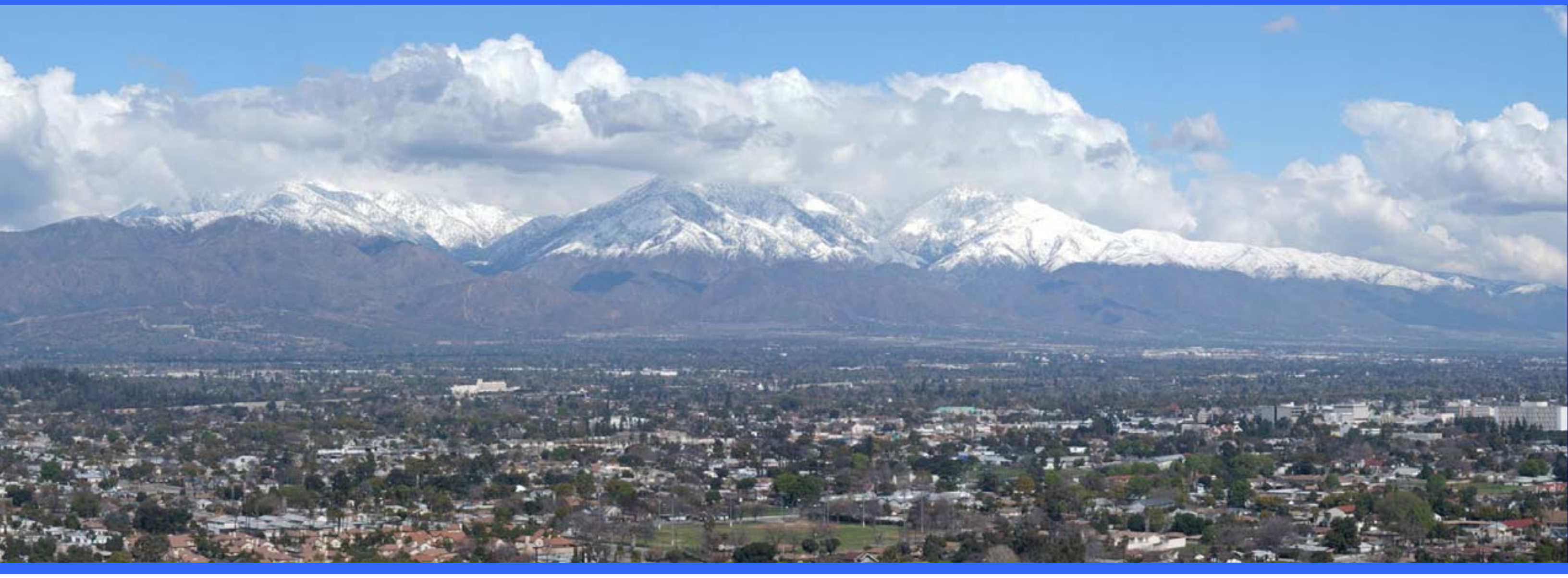
OPTIMUM BASIN MANAGEMENT PROGRAM

Chino Basin Dry-Year Yield Program Expansion

Project Development Report
Volume I

December 2008



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- **City of Chino**
- **City of Chino Hills**
- **Cucamonga Valley Water District**
- **Jurupa Community Services District**
- **Monte Vista Water District**
- **City of Ontario**
- **City of Pomona**
- **City of Upland**

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VOLUME I: PROGRAM BACKGROUND, OPERATIONS PLAN, AND IMPLEMENTATION PLAN

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VOLUME II: AGENCY-SPECIFIC FACILITY CONCEPTUAL DESIGNS
(See Volume II)

VOLUME III: MODELING REPORT
(See Volume III)

VOLUME IV: CEQA MITIGATED NEGATIVE DECLARATION AND INITIAL STUDY
(See Volume IV)

Executive Summary

EXECUTIVE SUMMARY

The Chino Groundwater Basin (Basin) Dry-Year Yield (DYY) Program Expansion (Program Expansion) is a proposed conjunctive-use program developed by the Chino Basin Watermaster (Watermaster) in association with Inland Empire Utilities Agency (IEUA), Metropolitan Water District of Southern California (Metropolitan), Three Valleys Municipal Water District (TVMWD), and Western Municipal Water District (WMWD). Most of the Basin's major appropriators also have expressed interest in participating.

The purpose of the Project Development Report (PDR) is to determine the facilities needed to store up to 150,000 acre-feet (acre-ft) and to recover up to 50,000 acre-feet per year (afy) of stored groundwater for dry-year use, in-lieu of imported water from Metropolitan, as defined in an agreement between Metropolitan and IEUA. PDR Volume I traces the development of the original DYY Program, describes the Program Expansion, and presents the technical, financial, and institutional framework within which individual projects will move forward. PDR Volume II consists of ten lettered sub-volumes (A-J) defining facilities to be developed by the ten participating agencies. Volumes III and IV, respectively, present groundwater modeling information and California Environmental Quality Act (CEQA) requirements.

This Volume I Executive Summary parallels report organization and introduces key Program concepts, describes water resources in the Basin, and reviews Program Expansion parameters. Results of the Asset Inventory of DYY Program participants are described, as are facility requirements and management of peak imported water deliveries. A preliminary Operations Plan is presented, and general conceptual design requirements are defined for DYY Program facilities, such as ion-exchange (IX), production wells, and aquifer storage and recovery (ASR) wells. Finally, an Opinion of Probable Cost and an Implementation Plan (schedule) are provided.

Introduction

IEUA, which manages the distribution of imported water to the Basin appropriators, acts as the liaison between the Watermaster and Metropolitan. IEUA authorized Black & Veatch (B&V), in coordination with Wildermuth Environmental, Inc. (WEI), and Tom Dodson and Associates (TDA), to develop the Program Expansion. This consultant team also worked together on the development of the initial DYY Program in 2002-2003. Both the initial and expanded Programs have been developed as part of the Chino Basin Optimum Basin Management Plan (OBMP). The OBMP is being implemented in compliance with the Judgment in the case of the Chino Basin Municipal Water District vs. the City of Chino et al. (Judgment).

This is the first of four volumes presenting the Chino Basin DYY Program Expansion.

The purpose of the OBMP is to ensure a continuing water supply for the long-term beneficial use of all Watermaster parties. By providing optimal management of both surface and groundwater to increase overall water supplies, the DYY Program meets OBMP objectives for salt management, groundwater storage management, and conjunctive-use.

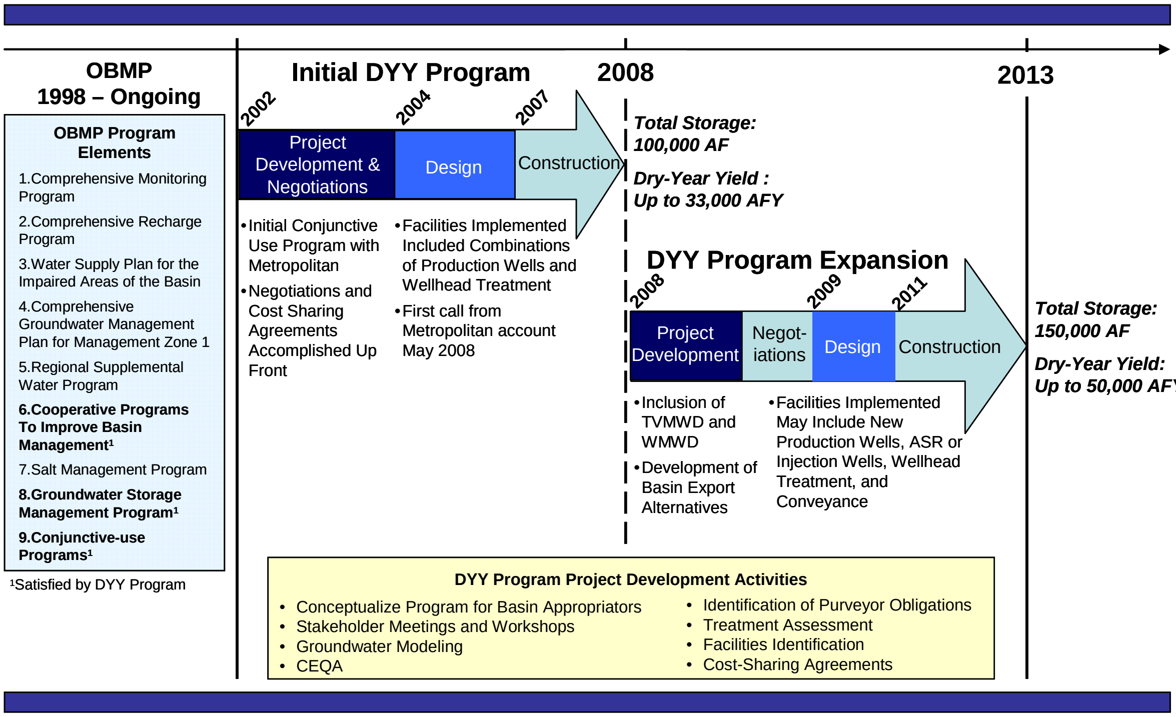
In 2008, Metropolitan, IEUA, Watermaster, and Basin appropriators began implementation of the initial DYY Program, which had been under development since 2002. The initial Program attains conjunctive-use primarily through "in-lieu exchange." In other words, Basin appropriators use Metropolitan surplus imported water in-lieu of groundwater during *wet* years, thereby storing unused groundwater for use during future *dry* years. Another option is direct recharge of surplus Metropolitan imported supplies, which is possible since most of the appropriators supplement their supplies with Metropolitan water.

As part of the DYY Program, the Basin appropriators agree to increase imported water deliveries and store water during a "put" year and decrease imported water deliveries and extract previously-stored groundwater during a "take" year. The increase or decrease of imported water complies with a predetermined amount in order to meet the "put" and "take" terms established to increase dry-year supplies for Metropolitan. In return, Metropolitan helps finance construction of new facilities that enable the appropriators to pump good-quality groundwater and treat otherwise unusable groundwater. Table ES-1 compares the storage ("put") and extraction ("take") goals of the initial DYY Program and the Program Expansion. The timeline below presents the key elements of these two programs.

Table ES-1
Summary Comparison of Initial and Expanded Program Goals

Item	Initial DYY Program	DYY Program Expansion Goals
Total Storage	100,000 acre-ft	150,000 acre-ft (+ 50,000)
Dry-Year Yield	33,000 afy	50,000 afy (+ 17,000)
Schedule:		
Project Development	2002 – 2003	2007 – 2008
Negotiations	Included in Project Development	2009
Design	2004 – 2007	2010 – 2011 (Est.)
Storage ("Put")	2005 – 2007	2012 -
Extraction ("Take")	May 2008	2013 -

The figure below presents a timeline schematic of Basin activities that ultimately lead to development of the DYY Program Expansion. As developed in Chapter 1, the OBMP served as the catalyst for development of the initial DYY Program, which was conceptualized in 2002 and the first call on Metropolitan's account was made in May 2008. The DYY Program Expansion project development phase would carry through 2009 and operations could begin as early as 2012, provided all agreements are in place. As shown on the graphic, the DYY Program Expansion provides additional export opportunities for the Basin and a wider range of facilities, thereby increasing the "put" and "take" capacity of the Basin.



Chino Basin Area Description

The Basin, which consists of about 235 square miles of the upper Santa Ana River watershed, lies within the Counties of San Bernardino and Riverside and includes some or all of the Cities of Chino, Chino Hills, Fontana, Montclair, Norco, Ontario, Pomona, Rancho Cucamonga, Upland, and several other communities. One of the largest groundwater basins in Southern California, the Basin contains about 5,000,000 acre-ft of water and has an unused storage capacity of about 1,000,000 acre-ft. Cities and other water supply entities within the Basin produce groundwater for all or part of their municipal and industrial supplies. Agricultural users also produce groundwater from the Basin, but irrigated agriculture has declined substantially in recent years and is projected to continue to decline.

As part of the DYY Program and Program Expansion, an investigation was undertaken of Basin geology and hydrogeology, water quality characteristics, and baseline water supply and demand projections. The supply and demand projections are summarized in Chapter 4 of this Volume.

Geology and Hydrogeology. The Basin is hydrologically subdivided into at least five groundwater zones or flow systems. Each groundwater zone has a unique hydrology, and water resource management activities that occur in each zone have little or no impact on the other zones. Thus, for purposes of the Program, the groundwater zones are referred to as management zones (MZs). These zones were used to characterize the groundwater level, storage, production and water quality conditions. The depth to the Basin varies from north to south with the distance to the aquifer being greater in the north. In general, for the same volume of water, wells located in the northern part of the Basin require more pumping power than those in the southern part due to the deeper groundwater level.

Water Quality. A Treatment Technology Technical Memorandum (TM) developed by B&V identified groundwater contaminants in the Basin and evaluated treatment strategies for removing them. The five most common constituents found were nitrate (NO_3^-), arsenic (As), perchlorate (ClO_4^-), volatile organic compounds (VOCs), and dibromochloropropane (DBCP). Constituents of most concern for the Program Expansion are nitrate, perchlorate, and arsenic. As discussed in detail in Chapter 7, IX was identified as the preferred treatment for these inorganic contaminants.

DYY Program Size, Constraints, and Institutional Arrangements

Eight Basin appropriators are expected to participate in the Program Expansion: City of Chino (Chino), City of Chino Hills (Chino Hills), Cucamonga Valley Water District (CVWD), Jurupa Community Services District (JCSD), Monte Vista Water District (MVWD), City of Ontario (Ontario), City of Pomona (Pomona), and City of Upland (Upland). Expanding the initial Program from 100,000 acre-ft to 150,000 acre-ft would require the participation of outside agencies. TVWMD and WMWD, two neighboring Metropolitan member agencies, expressed interest in the Program Expansion and are expected to participate through coordination with the Basin appropriators.

Meetings were conducted with each agency at the onset of the Program Expansion to determine the level of interest in potential "put" and/or "take" contributions towards an expanded DYY Program. Table ES-2 summarizes Initial and Expanded DYY Program participants and proposed additional "put" and "take" capacities.

Table ES-2
Summary of Initial and Expanded DYY Program Participants and Proposed Put/Take Capacities

Agency	Initial DYY Program (1)		DYY Program Expansion (2)	
	Put Capacity (afy)	Take Capacity (afy)	Put Capacity (afy) (4)	Take Capacity (afy) (6)
Chino	(3)	1,159	500-1,000	2,000
Chino Hills(5)		1,448	1,800	0
CVWD		11,353	4,000-5,000	0
JCSD		2,000	0	2,000
MVWD		3,963	3,000-4,000	3,000-5,000
Ontario		8,076	2,000-3,000	0
Pomona		2,000	0	2,000
Upland		3,001	0	1,000
TVMWD		0	1,000-2,000	0
WMWD		0	0	5,000
Total	25,000	33,000	12,300 – 16,800	15,000 – 17,000

Notes:
(1) Initial 100,000 acre-ft DYY Program includes maximum 25,000 afy "put" over a four-year period of surplus water and a maximum 33,000 afy "take" over a three-year dry period.
(2) DYY Program Expansion includes increases in total storage, "put" capacity, and "take" capacity.
(3) "Puts" for the initial DYY Program are accomplished by a combination of direct recharge and in-lieu deliveries.
(4) Does not include basin-wide in-lieu deliveries and direct recharge.
(5) MVWD assumed Chino Hills' shift obligation of 1,448 afy per an amendment to the agreement between the agencies dated March 5, 2007.
(6) Post modeling, adjusted take capacities. Refer to Chapter 5, Volume I, and Volume III, Modeling Report, for details.

Put/Take Mechanisms. The put capacity of the initial DYY Program was accomplished either through in-lieu deliveries (pumping groundwater in-lieu of taking imported water) or via direct (wet water) recharge using spreading basins to percolate stormwater, imported water, and recycled water into the ground. Since the initial DYY Program captured many of the in-lieu exchange opportunities to accomplish the "put," a variety of put and take mechanisms would be required to implement the Program Expansion.

The 25,000 afy "put" for the existing DYY Program is largely accomplished via in-lieu. Several of the participants from the DYY Program expressed concern about taking on additional shift in the Program Expansion, since increasing an agency's shift obligation would require reducing imported deliveries during dry years even further. Therefore, approximately 12,300 to 16,800 of the "put" would need to be accomplished via other alternatives such as direct recharge or ASR wells. The balance of the "put" term would be made up by in-lieu deliveries.

Direct recharge sources include storm water, imported water, and recycled water. Storm water and imported water are considered the primary sources of recharge supplies. The quantity of recycled water permitted to be used for recharge in the Basin is governed by guidelines provided by the California Regional Water Quality Control Board (RWQCB) and the California

Department of Public Health (CDPH) and is dependent on the volume of storm and imported water available for recharge.

Another option for putting water into the Basin for storage is through the use of ASR wells. The principle is to inject treated water through the well for storage in a confined aquifer system and later recovery up through the same well. A benefit of using an ASR well over a spreading basin is the comparatively smaller footprint that can make an ASR project more cost-effective to construct. In addition, the groundwater surrounding an ASR well can improve over time due to the cycles of "puts" and "takes" that inject better quality water into the ground.

Institutional Arrangements Required To Include TVMWD and WMWD as Participants. Both TVMWD and WMWD are ideal agencies to participate in the Program Expansion since their service areas border the Basin and have ongoing relationships and/or operational agreements with Basin appropriators. TVMWD supplies imported water to Pomona, a Basin appropriator, and also treats water from the Rialto Pipeline at the Miramar Water Treatment Plant (WTP). These arrangements provide potential opportunities to reduce imported water deliveries during dry years and increase imported water deliveries during wet years. WMWD's participation in the DYY Program Expansion would provide a direct export connection to the Basin. These opportunities are developed further in Chapter 3 of this PDR.

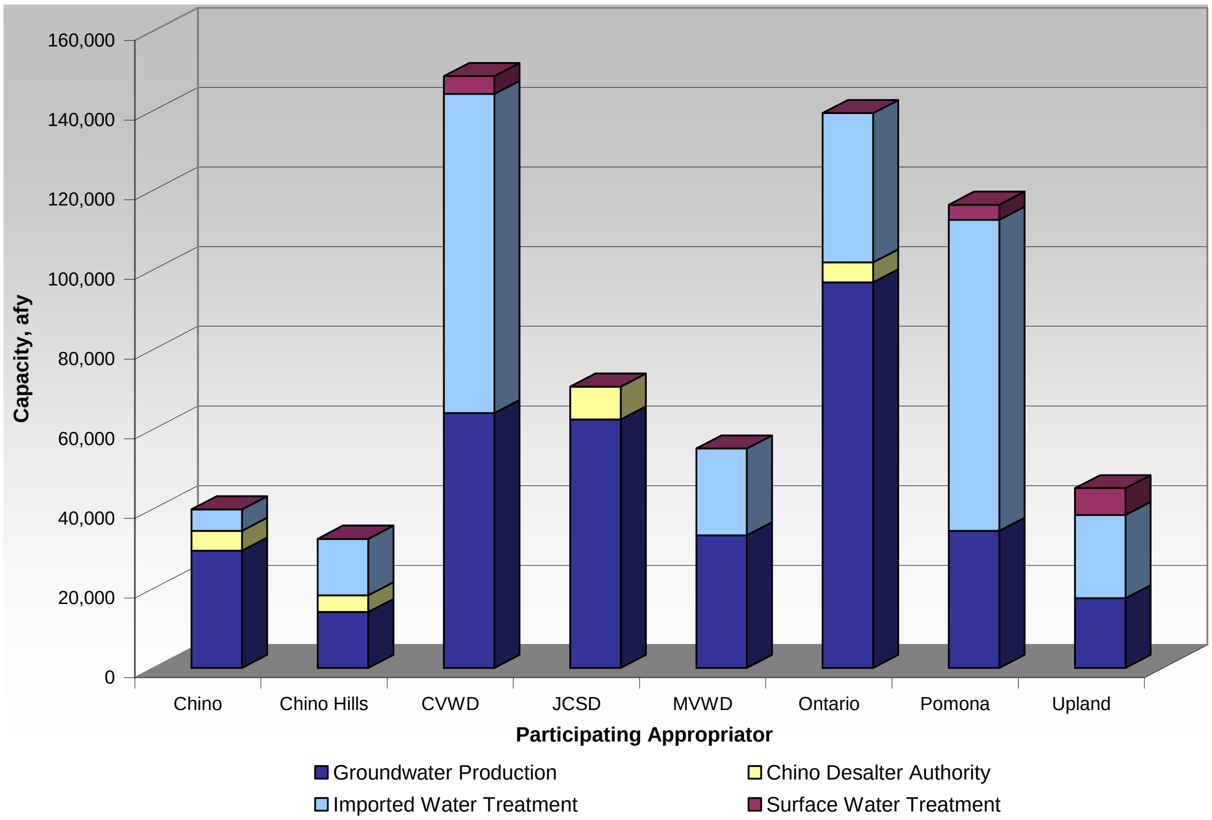
Water Quality Constraints Using TVMWD and WMWD for Direct Export. TVMWD and WMWD participation in the Program Expansion would include direct exports from the Basin for use in their respective service areas. Any water exported from the Basin to these agencies should be compatible with their existing system. Key compatibility considerations include variations in Basin water quality and pipeline corrosion issues resulting from potential chemical incompatibility between sources.

Asset Inventory and Storage and Recovery Opportunities

An investigation was conducted during the initial DYY Program in 2002-2003 to determine the existing facilities and production capacities of participating appropriators. This investigation, termed the "Asset Inventory," was updated to establish capabilities toward implementing the DYY Program Expansion. Several meetings and site visits were conducted to determine the condition of existing facilities and production capacities of each potential Program participant. The Asset Inventory developed a comprehensive list of the facilities available and identified groundwater production capabilities and imported water treatment capacity. The results of the Asset Inventory are presented in Appendix A of this Volume I.

The Basin appropriators receive their water from two primary sources: Basin groundwater and imported water from Metropolitan. Some appropriators supplement their supply with water from the Chino Desalters (also a Basin groundwater resource), recycled water, local surface water, and groundwater from other basins. In general, during Fiscal Year 2006/2007, the participating appropriators received approximately 40 percent of their water supply from Basin groundwater. Water demands are expected to increase due to the expanding population of the Santa Ana Watershed. Figure ES-1 summarizes the total water resource capacities for each of the participating appropriators as developed in the Asset Inventory.

Figure ES-1
Water Resource Capacities for Basin Appropriators



Notes:
(1) Although an imported water purchase capacity is not defined for JCSD, they would exchange local production with the City of Ontario in a dry year, thereby reducing Ontario's imported water purchases.

Facility Requirements and Management of Peak Imported Water Deliveries

This PDR defines eighteen potential facilities required for implementation of the Program Expansion, provides background on the facility selection process and CEQA documentation, summarizes facility requirements, and identifies additional projects beyond Program Expansion scope proposed to manage peak deliveries from Metropolitan's Rialto Pipeline.

Initial Facility Selection Process. The initial selection of facilities was based on interviews with Basin appropriators, neighboring Metropolitan member agencies, and current DYY Program participants to ascertain their interest in participating in the DYY Program Expansion. An analysis of each agency's existing facilities and infrastructure was also conducted using the Asset Inventory described above. Initial "put" and/or "take" contributions were evaluated qualitatively based upon the ability of the project to meet the Program Expansion goals.

The maximum storage volume allowed and maximum annual "put" and "take" values are constrained by the following Basin management strategies: (1) maintaining hydraulic control of the Basin, (2) minimizing/controlling movement or migration of contaminant plumes, (3) minimizing impact of water levels at key appropriator production wells, and (4) minimizing subsidence throughout the Basin.

Facility Selection Post-Modeling. The final, post-modeling adjusted "put" and "take" contributions are shown in the last two columns of Table ES-3. The combined "take" capacity of the proposed projects ranges from 15,000 to 17,000 afy. The combined "put" capacity of these projects is approximately 12,300 to 16,800 afy of direct capacity plus Basin-wide in-lieu deliveries and surface spreading contributions. While the final "take" contribution is lower than the initial pre-modeling contribution, the facility requirements remain the same. The way in which the facilities would be operated and the percentages of the facilities' capacities used towards each participant's contributions would be modified.

Table ES-3
Summary of Initial and Final DYY Program Expansion
Proposed Put/Take Capacities

Agency	Initial: Pre-Modeling		Final: Post-Modeling(3)	
	Put Capacity (afy)	Take Capacity (afy)	Put Capacity (afy) (1)	Take Capacity (afy)
Chino	500-1,000	2,000	500-1,000	2,000
Chino Hills(2)	0	1,000	1,800	0
CVWD	4,000-5,000	0	4,000-5,000	0
JCSD	0	2,000	0	2,000
MVWD	3,000-4,000	3,000-5,000	3,000-4,000	3,000-5,000
Ontario	2,000-3,000	0	2,000-3,000	0
Pomona	0	2,000	0	2,000
Upland	0	1,000	0	1,000
TVMWD	1,000-2,000	0	1,000-2,000	0
WMWD	0	8,000-10,000	0	5,000
Total	10,500 – 15,000	19,000 – 23,000	12,300 – 16,800	15,000 – 17,000

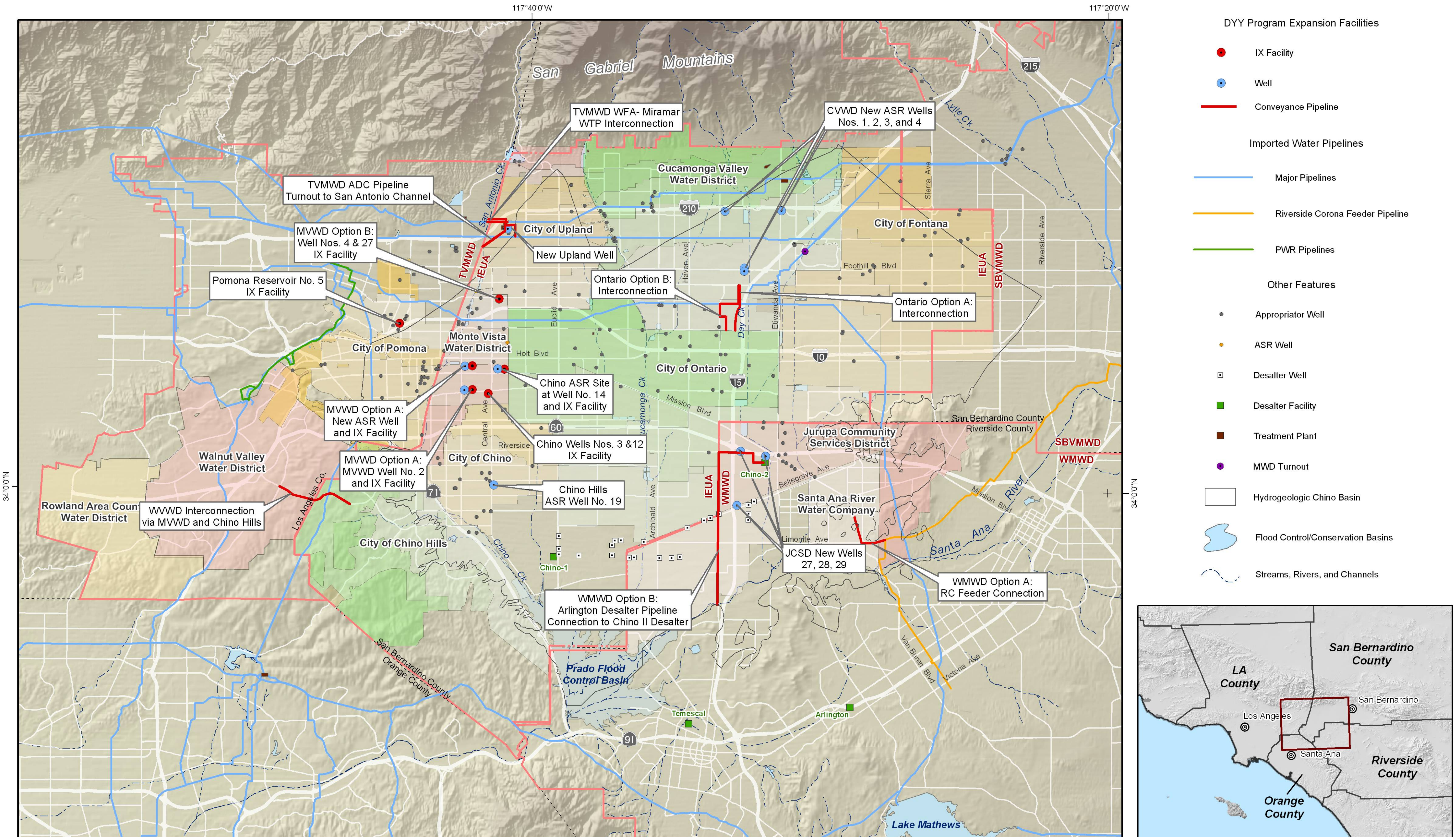
Notes:
(1) Does not include basin-wide in-lieu deliveries and direct recharge.
(2) MVWD assumed Chino Hills' shift obligation of 1,448 afy per an amendment to the agreement between the agencies dated March 5, 2007.
(3) Post modeling, adjusted capacities. See Volume III for details.

Recommended Facilities. Table ES-4 presents a summary of the DYY Program Expansion participants and their respective facility requirements. As shown in the table, several agencies require projects to allow them to participate on the "put" side and several agencies require projects to allow them to participate on the "take" side. "Put" facilities include ASR wells, interconnections, and conveyance facilities. "Take" facilities include IX treatment, wells, and conveyance facilities. Each project is developed further in Volume II. Figure ES-2 presents the location of the DYY Program Expansion facilities.

Table ES-4
Summary of Program Participants and Facility Requirements

Agency/PDR Volume	Facility Requirements
Chino (II A)	▸ Regenerable ion exchange (IX) treatment at existing Well Nos. 3 and 12 ▸ ASR Site at Well No. 14: Regenerable IX treatment at existing Well No. 14 and replacement of existing Chino agriculture well for injection
Chino Hills (II B)	▸ Convert existing Well No. 19 to ASR
CVWD (II C)	▸ Four new ASR wells
JCSD (II D)	▸ New Well No. 27 ("Galleano Well") ▸ New Well No. 28 ("Oda Well") ▸ New Well No. 29 ("IDI Well")
MVWD (II E)	▸ New ASR well and regenerable IX treatment ▸ Rehabilitate existing Well No. 2 and regenerable IX treatment ▸ Regenerable IX treatment at existing ASR Well No. 4 and Well No. 27 ▸ Conveyance facilities to deliver water from MVWD via Chino Hills to Walnut Valley Water District (WVWD) Service Area
Ontario (II F)	▸ Conveyance facilities to establish interconnection with CVWD
Pomona (II G)	▸ Regenerable IX treatment at existing Reservoir No. 5 site
Upland (II H)	▸ New well in Six Basins
TVMWD (II I)	▸ Treated water pipeline from Water Facilities Authority (WFA) Water Treatment Plant (WTP) to Miramar WTP ▸ Turnout along Azusa-Devil Cyn (ADC) Pipeline
WMWD (II J)	▸ Conveyance facilities to establish interconnection between planned Riverside-Corona (RC) Feeder and JCSD service area ▸ Conveyance pipeline to establish interconnection between WMWD service area and Chino II Desalter

CEQA Documentation. IEUA adopted a Program Environmental Impact Report (PEIR) for the OBMP in July 2000. The conclusion was that a Findings of Consistency Report was the requisite CEQA documentation for the initial Program. However, the scope of some of the potential projects under the Program Expansion may extend beyond that of the PEIR. IEUA, as the lead agency, was required to determine whether the proposed projects resulted in new significant impacts not evaluated in the PEIR and to decide what CEQA environmental determination to make if it chooses to approve the proposed projects. In order to cover each project under the same CEQA document, it was determined by TDA that a Mitigated Negative Declaration (MND) would need to be processed and approved. Highlights of the CEQA procedure are provided in PDR Volume I. Details are discussed in Volume IV.



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Inland Empire Utilities Agency

Western Municipal Water District

Three Valleys Municipal Water District

Chino Basin Watermaster

DYY Program Expansion Facilities Location Map

Figure ES-2

Concepts To Reduce Peak and Summer Deliveries from the Rialto Pipeline. One of Metropolitan's goals through implementation of the DYY Program Expansion is to reduce peak and summer-time demands on the Rialto Pipeline, a primary imported water transmission pipeline serving Basin appropriators. During dry years or potentially during periods of peak demand, Program Expansion participants would pump additional stored groundwater in-lieu of taking deliveries of imported water from the Rialto Pipeline. Based on anticipated, annual wet and dry conditions, the Program would be operated using a series of "put," "take," "summer-time take," and "hold" years. Both "take" and "summer-time take" years would reduce peak and summer-time demands on the Rialto Pipeline. The facilities implemented under the Program Expansion would be used to withdraw Basin water during "summer-time take" and "take" periods and would assist Metropolitan with reducing peaking off the local Rialto Pipeline during the summer and other peak periods.

In addition to the Program Expansion facilities that would allow Metropolitan to reduce demand during dry and/or peak delivery periods on the Rialto Pipeline, three other projects were identified:

- Rehabilitation of Ontario's Galvin WTP
- ADC Pipeline to the WFA Agua de Lejos WTP
- Rehabilitation of Pomona's Pedley WTP

Although not considered in the scope of the DYY Program Expansion, these projects could move forward under separate agreements with Metropolitan.

Program Operations Plan

A Basin Operations Plan was developed to establish which years the Basin appropriators would likely increase imported water deliveries (wet or "put" years) and when the appropriators would likely decrease imported water purchases (dry or "take" years). Considerations critical to development of the Operations Plan were coordinated with other water management programs within and outside of the Basin, availability of surplus water, and results of modeling conducted to evaluate the potential for material physical injury to the Basin.

Coordination with Other Water Management Programs. The primary objectives of developing an operations plan for the DYY Program Expansion are to: (1) ensure that implementation of the program is consistent with OBMP management objectives; (2) develop a sustainable program that does not impact other on-going Basin management strategies; and (3) develop an enhanced operations plan to determine the range of acceptable storage and flexibility of operations within the Basin. In addition to local Basin management programs, the Expansion Program builds from Metropolitan's recently-adopted Drought Allocation Plan. The Plan was developed by Metropolitan staff, working with its member agencies, to prepare for the possibility that sufficient supplies would not be available to meet future firm deliveries and that shortage allocations may be required.

Availability of Surplus Water. The availability of surplus water is also a critical criterion. During development of the initial DYY Program, the availability of surplus water was assumed to be seven out of every ten years based upon projections from Metropolitan at that time. However, subsequent events indicate that Program assumptions must be adjusted considerably. The current projected availability of surplus water from Metropolitan has been substantially reduced because of drought and the uncertainty of pumping operations from the State Water Project (SWP) due to requirements for protection of Delta Smelt and other environmental issues in the Sacramento-San Joaquin Bay-Delta. It now is assumed that surplus water would be available to the Watermaster in three out of ten years. This assumption impacts the rate at which Metropolitan may be able to replenish its DYY Program storage account and the facilities required to ensure that "put" capacity is available during periods of surplus supply.

Put, Take, and Hold Terms and Schedule. Based on anticipated annual wet and dry conditions, the Program would be operated using a series of "put," "take," "summer-time take," and "hold" years. By definition, a "summer-time take" year would occur when Metropolitan makes a withdrawal from its storage account during the summer months only. Such years would allow Metropolitan to reduce peaking off the local Rialto Pipeline during the summer months. "Summer-time take" years would most likely have less withdrawal from Metropolitan's DYY storage account than dry, or "take," years. A "hold" year is a normal or average year where "puts" or "takes" would not occur in Metropolitan's storage account.

Because Metropolitan's current planning projections indicate that, over a ten year period, surplus supplies may be available for three years during wet, or "put" years, the remaining seven years would therefore be considered either average or dry years. The Expansion Program operations plan assumes that three of these seven years may be dry (i.e., "take" years) and that the remaining four years would maintain average conditions (i.e., "hold" years). In-lieu deliveries were assumed to be available only during the wet, or "put," years over the same ten-year period.

Operations Plan Scenarios. Three operational scenarios were developed to define the flexibility of the DYY Program Expansion: typical storage, negative storage, and maximum storage. These scenarios, summarized in Table ES-5, were used as the basis for groundwater modeling undertaken for the Program Expansion.

Table ES-5
Summary of Operations Scenarios

Operations Scenario	Description	Range in Storage (AF)
No. 1: "Typical Storage"	Out of a ten year cycle, this scenario assumes a consistent 3-year "put" term, 3-year "take" term, and 4-year "hold" term. Maximum annual "puts" and "takes" are 50,000 afy.	0 to +150,000
No. 2: "Negative Storage"	This scenario assumes a 3-year "put" term but "takes" can extend beyond 3 years, thus allowing the storage account to accumulate a negative balance.	-100,000 to +150,000
No. 3: "Maximum Storage"	This scenario assumes a 3-year "put" term and assumes both maximum and smaller "summer-time" "takes," thus allowing the storage account to accumulate a higher balance.	0 to +300,000

Results of Modeling. Each of the three scenarios was modeled, as summarized in PDR Volume III. The modeling was conducted to evaluate the potential for material physical injury to the Basin including an analysis of groundwater-level changes, increased potential for subsidence, losses from storage, change in direction and speed of known water quality anomalies, and the ability to maintain hydraulic control. The modeling results showed that the initially proposed "takes" for Chino Hills and WMWD (via JCSD) could not be maintained due to hydraulic control limitations. Chino Hills' proposed "take" was reduced from 1,000 afy to 0 afy, and the WMWD proposed maximum "take" was reduced from 10,000 afy to 5,000 afy. However, it was determined that Chino Hills could participate on the take side if it modified its pumping plans to take more water from the shallow aquifer system. (Optimizing the Chino Hills pumping plan should be included in a subsequent Basin-wide analysis of pumping and recharge plans, performed separately by the Basin appropriators and CBWM.) It was also concluded that potential impacts related to storage losses, groundwater levels, and change in direction and speed of a known water quality anomaly (contaminant plume) could be mitigated during Expansion Program implementation.

Refined Shift Commitments. As part of the development of the Operations Plan, the "take" commitments from the potential Expansion Program participants were refined. The "take" occurs when agencies *shift* to groundwater production to meet demand instead of imported water deliveries. The amount of the shift is termed an agency's "shift commitment". The shift commitments initially proposed by both Chino Hills and WMWD were collectively decreased by 6,000 acre-ft, as described above. Therefore, the total potential shift, or "take," commitment for the DYY Program increased from 33,000 afy to 50,000 afy, for a net dry-year yield expansion of 17,000 afy.

Operations Plan for Expanded Program. The Operations Plan presented in this PDR would be used to conduct a Program consistent with the range of acceptable storage developed in Operations Plan Scenario Nos. 1-3. Tables ES-6 and ES-7, respectively, present a summary of the proposed "put" and "take" contributions and corresponding facility requirements for the Expansion Program.

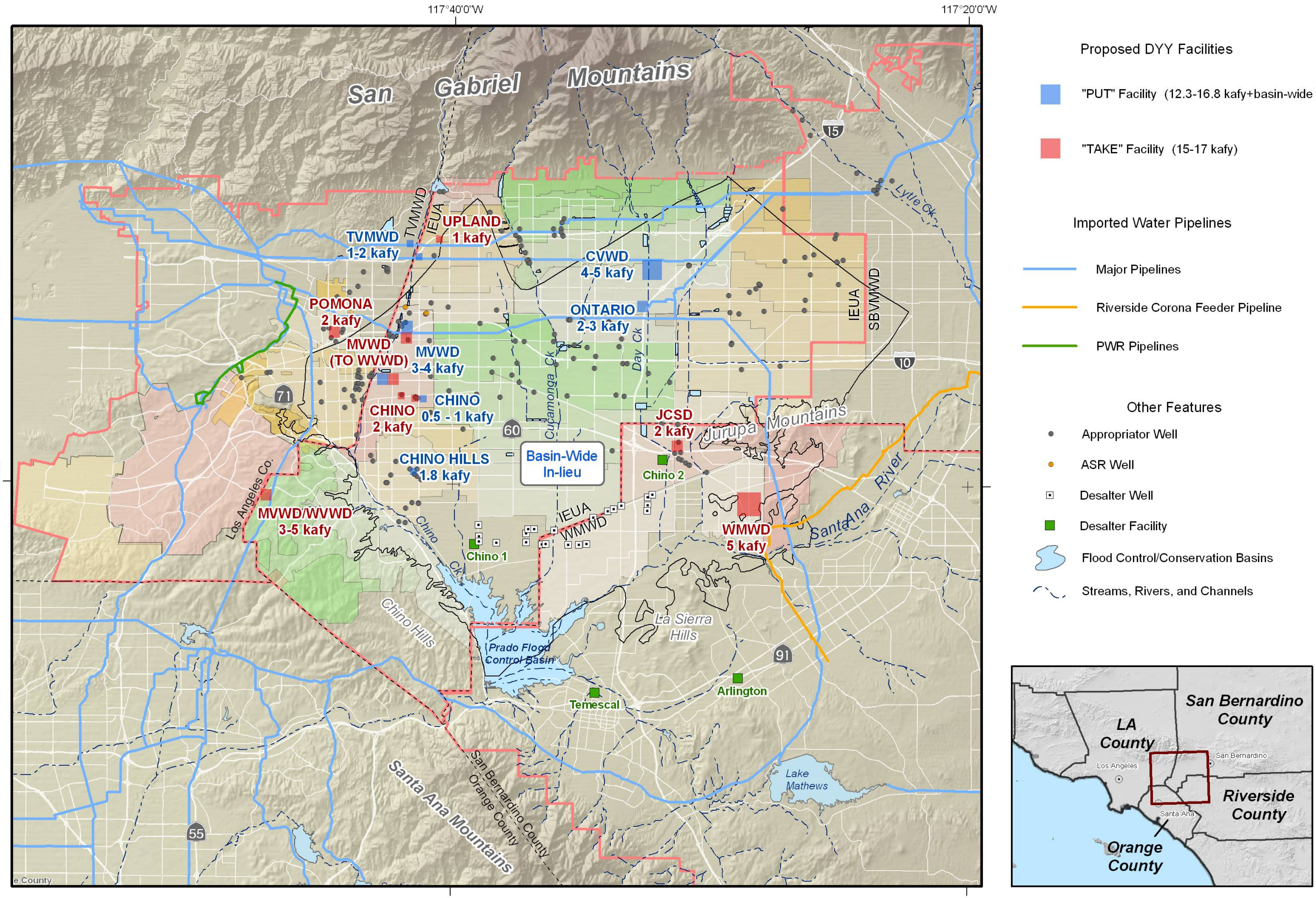
Table ES-6
Summary of "Put" Contributions for the DYY Expansion Program Operations Plan

Agency	"Put" (AFY)	Facility Requirement(s)
Chino	500 - 1,000	▸ Option B: Construct new injection well at Well No. 14 site
Chino Hills	500 - 1,000	▸ Convert existing Well No. 19 to ASR
CVWD	4,000 - 5,000	▸ Construct four new ASR wells
MVWD	3,000 - 4,000	▸ Option A: Use existing ASR Well Nos. 4, 30, 32, and 33; construct new ASR well ▸ Option B: Use existing ASR Well Nos. 4, 30, 32, and 33
Ontario	2,000 - 3,000	▸ Construct new imported water pipeline interconnection with CVWD to contribute in-lieu put
TVMWD	1,000 - 2,000	▸ Construct treated water pipeline from WFA WTP to Miramar WTP to contribute in-lieu put with Pomona ▸ Construct turnout along ADC pipeline to deliver supplemental water to San Antonio Channel for recharge
All Participants	1,000 - 6,000	▸ Coordinate additional in-lieu exchanges and/or direct recharge with Watermaster
TOTAL	17,000	--

Table ES-7
Summary of "Take" Contributions for the DYY Expansion Program Operations Plan

Agency	"Take" (AFY)	Facility Requirement(s)
Chino	2,000	▸ Option A: Construct new IX facility at Well Nos. 3 and 12 ▸ Option B: Construct new IX facility at Well No. 14
JCSD	2,000	▸ Construct three new production wells
MVWD	5,000	▸ Option A: Construct new ASR well and IX facility; rehabilitate existing Well No. 2 and construct IX facility ▸ Option B: Construct new IX facility at Well Nos. 4 and 27 ▸ Options A and B: construct new conveyance pipeline for export of shift to WVWD
Pomona	2,000	▸ Construct new IX facility at Reservoir No. 5
Upland	1,000	▸ Construct new Six Basins production well
WMWD	5,000	▸ Option A: Construct new JCSD-RC Feeder interconnection pipeline for export of shift to WMWD ▸ Option B: Construct new Chino II Desalter-Arlington Desalter Pipeline interconnection for export of shift to WMWD
TOTAL	17,000	--

Figure ES-3 presents the locations for the proposed "put" and "take" facilities. Also shown on the figure, and represented by the color and size of the squares, are each agency's level of contribution toward the Expansion Program.



Proposed DYY Facilities

"PUT" Facility (12.3-16.8 kafy+basin-wide in-lieu)

"TAKE" Facility (15-17 kafy)

Imported Water Pipelines

Major Pipelines

Riverside Corona Feeder Pipeline

PWR Pipelines

Other Features

Appropriator Well

ASR Well

Desalter Well

Desalter Facility

Flood Control/Conservation Basins

Streams, Rivers, and Channels

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Proposed DYY Participants and Put/Take Locations

Figure ES-3

Interagency Coordination Scenarios. The "put" and "take" facilities proposed under the DYY Program Expansion would work in concert to achieve a balanced storage program in the Basin, as confirmed by ongoing groundwater modeling and monitoring. Although all facilities work together to achieve the program objectives, two major interagency coordination scenarios are required to achieve the hydraulic balance proposed in this PDR. These scenarios are: (1) CVWD, Ontario, JCSD, and WMWD Coordination and (2) MVWD, Chino Hills, and WVWD Coordination.

