

ES.1 INTRODUCTION

The Chino I Desalter (Chino I) began operation in 2000 as the first phase of a groundwater management project. The Chino II Desalter (Chino II) began operation in 2006 to expand the capacity of the groundwater treatment system. Construction of these facilities constitutes the Chino Desalter Phase 1 and Phase 2 projects. Chino Desalter facilities are owned and operated by the Chino Basin Desalter Authority (CDA).

The City of Ontario (Ontario), the Jurupa Community Services District (JCSD), and the Western Municipal Water District (WMWD) have jointly developed a scope for the expansion of the Chino Desalter facilities (Chino Desalter Phase 3 project). The three participating agencies are referred to as the Phase 3 project Sponsors. The Sponsors authorized Carollo Engineers to prepare a comprehensive Predesign Report (PDR) for the Chino Desalter Phase 3 project in February 2009.

The scope of the Chino Desalter Phase 3 project is defined by the following groundwater withdrawal and product water capacity objectives:

- Increase desalter groundwater pumping from the lower Chino Basin to approximately 40,000 acre-feet per year (AF/yr).
- Provide at least 10 mgd of additional product water capacity.

The groundwater supply pumped to a desalter for treatment is referred to as raw water. The drinking water production of a groundwater desalter is referred to as product water, which is either treated water from the desalter treatment process facility or a blend of treated and raw water. The Chino Desalter treatment processes include reverse osmosis (RO), ion-exchange (IX), and VOC air stripping.

Increasing the Chino Desalter raw water supply and achieving additional product water capacity requires expansion of the desalter treatment capacity. Previous studies have concluded, and the PDR confirms, that expansion of Chino II is the lowest cost alternative for increasing desalter capacity.

The designated or theoretical capacity of a facility is referred to herein as the “nameplate” capacity. The following points are important considerations in existing desalter nameplate capacity:

- Chino I has a nameplate capacity of 14.2 mgd
- Chino II has two nameplate capacity designations:
 - 15 mgd nameplate capacity includes the water quality dependant raw water bypass capacity.
 - 10 mgd nameplate capacity includes the treatment capacity (RO and IX) and excludes the water quality dependant raw water bypass capacity.
- Historically the desalters have never operated at these nameplate capacities:
 - Chino I has never been able to achieve 14.2 mgd nameplate capacity.
 - Chino II has never been able to achieve 15 mgd nameplate capacity (including 5 mgd raw water bypass) but it has consistently exceeded 10 mgd nameplate capacity (treatment only) by using the raw water bypass.

CDA contracts do not distinguish between the desalters in allocating entitlements to the member agencies. Therefore, the CDA has used the raw water bypass at Chino II to make up the nameplate capacity deficit at Chino I.

ES.2 WELLS

To reach the 40,000 AF/yr desalter raw water objective requires an additional 12,040 AF/yr of groundwater pumping and will result in 10,600 AF/yr of additional product water, assuming an average desalter efficiency of 88 percent. Of the additional groundwater pumping, 5,000 to 7,700 AF/yr must come from new wells located at the direction of the Chino Basin Watermaster (Watermaster) to promote hydraulic control of the Chino Basin according to the Peace II agreements. The proposed new wells are collectively known as the Chino Creek Well Field (CCWF).

Watermaster intends for the CCWF to intercept flow to the Santa Ana River and thereby promote hydraulic control when operated in conjunction with the existing desalter wells. Six CCWF wells have been proposed and located in terms of general vicinity by geohydrologist consultants at the direction of Watermaster. The CCWF wells are located in the vicinity of the Chino I Desalter, as shown on Figure ES.1.

Because the new well field is located near Chino I but the desalter capacity expansion will occur at Chino II, it is necessary to find a method of transferring the new raw water capacity represented by the CCWF wells to the Chino II raw water supply. The recommended alternative is to connect three wells that currently pump to the Chino I Desalter (Wells I-13, 14, and 15) to the Chino II raw water supply. The capacity of these three wells, which are the most easterly Chino I wells, are approximately equivalent to the proposed capacity of the six CCWF wells, which will be connected to the Chino I raw water pipeline.

After construction of the CCWF wells and the connection of the Wells I-13, 14, and 15 to the Chino II raw water supply the overall operation factor for the Chino desalter well fields is less than 70 percent. The operation factor is defined as the required well field capacity divided by the actual capacity of the well field, where the actual well capacities are based on the most recent results of Southern California Edison performance tests. The lower the operation factor, the more capacity is available for reliability. An operation factor of 70 percent was established as the CDA objective in construction of the Chino I expansion and Chino II well fields. The proposed project, therefore, meets the CDA's operating criteria.

ES.3 RAW WATER PIPELINES

Two raw water pipeline systems are required as part of the Chino Desalter Phase 3 project:

- Connection of the CCWF wells to the Chino I RO/IX raw water supply pipeline.
- Connection of Wells I-13, 14, and 15 to the Chino II raw water system.

The existing pumps at Wells I-13, 14, and 15 do not produce enough head to supply the Chino II Desalter. Constructing an in-line booster pump station is recommended instead of replacing the existing well pumps. The raw water intertie pump station will incorporate booster pumps to lift water from the Chino I raw water system to the Chino II raw water system. It should also include a pressure reducing station to allow raw water to flow from the Chino II raw water supply system to the Chino I raw water supply system. This will increase the reliability of the CDA raw water system.

Some of the wells currently operating in the Chino I raw water supply system have nitrate levels that approach or exceed 135 mg/L (as NO_3^-) and may therefore be classified as extremely impaired by the California Department of Public Health (CDPH). CDPH has flexibility and discretion to allow use of nitrate-impaired wells without treatment. Currently, CDPH has authorized the bypass of nitrate-impaired wells at both Chino I and Chino II.

It would be beneficial to eliminate uncertainty about the effect of nitrate-impaired wells in the Chino I well field on the continued use of the Chino II raw water bypass as soon as possible. Although preliminary discussions have been held, CDPH will not issue a final decision until after receipt of an application for an amended operating permit. Carollo recommends that the CDA submit a draft application for an amended permit to CDPH as soon as the PDR is accepted by the CDA.

