Volume II F

City of Ontario

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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-F describes proposed facilities for the City of Ontario (Ontario). Individual chapters provide conceptual development of the agency interconnection facilities required for Ontario 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 Ontario 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 Ion Exchange (IX) treatment at existing well Nos. 3 and 12 ▸ Aquifer Storage 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 Area
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 Stet
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 WMWD service area and Arlington Desalter Pipeline

1.5 Conceptual Design Assumptions

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

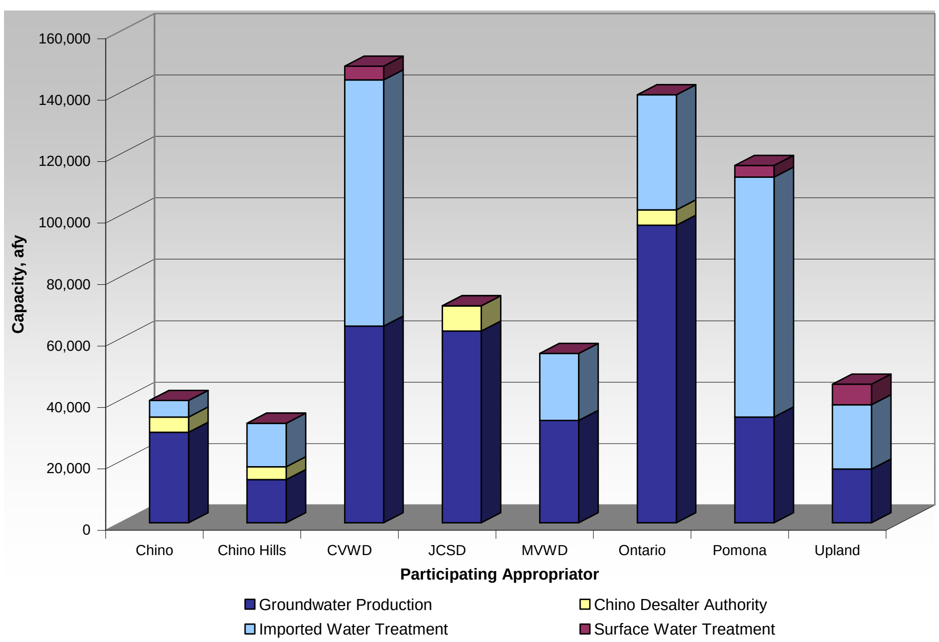
- Elevations were based upon United States Geological Survey (USGS) maps and maps obtained online from Google® Earth and are estimated to be accurate to within 10 percent of the actual elevation. Topographical surveys would be performed as part of the final design.
- Typical engineering calculations 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 Wastewater, or Waste, System (NRWS) was assumed to not have a significant impact on NRWS system capacity. The available capacity of the NRWS 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 potential 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.

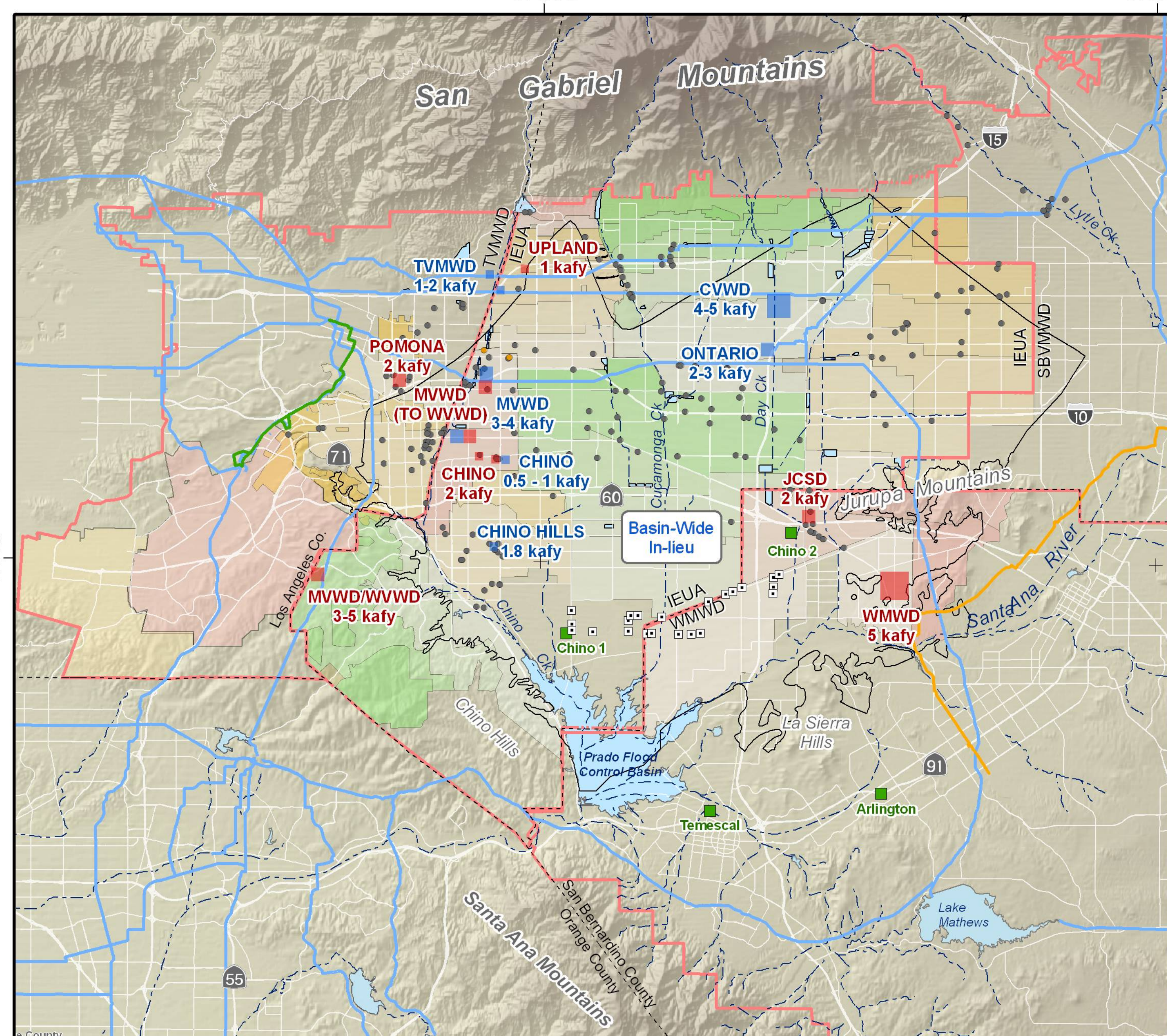
Figure 1-2 shows the locations of each agency's proposed facilities and/or locations where potential "puts" and "takes" could occur within the Basin. As the figure demonstrates, the "puts" and "takes" may be balanced on the east and west sides of the Basin. Through groundwater modeling, Program operations 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).