Ion-Exchange Facilities Conceptual Design

Increases in groundwater production during dry years may require groundwater treatment. During the initial DYY Program, IX was selected as the preferred treatment approach. Chapter 7 of this Volume presents general design criteria for an IX system. IX is relatively low in cost (both capital and O&M) and has a smaller reject stream than other treatment technologies, resulting in reduced impact on net groundwater production. Detailed conceptual design criteria for agencies with wellhead treatment facilities are presented in Volume II.

Production Well and ASR Facilities Conceptual Design

As part of the Program Expansion, design criteria were developed for both production wells and ASR wells. Chapter 8 presents general design criteria, including well drilling, wellhead pumping, site layout, electrical design, and I&C. Conceptual design criteria specific to each facility are presented in Volume II.

Opinion of Probable Cost

Detailed capital, operations and maintenance (O&M) and annual cost analyses for the ten program participants under the DYY Program Expansion are presented in PDR Volumes II A-J. Volume I presents a summary of general cost assumptions and the conceptual-level capital and annual O&M costs developed in Volume II.

Capital Cost Summary. Table ES-8 presents a summary of the opinion of probable capital cost(s) for each agency's facilities. In cases where agencies have two options rather than one, costs for both options (Options A and B) are provided. Detailed conceptual-level opinion of probable capital costs are provided in each agency's respective Volume II. As shown in the table, the total opinion of probable capital costs is estimated to range from $85,829,000 to $107,472,000, depending on the facility option(s) selected.

Table ES-8
Capital Cost Summary

Participating Agency	Opinion of Probable Capital Cost (1) (2)	
Chino (3) (Option B, A)	$7,854,000	$9,207,000
Chino Hills	2,154,000	
CVWD	15,410,000	
JCSD	11,526,000	
MVWD (3) (Option B, A)	10,811,000	17,755,000
Ontario (3) (Option A, B)	9,028,000	10,460,000
Pomona	7,348,000	
Upland	3,164,000	
TVMWD	6,410,000	
WMWD (3) (Option A, B)	12,124,000	24,038,000
TOTAL	**$85,829,000**	**$107,472,000**

Notes:
(1) Detailed conceptual-level opinion of probable cost provided in Volumes II A-J.
(2) Does not include midpoint of construction cost. Provided in Volumes II A-J.
(3) Both facility options A and B shown.
(4) Costs do not include use of existing ASR facilities for potential "put" contribution. The total capital value for the use of these facilities may range from $2.0-3.2M/1,000 afy of "put" capacity. See Appendix D for the preliminary evaluation of these costs.

Annual O&M Cost Summary. Table ES-9 presents a summary of the opinion of probable annual O&M cost(s) for each agency's facilities. Costs for facility Options A and B are provided where necessary. Detailed conceptual-level opinion of probable annual O&M costs are provided in each agency's respective Volume II. As shown in the table, the total opinion of probable annual O&M costs is estimated to range from $5,447,000 to $5,518,000, depending on the facility option(s) selected.

Table ES-9
Annual O&M Cost Summary

Participating Agency	Opinion of Probable Annual O&M Cost [1]	
Chino [2] (Option B, A)	$686,000	$823,000
Chino Hills	139,000	
CVWD	1,108,000	
JCSD	1,310,000	
MVWD [2] (Option B, A)	501,000	965,000
Ontario [2] (Option A, B)	9,000	10,000
Pomona	505,000	
Upland	231,000	
TVMWD	398,000	
WMWD [2] (Option A, B)	560,000	29,000
TOTAL	**$5,447,000**	**$5,518,000**

Notes:
(1) Detailed conceptual-level opinion of probable cost provided in Volumes II A-J.
(2) Both facility options A and B shown.

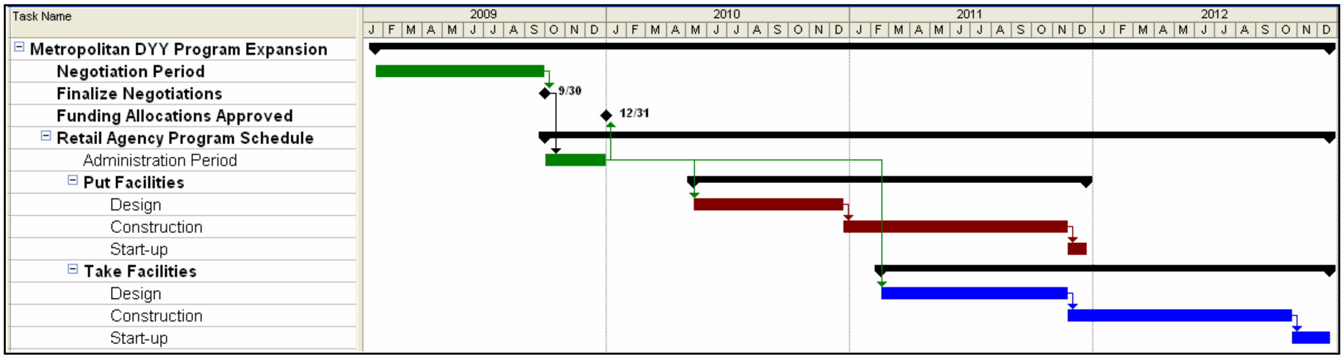
Program Implementation

Program implementation concepts were developed based on discussion with Program participants and B&V experience on recent, similar projects. The Program Expansion would be closely coordinated with other Basin management programs and agreements, such as the Drought Allocation Plan, the Recharge Master Plan Update, the Peace II Basin Agreement, the Forbearance MZ-1 Agreement, the Chino Desalter Authority (CDA) Local Resources Program, and the Chino Desalter Expansion/Chino Creek Wellfield.

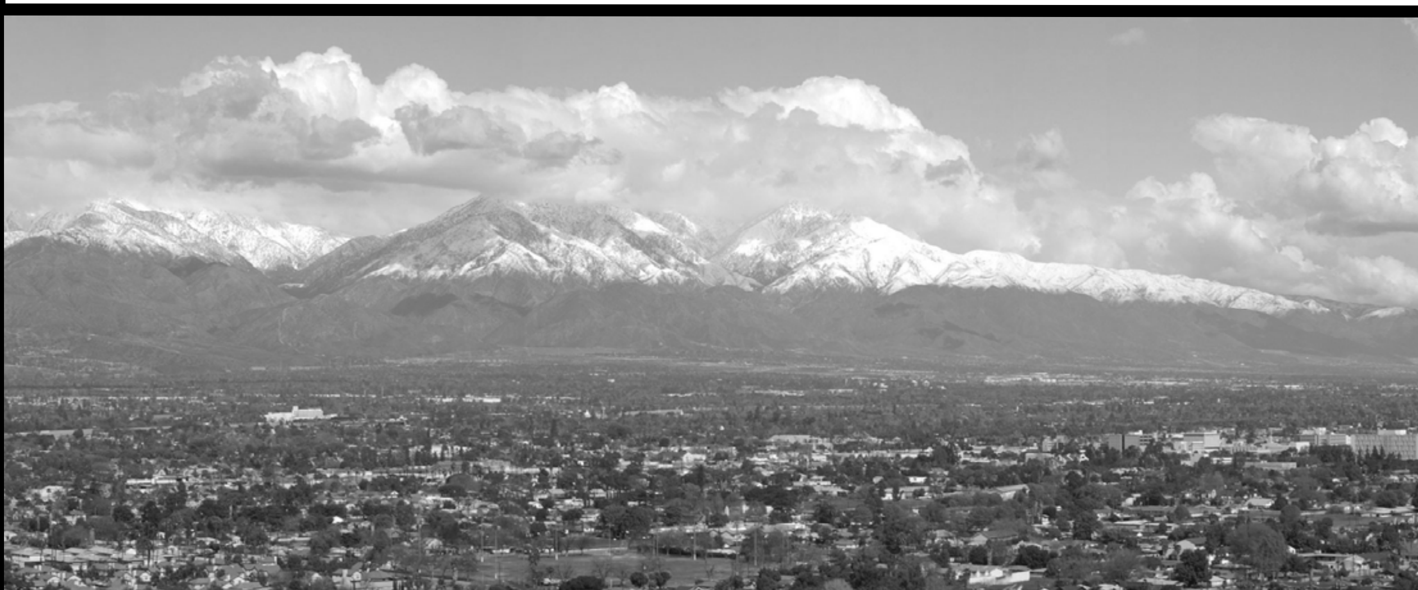
In general, project implementation is expected to follow four successive periods: Metropolitan Participating Agency Negotiation Period, Retail Agency Administration Period, Put Facility Development Period (Design, Construction, Start-up), and Take Facility Development Period (Design, Construction, Start-up). The implementation is for planning purposes only. Considerations that may affect individual project schedules include coordination with other local master planned projects, availability of local funding, water demand, and coordination with other Basin management programs and water quality objectives.

Figure ES-4 summarizes the preliminary schedule for the DYY Program Expansion. The Metropolitan negotiation period is anticipated to occur over a nine month period estimated to begin in January 2009 and to be finalized in September 2009. During this period, the Initial DYY Program Master Agreement would be updated or a new one developed to contain program legal funding and operation information between Metropolitan and participating member agencies. A retail agency administration period would follow the Master Agreement period to account for further conditions among member agencies and operating parties (retail agencies) that are served water.

Figure ES-4
DYY Program Expansion Preliminary Schedule



1.0 Introduction



1.0 INTRODUCTION

1.1 Overview

The Chino Basin (Basin) Dry-Year Yield (DYY) Program Expansion (Program Expansion) is a proposed conjunctive-use program developed by the Chino Basin Watermaster (CBWM, Watermaster), Inland Empire Utilities Agency (IEUA), Metropolitan Water District of Southern California (Metropolitan), in association with Three Valleys Municipal Water District (TVMWD), and Western Municipal Water District (WMWD).

This report consists of four volumes. Volumes I and II make up the Project Development Report (PDR) prepared by Black & Veatch (B&V). Volume III, prepared by Wildermuth Environmental, Inc. (WEI), provides details of the groundwater modeling and impacts of the DYY Program Expansion on the Basin. Volume IV consists of the California Environmental Quality Act (CEQA) documentation conducted for the Expansion prepared by Tom Dodson & Associates (TDA).

The following sections of this chapter discuss the purpose and scope of the DYY Program Expansion and present background information on the initial DYY Program developed in 2003 and the Chino Basin objectives. In addition, concepts of conjunctive-use are presented, and the methodology for conceptual design is described. Also discussed is the organization of the report, acronyms used, and references cited.

1.2 Purpose and Scope

The purpose of the PDR is to determine the fundamental components of a 150,000 acre-foot (acre-ft) conjunctive-use storage program between Metropolitan, IEUA, Watermaster, TVMWD, and WMWD. The DYY PDR outlines the facilities needed to store up to 150,000 acre-ft and to recover up to 50,000 acre-feet per year (afy) of stored groundwater for dry-year use, in-lieu of imported water from Metropolitan, as defined in the agreement between Metropolitan and IEUA. Most of the Basin's major appropriators are interested in participating in the Program and collectively they will contribute a portion of the additional dry-year yield. By providing Metropolitan with additional dry-year yield, the DYY Program Expansion benefits all major water purveyors in Southern California.

IEUA, which manages the distribution of imported water to the Basin appropriators, acts as the liaison between the Watermaster and Metropolitan. IEUA authorized B&V, in coordination with WEI and TDA, to prepare this PDR.

1.3 Background Information

This section presents a brief discussion of the Basin and describes the goals of the project. A detailed discussion of the Basin geology, hydrogeology, water quality, and participating appropriators is presented in Chapter 2 of this volume.

The Chino Basin consists of about 235 square miles of the upper Santa Ana River watershed. Figure 1-1 shows the Basin boundaries with the Cucamonga Basin and the San Gabriel Mountains to the north; the Rialto-Colton Basin to the northeast; the chain of Jurupa, Pedley, and La Sierra Hills to the southeast; the Temescal Basin to the south; Chino Hills and Puente Hills to the southwest; and San Jose Hills and the Pomona and Claremont Basins to the northwest. In addition, the Basin lies within the Counties of San Bernardino and Riverside and includes some or all of the Cities of Chino, Chino Hills, Fontana, Montclair, Norco, Ontario, Pomona, Rancho Cucamonga, Upland, and several other communities.

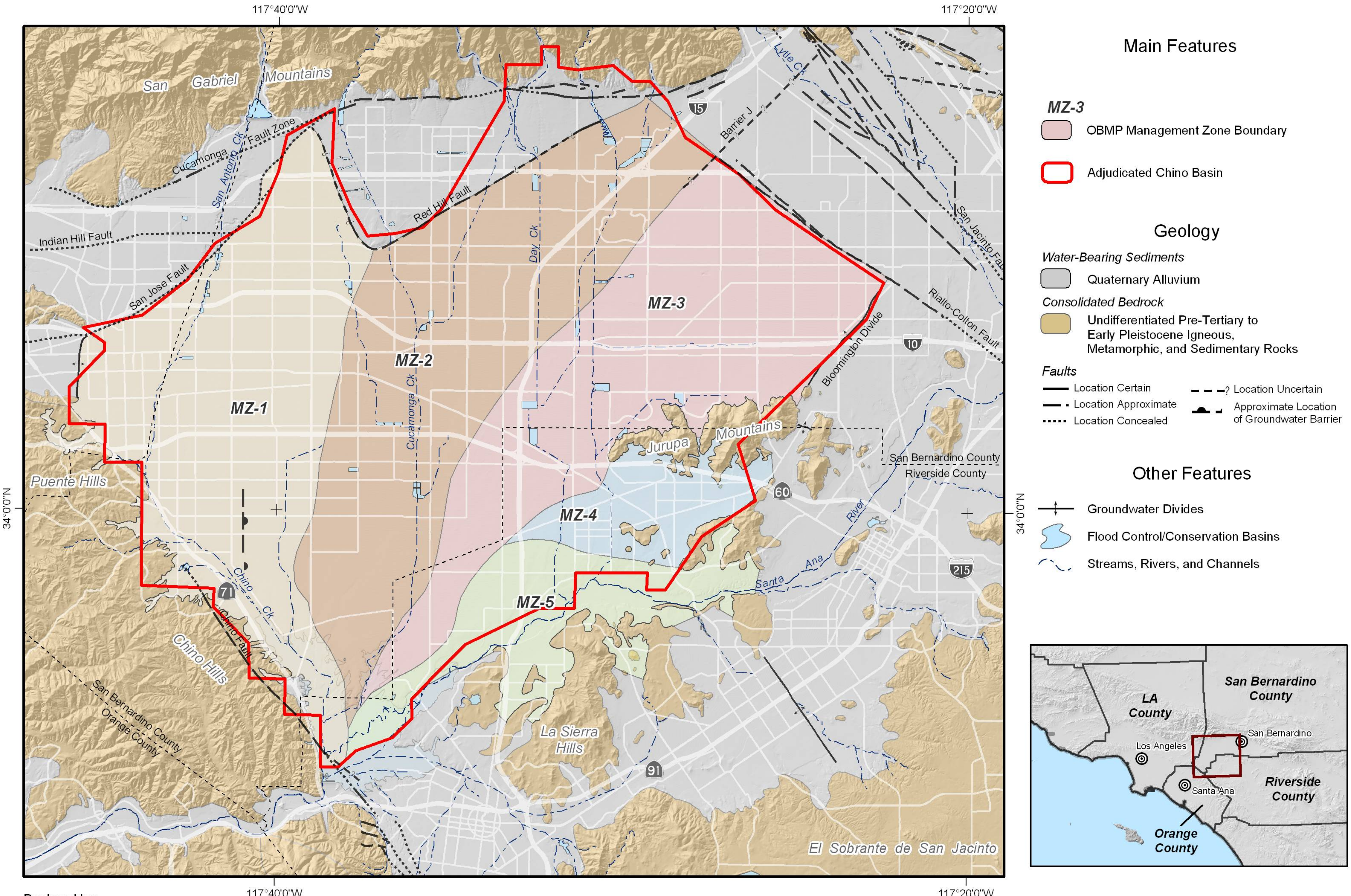
One of the largest groundwater basins in Southern California, the Basin contains about 5,000,000 acre-ft of water and has an unused storage capacity of about 1,000,000 acre-ft. Cities and other water supply entities produce groundwater for all or part of their municipal and industrial supplies. Agricultural users also produce groundwater from the Basin, but irrigated agriculture has declined substantially in recent years and is projected to continue to decline [CBWM, 1999].

The Basin is legally defined in the Judgment of the case of Chino Basin Municipal Water District vs. the City of Chino et al. (Judgment) (Superior Court of California for San Bernardino Case No. RCV 51010), issued in 1978 [SCSC, 1978]. Since that time, the Basin has been operated as described in the Judgment under the direction of the court-appointed Watermaster.

The Optimum Basin Management Program (OBMP) is being implemented pursuant to the Judgment and a 1998 ruling of the court in its exercise of continuing jurisdiction. The Court officially accepted the scope of work to develop the OBMP on November 5, 1998, and the OBMP Phase 1 Report was completed August 19, 1999 [CBWM, 1999]. The purpose of the OBMP is to ensure a continuing water supply for the long-term beneficial use of all Watermaster parties. The mission statement for the OBMP is as follows:

> *The purpose of the Optimum Basin Management Program is to develop a groundwater management program that enhances the safe yield and the water quality of the basin, enabling all groundwater users to produce water from the Basin in a cost-effective manner.*

The OBMP consists of two phases. Phase I defines the state of the Chino Groundwater Basin, establishes goals concerning major issues identified by stakeholders, and affirms a management plan for the achievement of said goals. Phase II is the development of the specific implementation plan that will effectively allow for the physical construction, operation, management, and monitoring of OBMP facilities. This phase consists of a series of Memoranda of Agreements, Technical Memoranda, Facility Reports, Policy Documents, and development of water supply plans, recharge master plans, Joint Powers Authority agreements, safe yield, and other related documents that will be completed during implementation of the OBMP over the 20 to 30 year planning period. When completed, these documents will provide detailed plans for the implementation of the Program Elements and the achievement of the OBMP Goals listed in Table 1-1. Collectively these documents will facilitate successful implementation of Phase II. It is intended that the OBMP be flexible enough that changes in future demands and situations can accommodated.



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Three Valleys Municipal Water District

Chino Basin Watermaster

Chino Basin Dry-Year Yield Program Expansion

Chino Basin Boundaries and OBMP Management Zones

Figure 1-1

Table 1-1 provides a summary of OBMP goals and lists activities necessary to meet the goals. A more thorough description of goals and action items is provided in Table 3-8 of the OBMP Phase I Report [CBWM, 1999].

Table 1-1
Goals of the OBMP

Goal	Activities Necessary to Meet Goals
Enhance Basin Water Supplies	• Enhance Recharge of Storm Water Runoff • Increase Recharge of Recycled Water • Develop New Sources of Supplemental Water • Promote Direct Use of Recycled Water • Promote Treatment and Use of Contaminated Groundwater • Reduce Groundwater Outflow • Re-determine Safe Yield
Protect and Enhance Water Quality	• Treat Contaminated Groundwater To Meet Beneficial Uses • Monitor and Manage the Basin To Reduce Contaminants and To Improve Water Quality • Manage Salt Accumulation Through Dilution or Blending and the Export of Salt • Address Problems Posed by Specific Contaminants
Enhance Management of the Basin	• Develop Policies and Procedures That Encourage Stable, Creative, and Fair Water Resources Management in the Basin • Optimize Use of Local Groundwater Storage • Develop and/or Encourage Production Patterns, Well Fields, Treatment and Water Transmission Facilities, and Alternative Water Supply Sources To Ensure Maximum and Equitable Availability of Groundwater and To Minimize Land Subsidence • Develop Conjunctive-Use Programs with Others To Optimize Use of the Chino Basin for In-Basin Producers and the People of California
Equitably Finance the OBMP	• Identify an Equitable Approach To Spread the Cost of OBMP Implementation • Identify Ways To Recover Value from Utilizing Basin Assets

The goals and activities shown above will be developed and implemented through nine OBMP Program Elements:

(1) Comprehensive Monitoring Program
(2) Comprehensive Recharge Program
(3) Water Supply Plan for the Impaired Areas of the Basin
(4) Comprehensive Groundwater Management Plan for Management Zone 1
(5) Regional Supplemental Water Program
(6) Cooperative Programs To Improve Basin Management
(7) Salt Management Program
(8) Groundwater Storage Management Program
(9) Conjunctive-use Programs

As a conjunctive-use project similar to the initial DYY Program, the DYY Program Expansion would accomplish OBMP Program Element 9 and contribute toward OBMP Program Elements 7 and 8.

Program Element 9 focuses on the development of conjunctive-use programs that account for water quantity and quality and will assist in balancing production and recharge in the Basin. The Watermaster will develop regional conjunctive-use programs to store supplemental water for Metropolitan and other entities that can allow supplemental water to be stored in the Basin. The regional conjunctive-use programs will provide benefits to all purveyors in the Basin and the people of California. Watermaster's conjunctive-use programs will take priority over conjunctive-use programs developed by others. Storage committed to conjunctive-use programs may consist of two parts: storage within a safe storage capacity and storage in excess of safe storage. Storage in excess of safe storage capacity will automatically require mitigation. The initial target storage for Watermaster's conjunctive-use program will be 150,000 to 300,000 acre-ft within the safe storage capacity which Watermaster established at 500,000 acre-ft. Cyclic storage may be folded into conjunctive-use storage.

1.4 Conjunctive-Use and In-lieu Exchange

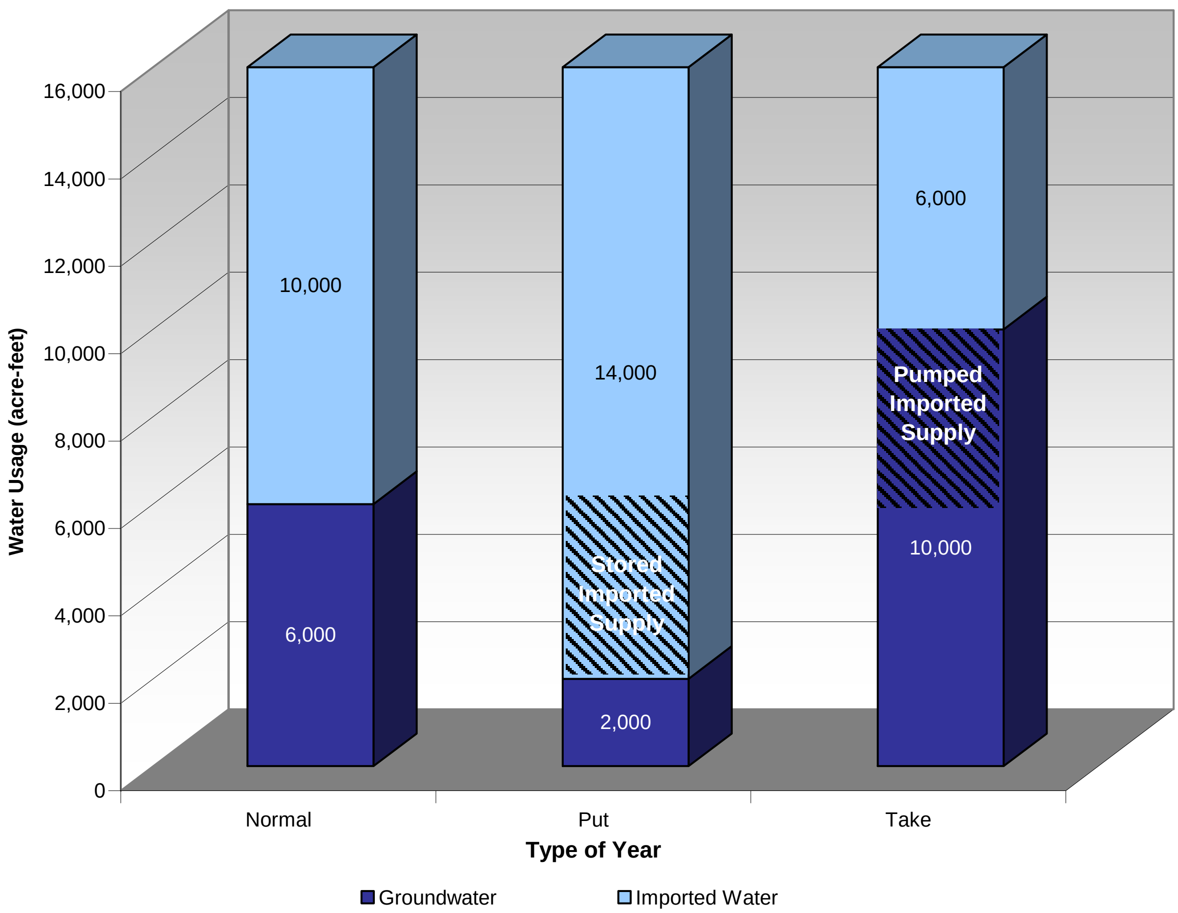
Conjunctive-use is the optimal management of both surface water and groundwater in order to increase overall water supplies. Storage or surplus surface supplies can be accomplished either directly or through "in-lieu." In 2008, Metropolitan, IEUA, and the Watermaster implemented the initial 100,000 acre-ft DYY Program, which was under development since 2002. The initial program attains conjunctive-use primarily through "in-lieu exchange" but may also include direct recharge of surplus Metropolitan imported supplies. This exchange is possible since most of the appropriators supplement their supplies with Metropolitan water.

The initial DYY Program is a proposed conjunctive-use program among Metropolitan, IEUA, Watermaster, and Chino Basin appropriators who elect to participate. Over the course of the initial program, the Chino Basin appropriators would decrease groundwater production and increase imported water deliveries from Metropolitan by 25,000 acre-ft during *wet* years. The program also provides the flexibility for Metropolitan to deliver "surplus" imported water for recharge, thereby increasing Basin storage. Conversely, during *dry* years, the Chino Basin appropriators would increase groundwater production and decrease imported water purchases from Metropolitan by 33,000 acre-ft. This exchange would allow the Chino Basin appropriators to use Metropolitan surplus imported water in-lieu of groundwater during wet years, thereby storing unused groundwater for use during future dry years. The DYY Program Expansion provides for maximum storage up to 150,000 acre-ft. Under this expanded program, assuming that withdrawals from Metropolitan's storage account would occur over the same three-year dry period (as with the initial program), the "take" from Metropolitan's account could be as high as 50,000 acre-ft. This Metropolitan conjunctive-use storage program represents about 20 percent of the Watermaster's long-term storage objectives. The Operations Plan for the expanded Program is further described in Chapter 6 of this Volume.

The initial DYY Program relied on in-lieu exchange to develop Metropolitan's storage account. During wet years when surface supplies exceed demand, imported water deliveries would increase and groundwater extraction would decrease by an equal amount. This unpumped groundwater is thereby stored and available for use in later years when surface supplies may be limited. This type of year is called a "put year." When surface supplies are short, i.e., in a dry year, the previously unpumped groundwater would be extracted, in addition to the normal groundwater production. This type of year is called a "take year." The in-lieu exchange capacity of any agency is limited by the resource with the least available supply.

Figure 1-2 presents a conceptual example of how a typical agency would allocate its water resources during normal, put, and take years. As shown, this typical agency would meet its demand during a normal year through 10,000 acre-ft of imported water and 6,000 acre-ft of groundwater. If imported deliveries increased by 4,000 acre-feet during a put year, groundwater pumping would be reduced by a similar amount. This would leave 4,000 acre-ft in a storage account available for future use. Therefore, during a dry year, if imported supplies were reduced by 4,000 acre-ft, the previously stored groundwater from the put year and would be extracted in addition to the normal groundwater production.

Figure 1-2
Dry-Year Yield Program Example Resource Allocation



1.5 DYY Program Participating Agencies

Eight Basin appropriators are expected to participate in the expanded program. TVMWD and WMWD are also expected to participate through coordination with Chino Basin appropriators.

- City of Chino (Chino)
- City of Chino Hills (Chino Hills)
- Cucamonga Valley Water District (CVWD)
- Jurupa Community Services District (JCSD)
- Monte Vista Water District (MVWD)
- City of Ontario (Ontario)
- City of Pomona (Pomona)
- City of Upland (Upland)
- TVMWD
- WMWD

Based upon the Basin Operations Plan described in Chapter 6.0 of this volume, a program operation plan will be developed to establish which years the Basin appropriators would likely increase imported water deliveries (wet or “put” years) and when the appropriators would likely decrease imported water purchases (dry or “take” years). The participants would increase or decrease the use of imported water by a predetermined amount in order to meet the “put” and “take” terms in order to increase dry-year supplies for Metropolitan. In return, Metropolitan would help finance construction of new facilities that would enable the Chino Basin appropriators to treat otherwise unusable groundwater and pump good-quality groundwater.

1.6 Methodology

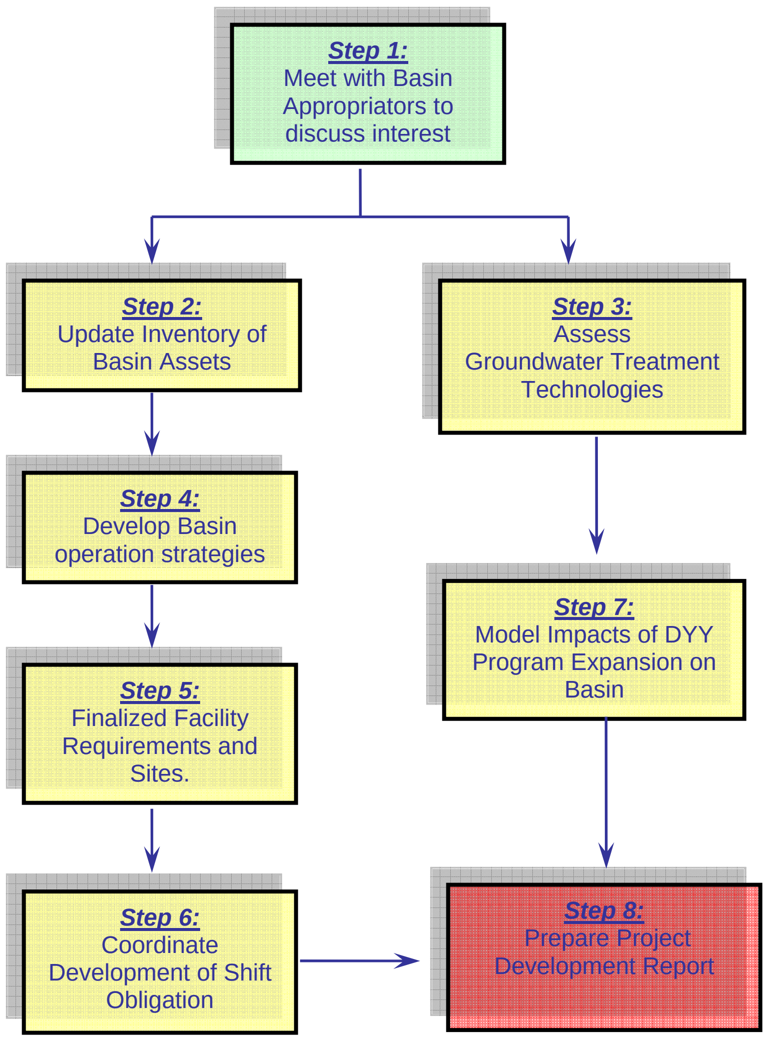
The preliminary design of the DYY Program Expansion was accomplished through a series of activities presented in the flow chart on Figure 1-3. This flow chart represents the steps taken while working extensively with IEUA, Watermaster, Basin appropriators, TVMWD, and WMWD. From this collaboration, several reports, technical memoranda, and computer models were produced, which serve as the framework of this PDR.

The first activity (Step 1) shown on Figure 1-3 was to meet with each individual agency to assess their level of interest in participating in the Program Expansion. Following this activity, the asset inventory list and map of existing facilities, which were developed for the initial DYY Program, (Step 2) were updated to provide current information for each appropriator’s wells and treatment facilities along with water supply and quality information. This information enabled the refinement of the number and size of the additional facilities needed to implement the expanded program. Furthermore, the water quality data, combined with research of various groundwater treatment technologies (Step 3), led to the selection of the ion exchange (IX) process as the most appropriate technology for the DYY Program Expansion groundwater treatment facilities.

B&V and WEI developed Basin operation strategies based upon the appropriators level of interest in participating in the Program (Step 4). The facility requirements and sites were then finalized through several meetings with the Basin appropriators (Step 5).

In addition, through meetings with interested participants, B&V coordinated the assessment of each appropriator's potential *shift obligation*, which is the amount of additional groundwater each appropriator must produce during a dry year that would subsequently reduce imported water supplies (Step 6). Computer models were developed in order to determine how the program would affect the Basin water supply and quality (Step 7). These models were based on the data collected from Steps 2 through 5. Finally, the information developed in Steps 2 through 7 was used to create the PDR (Step 8).

Figure 1-3
Methodology Flow Chart



The remainder of this PDR identifies the progression from this preliminary list of facilities into the facilities that will be implemented under the DYY Program Expansion.

1.7 Report Organization

The documentation is organized into four volumes. Volumes I and II, prepared by B&V, comprise the Project Development Report. They provide general information on the DYY Program Expansion and present the design criteria and analyses pertinent to the program as a whole as well as for specific facilities to be developed. Volume III, the Preliminary Modeling Report prepared by WEI, provides an evaluation of the water resources impacts of the DYY Program on the Chino Basin through development of a groundwater model. Volume IV is comprised of the CEQA documentation conducted for this project by TDA.

Volume I begins by describing the geology, hydrogeology, water supply/quality, and relevant organizations and facilities in the Basin. The volume also includes the size of the expanded program, the arrangement for participants outside of the Basin boundaries, and the conceptual Basin Operations Plan.

In addition, Volume I provides background and general information on the preliminary design of the wellhead treatment facilities, ASR wells, and new production wells, including the probable capital and operation and maintenance (O&M) cost for each facility. Finally, the methods for implementing the DYY Program Expansion are discussed.

1.8 Abbreviations and Acronyms

The following abbreviations/acronyms are used in this report:

ACI	American Concrete Institute
ACR	Application for Capacity Right
acre-ft	acre-feet
ADC	Azusa Devil Canyon
AFD	adjustable frequency drive
afy	acre-feet per year
AISC	aquifer storage and recovery
AOPs	advanced oxidation processes
As	arsenic
ASTM	American Society for Testing Materials
AWWA	American Water Works Association
B&V	Black & Veatch
Basin	Chino Basin
BATs	best available technologies
ft/day	feet per day
CBC	California Building Code
CBFIM	Chino Basin Facilities Improvement Project
CBWCD	Chino Basin Water Conservation District
CBWL	Chino Basin Wastewater Line
CBWM	Chino Basin Watermaster
CDA	Chino Desalter Authority
CDFM	cumulative departure from mean

CDPH	California Department of Public Health
CEQA	California Environmental Quality Act
cfs	cubic feet per second
Chino	City of Chino
Chino Hills	City of Chino Hills
CIP	capital improvements program
Cl^-	chloride
ClO_4^-	perchlorate
CML&C	cement mortar lined and coated
CMP	Comprehensive Monitoring Program
COPC	contaminant of potential concern
Cr	Chrome VI
CRA	Colorado River Aqueduct
CVWD	Cucamonga Valley Water District
DBCP	dibromochloropropane
DIC	dissolved inorganic carbon
DWR	California Department of Water Resources
DYY	Dry-Year Yield
DYY Program	initial Chino Basin Dry-Year Yield Program
DYY Program Expansion	Chino Basin Dry-Year Yield Program Expansion
EDR	electrodialysis reversal
EIR	Environmental Impact Report
FWC	Fontana Water Company
GAC	granular activated carbon
gpm	gallons per minute
HCO_3	bicarbonate
HDPE	high-density polyethylene
HMI	human machine interface
HVAC	heating, ventilation, and air conditioning
IBM	adsorption onto iron-based media
I&C	instrumentation and controls
ICF	iron coagulation followed by filtration
IEEE	Institute of Electrical and Electronics Engineers
IEUA	Inland Empire Utilities Agency
In SAR	synthetic aperture radar interferometry
IS	Initial Study
IX	Ion Exchange
JCSD	Jurupa Community Services District
Judgment	Chino Basin Municipal Water District vs. the City of Chino et al. (1978)
LACSD	Los Angeles County Sanitation District
LS	Lump Sum
MCCs	motor control centers
MCL	maximum contaminant level
mg	milligrams
mgd	million gallons per day

Metropolitan	Metropolitan Water District of Southern California
mg/L	milligrams per liter
MND	mitigated negative declaration
MTBE	methyl tertiary butyl ether
MVWD	Monte Vista Water District
ND	non-detect
NEC	National Electric Code
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Agency
NO_3^-	nitrate
NPDES	National Pollutant Discharge Elimination System
NRW	Non-Reclaimable Wastewater
OD	outside diameter
Ontario	City of Ontario
O&M	operation and maintenance
OBMP	Optimum Basin Management Program
OCSD	Orange County Sanitation District
PCE	tetrachloroethylene
PDR	Project Development Report
PEIR	Program Environmental Impact Report
PLC	programmable logic controller
ppb	parts per billion
Pomona	City of Pomona
Program	DYY Program, DYY Program Expansion
Program Expansion	Chino Basin Dry-Year Yield Program Expansion
psi	pounds per square inch
PTA	packed tower aeration
RC	Riverside-Corona
Riverside	City of Riverside
RO	reverse osmosis
ROW	right of way
RWC	recycled water contribution
RWD	Rowland Water District
RWQCB	Regional Water Quality Control Board
SARI	Santa Ana Regional Interceptor
SAWC	San Antonio Water Company
SAWPA	Santa Ana Watershed Project Authority
SCE	Southern California Edison
SGVMWD	San Gabriel Valley Municipal Water District
SO_4	sulfate
SWP	State Water Project
TCE	trichloroethylene
TDA	Tom Dodson & Associates
TDH	total dynamic head
TDS	total dissolved solids
TEFC	totally enclosed fan-cooled

TM	technical memorandum
TOC	total organic carbon
TVMWD	Three Valleys Municipal Water District
μg/L	micrograms per Liter
UL	Underwriters Laboratory
Upland	City of Upland
UWMP	Urban Water Management Plan
USEPA	U.S. Environmental Protection Agency
VOCs	volatile organic compounds
Watermaster	Chino Basin Watermaster
WEI	Wildermuth Environmental, Inc.
WFA	Water Facilities Authority
WTP	water treatment plant
WVWD	Walnut Valley Water District
WMWD	Western Municipal Water District

1.9 References

References consulted for the Initial DYY Program and Program Expansion are listed below. Many of these references were also used for the facilities development described in Volume II A through J. Agency-specific references are listed, as appropriate in Volume II.

[CBWM, Nov 2007] *CBWM Groundwater Model Documentation and Evaluation of the Peace II Project Description*, Wildermuth Environmental Inc., November 2007.

[CBWM, Jul 2007] *CBWM State of the Basin Report 2006*, Wildermuth Environmental Inc., July 2007.

[CBWM, 2002] *Initial State of the Basin Report*, Chino Basin Optimum Basin Management Program, prepared for Chino Basin Watermaster, Wildermuth Environmental Inc., October 2002.

[CBWM, 2001] *Optimum Basin Management Program - Recharge Master Plan: Phase II Report*, prepared for Chino Basin Watermaster, Black & Veatch, August 2001.

[CBWM, 2000] *Peace Agreement Chino Basin*, prepared for Chino Basin Stakeholders, Hatch & Parent, June 2000.

[CBWM, 1999] *Optimum Basin Management Program - Phase I Report*, prepared for Chino Basin Watermaster, Wildermuth Environmental Inc., August 19, 1999.

[CBWM, 1998] *Chino Basin Recharge Master Plan Phase 1 - Final Report*, prepared for Chino Basin Water Conservation District and Chino Basin Watermaster, Mark J. Wildermuth, Water Resources Engineer, January 1998.

[CDPH, 2008] *Draft Groundwater Recharge Reuse Regulation*, California Department of Public Health, August 5, 2008.

[IEUA, 2008] ACR Permit Application, http://www.ieua.org

[IEUA, 2007] *IEUA's Recycled Water Three-Year Business Plan*, IEUA, December 2007.

[IEUA, 2005] *2005 Urban Water Management Plan*, IEUA, 2005.

[Metropolitan, 1999] Water Surplus and Drought Management Plan, Report No. 1150.

[MJWWRE, 1997] *Final Task 2.2 and 2.3 Report, Describe Watershed Hydrology and Identify Current TDS and TIN Inflows to the Watershed*, Mark J. Wildermuth, 1997.

[SCSC, 1978] *Chino Basin Municipal Water District v. City of Chino, et al.*, prepared for both parties, Superior Court of the State of California for the County of San Bernardino, January 1978.

[USDCJ, 2007] U.S. District Court, Judge Oliver Wanger, NRDC vs. Kempthorne, 2007.

2.0 Chino Basin Area Description

2.0 CHINO BASIN AREA DESCRIPTION

2.1 Overview

This chapter briefly reviews Basin geology and hydrogeology, describes the groundwater management zones, introduces the major agencies and inventories their existing facilities, and Chino Basin groundwater quality is also discussed.

2.2 Geology and Hydrogeology

The Basin was formed when eroded sediments from the San Gabriel Mountains, Chino Hills, Puente Hills, and San Bernardino Mountains filled a structural depression. The formation of the Basin is described in detail in the Final Task 2.2 and 2.3 Report, issued in 1997 [MJWWRE, 1997]. The bottom of the Basin – the effective base of the freshwater aquifer – consists of impermeable sedimentary and igneous rocks. The base of the aquifer is overlain by older alluvium of the Pleistocene period followed by younger alluvium of the Holocene period.

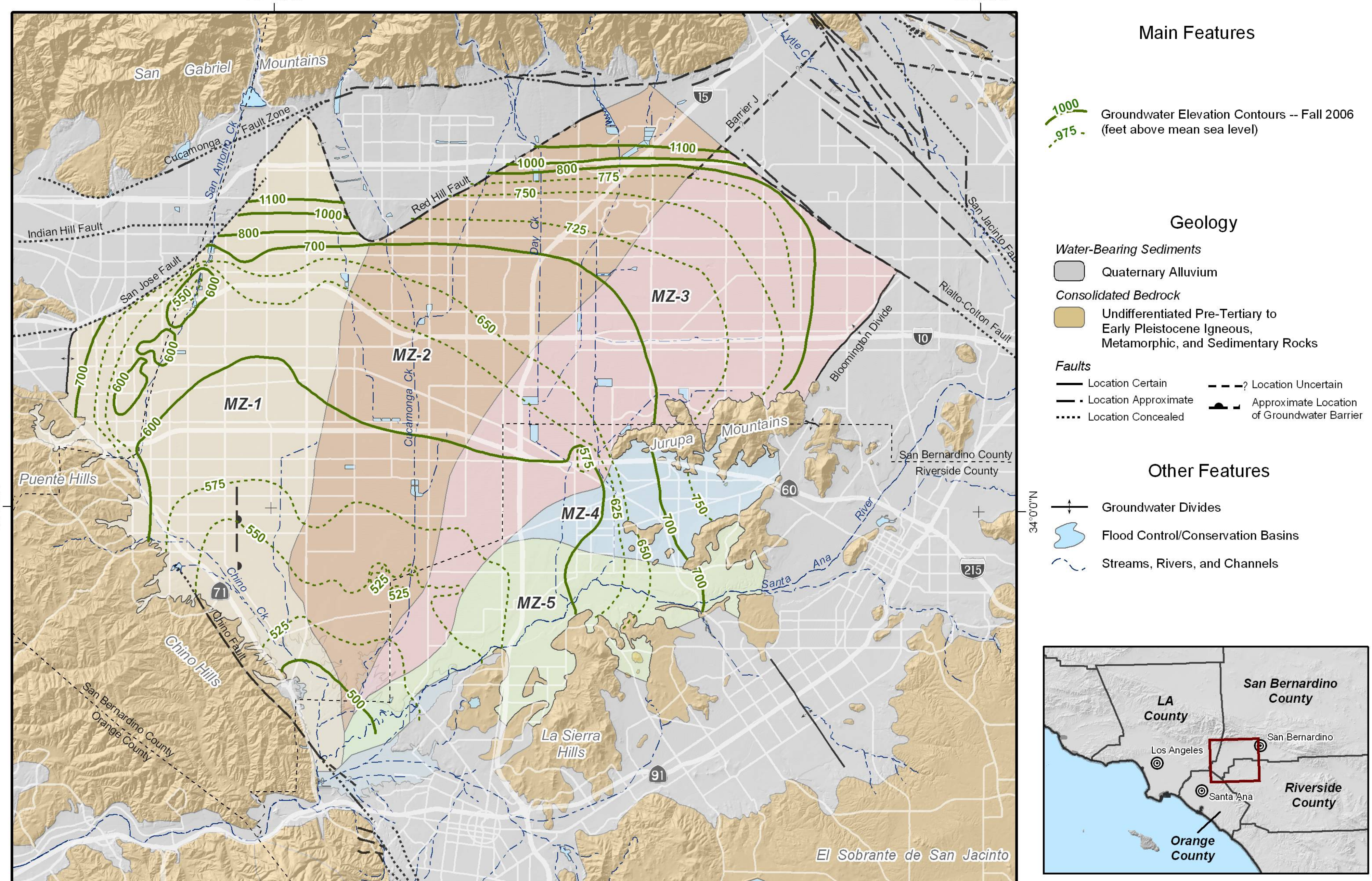
The younger alluvium varies in thickness from over 100 feet near the mountains to just a few feet south of Interstate 10 and generally covers most of the northern half of the Basin in undisturbed areas. The younger alluvium is not saturated and thus does not yield water directly to wells.

