Volume II G

City of Pomona

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1.0 INTRODUCTION

1.1 Overview

The Chino Groundwater Basin (Basin) Dry-Year Yield (DYY) Program Expansion (Program Expansion) is a comprehensive water resources management program to maximize conjunctive-use opportunities in the Basin. Program Expansion details are provided in a two-volume Project Development Report (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. Volume II consists of 10 lettered sub-volumes (A-J) defining facilities to be developed by the Program Expansion's ten participating appropriators. This Volume II-G describes proposed facilities for City of Pomona (Pomona). Individual chapters provide conceptual development of the ion exchange (IX) facilities required for Pomona to participate in the Program Expansion. An Opinion of Probable Cost is also presented. This Introduction Chapter provides background information on the DYY Program, the Program Expansion, and the Pomona system.

1.2 Evolution of DYY Program and Program Expansion

The Program Expansion is being developed by the Chino Basin Watermaster (Watermaster) in association with the Inland Empire Utilities Agency (IEUA), Metropolitan Water District of Southern California (Metropolitan), Three Valleys Municipal Water District (TVMWD), and Western Municipal Water District (WMWD). Table 1-1 summarizes the history and evolution of the Expansion Program, which could provide an additional 17,000 acre-feet (acre-ft) of groundwater for dry-year use.

Table 1-1
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 up to 17,000 afy of additional groundwater for dry-year use, in-lieu of imported water.	Each of the participating appropriators will contribute a portion of the 17,000 acre-ft of additional dry-year yield or necessary "puts" into the Basin.

* Additional details are provided in PDR Volume I.

1.3 Documentation

IEUA assembled the consultant team for both the DYY Program and the Program Expansion. Both Programs have been accomplished through a series of cooperative activities working extensively with Watermaster and the Basin appropriators. From this collaboration, several reports, technical memoranda (TMs), and computer models were produced, which served as the framework of this PDR.

The PDR is organized into four volumes. Volumes I and II, prepared by Black & Veatch (B&V), provide general information on the DYY Program Expansion. Volume I presents background information on the Basin and Program operation, while Volume II presents design criteria specific to each participating agency. Volume III, the Preliminary Modeling Report prepared by Wildermuth Environmental, Inc. (WEI), presents results of a groundwater model used to evaluate the water resources impacts of the DYY Program on the Basin. Volume IV presents the California Environmental Quality Act (CEQA) documentation conducted for this project and was prepared by Tom Dodson & Associates (TDA).

1.4 Summary of Program Participants

Volume II describes the specific site requirements and design criteria for the proposed facilities required to provide the 17,000 acre-ft of additional dry-year yield. Table 1-2 lists the appropriators and the corresponding PDR volume which identifies their project-specific facilities. Construction of these facilities is required for full Program implementation.

Table 1-2
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 ▸ Aquifer Storage and Recovery (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
Cucamonga Valley Water District (II C)	▸ Four new ASR wells
Jurupa Community Services District (II D)	▸ New well No. 27 ("Galleano Well") ▸ New well No. 28 ("Oda Well") ▸ New well No. 29 ("IDI Well")
Monte Vista Water District (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 Monte Vista Water District (MVWD) via Chino Hills to Walnut Valley Water District Service Areas
Ontario (II F)	▸ Conveyance facilities to establish interconnection with Cucamonga Valley Water District (CVWD)
Pomona (II G)	▸ Regenerable IX treatment at existing Reservoir No. 5 site
Upland (II H)	▸ New well in Six Basins
Three Valleys Municipal Water District (II I)	▸ Treated water pipeline from Water Facilities Authority (WFA) Water Treatment Plant (WTP) to Miramar WTP ▸ Turnout along Azusa-Devil Cyn Pipeline
Western Municipal Water District (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 Western Municipal Water District (WMWD) service area and Chino II Desalter

1.5 Conceptual Design Assumptions

Facilities described in Volume II were designed based upon information available and using the following general design assumptions:

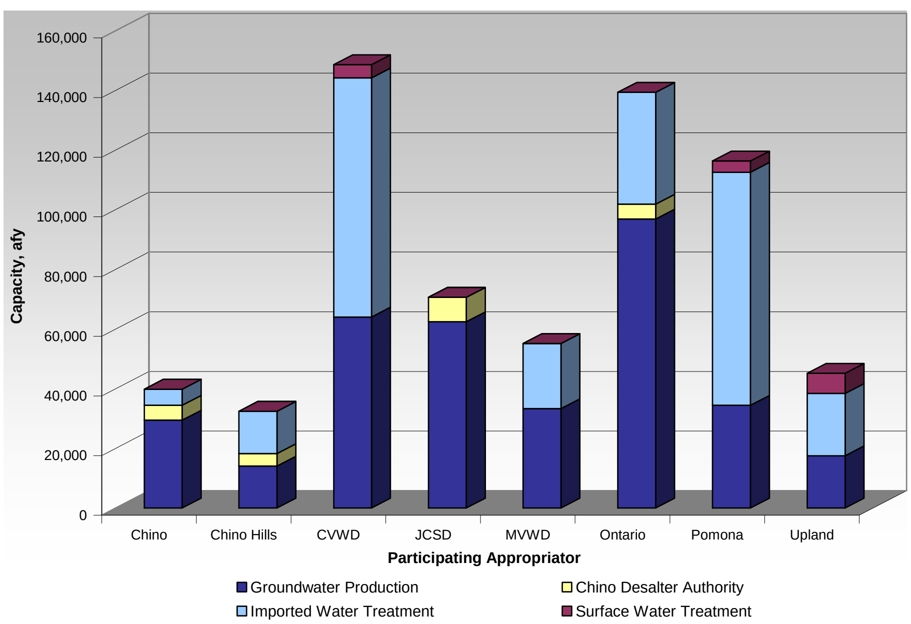
- Elevations were based upon United States Geological Survey (USGS) maps and maps obtained online from Google® Earth and are estimated to be accurate to within 10 percent of the actual elevation. Topographical surveys would be performed as part of the final design.
- Typical engineering calculations and assumptions were used to develop preliminary sizing for equipment and IX facilities. The final designs may vary slightly dependent upon results of the Title 22 water quality testing as well as detailed discussions with IX resin manufacturers.
- Conceptual designs assumed to not have significant permitting restrictions. Investigations of potential permit requirements for each project would be carried out during final design.

- Brine discharge to the non-reclaimable waste (NRW) system was assumed to not have a significant impact on NRW system capacity. The available capacity of the NRW System would be evaluated during final design.
- Groundwater levels and flows, anticipated drawdown from well operation and location, and concentration of contaminants was based upon available data provided by WEI based upon their recent modeling efforts.
- Facilities to be constructed on agency or City property were assumed to not require additional land purchase. In addition, pipelines constructed in City or County streets were assumed to be within the right-of-way limits.
- The opinion of probable cost is intended to provide a budgetary estimate of the capital and operational costs. Detailed quantity and unit cost figures for the facilities would depend on specific manufacturer equipment and prices.

1.6 Facility Requirements

An investigation ("Asset Inventory") consisting of several meetings and site visits was conducted to determine the condition of existing facilities and production capacities of each participating appropriator. The Asset Inventory presents a comprehensive list of the facilities available for each appropriator and identifies each participating appropriator's groundwater production capabilities and imported water treatment capacity. The results of the Asset Inventory are discussed in Volume I, Appendix A. Figure 1-1 summarizes Asset Inventory results.

Figure 1-1
Water Resource Capacities for Participating Appropriators(1)(2)



Notes:
(1) Participating Appropriators include current Basin appropriators interested in participating in the DYY Program Expansion. This does not include agencies outside the Basin, such as TVMWD and WMWD.
(2) Does not include recycled water deliveries provided by IEUA.