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.

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.



Proposed DYY Facilities

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

"TAKE" Facility (15-17 kafy)

Imported Water Pipelines

Major Pipelines

Riverside Corona Feeder Pipeline

PWR Pipelines

Other Features

Appropriator Well

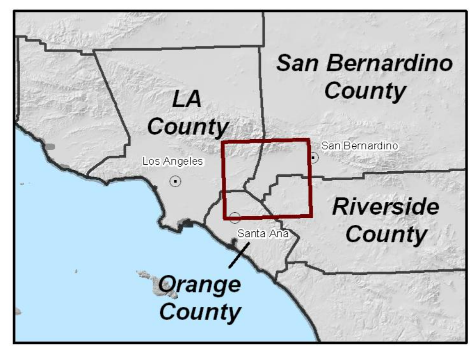
ASR Well

Desalter Well

Desalter Facility

Flood Control/Conservation Basins

Streams, Rivers, and Channels



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Date: 20081209

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0 1 2 3 4 Miles

0 2 4 KM

Prepared For:

BLACK & VEATCH Corporation

Proposed DYY Participants and Put/Take Locations

Figure 1-2

1.6.1 Water Resources, Historical Water Use, and Shift Obligation for Ontario

The Asset Inventory data summarizing Ontario'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 Ontario has an imported water treatment capacity of 25.43 million gallons per day (mgd) (28,482 afy) and groundwater production capacity of 83.57 mgd (93,611 afy). Ontario receives its treated imported water from the WFA Agua de Lejos WTP.

Table 1-4
Existing Water Resource Capacities for the City of Ontario

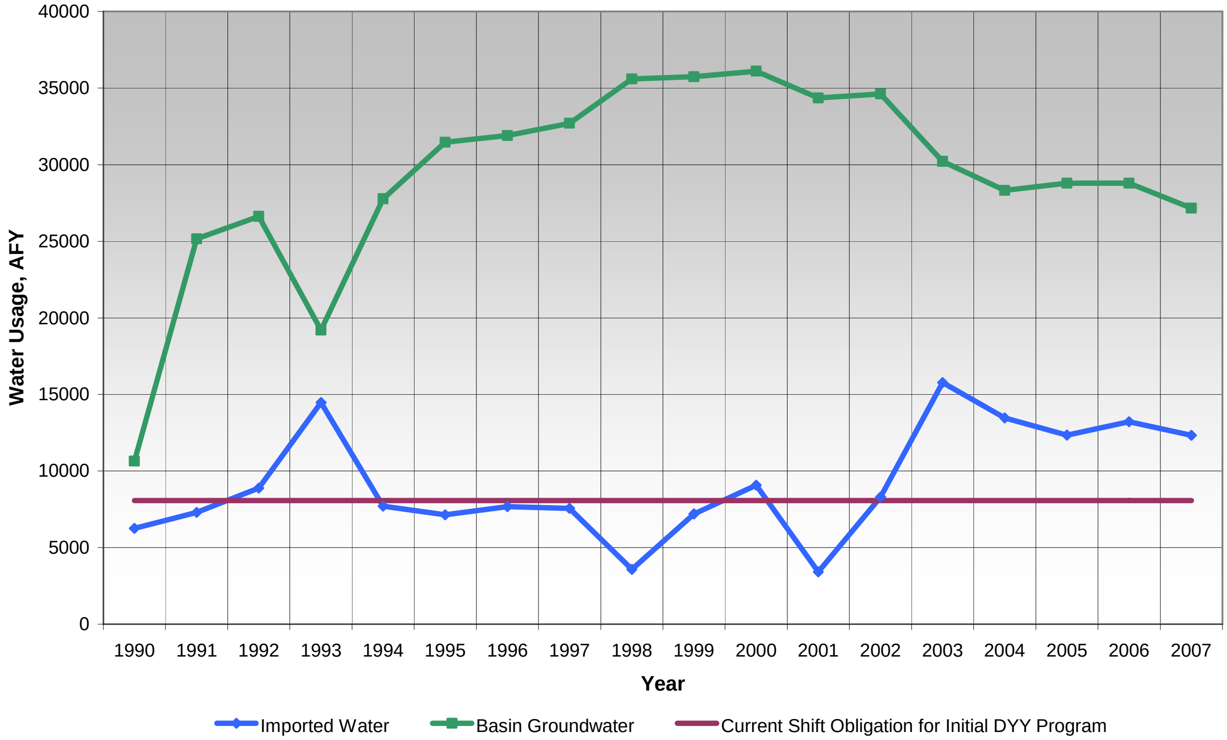
Water Resource	City of Ontario Capacity, mgd (afy)
Local Surface and Imported Water	
Local Surface Water	
Subtotal	0 (0)
Imported Metropolitan Water	
WFA	25.4 (28,500)
Galvin (1)	8.0 (9,000)
Subtotal	25.4 (28,500)
Total Local Surface and Imported Water	25.4 (28,500)
Groundwater	
Chino Basin Wells(2)	76.0 (85,100)
Non-Chino Basin Wells(2)	0
Chino Desalters (3)	7.6 (8,500)
Total Groundwater	83.6 (93,600)
TOTAL WATER RESOURCES	**109.0 (122,100)**

Notes:
(1) Galvin WTP currently inactive.
(2) Accounts for all well production capacity, regardless of water quality.
(3) Based on 3.5 mgd Chino II expansion.

Figure 1-3 presents Ontario's historical groundwater production and imported water purchases. In 2007, approximately 69 percent of Ontario's 39,489 acre-ft of water usage was Basin groundwater versus approximately 31 percent from imported water supplied by Metropolitan. As summarized in Table 1-3, although Ontario has elected to not participate further on the "take" side of the Program Expansion, Ontario has elected to contribute 2,000 to 3,000 afy on the "put" side. To achieve this potential "put" contribution, Ontario has proposed a new agency interconnection pipeline discussed in Section 1.5.2.