The older alluvium varies in thickness from about 200 feet thick near the southwestern end of the Basin to over 1,100 feet thick southwest of Fontana and averages about 500 feet thick throughout the Basin. Well capacities generally range between 500 and 1,500 gallons per minute (gpm). Well capacities exceeding 1,000 gpm are common, with some modern production wells test-pumped at over 4,000 gpm (e.g., Ontario Wells 30 and 31 in southeastern Ontario). In the southern part of the Basin, where sediments tend to be more clayey, wells generally yield 100 to 1,000 gpm.

Faults are one of the principal agents in the development of the landscape and restriction of groundwater flow in the Basin. The Basin is bounded by major fault systems along which the mountains and hills have been uplifted. The faults and groundwater barriers are significant in that they define the external boundaries of the Basin and influence the magnitude and direction of groundwater flow near the boundaries.

2.3 Groundwater Management Zones

The Basin is hydrologically subdivided into at least five groundwater zones or flow systems. Each groundwater zone has a unique hydrology, and water resource management activities that occur in each zone have little or no impact on the other zones. Hence, hereafter, these groundwater zones are referred to as management zones. Figure 2-1 shows the location of the five groundwater management zones, fault and groundwater boundaries, and Fall 2006



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Date: 20081007

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0 1 2 3 4 Miles

0 2 4 6 KM

BLACK & VEATCH Corporation · Inland Empire Utilities Agency · Western Municipal Water District · Three Valleys Municipal Water District · Chino Basin Watermaster

Chino Basin Dry-Year Yield Program Expansion

Fall 2006 Groundwater Elevations and Chino Basin Management Zones

Figure 2-1

groundwater contours. Table 2-1 summarizes the recharge sources for the five zones. These zones are used to characterize the groundwater level, storage, production, and water quality conditions.

Table 2-1
Summary of Recharge Sources for Basin Management Zones

MZ1	Direct percolation of precipitation and returns from irrigation, storm flows and imported water spreading basins, and subsurface inflows from Pomona, Claremont Heights, and Cucamonga Basins.
MZ2	Direct percolation of precipitation and returns from irrigation, storm flows and imported water spreading basins, and subsurface inflows from part of the Rialto Basin.
MZ3	Direct percolation of precipitation and returns from irrigation, storm flows and imported water spreading basins, and subsurface inflows from part of the Rialto Basin.
MZ4	Direct percolation of precipitation and returns from irrigation.
MZ5	Streambed percolation in the Santa Ana River, direct percolation of precipitation and returns from irrigation, and subsurface inflow from the Temescal Basin.

2.3.1 Management Zone 1

Management Zone 1 is bounded on the southwest by the Chino and Puente Hills; on the northwest by the San Jose fault that separates the Basin from the Pomona and Claremont Heights Basins; on the north by the Red Hill fault that separates the Basin from the Cucamonga Basin; and on the east by a flow line that stretches from the southern most edge of the Red Hill fault to Prado Dam.

Groundwater in Management Zone 1 flows generally south with some localized flows to the west in response to groundwater production. The major sources of recharge include direct percolation of precipitation and returns from irrigation, recharge of storm flows and imported water in spreading basins, and subsurface inflow from the Pomona, Claremont Heights, and Cucamonga Basins. Discharge is through groundwater production and through rising groundwater in Chino Creek and the Santa Ana River.

2.3.2 Management Zone 2

Management Zone 2 is bounded on the west by Management Zone 1; on the north by the Red Hill fault that separates the Chino Basin from the Cucamonga Basin; on the northeast by a segment of the Rialto-Colton fault; and on the east by a segment of Barrier J and a flow line extending from Barrier J in a southwesterly direction to a point of convergence with other management zone boundaries near Prado Dam.

Groundwater in Management Zone 2 flows generally in a southwesterly direction in the northern half of the zone and then due south in the southern half of the zone. The major sources of recharge include direct percolation of precipitation and returns from irrigation, recharge of storm flows and imported water in spreading basins, and subsurface inflow from the part of the Rialto

Basin northwest of Barrier J and the Cucamonga Basin. Discharge is mainly through groundwater production and potentially small amounts of rising groundwater in the Prado Basin area.

2.3.3 Management Zone 3

Management Zone 3 is bounded on the west by Management Zone 2; on the northeast by the Rialto-Colton fault that separates the Basin from the Rialto Basin; and on the southeast by the Bloomington divide, Jurupa Hills, and Management Zones 4 and 5. A southwesterly flow line from Jurupa Hills to Prado Dam represents the boundary between Management Zones 3 and Management Zones 4 and 5.

Groundwater in Management Zone 3 flows generally in a southwesterly direction. The major sources of recharge include direct percolation of precipitation, returns from irrigation, and subsurface inflow from the part of the Rialto Basin southeast of Barrier J. Discharge is mainly through groundwater production and potentially small amounts of rising groundwater in the Prado Basin area.

2.3.4 Management Zone 4

Management Zone 4 is bounded on the west by Management Zone 3; on the north by the Jurupa Hills; on the southeast by the Pedley Hills; and on the south by Management Zone 5. Groundwater flows to the southwest. The major sources of recharge include direct percolation of precipitation and returns from irrigation. Discharge is through groundwater production.

2.3.5 Management Zone 5

Management Zone 5 is bounded on the north and west by Management Zone 3; on the east by the Riverside Narrows; and on the south by the La Sierra area and Temescal Basin. The major sources of recharge include streambed percolation in the Santa Ana River, direct percolation of precipitation and returns from irrigation, and subsurface inflow from the Temescal Basin. Discharge is through groundwater production, consumptive use by phreatophytes (deep-rooted plants that obtain water from a permanent ground supply or from the water table), rising groundwater in the Prado Basin area, and potentially at other locations along the Santa Ana River depending on climate and season.

2.4 Major Water-Related Agencies and Facilities

This section presents a summary of the Basin Stakeholders and existing water supply facilities.

2.4.1 Chino Basin Stakeholders

The Basin stakeholders are divided into three major pools: overlying agricultural, overlying non-agricultural, and appropriative. Currently, imported water is delivered to members of the appropriative and overlying non-agricultural pools. The DYY Program Expansion participants include members of the appropriative pool only since most of them receive imported water from Metropolitan and therefore can shift back and forth between imported and groundwater supplies. These members are municipalities, water districts, and water companies which serve residences, small businesses, and landscapes. A complete list of Basin stakeholders from each of the three pools is presented in Table 2-2.

Table 2-2
List of Chino Basin Stakeholders

Overlying Agricultural Pool	
This pool is comprised of numerous individual producers and the State of California Department of Corrections, including the California Institute for Men, California Institute for Women, and the Youth Authority. Current individual representatives are listed under the member portion of "About Watermaster" on the Watermaster website at www.cbwm.org	
Overlying Non-Agricultural Pool	
California Steel Industries (CSI)	Reliant Energy
CCG Ontario, LLC (Catellus)	San Bernardino County, Department of Airports
General Electric Company	Space Center Mira Loma
Mobile Community Management (Swan Lake)	California Speedway
Praxair	Sunkist Growers, Inc.
Vulcan Materials (Calmat Division)	
Appropriative Pool	
Arrowhead Water Company	Monte Vista Water District(1)
City of Chino(1)	City of Norco
City of Chino Hills(1)	City of Ontario(1)
Cucamonga Valley Water District(1)	City of Pomona(1)
City of Fontana	San Antonio Water Company
Fontana Union Water Company	San Bernardino County (Prado Shooting Park)
Fontana Water Company(1)	Santa Ana River Water Company
Inland Empire Utility Agency	Southern California Water Company
Jurupa Community Services District(1)	City of Upland(1)
Niagara bottling Company	West Valley Water District
Marygold Mutual Water Company	Reliant Energy
Nicholson Trust	

Notes:
(1) Participating appropriator in the DYY Program Expansion.
(2) Stakeholders as of September 2008.

After several meetings with Watermaster and the Basin appropriators, the following agencies expressed an interest to participate in the DYY Program Expansion: Chino, Chino Hills, CVWD, JCSD, MVWD, Ontario, Pomona, and Upland. Since some appropriators do not receive imported water directly from Metropolitan, their participation will be possible by subagreement with other retailers. TVMWD and WMWD are also expected to participate through coordination with Basin appropriators. Program participants would increase or decrease imported water purchases at a predetermined amount to meet Program objectives.

2.5 Water Quality

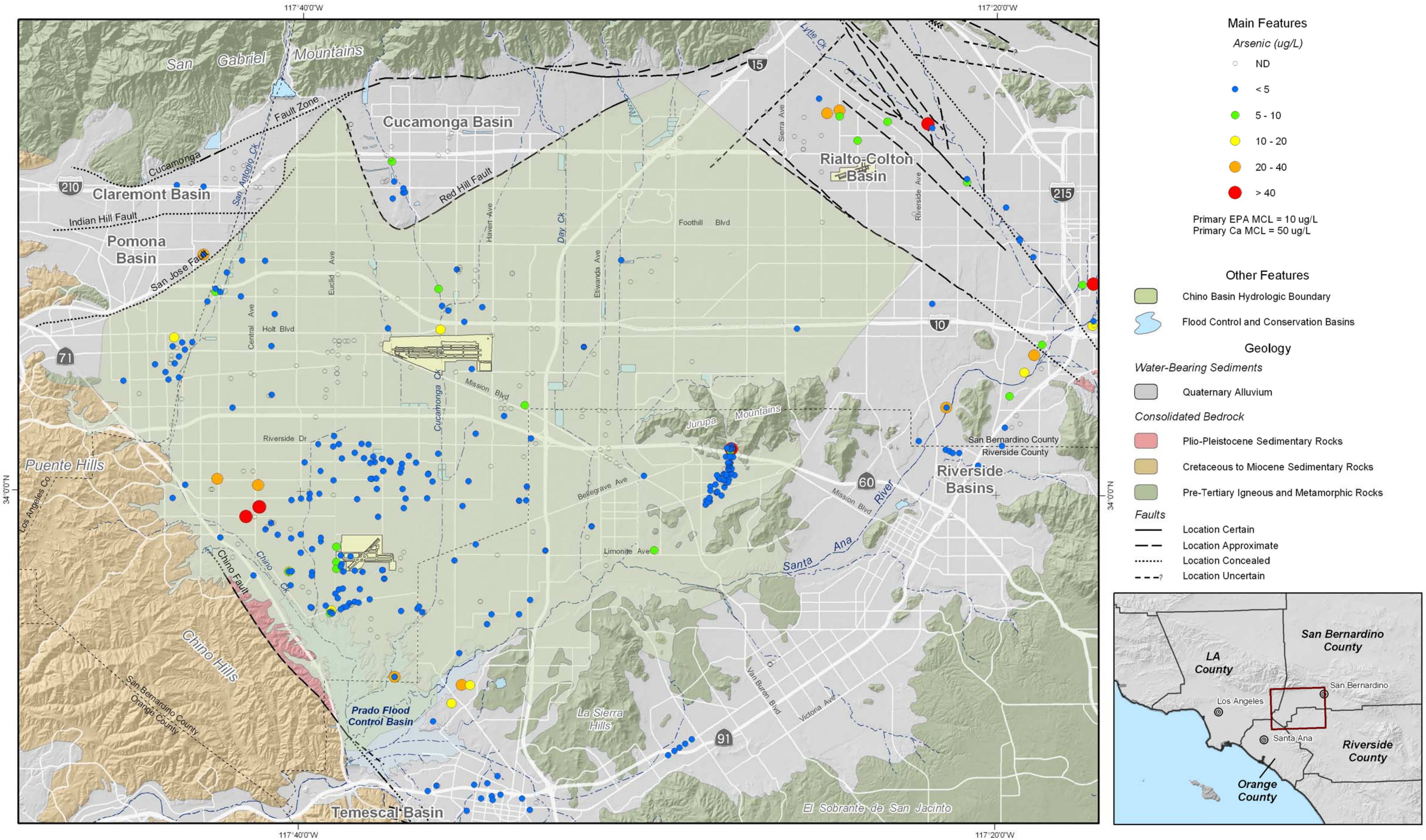
An investigation of groundwater contaminants commonly found at each of the wells was conducted for the Basin [CBWM, 1998]. The five most common constituents found include nitrate (NO_3^-), arsenic (As), perchlorate (ClO_4^-), volatile organic compounds (VOCs), and dibromochloropropane (DBCP).

Starting in 1999, the Comprehensive Monitoring Program initiated the systematic sampling of private water supply wells south of State Route 60 in the Basin. Over a three-year period, Watermaster sampled all available wells at least twice to develop a robust baseline data set. Currently, this program has been reduced to approximately 111 private water supply wells, and about half of these wells are sampled every other year. Groundwater quality samples are analyzed for general minerals and physical properties as well as any regional COPCs (e.g., perchlorate and VOCs in the vicinity of the Ontario International Airport and Chino Airport VOC plumes). This key well monitoring program provides a good representation of the areal groundwater quality in this portion of the basin [CBWM, 2007]. WEI developed a database of this water quality information, which was used to develop maps illustrating the distribution of various contaminants across the Basin. Table 2-3 presents a summary of the concentrations found in the Basin for each of the five constituents and their corresponding maximum contaminant levels (MCLs). The range in concentrations shown for each contaminant was developed from this database. Figures 2-2 through 2-8 present the distribution of arsenic, DBCP, nitrate, perchlorate, total dissolved solids (TDS), Chromium VI, and VOCs in the Basin, respectively.

A Treatment Technology Technical Memorandum (TM) developed by B&V in 2008 identified six contaminants of concern in the Basin and reviewed currently available treatment strategies for removing them from Basin groundwater. The treatment strategies are further described in Chapter 7 of this volume.

Table 2-3
Summary of Constituents Found in the Chino Basin

Constituent (MCL)	Appropriator (Well Nos.)							
	Chino Hills (19)	Chino (3 & 12)	Chino (14)	MVWD (New)	MVWD (2)	MVWD (4 & 27)	Pomona (3,7,8B, 32)	Upland (New)
Arsenic, 10 µg/L								
Min	23	--	2	0.7	--	--	1.7	--
Average	32	--	2	0.7	--	.4	3.7	--
Max	40	--	2	0.7	--	0.7	4.5	--
DBCP, 0.2 µg/L								
Min	--	--	.05	--	--	0.014	--	--
Average	--	0.01	0.06	--	0.01	0.18	--	--
Max	--	0.02	0.08	--	0.02	0.26	--	--
Nitrate, 1.0 mg/L as N								
Min	9	60	59	31	60	40.8	8.2	4.8
Average	10	66	66	43	66	59	56	35
Max	12	78	92	57	78	83	72	47
Perchlorate, 6.0 µg/L								
Min	--	8	6	4	8	--	2	--
Average	--	15	11	6	15	--	9	4
Max	--	18	14	10	18	--	11	6
TDS, 1,000 mg/L								
Min	170	294	290	330	294	--	320	130
Average	177	312	303	330	312	219	350	251
Max	180	324	326	330	324	226	356	290



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0 1 2 3 4 5 Miles
0 2 4 6 8 KM

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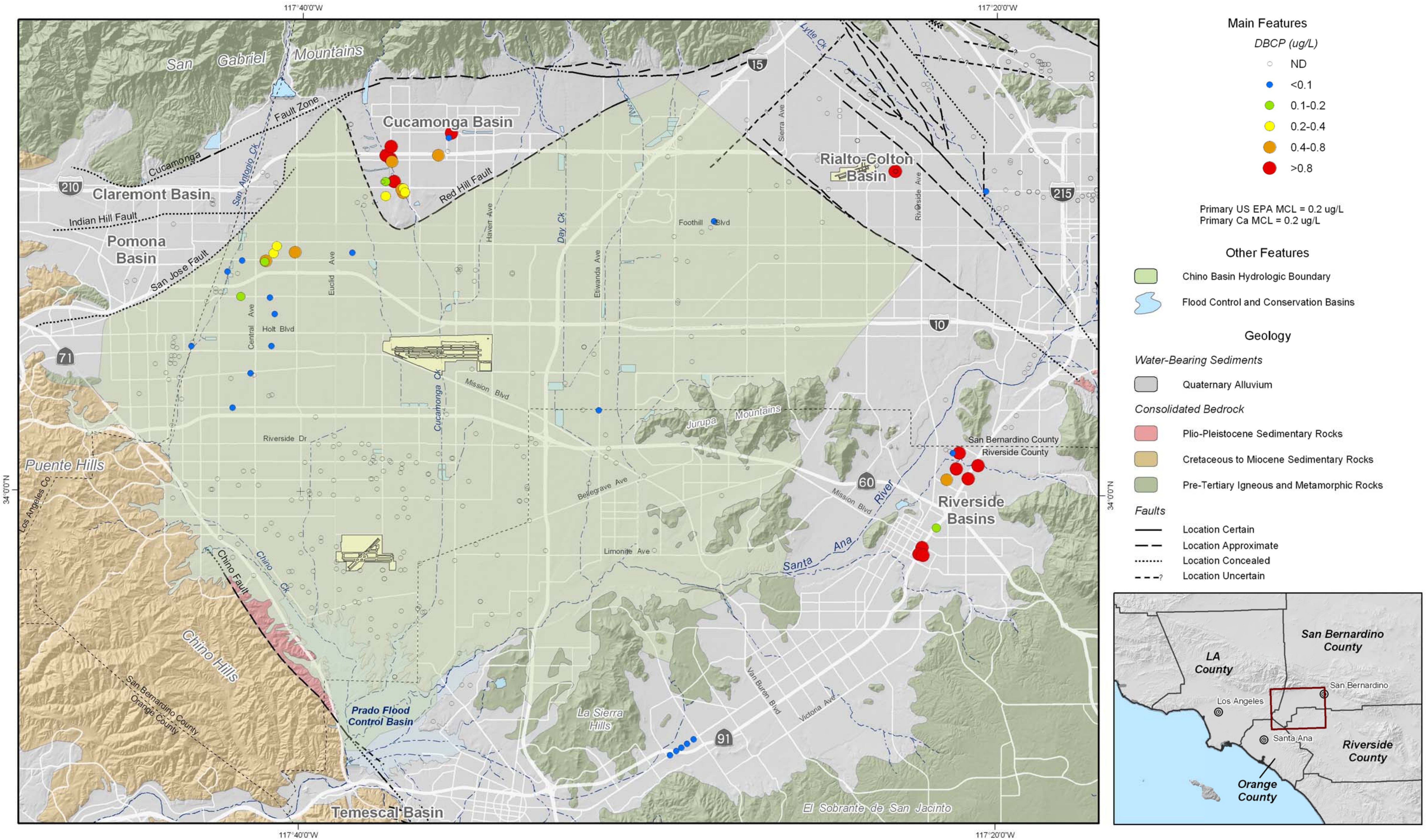
Arsenic in Groundwater

Maximum Concentration (2001-2006)

Figure 2-2



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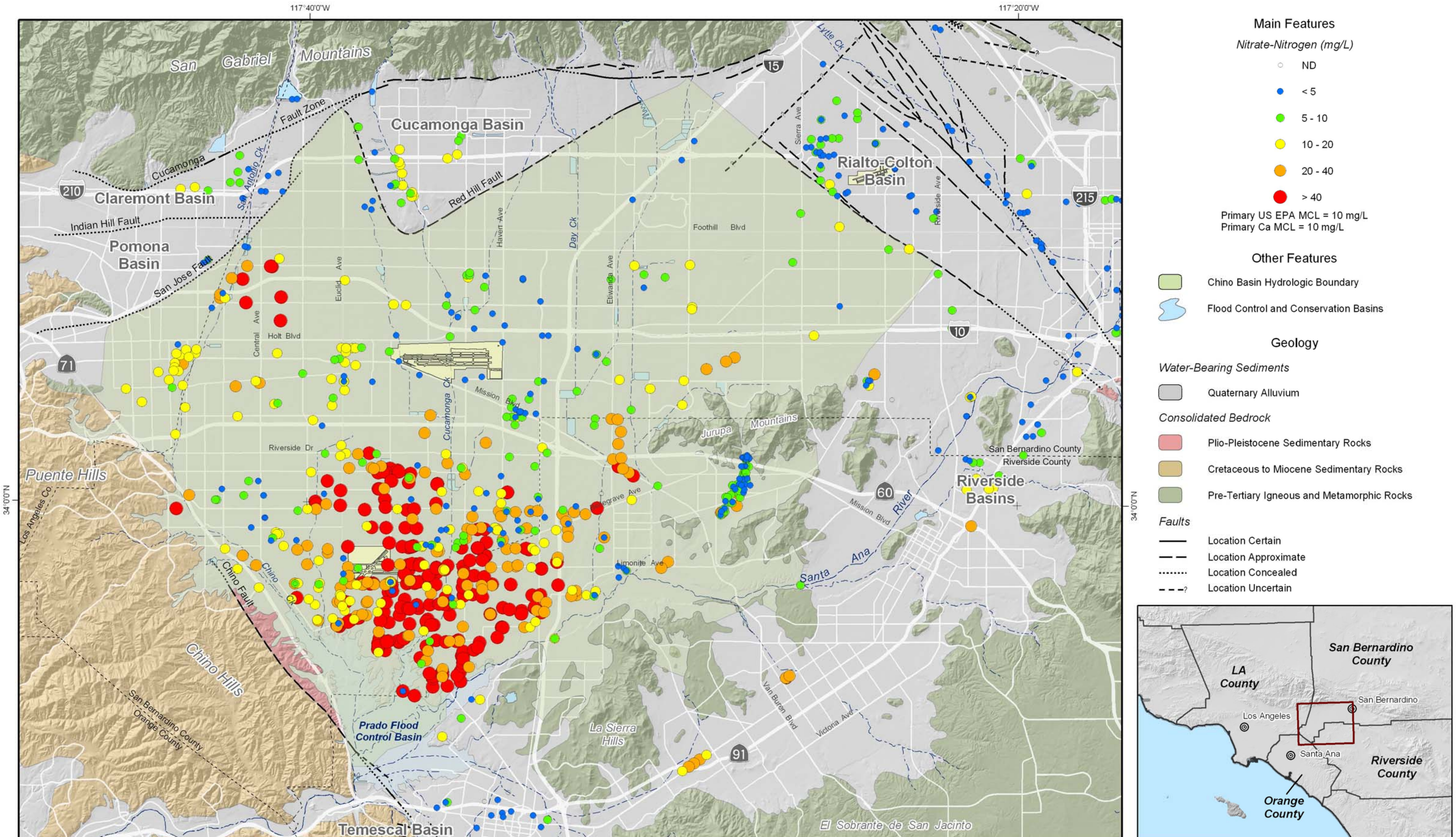
Chino Basin Watermaster

DBCP in Groundwater

Maximum Concentration (2001-2006)

Figure 2-3



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Date: 20080506
File: Figure_Nitrate_as_Nitrogen.mxd

0 1 2 3 4 5 Miles
0 2 4 6 8 KM

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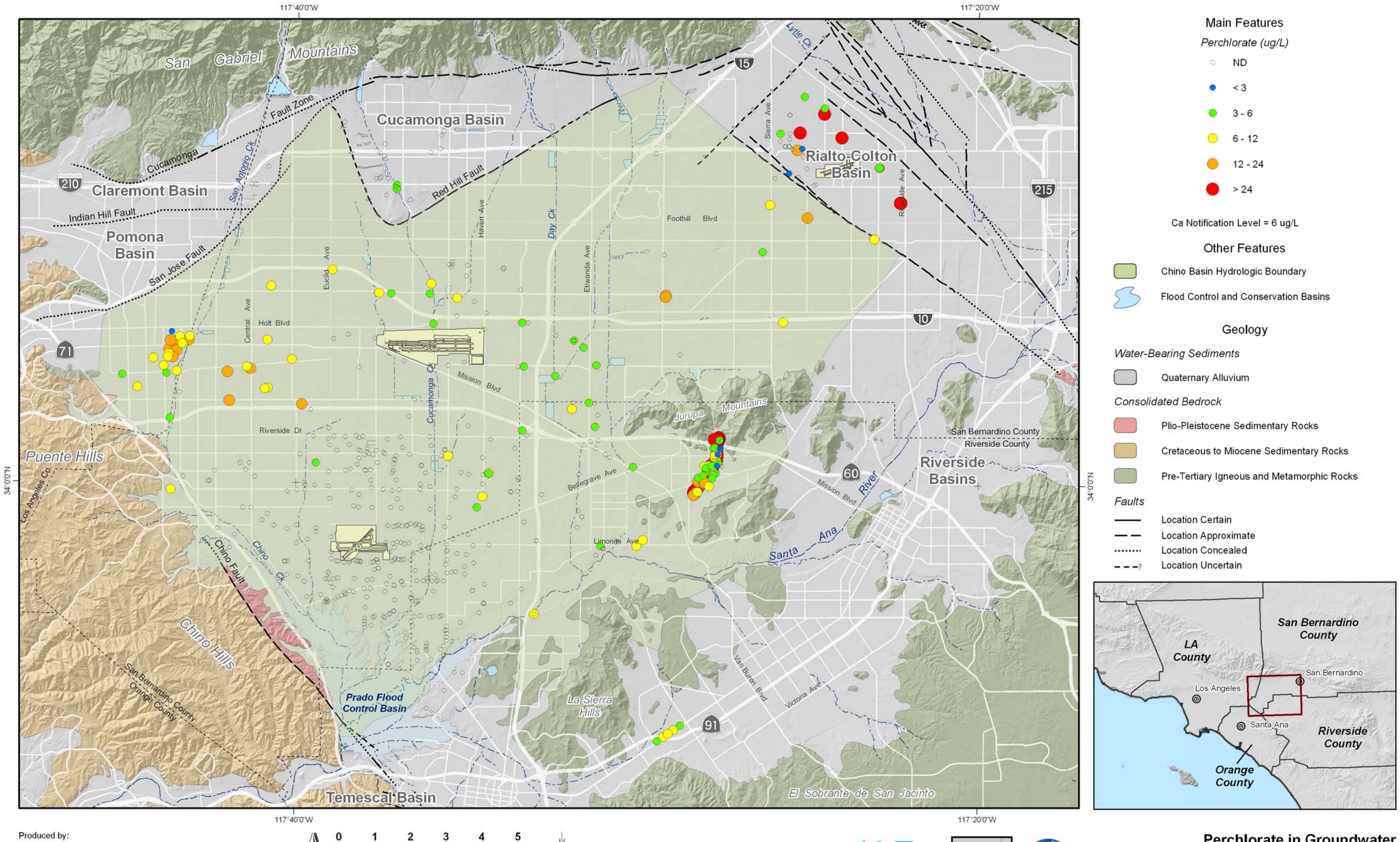
Western Municipal Water District
Three Valleys Municipal Water District
Chino Basin Watermaster

Nitrate as Nitrogen in Groundwater
Maximum Concentration (2001-2006)

Figure 2-4



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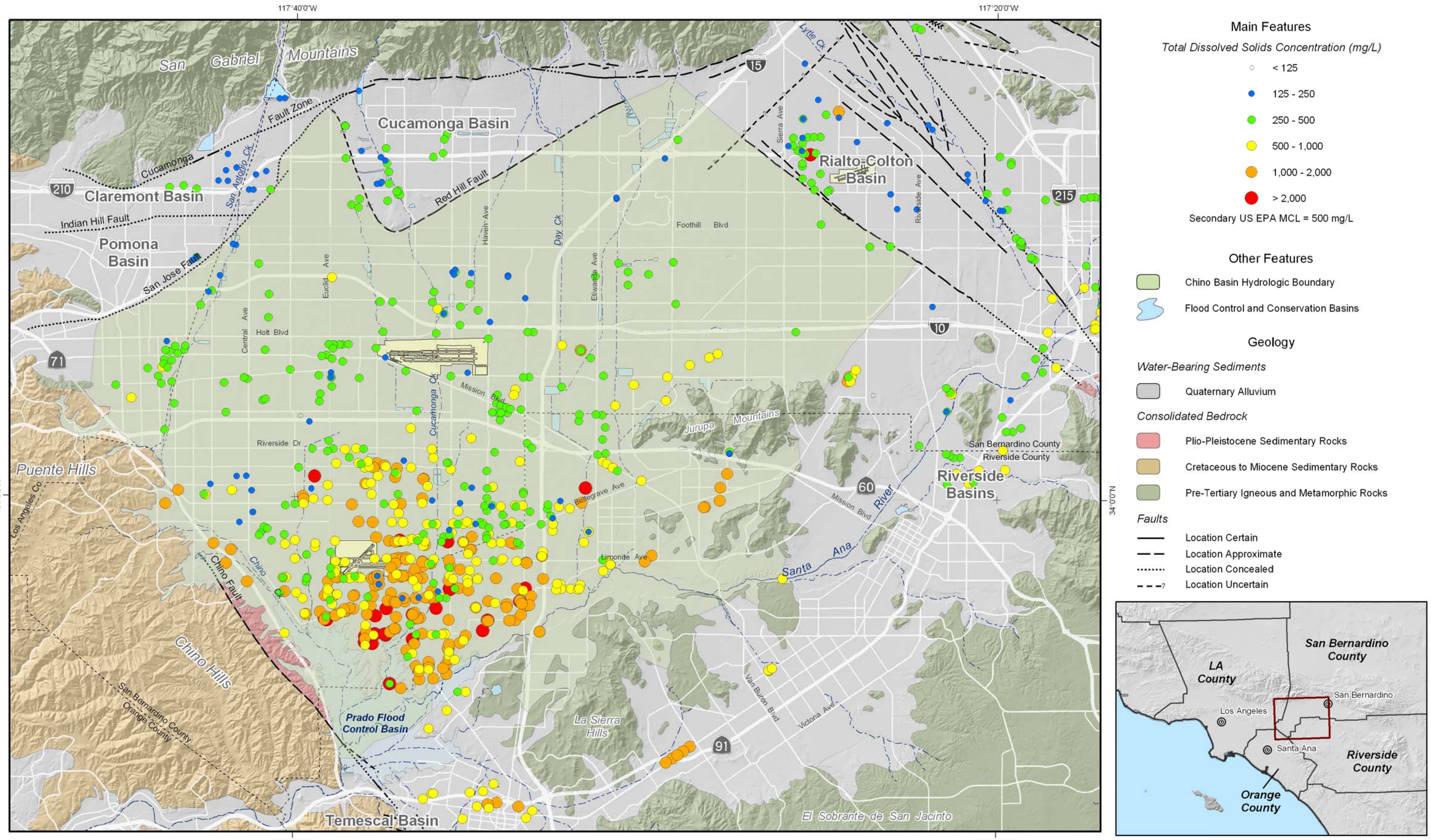
Perchlorate in Groundwater

Maximum Concentration (2001-2006)

Figure 2-5



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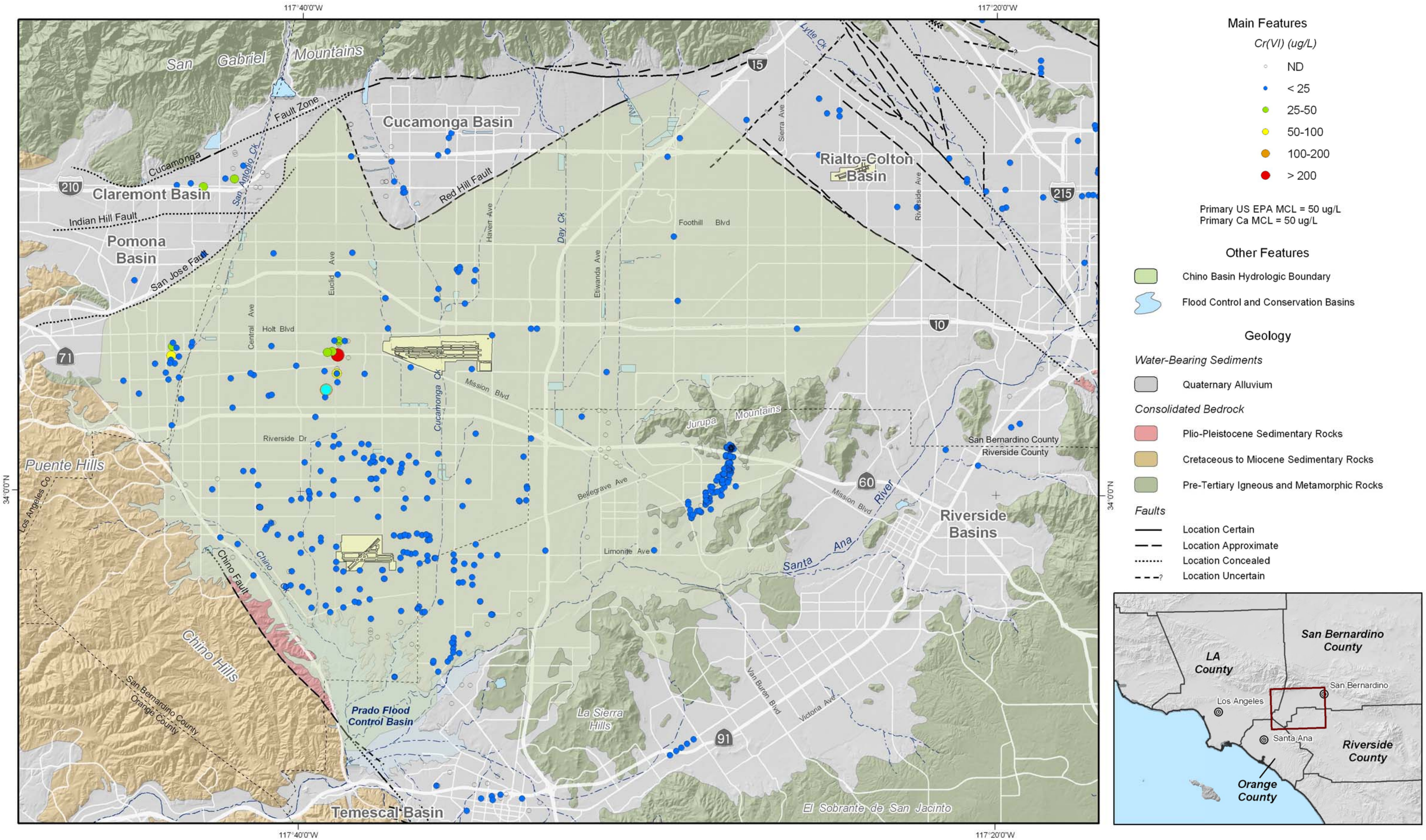
Total Dissolved Solids in Groundwater

Maximum Concentration (2001-2006)

Figure 2-6



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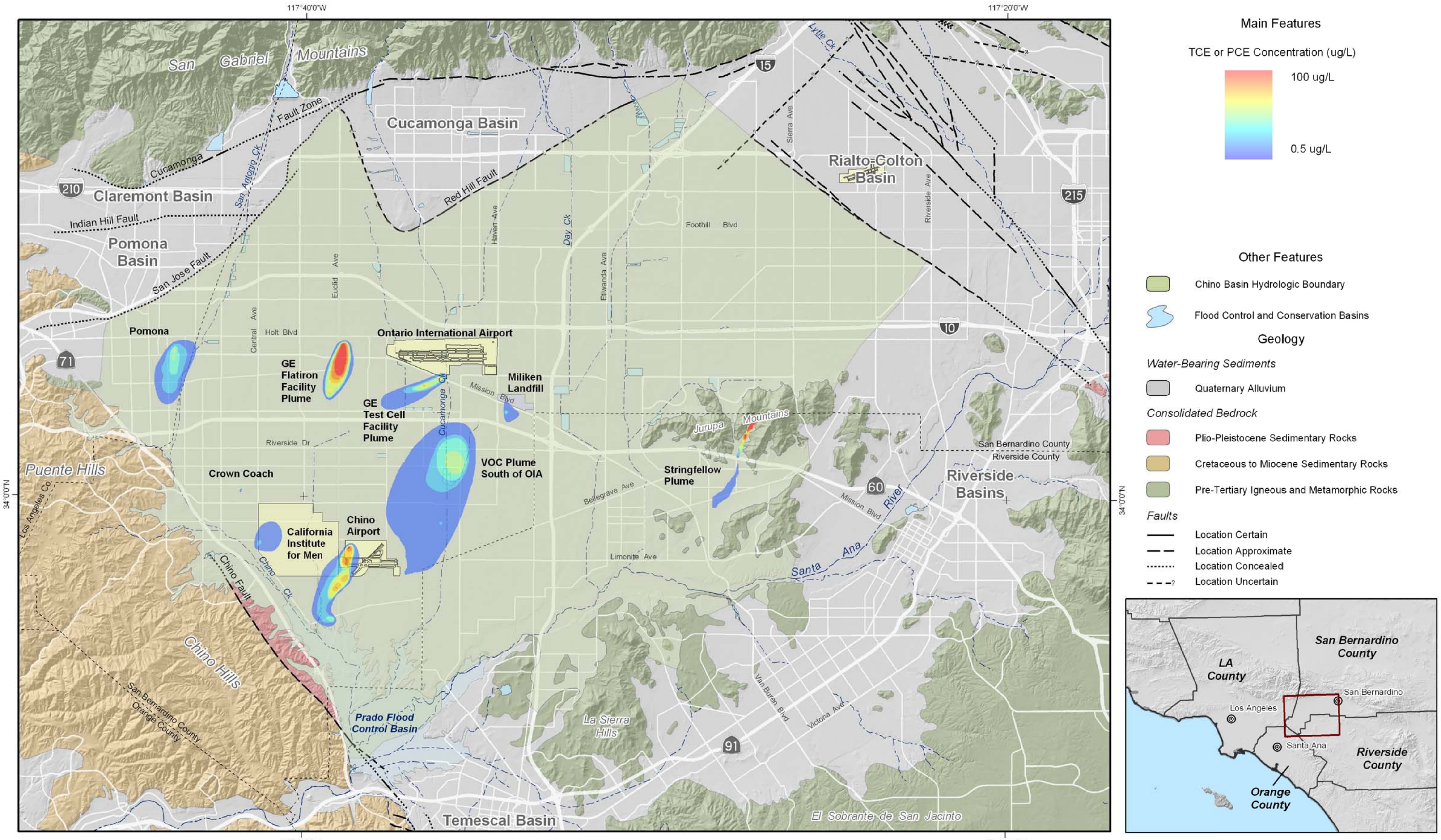
Chromium(VI) in Groundwater

Maximum Concentration (2001-2006)

Figure 2-7



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VOC Plumes in the Chino Basin

Represented by Maximum TCE Concentration (2001-2007) and Approximate Loction of Stringfellow Plumes

Figure 2-8

3.0 DYY Program Size, Constraints, and Institutional Arrangements

3.0 DYY PROGRAM SIZE, CONSTRAINTS, AND INSTITUTIONAL ARRANGEMENTS

3.1 Overview

The objective of the DYY Program Expansion is to increase the amount of groundwater storage and extraction currently established in the Chino Basin through the Initial DYY Program. This chapter presents the size of the DYY Program Expansion, the anticipated constraints, and the arrangements required to allow WMWD and TVMWD to participate in the Program.

3.2 Size of the DYY Program

The purpose of the Program Expansion is twofold: (1) increase Metropolitan's total amount of storage in the Basin and (2) increase Metropolitan's annual dry-year yield from the Basin beyond the initial DYY Program (i.e., annual extractions from their account) to further reduce imported water deliveries from Metropolitan during dry years. Additional facilities would be necessary to accommodate the expansion. The initial DYY Program is a 100,000 acre-ft storage program, and Metropolitan's request is to determine the Basin's ability and requirements to increase the storage to 150,000 acre-ft. Table 3-1 summarizes the history and evolution of the Program Expansion, which could provide additional groundwater for dry-year use on top of the 33,000 acre-ft established by the initial Program.

Table 3-1
Evolution of Chino Basin DYY Program Expansion

Item	Description	Comments
Chino Basin Optimum Basin Management Program (OBMP)	Developed in response to a 1998 court ruling governing water use in the Basin (Chino Judgment). The Judgment was a continuation of a 1978 ruling providing a legal definition for the Basin and establishing a court-appointed Watermaster.	OBMP objectives are to enhance Basin water supplies, protect and enhance water quality, enhance Basin management, and provide equitable financing. Of the OBMP's nine Program Elements, three are applicable to the Expansion Program: Salt Management (7), Groundwater Storage Management (8), and Conjunctive-use (9).
DYY Program	Conjunctive-use program initiated in 2002 among Metropolitan, IEUA, Watermaster, and participating Basin appropriators. IEUA, which manages the distribution of imported water to Basin appropriators, acts as liaison between Watermaster and Metropolitan.	The Program provides for 100,000 acre-ft of water through in-lieu exchange and direct recharge of surplus Metropolitan imported supplies. Water can be "put" into and "taken" out of the Basin at a maximum rate of 25,000 acre-feet per year (afy) and 33,000 afy, respectively.
DYY Program Expansion	Expansion of 2002 DYY Program to produce additional groundwater for dry-year use, in-lieu of imported water.	Each of the participating appropriators will contribute a portion of the additional dry-year yield or necessary "puts" into the Basin.

There are several potential methods for Metropolitan to increase its total storage account in the Chino Basin: (1) allow the account to increase by another 50,000 acre-ft by reducing the number of withdrawals between refills; (2) allow the account to increase by another 50,000 acre-ft by increasing the number of refills between withdrawals; or (3) increase the Basin's replenishment capacity by adding required supplemental water recharge facilities. Planning for additional storage by assuming either reduced dry-year withdrawals or increased wet-year refills is climate dependent and not considered a viable approach in light of Metropolitan's current Drought Allocation Plan and recent assessment of the availability of surplus supplies. Therefore, in order to increase Metropolitan's ability to store additional water in the Basin, this PDR focuses on development of the additional supplemental water recharge and/or additional in-lieu exchange requirements of the Basin appropriators. (Chapter 5 presents a summary of facilities development for the DYY Program Expansion, and Chapter 6 provides further review of Metropolitan's Drought Allocation Plan and assessment of surplus supplies.)

The initial DYY Program developed sufficient facilities to generate a total annual dry-year yield of 33,000 afy. For Metropolitan to increase its annual dry-year yield capacity from the Basin, facilities would be required to produce additional stored groundwater in-lieu of imported water deliveries.

As developed further in Chapter 5, meetings were conducted with each agency at the onset of the Program Expansion to determine the level of interest in potential "put" and/or "take" contributions toward an expanded DYY program. Each agency's proposed potential contributions were evaluated qualitatively based upon the ability of the proposed project to meet Program goals. It should be noted that any proposed DYY Program Expansion contributions developed in this PDR are conceptual only and are non-binding until a formal agreement is in place, which is beyond the scope of this PDR.

The contributions initially developed from each agency's level-of-interest were further refined based upon results of the groundwater modeling conducted by WEI. Both Chapter 6 and Volume III provide additional information on groundwater modeling. Table 3-2 summarizes agencies that expressed a level of interest in participating in the DYY Program Expansion. The combined withdrawal, or "take," capacity of the proposed projects ranges from 15,000 to 17,000 afy. The combined "put" capacity of these projects is approximately 12,300 to 16,800 afy of direct capacity, which does not include additional Basin-wide in-lieu deliveries and surface spreading contributions.

Table 3-2
Summary of Initial and Expanded DYY Program Participants and Proposed Put/Take Capacities

Agency	Initial DYY Program (1)		DYY Program Expansion (2)	
	Put Capacity (afy)	Take Capacity (afy)	Put Capacity (afy) (4)	Take Capacity (afy) (6)
Chino	(3)	1,159	500-1,000	2,000
Chino Hills(5)		1,448	1,800	0
Cucamonga Valley Water District		11,353	4,000-5,000	0
Jurupa Community Services District		2,000	0	2,000
Monte Vista Water District		3,963	3,000-4,000	3,000-5,000
Ontario		8,076	2,000-3,000	0
Pomona		2,000	0	2,000
Upland		3,001	0	1,000
Three Valleys Municipal Water District		0	1,000-2,000	0
Western Municipal Water District		0	0	5,000
Total	25,000	33,000	12,300 – 16,800	15,000 – 17,000

Notes:
(1) Initial 100,000 acre-ft DYY Program includes maximum 25,000 afy “put” over a four-year period of surplus water and a maximum 33,000 afy “take” over a three-year dry period.
(2) DYY Program Expansion includes increases in total storage, “put” capacity, and “take” capacity.
(3) “Puts” for the initial DYY Program are accomplished by a combination of direct recharge and in-lieu deliveries.
(4) Does not include basin-wide in-lieu deliveries and direct recharge.
(5) MVWD assumed Chino Hills’ shift obligation of 1,448 afy per an amendment to the agreement between the agencies dated March 5, 2007.
(6) Post modeling, adjusted take capacities. Refer to Chapter 5, Volume I, and Volume III, Modeling Report, for details.

3.3 Put/Take Mechanisms

As shown in Table 3-2, the put capacity of the initial DYY Program was accomplished either through in-lieu deliveries (pumping groundwater in-lieu of taking imported water) or via direct (wet water) recharge using spreading basins to percolate storm water, imported water, and recycled water into the ground. The initial DYY Program used a significant portion of the Basin’s in-lieu exchange capacity to accomplish the “put.” Therefore, a variety of new put mechanisms would be required to implement the Program Expansion. “Takes” from the Basin occur when appropriators shift from imported supplies to additional groundwater production, recycled water use, increased conservation, or other supplies.

