Potable Water Master Plan

City of American Canyon

May 2016

CITY OF AMERICAN CANYON
POTABLE WATER MASTER PLAN
AMERICAN CANYON, CALIFORNIA

Project No. 02536 - 8411338

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May, 2016

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The Cost Estimates have been prepared for the purpose of establishing budgets and must not be used for any other purpose.

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1. Executive Summary

The City of American Canyon (the City) has a water supply portfolio that relies on several sources of water to meet its needs including water from the State Water Project, water from the cities of Vallejo and Napa, and recycled water produced at the City's Water Reclamation Facility (WRF). This *2016 Potable Water Master Plan* (PWMP) relates to all water supply and demands except for recycled water, which is addressed separately in the City's *2016 Recycled Water Master Plan* (RWMP). However, it is important to note that the City is relying on increased recycled water use to offset potable water demands and the projected buildout conditions described herein are based on the City's successful implementation of the RWMP.

Referencing the City's last *Urban Water Management Plan* (UWMP) for 2010, the City has adequate water supply to meet its projected potable water demands under buildout conditions as shown in Table 1. This assumes that:

- The City receives 60% of its allotment from the State Water Project;
- The City maintains emergency water interconnections with Napa and Vallejo;
- The 2016 Recycled Water Master Plan is fully implemented; and
- Unaccounted for water does not exceed the current level.

Table 1 Potable Water Supply and Demand Summary

Description	Existing Conditions (afy)	Buildout Conditions (afy)
Available Water Supply	3,528 [1.]	5,130 [2.]
Average Day Demand (ADD)	2,910 [3.]	4,243 [4.]
Unaccounted For Water (17.5%)	618 [5.]	808 [6.]
ADD plus Unaccounted For Water	3,528 [7.]	5,051 [7.]

1. Water supplied and purchased by City from August 2013 through July 2014.
2. Projected water supply (excluding recycled water) for year 2035 from 2010 UWMP, Table 4.1.
3. Actual meter readings from August 2013 through July 2014.
4. Projected buildout potable water demands.
5. Calculated unaccounted for water for August 2013 through July 2014.
6. Estimated unaccounted for water assuming 16% of total water supplied and purchased, same as existing conditions.
7. Total volume of water supply needed to meet potable water demands and unaccounted for water.

Implementation of the capital improvement projects described in this master plan will likely reduce the amount of unaccounted for water by replacing old, deteriorating mains and services and thereby reduce the amount of water lost from leaks in the distribution system. This would create a safety margin between available water supply and potable water demands projected for buildout conditions.

The recommended capital improvements plan (CIP) for the potable water distribution system addresses current deficiencies and needed improvements to accommodate planned growth. Table 2 lists the CIP projects recommended for the near term (0 to 10 years). These near-term projects are prioritized based on need and benefits to the City, with projects addressing existing deficiencies prioritized over projects accommodating planned growth. The project drivers, funding sources, and estimated cost are provided for each project.

Table 2 Potable Water System Near-Term Capital Improvements Plan (0-10 Yrs)

CIP Project	Driver	Funding Source	Estimated Cost
W1 Zone 1 Storage	Additional operational and emergency storage needed	Water Operations and Water Capacity	$4,020,000
W2 Annual Water Main Replacements	Address hydraulic restrictions and leaks	Water Operations	$103,960,000
W3 Annual Water Service Replacements	Replace leaking services	Water Operations	$810,000
W4 High Pressure Zone System	Serve high pressure zone customers; reduce Vallejo water to emergency backup	Water Operations	$10,240,000
W5 Devlin Road Extension	Serve planned development	Water Capacity	$1,400,000
W6 Watson Ranch Main Zone	Serve Watson Ranch	Water Capacity	$4,170,000
W7 Watson Ranch High Pressure Zone	Serve Watson Ranch	Water Capacity	$2,240,000
W13 Main Zone Reliability Improvements	Improve system performance	Water Operations	$1,290,000
		Total Near-Term CIP	**$128,130,000**

The annual water main replacements (CIP W2) include replacing undersized 2- and 4-inch mains with new 8-inch mains, replacing deteriorated pipelines that are leaking and/or structurally deficient, and ongoing replacement of non-PVC mains. The City is planning to allot $1,674,000 per year for this work. Upsizing 2- and 4-inch mains will take two to three years to complete, replacing deteriorating mains will take another nine to ten years to complete. Replacement of the remaining non-PVC mains would be long-term projects.

The high pressure zone system improvements (CIP W4) will serve the American Canyon High School and the Montevino and La Vigne subdivisions, reducing the interconnection from the City of Vallejo to an emergency backup supply. In addition this high pressure zone will serve the eastern side of Watson Ranch when it is developed. The new 2.0 million gallon storage tank (mg) will provide operational and fire storage to these customers, plus emergency storage to the entire City.