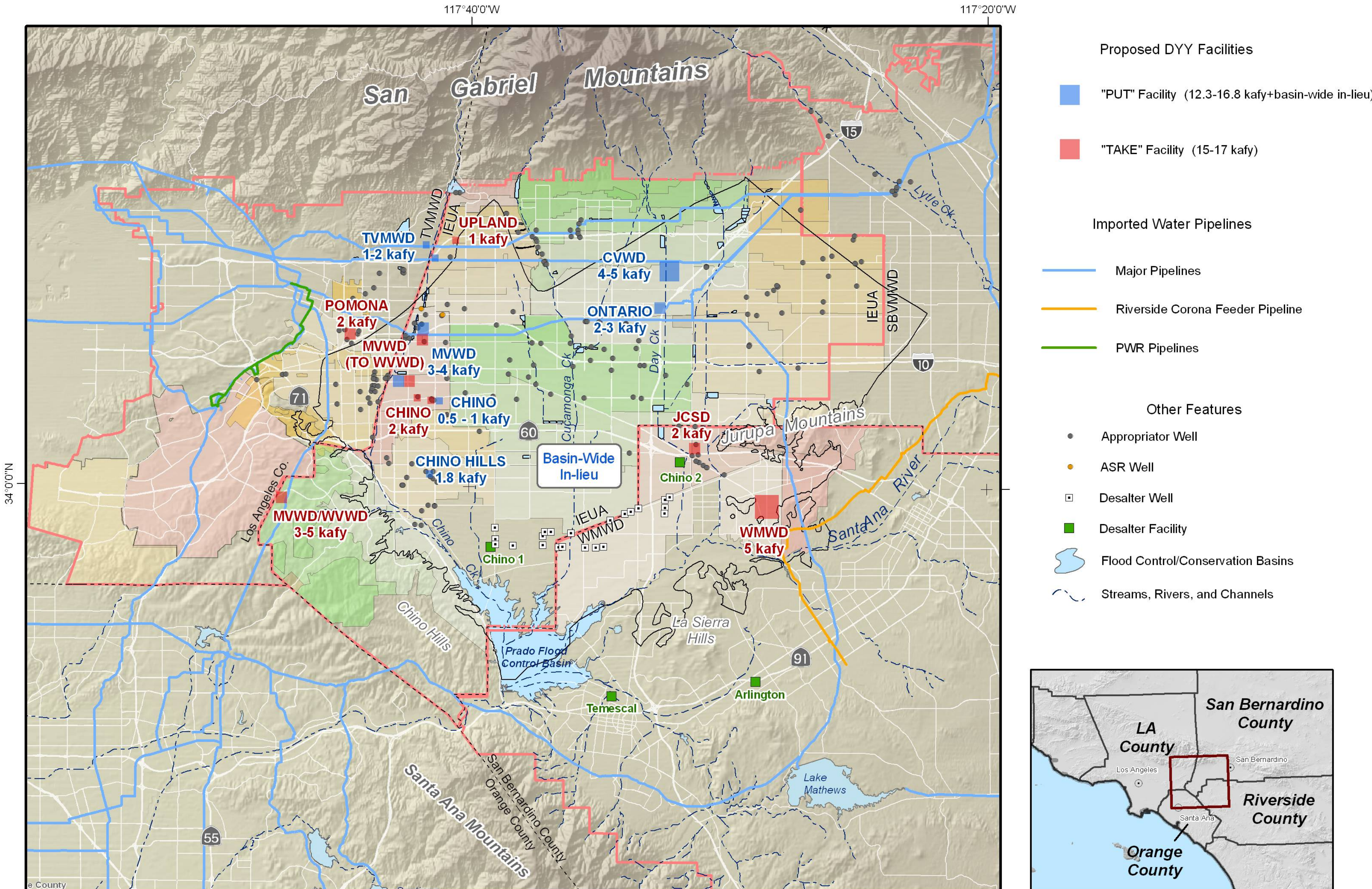
Table 1-3 lists Program participants and each agency's potential "put" and/or "take" contribution. The combined "take" capacity of these agencies ranges from 15,000 to 17,000 afy. The combined "put" capacity of these agencies is approximately 12,300 to 16,800 afy of direct capacity plus Basin-wide in-lieu deliveries and surface spreading contributions.

Table 1-3
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. See Volume III for details.

Figure 1-2 shows the locations of each agency's proposed facilities and/or locations where potential "puts" and "takes" could occur within the Basin. As the figure demonstrates, the "puts" and "takes" may be balanced on the east and west sides of the Basin. Through groundwater modeling, Program operations were evaluated to determine the potential for material physical injury to a party of the Chino Judgment or to the Chino Basin as required by the Peace Agreement (refer to Volume III, Program Modeling Report).



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Prepared For:

BLACK & VEATCH Corporation

Inland Empire

Proposed DYY Participants and Put/Take Locations

Figure 1-2

Therefore, while the Basin has adequate storage capacity, any increases in groundwater production during dry years would likely require additional production capacity and/or groundwater treatment. Groundwater treatment during dry years will contribute to the long term sustainable use of the Basin. A further discussion of the Basin Operations Plan is provided in Volume I.

1.6.1 Water Resources, Historical Water Use, and Shift Obligation

The Asset Inventory data summarizing Pomona's existing water resources capabilities is presented in Table 1-4. The complete Asset Inventory is provided in Appendix A of Volume I. The results of the Asset Inventory indicate that Pomona has an imported water treatment capacity of 49.7 million gallons per day (mgd) (55,664, afy) and groundwater production capacity of 30.7 mgd (34,684 afy). Pomona receives its treated imported water from the Miramar WTP.

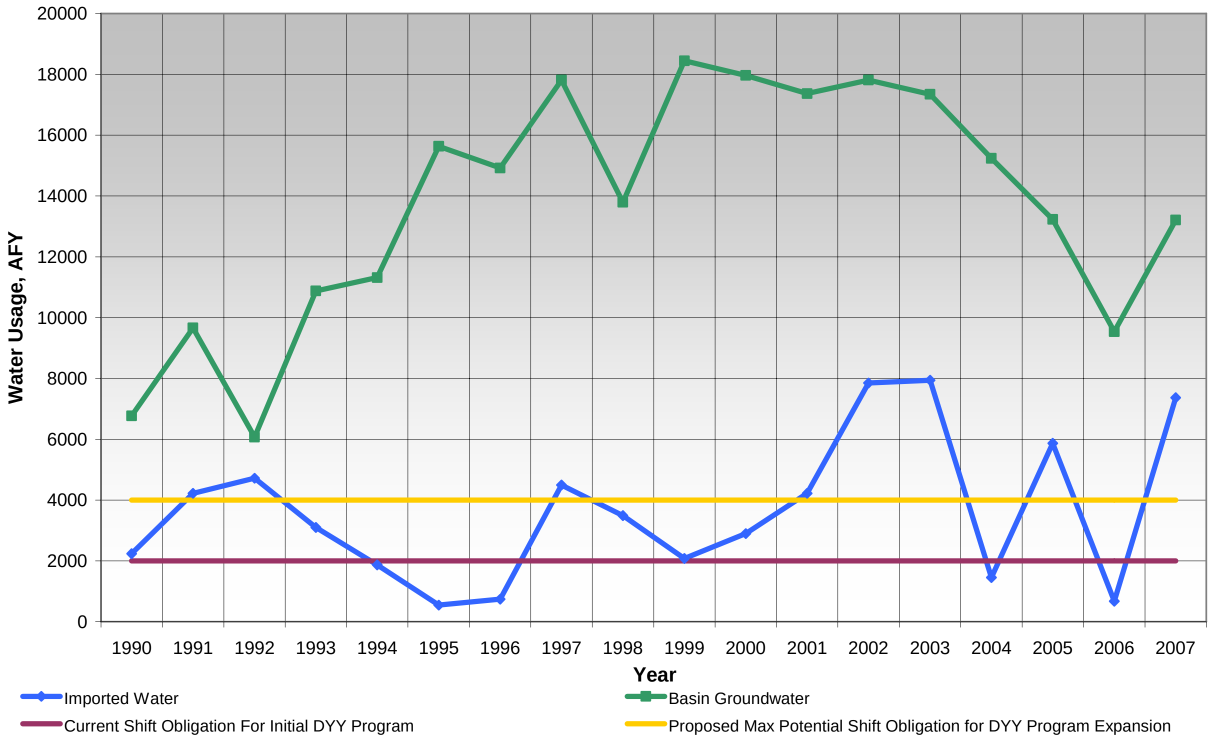
Table 1-4
Existing Water Resource Capacities for Pomona

Water Resource	Pomona Capacity, mgd (afy)
Local Surface and Imported Water	
Local Surface Water	
Pedley WTP	3.4 (3,800)
Subtotal	3.4 (3,800)
Imported Metropolitan Water	
Miramar WTP	49.7 (55,664)
Subtotal	49.7 (55,664)
Total Local Surface and Imported Water	53.1 (59,464)
Groundwater	
Pomona AEP	15.0 (16,800)
Total Groundwater	15.0 (16,800)
Groundwater Wells	
Chino Basin Wells[(1)]	21.7 (24,364)
Non-Chino Basin Wells[(1)]	8.9 (10,033)
Total Groundwater Wells	30.6 (34,397)
TOTAL WATER RESOURCES	**98.7 (110,661)**

Notes:
(1) Accounts for all well production capacity, regardless of water quality. Pomona treats a number of impaired groundwater wells at the Anion Exchange Plant.