3.3.1 In-Lieu Exchange

The existing 100,000 acre-ft DYY Program consists of "puts" and "takes" where Metropolitan, in consultation with Watermaster and IEUA, makes surplus imported water available to the Basin that appropriators can use in-lieu of pumping groundwater. This in-lieu exchange builds up Metropolitan's storage account within the Basin for future use. When Metropolitan makes a call during a dry year, the appropriators participating in the DYY Program reduce their demand for imported water and make up the difference by producing more groundwater. This change in operation is also referred to as an agency's "shift obligation," as the agency is required to shift from imported supplies to groundwater during a dry year. This method of in-lieu delivery allows Metropolitan to serve the imported water not delivered to the Basin to other Metropolitan member agencies or retail agencies outside of the Basin that do not have other facilities to rely upon in dry years, such as unimpaired groundwater wells or treated water for blending purposes.

The 25,000 afy "put" capacity for the existing DYY Program is largely accomplished via in-lieu. Several of the appropriators participating in the current DYY Program expressed concern about taking on additional shift in the Program Expansion, since increasing an agency's shift obligation requires reducing imported deliveries during dry years even further, which could result in system constraints. Approximately 12,300 to 16,800 of the "put" capacity will need to be accomplished via other alternatives such as wet water recharge or ASR wells. The balance of the "put" term would be made up by in-lieu.

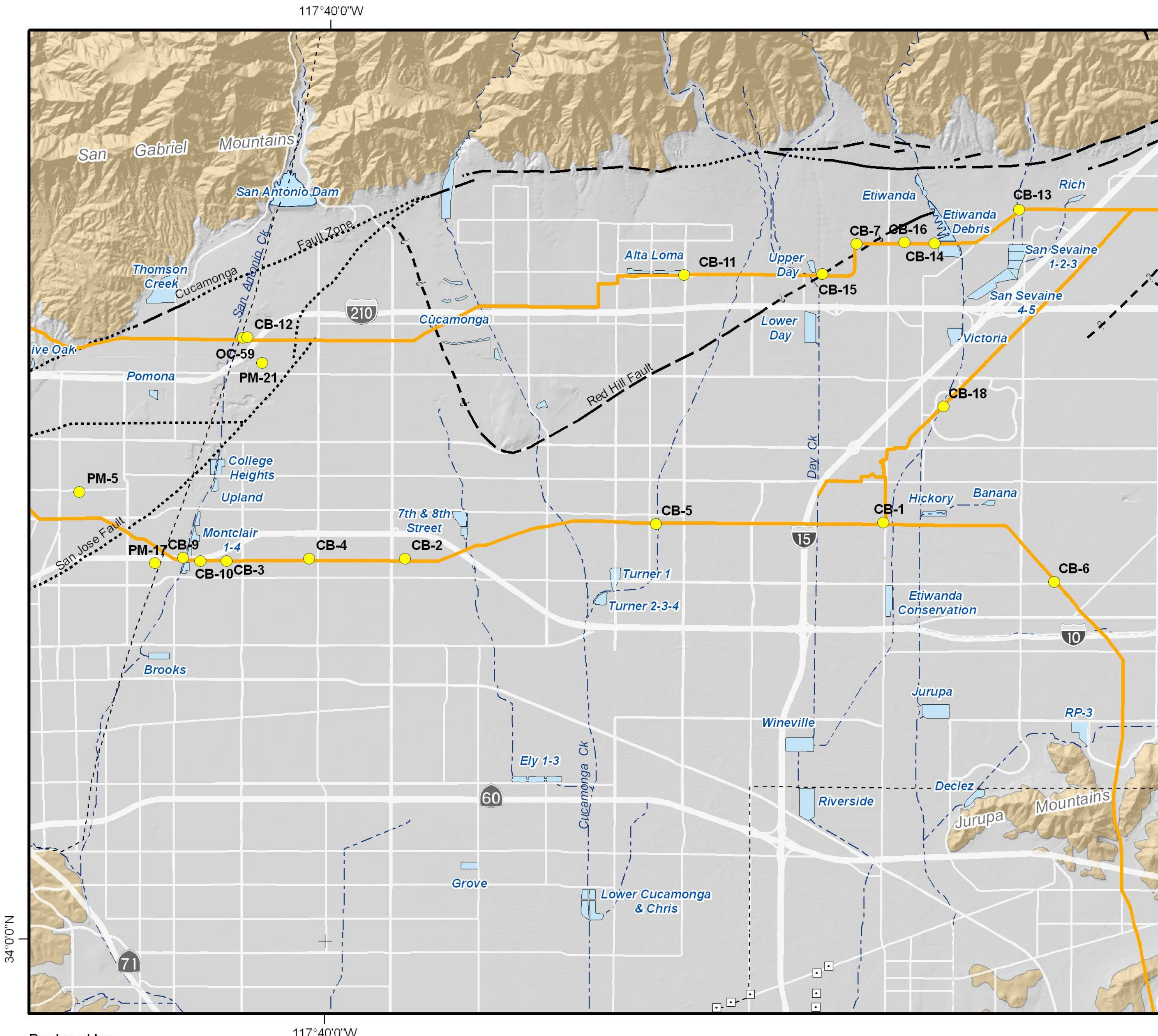
3.3.2 Direct Recharge

Water used for direct recharge could come from three different sources: storm water, imported water, and recycled water. Storm water and imported water are considered the primary sources of recharge supplies. The quantity of recycled water that is permitted to be used for recharge in the Basin is governed by guidelines provided by the California Regional Water Quality Control Board (RWQCB) and CDPH and is dependent on the volume of storm and imported water available for recharge. Figure 3-1 presents a location map for the recharge facilities in the Chino Basin. Table 3-3 presents a summary of direct recharge in the Basin. Figure 3-2 is a graphical representation of the recharge data.

Table 3-3
Summary of Recent Annual Direct Recharge in the Chino Basin [1]

Recharge Source Water	2001/02	2002/03	2003/04	2004/05	2005/06	2006/07
Imported Water	6,500	6,499	10,204	12,257	34,549	32959.8
Storm Water	5,889	6,517	6,012	18,434	12,940	4,745
Recycled Water	505	185	48	158	1,303	2,993
Total Recharged	**12,894**	**13,201**	**16,264**	**30,849**	**48,792**	**40,698**

Notes:
(1) Recharge data provided by WEI, 2008.



Main Features

Recharge Basins

Imported Water Facilities

Service Connection/Turnout

Imported Water Pipeline

Geology

Water-Bearing Sediments

Quaternary Alluvium

Consolidated Bedrock

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

Faults

Location Certain

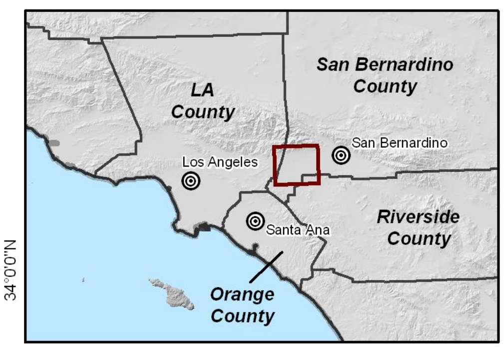
Location Approximate

Location Uncertain

Location Concealed

Other Features

Streams, Rivers, and Channels



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Location of Groundwater Recharge and Imported Water Facilities

Figure 3-1

Figure 3-2
Direct Recharge in the Chino Basin for FY 2001/02 through 2006/07

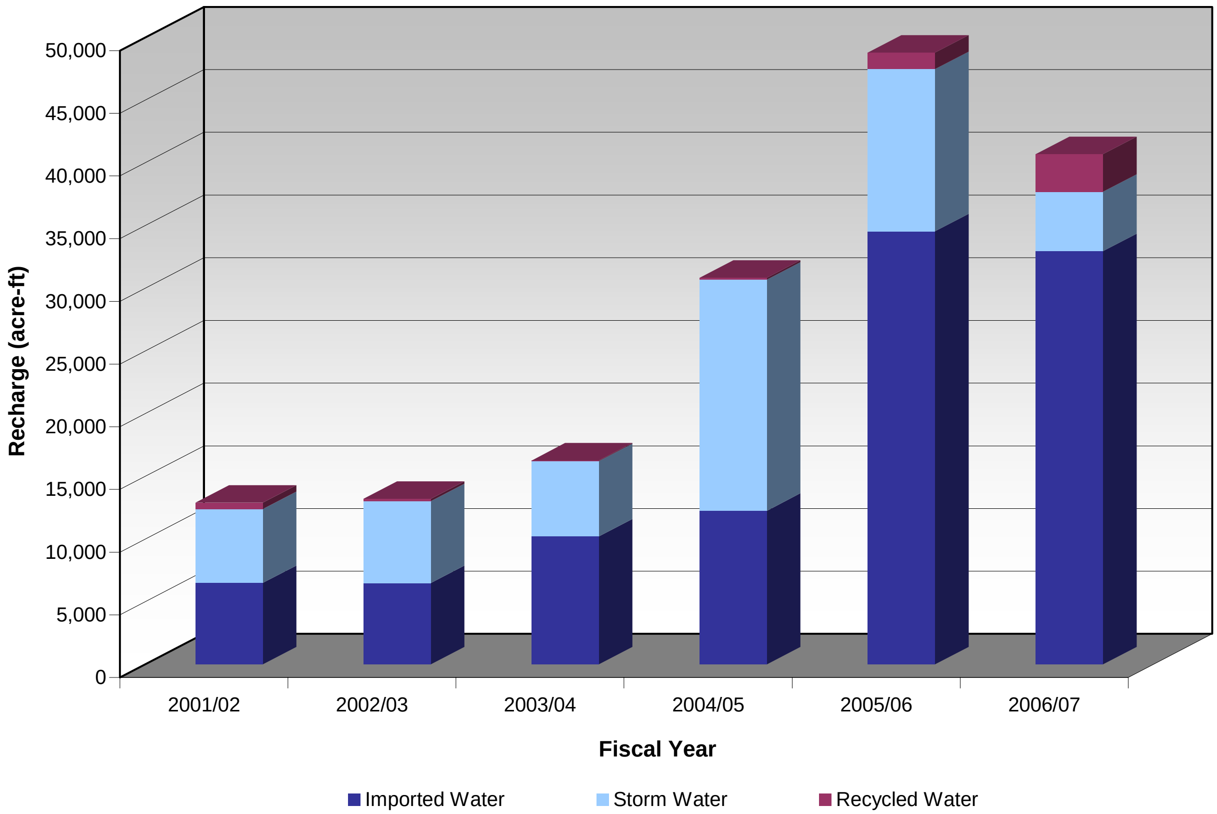


Table 3-4 summarizes the recharge capacity of the Basin. As shown in the table, there are 22 recharge facilities that can recharge various combinations of storm water and supplemental water. Supplemental water refers to both imported water and recycled water supplies. The total storm and supplemental recharge capacity of the Basin is approximately 115,800 afy. The assumed operational flexibility of the recharge facilities are: full (i.e., 100 percent) during the months of May through July, partial (i.e., 70 percent) during the months of October through April, and offline (i.e., 0 percent) during the months of August and September.

This total recharge capacity reflected in Table 3-4 represents the average annual storm flows into the Basin and the supplemental water recharge *capacity*. The reliability of imported supplies (currently 30 percent, see Chapter 6) and allowable blending contribution for recycled water (current maximum of 50 percent, see Section 3.3.2.3) reduce the recharge capabilities of the Basin. This effective recharge capacity of the Basin can be considerably less than the actual capacity. Based on preliminary discussions with WEI and CBWM, the effective recharge capacity of the Basin is likely fully allocated for Basin replenishment obligations resulting from over-production. Therefore, it is likely that the DYY Program Expansion may not be able to rely on the direct recharge capacity of the Basin to accomplish the “puts.” The recharge capacity of the Basin will be evaluated further during the Recharge Master Plan Update effort, currently underway and administered through the CBWM.

Table 3-4
Summary of Basin Storm and Supplemental Water Recharge Capacity

Recharge Facility	Average Annual Storm Water Recharge Capacity (afy) [(1)]	Estimated Supplemental Water Recharge Capacity (afy) [(1) (2) (3) (4)]
Brooks Street Basin	1,710	2,366
College Heights Basins	0	7,098
Montclair Basin Nos. 1-4	1,120	18,928
Seventh and Eighth Street Basins	510	2,366
Upland Basin	580	9,464
Ely Basins	500	2,366
Etiwanda Spreading Area/Debris Basin	500	2,839
Hickory Basin	780	2,366
Lower Day Basin	1,090	4,732
San Sevaine Basin Nos. 1-3	1,810	28,392
San Sevaine Basin Nos. 4-5	630	
Turner Basin Nos. 1-4	400	2,839
Victoria Basin	1,045	2,839
Banana Basin	410	3,097
Declez Basin	80	5,004
IEUA RP3 Ponds	665	9,257
Total	**11,830**	**103,953**

Notes:
(1) Data from WEI, 2008, based on Table 7-4 [CBWM, Nov. 2007]. Supplemental water recharge capacity updated per discussions with IEUA.
(2) Assumed operational flexibility: full (100 percent) May through July; partial (70 percent) October through April; and offline (0 percent) August and September.
(3) Supplemental water includes imported and recycled water.
(4) Effective recharge capacity of Basin less than amounts shown. Effective recharge capacity considers reliability of imported supplies (currently 30 percent, see Chapter 6) and recycled water blending contribution (up to 50 percent, see Section 3.3.2.3).

3.3.2.1 Storm Water

Due to projected changes in land use and flood control improvements over the years, the availability of storm water for recharge has decreased. The gradual conversion of agricultural land use to developments and commercial uses reduced the amount of irrigation return flows to the Basin. The precipitation-runoff relationship is directly affected by an increase in imperviousness in the watershed due to urbanization and improvement in drainage systems. In addition, flood control projects implemented to capture runoff and convey it to the Santa Ana River have reduced the amount of runoff that would percolate into the Basin through the stream channels and flood plains.

In an effort to regain the benefit of stormwater runoff, several improvements were made in 2003 including installation of rubber dams in the concrete-lined channels to divert runoff to spreading grounds rather than sending it to the Santa Ana River. Opportunities exist to offset the volume of stormwater runoff lost to urbanization and flood control improvements, thus providing a cost-effective way to recharge the Basin.

3.3.2.2 Imported Water

Imported water for direct recharge is coordinated with Metropolitan's Member Agency, IEUA. Metropolitan provides imported water to Southern California through the Department of Water Resources (DWR) State Water Project (SWP) and the Colorado River Aqueduct (CRA).

State Water Project
The SWP is the nation's largest state-built water development and conveyance facilities. Lake Oroville in Northern California captures Sierra snowmelt for release through natural channels and travels to the Sacramento-San Joaquin Delta. The 444-mile California Aqueduct begins at the southern portion of the Delta. The mainstem of the Aqueduct flows through the Central Valley and then travels up and over the Tehachapi Mountains. At the bottom of the mountains, the Aqueduct bifurcates into two branches: West Branch (serving Los Angeles, Orange, and San Diego Counties) and East Branch (serving Riverside and San Bernardino Counties). SWP water is delivered to the Basin through the Rialto Pipeline that flows east to west along the northern portion of the Basin. Artificial recharge from the designated replenishment connections to the Rialto Pipeline for the Basin has occurred through the Watermaster since the Basin was adjudicated.

When available, imported SWP water can be diverted into recharge basins via existing channels and turnouts. Capacity to recharge imported water is limited by percolation rates and Metropolitan connection capacities. Due to the time of year when most precipitation occurs in Southern California (December to March), a potential conflict exists with the availability of the recharge basins that are also used to recharge imported water, since replenishment water from Metropolitan is often available during the same winter months. Therefore, it is possible that water could be lost if the combination of imported water and storm water flows exceeds the capacities of a basin. As imported water reliability decreases and cost increases due to changes in climate and precipitation, other sources of artificial recharge, such as recycled water, may be required.

Colorado River Aqueduct
The CRA is a 242-mile aqueduct which diverts water from the Colorado River at Lake Havasu on the California-Arizona border west across the Mojave and Colorado Deserts to the east side of the Santa Ana Mountains. The CRA terminates at Lake Mathews in western Riverside County, where water is then distributed to Metropolitan's member agencies via the Upper Feeder. The CRA consists of two reservoirs, five pumping plants, 63 miles of canals, 92 miles of tunnels, and 84 miles of buried conduit and siphons. CRA water is essentially no longer used in the Basin due to high concentrations of TDS, which make it difficult for wastewater treatment plants to comply with discharge requirements in their National Pollutant Discharge Elimination System (NPDES) permits [CBWM, 2001].

3.3.2.3 Recycled Water

Recycled water is available in the region for recharge. Use of recycled water is governed by the RWQCB and the CDPH. The RWQCB issues the necessary permits for IEUA to produce and distribute recycled water to its member agencies. RWQCB enforces Title 22 regulations set forth by CDPH, and self-monitoring is required to ensure water quality standards are being met. Data from daily monitoring is compiled by IEUA into reports subsequently filed with the RWQCB.

Table 3-5 summarizes recycled water sources within the Basin. The facilities operated by IEUA provide the best source of recycled water for groundwater recharge due to the conveyance facilities in place and proximity to the recharge basins. The total capacity of wastewater currently produced by IEUA's facilities is 60 mgd (67,200 afy) with potential expansion to 85 mgd (95,200) by 2035. The IEUA 3-year Business Plan released in the summer of 2007 states that the recycled water production is expected to increase from approximately 12,000 acre-ft in 2007 to 50,000 acre-ft by 2010. Of the 50,000 acre-feet, the goal is to utilize 35,000 acre-ft for direct use and 15,000 acre-ft for recharge into the Basin [IEUA, 2007].

Table 3-5
Potential Sources of Recycled Water

Agency	Facility(1)
LA Sanitation District	Pomona Water Reclamation Plant
IEUA	Regional Plant 1
	Regional Plant 2
	Regional Plant 4
	Carbon Canyon Water Reclamation Plant
	Regional Plant 5(2)
City of Upland	Upland Hills Water Reclamation Plant
CA Institute for Men at Chino	CIM Water Reclamation Plant
Jurupa Community Services District	Indian Hills Water Reclamation Plant

Notes:
(1) While additional facilities capable of contributing recycled water to the Basin may exist, the plants operated by IEUA provide the best potential source for groundwater recharge.
(2) RP-5 currently under construction.

Due to water quality concerns, CDPH has developed a comprehensive set of regulations governing the use of recycled water for groundwater recharge. The latest Draft Groundwater Recharge Reuse Regulation was released on August 5, 2008. A summary of regulations that may apply to the use of recycled water in the Basin are summarized in Table 3-6. An important criterion is the maximum recycled water contribution (RWC) that limits the amount of recycled water to 50 percent of the total water being recharged. In other words, the recycled water must be blended 50/50 with another source for recharge. The RWC is calculated on the total volume of recycled municipal wastewater and dilution water for the preceding 60 calendar months [CDPH, 2008].

Table 3-6
Summary of CDPH Regulations for Recycled Water Recharge(1)

Maximum recycled water contribution (RWC) to total water recharge	Maximum 50%
Retention time underground prior to extraction	6 months
Maximum total nitrogen concentration(2)	5 or 10 mg/L
Minimum Monitoring Requirements	Two samples prior to operation 1 sample per quarter thereafter

Notes:
(1) This summary is not inclusive of all CDPH regulations on recycled water. This table presents the key criteria from the Draft Groundwater Recharge Reuse Regulations dated August 5, 2008.
(2) As per Section 60320.020, three methods for nitrogen sampling are acceptable. To determine which method is appropriate, agencies should contact CDPH.

In addition, the use of high-TDS water for recharge would exceed the 2004 Basin Plan Amendment which includes two sets of TDS objectives: anti-degradation objectives that ranged between 280, 250 and 260 mg/L for MZs 1, 2, and 3, respectively; and a maximum benefit-based TDS objective of 420 mg/L for the Chino North Management Zone, which consists of almost all of Management Zones 1, 2, and 3. Under the maximum benefit-based objective, the new TDS concentration limit for recycled water that is to be used for recharge and other direct uses is 550 mg/L as a 12-month average. This discharge requirement has been incorporated into IEUA's NPDES permits for its wastewater treatment facilities. [CBWM, July 2007].

3.3.3 ASR or Injection

A third mechanism for putting water into the Basin for storage is through the use of ASR or injection wells. An ASR well is a water management strategy that consists of injection of treated water through the well for storage in a confined aquifer system and later recovery up through the same well. A benefit of using an ASR well over a spreading basin is the comparatively smaller footprint that can make an ASR project more cost-effective to construct. In addition, the groundwater surrounding an ASR well can improve over time due to the cycles of "puts" and "takes" that inject better quality water into the ground. An injection well is similar to an ASR well, but without the ability to extract.

Due to the constraints on available in-lieu capacity of the Basin and the high cost of land in the area for construction of new spreading basins, the direct "puts" for the Program Expansion are assumed to be achieved through ASR and injection facilities. The design of ASR and injection facilities is further described in Chapter 8 of this volume. Agency-specific projects that include ASR and injection wells are described in Volume II.

3.4 Institutional Arrangements Required to Include TVMWD and WMWD as Participants

The initial DYY Program included Basin appropriators who have rights to produce groundwater from the Basin. In an effort to expand the program from 100,000 acre-ft to 150,000 acre-ft, the participation of outside agencies would be required. Two neighboring Metropolitan member agencies expressed interest in participating in the DYY Program Expansion: TVMWD and WMWD. Facilities required for TVMWD and WMWD participation are described in detail in Volume II I and J, respectively, and shown on Figure 3-3.

3.4.1 TVMWD Participation

TVMWD, located on the east side of the Basin, serves the Southeast region of Los Angeles County with water from Metropolitan via the SWP. TVMWD provides wholesale water to the cities of La Verne, Covina, Pomona, Glendora, and Rowland and Walnut Valley Water Districts. Water is also served to customers in Azusa, La Puente, Claremont, Diamond Bar, San Dimas, Walnut, Industry, West Covina, as well as California State Polytechnic University, Pomona, Mount San Antonio College, and the Firestone Reservation. TVMWD currently supplies approximately 68,000 acre-ft of water annually to its customers. The water is comprised of both treated and untreated water in the service area from various sources.

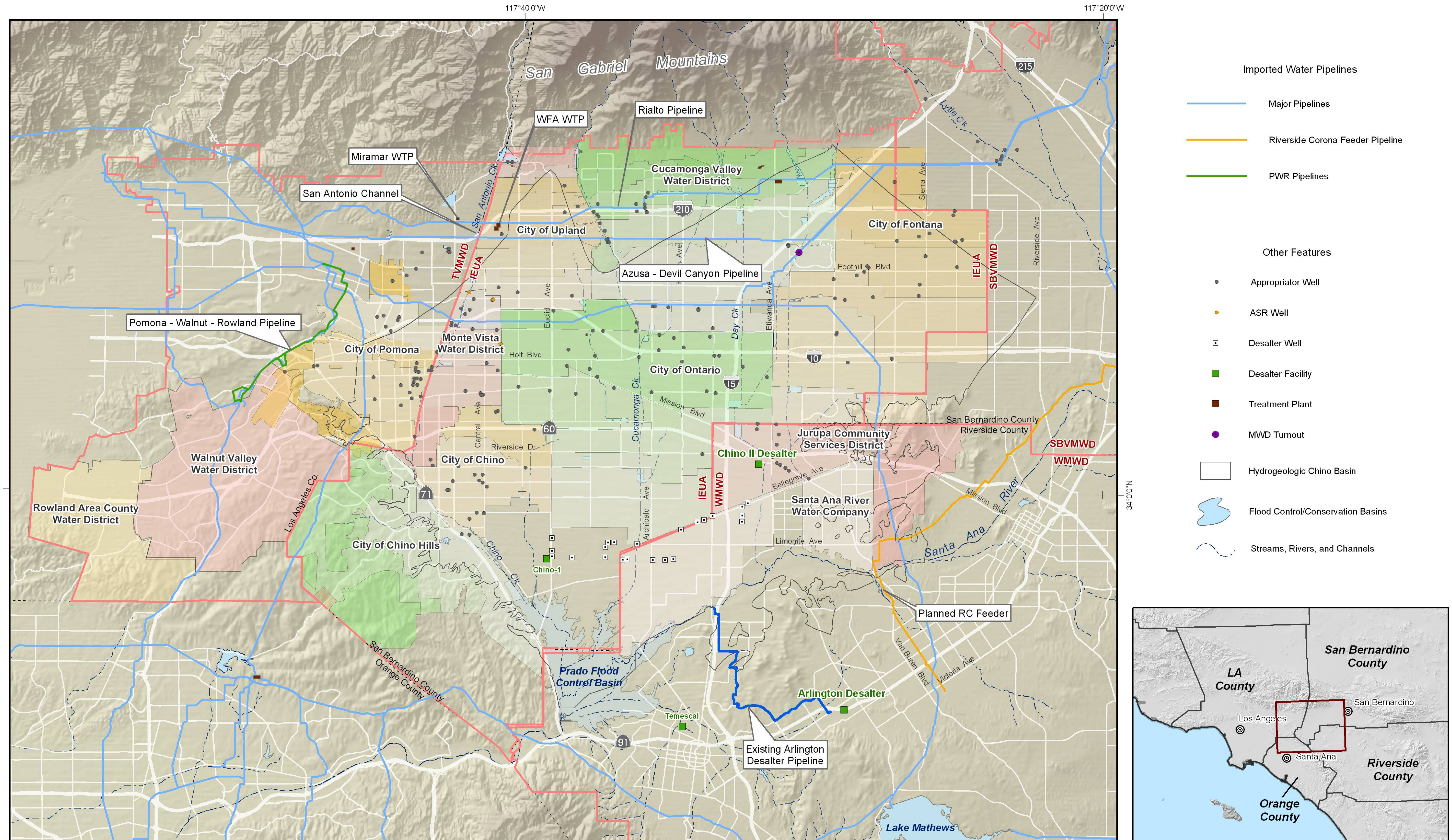
In addition to importing water from Metropolitan's Weymouth WTP, TVMWD owns and operates the 25 mgd Miramar WTP, which treats surface water imported via Metropolitan's Rialto Pipeline. TVMWD is also a member agency of the Six Basins Watermaster which, similar to the Chino Basin Watermaster, monitors the health of Six Basins including the Canyon, Upper and Lower Claremont Heights, Pomona, Live Oak, and Ganesha Basins.

TVMWD is an ideal agency to participate in the Program Expansion since it supplies imported water to Pomona, a Basin appropriator, and also treats water from the Rialto Pipeline at the Miramar WTP. Both of these arrangements provide potential opportunities to reduce imported water deliveries during dry years and increase imported water deliveries during wet years. A detailed description and conceptual design of TVMWD's proposed facilities are included in Volume II I.

3.4.2 WMWD Participation

WMWD serves western Riverside County with water from both the Colorado River and the SWP. A small portion of water is also received from the City of Riverside (Riverside). WMWD provides wholesale water to the cities of Corona, Norco, and Riverside and the water agencies of Elsinore Valley and Rancho California. Water is also served to customers in the unincorporated areas of El Sobrante, Eagle Valley, Temescal Creek, Woodcrest, Lake Mathews, and March Air Force Base. WMWD sells over 90,000 acre-ft of water annually to its customers identified above based upon 2005 data. The water is comprised of both treated and untreated water in the service area from various sources. The treated water portion accounts for about 60 percent of the total water supplied by WMWD, and the remaining amount is untreated or raw water.

WMWD's participation in the DYY Program Expansion would provide a direct export connection to the Chino Basin. WMWD's water resources planning includes enhancing its own dry-year supplies, and its primary role would be participation on the extraction, or "take" side, of the DYY Program Expansion. WMWD's point of connection to the Basin would be via JCSD, a Basin Appropriator and retail agency of WMWD.



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Inland Empire Utilities Agency

Three Valleys Municipal Water District

Western Municipal Water District

TVMWD and WMWD Regional Facilities Location Map

Figure 3-3

Similar to TVMWD having facilities in or near the Basin to enhance the feasibility of its participation in the DYY Program Expansion, WMWD's water resources planning includes two potential points of connection to the Basin, both of which are developed further in this PDR. The first is final development and construction of their Riverside-Corona (RC) Feeder pipeline, a major conveyance pipeline for treated SWP water purchased from Metropolitan that would support the future demands of WMWD's service area. The second is participation in the expansion of the Chino Desalter Authority (CDA) Chino II Desalter via its retail agency, JCSD, a current CDA agency. Connections to the Chino II Desalter would be possible via the existing Arlington Desalter Pipeline, another transmission pipeline that will help meet future demand and delivery needs.

3.4.3 Water Quality Constraints

TVMWD and WMWD's participation in the Program Expansion would include direct exports from the Basin for use in their respective service areas. Any water exported from the Basin to these agencies should be compatible with their existing system. Key considerations to ensure compatibility include:

- Variations in Basin versus existing system water quality
- Pipeline corrosion issues resulting from potential chemical incompatibility between sources

3.4.3.1 Variations in Water Quality

During detailed design and prior to implementation, water quality evaluations would be conducted to determine the compatibility of exported water with TVMWD and WMWD systems. As described in Chapter 2, five contaminants exceeding their respective MCLs have been identified within the Basin and would be of particular concern. These contaminants include nitrate, perchlorate, arsenic, VOCs, and DBCP.

Any groundwater produced by the Basin appropriators and ultimately made available for export would be treated using the Best Available Technology (BAT) for each contaminant and delivered with a water quality well below the MCL. Chapter 7 provides a description of treatment technologies evaluated and identifies a preferred treatment strategy for contaminants of concern found in the Basin. If needed, a possible alternative to treatment may include blending or dilution within the system.

In addition to the contaminants listed above, TDS is another important factor in the blended water to be exported. The TDS concentration of the water would require monitoring to ensure that concentration in the RC Feeder does not exceed 300 mg/L and that the concentration in the Arlington Desalter pipeline does not exceed its goal of 325 mg/L, based on discussions with WMWD.

3.4.3.2 Pipeline Corrosion

Corrosion of conveyance pipelines resulting from blending different water sources should be considered for Basin export projects. When water from different sources (surface water vs. groundwater) is blended, it is possible for the variation in water chemistry to cause reactions with the pipe material. Maintaining high water quality in the distribution system can be extremely difficult because changes in practice which benefit one treatment goal may cause adverse affects on a different treatment goal. Additionally, changes in practice which may be beneficial in the presence of one pipe material may be detrimental in the presence of another.

The major parameters to watch from a corrosion standpoint are pH, alkalinity, calcium, TDS, chloride, and sulfate.

Corrosion has been implicated in the following costly issues: increased pumping costs; loss of water and water pressure; water damage to buildings; replacement of hot water heaters; customer complaints of colored water, taste, and odor problems; increased wastewater treatment and disposal costs; and increased dosages of chlorine to maintain a residual throughout the distribution system. Corrosion can affect all pipe materials in a distribution system, including cement linings, galvanized or cast iron, lead, and copper. Iron corrosion is primarily responsible for causing aesthetic water quality problems, while lead and copper have come under increased scrutiny with the passage of the USEPA Lead and Copper Rule in 1991, which set the action level for lead at 15 micrograms per liter (µg/L) and for copper at 1,300 µg/L.

Corrosion indices have been developed to aid in predicting the corrosivity of a given water source. How corrosive a water will be depends on many parameters including dissolved oxygen, pH, alkalinity/dissolved inorganic carbon (DIC), calcium, suspended solids, organic matter, buffer intensity, metal ions, total salt concentration, specific anions (such as chloride or phosphate), silicate, biological factors, and temperature. Controlling this many parameters is difficult and in some cases impossible without creating other problems, such as formation of disinfection byproducts. Additionally, changes in water quality which reduce corrosion of one pipe material may increase corrosion of another pipe material.

In general, the worst water quality results from water which remains stagnant for long periods of time in the distribution system, and maintaining constant water flow is an effective corrosion control strategy. Further measures are often necessary to reduce corrosion in the distribution system. The most commonly employed are pH or alkalinity/DIC adjustment and the introduction of chemical inhibitors. Metals are typically more soluble at lower pH; thus, by raising the pH, metals can be kept out of solution. Additionally, at higher pH, precipitate scales are more likely to form on the pipe surfaces, reducing the dissolution of metals into the bulk fluid. For waters low in alkalinity, pH adjustment alone is often not enough to prevent corrosion. Increasing the carbonate alkalinity can be achieved through addition of lime or soda ash.

A detailed corrosion evaluation of blending Basin groundwater supplies with other agency surface water supplies is beyond the scope of this PDR. Further investigation of potential corrosion issues associated with the export of Basin water to neighboring agencies should be conducted during the design phase and prior to implementation.

4.0 Asset Inventory

4.0 ASSET INVENTORY

4.1 Overview

This chapter presents a summary of the groundwater, imported, and surface water capacities and facility information received from Basin appropriators who have expressed an initial level of interest in participating in the Program Expansion. Baseline water supply and demand projections for each of the water agencies interested in participating in the DYY Program Expansion are also provided.

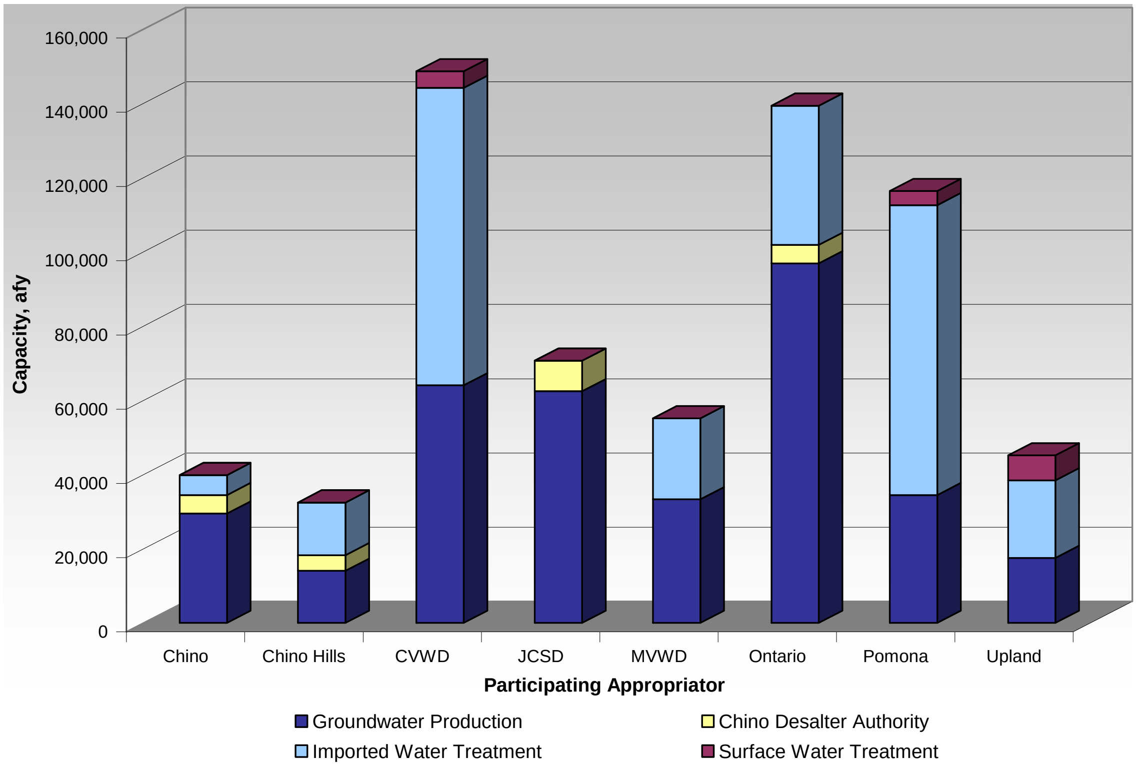
4.2 Development of Asset Inventory

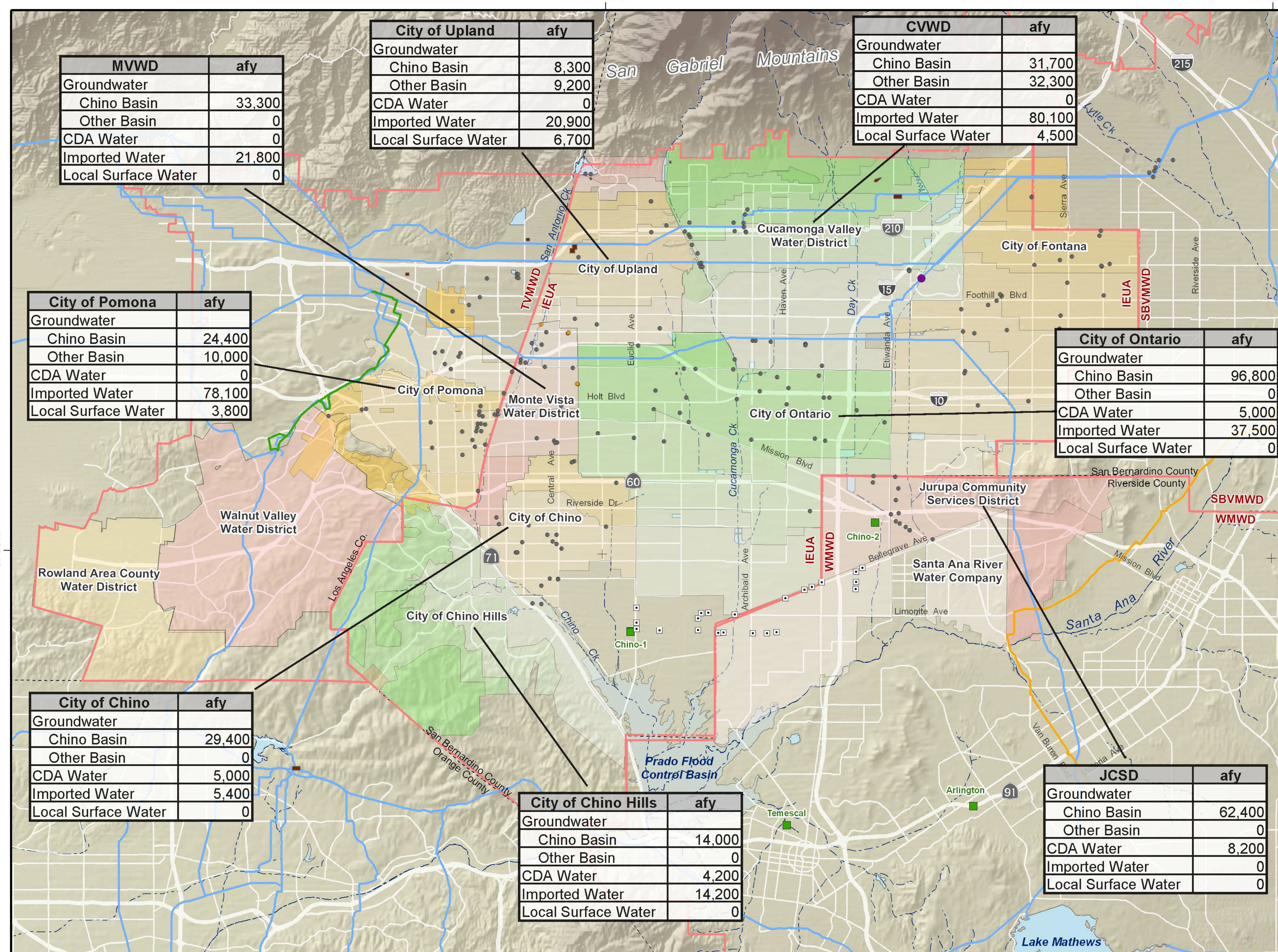
An investigation was conducted during the initial DYY Program in 2002-2003 to determine the existing facilities and production capacities of participating appropriators. This investigation and subsequent spreadsheet model was termed the "Asset Inventory" as it presented a comprehensive list of the facilities currently available to each appropriator. For the DYY Program Expansion, meetings were held with each Basin appropriator to determine a level of interest in participating in the expansion and information on existing facilities was gathered to update the Asset Inventory. The Asset Inventory identified each participating appropriator's groundwater production capabilities, groundwater treatment capabilities, and imported and surface water treatment capacities.

A series of meetings was held with each agency to review the purpose and objective of expanding the DYY Program and to identify potential projects that would satisfy the criteria. Following the meetings, agencies were asked to review the Asset Inventory data and provide updates as required to reflect changes to their system facilities or operation. Information included in the Asset Inventory includes: groundwater wells and corresponding water quality data, the location of the well (in Basin or out of Basin), the well capacity, notations about whether wellhead treatment or blending is required, and the priority tier (1-4) indicating whether the well is a primary source of water for the agency. The priority tier was primarily used for the groundwater modeling portion of the DYY Program Expansion (see Volume III) as it provided an indication of pumping locations within each participating agency's service area. The updated results of the Asset Inventory are presented in Appendix A.

Figure 4-1 summarizes the total water resource capacities for each of the participating appropriators as developed in the Asset Inventory. Figure 4-2 presents similar data on a Basin-wide location map. Table 4-1 presents the maximum capacity of these water resources by appropriator.

Figure 4-1
Water Resource Capacities for Basin Appropriators





MVWD	afy
Groundwater	
Chino Basin	33,300
Other Basin	0
CDA Water	0
Imported Water	21,800
Local Surface Water	0

City of Upland	afy
Groundwater	
Chino Basin	8,300
Other Basin	9,200
CDA Water	0
Imported Water	20,900
Local Surface Water	6,700

CVWD	afy
Groundwater	
Chino Basin	31,700
Other Basin	32,300
CDA Water	0
Imported Water	80,100
Local Surface Water	4,500

City of Pomona	afy
Groundwater	
Chino Basin	24,400
Other Basin	10,000
CDA Water	0
Imported Water	78,100
Local Surface Water	3,800

City of Ontario	afy
Groundwater	
Chino Basin	96,800
Other Basin	0
CDA Water	5,000
Imported Water	37,500
Local Surface Water	0

City of Chino	afy
Groundwater	
Chino Basin	29,400
Other Basin	0
CDA Water	5,000
Imported Water	5,400
Local Surface Water	0

City of Chino Hills	afy
Groundwater	
Chino Basin	14,000
Other Basin	0
CDA Water	4,200
Imported Water	14,200
Local Surface Water	0

JCSD	afy
Groundwater	
Chino Basin	62,400
Other Basin	0
CDA Water	8,200
Imported Water	0
Local Surface Water	0

Imported Water Pipelines

- Major Pipelines
- Riverside Corona Feeder Pipeline
- PWR Pipelines

Other Features

- Appropriator Well
- ASR Well
- Desalter Well
- Desalter Facility
- Treatment Plant
- MWD Turnout
- Flood Control/Conservation Basins
- Streams, Rivers, and Channels

afy = acre feet per year

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0 1 2 3 4 5 Miles
0 2 4 6 8 KM

Prepared For:

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Existing Water Resource Capabilities

Figure 4-2

Table 4-1
Existing Water Resource Capacities for Participating Chino Basin Appropriators

Water Resource	Agency/Capacity															
	City of Chino		City of Chino Hills		CVWD		JCSD		MVWD		City of Ontario		City of Pomona		City of Upland	
	(mgd)	(afy)	(mgd)	(afy)	(mgd)	(afy)	(mgd)	(afy)	(mgd)	(afy)	(mgd)	(afy)	(mgd)	(afy)	(mgd)	(afy)
IMPORTED WATER TREATMENT																
MWD Weymouth WTP	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	49.7	55,700	0.0	0
WFA-JPA Agua de Lejos WTP	4.8	5,400	12.7	14,200	0.0	0	0.0	0	19.4	21,800	25.4	28,500	0.0	0	18.6	20,900
TVMWD Miramar WTP	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	20.0	22,400	0.0	0
CVWD Lloyd Michael WTP	0.0	0	0.0	0	60.0	67,200	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0
CVWD Royer-Nesbit WTP	0.0	0	0.0	0	11.5	12,900	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0
City of Ontario Galvin WTP (1)	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	8.0	9,000	0.0	0	0.0	0
Subtotal	4.8	5,400	12.7	14,200	71.5	80,100	0.0	0	19.4	21,800	33.4	37,500	69.7	78,100	18.6	20,900
SURFACE WATER TREATMENT																
CVWD Arthur Bridge WTP	0.0	0	0.0	0	4.0	4,500	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0
City of Pomona Pedley WTP	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	3.4	3,800	0.0	0
City of Upland San Antonio WTP	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	6.0	6,700
Subtotal	0.0	0	0.0	0	4.0	4,500	0.0	0	0.0	0	0.0	0	3.4	3,800	6.0	6,700
GROUNDWATER PRODUCTION																
Chino Basin Wells (2)	26.2	29,400	12.5	14,000	28.3	31,700	55.7	62,400	29.7	33,300	86.5	96,800	21.8	24,400	7.4	8,300
Non-Chino Basin Wells (2)	0.0	0	0.0	0	28.8	32,300	0.0	0	0.0	0	0.0	0	9.0	10,000	8.2	9,200
Subtotal	26.2	29,400	12.5	14,000	57.1	64,000	55.7	62,400	29.7	33,300	86.5	96,800	30.7	34,400	15.7	17,500
CHINO DESALTER AUTHORITY																
Chino I Desalter	4.5	5,000	3.8	4,200	0.0	0	2.4	2,700	0.0	0	1.3	1,500	0.0	0	0.0	0
Chino II Desalter (3)	0.0	0	0.0	0	0.0	0	4.9	5,500	0.0	0	3.1	3,500	0.0	0	0.0	0
Subtotal	4.5	5,000	3.8	4,200	0.0	0	7.3	8,200	0.0	0	4.4	5,000	0.0	0	0.0	0
TOTAL WATER RESOURCES	**35.5**	**39,800**	**29.0**	**32,400**	**132.6**	**148,600**	**63.0**	**70,600**	**49.1**	**55,100**	**124.3**	**139,300**	**103.8**	**116,300**	**40.3**	**45,100**

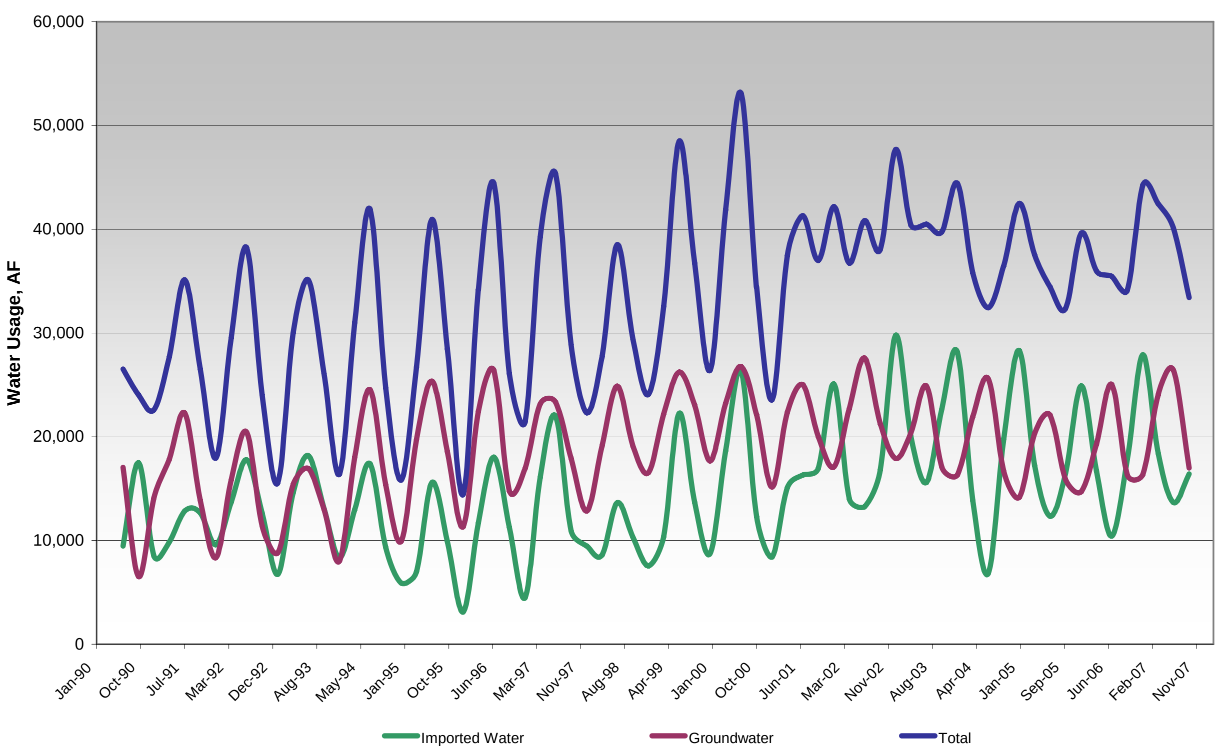
Notes:
(1) City of Ontario Galvin WTP is currently inactive.
(2) Accounts for all well production capacity, regardless of water quality.
(3) Chino II Desalter also supplies City of Norco and Santa Ana River Water Company.