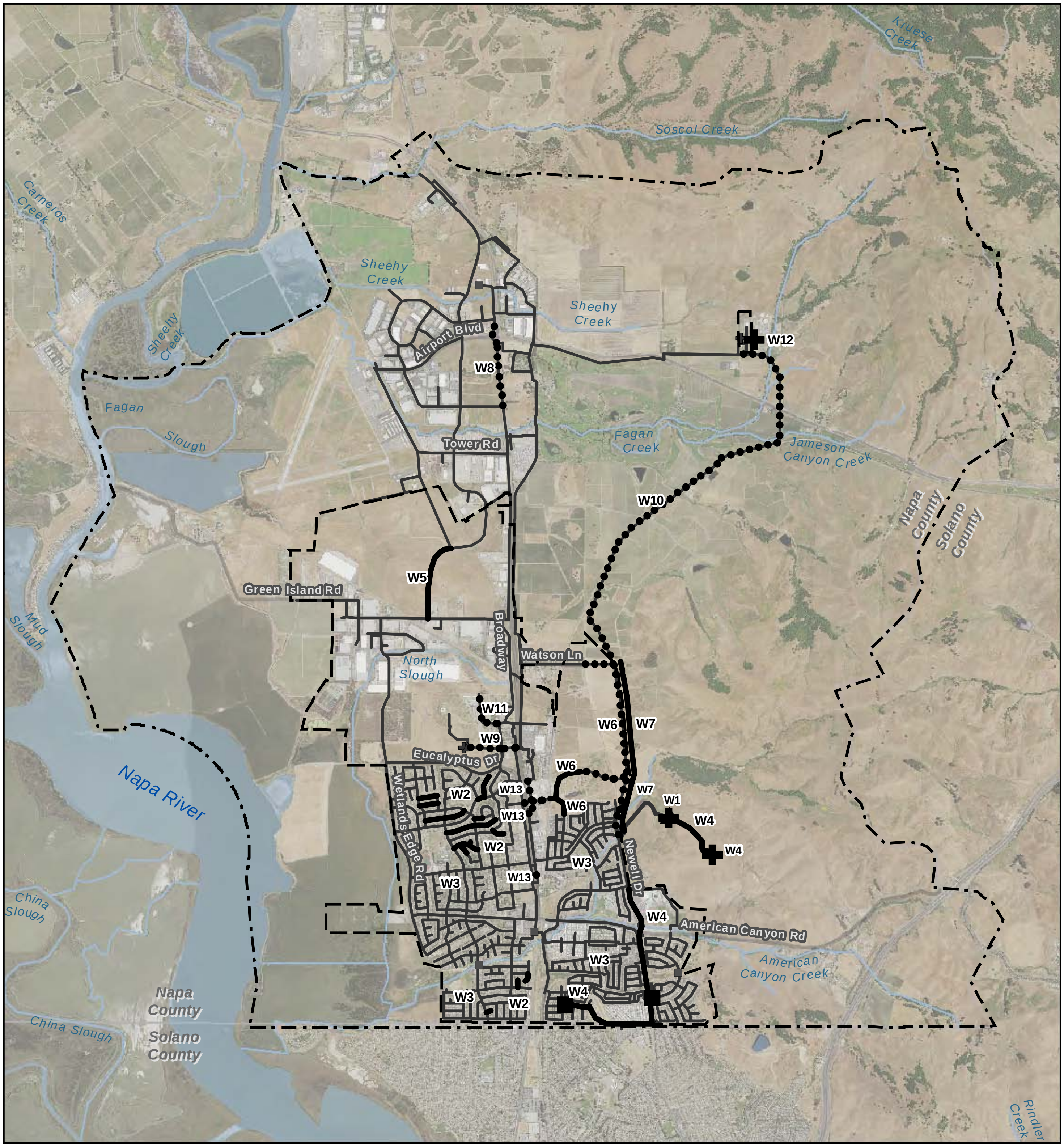
Capital improvement projects that can be implemented over the long term (11 to 20 years) are also needed to address existing deficiencies and accommodate planned growth, but are not as urgent as the near-term CIP projects. Long-term CIP projects addressing existing deficiencies are prioritized over projects accommodating planned growth. The recommended long-term CIP projects are listed in Table 3. The project drivers, funding sources, and estimated cost are provided for each project. The CIP project locations are shown in Figure 1 and detailed summaries are provided in Appendix D.

Table 3 Potable Water System Long-Term Capital Improvements Plan (11-20 Yrs)

CIP Project	Driver	Funding Source	Estimated Cost
W8 Replace Transmission Mains Near SR29	Leaking transmission mains	Water Operations	$1,960,000
W9 Replace Oat Hill Transmission Main	Leaks, hydraulic constraints	Water Operations	$1,280,000
W10 New Transmission Main from WTP	Improve performance and reliability	Water Capacity	$7,250,000
W11 Fire Flows in Hess Drive	Meet future fire flow needs	Water Operations	$790,000
W12 Zone 1 Storage at WTP	Operational and emergency storage	Water Capacity	$2,310,000
		Total Long-Term CIP	**$13,590,000**

CIP W10 consists of a new transmission main running between the City's Water Treatment Plant (WTP) and Newell Drive. This new 12-inch transmission main would partially take advantage of an existing abandoned 14-inch pipe owned by the City of Vallejo that runs north in Newell Drive and then northeast along the railroad tracks towards SR12. The 14-inch pipe would be sliplined with a new 12-inch HDPE main, and then the connection to the WTP would require construction of a new 12-inch main just east of the golf course.

CIP W12 consists of a new 1.2 mg storage tank at the WTP site that would serve the entire City. Available space on City property is limited and this project requires a siting study to evaluate potential tank sites and constructability issues. The tank siting study and CEQA process should be initiated in the near-term to allow time for property acquisition if it is required.



