
PRODUCT WATER FACILITIES

6.1 OVERVIEW

Because of limited onsite storage at the Chino Desalters, the product water pump stations and pipelines are not intended to operate at flow rates higher than the nameplate capacities of the treatment plants where they are located. Therefore, in order to deliver the required CDA member entitlement volumes, the total reliable delivery capacity of Chino II product water pump stations matches the nameplate capacity for the desalter.

To reduce the project costs, the original Chino II product water facilities took advantage of the fact that the desalter is located within the JCSD distribution system by transporting all product water through the JCSD 1110 pressure zone. JCSD, Ontario, Norco, and SARWC all receive Chino II product water entitlements via transportation through the JCSD 1110 zone. Because each of these CDA members (except JCSD) deliver their Chino II product water into lower pressure zones there is a loss of energy associated with pumping to the JCSD 1110 zone and then reducing the pressure for delivery to lower zones. Pumping costs are shared equally between all CDA members through use of a “postage stamp rate” calculation; therefore, a reduction in Chino II product water pumping costs will benefit all CDA members. One of the purposes of the Phase 3 expansion PDR is to evaluate opportunities to provide the most economical pumping scenario for the Chino II expansion.

Preliminary discussions of methods for distributing the Chino II expansion product water resulted in development of two alternatives, Options A and B.

- Option A uses a new 1010 zone pump station and dedicated pipeline to convey Chino II product water jointly to Ontario and WMWD.
- Option B uses a new 870 zone pump station to convey Chino II product water for JCSD and WMWD to the JCSD 870 zone distribution system. WMWD would receive water elsewhere from the JCSD 870 zone.

A technical memorandum (Carollo, April 2009) was prepared to evaluate the differences between Option A and Option B; a copy is included in Appendix F.1 for reference. Based upon subsequent discussions between the Sponsors, Option A has been selected as the basis for the PDR. Reasons for choosing Option A include the following:

- Option A allows WMWD to meet contractual water quality obligations (NO_3^- < 25 mg/L, TDS < 350 mg/L) to Norco with Chino II product water, independent of the blended water quality within the JCSD distribution system.
- Long-term delivery of WMWD product water under Option B requires construction of the Riverside-Corona Feeder Pipeline, which has uncertain funding and schedule at the present.

- Short-term delivery of WMWD product water under Option B requires construction of a pump station to transfer water from the JCSD 870 zone to the Arlington pipeline, which would be unused after construction of the Riverside-Corona Feeder.

JCSD's water distribution master plan requires delivery of all JCSD product water from Chino II to the JCSD 1110 zone. Therefore, the assumptions for Option A contained in the technical memorandum (Appendix F.1) are now modified to allow delivery of all JCSD product water from Chino II (both original and expansion entitlements) to the 1110 zone. It is assumed herein that pumping the JCSD Chino II expansion entitlement through the existing 1110 zone product water pump station will require expansion of the existing pump station capacity by the addition of another pump.

There are three options for the expansion of Chino II presented in Section 8 of this report. One of these options (desalter expansion Option A) requires an expansion of Chino II to 20.5 mgd, the other two options (desalter expansion Options B and C) require an expansion of Chino II to 22.7 mgd. A full explanation of the three options is given in Section 8; however, the pertinent points are listed below:

- Desalter Expansion Option A:
 - Chino I Capacity = 14.2 mgd (original nameplate capacity).
 - Chino II Capacity = 20.5 mgd (comprised of 20.5 mgd RO and IX process capacity).
- Desalter Expansion Option B:
 - Chino I Capacity = 12.0 mgd.
 - Chino II Capacity = 22.7 mgd (comprised of 20.5 mgd RO and IX process capacity plus 2.2 mgd of raw water bypass capacity).
- Desalter Expansion Option C:
 - Chino I Capacity = 12.0 mgd.
 - Chino II Capacity = 22.7 mgd (comprised of 20.5 mgd RO and IX process capacity plus 2.2 mgd of concentrate reduction permeate capacity).

The increased production of Chino II shown under desalter expansion Options B and C represents an increase in the delivery of product water entitlement from Chino II and a corresponding decrease in the delivery of product water entitlement from Chino I. It is assumed herein that a portion of the JCSD entitlement at Chino I is shifted to Chino II. The JCSD entitlement from Chino I is delivered to the JCSD 870 zone while the JCSD entitlement from Chino II is delivered to the JCSD 1110 zone.

The product water entitlements delivered from Chino II under these different scenarios (20.5 mgd or 22.7 mgd Chino II capacity) require different product water pump deliveries to different zones. The entitlement volumes, desalter capacity and required product water pump deliveries to match the desalter capacity are shown in Table 6.1 for the 20.5 mgd Chino II capacity scenario and Table 6.2 for the 22.7 mgd Chino II capacity scenario.

Figure 6.1 shows an overview of Chino II product water distribution facilities. Figure 6.2 shows the expanded Chino II product water pumping station schematic. Table 6.3 summarizes the energy cost savings that are available by construction of the proposed 1010 zone pump station and avoiding the cost of pumping to the 1110 zone with subsequent pressure reduction (energy loss).

A brief summary of product water deliveries to the receiving agencies involved in the Chino II expansion follows.

6.1.1 Deliveries to JCSD

The existing Chino II 1110 zone product water pump station has a firm capacity (largest pump out of service) of 10 mgd and a total capacity of 15 mgd at design conditions.

The following bullet items summarize the proposed delivery of Chino II product water to JCSD:

- Continue to deliver the original JCSD Chino II entitlement capacity (5.29 mgd) through the existing 1110 zone pump.
- 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.

6.1.2 Deliveries to Ontario

Ontario currently receives its original Chino II entitlement capacity (3.37 mgd) via transportation of product water through the JCSD 1110 zone with subsequent pressure reduction to the Ontario 1010 zone. Ontario has an agreement with JCSD for use of storage capacity within the JCSD system that provides for some daily peaking of Chino II delivery to Ontario as well as short-term reliability.

Table 6.1 Chino II Product Water Pumping Requirements: 20.5 mgd Capacity Chino Desalter Phase 3 PDR JCSD/Ontario/WMWD							
VOLUME		JCSD (AF/yr)	Ontario (AF/yr)	WMWD (AF/yr)	SARWC (AF/yr)	Norco (AF/yr)	Total (AF/yr)
Agency Entitlement							
Current		5,500	3,500	0	400	1,000	10,400
Expansion		3,533	3,533	3,534	0	0	10,600
Total		9,033	7,033	3,534	400	1,000	21,000
Existing Chino II Product Water Pumping							
Zone 1110 PS		5,500	3,500	0	400	1,000	10,400
Expanded Chino II Product Water Pumping							
Zone 1110 PS		9,033	0	0	400	0	9,433
Zone 1010 PS		0	7,033	3,534	0	1,000	11,567
Total		9,033	7,033	3,534	400	1,000	21,000
FLOW	Units	JCSD	Ontario	WMWD	SARWC	Norco	Total
Agency Capacity							
Current	mgd	5.29	3.37	0.00	0.38	0.96	10.0
Expansion	mgd	3.50	3.50	3.50	0.00	0.00	10.5
Total	mgd	8.79	6.87	3.50	0.38	0.96	20.5
Existing Chino II Product Water Capacity Requirement							
Zone 1110 PS	mgd	5.29	3.37	0.00	0.38	0.96	10.0
	gpm	3,670	2,336	0	267	667	6,940
Expanded Chino II Product Water Capacity Requirement							
Zone 1110 PS	mgd	8.79	0.00	0.00	0.38	0.00	9.2
	gpm	6,099	0	0	267	0	6,366
Zone 1010 PS	mgd	0.00	6.87	3.50	0.00	0.96	11.3
	gpm	0	4,764	2,429	0	667	7,861
Expanded Total	mgd	8.79	6.87	3.50	0.38	0.96	20.5
	gpm	6,099	4,764	2,429	267	667	14,227