4.3 Baseline Water Supply and Demand Projections

During development of the DYY Program Expansion, data was gathered from agencies to estimate water supplies through the 25-year planning period of 2010-2035. This data was then used to create preliminary water supply plans, which show projected water usage through the year 2035.

The Basin appropriators receive their water from two primary sources: Basin groundwater and imported water from Metropolitan. Some appropriators supplement their supply with water from the Chino Desalters (also a Basin groundwater resource), recycled water, local surface water, and groundwater from other basins. Historical imported water and groundwater usage is shown on Figure 4-3.

Figure 4-3
Historical Imported Water and Groundwater Usage for Basin Appropriators Participating in the DYY Program Expansion



Notes:
(1) Information presented in Figure 4-3 was obtained from Watermaster records of agency historical groundwater production and imported water purchases.
(2) Historical water usage does not include Fontana Water Company (FWC), Pomona, and JCSD.

Table 4-2 shows the actual fiscal year 2006/2007 and projected water supply plans through the year 2035 in five-year increments for each participating appropriator, respectively.

Table 4-2
Appropriator Water Supply Plans

Agency	Actual and Projected Water Use (afy)						
	'06/'07	2010	2015	2020	2025	2030	2035
Chino							
Chino Basin Groundwater	8,861	9,971	10,844	11,811	12,777	12,963	12,963
CDA Supply (Chino Basin GW)	4,690	5,000	5,000	5,000	5,000	5,000	5,000
Other Basin Groundwater	0	0	0	0	0	0	0
Imported Water (Metropolitan)	4,309	3,600	3,600	3,600	3,600	3,600	3,600
Recycled Water	0	3,000	5,500	6,000	6,000	6,000	6,000
Local Surface Water	0	0	0	0	0	0	0
Total Demand	17,860	21,571	24,944	26,411	27,377	27,563	27,563
Notes: 1. Actual '06/'07 data received from City of Chino via e-mail 1/22/08. 2. Projected data compiled and developed by IEUA, September 2008.							
Chino Hills							
Chino Basin Groundwater	4,154	4,823	4,823	4,823	4,823	4,823	4,823
CDA Supply (Chino Basin GW)	4,200	4,200	4,200	4,200	4,200	4,200	4,200
Other Basin Groundwater	0	0	0	0	0	0	0
Imported Water (Metropolitan)	1,200	1,200	1,200	1,200	1,200	1,200	1,200
Recycled Water	800	1,700	2,400	2,500	2,500	2,500	2,500
Local Surface Water	0	0	0	0	0	0	0
Supply from MVWD	10,300	9,500	9,900	10,200	10,700	10,700	10,701
Total Demand	20,654	21,423	22,523	22,923	23,423	23,423	23,424
Notes: 1. Actual '06/'07 data received from City of Chino Hills via e-mail 2/13/08 and modified for coordination with MVWD data. 2. Projected data compiled and developed by IEUA, September 2008, and modified for coordination with MVWD data.							
Cucamonga Valley Water District							
Chino Basin Groundwater	18,787	16,598	21,229	26,729	32,229	37,729	37,729
CDA Supply (Chino Basin GW)	0	0	0	0	0	0	0
Other Basin Groundwater	6,308	5,400	5,400	5,400	5,400	5,400	5,400
Imported Water (Metropolitan)	32,825	33,000	28,369	28,369	28,369	28,369	28,369
Recycled Water	147	3,300	6,500	6,500	6,500	6,500	6,500
Local Surface Water	4,369	2,500	2,500	2,500	2,500	2,500	2,500
Total Demand	62,436	60,798	63,998	69,498	74,998	80,498	80,498
Notes: 1. Actual '06/'07 data received from CVWD via e-mail 1/24/08. 2. Projected data compiled and developed by IEUA, September 2008.							

Table 4-2
Appropriator Water Supply Plans

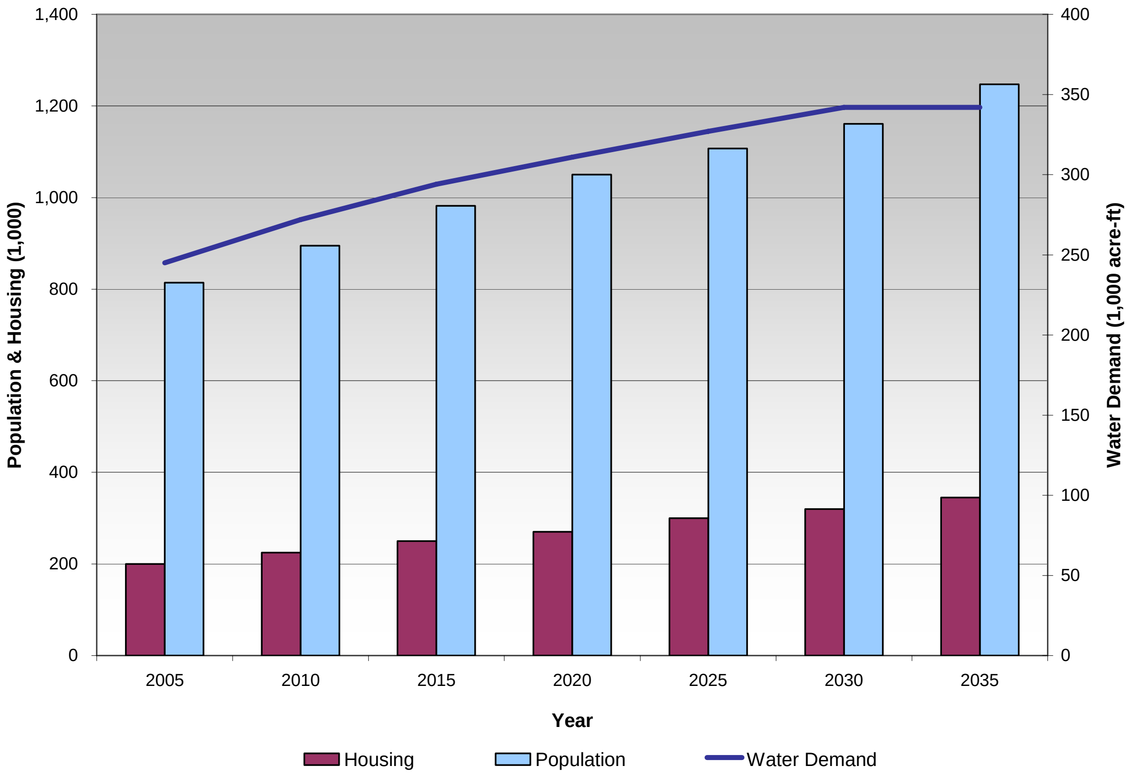
Agency	Actual and Projected Water Use (afy)						
	'06/'07	2010	2015	2020	2025	2030	2035
Jurupa Community Services District							
Chino Basin Groundwater	17,840	20,087	18,123	21,616	21,419	21,419	21,419
CDA Supply (Chino Basin GW)	0	8,200	8,200	8,200	8,200	8,200	8,200
Other Basin Groundwater	0	0	0	0	0	0	0
Imported Water (Metropolitan)	0	0	0	0	0	0	0
Recycled Water	0	0	0	0	0	0	0
Local Surface Water	0	0	0	0	0	0	0
Total Demand	17,840	28,287	26,323	29,816	29,619	29,619	29,619
Notes: 1. Actual '06/'07 data received from JCSD via e-mail 5/2/08. 2. Final projected data received from JCSD 5/2/08.							
Monte Vista Water District							
Chino Basin Groundwater	11,279	16,000	17,000	18,500	20,000	21,500	21,500
CDA Supply (Chino Basin GW)	0	0	0	0	0	0	0
Other Basin Groundwater	0	0	0	0	0	0	0
Imported Water (Metropolitan)	11,484	11,000	11,000	11,000	11,000	11,000	11,000
Recycled Water	0	300	400	450	500	500	500
Local Surface Water	0	0	0	0	0	0	0
Total Demand	22,763	27,300	28,400	29,950	31,500	33,000	33,000
Supply to Chino Hills	10,300	9,500	9,900	10,200	10,700	10,700	10,701
Notes: 1. Actual '06/'07 data received from MVWD via e-mail 1/21/08. 2. Projected data compiled and developed by IEUA, September 2008.							
Ontario							
Chino Basin Groundwater	28,014	28,796	27,211	32,360	37,508	42,658	42,658
CDA Supply (Chino Basin GW)	5,070	5,400	8,533	8,533	8,533	8,533	8,533
Other Basin Groundwater	0	0	0	0	0	0	0
Imported Water (Metropolitan)	13,314	16,200	19,850	19,900	19,950	20,000	20,000
Recycled Water		3,933	6,573	9,213	11,853	14,492	14,492
Local Surface Water	0	0	0	0	0	0	0
Total Demand	46,398	54,329	62,167	70,006	77,844	85,683	85,683
Notes: 1. Actual '06/'07 data received from City of Ontario via e-mail 1/23/08. 2. Projected data compiled and developed by IEUA, September 2008.							

Table 4-2
Appropriator Water Supply Plans

Agency	Actual and Projected Water Use (afy)						
	'06/'07	2010	2015	2020	2025	2030	2035
Pomona							
Chino Basin Groundwater	10,894	13,000	13,000	13,000	13,000	13,000	13,000
CDA Supply (Chino Basin GW)	0	0	0	0	0	0	0
Other Basin Groundwater	6,080	7,500	7,500	7,500	7,500	7,500	7,500
Imported Water (Metropolitan)	8,056	6,000	6,000	6,000	6,000	6,000	6,000
Recycled Water	4,593	3,000	3,000	3,000	3,000	3,000	3,000
Local Surface Water	2,969	2,000	2,000	2,000	2,000	2,000	2,000
Subtotal Demand	32,592	31,500	31,500	31,500	31,500	31,500	31,500
Notes: 1. Actual '06/'07 data received from City of Pomona via e-mail 3/26/08. 2. Projected data received from City of Pomona 3/26/08 and is consistent with data compiled by IEUA, September 2008.							
Upland							
Chino Basin Groundwater	2,237	1,284	2,140	2,140	2,140	2,140	2,140
CDA Supply (Chino Basin GW)	0	0	0	0	0	0	0
Other Basin Groundwater	14,074	6,420	6,420	6,420	6,420	6,420	6,420
Imported Water (Metropolitan)	4,725	5,778	4,280	4,280	4,280	4,280	4,280
Recycled Water	0	0	1,070	1,070	1,070	1,070	1,070
Local Surface Water	2,342	0	0	0	0	0	0
Supply from SAWCO	0	7,918	7,490	7,490	7,490	7,490	7,490
Subtotal Demand	23,378	21,400	21,400	21,400	21,400	21,400	21,400
Notes: 1. Actual '06/'07 data received from City of Upland via e-mail 1/23/08. 2. Projected data compiled and developed by IEUA, September 2008.							
Total for Participating Appropriators							
Chino Basin Groundwater	102,066	110,559	114,370	130,979	143,896	156,232	156,232
CDA Supply (Chino Basin GW)	13,960	22,800	25,933	25,933	25,933	25,933	25,933
Other Basin Groundwater	26,462	19,320	19,320	19,320	19,320	19,320	19,320
Imported Water (Metropolitan)	75,913	76,778	74,299	74,349	74,399	74,449	74,449
Recycled Water	5,540	15,233	25,443	28,733	31,423	34,062	34,062
Local Surface Water	9,680	4,500	4,500	4,500	4,500	4,500	4,500
Total	**233,621**	**249,190**	**263,865**	**283,814**	**299,471**	**314,496**	**314,496**

As shown in the above tables, water demands are expected to increase due to the rapidly expanding population of the Santa Ana Watershed. The 2000 census indicated the watershed had a population of 4.8 million, which is projected to increase to 7 million by 2025 and 10 million by 2050. In the Basin alone, the current population of almost 900,000 is estimated to reach 1.25 million or more by 2035. Figure 4-4 shows the population and housing projections and projected water demand within the IEUA service area for the next 25 years [IEUA, 2005].

Figure 4-4
Population, Housing, and Water Demand Projections



Notes:
(1) Demands shown include participating appropriators.
(2) Population data provided by IEUA, 2000.
(3) Housing data obtained from IEUA 2005 Urban Water Management Plan (UWMP).

One approach to increase local water supplies to meet growing demands is to develop impaired quality groundwater either via treatment or blending plans. As shown in Table 4-3, approximately 34 percent of the participating appropriators' wells are water quality impaired. Several appropriators blend good quality water from Metropolitan (nitrate concentrations less than 10 milligrams per liter [mg/L] as nitrate) with the poor quality groundwater (supplies with constituent concentrations near or exceeding the MCL). The table shows the groundwater production capacity for each participating appropriator and presents the percent of the total capacity that is water quality impaired. For the purpose of this summary, impaired water quality refers to the capacity of wells with concentrations within 10 percent of the current MCL for the six Basin contaminants of interest (nitrate, arsenic, perchlorate, VOCs, DBCP, and chromium VI). Figure 4-5 is a graphical representation of the water quality unimpaired and impaired groundwater production capacities for each appropriator.

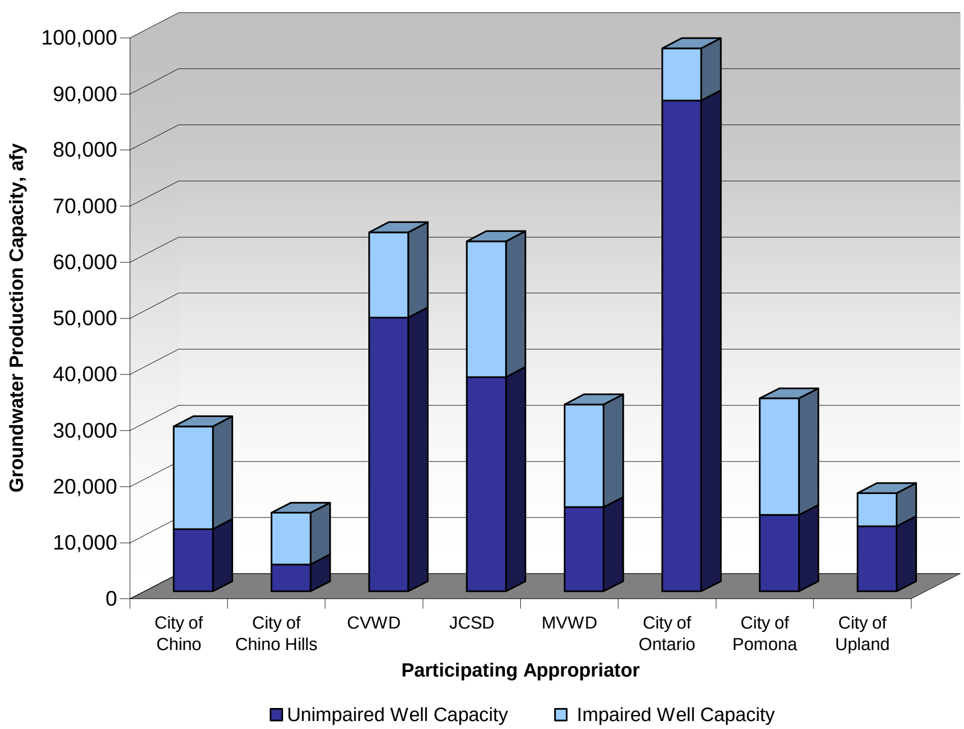
Since water from Metropolitan may not be available in sufficient amounts to meet future blending requirements, especially during dry years, treatment facilities may be necessary to continue using groundwater that are nitrate-impaired. Moreover, wellhead treatment will increase the overall reliability of the appropriator's water resources since they will be less dependent on imported blending water and existing unimpaired groundwater capabilities.

Table 4-3
Impaired and Unimpaired Capacities of Participating Appropriator Groundwater Production Facilities

Appropriator	Production Capacity (afy)	Unimpaired Capacity (afy)	Impaired Capacity (1) (afy)	Percent Capacity Impaired
Chino	29,400	11,100	18,300	62%
Chino Hills	14,000	4,800	9,200	66%
CVWD	64,000	48,800	15,200	24%
JCSD	62,400	38,200	24,200	39%
MVWD	33,300	15,000	18,300	55%
Ontario	96,800	87,500	9,300	10%
Pomona	34,400	13,600	20,800	60%
Upland	17,500	11,600	5,900	34%
TOTAL	**351,800**	**230,600**	**121,200**	**34%**

Notes:
(1) Capacity of wells within 10 percent of the current MCL for nitrate, arsenic, perchlorate, VOCs, DBCP, and chromium VI.

Figure 4-5
Comparison of Impaired and Unimpaired Well Capacities



The Basin currently provides approximately 44 percent of eight participating appropriators' water supply, compared to approximately 33 percent provided via imported Metropolitan water supply. The remaining 23 percent of water supplies are made up of other sources, including local surface water, recycled water, and other Basin groundwater production. To accomplish the dry-year yield objectives, the participating appropriators would need to increase groundwater based production without delivery of blending water from Metropolitan.

4.4 In-Lieu Exchange Capacity of Basin Appropriators

The Asset Inventory provides an estimate of the in-lieu capacity of the Basin. During a "put" year, an agency can only shift from groundwater supplies up to the amount that would normally be produced or that can be replaced by treated imported supplies. Therefore, the theoretical in-lieu "put" capacity of an agency is equivalent to the lesser of the projected groundwater production from the Basin (baseline) or imported water treatment capacity of the agency. This assumes that each participating agency has a connection to treated imported water supplies and that sufficient surplus supplies from Metropolitan are available.

Similarly, during a "take" year, an agency can only shift from treated imported supplies by an amount up to the amount normally purchased (baseline). Therefore, the theoretical in-lieu "take" capacity of an agency is equivalent to the most recent imported water deliveries (baseline) to the agency. The limiting factor in this preliminary analysis is whether it would be theoretically possible for an appropriator to completely roll off groundwater in favor of imported water. To determine the feasibility, a groundwater modeling and financial analysis would be required since production of groundwater tends to be more cost-effective than purchase of Metropolitan's replenishment or Tier 1 or Tier 2 water.

The preliminary theoretical in-lieu "put" and "take" capacities of each participating appropriator are summarized in Table 4-4.

Table 4-4
Preliminary Theoretical In-Lieu "Put" and "Take" Capacities

Participating Appropriator	In-Lieu Exchange Capacity (afy)	
	"Put" (1)	"Take" (2)
Chino	5,400	4,300
Chino Hills (3)	4,200	1,200
CVWD	18,800	32,800
JCSD (3)	17,800	0
MVWD	11,300	11,500
Ontario	28,000	13,300
Pomona	10,900	8,100
Upland	2,200	4,700
TOTAL	**98,600**	**75,900**

Notes:
(1) The theoretical in-lieu "put" capacity of an agency is equivalent to the lesser of the projected groundwater production from the Basin (baseline) or imported water treatment capacity of the agency. FY '06/'07 Chino Basin groundwater production data used for comparison.
(2) The theoretical "take" in-lieu capacity of an agency is equivalent to the most recent imported water deliveries (baseline) to the agency.
(3) Exchange agreements with neighboring agencies may enhance participation on the "take" side.

5.0 Facility Requirements and Reduction of Peak Imported Water Deliveries

5.0 FACILITY REQUIREMENTS AND REDUCTION OF PEAK IMPORTED WATER DELIVERIES

5.1 Overview

Ten participating agencies have selected 18 potential facilities required to participate further in the DYY Program Expansion. This chapter provides background on the facilities selection process and the CEQA documentation completed for the projects. Each participating agency's facility requirements are summarized and additional projects beyond the scope of this Program Expansion are proposed to manage peak deliveries from Metropolitan's Rialto Pipeline.

5.2 Initial Facility Selection Process

The initial selection of facilities was based on interviews with Basin appropriators, neighboring Metropolitan member agencies, and current DYY Program participants to ascertain the level of interest in participating in the DYY Program Expansion. Agencies provided a list of projects, ranging in forms of development from short-term, long-term, to ready for design. An analysis of each agency's existing facilities and infrastructure was also conducted using the Asset Inventory to confirm the potential for increased participation. As discussed in meetings conducted with each agency at the onset of the Expansion Program, potential "put" and/or "take" contributions were evaluated qualitatively based upon the ability of each project to meet the goals of the Program, as discussed in Chapter 1.

As described in Chapter 6, the maximum storage volume allowed and maximum annual "put" and "take" values are constrained by the following Basin management strategies:

- Maintain hydraulic control of the Basin
- Minimize/control movement or migration of contaminant plumes
- Minimize impact of water levels at key appropriator production wells
- Minimize subsidence throughout the Basin

The initial "put" and "take" contributions are shown in the first two columns of Table 5-1. The initial contributions reflect the level of interest received from each agency and are consistent with their proposed facilities. The combined "take" capacity of the proposed projects ranges from 19,000 – 23,000 afy. The combined "put" capacity of these projects ranges from 10,500 – 15,000 afy. These contributions were updated based on results of the groundwater modeling conducted by WEI. The modeling evaluated Program operations to determine the potential for material physical injury to a party of the Chino Judgment or to the Basin as required by the Peace Agreement, (refer to Chapter 6 and Volume III, Program Modeling Report).

After WEI conducted the groundwater modeling, it was determined that the initial "take" capacities proposed were too high and may result in adverse effects to several neighboring agencies. The "take" capacities of both Chino Hills and WMWD were lowered to minimize impact on the surrounding agencies. The final, post-modeling adjusted "put" and "take" contributions are shown in the last two columns of Table 5-1. The combined "take" capacity of the proposed projects ranges from 15,000 to 17,000 afy. The combined "put" capacity of these projects is approximately 12,300 to 16,800 afy of direct capacity plus Basin-wide in-lieu deliveries and surface spreading contributions. While the final "take" contribution is lower than the initial pre-modeling contribution, the facility requirements and capacities remain the same. The agencies for which "take" contributions were lowered have developed facilities that would accommodate the initial, pre-modeling "take" contributions since the facilities are needed as part of their system-wide planning for storage and supply. The difference between the initial (pre-modeling) and final (post-modeling) use of such facilities is that a lower percentage the facilities' capacities will be used toward the Program Expansion.

Table 5-1
Summary of Initial and Final DYY Program Expansion
Proposed Put/Take Capacities

Agency	Initial: Pre-Modeling		Final: Post-Modeling(3)	
	Put Capacity (afy)	Take Capacity (afy)	Put Capacity (afy) (1)	Take Capacity (afy)
Chino	500-1,000	2,000	500-1,000	2,000
Chino Hills(2)	0	1,000	1,800	0
Cucamonga Valley Water District	4,000-5,000	0	4,000-5,000	0
Jurupa Community Services District	0	2,000	0	2,000
Monte Vista Water District	3,000-4,000	3,000-5,000	3,000-4,000	3,000-5,000
Ontario	2,000-3,000	0	2,000-3,000	0
Pomona	0	2,000	0	2,000
Upland	0	1,000	0	1,000
Three Valleys Municipal Water District	1,000-2,000	0	1,000-2,000	0
Western Municipal Water District	0	8,000-10,000	0	5,000
Total	10,500 – 15,000	19,000 – 23,000	12,300 – 16,800	15,000 – 17,000

Notes:
(1) Does not include basin-wide in-lieu deliveries and direct recharge.
(2) MVWD assumed Chino Hills' shift obligation of 1,448 afy per an amendment to the agreement between the agencies dated March 5, 2007.
(3) Post modeling, adjusted capacities. See Volume III for details.

5.3 Recommended Facilities and Locations

Table 5-2 presents a summary of the DYY Program Expansion participants and their respective facilities. As shown in the table, several agencies require projects to allow them to participate on the "put" side and several agencies required projects to allow them to participate on the "take" side. "Put" facilities include ASR wells, interconnections, and conveyance facilities. "Take" facilities include IX treatment, wells, and conveyance facilities. Figure 5-1 presents the location of the DYY Program Expansion facilities.

Table 5-2
Summary of Program Participants and Facility Requirements

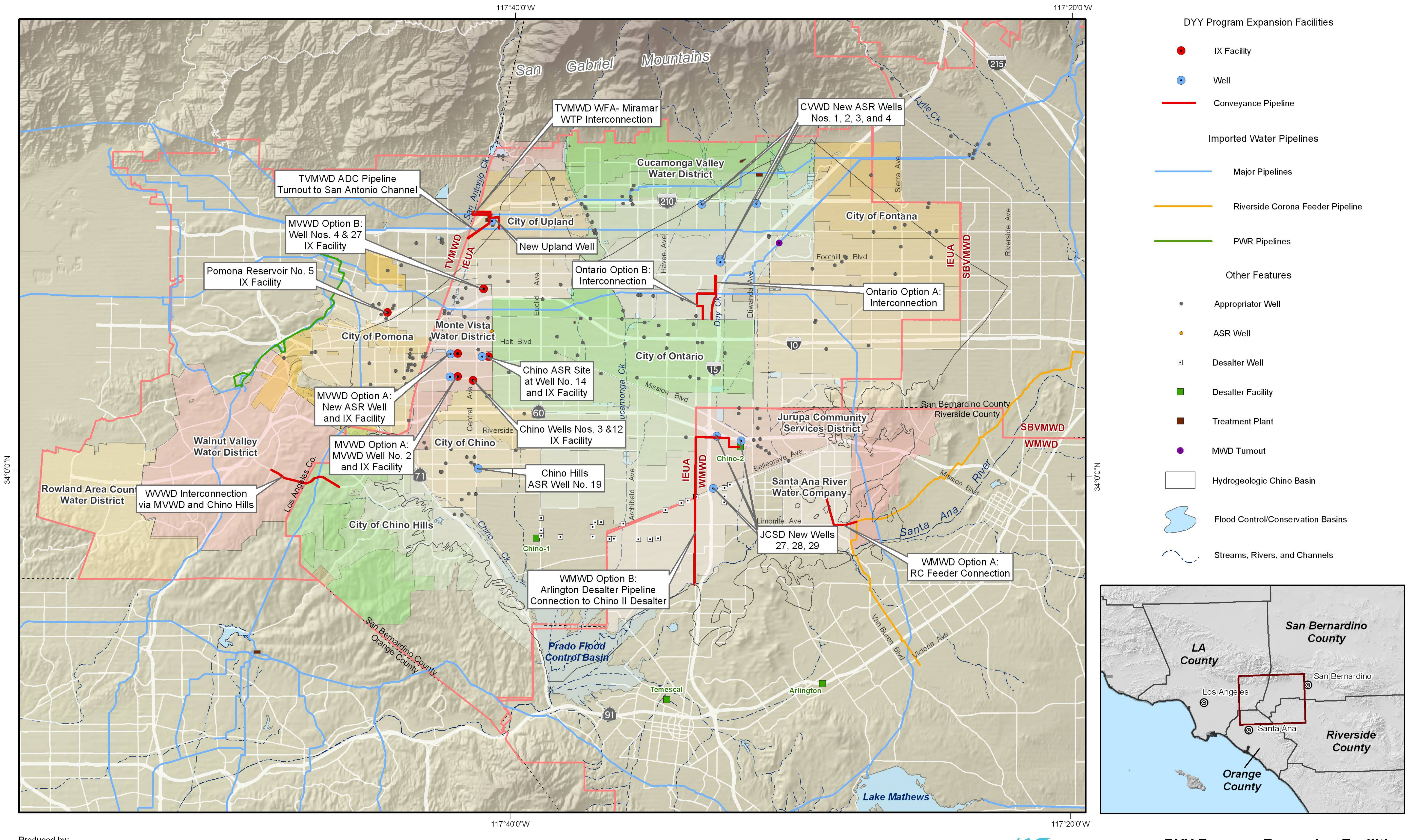
Agency/PDR Volume	Facility Requirements
Chino (II A)	▸ Regenerable IX treatment at existing Well Nos. 3 and 12 ▸ ASR Site at Well No. 14: Regenerable IX treatment at existing Well No. 14 and replacement of existing Chino agriculture well for injection
Chino Hills (II B)	▸ Convert existing Well No. 19 to ASR
CVWD (II C)	▸ Four new ASR wells
JCSD (II D)	▸ New Well No. 27 (“Galleano Well”) ▸ New Well No. 28 (“Oda Well”) ▸ New Well No. 29 (“IDI Well”)
MVWD (II E)	▸ New ASR well and regenerable IX treatment ▸ Rehabilitate existing Well No. 2 and regenerable IX treatment ▸ Regenerable IX treatment at existing ASR Well No. 4 and Well No. 27 ▸ Conveyance facilities to deliver water from MVWD via Chino Hills to WVWD Service Areas
Ontario (II F)	▸ Conveyance facilities to establish interconnection with CVWD
Pomona (II G)	▸ Regenerable IX treatment at existing Reservoir No. 5 site
Upland (II H)	▸ New well in Six Basins
TVWD (II I)	▸ Treated water pipeline from Water Facilities Authority (WFA) Water Treatment Plan (WTP) to Miramar WTP ▸ Turnout along Azusa-Devil Canyon Pipeline
WMWD (II J)	▸ Conveyance facilities to establish interconnection between planned Riverside-Corona (RC) Feeder and Jurupa Community Services District (JCSD) service area ▸ Conveyance pipeline to establish interconnection between WMWD service area and Chino II Desalter

A brief summary of each project is provided in the following text. Each project is developed further in Volume II.

Chino selected two potential well sites for wellhead treatment facilities for the purpose of removing nitrate and perchlorate from groundwater. One option is to provide treatment for Chino Well Nos. 12 and 3, which have groundwater production capacities of 2,250 and 500 gpm, respectively. A second option is to provide treatment for Well No. 14, which has a production capacity of 2,300 gpm. In addition, a new injection well would be provided on site to replace an existing Chino agriculture well.

Chino Hills selected Well No. 19 with a capacity of 1,500 gpm as a candidate for conversion from a standard production well to an ASR well. In addition, this well may be a candidate in the future for on-site wellhead treatment facilities for the purpose of removing arsenic from groundwater; however, the treatment facilities are not included in the DYY Program Expansion.

CVWD selected locations for four new ASR wells that would have an injection capacity of approximately 1,300 gpm each. Nearby water transmission mains were identified to deliver water to each ASR well for injection.



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DYY Program Expansion Facilities Location Map

Figure 5-1

JCSD selected three new wells in the southern area of MZ3 of the Basin that are currently nearing design completion. The Galleano, Oda, and IDI wells would each have a production capacity of 3,500 gpm. It is likely that treatment would not be required at each site.

MVWD has proposed two options for its put and take facilities. Option A facilities would include a new ASR well (2,000 gpm), a rehabilitated well (1,000 gpm), two new IX treatment plants to treat water delivered by each of the wells, and new conveyance pipe. Option B facilities would include a new IX treatment plant (2,830 gpm capacity) and new conveyance pipe. The conveyance pipe would deliver water from MVWD to WVWD via Chino Hills.

Ontario would become a further participant on the "put" side. Through a new interconnection with CVWD, Ontario would be able receive additional treated imported water in-lieu of pumping groundwater during the "put" years. During a dry, or "take," year, this previously stored groundwater would be available for JCSD to pump and deliver to WMWD. Ontario plans to construct two new 8-million gallon storage reservoirs (not part of DYY Program Expansion) as well as an interconnection with CVWD. The new reservoirs will be connected to the existing CVWD 30-inch transmission main along Rochester Avenue. This interconnection would also require a new 36-inch diameter conveyance pipe to deliver the water from this property to Ontario's service area.

Pomona selected a series of existing wells that would be candidates for wellhead treatment for the purpose of removing nitrate and possibly perchlorate from groundwater. Pomona Well Nos. 3, 7, 8 and 32 have groundwater production capacities of 600 gpm, 700 gpm, 1,000 gpm, and 600 gpm, respectively, and all are connected to the Reservoir No. 5 site. Groundwater from these wells would be blended and treated at the Reservoir No. 5 site where a new IX treatment facility would be constructed.

Upland selected a site for a new well with good quality groundwater not requiring treatment. If Upland participates during a "put" cycle using in lieu deliveries, it would increase deliveries from Metropolitan and decrease pumping in either Six Basins or Chino Basin by the same amount. During a "take" cycle, Upland would use the new well to pump from Six Basins and decrease deliveries from Metropolitan by the same amount.

TVMWD, a member agency of Metropolitan, treats imported water at its Miramar WTP and receives treated imported water from Metropolitan for delivery to its retail agencies. TVMWD selected two projects on the "put" side. TVWMD proposes to construct a treated water conveyance pipeline between the Miramar WTP and the WFA Agua de Lejos WTP, which has a capacity of 81 million gallons per day (mgd) and is only partially utilized during the fall and winter months. The proposed pipeline would provide additional treated water from WFA to Miramar for delivery to TVMWD's service area. Another proposed project to participate on the "put" side is to construct a pipeline and turnout facility from the Azusa Devil Canyon (ADC) Pipeline to the San Antonio Channel for eventual recharge into the Basin. The pipeline would be 36-inch diameter and would require a turnout structure and meter vault.

WMWD would become a new participant under the DYY Program Expansion Project. WMWD would receive groundwater pumped from the Basin in-lieu of imported water deliveries during dry years. This would be accomplished via (1) a new interconnection between WMWD's RC

Feeder and JCSD, or (2) a new connection to the Chino Desalter Authority's (CDA) Chino II Desalter via a new 30-inch pipeline to the existing Arlington Desalter Pipeline.

It should be noted that Fontana Water Company (FWC) elected not to participate in the DYY Program Expansion. However, FWC could be considered for potential future expansion beyond this program.

5.4 CEQA Documentation of Recommended Facilities and Locations

IEUA adopted a Program Environmental Impact Report (PEIR) for the OBMP in July 2000. The PEIR evaluated the use of the Basin for conjunctive-use and the installation of support infrastructure as permitted under the OBMP and addressed impacts as part of the environmental evaluation. The initial DYY Program included only projects located within the Basin and projects consistent with the types of facilities identified within the PEIR. The conclusion was that a Findings of Consistency Report was the requisite CEQA documentation for the initial DYY Program.

According to TDA, the scope of some of the potential projects under the Program Expansion may extend beyond that of the PEIR. IEUA was required to determine whether the proposed projects resulted in new significant impacts not evaluated in the PEIR and to decide what CEQA environmental determination to make if it chooses to approve the proposed projects. In order to cover each project under the same CEQA document, it was determined by TDA that a Mitigated Negative Declaration (MND) would need to be processed and approved. The following is a summary of the detailed CEQA procedure included in Volume IV.

5.4.1 Existing CEQA Documentation

A PEIR is used when a project consists of a program that will entail future actions or specific projects which can be characterized as a large project, such as a groundwater management plan over a large geographical area. A PEIR describes the broad program objectives and facilities and evaluates the impact of implementing the total project over a period of time with all its elements. Under this programmatic concept, future actions are reviewed in the context of the PEIR findings.

These future actions may include specific wells, pipelines, treatment facilities, and other infrastructure projects analyzed as part of a whole multi-faceted program in the PEIR. Where future facilities fall within the scope of impacts identified for the PEIR, in this case the OBMP PEIR, later environmental studies can be minimized through elimination of specific environmental issues deemed to be insignificant during the earlier stage of environmental review or through finding that the environmental impact analysis in the PEIR was sufficient to address the environmental impacts, including significant impacts.

The PEIR provides an environmental evaluation and determination for the activities permitted under the OBMP, which include desalters, wells, recharge basins, conjunctive-use, pipelines, treatment and other infrastructure systems, and groundwater monitoring. Later activities are then reviewed for consistency with the plan evaluated in the PEIR, which allows "tiering" of any future environmental review if subsequent environmental review is required. "Tiering" allows for certain review procedures to be bypassed for portions of the future activities that are environmentally consistent with the PEIR. An Initial Study (IS) of the DYY Program Expansion was performed to evaluate the environmental issues associated with each of the individual projects or "later activities." Existing conditions used to make impact forecasts in the IS were assumed to be comparable to those in the OBMP PEIR, although all of the baseline information was updated, particularly for specific facility locations.

5.4.2 Consistency of DYY Program Expansion with PEIR

The environmental issues associated with Program Expansion projects were evaluated to determine consistency with the PEIR. Determining consistency with the PEIR encompasses two tests. The first test entails a comparison of the proposed projects' environmental issues with all of the environmental issues addressed in the PEIR. An analysis of each of the environmental issues for the DYY Program Expansion is presented in the IS, which compares the effects from the construction and operation of the proposed project with the facts and findings of the PEIR.

The second test that may be used to determine whether a project falls within the scope of the PEIR is to determine whether new circumstances or reassessment of previously identified impacts may result in new significant impacts.

These tests were applied to the DYY Program Expansion, and a determination was made regarding the appropriate CEQA procedure to implement. To comply with CEQA, the IS was prepared to determine if environmental impacts of the DYY Program Expansion were encompassed by the impact analyses contained in the OBMP PEIR. Based on the evaluation provided in the IS, IEUA, as the lead agency, was given the following determinations and was tasked with selecting the one that applied:

1. The environmental effects at the proposed project were encompassed by the environmental evaluation in the PEIR. No further environmental review or determination is required.
2. The project's environmental effects fall within the scope of impacts identified for the PEIR. However, due to more detailed, project-specific information not available at the time the PEIR was prepared, impacts and mitigation not addressed in that document are identified in the IS. Adequate measures, however, are provided in the IS to mitigate potential impacts to a level of less than significant and a Negative Declaration is the appropriate CEQA determination.
3. The project requires some changes and/or additions to clarify impacts under current conditions, but none of the current conditions that call for the preparation of a subsequent EIR have occurred. Under this circumstance, an Addendum to a previously certified PEIR can be prepared and adopted.
4. The IS identifies potential impacts that fall outside the impact forecast in the PEIR and, since such impact(s) cannot be mitigated below a less than significant level, a subsequent EIR must be prepared.

5.4.3 Initial Study and Recommendation

An IS was developed to identify all of the potential environmental impacts associated with the DYY Program Expansion, compare the impacts with those identified in the PEIR, and provide an environmental determination for the required CEQA documentation. Table 5-3 lists all of the possible environmental factors that could be affected by any given project. The environmental factors checked in Table 5-3 could be potentially affected by this project, involving at least one impact that would be "Less than Significant with Mitigation Incorporation."

Table 5-3
Environmental Factors Potentially Affected by the Program Expansion

Potential Impact	Factor	Potential Impact	Factor
✓	Aesthetics		Mineral Resources
	Agriculture Resources	✓	Noise
✓	Air Quality		Population & Housing
✓	Biological Resources	✓	Public Services
✓	Cultural Resources		Recreation
✓	Geology & Soils	✓	Transportation/ Traffic
✓	Hazards & Hazardous Materials	✓	Utilities & Service Systems
✓	Hydrology & Water Quality		Mandatory Findings of Significance
	Land Use & Planning		

If all of the potential environmental effects identified in the IS for the DYY Expansion Project were previously addressed within the OBMP PEIR, it would be possible to rely on the content of that document under a Finding of Consistency document. However, due to site-specific environmental issues not addressed in the OBMP PEIR and the need to incorporate additional mitigation measures, environmental determinations that rely on a finding of consistency or an addendum are not possible. Further, based on the ability to mitigate all potential environmental impacts from implementing the DYY Expansion Project to a less than significant impact level, a subsequent or supplemental EIR is not required. The original OBMP PEIR identified one cumulative impact, and this disclosure is sufficient to proceed with adoption of a MND for this second tier specific project, which is being implemented as part of the OBMP.

Therefore, based on the findings in the IS, IEUA processed an MND as the appropriate CEQA environmental determination for the DYY Program Expansion. IEUA issued a Notice of Intent to Adopt a Negative Declaration and circulated the Negative Declaration package for public review for the required 30-day period. Following receipt of comments, IEUA prepared a final MND Package for consideration by its Board on behalf of all DYY Program Expansion stakeholders. Based on the final MND package, the Board will consider whether to proceed with implementation of the DYY Expansion Project as defined in the PDR and as presented to the Board at the time of the meeting, currently scheduled for December 17, 2008.

5.5 Concepts to Reduce Peak and Summer Deliveries from the Rialto Pipeline

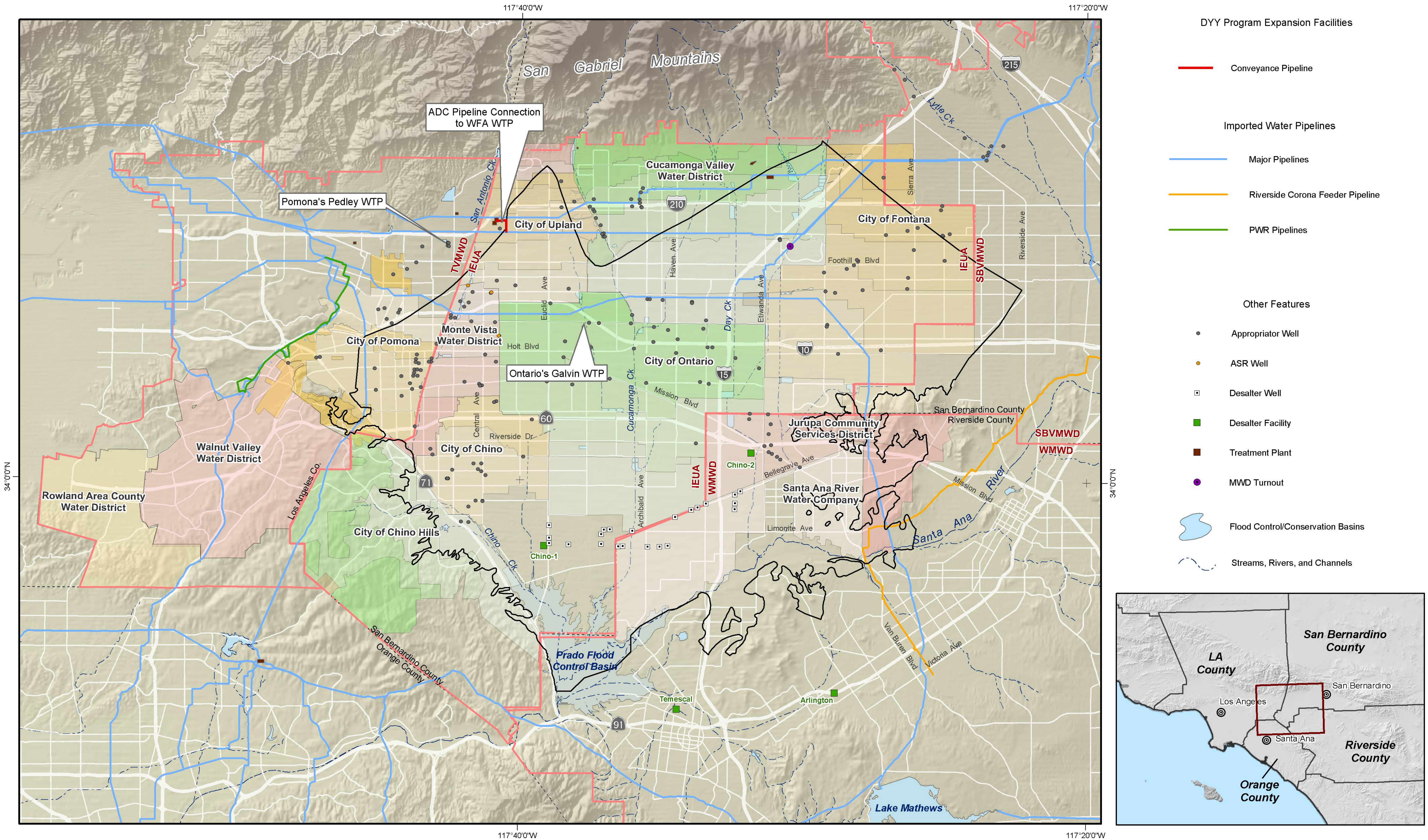
One of Metropolitan's goals through implementation of the Program Expansion is to reduce peak and summer-time demands on the Rialto Pipeline, a primary imported raw water transmission pipeline serving the Basin Appropriators. During dry years or potentially during periods of peak demand, Program Expansion participants would pump additional stored groundwater in-lieu of taking deliveries of imported water from the Rialto Pipeline using the projects listed in Section 5.3.