Figure 1-3 presents the historical groundwater production and imported water purchases for Pomona. In 2007, approximately 33 percent of Pomona's 32,592 acre-ft of water usage was Basin groundwater versus approximately 25 percent from imported water supplied by Metropolitan. Based on historical imports and on future growth projections, Pomona has elected to contribute 2,000 afy toward the potential 17,000 afy Program Expansion. To achieve this potential contribution, Pomona has proposed a new IX treatment facility discussed in Section 1.5.2. This option would incorporate a "take" facility, which would involve the use of existing wells and new IX treatment facility.

Figure 1-3
City of Pomona Historical Imported Water and Groundwater Usage



1.6.2 Program Expansion Facility Requirements

1.6.2.1 IX Facility

The new IX facility would be located on the existing Pomona Reservoir 5 site that currently has three existing reservoirs. The site is in Pomona, on the corner of La Verne Avenue and Royalty Drive. The location was selected because four existing wells (Well Nos. 3, 7, 8B, and 32) currently pump to the site and can therefore be easily treated by a single IX plant. The new plant would provide treated water capacity of 2,000 gallons per minute (gpm). The IX facility is described in Chapter 2. A preliminary opinion of probable cost is described in Chapter 3.

1.7 Abbreviations and Acronyms

The following abbreviations/acronyms are used in this report:

acre-ft	acre-feet
afy	acre-feet per year
ASR	aquifer storage and recovery
B&V	Black & Veatch
Basin	Chino Basin
bgs	below ground surface
bv/hour	bed volumes treated per hour

$CaCO_3$	calcium carbonate
CBWM	Chino Basin Watermaster
CBWW	Chino Basin Waste Water
CDA	Chino Desalting Authority
CDPH	California Department of Public Health
CEQA	California Environmental Quality Act
CML&C	concrete mortar lined and coated
CML&W	concrete mortar lined and wrapped
CVWD	Cucamonga Valley Water District
DBCP	dibromochloropropane
DYY	Dry-Year Yield
DYY Program	initial Chino Basin Dry-Year Yield Program
DYY Program Expansion	Chino Basin Dry-Year Yield Program Expansion
gpm	gallons per minute
HDPE	high-density polyethylene
HMI	human machine interface
HVAC	heating, ventilation, and air conditioning
I&C	instrumentation and control
IEUA	Inland Empire Utilities Agency
IX	Ion Exchange
JCSD	Jurupa Community Services District
Judgment	Chino Basin Municipal Water District vs. the City of Chino et al. (1978)
MCL	maximum contaminant level
mgd	million gallons per day
Metropolitan	Metropolitan Water District of Southern California
mg/L	milligrams per liter
MVWD	Monte Vista Water District
NaCl	salt
NEMA	National Electrical Manufacturers Association
NO_3^-	nitrate
NRW	Non-Reclaimable Wastewater
OD	outside diameter
Ontario	City of Ontario
O&M	operation and maintenance
OBMP	Optimum Basin Management Program
OEM	original equipment manager
PDR	project development report
PLC	programmable logic controller
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
PVC	polyvinyl chloride
RC	Riverside-Corona

TCE	trichloroethylene
TDA	Tom Dodson & Associates
TVMWD	Three Valleys Municipal Water District
USGS	United States Geological Survey
VOCs	volatile organic compounds
Watermaster	Chino Basin Watermaster
WEI	Wildermuth Environmental, Inc.
WFA	Water Facilities Authority
WTP	water treatment plant
WMWD	Western Municipal Water District

1.8 References

General references are listed in Volume I, Section 1.9. Agency-specific references for the facilities listed in this Volume II G are shown below.

[Pomona, 2005] *Water and Recycled Water Master Plan Final Report*, prepared for City of Pomona, MWH, May 2005.

2.0 ION EXCHANGE FACILITIES

2.1 Overview

This chapter presents a detailed description of the proposed (IX) treatment facility, which would provide Pomona's contribution to the DYY program obligation. This chapter reviews the raw water supply well quality, IX facility components, site requirements, electrical requirements, instrumentation and control (I&C) requirements, and brine discharge.

Pomona has four existing wells (Nos. 3, 7, 8B and 32) that will require wellhead treatment for removing nitrate and perchlorate from the groundwater. Currently, the four wells require 50/50 blending with imported water from Metropolitan to reduce the levels of contaminants to an acceptable range for potable water. To meet its DYY contribution, Pomona has proposed to construct an IX treatment facility on its existing Reservoir 5 site, located at the intersection of La Verne Avenue and Royalty Drive. An existing Packed Tower Aeration (PTA) system at the site is currently used by Pomona to treat volatile organic compounds (VOC) from three of the four wells. The addition of the IX system at the site would allow Pomona to stop using imported water for blending by reducing the contaminants in the source water to below potable water standards.

2.2 Raw Water Supply

The new IX Facility on the Reservoir 5 site would treat groundwater from all four existing wells. Currently, only Wells Nos. 7, 8B, and 32 go through the existing on-site PTA treatment facility. The imported water connection joins the same pipeline into the reservoir site as Well 3, and since the imported water is required for blending, Well No. 3 is not currently used. Based on discussions with Pomona staff, the new IX facility would be connected to the existing treatment system after the static mixer, which currently blends the PTA-treated water with the imported water/Well No. 3 water. Figure 2-1 presents a vicinity map for the four wells and the Reservoir 5 site.

Data collected by WEI for the existing wells was used as a basis for the operating conditions. Table 2-1 presents the historic groundwater elevations for these wells.

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Inland Empire Utilities Agency

Chino Basin Dry Year Yield Program Expansion Project

City of Pomona – Project Location

Figure 2-1

Table 2-1
Anticipated Operating Conditions [1]

Conditions	Well No. 3	Well No. 7	Well No. 8B	Well No. 32
General Conditions				
Basis for Operating Conditions, Well No.	3	7	8B	32
Distance from Basis Well Above, feet	0	0	0	0
Location	Garey/ Ford	Towne Ave.	Towne/ Banger	Orange Grove Ave.
Site Elevation, feet amsl [2]	993	999	1,012	969
Well HGL/Delivery Zone, feet amsl [3]	984/ Zone 5	984/ Zone 5	984/ Zone 5	984/ Zone 5
Operating Conditions				
Production Capacity, gpm	600	700	1,000	600
Est. Avg. Static Groundwater Elev., ft bgs [4]	46	52	63	N/A [7]
Estimated Average Drawdown, feet [5]	115	140	69	N/A [7]
Approximate Specific Capacity, gpm/ft [6]	5	5	14	N/A [7]

Notes:
(1) Estimated groundwater and drawdown water level data provided by WEI, 2008.
(2) Above mean sea level (amsl).
(3) From Pomona Water Master Plan, MWH, May 2005.
(4) Feet, below ground surface (bgs).
(5) Drawdown is the difference between static and dynamic groundwater elevations.
(6) Gallons per minute per foot of drawdown.
(7) Data not available for inactive Pomona Well No. 32.

As part of the concept design, pump performance design criteria were verified to ensure that water could be delivered through the new IX facility and to the required elevation listed in Table 2-1. A preliminary hydraulic investigation showed that no new pumps would be required to be installed on site. Table 2-2 lists criteria for assumed pump performance.

Table 2-2
Assumed Pump Performance

Description	Well No. 3	Well No. 7	Well No. 8B	Well No. 32
Pump				
Type	Vertical Turbine	Submersible	Submersible	Vertical Turbine
Capacity, gpm	600	700	1,000	600
Total Dynamic Head, feet (1)	240	340	340	340
No. of Stages (2)	4	9	5	6
Pump Efficiency, percent (2)	85	81	85	82
Discharge Column Diameter, inches (2)	8	7	8	8
Motor				
Nominal Motor Horsepower, HP (2)	75	75	100	60
Maximum Motor Speed, rpm (2)	1,800	1,750	1,800	1,800

Notes:
(1) Includes frictional losses and mechanical shaft losses.
(2) Obtained from Pump Data Sheets provided by Pomona.

