- Recycled water recharged in the Brooks Street Basin and the Seventh and Eighth Street Basins are actual through 2010-11 and planning estimates thereafter.

5 -- This is the net replenishment obligation based on the assumptions described in the text, negative values reported as zeros.

WILDERMUTH ENVIRONMENTAL INC.

Table 2-7

Scenario 4 -- Projected Groundwater Production and Production Rights per Table 2-4 with Appropriative Pool Production Increased by 10 Percent, with a Delay in the Decline of Agricultural Pool Production, and Efficient Market Assumption

(acre-ft)

Fiscal Year	Projected Groundwater Production per 2010 UWMP for Normal Year[1]	Production Rights							Net Replenishment Obligation[5]	Cumulative Replenishment Obligation from July 1, 2009
		Safe Yield[2]	Controlled Overdraft Pursuant to Judgment	Reoperation Water Offset to Desalter Production	6,500 acre-ft/yr Supplemental Water Recharge in MZ1 per Peace II	Mid-Range Recycled Water Recharge[3]	Credit Against 6,500 acre-ft/yr Obligation from Recycled Water Recharged in MZ1[4]	Total		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9) = (3)+(4)+(5)+(6)+(7)+(8)	(10) = min{0,(2)-(9)}	$(11)_t = [(2)_t-(9)_t] + (11)_{t-1}$
2009 - 2010	172,600	140,000	5,000	28,857	6,500	7,210	-2,762	184,805	0	-12,205
2010 - 2011	173,627	140,000	5,000	29,043	6,500	8,028	-3,244	185,327	0	-23,905
2011 - 2012	174,653	134,545	5,000	29,025	6,500	8,200	-3,200	180,071	0	-29,323
2012 - 2013	175,679	134,844	5,000	24,124	6,500	8,200	-3,200	175,468	212	-29,111
2013 - 2014	176,706	135,211	5,000	5,000	6,500	9,300	-3,200	157,811	18,895	-10,216
2014 - 2015	177,732	135,593	5,000	10,000	6,500	14,500	-3,200	168,393	9,339	-877
2015 - 2016	179,409	136,418	5,000	10,000	6,500	14,500	-3,200	169,218	10,192	9,315
2016 - 2017	181,087	137,123	5,000	10,000	6,500	14,500	-3,200	169,923	11,163	20,478
2017 - 2018	182,764	137,332	0	10,000	6,500	16,900	-3,200	167,532	15,232	35,710
2018 - 2019	184,441	137,170	0	10,000	6,500	16,900	-3,200	167,370	17,071	52,781
2019 - 2020	186,118	136,695	0	10,000	6,500	16,900	-3,200	166,895	19,223	72,004
2020 - 2021	185,338	136,055	0	10,000	6,500	16,900	-3,200	166,255	19,084	91,088
2021 - 2022	184,558	135,529	0	10,000	6,500	18,700	-3,200	167,529	17,029	108,117
2022 - 2023	183,778	134,947	0	10,000	6,500	18,700	-3,200	166,947	16,832	124,949
2023 - 2024	182,998	134,188	0	10,000	6,500	18,700	-3,200	166,188	16,811	141,760
2024 - 2025	182,218	133,281	0	10,000	6,500	18,700	-3,200	165,281	16,938	158,697
2025 - 2026	184,553	132,413	0	10,000	6,500	18,700	-3,200	164,413	20,141	178,838
2026 - 2027	186,888	131,603	0	10,000	6,500	18,700	-3,200	163,603	23,285	202,123
2027 - 2028	189,223	130,964	0	10,000	6,500	18,700	-3,200	162,964	26,259	228,382
2028 - 2029	191,558	130,485	0	10,000	6,500	18,700	-3,200	162,485	29,073	257,456
2029 - 2030	193,893	130,210	0	10,000	6,500	18,700	-3,200	162,210	31,683	289,139
2030 - 2031	196,072	130,010	0	0	0	18,700	0	148,710	47,362	336,501
2031 - 2032	198,251	129,810	0	0	0	18,700	0	148,510	49,742	386,243
2032 - 2033	200,431	129,610	0	0	0	18,700	0	148,310	52,121	438,364
2033 - 2034	202,610	129,410	0	0	0	18,700	0	148,110	54,500	492,864
2034 - 2035	204,789	129,210	0	0	0	18,700	0	147,910	56,880	549,744
Total	4,831,976	3,482,652	40,000	276,049	136,500	413,838	-66,806	4,282,233	579,066	
Average	185,845	133,948	1,538	10,617	5,250	15,917	-2,569	164,701	22,272	

1 --Linearly interpolated between planning years. No adjustment was made in Appropriate Pool production to account for increase ag production.
2 -- Safe yield estimate from the 2009 Production Optimization and Evaluation of the Peace II Project Description (WEI, 2009). Estimate includes new stormwater recharge from the
3 -- Based on Actual through 2010-11, IEUA 2010 Urban Water Management Plan starting in 2014-15 and thereafter, and linearly interpolated between 2010-11 and 2014-15.
4 -- Recycled water recharged in the Brooks Street Basin and the Seventh and Eighth Street Basins are actual through 2010-11 and planning estimates thereafter.
5 -- This is the net replenishment obligation based on the assumptions described in the text, negative values reported as zeros.

Table 2-8a
Historical Deliveries of Metropolitan's SWP Water to Recharge Basins - Fiscal Year 2000 to 2011
(acre-ft/yr)

Management Zone/Basin	1999/00	2000/01	2001/02	2002/03	2003/04	2004/05	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	Total
Recharge Basins in MZ 1													
College Heights East	0	0	0	0	0	0	1,798	1,337	0	0	0	0	3,135
College Heights West	0	0	0	0	0	0	3,528	1,788	0	0	382	559	6,257
Upland	0	0	0	0	0	0	5,986	7,068	0	0	0	899	13,953
Montclair 1, 2, 3, 4	1,001	6,530	6,500	6,499	7,582	7,887	5,579	10,681	0	0	4,593	3,672	60,524
Brooks	0	0	0	0	0	0	2,032	1,604	0	0	0	0	3,635
8th Street	0	0	0	0	0	0	0	0	0	0	3	448	451
7th Street	0	0	0	0	0	0	0	0	0	0	3	96	99
MZ 1 Total	1,001	6,530	6,500	6,499	7,582	7,887	18,923	22,477	0	0	4,981	5,674	88,055
Recharge Basins in MZ 2													
Ely 1-3	0	0	0	0	0	0	0	0	0	0	0	83	83
Turner 1& 2	0	0	0	0	0	310	151	243	0	0	0	0	704
Turner 3 & 4	0	0	0	0	0	0	195	70	0	0	0	0	265
Lower Day	0	0	0	0	0	107	2,810	2,266	0	0	3	893	6,079
Etiwanda Debris Basin	0	0	0	0	0	2,137	2,488	1,160	0	0	7	147	5,939
Victoria	0	0	0	0	0	0	0	0	0	0	2	69	71
San Sevaine 1	0	0	0	0	0	1,621	9,172	5,749	0	0	0	1,707	18,249
Hickory	0	0	0	0	0	197	636	212	0	0	7	10	1,062
MZ 2 Total	0	0	0	0	0	4,371	15,452	9,700	0	0	19	2,909	32,451
Recharge Basins in MZ 3													
Banana	0	0	0	0	0	0	193	783	0	0	0	0	976
RP3 Cell 1a	0	0	0	0	0	0	0	0	0	0	1	847	848
RP3 Cell 3b	0	0	0	0	0	0	0	0	0	0	0	36	36
MZ 3 Total	0	0	0	0	0	0	193	783	0	0	1	883	1,860
Fiscal Year Totals	1,001	6,530	6,500	6,499	7,582	12,259	34,567	32,960	0	0	5,001	9,466	122,365
Distribution by Management Zone													
MZ1	100%	100%	100%	100%	100%	64%	55%	68%	--	--	99.6%	60%	72%
MZ2	0%	0%	0%	0%	0%	36%	45%	29%	--	--	0.4%	31%	27%
MZ3	0%	0%	0%	0%	0%	0%	1%	2%	--	--	0.0%	9%	2%

Table 2-8b
Recycled Recharge - Fiscal Year 2000 to 2011
(acre-ft/yr)

Management Zone/Basin	1999/00	2000/01	2001/02	2002/03	2003/04	2004/05	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	Total
Recharge Basins in MZ 1													
College Heights East	0	0	0	0	0	0	0	0	0	0	0	0	0
College Heights West	0	0	0	0	0	0	0	0	0	0	0	0	0
Upland	0	0	0	0	0	0	0	0	0	0	0	0	0
Montclair 1, 2, 3, 4	0	0	0	0	0	0	0	0	0	0	0	0	0
Brooks	0	0	0	0	0	0	0	0	0	1,605	1,695	1,373	4,673
8th Street	0	0	0	0	0	0	0	0	1,054	352	999	1,586	3,991
7th Street	0	0	0	0	0	0	0	0	0	0	68	285	353
MZ 1 Total	0	0	0	0	0	0	0	0	1,054	1,957	2,762	3,244	9,017
Recharge Basins in MZ 2													
Ely 1-3	507	500	505	185	49	158	188	466	562	364	246	757	4,486
Turner 1& 2	0	0	0	0	0	0	0	624	0	97	38	8	767
Turner 3 & 4	0	0	0	0	0	0	0	613	0	74	359	45	1,091
Lower Day	0	0	0	0	0	0	0	0	0	0	0	0	0
Etiwanda Debris Basin	0	0	0	0	0	0	0	0	0	0	0	0	0
Victoria	0	0	0	0	0	0	0	0	0	0	0	778	778
San Sevaine 4 & 5	0	0	0	0	0	0	0	0	0	0	0	378	378
Hickory	0	0	0	0	0	0	586	647	567	46	856	785	3,487
MZ 2 Total	507	500	505	185	49	158	774	2,350	1,129	581	1,499	2,751	10,987
Recharge Basins in MZ 3													
Banana	0	0	0	0	0	0	529	643	157	40	898	267	2,534
RP3 Cell 1a	0	0	0	0	0	0	0	0	0	106	1,934	1,560	3,600
RP3 Cell 3b	0	0	0	0	0	0	0	0	0	0	117	188	305
MZ 3 Total	0	0	0	0	0	0	529	643	157	146	2,949	2,015	6,439
Fiscal Year Totals	507	500	505	185	49	158	1,303	2,993	2,340	2,684	7,210	8,010	26,443
Distribution by Management Zone													
MZ1	0%	0%	0%	0%	0%	0%	0%	0%	--	--	38.3%	40%	34%
MZ2	100%	100%	100%	100%	100%	100%	59%	79%	--	--	20.8%	34%	42%
MZ3	0%	0%	0%	0%	0%	0%	41%	21%	--	--	40.9%	25%	24%

Table 2-9

Historical and Projected Metropolitan Water Rates and IEUA Recycled Water Recharge Rate

($/acre-ft)

Year	Historical and Projected MWDSC Water Rates							IEUA Recycled Water Recharge Rate
	Replenishment Service	Untreated Tier 1 Service			Untreated Tier 2 Service			
		MWDSC	Low	High	MWDSC	Low	High	
2002	$233	$349						--
2003	$233	$326			$407			--
2004	$233	$326			$407			--
2005	$238	$331			$412			--
2006	$238	$331			$427			--
2007	$238	$331			$427			--
2008	$258	$351			$449			--
1/1/2009	$294	$412			$528			--
9/1/2009	$366	$484			$564			--
2010	$366	$484			$594			$89
2011	$409	$527			$652			$97
2012	$442	$560			$686			$145
2013	**	$593			$743			$195
2014	**	$593			$735			$255
2015	**	$617	$630	$658	$780	$780	$815	$335
2016	**	$641	$669	$730	$829	$829	$904	--
2017	**	$667	$710	$809	$880	$880	$1,003	--
2018	**	$694	$754	$898	$934	$934	$1,113	--
2019	**	$721	$800	$996	$992	$992	$1,234	--
2020	**	$750	$850	$1,104	$1,053	$1,053	$1,369	--
2021	**	$780	$902	$1,225	$1,119	$1,119	$1,518	--
2022	**	$812	$958	$1,359	$1,188	$1,188	$1,684	--
2023	**	$844	$1,017	$1,507	$1,261	$1,261	$1,868	--
2024	**	$878	$1,080	$1,672	$1,339	$1,339	$2,072	--
2025	**	$913	$1,147	$1,854	$1,422	$1,422	$2,298	--
2026	**	$949	$1,218	$2,057	$1,510	$1,510	$2,549	--
2027	**	$987	$1,293	$2,281	$1,603	$1,603	$2,828	--
2028	**	$1,027	$1,373	$2,530	$1,702	$1,702	$3,136	--
2029	**	$1,068	$1,458	$2,807	$1,807	$1,807	$3,479	--
2030	**	$1,111	$1,548	$3,113	$1,919	$1,919	$3,859	--
2031	**	$1,155	$1,644	$3,453	$2,038	$2,038	$4,280	--
2032	**	$1,201	$1,746	$3,830	$2,164	$2,164	$4,747	--
2033	**	$1,249	$1,854	$4,249	$2,297	$2,297	$5,266	--
2034	**	$1,299	$1,968	$4,713	$2,440	$2,440	$5,841	--
2035	**	$1,351	$2,090	$5,227	$2,590	$2,590	$6,479	--
2036	**	$1,405	$2,219	$5,798	$2,750	$2,750	$7,186	--
2037	**	$1,462	$2,356	$6,431	$2,921	$2,921	$7,971	--
2038	**	$1,520	$2,502	$7,133	$3,101	$3,101	$8,841	--
2039	**	$1,581	$2,657	$7,912	$3,293	$3,293	$9,807	--
2040	**	$1,644	$2,821	$8,776	$3,496	$3,496	$10,878	--
2041	**	$1,710	$2,995	$9,735	$3,712	$3,712	$12,066	--
2042	**	$1,778	$3,180	$10,798	$3,942	$3,942	$13,383	--
2043	**	$1,849	$3,377	$11,977	$4,186	$4,186	$14,845	--
Present Value Cost, 2014 through 2043		$15,538	$21,024	$44,000	$19,259	$26,058	$54,536	--

6.18% Low rate ensemble average (2003 - 2014)

10.92% High rate ensemble average (2007 - 2012)

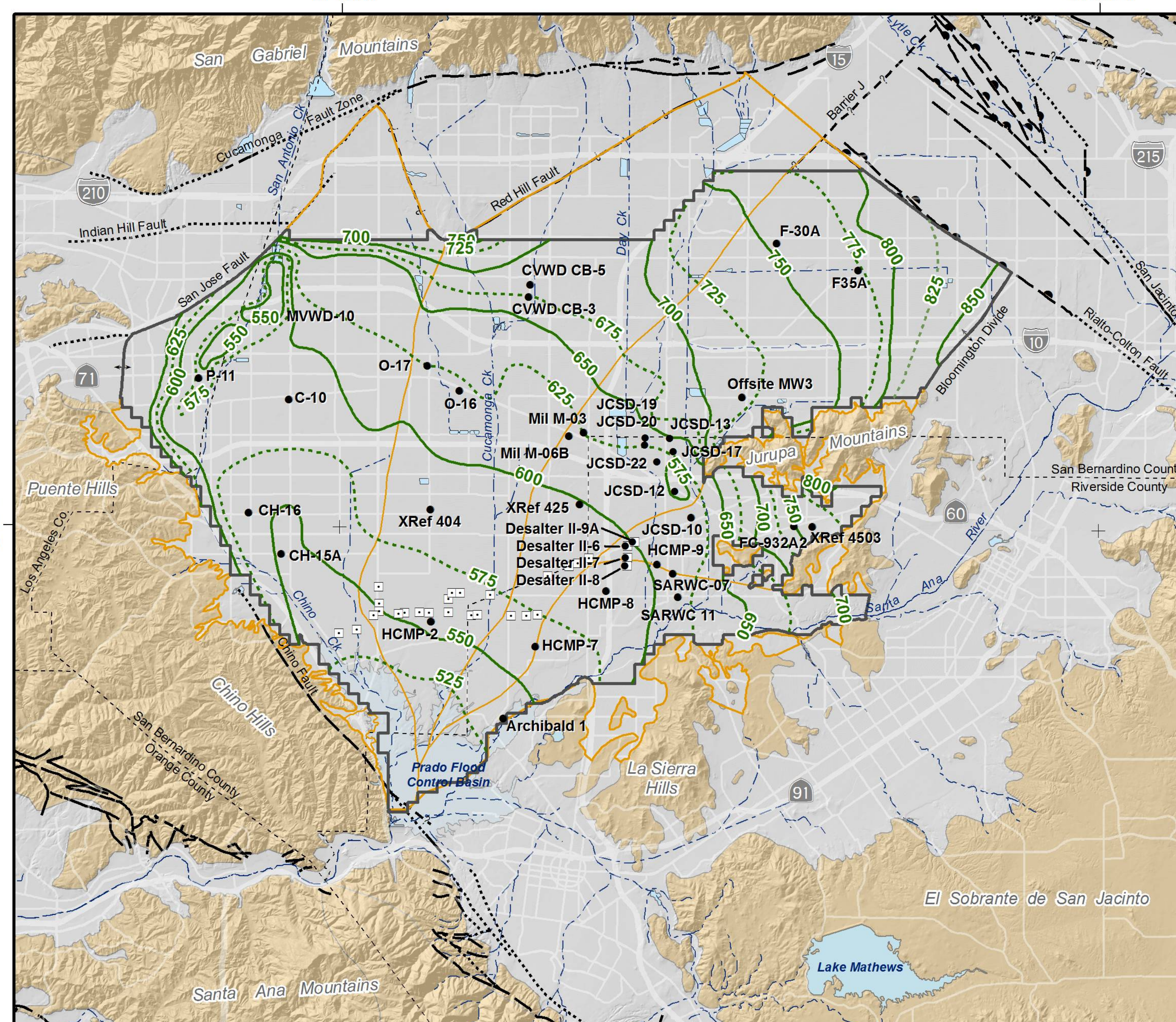
5.00% Assumed bond rate

4.00% MWDSC projected rate for 2013-2017 from page 27 of biennial budget report for fiscal years 12/13 and 13/14 and were obtained from http://www.mwdh2o.com/mwdh2o/pages/finance/finance01.html

** Replenishment water service assumed not available.

-- Rate projection unavailable

Grey shaded values are historical or MWDSC Board-approved rates and were obtained from http://www.mwdh2o.com/mwdh2o/pages/finance/finance01.html



Groundwater Elevation Contours (feet above mean sea-level)

Boundary of Contoured Area (Contours are not shown outside of this boundary due to a lack of water level data.)

Well used for Time History Analysis (Figures 2-6a-e and 2-7a-b)

Other Features

OBMP Management Zones

Chino Desalter Well

Groundwater Divides

Flood Control/Conservation Basins

Streams, Rivers, and Channels

Geology

Water-Bearing Sediments

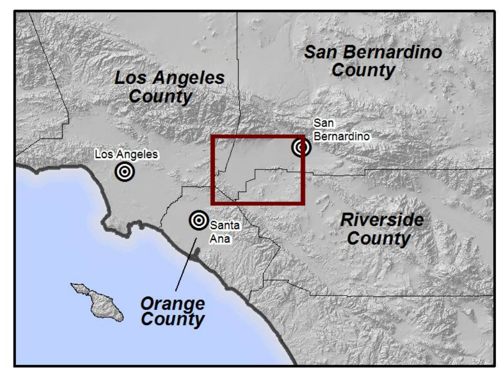
Quaternary Alluvium

Consolidated Bedrock

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

Faults

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



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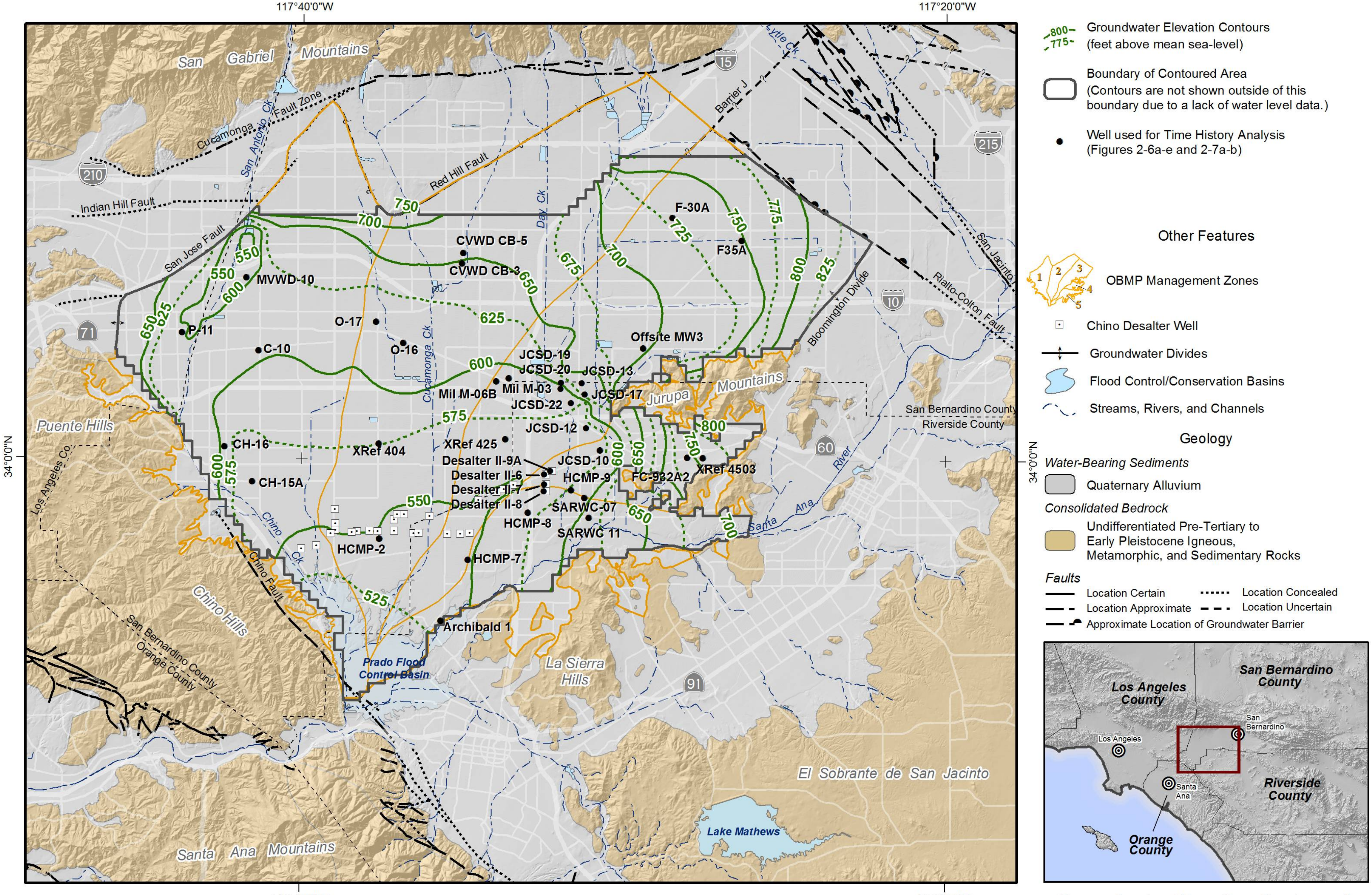
0 1 2 3 4 Miles
0 2 4 6 Kilometers

2013 Recharge Masterplan Update

Groundwater Elevation Contours for Layer 1
Spring 2000

Figure 2-1a



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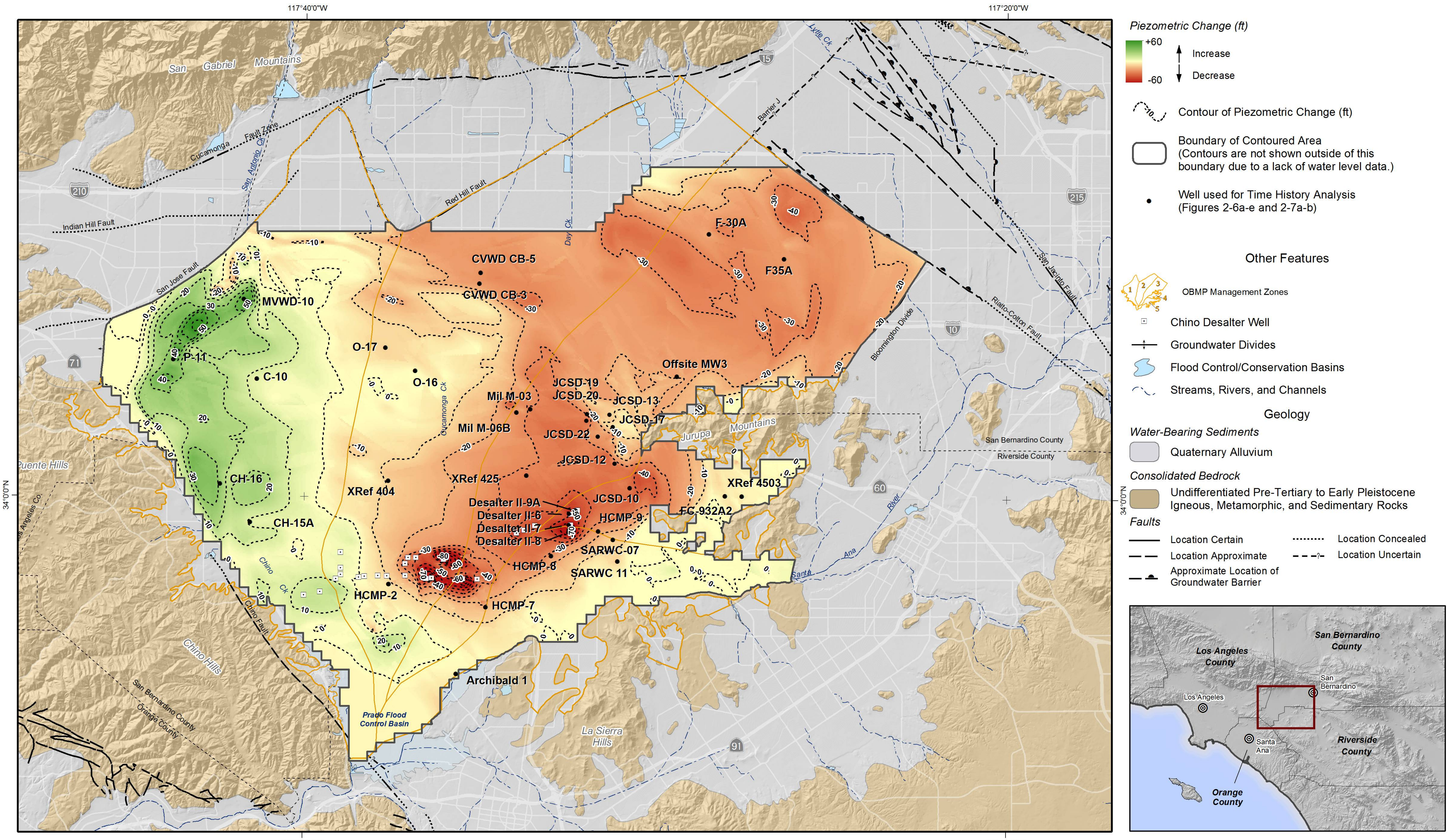
2013 Recharge Masterplan Update

Groundwater Elevation Contours for Layer 1
Spring 2010

Figure 2-1b



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2013 Recharge Masterplan Update

Groundwater Level Change for Layer 1

Spring 2000 to Spring 2010

Figure 2-2

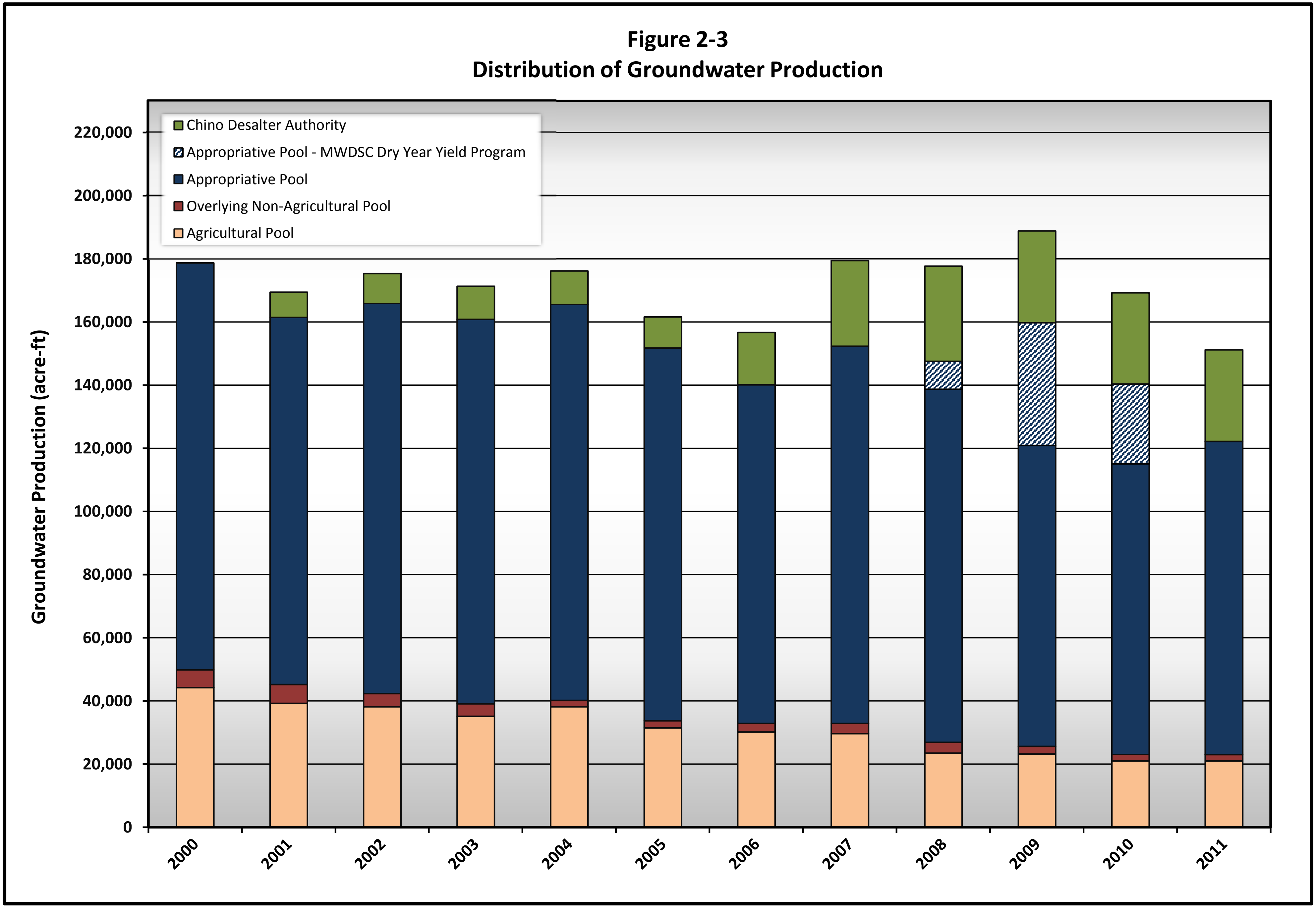
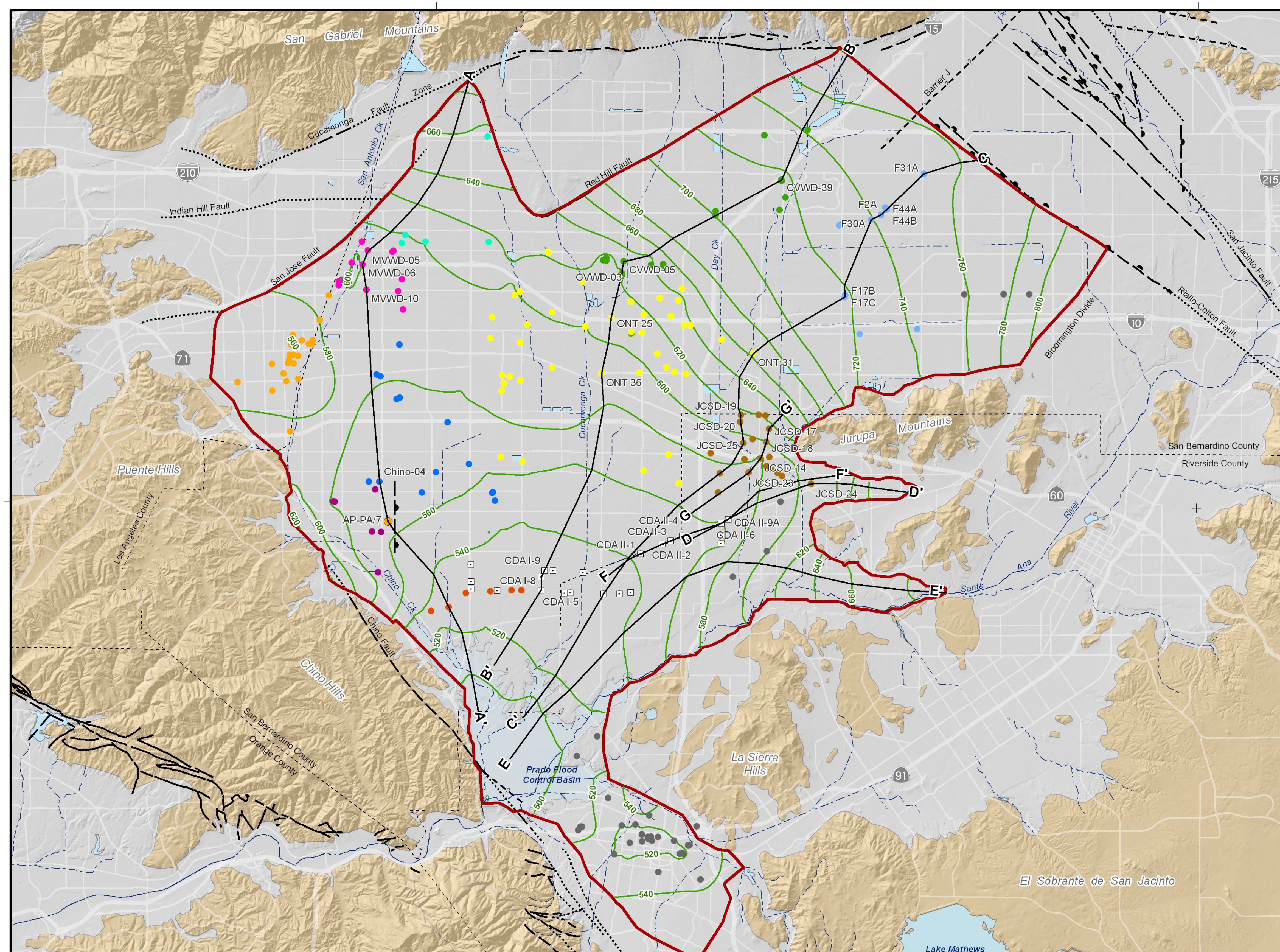


Figure2-3.xlsx -- Figure 2-3_RMPU_2000_11



Cross-section Profile

April 2010 Groundwater Elevation Contours *(feet above mean sea-level)*

Production Wells

- Chino Desalter Authority
- City of Chino
- City of Chino Hills
- City of Ontario
- City of Pomona
- City of Upland
- Cucamonga Valley Water District
- Fontana Water Company
- Jurupa Community Services District
- Monte Vista Water District
- Other Appropriators

Other Features

- Groundwater Flow Model Boundary
- Groundwater Divides
- Flood Control/Conservation Basins
- Streams, Rivers, and Channels

Geology

Water-Bearing Sediments

- Quaternary Alluvium

Consolidated Bedrock

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

Faults

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

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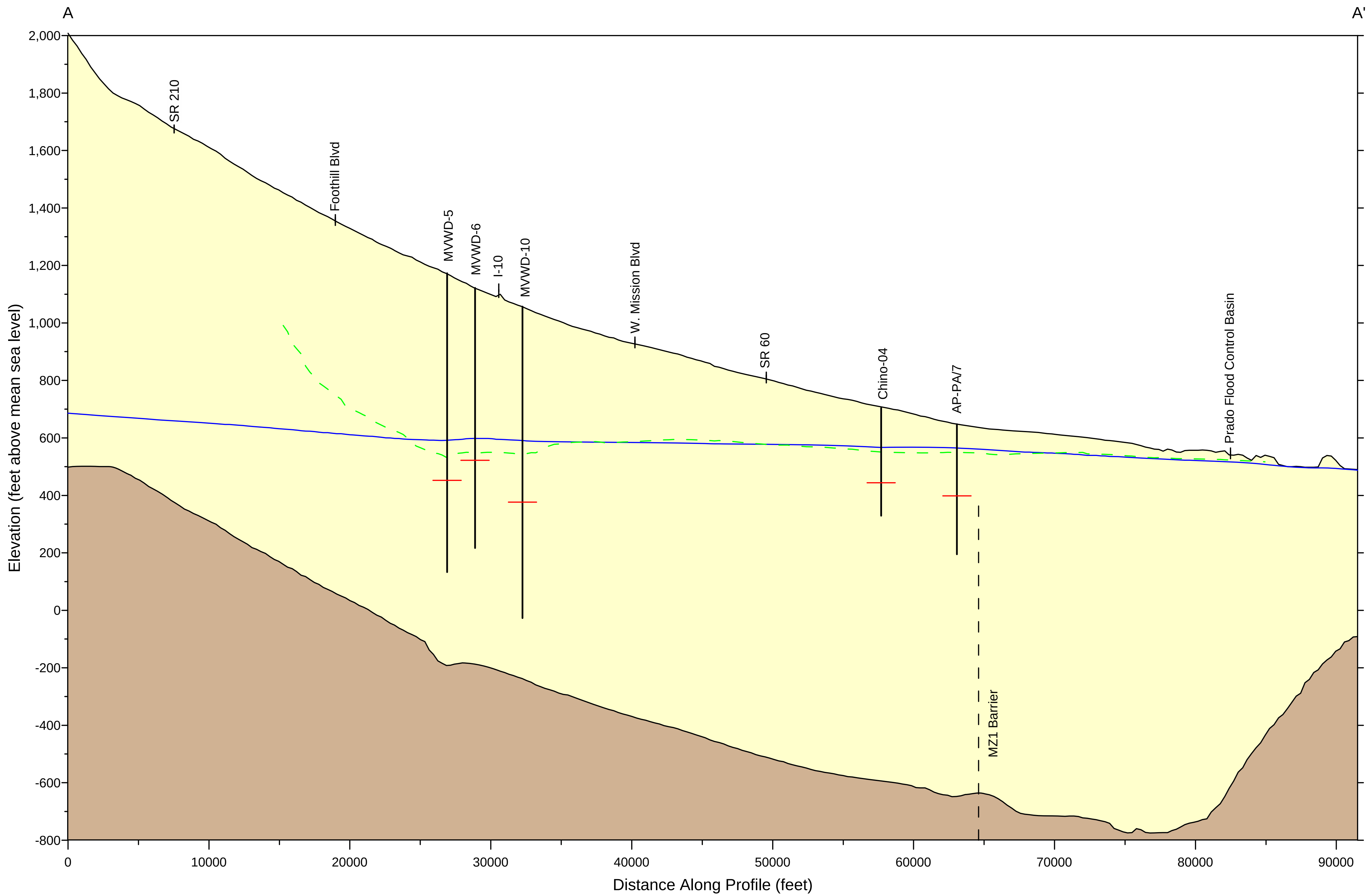
0 1 2 3 4 Miles

0 2 4 6 Kilometers

2013 Recharge Masterplan Update

Flow-line Based Cross-section Profiles
for the 2010 Initial Groundwater Condition

Figure 2-4



Vertical Exaggeration: 20x

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File: Figure2-4a.grf

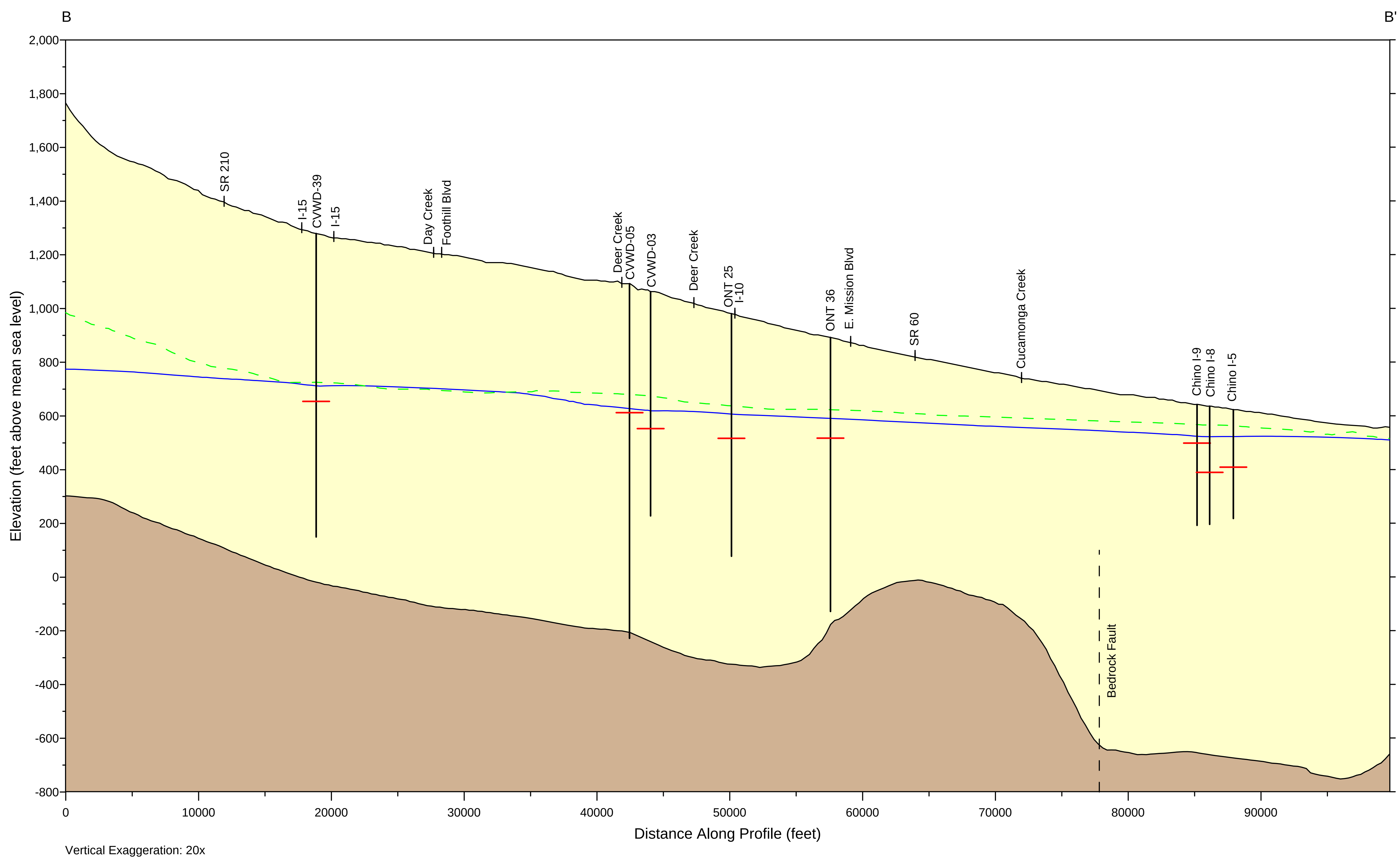
Explanation

- Freshwater Aquifer
- Effective Base Freshwater Aquifer
- Groundwater Well Showing Sustainability Metric
- Water Level (Spring 2000)
- Water Level (April 2010)

2013 Recharge Master Plan Update
Groundwater Level Conditions

Groundwater Level Conditions in 2000 and 2010
MZ1

Figure 2-5a



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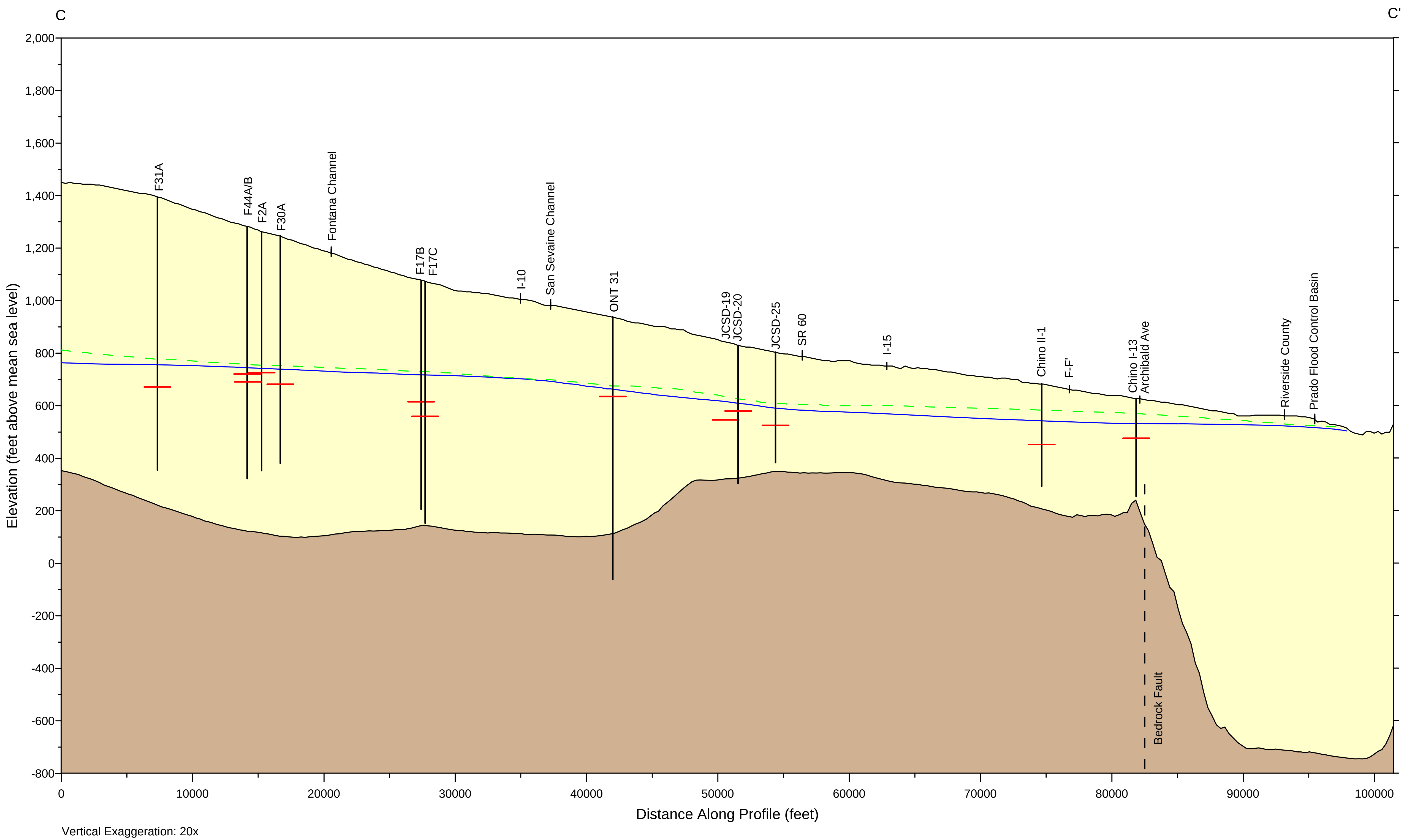
Explanation

Freshwater Aquifer	Water Level (Spring 2000)
Effective Base Freshwater Aquifer	Water Level (April 2010)
Groundwater Well Showing Sustainability Metric	

2013 Recharge Master Plan Update
Groundwater Level Conditions

Groundwater Level Conditions in 2000 and 2010
MZ2

Figure 2-5b



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File: Figure2-4c.grf

Explanation

- Freshwater Aquifer
- Effective Base Freshwater Aquifer
- Groundwater Well Showing Sustainability Metric
- Water Level (Spring 2000)
- Water Level (April 2010)

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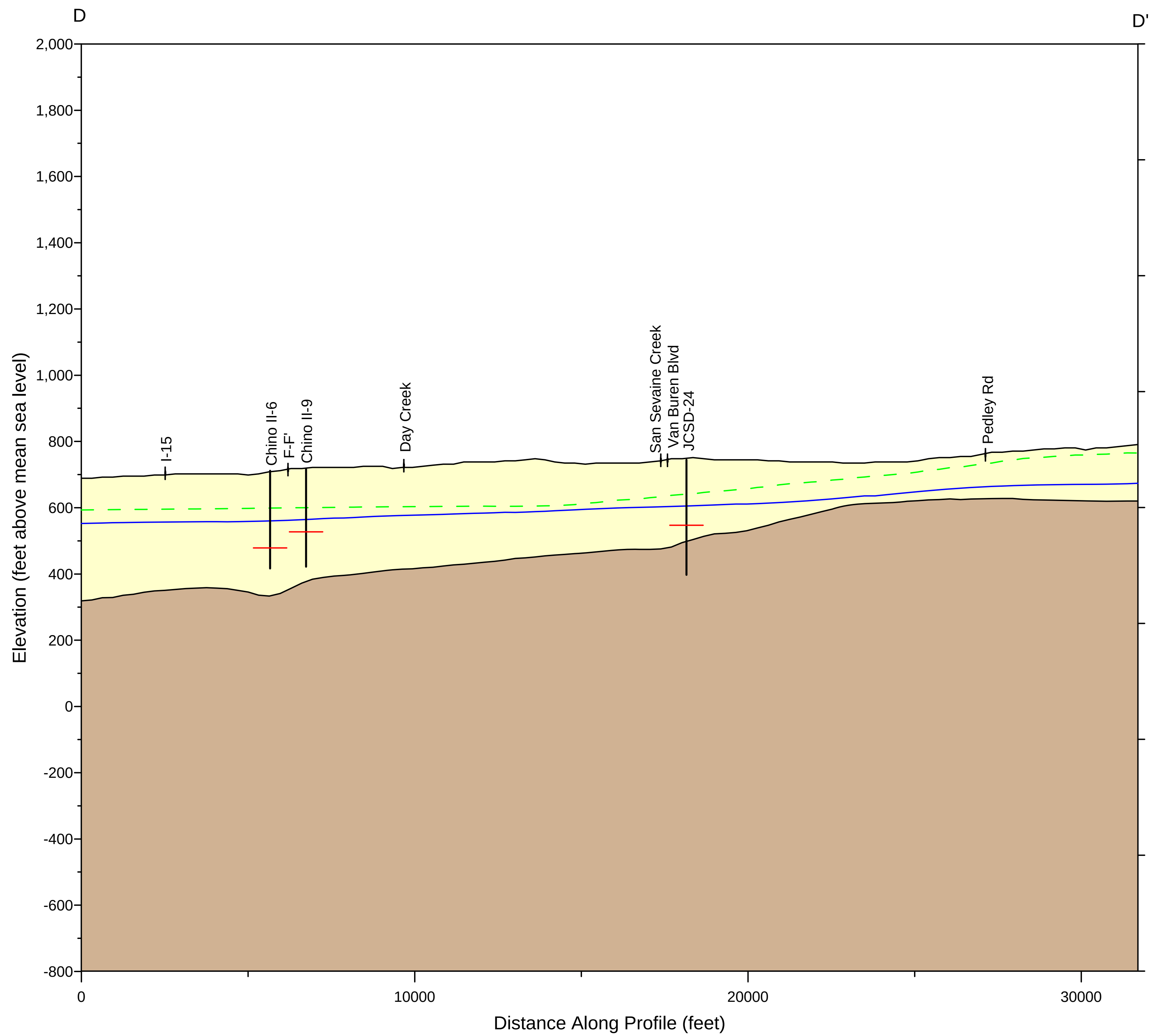
2013 Recharge Master Plan Update
Groundwater Level Conditions