As discussed further in Chapter 6, based on anticipated annual wet and dry conditions, the Program would be operated using a series of "put," "take," "summer-time take," and "hold" years. Both "take" and "summer-time take" years would reduce peak and summer-time demands on the Rialto Pipeline. The facilities implemented under the Expansion Program would be used to withdraw Basin water during "summer-time take" and "take" periods and would assist Metropolitan with reducing peaking off the local Rialto Pipeline during the summer and other peak periods.

Discussions with participants led to the identification of three additional projects that would allow Metropolitan to reduce demand during dry and/or peak delivery periods on the Rialto Pipeline. These three projects are not covered by CEQA and were not included in the DYY Program Expansion because they were considered to be beyond the scope of the program. The cost of implementing these projects would be too high and/or the completion schedule would extend beyond that of the Program Expansion. However, if implemented under a separate project or agreement with Metropolitan, these three projects may have the ability to substantially reduce imported deliveries from the Rialto Pipeline to the Basin during dry years or periods of peak demand. The locations of the three projects are shown on Figure 5-2.

5.5.1 Rehabilitation of Ontario's Galvin WTP

Ontario is interested in rehabilitating and reactivating its existing Galvin WTP, which was initially designed in 1958 and has been out of service for over ten years. Once the Surface Water Treatment Rule was implemented by the CDPH in June 1993, the existing WTP could no longer comply with regulatory criterion, nor was there sufficient space within the existing building for additional processes. The WTP would likely require demolition, expansion, and conversion to membrane filtration. The raw water supply for the Galvin WTP is the Upper Feeder, which may benefit Metropolitan by reducing summer-time peaking demand on the Rialto pipeline (by equivalent reductions in supply from WFA, which is fed off the Rialto pipeline). This project is likely more than 5-10 years out and is part of Ontario's long-term planning. This project could be considered by Metropolitan in the future as an option to reduce summer-time peaking demand on the Rialto Pipeline.



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Three Valleys Municipal Water District

Location Map for Potential Rialto Pipeline Peak Shaving Facilities

Figure 5-2

5.5.2 ADC Pipeline Connection to WFA WTP

An additional proposed project to manage Rialto Pipeline peaking would be to construct a pipeline and turnout from the ADC Pipeline to the WFA Agua de Lejos WTP, providing an alternate source of raw water supply to the WTP. The 81 mgd WFA WTP's only raw water source is the Rialto Pipeline. To reduce reliance on this pipeline, a new supply pipeline would be constructed from the ADC Pipeline to the WFA Agua de Lejos WTP, which is located along Baseline Avenue (West 16th Avenue) and owned by the San Gabriel Valley Municipal Water District (SGVMWD). The new pipeline would be 36-inch diameter, capable of handling 55 cubic feet per second (cfs) of flow, approximately 3,400 feet long, and would require a turnout structure and meter vault. This new raw water supply would directly offset raw water deliveries from the Rialto Pipeline to the WFA WTP.

5.5.3 Rehabilitation of Pomona's Pedley WTP

Pomona's existing 4 mgd Pedley WTP treats local surface water from the San Antonio Canyon and Evey Canyon. Average flows from these sources vary due to fluctuations in climate and precipitation. The existing WTP is aging and rehabilitation is needed to ensure that the WTP will continue to operate and that newly promulgated regulations are met. Pomona is currently undertaking a feasibility study to determine the rehabilitation requirements of the Pedley WTP, including an evaluation of expansion potential.

The current source of water for the Pedley WTP is local surface water, which is typically unavailable during the summer months or during dry periods. It may be possible to modify the WTP to treat raw State Water Project (SWP) water from the nearby ADC pipeline, which could reduce peak and summer-time demands on the Rialto Pipeline. This would directly offset summer-time raw water deliveries from the Rialto Pipeline to the TVMWD Miramar WTP and Metropolitan's Weymouth WTP, both of which serve imported supplies to Pomona.

6.0 Program Operations Plan

6.0 PROGRAM OPERATIONS PLAN

6.1 Overview

This chapter presents the foundation and conceptual Operations Plan for the DYY Program Expansion. The objectives of the operations plan, availability of surplus water and Metropolitan Drought Allocation Plan, modeling summary, proposed shift commitments and facility requirements, and conceptual operations plan for the expanded program are presented below. Several of the referenced modeling analyses and evaluations are presented in detail in Volume III.

6.2 Objectives of Operations Plan

The primary objectives of developing an operations plan for the DYY Program Expansion are to: (1) ensure that implementation of the program is consistent with OBMP management objectives; (2) develop a sustainable program that does not impact other on-going Basin management strategies; and (3) determine the range of acceptable storage and flexibility of operations within the Basin.

6.2.1 OBMP Management Objectives

As discussed in Chapter 1, the Chino Basin OBMP is based on four primary goals, each supported by a series of management objectives. Table 6-1 lists the management objectives considered for development of the Operations Plan.

Table 6-1
Management Objectives Used In Development of the Operations Plan

OBMP Goal	Management Objective
Enhance Basin Water Supplies	▸ Develop new sources of supplemental water ▸ Promote treatment and use of contaminated groundwater
Protect and Enhance Water Quality	▸ Treat contaminated groundwater to meet beneficial uses
Enhance Management of the Basin	▸ Develop and/or encourage production patterns, treatment, transmission, and alternative water supply sources to ensure maximum and equitable availability of groundwater and to minimize land subsidence ▸ Develop conjunctive-use programs with others to optimize the use of the Basin for in-Basin producers and the people of California
Equitably Finance the OBMP	▸ Recover value from utilization of storage of supplemental water and from rising water outflow

6.2.2 Sustainability

The proposed DYY Program Expansion project would build off the current DYY Program, other Basin groundwater management programs, and the recent Drought Allocation Plan. As developed in Chapter 1, the current 100,000 acre-ft DYY Program requires reductions in groundwater pumping during years of surplus imported water supplies and additional groundwater pumping during dry periods. Other Basin management programs, such as the MZ1 forbearance program, hydraulic control program, and the Basin re-operation plan per the Peace II Agreement [CBWM, October 2007] also require controlled groundwater pumping within the Basin. Finally, Metropolitan's regional Drought Allocation Plan would likely develop additional restrictions on imported water use during dry periods, which in turn may require an increased amount of groundwater production. (The Drought Allocation Plan is discussed further in Section 6.3.)

Each program listed above adjusts groundwater pumping patterns in the Basin and was considered during development of the Operations Plan. Groundwater modeling, as discussed in Section 6.4 and Volume III of this PDR, would be conducted to ensure that implementation of the DYY Program Expansion would not result in material physical injury to the Basin. Per the Peace Agreement [CBWM, June 2000], material physical injury is defined as: "material injury that is attributable to recharge, transfer, storage and recovery, management, movement or production of water or implementation of the OBMP, including, but not limited to, degradation of water quality, liquefaction, land subsidence, increases in pump lift and adverse impacts associated with rising groundwater."

6.2.3 Range of Acceptable Storage

As developed in Chapter 3, the size of the DYY Program Expansion is dependent on several key factors, including: (1) level of interest from Basin Appropriators; (2) the in-lieu exchange capacity of Basin Appropriators; (3) available wet water recharge capacity; (4) availability of alternative "put" methods (i.e., injection or ASR wells); (5) water quality constraints; and (6) ability to export water from the Basin to neighboring Metropolitan member agencies.

Another key component of the Operations Plan is to determine the range of acceptable storage in the Basin, which would ultimately impact the operational flexibility of the DYY Program Expansion. Variations in the availability of surplus imported water and/or the extent to which a storage account is withdrawn help define the operable limits of the program. Three operational scenarios were developed to define the flexibility of the DYY Program Expansion. These scenarios are defined further in Section 6.4 and were used as the basis for groundwater modeling as presented in Volume III.

6.3 Availability of Surplus Supplies and Metropolitan Drought Allocation Plan

This section presents a summary of the projected availability of surplus supplies and its impact on development of the Operations Plan. The objectives and impact of the Metropolitan Drought Allocation Plan are also reviewed.

6.3.1 Availability of Surplus Supplies

The availability of surplus water was a critical criterion used in development of the DYY Program Expansion. The availability essentially refers to the likelihood of sufficient water being available during a ten year period to build up a storage account or to fulfill Basin replenishment obligations due to over production. During development of the initial DYY Program, the availability of surplus water was assumed to be seven out of every ten years based upon projections from Metropolitan at that time.

During the past several years, Metropolitan has tracked the dry conditions affecting its service area and main supply sources, in addition to the uncertainty of pumping operations from the SWP due to protection of Delta Smelt in the Sacramento-San Joaquin Bay-Delta. The current projected availability of surplus water from Metropolitan has been substantially reduced due to environmental and judicial constraints and drought.

Although no official forecast is available from Metropolitan to characterize the availability of surplus water, Metropolitan staff has presented relevant information to its member agencies as part of an ongoing regional groundwater workshop process. These workshop presentations showed that, under the Interim Remedy Order to protect Delta Smelt [U.S. District Court Judge Oliver Wanger, NRDC vs. Kempthorne 2007], surplus water may only be available in approximately three out of ten years.

Although Metropolitan staff also presented the benefits of potential improvements to the SWP system, for the purposes of the proposed DYY Program Expansion, it was assumed the surplus water would be available to the Watermaster in three of ten years. This assumption impacts the rate at which Metropolitan may be able to replenish its DYY Program storage account and the facilities required to ensure the "put" capacity is available during periods of surplus supply.

6.3.2 Metropolitan Drought Allocation Plan

Continuing dry conditions and restrictions on SWP pumping operations due to environmental issues have contributed to the possibility that Metropolitan may not have sufficient supplies to meet future firm deliveries. Therefore, shortage allocations to its member agencies may be required in the interim. During 2007 and 2008, Metropolitan staff worked with its member agencies to develop a Drought Allocation Plan to prepare for this possibility. The Drought Allocation Plan addressed the principles adopted by the Metropolitan Board in the 1999 Water Surplus and Drought Management Plan (WSDM Plan). The guiding principle in the WSDM Plan is the following:

> *"Metropolitan will encourage storage of water during periods of surplus and work jointly with its Member Agencies to minimize the impacts of water shortages on the region's retail customers and economy during periods of shortage."*

Several considerations were highlighted in the WSDM Plan to accomplish an equitable regional allocation of Metropolitan supplies during times of shortage, including:

- Impact on retail customers and the economy
- Allowance for population and growth
- Change and/or loss of local supply
- Recycling
- Conservation
- Investment in local resources

The proposed DYY Program Expansion would build off the initial 100,000 acre-ft DYY Program and Metropolitan's recently adopted Drought Allocation Plan. (The Metropolitan Board adopted the Drought Allocation Plan in February 2008 and is predicting to implement the plan in April 2009, which may correspond to an actual start date of July 1, 2009.) These programs were considered during development of the DYY Program Expansion Operations Plan because both would restrict deliveries of imported water during dry years and/or periods of drought. Any additional reductions in imported water deliveries, such as those defined under an expanded DYY Program, would need to consider the reductions already in effect.

6.4 Assumptions Used To Develop Operations Plan and Groundwater Modeling

This section presents a summary of the definitions, assumptions, operation plan scenarios and results from the groundwater modeling evaluations conducted for the DYY Program Expansion.

6.4.1 Put, Take, and Hold Terms and Schedule

The DYY Program Expansion would involve a series of "puts" and "takes" into and out of the Basin, similar to the current DYY Program. As described in Chapter 3, in-lieu deliveries and direct deliveries are mechanisms to "put" water into the Basin. "Takes" occur when participating agencies shift from Metropolitan supplies to increased groundwater production, increased recycled water deliveries, increased conservation, or other alternate supplies.

Based on anticipated annual wet and dry conditions, the Program would be operated using a series of "put," "take," "summer-time take," and "hold" years. By definition, a "summer-time take" year occurs when Metropolitan makes a withdrawal from its storage account during the summer months only. Such years would allow Metropolitan to reduce peaking off the local Rialto Pipeline during the summer months. "Summer-time take" years would most likely have less withdrawal from Metropolitan's DYY storage account than dry, or "take," years. A "hold" year is a normal or average year where "puts" or "takes" would not occur in Metropolitan's storage account.

As discussed in Section 6.3.1, Metropolitan's current planning projections indicate that, over a ten year period, surplus supplies may be available for three years during wet, or "put" years. The remaining seven years can therefore be considered either average or dry years. The DYY Program Expansion Operations Plan assumes that of these seven years, three years may be dry (i.e., "take" years) and the remaining four years would maintain average conditions (i.e., "hold" years). In-lieu deliveries were assumed to only be available during the wet, or "put," years over the same ten-year period.

Based on current and projected SWP and Colorado River supply conditions and the demand for imported water, Metropolitan would help develop program "put" or "take" schedules. For modeling purposes, the planning period used in development of the DYY Program Expansion consisted of a 27-year period from October 2008 through September 2035. This period corresponds to a 25-year period of operation from years 2010 through 2035, as may be proposed under the DYY Program Expansion Master Agreement, to be drafted in 2009.

During a wet or "put" schedule, appropriators would increase imported water deliveries using in-lieu deliveries, direct spreading, and/or injection to increase the amount of water stored in Metropolitan's account. During a dry or "take" schedule, the appropriators would increase groundwater production thus extracting water from Metropolitan's storage account. Over a 10-year cycle, unless Watermaster authorizes greater storage or extraction, Basin appropriators would increase imported water deliveries or allow direct recharge or injection by up to 50,000 afy, or greater, if available, during three "put" years and decrease imported surface water deliveries by a maximum of 50,000 afy during three "take" years.

6.4.2 Typical, Negative, and Maximum Storage Operations Scenarios

Three potential operational scenarios were developed, as shown in Table 6-2.

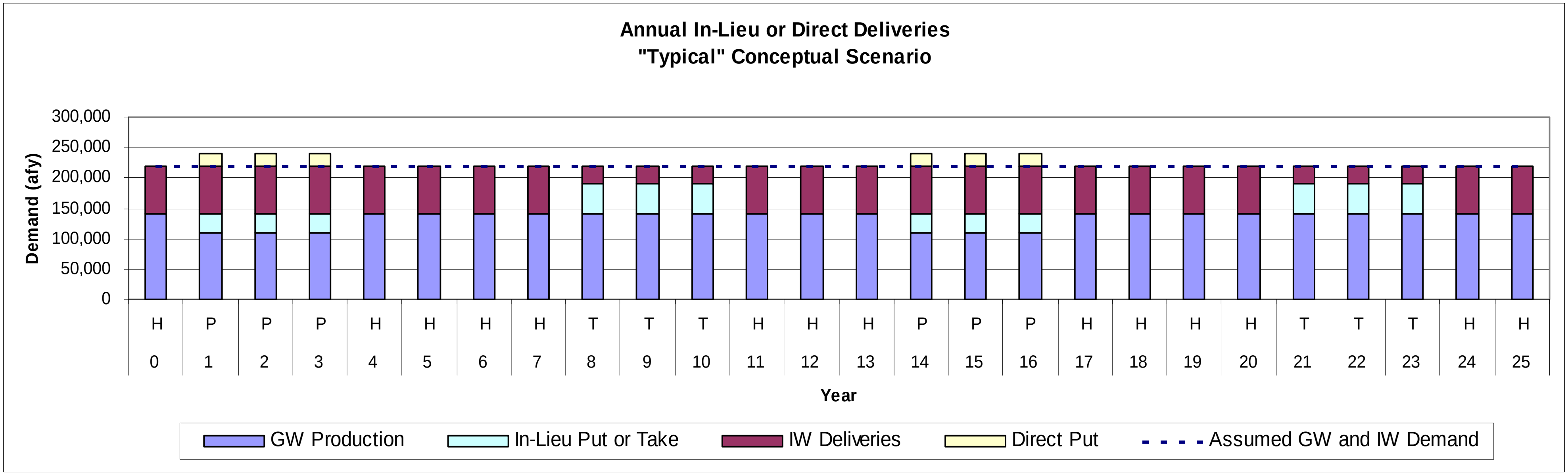
Table 6-2
Summary of Operations Scenarios

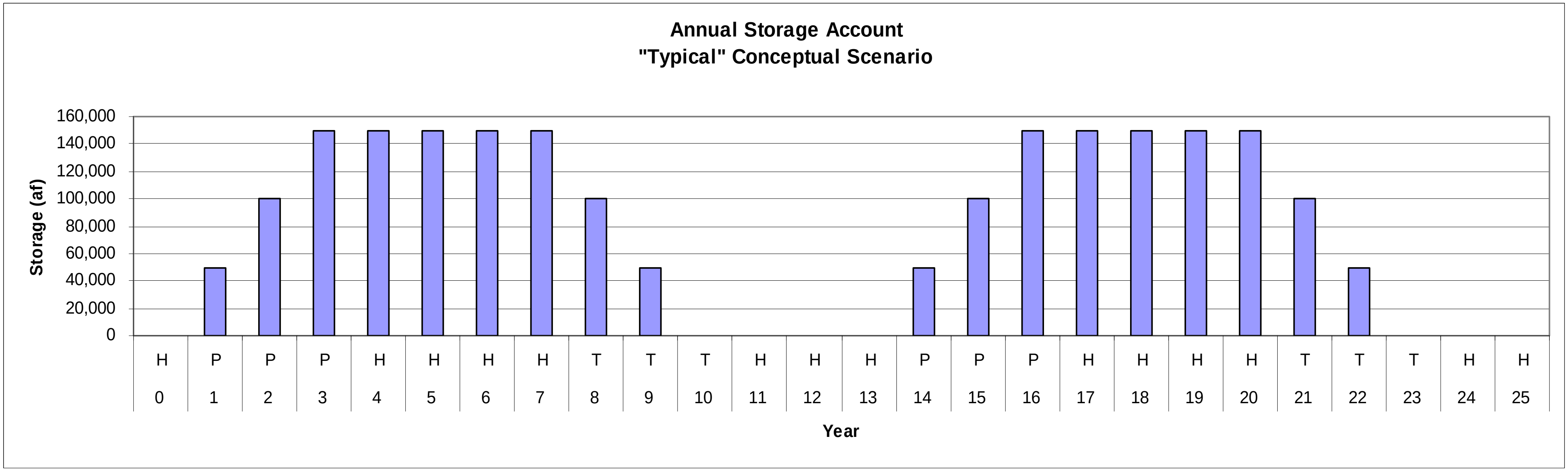
Operations Scenario	Description	Range in Storage (acre-ft)
No. 1: "Typical Storage"	Out of a ten year cycle, this scenario assumes a consistent 3-year "put" term, 3-year "take" term, and 4-year "hold" term. Maximum annual "puts" and "takes" are 50,000 afy.	0 to +150,000
No. 2: "Negative Storage"	This scenario assumes a 3-year "put" term but "takes" can extend beyond 3 years, thus allowing the storage account to accumulate a negative balance.	-100,000 to +150,000
No. 3: "Maximum Storage"	This scenario assumes a 3-year "put" term and assumes both maximum and smaller "summer-time" "takes," thus allowing the storage account to accumulate a higher balance.	0 to +300,000

Figures 6-1 through 6-4 show three potential operating scenarios for the DYY Program Expansion, with each figure containing two charts. These analyses depict the conceptual range of Program operations and do not necessarily reflect how the Program would be operated each year. The top chart presents the annual deliveries into or out of the DYY storage account and the bottom chart shows the effect of the "puts" and "takes" on the DYY storage account. Each figure also shows the 25-year operating period and the assumed type of year; an "H" represents a "hold" year, a "P" represents a "put" year, a "T" represents a "take" year, and an "S" represents a "summer-time take" year.

6.4.2.1 Operations Scenario No. 1: 150,000 acre-ft DYY Program ("Typical")

Figure 6-1 depicts a "typical" operating scenario, where Metropolitan would conduct maximum annual "puts" and "takes" into and out of the Basin. This figure shows that after an initial "hold" (average) year, Metropolitan would begin putting water into its storage account over a three-year period at the maximum rate of 50,000 afy. This period would be followed by a series of "hold" years where the storage account would remain full. The next three years would be considered dry, or "take," years and the storage account would be emptied at its annual maximum rate of up to 50,000 afy. This cycle may be repeated throughout the 25-year operating period.





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Chino Basin DYY Expansion Program

Operations Scenario No. 1 – 150,000 acre-ft DYY Program ("Typical")

Figure 6-1

6.4.2.2 Operations Scenario No. 2: 150,000 acre-ft DYY Program with 100,000 acre-ft "Negative Storage"

Figure 6-2 presents a "negative storage" scenario, where Metropolitan would conduct maximum annual "puts" and "takes" into and out of the Basin, but may withdraw additional water from the Basin that was previously not stored by Metropolitan. In this case, the "typical" scenario would be modified to allow five consecutive "take" years, and Metropolitan would borrow supplies from the Basin and replenish when supplies are once again plentiful. Metropolitan's storage account would therefore range from +150,000 acre-ft to -100,000 acre-ft. For illustration purposes, this scenario is only shown to reflect the range in which the Program may be operated.

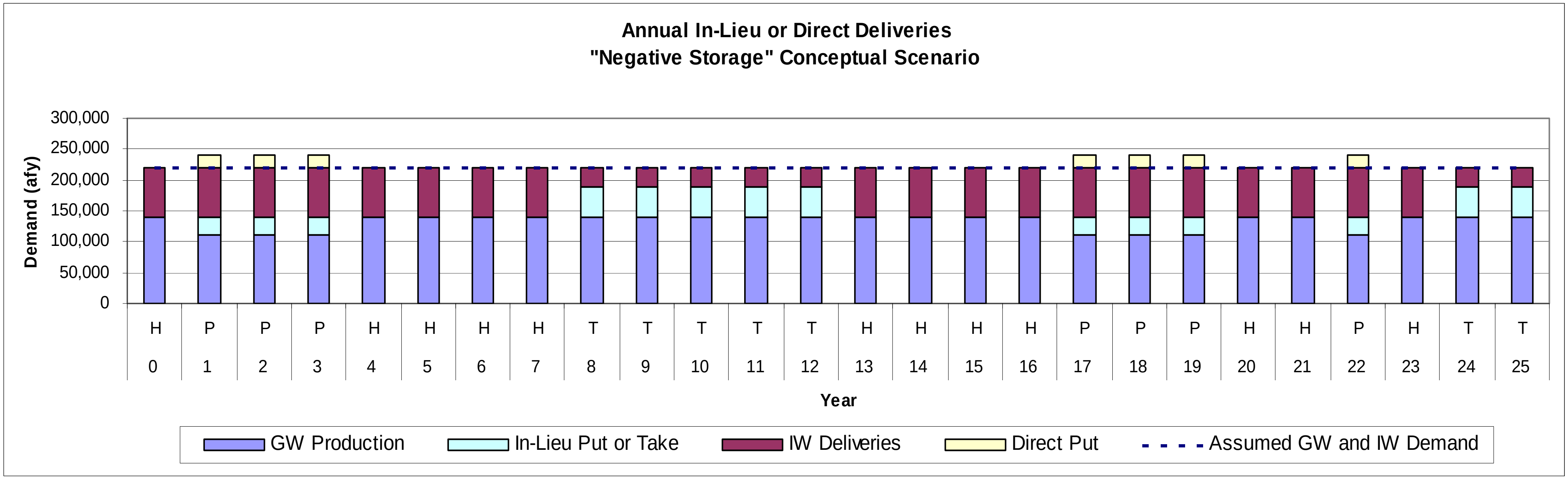
6.4.2.3 Operations Scenario No. 3: 150,000 acre-ft DYY Program with 300,000 acre-ft "Maximum Storage"

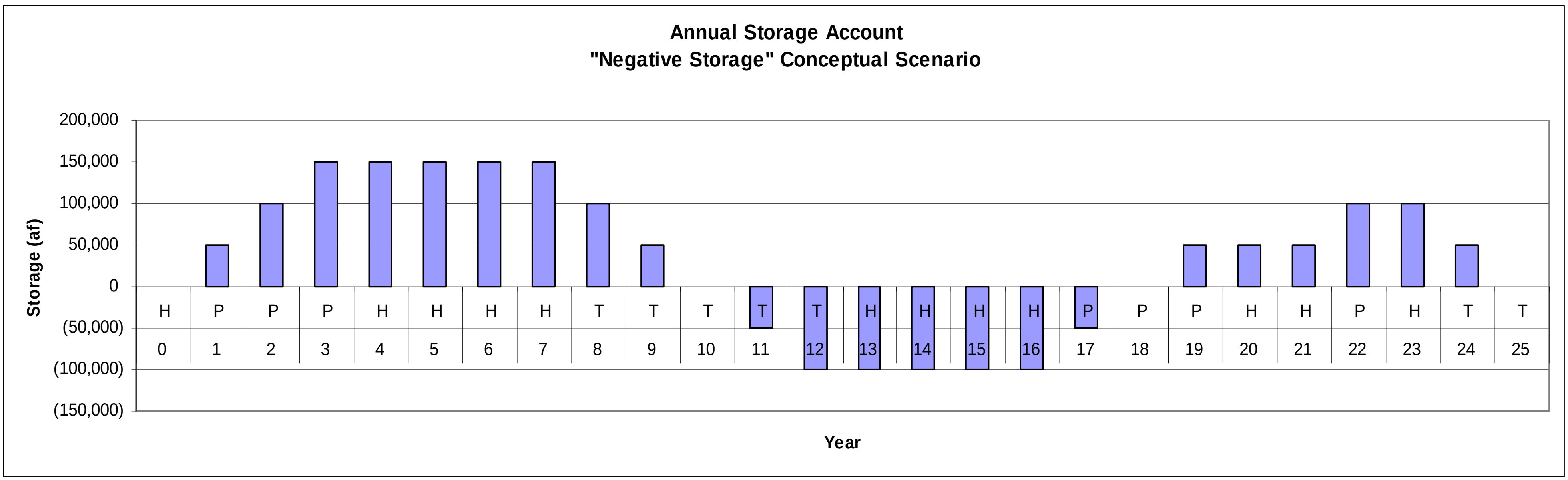
Figure 6-3 demonstrates a "maximum storage" scenario where Metropolitan could initially "put" water into the Basin at the maximum allowable rate. The difference between this scenario and the "typical" operating scenario is that during initial "take" years, Metropolitan would only withdraw water during the summer months (a "summer-time take") at the rate of approximately 6,250 afy. At the end of the first dry period under this scenario, a portion of Metropolitan's storage account would remain and could be built upon during the next "put" cycle. Under the next "put" cycle, if water were "put" into the Basin at the maximum allowable rate over a three-year period, the total amount of storage could climb as high as about 300,000 acre-ft (281,250 acre-ft exact), thereby using the majority of the initial target storage in the Basin as outlined in the OBMP Program Element 9. Similar to the "negative storage" scenario presented above, this scenario is only shown for illustration purposes to reflect the range at which the DYY Program may be operated.

Each of the scenarios above was modeled and is summarized in Volume III. Under all DYY planning scenarios, Metropolitan must provide enough replenishment water to the Watermaster to meet its replenishment obligations pursuant to the Judgment. There would be no "put" into the Basin if the "put" conflicts with Watermaster replenishment activities.

6.4.3 Summary of Modeling Results

Groundwater modeling was conducted to evaluate the potential for material physical injury to the Basin including an analysis of groundwater-level changes, increased potential for subsidence, losses from storage, change in direction and speed of known water quality anomalies, and the ability to maintain hydraulic control. An updated version of the Watermaster Model [CBWM, November 2007] was used to evaluate a baseline alternative along with the three proposed Operations Plan scenarios against the criteria listed above. The baseline alternative is based on the Alternative 1C Peace II Project Description with the current 100,000 acre-ft DYY Program. This baseline, Alternative 1C, was determined to have no material physical injury to the Basin and was therefore used as the basis from which to evaluate any impacts resulting from the three DYY Program Expansion operations scenarios summarized above.





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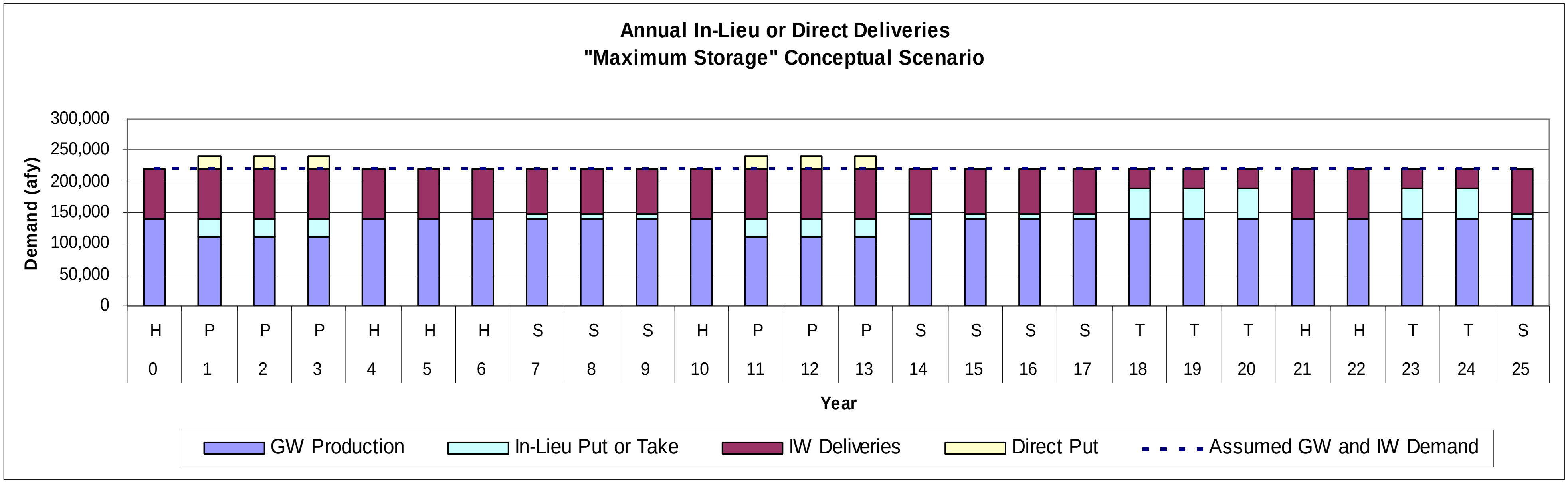
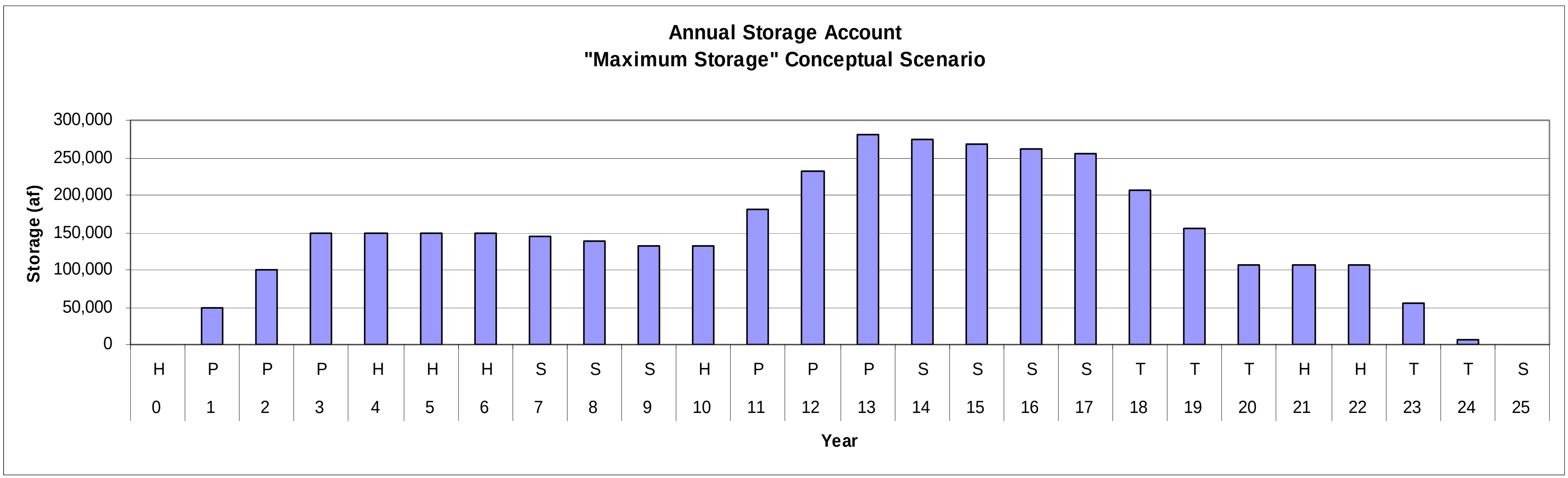
Chino Basin DYY Expansion Program

Operations Scenario No. 2 – 150,000 acre-ft DYY Program with 100,000 acre-ft "Negative Storage"

Figure 6-2





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Chino Basin DYY Expansion Program

Operations Plan Scenario No. 3 – 150,000 acre-ft DYY Program with 300,000 acre-ft "Maximum Storage"

Figure 6-3

The groundwater modeling essentially integrated the DYY Program Expansion groundwater production requirements during “put” or “take” years with the latest groundwater pumping projections for the Basin. The preliminary pumping plan prepared by IEUA staff during the summer of 2008 was used as the basis for the initial baseline pumping projections. Using specific locations for the new potential facilities identified in this PDR, the groundwater pumping projections in the model were modified to reflect reduced groundwater pumping during the “put” years and increased groundwater pumping during the “take” years to determine the potential for material physical injury to the Basin. The groundwater modeling started with the initially proposed “takes” from the Basin appropriators and, if necessary, was reiterated with reduced “takes” until there were no signs of material physical injury.

Due to hydraulic control limitations, the modeling results showed that the initially proposed “takes” for Chino Hills and WMWD (via JCSD) could not be maintained. Chino Hills’ proposed “take” was reduced from 1,000 afy to 0 afy, and the WMWD proposed maximum “take” was reduced from 10,000 afy to 5,000 afy. However, it was determined that Chino Hills could participate on the take side if it modified its pumping plans to take more water from the shallow aquifer system. (Optimizing the Chino Hills pumping plan should be included in a subsequent Basin-wide analysis of pumping and recharge plans, performed separately by the Basin appropriators and CBWM.)

Upon finalization of the DYY Program Expansion proposed “takes,” it was concluded that there may be potential material physical injury related to storage losses, groundwater levels, and change in direction and speed of a known water quality anomaly (contaminant plume). However, as summarized in Table 6-3, these impacts could be mitigated during implementation of the DYY Program Expansion and are considered to be beyond the scope of this investigation.

Table 6-3
Summary of Potential Material Physical Injuries and Mitigation Plans

Potential Injury	Background	Potential Mitigation
Storage Losses	Losses from storage caused by increasing the storage in the Basin for the DYY Program Expansion are projected to range from 50,000 to 100,000 acre-feet.	Implement reduced “takes” or supplemental “puts” to replace water lost from storage.
Groundwater Levels	The projected rising groundwater and declines in parts of the Basin from the scenarios are generally small and sustainable. However, per the Peace Agreement, any groundwater level declines are considered material physical injury and must be mitigated.	A mitigation plan may include strategic supplemental “puts” to maintain groundwater levels.
Change in Direction and Speed of Water Quality Anomalies	In the baseline alternative and DYY Program Expansion Operations Plan Scenario No. 1, the leading edge of a known plume traveled slightly more than 4 miles in the southwesterly direction and decreased in size near the Ontario and JCSD wells. This suggests that the DYY Program Expansion may contribute to water quality degradation in some wells.	Mitigation plans may include modified pumping patterns in MZ3, future installation of wellhead treatment, or other forms of remediation.

6.5 Proposed Shift Commitments and Required Facilities

This section presents the final shift commitments proposed under the DYY Program Expansion and each agency's required facilities to conduct the proposed "put" and "take" shifts. A "shift" refers to an agency's ability to roll off, or "shift" from, one supply in exchange for another.

6.5.1 Refined Shift Commitments

As discussed in Chapter 5, meetings were held with each of the major Basin Appropriators to determine their initial level of interest in participating in an expanded DYY Program. Agencies provided input on their interest in participating on the "put" side, "take" side, both, or neither. One of the variations between the DYY Program Expansion and the current DYY Program is the need for additional "put" facilities to supplement both in-lieu deliveries and wet water recharge. Enhancing the Basin's ability to "put" water into the Basin is a key objective of the DYY Program Expansion implementation and consistent with the Watermaster's Basin management objectives, including development of the future Recharge Master Plan (to be completed in 2010). Therefore, adjustments to any "put" contributions to the DYY Program Expansion were not required, and post-modeling adjustments were limited to the "take" side.

Table 6-4 presents a summary of the development of the final shift, or "take," commitments from the potential DYY Program Expansion participants. As shown in the table and as described in Section 6.4.3 above, the "take" commitments initially proposed by both Chino Hills and WMWD were decreased due to hydraulic limitations in the Basin. This total 6,000 acre-ft decrease is reflected in the difference between the totals of columns B and C in Table 6-4. Therefore, the total potential shift, or "take," commitment for the DYY Program has increased from 33,000 afy to 50,000 afy, for a net dry-year yield expansion of 17,000 afy.

Table 6-4
Summary of Development of Final Proposed Shift ("Take") Commitments

Agency	Shift ("Take") Commitment				
	Current DYY Program	Initial Proposed DYY Expansion	Proposed Total	Post-Modeling DYY Expansion	Final DYY Expansion
	A	B	A + B	C	A + C
Chino	1,159	2,000	3,159	2,000	3,159
Chino Hills(1)	1,448	1,000	2,448	0	1,448
CVWD	11,353	0	11,353	0	11,353
JCSD	2,000	2,000	4,000	2,000	4,000
MVWD (1)	3,963	5,000	8,963	5,000	8,963
Ontario	8,076	0	8,076	0	8,076
Pomona	2,000	2,000	4,000	2,000	4,000
Upland	3,001	1,000	4,001	1,000	4,001
TVMWD	0	0	0	0	0
WMWD	0	10,000	10,000	5,000	5,000
TOTAL	33,000	23,000	56,000	17,000	50,000

Notes:
(1) MVWD assumed Chino Hills' shift obligation of 1,448 afy per an amendment to the agreement between the agencies dated March 5, 2007.

6.5.2 Refined Facility Requirements

Chapter 5 presents the facility requirements for the potential Program Expansion participants. Although the modeling process restricted “take” contributions for both Chino Hills and WMWD, their facility requirements listed in Chapter 5 remained the same.

Chino Hills’ proposed Well No. 19 conversion to ASR would be an important “put” mechanism for the DYY Program Expansion. Although Chino Hills would be limited on any additional groundwater production contribution, modeling has shown that the extraction cycle for the ASR well may be used as backup for one of Chino Hills’ existing production wells should it be down for maintenance.

Although WMWD’s “take” contribution was reduced based on the groundwater modeling conducted for the DYY Program Expansion, the proposed Basin pipeline interconnection options would still be required at reduced capacity to export the shift to WMWD’s system. However, based upon communications with WMWD staff, construction of the full capacity of the pipeline interconnection options is desired in order to meet WMWD’s future planned deliveries into and out of the Basin.

6.6 Operations Plan for Expanded Program

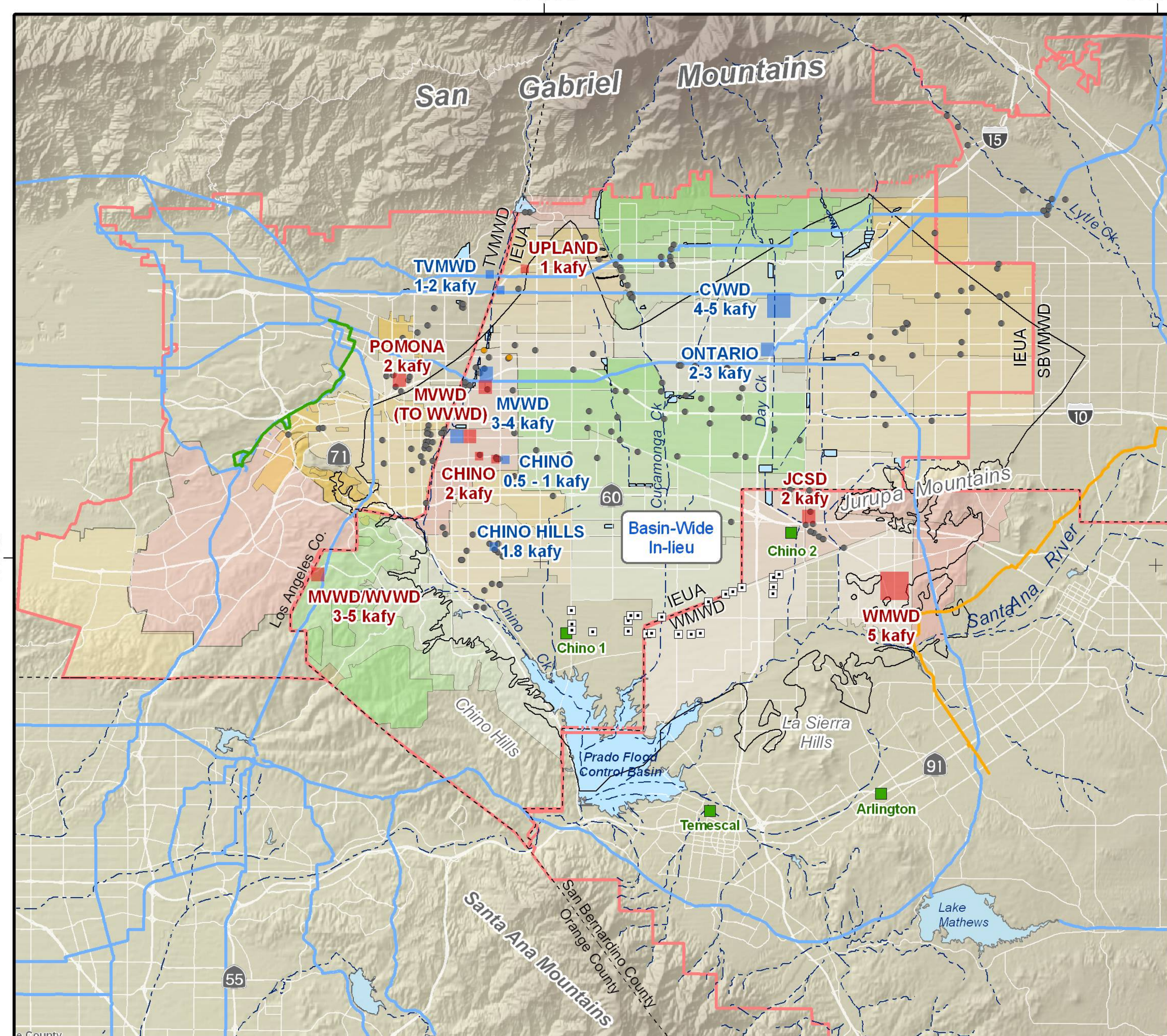
This section presents a summary of how the proposed facilities meet the “put” and “take” requirements for implementation of the DYY Program Expansion. The Operations Plan presented below would be used to conduct a program consistent with the range of acceptable storage developed in Operations Plan Scenario Nos. 1-3. It should be noted that the proposed shift commitments, facility requirements and operations scenarios developed in this PDR are conceptual only and are non-binding until a formal agreement is in place.

Figure 6-4 presents the locations for the proposed facilities proposed under the DYY Program Expansion. Also shown on the figure, and represented by the color and size of the marking squares, are each agency’s level of contribution toward the DYY Program Expansion.