Table 6.2 Chino II Product Water Pumping Requirements: 22.7 mgd Capacity Chino Desalter Phase 3 PDR JCSD/Ontario/WMWD							
VOLUME		JCSD (AF/yr)	Ontario (AF/yr)	WMWD (AF/yr)	SARWC (AF/yr)	Norco (AF/yr)	Total (AF/yr)
Agency Entitlement							
Current		5,500	3,500	0	400	1,000	10,400
Expansion		3,533	3,533	3,534	0	0	10,689
Chino I Deficit		1,811	0	0	0	0	1,811
Total		10,844	7,122	3,534	400	1,000	22,900
Existing Chino II Product Water Pumping							
Zone 1110 PS		5,500	3,500	0	400	1,000	10,400
Expanded Chino II Product Water Pumping							
Zone 1110 PS		10,844	0	0	400	0	11,244
Zone 1010 PS		0	7,122	3,534	0	1,000	11,656
Total		10,844	7,122	3,534	400	1,000	22,900
FLOW	Units	JCSD	Ontario	WMWD	SARWC	Norco	Total
Agency Capacity							
Current	mgd	5.29	3.37	0.00	0.38	0.96	10.0
Expansion	mgd	3.50	3.50	3.50	0.00	0.00	10.5
Chino I Deficit	Mgd	2.20	0.00	0.00	0.00	0.00	2.2
Total	mgd	10.96	6.87	3.50	0.38	0.96	22.7
Existing Chino II Product Water Capacity Requirement							
Zone 1110 PS	mgd	7.49	3.37	0.00	0.38	0.96	12.20
	gpm	5,197	2,336	0	267	667	8,467
Expanded Chino II Product Water Capacity Requirement							
Zone 1110 PS	mgd	10.96	0.00	0.00	0.38	0.00	11.34
	gpm	7,606	0	0	267	0	7,872
Zone 1010 PS	mgd	0.00	6.87	3.50	0.00	0.96	11.33
	gpm	0	4,765	2,429	0	667	7,861
Expanded Total	mgd	10.96	6.87	3.50	0.38	0.96	22.67
	gpm	7,606	4,765	2,429	267	667	15,733

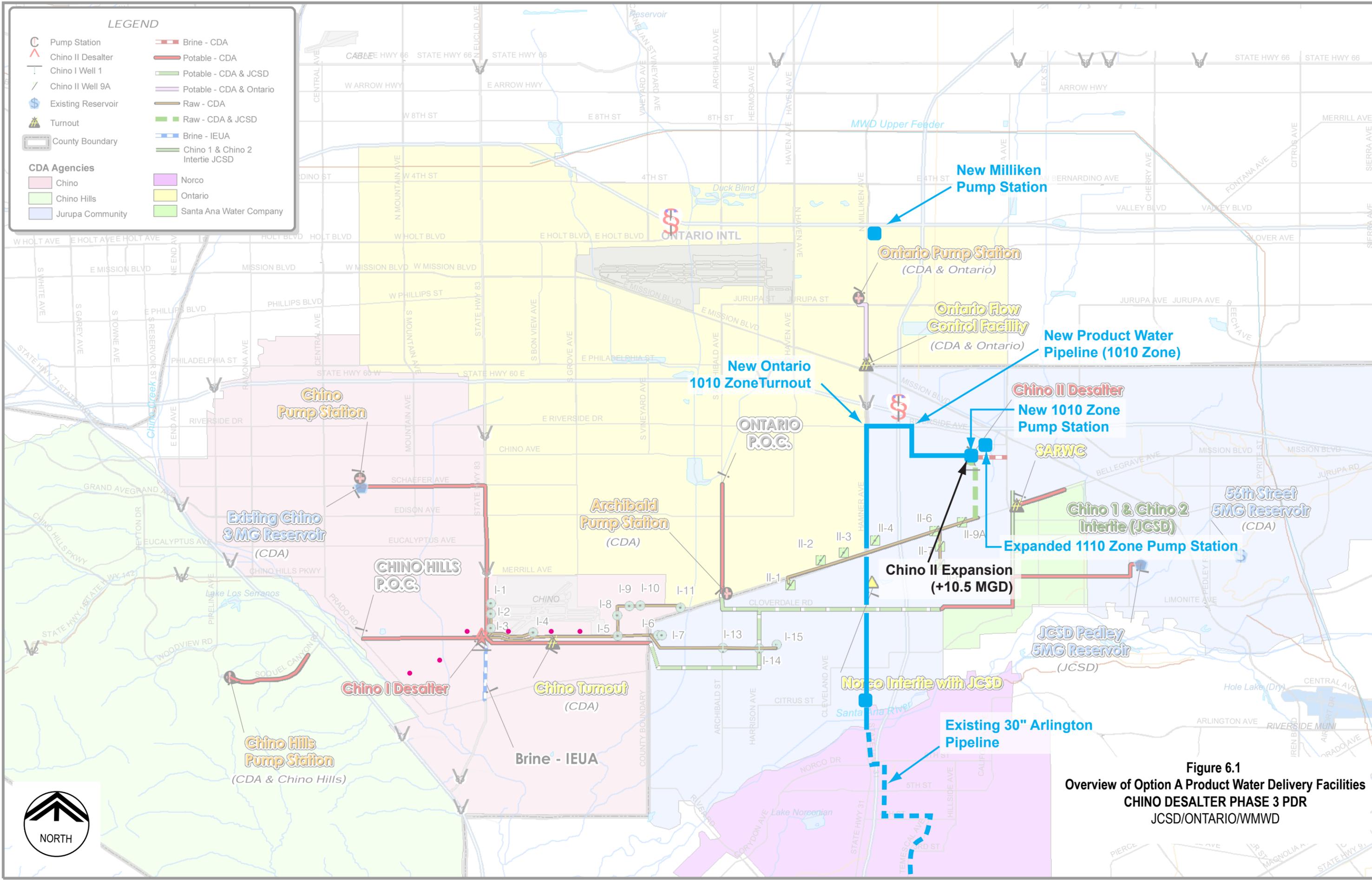
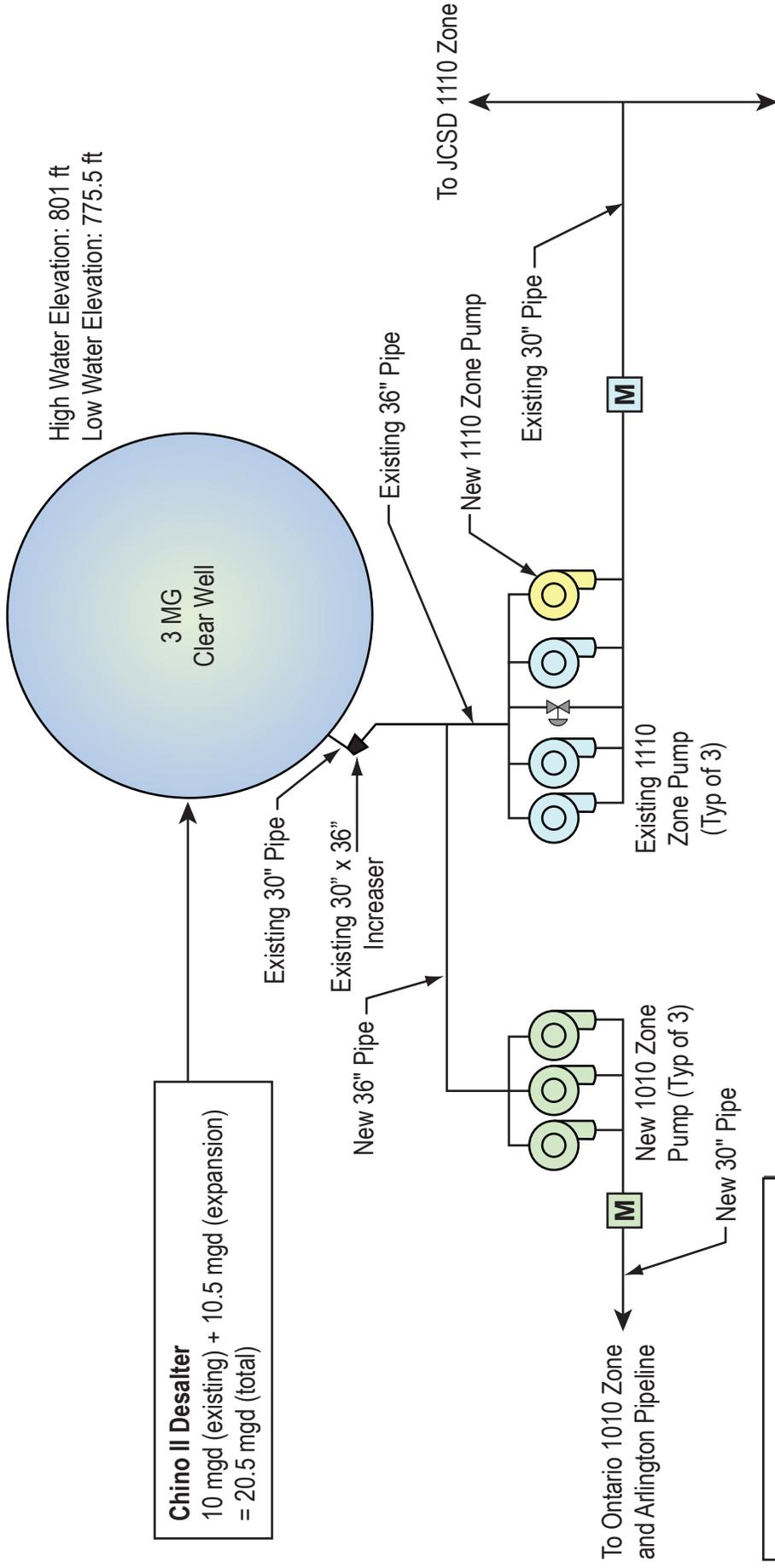