Groundwater Level Conditions in 2000 and 2010
MZ3

Figure 2-5c



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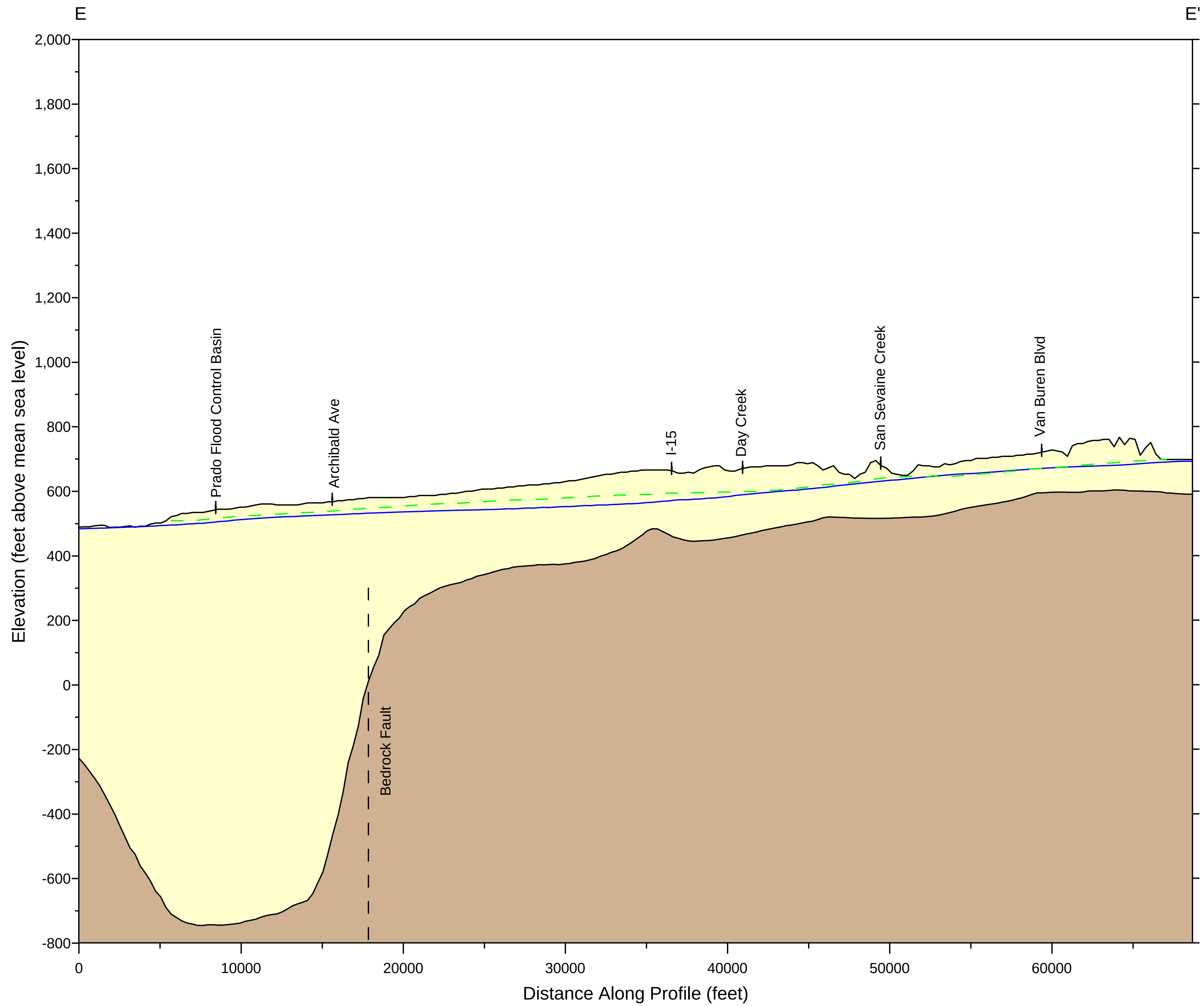
Explanation

- Freshwater Aquifer
- Effective Base Freshwater Aquifer
- Groundwater Well Showing Sustainability Metric
- Water Level (Spring 2000)
- Water Level (April 2010)

2013 Recharge Master Plan Update
Groundwater Level Conditions

Groundwater Level Conditions in 2000 and 2010
MZ4

Figure 2-5d



Vertical Exaggeration: 20x

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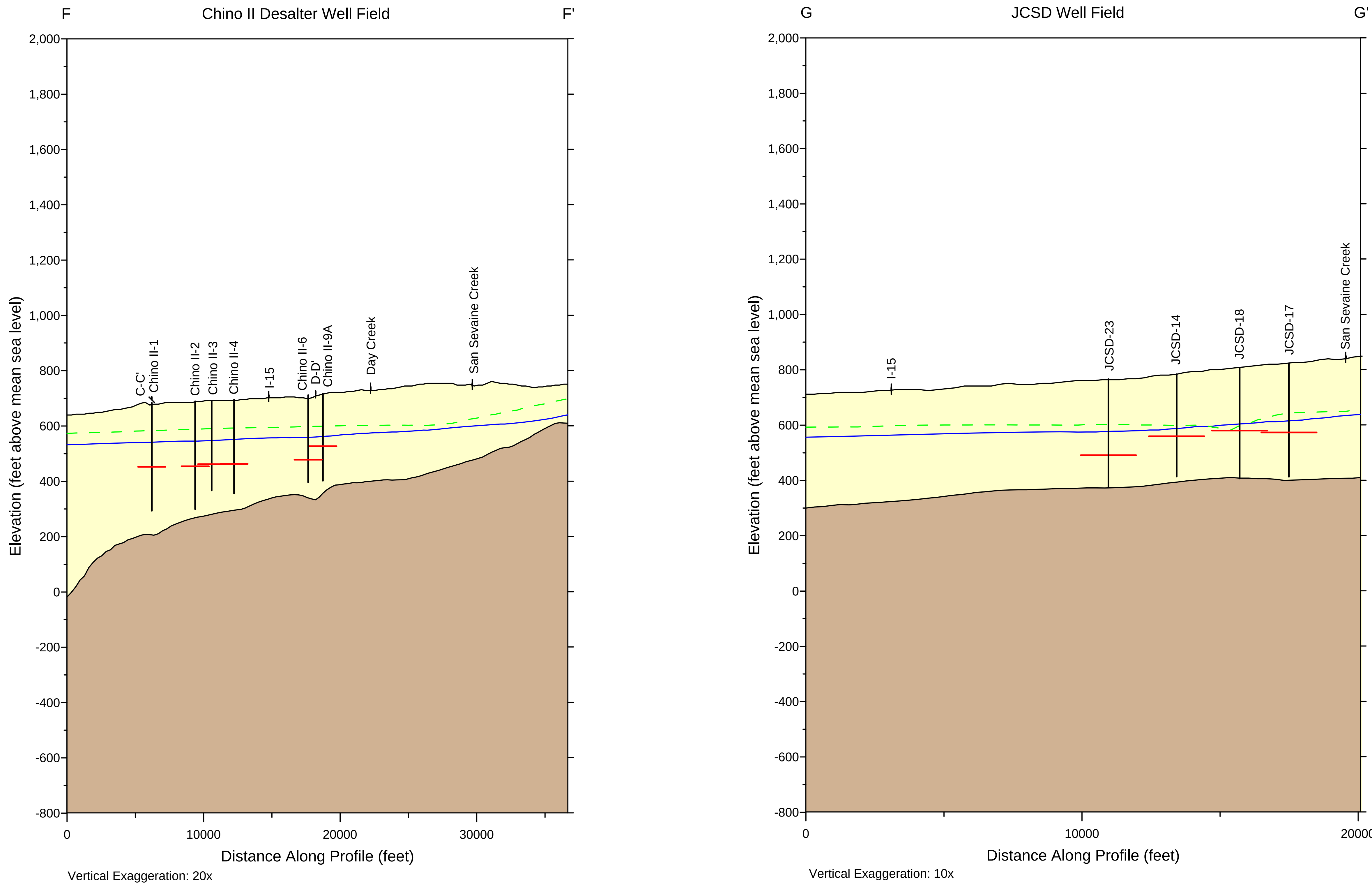
Explanation

- Freshwater Aquifer
- Effective Base Freshwater Aquifer
- Groundwater Well Showing Sustainability Metric
- Water Level (Spring 2000)
- Water Level (April 2010)

2013 Recharge Master Plan Update
Groundwater Level Conditions

Groundwater Level Conditions in 2000 and 2010
MZ5

Figure 2-5e



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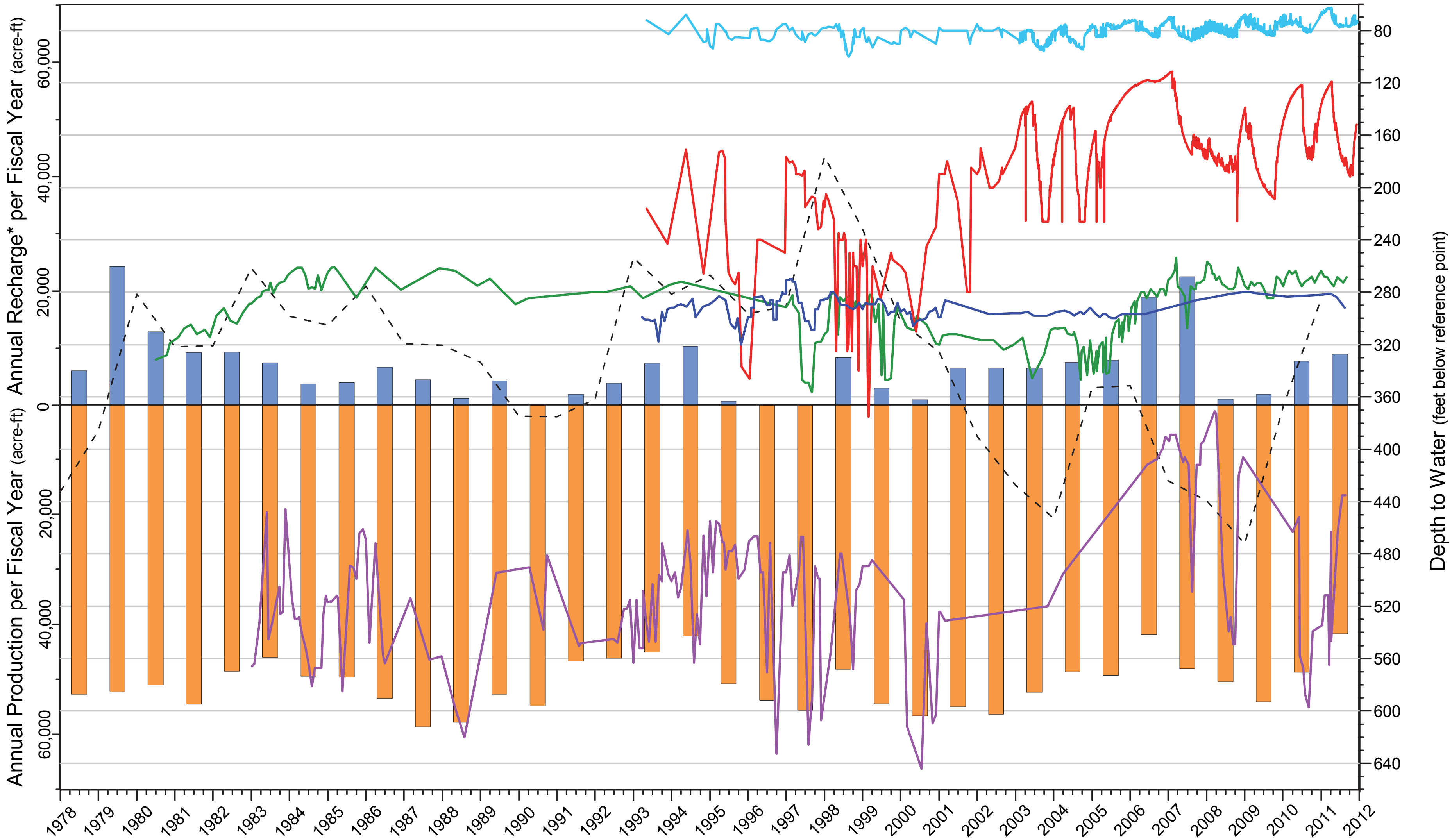
Explanation

- Freshwater Aquifer
- Effective Base Freshwater Aquifer
- Groundwater Well Showing Sustainability Metric
- Water Level (Spring 2000)
- Water Level (April 2010)

2013 Recharge Master Plan Update
Groundwater Level Conditions

Groundwater Level Conditions in 2000 and 2010
Chino II Desalters and JCSD Wells

Figure 2-5f



* Recharge includes imported water and recycled water delivered to recharge basins; it does not include in-lieu replenishment water.

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Water Levels (top-bottom of well screen)

- MVWD-10 (540-1,084 ft-bgs)
- P-11 (168-550 ft-bgs)
- C-10 (350-1,090 ft-bgs)
- CH-16 (430-940 ft-bgs)
- CH-15A (190-310 ft-bgs)

Production and Recharge

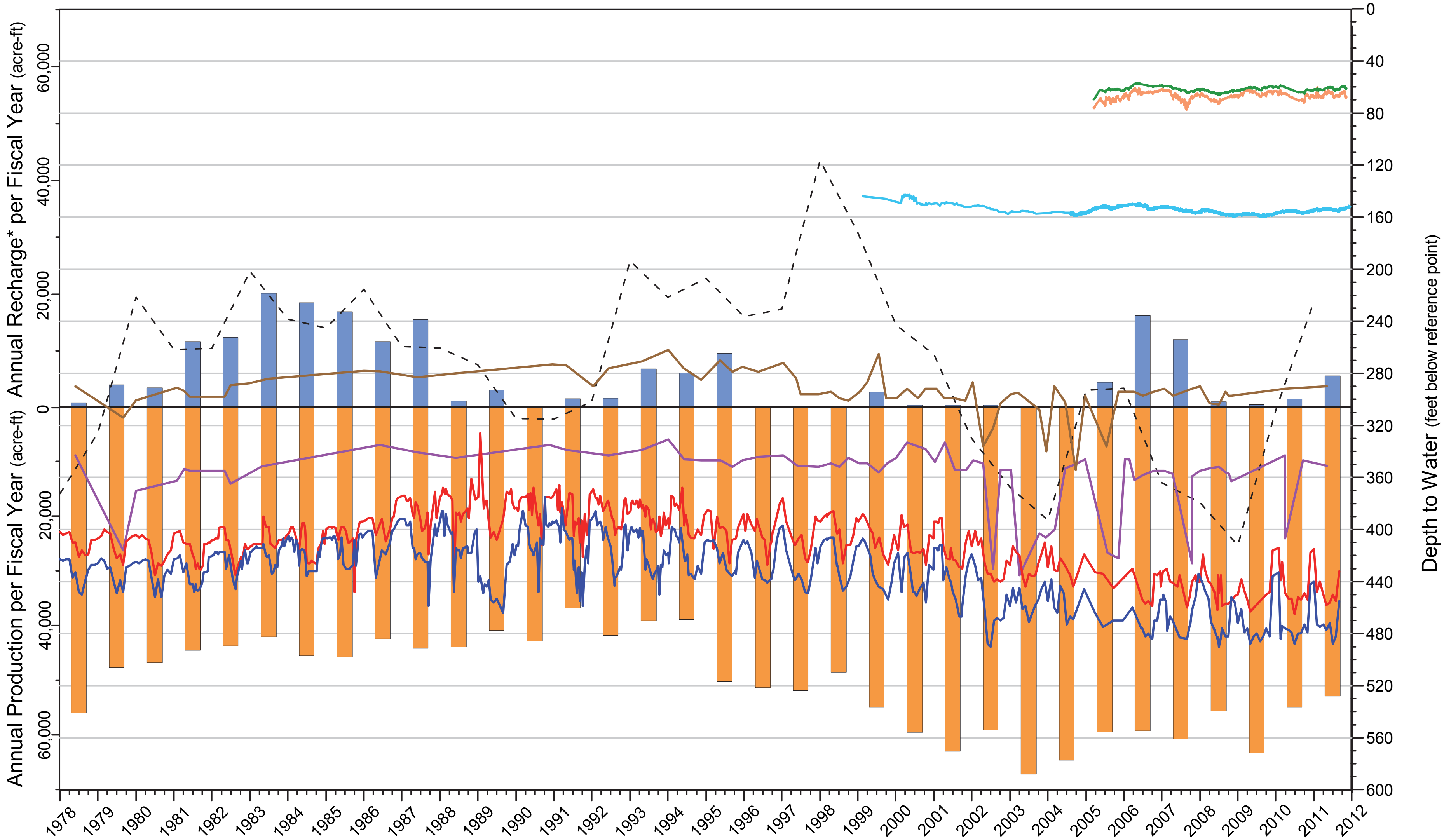
- Recharge*
- Groundwater Production
- Cumulative Departure from Mean Precipitation

2013 Recharge Master Plan Update

Long-Term Trends in Groundwater Levels versus Climate, Production, and Recharge - *MZ1*

1978 to 2011

Figure 2-6a



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File: Figure_2-6b.grf

Water Levels (top-bottom of well screen)

- CVWD CB-5 (538-1,238 ft-bgs)
- CVWD CB-3 (341-810 ft-bgs)
- O-17 (415-1,007 ft-bgs)
- O-16 (366-630 ft-bgs)
- X Ref 404 (274-354 ft-bgs)
- HCMP 2/1 (124-164 ft-bgs)
- HCMP 2/2 (296-316 ft-bgs)

Production and Recharge

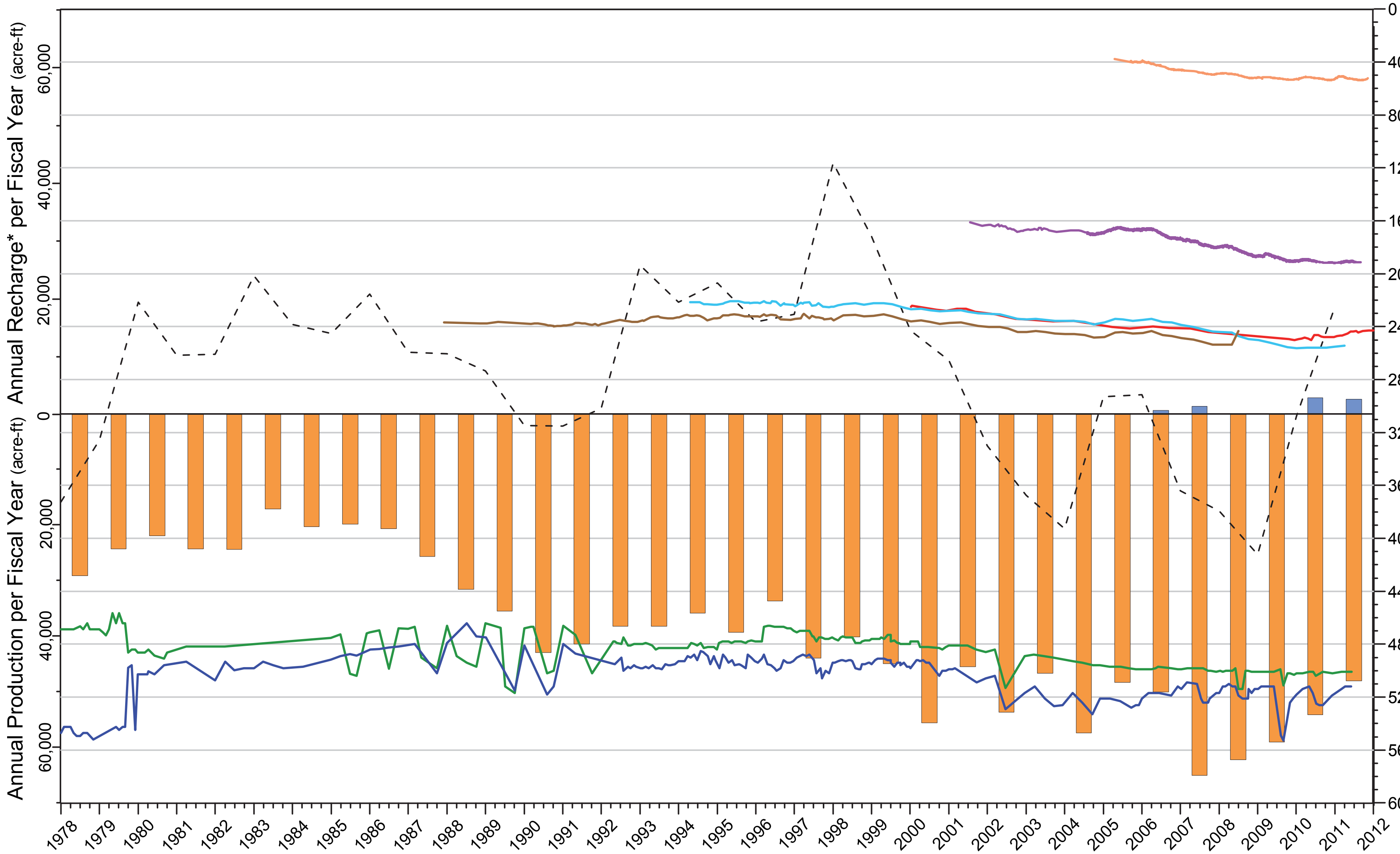
- Recharge*
- Groundwater Production
- Cumulative Departure from Mean Precipitation

2013 Recharge Master Plan Update

Long-Term Trends in Groundwater Levels versus Climate, Production, and Recharge - *MZ2*

1978 to 2011

Figure 2-6b



* Recharge includes imported water and recycled water delivered to recharge basins; it does not include in-lieu replenishment water.

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File: Figure_2-6c.grf

Water Levels (top-bottom of well screen)

- F-30A (507-864 ft-bgs)
- F-35A (700-852 ft-bgs)
- Mil M-03 (244-262 ft-bgs)
- Mil M-06B (255-275 ft-bgs)
- Offsite MW3 (no perf data)
- XRef 425 (no perf data)
- HCMP-7/1 (70-110 ft-bgs)

Production and Recharge

- Recharge*
- Groundwater Production
- Cumulative Departure from Mean Precipitation

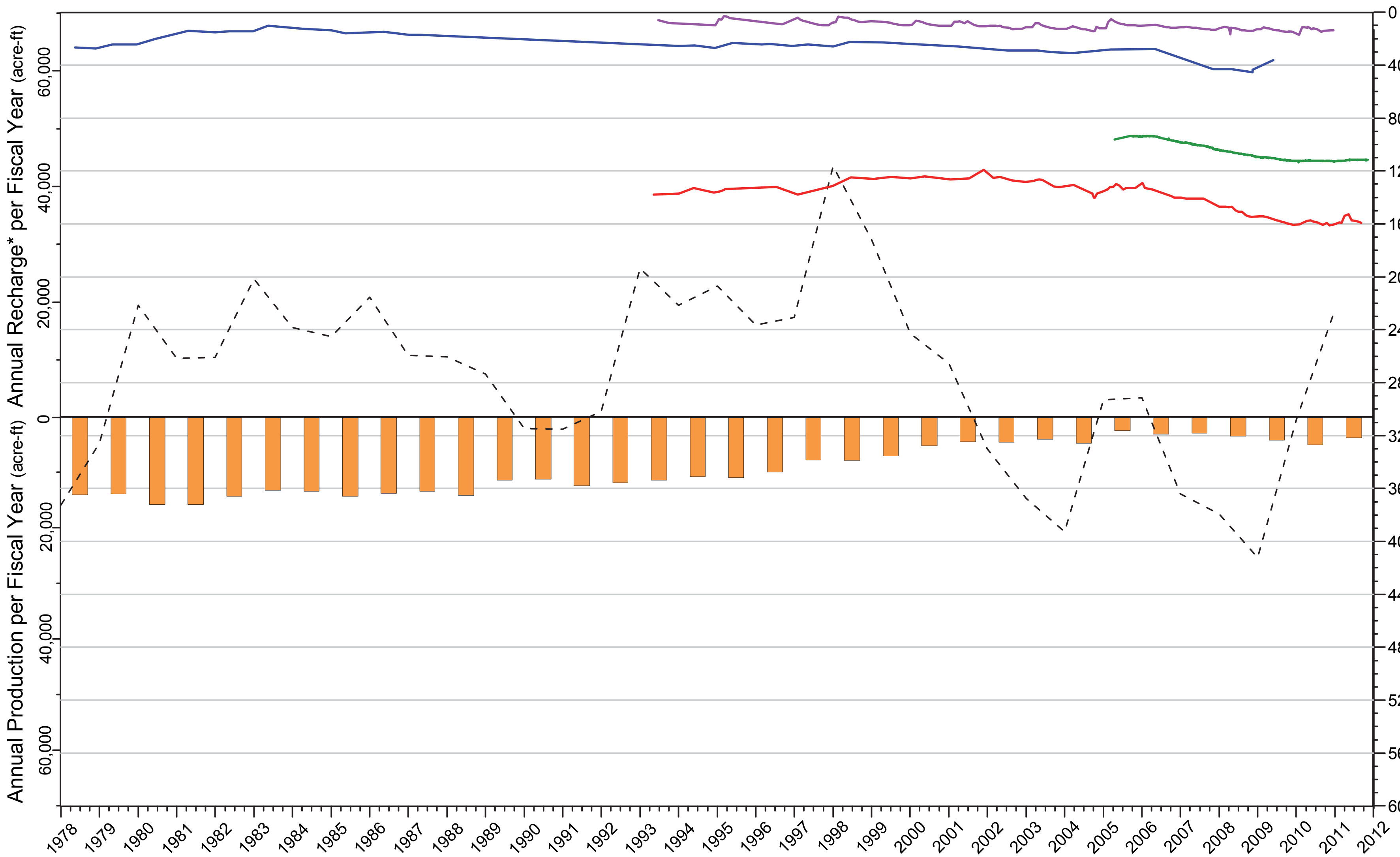
CHINO BASIN WATERMASTER Partners in Basin Management

2013 Recharge Master Plan Update

Long-Term Trends in Groundwater Levels versus Climate, Production, and Recharge - *MZ3*

1978 to 2011

Figure 2-6c



* Recharge includes imported water and recycled water delivered to recharge basins; it does not include in-lieu replenishment water. No imported or recycled waters are delivered to basins within MZ4.

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Water Levels (top-bottom of well screen)

- JCSD-10 (no perf data)
- HCMP-9/1 (110-150 ft-bgs)
- X Ref 4503 (no perf data)
- FC-932A2 (no perf data)

Production and Recharge

- Groundwater Production
- Cumulative Departure from Mean Precipitation

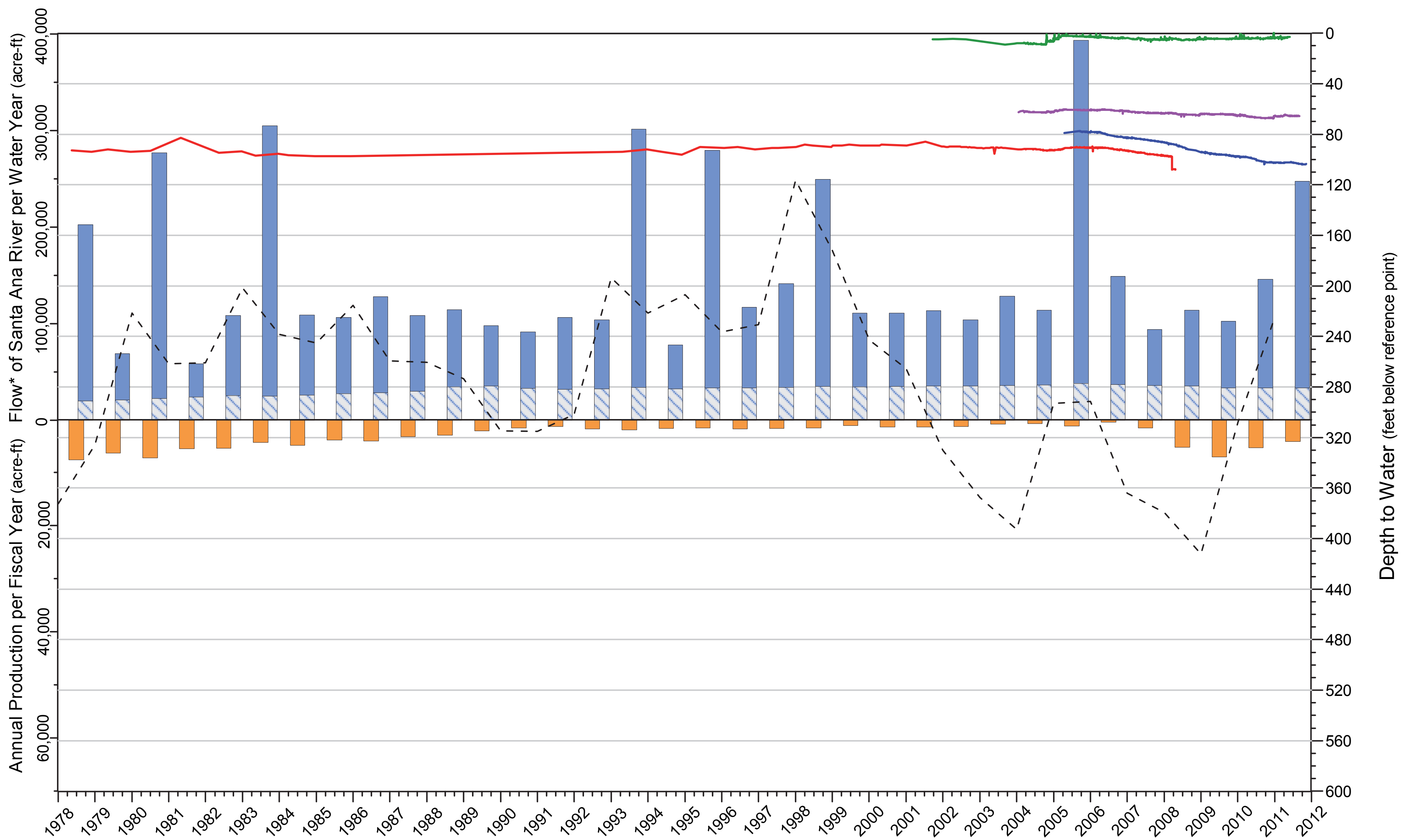
CHINO BASIN WATERMASTER — Partners in Basin Management

2013 Recharge Master Plan Update

Long-Term Trends in Groundwater Levels versus Climate, Production, and Recharge - *MZ4*

1978 to 2011

Figure 2-6d



* Flow of the Santa Ana River through Management Zone 5 includes the flow measured at the USGS gauging station at Riverside Narrows plus effluent discharge from City of Riverside Wastewater Treatment Plant.

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Water Levels (top-bottom of well screen)

- SARWC-07 (100-172 ft-bgs)
- HCMP-8/1 (75-115 ft-bgs)
- SARWC-11 (75-230 ft-bgs)
- Archibald-1 (75-85 ft-bgs)

Production and Recharge

- City of Riverside WWTP
- Santa Ana River at Riverside Narrows
- Groundwater Production
- Cumulative Departure from Mean Precipitation

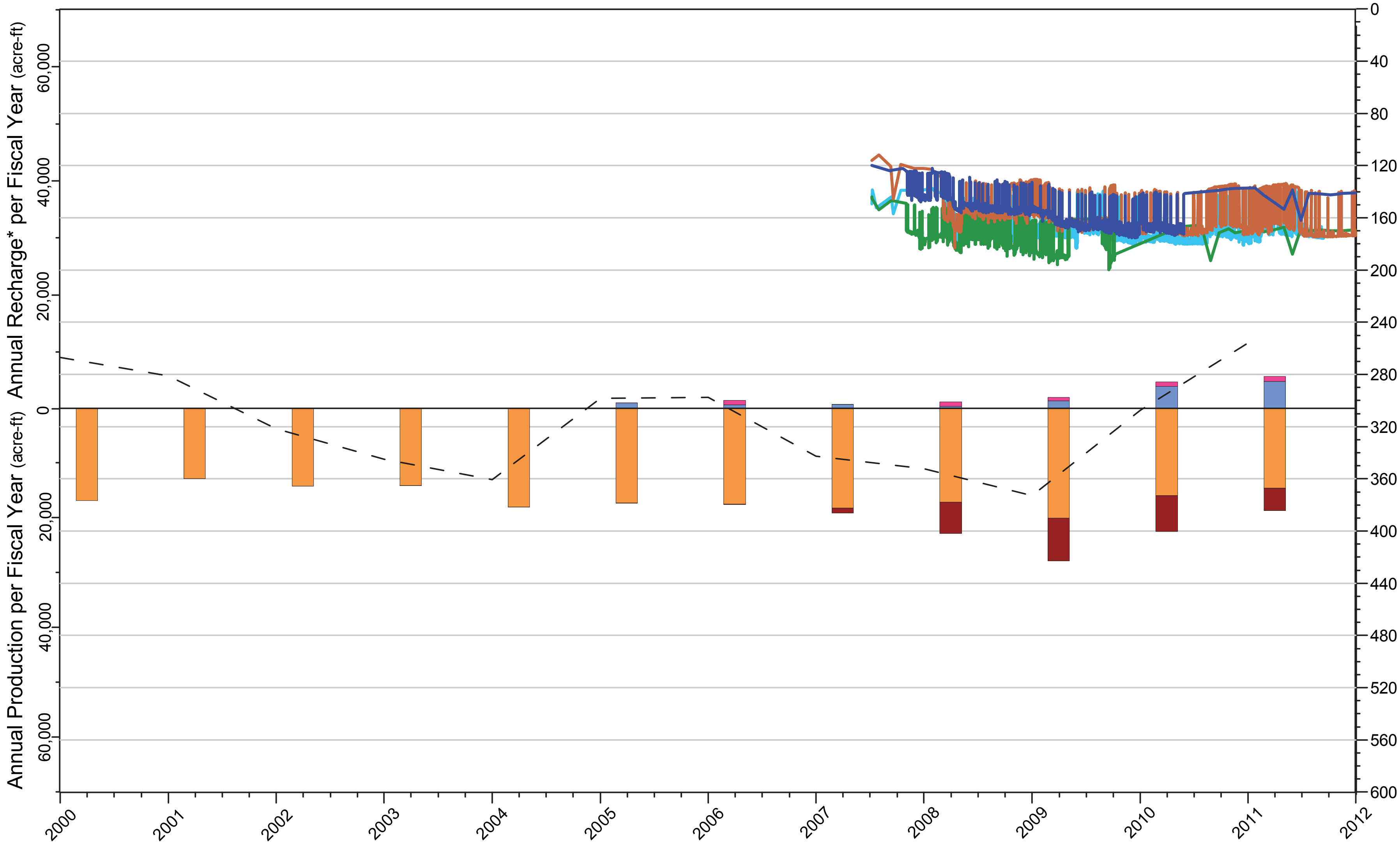
CHINO BASIN WATERMASTER — Partners in Basin Management

2013 Recharge Master Plan Update

Long-Term Trends in Groundwater Levels versus Climate, Production, and Recharge - *MZ5*

1978 to 2011

Figure 2-6e



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Water Levels (top-bottom of well screen)

- Desalter II-6 (150-295 ft-bgs)
- Desalter II-7 (140-245 ft-bgs)
- Desalter II-8 (130-230 ft-bgs)
- Desalter II-9A (160-295 ft-bgs)

Production and Recharge

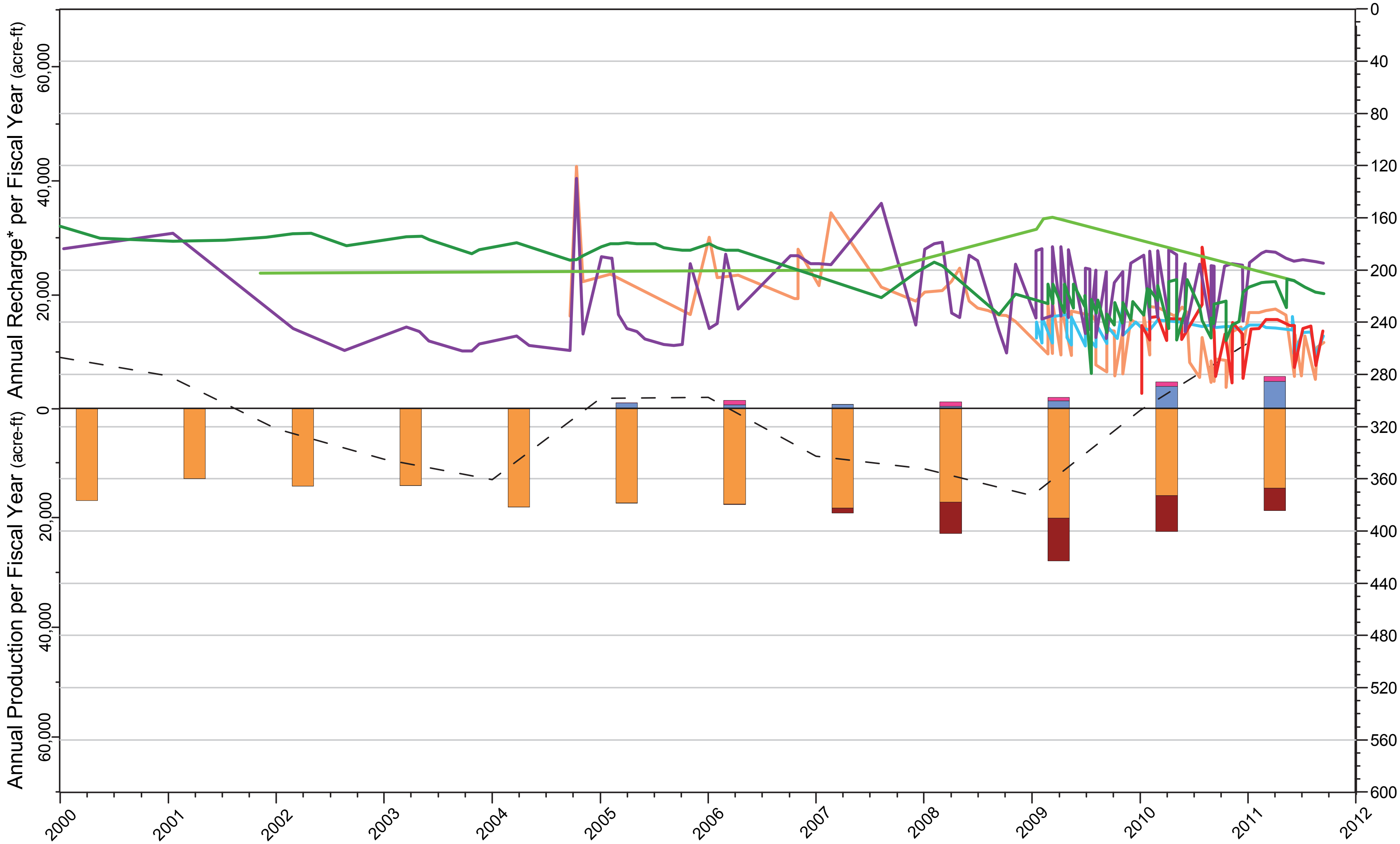
- Recharge to RP3 Basin*
- JCSD Production
- Recharge to Declez Basin*
- Desalter-II Production
- Cumulative Departure from Mean Precipitation

2013 Recharge Master Plan Update

Long-Term Trends in Groundwater Levels versus Climate, Production, and Recharge - *Desalter-II Wells*

2000 to 2011

Figure 2-7a



* Recharge includes imported water and recycled water delivered to recharge basins, and does not include in-lieu replenishment water.

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Water Levels (top-bottom of well screen)

- JCSD 12 (215-330 ft-bgs)
- JCSD 13 (220-446 ft-bgs)
- JCSD 17 (250-400 ft-bgs)
- JCSD 19 (no perf data)
- JCSD 20 (170-406 ft-bgs)
- JCSD 22 (no perf data)

Production and Recharge

- Recharge to RP3 Basin*
- Recharge to Declez Basin*
- JCSD Production
- Desalter-II Production
- Cumulative Departure from Mean Precipitation

CHINO BASIN WATERMASTER *Partners in Basin Management*

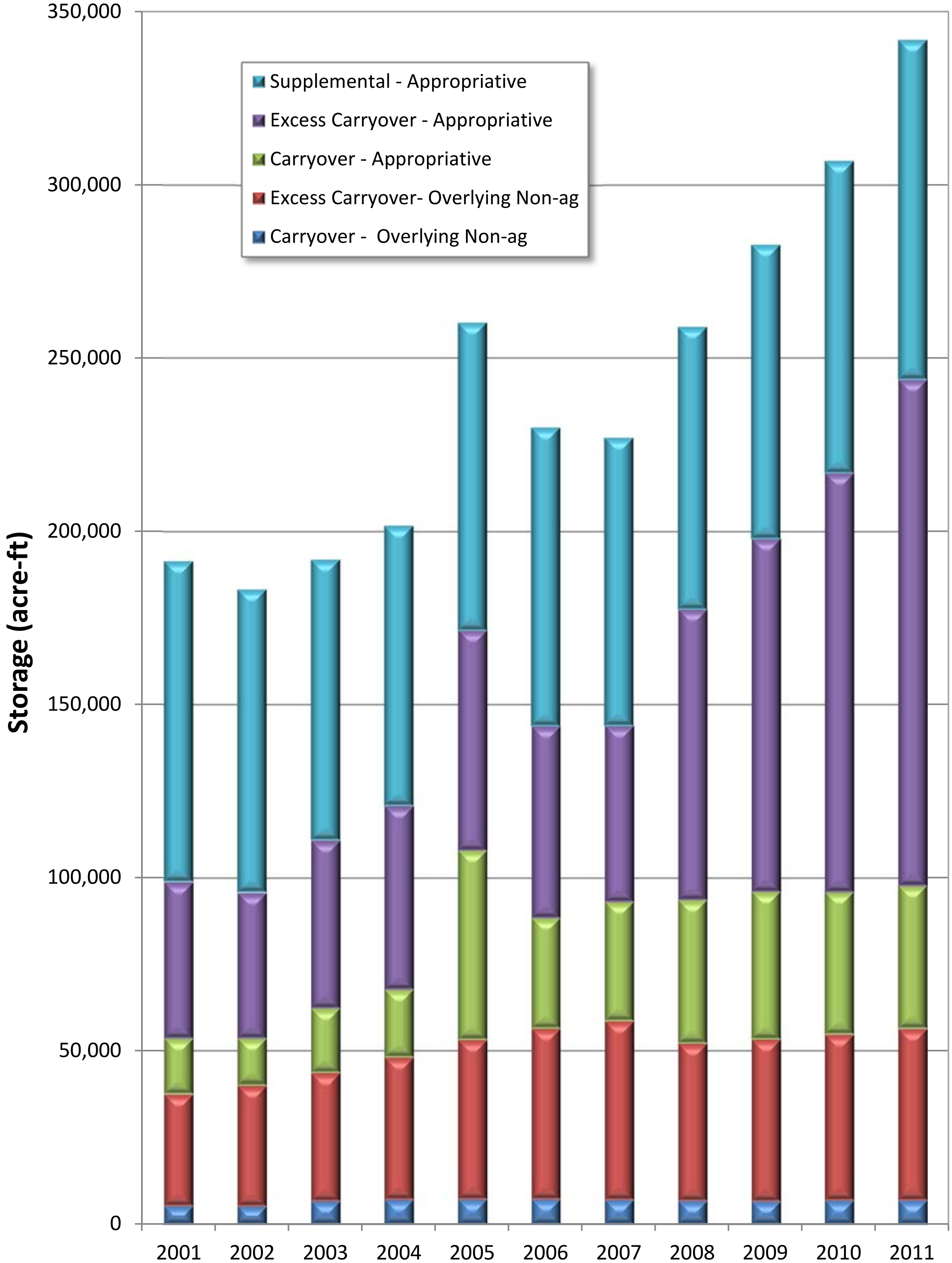
2013 Recharge Master Plan Update

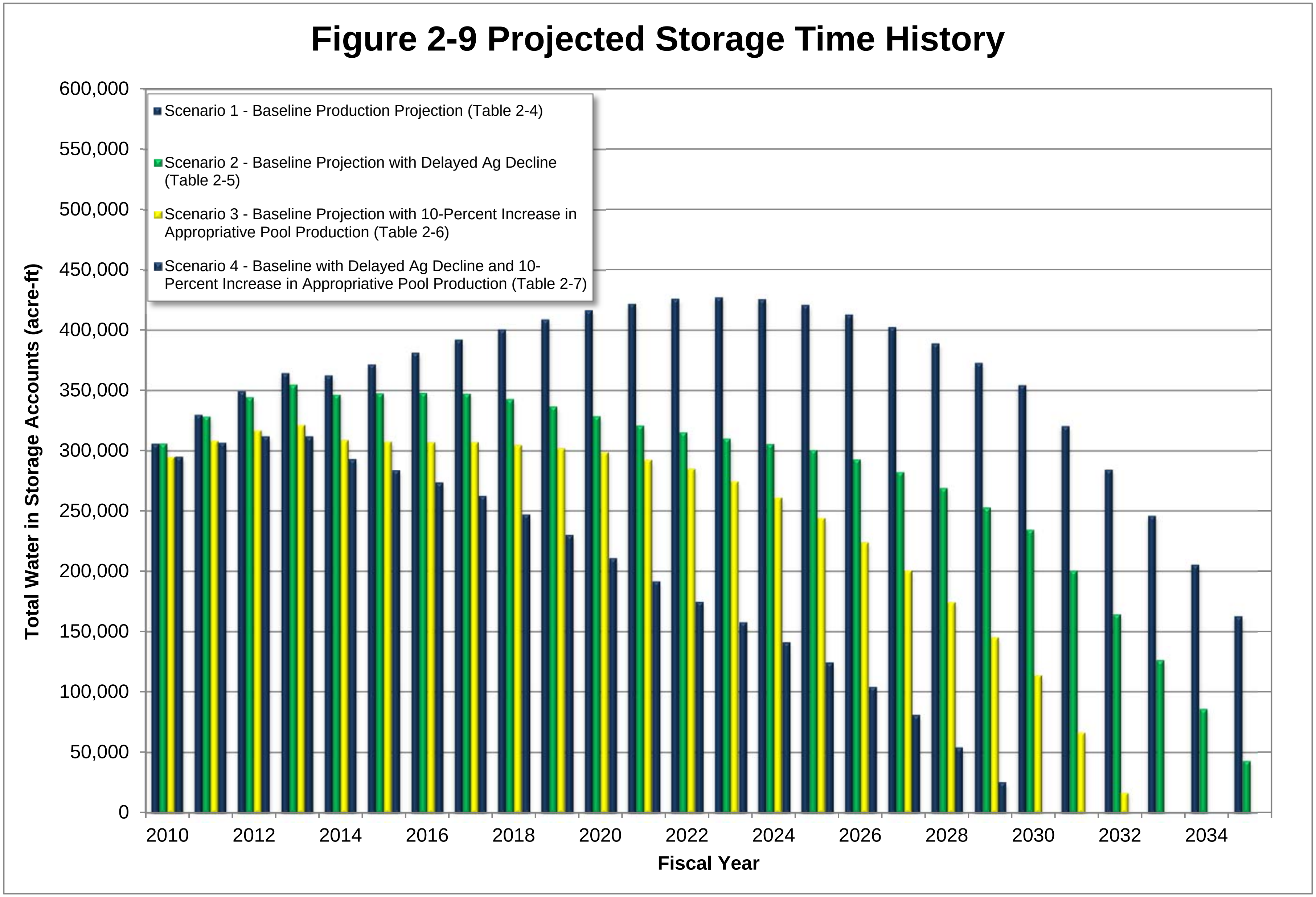
Long-Term Trends in Groundwater Levels versus Climate, Production, and Recharge - *JCSD Wells*