ES.4 DESALTERS

Currently, both Chino I and Chino II treat groundwater (raw water) for removal of total dissolved solids (TDS) and nitrate using a combination of RO and IX treatment. In addition, Chino I treats four wells for volatile organic compounds (VOCs) using dedicated air stripping towers.

ES.4.1 VOCs

VOCs from several contaminant plumes have been identified within the Chino Desalter well field. The following contaminants have been identified in the raw water supply:

- Trichloroethylene (TCE)
- Tetrachloroethylene (PCE)
- 1,2,3-Trichloropropane (TCP)

TCE and PCE have a high volatility in water and are readily removed in the existing VOC air stripping towers at Chino I. Although TCE has been identified in the raw water supply, it has not been detected in the Chino I product water and the plant meets the maximum contaminant level (MCL) for this contaminant. PCE has not been detected in the Chino I raw water supply at levels above the limit of detection for reporting.

TCP is the primarily VOC of concern because it is not readily removed by air stripping; Chino I data show approximately 60 to 70 percent removal across the VOC air stripping process. The Chino I product water has exceeded the TCP drinking water notification level of 0.005 µg/L, which is also the detection limit for reporting. If TCP levels in the product water exceed the CDPH response level (0.5 µg/L) then CDPH recommends removing the source from service. To date, Chino I product water TCP levels have not exceeded the response level.

Groundwater quality modeling of the VOC contaminant plumes has been provided by geohydrologist consultants. Long-term water quality model projections predict that TCP levels in the existing Chino I VOC air stripping supply wells will continue to decline until the year 2040. TCP levels are predicted to drop below the notification level by the year 2015 and remain below the notification level until the year 2050.

The groundwater quality model predicts that the CCWF wells will have a different response to the VOC plumes. The model predicts that TCP production from the CCWF will peak around the year 2025 and decline thereafter. The majority of TCP production is predicted to occur in only three of the proposed six CCWF wells.

ES.4.1.1 TCE Treatment Recommendations

Unless the regulatory limit for TCE changes significantly, the current air stripping treatment will continue to be adequate for TCE removal in the future, particularly in view of the declining VOC levels projected over the next 40 years. Continued practice of exhausting air stripping towers to atmosphere will also continue to be feasible unless air quality regulations change.

ES.4.1.2 TCP Treatment Recommendations

Carollo recommends acquiring well sites for the CCWF wells that are large enough to support granular activated carbon (GAC) pressure vessels for wellhead removal of TCP in the future, if required. At the present time, GAC is designated as the best available technology (BAT) for TCP; however, if better technologies (e.g., smaller footprint, or lower cost) are available in the future, they can be used instead of GAC treatment.

ES.4.2 Desalter Capacity

There is no need to expand Chino I above nameplate capacity (14.2 mgd) as part of the Phase 3 desalter expansion; however, Chino I has never operated at nameplate capacity and a portion of the operating capacity at Chino II is currently used to make up the deficit in Chino I production. This is possible because Chino II is capable of operating at product water flows greater than the 10 mgd RO/IX nameplate capacity by using the raw water bypass.

Currently, Chino I capacity is limited by the blended product water TDS. Analysis indicates that the existing Chino I facilities cannot reach 14.2 mgd nameplate capacity unless the TDS of the RO/IX raw water supply is less than approximately 720 mg/L. Historical data indicate that the RO/IX raw water supply TDS always exceeds 720 mg/L. The existing Chino I facility is not capable of producing at nameplate capacity with the available raw water quality.

Modification of Chino I to achieve nameplate capacity (14.2 mgd) is possible and would require the expansion of RO treatment capacity and purchase of additional Santa Ana Regional Interceptor (SARI) capacity to accommodate the increased concentrate flow. Purchase of SARI capacity would cost \$13.4M at current rates.

Three options for the Phase 3 expansion of desalter capacity have been developed. The first is based upon the modification of Chino I to achieve nameplate capacity, the other two leave Chino I at the present capacity. All of the alternatives include the expansion of Chino II by 10.5 mgd of RO and IX treatment capacity—this expansion of Chino II is currently under construction.

- Option A - Expand Chino II to 20.5 mgd and modify Chino I to achieve nameplate capacity (14.2 mgd).

- Option B - Expand Chino II to 22.7 mgd (including raw water bypass) and maintain Chino I at current capacity.
- Option C – Expand Chino II to 22.7 mgd (including concentrate reduction facilities) and leave Chino I at current capacity.

Given the information available at the present time, Option C is the recommended alternative for desalter expansion. Reasons include the following:

- It provides equal product water as the other options but requires approximately 5 percent less raw water.
- In comparison to Option B, it shifts groundwater withdrawal away from Chino II and relies less on the higher quality groundwater pumping necessary to operate the raw water bypass as part of the entitlement production.
- It reduces the requirement for SARI waste capacity, which reduces the capital cost of the Phase 3 project and frees up capacity in the SARI pipeline for other projects or uses.

ES.5 CONCENTRATE DISPOSAL

High salinity waste (concentrate) from the Chino desalters is disposed of through the SARI pipeline. The SARI line allows transport of saline waste out of the watershed for disposal to the Pacific Ocean through the Orange County Sanitation District water reclamation facilities and ocean outfalls. RO concentrate comprises the majority of SARI waste at the Chino desalters.

The development of more efficient RO processes, that is, concentrate reduction processes, is the subject of significant research and development. Benefits of concentrate reduction to the Chino desalters include the following:

- Reducing concentrate flow decreases the flow to the SARI system resulting in a reduced SARI capacity requirement and reduced SARI operating costs.
- Concentrate reduction transforms a waste product (brine) into salable product water.
- Because concentrate is converted to product water, the process can either reduce the raw water usage or increase the product water capacity.

The last point is an important consideration in the long-term sustainability of the Chino groundwater basin. Every million gallons of concentrate that is discharged to the SARI system leaves the basin forever. Concentrate that is converted to product water can be retained within the basin to a significant extent through recycling, reuse, or recharge.