2.3 Raw Water Quality

The water quality data for the Pomona raw water supplies were developed from the WEI database of California Department of Public Health (CDPH) records and cross-referenced with water quality data received during the development of the Asset Inventory. Table 2-3 presents the estimated raw water quality data for the existing wells. The maximum values listed were proportionally averaged and used as the preliminary design water quality for the IX facility. It should be noted that the raw water from Well No. 3 will be blended upstream of the IX facility with treated water coming from the PTA wet well, which would result in the IX being designed to treat the blended water numbers listed in the last two columns of Table 2-3.

It is also important to note that the water quality data shows perchlorate concentrations ranging from 9 to 11 ppb in the blended flow. Further water quality testing should be performed prior to design to determine whether using a single-pass non-regenerable IX treatment process would be more cost-effective over the life of the plant compared to a regenerable IX facility. For the purposes of the PDR, a regenerable IX facility has been selected based upon a cursory review of water quality data with IX system manufacturers.

Table 2-3
Pomona Facility Raw Water Quality Wells 3, 7, 8B, and 32

Constituent	Well No. 3		Well No. 7		Well No. 8B		Well No. 32		Blend	
	Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Max
Pumping Capacity (gpm)	--	600	--	700	--	1,000	--	600	--	2,900
Cations (mg/L) (1)										
Calcium	42	43	40	40	66	66	67	72	55	56
Magnesium	4	5	3	3	7	7	11	12	6	7
Sodium	64	69	59	59	38	38	18	21	44	46
Potassium	2	2	4	4	3	3	2	3	2	3
Anions (mg/L)										
Alkalinity (as $CaCO3$(2))	115	120	100	100	130	130	134	140	120	123
Sulfate	64	66	65	65	80	80	51	62	67	70
Chloride	21	22	18	18	22	22	30	38	22	24
Nitrate	65	78	64	78	56	77	37	48	56	72
Other (ug/L) (3)										
DBCP(4)	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00
Arsenic	8	9	5	5	2	2	1	3	4	4
TCE(5)	2	3	5	8	6	8	0	0	4	5
Perchlorate	8	11	11	13	9	12	6	9	9	11
General										
Total Dissolved Solids (mg/L)	345	350	320	320	400	400	309	330	350	356
pH	8	8	8	8	7	8	8	8	8	8

Notes:
(1) Milligrams per liter.
(2) Calcium carbonate.
(3) Micrograms per liter
(4) Dibromochloropropane
(5) Trichloroethylene

It is recommended that the Pomona conduct a complete Title 22 water quality analysis on the feed water wells to ensure that recent and accurate water quality data is available during the final process design stage.

2.4 IX Facilities

The IX facility would be constructed on Pomona property and would treat groundwater with elevated nitrate and perchlorate levels from the existing Pomona wells. A general discussion on IX design and a typical process schematic are provided in Volume I. The sections that follow describe design criteria and components of the Pomona IX facilities. The calculations used to develop the information below are provided in Appendix A.

Figure 2-2 presents a process schematic for incorporating the new plant into the existing treatment scheme. Figure 2-3 presents a hydraulic profile that illustrates the effect of the new IX system on the existing treatment process. Figure 2-4 presents a conceptual site layout for the new IX facility on the Reservoir 5 site.

2.4.1 Design Capacity

The IX facility would treat groundwater with elevated levels of nitrate and perchlorate from existing Wells Nos. 3, 7, 8B, and 32. As shown in Table 2-2, the production capacities for wells 3, 7, 8B, and 32 are 600 gpm, 700 gpm, 1,000 gpm, and 600 gpm, respectively. Using the raw water quality data from Table 2-3 and assuming a treated water nitrate concentration of 5 mg/L as nitrate (NO_3) and a blended water nitrate concentration of 25 mg/L as NO_3, the IX feed and treated water flows would be approximately 2,028 gpm for the new IX facility. Therefore, the bypass flow would be approximately 872 gpm and the blended water flow would be 2,900 gpm for the IX facility. Because the IX feed and treated water flows also serve as the process water required for resin regeneration, the actual IX facility output would be slightly less than the capacities stated above during certain stages of the resin regeneration cycle. Table 2-4 presents the design capacity criteria for the new IX facilities.

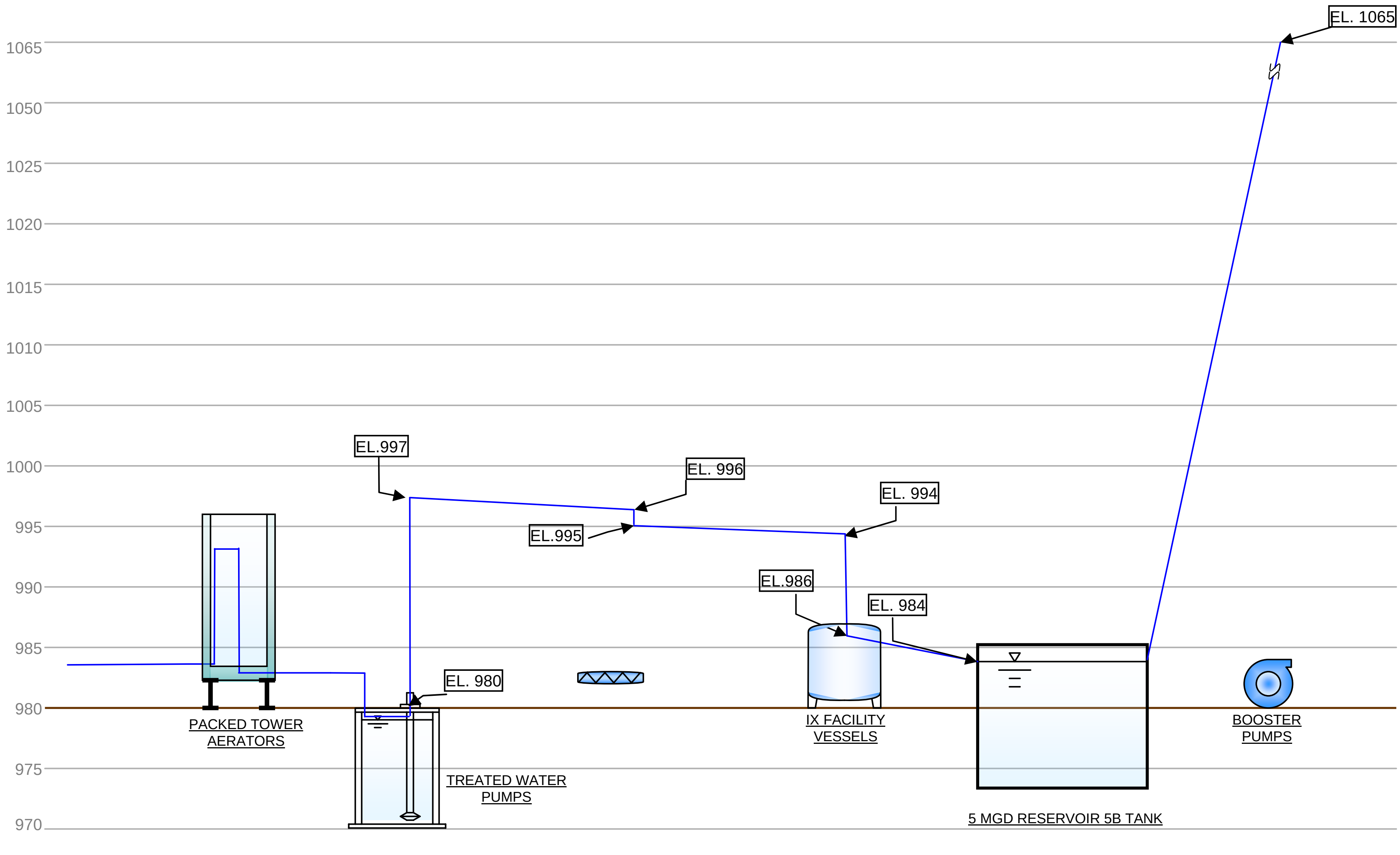
Table 2-4
Pomona IX Facility Design Criteria

Parameter	New IX Facility
Water Quality (1)	
Raw Water Nitrate (max), mg/L	72
Treated Water Nitrate, mg/L	5
Blended Water Nitrate Goal, mg/L	25
Average Nitrate Leakage, percent	7.0
Process Flows (2)	
Raw Water, gpm	2,900
Feed Water, gpm	2,028
Treated Water, gpm	2,028
Bypass Flow, gpm	872
Blended Flow, gpm	2,900

Notes:
(1) Values expressed as nitrate as NO_3.
(2) During production mode. Process flows vary slightly during the regeneration mode.
(3) Bench scale or pilot testing should be conducted prior to design to determine the plant's ability to remove perchlorate. If necessary, a non-regenerable polishing step could be added to further reduce perchlorate levels.