City Limits

Water Service Boundary

Existing System:

- Pump Station
- Pressure Regulating Station
- Tank
- Pipe

CIP Projects:

- Near Term
- Long Term
- Tank
- Pump Station
- Pressure Regulating Station

Paper Size 8.5" x 11" (ANSI A)

0 2,500 5,000

Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: NAD 1983 StatePlane California II FIPS 0402 Feet

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City of American Canyon
Potable Water Master Plan

Job Number	8411338
Revision	2
Date	02 May 2016

Recommended Potable Water
Capital Improvement Projects

Figure 1

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N:\US\Santa Rosa\Projects\02536 - American Canyon\02536-8411338 Master Plan Updates\08-GIS\Maps\Figures\Water\Master Plan\Final\Fig 1 - Recommended PW CIPs.mxd

Data source: USDA, Imagery, 2014; County of Napa, Roads, 2015; GHD, PW System and Customers, 2015. Created by:afisher2

2. Introduction

2.1 Background

The City of American Canyon is located approximately 35 miles northeast of San Francisco at the southern end of Napa County. The City provides potable water service to customers within the City and the industrial/commercial area north of the City boundary along Highway 29, including the Napa Airport Industrial Park. The City's existing potable water system includes treatment, storage, pumping and distribution infrastructure serving approximately 5,500 residential, industrial, commercial and agricultural customers. Water service elevations range from approximately 10 feet above sea level to approximately 240 feet above sea level.

2.2 Scope

The purpose of this master plan is to create a new hydraulic model that incorporates the development that has occurred since the last update in 2011, and identifies system improvements needed to eliminate existing system deficiencies and to expand the system to accommodate planned growth. Specifically this master plan achieves the following objectives:

- Evaluate hydraulic performance of the existing potable water distribution system, including storage tanks, pump stations and interconnections;
- Update existing and projected future potable water demands based on the latest information available from the City; and
- Identify and prioritize capital improvement projects that address current system deficiencies and will meet projected buildout demands for planned growth.

2.3 References

The following references were provided by the City and used in preparing this master plan:

- *Water Distribution System Master Plan*, West Yost & Associates (December 1996)
- *Water System Master Plan*, Hydroscience Engineers (February 2003)
- Analysis and Calibration American Canyon City Water Model, GC Wallace Companies (July 2010)
- Final Urban Water Management Plan 2010, Winzler & Kelly (September 2011)

3. Utility Land Use Classifications

3.1 Utility Service Area

The City's potable water service area encompasses the City limits and its sphere of influence, and extends from the Napa River to the west to the Napa/Solano County line to the east, and from the Napa/Solano County line to the south to Soscal Ridge north of the airport. Figure 2 shows the boundaries for the American Canyon City Limits and Sphere of Influence, and Figure 3 depicts the potable water service area.

3.2 Utility Land Use Classifications

For the purpose of updating the utility master plans, the twenty land use categories listed under the City and County General Plans were consolidated into ten utility land use classifications in order to simplify the process of generating potable water demands. The ten classifications are described in Table 4. Figure 4 depicts the classifications spatially within the City's water and sewer service areas and are based on the City of American Canyon's published Zoning Map (2012) and the County's Land Use Map from the 2009 General Plan (Figure AG/LU-3).

Table 4 Utility Land Use Classifications

Utility Land Use Classifications	Description
Single-family	Single family dwelling units (RE, RR, RS, SP-1SF)
Multi-family	Multi-family dwelling units (RM, RH, PC, SP-1CR)
Commercial	Sale or rental of goods and the provision of services other than classified as public or quasi-public or industrial (CN, CC)
Industrial	Onsite production of goods by methods not agricultural in nature, distribution, warehousing and storage activities, research and development, and vehicle and equipment services other than those classified as commercial (SP-2, L1, G1)
Institutional/Governmental	Public areas, including churches, schools, lodges, and government or public buildings (P)
Landscape	Parks and streetscapes
Open Space	Open space areas, creek areas, water quality basins and detention basins other than landscape (OS)
Watson Ranch	Designated area within the Watson Ranch SPA
Recreation	Areas designated for recreation other than landscape and open space (REC)
Agricultural	Areas used for agricultural production

3.3 Buildout Conditions

Buildout conditions assume that current plans for development projects in the planning and approval stages will be completed and that all other undeveloped land will be developed in accordance with the City Zoning Map and County Land Use Map. Currently identified projects in the planning and approval stages are described below based on information available as of December 2015.

3.3.1 Watson Ranch

This project covers approximately 300 acres in the area shown in Figure 4. The proposed project includes residential neighborhoods with parks and an elementary school, and a mixed use commercial area with a hotel, winery, farmers market and restaurants. Figure 5 shows the Specific Plan Land Use Map from the *Watson Ranch Specific Plan – Administrative Draft* (November 2014) adjusted to the utility land use classifications listed in Table 4. Table 5 provides a breakdown of acres and units by utility land use classification.

Table 5 Proposed Watson Ranch Development Intensity[1.]

Utility Land Use Classification	Acres	Intensity
Single Family	163	1,030 Units
Multi-family	9	223 Units
Commercial	37	100-room Hotel 93.5 ksf Commercial
Landscape	50	Parks
Institutional/Governmental	10	Elementary School 600 Students

1. Acres and intensity from the *Watson Ranch Specific Plan – Administrative Draft* (November 2014).

3.3.2 Highway 29 Priority Development Area (PDA)

The Highway 29 Priority Development Area is about 225 acres along the transportation corridor running north/south through the heart of American Canyon. The City's Zoning Map is consistent with approved PDA land uses and Table 4 depicts the utility land use classifications for estimating future water demands and sewer flows.

3.3.3 Miscellaneous Projects

Other proposed development projects that were in the planning and approval process as of July 2015 are listed in Table 6 along with estimated potable water and recycled water demands. These projects will be incorporated into the buildout condition scenarios for the utility master plans.