The new interconnection would act as a "put" facility for the Program Expansion. An in-lieu shift would be arranged between Ontario and CVWD. Water from CVWD's Lloyd Michael WTP would be delivered to Ontario, where it would be used in-lieu of pumping Basin groundwater. The in-lieu shift with CVWD would be provided using existing conveyance facilities, future facilities not included in the Program Expansion, and a new section of pipeline.

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



1.6.2 Program Expansion Facility Requirements

A new 36-inch interconnection pipe would be needed to connect the CVWD and the City of Ontario's service areas. The new pipeline would start at Ontario's two future 8 million gallon (MG) reservoirs, located near the intersection of Foothill Boulevard and Rochester Avenue, and travel south via one of two alternative routes, discussed in Section 2.3, terminating at Ontario's 4th Street transmission main.

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
ASTM	American Society for Testing Materials
AWWA	American Water Works Association
B&V	Black & Veatch
Basin	Chino Basin
ft/day	feet per day
Cal-OSHA	State of California Occupational Safety and Health Administration

CDPH	California Department of Public Health
CEQA	California Environmental Quality Act
cfs	cubic feet per second
CVWD	Cucamonga Valley Water District
d/t	diameter/thickness
DYY	Dry-Year Yield
DYY Program	initial Chino Basin Dry-Year Yield Program
DYY Program Expansion	Chino Basin Dry-Year Yield Program Expansion
fps	feet per second
HDPE	high-density polyethylene
HGL	hydraulic grade line
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)
lbs/ft^3	pounds per cubic foot
MG	million gallons
mgd	million gallons per day
Metropolitan	Metropolitan Water District of Southern California
MVWD	Monte Vista Water District
NRWS	Non-reclaimable Wastewater, or Waste, System
OD	outside diameter
Ontario	City of Ontario
OBMP	Optimum Basin Management Program
PDR	Project Development Report
Program	DYY Program, DYY Program Expansion
Program Expansion	Chino Basin Dry-Year Yield Program Expansion
psi	pounds per square inch
R-C	Riverside-Corona
ROW	right of way
TDA	Tom Dodson & Associates
TM	technical memorandum
TVMWD	Three Valleys Municipal Water District
Upland	City of Upland
USGS	U.S. Geological Survey
USEPA	U.S. Environmental Protection Agency
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 F are shown below.

[Ontario/JCSD/WMWD, 2008]

Chino Desalter Phase 3 Report, prepared for City of Ontario, Jurupa Community Services District, and Western Municipal Water District, Carollo Engineers, July 2008.

[Ontario, 2006] *Water and Recycled Water Master Plan*, prepared for City of Ontario, MWH, 2006.

[Ontario, 2005] *8th Street Zone Water Transmission Main Final Alignment Report*, prepared for City of Ontario, Parsons, July 2005.

2.0 AGENCY INTERCONNECTION FACILITIES

2.1 Overview

This chapter describes the interconnection facilities required to transfer treated, imported water from CVWD to Ontario. The facilities would include approximately 11,300 to 13,600 feet of new 36-inch diameter pipe. Water from the CVWD system would be delivered to Ontario's two 8 MG reservoirs (by others) through an existing transmission main and conveyed via a new pipeline to Ontario's distribution system, where it would be used in-lieu of pumping groundwater. This new interconnection would allow delivery of approximately 2,000 to 3,000 afy during the "put" years. Coordination with CVWD would be required to arrange the in-lieu shift.

2.2 Water Supply

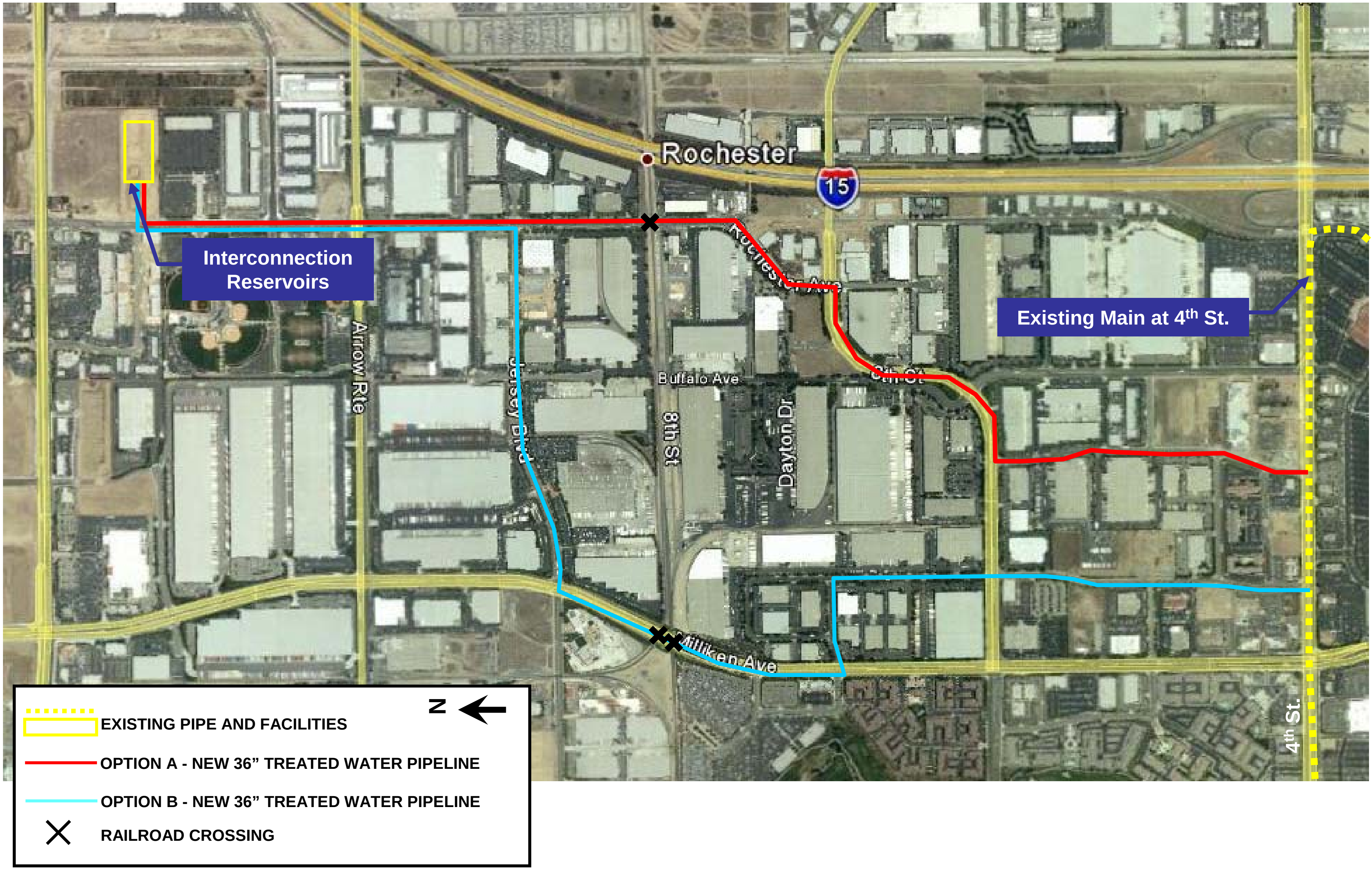
The in-lieu shift with CVWD's Lloyd Michael WTP would be provided using existing and future conveyance facilities. Water from CVWD would be conveyed south via the existing 30-inch CVWD transmission main that runs along Rochester Avenue to Ontario's future reservoirs. Ontario currently owns five acres of property near the southeast corner of Foothill Boulevard and Rochester Avenue, which is planned to be the future site of two 8 MG reservoirs, not within the scope of the Program Expansion. From this location, a new 36-inch pipeline would be required to connect the reservoirs to the Ontario service area. The 36-inch pipeline would terminate at a new interconnection to the City of Ontario's existing 24-inch 4th Street transmission main for distribution. Additional capacity may become available with future construction or expansion of transmission mains.