2000 to 2011

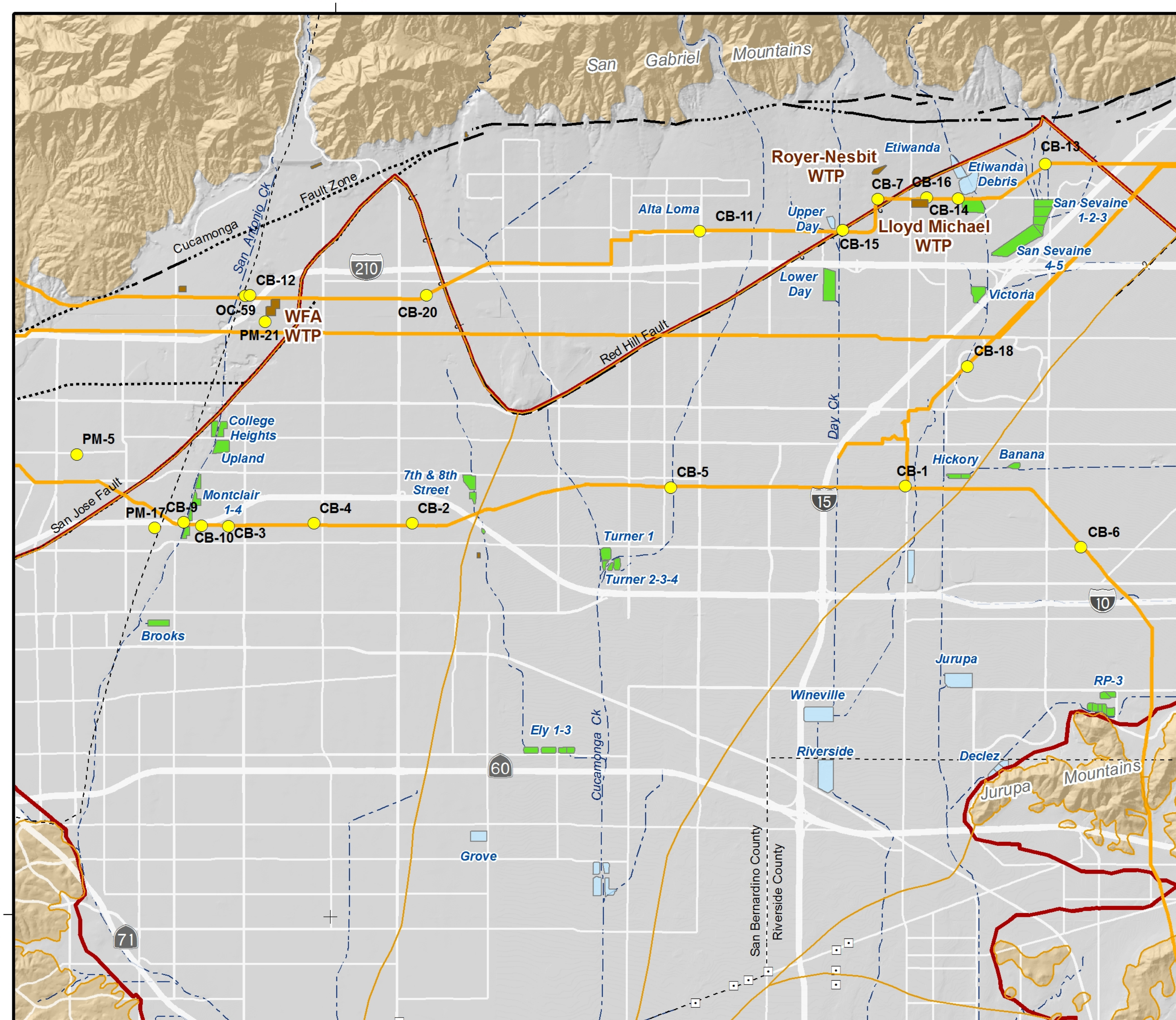
Figure 2-7b

Figure 2-8 Water in Storage in the Chino Basin





20120501 Figure 2-9 Tables 2-3 through 2-7.xlsx -- Figure 2-9
Created on 5/2/2012
Printed on 5/2/2012



Recharge Basins

Imported Water

Flood Control Basin

Imported Water Facilities

Water Treatment Plant

Service Connection/Turnout

Imported Water Pipeline

Other Features

OBMP Management Zones

Geology

Water-Bearing Sediments

Quaternary Alluvium

Consolidated Bedrock

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

Faults

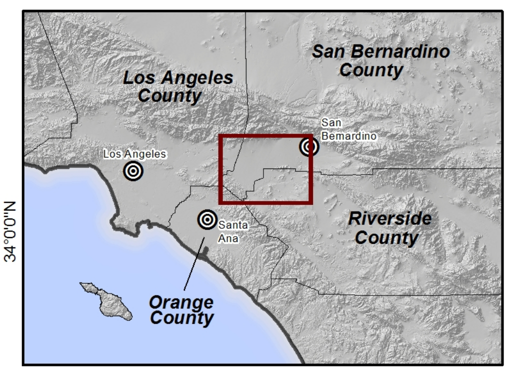
Location Certain

Location Concealed

Location Approximate

Location Uncertain

Approximate Location of Groundwater Barrier



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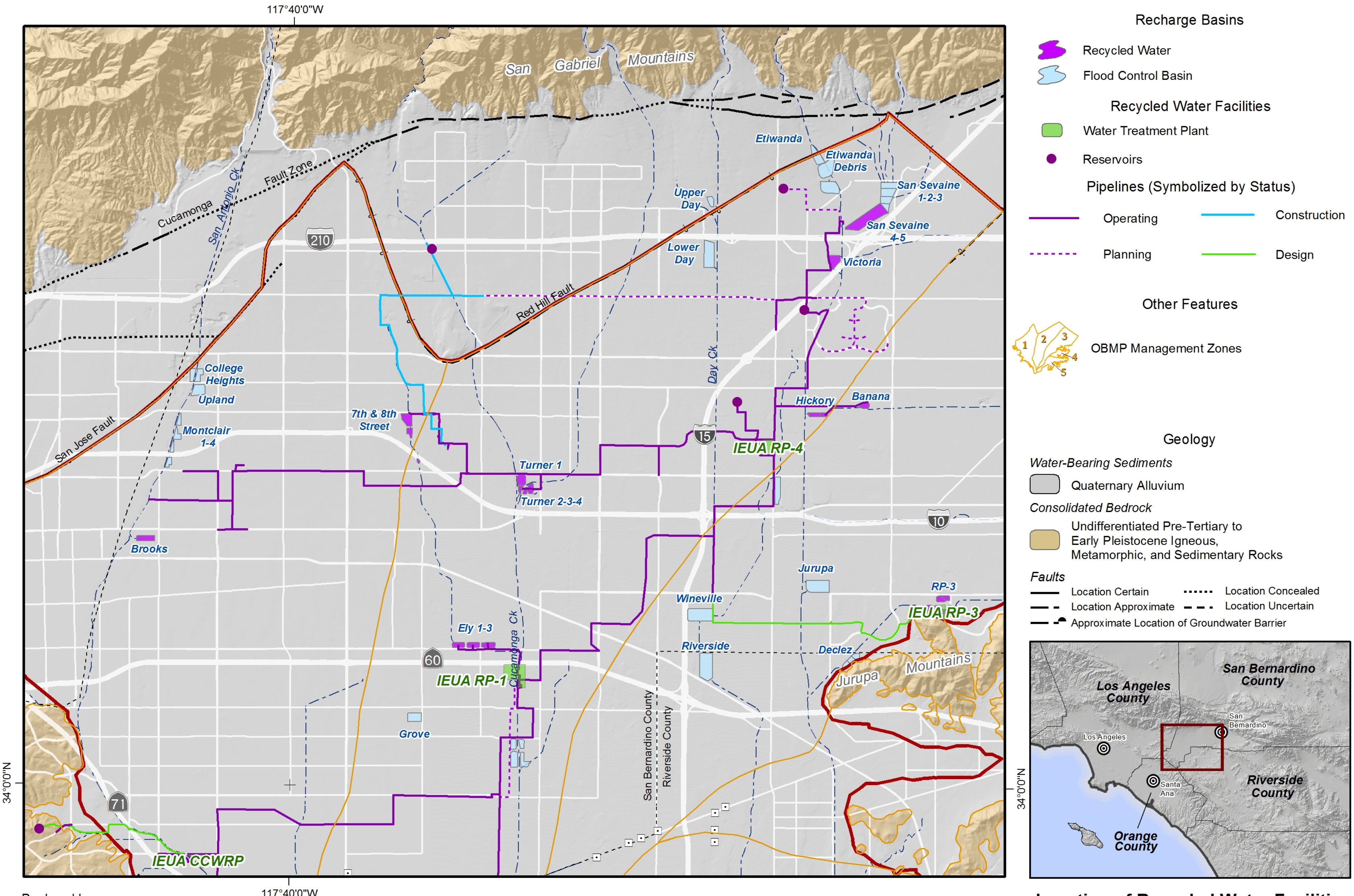
0 1 2 Miles

0 2 Kilometers

2013 Recharge Master Plan Update

Location of Imported Water Facilities
Recharge Basins, Pipelines, Turnouts, and Treatment Plants

Figure 2-10



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Name: Figure_2-11

2013 Recharge Master Plan Update

Location of Recycled Water Facilities
Recharge Basins, Pipelines, Reservoirs, and Wastewater Treatment Plants

Figure 2-11

Section 3 – Impacts of Revised Groundwater Production and Replenishment Projections

The objectives of this section are to describe changed conditions from what was assumed in the 2010 RMPU and to update the information included in the 2010 RMPU. Specifically this section answers the following questions:

1. How are groundwater levels projected to change with the revised projections?

2. What areas in the basin are facing sustainability challenges?

In 2006 and 2007, Watermaster conducted extensive hydrologic and modeling investigations in support of the development of the Peace II Agreement and the facilities and basin operating strategies that are contained in the Peace II Agreement. And, Watermaster developed a sophisticated suite of computer simulation tools that are collectively referred to as the 2007 Watermaster Model. Based on these investigations, Wildermuth Environmental Inc. (WEI), Watermaster's consultant, concluded that:

- the safe yield of the Basin would likely decline from about 140,000 acre-ft/yr in 2006 to about 130,000 acre-ft/yr in 2030;

- projected future production may not be sustainable for some Appropriators due to excessive drawdown; and

- given Watermaster's traditional approach to replenishment operations, future production may have to be limited by Watermaster's existing replenishment capacity (WEI, 2007).

In 2008, Watermaster conducted a material physical injury analysis of the proposed Dry-Year Yield Expansion—using updated groundwater production projections provided by the IEUA—and reached identical conclusions regarding production sustainability and replenishment limitations (WEI, 2008a). However, in this analysis, WEI recommended additional work to optimize the location and magnitude of groundwater production and replenishment in order to maximize groundwater production capabilities.

The sustainability issue identified in these reports occurs because the municipal groundwater producers had not coordinated their future groundwater production plans that include new wells and increased production. In early 2009, the preparation of an environmental impact report PEIR for the Peace II Agreement commenced. Prior to evaluating the hydrologic changes that are expected to occur through the implementation of the Peace II Project Description, Watermaster conducted an analysis of existing and future projected groundwater production patterns and developed new groundwater production patterns and supplemental water recharge plans that ensure sustainability. These new groundwater production and replenishment patterns are based on optimization studies that were constrained to meet projected production requirements, to use existing and master-planned well locations, to use existing spreading basins and planned injection wells, and to balance recharge and discharge in every area and subarea (a Peace Agreement requirement). Watermaster requested that each Appropriator party provide an elevation at each well for which if the model-projected groundwater elevation remained above that elevation, groundwater production sustainability at that well would be assured. These elevations were referred to as sustainability metrics. The groundwater production patterns developed in this investigation are voluntary. This work was documented in *2009 Production Optimization and Evaluation of the Peace II Project Description* (WEI, 2009).

A similar analysis was conducted by in the 2013 RMPU process that used the 2007 Watermaster Model with:

- updated groundwater production and replenishment projections for Scenario 1 and 3 (described in Section 2 herein),
- updated recycled water recharge projections,
- management zone specific supplemental water recharge plans, and
- updated sustainability metrics.

The Steering Committee stakeholders reviewed Scenarios 1 through 4 that are described in Section 2 and subsequently selected Scenarios 1 and 3 as the most representative scenarios to bookend the range of future groundwater production and replenishment.

Table 3-1 lists the location and magnitude of projected recycled water recharge, as provided by the IEUA.[10] Given the IEUA's recycled water recharge projection, supplemental water recharge was programmed for Scenarios 1 and 3 as follows:

- First priority – recycled water recharge in amounts and basins as projected by IEUA.
- Second priority – recycled and imported water were recharged in MZ1 at 6,500 acre-ft/yr.
- Third priority – if there was still a replenishment obligation after the recharge of imported water in MZ1, then imported water was recharged in the MZ3 spreading basins at a rate equal to the minimum of either the imported water recharge capacity or the remaining replenishment obligation.
- Fourth priority – if there was still a replenishment obligation after the recharge capacity of the first three priorities has been exhausted, then imported water was

[10] Mid-range estimate, email from Chris Berch, dated February 14, 2012

recharged in the MZ2 spreading basins at a rate equal to the minimum of either the imported water recharge capacity or the remaining replenishment obligation.

- Fifth priority – if there was still a replenishment obligation after the recharge capacity of the first four priorities has been exhausted, then imported water was recharged in the MZ1 spreading basins at a rate equal to the minimum of either the remaining imported water recharge capacity or the remaining replenishment obligation.

3.1 Summary of 2009 Peace II Modeling Results

Figure 3-1 illustrates the estimated groundwater elevation contours for July 2005 for model layer 1. This map shows the initial groundwater elevations throughout the basin and illustrates the initial groundwater levels for the planning period. Figures 3-2a and 3-2b show the projected groundwater elevations in June 2030, the end of the planning period, for model layer 1[11] for the Baseline (non-Peace II) alternative and the Peace II alternative respectively. And, Figures 3-3a and 3b show the change in groundwater levels across the basin for June 2030 for model layer 1 for the Baseline and Peace II alternatives. Figures 3-3a and 3-3b also show the Appropriators' water service area boundaries.

Review of Figures 3-1, 3-2a, and 3-2b indicates that the direction of groundwater flow in the Chino Basin is generally the same in 2005 and 2030 with groundwater flowing from the northeast and north to the southwest and south. A small area in the western part of the basin experiences slight groundwater elevation increases while the rest of the basin experiences declines. The 2030 groundwater level projections for both alternatives show a significant pumping depression around the desalter well field area. The 2009 report included comparisons of projected groundwater level time histories at selected wells to their respective sustainability constraints in an appendix and based on a review of these time-history charts concluded that:

"The groundwater elevation projections in Appendix B and in Figures 4-13a through 4-13j show that groundwater production is sustainable for the Baseline and Peace II Alternatives. At some wells, the groundwater elevation falls below constraints prescribed by the Appropriators. For these cases, it was assumed that the pumps would be lowered to maintain production."

3.2 Basin Response to Updated Groundwater Production and Replenishment

Figure 3-4 illustrates the estimated groundwater elevation contours for July 2010 for model layer 1. This map shows the initial groundwater elevations throughout the basin and illustrates the initial groundwater levels for the planning period used to evaluate Scenarios 1 and 3.

[11] The model consists of three layers with layer 1 being the uppermost layer. With the exception of the western part of the basin, the piezometric head in layers 2 and 3 correlate and lag slightly compared to the head changes in layer 1; as such, only layer 1 is discussed herein.

Figures 3-5a and 3-5b show the projected groundwater elevations in June 2030 (the end of the planning period) for model layer 1 for Scenarios 1 and 3, respectively. And, Figures 3-6a and 3-6b show the change in groundwater levels across the basin in June 2030 for model layer 1 for Scenarios 1 and 3, respectively. Figures 3-6a and 3-6b also show the appropriators' water service area boundaries.

The direction of groundwater flow in the Chino Basin in 2010 and 2030 is generally the same with groundwater flowing from the northeast and north to the southwest and south. Appendix A contains charts that illustrate the projected groundwater level time series for all the wells shown in Figures 3-6a and 3-6b along with their sustainability metrics. Appendix A also includes a table that lists these wells and their respective sustainability metrics. Table 3-2 characterizes the average, maximum, and minimum changes in groundwater elevations across the water service areas of appropriators that overlie the Chino Basin for Scenario 1 and 3 from 2010 through 2030.

The groundwater elevation projections shown in Appendix A indicate that production will be sustainable for most wells. At some wells, the groundwater elevation falls below the sustainability metric prescribed by the appropriators. For most of these cases, it was assumed that the pumps would be lowered to maintain production. The exception is the JCSD well field area. At some JCSD wells, the groundwater elevation falls below the sustainability metric provided by the JCSD, and the pumps cannot be lowered further because they are already at their lowest practical depths.

The maximum, minimum and average groundwater elevation changes, depicted in Table 3-2 for each municipal service area, were computed from all of the computed groundwater elevations at 200-foot by 200-foot model cells within each service area.

- Average change in groundwater level
    - For Scenario 1, the water service area average change groundwater level ranges from -11 feet for the Upland service area to -35 feet for the Ontario service area. Relative to the Peace II alternative, in 2030, the average change in groundwater elevation ranges from a low of +12 feet for the Upland service area to +34 feet for the Pomona service area.
    - For Scenario 3, the water service area average change groundwater level ranges from +3 feet for the Upland service area to -36 feet for the Ontario service area. Relative to the Peace II alternative, in 2030, the average change in groundwater elevation ranges from a low of +12 feet for the Upland service area to +34 feet for the Pomona service area.
    - The difference in the water service area average change groundwater level between Scenario 3 and Scenario 1 ranges from +4 feet for the Fontana Water Company service area to -14 feet for the City of Upland and Monte Vista Water District service areas.

- Maximum change in groundwater level
  - For Scenario 1, the maximum change in groundwater level at a model cell in a water service area[12] ranges from +4 feet for the City of Upland service area to -17 feet for the City of Pomona service area. Relative to the Peace II alternative, in 2030, the maximum change in groundwater elevation ranges from a low of +21 feet for the City of Upland service area to +44 feet for the Cities of Ontario and Pomona service areas.
  - For Scenario 3, the maximum change in groundwater level at a model cell in a water service area ranges from -6 feet for the Fontana Water Company service area to 39 feet for the City of Upland service area. Relative to the Peace II alternative, in 2030, the maximum change in groundwater elevation ranges from a low of +15 feet for the City of Upland service area to +49 feet for the City of Ontario service area.
  - The difference in the maximum change in groundwater level in a water service area average between Scenario 3 and Scenario 1 ranges from +2 feet for the City of Upland service area to +11 feet for the JCSD service area.
- Minimum change in groundwater level
  - For Scenario 1, the minimum change in groundwater level at a model cell in a water service area[13] ranges from -25 feet for the City of Upland service area to -54 feet for the City of Ontario service area. Relative to the Peace II alternative, in 2030, the minimum change in groundwater elevation ranges from a low of +7 feet for the Cucamonga Valley Water District service area to -24 feet for the City of Upland and Monte Vista Water District service areas.
  - For Scenario 3, the minimum change in groundwater level at a model cell in a water service area ranges from -25 feet for the City of Upland service area to -54 feet for the City of Ontario service area. Relative to the Peace II alternative, in 2030, the minimum change in groundwater elevation ranges from a low of -18 feet for the City of Upland service area to -61 feet for the JCSD service area.

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[12] The maximum change is computed as the maximum change at a model cell and is not equal to the difference between the maximum elevations at a cell across scenarios unless the maximum occurs at the same model cell across the scenarios.

[13] The minimum change is computed as the minimum change at a model cell and is not equal to the difference between the minimum elevations at a cell across scenarios unless the minimum occurs at the same model cell across the scenarios.

- o The difference in the minimum change in groundwater level in a water service area average between Scenario 3 and Scenario 1 ranges from +2 feet for the Fontana Water Company service area to -36 feet for the City of Upland service area.

Figure 2-4 shows the locations of flow-line based cross-section profiles through each of the management zones, through a part of the Chino II Desalter well field, and through part of the JCSD well field. These flow-line based cross-sections are shown in Figures 3-7a through 3-7e for MZ1 through MZ5, respectively. These figures are identical to Figures 2-5a through 2-5e except that 3-7a through 3-7e contain the model-estimated groundwater levels for Scenarios 1 and 3. The intent of these cross-sections is to show the saturated thickness through these cross-sections for 2010, 2020 and 2030, and wells located on or near these cross-sections. The horizontal red bars shown at most wells are the sustainability metrics provided by the well owners. Groundwater production at wells is presumed to be sustainable if the groundwater level at the well is greater than the sustainability metric. If the groundwater level falls below the sustainability metric, the owner will either lower their pumping equipment in their well or will have to reduce production. Careful review of Appendix A and these cross-sections indicates that groundwater levels for some Fontana Water Company (FWC) wells and a CVWD well come close falling below their respective sustainability metrics (see Figures 3-7b and 3-7c). The pumping equipment in these wells will likely have to be lowered at some time in the future. Wells where pumping equipment may have to be lowered include the following:

- City of Chino – Well No. 5
- CVWD – Well No. CB-5
- FWC – Well Nos. F2A, F44A, F44B, F44C,
- City of Ontario – Well Nos. No. 24, 27, 31, 37, 38, 39, 44, 50
- CDA – Well Nos. CDA I-9, I-10, I-14, I-15, II-1

The groundwater levels at several JCSD wells are projected to be close to or fall below their respective sustainability metrics. Because the saturated thickness is thin in the JCSD well field and many of their pumps are already near the well bottoms, it would be difficult, and in some cases impossible, to lower the pumping equipment to assure sustainable production. This includes most of the wells used by the JCSD for potable water supply:

- JCSD – Well Nos. 6, 8, 11, 12, 13, 14, 15, 16, 17, 18, 20, 22, 25

3.3 Recharge and/or Forbearance Required to Achieve Sustainable Production

The sustainability challenge for the JCSD wells was hydrologically evaluated by conducting a sensitivity analysis to determine how sensitive groundwater levels at the JCSD wells were to new recharge at facilities near the JCSD wells and to reductions in production by the JCSD. The following scenarios were evaluated:

- Scenario 1A – Same as Scenario 1 except that the planned JCSD production was reduced by 20 percent starting in 2017 with the reductions spread among the JCSD wells on a pro rata basis.
- Scenario 1B – Same as Scenario 1 except that recharge totaling 20 percent of the JCSD annual production is assumed to occur at the Wineville Basin starting in 2017.
- Scenario 1C – Same as Scenario 1 except that the planned JCSD production was reduced by 50 percent starting in 2017 with the reductions spread among the JCSD wells on a pro rata basis.
- Scenario 1D – Same as Scenario 1 except that recharge totaling 50 percent of the JCSD annual production is assumed to occur at the Wineville Basin starting in 2017.
- Scenario 3A – Same as Scenario 3 except that the planned JCSD production was reduced by 20 percent starting in 2017 with the reductions spread among the JCSD wells on a pro rata basis.
- Scenario 3B – Same as Scenario 3 except that recharge totaling 20 percent of the JCSD annual production is assumed to occur at the Wineville Basin starting in 2017.
- Scenario 3C – Same as Scenario 3 except that the planned JCSD production was reduced by 50 percent starting in 2017 with the reductions spread among the JCSD wells on a pro rata basis.
- Scenario 3D – Same as Scenario 3 except that recharge totaling 50 percent of the JCSD annual production is assumed to occur at the Wineville Basin starting in 2017.

Table 3-3 lists the assumed JCSD production and recharge for each scenario. The intent of these scenarios is determine whether a reduction in JCSD production, an increase in near-field recharge, or both activities will ensure sustainable production in the JCSD well field. For scenarios with reduced groundwater production, the reduced production would be offset through either imported water served to the JCSD or by groundwater produced elsewhere in the Basin and conveyed to the JCSD. New recharge for Scenarios 1B, 1D, 3B, and 3D was assumed to occur at the Wineville Basin. The storm and supplemental water recharge capacity of the Wineville Basin is unknown. Recharge could be also be done by injection at JCSD wells.

These scenarios were simulated with the 2007 Watermaster model, and the results are summarized as time history charts in Appendix B and in tabular form in Table A-1 in Appendix A. Review of these charts indicates the following:

- Most of the JCSD wells that failed the sustainability test in Scenarios 1 and 3 failed the test for some or most the scenarios investigated above; although, the failures that did occur occurred later for some of the wells, and some failures were marginal.

- Production from three of the twelve wells that failed the sustainability tests for Scenario 1 and production from two of the thirteen wells that failed the sustainability tests for Scenario 3 was projected to be sustainable with a reduction in JCSD production of twenty percent.

- Production from two of the twelve wells that failed the sustainability tests for Scenario 1 and production from one of the thirteen wells that failed the sustainability tests for Scenario 3 was projected to be sustainable with an increase in recharge at the Wineville Basin equal to twenty percent of the JCSD's annual production.

- Production from four of the twelve wells that failed the sustainability tests for Scenario 1 and production from four of the thirteen wells that failed the sustainability tests for Scenario 3 was projected to be sustainable with a reduction in production of fifty percent.

- Production from four of the twelve wells that failed the sustainability tests for Scenario 1 and production from four of the thirteen wells that failed the sustainability tests for Scenario 3 was projected to be sustainable with an increase in recharge at the Wineville Basin equal to fifty percent of JCSD's annual production.

- Several wells that failed the sustainability test had projected groundwater levels from either decreased production or increased recharge that were close to passing the sustainability test.

- A twenty-percent and fifty-percent reduction in JCSD production are more hydraulically efficient at ensuring sustainability than increasing recharge at the Wineville Basin and not reducing production. In fact after 2017, the year that reductions in JCSD production was assumed to occur, production at almost all the wells that failed the sustainability test was projected to be sustainable or to marginally fail the test.

- The spatial and temporal production plans assumed in the sensitivity analysis were provided by the appropriator parties. These plans were not adjusted or optimized during the sensitivity analysis to improve sustainability and thus the sustainability challenges projected herein may be overstated.

This sensitivity analysis suggests that reducing production or relocating production away from the JCSD well field is more hydraulically efficient than recharge. There are unknowns that will need to be resolved before imported water can be recharged at the Wineville Basin or other stormwater management facilities in the area. The sensitivity analysis also suggests that aquifer storage and recovery with injection totals up to fifty percent of JCSD production could ensure sustainability. Watermaster and the IEUA are developing a proof-of-concept project to test the feasibility of large-scale recharge in the Wineville Basin. The Steering Committee investigated the means and methods to either relocate JCSD production or provide JSCD another supply that would enable JCSD to reduce its production from its existing well field. These concepts are articulated in Section 6 herein and evaluated in Section 8.

Table 3-1
IEUA Projected Recycled Water Recharge
(acre-ft/yr)

Basin	FY11/12	FY12/13	FY13/14	FY14/15	FY15/16	FY16/17	FY17/18	FY18/19	FY19/20	FY20/21	FY21/22
7th Street	595	595	595	595	595	595	595	595	595	595	595
8th Street	595	595	595	595	595	595	595	595	595	595	595
Banana	816	816	816	816	816	816	816	816	816	816	816
Brooks	1,314	1,314	1,314	1,314	1,314	1,314	1,314	1,314	1,314	1,314	1,314
Declez (2 & 3)	-	-	-	1,057	1,057	1,057	1,057	1,057	1,057	1,057	1,057
Ely	964	964	964	964	964	964	964	964	964	964	964
Hickory	949	949	949	949	949	949	949	949	949	949	949
Lower Day	-	-	-		-	-	2,377	2,377	2,377	2,377	2,377
Etiwanda Debris Basin	-	-	-		-	-	-	-	-	-	1,840
RP-3	1,224	1,224	1,224	5,320	5,320	5,320	5,320	5,320	5,320	5,320	5,320
San Sevaine (1-3)	-	-	-	-	-	-	-	-	-	-	-
San Sevaine 5	540	540	540	540	540	540	540	540	540	540	540
Turner (1-4)	400	400	1,540	1,540	1,540	1,540	1,540	1,540	1,540	1,540	1,540
Victoria	800	800	800	800	800	800	800	800	800	800	800
Total	8,197	8,197	9,337	14,490	14,490	14,490	16,867	16,867	16,867	16,867	18,706

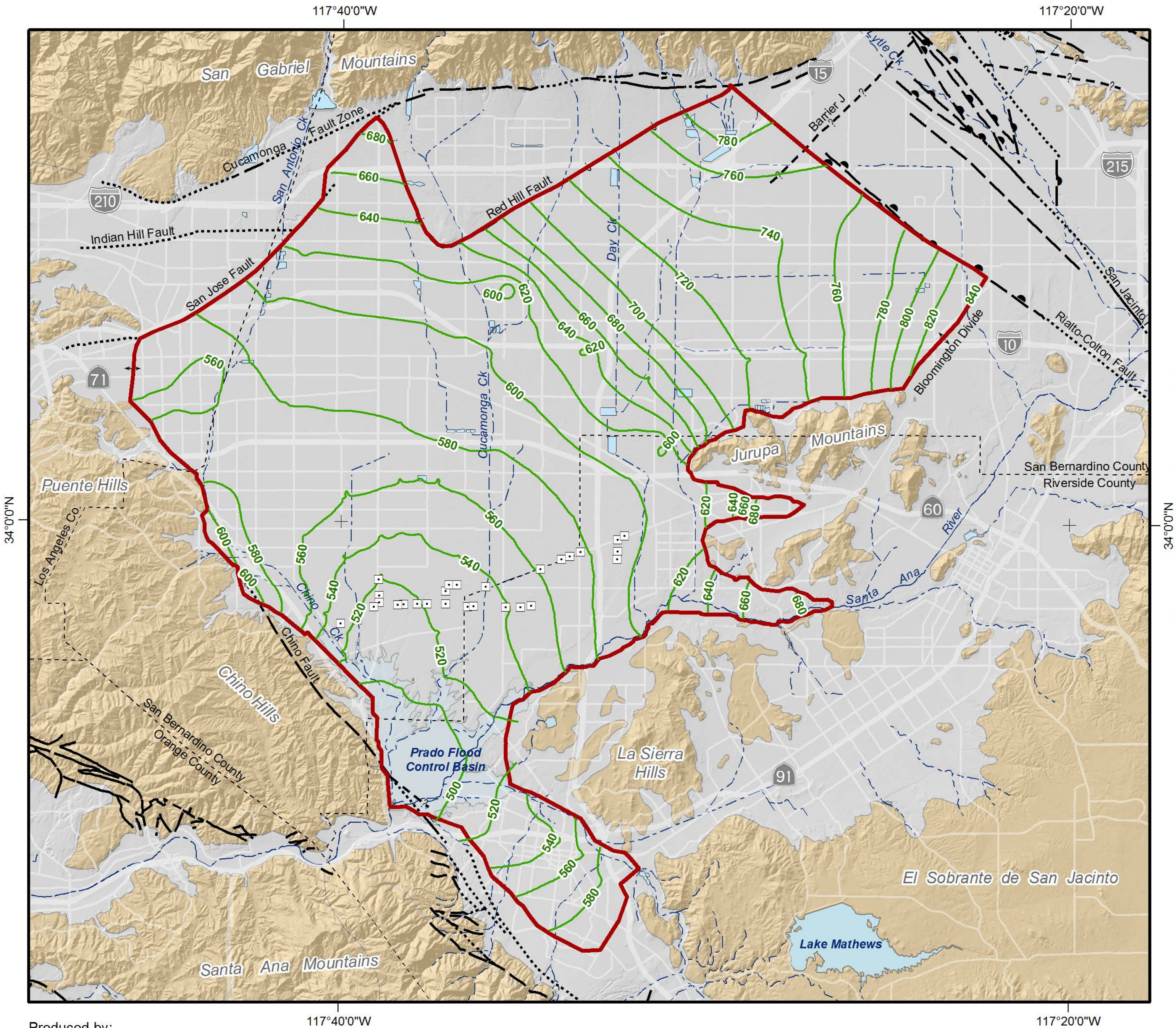
Table 3-2
Summary of Groundwater Level Changes by Water Service Area, 2010 through 2030
(feet)

Agency Service Area	Initial Groundwater Elevation 2010			Projected Scenario 1 Groundwater Elevation 2030			Projected Change in Groundwater Elevation Scenario 1 2030-2010			Projected Scenario 3 Groundwater Elevation 2030			Projected Change in Groundwater Elevation Scenario 3 2030-2010			Projected Difference in Groundwater Elevation Between Scenario 1 and Scenario 3 2030		
Layer 1	Min	Max	Average	Min	Max	Average	Min	Max	Average	Min	Max	Average	Min	Max	Average	Min	Max	Average
Cucamonga Valley Water District	612	775	695	577	771	671	-38	-2	-24	578	769	667	-44	-5	-27	-7	6	3
Fontana Water Company	625	800	738	587	772	710	-47	-3	-29	579	770	706	-53	-6	-33	2	8	4
City of Upland	591	681	630	582	674	619	-25	4	-11	597	681	633	-18	39	3	-36	-7	-14
City of Pomona	561	591	575	524	569	542	-41	-17	-33	531	595	551	-35	9	-24	-26	-1	-9
Monte Vista Water District	572	603	585	535	595	560	-37	0	-25	541	627	574	-34	34	-11	-34	1	-14
City of Ontario	530	685	586	504	654	551	-54	-10	-35	500	649	550	-59	10	-36	-20	8	1
City of Chino	489	613	551	477	590	525	-50	0	-26	474	587	523	-53	0	-28	-6	4	1
Jurupa Community Services District	500	693	575	499	693	554	-52	0	-21	499	693	551	-61	0	-24	0	11	3

Agency Service Area	Projected Peace II Baseline Alternative Groundwater Elevation 2030			Projected Difference in Groundwater Elevation Between Peace II Baseline Alternative and Scenario 1 2030			Projected Difference in Groundwater Elevation Between Peace II Baseline Alternative and Scenario 3 2030			Projected Peace II Alternative Groundwater Elevation 2030			Projected Difference in Groundwater Elevation Between Peace II Alternative and Scenario 1 2030			Projected Difference in Groundwater Elevation Between Peace II Alternative and Scenario 3 2030		
Layer 1	Min	Max	Average	Min	Max	Average	Min	Max	Average	Min	Max	Average	Min	Max	Average	Min	Max	Average
Cucamonga Valley Water District	601	793	690	7	32	19	10	35	22	575	781	670	-18	21	0	-15	23	3
Fontana Water Company	606	794	735	16	43	26	20	48	30	588	785	723	1	33	13	6	38	17
City of Upland	567	688	632	-24	21	12	-59	15	-1	539	671	609	-51	-2	-11	-85	-9	-24
City of Pomona	557	592	577	-3	44	34	-29	38	25	529	570	552	-29	19	10	-55	15	1
Monte Vista Water District	560	587	575	-24	37	15	-58	32	1	532	567	550	-51	13	-10	-85	10	-23
City of Ontario	518	678	576	-1	44	25	-20	49	26	507	662	556	-28	25	6	-46	30	7
City of Chino	486	601	540	-6	32	15	-6	35	16	478	589	527	-8	13	2	-7	16	4
Jurupa Community Services District	498	695	567	-3	36	14	-3	38	17	498	694	560	-4	31	6	-3	33	9

Table 3-3
Pumping and New Recharge for Sensitivity Analysis
(acre-ft)

Scenario	Year	JCSD Annual Pumping	New Recharge Near JCSD Well Field
1	2015	16,900	
	2020	18,800	
	2025	18,800	
	2030	18,800	
1A	2015	13,520	
	2020	15,040	
	2025	15,040	
	2030	15,040	
1B	2015	16,900	3,380
	2020	18,800	3,760
	2025	18,800	3,760
	2030	18,800	3,760
1C	2015	8,450	
	2020	9,400	
	2025	9,400	
	2030	9,400	
1D	2015	16,900	8,450
	2020	18,800	9,400
	2025	18,800	9,400
	2030	18,800	9,400
3	2015	18,590	
	2020	20,680	
	2025	20,680	
	2030	20,680	
3A	2015	14,872	
	2020	16,544	
	2025	16,544	
	2030	16,544	
3B	2015	18,590	3,718
	2020	20,680	4,136
	2025	20,680	4,136
	2030	20,680	4,136
3C	2015	9,295	
	2020	10,340	
	2025	10,340	
	2030	10,340	
3D	2015	18,590	9,295
	2020	20,680	10,340
	2025	20,680	10,340
	2030	20,680	10,340



Groundwater Elevation Contours (feet above mean sea-level)

Other Features

- Chino Desalter Well
- Groundwater Flow Model Boundary
- Groundwater Divides
- Flood Control/Conservation Basins
- Streams, Rivers, and Channels

Geology

Water-Bearing Sediments

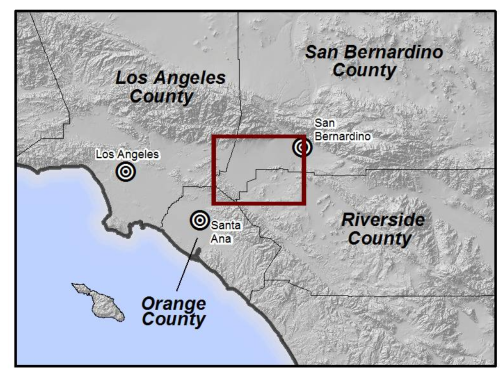
- Quaternary Alluvium

Consolidated Bedrock

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

Faults

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



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Author: MJC
Date: 3/13/2012
Name: Figure_3-1

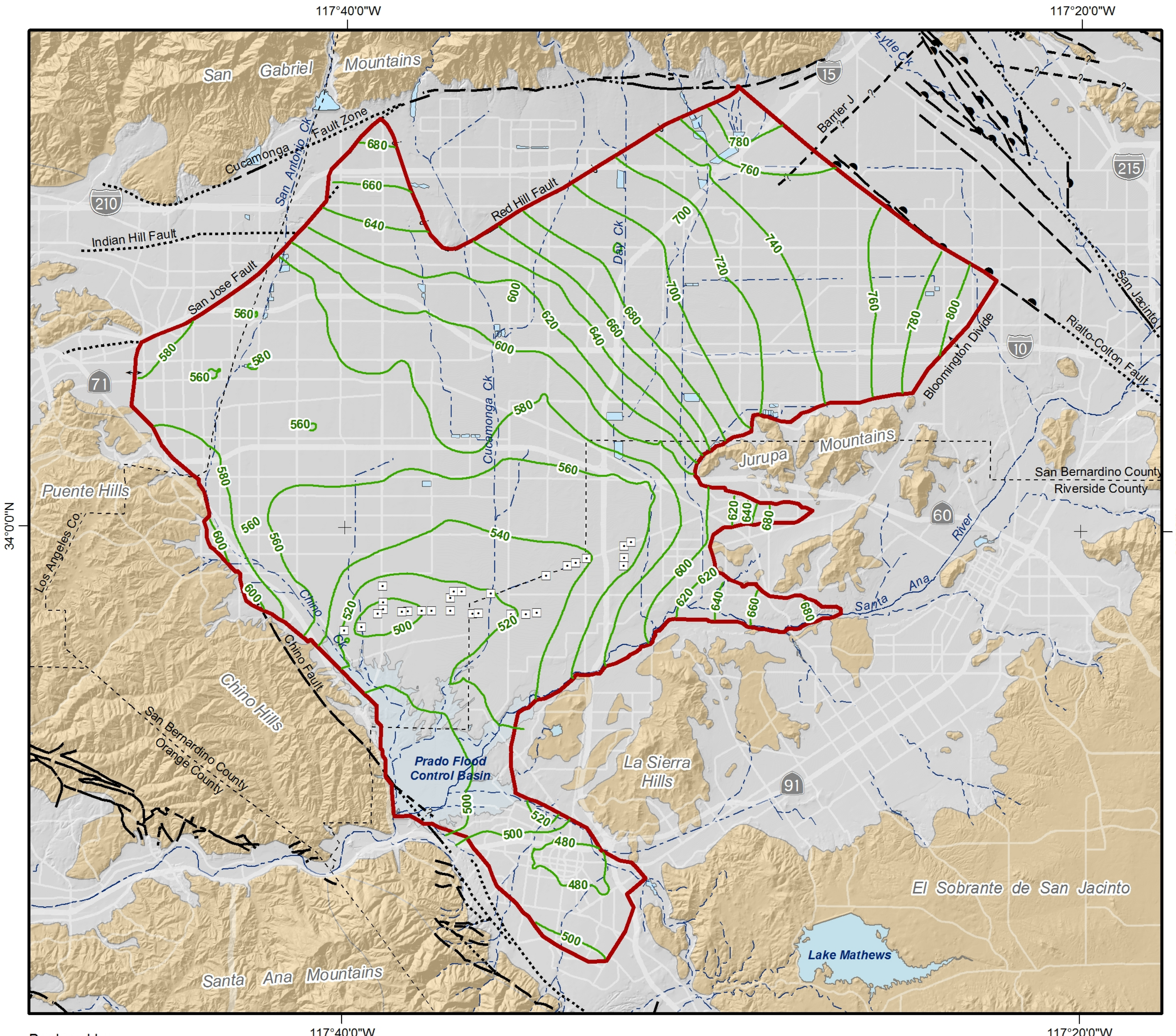
0 1 2 3 4 Miles

0 2 4 6 Kilometers

2013 Recharge Master Plan Update

Groundwater Elevation for Layer 1
July 2005

Figure 3-1



Groundwater Elevation Contours (feet above mean sea-level)

Other Features

- Chino Desalter Well
- Groundwater Flow Model Boundary
- Groundwater Divides
- Flood Control/Conservation Basins
- Streams, Rivers, and Channels

Geology

Water-Bearing Sediments

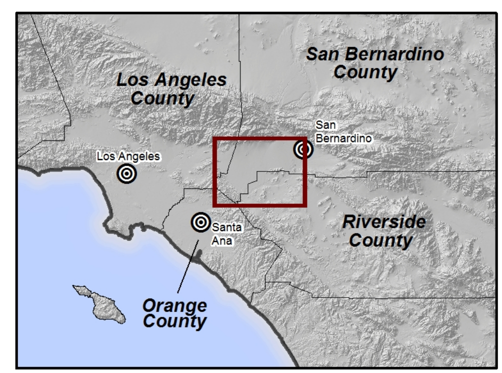
- Quaternary Alluvium

Consolidated Bedrock

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

Faults

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



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0 1 2 3 4 Miles

0 2 4 6 Kilometers

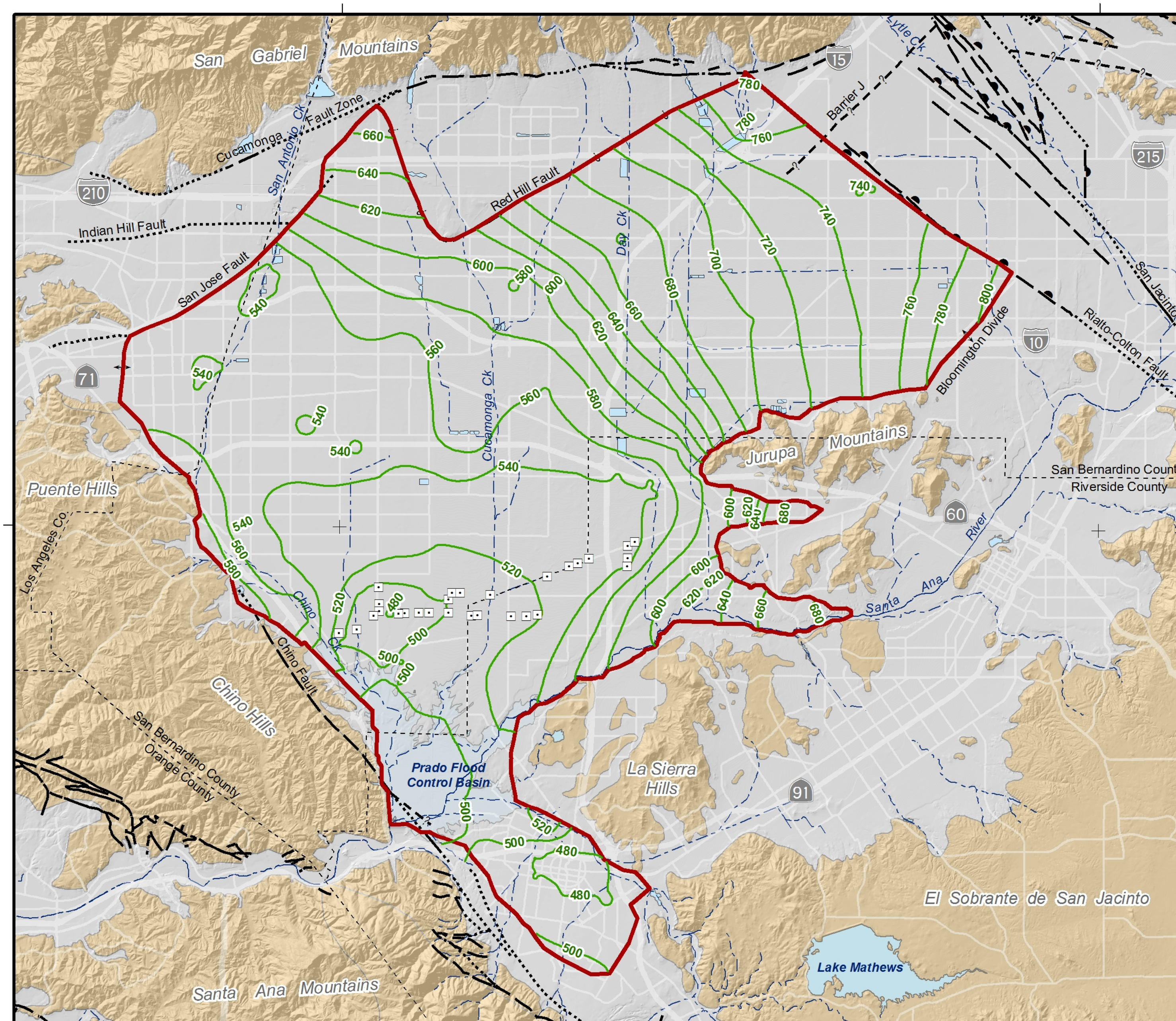
CHINO BASIN WATERMASTER — Partners in Basin Management

2013 Recharge Master Plan Update

Projected Peace II Baseline Alternative Groundwater Elevations for Layer 1

July 2030

Figure 3-2a



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Date: 3/20/2012
Name: Figure_3-2b

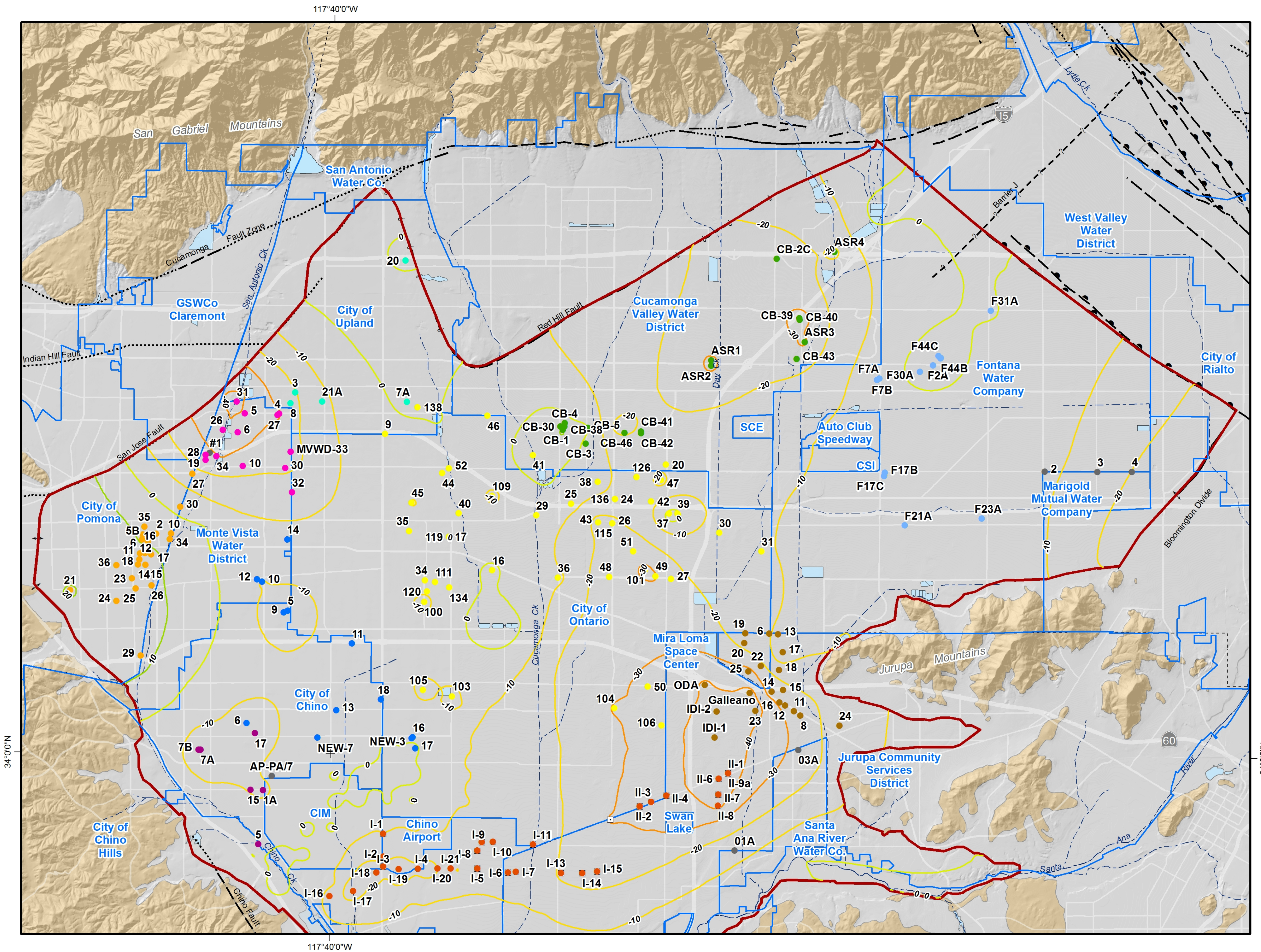
0 1 2 3 4 Miles
0 2 4 6 Kilometers

CHINO BASIN WATERMASTER — Partners in Basin Management

2013 Recharge Master Plan Update

Projected Peace II Alternative Groundwater Elevations for Layer 1
July 2030

Figure 3-2b



Contours of Equal Groundwater Elevation Change from July 2005 to June 2030 (feet)

- 50 - 75
- 25 - 50
- 0 - 25
- 0
- 0 - -25
- -25- -50
- -50 - -75
- -75 - -100

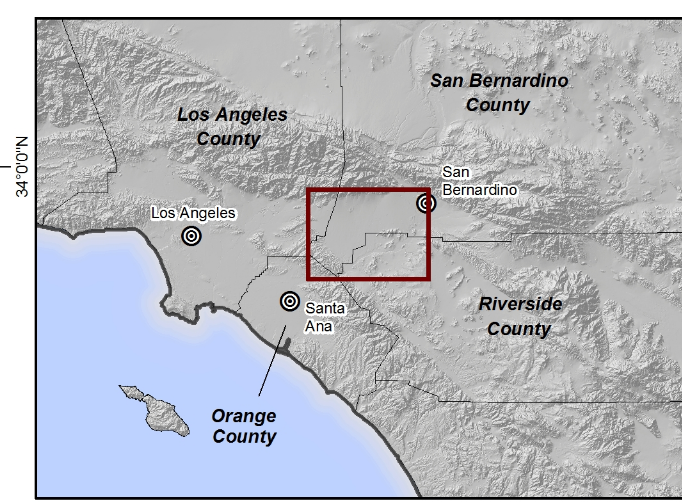
Water Service Area Boundaries

Production Wells

- Chino Desalter Authority
- City of Chino
- City of Chino Hills
- City of Ontario
- City of Pomona
- City of Upland
- Cucamonga Valley Water District
- Fontana Water Company
- Jurupa Community Services District
- Monte Vista Water District
- Other Appropriators