Figure 6.1
Overview of Option A Product Water Delivery Facilities
CHINO DESALTER PHASE 3 PDR
JCSD/ONTARIO/WMWD





LEGEND

	Pump
	Flow Meter
	Pressure Reducing Valve
	Existing 1110 Zone
	New 1010 Zone
	New 1110 Zone

Figure 6.2
Chino II Product Water Pumping Schematic
CHINO DESALTER PHASE 3 PDR
 JCSD/ONTARIO/MMWD

Table 6.3 Summary of Chino II Pressure Zone Pumping Costs Chino Desalter Phase 3 PDR JCSD/Ontario/WMWD								
	JCSD		Ontario		WMWD		Norco	
	Existing AF/yr (mgd)	Expansion AF/yr (mgd)	Existing AF/yr (mgd)	Expansion AF/yr (mgd)	Existing AF/yr (mgd)	Expansion AF/yr (mgd)	Existing AF/yr (mgd)	Expansion AF/yr (mgd)
1110 Zone	5,500 (5.29)	3,533 (3.5)	3,500 (3.37)	3,533 (3.5)			1,000 (0.96)	
			$\begin{matrix} \text{---} \\ \downarrow \\ \text{\$58,000}^{\text{a}} \\ \text{\$890,000}^{\text{b}} \end{matrix}$	$\begin{matrix} \text{---} \\ \downarrow \\ \text{\$60,000}^{\text{a}} \\ \text{\$920,000}^{\text{b}} \end{matrix}$			$\begin{matrix} \text{---} \\ \downarrow \\ \text{\$16,000}^{\text{a}} \\ \text{\$250,000}^{\text{b}} \end{matrix}$	
1010 Zone			3,500 (3.37)	3,533 (3.5)		3,534 (3.5)	1,000 (0.96)	
Notes: a. Annual energy cost difference calculated from change in TDH, assuming 75% wire-to-water efficiency and \$0.125/kWh energy cost. b. Present worth value of energy (in parentheses) assumes 30 years at 5% interest.								

Although the existing Chino II 1110 zone product water pump station could be expanded to allow delivery of the additional product water to Ontario through the JCSD 1110 zone, the construction of a dedicated pipeline and new 1010 zone pump station offers the following benefits:

- Water delivered to Ontario through a dedicated pipeline is Chino II product water quality rather than JCSD 1110 zone blended water quality.
- As shown in Table 6.3, energy cost savings result from pumping to the 1010 zone instead of pumping to the 1110 zone followed by pressure reduction.
- WMWD intends to participate in construction of the required 1010 zone pump station and dedicated pipeline, thus allowing cost sharing with Ontario.

The original Ontario entitlement capacity is still available in the Chino II 1110 zone product water pump station. Ontario will have flexibility to delivery the original entitlement capacity through the 1110 zone pump station (with JCSD storage benefits) or through the new 1010 zone pump station and dedicated pipeline (with lower pumping costs and improved water quality benefits).

The following points summarize the delivery of Chino II product water to Ontario:

- Construct a new 1010 zone pump station and pipeline large enough to accommodate Ontario's existing entitlement capacity (3.37 mgd) and expansion entitlement capacity (3.5 mgd).
 - Facilities are shared with WMWD.
 - Lower pumping costs and water quality benefits result.
- 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.

6.1.3 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 4,000 acre-feet of Arlington Desalter product water annually but has been willing to take 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 6.1. 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.

There are three basic alternatives for delivery of the additional Arlington Desalter product water made available by both the expansion of the Chino II Desalter and the expansion of the Arlington Desalter; the locations of key facilities are shown in Figure 6.3.