Future Site of Ontario's Two 8 MG Reservoirs

2.3 Pipeline Alignment and Conceptual Design

This section presents conceptual design criteria for the interconnection pipeline.

Two preferred alternative alignments were identified for the new pipeline by Parsons Engineering in the 8th Street Zone Water Transmission Main Final Alignment Report, prepared for Ontario in 2005. The report evaluated seven potential alignments, based on pipe length, constructability and underground utilities, public impact and traffic control, and hydraulic performance. The preferred alternatives, Options A and B, are described below and are illustrated on Figure 2-1.



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ENERGY WATER INFORMATION GOVERNMENT

Chino Basin Dry Year Yield Program Expansion Project

City of Ontario – Interconnection Pipeline Alignment

Figure 2-1

Option A

The new pipeline would begin at the reservoir site located at Rochester Avenue and Sebastian Way. The pipeline would run south along Rochester Avenue, turn southwest onto 6th Street, and continue south along Richmond Place, terminating at the 4th Street intersection. The section of pipe would be approximately 11,300 feet long and 36 inches in diameter.

Option B

The new pipeline would begin at the reservoir site located at Rochester Avenue and Sebastian Way. The pipeline would run south along Rochester Avenue, turn west on Jersey Boulevard, continue south along Milliken Avenue, turn east on 7th Street, and run south along Pittsburgh Avenue, terminating at the 4th Street intersection. The section of pipe would be approximately 13,600 feet long and 36 inches in diameter.

Design parameters for both alignment options are discussed and include general design criteria, steel pipe design, coating, and lining materials, load criteria, pipeline plate thickness, joint configurations, trench detail, pipeline crossings, pipeline appurtenances and cathodic protection. At this stage of project development, it has been assumed that steel pipe would be the selected pipe material for the purposes of developing an opinion of probable cost. Alternative pipe materials, such as ductile iron, and high-density polyethylene (HDPE), may also be appropriate and should be investigated during the design phase in order to provide a competitive bidding scenario. A summary of the design criteria for the pipeline options is presented in Table 2-1.

Table 2-1
Summary of Pipeline Design Criteria

	Option A	Option B
Pipe		
Pipe Diameter, inches (1)	36	36
Pipe Length, feet	11,300	13,600
Flow, cubic feet per second (cfs)		
Design	35.3	35.3
Average (2)	5.6	5.6
Velocity, feet per second (fps)		
Design	5.0	5.0
Average (2)	0.80	0.80
Design Pressure		
Reservoir Water Surface Elevation, feet	1,212	1,212
Approximate Top of Pipe Elevation, feet (4)	1,038	1,032
Minimum 4th St Pipeline Fire Flow Pressure, pounds per square inch (psi) (3)	40	40
Approximate 4th St Pipeline Hydraulic Grade Line Elevation, feet	1,130	1,124
Static Design Pressure, psi	75	78
Pipe Wall Design		
Diameter/Thickness ratio (d/t)	165	165
Minimum Thickness, inch	0.25 (Min. steel thickness)	0.25 (Min. steel thickness)
Pipe and Fittings Materials	Cement Mortar Lined and Coated Welded Steel	Cement Mortar Lined and Coated Welded Steel
Pipe	Steel AWWA C200	Steel AWWA C200
Lining	Plant applied cement mortar, AWWA C205	Plant applied cement mortar, AWWA C205
Coating	Cement mortar, AWWA C205	Cement mortar, AWWA C205
Pipe Trench Criteria, Minimum Cover, feet	6	6
Allowable Nominal Deflection, Percent of Nominal Diameter	2	2
Modulus of Soil, psi (assumed)	1,400	1,400
Pipe Joints	Single or double welded, or butt strap, as required by Ontario	Single or double welded, or butt strap, as required by Ontario

Notes:
(1) Specified by Ontario.
(2) Based on 3,000 afy put shift delivered over a 9-month period.
(3) Based on conversation with Ontario staff and used to estimate the 4th Street Pipeline HGL.
(4) Approximate centerline elevation of pipeline at its lowest point at the intersection with the 4th Street Transmission Main.

2.3.1 Applicable Codes and Standards

The following codes and standards are applicable to the design and construction of the pipeline:

- American Society for Testing Materials (ASTM)
- American Water Works Association (AWWA) Codes and Standards

- AWWA Manual M11 (Steel Pipe – A Guide for Design & Installation)
- AWWA Manual M51 (Air Release, Air/Vacuum, and Combination Air Valves)
- B&V Design Procedures
- California Code of Regulations
- State of California Construction Safety Orders (California Occupational Safety and Health Administration (Cal-OSHA))
- California Department of Public Health (CDPH)
- City of Ontario Standards

2.3.2 Hydraulic Design

Pipeline hydraulic design and requirements are based on information obtained from Ontario. Table 2-2 summarizes the potential hydraulic losses for both alignment options of the 36-inch diameter pipeline. The 4th Street transmission main operates at the top of Ontario's 1212 pressure zone, which is served by several reservoirs with hydraulic elevations of 1212 feet. For Options A and B, the 4th Street transmission main is located at an approximate ground surface elevation of 1,044 feet and 1,032 feet, respectively. Assuming a minimum operating pressure of 40 psi, the minimum HGL for Option A and B at the point of connection to the 4th Street transmission main, are 1,130 and 1,124 feet. The maximum HGL for both Options is 1,212 feet. Hydraulic profiles are provided for both Options and for both the design flow and average flow on Figures 2-2 and 2-3.