2.4.2 Process Requirements

The IX process would reduce the nitrates present to about 5 mg/L assuming 7 percent leakage. The IX exchange vessels would have Type I strong base anion exchange resin and would be approximately 7.5 feet in diameter. Resin depth would be approximately 4.8 feet to provide approximately 362 cubic feet of resin in each exchange vessel. Sidewall depth would be approximately 11 feet. A viewing port would be provided in the sidewall at the top of the resin.



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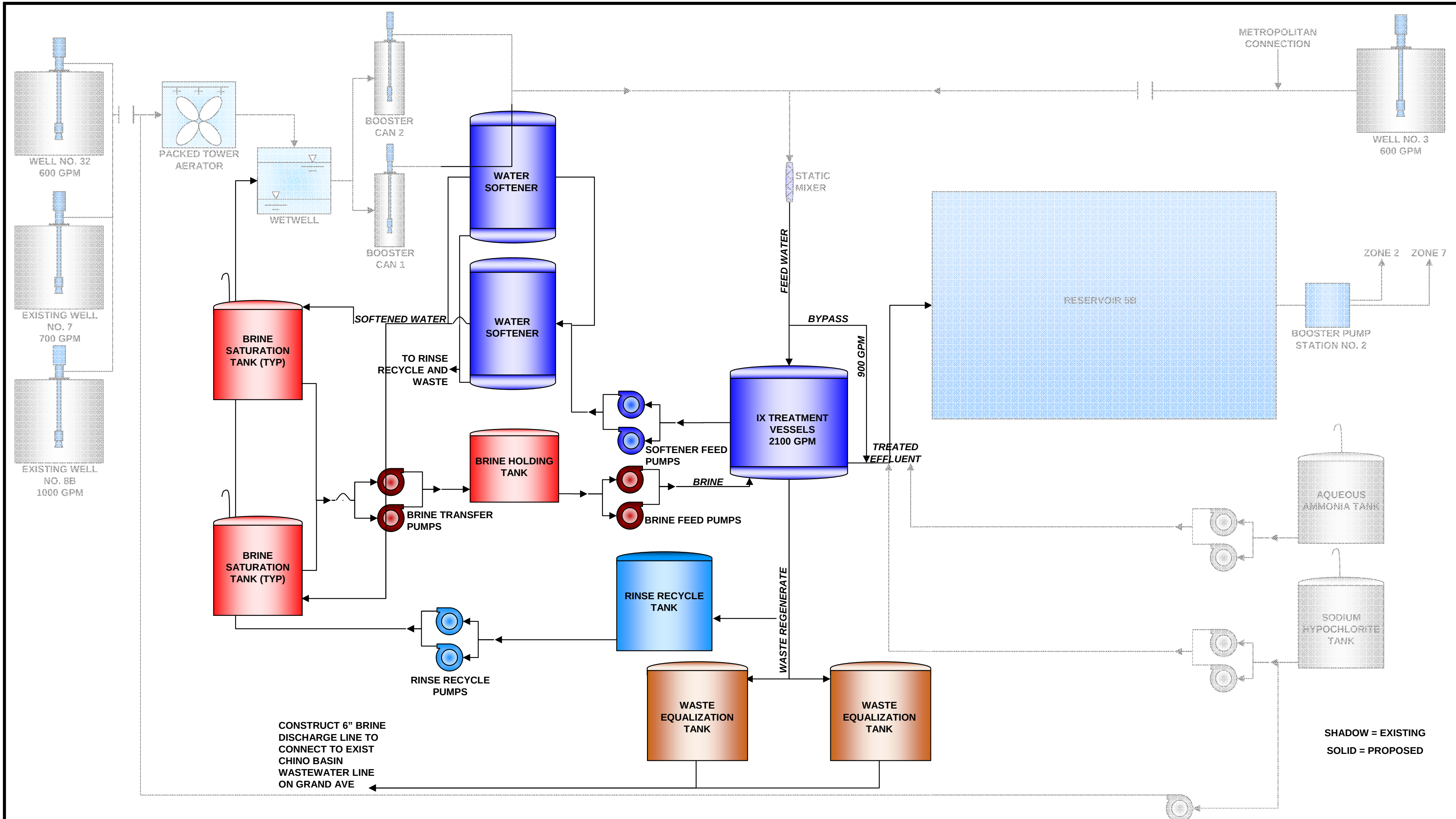
Chino Basin Dry Year Yield Program Expansion Project

City of Pomona – Hydraulic Profile

Figure 2-2



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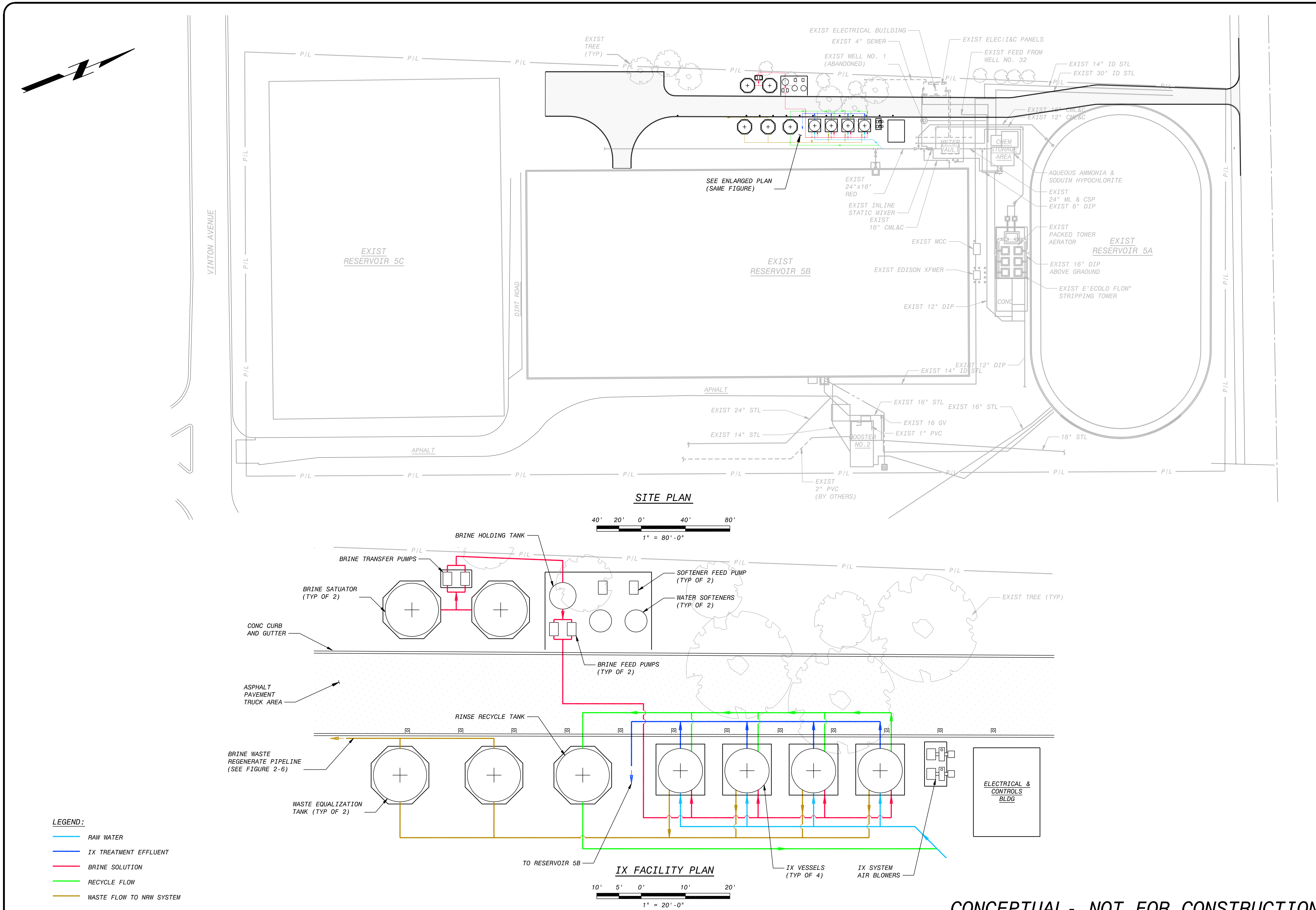
Chino Basin Dry Year Yield Program Expansion Project

City of Pomona – Reservoir No. 5 Process Flow Diagram

Figure 2-3



CONCEPTUAL - NOT FOR CONSTRUCTION

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XREF3:
XREF4:
XREF5:

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Black & Veatch Corporation
Irvine, California

CHINO BASIN DYY PROGRAM EXPANSION PROJECT
PROJECT DEVELOPMENT REPORT

CITY OF POMONA
RESERVOIR NO. 5 IX TREATMENT FACILITY
SITE PLAN AND YARD PIPING

DESIGNED: GP
DETAILED: JEG
CHECKED:
APPROVED:
DATE:

PROJECT NO.
160374

FIGURE 2-4

Four exchange vessels would be provided, three duty and one standby. Each IX vessel would be regenerated approximately every 21 hours when operated at full design capacity. A standby vessel would be included to allow for continuous operation while one of the vessels is removed from service for regeneration. The IX exchange vessels would be operated in a "staggered exhaustion" mode, such that only one vessel would require regeneration at any given time. IX vessel regeneration would require approximately 3 hours per unit. Figure 2-5 presents a typical 84-hour startup and operation sequence for the four IX vessels.