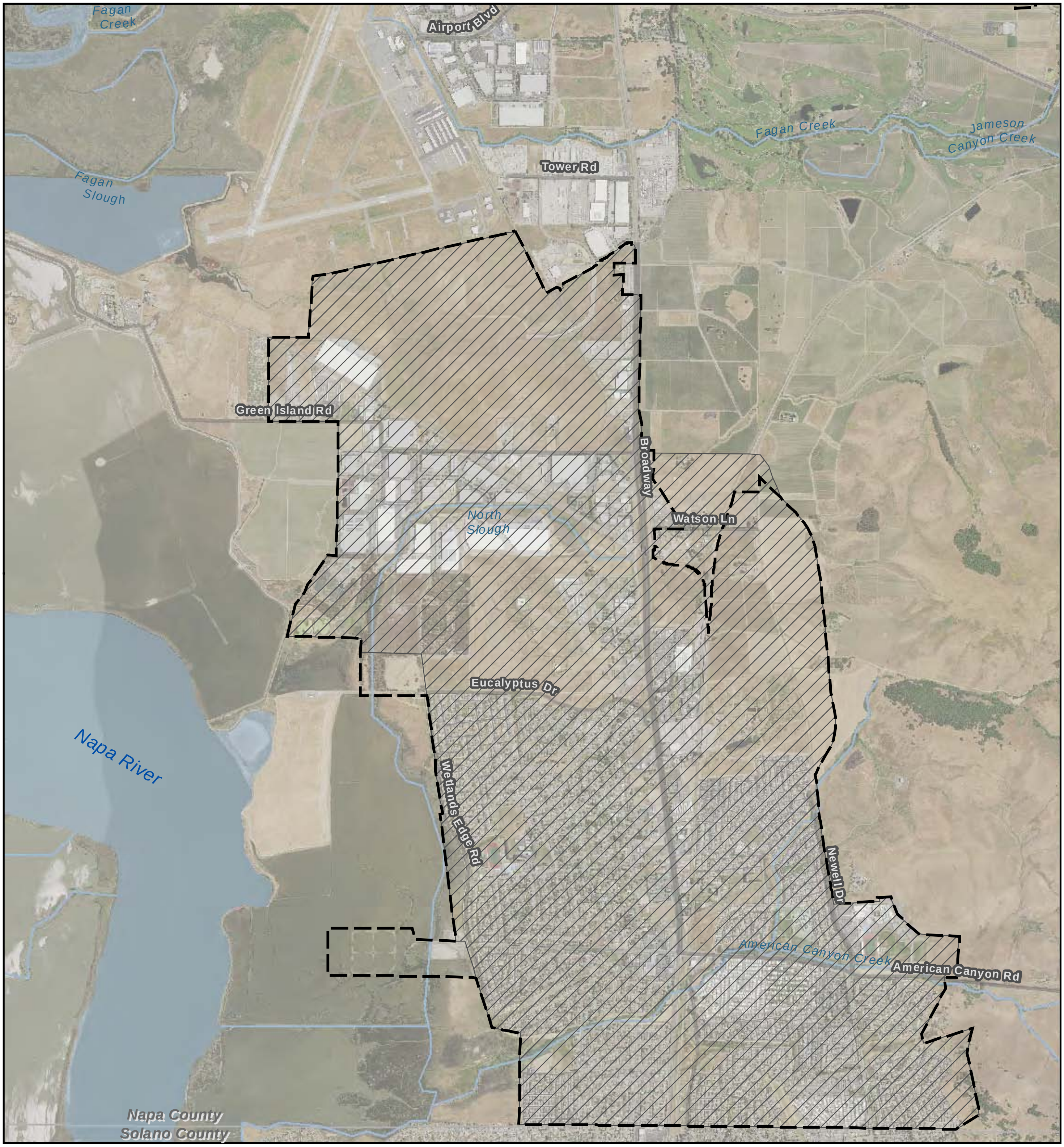
Table 6 Other Proposed Development Projects in Planning and Approval Phase

Project Name	Intensity and Zoning	Estimated Potable Water Demand (gpd)	Estimated Recycled Water Demand (gpd)
Napa Logistics Park	2,846 ksf Industrial	35,178 [1.]	65,600 [1.]
Napa Junction III (Area A)	18.5 ksf Commercial	2,544	1,654
Napa Junction III (Area B)	148 Apts. Commercial	22,923 [1.]	6,396 [1.]
Napa Junction III (Area C)	100-room Hotel Commercial	7,500	800
Village at Vintage Ranch	158 Apts. Multi-family	30,620	5,000
Napa Airport Corporate Center	5 Bldgs. Industrial	4,700	5,600
Napa Valley Gateway Park	Expansion Industrial	22,000	0 [2.]
Napa Junction I & II	Landscaping	(27,393) [3.]	27,393 [3.]
Jamieson Ranch Vineyard Expansion	Industrial	15,000	0
Canyon Estates	38 Homes Single Family	12,000	12,000 [4.]
Valley View	Senior Housing Multi-family	17,700 [4.]	0 [4.]
255/265 Lombard Road	Industrial	580 [1.]	2,000 [1.]
Montalcino Resort	Institutional/Governmental	60,670	0 [2.]

1. Assumes dual-plumbed buildings.
2. Recycled water provided by Napa Sanitation District.
3. Convert landscaping from potable water to recycled water.
4. Estimated.

3.3.4 Other Development

There may be other developments approved between now and General Plan buildout which have not yet been submitted for consideration. For undeveloped property that has the potential for development under the approved General Plan, water demands will be estimated using gallons per day per acre based on average demands/flows for developed properties with the same utility land use classification. Potable water unit demands include indoor use, irrigation, and process water demands; where recycled water is available for irrigation and/or process water uses, the recycled water demands should be subtracted from the total unit demand per acre.