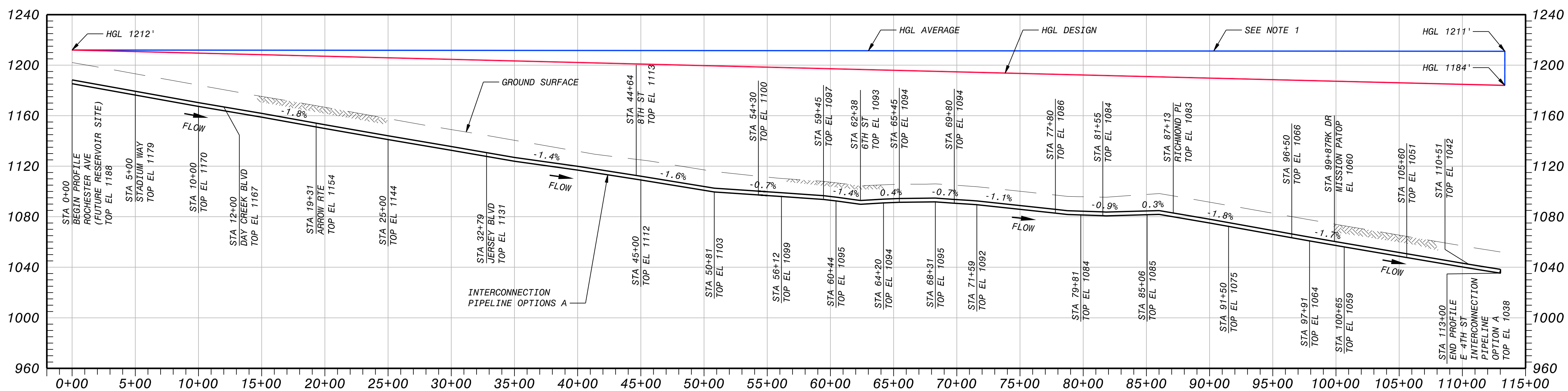
Table 2-2
Summary of Hydraulic Losses

	Option A	Option B
Design Flow, cfs (1)	35.3	35.3
Approximate Head Loss, feet	27.6	33.3
Average Flow, cfs (2)	5.6	5.6
Approximate Head Loss, feet	0.9	1.1

Notes:
(1) Assumed design flow through a 36-inch diameter pipeline, based on 5 fps water velocity.
(2) Based upon 3,000 afy put shift delivered over a 9-month period.

PLAN STA 0+00 TO STA 113+00

HORIZ - 1" = 1000'



HYDRAULIC PROFILE STA 0+00 TO STA 113+00

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

HYDRAULIC LEGEND

HGL	FLOW SENARIO	FLOW RATE	NOTES
(red line)	DESIGN CAPACITY	25,600 AFY	BASED ON MAX VELOCITY OF 5 FT/SEC
(blue line)	AVERAGE CAPACITY	3,000 AFY	BASED ON SHIFT

NOTE:
1. MAXIMUM HGL @ 1212'
MINIMUM HGL @ 1130' (ASSUMES MIN 40 PSI OPERATING PRESSURE)

CONCEPTUAL - NOT FOR CONSTRUCTION

DATE	REVISIONS AND RECORD OF ISSUE	NO.	BY	CK	APP

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XREF1: Ontario Aerial.jpg
XREF2:
XREF3:
XREF4:
XREF5:
DWG VER: 1.8