- Exchange or sale of water to Corona through the Arlington pipeline.
- Exchange or sale of water to the City of Riverside through the Arlington pipeline.
- Construction of the La Sierra (or equivalent) pipeline for direct transportation of Arlington Desalter product water to Western's retail system.



Figure 6.3
 Overview of WMWD Delivery Facilities
 CHINO DESALTER PHASE 3 PDR
 JCSD/ONTARIO/WMWD

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.

6.2 PRODUCT WATER PIPELINES

The design standards for water transmission and distribution pipelines vary between the three sponsoring agencies: JCSD, Ontario, and WMWD. A review of the pipeline design standards and criteria of each of these Sponsors was developed previously for the Chino Desalter Phase 3 project (Webb, July 2008) and is included in Appendix F.2. Key criteria are summarized in Table 6.4.

It should be noted that the calculations of headloss under the Sponsors' criteria use the Hazen-Williams C-factor whereas headloss calculations for this report are based on the Darcy-Weisbach headloss equation, which uses pipe absolute roughness (ϵ) instead of the Hazen-Williams C-factor. For this report, the absolute roughness was adjusted to provide the equivalent C-factor shown in Table 6.4 and varies with pipe diameter; for example, the ϵ equivalent to a Hazen-Williams C-factor = 120 ranges from 0.0015 to 0.0025 depending upon pipe diameter.

The Sponsors' criteria for mainline valve spacing for pipeline is a maximum of 1,320 feet (1/4 mile). This criteria is appropriate for distribution systems but is conservative for long transmission pipelines. Although we have used 1,320 feet as the maximum mainline valve spacing we recommend giving consideration to increasing the spacing to at least 2,640 feet (1/2 mile) for the long transmission pipelines used for product water distribution. Because there are no retail consumer connections the more frequent (and expensive) valve spacing is conservative and 1/2 mile spacing should be adequate for convenient pipeline shutdown in the event of breaks or leak repairs.

Table 6.4 Summary of Pipeline Design Criteria^a Chino Desalter Phase 3 PDR JCSD/Ontario/WMWD					
Criteria	Units	JCSD	Ontario	WMWD	Criteria Used
Hazen-Williams C-factor					
PVC Pipe		120	150	130	130
Steel Pipe		120	120	120	120
Maximum Velocity	fps	≤5	–	<7.5	≤5 ^b
Mainline Valve	LF	1,000	1,000	1,320	1,320
Spacing (max) Mainline Valve Type					
Max Gate Valve Size	Inches	12	–	12	12
Min Butterfly Valve Size	Inches	14	–	14	14
Notes: a. Criteria are summarized from Appendix F.1. b. New construction.					

6.2.1 Chino II to Riverside-Hamner and Arlington Pipelines

Other than yard piping constructed as part of the new product water pump stations, the only product water piping required by the Chino Desalter Phase 3 expansion is the 1010 zone pump station transmission pipe, which has the following purposes:

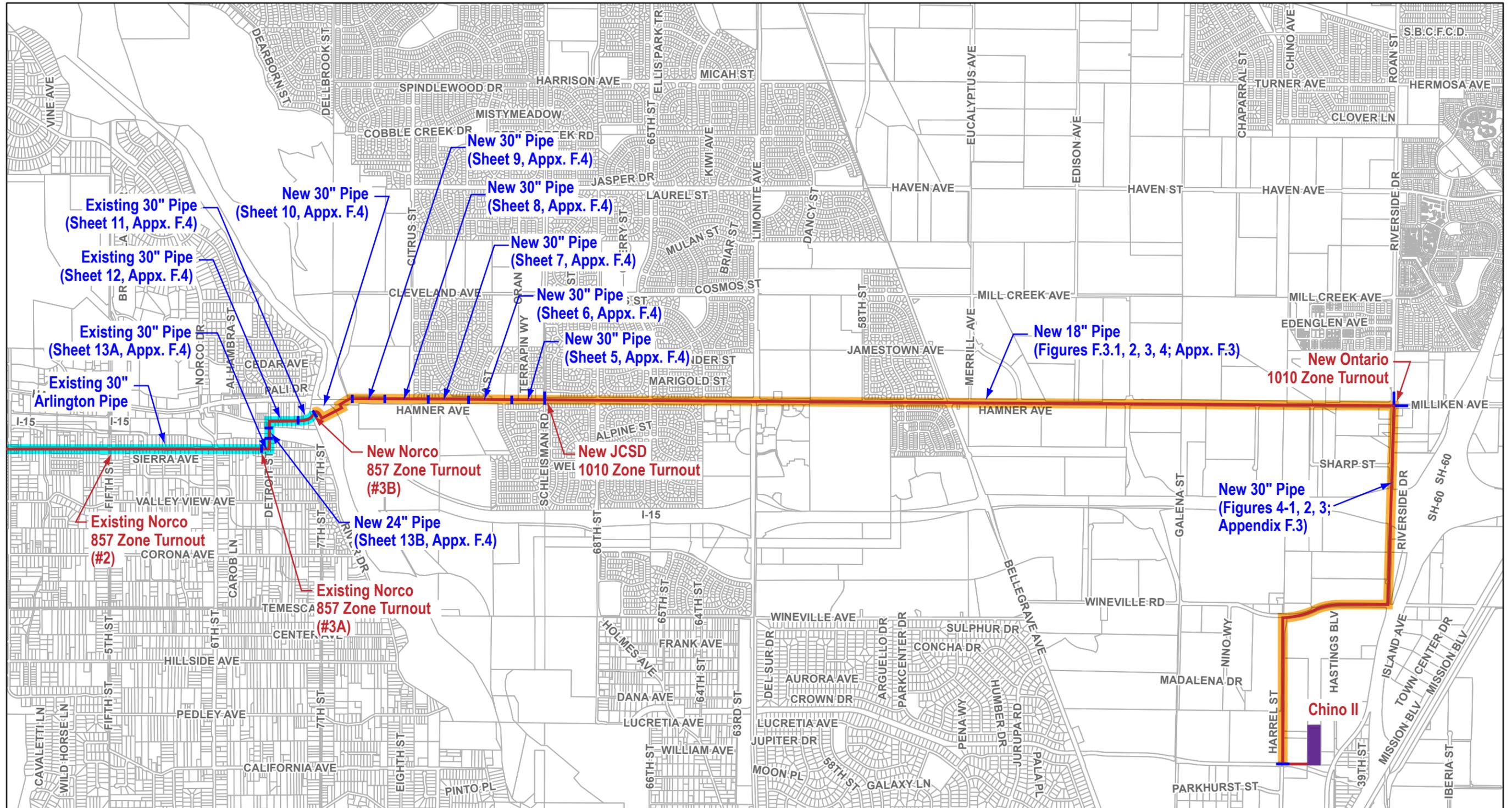
- Convey up to 6.87 mgd of product water from Chino II to a new Ontario 1010 zone turnout located at the intersection of Riverside Drive and Hamner Avenue.
- Convey 3.5 mgd of product water from Chino II to the existing Arlington pipeline south of the Santa Ana River on Hamner Avenue for use by WMWD through exchange for Arlington desalter water used by Norco.
- Convey 0.96 mgd of Chino II product water to Norco through existing turnouts on the Arlington pipeline,

The Riverside-Hamner product water pipeline will be a regional delivery facility shared between Ontario, WMWD, and Norco. As shown in Figure 6.4, it is proposed that the pipeline south of the Santa Ana River is operated and maintained by WMWD as an extension of the Arlington pipeline because the first Norco turnout is south of the river. The pipeline north of the Santa Ana River, and including the river crossing, would be operated and maintained by CDA as part of the Chino Desalter Project. Portions of the pipeline have been constructed and other portions have been previously designed but not built. Figure 6.4 serves as a overall key plan for the plan and profile drawings that are included in Appendices F.3 and F.4.