City Limits

Sphere of Influence

Source:
Sphere of Influence and City Limits, LAFCO of Napa County, 2013

Paper Size 8.5" x 11" (ANSI A)

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Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: NAD 1983 StatePlane California II FIPS 0402 Feet

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City of American Canyon
Potable Water Master Plan

City Limits and
Sphere of Influence

Job Number	8411338
Revision	2
Date	20 Apr 2016

Figure 2

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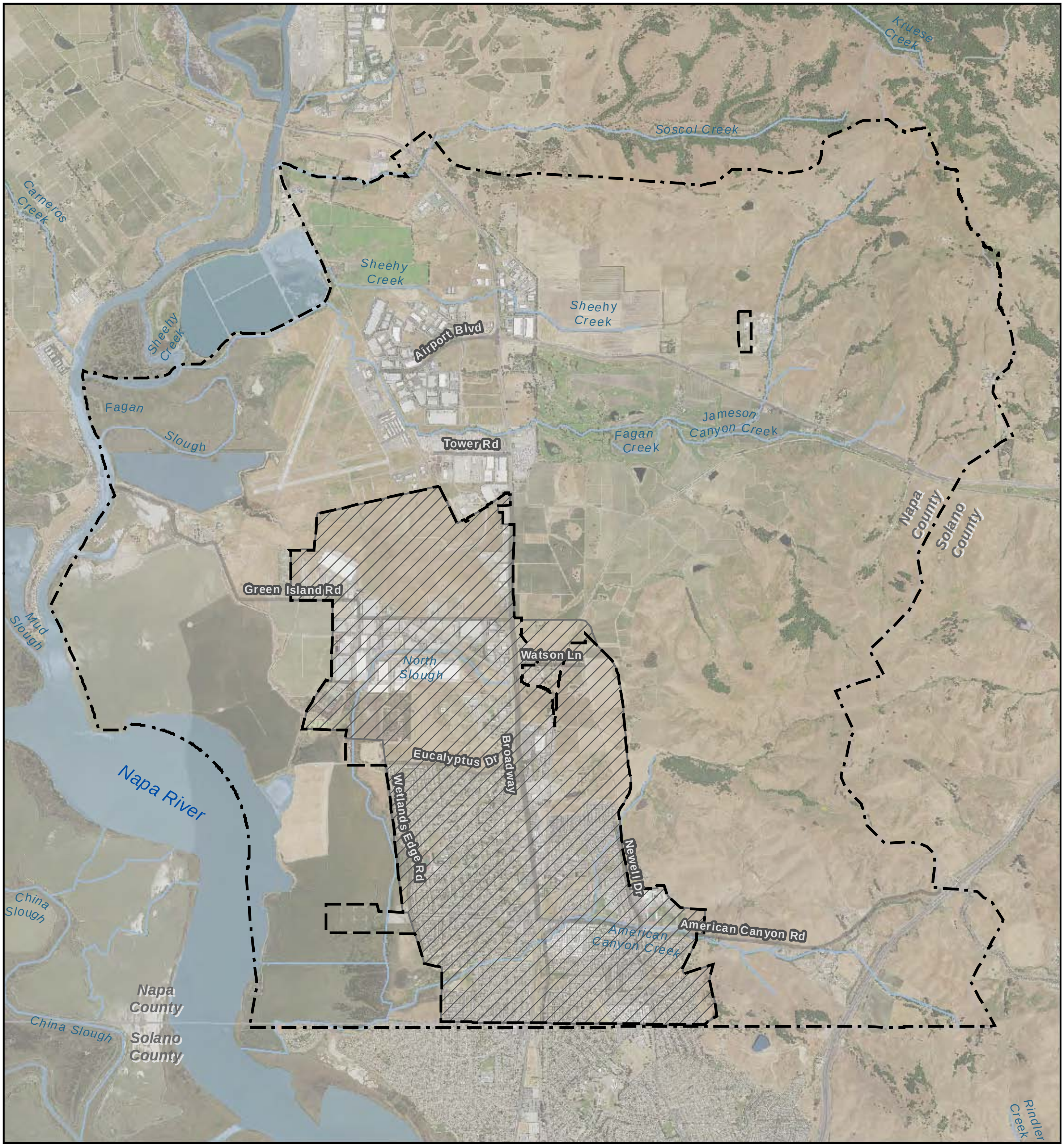
N:\US\Santa Rosa\Projects\02536 - American Canyon\02536-8411338 Master Plan Updates\08-GIS\Maps\Figures\Water\Master Plan\Final\Fig 2 - City Limits and SOI.mxd

Data source: USDA, Imagery, 2014; County of Napa, Roads, 2015; City Limits, American Canyon, 2013. Created by:afisher2



City Limits

Water Service Boundary

Sphere of Influence

Source:
Water Service Boundary, Brown and Caldwell (via American Canyon), October, 2014.

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Feet
Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: NAD 1983 StatePlane California II FIPS 0402 Feet

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City of American Canyon
Potable Water Master Plan