6.6.1 Puts

Table 6-5 presents a summary of the potential “put” contribution and corresponding facility requirements from participating agencies. As described in Section 6.4.1, three “put” and “take” years are assumed to occur in any given ten year period. Therefore, for every acre-ft of additional dry-year yield developed under the DYY Program Expansion, an equivalent volume of “put” supply would be required to achieve a hydraulic balance.

As summarized in Section 6.6.2, the total additional dry-year yield generated under the DYY Program Expansion would be 17,000 afy, which, when combined with the initial DYY Program’s yield of 33,000 afy, would provide a total program yield of 50,000 afy. Therefore, a minimum “put” supply of 17,000 afy would be required. As shown in Table 6-5, about 11,000 to 16,000 afy of this amount would be generated by construction of new “put” facilities. The remainder would be made up by any combination of Basin-wide in-lieu deliveries and wet water recharge.



Proposed DYY Facilities

"PUT" Facility (12.3-16.8 kafy+basin-wide in-lieu)

"TAKE" Facility (15-17 kafy)

Imported Water Pipelines

Major Pipelines

Riverside Corona Feeder Pipeline

PWR Pipelines

Other Features

Appropriator Well

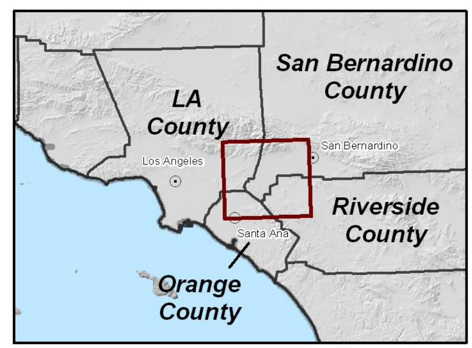
ASR Well

Desalter Well

Desalter Facility

Flood Control/Conservation Basins

Streams, Rivers, and Channels



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Proposed DYY Participants and Put/Take Locations

Figure 6-4

Table 6-5
Summary of "Put" Contributions for the DYY Program Expansion Operations Plan

Agency	"Put" (AFY)	Facility Requirement(s)
Chino	500 - 1,000	▸ Option B: Construct new injection well at Well No. 14 site
Chino Hills	500 - 1,000	▸ Convert existing Well No. 19 to ASR
CVWD	4,000 - 5,000	▸ Construct four new ASR wells
MVWD	3,000 - 4,000	▸ Option A: Use existing ASR Well Nos. 4, 30, 32, and 33; construct new ASR well ▸ Option B: Use existing ASR Well Nos. 4, 30, 32, and 33
Ontario	2,000 - 3,000	▸ Construct new imported water pipeline interconnection with CVWD to contribute in-lieu put
TVMWD	1,000 - 2,000	▸ Construct treated water pipeline from WFA WTP to Miramar WTP to contribute in-lieu put with Pomona ▸ Construct turnout along Azusa-Devil Canyon pipeline to deliver supplemental water to San Antonio Channel for recharge
All Participants	1,000 - 6,000	▸ Coordinate additional in-lieu exchanges and/or wet water recharge with Watermaster
TOTAL	17,000	--

A notable variance between the initial DYY Program and the proposed DYY Program Expansion is the "put" term. The Master Agreement for the initial DYY Program specified a maximum "put" of 25,000 afy, which, over a four-year "put" term, would provide 100,000 acre-ft of storage. The "put" from the initial DYY Program is accomplished by any combination of in-lieu exchanges and wet water recharge. To achieve a total program annual "put" of 50,000 afy (i.e., equivalent to the total program "take" and required if surplus supplies are available only three versus four years out of ten), approximately 34,000 to 39,000 afy of any combination of in-lieu exchanges or wet water recharge would be required.

6.6.2 Takes

Table 6-6 presents a summary of the potential "take" contribution and corresponding facility requirements from participating agencies. To achieve the total maximum 50,000 acre-ft "take" during a dry year, the facilities below would require construction to provide an additional 17,000 acre-ft of shift to the 33,000 acre-ft already developed under the Initial DYY Program.

Table 6-6
Summary of "Take" Contributions for the DYY Program Expansion Operations Plan

Agency	"Take" (AFY)	Facility Requirement(s)
Chino	2,000	▸ Option A: Construct new IX facility at Well Nos. 3 and 12 ▸ Option B: Construct new IX facility at Well No. 14
JCSD	2,000	▸ Construct three new production wells
MVWD	5,000	▸ Option A: Construct new ASR well and IX facility; rehabilitate existing Well No. 2 and construct IX facility ▸ Option B: Construct new IX facility at Well Nos. 4 and 27 ▸ Options A and B: construct new conveyance pipeline for export of shift to WVWD
Pomona	2,000	▸ Construct new IX facility at Reservoir No. 5
Upland	1,000	▸ Construct new Six Basins production well
WMWD	5,000	▸ Option A: Construct new JCSD-RC Feeder interconnection pipeline for export of shift to WMWD ▸ Option B: Construct new Chino II Desalter-Arlington Desalter Pipeline interconnection for export of shift to WMWD
TOTAL	17,000	--

6.6.3 Coordination of Facilities to Meet Operations Plan Requirements

The facilities proposed under the DYY Program Expansion would work in concert to achieve a balanced storage program in the Basin. Although some agencies elected to only participate on the "put" side, their contribution is vital to support the "take" conducted by other agencies. Balancing of these proposed "puts" and "takes" was confirmed by the groundwater modeling conducted for the Program. Although all facilities would work together to achieve the Program objectives, two major inter-agency coordination scenarios would be required to achieve the hydraulic balance proposed in this PDR. These scenarios are summarized as follows:

6.6.3.1 CVWD, Ontario, JCSD, and WMWD Coordination

Approximately 7,000 acre-ft of the total proposed DYY Program Expansion "take" would be accomplished by JCSD and exported out of the Basin to WMWD. The primary "put" supplies necessary to accomplish this "take" would include in-lieu deliveries into the Basin made possible by Ontario's proposed CVWD interconnection pipeline and CVWD's proposed ASR wells. These "put" facilities would provide the groundwater supply in MZ3 that is ultimately pumped out and delivered to JCSD and WMWD in exchange for reduced deliveries from Metropolitan.

6.6.3.2 MVWD, Chino Hills, and WVWD Coordination

Approximately 5,000 acre-ft of the total proposed DYY Program Expansion "take" would be exported out of the Basin to WVWD. MVWD's existing and proposed ASR and IX facilities would provide both the "put" and "take" capacity required to achieve this shift. The deliveries exported to WVWD would be wheeled through MVWD's and ultimately Chino Hills' existing transmission systems. Final delivery to WVWD would be accomplished via a new interconnection pipeline.

7.0 Ion Exchange Facilities Conceptual Design

7.0 ION EXCHANGE FACILITIES CONCEPTUAL DESIGN

7.1 Overview

This chapter presents a brief summary of available treatment technologies for removing contaminants from the Basin. General treatment facility design criteria and components are summarized for IX, which is a "Best Available Technology" (BAT) for nitrate removal. Detailed conceptual design criteria for agencies with wellhead treatment facilities are presented in Volume II.

7.2 Water Quality Design Requirements

Due to irrigation return flows from agriculture, dairy waste, municipal waste discharge, and groundwater pumping patterns, groundwater within the Chino Basin is impaired with several water quality contaminants. A Treatment Technology TM developed by B&V in 2008 identified six contaminants of concern in the Basin and reviewed currently available treatment strategies for removing them from the Basin groundwater supplies. The TM is included as Appendix B of this Volume. These six contaminants are summarized in Table 7-1 below.

Table 7-1
Groundwater Contaminants of Concern

Contaminant	Source	Range in Concentrations	Max. Contaminant Level
Nitrate (as NO_3^-)	Dairy waste disposal areas	ND – 122.0 mg/L	45 mg/L
Perchlorate (ClO_4^-)	Rocket fuel	ND – 17.0 µg/L	6.0 µg/L
Arsenic (As)	Naturally occurring	ND – 110 µg/L	10.0 µg/L
Volatile Organic Compounds (VOCs)	Trichloroethylene (TCE) & tetrachloroethylene (PCE) widely used industrial solvents for degreasing	ND – 12 µg/L	5 to 6 µg/L
Dibromochloropropane (DBCP)	Soil fumigant in orchards	ND – 1.27 µg/L	0.2 µg/L
Chrome VI (Cr)	Still under investigation	ND – 81 µg/L	<50 µg/L

Notes:
(1) ND – Non-detect
(2) µg/L – micrograms per liter
(2) Range in concentrations based on data collected from Basin appropriators and summarized in the Asset Inventory.

7.3 Available Treatment Technologies

Eight treatment technologies capable of treating the six Basin contaminants identified above were evaluated in the B&V TM. These processes include IX, reverse osmosis (RO), electrodialysis reversal (EDR), granular activated carbon (GAC), air stripping via packed tower aeration (PTA), advanced oxidation processes (AOP), iron coagulation followed by filtration (ICF), and adsorption onto iron-based media (IBM). Evaluation criteria included the technology's ability to treat specific contaminants and unit cost. Table 7-2 lists the technologies and the contaminants they can treat.

Table 7-2
Available Treatment Technologies for Basin Contaminants

Contaminant	Available Treatment Technologies							
	IX	RO	EDR	GAC	PTA	AOP	ICF	IBM
NO_3^-	✓	✓	✓					
ClO_4^-	✓	✓	✓					
As	✓	✓	✓				✓	✓
VOCs		✓(1)		✓	✓	✓		
DBCP		✓		✓	✓(2)	✓		
Cr	✓(3)	✓					✓(4)	✓(3)

Notes:
(1) Some RO membranes can remove limited amounts of VOCs.
(2) PTA designed for VOC removals can also remove limited amounts of DBCP.
(3) Anion exchange of Cr(VI) or adsorption of Cr(VI).
(4) Co-precipitation of Cr(III) in colloidal or particulate form.

While portions of the Basin are affected by one or more of the six constituents specified, the contaminant distribution maps developed by WEI, and presented in Chapter 2 of this Volume, show that the project areas being considered may contain elevated levels of nitrate, perchlorate, and arsenic. For inorganic contaminants such as these, IX would have the best combination of lower costs (both capital and O&M) and largest number of contaminants effectively removed. IX also has a smaller reject stream compared to both RO and EDR. The reject streams of 10 to 20 percent for both RO and EDR would add to the groundwater production loss; while the waste stream percentage of overall treated water flow for IX is much smaller, having a smaller impact on net groundwater production. Another advantage of IX for nitrate removal is that nitrate vessels can also remove limited concentrations of perchlorate in the feed water. Over time, the perchlorate can build up on the resin, resulting in a slightly shorter resin life.

7.4 IX Facility Parameters

IX is used extensively for softening municipal water supplies and for demineralization of water for industrial uses, such as production of semiconductor rinse water in the electronics industry and high-pressure boiler feedwater in the electric utility industry. Nitrate removal using IX for potable water use is a BAT currently in use by Pomona and Upland in the Basin. Figure 7-1 provides photos of typical IX installations.

NOTE:

This figure represents a typical IX facility and is not representative of a Calgon Carbon Corporation ISEP® facility, which would require a different arrangement of vessels.

BLACK & VEATCH building a world of difference™ ENERGY WATER INFORMATION GOVERNMENT	**Chino Basin Dry Year Yield Program Expansion Project** **IX Photos**	**Figure** **7-1**

7.4.1 Process Overview

IX refers to the exchange of one ion for another. The process consists of two cycles: production and regeneration. In the production mode, the pressurized feed water is passed through a pressure vessel holding a packed resin bed that selectively removes a targeted constituent for another benign species of equal charge. For example, chloride is exchanged for nitrate. The surface of the resin is covered with exchange sites. Eventually, the available exchange sites are filled, the bed is exhausted, and breakthrough of the contaminant can occur. The process then switches to regeneration mode.

In regeneration mode, the exhausted bed is regenerated with high concentration solutions that reverse the IX process. Using nitrate IX as an example, the anionic resin bed is regenerated with concentrated sodium chloride brine solution. The high concentration of chloride in the brine solution displaces the nitrate ion from the active sites. The concentrated waste regenerate is then captured and sent to disposal.

During regeneration, the brine solution is introduced countercurrent to the feed water to minimize nitrate leakage. The brine regeneration is followed by a slow rinse using softened water, also in the countercurrent mode. Regeneration requires storage tanks for brine solution and softened water, waste regenerate equalization tanks, brine and softened water production units, and associated pumps and valves.

Because the IX resin generally produces a higher quality water than required, the treated water can sometimes be blended with raw water to meet the desired finished, or blended, water quality and reduce the overall water treatment costs. The finished water may need to be pH-adjusted prior to distribution, depending on the pH of the source water.

7.4.2 Treatment of Specific Contaminants

An anionic exchange resin could be used to remove nitrate, arsenic, and perchlorate from water. Nitrate leakage through IX vessels is approximately 4 percent on average. With blending, overall nitrate removal is typically between 75 to 98 percent. Full-scale treatment facilities have also demonstrated arsenate removals of 95 to 99 percent. Similar removal of the arsenite form can be achieved if provisions for oxidation to arsenate are included prior to the IX process. Bench-scale tests show that IX can decrease perchlorate concentrations to below detection levels.

7.5 General IX Facility Design

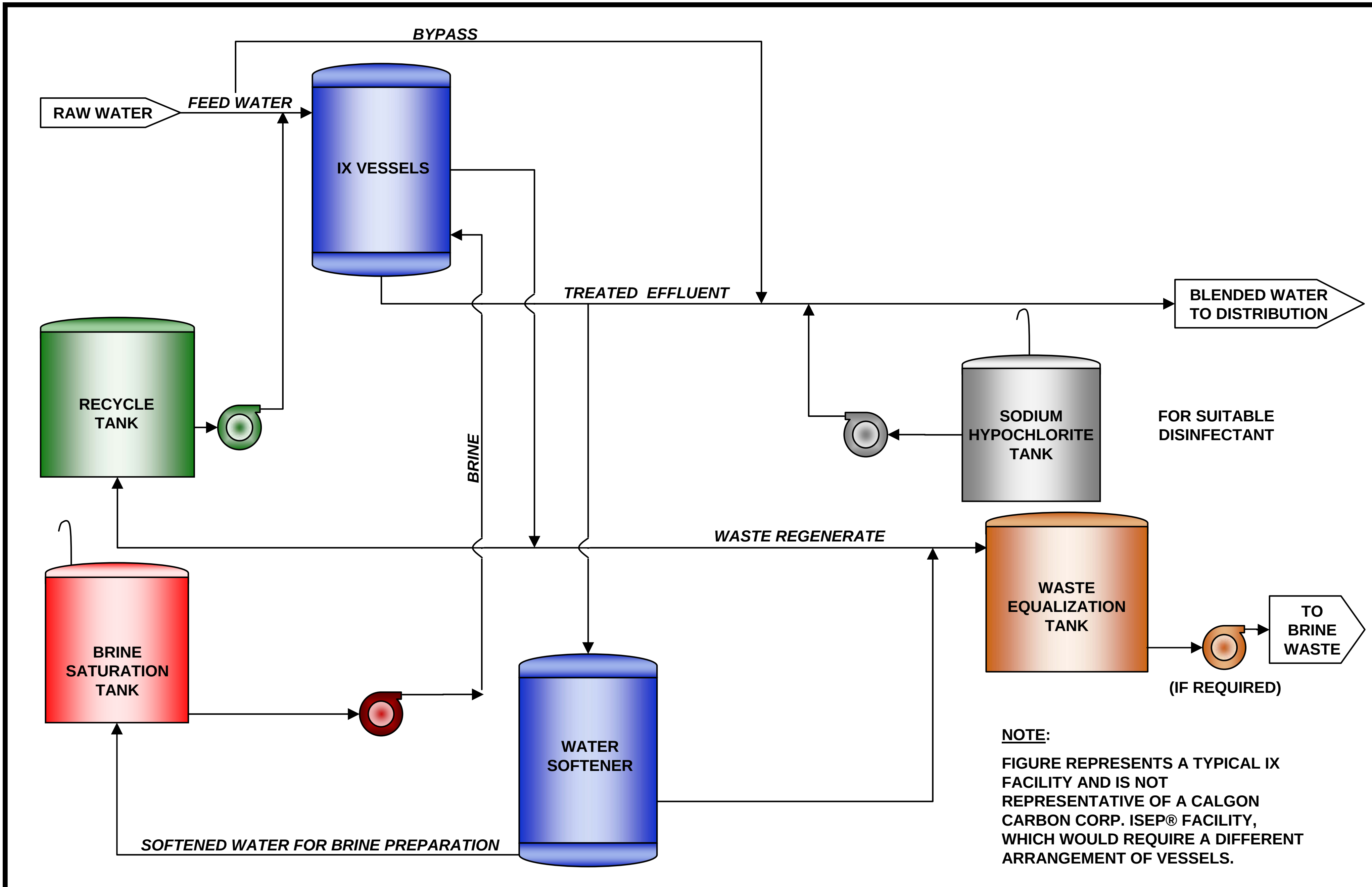
IX resins have high surface areas, which provide numerous exchange sites for the adsorption of contaminants. An important property of IX resins is their "selectivity." When exposed to a mixed solution of ions, a resin will exchange one type of ion preferentially over another. A standard anion resin has selectivity expressed as follows:

$$HCO_3^- < Cl^- < NO_3^- < SO_4^-$$

Therefore, a standard anion resin has a greater affinity for sulfate (SO_4^-) than for nitrate (NO_3^-). As the resin's capacity to exchange nitrate and sulfate ions is exhausted, the resin will begin to release nitrate ions in order to continue to exchange sulfate ions. The same applies for bicarbonate (HCO_3^-) because high concentrations of bicarbonate are commonly found in groundwater. As the number of exchange sites in the resin bed become limited, bicarbonate ions are displaced for more selective ions such as nitrate and sulfate. This is known as "chromatographic peaking" and can result in a much higher nitrate concentration in the treated water than in the raw water applied to the resin bed. Problems related to chromatographic peaking and release of nitrate from the resin bed to the treated water can be avoided through periodic monitoring of the treated water quality.

Figure 7-2 presents a process schematic of a typical IX facility. As shown on the figure, a typical IX facility consists of five major components: a raw water supply, IX treatment, blended water delivery, resin regeneration, and waste disposal systems. The raw water supply consists of an on-site well or a pipeline delivering either groundwater from an off-site series of wells or surface water. The IX treatment system consists of a series of vessels and appurtenant facilities that remove nitrate and other constituents from the raw water supply. The treated water delivery system consists of appropriate disinfection facilities (chemical tanks and metering pumps) and a pipeline conveying the treated water to the local distribution system. The IX regeneration system consists of a water supply source, water softener, brine tank, and pumps that deliver the brine to the IX vessels. Finally, the waste disposal system consists of a waste equalization tank to deliver a constant flow of waste to the local Non-Reclaimable Wastewater (NRW) System. The waste disposal system would consist of a waste holding tank and a series of pumps if gravity flow is not possible. A waste recycle system can also be implemented in conjunction with the waste disposal system to reduce the amount of waste conveyed to the NRW System by recycling water used for regeneration to the head of the plant prior to the introduction for the brine solution.

The size of an individual IX facility is specific to the application. However, most IX facilities are modular in construction and are comprised of a series of treatment vessels. The number and capacity of these vessels are determined so that the entire process flow can be treated with one of the vessels out of service for maintenance or in the regeneration mode. The modular design also facilitates future expansion of the IX facility, if required. The IX process can be defined more easily when broken into the: production and regeneration modes.



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Chino Basin Dry Year Yield Program Expansion Project

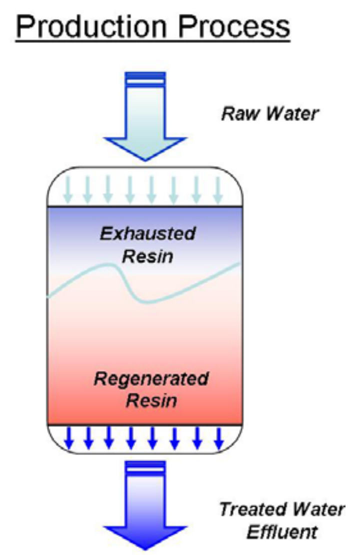
IX Process Schematic

Figure

7-2

7.5.1 IX Production Mode

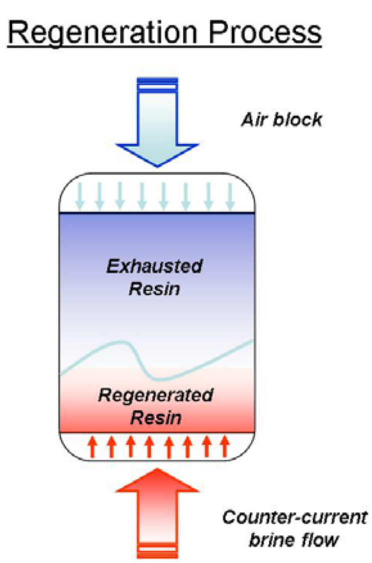
While one of the IX vessels is in the regeneration mode, the remaining vessels are in the production mode at different stages of nitrate breakthrough. During the production mode, raw water is conveyed to the IX facility from either an on-site well or a series of off-site wells. Before the raw water is conveyed to the IX vessels for treatment, the raw water flow is split into two streams: a feed water stream and a bypass stream. Because the IX resin generally produces higher quality water than required, the resulting treated water can be blended with raw water to meet the design blended water quality and reduce the overall water treatment costs. The feed water stream is conveyed to the IX treatment vessels in production mode, where the raw water is passed through the anionic resin beds in a downflow direction. This treated water stream is then combined with the bypass stream to form a blended water stream that meets the specific water quality requirements of the IX facility. The blended water is disinfected and discharged to the local area distribution system or reservoir.



As raw water flows through the vessel, the resin bed gradually becomes exhausted.

7.5.2 IX Regeneration Mode

One of the IX vessels would be in regeneration mode while the remaining vessels are in production mode. When the IX capacity of the resin bed has become exhausted, the nitrate concentration in the treated water from an individual vessel will increase, thus signaling the need for bed regeneration. Countercurrent regeneration would be used in order to minimize nitrate leakage through the IX vessels and to minimize the potential impacts of variations in raw water nitrate concentrations. For countercurrent regeneration, the regenerate solution is introduced in an upflow direction at the bottom of the IX vessel. The resin at the bottom of the vessel is therefore essentially completely regenerated. The IX resin would be regenerated using a sodium chloride (brine) solution. The concentrated brine solution is diluted prior to entering the IX vessels. An automated brine production system, which incorporates bulk salt storage and brine preparation and storage facilities within a single tank, would be provided. A typical IX vessel regeneration cycle consists of the following steps shown in Table 7-3.



Counter-current regenerated IX systems reduce potential nitrate breakthrough.

Table 7-3
IX Facility Regeneration Cycle

Step	Description	Flow to Waste	Flow to Recycle
1	Brief low-rate backwash using IX system feed water		✓
2	Allow resin bed to settle	N/A	N/A
3	Compact bed using IX system feed water		✓
4	Drain freeboard from vessel		✓
5	Upflow regeneration using the diluted brine solution	✓	
6	Upflow salt rinse using softened water	✓	
7	Refill freeboard with IX system feed water	✓	
8	Brief downflow fast rinse using IX system feed water	✓	

In accordance with IX system manufacturer recommendations, the water used to prepare the salt solution and to perform the upflow slow rinse following vessel regeneration should be softened in order to minimize the potential for calcium carbonate precipitation within the resin beds. Although the precipitation is not detrimental in the short term, the long term effects may include increased resin attrition and leakage of nitrates [Purolite A-520E Technical Data]. It is also recommended that the brine waste from the IX vessels be conveyed separately to the NRW System from the softener brine waste, which can be accomplished with paralleled NRW pipelines.

Waste produced from the IX treatment system regeneration mode would consist of vessel backwash and rinse flows and the regenerate stream discharge from the IX vessels (containing the nitrate ions removed from the resin). Waste flows from the water softener would also contribute to the IX facility waste generation. All of these waste flows would be conveyed to a waste equalization tank, where they would be pumped or drained via gravity at a controlled rate to the NRW System.

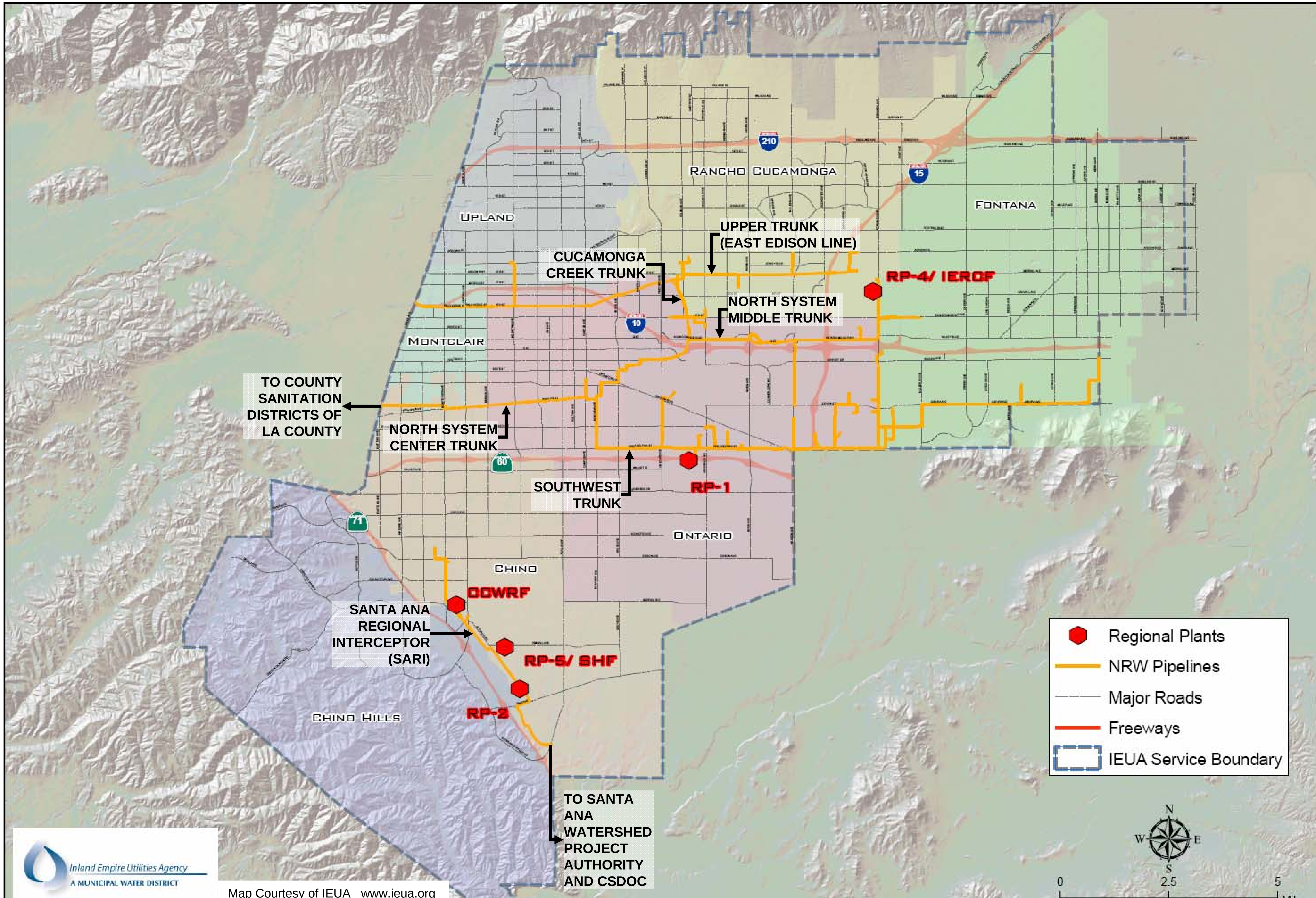
7.6 General Design Criteria

7.6.1 Site Requirements

Each site would include all necessary electrical enclosures, security fencing, driveway accessibility, and maintenance space as required. Drainage would be provided and be designed on a site-by-site basis.

7.6.2 Waste Disposal

The IX facility would deliver waste regenerate to the NRW System, owned and operated by IEUA, or to the Chino Basin Wastewater Line (CBWL) operated by the Los Angeles County Sanitation District (LACSD), Figure 7-3 provides a map of the NRW System pipeline. The system conveys industrial wastewater and other salt-laden water to the LACSD and Orange County Sanitation District (OCSD) wastewater plants. Two methods for delivering waste to the NRW System would be through connecting a waste regenerate line directly to the NRW System or by hauling the waste regenerate to an NRW System disposal site.



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Chino Basin Dry Year Yield Program Expansion Project

Inland Empire Utilities Agency Non-Reclaimable Waste System

Figure 7-3

All IX facilities considered in the Program Expansion would use waste regenerate lines to connect directly to the NRW System through the Upper Trunk (East Edison and West Edison Lines), CBWL, or to Santa Ana Regional Interceptor (SARI) via the South System Chino Line. Since these lines operate under gravity flow, the waste regenerate lines for the IX facilities would convey the waste flow without boosting.

Connecting waste regenerate lines to the NRW System or CBWL requires completing the Application for Capacity Right (ACR) Agreement, purchasing hydraulic capacity in the NRW System or CBWL, and completing an application for a wastewater discharge permit. The ACR Agreement stipulates the flow rate of waste regenerate to be discharged into the NRW System. Hydraulic capacity fees cover the cost for IEUA's operation and maintenance of the NRW System. The wastewater discharge permit is a joint authorization form to the relevant wastewater agency and IEUA in order to discharge waste regenerate into the NRW System with specific limits for pollutants of concern. To apply for the wastewater permit, the following is required:

1) A complete permit application.
2) Six sets of plans.
3) A schematic diagram for the water mass balance with average flow rates for water usage and discharge for the facility.
4) Descriptions of manufacturing process, wastewater generation process, and wastewater treatment practice, if any.
5) Lists of primary raw material and products.
6) A wastewater characteristic report from a similar facility.

Applications and additional information can be found on IEUA's website (http://www.ieua.org).

7.6.3 Structural and Seismic

Design of all structural elements shall comply with the applicable design codes, standards, and references listed below.

- Available geotechnical reports for area
- California Building Code (CBC), 2007 Edition
- American Concrete Institute (ACI) 318-05, "Building Code Requirement for Reinforced Concrete"
- American Institute for Steel Construction (AISC) Manual of Steel Construction, 9th Edition
- Aluminum Construction Manual "Specifications for Aluminum Structures"
- Reinforced Masonry Engineering Handbook, Masonry Institute of America, J.E. Amrhein, 5th Edition

7.6.4 Electrical Design Criteria

Design of all electrical components shall comply with the applicable design codes, standards, and references listed below.

- National Electrical Code (NFPA 70)
- National Electrical Manufacturers Association (NEMA)
- American National Standards Institute (ANSI)
- Institute of Electrical and Electronics Engineers (IEEE)
- Underwriters Laboratory (UL)

The majority of new electrical loads would be from the process pumps (brine pumps, recycle pumps, and waste disposal pumps). The need for new Southern California Edison (SCE) utility transformers would be assessed on a facility by facility basis as some of the new IX facilities would be constructed adjacent to existing infrastructure that may already have an existing transformer with available capacity.

Site lighting would be provided at each of the major process areas. The load required for the site lighting would be factored into the load requirements for the entire IX facility.

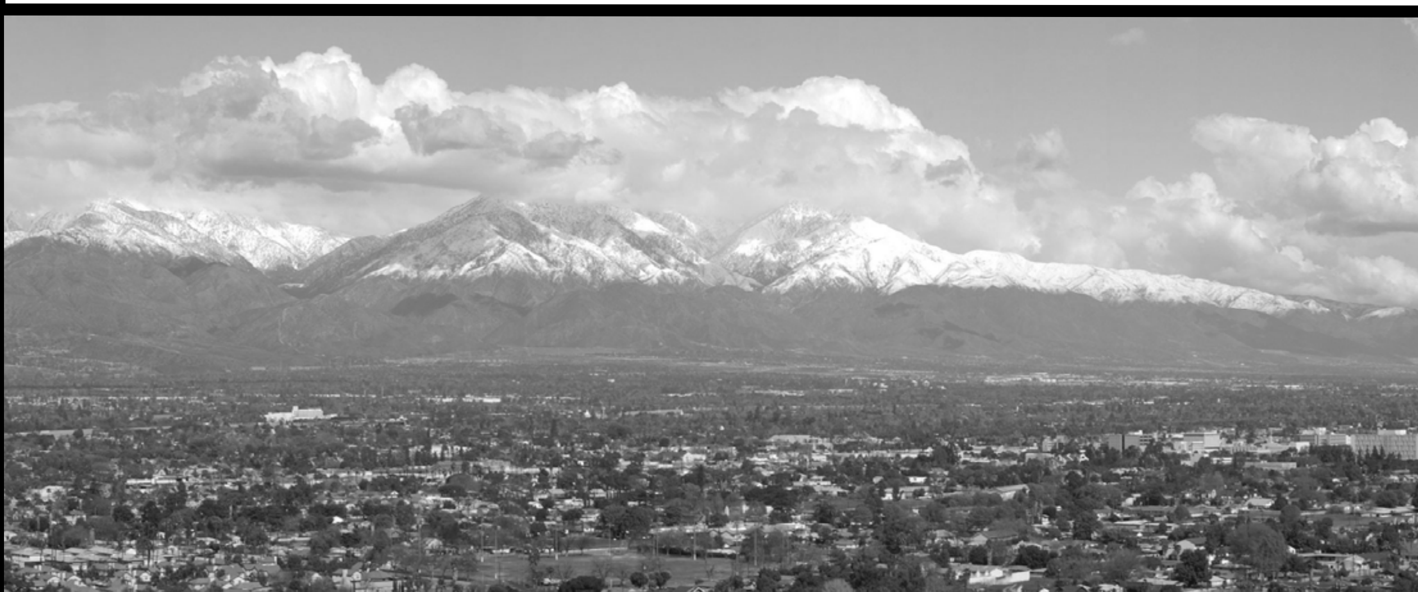
New motor control centers (MCCs) would be provided for new added loads from the IX facility.

7.6.5 Instrumentation and Control Design Criteria

All equipment and instrumentation would be designed to be monitored remotely by the operation center. All systems would be provided with adequate alarming and monitoring to ensure a safe shutdown or systems should a failure occur.

All systems would be provided with both remote and local control (local control would not require the use of the computer system; local control would override any remote control for the equipment). Instrumentation would be provided with local displays for monitoring without the plant control system.

8.0 Production Well and ASR Facilities Conceptual Design



8.0 PRODUCTION WELL AND ASR FACILITIES CONCEPTUAL DESIGN

8.1 Overview

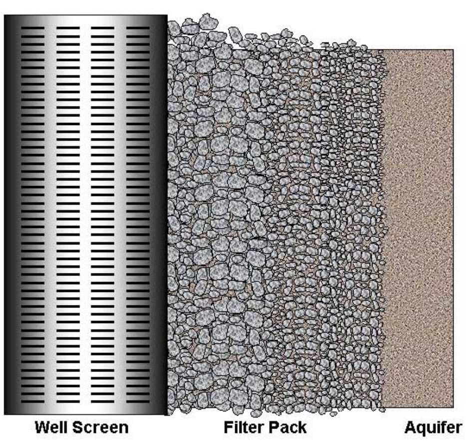
This chapter presents the design principles and general design criteria for production and ASR well facilities. Detailed conceptual design criteria for agencies with production well and ASR facilities are presented in Volume II.

8.2 Groundwater Production Wells

A groundwater production well enables groundwater to be extracted from an underground aquifer to the surface, where it can be used for water supply. Following drilling, the well is stabilized with a solid steel or stainless steel casing to the point of contact with the aquifer. The casing is perforated for the depth of the aquifer and maintains the integrity of the hole while allowing water from the aquifer to pass through it. A gravel pack around the screen prevents the perforations from becoming blocked with fines from the surrounding soil.

Water passing through the screen is drawn to the surface through either a down-well submersible pump or a vertical lineshaft pump, where the drive unit and discharge head are mounted at the top of the well. If the water meets appropriate quality standards, it would be disinfected and sent to a reservoir or directly to the agency's distribution system. If it does not meet standards, further treatment would be necessary. Anticipated water quality concerns for the Basin and suggested treatment strategies are described in Chapter 5.

The power consumption of a well is a direct measure of the energy required to pump the water out of the aquifer to its discharge point and therefore generally depends on the depth of the well and the volume of water involved. The depth to the Basin varies from north to south, with the distance to the aquifer being greater in the north. In general, for the same volume of water, wells located in the northern part of the Basin require more pumping power than those in the southern part, due to the deeper groundwater level.



Cross-sectional view of a groundwater well casing and gravel pack.

Figure 8-1 presents photo renderings of a typical well installation. A small building or block wall may be provided as required to enclose the well and provide a visual buffer, as well as a security barrier. This form of screening may also be required in order to reduce potential noise disturbance from a surface-mounted motor mounted on a vertical pump. A typical production well plan and section is provided on Figure 8-2.

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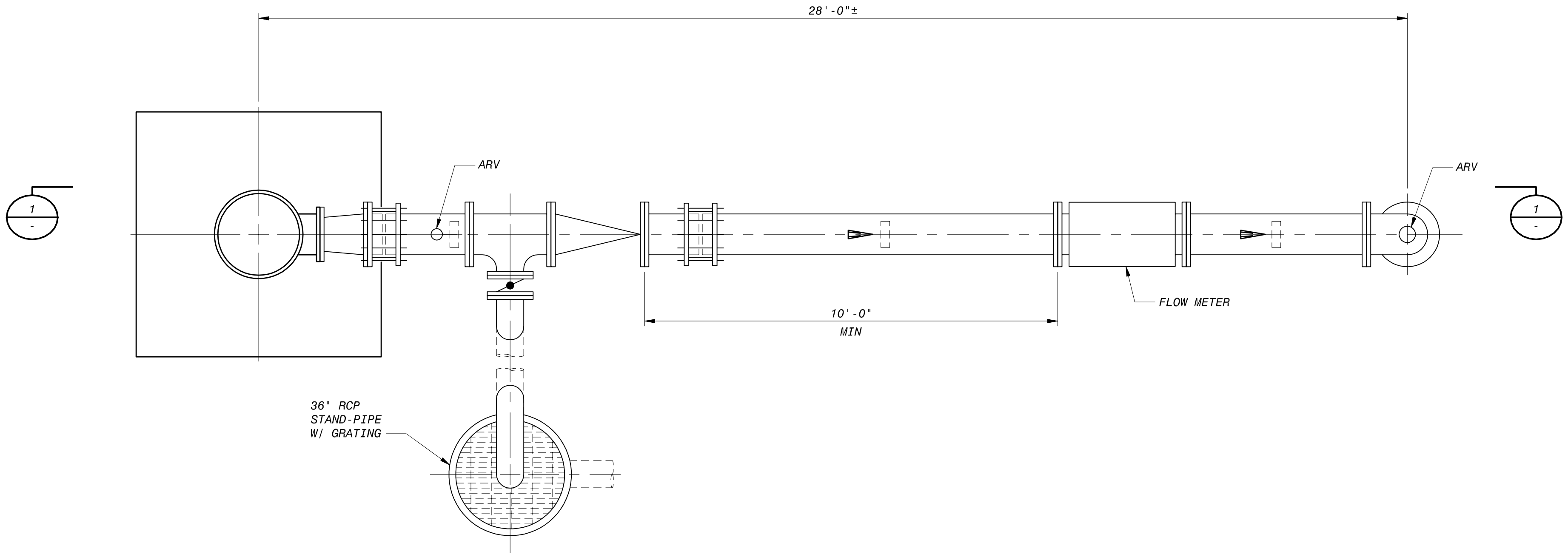
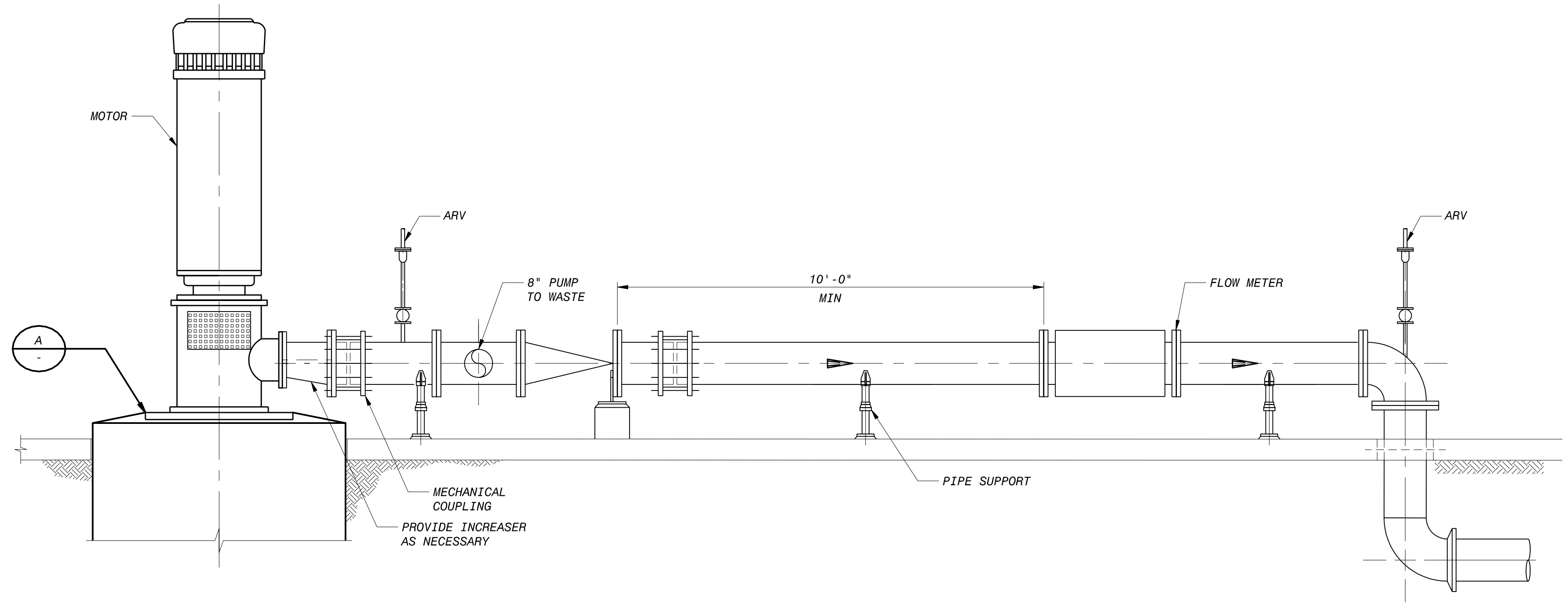
Photo Renderings of Typical Well Installation

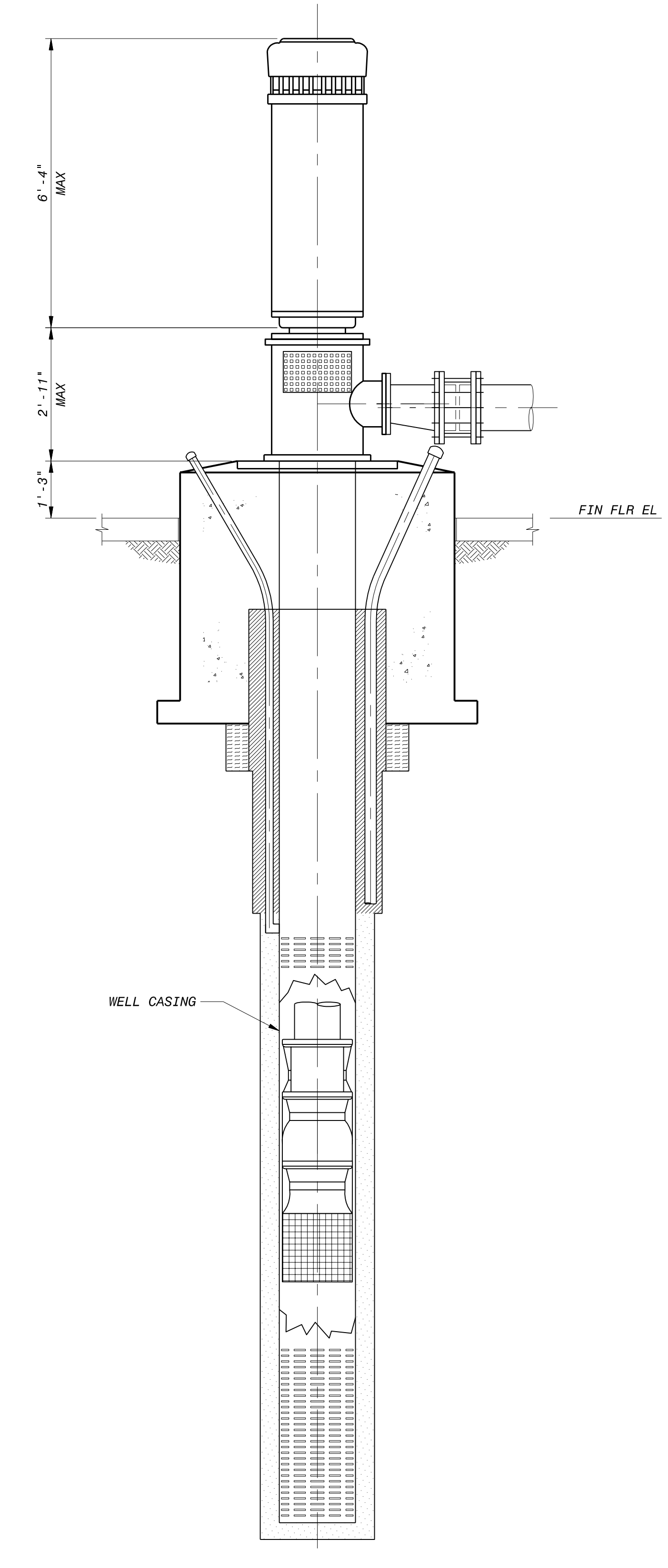
Figure 8-1



PLAN
1/4" = 1'-0"



SECTION 1/-
1/4" = 1'-0"



WELL PUMP SETTING DETAIL A/-
1/4" = 1'-0"

CONCEPTUAL - NOT FOR CONSTRUCTION

DATE	REVISIONS AND RECORD OF ISSUE	NO.	BY	CK	APP

CYGNET ID: 160374-2000-WTUP-C-N00013YGC XREF1:
WF:Figure 8-3.dwg XREF2:
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PLOTTED:GLA36511, 12/11/2008 10:56:59 AM XREF4:
USER:GLA36511 DWG VER:1.3 XREF5:

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Black & Veatch Corporation
Irvine, California

CHINO BASIN DYY PROGRAM EXPANSION PROJECT
PROJECT DEVELOPMENT REPORT

TYPICAL PRODUCTION WELL
PLAN AND SECTION

DESIGNED: JEG
DETAILED: BF
CHECKED:
APPROVED:
DATE:

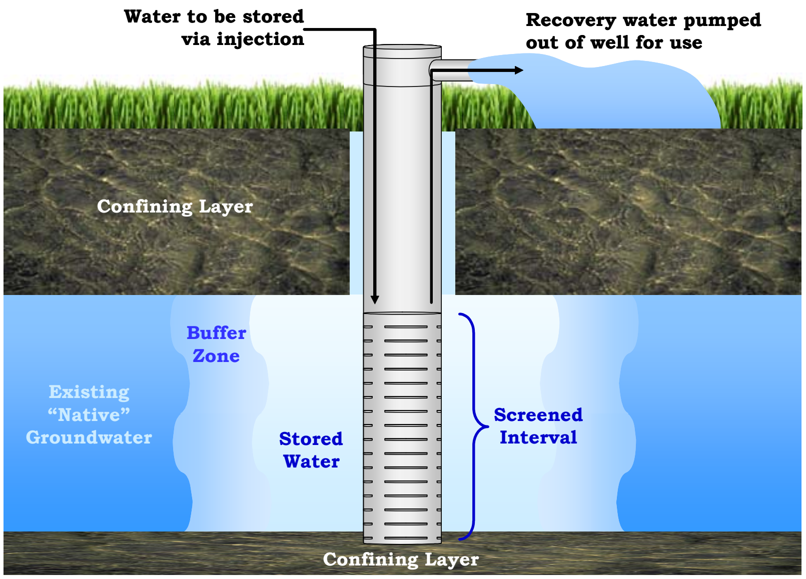
PROJECT NO.
160374

FIGURE 8-2

FD160374
D160374

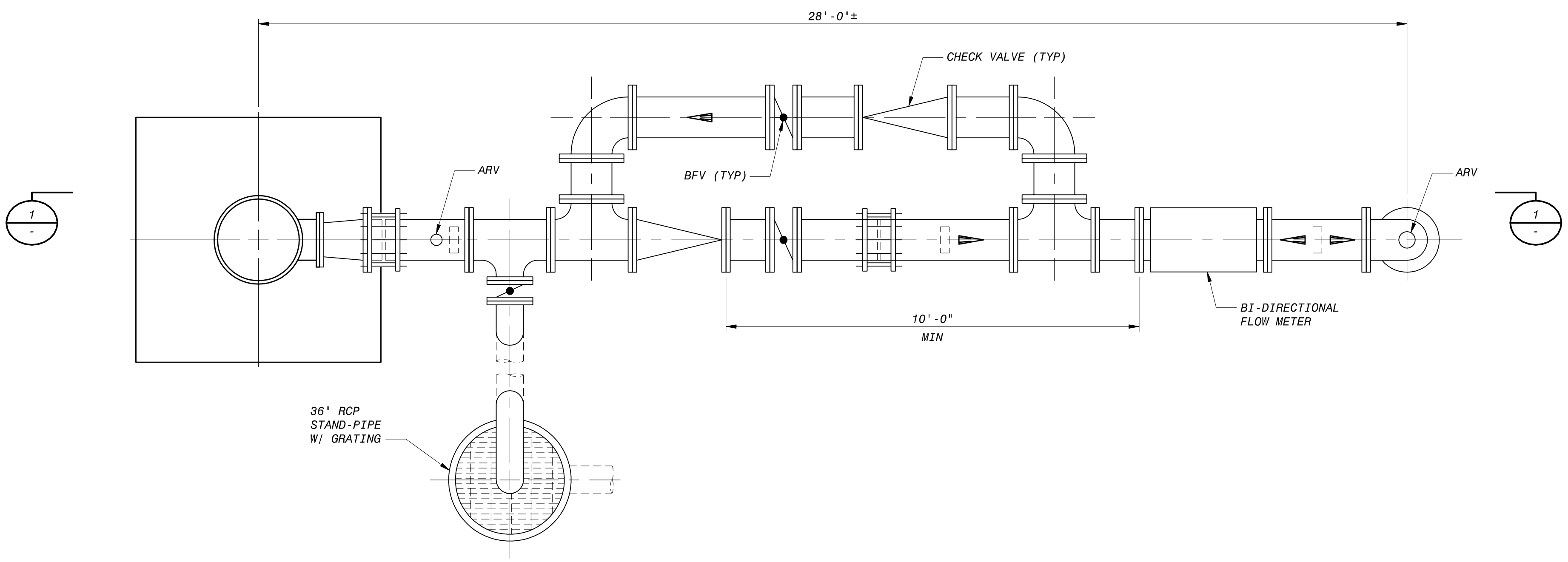
8.3 ASR Wells

ASR is a water management approach that typically consists of placement (injection) of treated water down through a well for storage in a confined aquifer system and later recovery up through the same well. In general, the recovered water quality would not be the same as the quality of the injected water because of mixing within the aquifer between native groundwater and recharged water. Typically, the recovered water quality improves over successive cycles of “puts” and “takes”; however, the complex geochemical reactions involved with mixing sources with different water quality characteristics can potentially lead to issues such as clogging or blocking of the aquifer, thereby impacting the long term production capacity of the well. Because the quality of the recovered water is difficult to predict, testing to assess the suitability of a location prior to installing an ASR well would be critical.