The pipeline south of the Santa Ana River has been constructed except for the Detroit Street Bridge crossing of I-15. Although the adjacent, constructed pipeline portions east and west of the Detroit Street Bridge are 30-inch diameter the bridge crossing itself will utilize an existing 24-inch diameter Norco water distribution system pipeline. The Norco water system will be transferred to a new 14-inch pipeline to be installed within an existing 18-inch casing on the Detroit Street Bridge. The 18-inch casing currently contains an 8-inch sewer pipeline, which will be removed. Construction of the Detroit Street Bridge crossing will require agreements with Norco as well as a new California Department of Transportation (CALTRANS) permit. The CALTRANS permit acquired previously for the crossing has expired.

Other than the 24-inch Detroit Street Bridge crossing, the Riverside-Hamner pipeline is 30-inch diameter south of Schleisman Road, where the new 30-inch pipeline will connect to an existing 24-inch JCSD 870 zone pipeline. This connection allows the Riverside-Hamner pipeline to serve as an extension of the existing 30-inch Arlington pipeline to convey water to JCSD from any sources available to WMWD in the event of an emergency or local supply shortage. Supplies available to WMWD for transportation to JCSD would include either the Arlington Desalter or a connection to the Mills WTP gravity pipeline through the proposed La Sierra pipeline, or its equivalent.

Between the Ontario 1010 zone turnout, located at Riverside Drive, and the JCSD 870 zone turnout, located at Schleisman Road, the required pipeline diameter will depend on whether the original 0.96 mgd Norco entitlement capacity is delivered through the Riverside-Hamner pipeline. The original Norco entitlement is currently delivered to Norco by transportation through the JCSD 1110 zone. As shown previously in Table 6.3, moving the original Norco entitlement delivery from the 1110 zone to the 1010 zone conveyance system would result in annual energy savings of \$16,000 per year or a present worth value of \$250,000.



Legend

- Pipeline operated by WMWD
- Pipeline operated by CDA

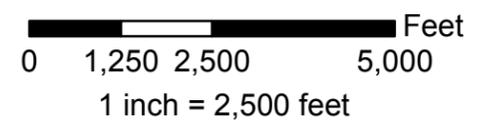


Figure 6.4
Overview of Riverside - Hamner Product Water Pipeline
CHINO DESALTER PHASE 3 PDR
 JCSD/ONTARIO/WMWD

As shown in Table 6.5, the incremental cost of increasing the size of the Hamner pipeline between Riverside Drive south to Schleisman Road to accommodate delivery of the existing Norco entitlement exceeds the present worth energy savings. It is assumed in this report that the Norco capacity is included in the Riverside-Hamner pipeline and that the pipeline between Riverside and Schleisman is 18-inch diameter.

The pipeline diameter between Chino II and the Ontario 1010 zone turnout at the intersection of Riverside Drive and Hamner Avenue is 30-inch diameter. This is the smallest diameter that will meet the required velocity criteria (< 5 fps) for the combined Ontario and WMWD entitlement capacity from Chino II.

Table 6.5 Comparison of Hamner Avenue Pipe Diameter Options Between Riverside Dr. and Schleisman Rd. ^a Chino Desalter Phase 3 PDR JCSD/Ontario/WMWD						
Pipe Diameter (inches)	Velocity (fps)	HGL ^{b,d} (ft AMSL)	Velocity (fps)	HGL ^{c,d} (ft AMSL)	Construction Cost	Incremental Cost of Upsizing Pipe
14	6.5	724	5.1	8.0		
16	4.9	860	3.9	915	\$4,910,000	
18	3.9	924	3.1	954	\$5,390,000	\$480,000
20	3.2	956	2.5	947	\$5,760,000	\$370,000
24	2.2	983	1.7	990	\$6,590,000	\$830,000
30	1.4	994	1.1	997	\$7,040,000	\$450,000

Notes:

- Between Riverside Drive and Schleisman Road the pipeline length = 21,074 feet.
- 4.5 mgd total flow, consisting of 3.5 mgd WMWD entitlement + 0.96 mgd existing Norco entitlement (see Table 6.1).
- 3.5 mgd total flow, consisting of WMWD entitlement without existing Norco entitlement.
- Hydraulic grade line at west side of Detroit Street bridge cross I-15. HGL values in bold are assumed to be adequate to allow delivery to the Norco 857 zone. Border indicates smallest (lowest cost) pipe capable of providing the required HGL.

Final design should be closely coordinated with JCSD to minimize the impact on future JCSD pipelines that are currently planned for future installation in the same public rights-of-way.

6.3 PUMP STATIONS

As part of the Chino Desalter Phase 1 and 2 projects, CDA owns and operates eight separate product water pump stations, as summarized in Table-6.6. Under the postage stamp rate concept, all CDA members share equally in the cost of pumping Chino Desalter product water through these eight pump stations, regardless of pump lift. Four of the pump stations are located at the Chino I and Chino II desalters, the other four stations are off-site and pump desalter product water from CDA pipelines or internally within the member agencies' distribution systems. Currently, the largest pump lift included in the CDA postage stamp rate is from Chino II to the Ontario 1212 zone, approximately 410 feet of static lift.

Because of limited on-site storage and lack of standby power for the Chino Desalter treatment facilities there is no standby power for the Chino Desalter product water pump stations. In the event of a power outage at the plant, the treatment capacity is zero and product water storage is minimal; therefore, standby power on the desalter product water pump stations would have limited value. Some of the off-site CDA pump stations, which have access to agency distribution system storage, do include standby power for reliability during a power outage.

An important criteria for pump stations is the firm capacity. Firm capacity is defined as the total station capacity with the largest pump out of service. The pumps at each of the existing and proposed Chino Desalter product water pump stations are equally sized; therefore, the firm pump station capacity is total capacity less one pump. The design criteria used herein provide firm capacity equal to the required entitlement capacity. The total pump station capacity (with all of the pumps operating) will exceed the required entitlement capacity.

6.3.1 Chino II Product Water Pump Stations

Table 6.7 shows criteria for the existing Chino II 1110 zone pump station under existing and expanded conditions as well as proposed criteria for the new 1010 zone pump station. These criteria are based upon the following assumptions regarding the original entitlement capacities:

- The original Ontario entitlement capacity (3.47 mgd) is transferred from the existing 1110 zone pump station to the new 1010 zone pump station.
- The original Norco entitlement capacity (0.96 mgd) is transferred from the 1110 zone pump station to the 1010 zone pump station.
- The expansion entitlement capacities for Ontario (3.5 mgd) and WMWD (3.5 mgd) are conveyed through the 1010 zone pump station.
- The expansion entitlement capacity for JCSD (3.5 mgd) is conveyed through the expanded 1110 zone pump station.
- If Chino II capacity is 22.7 mgd (desalter expansion Options B or C) then 2.2 mgd of JCSD delivery capacity is shifted from Chino I (delivery to JCSD 870 zone) to Chino II (delivery to JCSD 1110 zone).