Figure 2-5
Pomona IX Facility
Typical 84-hour Startup and Operation Sequence

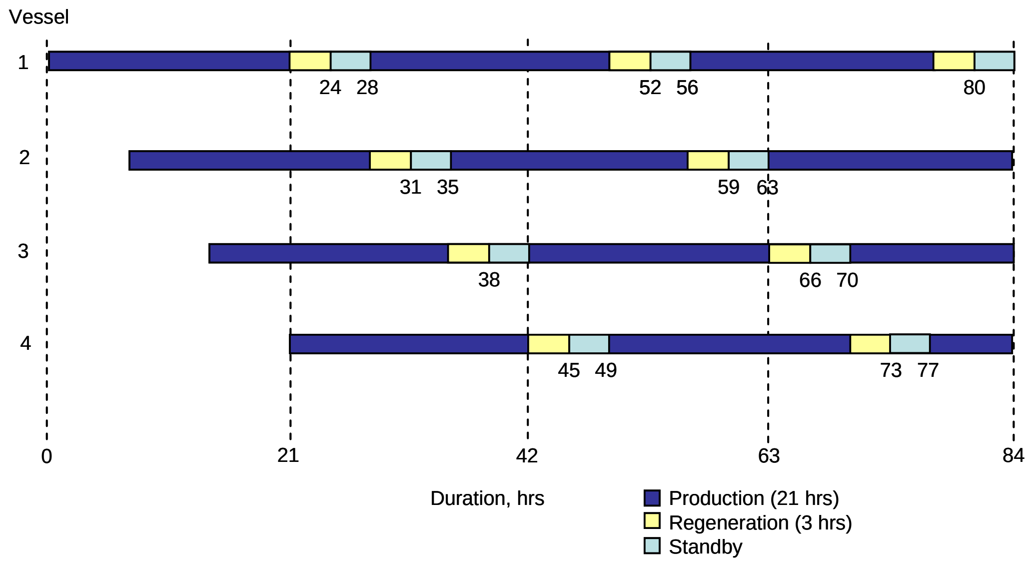


Table 2-5 presents the process requirements for the Pomona IX facility. The actual vessel dimensions and resin requirements may vary slightly between manufacturers. Most IX system manufacturers furnish all process equipment within the IX treatment system "black box." This would include all IX vessels, process piping, valves and other appurtenances, brine saturators, and waste equalization tanks.

Table 2-5
Pomona IX Facility Process Requirements

Parameter	New IX Facility
No. of IX Vessels (duty/standby)	3/1
Hydraulic Loading, gpm/square foot	9
Bed Volumes Treated per Hour (BV/hour)	15
Production Cycle Length, hours	21
IX Vessel capacity, each, gpm	676
IX Vessel Dimensions	
Diameter, feet	10
Sidewall Depth, feet	11
IX Resin	
Type	Type 1 Strong Base Anionic
Depth, feet	4.8
Volume per Vessel, cubic feet	362

2.4.3 Regeneration System

Countercurrent regeneration is recommended for use in order to minimize nitrate leakage through the IX vessels and the potential impacts of variations in raw water nitrate concentrations. For countercurrent regeneration, the regenerate solution (brine) is introduced in an upflow mode at the bottom of the IX vessel; the resin at the bottom of the vessel is therefore essentially completely regenerated and free of nitrate. The IX resin would be regenerated using a 7 percent salt solution (0.58 lbs salt per gallon). The brine solution would be applied at a rate of 7.50 pounds of salt per cubic foot of resin. The salt solution would be prepared and stored as concentrated 26 percent brine and diluted to a 7 percent solution prior to entering the IX vessels. Treated water from the IX process would be used as dilution water for the brine generation process. An automated brine production system, which incorporates bulk salt storage and brine preparation/storage facilities within a single tank, would be provided.

The resin regeneration cycle consists of eight steps: 1) a downflow initial backwash is used to remove any remaining suspended solids from the resin; 2) following the backwash, the resin bed is allowed to settle for approximately four minutes, which allows the bed to compact more easily; 3) bed compaction is provided to reduce the bed depth in order to provide closer contact of the media with the salt brine during regeneration; 4) the freeboard above the resin bed is drained to ensure that the brine solution added to the vessel will be applied directly to the resin bed and not diluted with any remaining water in the vessel; 5) the resin is regenerated with a 7 percent salt solution, which would be a blended flow of nitrate-free treated water and concentrated 26 percent salt solution; 6) a slow rinse is performed using softened water to flush out the brine solution; 7) the freeboard is refilled; 8) a fast rinse is performed to ensure that any remaining brine is removed from the resin bed and that the bed is ready for a new production cycle. Table 2-6 summarizes the IX vessel regeneration cycle.

Table 2-6
Pomona IX Facility Regeneration Cycle

Step	Description	Direction of Flow	Time (min)	Flowrate (gpm)	Source	Wastewater (gal)	
						Recycle	Waste
1	Initial Backwash	Down	15	225.33	IX feed	3,340	--
2	Settle Bed	--	4	--	--	--	--
3	Compact Bed	Down	2	700.00	IX feed	1,400	--
4	Drain Freeboard	Down	15	149.82	Water in vessel	2,250	--
5	Resin Regeneration	Up	35	132.69	7% Salt Brine	--	4,645
6	Slow Rinse	Up	37	125.00	Softened Water	--	4,625
7	Refill Freeboard	Down	16	140.46	IX Feed	--	2,250
8	Fast Rinse	Down	5	700.00	IX feed	--	3,500
Total	--	--	129	--	--	6,990	15,020

2.4.4 Waste Disposal

In order to reduce the wastewater discharge to the non-reclaimable waste (NRW) system and conserve raw water supply, the wastewater stream would be divided into two streams. One stream would be intercepted for recycling to the front of the IX facility and the second stream would be conveyed to a waste equalization tank for ultimate delivery to the Chino Basin Waste Water (CBWW) line. The CBWW line is the same as the IEUA's NRW line, but it is renamed to CBWW as it crosses the county boundary and becomes the jurisdiction of Los Angeles County. Table 2-7 summarizes the duration and volumes of these two streams.

Table 2-7
Pomona New IX Facility Design Capacity Criteria

Parameter	New IX Facility
Recycle Stream	
Storage Tank Volume, gallons	8,400
Storage Tank Drain System	
Type	Pumped
Average Drain Rate, gpm	65
Delivery Pressure, psi(1)	44
Time to Drain 1 Regeneration Cycle, minutes	129
Waste Regenerate Stream	
Equalization Tank Volume, gallons	15,100
Equalization Tank Drain System	
Type	Gravity
Average Drain Rate, gpm	40
Maximum Drain Rate, gpm	117
Time to Drain 1 Regeneration Cycle, hours	2.15

Notes:
(1) Pounds per square inch.

The first stream would be intercepted for recycling and would consist of the initial backwash, the bed compaction, and the draining of freeboard. The total volume of wastewater produced from these three steps would occur every 21 hours for each unit. The option of discharging this component to the CBWW line will also be provided for operational flexibility.

The second stream would be discharged to the CBWW line and would consist of the regeneration, slow rinse, and fast rinse. The total volume of wastewater produced from these three steps would occur every 21 hours for each unit.

A waste regenerate equalization tank would be provided to reduce the instantaneous flow rate being discharged to the CBWW line. Waste regenerate would enter the equalization tank at the required flow rate for regeneration and would exit the equalization tank at a constant rate by gravity. A metering station would be provided on the wastewater discharge to the CBWW line.