Other Features

- Groundwater Flow Model Boundary
- Flood Control and Conservation Basins



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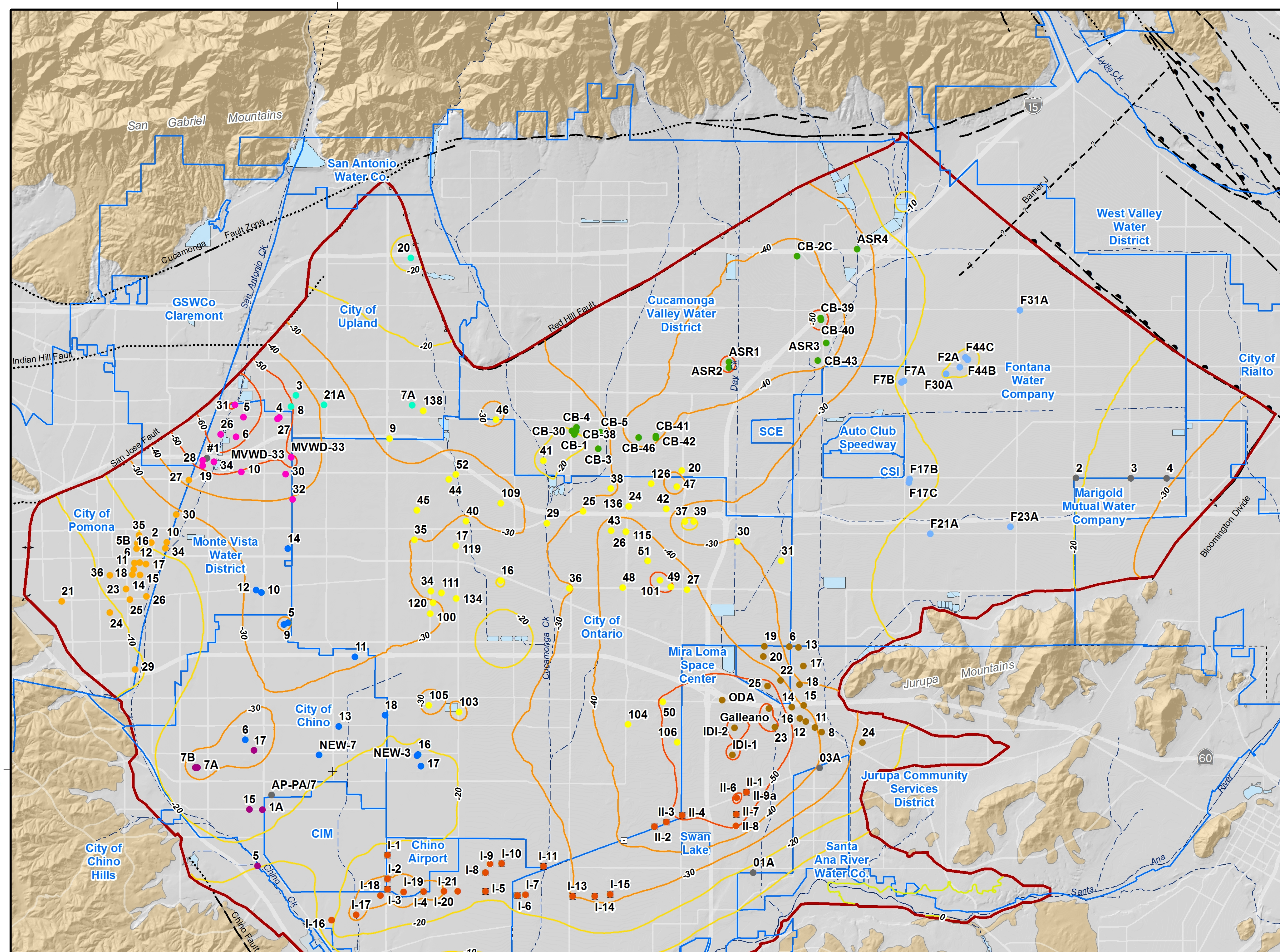
0 1 2 Miles

0 2 4 Kilometers

2013 Recharge Masterplan Update

Projected Peace II Baseline Alternative Groundwater Elevation Change
for Layer 1 July 2005 to June 2030

Figure 3-3a



Contours of Equal Groundwater Elevation Change from July 2005 to June 2030 (feet)

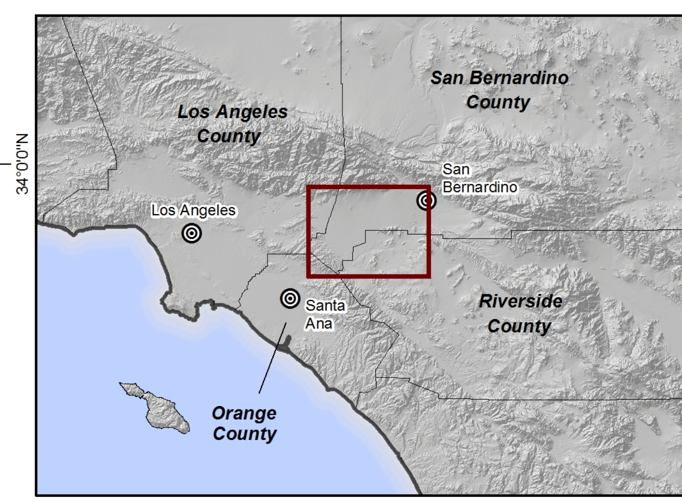
- 50 - 75
- 25 - 50
- 0 - 25
- 0
- 0 - -25
- -25- -50
- -50 - -75
- -75 - -100
- Water Service Area Boundaries

Production Wells

- Chino Desalter Authority
- City of Chino
- City of Chino Hills
- City of Ontario
- City of Pomona
- City of Upland
- Cucamonga Valley Water District
- Fontana Water Company
- Jurupa Community Services District
- Monte Vista Water District
- Other Appropriators

Other Features

- Groundwater Flow Model Boundary
- Flood Control and Conservation Basins



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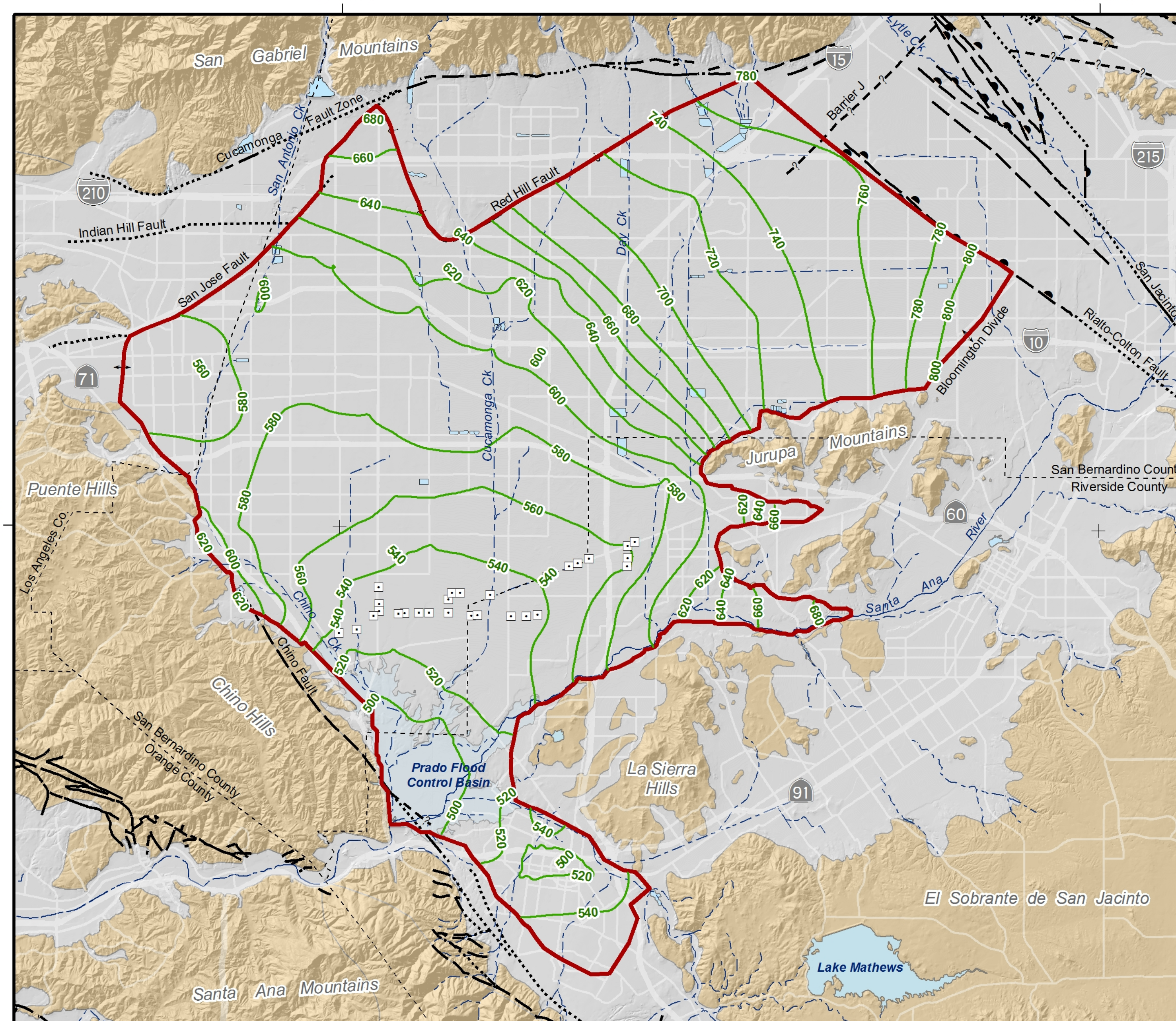
0 1 2 Miles
0 2 4 Kilometers

2013 Recharge Masterplan Update

Projected Peace II Alternative Groundwater Elevation Change
for Layer 1 July 2005 to June 2030

Figure 3-3b



- 800 Groundwater Elevation Contours (feet above mean sea-level)

Other Features

- Chino Desalter Well
- Groundwater Flow Model Boundary
- Groundwater Divides
- Flood Control/Conservation Basins
- Streams, Rivers, and Channels

Geology

Water-Bearing Sediments

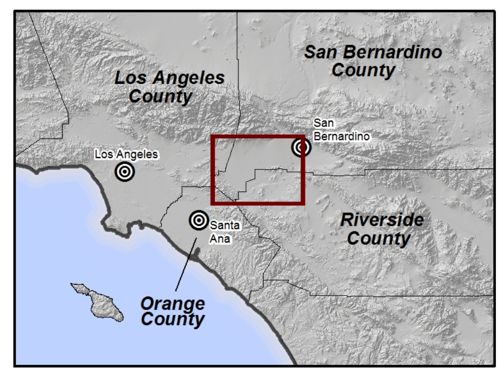
- Quaternary Alluvium

Consolidated Bedrock

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

Faults

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



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0 1 2 3 4 Miles
0 2 4 6 Kilometers

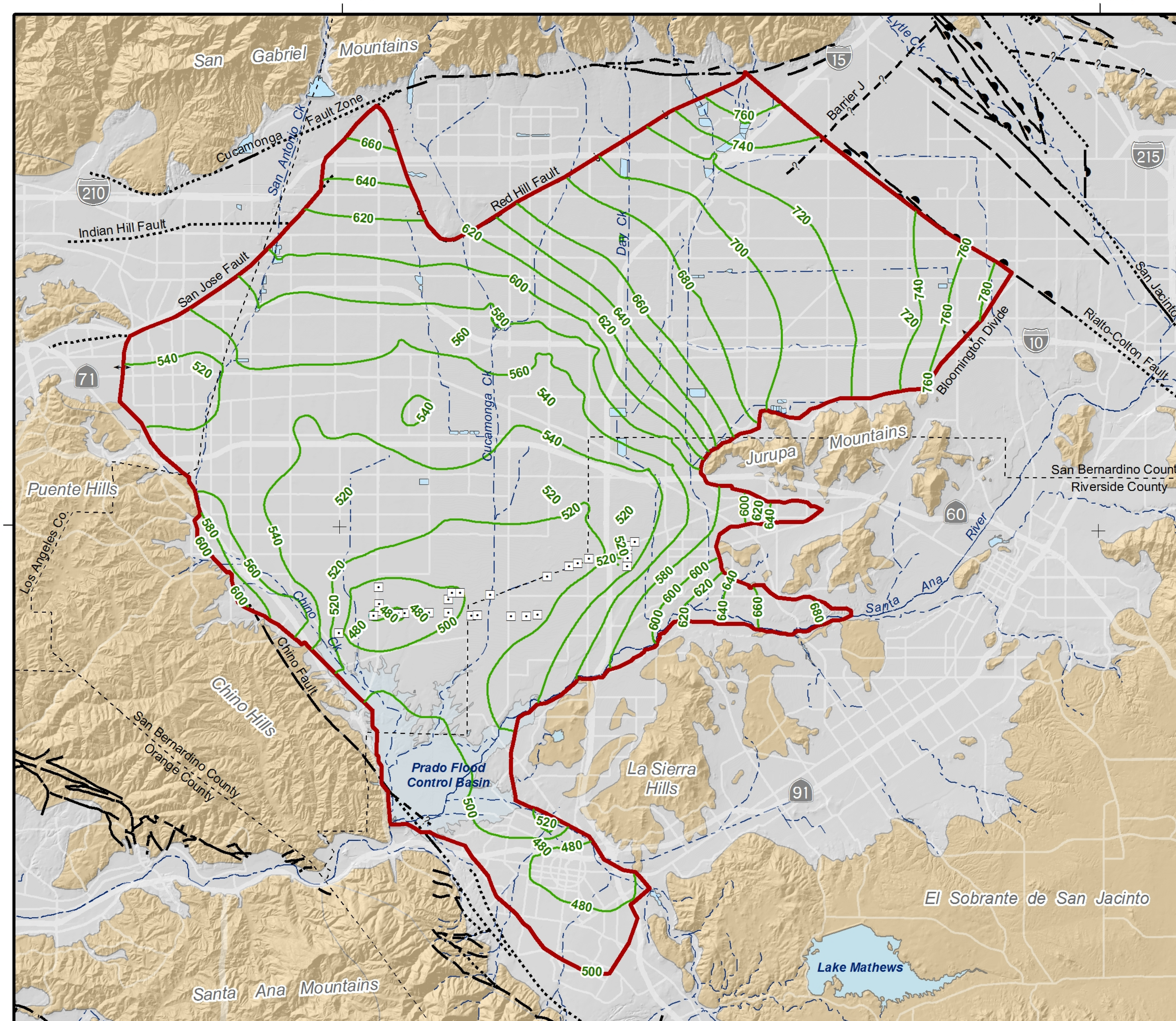
2013 Recharge Master Plan Update

Groundwater Elevation for Layer 1

Initial Condition -- April 2010

Figure 3-4

117°40'0"W 117°20'0"W



117°40'0"W 117°20'0"W

Groundwater Elevation Contours *(feet above mean sea-level)*

Other Features

Chino Desalter Well

Groundwater Flow Model Boundary

Groundwater Divides

Flood Control/Conservation Basins

Streams, Rivers, and Channels

Geology

Water-Bearing Sediments

Quaternary Alluvium

Consolidated Bedrock

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

Faults

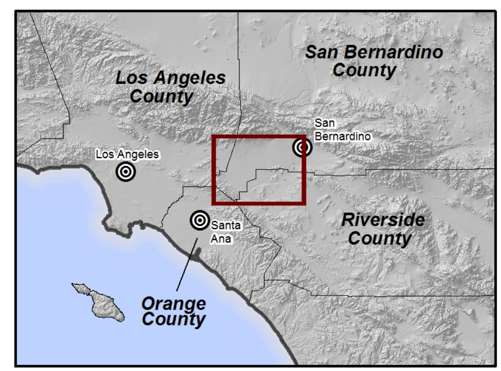
Location Certain

Location Concealed

Location Approximate

Location Uncertain

Approximate Location of Groundwater Barrier



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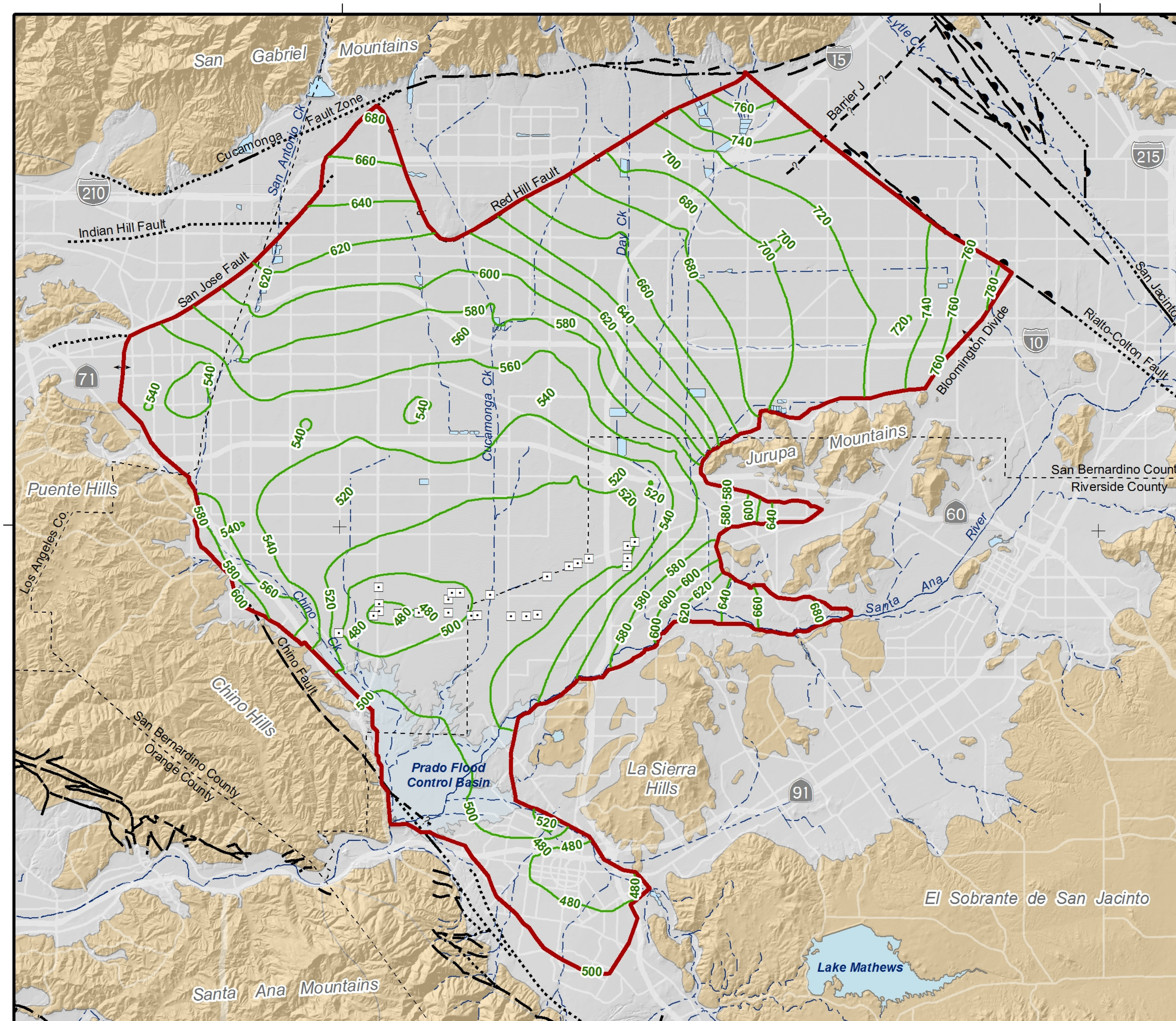
0 1 2 3 4 Miles

0 2 4 6 Kilometers

2013 Recharge Master Plan Update

Projected Scenario 1
Groundwater Elevations for Layer 1
April 2030

Figure 3-5a



Groundwater Elevation Contours

(feet above mean sea-level)

Other Features

- Chino Desalter Well
- Groundwater Flow Model Boundary
- Groundwater Divides
- Flood Control/Conservation Basins
- Streams, Rivers, and Channels

Geology

Water-Bearing Sediments

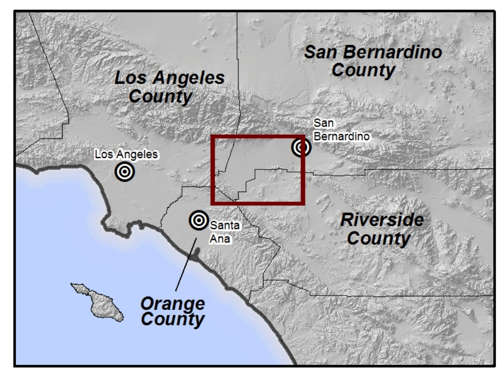
- Quaternary Alluvium

Consolidated Bedrock

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

Faults

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



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Name: Figure_3-5b

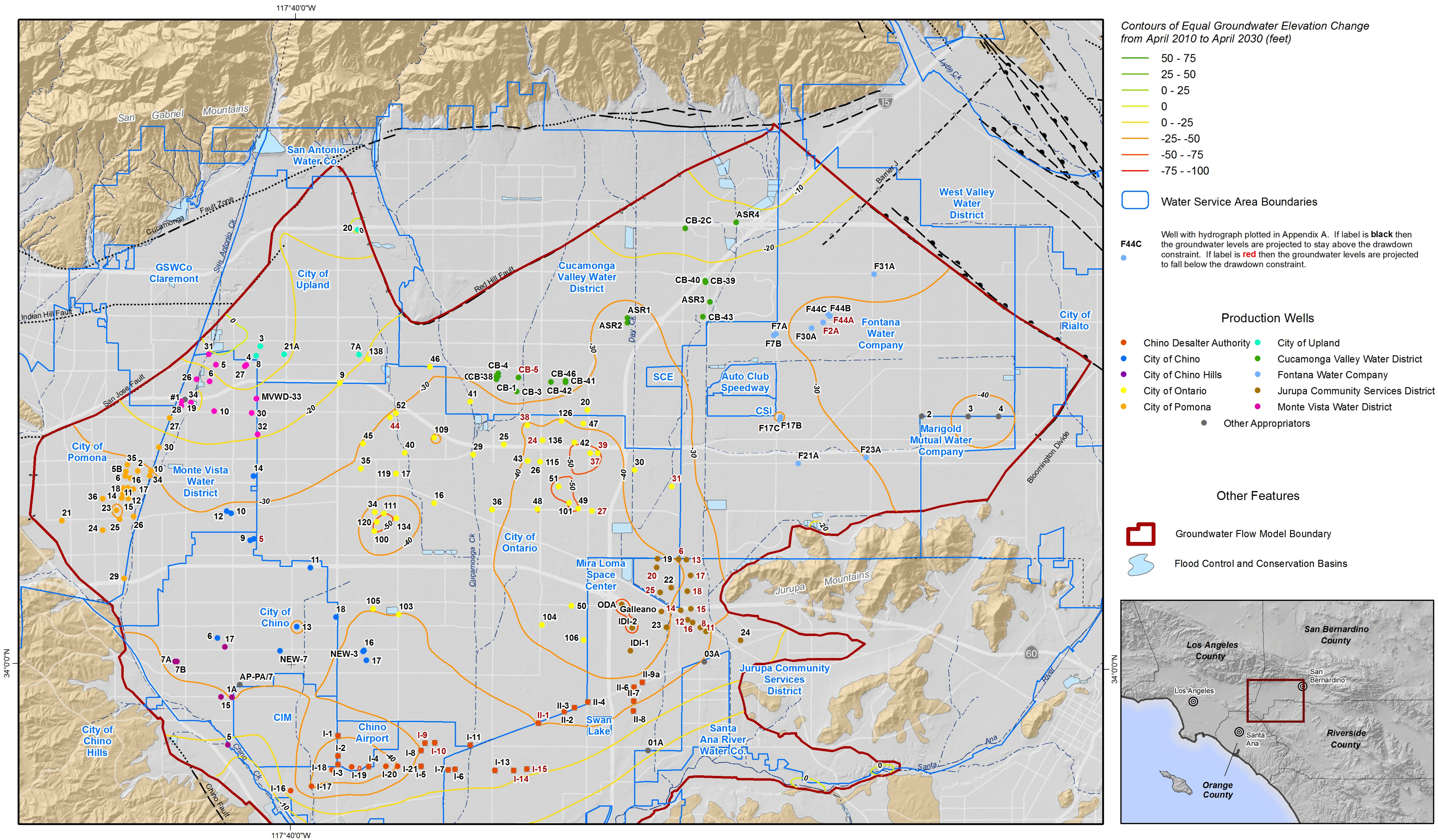
0 1 2 3 4 Miles

0 2 4 6 Kilometers

2013 Recharge Master Plan Update

Projected Scenario 3
Groundwater Elevations for Layer 1
April 2030

Figure 3-5b



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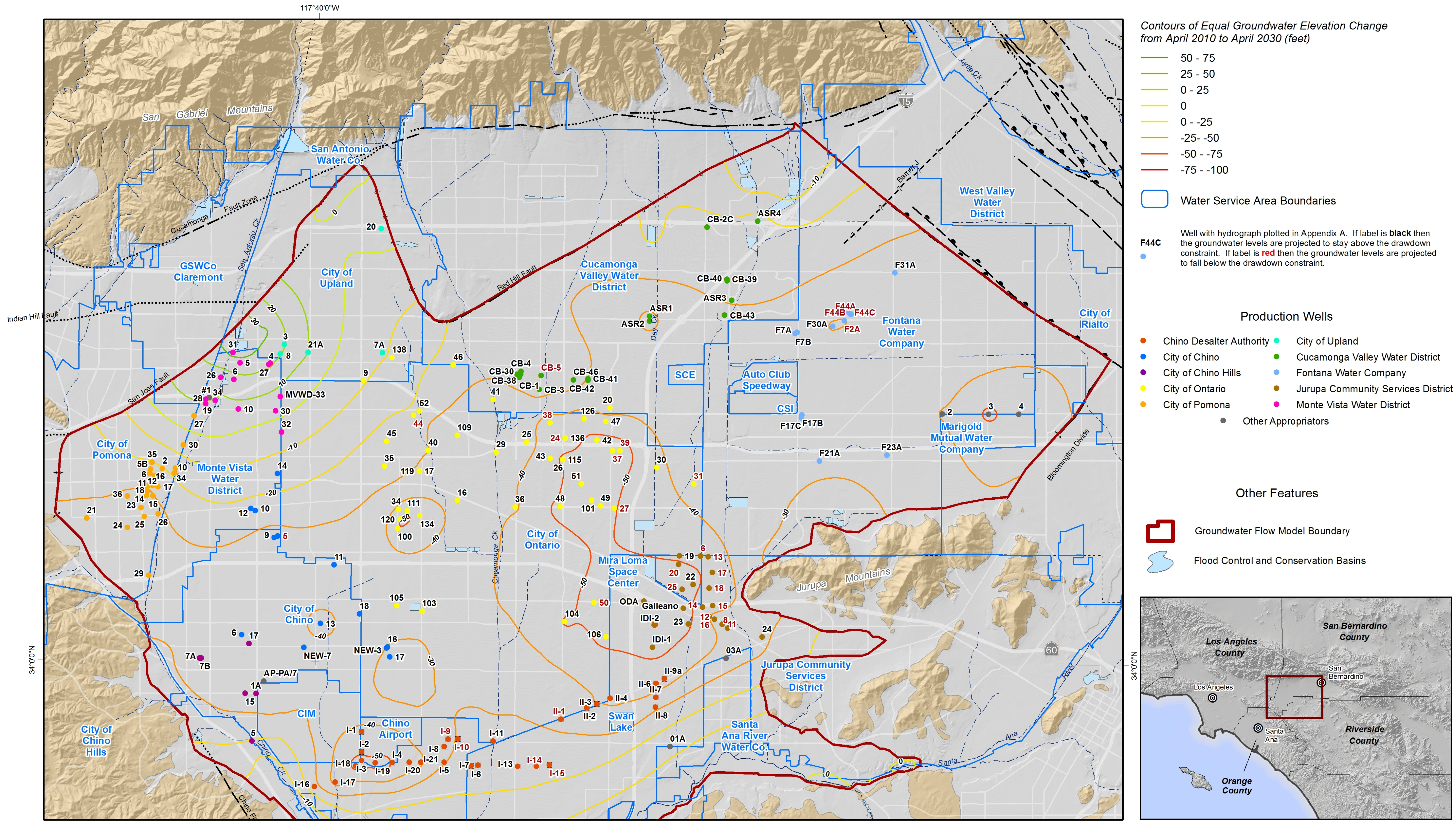
0 1 2 Miles
0 2 4 Kilometers

2013 Recharge Masterplan Update

Projected Scenario 1
Groundwater Elevation Change
for Layer 1 April 2010 to April 2030

Figure 3-6a



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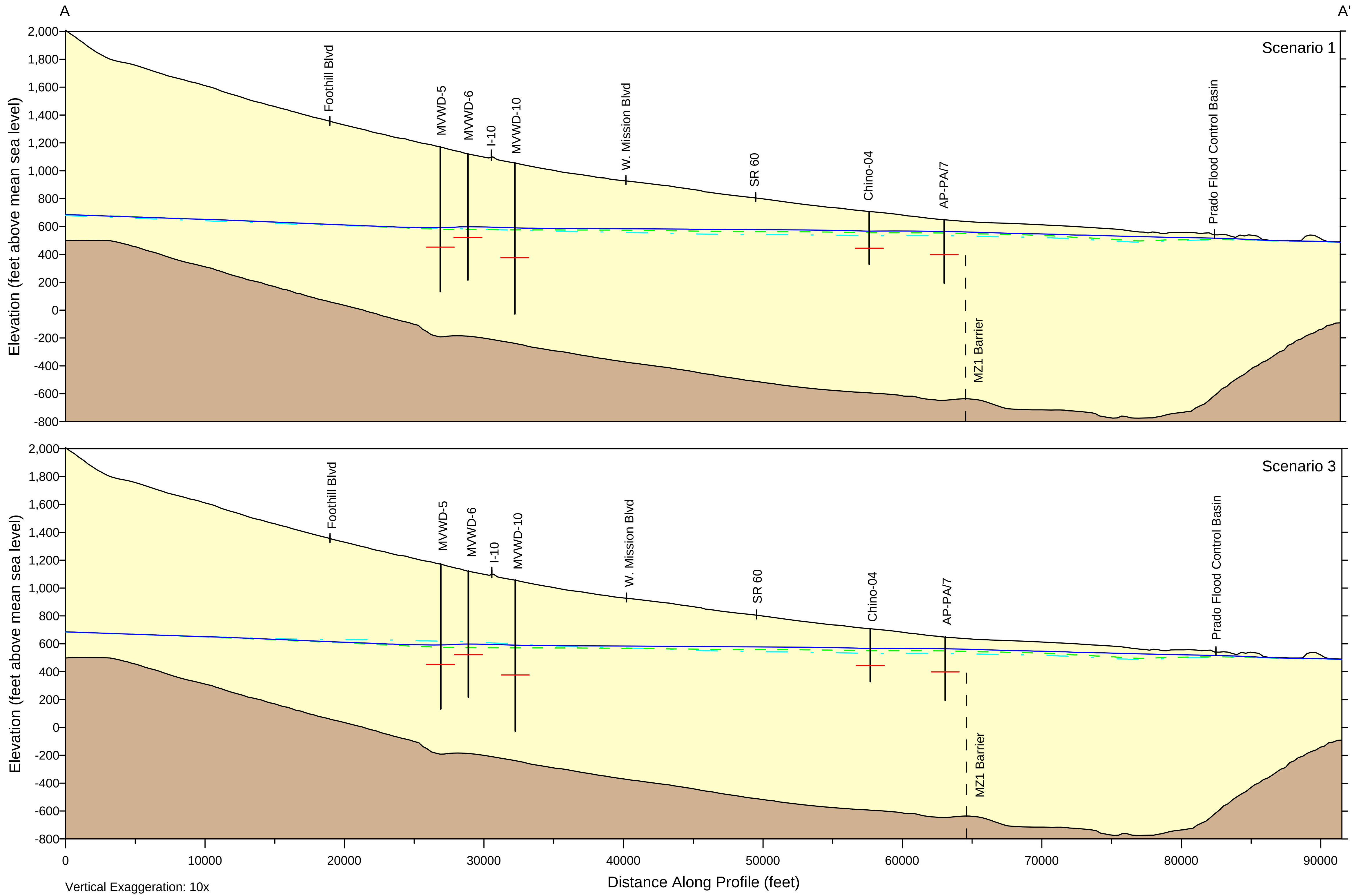
0 1 2 Miles

0 2 4 Kilometers

2013 Recharge Masterplan Update

Projected Scenario 3
Groundwater Elevation Change
for Layer 1 April 2010 to April 2030

Figure 3-6b



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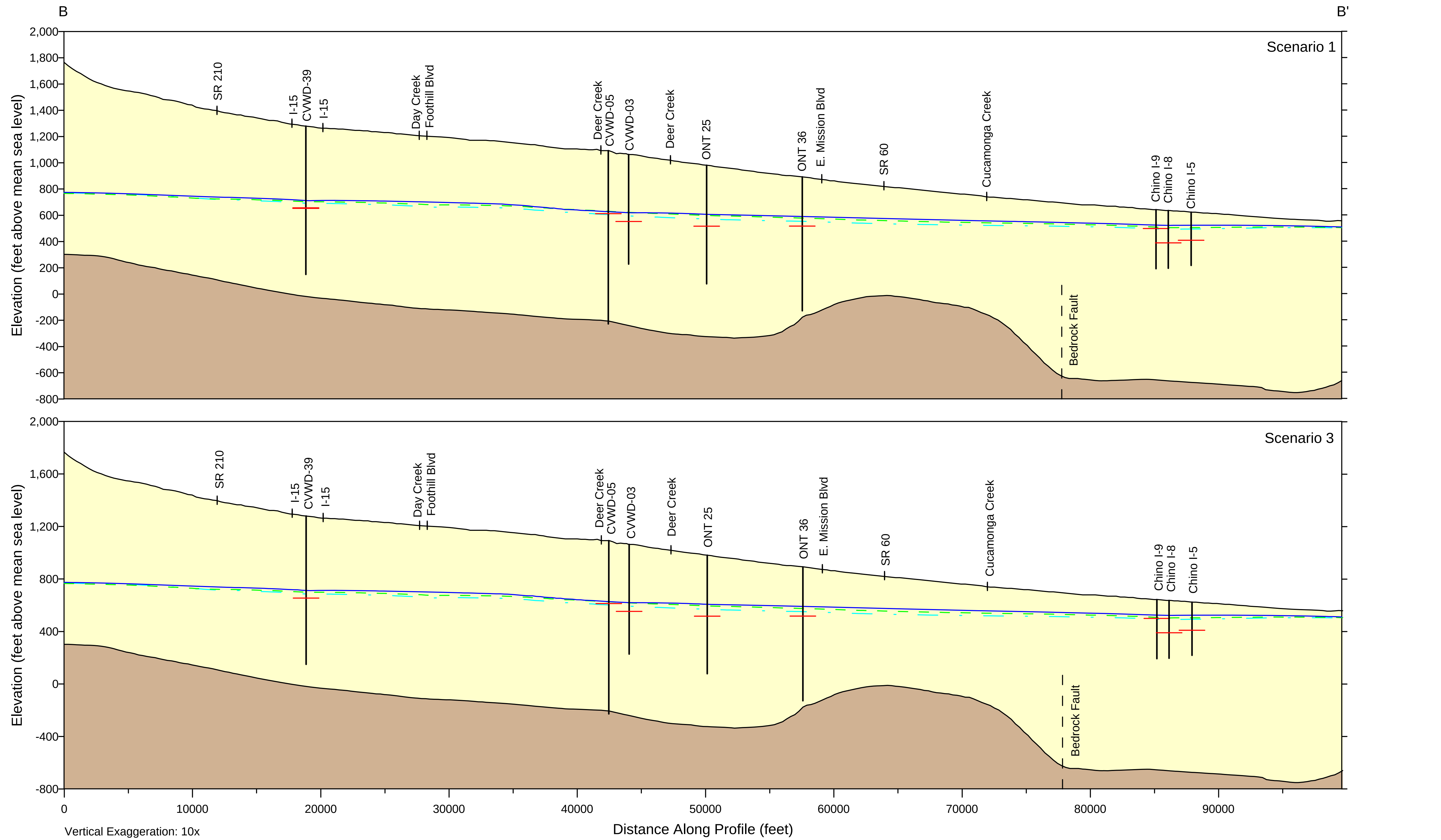
Explanation

- Freshwater Aquifer
- Effective Base Freshwater Aquifer
- Groundwater Well Showing Sustainability Metric
- Water Level (April 2010)
- Water Level (April 2020)
- Water Level (April 2030)

2013 Recharge Master Plan Update
Groundwater Level Conditions

Projected Groundwater Level Conditions in 2010, 2020, and 2030 for Scenarios 1 and 3
MZ1

Figure 3-7a



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File: Figure3-7b.grf

Explanation

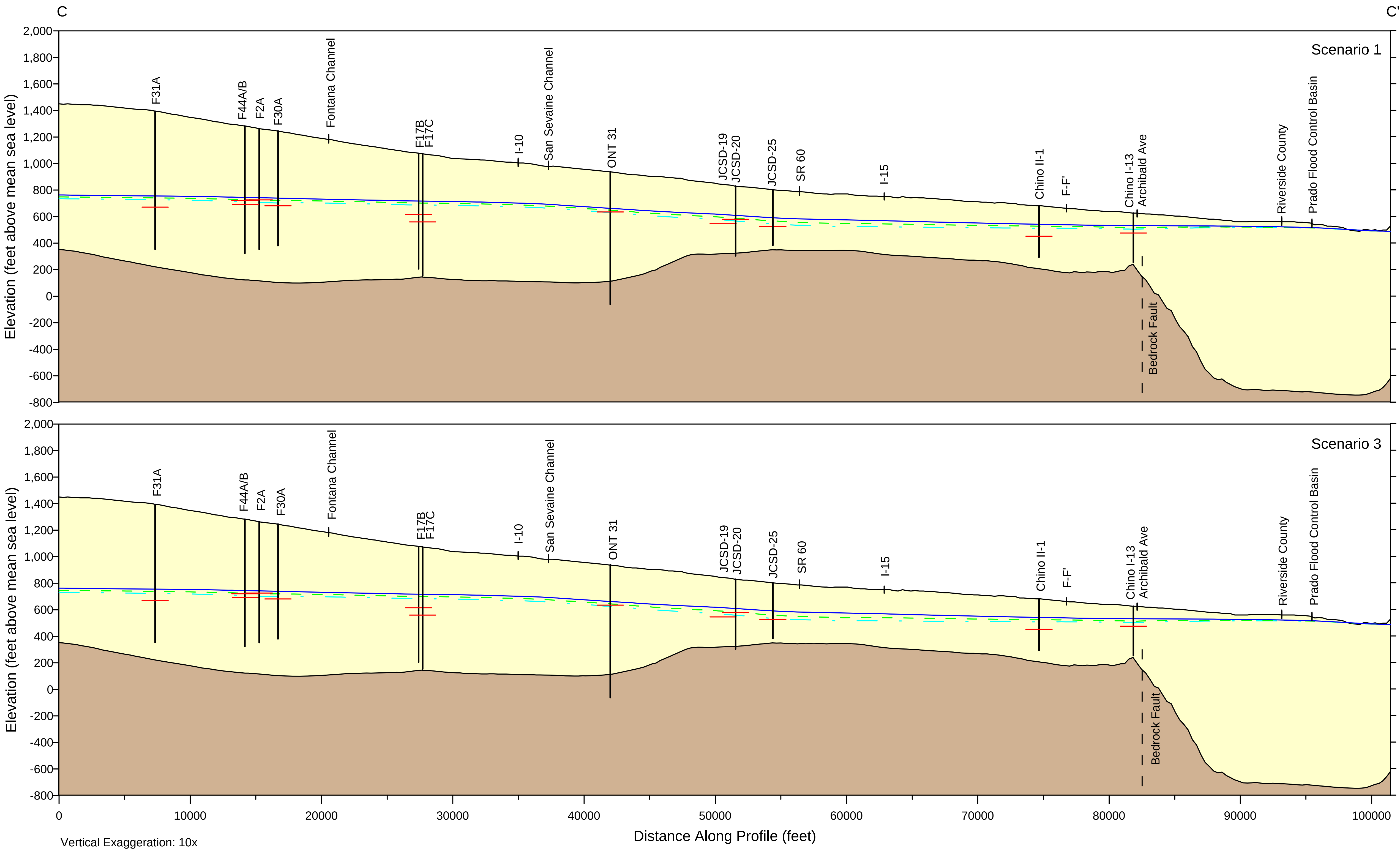
- Freshwater Aquifer
- Effective Base Freshwater Aquifer
- Groundwater Well Showing Sustainability Metric
- Water Level (April 2010)
- Water Level (April 2020)
- Water Level (April 2030)

CHINO BASIN WATERMASTER — Partners in Basin Management

2013 Recharge Master Plan Update
Groundwater Level Conditions

Projected Groundwater Level Conditions in 2010, 2020, and 2030 for Scenarios 1 and 3
MZ2

Figure 3-7b



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Date: 20120227
File: Figure3-7c.grf

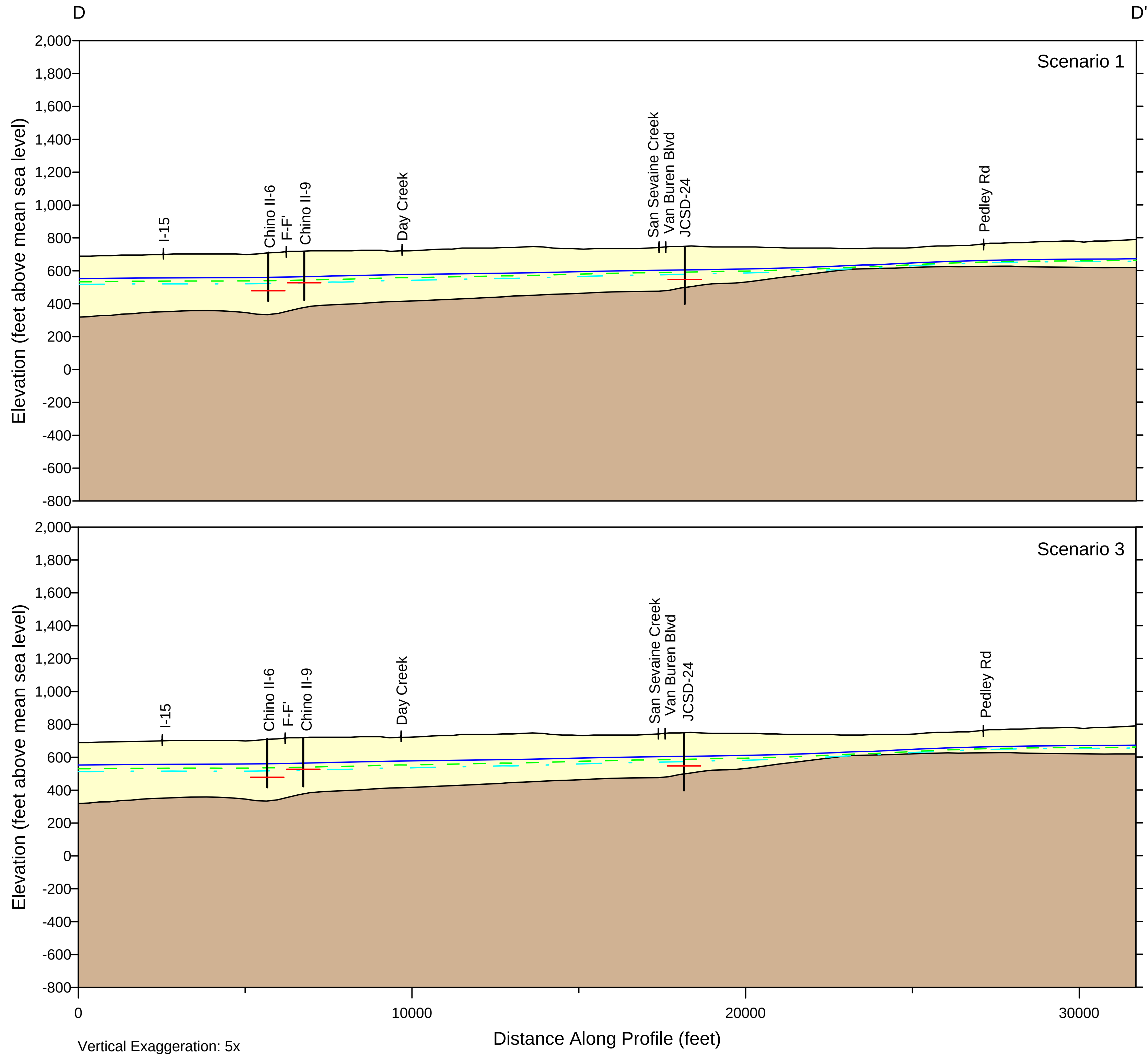
Explanation

- Freshwater Aquifer
- Effective Base Freshwater Aquifer
- Groundwater Well Showing Sustainability Metric
- Water Level (April 2010)
- Water Level (April 2020)
- Water Level (April 2030)

2013 Recharge Master Plan Update
Groundwater Level Conditions

Projected Groundwater Level Conditions in 2010, 2020, and 2030 for Scenarios 1 and 3
MZ3

Figure 3-7c



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Date: 20120227
File: Figure3-7d.grf

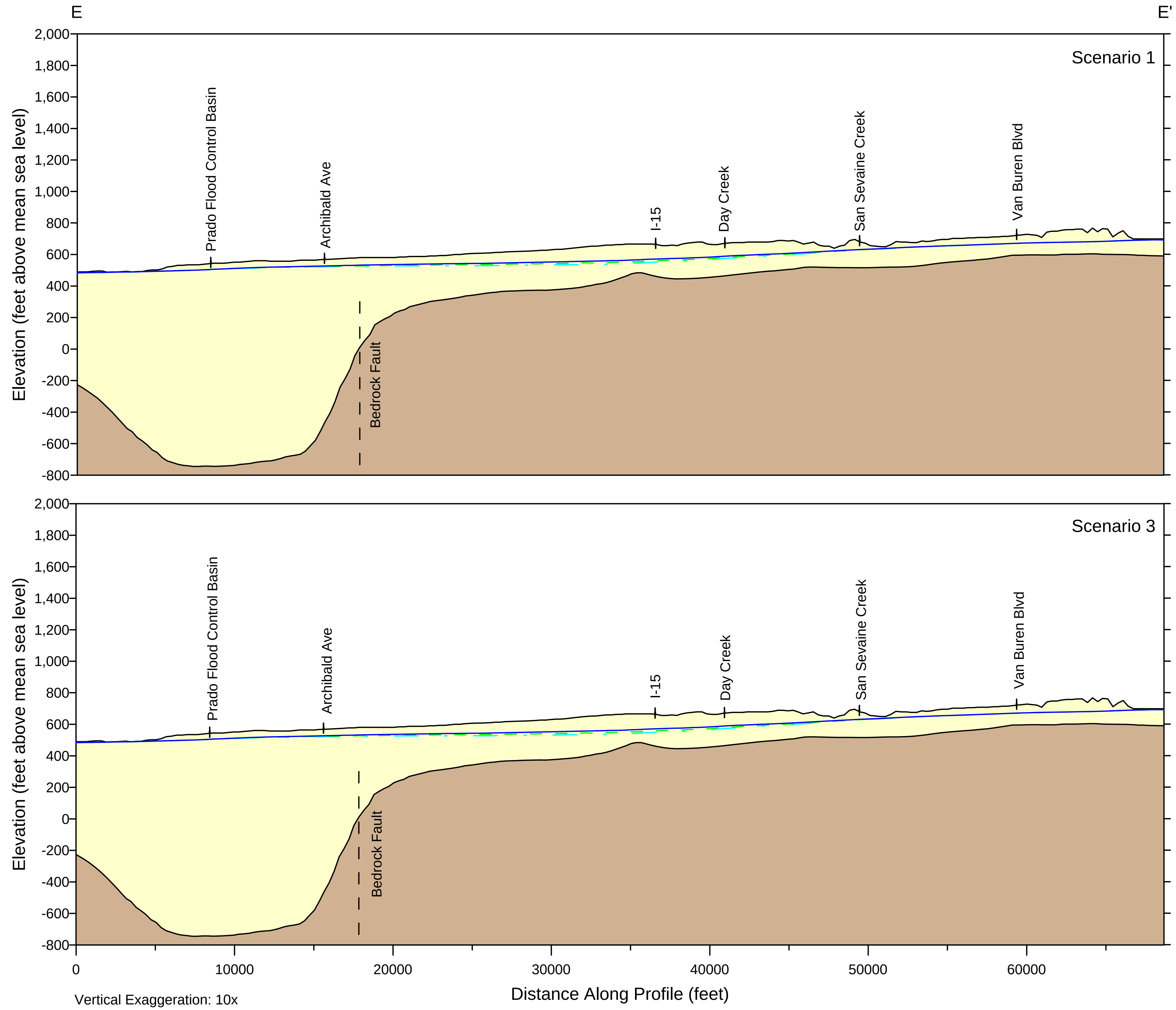
Explanation

- Freshwater Aquifer
- Effective Base Freshwater Aquifer
- Groundwater Well Showing Sustainability Metric
- Water Level (April 2010)
- Water Level (April 2020)
- Water Level (April 2030)

2013 Recharge Master Plan Update
Groundwater Level Conditions

Projected Groundwater Level Conditions in 2010, 2020, and 2030 for Scenarios 1 and 3
MZ4

Figure 3-7d



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Date: 20120227
File: Figure3-7e.grf

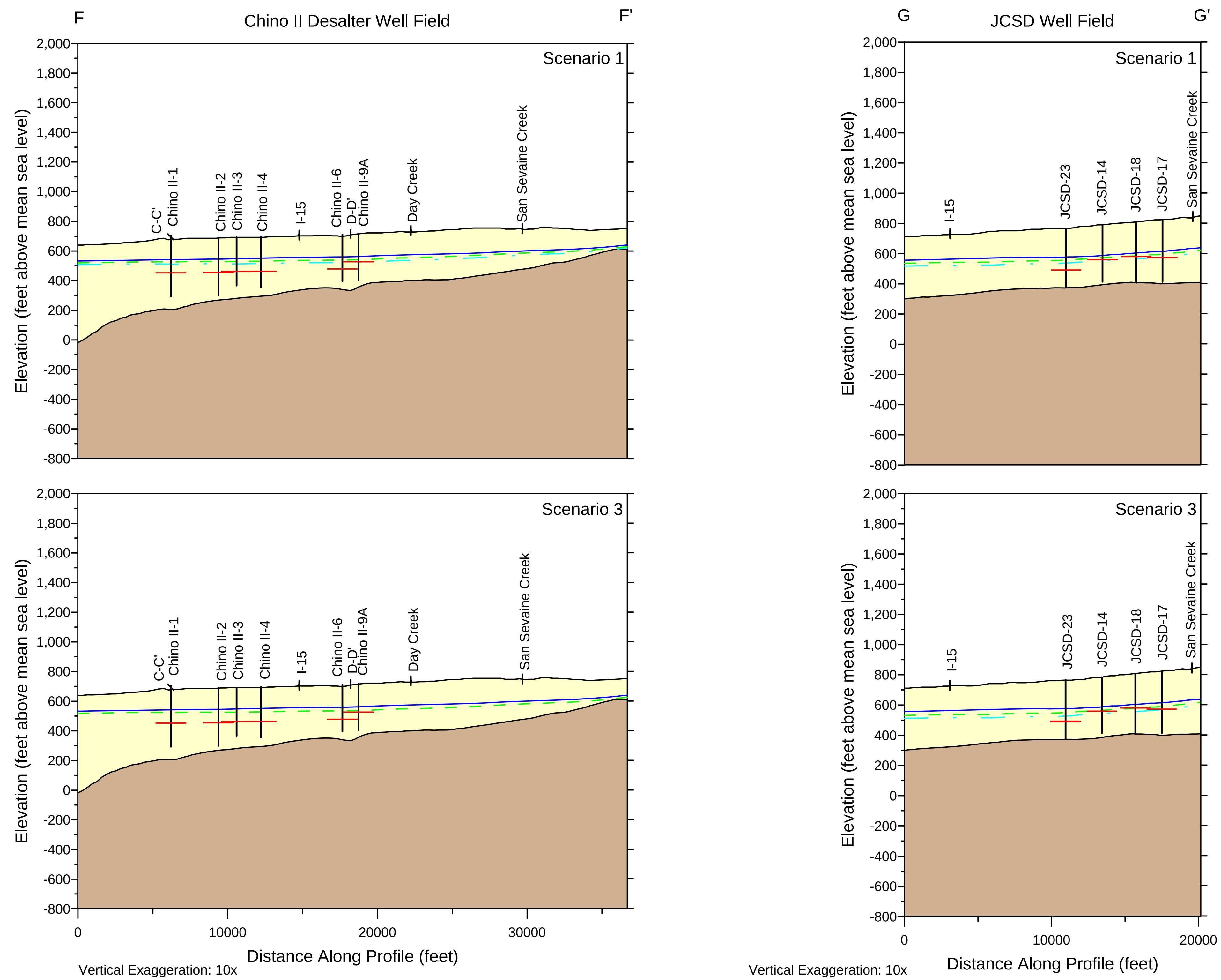
Explanation

Freshwater Aquifer
Effective Base Freshwater Aquifer
Groundwater Well Showing Sustainability Metric
Water Level (April 2010)
Water Level (April 2020)
Water Level (April 2030)

2013 Recharge Master Plan Update
Groundwater Level Conditions

Projected Groundwater Level Conditions in 2010, 2020, and 2030 for Scenarios 1 and 3
MZ5

Figure 3-7e



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File: Figure3-8.grf

Explanation

- Freshwater Aquifer
- Effective Base Freshwater Aquifer
- Groundwater Well Showing Sustainability Metric
- Water Level (April 2010)
- Water Level (April 2020)
- Water Level (April 2030)

CHINO BASIN WATERMASTER *Partners in Basin Management*

2013 Recharge Master Plan Update
Groundwater Level Conditions

Projected Groundwater Level Conditions in 2010, 2020, and 2030 for Scenarios 1 and 3
Chino II Desalters and JCSD Wells

Figure 3-8

Section 4 – Inventory of Existing Recharge Facilities and Their Capabilities

The objectives of this section are to describe existing recharge facilities and their capabilities and some new recharge concepts that were not included in the 2010 RMPU. Specifically this section answers the following questions:

1. What are the existing recharge facilities and what is their ability to recharge storm and supplemental waters?
2. What physically/institutionally limits the ability to recharge storm water at existing facilities and what improvements could be made to these facilities to capture more stormwater?
3. What physically/institutionally limits the supplemental water recharge capacity of the existing recharge facilities?
4. What are the implications of the most recent draft recycled water recharge regulations for the Chino Basin?
5. What is the recharge capacity of existing ASR facilities in the Chino Basin?
6. What is the projected in-lieu recharge capacity in the Basin and what limits it?