BLACK & VEATCH
Black & Veatch Corporation
Irvine, California

CHINO BASIN DYY PROGRAM EXPANSION PROJECT
PROJECT DEVELOPMENT REPORT

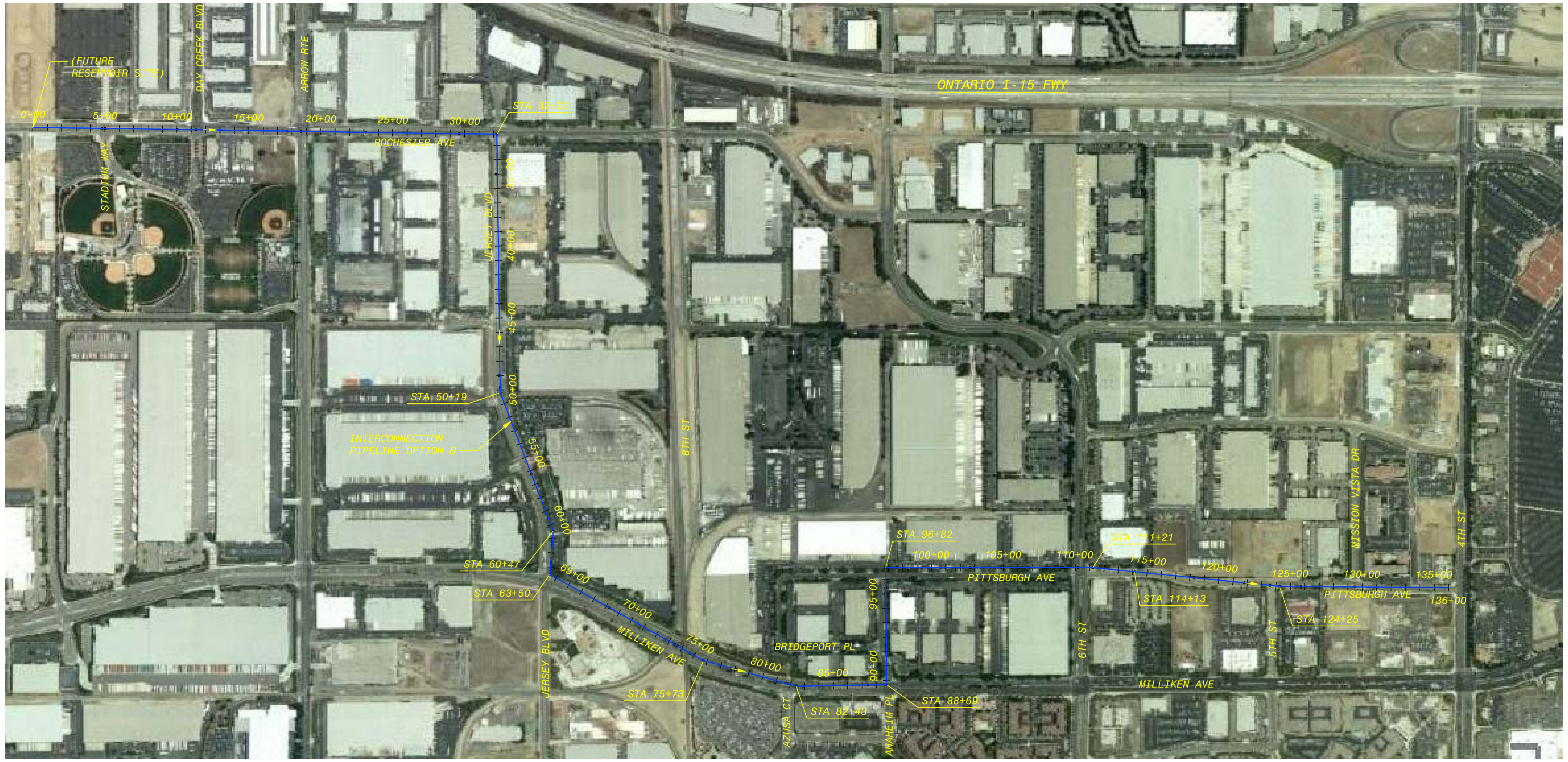
CITY OF ONTARIO
OPTION A INTERCONNECTION PIPELINE
PLAN AND PROFILE

DESIGNED: MEM
DETAILED: JEG
CHECKED:
APPROVED:
DATE:

PROJECT NO.
160374

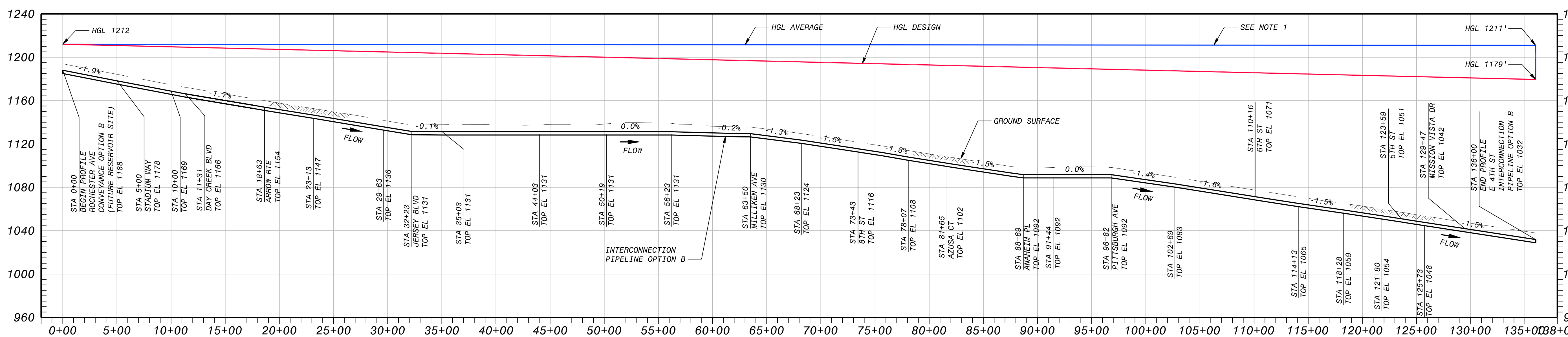
FIGURE 2-2

FD160374
D160374



PLAN STA 0+00 TO STA 136+00

HORIZ - 1" = 1000'



HYDRAULIC PROFILE STA 0+00 TO STA 136+00

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

HYDRAULIC LEGEND

HGL	FLOW SENARIO	FLOW RATE	NOTES
(red line)	DESIGN CAPACITY	25,600 AFY	BASED ON MAX VELOCITY OF 5 FT/SEC
(blue line)	AVERAGE CAPACITY	3,000 AFY	BASED ON SHIFT

NOTE:
1. MAXIMUM HGL @ 1212'
MINIMUM HGL @ 1124' (ASSUMES MIN 40 PSI OPERATING PRESSURE)

CONCEPTUAL - NOT FOR CONSTRUCTION

BLACK & VEATCH
Black & Veatch Corporation
Irvine, California

CHINO BASIN DYY PROGRAM EXPANSION PROJECT
PROJECT DEVELOPMENT REPORT

CITY OF ONTARIO
OPTION B INTERCONNECTION PIPELINE
PLAN AND PROFILE

DESIGNED: MEM
DETAILED: JEG
CHECKED:
APPROVED:
DATE:

PROJECT NO.
160374

FIGURE 2-3

FD160374
D160374

2.3.3 Pipe Diameter

The new pipeline from the Rochester Avenue reservoir site to Ontario's 4th Street transmission main is master planned as part of Ontario's future distribution needs. To meet future, master planned and DYY "put" flow requirements from the new CVWD supply, the new pipeline would have a capacity and diameter of 35.3 cfs and 36 inches, respectively. The additional capacity in this pipeline could also be available for future increased in-lieu "put" capacity into the Basin.

2.3.4 Pipe Materials

Pipeline materials would be selected to meet ductility and joint design guidelines for superior seismic performance. Steel pipe was selected for the basis of this PDR; however, alternative pipe materials could be evaluated during final design. The pipeline would be cement mortar lined and coated steel pipe conforming to AWWA C200. The pressure class would be allowed to vary along the pipe. The required pipeline wall thickness would be determined for the pipeline and indicated on the final design plan and profile drawings.

2.3.5 Pipe Sections

Typical pipe sections are available in alternative lengths from 40 to 60 feet, depending on the pipe manufacturer's mill capabilities. For Option A, a total of 11,300 feet of pipe would require approximately 282 sticks of 40-foot pipe and 188 sticks of 60-foot pipe. Option B consists of 13,600 feet of pipe, would need 340 sticks and 227 sticks of each respective pipe section length.

2.3.6 Load Criteria

Internal and external loads must be considered to ensure appropriate pipeline design.

2.3.6.1 Internal Load

Design for internal loading would be based on the design HGLs. Design pressures would be based on the considerations of normal operating conditions, transient surge conditions, hydrostatic test pressures, and other conditions if warranted.