Among the many concentrate reduction technologies available, the one evaluated in the PDR was recently ranked as the number one alternative by the U.S. Bureau of Reclamation. The process uses a high rate pellet softener to remove calcium and silica

from RO concentrate. After these fouling agents are reduced, the concentrate is applied as feed water to a secondary RO treatment train. The calcium and silica pellets are hauled from the site by truck.

A recently completed market survey has identified several users willing to pay between \$10/ton and \$20/ton for the entire output (approximately 40 tons/day) of the proposed Chino II concentrate reduction process.

The following steps are recommended as a preliminary step in pursuing concentrate reduction as part of Option C:

- Coordinate with SAWPA to identify potential issues with secondary RO concentrate discharge to the SARI system.
- Coordinate with CDPH to identify requirements for process implementation, such as pilot- or demonstration-scale studies.
- Coordinate with desalter staff to develop improved site layouts and cost estimates.
- Identify potential grant funding sources.
- Identify and acquire additional property adjacent to the Chino II site for construction of concentrate reduction facilities.
 - Authorize initial property negotiations.
 - Actual purchase is contingent upon successful completion of concentrate reduction feasibility investigations (e.g., pellet market study, pilot study, etc.)

ES.6 PRODUCT WATER FACILITIES

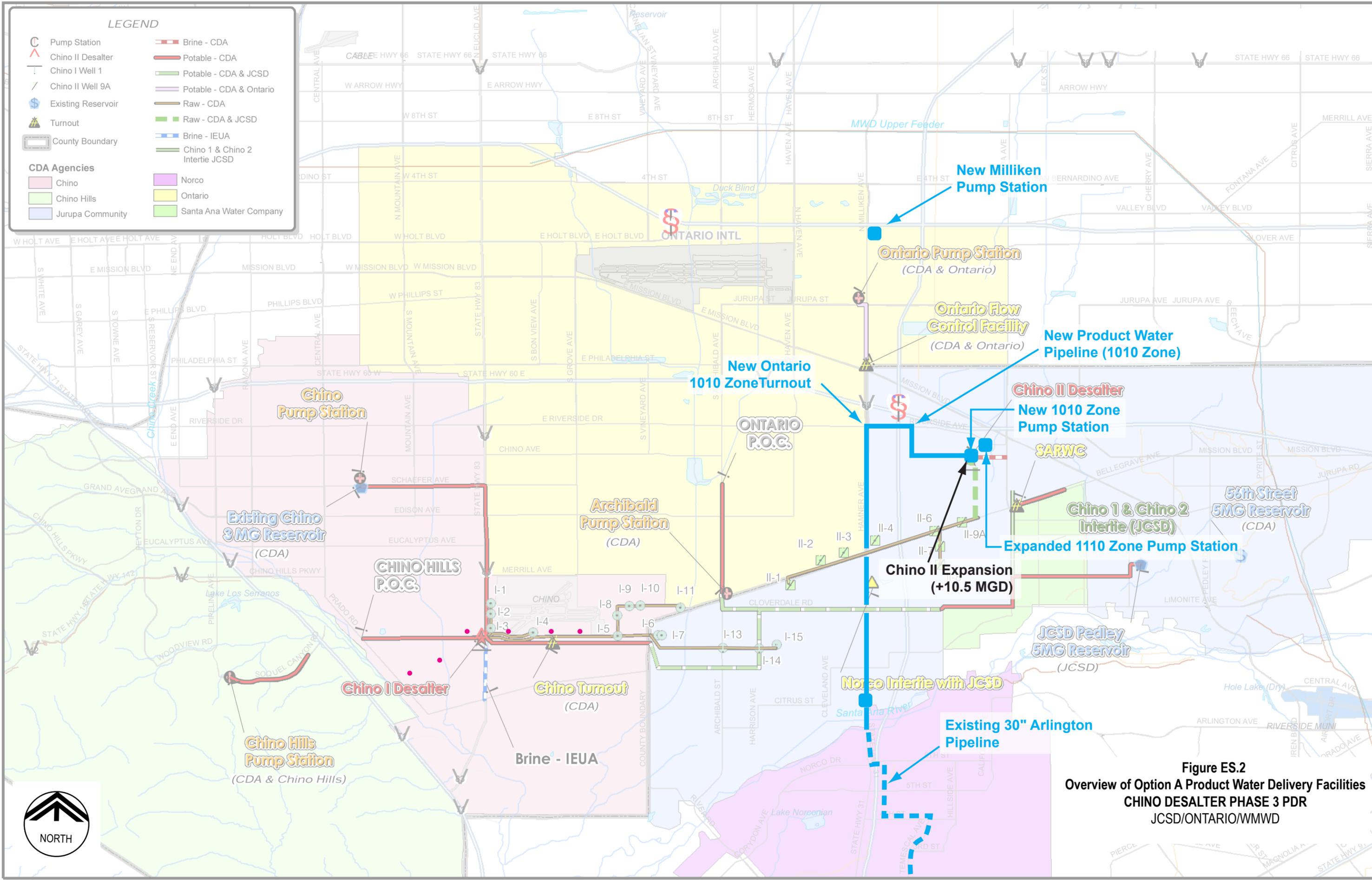
The additional 10.5 mgd of capacity made available at Chino II by the Phase 3 expansion will be distributed through the new product water facilities shown on Figure ES.2.

ES.6.1 Deliveries to JCSD

JCSD's water distribution master plan requires delivery of all JCSD product water from Chino II to the JCSD 1110 zone. Pumping the JCSD Chino II expansion entitlement through the existing Chino II 1110 zone product water pump station will require addition of another pump.

The following points summarize Chino II product water deliveries to JCSD:

- Continue to deliver the original JCSD Chino II entitlement capacity (5.29 mgd) through the existing 1110 zone pump station.
- Deliver the JCSD Chino II expansion entitlement capacity (3.5 mgd) through the existing 1110 zone pump station with the addition of one more pump.
- No additional product water pipe is required for delivery to JCSD.