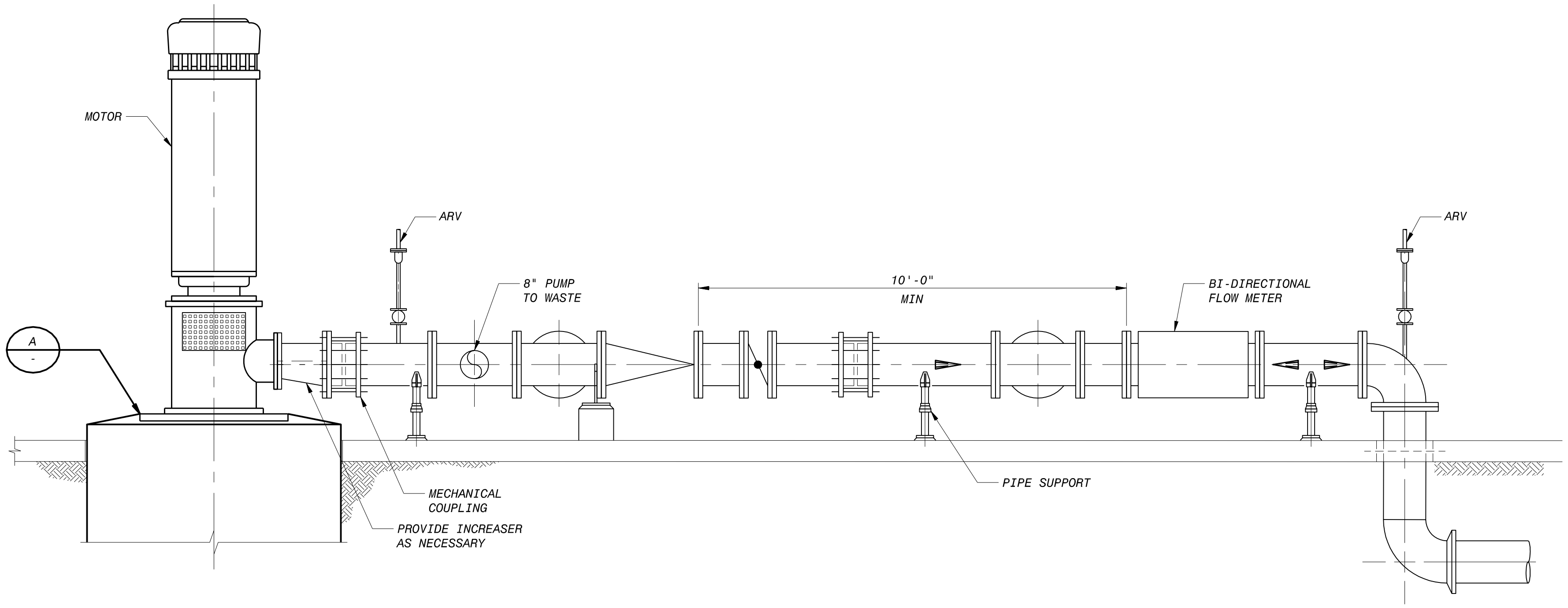


ASR well schematic showing the storage and recovery of water in an aquifer.

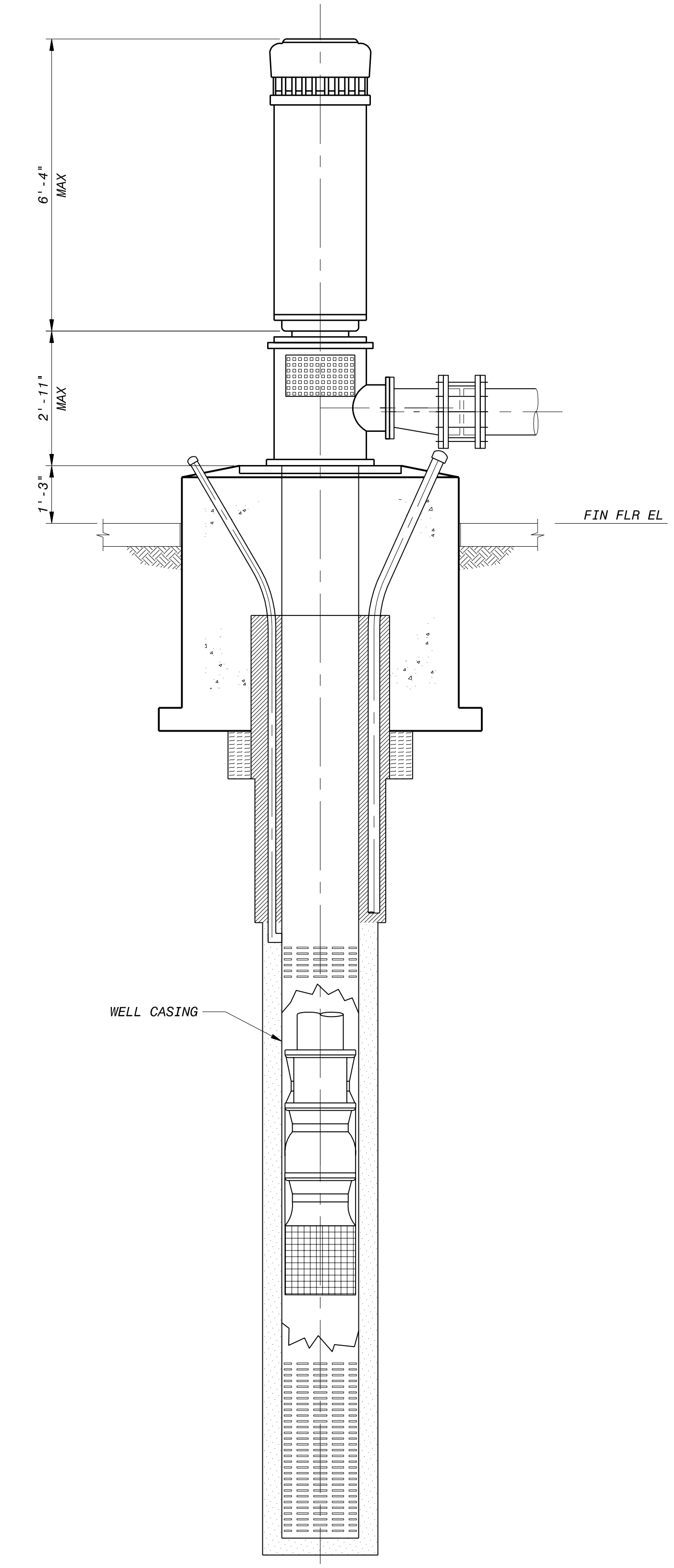
The construction of an ASR well, the equipment, and the land area required are similar to the groundwater production well discussed in Section 8.2. Unlike production wells, the well screen and packing material would be designed to allow bi-directional flow between the aquifer and the pump column. Additional piping, valves, and controls would be added to provide the option for storage in the aquifer. As shown on Figure 8-3, the function of the ASR well is controlled by two butterfly valves. During recovery, the butterfly valve in the injection leg section is closed; water is pumped from the aquifer through the production leg of the horizontal pipe and into the distribution system. During storage, the butterfly valve in the production leg section is shut, and water is pumped or flows by gravity through the injection leg and into the aquifer. The hydraulic difference in elevation between the supply line and the groundwater allows water to flow out through the well screen and into the surrounding aquifer, creating a localized bubble of good quality water around the injection location.



PLAN
1/4" = 1'-0"



SECTION 1 -
1/4" = 1'-0"



WELL PUMP SETTING DETAIL A -
1/4" = 1'-0"

CONCEPTUAL - NOT FOR CONSTRUCTION

NO. | BY | CK | APP

DATE | REVISIONS AND RECORD OF ISSUE

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USER:GLA36511 | DWG VER:1.3 | XREF5:

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Black & Veatch Corporation
Irvine, California

CHINO BASIN DYY PROGRAM EXPANSION PROJECT
PROJECT DEVELOPMENT REPORT

TYPICAL ASR WELL
PLAN AND SECTION

DESIGNED: JEG
DETAILED: BF
CHECKED:
APPROVED:
DATE:

PROJECT NO.
160374

FIGURE 8-3

FD160374
D160374

8.4 Well Facility Design Criteria

The design criteria for the proposed production and ASR wells facilities would conform to the following general design criteria. Conceptual design criteria specific to each facility are presented in Volume II.

8.4.1 Well Drilling

A geotechnical survey would be conducted for the proposed well site to establish the most suitable drilling method for the anticipated ground conditions. Based on the recommendations, a small-bore pilot bore hole would generally be drilled and downhole geophysical surveying (electric logging) carried out. Once the geophysical conditions of the pilot bore hole have been evaluated, the pilot bore hole would be enlarged by reaming to form the production well. Requirements for on-site monitoring wells would be determined for each specific site.

The final depth of the proposed well and required length and elevations of screens would depend on the geophysical conditions determined during the electric logging.

After the well has been drilled, the well casing, screens, gravel pack and sanitary seals would be installed. The well would then undergo a development and test period. For the development and testing, a temporary pump would be installed, and the water would be discharged to a drain. The mechanical development of the well would include pumping and surging at a higher rate than the anticipated production rate to clear the well and maximize the production capacity. Step-drawdown and constant-rate testing would establish the sustainable output from the well.

During pump testing of a new drinking water supply well, samples would be taken to establish the raw water quality and determine the need for treatment.

8.4.2 Wellhead Equipment

After the well has been installed and developed, the final design production rate, specific capacity and drawdown, and total dynamic head criteria would be determined to confirm the sizing and selection of the pump and motor.

8.4.2.1 Deep Well Pump and Motor

The well may be equipped with either an aboveground, line-shaft, vertical turbine pump or a submersible motor, vertical turbine pump.

Line-shaft, vertical turbine pumps for deep wells require lubrication of the shaft with either water or vegetable oil. These pumps are generally suitable for wells up to 600 feet deep. For depths greater than 600 feet, power loss in line-shafting, shaft and column stretch, and the well alignment itself become areas of concern that need careful consideration during design. However, the above grade electric motors typically have excellent efficiencies of between 85 and 90 percent. Their surface-mounted location makes them easier to maintain than submersible pumps, but also means that consideration needs to be given to the location of the site and potential noise impact on surrounding property.

Submersible motor, deep well vertical turbine pumps do not require special line shaft lubrication, do not suffer from line shaft stretch, and emit negligible above ground noise. They are generally more suitable than vertical lineshaft pumps in deep wells, greater than 600 feet, where the alignment is not necessarily plumb. The capital cost of the submersible motor is more than the cost of an above ground motor and maintenance is more difficult since the entire pump column must be pulled out to access the motor. In addition, the well would have to be larger in diameter to accommodate the pump and its associated power cabling. Efficiencies are typically between 80 to 85 percent, which corresponds to an increase in motor size of about 10 to 15 percent compared to above ground motors.

Because vertical line-shaft pumps are much more common in the Basin than submersible pumps, conceptual designs for all new wells provided in this PDR assume multi-stage, line-shaft, vertical turbine pumps with above ground high efficiency motors. The motors would be either adjustable frequency drives (AFDs) or fixed speed drives, depending on the application. This should be re-evaluated at the detailed design stage to determine if submersible motor vertical turbine pumps would be a more suitable alternative.

8.4.2.2 Piping, Valves, and Appurtenances

The discharge piping would include a check valve, a motor operated isolation valve, and air release valves. At least one pressure indicator and one high-accuracy flow meter would also be included. The well site would include pump-to-waste capabilities for use during development. The pump-to-waste piping would include isolation valves and possibly a pressure reducing device such as an orifice plate. The waste flow would have an air gap at the point of discharge and would preferably be disposed of to a storm drain.

8.4.3 Site Requirements

The well site would include all necessary electrical enclosures, security fencing, driveway accessibility, and maintenance space as required by each appropriator. Drainage would be provided and be designed on a site-by-site basis.

Unless otherwise required by the agency, the pump motor and discharge piping would generally be located uncovered and outdoors. Depending on other site considerations, the use of a sunshade, wall or screen to control noise, or a small masonry building for security may be required.

8.4.4 Electrical Design Criteria

Design of all electrical components would comply with current applicable design codes, standards, and references.

The majority of the new electrical load would be from the well pump. New stipulations from SCE are for only one meter per Agency site. The additional load from the well may result in the requirement for a single, new transformer to power the entire site, including the existing equipment.

The need for a new SCE utility transformer would be assessed on a facility by facility basis during detailed design.

Site lighting would be provided at each site as required by the agency's standards. A new MCC would be provided for the pump motor.

8.4.5 Instrumentation and Control Design Criteria

The well site would have instrumentation and telemetry to support remote control and monitoring.

All equipment and instrumentation would be designed to be monitored remotely at the appropriator's operations center. All systems would be provided with adequate alarming and monitoring to ensure a safe shutdown of systems should a failure occur.

All systems would be provided with both remote and local control. Local control would not require the use of a computer system and would override any remote control for the equipment.

Actuators on the flow control valves at the well would allow automatic and remote control of the 'put', 'take', and 'run to waste' phases of the well operation.

9.0 Opinion of Probable Cost

9.0 OPINION OF PROBABLE COST

9.1 Overview

Conceptual-level capital, operations and maintenance (O&M) and annual cost breakdowns for the ten program participants under the DYY Program Expansion are presented in Volumes II A-J of the PDR. This chapter presents general cost assumptions and a summary of the conceptual-level capital and annual O&M costs developed in Volume II.

9.2 General Cost Assumptions

9.2.1 Basis for Cost Assumptions

The conceptual-level Opinion of Probable Capital and Annual O&M Costs developed in this PDR were derived from quotes received from equipment manufacturers, a survey of bid pricing from participating agency facilities previously or currently under construction, and bid results or construction cost estimates from similar and recent B&V projects. Table 9-1 summarizes some of the major Program Expansion facility components and an overview of the basis for the major unit cost assumptions used in this PDR.

Table 9-1
Summary of Major Facility Unit Cost Assumptions

Facility Component	Basis for Unit Cost Assumption
New Production and ASR Wells	Average of survey results from recent well construction projects constructed for the CVWD, JCSD, MVWD, and Ontario. Information obtained was divided into five categories, including: (1) drilling and casing; (2) equipping, sitework, electrical and mechanical; (3) emergency generator; (4) disinfection system; and (5) pumphouse or electrical building.
Well/ASR Conversions	Estimate based on survey results from new production/ASR wells above.
IX Treatment	Equipment quotations received from Hungerford and Terry and Calgon Carbon Corporation for typical regenerable and ISEP®-type facilities, respectively.
Conveyance Pipelines	Average unit cost per inch diameter linear foot based on evaluation of bid pricing from recent B&V pipeline projects.
Pump Stations	Unit cost criteria based on previous, local construction cost estimates and similar conceptual-level evaluations.
River, Freeway, Railroad and Storm Channel Crossings	Unit costs developed by B&V cost estimating professionals.
SARI/NRW Capacity and Operational Charges	Unit costs derived from Resolution No. 2008-10-1, provided by IEUA staff.
Land	Unit cost based on estimated average land value derived from previous Chino Basin conceptual-level reports.

9.2.2 Cost Criteria Assumptions

This section presents the unit cost criteria assumptions used in development of the Opinion of Probable Capital and Annual O&M Costs provided in this PDR. Unit cost criteria and assumptions were developed for construction costs, annual O&M costs, and other general and financing terms. Some of the major unit costs included rolled up costs as part of the lump sum (LS) costs. The following list identifies the components included as part of the rolled up unit cost criteria:

- Source Water Systems (Production, ASR, Injection Wells)
  - Drilling/casing/cap – Drilling, casing installation, and geophysical testing
  - Equipping/Sitework/Electrical/Mechanical – Major sitework, piping, valving, pump motor, water sampling, PLC Equipment, removal of existing equipment when applicable
  - Pumphouse/Electrical Building – Major material, electrical, mechanical, structural components
- Treatment Facilities
  - IX Treatment – Major equipment, sitework, controls, piping, valving
- Conveyance Facilities
  - Piping – Major material, trenching and installation
  - Pump Stations – Major equipment, sitework, electrical, mechanical, instrumentation

These criteria were used in development of an Excel spreadsheet-based Cost Development Tool generated to provide cost estimates for the facilities identified in this PDR. The Cost Development Tool used the unit cost criteria summarized below and the engineering criteria developed in Volume II of this PDR to generate Opinions of Probable Capital and Annual O&M Costs. The Cost Development Tool output for this Program Expansion is provided in Appendix C of this volume.

9.2.2.1 Construction Cost

Table 9-2 presents a summary of the unit cost criteria used in development of the Opinion of Probable Capital Costs.

Table 9-2
Summary of Unit Construction Cost Criteria

Item	Unit	Cost
Source Water Systems		
New Well(s)		
Drilling/casing/cap	LS (1)	$900,000
Equipping/sitework/electrical/mechanical	LS	$1,000,000
Emergency generator	LS	$275,000
Disinfection system	LS	$200,000
Pumphouse/electrical building	LS	$250,000
New ASR Well(s)		
Drilling/casing/cap	LS	$1,250,000
Equipping/sitework/electrical/mechanical	LS	$1,100,000
Emergency generator	LS	$275,000
Disinfection system	LS	$200,000
Pumphouse/electrical building	LS	$250,000
New Injection Well(s)		
Drilling/casing/cap	LS	$900,000
Equipping/sitework/electrical/mechanical	LS	$200,000
Building/enclosure	LS	$250,000
Well/ASR Conversion(s)		
Casing/cap	LS	$500,000
Equipping/sitework/electrical/mechanical	LS	$1,100,000
Emergency generator	LS	$275,000
Disinfection system	LS	$200,000
Pumphouse/electrical building	LS	$250,000
Well(s) Rehabilitation		
Casing/cap	LS	$500,000
Equipping/sitework/electrical/mechanical	LS	$1,000,000
Emergency generator	LS	$275,000
Disinfection system	LS	$200,000
Pumphouse/electrical building	LS	$250,000
Treatment Facilities		
Regenerable IX		
Typical	$/gpd	$0.76
ISEP®	$/gpd	$0.85
Non-regenerable IX	$/gpd	$0.50
Pre-engineered building	LS	$200,000
Conveyance Facilities		
Pipelines		
Collection (welded steel pipe)	$/in-dia./ft	$15
Distribution (welded steel pipe)	$/in-dia./ft	$15
Brine (double PVC)	$/in-dia./ft	$15
Pump Station(s)		
Distribution system booster station	$/HP	$5,000
Plant booster station	$/HP	$2,500
River Crossing		
Horizontal Directional Drilling (HDD)	LS	$1,800,000
Bridge supported	$/LF	$900
Freeway crossing (microtunnel)	$/LF	$1,080
Railroad crossing (auger boring)	LS	$200,000
Storm channel crossing (auger boring)	LS	$150,000

Table 9-2
Summary of Unit Construction Cost Criteria

Item	Unit	Cost
Transmission pipeline turnout	LS	$400,000
Connection to storm channel	LS	$50,000
Misc. valves & flow meter for interconnections	LS	$25,000
SARI/NRW		
Brine connection	$/C.U. (2)	$150,000
Brine capacity unit	gpm	15
Land		
Undeveloped	$/acre	$500,000
General		
General mechanical (3)	% const.	3
General electrical (3)	% const.	10
General site work (3)	% const.	5
General requirements (mob/demob) (4)	% const.	2

Notes:
(1) LS = lump sum
(2) $/C.U. = cost per brine capacity unit
(3) Percent of total construction cost for all IX facilities and booster stations
(4) Percent of total construction cost for all components except land and SARI/NRW capacity charges

9.2.2.2 Annual O&M Cost

Table 9-3 presents a summary of the unit cost criteria used in development of the Opinion of Probable Annual O&M Costs.

Table 9-3
Summary of Unit O&M Cost Criteria

Item	Unit	Cost
Source Water Systems		
Miscellaneous Well Maintenance	LS	$25,000
Treatment		
Regenerable IX	$/1000 gal	$0.30
Non-Regenerable IX	$/1000 gal	$0.30
Resin Replacement	$/CF	$170.00
No. of Years	Years	10
Escalation Rate	%	3 percent
Conveyance		
Pipelines - General	$/mile	$4,000
Pump station - General	% const.	2 percent
SARI/NRW		
Monthly Capacity Charges		
North	$/C.U.-mo.	$262.20
South	$/C.U.-mo.	$182.76
Monthly Volumetric Charge		
North	$/MG/mo	$1,395.50
South	$/MG/mo	$792.00
Monthly CIP Charge	$/C.U.-mo.	$85.00

9.2.2.3 General and Financing

Table 9-4 presents a summary of the financing and general unit cost criteria used in development of the Opinion of Probable Capital and Annual O&M Costs. A 20 percent contingency was applied to all costs, which is both reflective of the level of detail developed in the PDR and consistent with the initial DYY Program PDR. A 12 percent factor was also applied to all costs to account for engineering, administration, and construction management activities. The Midpoint of Construction costs assumes projected construction costs in year 2012 using an escalation rate of 3 percent. Midpoint of construction costs are provided in Volume II. The facility online factor refers to the portion of full-time operation that a facility is operational (i.e., for evaluation of annual power costs or water deliveries). The financing amortization period and discount rate were used to develop annualized capital costs and are presented in Volume II.

Table 9-4
Summary of Financing and General Unit Cost Criteria

Item	Unit	Cost
Contingency	%	20
Engineering/Administration/CM	%	12
Energy Cost	$/kWh	0.14
Midpoint of Construction		
No. of Years (2009-2012)	Years	3
Escalation Rate	%	3
General Facility Online Factor	%	90
ASR Facility Production Factor	%	50
Financing Amortization Period (Life of Program)	Years	25
Financing Discount Rate	%	6

9.3 Preliminary Opinion of Probable Cost

9.3.1 Capital Cost Summary

Table 9-5 presents a summary of the Opinion of Probable Capital Cost(s) for each agency's facilities. Costs for facility Options A and B are provided where necessary. Further breakdowns of the conceptual-level opinion of probable capital costs are provided in each agency's respective Volume II. The total opinion of probable capital costs is estimated to range from $85,829,000 to $107,472,000, depending on the facility option(s) selected.

Table 9-5
Capital Cost Summary

Participating Agency	Opinion of Probable Capital Cost (1) (2)	
Chino (3) (Option B, A)	$7,854,000	$9,207,000
Chino Hills	2,154,000	
CVWD	15,410,000	
JCSD	11,526,000	
MVWD (3) (4) (Option B, A)	10,811,000	17,755,000
Ontario (3) (Option A, B)	9,028,000	10,460,000
Pomona	7,348,000	
Upland	3,164,000	
TVMWD	6,410,000	
WMWD (3) (Option A, B)	12,124,000	24,038,000
TOTAL	**$85,829,000**	**$107,472,000**

Notes:
(1) Detailed conceptual-level opinion of probable cost provided in Volume II A-J.
(2) Does not include midpoint of construction cost. Provided in Volume II A-J.
(3) Both facility options A and B shown.
(4) Costs do not include use of existing ASR facilities for potential "put" contribution. The total capital value for the use of these facilities may range from $2.0-3.2M/1,000 AFY of "put" capacity. See Appendix D for the preliminary evaluation of these costs.

9.3.2 Annual O&M Cost Summary

Table 9-6 presents a summary of the Opinion of Probable Annual O&M Cost(s) for each agency's facilities. Costs for facility Options A and B are provided where necessary. Detailed conceptual-level opinion of probable annual O&M costs are provided in each agency's respective Volume II. The total opinion of probable annual O&M costs is estimated to range from $5,447,000 to $5,518,000, depending on the facility option(s) selected.

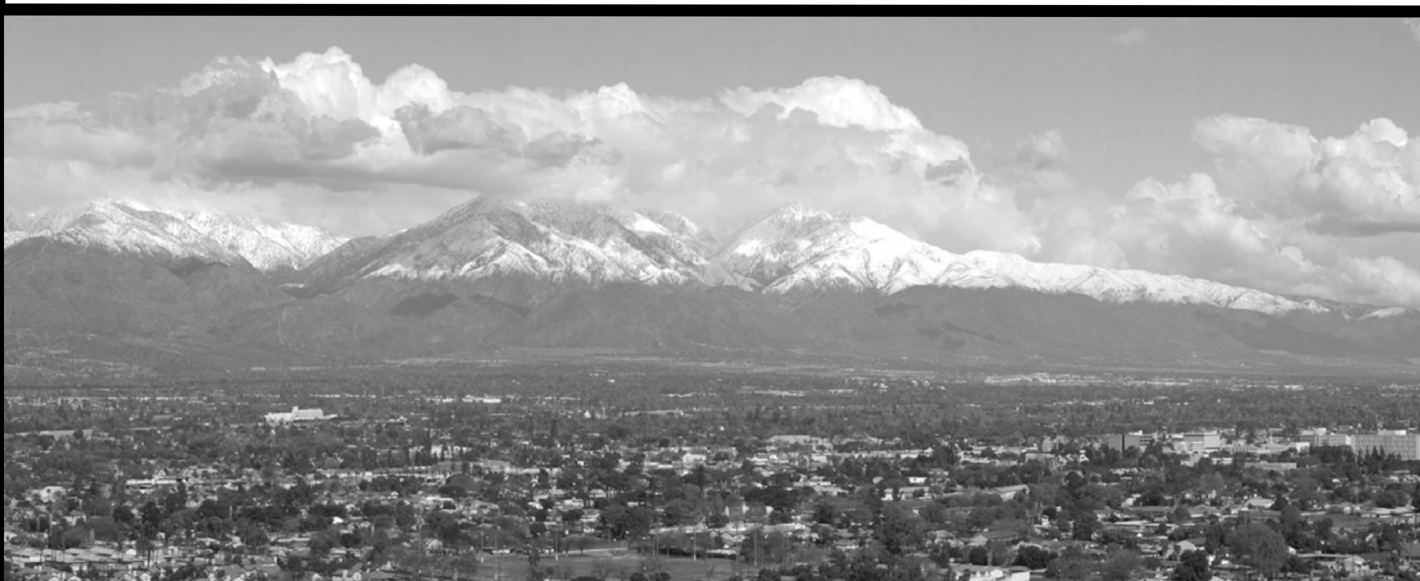
Table 9-6
Annual O&M Cost Summary

Participating Agency	Opinion of Probable Annual O&M Cost (1)	
Chino (2) (Option B, A)	$686,000	$823,000
Chino Hills	139,000	
CVWD	1,108,000	
JCSD	1,310,000	
MVWD (2) (Option B, A)	501,000	965,000
Ontario (2) (Option A, B)	9,000	10,000
Pomona	505,000	
Upland	231,000	
TVMWD	398,000	
WMWD (2) (Option A,B)	560,000	29,000
TOTAL	**$5,447,000**	**$5,518,000**

Notes:
(1) Detailed conceptual-level opinion of probable cost provided in Volumes II A-J.
(2) Both facility options A and B shown.

A summary of the total annual O&M and annualized capital costs are provided in Volume II of the PDR.

10.0 Program Implementation

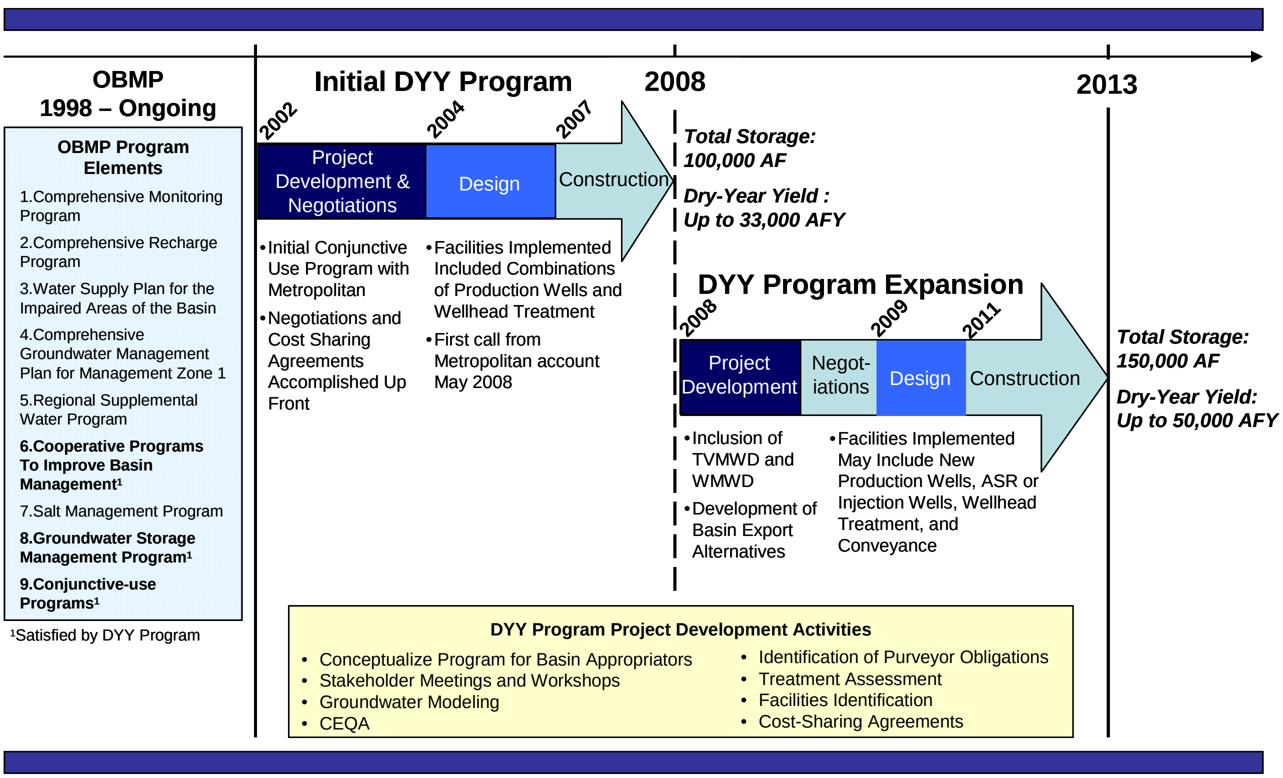


10.0 PROGRAM IMPLEMENTATION

10.1 Overview

This chapter presents a conceptual implementation plan for the DYY Program Expansion. Metropolitan's program schedule requirements and other pertinent Basin management project schedules are described. A preliminary implementation schedule of the Program Expansion facilities is also presented. The implementation schedule has been developed based on discussion with program participants and B&V experience on recent, similar projects.

The figure below presents a timeline schematic of Basin activities that ultimately lead to development of the DYY Program Expansion. As developed in Chapter 1, the OBMP served as the catalyst for development of the Initial DYY Program, which was conceptualized in 2002 and the first call on Metropolitan's account was made in May 2008. The DYY Program Expansion project development phase would carry through 2009 and operations could begin as early as 2012, provided all agreements are in place. As shown on the graphic, the DYY Program Expansion provides additional export opportunities for the Basin and a wider range of facilities, thereby increasing the "put" and "take" capacity of the Basin.



10.2 Metropolitan and Other Basin Management Project Schedule Requirements

Table 10-1 presents a summary of the existing Metropolitan and Basin management programs and objectives. The DYY Program Expansion should be closely coordinated with the existing management objectives to best satisfy the future water needs of the entire Basin.

Table 10-1
Existing Metropolitan and Basin Management Programs

Program	Description
Current DYY Program	This 100,000 acre-ft conjunctive-use program was initiated in 2002 among Metropolitan, IEUA, Watermaster, and participating Basin appropriators. IEUA, which manages the distribution of imported water to Basin appropriators, acts as liaison between Watermaster and Metropolitan.
Metropolitan Drought Allocation Plan	The Drought Allocation Plan was developed in cooperation with retail agencies and covers all aspects of drought planning – including steps to avoid rationing, drought response stages, allocation, methodology, pricing, and communications strategy.
Recharge Master Plan Update	The goals of this program are to maximize the capture of storm flows for recharge of the groundwater basin and to maximize the recharge capacity for supplemental water for replenishment purposes.
Peace II Basin Agreement	This agreement recognizes that Hydraulic Control is an essential goal of the Watermaster and critical to the implementation of the Basin Plan for the Chino Basin. To accomplish this, Watermaster parties will pump 400,000 acre-ft of water from the southern end of the Basin, creating a capture zone that prevents any measurable amount of low quality water from escaping into Prado Reservoir and eventually making its way into the Orange County aquifer.
Forbearance MZ-1	This multifaceted land surface monitoring program was developed by Watermaster to track data for a long-term management plan for land subsidence in MZ-1. The monitoring program consists of elements of aquifer monitoring, synthetic aperture radar interferometry (InSAR) measure of historical land surface deformation, and benchmark surveys.
Chino Desalter Authority (CDA) - Local Resource Program	The goal of this program is to create new water supplies, achieving hydraulic control of the Basin outflow to the Santa Ana River, increasing desalter groundwater pumping from the lower Basin to 40,000 afy, and removing salts and other impurities from the groundwater basin.
Chino Desalter Expansion and Chino Creek Wellfield	The expansion project is intended to provide hydraulic control of the Basin while improving reliability and efficiency of expanded CDA water production facilities. Creating this hydraulic control and at the same time removing salts from the groundwater will allow continued and expanded use of recycled water.

10.3 Preliminary Design, Construction, and Operations Schedule for Program Facilities

A preliminary implementation schedule was developed based on discussions between Metropolitan, IEUA, Watermaster, and the ten participating program participants. Major implementation components are established and critical milestones identified based on the duration of similar tasks from the original DYY Program. In general, the preliminary implementation schedule assumes the following successive periods:

- Metropolitan / Participating Agency Negotiation Period
- Retail Agency Administration Period
- Put Facility Development Period (Design, Construction, Start-up)
- Take Facility Development Period (Design, Construction, Start-up)

The Metropolitan negotiation period is anticipated to occur over a nine month period estimated to begin January 2009 and to be finalized September 2009. During this period, the Initial DYY Program Master Agreement would be updated or a new one developed to contain program legal funding and operation information between Metropolitan and participating member agencies (IEUA, TVMWD, WMWD, and Watermaster) for the Program Expansion. The Master Agreement would contain content related to several items, including effective date and terms, preconditions, program planning and construction, and project construction funding. Executing the Master Agreement would be considered a milestone activity for the overall project implementation, representing a significant step toward obtaining project funding by Metropolitan and implementation of the Program facilities by the participating agencies. The Master Agreement would then be cascaded down to the retail agency level to finalize individual agency program planning efforts.

A retail agency administration period would follow the Master Agreement period to account for further conditions between the member agencies and the operating parties (retail agencies) that are served water. This period is estimated to occur over a three month period (October 2009 through December 2009) and would finalize any program planning issues at the operating party level. At the end of the retail agency administration period, the various program expansion projects would be clearly defined and ready to be integrated into existing agency capital improvements programs (CIP).

The next phase would include activities related to design, construction, and start up of facilities and can be subdivided into two stages: “put” and “take”. The “put” facilities are considered to be the first projects to be initiated, followed immediately by the “take” facilities. This approach assumes the Program Expansion would begin with a series of “puts,” per the operations scenarios provided in Chapter 6. The implementation plan developed in this chapter is for planning purposes only. Other considerations to be further coordinated by the participating agencies that may affect the final individual project schedules include:

- Coordination with other local master planned projects
- Availability of local funding

- Water demand
- Coordination with other Basin management programs and water quality objectives

Table 10-2 summarizes the estimated duration for project components within the Program Expansion. Each project has been broken into three separate stages: design, construction, and start-up.

Table 10-2
Project Components and Estimated Duration of Activities

Facility / Activity	Duration
New Well Construction / Rehabilitation	
Design Phase	8 months
Construction Phase	10 months
Start-Up Phase	1 months
IX Treatment Facility	
Design Phase	10 months
Construction Phase	12 months
Start-Up Phase	2 months
Pipeline (Length Less than 3,000 feet)	
Design Phase	6 months
Construction Phase	10 months
Start-Up Phase	1 months
Pipeline (Length Greater than 3,000 feet)	
Design Phase	8 months
Construction Phase	12 months
Start-Up Phase	1 months

Figure 10-1 shows a preliminary implementation schedule for the Program Expansion.

10.4 Summary of Program Expansion Implementation

The next major step to begin in January 2009 includes the negotiation period between Metropolitan and the participating agencies for funding of the facilities developed in this PDR. Upon completion, an agreement would be drafted to define the funding terms and obligations of participating agencies. Table 10-3 presents a summary comparison of the initial and expanded DYY Program implementation.

Table 10-3
Summary Comparison of Initial and Expanded Programs

Item	Initial DYY Program	DYY Program Expansion
Total Storage	100,000 acre-feet	150,000 acre-feet (+ 50,000)
Dry-Year Yield	33,000 afy	50,000 afy (+ 17,000)
Schedule:		
Project Development	2002 – 2003	2007 – 2008
Negotiations	Included in Project Development	2009
Design	2004 – 2007	2010 – 2011 (Est.)
Storage ("Put")	2005 – 2007	2012 –
Extraction ("Take")	May 2008	2013 –

FIGURE 10-1
DYY PROGRAM EXPANSION
PRELIMINARY IMPLEMENTATION SCHEDULE

ID	Task Name
1	**Metropolitan DYY Program Expansion**
2	**Negotiation Period**
3	**Finalize Negotiations**
4	**Funding Allocations Approved**
5	**Put Facilities Finalized**
6	**Take Facilities Finalized**
7	**City of Chino**
8	Administration Period
9	**Option A or B IX Facilities (Take)**
10	Design
11	Construction
12	Start-up
13	**Injection Well (Put)**
14	Design
15	Construction
16	Start-up
17	**City of Chino Hills**
18	Administration Period
19	**Well No. 19 to ASR Conversion (Put)**
20	Design
21	Construction
22	Start-up
23	**Cucamonga Valley Water District**
24	Administration Period
25	**Four ASR Wells (Put)**
26	Design
27	Construction
28	Start-up
29	**Jurupa Community Services District**
30	Administration Period
31	**"Galleano", "Oda", and "IDI" Wells (Take)**
32	Design
33	Construction
34	Start-up
35	**Monte Vista Water District**
36	Administration Period
37	**Option A or B ASR Facilities (Put)**
38	Design
39	Construction
40	Start-up
41	**Option A or B IX Facilities (Take)**
42	Design
43	Construction
44	Start-up
45	**City of Ontario**
46	Administration Period
47	**CVWD Interconnection Conveyance Facilities (Put)**
48	Design
49	Construction
50	Start-up
51	**City of Pomona**
52	Administration Period
53	**Reservoir No. 5 IX Facility (Take)**
54	Design
55	Construction
56	Start-up
57	**City of Upland**
58	Administration Period
59	**New Six Basins Production Well (Take)**
60	Design
61	Construction
62	Start-up
63	**Three Valleys Municipal Water District**
64	Administration Period
65	**Treated Water Pipeline from WFA WTP to Miramar WTP (Put)**
66	Design
67	Construction
68	Start-up
69	**Azusa-Devil Canyon Pipeline to San Antonio Channel Turnout (Put)**
70	Design
71	Construction
72	Start-up
73	**Western Municipal Water District**
74	Administration Period
75	**RC Feeder or Arlington Desalter Interconnection (Take)**
76	Design
77	Construction
78	Start-up