4.1 Existing Spreading Basins and Their Capacities

As outlined as one of the goals of the Optimum Basin Management Program (OBMP), Watermaster and the IEUA partnered with the San Bernardino County Flood Control District (SBCFCD) and Chino Basin Water Conservation District to construct and/or improve eighteen recharge sites. This project, known as the Chino Basin Facilities Improvement Project (CBFIP), anticipated a total potential recharge capacity of 130,000 acre-ft/yr. This value was derived from the original design infiltration estimates for each site, anticipated stormwater capture, reliable availability of imported water, and a recycled water contribution limit of 20 percent for each basin. The potential recharge capacity for each basin and each type of water supply, as developed as part of the CBFIP, is provided in Table 4-1 for further reference. As part of the CBFIP, significant improvements were made to each recharge site to enhance water conveyance, recharge capabilities, data collection, and monitoring.

Water conveyance improvements included various new water supply connections and diversions. Through the expansion of the IEUA recycled water distribution system, turnouts were connected to eleven of the eighteen sites. Similarly, as part of the CBFIP, several imported water turnouts were modified and/or constructed along Metropolitan's Rialto Feeder pipeline. Stormwater conveyance improvements were made through the installation of in-channel diversion structures, such as rubber dams and grated drop inlets.

Recharge capability improvements primarily consisted of removal of fine grained deposits from within the basin and the construction of internal levies. Many of these sites were not maintained for the purpose of recharge and were therefore sealed with fine grained sediments that were deposited at the bottom of the basins during the many years of stormwater retention and release operations. This project removed these sediments and restored the base and side slopes of the basins in a condition that best meets the recharge needs of the project. At several sites, internal levies were constructed to enhance the capture and storage capacity of the basin as well as to better manage the maintenance and recharge of each basin.

A key component to the CBFIP was the development of the Supervisory Control and Data Acquisition (SCADA) system. The existing SCADA system is comprised of a wide range of equipment that is located at various remote sites and facilities throughout the service area. The existing equipment has reached its end of useful life. A SCADA Master Plan was prepared with a thorough and comprehensive evaluation of the system. The Master Plan recommended upgrades to provide a robust, reliable and seamless SCADA system to sustain and support the growth of the program. Through the SCADA system, field instrumentation such as level sensors, automated gates, valves, pumps, and flow meters, staff can monitor and control field equipment remotely. The SCADA has also enabled Watermaster and the IEUA to conduct detailed reporting and analysis of recharge performance, and continue to optimize operations.

4.1.1 Spreading Facilities

The CBFIP sites are located primarily in the northern portion of the Chino Basin and are spread from the San Antonio channel on the west to the base of the Jurupa Mountains on the east. In addition to being tracked on a regional basis, recharge operations are tracked and managed within three distinct management zones. The locations of the eighteen sites within their corresponding management zones are shown in Figure 2-10. As water supplies can be preferentially delivered to recharge facilities located within a specific management zone, Watermaster will set priorities based on basin and sub-basin recharge needs.

There are two primary types of recharge basins within the CBFIP: conservation and multipurpose basins. Conservation basins are operated to recharge storm and supplemental water (ten sites). Multipurpose basins are operated primarily for flood peak discharge attenuation and secondarily for the recharge of storm and supplemental water (eight sites).

The CBFIP consisted of approximately $50M in improvements throughout the Chino Basin. Approximately 50 percent of these improvements were funded through grant proceeds from the State Water Resources Control Board. The remaining 50 percent was funded equally by the IEUA and Watermaster. Through the first seven years of operation, it is estimated that the project facilities have resulted in the recharge of nearly $52,000,000 of water into the Chino Basin. A summary of the value of water recharged by type and fiscal year is outlined in Table 4-2.

4.1.2 Spreading Basin Recharge Performance

Since initiation in 2005, data has been tracked closely for recharge of all types of water at each site. To date, the project has accounted for more than 200,000 AF of recharge into the Chino Basin. The historical recharge for each basin, in total and on average, is summarized in Tables 4-3 and 4-4, respectively.

During this same time frame (2005-2012), recharge by management zone has also been tracked. Recharge by management zone is part of the Peace Agreement and OBMP and a critical component when considering known concerns of pumping depressions, subsidence, water quality, and changing water levels throughout the Chino Basin. Figures 4-1 and 4-2 show average recharge by management zone and type from 2005 to the most recent full year of data (2011). As evident in these figures, the MZ1 recharge requirement of 6,500 acre-ft/yr has been met on an average if not annual basis, and in recent years, recharge within MZ3 has increased.

Through the evaluation of the collected recharge data, it was generally observed that the actual recharge rates have been lower than those planned during design of the CBFIP. The reduced recharge rates have been primarily attributed to reduced infiltration rates due to compaction or clogging of the basin surface with fine sediments or biological growth. A summary of the planned and actual infiltration rates, measured in feet per day, is shown in Figure 4-3.

The most effective way to keep infiltration rates maximized at each site is through a well-planned and managed maintenance program. The existing maintenance program is funded by Watermaster and the IEUA and is proposed in March of the year prior to the planned fiscal year. Contractually, Watermaster's share of funding is based on the actual storm and imported water recharged at each basin plus related turnout and habitat mitigation commitments, while the IEUA's share is based on recycled water recharge at each basin. In practice, Watermaster funding is typically based on what is available through Watermaster assessments, which is generally consistent with the prior year's budget. Basin maintenance is therefore prioritized based on available funds and has not been based on the economic merits of rehabilitated recharge potentials.

Through an evaluation of the historical recharge volumes and infiltration rates, several basins have been identified as impediments in meeting the original project potential capacity. A few of the key facilities are outlined below.

4.1.2.1 Banana & Hickory Basins

Although designated as separate basins, the Banana and Hickory Basins are within 1/2 mile and share various water supply sources, channels, and pipelines, and have similar geological characteristics. These basins were anticipated to have infiltration rates between 1.5 and 2.0 feet per day for a combined recharge volume of up to 11,600 acre-ft/yr. However, the historical infiltration rates have averaged approximately 0.5 feet per day for both sites with an average total recharge of 1,300 acre-ft/yr.

4.1.2.2 Etiwanda Debris Basin

The Etiwanda Debris Basin recently underwent a series of environmental restoration improvements by the SBCFCD. These improvements resulted in rerouting of native and imported water recharge areas. Although the average infiltration rate of 1 feet day is less than the planned 3 feet per day, post improvement infiltration rates are closer to 0.5 feet per day.

4.1.2.3 Upland Basin

The Upland Basin is a critical flood control facility for the City of Upland. As a required condition of the site development, a buttress was constructed on several sides of the basin. It is suspected that the recharge capacity of the basin was significantly affected by the depth of the basin and the compaction of the side wall sediments.

It is also important to note that the original potential capacities for these sites were based on modeled stormwater flows and the availability of imported water supplies.

Stormwater: As data has become available, the stormwater flow projections have been further refined. Based on the maximum recharge year for each basin, over 19,000 AF of stormwater was captured and recharged (92% of planned recharge capacity).

Imported Water: It is anticipated that nearly 70% of the total anticipated recharge was through the spreading of imported water purchased through Metropolitan. Historically, it was anticipated that this water would be available 7 out of every 10 years. Starting in 2008, it became apparent that imported water would be available much less often (less than 3 out of every 10 years) and that the focus of the CBFIP should be primarily on the recharge of stormwater and recycled water.

Within the Chino Basin, there are several channel drainage systems that feed various recharge sites. Evaluating the historical data and performance of each recharge site, each recharge drainage system was reviewed to determine if the capture and recharge of various types of water were maximized. Figures 4-4 through 4-13 (attached) summarize the findings of recharge performance/limitations for each drainage system.

Watermaster has an existing appropriative water right permit from the State Water Resources Control Board, Division of Water Rights. Permit No. 21225 was issued on October 9, 2008 in response to Application No. 31369. The permit allows the diversion of surface water flowing in a channel for purposes of groundwater recharge within the boundaries of the area administered by Watermaster. The water appropriated is limited to the quantity that can be beneficially used for purposes of industrial, irrigation, stock watering (dairy use), or municipal use. The total combined amount taken by direct diversion and storage during any one year is 68,500 acre-feet. The permit lists 29 intended points of diversion into recharge basins from the various Chino Basin creek systems.

The permit requires that 68,500 acre-ft/yr of stormwater be put to beneficial use by December 31, 2075. Water which is not put to beneficial use by that date is no longer authorized to be diverted. Waste or unreasonable use of water or unreasonable method of diversion and use of the water is not allowed. Over the past six years (July 2005 to June 2011), an average of approximately 11,000 acre-ft/yr of stormwater has been diverted for recharge. The minimum and maximum amounts diverted were 4,734 acre-ft/yr and 17,051 acre-ft/yr, respectively.

4.1.3 Historical Spreading of Supplemental Water

Supplemental water recharge in the Chino Basin can either be imported water or recycled water. Imported water is used for replenishment purposes to offset overproduction of the basin, and recycled water is assigned (pro-rata) to the IEUA agencies that provide wastewater. Imported water comes from the State Water Project (SWP) via Metropolitan/the IEUA, and recycled water is delivered by the IEUA. This imported and recycled water is delivered to the recharge basins through several locations, as shown in Figure 2-10 and 2-11.

4.1.3.1 Imported Water

Historically, Watermaster purchases replenishment water when one or more of the parties overproduces. Watermaster has traditionally met its replenishment obligations by purchasing imported water from Metropolitan (replenishment water service) and unproduced groundwater from the appropriators. In the recent past, Metropolitan was typically able to supply all of the replenishment needs in its service area with replenishment water service, which was estimated to be available seven out of ten years. Recent court rulings regarding endangered species and the drought have severely limited the ability of Metropolitan and other SWP contractors to obtain SWP water. In 2008, Metropolitan provided a revised replenishment water service forecast, projecting that replenishment water would be available three out of ten years.

Watermaster has an obligation under the Judgment to provide replenishment water for overproduction[14] with the cost borne mostly or entirely by the overproducing party. Because Metropolitan eliminated the replenishment program and discounted rate, Watermaster will have to acquire new non-traditional supplemental water supplies for replenishment. These non-traditional supplemental water supplies could consist of Metropolitan Tier I and Tier II service waters, non-IEUA recycled water, and other imported supplies from the Central Valley, the Colorado River, and other areas.

4.1.3.2 Recycled Water

In 2005, the IEUA initiated an aggressive recycled water reuse program for its service area. Under this program, most of the recycled water produced in the IEUA service area will be directly reused for irrigation, landscaping, and other direct reuse purposes. The remaining recycled water is recharged at selected spreading basins.

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[14] Judgment, paragraph 45

Recycled water recharge is not used to satisfy replenishment obligations. Instead, it is recharged into the basin and subsequently assigned to certain Appropriator parties' supplemental storage accounts, thereby potentially increasing the Appropriators' production rights and reducing their future replenishment liabilities. Watermaster assigns recharged recycled water to Appropriators based on the relative sewage contributions of the Appropriators to the IEUA.

4.1.4 Increase in Recharge from Operational and Minor Facility Improvements

As part of the review of the 2010 GWRMP Update, several additional operational and minor facility improvements were identified as potential opportunities to quickly enhance recharge within the Chino Basin. These enhancements are generally broken down into the following categories.

4.1.4.1 Internal Berms

- San Sevaine Basin – construction of internal berms within basin 5 would enable a larger portion of the basin floor to be wet, therefore increasing stormwater capture and recharge.

- College Heights Basins – the construction of internal berms (E-W) within basins will better spread recharge within the basin and is anticipated to reduce the potential of site seepage to the west.

4.1.4.2 Basin Rehabilitation

- Etiwanda Debris Basin – less than expected infiltration rates have been observed. Ripping of the basin and rebuilding of an internal berm would enhance capture and recharge.

4.1.4.3 Conveyance Improvements

- Jurupa Basin – the pump station at Jurupa Basin currently has only one pump that supplies a maximum delivery of 10 cfs of imported or stormwater to RP-3. The facility was constructed with an empty bay for a second pump. Installation of the second pump would enable the facility to capture all flows from the San Sevaine channel.

- Montclair Basins – as part of the CBFIP, it was originally planned to automate the inlet gate into Montclair Basin No. 1 as well as to construct an inlet from the San Antonio channel into Montclair Basin Nos. 2 or 3. These improvements would enable the Montclair Basin to make inlet adjustments remotely and ensure that diversion could remain in effect during maintenance activities.

In addition to the abovementioned operational and minor facility improvements, the following projects have been identified as viable opportunities to promote recharge with only minor improvements.

- Wineville Basin[15] – as outlined in detail within the 2010 GWRMP Update, Wineville Basin is a very large basin with outstanding conveyance infrastructure (flow through stormwater basin with upstream recycled water and imported water turnout facilities). It is proposed that as a short term improvement, a dirt berm be installed in this basin to promote water storage and recharge.

- Princeton Basin – this basin is a flow through basin that currently receives water released from 8th Street Basins prior to being recaptured at Ely Basin. Enhancement of this site would include minor grading and rehabilitation and would help relieve the heavy hydraulic loading to Ely Basin.

The Wineville Basin and Princeton Basin projects, mentioned above, are only two examples of numerous additional potential recharge basins within the service area. There are additional recharge basins that were not a part of the original eighteen CBFIP basins that have been identified by individual parties (i.e. recharge basins in Fontana). These additional stormwater retention basins are not owned by any of the existing parties to the Four-Party Agreement; however, these additional recharge opportunities will be pursued with the required coordination and agreements, if determined feasible. There are presently no estimates of increased storm or supplemental recharge capacity from the implementation of these projects.

4.1.5 Impact of Anticipated Changes in the Draft Title 22 Rules for Groundwater Recharge with Recycled Water

The California Department of Public Health (CDPH) is responsible for the development of regulations for the use of recycled water for groundwater recharge. The CDPH works with the local Regional Water Quality Control Board (RWQCB) to issue site-specific permits. The IEUA and Watermaster currently have 13 sites that are permitted through the RWQCB (Order No. R8-2007-0039)[16] for groundwater recharge of recycled water.

In 2010, Senate Bill 918 was enacted, which required the CDPH to adopt uniform water recycling criteria for groundwater recharge (using recycled water) by December 31, 2013. Following the release of new proposed recycled water groundwater recharge regulations, the

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[15] The Wineville Basin project was identified in the 2010 RMPU. The project described herein is part of reduced project that was described as "proof of concept" project to assess the infiltration characteristics and feasibility of the project identified in the 2010RMPU. The suggestion herein is that the proof of concept project could be the final project.

[16] http://www.waterboards.ca.gov/rwqcb8/board_decisions/adopted_orders/orders/2007/07_039_wdr_ieuacbw_cbrwgrp_06292007.pdf

CDPH initiated a series of workshops in late 2011. Key changes to the proposed regulations included additional monitoring (type and frequency), diluent water characterization, and travel time determination.

Based on these proposed changes, the primary change of concern that could affect recharge capabilities for new recharge projects is the diluent water characterization. The new regulations infer that stormwater will be regulated to meet maximum contaminant levels (MCLs). If MCLs are not met, the water cannot be used as diluent water when calculating the allowable recycled water contribution for that specific basin, hence reducing potential recycled water deliveries.

It is not expected that the requirements within the proposed regulations would affect the IEUA/Watermaster, as they are operating under an existing Order. In the event that the CDPH or the RWQCB identifies components of the Order that do not adequately meet public health targets, portions of all of the new regulations could be imposed on the IEUA/Watermaster.

4.2 Other Recharge/Storage Management Methods

4.2.1 In-Lieu Recharge

In-lieu recharge occurs when a water purveyor with production rights in the Chino Basin elects to use supplemental water (typically imported water) in-lieu of pumping Chino Basin groundwater. The unproduced Chino Basin groundwater is reclassified as supplemental water pursuant to the Judgment and can be used to satisfy a replenishment obligation by an equal amount. In-lieu recharge has proven to be a more feasible form of recharging the Chino Basin than constructing recharge basins or aquifer storage and recovery (ASR) wells. However, it typically requires economic incentives that are not always available to entice participation.

4.2.2 Existing In-lieu Recharge Capacity

The in-lieu recharge capacities estimated during the Dry Year Yield Program Expansion in 2008 range from 25,000 to 40,000 acre-ft/yr (Black & Veatch, 2008). The only other major Chino Basin groundwater producer that also receives imported water is the Fontana Water Company (FWC). Based on FWC imported water capacity, Chino Basin groundwater production capacity, and historical demands, it is estimated that another 5,000 to 10,000 acre-ft/yr of in-lieu potential could theoretically be added. This would give a total of 30,000 to 50,000 acre-ft/yr of estimated in-lieu potential for the Chino Basin.

4.2.3 Historical In-lieu Recharge

The Chino Basin has taken imported water in-lieu of groundwater production through a number of conjunctive use programs provided by Metropolitan (i.e. Replenishment, Cyclic, Trust Storage/Forbearance, and Dry Year Yield). All four programs have provided water to the Chino Basin in years when Metropolitan has surplus supplies; this water is then pumped out at a later date when Metropolitan has limited supplies. Each program has slightly different supply costs and incentives, but all programs increase local supplies to the Chino Basin that can be used in times of imported water shortages. Since 1978, an estimated 350,000 AF of imported water has come into the Chino Basin through in-lieu methods.

4.2.4 Increase in In-lieu Recharge Capacity from Operational and Minor Facility Improvements

As described above, historically there are several programs that Chino Basin parties have participated in that have brought surplus water into the basin via in-lieu. However, the parties have other local resources (i.e. groundwater, surface water, desalter water, and recycled water) that provide additional opportunities to bring surplus water into the basin through in-lieu methods. Below are few examples of potential in-lieu opportunities within the Chino Basin.

- Potable Water Interconnections – between the JCSD and the City of Ontario, the CVWD, and the Fontana Water Company (FWC).[17] Existing or constructed potable water interconnections between agencies (i.e. the CVWD, Ontario, the FWC, and the JCSD) can be utilized to deliver surplus surface water, other groundwater, or imported water in-lieu of Chino Basin groundwater production. This would achieve replenishment and improve the balance of recharge and discharge in management zones of concern by decreasing the JCSD's groundwater production.

- Desalter Production Reallocation – i.e. more to the JCSD. Desalter production could be reallocated to the JCSD, from any other CDA agency, in-lieu of Chino Basin groundwater production, which would achieve replenishment and improve the balance of recharge and discharge in the JCSD area.

- Metropolitan Improvements – i.e. Riverside/Corona feeder. The Riverside/Corona Feeder could supply treated SWP water to the JCSD in-lieu of groundwater production, which would achieve replenishment and improve the balance of recharge and discharge in the JCSD area.

4.3 Existing ASR Capacity

ASR wells are usually wells that function as injection and recovery wells. Water treated to drinking water standards is injected into an aquifer when surplus water is available and recovered later when needed. The only existing ASR wells in the Chino Basin are owned and

[17] In-lieu recharge requires that a party have a supplemental supply and possession of groundwater production rights. The Fontana Water Company's share of operating safe yield is about .009 percent and is likely too small to affect significant in-lieu recharge. However, an interconnection with the JCSD could be used for in-lieu recharge by the JCSD forgoing the production of some of its production rights and would provide significant benefits to the JCSD.

operated by Monte Vista Water District (MVWD). Typically, the MVWD can recharge up to 3,500 acre-ft/yr (can be as high as 5,400 acre-ft/yr, depending on maintenance schedules) of treated SWP water by injection at its wells—4, 30, 32, and 33 (ASR project)—and subsequently recover most this water within the same year. Injection has generally occurred in the seven-month period of October through April, and recovery has generally occurred in the five-month period of May through September. Table 4-5 lists the MVWD ASR wells and their respective injection and extraction capacities.

Through the RMPU process, four additional ASR projects were identified that could be used to increase the supplemental water recharge capacity of the Chino Basin, to provide Watermaster additional recharge capacity during the rainy season, and to provide Watermaster with another tool to balance recharge and discharge pursuant to the Peace Agreement.

These ASR projects would include the conversion of existing production wells or the construction of new wells within each service area. These facilities would be owned and operated by the individual agencies. These projects would not only provide additional water supply but increase the supplemental water recharge capacity of the Chino Basin and reduce the groundwater level impacts of reoperation in each service area. In addition, they will provide Watermaster with more wintertime recharge capacity when its recharge basins are being used to recharge stormwater. Table 4-6 shows the existing and potential ASR injection capacities.

4.4 Total Supplemental Recharge Capacity

The 2010 RMPU evaluated the frequency of storms and runoff into recharge facilities that also recharge imported water and determined that the supplemental water recharge capacity of the existing spreading basins is about 99,000 acre-ft/yr but is limited to about 83,100 acre-ft/yr due to turnout limitations on the Rialto Pipeline. Existing ASR capacity for supplemental water recharge is about 3,500 acre-ft/yr. The total wet-water recharge capacity (supplemental water recharge capacity in spreading basins + ASR recharge capacity) is 86,600 acre-ft yr. In-lieu recharge capacity ranges from about 25,000 to 40,000 acre-ft/yr. In-lieu recharge can be used to improve the balance of recharge and discharge in the basin. The total supplemental water recharge capacity (supplemental water recharge capacity in spreading basins + ASR recharge capacity + in-lieu capacity) ranges from 111,600 to 126,600 acre-ft yr.

Table 4-1
Storm and Supplemental Water Recharge Capacity Estimates

(acre-ft/yr)

Basin	IEUA Estimated Recharge Capacity[1]				2010 RMPU Recharge Capacity[2]		
	Storm	Imported	Recycled	Total	Storm	Supplemental[4]	Total
Brooks Street Basin	1,900	3,600	1,400	6,900	672	2,474	3,146
College Heights Basins	100	7,900	0	8,000	0	7,421	7,421
Montclair Basin 1 Montclair Basin 2 Montclair Basin 3 Montclair Basin 4	2,100	9,900	0	12,000	1,024	19,789	20,813
Seventh and Eighth Street Basins	1,600	2,600	1,100	5,300	1,223	2,474	3,697
Upland Basin	1,000	8,700	0	9,700	479	9,895	10,373
Subtotal Management Zone 1	***6,700***	***32,700***	***2,500***	***41,900***	***3,398***	***42,052***	***45,450***
Ely Basins	1,000	0	2,300	3,300	1,366	2,474	3,840
Etiwanda Spreading Area (Joint Use of Etiwanda Debris Basin)	1,700	7,900	2,400	12,000	883	3,463	4,346
Etiwanda Ponds[3]	1,100	5,300	1,600	8,000	0	0	0
Hickory Basin	900	4,200	1,300	6,400	213	2,061	2,274
Lower Day Basin	500	3,700	1,000	5,200	555	4,453	5,008
San Sevaine No. 1 San Sevaine No. 2 San Sevaine No. 3 San Sevaine Nos. 4 and 5	2,200	14,500	4,100	6,900	2,865	11,379	14,243
Turner Basins Nos. 1 and 2 Turner Basins Nos. 3 and 4[5]	2,700	5,100	1,900	6,900	1,485	1,484	2,970
Victoria Basin	1,000	4,700	1,400	7,100	561	2,968	3,530
Subtotal Management Zone 2	***11,100***	***45,400***	***16,000***	***72,500***	***7,928***	***28,282***	***36,210***
Banana Basin	800	3,400	1,000	5,200	445	2,061	2,506
Declez Basin	300	1,600	500	2,400	912	2,474	3,385
IEUA RP3 Ponds	1,700	7,900	2,400	12,000	444	8,245	8,689
Subtotal Management Zone 3	***2,800***	***12,900***	***3,900***	***19,600***	***1,801***	***12,780***	***14,581***
Total	**20,600**	**91,000**	**22,400**	**134,000**	**13,126**	**83,114**	**96,241**

[1] From IEUA draft report dated April __, 2012 sent to Watermaster by email
[2] 2010 Recharge Master Plan (WEI, 2010)
[3] The Etiwanda Ponds became unavailable after the IEUA recharge capacity estimates were prepared
[4] Supplemental water includes imported and recycled water.
[5] New recharge improvements are being constructed on the land on which Turner Basins Nos. 3 and 4 is located and the recharge capacity on this land will subsequently be increased.

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Table 4-2

Chino Basin Groundwater Recharge Value FY 2005/06 – FY 2011/12

Period	Stormwater	Metropolitan Water District	Recycled	Total
FY 2005/06	$4,302,729	$3,139,307	$333,762	$7,775,798
FY 2006/07	$1,566,967	$3,068,141	$704,928	$5,340,036
FY 2007/08	$3,492,863	-	$622,434	$4,115,297
FY 2008/09	$2,895,585	-	$842,875	$3,738,460
FY 2009/10	$6,737,328	$590,000	$2,862,370	$10,189,698
FY 2010/11	$8,620,292	$1,116,858	$3,134,934	$12,872,084
FY 2011/12*	$2,792,573	$2,662,092	$2,302,696	$7,757,361
Subtotals	**$30,408,337**	**$10,576,398**	**$10,803,999**	**$51,788,734**

*Note: Values (thru Feb) are calculated based on year specific water supply costs vs. MWD's Tier I untreated rate.

Table 4-3
Chino Basin Total Recharge
FY 2005/06 through FY 2011/12

Chino Basin Groundwater Recharge Sites	Stormwater and Local Runoff	Metropolitan Water District	Recycled	Total
8th Street 1 & 2	7,871	1,122	4,507	13,500
Banana	1,844	1,001	4,320	7,165
Brooks	3,637	5,045	5,166	13,848
College Heights	944	10,074	-	11,018
Declez	4,820	-	65	4,885
Ely	10,986	968	2,976	14,930
Etiwanda Conservation	-	-	-	0
Etiwanda Debris Basin	2,116	4,367	-	6,483
Grove	2,074	-	-	2,074
Hickory	3,468	1,340	4,061	8,869
Lower Day	2,508	7,310	-	9,818
Montclair	7,087	35,583	-	42,670
RP3	6,999	2,607	4,974	14,580
San Sevaine	5,448	17,132	851	23,431
Turner 1/2 and 3/4	11,763	860	2,500	15,123
Upland	3,280	16,013	-	19,293
Victoria	2,341	352	927	3,620
Total Replenishment	**77,186**	**103,774**	**30,347**	**211,307**

Table 4-4
Chino Basin Average Annual Recharge
FY 2005/06 through FY 2011/12

Chino Basin Groundwater Recharge Sites	Stormwater and Local Runoff	Metropolitan Water District	Recycled	Total
8th Street 1 & 2	1,124	160	644	1,928
Banana	263	143	617	1,023
Brooks	520	721	738	1,979
College Heights	135	1,439	-	1,574
Declez	689	-	9	698
Ely	1,569	138	425	2,132
Etiwanda Conservation	-	-	-	0
Etiwanda Debris Basin	302	624	-	926
Grove	296	-	-	296
Hickory	495	191	580	1,266
Lower Day	358	1,044	-	1,402
Montclair	1,012	5,083	-	6,095
RP3	1,000	372	711	2,083
San Sevaine	778	2,447	122	3,347
Turner 1/2 and 3/4	1,680	123	357	2,160
Upland	469	2,288	-	2,757
Victoria	334	50	132	516
Total Replenishment	**11,024**	**14,823**	**4,335**	**30,182**

Table 4-5
Chino Basin ASR Injection and Extraction Capacity[1]

ASR Facility	Injection Capacity[2]		Extraction Capacity[2]	
	(gpm)	(acre-ft/month)	(gpm)	(acre-ft/month)
MVWD-4	400	53	800	106
MVWD-30	1,000	133	2,000	265
MVWD-32	1,000	133	2,000	265
MVWD-33	1,000	133	2,000	265
Total	**3,400**	**451**	**6,800**	**902**

1. All of the existing ASR wells owned by the Monte Vista Water District with the exception being MVWD-33, which is co-owned by the City of Chino.

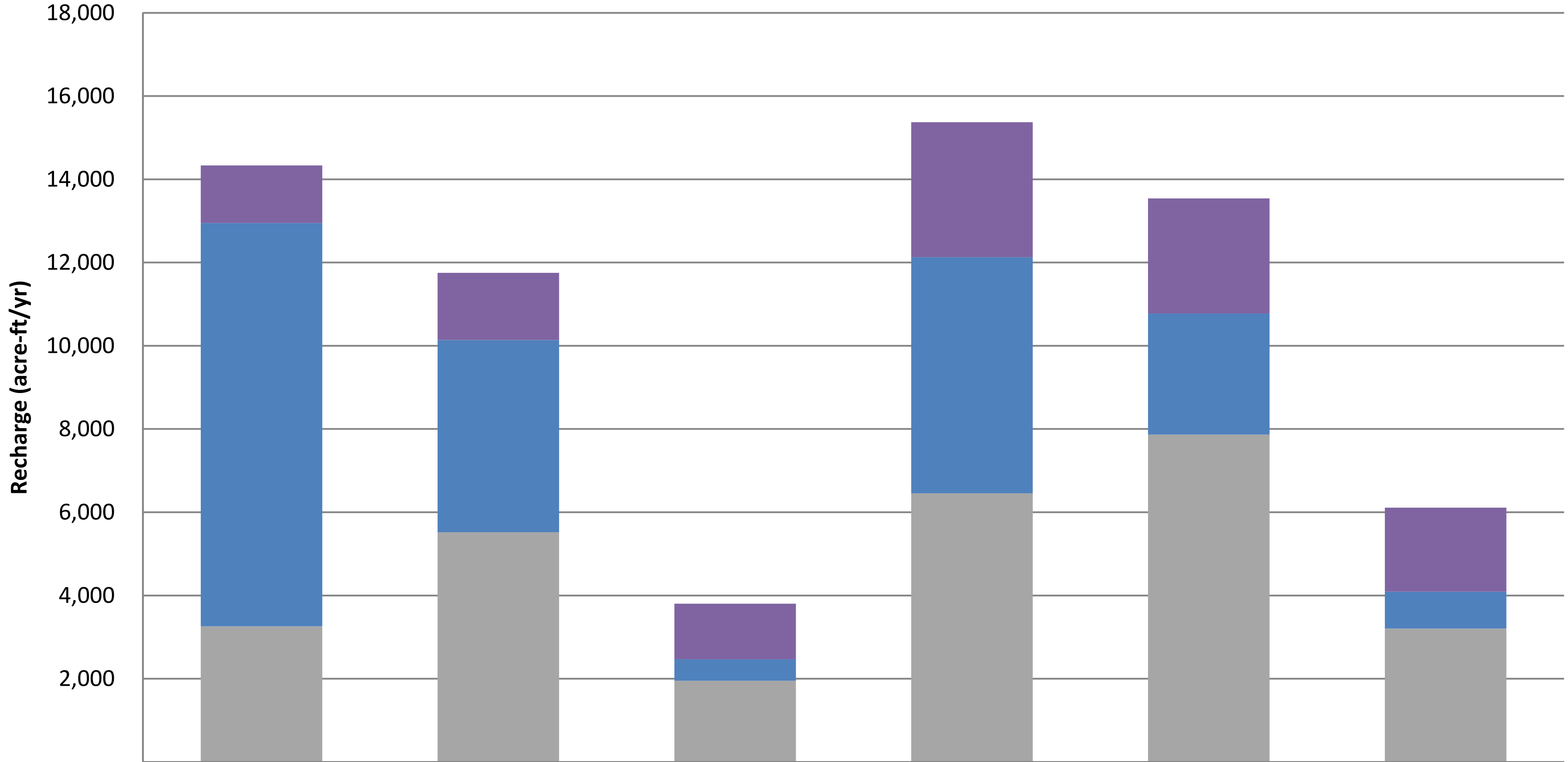
2. The injection and extraction capacities assume the wells are operating 24 hours a day for 30 days.

Table 4-6
Chino Basin Existing and Potential ASR Injection Capacity

Agency	Injection Capacity[1]	
	(gpm)	(acre-ft/yr)
Cucamonga Valley Water District	7,975	6,433
Jurupa Community Services District	4,000	3,228
City of Ontario	6,225	5,020
Fontana Water Company	0	0
Monte Vista Water District	3,400	2,742
Total	**21,600**	**17,423**

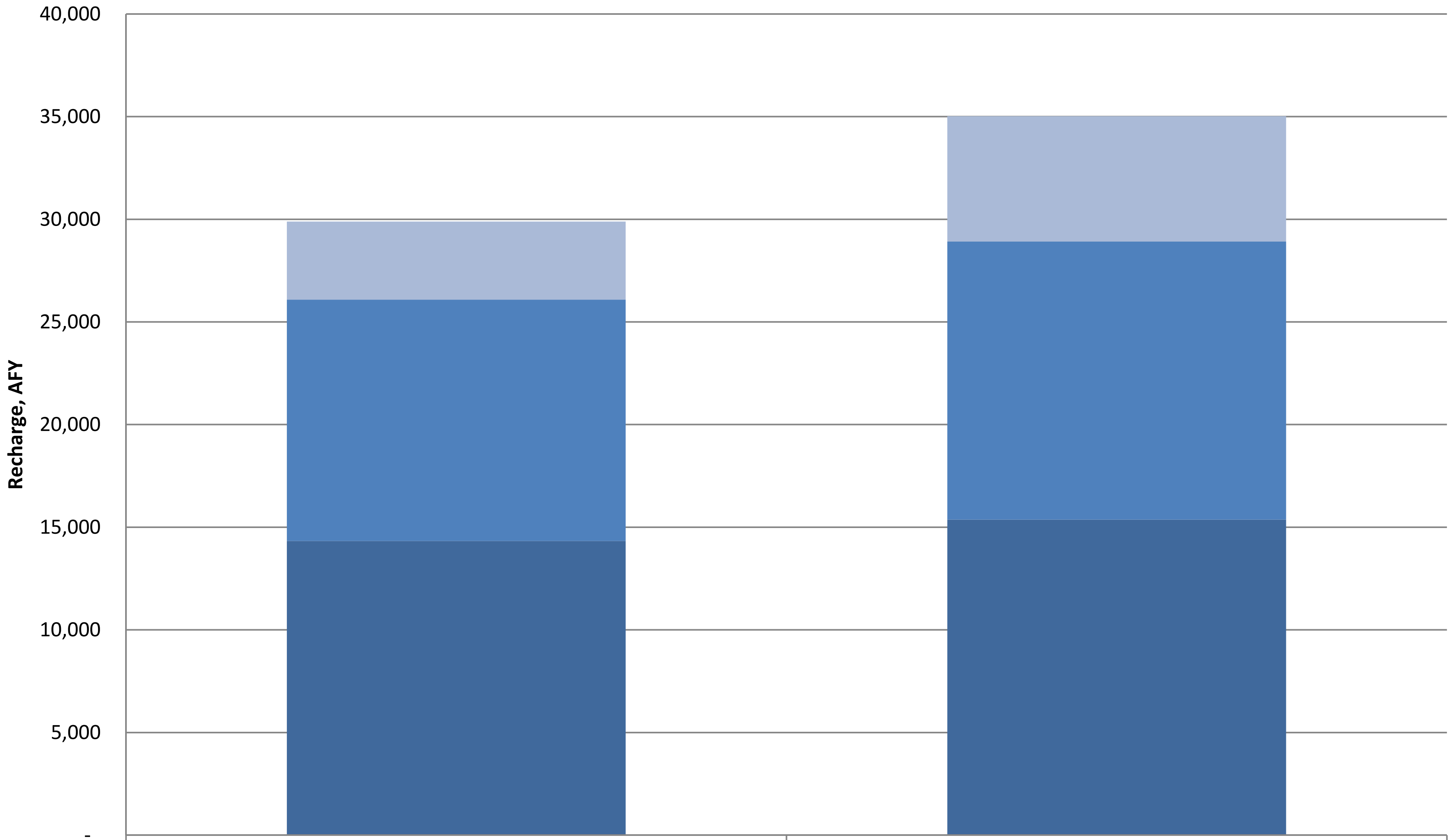
1. The injection capacity assumes the injection occurs six months out of the year.

Figure 4-1
Recharge by Management Zone and Type



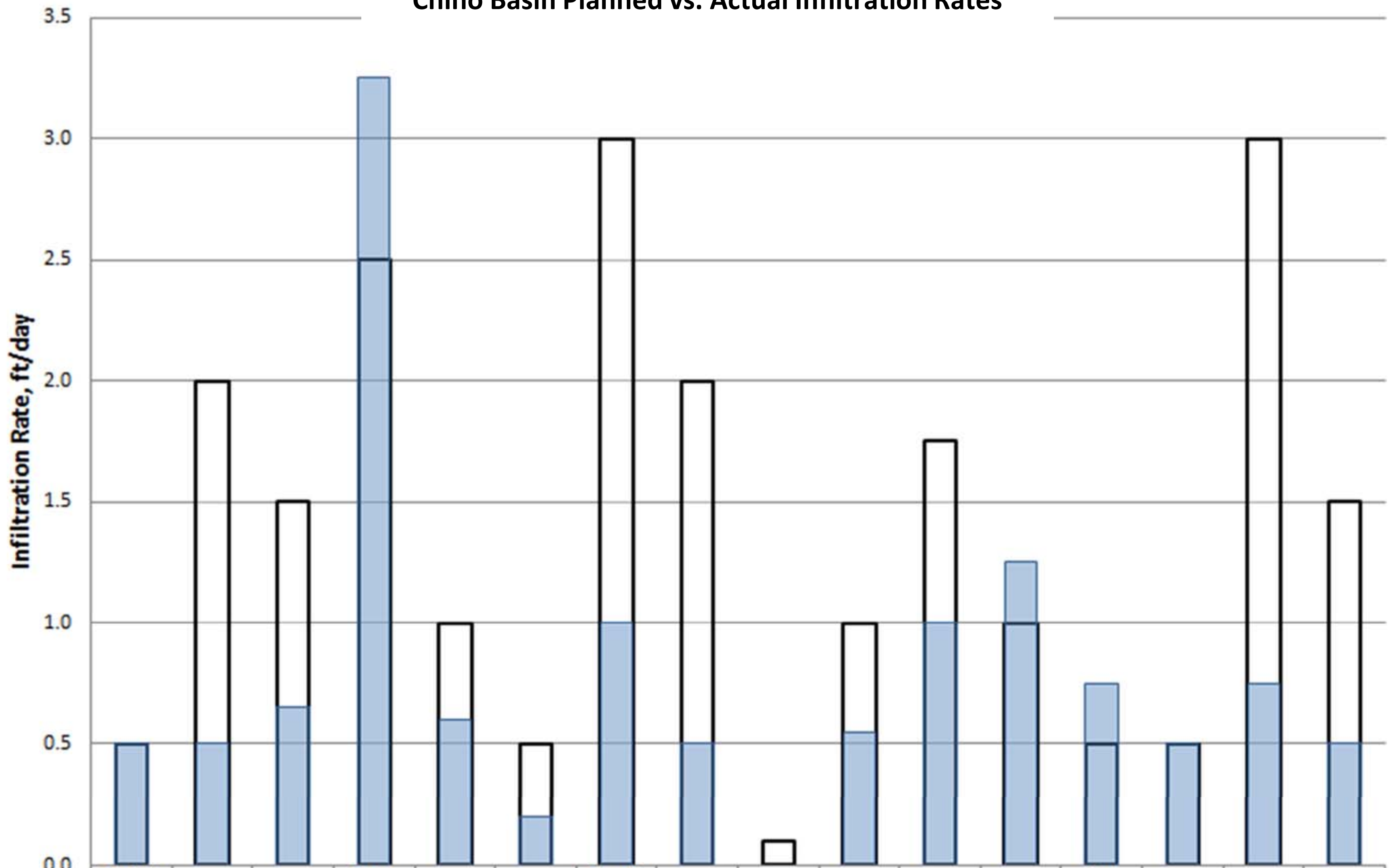
	MZ-1	MZ-2	MZ-3	MZ-1	MZ-2	MZ-3
Recycled	1,382	1,616	1,337	3,244	2,764	2,020
MWD	9,691	4,618	515	5,673	2,909	882
SW/LR	3,260	5,519	1,952	6,456	7,866	3,207
	Average for 2006-2011			FY2010/11		

Figure 4-2
Chino Basin Facilities Improvement Program Recharge by Management Zone



	2005-2011	FY10/11
MZ-3	3,804	6,109
MZ-2	11,754	13,539
MZ-1	14,333	15,373

Figure 4-3
Chino Basin Planned vs. Actual Infiltration Rates



	7th & 8th St.	Banana	Brooks	College Heights	Declez	Ely	Etiwanda Debris	Hickory	Jurupa	Lower Day	Montclair	RP3	San Sevaine	Turner	Upland	Victoria
Planned	0.5	2.0	1.5	2.5	1.0	0.5	3.0	2.0	0.1	1.0	1.8	1.0	0.5	0.5	3.0	1.5
Actual	0.5	0.5	0.7	3.3	0.6	0.2	1.0	0.5	0.0	0.6	1.0	1.3	0.8	0.5	0.8	0.5

Section 5 – Monitoring, Reporting, and Accounting Practices to Estimate Long-Term Average Annual Net New Stormwater Recharge

One of the conclusions of the engineering investigations that supported the development of the Peace II Agreement was that the safe yield of the Chino Basin was declining due changes in landuse and stormwater management practices. In the Final Report and Recommendations on Motion for Approval of Peace II Documents (Schneider, 2007), the Special Referee recommended and the Court ultimately ordered that several elements be included within the 2010 RMPU (Motion to Approve Watermaster's Filing in Satisfaction of Condition Subsequent 5; Watermaster Compliance with Condition Subsequent 6, August 21, 2008) one of which was:

> "3. Measures should be evaluated to lessen or stop the projected Safe Yield decline. All practical measures should be evaluated in terms of their potential benefits and feasibility."

The 2010 RMPU identified that the implementation of Municipal Separate Storm Sewer System (MS4) permit in the Chino Basin watershed had the potential to mitigate or offset some of the projected decline in safe yield. In its acceptance of 2010 RMPU, the Court ordered:

> "(3) Watermaster is hereby ordered to convene the committee described in item 3 of section 7.1 of the updated RMP to develop the monitoring, reporting, and accounting practices that will be required to estimate local project stormwater recharge and new yield."

Item 3 of Section 7.1 of the 2010 RMPU reads as follows:

> "3. In implementing the above, Watermaster should form a committee—consisting of itself, the landuse control entities, the County Flood Control Districts, the CBWCD, the IEUA, and others—to develop the monitoring, reporting, and accounting practices that will be required to estimate local project stormwater recharge and new yield. This committee should be formed immediately, and the monitoring, reporting, and accounting practices should be developed as soon as possible."[18]

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[18] The term "New Yield" is defined in the Peace Agreement to mean "proven increases in yield in quantities greater than historical amounts from sources of supply including but not limited to, capture of rising water, capture of available storm flow, operation of the Desalters (including the Chino I Desalter), induced recharge and other management activities implemented and operational after June 1, 2000."

The RMPU Steering Committee was formed in November 2011 in response to the Court's order.[19] This section describes the monitoring, reporting, and accounting practices discussed and recommended by the RMPU Steering Committee. In June 2012, the Steering Committee started its investigation on the nature and occurrence of MS4 projects. A subcommittee of the Steering Committee (hereafter, the Subcommittee) was formed to review the formal process used by the MS4 permitees (land use control entities) to review and approve MS4 projects. The Subcommittee consisted of Dave Crosley of the City Chino, Rosemary Hoerning of the City of Upland, and Peter Kavounas of the Chino Basin Watermaster. The Subcommittee developed and presented draft procedures to the Steering Committee for the monitoring, reporting, and accounting practices required to estimate and account for recharge from MS4 projects.

The Watermaster pleading and subsequent Court order did not include the other two recommendations (1 and 2) described in Section 7.1 of the 2010 RMPU, which included:

> "1. Watermaster should allocate new yield that is created by new recharge above that required by MS4 permit compliance to the owners of those projects that create new recharge. This will require the development of (a) new agreements involving the Watermaster, project owners, and others, and (b) the development of new practices and procedures that can quantify new recharge during project development and subsequently verify that the new recharge is occurring during the project lifetime.
>
> 2. Watermaster, working with the Parties, should encourage the construction of local recharge projects in developed areas that will increase the capture and recharge of stormwater. The recommendations for local stormwater recharge projects in developed areas are the same as those for newly developed areas, articulated above."

5.1 MS4 Permit Background

The Cities and Counties that overlie the Chino Basin are obligated to implement the National Pollutant Discharge Elimination System (NPDES) MS4 Permit (Order R8-2010-0036 in San Bernardino County and Order R8-2010-0033 in Riverside County) adopted by the Santa Ana Regional Water Quality Control Board in 2010. Essentially, the new permits require that all stormwater generated from new development from a 24-hour, 85th percentile storm (about 1 inch over 24-hours in the Chino Basin) be detained and recharged onsite if recharge is feasible; if recharge is not feasible, the stormwater must be detained and treated and subsequently discharged. The specific technologies for detention and recharge are to be developed by landuse control entities. The landuse control entities are responsible for the inspection and maintenance of these new stormwater management facilities. The recharge

[19] The mandate of the Steering Committee was subsequently expanded to the scope of the entire 2013 RMPU amendment.

facilities could include detention and sedimentation basins, recharge basins, dry wells, and managed swales. The implementation of the new MS4 permits may result in new stormwater recharge relative to pre-project conditions in areas where recharge is feasible.

As part of the 2010 RMPU, projections of new stormwater recharge from the implementation of the 2010 MS4 permits were prepared. Models[20] were used to estimate the increase in stormwater recharge from new development by applying the stormwater management criteria from the new MS4 permit for two conditions: (1) half of the stormwater managed pursuant to the MS4 permit is recharged and (2) all of the stormwater managed pursuant to the MS4 permit is recharged. No assumptions were made as to the specific new stormwater management facilities used to comply with the permits except that they were maintained and functioned as originally conceived – there was no deterioration in infiltration capacity over time. The new stormwater recharge created through permit compliance was estimated to range from about 6,300 acre-ft/yr if half of the stormwater managed pursuant to the MS4 permit is recharged and 12,600 acre-ft/yr if all of the stormwater managed pursuant to the MS4 permit is recharged. This new recharge, if realized, would increase gradually from zero in the present to the above estimated value over the time that the land was improved. This could be a period of 40 to 50 years or more.

The recharge at downstream stormwater management facilities was projected to decrease slightly with MS4 permit implementation through the diversion of runoff that would have otherwise been recharged at these existing facilities. The adjusted recharge projections, correcting for reduction in downstream recharge, were about 5,300 acre-ft/yr if half of the stormwater managed pursuant to the MS4 permit is recharged and 10,500 acre-ft/yr if all of the stormwater managed pursuant to the MS4 permit is recharged. Finally, these adjusted estimates would need to be adjusted downward one more time to reduce them for incidental deep infiltration of precipitation that would have occurred in the pre-project condition. Thus, the net new recharge from the implementation of 2010 MS4 permit is equal to the stormwater recharge caused by the implementation of stormwater management projects pursuant to the MS4 permit minus the decrease in recharge at existing stormwater management facilities minus the incidental deep infiltration of precipitation that would have occurred in the pre-project condition. A strict accounting method would have to be able to provide the information necessary to estimate net new recharge.

5.2 Expected New Development

During the April 4, 2013 Steering Committee meeting, the Steering Committee expressed interest in knowing the projected development within Chino Basin to develop an estimate of potential MS4 recharge. The Committee discussed possible methods of obtaining

[20] Specifically, the Rainfall, Runoff, Router, and Rootzone (R4) Model (refer to Section 3 of the *2010 Recharge Master Plan Update* for more discussion on the recharge estimates for future MS4 compliance and more specifically to Appendix C of that report for a description of the R4 Model).

information, and the consensus was to ask Appropriators for assistance. The concept articulated was that the land use planning agencies have adopted General Plans that show, with a fairly high degree of accuracy, planned development information, including the acreage proposed to be developed; in addition, there is likely a projected timeline for development to occur. Watermaster staff issued a request by email to the Appropriators, requesting that, if they were a landuse control agency, that they could provide this planning information to Watermaster staff. If not a landuse control agency, it was requested that the Appropriator request this information from the landuse control agency whose areas they serve and provide it to Watermaster staff. Only a few agencies responded, and their responses suggested a lack of confidence in the rate of future development. The response received, or lack thereof, reflects the level of confidence the Appropriators and landuse control agencies have in predicting future development.