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Revision 2
Date 20 Apr 2016

Potable Water
Service Area

Figure 3

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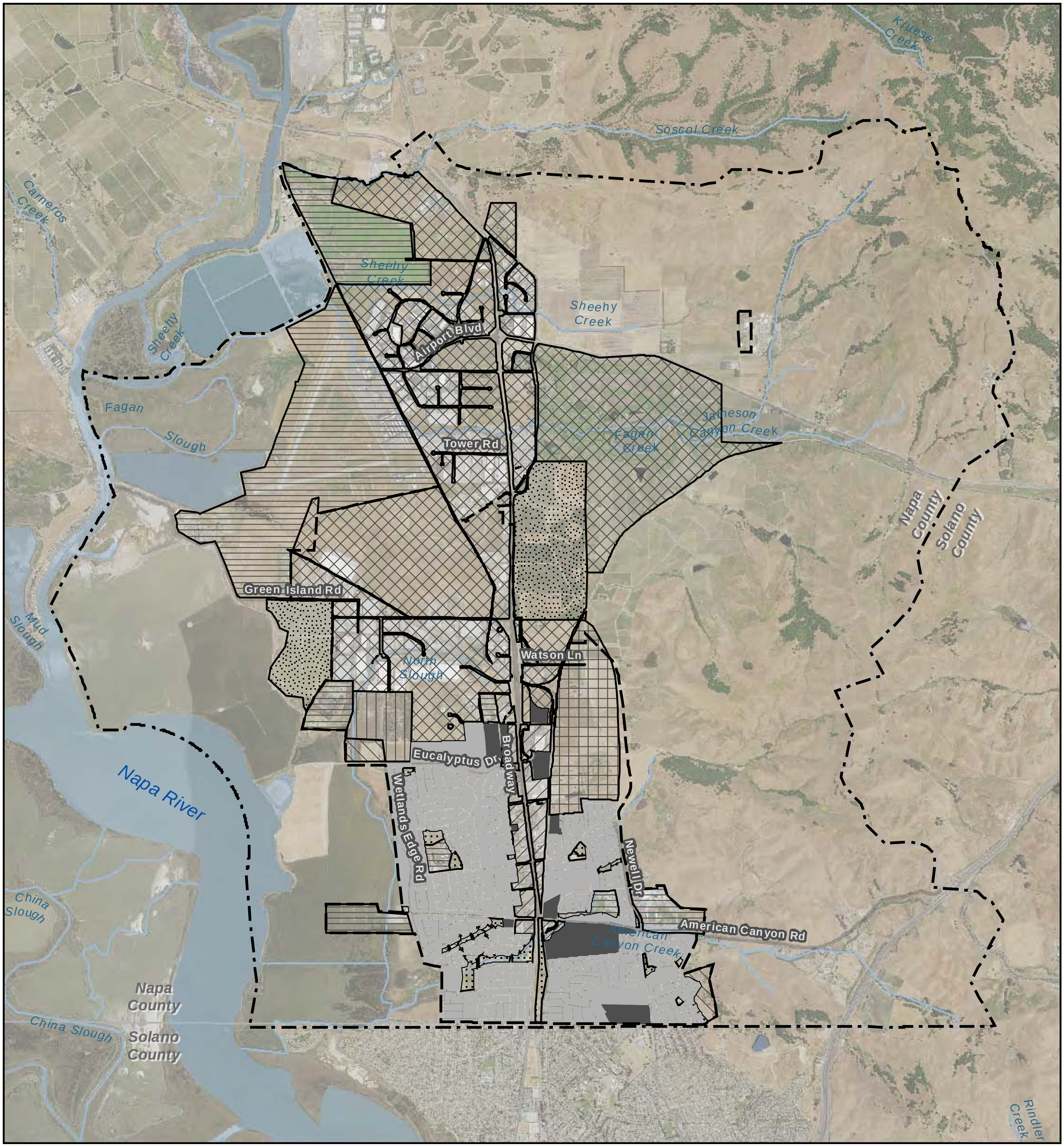
N:\US\Santa Rosa\Projects\02536 - American Canyon\02536-8411338 Master Plan Updates\08-GIS\Maps\Figures\Water\Master Plan\Final\Fig 3 - Potable Water Service Area.mxd

Data source: USDA, Imagery, 2014; County of Napa, Roads, 2015; GHD, PW System and Customers, 2015. Created by:afisher2



City Limits
Water Service Boundary
Agriculture
Commercial
Industrial
Institutional/Governmental
Landscape
Multi-Family
Open Space
Recreation
Single-Family
Watson Ranch

Source:
City Zoning Map, 2012
County Land Use Map, 2009
American Canyon Comments, 2016

Paper Size 8.5" x 11" (ANSI A)
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Feet
Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: NAD 1983 StatePlane California II FIPS 0402 Feet

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City of American Canyon
Potable Water Master Plan