2.3.6.2 External Load

Design of the pipe for external loading would consider the depth of earth cover, live loads, and construction loads. A maximum deflection of two percent of nominal pipe diameter would be allowed. A maximum allowable design deflection of two percent for the 36-inch diameter pipe is 0.72 inches. Based on a modulus of elasticity of 1400 psi for soil, the minimum cover over the pipeline would be six feet while the maximum would be 23 feet. Concrete slurry would be required for deeper installation. In areas where utility crossings may occur, pipe cover would range from six to ten feet or be governed by the geotechnical engineer's recommendations.

2.3.7 Pipeline Wall Thickness

Minimum pipe wall thickness is an important consideration for handling and installation as well as for protection against collapse or buckling due to internal vacuum. Hydraulic requirements often dictate that the pipe wall thickness be increased for internal pressure. The minimum wall thickness and internal pressure were calculated to determine the governing criteria for wall thickness. For this pipeline, the minimum guidelines governed pipe wall thickness design.

The d/t ratio provides the minimum steel thickness for safe transport of the pipe. A d/t of 165 is recommended for this pipeline, which would result in a minimum wall thickness for a 36-inch pipeline of 0.22-inch; however, because the pipeline would be buried in streets with congested underground utilities and/or in areas where future construction may expose the pipe, a wall thickness of 0.25-inch is recommended.

The steel thickness necessary to withstand the internal pressure was also calculated to ensure the minimum thickness would be adequate. Based upon preliminary calculations, the internal pressure considered is negligible when assuming a thickness of 0.25-inch. The pipe wall thickness would vary along the alignment based on the test HGL and the actual centerline of the installed pipe. These thicknesses would be determined during final design, although the recommend pipe wall thickness would not be less than 0.25-inch at a minimum.

2.3.8 Pipe Deflection

Since steel pipe is a flexible conduit, the maximum cover depth is dependent on the allowable deflection caused by external loads. Maximum allowable deflection resulting from external loading conditions is limited to two percent of the pipe diameter for pipe with shop applied cement mortar coating. The maximum allowable design deflection of two percent for the 36-inch diameter pipe would be 0.72 inches.

Estimated deflections using the minimum pipe wall thicknesses were calculated assuming a soil unit weight of 120 pound per cubic feet (lbs/ft^3) and assuming Class B bedding as summarized in Table 2-3.

Table 2-3
Estimated Pipe Deflection

	36-inch Pipe Diameter [(1)]
Deflection, inches	0.19
Max. Cover Depth, feet	23

Notes:
(1) Assumes w = 120 lbs/ft3 and Class B bedding.

2.3.9 Joints and Fittings

Pipe installation would use single or double welded joints to join pipe sections, depending upon Ontario standards.

2.3.10 Trench Design

Excavation for pipe installation would be in accordance with the requirements established by Cal-OSHA and by the applicable agencies. Shoring may be required due to space constraints and possibly soil considerations. Shoring design would be specified to be the responsibility of the contractor. Trench depth should be generally selected based on minimum cover to protect the pipe safely from transient loads. Depth of trenching in city streets may be governed by existing utilities or other conditions. If the sides of the trench remain vertical after excavation, and if bedding and backfill were consolidated by hydraulic methods, the minimum trench width at the top of the pipe would then be pipe outside diameter (OD) plus 20 inches on each side of the pipe. If the pipe-zone bedding and backfill require densification by compaction, then the width of the trench at the bottom of the pipe should be determined by the space required for the proper and effective use of tamping equipment, but it should never be less than pipe OD plus 20 inches on each side. Flat bottom trenches should be excavated to a depth of minimum of four inches below the established grade line of the outside bottom of the pipe. Specified building material should be used to fill the excess excavation. Loose subgrade material should be graded uniformly to the established grade line for the full length of the pipe.

2.3.10.1 Open Trench with Flared Sidewalls

This method would require more construction area than any other method due to the type of equipment used. However, open trenching with flared sidewalls is the least expensive form of excavation for pipelines. This method would generally be used in open terrain and would not likely be used in an installation along city streets. An open trench would demand the width of two lanes, possibly halting traffic flow.

2.3.10.2 Open Trench with Shoring

Shored open trench construction would be required for the majority if not all of the pipeline and would be used for confined construction areas and restricted rights-of-way (ROW). Pipe placement along the street would require this method because of space confinement. The entirety of the pipeline would be constructed within the ROW for existing public streets.

2.3.10.3 Jack and Bore Method

The jack and bore method may be utilized if conditions exist that would not allow sections of the street to be opened such as a congested intersection. The contractor would install a prefabricated pipe through the ground from a jacking pit to a receiving pit. The pipe would be propelled by jacks located in the jacking pit. As the pipe installation progresses, the spoils would be transported out of the pipe either manually or by mechanical methods. The casing pipe material would be steel pipe welded at each joint. The casing pipe would need to accommodate the carrier pipe plus the skids, or pipe spacers, to support the carrier pipe. For a 36-inch pipeline, the casing pipe would be 48-inch. The contractor would need space for the jacking pit (approximately 20 by 40 feet), equipment, (e.g. excavator, crane, generator, small equipment, storage containers), materials, temporary spoils piles, and delivery equipment. The jacking and receiving pits would be supported in a manner similar to open trench excavation with shoring. The contractor would require space around the boring pit for the excavator, crane, and other equipment for this construction method.

As stated in the Parsons 8th Street Zone Water Transmission Main Final Alignment Report, both alignments, Options A and B, include crossing an existing 120-inch storm drain at the intersection of Arrow Route and Rochester Avenue. Option A also includes Metrolink track crossings. All of these crossings would require the jack and bore method of installation.

2.3.11 Pipeline Connections

The first pipeline connection would be made at Ontario's two new 8 MG reservoirs. The final connection would be at the terminus of the pipeline at the 24-inch 4^{th} Street transmission main.

2.3.12 Lining and Coatings

All buried steel pipe would be coated and lined. The pipe coating and lining would be a cement mortar in accordance with AWWA C205. The lining and coating would be used to protect the pipeline from wear during installation and operation, as well as from corrosion.

2.3.13 Corrosion Control

The water conveyed in the pipeline is potable water and is not known to be corrosive. Cement mortar lining on the inside of the steel pipe would provide the primary corrosion protection for the steel shell.