5.3 Alternatives for Estimation of Net New Recharge from MS4 Projects

Three alternative procedures were discussed by the Steering Committee. These alternatives included:

- Alternative 1 – Project-specific monitoring, reporting, and accounting
- Alternative 2 – Indirect estimation during the periodic redetermination of safe yield
- Alternative 3 – a hybrid of Alternatives 1 and 2.

5.3.1 Alternative 1 Project-Specific Monitoring, Reporting, and Accounting Alternative

In this alternative, systematic data collection and evaluation would be used to identify MS4 projects as they were implemented and estimate the projected long-term average annual net new stormwater recharge estimates for each project in the year that they were reported to the Watermaster. This alternative was identified by the Subcommittee.[21] The process to identify these projects and estimate net new recharge is illustrated in Figure 5-1 and Table 5-1. Figure 5-1 defines the proposed timeline and roles of the Chino Basin Watermaster and the Appropriator parties in this alternative. The process Figure 5-1 shows is as follows:

- The Watermaster will send quarterly reminders to the Appropriator parties to collect and compile Water Quality Management Plan (WQMP) reports and "as-built" drawings for all MS4 projects constructed (herein, collectively referred to as MS4 documentation) in the current fiscal year.

[21] The Subcommittee presented this alternative to the 2013 RMPU Steering Committee on February 7, 2013, and subsequently modified it to incorporate Steering Committee comments.

- In August, the Watermaster will request MS4 documentation from the Appropriators.
- The Appropriators will provide the MS4 documentation to the Watermaster in September in a digital format (e.g., an Adobe .pdf document).
- Watermaster staff will review the MS4 documentation, extract the information required to estimate the net new stormwater recharge from each new stormwater management facility. These recharge estimates will be prepared in October. The results will be provided in the format shown in Table 5-1.
- Watermaster will prepare and distribute these estimates in an annual report in November.
- Watermaster will true up the net new stormwater recharge estimates during the next scheduled safe yield redetermination.
- The trued up values will be included in this safe yield redetermination.

Table 5-1 lists the data required to create an annual report and quantify the theoretical potential New Yield. The table is organized as follows by column number.

1. Project Name
2. Date of Entry
3. Existence (or not) of Signed Maintenance Agreement
4. Ongoing Maintenance Verified (Every 3 years)
5. MS4-Required Capture volume (cubic feet)
6. Constructed Capture Volume (cubic feet)
7. Long-Term Average Annual Runoff from Site (acre-ft/yr)
8. Estimate of Pre-Project On-Site Incidental Recharge (acre-ft/yr)
9. Decrease in Recharge at Downstream Stormwater Management Facilities with MS4-required Capture Volume (acre-ft/yr)
10. Decrease in Recharge at Downstream Stormwater Management Facilities with Constructed Capture Volume (acre-ft/yr)
11. Long-Term Average Annual Recharge with MS4-Required Capture Volume (acre-ft/yr)
12. Long-Term Average Annual Recharge with Constructed Capture Volume (acre-ft/yr)

13. Long-Term Average Annual Net New Recharge with MS4-Required Capture Volume (acre-ft/yr)

14. Long-Term Average Annual Net New Recharge with Constructed Capture Volume (acre-ft/yr)

15. Chino Basin Management Zone

16. County

17. Land Use Control Agency

18. Service Provider (Appropriator)

The information contained in columns 1, 5, 6, and 15 through 18 can be found in the Water Quality Management Plan (WQMP) and drainage study reports associated with new development. Column 2 needs to be verified by the Appropriator when the project is built.

Columns 3 and 4 need to be provided by the Appropriator. Orders R8-2010-0036 and R8-2010-0033 contains the following language in reference to the operation and maintenance of post-construction best management practices (BMPs):

1. The Permittees shall ensure, to the maximum extent possible (MEP), that all post-construction BMPs continue to operate as designed and implemented with control measures necessary to effectively minimize the creation of nuisance or pollution associated with vectors, such as mosquitoes, rodents, flies, etc. WQMPs shall identify the responsible party for maintenance, including vector minimization and control measures, and funding source(s) for operation and maintenance of all site design and structural treatment control systems. Permittees shall, through conditions of approval and during inspections, ensure proper maintenance and operation of all permanent structural post-construction BMPs installed in new developments. Design of these structures shall allow adequate access for maintenance.

2. Within twelve months of adoption of this Order, the Permittees shall develop a database to track operation and maintenance of post-construction BMPs. The database should include available BMP information such as the type of BMP design, location of BMPs (latitude and longitude), date of construction, party responsible for maintenance, maintenance frequency, source of funding for operation and maintenance, maintenance verification, and any problems identified during inspection including any vector or nuisance problems. A copy of this database shall be submitted with the annual report.

The values in columns 7 through 14 would be calculated using modeling tools, such as those used in the 2010 RMPU, and the Chino Basin Groundwater Model. Models are required to estimate stormwater recharge at the new MS4 facilities as these facilities are currently not metered nor can they be practically metered. Models are required to estimate pre-project incidental recharge and the impact of recharge at MS4 facilities on existing downstream stormwater management facilities. The existing modeling tools would be modified to enable

Watermaster staff to efficiently estimate net new recharge from each MS4 project. The approximate cost to develop, demonstrate and document these modeling tools is about $50,000.[22] The cost to apply these tools to individual MS4 projects would be about $1,600 each.

The Chino Fire Station No.1 and Training Center was chosen by Watermaster staff to be a case study to demonstrate the major features of this alternative. Chino Fire Station 1 is located on a 3.6-acre site on the northeast corner of Schaefer and 4th Street. The WQMP for this site was provided by the City and reviewed by Watermaster staff. The data and results of this case study are shown in Table 5-1. The site has three subareas that drain to three bio retention basins. The storage capacity of the bio retention basins is made up of 1) the surface volume of the swale, 2) the subsurface 6-foot diameter perforated storm drain which is filled through grated inlets, and 3) the volume of the void spaces that fill the 12-foot deep space below the bio retention basin. The total storage capacity was estimated to be about 24,243 cubic feet or about 0.55 acre-ft (column 6 on Table 5-1). The MS4 permit required stormwater management volume is 15,857 cubic feet or about 0.36 acre-ft (column 5 on Table 5-1).

The long-term average annual runoff generated on the project site is 3.17 acre-ft/yr (column 7 on Table 5-1). The pre-project condition was assumed to be the land use immediately before development; in this case vacant land[23]. The long-term average annual deep infiltration of precipitation for the pre-project condition was estimated to be about 1.33 acre-ft/yr (column 8 on Table 5-1). The table below shows the calculation of long-term average annual net new recharge (in units of acre-ft/yr) as a function of infiltration rate.

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[22] The cost to revise the models alone is about $8,000. The additional cost includes the cost of documentation and demonstrating model to the Watermaster.

[23] The appropriate assumption for pre-project condition is a significant unknown. The Steering Committee members have suggested various options, including [i] land use immediately before development; [ii] land use in 1974, representing the end of the model calibration period; [iii] land use at the time nearby flood control channels were concrete-lined, representing the loss of infiltration in those channels; and [iv] June 1, 2000 to be consistent with the definition of New Yield in the Peace Agreement. For this example, we have used the first of these possibilities.

Estimated Long-Term Recharge Estimates
for the Chino Fire Station No.1 and Training Center

	MS4-Required Capture Volume		Constructed Capture Volume	
Infiltration rate for MS4 Facility	0.5 ft/day	1.0 ft/day	0.5 ft/day	1.0 ft/day
Pre-project Deep Infiltration of Precipitation	1.33	1.33	1.33	1.33
Recharge at MS4 Facility	2.12	2.47	2.55	2.82
Net New Recharge	0.79	1.14	1.22	1.49

The recharge volumes shown in Table 5-1 columns 11 through 14 correspond to an infiltration rate of 0.5 ft/day. These recharge estimates assume that the infiltration rate is constant over the life of the project.

This project is located downstream of the existing regional stormwater management facilities; therefore, an adjustment is not required to account for the reduction in recharge at the regional stormwater management facilities that might be caused by construction of the BMP at the Chino Fire Station.

5.3.2 Alternative 2 Indirect Estimation during the Periodic Re-determination of Safe Yield Alternative

Watermaster is currently in the process of re-determining safe yield and will re-determine safe yield periodically in the future.[24] In this alternative, in regard to MS4 recharge, the net new recharge from determining safe yield would be automatically incorporated into the safe yield and the direct estimation of net new recharge would not be made. The volume of net new stormwater recharge caused by the implementation of stormwater management projects pursuant to the MS4 permit would likely be included as a minor calibration adjustment to parameters used in the equations (processes) that estimate the deep infiltration of precipitation and applied water.

5.3.3 Alternative 3 Hybrid Alternative

Watermaster staff would annually acquire and store electronic versions of MS4 project-related reports and maintenance verification databases. When scoping a future safe yield

[24] Watermaster is required to re-determine the safe yield every ten years pursuant to the OBMP Implementation Plan (page 45).

re-determination, Watermaster would use its judgment and discretion to determine if there has been a significant potential increase in MS4 project-related recharge. If judged significant, the Watermaster would explicitly incorporate significant MS4 projects into the modeling and other technical activities required to re-determine safe yield. The calibration process for the groundwater model used in the safe yield re-determination would be used to refine the MS4 recharge estimates. Net new recharge would be estimated by rerunning the calibration without the new MS4 facilities and comparing both simulations.

5.4 Alternatives Comparison

Three criteria were used to evaluate these alternative methods to estimate net new recharge from MS4 projects: timeliness of the estimates, relative cost, and expected relative accuracy. This comparison is shown in Table 5-2 and discussed below.

5.4.1 Timeliness of Estimates

The timeliness criterion speaks to the utility of the net new stormwater recharge being classified as New Yield and assigned to the Appropriators pursuant to the Peace Agreement. Alternative 1, the *project specific monitoring, reporting and accounting alternative,* will produce net new stormwater recharge estimates each year while the other two alternatives will produce estimates when Watermaster re-determines safe yield. The utility of annual net new stormwater recharge estimates over less frequent estimates would be the development of New Yield estimates and the allocation of these New Yield estimates in the Watermaster assessment process pursuant to the Peace Agreement.

The accuracy of net new recharge estimates *from Alternative 1* will likely be challenged during subsequent safe yield re-determination causing Watermaster to make downward corrective adjustments in future assessment processes. By contrast the other two alternatives will not provide timely estimates of New Yield – they will provide estimates of changes in safe yield that may or may not be attributable to new stormwater recharge.

5.4.2 Relative Cost

The relative cost to estimate net new stormwater recharge would be least (probably zero) for Alternative 2 and greatest for Alternative 1. Alternative 3, the *hybrid alternative,* would be relatively close in cost to *Alternative 2* provided that Watermaster annually acquires and stores electronic versions of the MS4 project related reports and maintenance verification databases that are developed by the land use control agencies and mandated by the Regional Board.

5.4.3 Expected Relative Accuracy of the Net New Recharge Estimate

The expected relative accuracy of the net new stormwater recharge estimates derived by Alternative 1 would be the lowest of the three alternatives because there is no way to validate the estimates. Alternative 3 is expected to have the greatest accuracy because preliminary estimates of the net new recharge and its location can be made (a theoretical cap) and subsequently adjusted and validated in calibration. The expected relative accuracy criterion is not applicable to Alternative 2 because net new stormwater recharge would not be explicitly estimated.

5.4.4 Discussion

The net new recharge from MS4 project implementation may, in the fullness of time, add significant recharge to the Chino Basin but there is reason to doubt that over the next 20 to 30 years that it will do so. First, it will be difficult to monitor on the surface and verify that each project is operating at design capacity. There are no provisions for monitoring the volume of water that will be recharged at these proposed facilities, and in most cases, it will be impossible to monitor them for recharge. From an engineering perspective, there is considerable doubt that most of these facilities can be maintained to ensure that these facilities will perform consistently and as designed for the next 20 to 30 years.

Second, these facilities will be constructed for new development and redevelopment. This means that these facilities will be constructed for relatively small areas spanning decades of time and thus will gradually increase recharge over time with each project contributing small amounts of new recharge. New, small amounts of recharge occurring over time and distributed across the basin will not noticeably impact groundwater levels and hence safe yield for several years[25], perhaps decades. The implication of the slow accumulation of net new recharge is that it will be difficult to quantify the changes in safe yield attributable to the MS4 project implementation in subsequent safe yield determination until considerable recharge, say 50,000 to 100,000 acre-ft, has occurred and accumulated in the basin.

If Alternative 1 were implemented, it's likely that most of the New Yield estimated directly from the MS4 project documents will have to retracted in the next safe yield determination, that will be done in 2021. Alternatives 2 and 3 will not have this problem, and Alternative 3 has the best chance of providing estimates of net new recharge from implementation of future MS4 projects.

Alternative 3 is the most appropriate way to estimate net new stormwater recharge. Alternative 3 will produce the most accurate estimates of the safe yield during future safe yield re-determination efforts.

5.5 Recommended Alternative

At the May 16, 2013 and June 6, 2013 Steering Committee meetings, the Committee discussed these three alternatives recommended Watermaster implement Alternative 3, and to

[25] Due to the time lag between recharge at the ground surface and arrival at the water table and the availability of groundwater level observations to sense it.

periodically review the time and effort in its implementation, and reassess the value provided by it. They further recommended that Watermaster subsequently implement Alternative 2 if the landuse agencies do not consistently provide the data to Watermaster or, based on the completeness and usefulness of the submitted data, the data collection effort is of limited value. As part of this alternative, Watermaster will keep updated maps and lists that document the available information on MS4 compliance measures received by Watermaster, and this information will be reviewed annually.

Table 5-1
Sample Annual Report to be Produced by Watermaster

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
												=(11)-(8)-(9)	=(12)-(8)-(10)				
Project Name	**Date of Entry**	**Existence (or not) of Signed Maintenance Agreement**	**Ongoing Maintenance Verified (every 3 years)**	**MS4-Required Capture Volume (cubic feet)**	**Constructed Capture Volume (cubic feet)**	**Long-Term Average Annual Runoff from Site (acre-ft/yr)**	**Estimate of Pre-Project On-Site Incidental Recharge (acre-ft/yr)**	**Decrease in Recharge at Downstream Stormwater Management Facilities (acre-ft/yr)**		**Long-Term Average Annual Recharge[1] (acre-ft/yr)**		**Long-Term Average Annual Net New Recharge (acre-ft/yr)**		**Chino Basin MZ**	**County**	**Land Use Control Agency**	**Service Provider (Appropriator)**
								MS4-Required Capture Volume	**Constructed Capture Volume**	**MS4-Required Capture Volume**	**Constructed Capture Volume**	**MS4-Required Capture Volume**	**Constructed Capture Volume**				
Chino Fire Station No. 1				15,857	24,243	3.17	1.33	0	0	2.12	2.55	0.79	1.22	1	SB	City of Chino	City of Chino

[1]The long-term average annual recharge assumes an infiltration rate of 0.5 ft/day.

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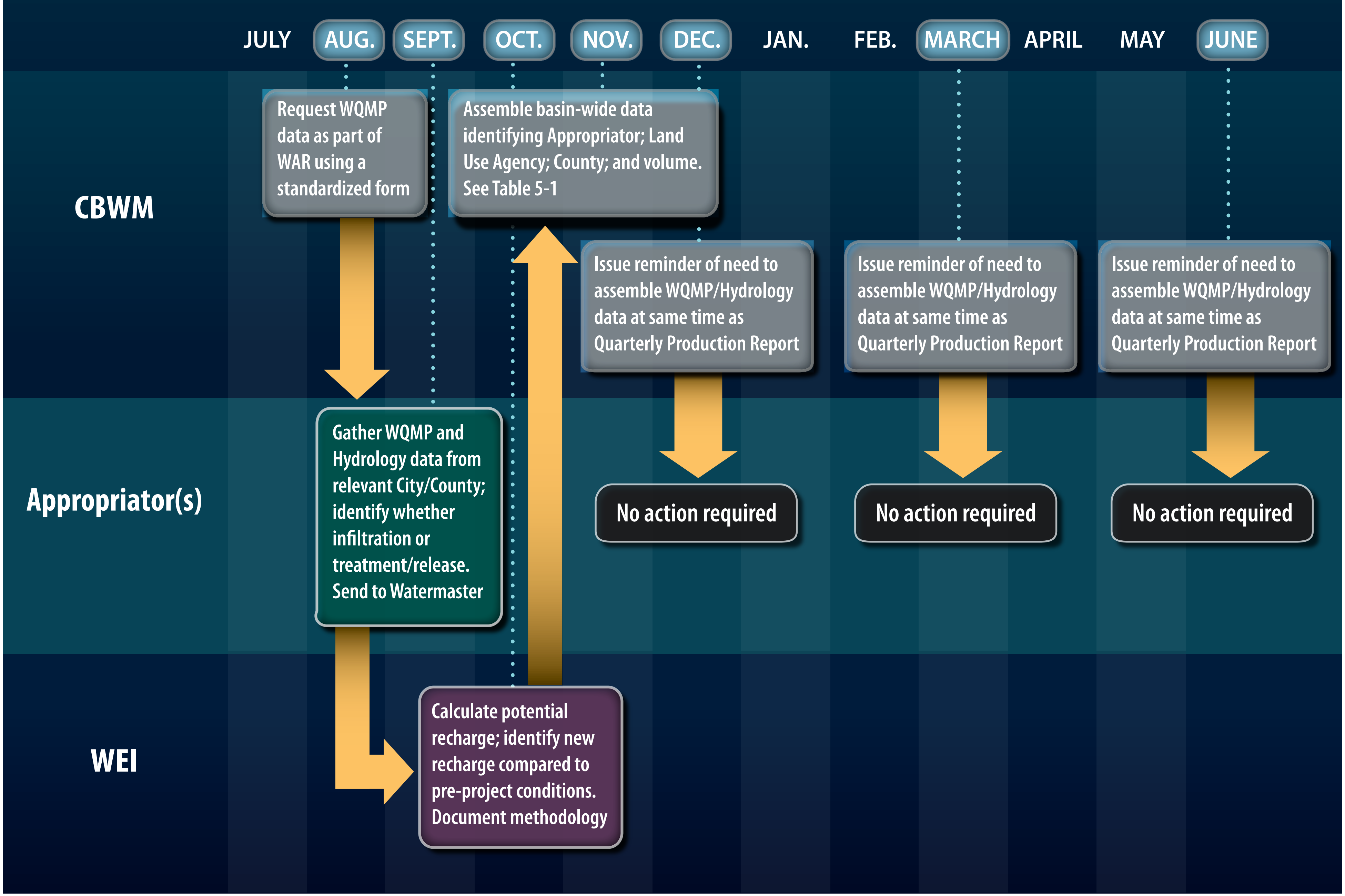
Table 5-2
Comparison of Alternatives to Estimate Net New Recharge from New MS4 Projects

Criterion	Alternative to Compute Net New Recharge		
	Project-Specific Monitoring, Reporting, and Accounting	Indirect Estimation During the Periodic Redetermination of Safe Yield	Hybrid
Summary of Method	Collect MS4 related documentation from Appropriators annually and use modeling tools to estimate long term average net new recharge.	Use future model calibration efforts to adjust areal recharge estimates (deep infiltration of precipitation and applied water) if necessary to account for new recharge from new MS4 facilities.	Collect MS4 related documentation from Appropriators annually and file for later review. Incorporate constructed MS4 facilities into recharge models and subsequent groundwater model calibration to estimate actual recharge from MS4 facilities. Net new recharge would be estimated by rerunning the calibration without the New MS4 facilities and comparing both simulations.
Timeliness of Information	Long-term average annual net new recharge is computed annually as new facilities come online.	Safe yield is redetermined every ten years.	Estimates of net new recharge will be computed when Watermaster redetermines safe yield. Safe yield is redetermined every ten years.
Cost	One time cost to revise recharge models. Annual cost to compile MS4 documentation and estimate net new recharge.	No new cost.	Annual cost to compile MS4 documentation and minor cost to incorporate into the groundwater model recalibration.
Relative Accuracy of Net New Recharge Estimate	Least because there is no way to validate estimates.	Not applicable because the net new recharge would not be estimated and would be incorporated directly into the safe yield.	Greatest because the groundwater level response due to new recharge can be validated by comparing groundwater model projected groundwater levels to measure groundwater levels. Could be years before the groundwater levels respond significantly to recharge from MS4 facilities -- the hybrid approach has the capability of assessing this lag.

Figure 5-1 MS4 Recharge Data Gathering and Accounting Procedure



Section 6 – Recharge Options to Improve Yield and Assure Sustainability

6.1 Background

In June 2012, Watermaster staff sent a "call for projects" to the Watermaster parties, seeking their recommendations for recharge improvement projects. Responses were provided by the CBWCD, Cities of Fontana, Ontario and Upland, the JCSD; and the IEUA. Watermaster staff combined these proposed projects with the 2010 RMPU projects and subsequently prepared an initial listing of these projects in July 2012.

The Steering Committee conducted seven meetings to discuss these recharge projects, among other things, over the period of July 19, 2012 through November 29, 2012. The projects in the initial list were characterized by their potential impact on production sustainability and their contribution to improving the balance of recharge and discharge in the Basin. Several potential project groupings based on these characterizations were discussed by the Steering Committee. At the end of these discussions, the Steering Committee recommended the complete initial list of projects be included by the Watermaster for consideration in the 2013 RMPU Amendment process. The Steering Committee recommendation was based on the collective opinion that the cost and benefit of each project should be understood before any projects were eliminated from consideration.

The Steering Committee recommendations are included in Table 6-1 which lists these projects. This table is described in more detail below. The final project list is a result of extensive discussions in which all the Steering Committee members' comments and suggestions were considered. The final list of projects for consideration in the 2013 RMPU Amendment was approved in December 2012 by the Watermaster Pool Committees, the Advisory Committee and the Board.

6.2 Recharge Projects Being Considered

Table 6-1 lists the projects submitted by the Steering Committee for consideration in the 2013 RMPU Amendment as approved by the Watermaster. Figure 6-1 shows the approximate location of these projects. The projects can be grouped by owner/advocate to include the 2010 RMPU projects, IEUA suggested projects, and projects suggested by Parties. Those projects characterized as 2010 RMPU projects include those projects included in the 2010 RMPU. In November 2011, the Steering Committee requested that IEUA develop a list of improvements and suggested actions that, based on their experience in operating the CBFIP facilities, could increase stormwater recharge at a reasonable cost – the IEUA suggested projects include these projects. Finally, several Watermaster Parties suggested projects that include stormwater management facilities and other recharge facilities that can be used to improve sustainable production in the JCSD and CDA Desalter II well field areas.

Table 6-1 lists the projects and other information that was used by the Steering Committee to characterize the projects.[26] Table 6-1 contains the following:

- Project Name – generally a facility name or, in some cases, a name more descriptive of what the project does.
- Facility Owner – generally the facility owner for an existing stormwater management facility or the probable owner for a future stormwater management facility or other recharge facility.
- Project Advocate – generally the entity that proposed the recharge project. In IEUA's case, "IEUA" is used herein to represent a larger group of stakeholders including IEUA that "advocate" the project.
- Map Code – denotes a location code for the project on Figure 6-1.
- Management Zone – denotes the management zone(s) that will be directly recharged from the proposed project.
- Estimated Increase in Recharge from Improvements – if known, contains estimates of the three sources of water that could potentially be recharged: storm and dry-weather discharge, imported water, and recycled water.
- Proposed Improvements – includes a list of the proposed improvements, their cost if known, and expected benefits.

The proposed improvements are characterized with either a: "C" which means a capital improvement, an "O," which signifies an operational improvement, or an "I" which signifies a proposed investigation. Capital improvements could include the construction or expansion of new basins, drainage improvements, pump stations and other conveyance facilities, etc. Operational improvements include more aggressive operations and maintenance activities that will increase stormwater recharge. The types of investigations proposed in Table 6-1 include investigations to determine: the recharge feasibility on presently undeveloped land, the causes of poor infiltration performance at select existing basins and ways to improve their infiltration rates, the feasibility of recycled water recharge in select existing basins, and the feasibility of drainage improvements in the Cucamonga Basin that could increase recharge in the Chino and Cucamonga Basins.

All the proposed projects listed in Table 6-1 will be evaluated using the evaluation criteria discussed in Section 7 Evaluation Criteria. Section 8 summarizes the evaluation and ranking of the proposed projects and Appendix D contains the detailed evaluation of the proposed projects.

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[26] Table 6-1 is a summary table that was based on a more expansive table.

Table 6-1
Recharge Improvements Recommended by the Chino Basin Recharge Master Plan Steering Committee For Evaluation in Task 8

Project Name	Facility Owner	Project Advocates[2]	Map Code	Estimated Increase in Recharge from Improvements (acre-ft/yr)			Proposed Improvements	
				Storm/Dry Weather	Imported	Recycled	Description of Improvements[1]	Expected Benefits
Management Zone 1								
15th Street Basin	City of Upland	IEUA	20	Unknown	Unknown	Unknown	I1 Investigate ways to improve storm and supplemental water recharge	1. Increase storm and supplemental water recharge
Upland Basin	City of Upland	City of Upland	22	na	na	Unknown	I1 Investigate the recharge of recycled water	1. Increase the recharge of recycled water; helps achieve the Peace II 6,500 acre-ft/yr recharge commitment to MZ1
		IEUA		Unknown	Unknown	na	C1 Construct a low-level drain or pump station to drain basin for maintenance	1. Increase recharge of storm and imported water
Montclair Basins	CBWCD	CBWCD	23	150 to 200	Unknown	na	C1 Clean and grub Basin 4, remove 5 feet of bottom materials from Basin 4, construct pump stations and pipelines to convey water from Basin 4 to Basins 2 and 3 and from Basin 3 to Basin 2	1. Increase storm water recharge
		IEUA		Unknown	Unknown	na	C2 Construct new inlets from San Antonio Creek to Basins 2 and 3	1. Increase storm water recharge
				Unknown	Unknown	na	C3 Automate inlet to Basin 1	1. Increase storm water recharge
				Unknown	Unknown	na	C4 Construct low-level drains from Basin 1 to 2 and 2 to 3	1. Increase recharge of storm and imported water
				na	na	na	I1 Investigate the recharge of recycled water	1. Increase the recharge of recycled water; helps achieve the Peace II 6,500 acre-ft/yr recharge commitment to MZ1
College Heights	CBWCD	IEUA	24	Unknown	Unknown	na	C1 Construct internal berms to reduce seepage to Upland Basin	1. Increase recharge of imported water
				na	na	unknown	I1 Investigate the recharge of recycled water	1. Increase the recharge of recycled water; helps achieve the Peace II 6,500 acre-ft/yr recharge commitment to MZ1
Brooks Basin	CBWCD	IEUA	25	Unknown	Unknown	Unknown	O1 Remove trees from below high-water line	
				Unknown	na	Unknown	I1 Investigate the rerouting of recycled water and street runoff to State Street storm drain	1. Increase storm and recycled water recharge
				Unknown	Unknown	Unknown	I2 Evaluate the installation of a low elevation pump station to drain basin for maintenance	1. Increase storm and storm and supplemental water recharge
North West Upland Basin	City of Upland	City of Upland	36	Unknown	Unknown	Unknown	C1 Construct a new stormwater management basin that will recharge water	1. Increase storm water recharge with unknown potential for supplemental water recharge.

Table 6-1
Recharge Improvements Recommended by the Chino Basin Recharge Master Plan Steering Committee
For Evaluation in Task 8

Project Name	Facility Owner	Project Advocates[2]	Map Code	Estimated Increase in Recharge from Improvements (acre-ft/yr)			Proposed Improvements	
				Storm/Dry Weather	Imported	Recycled	Description of Improvements[1]	Expected Benefits
Management Zone 2								
Princeton Basin	City of Ontario	City of Ontario, IEUA	21	Unknown	Unknown	Unknown	C1 Construct improvements to enable storm and supplemental water recharge	1. Increase recharge of storm and supplemental water
San Sevaine Basins 1 - 5 Improvements	SBCFCD	IEUA	5	Unknown	Unknown	Unknown	C1 Construct Internal berms in SS1 and SS2	1. Would help mitigate vector problems
				Unknown	Unknown	Unknown	C2 Install gate between SS1 and SS2	
				Unknown	Unknown	Unknown	C3 Construct internal berms in SS5	1. Would help mitigate vector problems and increase recharge capacity for storm and supplemental water
				Unknown	Unknown	Unknown	C4 Construct pump station from SS5 to SS3 or higher	1. Increase storm and recycled water recharge capacity
				Unknown	Unknown	Unknown	C5 Extend IEUA recycled water pipeline to SS3 or higher	1. Increase recycled water recharge
				Unknown	Unknown	Unknown	C6 CB13T power supply	
				na	Unknown	Unknown	C7 Increase CB13T capacity	1. Increase imported and recycled waters recharge
				Unknown	Unknown	Unknown	I1 Investigate SS5 poor infiltration rate	1. Increase storm and supplemental water recharge
				Unknown	Unknown	Unknown	I2 Evaluation of Etiwanda Creek and San Sevaine Channel area properties for new recharge sites	1. Increase storm and supplemental water recharge
				na	na	Unknown	I3 Conduct investigation/regulatory process to permit recycled water recharge in SS1 through SS4	1. Increase recycled water recharge
Etiwanda Debris Basin	SBCFCD	IEUA	6	Unknown	Unknown	Unknown	O1 Rip basin and shore up Berm	1. Increase storm and imported water recharge
				na	na	na	I1 Evaluate opportunity to use the "Etiwanda habitat Area" for recharge use	Increase storm and imported water recharge
Victoria Basin	SBCFCD	IEUA	7	Unknown	Unknown	Unknown	C1 Abandon the mid-level outlet	1. Increase storm and supplemental water recharge
				Unknown	Unknown	Unknown	C2 Remove fine-grained materials from basin floor	1. Increase storm and supplemental water recharge
				na	na	Unknown	C3 Extension of lysimeters	1. Increase the amount of recycled water recharge
Hickory Basin	SBCFCD	IEUA	9	na	na	na	O1 Increase frequency of basin maintenance	1. Increase storm and supplemental water recharge

Table 6-1
Recharge Improvements Recommended by the Chino Basin Recharge Master Plan Steering Committee
For Evaluation in Task 8

Project Name	Facility Owner	Project Advocates[2]	Map Code	Estimated Increase in Recharge from Improvements (acre-ft/yr)			Proposed Improvements	
				Storm/Dry Weather	Imported	Recycled	Description of Improvements[1]	Expected Benefits
Lower Day Basin	SBCFCD	IEUA	10	Unknown	Unknown	Unknown	C1 Install gate on mid-level outlet to increase conservation storage	1. Increase storm and supplemental water recharge
				1,470	Unknown	Unknown	C2 Improve inlet per 2010 RMPU	1. Increase storm and recycled water recharge
				Unknown	Unknown	Unknown	I1 Evaluate the use of the northern part of the basin	1. Increase storm and supplemental water recharge
				Unknown	na	na	I2 Evaluate recharge potential of 200 acre-s of SBCFCD land just north of the 210 freeway	1. Increase storm and supplemental water recharge
Existing Turner Basins	CBWCD, SBCFCD	IEUA	16	Unknown	Unknown	Unknown	C1 Raise the Turner 2 spillway	1. Increase storm water recharge
				na	na	na	I1 Evaluate the property next to Turner 1 as a potential recycled water storage site	1 Increase recycled water recharge
Turner Basin Expansion East of Archibald Ave	IEUA	2010 RMPU	35	1,300	na	Unknown	C1 Construct basin and appurtenances	1. Increase storm and supplemental water recharge
Ely Basin	CBWCD, SBCFCD	IEUA	19	Unknown	na	Unknown	O1 Increase maintenance frequency	1. Increase storm and recycled water recharge
				Unknown	na	Unknown	I1 Investigate the poor infiltration rate	1. Increase storm and recycled water recharge
	City of Ontario	City of Ontario		Unknown	na	Unknown	C1 Construct storm drain improvements to increase drainage area by 770 acres and increase the conservation storage in the Ely Basin by 310 acre-ft.	1. Increase storm water recharge and potentially recycled water recharge.
Ontario Municipal Services Center Bioswale Project	City of Ontario	City of Ontario	37	1	na	na	C1. Construct infiltration/detention basin approximately 35 feet wide x 580 feet long with a depth varying from 0 to 4 feet.	1. Increase storm water recharge.
Lower San Sevaine Basin	TBD	2010 RMPU	34	1,679	Unknown	Unknown	C1 Construct basin and appurtenances	1. Increase storm and supplemental water recharge
Regulatory Storage in the Alta Loma Basin	SBCFCD	IEUA	34	Unknown	na	Unknown	C1 Improve basin and construct appurtenances	1. Increase storm water recharge in the Turner Basins

Table 6-1
Recharge Improvements Recommended by the Chino Basin Recharge Master Plan Steering Committee For Evaluation in Task 8

Project Name	Facility Owner	Project Advocates[2]	Map Code	Estimated Increase in Recharge from Improvements (acre-ft/yr)			Proposed Improvements	
				Storm/Dry Weather	Imported	Recycled	Description of Improvements[1]	Expected Benefits
Management Zones 2 and 3 Capture, Pump and Recharge Project								
Lower Cucamonga Basin	TBD	2010 RMPU	17	na	na	na	C1 Construct Basin C2 Construct a pump station and pipeline to Wineville Basin with a 20 cfs diversion rate	1. Increase stormwater recharge at other basins by pumping storm water captured at the LCB to other recharge basins; could increase recycled water by providing diluent water
Wineville Basin to Etiwanda Pump Station	TBD	2010 RMPU	26	na	na	na	C1 Construct a pump station and pipeline to Etiwanda Pump Station with a 40 cfs diversion rate	1. Increase stormwater recharge at other basins by pumping storm water captured at the Lower Cucamonga, Wineville and Jurupa Basins to other recharge basins; could increase recycled water by providing new diluent water supply
Etiwanda Pump Station & Pipeline to Hickory	TBD	2010 RMPU	27	2	na	na	C1 Construct a pump station and pipeline to Hickory Basin with a 40 cfs diversion rate	
Hickory Pump Station & Pipeline to Victoria	TBD	2010 RMPU	28	810	na	na	C1 Construct a pump station and pipeline to Victoria Basin with a 40 cfs diversion rate	
Hickory Pump Station & Pipeline to Banana	TBD	2010 RMPU	29	520	na	na	C1 Construct a pump station and pipeline to Banana Basin with a 6 cfs diversion rate	
Victoria Pump Station & Pipeline to Lower Day	TBD	2010 RMPU	30	260	na	na	C1 Construct a pump station and pipeline to Lower Day Basin with a 8 cfs diversion rate	
Victoria Pump Station & Pipeline to Etiwanda Debris	TBD	2010 RMPU	31	720	na	na	C1 Construct a pump station and pipeline to Etiwanda Debris Basin with a 7 cfs diversion rate	
Victoria Pump Station & Pipeline to San Sevaine 1-4	TBD	2010 RMPU	32	4,100	na	na	C1 Construct a pump station and pipeline to San Sevaine 1-4 Basins with a 27 cfs diversion rate	
Victoria Pump Station & Pipeline to San Sevaine 5	TBD	2010 RMPU	33	550	na	na	C1 Construct a pump station and pipeline to San Sevaine 5 Basin with a 17 cfs diversion rate	

Table 6-1
Recharge Improvements Recommended by the Chino Basin Recharge Master Plan Steering Committee
For Evaluation in Task 8

Project Name	Facility Owner	Project Advocates[2]	Map Code	Estimated Increase in Recharge from Improvements (acre-ft/yr)			Proposed Improvements	
				Storm/Dry Weather	Imported	Recycled	Description of Improvements[1]	Expected Benefits
Management Zone 3								
CSI Storm Water Basin	CSI	CSI	38	Unknown	Unknown	Unknown	C1 Expand Basin Volume and construct recycled water recharge improvements	1. Increase storm water recharge with unknown potential for supplemental water recharge.
Wineville Basin	SBCFCD	2010 RMPU	11	1,529	0	0	C1 Gate the low-elevation outlet, replace embankment with dam, and construct a pneumatic gate on the spillway	1. Increase storm water and supplemental water recharge
				0	0	0	C2 Construct a pump station and pipeline to Jurupa Basin with a 20 cfs diversion rate	1. Divert storm water from the Day Creek system for recharge in RP3 and Declez Basins
				0	0	0	C3 Construct pump station and pipeline to Etiwanda Basin with a 40 cfs diversion rate	1. Divert storm water from the Day Creek system to recharge basins high up in the San Sevaine system and to the Lower Day Creek Basin
Jurupa Basin	SBCFCD	2010 RMPU	15	0	0	0	C1 Inlet improvements	1. Increase storm and supplemental water recharge at RP3 and Declez Basins
				0	0	0	C2 Construct a pump station and pipeline to RP3 Basins with a 40 cfs diversion rate	1. Increase storm and supplemental water recharge at RP3 and Declez Basins
				0	0	0	C3 Increase conservation storage by basin enlargement	1. Increase storm and recycled water recharge at RP3 and Declez Basins
				na	Unknown	Unknown	C3 Increase CB18 turnout capacity	1. Increase supplemental water recharge at RP3 and Declez Basins
				na	na	na	I1 Investigate poor recharge capacity	1. Increase storm and supplemental water recharge
RP3 Basins	IEUA	2010 RMPU	13	2,810	Unknown	Unknown	C1 Inlet improvements	1. Increase storm and supplemental water recharge
				733	Unknown	Unknown	C2 Basin Enlargement	1. Increase storm and supplemental water recharge
Vulcan Pit		2010 RMPU	4	1,077	Unknown	Unknown	C1 Basin grading, Inlet and outlet improvements	1. Increase storm and supplemental water recharge
Sierra Avenue Water Conservation Project	City of Fontana	City of Fontana, FWC and JCSD	1	423	Unknown	Unknown	C1 Increase conservation storage, other onsite improvements and connection to recycled water system	1. Increase recharge of storm and recycled waters 2. Improve the balance of recharge and discharge in MZ3
Sultana Avenue/Miller Avenue Water Conservation Improvement Project	City of Fontana	City of Fontana, FWC and JCSD	2	94	Unknown	Unknown	C1 Increase conservation storage, other onsite improvements and connection to recycled water system	1. Increase in yield from storm water recharge and water supply from recycled water recharge 2. Improve the balance of recharge and discharge in MZ3
Alder Basin Water Conservation Improvement Project	City of Fontana	City of Fontana, FWC and JCSD	3	126	Unknown	Unknown	C1 Increase conservation storage, other onsite improvements and connection to recycled water system	1. Increase recharge of storm and recycled water 2. Improve the balance of recharge and discharge in MZ3; not included in Watermaster diversion permits
Banana Basin	SBCFCD	IEUA	8	Unknown	Unknown	Unknown	O1 Increase frequency of basin maintenance	1. Increase storm and supplemental water recharge
				na	na	na	C1 Extend level sensor to more readily monitor recharge at low levels	1. Improve estimates of recharge

Table 6-1
Recharge Improvements Recommended by the Chino Basin Recharge Master Plan Steering Committee
For Evaluation in Task 8

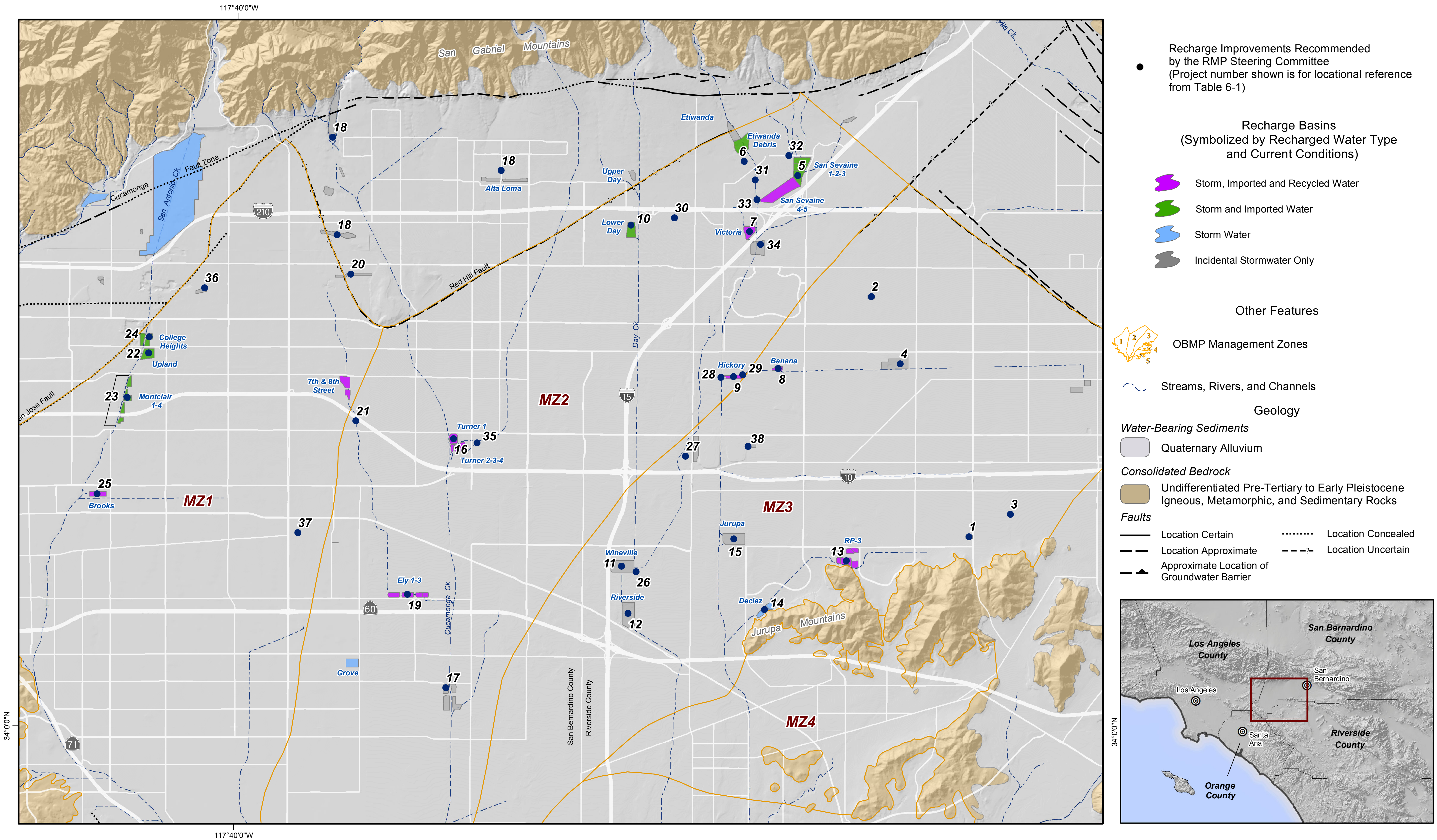
Project Name	Facility Owner	Project Advocates[2]	Map Code	Estimated Increase in Recharge from Improvements (acre-ft/yr)			Proposed Improvements	
				Storm/Dry Weather	Imported	Recycled	Description of Improvements[1]	Expected Benefits
Riverside Basin	SBCFCD	IEUA	12	Unknown	Unknown	Unknown	I1 Conduct proof of concept investigation to determine recharge feasibility	1. Increase storm and supplemental water recharge
Basins Adjacent to the RP3 Basins	IEUA	IEUA, JCSD	13	Unknown	Unknown	Unknown	C2 Construct horizontal recharge wells under Fontana RDA and SCE rights of way	1. Increase storm and supplemental water recharge
				na	na	na	I1 Investigate the recharge feasibility of adjacent 60 acres	1. Increase storm and supplemental water recharge
Declez Basin	SBCFCD	IEUA	14	Unknown	Unknown	Unknown	O1 increase basin maintenance frequency	1. Increase storm and supplemental water recharge
				35	Unknown	Unknown	C1 construct improvements per 2010 RMPU	1. Minor increase storm and supplemental water recharge. RMPU did not recommend this project.
				na	na	na	I1 Investigate the recharge feasibility of adjacent 12 acres	1. Increase storm and supplemental water recharge

Table 6-1
Recharge Improvements Recommended by the Chino Basin Recharge Master Plan Steering Committee
For Evaluation in Task 8

Project Name	Facility Owner	Project Advocates[2]	Map Code	Estimated Increase in Recharge from Improvements (acre-ft/yr)			Proposed Improvements	
				Storm/Dry Weather	Imported	Recycled	Description of Improvements[1]	Expected Benefits
Management Zones 3, 4 and 5 Production Sustainability Projects								
Ontario MZ3 In-Lieu	na	City of Ontario and JCSD	na	na	na	na	O1 Exchange 3,200 to 9,500 acre-ft/yr using existing connections from the City of Ontario to JCSD	1. Reduce groundwater production in the JCSD Well Field area
Fontana MZ3 In-Lieu	na	FWC and the JCSD	na	na	na	na	C1 Construct a pipeline to connect to FWC. O1 Exchange 3,200 to 9,500 acre-ft/yr from FWC to JCSD	1. Reduce groundwater production in the JCSD Well Field area
CVWD MZ3 In-Lieu	na	CVWD and JCSD	na	na	na	na	O1 Exchange 3,200 to 9,500 acre-ft/yr from CVWD to JCSD conveyed by City of Ontario or FWC	1. Reduce groundwater production in the JCSD Well Field area
MZ3 In-Lieu Partnership	na	Partnership and the JCSD	na	na	na	na	O1 Exchange 3,200 to 9,500 acre-ft/yr from CVWD, City of Ontario or FWC to JCSD conveyed by some or all of the project owners	1. Reduce groundwater production in the JCSD Well Field area
CDA MZ3 In-Lieu	na	CDA and JCSD	na	na	na	na	O1 Exchange 3,200 to 9,500 acre-ft/yr using existing connections from CDA to JCSD	1. Reduce groundwater production in the JCSD Well Field area
Two JCSD ASR Wells - A	na	City of Ontario and JCSD	na	na	na	na	O1 Exchange 2,680 acre-ft/yr using existing connections from the City of Ontario to JCSD C1 Equip ASR wells	1. Reduce net groundwater production in the JCSD Well Field area
Two JCSD ASR Wells - B	na	FWC and the JCSD	na	na	na	na	C1 Construct a pipeline to connect to FWC. C2 Equip ASR wells O1 Exchange 2,680 acre-ft/yr from FWC to JCSD	1. Reduce net groundwater production in the JCSD Well Field area
Two JCSD ASR Wells - C	na	CVWD and JCSD	na	na	na	na	O1 Exchange 2,680 acre-ft/yr from CVWD to JCSD conveyed by City of Ontario or FWC C1 Equip ASR wells	1. Reduce net groundwater production in the JCSD Well Field area
Two JCSD ASR Wells - Partnership	na	Partnership and the JCSD	na	na	na	na	O1 Exchange 2,680 acre-ft/yr from CVWD, City of Ontario or FWC to JCSD conveyed by some or all of the project owners C1 Equip ASR wells	1. Reduce net groundwater production in the JCSD Well Field area

[1] O=Operational, I=Investigation, C=Capital

[2] In November 2011, the Steering Committee requested that IEUA develop a list of improvements and suggested actions that, based on their experience in operating the CBFIP facilities, could increase stormwater recharge at a reasonable cost – the IEUA suggested projects include these projects. "IEUA" is used herein to represent a larger group of stakeholders including IEUA that "advocate" the project.



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2013 Amendment to the 2010 RMPU

Recharge Improvements Recommended by the RMPU Steering Committee

Figure 6-1

7.1 Background

Section 6 contains lists of projects and project groupings that were reviewed and discussed by the Steering Committee. Subsequently the pool committees, advisory committee, and the Board approved Project Grouping 6, "Maximize Recharge" that is listed in Table 6-1. The project evaluation criteria discussed in this section were adopted by Watermaster to evaluate these projects to determine if the proposed projects are consistent with Watermaster's 2013 goals, to prioritize the projects, and to ultimately provide the Watermaster recommendations for implementation.

7.2 Watermaster's Recharge Goals

Given 2013 planning information discussed in Section 2, Watermaster will not likely be recharging significant quantities of supplemental water in the near future for replenishment purposes. The potential sustainability challenges faced by the JCSD and the CDA cannot be mitigated through spreading alone as was demonstrated in draft Section 3 of the 2013 RMPU Amendment report. Watermaster can work with the Appropriative Pool parties to facilitate the development of in-lieu recharge/exchange and aquifer storage and recovery (ASR) projects to mitigate potential sustainability challenges and direct that replenishment occur by providing replenishment water to the in-lieu recharge/exchange and/or ASR projects. Alternatively, the Appropriative Pool parties could make their own arrangements, independent of the Watermaster, to achieve the same purposes.

Changes in production patterns and reoperation have caused groundwater levels to decline in the northern parts of MZ2 and MZ3, specifically in areas where the CVWD, FWC, and the City of Ontario produce groundwater. Model investigations, discussed in a report titled *2009 Production Optimization and Evaluation of the Peace II Project Description* prepared by WEI suggest that this drawdown will continue through 2030. To improve the balance of recharge and discharge in the northern parts of MZ2 and MZ3, Watermaster could implement storm and dry-weather recharge projects listed in Table 6-1 that recharge in MZ2 and MZ3. These projects would increase the recharge of storm water and dry-weather flow in these management zones and add New Yield to the Chino Basin. Alternatively, a Party could implement these projects and Watermaster could facilitate their implementation by petitioning for amendment of its existing State Water Board stormwater diversion permits to include other recharge sites, in effect "sharing" its rights under its stormwater diversion permits with the implementing Party[27]. In terms of balance, MZ3 has the greatest need of new storm and dry-weather flow recharge and supplemental recharge capacity.

7.2.1 Watermaster Minimum Standard of Performance

The Watermaster is tasked with recharging the Basin in order to fulfill the following numeric obligations: first, the Watermaster coordinates the replenishment of the Basin in order to offset production in excess of the Safe Yield (Judgment, ¶ 49-50); and second, the Watermaster is obligated, pursuant to the Peace and Peace II Agreements, to recharge, on average, 6,500 acre-ft/yr of supplemental water to MZ1 (Peace Agreement, § 5.1[g], Peace II Agreement, § 8.4).

In the 2013 RMPU Amendment, the Watermaster's minimum standard of performance, related to the evaluation of new recharge facilities and their operations, comes from the Peace Agreement and the December 2011 Watermaster Board action. The Peace Agreement § 5.1 (e) items (i), (iii), (v), (vii), and (viii), read as follows (see Peace Agreement, pages 20 and 21):

"Watermaster shall exercise Best Efforts[28] to:

(i) protect and enhance the safe yield of the Chino Basin through Replenishment and Recharge; […]

(iii) direct Recharge relative to Production in each area and sub-area of the Basin to achieve long term balance and to promote the goal of equal access to groundwater in all areas and sub-areas of the Chino Basin; […]

(v) establish and periodically update criteria for the use of water from different sources for Replenishment purposes; […]

(vii) recharge the Chino Basin with water in any area where groundwater levels have declined to such an extent that there is an imminent threat of Material Physical Injury to any party to the Judgment;

(viii) maintain long-term hydrologic balance between total Recharge and discharge in all areas and sub-areas; […]."