Utility Land Use Classifications

Job Number | 8411338
Revision | 2
Date | 25 Apr 2016

Figure 4

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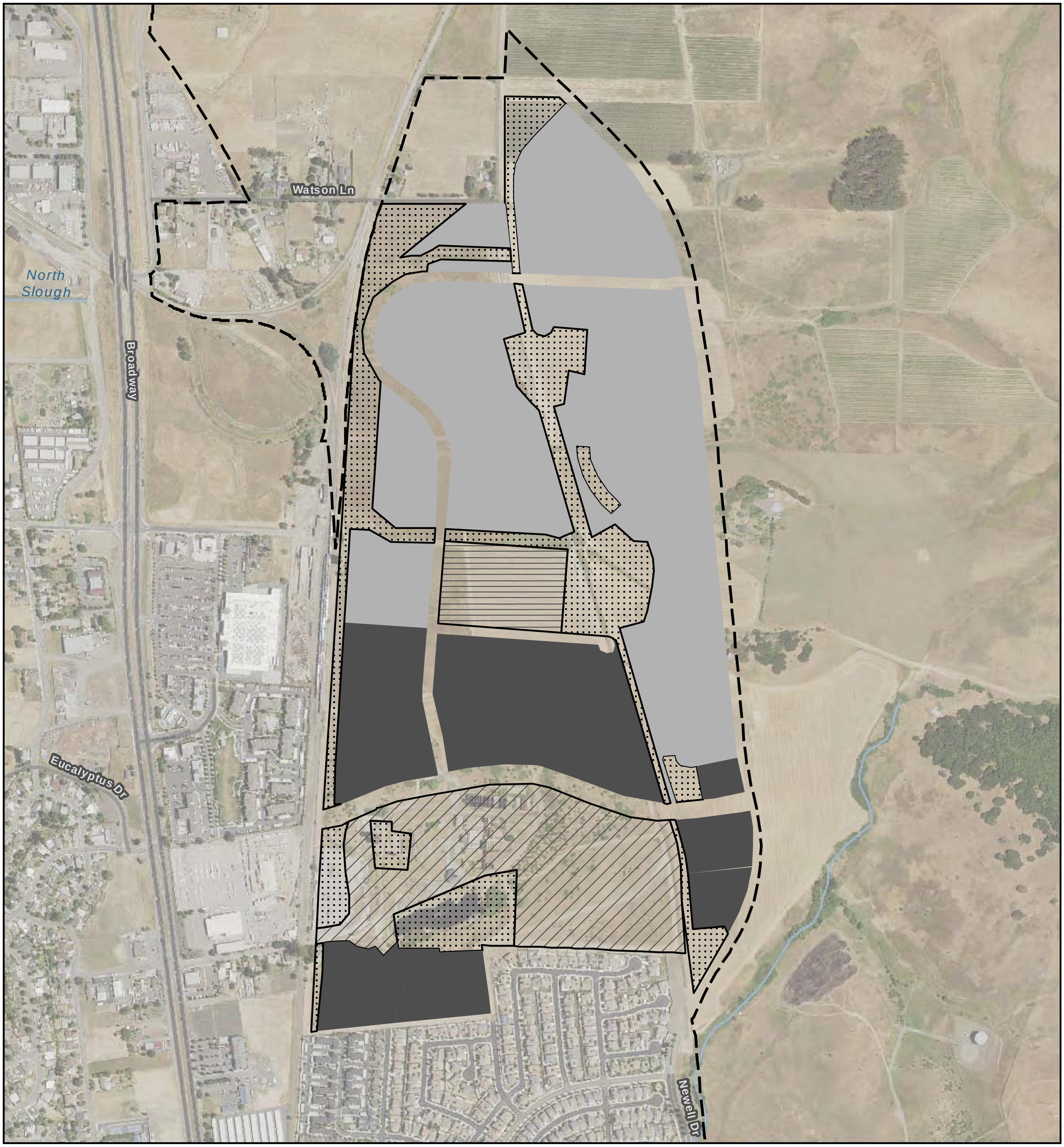
N:\US\Santa Rosa\Projects\02536 - American Canyon\02536-8411338 Master Plan Updates\08-GIS\Maps\Figures\Water\Master Plan\Final\Fig 4 - Utility Land Use Classifications.mxd

Data source: USDA, Imagery, 2014; County of Napa, Roads, 2015; GHD, PW System and Customers, 2015. Created by:afisher2



City Limits
Commercial
Institutional/Governmental
Landscape
Multi-Family
Single-Family

Source:
Watson Ranch Specific Plan - Administrative Draft, Nov 2014

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Feet
Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: NAD 1983 StatePlane California II FIPS 0402 Feet

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City of American Canyon
Potable Water Master Plan

Job Number 8411338
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Date 25 Apr 2016

Watson Ranch
Utility Land Use Classifications

Figure 5

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N:\US\Santa Rosa\Projects\02536 - American Canyon\02536-8411338 Master Plan Updates\08-GIS\Maps\Figures\Water\Master Plan\Final\Fig 5 - Watson Ranch Utility Land Use Classifications.mxd

Data source: USDA, Imagery, 2014; County of Napa, Roads, 2015; GHD, PW System and Customers, 2015. Created by:afisher2

4. Planning and Evaluation Criteria

4.1 Background

The City has conducted planning and evaluation of the potable water distribution system since its incorporation in 1992. In 1996, the City completed the *Water Distribution System Master Plan* and in 2003, the *Water System Master Plan* was prepared. Most recently, in July 2010, the City performed an analysis and calibration of the water model. Guidelines used in the planning and design of the water system facilities were developed in these previous studies and updated as necessary.

In addition, the City Public Works Department's *Engineering Standard Plans and Specifications for Public Improvements* (Standards), dated May 2005, include minimum design standards for water distribution facilities, particularly pipelines and their appurtenances, primarily for new development. In addition to details on new facility construction, the Standards set forth minimum criteria for fire flows and pressures. While the Standards adequately delineate guidelines for new construction to set minimum standards, they do not specifically address overall evaluation and performance of the distribution system similar to the work conducted in this master plan.

In order to perform the required hydraulic evaluation of the existing and buildout water system, conduct storage and pumping capacity evaluations and develop recommendations for the Capital Improvement Plan (CIP), it is necessary to identify the evaluation criteria that will enable identification of deficiencies and to judge the effectiveness of alternative improvements. Performance and evaluation criteria include:

- Water demand peaking factors for use in developing current and buildout water demands;
- Water system operating criteria for use in evaluating system hydraulic operation under various demand scenarios;
- Storage capacity goals;
- Pumping capacity goals; and
- System reliability goals.

4.2 Planning Criteria

Planning criteria establish the minimum design standards for infrastructure improvements in the potable water distribution system relating to the demands, storage requirements, pumping requirements and pipelines. Table 7 lists the planning criteria used for master planning the City's potable water system, which generally conform with previous master planning efforts and industry norms.