If cathodic protection is desired, cathodic test stations would be included in the pipeline design. Installation of wire jumpers at joints, harness assemblies, and couplings would be provided for continuity along the pipeline. Insulating flanges would be provided to isolate pipeline segments. Where cement mortar coatings are not provided on the pipeline, the pipe would be coated with a high performance protective coating, coated with mastic, and wrapped with polyethylene sheeting.

2.3.14 Construction Requirements

The entire alignment lies within the public ROW. Encroachments through public streets would be coordinated by the Ontario or by San Bernardino, as required. The contractor would have to work within a restricted construction zone along the road, either on the shoulder or within an identified lane, where the trench would be located using a shored trench. A detailed evaluation of the construction zone requirements versus available width would be required during design.

2.3.14.1 Pipeline Appurtenances

Water conveyance facilities include appurtenant structures for operation and protection against damaging hydraulic transients, as well as facilities to permit periodic maintenance. Specific appurtenances would include couplings, isolation valves, air and vacuum relief, blow-off facilities, access manways, pipe draining and filling, and marker posts.

2.3.14.2 Couplings

Sleeve couplings provide tightness and strength with flexibility. Flexible sleeve couplings would be able to handle acceptable pipe axial movement. If greater displacement were needed, a harness assembly could be installed with each flexible coupling according to AWWA M11.

2.3.14.3 Isolation Valves

The pipeline would be designed to resist damage from earthquakes. In addition, valves may be provided to isolate portions of the pipeline should damage occur. Isolation valves would be the same size as the pipeline and would be manually operated. The location of these valves, if desired, would be determined after the completion of the geotechnical report during final design.

2.3.14.4 Air Release/Vacuum Relief

Air release/vacuum relief valves allow entrained air to vent out of the pipeline during fill, allow air back into the pipeline when it is being drained, and protect the pipeline from collapse due to negative pressures. The air release/vacuum relief valves would be installed at every summit along the pipeline; the valves would prevent accumulation of air pockets at high points, which might impair the pipe's flow capacity. Air release/vacuum relief valves would be designed to meet all the criteria in AWWA M11 and M51.

2.3.14.5 Blowoff Facilities

Blowoff facilities would be located at the low points and upstream of line valves located on a slope of the pipeline. Blowoff facilities would be used to drain pipe sections and to allow for relief of pipe pressure for inspection and maintenance purposes. The blow off facilities would consist of a short length of pipe connected to the bottom of the main pipe and carried away from the main to a gate valve where the operating nut must be accessible from the surface. The blowoff facility would be designed and set with the stem vertical and just beyond the side of the pipeline.

2.3.14.6 Access Manway

Access to the pipeline would be provided from the top of the pipe by a tee in the pipeline with a blind flange. The manholes would typically be 30-inch flanged tees, either buried or contained within a concrete structure and located at about 2,000 foot spacings along the alignment. Access manholes would be located close to valves and low points, as well as intermediate locations along the pipeline.

2.3.14.7 Utility Research

An investigation of existing facilities should be performed to identify approximate locations of crossing or parallel utilities in relation to that of the pipeline. Potholing is also expected in some locations along the pipeline alignment during final design to determine unknown or verify as-built utility locations.

3.0 OPINION OF PROBABLE COST

3.1 Overview

This chapter presents the opinion of probable cost for the facilities described in this Volume IIF 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 for Option A facilities would be $9,028,000 and $9,000, respectively. The total opinion of probable capital and annual O&M costs for Option B facilities would be $10,460,000 and $10,000, respectively.

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

Component	Option A	Option B
Capital Cost		
Construction Cost	$6,839,000	$7,924,000
Contingency (1)	$1,368,000	$1,585,000
Engineering/Administration/CM (2)	$821,000	$951,000
Total Capital Cost	**$9,028,000**	**$10,460,000**
Midpoint of Construction Cost (3)	$9,865,000	$11,430,000
Annual Cost		
Annual O&M Cost	$9,000	$10,000
Annualized Capital Cost (4)	$772,000	$894,000
Total Annual Cost	**$781,000**	**$904,000**

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 Option A facilities. As shown, the total estimated capital cost for the new Option A facilities would be $9,028,000. 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--Option A Facilities

Component/Facility Detail	Option A Cost
Conveyance Facilities	
Distribution Pipeline: 12,000 feet @ 36" Diameter	$6,480,000
Railroad Crossing (auger boring)	$200,000
Misc. Valves and Flowmeters	$25,000
General Costs	
General Requirements (1)	$134,000
Total Construction Cost	$6,839,000
Contingency (2)	$1,368,000
Engineering/Administration/CM (3)	$821,000
Total Capital Cost	**$9,028,000**
Total Midpoint of Construction Cost (4)	$9,865,000

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

Table 3-3 presents the opinion of probable capital cost for construction of the City's Option B facilities. As shown, the total estimated capital cost for the new Option B facilities would be $10,460,000.

Table 3-3
Summary of Opinion of Probable Capital Cost--Option B Facilities

Component/Facility Detail	Option B Cost
Conveyance Facilities	
Distribution Pipeline: 13,600 feet @ 36" Diameter	$7,344,000
Railroad Crossing (two, auger boring)	$400,000
Misc. Valves and Flowmeters	$25,000
General Costs	
General Requirements (1)	$155,000
Total Construction Cost	$7,924,000
Contingency (2)	$1,585,000
Engineering/Administration/CM (3)	$951,000
Total Capital Cost	**$10,460,000**
Total Midpoint of Construction Cost (4)	$11,430,000

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

3.4 Annual O&M Cost

Table 3-4 presents the opinion of probable annual O&M cost for the City's Option A facilities. As shown, the total estimated annual O&M cost for the new Option A facilities would be $9,000.

Table 3-4
Summary of Opinion of Probable Annual O&M Cost--Option A Facilities

Component/Facility Detail	Option A Cost
Conveyance Facilities	
General Pipeline Maintenance: Distribution	9,000
Total Annual O&M Cost	$9,000
Annualized Capital Cost (1)	$772,000
Total Annual Cost	**$781,000**

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

Table 3-5 presents the opinion of probable annual O&M cost for the City's Option B facilities. As shown, the total estimated annual O&M cost for the new Option B facilities would be $10,000.

Table 3-5
Summary of Opinion of Probable Annual O&M Cost--Option B Facilities

Component/Facility Detail	Option B Cost
Conveyance Facilities	
General Pipeline Maintenance: Distribution	$10,000
Total Annual O&M Cost	**$10,000**
Annualized Capital Cost (1)	$894,000
Total Annual Cost	$904,000

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