LEGEND

	Pump Station		Brine - CDA
	Chino II Desalter		Potable - CDA
	Chino I Well 1		Potable - CDA & JCSD
	Chino II Well 9A		Potable - CDA & Ontario
	Existing Reservoir		Raw - CDA
	Turnout		Raw - CDA & JCSD
	County Boundary		Brine - IEUA
CDA Agencies			Chino 1 & Chino 2 Intertie JCSD
	Chino		Norco
	Chino Hills		Ontario
	Jurupa Community		Santa Ana Water Company

Figure ES.2
Overview of Option A Product Water Delivery Facilities
CHINO DESALTER PHASE 3 PDR
JCSD/ONTARIO/WMWD



ES.6.2 Deliveries to Ontario

Ontario currently receives its original Chino II entitlement capacity (3.37 mgd) through the existing Chino II 1110 zone pump station with transportation through the JCSD distribution and pressure reduction to the Ontario 1010 zone. Ontario has elected to build a new pump station and product water pipeline to take delivery of Chino II product water directly into the Ontario 1010 zone.

The following points summarize Chino II product water deliveries to Ontario:

- Construct a new Chino II 1010 zone pump station large enough to accommodate Ontario's existing entitlement capacity (3.37 mgd) and expansion entitlement capacity (3.5 mgd). The new 1010 zone pump station is shared with WMWD.
- Construct a new product water pipeline from the Chino II 1010 zone pump station to the intersection of Riverside Drive and Hamner Avenue where Ontario will take delivery of Chino II product water. The pipeline is shared with WMWD.
- Maintain flexibility of taking delivery of the original Chino II entitlement capacity through the existing 1110 zone pump station and JCSD distribution system.
- Construct a new pump station at the Milliken Reservoir site to transfer Chino II product water from the Ontario 1010 zone to the 1212 zone.

ES.6.3 Deliveries to WMWD

WMWD will receive product water from the Chino II expansion indirectly by means of an exchange using Arlington Desalter product water currently sold to the City of Norco. The Arlington Desalter (operated by WMWD) delivers water to Norco through the existing 30-inch Arlington pipeline. Water delivered to Norco from WMWD's Chino II expansion entitlement in lieu of Arlington Desalter product water will make the equivalent amount of Arlington Desalter product water available for other WMWD customers. Norco has a contract to take 4,400 acre-feet of Arlington Desalter product water annually but has been taking delivery of the entire output of the desalter, which is currently approximately 6,400 acre-feet per year.

The 3,534 acre-feet per year available to WMWD from the Chino II expansion can be delivered to Norco through the proposed 1010 zone pump station and dedicated product water pipeline shown in Figure ES.2. The proposed pipeline on Hamner Avenue will connect to the existing 30-inch Arlington pipeline. Therefore, at least 3,534 acre-feet of product water per year, currently sold to Norco from the Arlington Desalter, will be available for distribution elsewhere. In addition, WMWD plans on increasing the product water capacity of the Arlington Desalter by approximately 3,300 acre-feet per year.

The following points summarize Chino II product water deliveries to WMWD:

- Construct a new 1010 zone pump station and pipeline large enough to accommodate WMWD's expansion entitlement capacity (3.5 mgd).
 - Facilities are shared with Ontario up to the Ontario 1010 zone turnout located at Riverside Drive and Hamner Avenue.
 - The Hamner pipeline, south of Riverside Drive, is used by WMWD and Norco.
 - Dedicated delivery of Chino II product water to Norco will meet contractual water quality requirements.
- Chino II expansion product water delivered to Norco will allow equal capacity from the Arlington Desalter (currently delivered to Norco) available for use elsewhere by WMWD.
- Norco will be able to take delivery of its existing CDA entitlement plus the expansion capacity through the proposed Hamner Avenue pipeline.

ES.6.4 Chino I – Chino II Product Water Intertie

Although, historically, Chino I has been unable to produce at its 14.2 nameplate capacity, Chino II is able to consistently produce in excess of its 10 mgd RO/IX nameplate capacity by using the raw water bypass. Chino and Chino Hills are presently unable to physically take delivery of water from Chino II; however, Ontario, JCSD, and SARWC have connections to both desalters and when these agencies increase their deliveries of product water from Chino II the corresponding flow is then available at Chino I for delivery to Chino and Chino Hills.

This practice represents an operational product water intertie between Chino I and Chino II. The operational intertie relies on the ability and willingness of JCSD to reduce deliveries from Chino I in return for increased deliveries from Chino II. Two of the Phase 3 expansion alternatives (Options B and C) require a continuation of this product water exchange because they assume that the raw water bypass capacity (or concentrate reduction capacity) at Chino II is used to make delivery of CDA entitlements that were originally anticipated to be met by operation of Chino I at nameplate capacity.

ES.7 COST ESTIMATES

The scope of the Phase 3 project includes expansion of Chino II by 10.5 mgd in order to increase total desalter raw water usage to 40,000 AF/yr. At the same time, the Phase 3 project should not result in a reduction in reliability of delivery of current entitlement volumes to the non-sponsored CDA members. Three basic options for expansion of desalter treatment capacity without impairing the delivery of current entitlements were evaluated. Capital costs are summarized in Table ES.1.

Table ES.1 Summary of Phase 3 Project Options Capital Costs Chino Desalter Phase 3 PDR JCSD/Ontario/WMWD		
Option A—Expand Chino II to 20.5 mgd and Modify Chino I to Nameplate Capacity (14.2 mgd)	Option B—Expand Chino II to 22.7 mgd (Including Raw Water Bypass at 2.2 mgd)	Option C—Expand Chino II to 22.7 mgd (Including Concentrate Reduction at 2.2 mgd)
\$129,070,000	\$126,010,000	\$110,610,000
Notes:		
a. Capital costs in 2009 dollars represent construction costs plus 20 percent engineering (except concentrate reduction is 30 percent) and 5 percent legal/administration costs.		
b. Does not include resale value of SARI capacity made available by concentrate reduction.		