Table 6.6 Summary of Existing CDA Product Water Pump Station Chino Desalter Phase 3 PDR JCSD/Ontario/MMWD							
Pump Station	Location	Agencies Receiving Service	From Pressure Zone (Suction)	To Pressure Zone (Discharge)	Static Lift (feet)	Pump Lift Payment by CDA	Non-CDA Water Pumped?
Chino Pump Station	Schaefer Ave.	Chino	?	890	?	100%	Yes
Chino Hills Pump Station	Soquel Canyon Rd.	Chino Hills	?	1033	?	100%	No
Archibald Pump Station	Archibald Ave. & Bellegrave Ave.	Ontario	?	1010	?	100%	No
Ontario Pump Station	Milliken Ave. & Jurupa St.	Ontario	1110	1212	102	Partial ^a	Yes
Chino I PW Pump Station (Chino)	Chino I Desalter	Chino	594	?	290 ^b	100%	No
Chino I PW Pump Station (Chino Hills)	Chino I Desalter	Chino Hills	594	?	260 ^b	100%	No
Chino I PW Pump Station (JCSD)	Chino I Desalter	JCSD, Ontario, SARWC	594	870	576	100%	No
Chino II PW Pump Station	Chino II Desalter	JCSD, Ontario, SARWC, Norco	801	1110	309	100%	No

Notes:

a. CDA pays energy cost for pumping 3,500 AF/yr from 1110 zone to 1212 zone. Ontario pays the energy cost for breaking head at the 925 zone reservoir.

b. Pump design TDH from Chino I O&M manual.

**Table 6.7 Chino II Product Water Pump Station Criteria
Chino Desalter Phase 3 PDR
JCSD/Ontario/WMWD**

Description	Units	10.0 mgd Capacity	20.5 mgd Capacity	22.7 mgd Capacity
<u>1110 Zone Pump Station</u>				
Type: Vertical Turbines in Cans				
Required Flow Capacity				
Without Current Ontario Capacity	gpm (mgd)	6,940 (10.0)	3,960 (5.7)	7,870 (11.3)
With Current Ontario Capacity	gpm (mgd) ³	6,940 (10.0)	8,790 (12.7)	10,300 (14.8)
No. of Pumps				
In Service	No.	2	3	3
Reliability (Standby)	No.	1	1	1
Total	No.	3	4	4
Design Pump Flow Rate				
Each	gpm (mgd)	3,450 (5.0)	3,450 (5.0)	3,450 (5.0)
All Pumps	gpm (mgd)	10,350 (15)	13,800 (20)	13,800 (20)
Firm	gpm (mgd)	6,900 (10)	10,350 (15)	10,350 (15)
Design Total Dynamic Head (TDH)	ft (psi)	375 (162)	375 (162)	375 (162)
Motor Horsepower				
Each	Hp	450	450	450
Total	Hp	1,350	1,800	1,800
Drives:		3 constant speed	2 VFD/2 Cnst. Spd.	2 VFD/2 Cnst. Spd.
<u>1010 Zone Pump Station</u>				
Type: Vertical Turbines in Cans				
Required Flow Capacity	gpm (mgd)	0 (0.0)	7,860 (11.3)	7,860 (11.3)
No. of Pumps				
In Service	No.	0	2	2
Reliability (Standby)	No.	0	1	1
Total	No.	0	3	3
Design Pump Flow Rate				
Each	gpm (mgd)	- (-)	3,920 (5.6)	3,920 (5.6)
Firm	gpm (mgd)	- (-)	7,840 (11.3)	7,840 (11.3)
Design Total Dynamic	ft (psi)	- (-)	270 (117)	270 (117)

Table 6.7 Chino II Product Water Pump Station Criteria Chino Desalter Phase 3 PDR JCSD/Ontario/WMWD				
Description	Units	10.0 mgd Capacity	20.5 mgd Capacity	22.7 mgd Capacity
Head (TDH)				
Motor Horsepower				
Each	Hp	–	400	400
Total	Hp	–	1,200	1,200
Drives: VFD				

A site plan for the proposed Chino II Desalter product water is shown in Figure 6.5. Final design should be closely coordinated with JCSD to minimize the impact of pipelines and utilities (e.g., a new electrical power feed) crossing JCSD property.

6.3.1.1 Chino II 1010 Zone Pump Station

A system head curve for the Chino II 1010 zone pump station is shown in Figure 6.6. The calculations to produce the system curve are included in Appendix F.5. These calculations result in a recommended design TDH of 270 feet. Assuming firm capacity of 11.3 mgd with two pumps (a third pump is in standby) and a pump efficiency of 75 percent the required motor size is 400 hp per pump.

The system head calculations are based on the following assumptions:

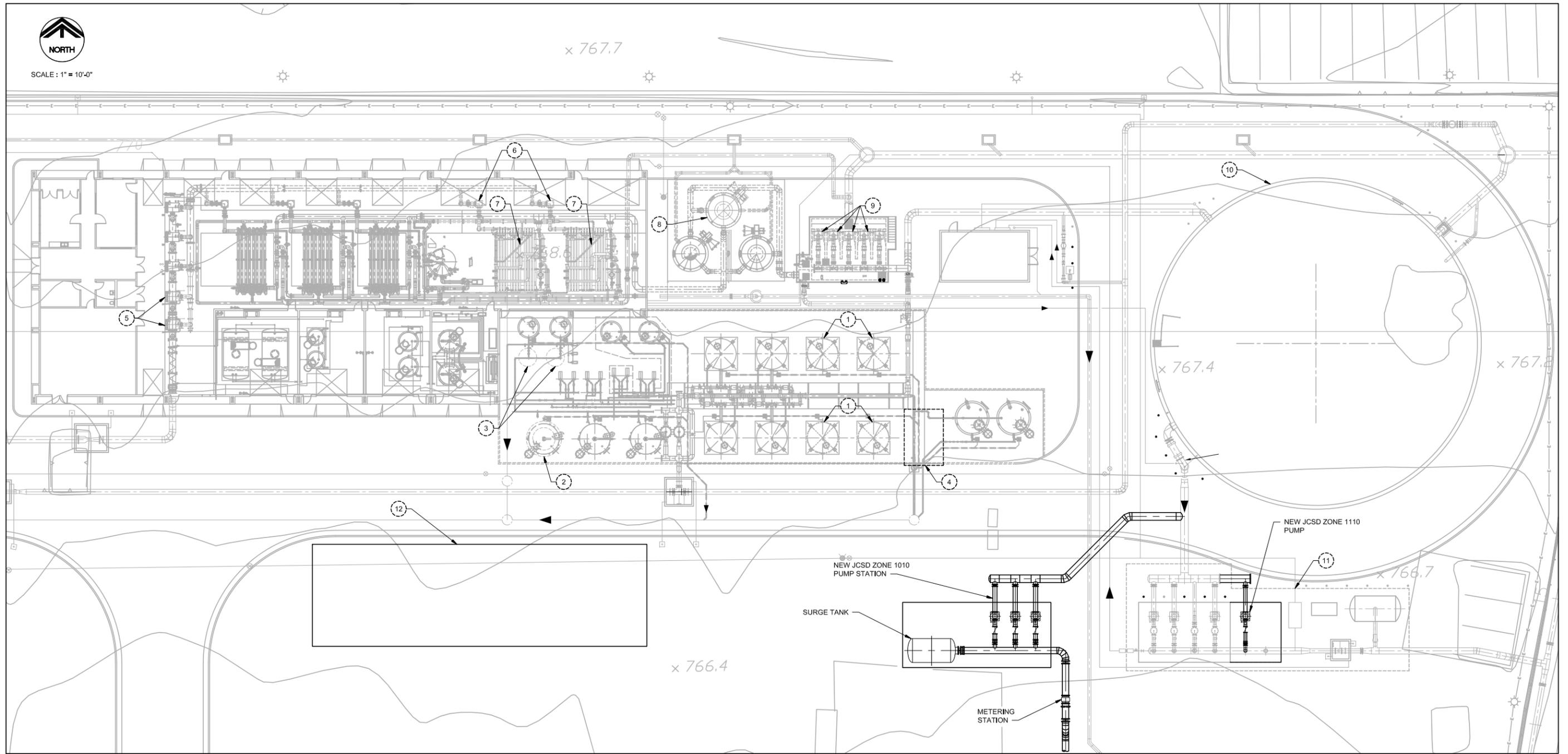
- Delivery of product water to each member agency as shown in Table 6.1.
- Design TDH is 75 percent of the difference between maximum TDH and minimum TDH:
 - Maximum pump TDH is calculated with the Chino II clearwell at minimum level and the Ontario 1010 zone reservoir at maximum level.
 - Minimum pump TDH is calculated with the Chino II clearwell at maximum level and the Ontario 1010 zone at a minimum level.
- All flow from the Ontario turnout to the 1010 zone reservoirs is through the existing 24-inch pipeline with no flow adjustment for system demand.

The last assumption is conservative because it means that all flow from the Ontario turnout at the intersection of Riverside and Hamner reaches the 1010 reservoirs at Milliken and the I-10 freeway without dispersal through the distribution network piping or reduction in flow to satisfy local system demand.



SCALE: 1" = 10'-0"

x 767.7



- | | |
|-----------------------------------------------------------|--------------------------------------------|
| ① NEW IX VESSELS | ⑨ NEW SST TRANSFER PUMPS (EXISTING MOTORS) |
| ② NEW SALT STORAGE TANK | ⑩ 3 MG CLEARWELL |
| ③ NEW SOFTENED WATER STORAGE TANKS | ⑪ EXISTING PRODUCT WATER PUMP STATION |
| ④ NEW BAG FILTERS (CONFIGURATION BY HUNGERFORD AND TERRY) | ⑫ NEW STORAGE / ELECTRICAL BUILDING |
| ⑤ NEW CATRIDGE FILTERS | |
| ⑥ NEW RO FEED PUMPS | |
| ⑦ NEW RO TRAINS | |
| ⑧ NEW DECARBONATOR | |

Figure 6.5
CHINO II PRODUCT WATER PUMP STATION SITE PLAN
CHINO DESALTER PHASE 3 PDR
JCSD/ONTARIO/WMWD



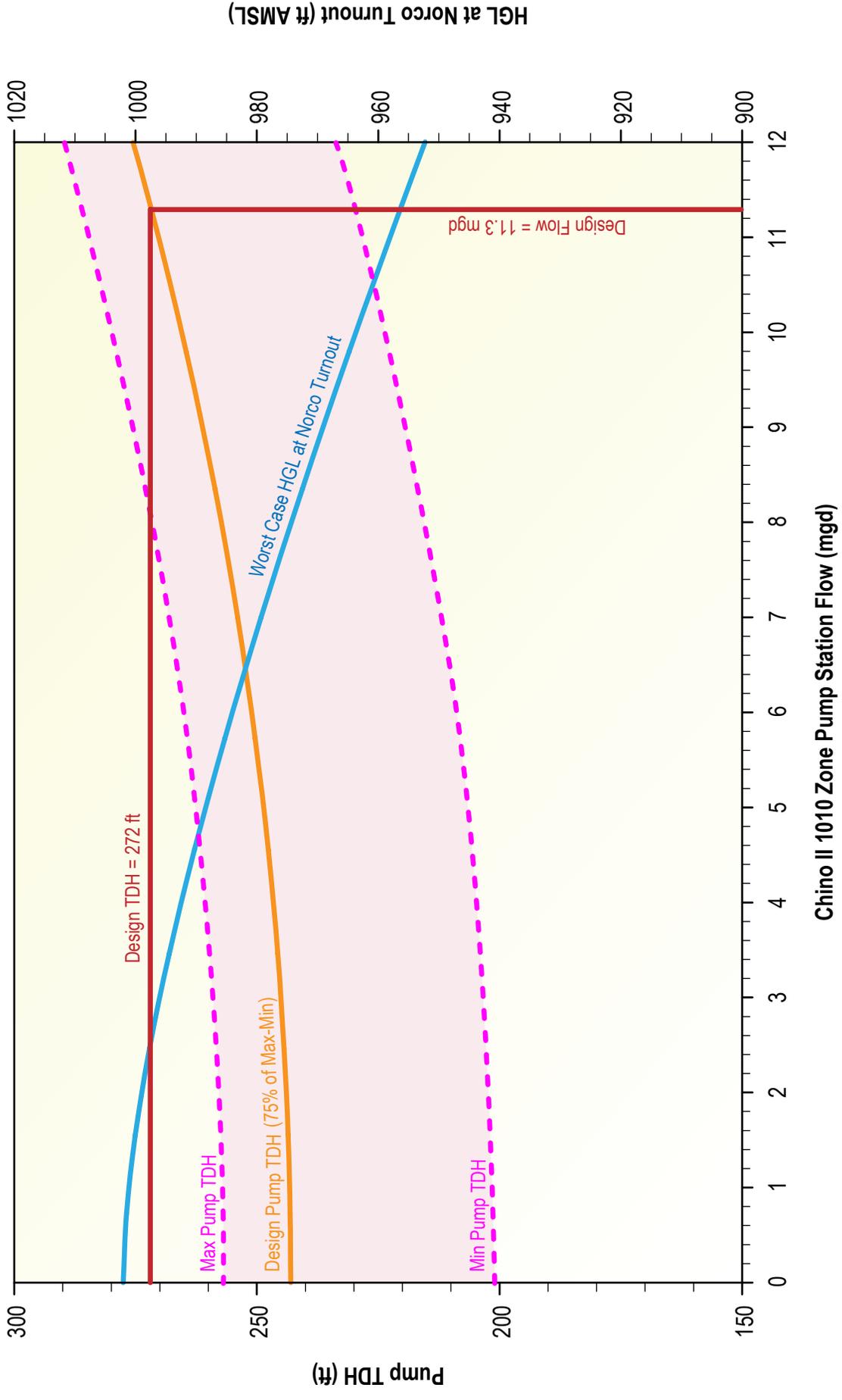


Figure 6.6
 Chino II 1010 Zone Pump Station System Curves
 CHINO DESALTER PHASE 3 PDR
 JCSD/ONTARIO/WMWD

6.3.2 Milliken Pump Station

The proposed Milliken Pump Station is located at the Ontario 1010 zone reservoir site, on the southeast corner of the intersection of Milliken Avenue and the I-10 freeway. The purpose of the facility is to pump water from the Ontario 1010 zone to the 1212 zone. Water to be pumped would be from the Chino II Desalter, or the Chino I Desalter (via the Archibald Pump Station), or other Ontario sources. Criteria for the Milliken Pump Station are shown in Table 6.8.