27 The addition of points of diversion to Watermaster's stormwater diversion permits would affect a change only in the ability to divert stormwater pursuant to the permits, as enforced by the California State Water Resources Control Board. Such addition does not contemplate any change in Watermaster's own mechanisms for the allocation of stormwater yield, which is outside the scope of the State Water Resources Control Board's oversight.

28 Best Efforts, per the Peace Agreement (see Peace Agreement, page 4), "means reasonable diligence and reasonable efforts under the totality of the circumstances. Indifference and inaction do not constitute Best Efforts. Futile action(s) are not required."

On December 15, 2011, the Watermaster Board directed that the 2013 RMPU Amendment's Implementation Plan "[…] address balance issues within the Chino Basin subzones […]."[29]

The following conclusions were documented in the draft Sections 2 through 4 herein and the *2009 Production Optimization and Evaluation of the Peace II Project Description*:

- "There is enough existing recharge capacity in the Chino Basin to meet projected replenishment obligations for the foreseeable future. Most of this recharge capacity is in MZ1 and MZ2.

- There are no recharge obstacles to meeting the MZ1 supplemental water recharge requirement of 6,500 acre-ft/yr. The IEUA projects that it will recharge about 3,300 acre-ft/yr of recycled water in MZ1. Therefore, to the extent that the annual replenishment obligation is less than the difference between the MZ1 recharge obligation and recycled water recharged by the IEUA in MZ1, the Watermaster will have to purchase some imported water from Metropolitan and recharge it in MZ1 to meet the 6,500 acre-ft/yr commitment.

- In the future, when the replenishment obligation becomes significant, the Watermaster will lack access to facilities to enable it to direct recharge in such a way as to balance recharge and discharge in MZ3.

- There are potential production sustainability challenges in the JCSD and CDA well field areas located in MZ3, MZ4, and MZ5. This challenge is caused by production in the well fields in excess of recharge and the inability of the aquifer to efficiently transmit recharge to the affected wells. Groundwater modeling investigations over the last five years suggest that the new artificial recharge at existing stormwater retention facilities will provide some benefits towards resolving the sustainability challenge faced by the JCSD and the CDA and that reducing net production in the JCSD well field would be beneficial in resolving the production sustainability challenge."

The following questions were developed for discussion purposes to guide the development of criteria that could be used by the Watermaster and the Parties to determine which projects are consistent with Watermaster goals, to rank the projects, and to determine which projects should be implemented.

Is the Project Cost Effective?

Planning for a storm and dry-weather flow recharge project begins when the estimated present value cost of the new storm water and dry-weather flow recharge project is determined to be less than the present value cost of recharging the next least cost supplemental water. There are limited supplies of recycled water given current and expected future land use at build out. Therefore, the next least cost supply is assumed herein to be imported water from Metropolitan or other imported water that is wheeled into the Chino Basin through

[29] From the minutes of the December 15, 2011 Watermaster Board meeting.

Metropolitan's facilities. The next least cost of supply is assumed herein to be the Metropolitan untreated Tier 1 rate.

A proposed storm and dry-weather flow recharge project will be considered for implementation when the unit cost of new recharge is determined to be comparable to or less than the unit cost of importing a comparable volume of untreated Tier 1 water from Metropolitan. A Funding Plan and an Implementation plan will be presented in Section 8 of the 2013 Amendment (2010 RMPU). These plans will include a list of projects that will collectively make sense to implement after being examined under all of the proposed criteria. The cost effectiveness test of comparison to Tier 1 cost will not be a strict Pass/Fail criterion.

There are limits to funding available to implement these new projects. Thus, the projects that will be implemented must meet the recharge goals and priorities of the Watermaster and must be the most cost-efficient.

Does a Proposed Project Create Significant New Storm Water Recharge and Dry-Weather Flow Recharge?

Smaller projects require relatively more resources to develop and operate than larger projects. For discussion purposes, significant is defined herein to be greater than 100 acre-ft/yr.

Does the Project Create New Supplemental Water Recharge Capacity?

New storm and dry-weather flow recharge facilities can be used to recharge supplemental water if supplemental water can be conveyed to them. In fact, because of the hydrology of the watershed, it is likely that the supplemental water recharge capacity of a new project will be greater than the storm water and dry-weather flow recharge capacity.

There is also the possibility of constructing recharge facilities for supplemental water recharge only. These recharge facilities include injection wells and ASR wells and may include recharge basins.

What are the Barriers to Implementation?

Spreading basins that will be developed from existing retention basins will require outlet controls, SCADA, potentially significant grading, and increased maintenance. The barriers for these recharge projects may include: developing an agreement with the basin owner to construct improvements and allow recharge; the flood control function of an existing or planned retention basin; mitigation for habitat losses and other resource agency requirements; Watermaster material physical injury findings; obtaining the ability, pursuant to a water right permit, to divert water for recharge and subsequent beneficial use; and the potential for diverting water that would otherwise be captured at an existing downstream facility.

For a new spreading basin that would not be otherwise built for flood control purposes, the implementation barriers may include: property acquisition; obtaining change in the general plan to allow the land to be developed as a recharge basin; agreement with the owner of the drainage works to divert storm water and convey excess back to the drainage works;

mitigation for habitat losses and other resource agency requirements; Watermaster material physical injury findings; obtaining the ability, pursuant to a water right permit, to divert water for recharge and subsequent beneficial use; and the potential for diverting water that would otherwise be captured at an existing downstream facility.

The barriers to supplemental water recharge in existing and future retention basins may include: developing agreement with the owners of the basin to allow construction of improvements and supplemental water recharge; cost of obtaining and conveying supplemental water supplies to the basin; obtaining permit to recharge recycled water, conflicting schedules for supplemental water recharge and basin maintenance, mitigation for habitat losses and other resource agency requirements; and Watermaster material physical injury findings.

In-lieu recharge/exchange projects involve the conveyance of supplemental and or groundwater[30] to the JCSD from the Appropriative Pool Parties, the IEUA, the TVMWD, the WMWD, and/or some combination of these sources. Interties would be constructed among these agencies. The barriers to in-lieu recharge/exchange projects anticipated herein include: the drafting of agreements to allow in-lieu recharge/exchange; source water availability and cost, and Watermaster material physical injury findings.

All the ASR projects listed in Table 6-3 involve the JCSD with the injection water supplied by the Appropriative Pool Parties, the IEUA, the TVMWD, the WMWD, or some combination of these sources, as in the in-lieu recharge/exchange projects. In fact, it is possible that the in-lieu recharge/exchange and ASR projects could be combined to form a more robust project. The barriers to the ASR well projects are essentially the same as in-lieu recharge/exchange projects.

Barriers to Implementation cannot be quantitatively assessed. They will be used as a qualitative factor in ranking projects.

Is This Project Solely Required for MS4 Compliance?

If a project on the list is serving the purpose of meeting MS4 compliance exclusively, then that project will not be included in the Funding and Implementation plans. If, on the other hand, the project represents enhancements beyond those required for MS4 compliance, then the enhancements and their associated yield will be considered.

[30] Where this groundwater production would not impact the groundwater levels in the JCSD well field.

7.3 Recommended Criteria

7.3.1 Exercise Best Efforts to Sustain Production in the JCSD Well Field

Watermaster will use its best efforts to facilitate recharge project implementation that sustain groundwater production in the JCSD well field. These projects will have the highest priority in the 2013 RMPU Amendment and, except for cost considerations, will not be comparatively evaluated with storm, dry-weather, and supplemental water recharge projects that use existing and proposed spreading facilities. These new projects need to consider the following:

- The groundwater modeling work described in Section 3, suggested that this could best be done by the JCSD reducing production in their existing well field and either producing groundwater elsewhere or using another water supply in lieu of producing groundwater from the area where their existing wells are located.

- Increasing recharge in existing recharge basins and new recharge accomplished through the conversion of stormwater retention basins to recharge facilities was found to not significantly increase the production sustainability in the JCSD well field.

- The modeling work also demonstrated that reoperation has little impact on sustainable production in the JCSD well field.

These facts mean that the Watermaster and the Parties concentrate their best efforts on projects that reduce groundwater production by JCSD and replace the reduced groundwater production with another supply. This can be accomplished through interconnections with the Appropriative Pool Parties, the IEUA, the TVMWD and/or the WMWD. There are multiple in-lieu recharge/exchange and ASR project alternatives. The criteria that will be applied to evaluate these production sustainability projects:

- Reliability of the supply to ensure sustainability – the project must be sized, scalable, and sourced to ensure sustainability.

- Cost – the cost to the Watermaster and the Parties should be minimized.

- Water quality – the project must not cause new water quality challenges and would hopefully improve groundwater quality.

- Ease of implementation – the project must be readily implementable with minimum institutional and regulatory difficulties.

7.3.2 Storm water and Dry-Weather Flow Recharge Projects

There are three types of storm water recharge projects that include: improvements at existing recharge facilities, improvements at existing storm water management facilities that currently produce only incidental recharge, and new facilities. The criteria that will be applied to storm and dry-weather flow recharge projects (hereafter yield enhancement projects) include:

- Confidence in the estimate of new storm water and dry-weather flow recharge – The procedure used by Watermaster to estimate new stormwater recharge is summarized as follows:
    - Watermaster will develop estimates of stormwater discharge and recharge at all the facilities proposed in Section 6 using the WasteLoad Allocation Model (WLAM), developed by WEI, using current land use and drainage system data and the daily precipitation for the period of July 1, 1949 through June 30, 2011. This is an updated version of the modeling approach used in the 2010 RMPU.
    - WEI will compare the historical recharge performance at existing facilities to the WLAM estimates for the period 2005 through 2011, develop correlation statistics, and implement a bias correction procedure for flow-through, flow-by, and hybrid facilities. All assumptions will be reviewed by the Steering Committee prior to conducting the evaluations.
    - New recharge will be estimated at 90 percent of the bias-corrected model estimate.
- Location of recharge – current preference will be given to MZ3 then MZ2 and then MZ1, up to specific new recharge goals per management zone. These recharge goals are discussed in Section 8 and are based on the 2013 Chino Basin Groundwater Model.
- Expandability of the project to include supplemental water recharge if recharge location is desirable.
- Cost – the cost to the Watermaster and the Parties should be minimized with the goal that the unit cost of the new recharge be less than the Metropolitan Tier 1 untreated rate. The unit cost of recharge will be based on the sum of amortized capital plus operations and maintenance costs divided by average annual new recharge.
- Water quality – the new recharge must not cause existing contaminant plumes to be redirected in such a way as to cause contamination to wells or interfere with existing groundwater cleanup programs.
- Ease of implementation – the project must be readily implementable with minimal institutional and regulatory difficulties.

7.3.3 Application of Criteria

The following information will be compiled, where appropriate, for all of the projects identified in Section 6 for consideration in the 2013 RMPU Amendment:

- Project name and management zone
- Average annual New Yield (new storm and dry-weather flow recharge)
- Average annual new recharge
- Supplemental water recharge capacity
- Capital and operations and maintenance costs
- Supplemental water acquisition cost
- Annual cost of the project and confidence in that cost estimate
- Unit cost of recharge (storm and dry-weather flow recharge separate from supplemental water recharge)[31]
- Production sustainability score[32]
- Management zone where project contributes to balance of recharge and discharge
- Water quality challenges
- Institutional challenges (water rights, access, environmental, and regulatory)

Tables 7-1a through 7-1c are mockups of the table format that will be used for characterizing the MZ3/MZ4/MZ5 production sustainability projects and include: the summary of important project characteristics (Table 7-1a), the final screening of all the projects (Table 7-2b), and the final ranked projects (Table 7-1c).

Table 7-2a through 7-2c are similar table mockups for the yield enhancement projects. Yield enhancement projects with unit cost exceeding the Metropolitan untreated Tier 1 rate may be recommended.

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[31] Expressed in dollars per acre-ft and which includes amortized capital and operations and maintenance costs. The intent is to capture all costs and express it as a unit cost for comparison to the cost of the next least cost supply.

[32] The production sustainability score is a tool to characterize a project's contribution to production sustainability in areas with sustainability challenges. In simple terms, the score will be as follows: 0 – does not contribute to production sustainability; 1 – contributes minimally to production sustainability (a necessary but not sufficient condition of sustainability); 2 – contributes significantly to production sustainability (a necessary and sufficient condition of sustainability).

Table 7-1a
Project Data for MZ3/MZ4/MZ5 Sustainability Projects

Project	Management Zone	Summary of Key Project Features	New Recharge	Capital Cost	Annualized Capital Cost	Annual O&M Cost	Other Annual Cost	Supplemental Water Acquisition Cost	Total Annual Cost	Unit Cost	Reliability of the Water Supply	Production Sustainability Score
X_1												
X_2												
"												
"												
"												
X_z												

Table 7-1b
Screening of MZ3/MZ4/MZ5 Sustainability Projects

Project	New Recharge	Unit Cost	Capital Cost	Reliaiblity of the Water Supply	Water Quality Challenges	Institutional Challenges
X_m X_j " " " X_q						

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Table 7-1c
Ranked MZ3/MZ4/MZ5 Sustainability Projects

Project	New Recharge	Unit Cost[1]	Capital Cost
Recommended Projects			
X_l			
X_n			
X_q			
Total of Recommended Projects[1]			
Other Projects			
Xa			
Xb			
"			
"			
Xz			

[1] "Total" unit cost is a yield-weighted average.

Table 7-2a
Project Data for Yield Enhancement Projects

Project	Management Zone	Summary of Key Project Features	New Yield	Capital Cost	Annualized Capital Cost	Annual O&M Cost	Other Annual Cost	Supplemental Water Acquisition Cost	Total Annual Cost	Unit Cost	Supplemental Water Recharge Capacity	Production Sustainability Score
Y_1												
Y_2												
"												
"												
"												
Yz												

Table 7-2b
Screening of Yield Enhancement Projects

Project	Management Zone	New Yield	Unit Cost	Capital Cost	Water Quality Challenges	Institutional Challenges
Y_m						
Y_j						
"						
"						
"						
Yq						

Table 7-2c
Ranked Yield Enhancement Projects

Project	Yield	Unit Cost[1]	Capital Cost
Recommended Projects to Balance MZ3			
Y_l			
Y_n			
Y_p			
Y_q			
Total MZ3			
Recommended Projects to Balance MZ2			
Y_g			
Y_n			
Y_m			
Y_o			
Total MZ2			
Recommended Projects to Balance MZ1			
Y_a			
Y_d			
Y_r			
Y_j			
Total MZ1			
Other Recommended Projects, Not MZ Specific			
Y_u			
Y_v			
Y_w			
Y_x			
Total Other Recommended			
Total Recommended Projects			
Other Projects			
Y_1			
Y_2			
"			
"			
"			
Yz			

[1] "Total" unit cost is a yield-weighted average.

Section 8 – Recommended 2013 Recharge Master Plan

8.1 Introduction

This section presents the recommended recharge master plan update based on the list of projects identified in Section 6 and the criteria described in Section 7. Specific projects are recommended in Tables 8-1c and 8-2c for production sustainability and yield enhancement projects, respectively. Implementation and financing plans are also described for the recommended projects.

8.2 Initial Project Screening

8.2.1 Production Sustainability Projects

Table 6-1 contains nine production sustainability projects that the Steering Committee and Watermaster approved for initial screening. In contrast to the yield enhancement projects, the production sustainability projects were described conceptually and needed further development prior to screening and ranking. In the winter and spring of 2013, Watermaster staff encouraged capable Appropriators to participate with the JCSD in projects that would supply the JCSD with water in-lieu of JCSD production from the parts of MZ3/MZ4/MZ5 where production sustainability is a concern. Members of the Steering Committee convened informal meetings to discuss various alternatives in which water could be provided to the JCSD and potentially to the CDA that would result in reduced production by the JCSD. From these meetings, subsequent discussions, and information provided by the City of Ontario, the Monte Vista Water District and others, four project categories were identified: 1) transfer of CDA water from CDA members to the JCSD in lieu of JCSD production; 2) supply of water from other Appropriator parties through new connections among the parties, potentially including new wells and pipelines; 3) oversizing the proposed Ontario Groundwater Recovery Project (OGRP) and using the increased supply to reduce CDA Desalter II production; and 4) the use of JCSD ASR wells to seasonally increase groundwater levels in the JCSD well field area. Figure 8-1 shows the locations of the existing water distribution systems, wells, and the proposed OGRP in the parts of MZ3/MZ4/MZ5 where production sustainability is a concern. The production sustainability projects considered herein include:

1. The City of Ontario could sell the JCSD up to 5,000 acre-ft/yr of its CDA deliveries from the Chino II Desalter without the construction of new additional facilities. The sales price would be Ontario's cost of water from the CDA of $920 per acre-ft.[33] Ontario and the JCSD take their Desalter II deliveries from a common reservoir in the JCSD service area, and Ontario would forego its deliveries from this reservoir and sell some or all of its share of CDA allocation from the Chino II Desalter to the JCSD. This would be an interim supply until Ontario needs its capacity in the Chino II

[33] CDA charge to the City of Ontario for fiscal 2013/14.

Desalter to meet its water supply needs. As an interim supply, this project could also be a proof-of-concept demonstration to determine the amount and timing of alternative supplies required to ensure production sustainability.

2. The City of Chino Hills and the Monte Vista Water District (MVWD) have proposed an in-lieu exchange project where the MVWD and Chino Hills would use more groundwater produced in Management Zone 1 and/or imported water, and Chino Hills would forego taking some of its 4,200 acre-ft/yr CDA Desalter I allocation, having that desalter water conveyed to the JCSD through existing CDA facilities. The JCSD would exchange annual production rights to Chino Hills and the MVWD equal to the amount of water supplied to the JCSD in this project. This proposal is modeled on the interim forbearance plan that was implemented during the development of the Management Zone 1 subsidence management plan. Similar to the Management Zone 1 forbearance plan, this project may be interim in nature, while a more permanent management strategy is developed by the affected party(ies).

3. Other than through CDA facilities, there are no physical connections to the JCSD system from Chino Basin Appropriator parties that would permit a direct supply of water to the JCSD. A new connection would be required from the Ontario distribution system 1212 zone to the JCSD's 1100 zone. If this connection were constructed, Ontario could be a source of alternative supply as well as other Appropriators that could exchange water with the JCSD through Ontario's system. A new connection from the Cucamonga Valley Water District (CVWD) to the City of Ontario would be required to enable the CVWD to supply water to the JCSD. A new connection from the Fontana Water Company (FWC) to either the City of Ontario or directly to the JCSD would be required for the FWC to supply water to the JCSD. Other Appropriators may have the ability to connect to the City of Ontario to wheel water to the JCSD. Watermaster staff has encouraged the Appropriator parties that could participate in these water supply projects to review their capabilities and interests in participating in production sustainability projects and to provide Watermaster staff with alternative descriptions, operating plans, and costs. At the time this report was written, only three of the potential participants had provided alternatives to Watermaster staff. Watermaster staff developed two generic in-lieu or exchange projects to bracket the scale and cost of such projects that will improve production sustainability in the JCSD service area: Minimum (Min) Generic In-Lieu and Maximum (Max) In-Lieu projects. These projects are described in Appendix D and listed herein in Table 8-1a.

4. The City of Ontario has developed a project concept, the OGRP. The purpose of the OGRP is to produce groundwater near the southern leading edge of the South Archibald VOC plume, treat that water to remove VOCs, treat it again at the Chino II Desalter for nitrate and TDS reduction, and subsequently serve it. The locations of the OGRP wells and raw water pipeline are shown in Figure 8-1. Ontario has suggested that the OGRP could be oversized with the resulting surplus capacity used to reduce CDA Desalter II groundwater production, and thereby providing a sustainable supply of raw water to the CDA Desalter II and helping to maintain higher groundwater levels in the JCSD well field area.

The JCSD has developed ASR wells that could be used to improve production sustainability but has not identified the water supply that would be used for injection or the magnitude and timing of that supply. As of the time of this report's preparation, the JCSD had not provided Watermaster staff with a plan to improve production sustainability with its ASR wells. Therefore, consideration of specific production sustainability projects utilizing the JCSD's ASR wells will not be included in the 2013 RMPU Amendment. Exclusion of the JCSD ASR project in the 2013 RMPU Amendment does not preclude them from future development and implementation before the next Recharge Master Plan update.

The water supply sources for the production sustainability projects include Chino Basin groundwater produced sufficiently far from the sustainability challenged area and imported water. For projects 2 and 3 described above, the JCSD would contribute its unused production rights to the Appropriator(s) that supplies them water to offset the water supply cost. The cost to produce and convey the water to the JCSD could be paid for by the JCSD or some other arrangement that could involve Watermaster. Some or all the cost to produce and convey water to the JCSD would be offset by the JCSD's avoided cost to produce and convey its own water. Table 8-1a contains the list of production sustainability projects considered for evaluation and ranking. The JCSD ASR well project is not included in Table 8-1a for the reasons described above. Table 8-1a contains project names, descriptions, new supplies generated by the projects, capital cost estimates, supplemental water costs, annual costs, unit costs, and ratings for water quality and reliability.

8.2.2 Yield Enhancement Projects

Table 6-1 contains 41 yield enhancement projects that the Steering Committee recommended and approved through the Watermaster process for initial screening. These projects involve the construction of new facilities and four proposals to increase the frequency of operations and maintenance at existing facilities. Watermaster, the IEUA, and WEI reviewed all of the projects based on the information that was readily available to define how each project would operate, to estimate their storm and recycled water recharge performance, and to estimate their cost. Certain projects listed in Table 6-1 were not analyzed as their projected unit costs were higher than the initial screening level of $1,500 per acre-ft. Table 8-2a lists the projects that were advanced to detailed evaluation using the criteria described in Section 7. Table 8-2a contains the following:

- Project identification numbers, names, and descriptions
- Indications of when a project was combined with another project or projects to take advantage of increased yield or cost efficiencies
- Opportunities for IEUA and Watermaster joint financial participation pursuant to the Peace II Agreement
- Characterizations of the new storm water recharge created by the proposed projects
- Indications as to whether a project would be constructed for regulatory compliance purposes and whether a project was already constructed

- Capital cost opinions for stormwater improvements, annualized capital costs, operations and maintenance costs, total annual costs, and unit costs of stormwater recharge

- New recycled water recharge capacities and recycled water acquisition costs

- Capital cost opinions for recycled water, annualized capital costs, operations and maintenance costs, total annual costs, and unit costs of recycled water recharge

- New imported water recharge capacities and imported water acquisition costs

- Capital cost opinions for imported water, annualized capital costs, operations and maintenance costs, total annual costs, and unit costs of imported water recharge

- Total combined recharge capacities for all storm, recycled, and imported waters

- Indications of additional project benefits and contributions to production sustainability

The projected new stormwater recharge estimates are based on the updated and calibrated Wasteload Allocation Model (WLAM), which has been used in past recharge investigations and to support Watermaster's groundwater model. The capital and operation and maintenance costs are based on recent experience in the construction and operations of the CBFIP projects and other construction projects. The IEUA also provided estimates of new recycled water recharge capabilities for some of the proposed projects listed in Table 8-2a. Appendix D contains all available detailed drawings and cost opinions for each project listed in Table 8-2a. In total, Table 8-2a contains 54 projects and combinations of projects. Some of the projects are mutually exclusive as indicated in the notes. Table 8-2a was vetted thoroughly by the Steering Committee in the period of April through June of 2013.

8.3 Project Evaluation and Ranking

8.3.1 Production Sustainability Projects

8.3.1.1 Application of Section 7 Criteria

Table 8-1a contains the five production sustainability projects that were selected for screening by the Steering Committee. The purpose of Table 8-1a is to provide a detailed characterization of the projects in tabular form. Table 8-1b lists the same projects and the criteria upon which they will be screened. Table 8-1c lists the production sustainability projects in their order of preference, based on the screening criteria of Section 7 and as described below.

8.3.1.1.1 Reliability

To achieve the desired sustainability benefits, the water substituted for JSCD groundwater production must be at least as reliable as the current JCSD supplies. The production sustainability project must be sized, scalable, and sourced to ensure sustainability. The five projects listed in Table 8-1b are all assumed to use Chino Basin groundwater as a source supply, produced from parts of the Basin that are sustainable, and/or imported water treated at an existing treatment plant. Therefore, the reliability for all five projects will be high and the five projects are assumed to be of equivalent reliability to one another. The amount and timing of supply required to ensure sustainability is currently unknown. Two or more of the projects listed in Table 8-1b could be combined to ensure sustainability.

8.3.1.1.2 Cost

The capital costs vary greatly among the four projects and range from zero to about $10.6 million with unit costs ranging from $95 to $920 per acre-ft. There could be additional costs for the Max General In-Lieu and Min General In-Lieu projects if the water quality produced for these projects becomes degraded. There is also opportunity for the Appropriator(s) that constructs the new wells and conveyance facilities used in these projects to use these same facilities for other uses when not used to supply the JCSD.

8.3.1.1.3 Water Quality

The Ontario-CDA MZ3 In-Lieu, the Chino Hills/MVWD, and the OGRP projects will always produce potable water that can be used to replace JCSD groundwater production. For the Max General In-Lieu and Min General In-Lieu projects, water will be wheeled through an adjacent Appropriator's water system where it is assumed that the water will already be potable. The new wells associated with this project will presumably be sited to avoid water quality challenges and may in fact provide water quality benefits to the source agency. That said, future groundwater degradation could occur, necessitating treatment, and the level of risk is unknown.

8.3.1.1.4 Ease of Implementation

The facilities required to implement the Ontario-CDA MZ3 In-Lieu project and the Chino Hills/MVWD project exist, and these projects could be initiated quickly after an agreement between the parties is negotiated.

The OGRP project, if implemented, is several years out and is dependent on 1) the potentially responsible parties involved in the South Archibald Plume paying for VOC treatment prior to delivery of the source water to the Chino II Desalter and 2) the project proponents obtaining substantial grant funding. The JCSD would benefit from reduced Chino II Desalter pumping at the existing wells by about 2,900 acre-ft/yr and would not receive any new water directly from the project.

The Max General In-Lieu and Min General In-Lieu projects would require an agreement between the JCSD and the Appropriator(s) that serves it water. Existing wells, potentially new wells, existing treatment plant capacity, or some combination of these will be required. Interconnections between the JCSD and the City of Ontario and potentially Ontario and other Appropriators will be required. There may also be other benefits to participating Appropriators that include increasing their groundwater production capacity (joint use of wells) and improving conveyance capacity within their own distribution systems. The agreement(s) will need to consider the cost to construct and operate the improvements and economic consideration for the source water.

8.3.1.2 Ranking of Production Sustainability Projects

Table 8-1c shows a preliminary ranking of these projects by unit cost. The projects, in order of unit cost priority, are: the Min General In-Lieu project, the Chino Hills/MVWD project, the Max General In-Lieu project, the OGRP, and the Ontario-CDA MZ3 In-Lieu project. At the time this report was written, there were no cost estimates available for the Chino Hills/MVWD project, but it is believed to have an implementation cost less than the Max General In-Lieu and Min General In-Lieu projects. The Min General In-Lieu and Max General In-Lieu are ranked higher than the OGRP project even though their estimated unit cost is 50 percent greater ($150 per acre-ft versus $95 per acre-ft). The Min and Max General In-Lieu and Chino Hills/MVWD projects were rated higher than the OGRP project due to ease of implementation. The OGRP depends on substantial grant funding and cooperation with private entities, which is speculative at this time. In contrast, the Max and Min General In-Lieu and Chino Hills/MVWD projects can be more readily implemented and may provide benefits to the Appropriators that participate. The Ontario-CDA MZ3 in-Lieu project was ranked last due to its unit cost of greater than $900 per acre-ft.

Specific recommended projects will be identified through the implementation plan process described in Section 8.4.2.

8.3.2 Yield Enhancement Projects

8.3.2.1 Application of Section 7 Criteria

Table 8-2b lists the yield enhancement projects and summarizes their features pursuant to the screening criteria articulated in Section 7 herein. Some projects have two variants where the difference is how excavation cost is accounted for in the construction cost. Projects with an "a" attached to their identification numbers have their excavation costs reduced by 90 percent under the assumption that sand and gravel operators will extract the materials at their cost. Table 8-2b summarizes the project economics in Table 8-2a and includes information on the water quality and institutional challenges of each project. Table 8-2c contains the final rankings based on the Section 7 criteria and input from the Steering Committee. The application of the criteria is described below.

8.3.2.1.1 Confidence in Recharge Estimate

The WLAM was calibrated for selected recharge basins where the IEUA develops recharge estimates based on observed data. The results of these calibration efforts are contained in Appendix D. Subsequently, recharge estimates were developed for the proposed yield enhancement projects included in Table 8-2a as well as for the no-project condition at the proposed recharge sites. Pursuant to the screening and evaluation criteria contained in Section 7, new recharge is estimated as 90 percent of the difference between the recharge estimate for the proposed project and the estimate of recharge for the no-project condition. This 10 percent reduction produces a reliable and conservative estimate of new recharge.

The IEUA prepared estimates of recycled water recharge capacity for some of the proposed projects listed in Table 8-2a. These estimates are based on the availability of recycled water that is not currently being recharged and will not be used to meet direct reuse demands;

therefore, recycled water is considered highly reliable. The reliability of new recharge estimates is equal among the projects.

8.3.2.1.2 Location of Recharge

The locations of new storm and supplemental (imported and recycled) water recharge projects have been prioritized to assist Watermaster in its best efforts to balance recharge and discharge in every area and subarea of the basin. Watermaster's current recommended supplemental water recharge plan[34] calls for Watermaster to prioritize supplemental water recharge as follows:

- Recharge the first 6,500 acre-ft/yr of supplemental water in Management Zone 1 pursuant to the Peace Agreement.
- Recharge Management Zone 3 up to its maximum supplemental water recharge capacity (current supplemental water recharge capacity is 12,700 acre-ft/yr).
- Recharge Management Zone 2 up to its maximum supplemental water recharge capacity (current supplemental water recharge capacity is 28,300 acre-ft/yr).
- Recharge Management Zone 1 up to its maximum supplemental water recharge capacity (current supplemental water recharge capacity is 42,100 acre-ft/yr).[35]

This priority scheme was developed to balance recharge and discharge at the management zone level when supplemental water recharge is being done. Watermaster recharges imported water primarily to replenish overproduction, to store imported water for the existing Dry-Year Yield program, and more recently for preemptive replenishment. The IEUA recharges recycled water in certain basins where the IEUA and Watermaster have a joint permit to recharge recycled water.

The yield enhancement projects are prioritized by management zone in Table 8-2c with the priorities that mirror the supplemental water recharge priority.

8.3.2.1.3 Expandability to Include Supplemental Water Recharge

The IEUA has identified recharge projects that could be used to recharge recycled water. These projects have been identified in Table 8-2a and feature prominently in Table 8-2c.

8.3.2.1.4 Cost

Watermaster, the IEUA, and WEI developed Level-5[36] cost opinions for each of the projects listed in Table 8-2a. The backup for these cost opinions is included in Appendix D. For

[34] 2009 Production Optimization and Evaluation of the Peace II Project Description (WEI, 2009).

[35] The supplemental water recharge capacities cited above are based on Table 6-3 in the 2010 Recharge Master Plan Update (WEI et al., 2010).

projects that consist of only operations and maintenance activities, the IEUA prepared annual cost estimates based on their experience in basin operations and maintenance.

8.3.2.1.5 Water Quality Challenges

Storm water is considered an impaired water source for surface waters. After filtration through the soil and unsaturated zone, storm water is considered to be of suitable quality for potable uses.

There are some instances where storm and supplemental water recharge may cause or exacerbate existing groundwater quality challenges. Storm water and supplemental water recharge can cause groundwater mounding under recharge sites that can redirect movement of existing contaminant plumes. Recharge can also flush contaminants from the unsaturated zone to the saturated zone, thus mobilizing contaminants that could subsequently impact well water quality. Figure 8-2 shows the locations of all recharge projects listed in Table 8-2a by identification number and the locations of significant water quality anomalies. For example some of the concerns include:

- Increased recharge at the Ely Basins could redirect the GE Test Cell plume further to the west and impact down-gradient wells.
- Increased recharge at the Wineville Basin could redirect the Kaiser Steel Mill plume and potentially impact down-gradient wells.
- Contaminants in the unsaturated zone near the CSI Basin could be mobilized with increased recharge and impact down-gradient wells.
- Contaminants that may exist in the soil and unsaturated zone from historical operations in and adjacent to the Vulcan Pit could be mobilized with increased recharge and impact down-gradient wells

Watermaster reviewed the locations of these water quality anomalies relative to the locations of potential yield enhancement projects and concluded that water quality impacts, if any, from new recharge at the potential yield enhancement projects would be determined and vetted during the preliminary engineering, CEQA and Watermaster Material Physical Injury review processes, and appropriate mitigation measures would be identified and committed to during these processes.

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[36] See Recommended Practice Nu. 17R-97, Cost Estimate Classification System,

http://www.google.com/url?sa=t&rct=j&q=&esrc=s&frm=1&source=web&cd=2&ved=0CDUQFjAB&url=http%3A%2F%2Fwww.aluminium.gl%2Fsites%2Fdefault%2Ffiles%2Fpdf%2Fnogletal%2Fcostestimatingsystemaace-208a.pdf&ei=VcQGUu6RBIaSyAHFjoDoAg&usg=AFQjCNH5E6v6F-qxcQXIDW894iTFN48eGA&sig2=wWQ1gparE5ed1pEVkrOpJg

8.3.2.1.6 Institutional Challenges

The common potential institutional challenges to implement the projects listed in Table 8-2a consist of the following:

- Determination of a lead entity for California Environmental Quality Act (CEQA) review and project implementation
- Determination of who pays and who benefits
- Obtaining access to recharge sites and the ability to construct and operate recharge facilities
- Modification of the IEUA-Watermaster recharge permit to include recycled water recharge at new recharge basins and to increase recycled water recharge amounts at existing basins

Table 8-2b includes the institutional challenges at specific basins above and beyond those listed above.

8.3.2.2 Ranking of Yield Enhancement Projects

Table 8-2c contains the yield enhancement projects ranked using the Section 7 criteria and based on input from the Steering Committee. The projects are listed by management zone in order of increasing unit cost. The Project ID numbers with an "a" extension indicate that the project includes excavation and haul-off costs, and the capital cost shown assumes that the project's excavation and haul-off costs are reduced by 90 percent with the excavated materials being used in another construction project or leased to a mining operator. The cost effectiveness threshold for a recharge project was identified in Section 7 as the MWD Tier 1 rate, however it was determined that it would not be used as a pass/fail mechanism. The projects were evaluated using three thresholds: a marginal unit cost less than $600 per acre-ft, a melded unit cost less than $600 per acre-ft, and a melded unit cost less than $612 per acre-ft. The three unit cost thresholds were analyzed with and without the excavation discount. The associated tables and a description of each unit cost threshold are located in Appendix D (Tables D-20 through D-24).

The Steering Committee indicated a preference for a melded unit cost less than $612 per acre-ft would be considered for implementation. As shown on Table 8-2c, there are eleven projects recommended for construction that will increase stormwater recharge by about 6,780 acre-ft/yr and increase recycled water recharge capacity by 4,900 acre-ft/yr. The average unit cost of stormwater recharge is about $612 per acre-ft, the capital cost is about $57,000,000, and an annual cost of $4,150,000. The distribution of recharge by management zone is listed below:

Distribution of New Recharge by Management Zone for the Yield Enhancement Projects (acre-ft/yr)

Management Zone	Stormwater Recharge	Recycled Water Recharge	Total
1	250	0	250
2	2,980	2,000	4,980
3	3,550	2,900	6,450
Total	6,780	4,900	11,680

Most of the new recharge is concentrated in Management Zone 3 and 2, which will contribute to production sustainability in these management zones and more specifically in the JCSD well field area.

The IEUA is committing to cost share on three projects; San Sevaine Basin (PID 7), Victoria Basin (PID 11), and RP3 Basin (PID 22a). The table below displays the capital costs of the cost shared projects assuming a 50/50 split of the capital cost per Peace II Agreement Article VIII.

Project ID	Project	Yield	Recycled Water	Capital Costs		Total Capital Cost
				Watermaster	IEUA	
11	Victoria Basin	43	120	$ 75,000	$ 75,000	$ 150,000
7	San Sevaine Basins	642	1,911	$ 1,775,000	$ 1,775,000	$ 3,550,000
22a	RP3 Basin Improvements (2013 RMPU)	137	2,905	$ 1,855,000	$ 1,855,000	$ 3,710,000
Total		**822**	**4,936**	**$ 3,705,000**	**$ 3,705,000**	**$ 7,410,000**

8.4 Final Project Recommendations and Implementation Plan

This section describes the overall implementation strategy, recommended projects, implementation plan and financing plan. There are two types of projects being considered in the 2013 RMPU: production sustainability and yield enhancement projects. The magnitude of the production sustainability challenge is currently unknown and will depend on future groundwater production and recharge at existing recharge facilities, and the recharge at proposed yield enhancement projects located in Management Zones 2 and 3. The yield enhancement projects in Management Zones 2 and 3 being considered herein will provide some production sustainability benefits to the JCSD area where production sustainability challenges may occur in the future. Therefore it seems premature to recommend specific production sustainability projects until the magnitude of its production sustainability challenges can be more definitively characterized. The effort to definitively characterize the production sustainability challenges faced by JCSD and others is incorporated in the first year of the implementation plan of the 2013 Recharge Master Plan Update. (See Section 8.4.2.1)

8.4.1 Yield Enhancement and Production Sustainability Project Recommendations

Upon reviewing all available information, it is recommended that the parties proceed with additional characterization of the production sustainability challenges to determine the magnitude of sustainable groundwater production in the JCSD well field area with and without the yield enhancement projects proposed herein.

It is recommended that the yield enhancement projects listed in Table 8-2c be implemented according to the implementation and financing plan detailed in the following sections.

8.4.2 Implementation Plan

The implementation plan described below presents an orderly way to implement the yield enhancement projects and the production sustainability project(s) as needed. Time is of the essence in this implementation plan. The implementation plan is described by calendar year or years. Figure 8-3 is a graphical summary of the implementation plan.

8.4.2.1 Year 1 – 2014

Determine Need and Refine Production Sustainability Projects. The objectives of this work are to definitively characterize the magnitude of the production sustainability challenges faced by the JCSD and others, and to define the magnitude and timing of water deliveries to the JCSD to ensure production sustainability. During this year, technical investigations will be done to define the production sustainability challenges, to estimate the magnitude and timing of water deliveries to the JCSD to ensure production sustainability and to identify and refine alternative sources of supply. The end product of this work will be an optimized JCSD groundwater production plan, up to three alternative water supplies that will enable the JCSD to reduce groundwater production to sustainable levels, and a recommended project. This work will be done by the JCSD and participating Appropriators and facilitated by Watermaster.

There are benefits to developing sustainability projects as quickly as possible. Ideally sustainability projects could be developed in advance of the yield enhancement projects. Implementation of sustainability projects depend on the Appropriators willingness and ability to engage.

Contact Sand and Gravel Companies. Sand and gravel companies will be contacted to determine their interest in participating in yield enhancement projects.

Watermaster and the IEUA Yield Enhancement Project Implementation Agreement. The objective of this agreement is to define the roles of Watermaster and the IEUA in the planning, permitting, design, and implementation of the yield enhancement projects, and the cost allocations pursuant to the Peace II Agreement.

Appropriative Pool New Yield and Cost Allocation Agreement. Watermaster assumes that capital cost and New Yield will be allocated to the Appropriator parties based on their share of Operating Safe Yield, and future operation and maintenance expenses will be production based per Peace II Section 8.1. Any change in allocation method would first require a negotiation process to reach agreement among the Appropriative Pool parties. The objectives of this agreement would be to determine the allocation of New Yield and cost among the Appropriative Pool parties.

Flood Control and Water Conservation Agreement. The parties to this agreement include San Bernardino County Flood Control District (SBCFCD), Watermaster, and the IEUA. The objectives of this agreement are to define the terms and conditions to jointly explore and construct new conservation works on SBCFCD and IEUA properties and to conduct flood control and water conservation activities utilizing those same conservation works on the properties. The agreement will define the project sites, facility improvements, construction and maintenance cost allocations, user or license fees, operating criteria (with flood control purposes taking priority over conservation for joint use facilities), and other conditions.

The SBCFCD will require Watermaster and the IEUA to fund SBCFCD engineering studies and analyses to demonstrate that all conservation improvements at flood control facilities will not negatively impact the operation and maintenance of SBCFCD facilities or reduce the level of the designed flood protection. All engineering studies and analyses shall be done and provided to SBCFCD for review and approval and an encroachment permit obtained from SBCFCD before the construction of any conservation improvements can commence. SBCFCD will require that all applicable Environmental Agencies' permits and approvals be obtained and submitted to the SBCFCD before an encroachment permit can be issued.

Agreement with Property Owners. Develop an agreement among a property owner, IEUA, and Watermaster on the terms for use of land where land is required for a recharge project.

In addition to these agreements, the Watermaster will determine whether it is necessary to submit a Petition for Change with the State Water Resources Control Board for projects shown in 8-2c that are not included in the Watermaster's current diversion permits. The duration of the Petition for Change process is unknown but would likely be more than one year.

8.4.2.2 Years 2 and 3 – 2015 and 2016

Develop an Implementation Agreement among the Parties Participating in the Production Sustainability Project. The objective of this agreement would be to define the roles of the parties that would participate in the recommended production sustainability project; in the planning, permitting, design, and implementation of the production sustainability projects; and the cost allocations. This work will be done by the JCSD and participating Appropriators and facilitated by Watermaster.

Appropriative Pool Production Sustainability Cost Allocation Agreement. The objective of this agreement is to define how the Appropriators would participate in a production sustainability agreement and what, if any, production sustainability project costs will be borne by the Appropriators and how the projects costs would be allocated.

Preliminary Design of Recommended Yield Enhancement Projects. The level of design will be such that it enables the preparation of environmental documentation pursuant to CEQA, provides information for identifying and acquiring construction and related permits, and produces updated New Yield and cost estimates. This work will start in January 2015 and be completed in September 2015.

Prepare Environmental Documentation for Yield Enhancement Projects. CEQA will cover the recommended projects in Table 8-2c at the project level and the deferred projects at a programmatic level, based on the project descriptions contained herein. Watermaster will conduct a Material Physical Injury analysis in parallel with the CEQA process. This work will start in July 2015 and be completed in June 2016.

8.4.2.3 Years 3 and 4 – 2016 and 2017

Preliminary Design of Recommended Production Sustainability Projects. If new facilities are required, then one of the parties to the implementation agreement will contract for preliminary design. The level of design will be such that it enables the preparation of environmental documentation pursuant to the CEQA, provides information for identifying and acquiring construction and related permits, and produces cost estimates. This work will start in January 2016 and be completed in September 2016.

Prepare Environmental Documentation for Production Sustainability Projects. One of the parties to the implementation agreement will be the lead agency and contract for the preparation of environmental documentation. The lead agency will determine the type of environmental documentation and subsequently prepare it. This work will start in July 2016 and be completed in June 2017.

Prepare Final Designs and Acquire Permits for Production Sustainability Projects. One of the parties will contract for the development of final designs and acquire permits. This work will begin in July 2017 and be completed by December 2017.

Prepare Final Designs and Acquire Necessary Permits for the Yield Enhancement Projects. This work will begin in July 2016 and be completed by December 2017.

8.4.2.4 Years 5 and 6 – 2018 and 2019

Construct 2013 RMPU Amendment Production Sustainability Projects. One of the parties will contract for the construction of the recommended production sustainability project and construct the project during calendar 2018.

Construct 2013 RMPU Amendment Yield Enhancement Projects. The recommended projects will be constructed over the two-year period of 2018 and 2019.

8.4.3 Financing Plan

The financing plan for the production sustainability projects will be developed during the second year of the implementation plan as part of the process to develop an implementation agreement among the parties participating in the production sustainability project and in the third year if some of the project costs are allocated among all Appropriators. Parties are encouraged to complete these efforts sooner than the above schedule if possible.

The financing plan for the yield enhancement projects consists of the following elements:

- Identify the IEUA and Watermaster cost share. Watermaster and the IEUA will determine each party's cost share based on the Peace II Agreement and on the benefit to the parties. This will be negotiated and memorialized in an agreement as identified in the Implementation Plan above.

- Once the scope of the Montclair Basins project is defined, the IEUA and Watermaster will request that the CBWCD consider contributing funding to recharge improvements at the Montclair Basins.

- Identify grant-funding share. The IEUA, Watermaster, and the Appropriators will combine their efforts to secure grant funding and low-interest financing from the State Water Resources Control Board, the DWR, and others.

- Allocation of cost and benefit among the Appropriators. Watermaster assumes that capital cost and New Yield will be allocated to the Appropriator parties based on their share of Operating Safe Yield and future operation and maintenance expenses will be production based per Peace II Section 8.1. Any change in allocation method would first require a negotiation process among the Appropriative Pool parties.

- Finance the construction of recharge improvements. The IEUA, the TVMWD, the WMWD, and potentially certain Appropriator parties will use their revenue structure and other means (municipal bonds, pay-as-you-go, etc.) to construct the recommended yield enhancement projects.

- Apply pay-as-you-go for all the soft costs through completion of the final design. The soft costs were distributed between IEUA and Watermaster by the proportion of the total capital cost of the recommended projects to IEUA's portion of the cost shared projects (about six percent). The soft costs through completion of final design are:

Approximate Annual Costs for Pay-As-You-Go for All Soft Costs

	Fiscal 2014/15	Fiscal 2015/16	Fiscal 2016/17	Fiscal 2017/18	Fiscal 2018/19
Watermaster	$ 100,000[37]	$ 668,000	$ 668,000	$ 3,213,000	$ 3,213,000
IEUA	$ -	$ 44,000	$ 44,000	$ 211,000	$ 211,000
Total	$ 100,000	$ 712,000	$ 712,000	$ 3,424,000	$ 3,424,000

- All costs associated with the development of implementing agreements, preliminary design, proof-of-concept, completion of the CEQA process, and final design are considered part of the project capital cost and will be paid for through the Watermaster assessment process pursuant to the Peace II Agreement unless a new Appropriative Pool New Yield and Cost Allocation agreement is reached. In the case that such an agreement is reached, an assessment reconciliation will be done consistent with the new agreement.

A detailed financing plan will be developed in a process running in parallel to the development of the implementation agreements in years 2014 and 2015.

[37] Watermaster's cost to negotiate implementation agreements, legal costs and staff time.

Table 8-1a
Project Data for MZ3/MZ4/MZ5 Sustainability Projects[1]

Project	Benefiting Management Zone	Summary of Key Project Features	New Supply (acre-ft/yr)	Capital Cost ($)	Annualized Capital Cost ($)	Annual O&M Cost ($)	Other Annual Cost ($/acre-ft)	Supplemental Water Acquisition Cost ($)	Total Annual Cost ($)	Unit Cost ($/acre-ft)	Reliability of the Water Supply	Production Sustainability Score[4]
Min General In-Lieu	3	Construct two wells and related conveyance to move non-MZ3 groundwater or imported water to the JCSD.	5,800	$ 5,440,000	$ 354,000	$ 524,000	$ -	$ -	$ 878,000	$ 151	High	2
Max General In-Lieu	3	Construct four wells and related conveyance to move non-MZ3 groundwater or imported water to the JCSD.	11,600	$ 10,640,000	$ 692,000	$ 1,048,000	$ -	$ -	$ 1,740,000	$ 150	High	2
Chino Hills/MVWD Exchange Project	3	Chino Hills forgoes taking Desalter I water and provides that water to the JCSD. Chino Hills makes up the exchanged supply from MZ1 groundwater production or imported water treated at the WFA plant.	2,800	$ -	$ -	(see note 5 below)	$ -	$ -	(see note 5 below)		High	2
OGRP Project[2]	3	Installation of one well and extend OGRP raw water conveyance.	2,900	$ 4,222,500	$ 275,000	$ -	$ -	$ -	$ 275,000	$ 95	High	2
Ont-CDA MZ3 In-Lieu[3]	3	Ontario sale of 5,000 acre-ft/yr of their CDA water to the JCSD using existing connections.	5,000	$ -	$ -	$ -	$ 920	$ -	$ 4,600,000	$ 920	High	2

[1] The amount and timing of in-lieu supply required to ensure sustainability is unknown.

[2] The total estimated costs for the well and pipeline were derived from Table 9 of the Technical Report, Ontario Groundwater Recovery Project(Carollo, 2013). The production rate was assumed to be 2,000 gpm (2,900 acre-ft/yr at an operating factor of 90%).

[3] The Other Annual Cost for the CDA MZ3 In-Lieu project is the Fiscal Year 2013/14 gross cost/acre-ft for Ontario before the MWD local projects contribution. Source is Exhibit A of the June 6, 2013 CDA Special Board of Directors Meeting Agenda. Note that this cost does not reflect a credit for the avoided cost of pumping by JCSD.

[4] The production sustainability score is a tool to characterize a project's contribution to production sustainability in areas with sustainability challenges. Per the evaluation criteria described in Section 7, the score will be as follows: 0 – does not contribute to production sustainability, 1 – contributes minimally to production sustainability (a necessary but not sufficient condition of sustainability), and 2 – contributes significantly to production sustainability (a necessary and sufficient condition of sustainability).

[5] Annual and unit costs are unknown. The amount of available water and required in-lieu supply may be operationally limited due to water quality and reliability concerns. The cost to produce and convey water to the JCSD could be paid for by the JCSD or some other arrangement that could involve the Watermaster. Some or all the cost to produce and convey the water to the JCSD would be offset by the JCSD's avoided cost to produce and convey its own water. There is a possibility of no new capital cost and that this alternative could be the lowest cost production sustainability alternative.

Table 8-1b
Screening of MZ3/MZ4/MZ5 Sustainability Projects[1]

Project	New Supply (acre-ft/yr)	Unit Cost ($/acre-ft)	Capital Cost ($)	Reliability of the Water Supply	Water Quality Challenges	Ease of Implementation
Min General In-Lieu[3]	5,800	$ 151	$ 5,440,000	High	None[2]	b
Max General In-Lieu[3]	11,600	$ 150	$ 10,640,000	High	None[2]	b
Chino Hills/MVWD Exchange Project	2,800	(See note 5 on Table 8-1a)		High	None[2]	d
OGRP Project	2,900	$ 95	$ 4,222,500	High	None	c
Ont-CDA MZ3 In-Lieu	5,000	$ 920	$ -	High	None	a

[1] The amount and timing of in-lieu supply required to ensure sustainability is unknown.

[2] The water supplied will be wheeled through adjacent agency's water system where it is assumed that the water will already be potable. The new wells associated with this project will presumably be sited to avoid water quality challenges and may in fact provide water quality benefits to the source agency. That said, future groundwater degradation could occur necessitating treatment.