The capital costs for the Phase 3 project are shared primarily between the Sponsors. However, some capital costs are shared with non-sponsor CDA members because they constitute improvements to existing facilities that benefit the entire CDA membership. A recommended breakdown of capital costs for the Phase 3 project, escalated to mid-point of construction with proposed cost sharing, is presented in Table ES.2 for the recommended option (Option C).

The CDA uses a postage stamp rate concept for distribution of operations and maintenance (O&M) costs among the CDA member agencies. The postage stamp rate means there is no segregation of facility costs in determining the cost sharing of annual O&M expenses.

A summary of O&M costs for the current baseline budget (CDA FY 09/10) and the projected impact on the baseline budget due to implementation of the recommended Phase 3 project alternative (Option C) is shown in Table ES.3.

This analysis indicates that the recommended Phase 3 project alternative (Option C) will decrease the CDA O&M costs by 0.8 percent from the current baseline level. Because the impact on O&M costs is a critical issue to CDA members, the Phase 3 project Sponsors commissioned an independent review of O&M costs by a separate consultant (RBF Consulting). The conclusion of the independent review was that O&M costs would increase by 5.5 percent from the current baseline level for Option C.

However, the RBF Consulting analysis was completed prior to the pellet market survey and assumes a \$30/ton disposal cost for pellets. Using the low range pellet sale value of \$10/ton identified by the market survey, the increase in O&M calculated by the independent review would be 2 percent instead of 5.5 percent.

Both analysis indicate a unit O&M cost impact well within the previously negotiated 10 percent impact margin.

Table ES.2 Capital Cost Distribution for Option C (Expand Chino II to 22.7 mgd with Concentrate Reduction) Chino Desalter Phase 3 PDR JCSD/Ontario/WMWD																		
	Chino Phase 3 Sponsors						Non-Sponsors						TOTAL ^a					
	Ontario		JCSD		Western		Chino		Chino Hills		Norco				SARWC			
PRODUCT WATER ALLOCATION																		
Phases 1 and 2 (Acre-Feet/Year)	20%	5,000	33%	8,200	0%	0	20%	5,000	17%	4,200	4%	1,000	5%	1,200	100%	24,600		
Phase 3 (Acre-Feet/Year)	33%	3,533	33%	3,533	33%	3,534	0%	0	0%	0	0%	0	0%	0	100%	10,600		
Total (Acre-Feet/Year)	24%	8,533	33%	11,733	10%	3,534	14%	5,000	12%	4,200	3%	1,000	3%	1,200	100%	35,200		
RAW WATER SYSTEM CAPITAL COSTS:																		
<u>Wells:</u>																		
Wells CCWFA-1, 2, 3, 4, 5, and 6 + Monitoring Wells	33%	\$6,729,365	33%	\$6,729,365	33%	\$6,731,270	0%	\$0	0%	\$0	0%	\$0	0%	\$0	100%	\$20,190,000		
<u>Pipelines:</u>																		
Raw Water Pipeline from Well CCWFA-6 to Chino I	33%	\$646,606	33%	\$646,606	33%	\$646,789	0%	\$0	0%	\$0	0%	\$0	0%	\$0	100%	\$1,940,000		
Raw Water Intertie Pipeline	33%	\$1,979,813	33%	\$1,979,813	33%	\$1,980,374	0%	\$0	0%	\$0	0%	\$0	0%	\$0	100%	\$5,940,000		
<u>Raw Water Pump Station</u>																		
Raw Water Intertie Pump Station	33%	\$1,256,548	33%	\$1,256,548	33%	\$1,256,904	0%	\$0	0%	\$0	0%	\$0	0%	\$0	100%	\$3,770,000		
WATER TREATMENT FACILITIES CAPITAL COSTS:																		
Chino I Modifications to Maintain Current Capacity (100% Sponsors)	33%	\$873,251	33%	\$873,251	33%	\$873,498	0%	\$0	0%	\$0	0%	\$0	0%	\$0	100%	\$2,620,000		
Chino II 10.5 mgd RO/IX Expansion (100% Sponsors)	33%	\$5,069,522	33%	\$5,069,522	33%	\$5,070,957	0%	\$0	0%	\$0	0%	\$0	0%	\$0	100%	\$15,210,000		
Chino II Transfer Pumps (48.8% CDA/51.2% Sponsors)	27%	\$264,441	33%	\$326,651	17%	\$167,285	10%	\$97,203	8%	\$81,651	2%	\$19,441	2%	\$23,329	100%	\$980,000		
Chino II Chemical System Modifications (100% CDA)	24%	\$2,424	33%	\$3,333	10%	\$1,004	14%	\$1,420	12%	\$1,193	3%	\$284	3%	\$341	100%	\$10,000		
Chino II Spare Parts (100% CDA)	24%	\$106,663	33%	\$146,663	10%	\$44,175	14%	\$62,500	12%	\$52,500	3%	\$12,500	3%	\$15,000	100%	\$440,000		
HVAC Modifications (38% CDA/62% Sponsors)	28%	\$88,004	33%	\$103,327	21%	\$64,079	8%	\$23,943	6%	\$20,112	2%	\$4,789	2%	\$5,746	100%	\$310,000		
Concentrate Reduction Facilities (100% Sponsors)	33%	\$10,735,654	33%	\$10,735,654	33%	\$10,738,692	0%	\$0	0%	\$0	0%	\$0	0%	\$0	100%	\$32,210,000		
PRODUCT WATER SYSTEM CAPITAL COSTS:																		
<u>Pipelines:</u>																		
Pipeline from Chino II to Riverside Dr./Hamner Ave. (Ontario Zone 1010)	61%	\$5,089,151	0%	\$0	39%	\$3,280,849	0%	\$0	0%	\$0	0%	\$0	0%	\$0	100%	\$8,370,000		
Pipeline from Riverside Dr./Hamner Ave. to Detroit St.	0%	\$0	0%	\$0	100%	\$17,920,000	0%	\$0	0%	\$0	0%	\$0	0%	\$0	100%	\$17,920,000		
<u>Pump Stations:</u>																		
Chino II - JCSD Product Water (Clearwell to Zone 1110)	0%	\$0	100%	\$1,090,000	0%	\$0	0%	\$0	0%	\$0	0%	\$0	0%	\$0	100%	\$1,090,000		
Chino II - Ontario/Western Product Water (Clearwell to Zone 1010)	61%	\$1,653,822	0%	\$0	39%	\$1,066,178	0%	\$0	0%	\$0	0%	\$0	0%	\$0	100%	\$2,720,000		
Milliken Res - Ontario (Zone 1010 to Zone 1212)	100%	\$2,750,000	0%	\$0	0%	\$0	0%	\$0	0%	\$0	0%	\$0	0%	\$0	100%	\$2,750,000		
		Capital Costs Subtotal		\$37,245,263		\$28,960,732		\$49,842,053		\$185,067		\$155,456		\$37,013		\$44,416		\$116,470,000
		Less Approved Grant Funding		(\$8,922,324)		(\$6,937,716)		(\$11,939,960)		\$0		\$0		\$0		\$0		(\$27,800,000)
		Adjusted Capital Costs		\$28,322,939		\$22,023,017		\$37,902,092		\$185,067		\$155,456		\$37,013		\$44,416		\$88,670,000
		30 Year Amortization Period 5.0% Fixed Amortization Rate																
		ANNUALIZED CAPITAL (\$/YEAR)		\$1,842,448		\$1,432,629		\$2,465,586		\$12,039		\$10,113		\$2,408		\$2,889		\$5,768,111