Table 6.8 Milliken Pump Station Criteria Chino Desalter Phase 3 PDR JCSD/Ontario/WMWD		
Description	Units	Initial Capacity
Discharge Side Condition: Ontario 1212 Zone		
Suction Side Condition: Ontario 1010 Zone		
Type Vertical Turbine in Cans		
No. of Pumps		
In Service	No.	2
Reliability (Standby)	No.	1
Total	No.	3
Design Pump Flow Rate		
Each	gpm (mgd)	2,780 (4.0)
All Pumps	gpm (mgd)	8,340 (12.0)
Firm	gpm (mgd)	5,560 (8.0)
Design Total Dynamic Head (TDH)	ft (psi)	230 (100)
Motor Horsepower		
Each	hp	250
Total	hp	750
Drives:		2 VFD/1 Const. Spd.

These design criteria are based upon a technical memorandum prepared by others (MWH, 2006) to determine the required pump station TDH for the Milliken Pump Station. The technical memorandum is included in Appendix F.7. A site plan showing the planned pump station location is included as Figure 6.7.

6.3.3 Surge Protection

Preliminary surge analysis for the proposed Chino II product water pumping stations has been prepared previously (“Preliminary Design Report for Chino Desalter Phase 3 Pipeline Alignments and Hydraulic Analysis for Pumps Stations,” Albert A. Webb Associates, July 2008). A summary of these results is presented below; preliminary results should be confirmed by additional analysis during final design after selection of pumping equipment and pipeline materials.

6.3.3.1 Chino II 1010 Zone Product Water Pumping Station Surge Analysis

Pumping to the Ontario 1010 zone through a new pipe system was analyzed under sudden shutdown conditions. Pressure transient computations without surge protection predicted negative pressure and potential vapor cavity formation. Modeling utilizing a 700 cubic foot air chamber for surge protection showed positive pressures during downsurge with return upsurge (less than 145 psi) within pipeline pressure ratings. A 700 cubic foot surge tank installed at the pump station using a 96-inch diameter surge tank with a 10-inch diameter inlet connection was recommended.

6.4 CHINO I – CHINO II PRODUCT WATER INTERTIE

The CDA Joint Powers Agreement does not specify which desalter facilities are used to provide deliveries of product water entitlements to the individual CDA member agencies. As a consequence, one of the basic premises in operating the CDA is that all facilities are shared equitably to make deliveries to the member agencies. This has resulted in practices that provide an operational intertie between the product water capacity of Chino I and Chino II. It is also possible to provide a physical intertie between the Chino I and Chino II product water facilities. Both of these concepts are discussed below.

6.4.1 Operational Intertie Practices

Although historically Chino I has been unable to produce at its 14.2 mgd 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. The cities of 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 delivery 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 options presented in Section 8 (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.

6.4.2 Physical Intertie Options

Chino and Chino Hills receive product water through separate pumps stations connected to the Chino I clearwell. Ontario, JCSD, and SARWC receive Chino I product water from a separate pump station also connected to the Chino I clearwell (the Chino I O&M Manual refers to these as the “JCSD Pumps” and that convention is followed herein). Chino also has a connection to the JCSD pump discharge pipe on Kimball Avenue.

The criteria for these pump stations are presented in Appendix D.2 and are summarized below. The pump discharge hydraulic grade line (HGL) shown assumes the pump operates at design TDH and the clearwell is at elevation 591 feet above mean sea level (AMSL).

- JCSD Product Water Pumps
 - Number of Pumps: 4
 - Total Pump Capacity: 9.1 mgd
 - Design Total Dynamic Head: 367 feet (159 psi)
 - Pump Discharge HGL: 958 feet AMSL
- City of Chino Product Water Pump Stations
 - Number of Pumps: 3
 - Total Pump Capacity: 10.2 mgd
 - Design Total Dynamic Head: 260 feet (113 psi)
 - Pump Discharge HGL: 851 feet AMSL
- City of Chino Hills Product Water Pumps
 - Number of Pumps: 3
 - Total Pump Capacity: 7.9 mgd
 - Design Total Dynamic Head: 290 feet (126 psi)
 - Pump Discharge HGL: 881 feet AMSL

The 30-inch diameter CDA-owned pipeline from the JCSD product water pumps at Chino I is connected to the JCSD 870 zone. The design HGL of 958 at the Chino I product water pump station allows for friction loss in the interconnecting pipelines and distribution system.

The JCSD 870 zone can be furnished with water from Chino II via the JCSD 1110 zone product water pump station at the present time. From the JCSD 870 zone it is possible to physically deliver Chino II product water to the cities of Chino and Chino Hills using one of the following options.

- Pipe Connection to Clearwell. A new pipe connection from the JCSD pump station discharge pipe could be installed to allow water to flow from the JCSD 870 zone to the Chino I clearwell. Once water is delivered to the clearwell it can be pumped to Chino and Chino Hills through the existing product water pump stations. The new pipe connection would require orifice plates, or equivalent, to dissipate the head differential between the 870 zone and the clearwell. This is the lowest capital cost option for delivering water to the Chino and Chino Hills through the Chino I pumps; however, it results in the loss of energy available at the 870 zone head.
- Pumped Connection between 30-inch Pipeline and Chino/Chino Hills Pump Discharge. The pipe connection from the 30-inch JCSD pump discharge pipe to the clearwell has a low capital cost but it wastes the head available in the JCSD 870 zone. Assuming a 280 foot head differential between the 30-inch pipeline and the clearwell with an energy value of \$0.125/kWh and a wire-to-water efficiency of 70 percent then the replacement cost of repumping the lost head is approximately \$50/AF. A booster pump between the 870 zone pipeline and the Chino and Chino Hills pump discharge would eliminate wasting the energy.

The pipe connection between the 30-inch JCSD pump discharge pipeline and the clearwell would be a useful feature in the event of a short-term loss of product water production at Chino I. It would involve a relatively low capital cost and the energy wasted in repumping the lost head would not be significant in short-term operation. The booster pump option would preserve the value of the head differential but would be significantly higher in construction cost and would only be useful if the JCSD pumps are not operating, which is unlikely to occur over long periods of time.

The cost of a physical product water intertie is not included as a cost of the Sponsors in the Phase 3 expansion project because it enhances the reliability of the existing facilities to deliver water to Chino and Chino Hills.