[3] Assumes that the water supply cost is offset by the JCSD's avoided production and annual transfer of an equal amount of water from their own production rights.

a - Requires an agreement between the City of Ontario and the JCSD.

b - Requires an agreement between the JCSD and others to construct, operate, and pay for the improvements.

c - Requires an agreement with non-Watermaster Parties that are PRPs may not want to participate in VOC treatment costs, and is dependent on grant funding.

d - Requires an agreement between the City of Chino Hills, the MVWD, the CDA, and the JCSD.

Table 8-1c
Ranked MZ3/MZ4/MZ5 Sustainability Projects

Project	New Supply (acre-ft/yr)	Unit Cost ($/acre-ft)	Capital Cost ($)
Min General In-Lieu	5,800	$ 151	$ 5,440,000
Chino Hills/MVWD Exchange Project[1]	2,800	Unknown	Unknown
OGRP Project	2,900	$ 95	$ 4,222,500
Max General In-Lieu	11,600	$ 150	$ 10,640,000
Ont-CDA MZ3 In-Lieu	5,000	$ 920	$ -

[1] Annual and unit costs are unknown. The cost to produce and convey water to the JCSD could be paid for by the JCSD or some other arrangement that could involve the Watermaster. Some or all the cost to produce and convey the water to the JCSD would be offset by the JCSD's avoided cost to produce and convey its own water. There is possibility of no new capital cost and that this alternative could be the lowest cost production sustainability alternative.

Table 8-2a
Project Data for Yield Enhancement Projects

Project ID	Project Combinations	Group[1]	Project	Man. Zone	Summary of Key Project Features	Potential Cost Share if Mutually Agreed?	Storm Water Recharge								
							Baseline Storm Water Recharge (acre-ft/yr)	New Storm Water Recharge (acre-ft/yr)	Constructed for Regulatory Compliance?	Project Complete?	Capital Cost ($)	Annualized Capital Cost ($)	Annual O&M Cost ($)	Total Annual Cost ($)	Storm Water Recharge Unit Cost[2]
Proposed Projects in Table 6-1 that Were Analyzed in Detail															
1		i	Montclair Basins	1	Transfer water between Montclair Basins and deepen MC 4	N	1,188	71	N	N	$ 5,450,000	$ 354,500	$ 2,631	$ 357,131	$ 4,997
1a		i	Montclair Basins	1	Transfer water between Montclair Basins and deepen MC 4	N	1,188	71	N	N	$ 5,050,000	$ 328,500	$ 2,631	$ 331,131	$ 4,633
2		i	Montclair Basins	1	New drop inlet structures to MC 2 and MC 3	N	1,188	248	N	N	$ 1,440,000	$ 93,700	$ 9,132	$ 102,832	$ 415
3		i	Montclair Basins	1	Automate inlet to MC 1[6]	N	1,188	0	N	N	$ 50,000	$ 3,300	$ (6,000)	$ (2,700)	$ -
4		i	Montclair Basins	1	Construct low-level drains from Basin 1 to 2 and 2 to 3	N	1,188	0	N	N	$ 790,000	$ 51,400	$ -	$ 51,400	$ -
5		i	North West Upland Basin	1	Increase drainage area and basin enlargement	N	29	93	N	N	$ 5,490,000	$ 357,100	$ 3,441	$ 360,541	$ 3,858
5a		i	North West Upland Basin	1	Increase drainage area and basin enlargement	N	29	93	N	N	$ 4,640,000	$ 301,800	$ 3,441	$ 305,241	$ 3,266
6		i	Princeton Basin	2	Basin enlargement and increased drainage area[22]	N	48	0	N	N	$ -	$ -	$ -	$ -	$ -
7		ii	San Sevaine Basins	2	Construct pump station, pump water from SS 5 to SS 3, and construct internal berm in SS 5[7]	Y	1,177	642	N	N	$ 1,775,000	$ 115,500	$ 23,641	$ 139,141	$ 217
8		ii	San Sevaine Basins	2	Extend IEUA recycled water pipeline to SS 3 and construct internal berm in SS 5[7]	Y	1,177	345	N	N	$ 1,310,000	$ 85,200	$ 12,719	$ 97,919	$ 283
9		i	San Sevaine Basins	2	Construct internal berms in SS 1 and SS 2 and install a gate between SS 1 and SS 2	N	1,177	0	N	N	$ 300,000	$ 19,500	$ -	$ 19,500	$ -
10		i	San Sevaine Basins	2	Increase CB13T capacity and power supply	N	1,177	0	N	N	$ -	$ -	$ -	$ -	$ -
11		i	Victoria Basin	2	Abandon the mid-level outlet and extend the lysimeters	Y	439	43	N	N	$ 75,000	$ 4,900	$ 1,576	$ 6,476	$ 151
12		ii	Lower Day Basin (2010 RMPU)	2	Inlet improvements, rebuilding embankment, elimination of mid-level outlet	N	395	789	N	N	$ 2,480,000	$ 161,300	$ 29,041	$ 190,341	$ 241
13		ii	Lower Day Basin	2	Install gate on mid-level outlet	N	395	75	N	N	$ 600,000	$ 39,000	$ 2,777	$ 41,777	$ 554
14		i	Turner Basin	2	Raise Turner 2 spillway[8]	N	1,226	66	N	N	$ 890,000	$ 57,900	$ 2,426	$ 60,326	$ 916
15		i	Ely Basin	2	Basin enlargement and increased drainage area	N	1,103	221	N	N	$ 9,120,000	$ 593,300	$ 8,122	$ 601,422	$ 2,726
15a		i	Ely Basin	2	Basin enlargement and increased drainage area	N	1,103	221	N	N	$ 3,200,000	$ 208,200	$ 8,122	$ 216,322	$ 981
16		i	Ontario Bioswale Project	2	New bioswale	N	0	8	Y	Y	$ 650,000	$ 42,300	$ 277	$ 42,577	$ -
17		i	Lower San Sevaine Basin (2010 RMPU)	2	New basin	Y	0	1,221	N	N	$ 22,715,000	$ 1,477,600	$ 44,947	$ 1,522,547	$ 1,247
17a		i	Lower San Sevaine Basin (2010 RMPU)	2	New basin	Y	0	1,221	N	N	$ 11,275,000	$ 733,500	$ 44,947	$ 778,447	$ 638
18		i	CSI Storm Water Basin	3	Deepen basin by 10 feet	N	72	81	N	N	$ 900,000	$ 58,500	$ 2,998	$ 61,498	$ 755
18a		i	CSI Storm Water Basin	3	Deepen basin by 10 feet	N	72	81	N	N	$ 440,000	$ 28,600	$ 2,998	$ 31,598	$ 388
19		iii	Wineville Basin (2010 RMPU)	3	Gate the low-elevation outlet, replace embankment with dam, and construct a pneumatic gate on the spillway[9]	Y	5	2,157	N	N	$ 3,140,000	$ 204,300	$ 79,438	$ 283,738	$ 132
19a		iii	Wineville Basin (2010 RMPU)	3	Gate the low-elevation outlet, replace embankment with dam, and construct a pneumatic gate on the spillway[9]	Y	5	2,157	N	N	$ 2,445,000	$ 159,100	$ 79,438	$ 238,538	$ 111
20		iii	Jurupa Basin	3	Inlet improvements and CB-18 turnout modifications	N	234	421	N	N	$ 2,150,000	$ 139,900	$ 15,516	$ 155,416	$ 369
21		ii	RP3 Basin Improvements (2010 RMPU)	3	Inlet improvements and enlargement	N	628	406	N	N	$ 22,044,000	$ 1,434,000	$ 14,931	$ 1,448,931	$ 3,573
21a		ii	RP3 Basin Improvements (2010 RMPU)	3	Inlet improvements and enlargement	N	628	406	N	N	$ 13,464,000	$ 875,900	$ 14,931	$ 890,831	$ 2,197
22		ii, iii	RP3 Basin Improvements (2013 RMPU)	3	Increase conservation storage[10]	Y	628	137	N	N	$ 2,645,000	$ 172,100	$ 5,062	$ 177,162	$ 1,289
22a		ii, iii	RP3 Basin Improvements (2013 RMPU)	3	Increase conservation storage[10]	Y	628	137	N	N	$ 1,855,000	$ 120,700	$ 5,062	$ 125,762	$ 915
23	Includes PID's 19,20,22	iv	2013 RMPU Proposed Wineville PS to Jurupa, Expanded Jurupa PS to RP3 Basin with 2013 Proposed RP3 Improvements	3	2010 RMPU Proposed Wineville Basin Improvements, Wineville 20 cfs PS to Jurupa, Improved Jurupa Basin Inlet, 40 cfs PS to RP3 Basin with Proposed 2013 RMPU RP3	Y	867	3,166	N	N	$ 11,662,000	$ 758,600	$ 311,014	$ 1,069,614	$ 338
23a	Includes PID's 19,20,22	iv	2013 RMPU Proposed Wineville PS to Jurupa, Expanded Jurupa PS to RP3 Basin with 2013 Proposed RP3 Improvements	3	2010 RMPU Proposed Wineville Basin Improvements, Wineville 20 cfs PS to Jurupa, Improved Jurupa Basin Inlet, 40 cfs PS to RP3 Basin with Proposed 2013 RMPU RP3	Y	867	3,166	N	N	$ 10,657,000	$ 693,300	$ 311,014	$ 1,004,314	$ 317
24		i	Vulcan Pit	3	Construct new inflow and outflow structures[11]	Y	0	857	N	N	$ 13,850,000	$ 901,000	$ 31,548	$ 932,548	$ 1,088
25		i	Sierra	3	Deepen basin by 10 feet	N	12	64	N	N	$ 1,000,000	$ 65,100	$ 2,351	$ 67,451	$ 1,056
25a		i	Sierra	3	Deepen basin by 10 feet	N	12	64	N	N	$ 490,000	$ 31,900	$ 2,351	$ 34,251	$ 536
26		i	Sultana Avenue	3	Deepen basin by 10 feet	N	89	7	N	N	$ 1,026,200	$ 66,800	$ 258	$ 67,058	$ 9,556
26a		i	Sultana Avenue	3	Deepen basin by 10 feet	N	89	7	N	N	$ 502,200	$ 32,700	$ 258	$ 32,958	$ 4,697
27		i	Declez Basin	3	Reconstruct existing embankment and install a gate on the low level outlet[12]	N	674	241	N	N	$ 4,070,000	$ 264,800	$ 8,877	$ 273,677	$ 1,135
Operations and Maintenance[13]															
28		ii	Banana Basin (annual cleaning)	3	Increase frequency of basin maintenance (Increased infiltration rate to 0.6 ft/day)	Y	317	11	N	N			$ 3,183	$ 3,183	$ 294
29		ii	Banana Basin (semiannual cleanings)	3	Increase frequency of basin maintenance (Increased infiltration rate to 0.72 ft/day)	Y	317	31	N	N			$ 15,192	$ 15,192	$ 495
30		ii	Declez Basin (annual cleaning)	3	Increase basin maintenance frequency (Increased infiltration rate to 0.66 ft/day)	Y	674	16	N	N			$ 6,537	$ 6,537	$ 409
31		ii	Declez Basin (semiannual cleanings)	3	Increase basin maintenance frequency (Increased infiltration rate to 0.78 ft/day)	Y	674	47	N	N			$ 32,923	$ 32,923	$ 701
32		ii	Ely Basin (annual cleaning)	2	Increase maintenance frequency (Increased infiltration rate to 0.27 ft/day)	Y	1,103	44	N	N			$ 29,450	$ 29,450	$ 668
33		ii	Ely Basin (semiannual cleanings)	2	Increase maintenance frequency (Increased infiltration rate to 0.33 ft/day)	Y	1,103	128	N	N			$ 127,949	$ 127,949	$ 997
34		ii	Hickory Basin (annual cleaning)	2	Increase frequency of basin maintenance (Increased infiltration rate to 0.44 ft/day)	Y	353	7	N	N			$ 3,812	$ 3,812	$ 518
35		ii	Hickory Basin (semiannual cleanings)	2	Increase frequency of basin maintenance (Increased infiltration rate to 0.52 ft/day)	Y	353	20	N	N			$ 17,640	$ 17,640	$ 877
Proposed Projects in Table 6-1 that Were Not Analyzed															
36			Turner Expansion	2	Basin improvements to the basins east of Archibald Ave and new basins adjacent to Turner 4[14]										
37			Upland Basin	1	Construct low level drain[15]										
38			College Heights	1	Construct internal berms to reduce seepage to the Upland basin[16]										
39			Lower Cucamonga Basin	2	Basin enlargement for distribution[17]										
40			Management Zones 2 and 3 Capture, Pump and Recharge	2,3	Capture water in MZ-2 and 3 basins low in the system and pump to basins higher in the system[17]										
41			Jurupa Basin	3	Inlet improvements and basin enlargement[17]										
42			RP3 Basins	3	Inlet improvements[18]										
43			Alder Basin	3	Deepen basin[17]										

Project ID	Recycled Water Recharge							Imported Water Recharge							All Recharge			Additional Benefit	Production Sustainability Score[5]
	New Recycled Water Recharge (acre-ft/yr)	Recycled Water Acquisition Cost[3]	Capital Cost ($)	Annualized Capital Cost ($)	Annual O&M Cost ($)	Total Annual Cost ($)	Recycled Water Recharge Unit Cost[2]	New Imported Water Recharge (acre-ft/yr)	Imported Water Acquisition Cost[4]	Capital Cost ($)	Annualized Capital Cost ($)	Annual O&M Cost ($)	Total Annual Cost ($)	Imported Water Recharge Unit Cost[2]	Total New Storm and Supplemental Water (acre-ft/yr)	Total Capital Cost ($)	Total Unit Cost of All New Recharge		
Proposed Projects in Table 6-1 that Were Analyzed in Detail																			
1	0	$ -	$ -	$ -	$ -	$ -	$ -	0	$ -	$ -	$ -	$ -	$ -	$ -	71	$ 5,450,000	$ 4,997		0
1a	0	$ -	$ -	$ -	$ -	$ -	$ -	0	$ -	$ -	$ -	$ -	$ -	$ -	71	$ 5,050,000	$ 4,633		
2	0	$ -	$ -	$ -	$ -	$ -	$ -	0	$ -	$ -	$ -	$ -	$ -	$ -	248	$ 1,440,000	$ 415		0
3	0	$ -	$ -	$ -	$ -	$ -	$ -	0	$ -	$ -	$ -	$ -	$ -	$ -	0	$ 50,000	$ -	Y[19]	0
4	0	$ -	$ -	$ -	$ -	$ -	$ -	0	$ -	$ -	$ -	$ -	$ -	$ -	0	$ 790,000	$ -		0
5	0	$ -	$ -	$ -	$ -	$ -	$ -	0	$ -	$ -	$ -	$ -	$ -	$ -	93	$ 5,490,000	$ 3,858		0
5a	0	$ -	$ -	$ -	$ -	$ -	$ -	0	$ -	$ -	$ -	$ -	$ -	$ -	93	$ 4,640,000	$ 3,266		
6	0	$ -	$ -	$ -	$ -	$ -	$ -	0	$ -	$ -	$ -	$ -	$ -	$ -	0	$ -	$ -		0
7	1,911	$ 372,645	$ 1,775,000	$ 115,500	$ 45,311	$ 533,456	$ 279	0	$ -	$ -	$ -	$ -	$ -	$ -	2,553	$ 3,550,000	$ 263		0
8	1,911	$ 372,645	$ 1,310,000	$ 85,200	$ 45,311	$ 503,156	$ 263	0	$ -	$ -	$ -	$ -	$ -	$ -	2,256	$ 2,620,000	$ 266		0
9	0	$ -	$ -	$ -	$ -	$ -	$ -	0	$ -	$ -	$ -	$ -	$ -	$ -	0	$ 300,000	$ -	Y[20]	0
10	0	$ -	$ -	$ -	$ -	$ -	$ -	1,235	$ 766,935	$ 1,980,000	$ 128,800	$ 29,283	$ 925,018	$ 749	1,235	$ 1,980,000	$ 749		0
11	120	$ 23,400	$ 75,000	$ 4,900	$ 2,845	$ 31,145	$ 260	0	$ -	$ -	$ -	$ -	$ -	$ -	163	$ 150,000	$ 231		0
12	0	$ -	$ -	$ -	$ -	$ -	$ -	0	$ -	$ -	$ -	$ -	$ -	$ -	789	$ 2,480,000	$ 241		0
13	0	$ -	$ -	$ -	$ -	$ -	$ -	0	$ -	$ -	$ -	$ -	$ -	$ -	75	$ 600,000	$ 554		0
14	0	$ -	$ -	$ -	$ -	$ -	$ -	0	$ -	$ -	$ -	$ -	$ -	$ -	66	$ 890,000	$ 916		1
15	0	$ -	$ -	$ -	$ -	$ -	$ -	0	$ -	$ -	$ -	$ -	$ -	$ -	221	$ 9,120,000	$ 2,726		0
15a	0	$ -	$ -	$ -	$ -	$ -	$ -	0	$ -	$ -	$ -	$ -	$ -	$ -	221	$ 3,200,000	$ 981		
16	0	$ -	$ -	$ -	$ -	$ -	$ -	0	$ -	$ -	$ -	$ -	$ -	$ -	8	$ 650,000	$ -		0
17	500	$ 97,500	$ 22,715,000	$ 1,477,600	$ 11,855	$ 1,586,955	$ 3,174	0	$ -	$ -	$ -	$ -	$ -	$ -	1,721	$ 45,430,000	$ 1,807		0
17a	500	$ 97,500	$ 11,275,000	$ 733,500	$ 11,855	$ 842,855	$ 1,686	0	$ -	$ -	$ -	$ -	$ -	$ -	1,721	$ 22,550,000	$ 942		0
18	0	$ -	$ -	$ -	$ -	$ -	$ -	0	$ -	$ -	$ -	$ -	$ -	$ -	81	$ 900,000	$ 755		0
18a	0	$ -	$ -	$ -	$ -	$ -	$ -	0	$ -	$ -	$ -	$ -	$ -	$ -	81	$ 440,000	$ 388		0
19	630	$ 122,850	$ 3,140,000	$ 204,300	$ 14,938	$ 342,088	$ 543	0	$ -	$ -	$ -	$ -	$ -	$ -	2,787	$ 6,280,000	$ 225		2
19a	630	$ 122,850	$ 2,445,000	$ 159,100	$ 14,938	$ 296,888	$ 471	0	$ -	$ -	$ -	$ -	$ -	$ -	2,787	$ 4,890,000	$ 192		2
20	0	$ -	$ -	$ -	$ -	$ -	$ -	0	$ -	$ -	$ -	$ -	$ -	$ -	421	$ 2,150,000	$ 369	Y[21]	2
21	0	$ -	$ -	$ -	$ -	$ -	$ -	0	$ -	$ -	$ -	$ -	$ -	$ -	406	$ 22,044,000	$ 3,573		2
21a	0	$ -	$ -	$ -	$ -	$ -	$ -	0	$ -	$ -	$ -	$ -	$ -	$ -	406	$ 13,464,000	$ 2,197		
22	2,905	$ 566,475	$ 2,645,000	$ 172,100	$ 68,879	$ 807,454	$ 278	0	$ -	$ -	$ -	$ -	$ -	$ -	3,042	$ 5,290,000	$ 324		2
22a	2,905	$ 566,475	$ 1,855,000	$ 120,700	$ 68,879	$ 756,054	$ 260	0	$ -	$ -	$ -	$ -	$ -	$ -	3,042	$ 3,710,000	$ 290		2
23	3,535	$ 689,325	$ 11,662,000	$ 758,600	$ 83,817	$ 1,531,742	$ 433	0	$ -	$ -	$ -	$ -	$ -	$ -	6,701	$ 23,324,000	$ 388		2
23a	3,535	$ 689,325	$ 10,657,000	$ 693,300	$ 83,817	$ 1,466,442	$ 415	0	$ -	$ -	$ -	$ -	$ -	$ -	6,701	$ 21,314,000	$ 369		2
24	840	$ 163,800	$ 13,850,000	$ 901,000	$ 19,917	$ 1,084,717	$ 1,291	0	$ -	$ -	$ -	$ -	$ -	$ -	1,697	$ 27,700,000	$ 1,189		1
25	0	$ -	$ -	$ -	$ -	$ -	$ -	0	$ -	$ -	$ -	$ -	$ -	$ -	64	$ 1,000,000	$ 1,056		1
25a	0	$ -	$ -	$ -	$ -	$ -	$ -	0	$ -	$ -	$ -	$ -	$ -	$ -	64	$ 490,000	$ 536		1
26	0	$ -	$ -	$ -	$ -	$ -	$ -	0	$ -	$ -	$ -	$ -	$ -	$ -	7	$ 1,026,200	$ 9,556		1
26a	0	$ -	$ -	$ -	$ -	$ -	$ -	0	$ -	$ -	$ -	$ -	$ -	$ -	7	$ 502,200	$ 4,697		1
27	0	$ -	$ -	$ -	$ -	$ -	$ -	0	$ -	$ -	$ -	$ -	$ -	$ -	241	$ 4,070,000	$ 1,135		2
Operations and Maintenance[13]																			
28	130	$ 25,350	$ -	$ -	$ 38,159	$ 63,509	$ 489	0	$ -	$ -	$ -	$ -	$ -	$ -	141		$ 474		0
29	155	$ 30,225	$ -	$ -	$ 76,744	$ 106,969	$ 690	0	$ -	$ -	$ -	$ -	$ -	$ -	186		$ 658		0
30	178	$ 34,710	$ -	$ -	$ 72,735	$ 107,445	$ 604	0	$ -	$ -	$ -	$ -	$ -	$ -	194		$ 588		0
31	210	$ 40,950	$ -	$ -	$ 147,109	$ 188,059	$ 896	0	$ -	$ -	$ -	$ -	$ -	$ -	257		$ 860		0
32	217	$ 42,315	$ -	$ -	$ 144,868	$ 187,183	$ 863	0	$ -	$ -	$ -	$ -	$ -	$ -	261		$ 830		0
33	258	$ 50,310	$ -	$ -	$ 257,342	$ 307,652	$ 1,192	0	$ -	$ -	$ -	$ -	$ -	$ -	386		$ 1,128		0
34	148	$ 28,860	$ -	$ -	$ 76,622	$ 105,482	$ 713	0	$ -	$ -	$ -	$ -	$ -	$ -	155		$ 703		0
35	175	$ 34,125	$ -	$ -	$ 153,435	$ 187,560	$ 1,072	0	$ -	$ -	$ -	$ -	$ -	$ -	195		$ 1,052		0
Proposed Projects in Table 6-1 that Were Not Analyzed																			
36																			
37																			
38																			
39																			
40																			
41																			
42																			
43																			

[1] The project group column was created to determine the total yield from different combinations of projects. The group was determined as follows: i- the project can be standalone; ii- the project is mutually exclusive; iii- the project can be standalone but is also included in a multi-project scenario; iv- the project is included in a "iii" group.
[2] The results of this table provide an estimate of the cost per acre-ft of recharge. These estimates are reconnaissance level (level 5) estimates, and additional technical work needs to be done to assure feasibility.
[3] The IEUA recycled water recharge rate was assumed to be $195/acre-ft per Table 2-9.
[4] The MWD imported water recharge rate was assumed to be untreated Tier 1 Service at a price of $621 an acre-ft per Table 2-9.
[5] The production sustainability score is a tool to characterize a project's contribution to production sustainability in areas with sustainability challenges. In simple terms, the score is as follows: 0 – does not contribute to production sustainability; 1 – contributes minimally to production sustainability (a necessary but not sufficient condition of sustainability); 2 – contributes significantly to production sustainability (a necessary and sufficient condition of sustainability).
[6] The automation of the inlet gate and flume data to MC 1 results in a reduction of O&M.
[7] With a 40-percent RWC limitation, an additional 1,911 acre-ft/yr of recycled water can be recharged.
[8] The baseline for the Turner 2 Spillway Project and the Turner Expansion includes the recharge from Turner 1, 2, 3, and 4.
[9] The results from the Wineville proof-of-concept project may render the project infeasible. Recycled water recharge was estimated to be 630 acre-ft/yr, assuming an infiltration rate of 0.10 ft/day over 30 acres.
[10] The maximum amount of recycled water that can be recharged is 12,800 acre-ft/yr at RP3 due to the RWC.
[11] Recycled water recharge based upon an estimated 0.1 ft/day infiltration at 40-acres for 7-months of operations. Actual RWC is unknown; recharge based upon an assumed RWC at 25% with the following flows: 840 AFY storm water, 1,800 AFY underflow, and diluent water the same at Banana Basin. The project includes the price of land at $14 million.
[12] Recycled water recharge operations will not benefit from the increased operating level.
[13] Based on available information, it can be assumed that basin infiltration can be increased 10 to 20% with annual cleaning and 20 to 50 % with cleaning twice a year. Field data needs to be established to determine optimum cleaning frequencies per basin.
[14] The Turner Basin expansion project was not included because it is currently under construction.
[15] The Upland Basin Project was removed by the IEUA because the basin performs well, and limited cleaning is needed.
[16] The College Heights project does not affect stormwater recharge.
[17] The projects did not pass the screening criteria and were not considered.
[18] The estimated total stormwater recharge gained by the 2010 RMPU RP3 inlet improvement is comparable to the currently achievable stormwater recharge at RP3 due to enhance stormwater recharge efforts by IEUA.
[19] Reduces the amount of lost water due to basin inlet constraints and clogging.
[20] Will increase the amount of time water can be recharged in SS-1 by solving the vector control issues.
[21] Will allow the Jurupa Basin to accept an additional 15 cfs from the CB 18 if Hickory and Banana Basins were offline.
[22] The SBCFCD did not allow the City of Ontario to connect the new 5th Street storm drain to the Princeton Basin. The SBCFCD required improvements to the Princeton Basin such as enlarging the basin by purchasing the adjacent property, deepening the basin, and enlarging the outlet structures in order to allow the diversion of the 15th St storm drain to the Princeton Basin. These costs made the improvement infeasible. The City of Ontario connected the 60" storm drain to the West Cucamonga channel to the south of the Princeton Basin. This information was not presented until after the model runs and cost estimates were completed.
a - The project includes excavation costs, and the capital cost shown assumes that the project's excavation costs would be reduced by 90%. The material excavated could be used for another construction site or leased to a mining operator.

Table 8-2b
Screening of Yield Enhancement Projects

Project ID	Project	Management Zone	Capital Cost	Annualized Capital Cost ($)	Annual O&M Cost ($)	Total Annual Cost ($)	New Yield	Recycled Water	Unit Cost	Water Quality Challenges	Institutional Challenges
1	Montclair Basins	1	$ 5,450,000	$ 354,500	$ 2,644	$ 357,144	71	0	$ 4,997		c
1a	Montclair Basins	1	$ 5,050,000	$ 328,500	$ 2,644	$ 331,144	71	0	$ 4,634		c
2	Montclair Basins	1	$ 1,440,000	$ 93,700	$ 9,176	$ 102,876	248	0	$ 415		c
3	Montclair Basins	1	$ 50,000	$ 3,300	$ -	$ 3,300	0	0	--		c
4	Montclair Basins	1	$ 790,000	$ 51,400	$ -	$ 51,400	0	0	--		c
5	North West Upland Basin	1	$ 5,490,000	$ 357,100	$ 3,458	$ 360,558	93	0	$ 3,858		c, g
5a	North West Upland Basin	1	$ 4,640,000	$ 301,800	$ 3,458	$ 305,258	93	0	$ 3,267		c, g
6	Princeton Basin	2	$ -	$ -	$ -	$ -	0	0	--		c
7	San Sevaine Basins	2	$ 1,775,000	$ 115,500	$ 23,756	$ 139,256	642	1,911	$ 217		c, e, f
8	San Sevaine Basins	2	$ 2,620,000	$ 170,400	$ 12,781	$ 183,181	345	1,911	$ 530		c, e
9	San Sevaine Basins	2	$ 300,000	$ 19,500	$ -	$ 19,500	0	0	--		c
10	San Sevaine Basins	2	$ 1,980,000	$ 128,800	$ -	$ 128,800	0	0	--		c
11	Victoria Basin	2	$ 75,000	$ 4,900	$ 1,584	$ 6,484	43	120	$ 151		c, e, f
12	Lower Day Basin (2010 RMPU)	2	$ 2,480,000	$ 161,300	$ 29,182	$ 190,482	789	0	$ 242		c
13	Lower Day Basin	2	$ 600,000	$ 39,000	$ 2,791	$ 41,791	75	0	$ 554		c
14	Turner Basin	2	$ 890,000	$ 57,900	$ 2,438	$ 60,338	66	0	$ 916		c
15	Ely Basin	2	$ 9,120,000	$ 593,300	$ 8,162	$ 601,462	221	0	$ 2,727	b	
15a	Ely Basin	2	$ 3,200,000	$ 208,200	$ 8,162	$ 216,362	221	0	$ 981	b	
16	Ontario Bioswale Project	2	$ 650,000	$ 42,300	$ 279	$ 42,579	8	0	$ 5,652		
17	Lower San Sevaine Basin (2010 RMPU)	2	$ 45,430,000	$ 2,955,300	$ 45,165	$ 3,000,465	1,221	500	$ 2,458		d, e
17a	Lower San Sevaine Basin (2010 RMPU)	2	$ 22,550,000	$ 1,466,900	$ 45,165	$ 1,512,065	1,221	500	$ 1,239		d, e
18	CSI Storm Water Basin	3	$ 900,000	$ 58,500	$ 3,012	$ 61,512	81	0	$ 756	b	g
18a	CSI Storm Water Basin	3	$ 440,000	$ 28,600	$ 3,012	$ 31,612	81	0	$ 388	b	g
19	Wineville Basin (2010 RMPU)	3	$ 6,280,000	$ 408,500	$ 79,824	$ 488,324	2,157	630	$ 226	b	
19a	Wineville Basin (2010 RMPU)	3	$ 4,890,000	$ 318,100	$ 79,824	$ 397,924	2,157	630	$ 184	b	
20	Jurupa Basin	3	$ 2,150,000	$ 139,900	$ 15,591	$ 155,491	421	0	$ 369		
21	RP3 Basin Improvements (2010 RMPU)	3	$ 22,044,000	$ 1,434,000	$ 15,004	$ 1,449,004	406	0	$ 3,573		
21a	RP3 Basin Improvements (2010 RMPU)	3	$ 13,464,000	$ 875,900	$ 15,004	$ 890,904	406	0	$ 2,197		
22	RP3 Basin Improvements (2013 RMPU)	3	$ 2,645,000	$ 172,100	$ 5,087	$ 177,187	137	2,905	$ 1,289		f
22a	RP3 Basin Improvements (2013 RMPU)	3	$ 1,855,000	$ 120,700	$ 5,087	$ 125,787	137	2,905	$ 915		f
23	2013 RMPU Proposed Wineville PS to Jurupa, Expanded Jurupa PS to RP3 Basin with 2013 Proposed RP3 Improvements	3	$ 23,324,000	$ 1,517,300	$ 311,014	$ 1,828,314	3,166	3,535	$ 577		d, e
23a	2013 RMPU Proposed Wineville PS to Jurupa, Expanded Jurupa PS to RP3 Basin with 2013 Proposed RP3 Improvements	3	$ 21,314,000	$ 1,386,500	$ 311,014	$ 1,697,514	3,166	3,535	$ 536		d, e
24	Vulcan Pit	3	$ 27,700,000	$ 1,801,900	$ 31,701	$ 1,833,601	857	840	$ 2,140	b	d, e, g
25	Sierra	3	$ 1,000,000	$ 65,100	$ 2,362	$ 67,462	64	0	$ 1,057		g
25a	Sierra	3	$ 490,000	$ 31,900	$ 2,362	$ 34,262	64	0	$ 537		g
26	Sultana Avenue	3	$ 1,026,200	$ 66,800	$ 260	$ 67,060	7	0	$ 9,556		g
26a	Sultana Avenue	3	$ 502,200	$ 32,700	$ 260	$ 32,960	7	0	$ 4,697		g
27	Declez Basin	3	$ 4,070,000	$ 264,800	$ 8,920	$ 273,720	241	0	$ 1,135		
28	Banana Basin (annual cleaning)	3					11	130	$ 294		
29	Banana Basin (semiannual cleanings)	3					31	155	$ 495		
30	Declez Basin (annual cleaning)	3					16	178	$ 409		
31	Declez Basin (semiannual cleanings)	3					47	210	$ 701		
32	Ely Basin (annual cleaning)	2					44	217	$ 668	b	
33	Ely Basin (semiannual cleanings)	2					128	258	$ 997	b	
34	Hickory Basin (annual cleaning)	2					7	148	$ 518		
35	Hickory Basin (semiannual cleanings)	2					20	175	$ 877		

a - Project ID no.'s with an "a" extension indicate that the project includes excavation and haul-off costs, and the capital cost shown assumes that the project's excavation and haul-off costs are reduced by 90 percent with the excavated materials being used in another construction project.

Key to Water Quality Challenges

b - A potential water quality challenge has been identified with this project.

Key to Institutional Challenges

c - An agreement will be required with the property owner to construct and operate stormwater recharge facilities. Other agreements with resource agencies may also be required. The time required to negotiate and approve these agreements could range from one to two years.

d - This basin is not currently included in the Watermaster/IEUA recharge permit. Therefore, the existing permit will need to be amended to include recycled water at this basin. The time required to prepare the Title 22 engineering report and regulatory process is about two years.

e - The project includes a recycled water recharge component. The IEUA has discretion as to whether to participate or not in this project.

f - At the July 18, 2013 Steering Committee Meeting, Ryan Shaw (IEUA) indicated that Project IDs 7, 11, and 22a are being recommended to be cost shared. The capital cost shown assumes a 50/50 split of the capital cost per Peace II Agreement Article VIII.

g - The Watermaster will have to submit a Petition for Change with the State Water Resources Control Board for the project because it is not included in the Watermaster's current diversion permits.

Table 8-2c
Ranked Yield Enhancement Projects (Melded Unit Cost Under $612 acre-ft)

Project ID	Group[1]	Project	Yield	Recycled Water	Storm Water Recharge Unit Cost	Capital Cost	Total Annual Cost
Recommended MZ3 Projects							
18a	i	CSI Storm Water Basin	81	0	$ 388	$ 440,000	$ 31,612
23a	iv	2013 RMPU Proposed Wineville PS to Jurupa, Expanded Jurupa PS to RP3 Basin, and 2013 Proposed RP3 Improvements[2,3]	3,166	2,905	$ 500	$ 19,552,000	$ 1,582,914
25a	i	Sierra	64	0	$ 537	$ 490,000	$ 34,262
27	i	Declez Basin	241	0	$ 1,135	$ 4,070,000	$ 273,720
Total MZ3			**3,552**	**2,905**	**$ 541**	**$ 24,552,000**	**$ 1,922,509**
Recommended MZ2 Projects							
11	i	Victoria Basin[2, 4]	43	120	$ 151	$ 75,000	$ 6,484
7	ii	San Sevaine Basins[2, 5]	642	1,911	$ 217	$ 1,775,000	$ 139,256
12	ii	Lower Day Basin (2010 RMPU)	789	0	$ 242	$ 2,480,000	$ 190,482
14	i	Turner Basin	66	0	$ 916	$ 890,000	$ 60,338
15a	i	Ely Basin	221	0	$ 981	$ 3,200,000	$ 216,362
17a	i	Lower San Sevaine Basin (2010 RMPU)	1,221	0	$ 1,239	$ 22,550,000	$ 1,512,065
Total MZ2			**2,981**	**2,031**	**$ 713**	**$ 30,970,000**	**$ 2,124,987**
Recommended MZ1 Projects							
2	i	Montclair Basins	248	0	$ 415	$ 1,440,000	$ 102,876
Total MZ1			**248**	**0**	**$ 415**	**$ 1,440,000**	**$ 102,876**
Total Recommended Projects			**6,781**	**4,936**	**$ 612**	**$ 56,962,000**	**$ 4,150,372**
Other Projects							
19a	iii	Wineville Basin (2010 RMPU)	2,157	0	$ 184	$ 4,890,000	$ 397,924
20	iii	Jurupa Basin	421	0	$ 369	$ 2,150,000	$ 155,491
22a	ii, iii	RP3 Basin Improvements (2013 RMPU)	137	2,905	$ 915	$ 1,855,000	$ 125,787

Note - color shading within each MZ indicates mutually exclusive projects.

1 The project group column was created to determine the total yield from different combinations of projects. The group was determined as follows: i- the project can be standalone; ii- the project is mutually exclusive; iii- the project can be standalone but is also included in a multi-project scenario; and iv- the project includes the "iii" group.

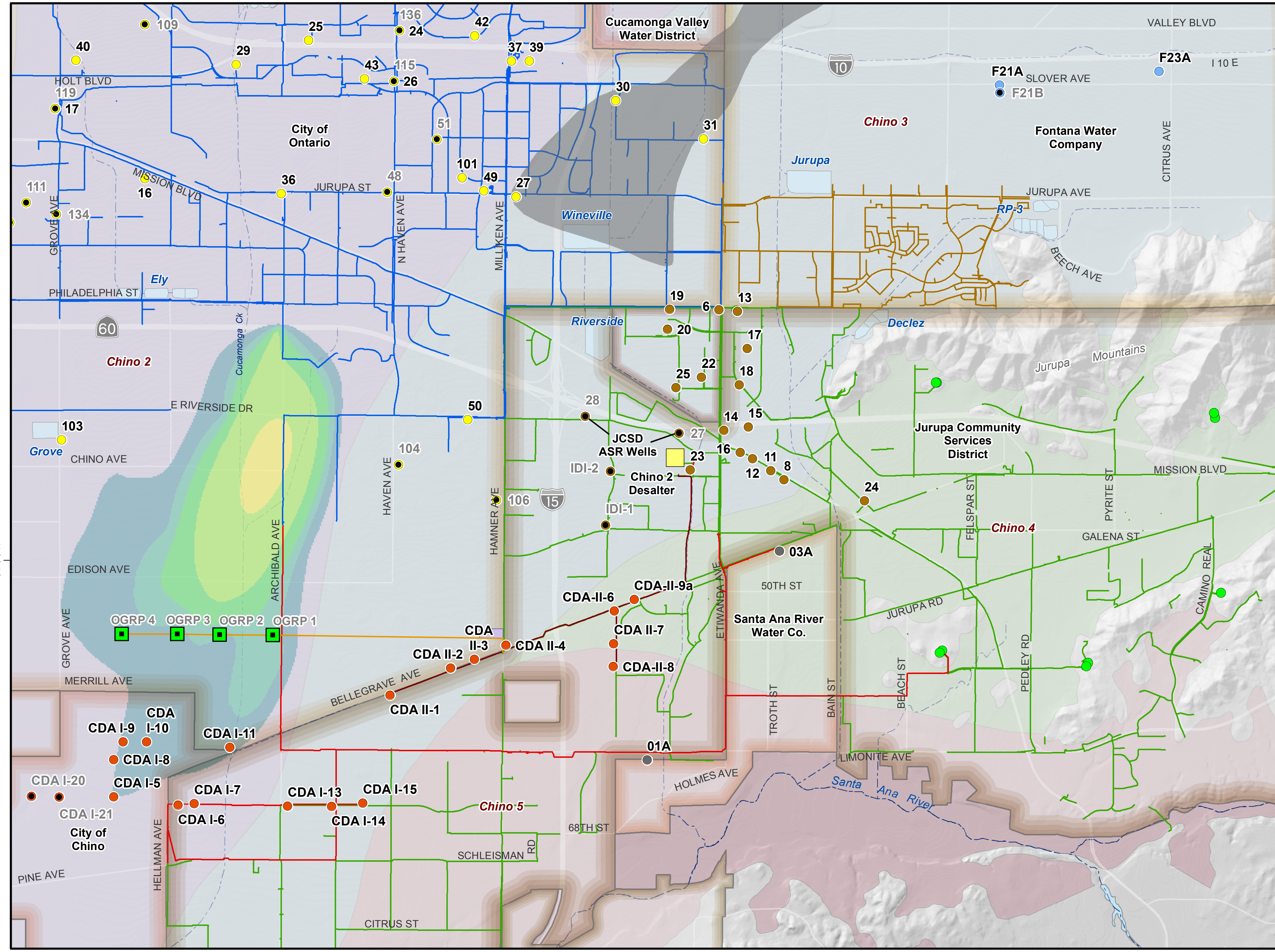
2 At the July 18, 2013 Steering Committee Meeting, Ryan Shaw (IEUA) indicated that Project IDs 7, 11, and 22a are being recommended to be cost shared and the capital cost shown assumes a 50/50 split of the capital cost per Peace II Agreement Article VIII.

3 Project ID 23a includes Project IDs 19a, 20, and 22a and associated conveyance facilities. The total capital cost represents an IEUA capital cost share for only Project ID 22a. The capital costs associated with Project IDs 19a and 20 and the associated conveyance facilities were not cost shared. The recycled water recharge shown represents the increase in Project ID 22a. The recycled water recharge associated with Project ID 19a was not included because the project was not recommended to be cost shared by IEUA. The total capital cost of Project ID 23a is about $21,300,000.

4 The total capital cost for Project ID 11 is about $150,000.

5 The total capital cost for Project ID 12 is about $3,550,000.

a - Project ID no.'s with an "a" extension indicate that the project includes excavation and haul-off costs, and the capital cost shown assumes that the project's excavation and haul-off costs are reduced by 90 percent with the excavated materials being used in another construction project.



Water Supply Infrastructure

- City of Ontario Potable Water Mainlines
- JCSD Potable Water Mainlines
- FWC Potable Water Mainlines
- CDA Desalter I Product Water Pipeline
- CDA Desalter II Raw Water Pipeline
- JCSD Storage Reservoir
- OGRP Well
- OGRP Convyance Pipelines

Archibald South
VOC Concentration (ug/L)

- > 0 and ≤ 5
- > 5 and ≤ 10
- > 10 and ≤ 20
- > 20 and ≤ 50
- > 50 and ≤ 100

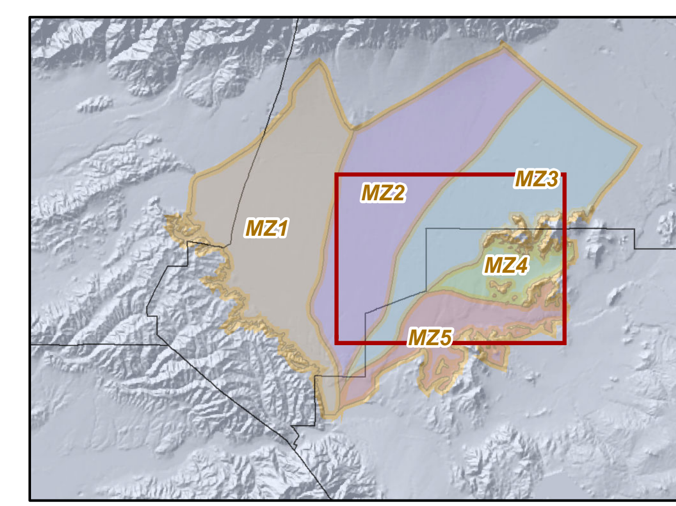
Production Wells

- Chino Desalter Authority
- City of Ontario
- Fontana Water Company
- Jurupa Community Services District
- Other Appropriators

Note: A black dot and gray label indicates that the well is not currently active but will be in the future or is a planned well

Other Features

- Flood Control and Conservation Basins



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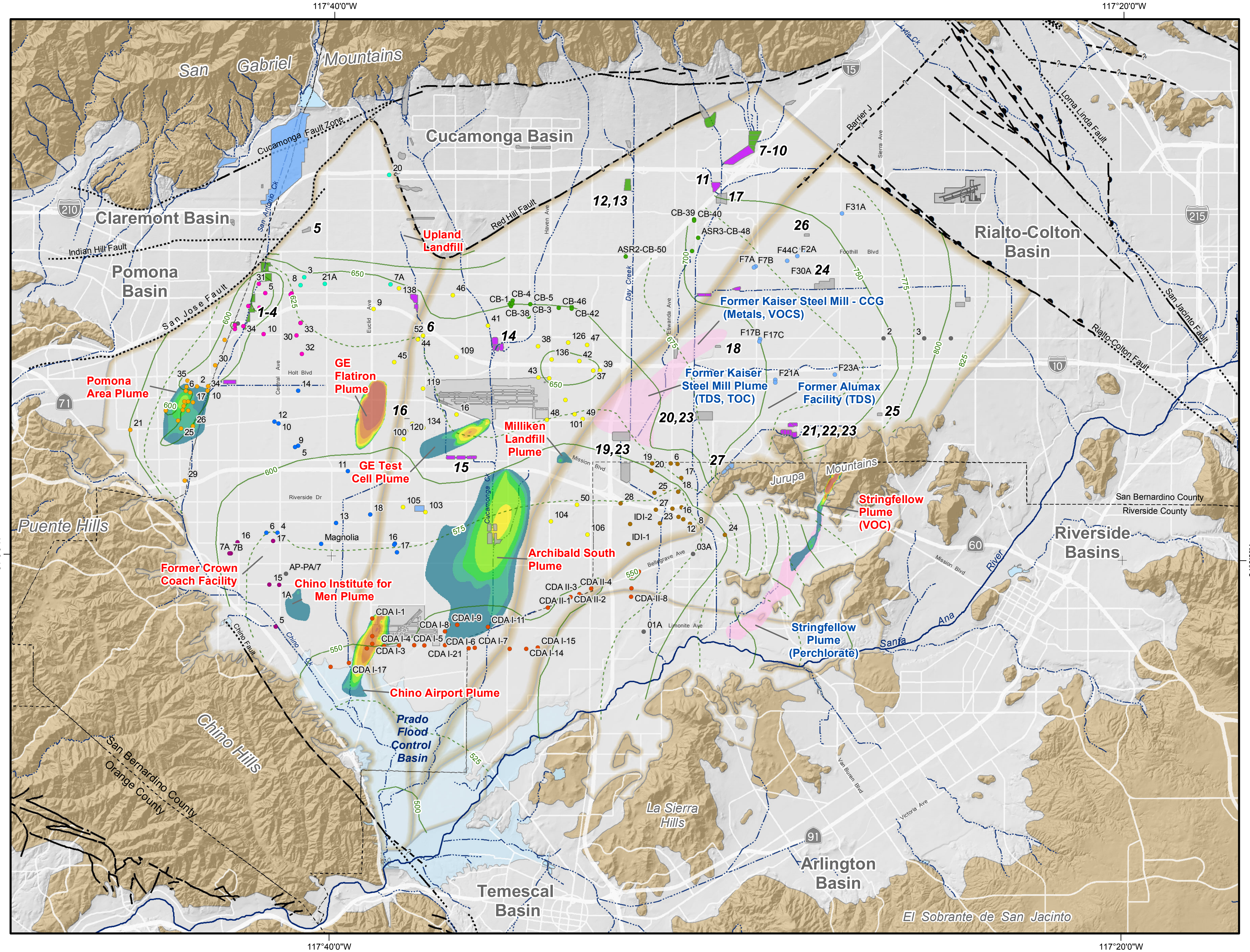
Name: Figure_8-1

0 1 Miles
0 2 Kilometers

2013 Amendment to the 2010 RMPU

In-Lieu Recharge/Exchange Project Configurations Submitted by Steering Committee Members

Figure 8-1



VOC Concentration (ug/L)

- > 0 and ≤ 5
- > 5 and ≤ 10
- > 10 and ≤ 20
- > 20 and ≤ 50
- > 50 and ≤ 100
- > 100 and ≤ 200
- > 200 and ≤ 500
- > 500

The VOC plumes shown on this map are generalized illustrations of the estimated spatial extent of TCE or PCE, based on maximum concentration measured over the 5-year period of August 2007 to July 2012. Interpretations of plume extent and boundary delineation were made based on measured concentrations and local groundwater flow patterns.

Other plumes (labeled by name and dominant contaminant)

1 Yield Enhancement Project (Project ID is for locational reference from Table 8-2b)

OBMP Management Zones

Streams & Flood Control Channels

Flood Control & Conservation Basins (Symbolized by Recharged Water Type)

800 Spring 2012 Groundwater Elevation Contours *(feet above mean sea-level)*

CDA & Appropriator Production Wells

- Chino Desalter Authority
- City of Chino
- City of Chino Hills
- City of Ontario
- City of Pomona
- City of Upland
- Cucamonga Valley Water District
- Fontana Water Company
- Jurupa Community Services District
- Monte Vista Water District
- Other Appropriators

Geology

Water-Bearing Sediments

Quaternary Alluvium

Consolidated Bedrock

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

Faults

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

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Date: 20130612

File: Figure_8-_WQ_v2.mxd

0 1 2 3 4 5 Miles

0 2 4 6 8 KM

2013 Amendment to the 2010 RMPU

Delineation of Groundwater Contamination Plumes and Point-Sources of Concern in Relation to the Yield Enhancement Projects

Figure 8-2

Figure 8-3
Implementation Plan and Schedule

Implementation Step	Project Type (PS or YE)	Implementation Period											
		2014		2015		2016		2017		2018		2019	
		H1	H2	H1	H2	H1	H2	H1	H2	H1	H2	H1	H2
Determine Need and Refine Production Sustainability Projects	PS	■	■										
Contact Sand and Gravel Companies	YE	■	■										
Develop Watermaster and the IEUA Yield Enhancement Project Implementation Agreement	YE	■	■										
Consider Appropriative Pool New Yield and Cost Allocation Agreement	YE	■	■										
Develop Flood Control and Water Conservation Agreement	YE	■	■	■	■								
Develop an Implementation Agreement among the Parties Participating in the Production Sustainability Project(s)	PS			■	■								
Develop Appropriative Pool Production Sustainability Cost Allocation Agreement	PS			■	■								
Prepare Preliminary Design of Recommended Yield Enhancement Projects	YE			■	■								
Prepare Environmental Documentation for Yield Enhancement Projects	YE				■	■							
Select Final Set of Yield Enhancement Projects from the 2013 RMPU for Implementation and Finalize Capital Requirements	YE					*							
Prepare Preliminary Design of Recommended Production Sustainability Projects	PS					■							
Prepare Environmental Documentation for Production Sustainability Projects	PS						■	■					
Select Final Set of Production Sustainability Projects from the 2013 RMPU for Implementation and Finalize Capital Requirements	PS							*					
Prepare Final Designs and Acquire Permits for Production Sustainability Projects	PS								■				
Prepare Final Designs and Acquire Permits for Yield Enhancement Projects	YE						■	■	■				
Construct 2013 RMPU Amendment Production Sustainability Projects	PS									■	■		
Construct 2013 RMPU Amendment Yield Enhancement Projects	YE									■	■	■	■

* -- Decision Point Milestone

S:\Clients\CBWM\OBMP_Implementation\Peace II Implementation\2012 RMPU Implementation\Task 8 Concepts\Figures\20130818 Figure 8-3 Implementation Plan for Yield Ehancement projects.xlsx
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