Notes:
a. Capital costs are construction costs plus engineering/contingency and legal/administration costs escalated to construction midpoint.

Table ES.3 Summary of O&M Costs Chino Desalter Phase 3 PDR JCSD/Ontario/WMWD			
	Original^a	New^b	Increase or (Decrease)
Fixed O&M (\$/yr)	\$5,760,783	\$6,111,783	\$351,000
Variable O&M (\$/yr)	<u>\$7,636,386</u>	<u>\$ 12,904,862</u>	<u>\$5,898,476</u>
Total O&M (\$/yr)	\$13,397,169	\$ 19,016,645	\$6,249,476
Product Water (AF/yr)	24,600	35,200	10,600
Unit Cost (\$/AF)	\$545	\$ 541	(\$4) (-0.8%)
Notes:			
a. Original O&M costs are from CDA FY 09/10 Budget.			
b. New costs are adjusted for impacts of Phase 3 project, Option C, assuming low range pellet sale value (\$10/ton) per pellet market survey.			

ES.8 REVIEW

The draft PDR has received extensive review, as indicated by the following history.

- The first draft PDR was issued to the Sponsors on August 20, 2009.
- The first draft PDR was issued to non-Sponsor CDA TAC members on September 22, 2009 with a request for review comments.
- Addendum No. 1 to the PDR containing additional information requested by the Sponsors was issued October 16, 2009.
- 298 written comments were received from CDA TAC members and other reviewers by November 9, 2009.
- The second draft PDR including responses to all written comments with appropriate revisions was issued to CDA TAC members and other reviewers as Addendum No. 2 on December 7, 2009.
- An additional 108 written comments were received from CDA TAC members and other reviewers by January 22, 2010.
- The third draft PDR including responses to all written comments with appropriate revisions was issued to CDA TAC members and other reviewers as Addendum No. 3 on February 19, 2010.
- PDR presentations and review sessions were held with the CDA TAC on January 12, 2010 and February 23, 2010 and with CDA member agency managers on March 9, 2010.

- 27 additional comments related to the draft PDR were received from the City of Chino April 29, 2010 and were reviewed and resolved in a conference call on May 5, 2010.
- The final draft of the PDR was unanimously approved by the CDA TAC on May 25, 2010.

Since the first draft of the PDR was issued to the Sponsors in August, 2009 a second and third draft with four addenda have been issued to 27 reviewers within 14 different agencies including the CDA technical advisory committee (TAC), geohydrologist consultants, Chino Basin Watermaster, U.S. Bureau of Reclamation, and an independent consultant engaged by the Sponsors to provide a third-party review. A separate review was commissioned by the Sponsors to provide an independent O&M cost analysis. Over four hundred written comments have been received and the appropriate revisions have been made. Written comments and responses are included in an appendix to the PDR.

INTRODUCTION

1.1 BACKGROUND

With more than 800 wells, the Chino Groundwater Basin provides a critical water supply for agriculture, industry, and public drinking water suppliers. Although over pumping of groundwater has resulted in subsidence in some areas of the Chino Basin there is also a hydraulic surcharge that results in overflow of contaminated groundwater to the Santa Ana River. The primary groundwater contaminants of concern are total dissolved solids (TDS), nitrates, and volatile organic compounds (VOCs).

The Chino I Desalter (Chino I) began operation in 2000 as the first phase of a groundwater management project to help promote Watermaster's goal of achieving hydraulic control of the Chino Basin, preserve or increase yield of the Basin, remove contaminants from the groundwater, and to provide a drinking water supply. The Chino II Desalter (Chino II) began operation in 2006 to expand the capacity of the groundwater treatment system. Treatment technologies used at Chino I and Chino II include reverse osmosis (RO), ion-exchange (IX), and VOC air stripping.

Construction of these facilities constitutes the Chino Desalter Phase 1 and Phase 2 projects. Chino Desalter facilities are owned and operated by the Chino Basin Desalter Authority (CDA), a joint powers authority composed of water utility member agencies.

1.1.1 Phase 3 Project

During the years 2006 and 2007, the City of Ontario (Ontario) and the Western Municipal Water District (WMWD) jointly developed a scope for the expansion of the Chino Desalter facilities (Chino Desalter Phase 3 Project). The Phase 3 project scope was defined in a report entitled "Chino Desalter Phase 3 Alternatives Evaluation," dated May 2007, prepared by Carollo Engineers. Since the publication of the May 2007 report, the Jurupa Community Services District (JCSD) has elected to participate in the Phase 3 project.

1.1.2 Project Sponsors

The three participating agencies are referred to herein as the Phase 3 project Sponsors. JCSD and Ontario are original members of the CDA. WMWD was formally admitted to CDA membership by CDA Board action on April 2, 2009.