2.4.5 Salt Brine Storage and Feed System

Salt storage facilities would be provided on site for the brine generation process. Salt for the preparation of brine would be delivered to the site dry in bulk tanker trucks. The salt delivery trucks have a maximum capacity of approximately 20 tons (40,000 pounds), and the salt would be unloaded pneumatically into the bulk salt storage tanks on site. The maximum total salt stored on site would be approximately 186,000 pounds, which would provide a sufficient salt stock for 14 days of brine production and extra capacity for one entire salt delivery. The salt would be stored in two 44 ton, 12 foot diameter by 11 foot high storage tank. Each storage tank would be equipped with a water feed connection to prepare a 26 percent salt brine solution within the tank. Brine production would be limited to approximately 50 gpm from the brinemaker that is part of the storage tank. The IX facility would require approximately 133 gpm of diluted salt brine for the resin regeneration cycle. Brine pumps would transfer the salt brine from the storage tank and inject it into the backwash water for resin regeneration. Two salt brine pumps would be provided, one duty and one for standby. The pumps would have variable speed drives. Table 2-8 presents the components of the IX facility salt brine storage and feed system.

Table 2-8
Pomona IX Facility Components

Parameter	IX Facility
Chemical	Salt (NaOCl)
Product Form	Delivered in bulk
Brine Pumps	
Type	Centrifugal
Number	2
Rated Capacity, gpm	36
Salt Application Rate, lbs. NaOCl/cu. ft. resin	7.5
Salt Required per Regeneration Cycle, lbs.	2,712
Salt Brine Solution Concentration, percent by weight	26
Required 26% Brine Volume per cycle, gallons	4,645
Dilution (Softened) Water Feed Rate, gpm	97
Feed Brine Solution Concentration, percent salt by weight	7
Assumed Regeneration Frequency (1), hours	Once every 7
No. of Regeneration Cycles per day	4
Salt Usage at Design Flow, tons/day	4.8
Bulk Brine Storage Tanks (Saturators)	
Dimensions, diameter x sidewall height	12' x 11'
No. of tanks	2
Total Salt Storage Capacity, tons	44
Materials of Construction	Fiberglass Reinforced Plastic
Salt Delivery Quantity, tons	20
Storage Duration, days	14

Notes:
(1) At design flow.

2.4.6 Disinfection

Disinfection would be required to satisfy chlorine demand and residual. The existing Reservoir 5 site contains a sodium hypochlorite and an aqueous ammonia feed system. Sodium hypochlorite has minimal chemical handling hazards (i.e. scrubbers are not required). The addition of the IX plant would remove the need for the blending with the chloraminated imported water. Therefore, all disinfection can be done by using free chlorine from sodium hypochlorite. However the aqueous ammonia facility would be retained to generate chloramines for disinfection should the imported water be required in an emergency. The injection points for the chemicals would be moved so they are downstream of the IX plant.

2.4.7 Site Requirements

2.4.7.1 Site Descriptions and Existing Facilities

New IX Facility

The IX Facility would be located on City property in the Pomona, north of La Verne Avenue. and east of Royalty Drive. The site contains an existing PTA system, existing ammonia and chlorine tanks, three existing storage reservoirs, and one booster pump station to pump the treated water to the designated zones. The existing Reservoir 5B would be used as the treated water storage facility. The portion of the site available for the new facility has space constraints for the truck delivery access due to the existing wall on the north side of Reservoir 5A. Therefore, it is recommended that the wall be moved back to allow for maximum truck access.

The new IX facility would be constructed on the Reservoir 5 site, to the west of the existing PTA units.

2.4.7.2 New Facilities

The IX Facility would require site space for the following new major components listed in Table 2-9:

Table 2-9
Major IX Components

Components	Quantity
IX Vessels	4
Salt Saturator Tank and Transfer Pumps	2
Water Softener Tank	2
Waste Equalization Tank	2
Recycle Storage Tank and Transfer Pumps	1

A salt saturator and water softener would be required. Together, these facilities would produce the concentrated brine solution required for resin regeneration. This concentrated brine solution would be conveyed to the IX vessels via transfer pumps, where the waste regenerate and rinse flows would be conveyed to either the waste recycle tank or the waste equalization tanks. Flows from the waste equalization tank would be delivered to the CBWW line via gravity flow. Water from the downflow backwash, compact bed, and drain freeboard steps would be conveyed to the recycle tank. Recycle flows would be returned to the raw water feed stream via two transfer pumps.

Raw water from three of the wells would be conveyed to the PTA system currently in use on the Reservoir 5 Site. The PTA effluent would then be joined by water from the fourth well and conveyed to the IX vessels, where a portion of the flow would be diverted as a bypass stream. Treated water from the IX vessels would be blended with the bypass stream and would be sent through with the disinfection line connection and delivered to the Reservoir 5B treated water storage reservoir.

2.4.7.3 Demolition

Demolition would include removal of the existing vegetation and modification of the existing yard piping to construct the new IX facility feed water lines. The existing buildings would remain in place, as would the existing booster station No. 2, the PTA, and existing reservoirs. Portions of the existing piping would need to be modified to install underground electrical and piping facilities.

Construction in this area would not impact the existing electrical building.

2.4.7.4 Site Improvements

The process areas and ancillary support equipment would be constructed on concrete slabs having shallow foundations. This is possible since the system hydraulics after exiting the PTAs are boosted from an existing wet well.

The process areas can be exposed, covered, or completely enclosed depending on project economics. The decision to determine whether a canopy or a building is required would be addressed by Pomona once planning level cost opinions have been developed.

Driveway access and site vehicle access would be required for maintenance vehicle access, bulk salt deliveries, and bulk chemical deliveries. Improvements to an existing paved connection to adjacent streets would allow safe access to the site. Where access is provided from paved roads, storm drainage would be provided. The surface contour on the site is relatively flat and would not involve major earthwork for grading. The existing site does not permit a circular access road to be installed so a vehicle turn-around tee would be provided.

2.4.8 Electrical Requirements

The extent of the additional electrical demand for the IX Facility is largely dependent on the system hydraulics. Feed water pumping would not be required as the existing on site booster pumps should have enough head to drive the water through the IX process. The electrical loads would include well pumping panels, site lighting, and heating, ventilation, and air conditioning (HVAC) (if the building enclosure option is selected), etc.

2.4.9 Instrumentation & Control Requirements

Given the size and requirements of the proposed IX systems, the IX system controls packages would probably be furnished by a qualified original equipment manager (OEM) under the general contractor. This would provide the opportunity for the controls packages to be specified using Pomona standard programmable logic controller (PLC) hardware and human/machine interface (HMI) software.

Monitoring equipment (including analyzers) would be provided in the final design in conformance with CDPH requirements. Additional process monitoring equipment (including analyzers, flow meters and pressure transducers) would be required for operators to control operations and gauge system performance. Signals from the monitoring equipment would be linked via radio telemetry to Pomona's central operations center.

2.5 Conveyance Piping

Conveyance piping would include on-site raw water piping, on-site finished water piping, and the waste regenerate piping from the IX facility to the CBWW pipeline. Figure 2-5 also presents a schematic showing the general yard piping layout in addition to the site layout.

2.5.1 Raw Water Piping

The proposed IX facility would be installed and connected to the existing PTA system immediately after the existing inline static mixer and be able to combine and treat water from all four wells. The treated water would then be injected with sodium hypochlorite and aqueous ammonia before being discharged into Reservoir 5B. This configuration would ensure that the extra head loss due to the IX facility can be accommodated with the existing booster pumps at the site without having to resize the pumps. The discharge pressure zone for the Reservoir 5 is 984 feet above mean sea level, and no additional boosting would be required from the reservoir facility to Pomona Zone 2 and Zone 7.

Currently raw water piping exists from the wells to the PTA system, then it connects to Reservoir 5B and then to the booster pump station. No raw water piping currently exists to convey water from the PTA system to the IX facility.

The proposed operations would include redirection of the flow from the raw water wells to the new IX facilities. Treated water would be blended with a raw water bypass stream and conveyed on-site for disinfection. The blend would require a flowmeter and valving.

Any new yard piping would either be concrete mortar lined and coated (CML&C) and or concrete mortar lined and wrapped (CML&W) steel. Buried piping would have a polyethylene wrap and may be concrete encased in areas where high vehicle loadings are expected.