For the purposes of the Phase 3 project, WMWD acts as the lead Sponsor in entering into contracts with consultants, contractors, and suppliers. Cost sharing agreements between the Sponsors provide for reimbursement of appropriate costs incurred by the lead Sponsor.

It is anticipated that during the Phase 3 project some facilities will be constructed or modified that benefit the entire CDA membership while other facilities will be constructed to benefit only the Sponsors, either collectively or individually. Purposes of this report include identifying all facilities that are part of the Phase 3 project, providing cost estimates, and recommending cost sharing between the individual Sponsors and, as appropriate, the non-Sponsor CDA members.

1.2 OBJECTIVES

The scope of the Chino Desalter Phase 3 project is defined in terms of the following groundwater withdrawal and product water capacity objectives:

- Increase desalter groundwater pumping from the lower Chino Basin to 40,000 acre-feet per year (AF/yr) in accordance with the Optimum Basin Management Plan (OBMP) and
- Provide at least 10 mgd of additional product water capacity.

Throughout this report, the groundwater supply pumped to a desalter for treatment is referred to as raw water. The drinking water production of a groundwater desalter is referred to as product water, which is either treated water from the desalter treatment process facility or a blend of treated and raw water.

Increasing the Chino Desalter raw water supply to 40,000 AF/yr and achieving an additional 10 mgd (minimum) product water capacity require expansion of the desalter treatment capacity. The 2007 Report evaluated alternatives including expansion of Chino I, expansion of Chino II, and construction of a new desalter and concluded that expansion of Chino II was the lowest cost alternative.

CDA members are required to purchase a minimum quantity of product water during each fiscal year. The minimum quantity commitment is referred to as entitlement in this report; entitlement volumes are used as the basis of allocating capacity and costs. The entitlement of each CDA member is shown in Table 1.2, both as a product water volume and a proportional flow capacity, for the existing desalter capacity and the Phase 3 expansion.

Both Tables 1.1 and 1.2 refer to the existing Chino Desalter capacity as “nameplate” capacity. The nameplate capacity is the nominal design capacity for the desalter, where nominal capacity is defined as “a designated or theoretical size that may vary from the actual” (Merriam Webster’s Collegiate Dictionary, 10th Ed.).

The raw water and product water volumes and capacities for the existing Chino Desalters and the proposed Phase 3 expansion are shown in Table 1.1.

Table 1.1 Volumes and Capacities Chino Desalter Phase 3 PDR JCSD/Ontario/WMWD				
	Raw Water^a (AF/yr)	Product Water^b (AF/yr)	Desalter Nameplate Capacity (mgd)	Desalter Efficiency^c (percent)
Chino I				
Existing	16,140	14,200	14.2	88
Chino II				
Existing	11,820	10,400	10.0 ^d /15.0 ^e	88
Expansion	12,040	10,600	10.5	88
Subtotal	23,860	21,000	20.5	88
All Desalters				
Existing	27,960	24,600	24.2	88
Expansion	12,040	10,600	10.5	88
Total	40,000	35,200	34.7	88
Notes:				
a. Raw Water volumes are based on the desalter efficiencies shown and will vary with actual desalter efficiencies.				
b. Product Water volumes are based upon the CDA member entitlements as modified by Amendment No. 2 to CDA Joint Powers Agreement.				
c. Desalter Efficiency = Product Water/Raw Water and is dependant upon factors such as RO process recovery and RO bypass. 88 percent is the average desalter efficiency.				
d. 10 mgd excludes the water quality dependent raw water bypass.				
e. 15 mgd includes the water quality dependent raw water bypass.				

Table 1.2 CDA Product Water Entitlement Chino Desalter Phase 3 PDR JCSD/Ontario/WMWD								
VOLUME^a	Chino (AF/yr)	Chino Hills (AF/yr)	JCSD (AF/yr)	Norco (AF/yr)	Ontario (AF/yr)	SARWC (AF/yr)	WMWD (AF/yr)	Total
Chino I								
Existing	5,000	4,200	2,700	0	1,500	800	0	14,200
Chino II								
Existing	0	0	5,500	1,000	3,500	400	0	10,400
Expansion	0	0	3,533	0	3,533	0	3,534	10,600
Subtotal	0	0	9,033	1,000	7,033	400	3,534	21,000
All Desalters								
Existing	5,000	4,200	8,200	1,000	5,000	1,200	0	24,600
Expansion	0	0	3,533	0	3,533	0	3,534	10,600
Total	5,000	4,200	11,733	1,000	8,533	1,200	3,534	35,200
FLOW^b	Chino (mgd)	Chino Hills (mgd)	JCSD (mgd)	Norco (mgd)	Ontario (mgd)	SARWC (mgd)	WMWD (mgd)	Total^c
Chino I								
Existing	5.0	4.2	2.7	0	1.5	0.8	0	14.2
Chino II								
Existing	0	0	5.3	1.0	3.4	0.4	0	10.0
Expansion	0	0	3.5	0	3.5	0	3.5	10.5
Subtotal	0	0.0	8.8	1.0	6.9	0.4	3.5	20.5
All Desalters								
Existing	5.0	4.2	8.0	1.0	4.9	1.2	0	24.2
Expansion	0	0	3.5	0	3.5	0	3.5	10.5
Total	5.0	4.2	11.5	1.0	8.4	1.2	3.5	34.7
Notes:								
a. Volumes are based upon the CDA member entitlements as modified by Amendment No. 2 to CDA Joint Powers Agreement with breakdown by desalter per annual budget spreadsheets.								
b. Flow is the share of Total Flow proportional to entitlement volume. Total flow is higher than the average annual flow required to produce the annual entitlement volume by the ratio of the Operation Factor.								
c. Total flow is Desalter nominal design (nameplate) capacity.								

Table 1.2 (footnote b) refers to the “Operation Factor,” which is a term used throughout this report. The operation factor is the ratio between the nameplate capacity of a facility and the annual average flow required to deliver a specified volume of water per year. The operation factor accounts for the fact that facilities are generally unable to operate continuously at nameplate capacity for an entire year. The operation factor accounts for equipment downtime for repairs, cleaning, replacement and maintenance, power outages and other shutdowns, both planned and unplanned.

The following points apply to Tables 1.1 and 1.2:

- The information is presented to document historically designated nameplate capacities, raw water requirements, and distribution of product water capacity. These values have appeared in previous CDA documents, budgets, and spreadsheets.
- Chino II is shown with two nameplate capacity designations:
 - 15 mgd nameplate capacity includes the water quality dependent raw water bypass capacity.
 - 10 mgd nameplate excludes the water quality dependent raw water bypass capacity.
- Historically, the desalters have never operated at these nameplate capacities:
 - Chino I has never been able to achieve 14.2 mgd nameplate capacity.
 - Chino II has never been able to achieve 15 mgd nameplate capacity (including raw water bypass) but it has consistently exceeded 10 mgd nameplate capacity (excluding raw water bypass).
- Table 1.2 shows annual entitlement volumes for each CDA member agency distributed between Chino I and Chino II. Although this information has appeared in CDA budgets and spreadsheets there is no contractual basis for allocating entitlements to the individual desalters. CDA contracts do not distinguish between the desalters in allocating entitlements to the member agencies.

Table 1.1 shows two nameplate values for Chino II: 10.0 mgd and 15.0 mgd. The 10.0 mgd nameplate capacity designation excludes the water quality dependent raw water bypass capacity whereas the 15.0 mgd nameplate capacity designation includes the water quality dependent raw water bypass capacity. The issue of raw water bypass capacity and water quality are defined by the California Department of Public Health (CDPH) in the Chino II operating permit.

CDPH approved the following capacities in the Chino II operating permit:

“The Chino II Desalter is approved for a design capacity of 6 MGD of reverse osmosis permeate flow, a design capacity of 4 MGD of ion exchange treated flow, and up to 5 MGD of by-pass blend flow to meet the treatment target. The Desalter shall not be operated at a daily flow in excess of these capacities without approval from the Department.”

(Permit No. 05-20-06P-005, page 5).

The “treatment target” referred to is the blended product water TDS or nitrate goal. The actual capacity of the Chino II bypass flow is constrained by both the performance of the RO and IX processes and the quality of the raw water, which is dependent upon the wells being operated on a given day and changes in groundwater TDS and nitrates over time.

In other words, the capacity of the raw water bypass at Chino II is limited by water quality under the terms of the CDPH permit. Because of the CDPH water quality limitation the Chino II bypass has never operated at the allowable maximum rate of 5 mgd. The historical average Chino II raw water bypass capacity is 2.2 mgd and the 90th percentile bypass capacity is less than 3 mgd (see Section 4.4). Consequently, the Chino II product water capacity has historically ranged between 12 and 13 mgd.

The CDPH permit capacity of Chino II without including the water quality dependent raw water bypass is the sum of the permitted RO and IX capacities: 10 mgd. Historically, this capacity has been used as the Chino II nameplate capacity in some cases. For example, the original Chino II construction drawings show a “Phase 1 Blended Product Water” capacity of 10 mgd with a raw water bypass capacity of 0 mgd (Dwg. I-4, Process Flow Diagram, Chino II Desalter Onsite Improvements, July 2003). This is the basis of the preliminary buy-in analysis provided by RBF in 2006 and 2007, in which RBF assigned the existing Chino II Desalter a “nominal 10 mgd” capacity and treats all capacity in excess of 10 mgd as “built-in expansion” capacity to be purchased by the Sponsors as part of the Phase 3 expansion of Chino II.

1.3 AUTHORIZATION

Carollo Engineers was authorized to prepare the Chino Phase 3 Comprehensive Predesign Report (PDR) by a purchase order from WMWD, the lead Sponsor, dated February 13, 2009.

1.4 ABBREVIATIONS

ACE	Army Corps of Engineers
AF	acre-feet
AF/yr	acre-feet per year
AMSL	above mean sea level
AQMD	Air Quality Management District
ASME	American Society of Mechanical Engineers
BAT	best available technology
CAL/OSHA	California Division of Occupational Safety and Health
CALTRANS	California Department of Transportation
CCWF	Chino Creek Well Field
CDA	Chino Basin Desalter Authority
CDPH	California Department of Public Health
CEQA	California Environmental Quality Act
Chino I	Chino I Desalter
Chino II	Chino II Desalter
CS	constant speed
CVIFD	Chino Valley Independent Fire District
DFG	California Department of Fish and Game
DYYP	Dry-Year Yield Program
EMWD	Eastern Municipal Water District
ERCs	Emission Reduction Credits
fps	foot per second
ft	feet or foot
GAC	granular activated carbon
gfd	gallons per day per square foot
gpm	gallons per minute
hp	horsepower
IEUA	Inland Empire Utility Agencies
IX	ion-exchange
JCSD	Jurupa Community Services District
LDR	limit of detection for reporting
MCL	maximum contaminant level
mgd	million gallons per day
µg/L	micrograms per liter
mg/L	milligrams per liter

NO ₃ ⁻	nitrate
O&M	operations and maintenance
OBMP	Optimum Basin Management Plan
OCSD	Orange County Sanitation District
OCWD	Orange County Water District
OEHHA	Office of Environmental Health Hazard Assessment
PCE	tetrachloroethylene
PDR	Predesign Report
PHG	public health goal
psi	pounds per square inch
PVC	polyvinyl chloride
RO	reverse osmosis
SARI	Santa Ana Regional Interceptor
SAWPA	Santa Ana Watershed Project Authority
SBVMWD	San Bernardino Valley Municipal Water District
SCE	Southern California Edison
TCE	trichloroethylene
TDH	total dynamic head
TDS	total dissolved solids
UPRR	Union Pacific Railroad
UV	ultraviolet
VFD	variable frequency drive
VOCs	volatile organic compounds
VTLS	vertical Turbine line-shaft
WMWD	Western Municipal Water District
WEI	Wildermuth Environmental, Inc.

1.5 REFERENCES

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