2.5.2 Finished Water Piping

Treated water from the IX facility would be sent to Reservoir 5B through the existing finished water pipeline. A connection between the IX facility and the existing treated water piping would be made.

2.5.3 Waste Regenerate Piping

Approximately 12,500 feet of new 6-inch diameter brine waste discharge piping would convey the waste regenerate by gravity from the waste equalization tanks of the IX facility west along La Verne Avenue, then south along Towne Avenue to the existing 36-inch CBWW pipeline in Grand Avenue. The piping is assumed to be in existing Pomona property or public right-of-way. Figure 2-6 shows the waste regenerate pipeline plan and profile.

Since there is adequate elevation difference between the Reservoir 5 site and the CBWW tie-in points, the waste regenerate pipelines would operate under gravity from the IX plant to the CBWW line, owned by Los Angeles County. The hydraulic conditions of the pipelines are summarized in Table 2-10.

Table 2-10
Pomona Waste Regenerate Pipeline Hydraulic Conditions

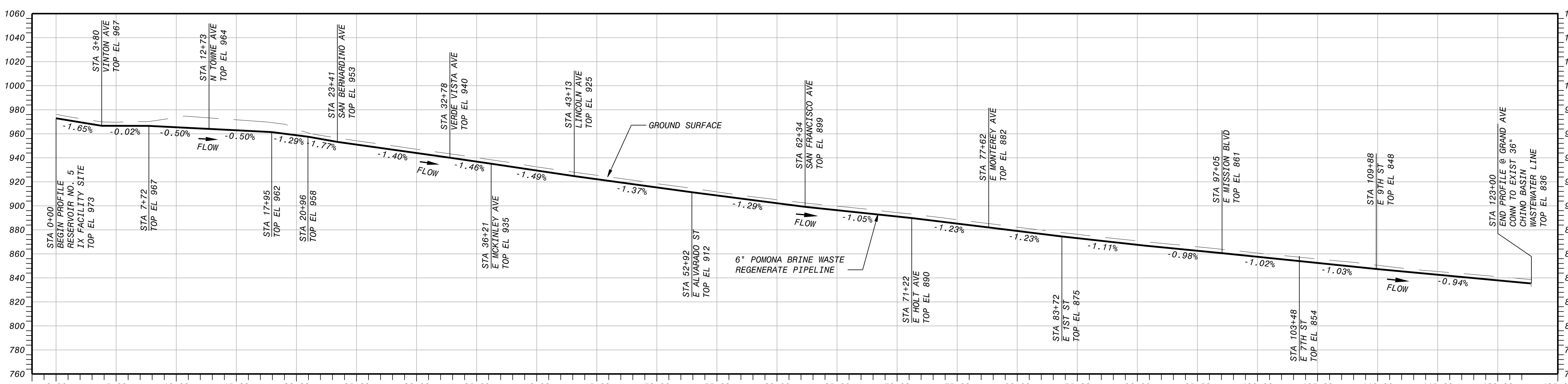
Criteria	New IX Facility
IX Facility	
Location	Vinton Ave. & Towne Ave.
Site Elevation, feet (1)	973
NRW Line	
Location	Grand Ave. & Towne Ave.
Connection Invert Elevation, feet (1)	836
Hydraulic Conditions	
Elevation Difference, feet	-137
Pipeline Diameter, inches	6
Pipeline Length, feet	12,500

Notes:
(1) Elevation above mean sea level based upon USGS maps.

The proposed pipe material for the waste regenerate pipeline is polyvinyl chloride (PVC) sewer pipe. An alternative pipe material is high density polyethylene (HDPE). Pipe materials used at major crossings would be selected based on the type of construction as well as design requirements of the permitting agency.

PLAN STA 0+00 TO STA 123+00

HORIZ - 1" = 1000'



HYDRAULIC PROFILE STA 0+00 TO STA 123+00

HORIZ - 1" = 1000'
VERT - 1" = 100'

CONCEPTUAL - NOT FOR CONSTRUCTION

DATE	REVISIONS AND RECORD OF ISSUE	NO.	BY	CK	APP

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BLACK & VEATCH
Black & Veatch Corporation
Irvine, California

CHINO BASIN DYY PROGRAM EXPANSION PROJECT
PROJECT DEVELOPMENT REPORT

CITY OF POMONA
IX FACILITY BRINE WASTE REGENERATE PIPELINE
PLAN AND PROFILE

DESIGNED: GP
DETAILED: JEG
CHECKED:
APPROVED:
DATE:

PROJECT NO.
160374

FIGURE 2-6

FD160374
D160374

3.0 OPINION OF PROBABLE COST

3.1 Overview

This chapter presents the opinion of probable cost for the facilities described in this Volume IIG of the PDR. General cost assumptions and the opinion of probable capital and annual operations and maintenance (O&M) costs are presented below.

The opinion of probable cost was based on conceptual-level unit cost criteria intended to provide a budgetary estimate of each facility's capital and annual O&M costs. Table 3-1 summarizes the estimated capital and annual O&M costs for the City's proposed facilities. As shown in the table, the total opinion of probable capital and annual O&M costs the new facilities would be $7,348,000 and $505,000, respectively.

Table 3-1
Summary of Opinion of Probable Capital and Annual O&M Costs

Component	Cost
Capital Cost	
Construction Cost	$5,567,000
Contingency (1)	$1,113,000
Engineering/Administration/CM (2)	$668,000
Total Capital Cost	**$7,348,000**
Midpoint of Construction Cost (3)	$8,029,000
Annual Cost	
Annual O&M Cost	$505,000
Annualized Capital Cost (4)	$628,000
Total Annual Cost	**$1,133,000**

Notes:
(1) Based on 20 percent contingency.
(2) Based on 12 percent engineering/administration/construction management (CM).
(3) Assumes midpoint of construction in year 2012 at 3 percent escalation rate.
(4) Assumes amortization period of 25 years and discount rate of 6 percent.

3.2 General Cost Assumptions

The conceptual-level opinion of probable capital and 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. Volume I, Chapter 9, presents a summary of the basis for the unit costs used in this PDR.

Volume I, Chapter 9, also presents the construction, annual O&M, general, and financing unit cost criteria used to develop the cost estimates provided in this chapter.

3.3 Capital Cost

Table 3-2 presents the opinion of probable capital cost for construction of the City's new facilities. As shown, the total estimated capital cost for the facilities would be $7,348,000. Midpoint of construction costs are also provided and indicate the constructions costs in year 2012 using a 3 percent escalation rate.

Table 3-2
Summary of Opinion of Probable Capital Cost

Component/Facility Detail	Cost
Treatment Facilities: Reservoir No. 5 IX System (2,704 gpm installed)	
IX	$2,959,000
Pre-engineered Building	$200,000
Conveyance Facilities	
Brine Pipeline: 12,500 feet @ 6" Diameter	$1,125,000
Railroad Crossing (auger boring)	$200,000
SARI/NRWS Facilities	
Initial Capacity Charge	$450,000
General Costs	
Mechanical (1)	$89,000
Electrical (1)	$296,000
Site Work (1)	$148,000
General Requirements (2)	$100,000
Total Construction Cost	$5,567,000
Contingency (3)	$1,113,000
Engineering/Administration/CM (4)	$668,000
Total Capital Cost	**$7,348,000**
Total Midpoint of Construction Cost (5)	$8,029,000

Notes:
(1)Includes general costs for all treatment and booster station facilities.
(2) Includes general requirements costs for all facilities (except land and SARI/NRWS).
(3) Based on 20 percent contingency.
(4) Based on 12 percent engineering/administration/CM.
(5) Assumes midpoint of construction in year 2012 at 3 percent escalation rate.

3.4 Annual O&M Cost

Table 3-3 presents the opinion of probable annual O&M cost for the City's new facilities. As shown, the total estimated annual O&M cost for the facilities would be $505,000.

Table 3-3
Summary of Opinion of Probable Annual O&M Cost

Component/Facility Detail	Cost
Treatment Facilities: Reservoir No. 5 IX System (2,704 gpm installed)	
General	$426,000
Resin replacement	$29,000
Conveyance Facilities	
General pipeline maintenance: brine	$9,000
SARI/NRWS Facilities	
Capacity charge	$9,000
Volumetric charge	$29,000
CIP charge	$3,000
Total Annual O&M Cost	**$505,000**
Annualized Capital Cost [(1)]	$628,000
Total Annual Cost	$1,133,000

Notes:
(1) Assumes amortization period of 25 years and discount rate of 6 percent.