Table 7 Potable Water System Planning Criteria

Item	Criteria
Demand Scenarios	• Average day demand (ADD) – the average water demand for the year • Maximum day demand (MDD) – the daily demand representing the single highest demand day • Peak hour demand (PHD) – the highest hourly demand for the year, assumed to coincide with the MDD
Water Demand Peaking Factors	• Maximum day demand (MDD) = ADD x 2.0 • Peak hour demand (PHD) = MDD x 1.75
Fire flow/storage goals	• Main Zone: 3500 gpm for two hours for commercial and industrial land uses (420,000 gallons storage capacity) • 1500 gpm for two hours for residential land use (180,000 gallons storage capacity)
Storage capacity goals	• Storage capacity goal per zone is sum of operational, fire, and emergency storage volumes • Operational storage = 0.25 x MDD • Fire storage = 600,000 gallons • Emergency storage = 1.0 x MDD
Pumping capacity goals	• Pump station firm capacity is equal to maximum day demand pumped over 16 hour duration, with the largest pump out of service

4.2.1 Water Demand Peaking Factors

Water demand peaking factors represent the increase above the average annual demand experienced during a specified time period. The various peaking conditions are statistical concepts or numerical values obtained from a review of historical data and, at times, tempered by engineering judgment. The following peaking conditions are of particular significance to the hydraulic analysis of the water system.

Average Day Demand

The Average Day Demand (ADD) is the average demand for the entire year, and is generally calculated by dividing the total annual demand by 365 days.

Maximum Day Demand

The maximum day demand (MDD) represents the highest daily demand for the entire year. A water system is usually evaluated under maximum day demand conditions or maximum day demand plus fire flow conditions. This condition allows the system to be stressed at a higher demand rate to ascertain if supply sources and pipeline carrying capacities are adequate. Hydraulic evaluation under maximum day plus fire flow demand conditions represents a reasonable “worst case” scenario of system operation.

The MDD/ADD peaking factor is used in the hydraulic evaluation to increase the base average demands to represent the maximum day demand scenario. Maximum day to average day demand peaking factors generally range from 1.2 to 2.5 per American Water Works Association (AWWA) guidelines. The 2003 and 1996 water system master plans utilized a MDD/ADD peaking factor of

2.0. Based on a review of the available water meter records, a MDD/ADD peaking factor of 2.0 will be utilized in this master plan update as well.

Peak Hour Demand

The peak hour demand (PHD) represents the highest hourly demand on the entire system, and approximates the highest flow rate expected on the hottest day of the year. Peak hour demand usually occurs in the morning or evening peak demand periods. PHD is typically used to evaluate maximum flow velocities in the distribution piping and low pressure areas.

Actual operational data is not available to determine the peak hour to maximum day demand peaking factor for the water system. Peak hour to maximum day demand peaking factors generally range from 1.3 to 2.0 per AWWA guidelines. Based on review of available records and comparison with other similar water systems, the peak hour to maximum day demand peaking factor is estimated to be 1.75. The 2003 and 1996 master plans utilized a PHD/MDD peaking factor or 1.75, which equates to a PHD/ADD peaking factor of 3.5.

4.2.2 Storage Facilities

Storage capacity goals for each zone consist of three components:

- Operational storage volume
- Fire storage volume
- Emergency storage volume

The sum of these three components is the total storage capacity for the specific pressure zone. The total storage capacity goal is compared to the existing storage capacity to determine if a surplus or deficit exists within the zone. Water storage capacity provides for gravity supply of demands if the pump station is off-line or out of service.

Operational Storage Volume

Operational storage volume is the amount of storage capacity in a system to absorb fluctuations of demand versus supply. Ideally, water supply sources are sized to provide the maximum day demand, with gravity storage capacity delivering the remainder during peak demand periods. With adequate operational storage capacity, system pressures are stabilized and adequate storage capacity can be provided for fire and emergency use. AWWA guidelines specify operational storage capacity is assumed to be 25 percent of the maximum day demand for each pressure zone. Based on the previous master plan reports and AWWA guidelines, the operational storage capacity goal is assumed to be 25% of MDD.

Fire Storage Volume

Fire storage volume is provided for fire-fighting purposes to allow gravity flow in the event the source flow is interrupted. Fire storage volumes vary and are based on the specified fire flow rate for a specified duration based on the type of building construction and land use. These are normally based on the requirements of the local Fire Marshall and Insurance Services Office (ISO) requirements. The American Canyon Fire Protection District references the National Fire Protection Association (NFPA) 2007 Fire Code for requirements.

As stated in Table 7, the Standards require minimum fire flows at all hydrants of 1,500 gpm with a 20 psi residual pressure for residential and commercial and industrial areas, the required minimum fire flow is 3,500 gpm with a 20 psi residual pressure (or as approved by the Fire Marshall). These fire flow rates will be incorporated into the hydraulic modeling evaluation to determine the system's ability to meet fire demands.

Given the representative land uses throughout the City's water distribution system, the assumed fire flow requirement for the Main Zone (Zone 1) is 3,500 gpm for two hours, or 420,000 gallons.

Emergency Storage Volume

Emergency storage volume is the storage volume available to meet demands during emergency situations such as pipeline failures, major trunk main failures, pump failures, electrical power outages or other natural disasters. The volume of water allocated for emergency use is determined by historical record of emergencies experienced and by the amount of time which is expected to lapse before the emergency can be corrected. The amount of emergency storage volume included within a particular water system is based on an assessment of risk and the desired degree of system reliability. In California, emergency storage volumes range from 25 percent of average day demand to over 100 percent of maximum day demand. The lower criterion would apply to systems with a single pressure zone, adequate and reliable water supply sources (usually with emergency power), and redundant sources. If some, or all, of these criteria do not apply, it is appropriate to use a higher figure.

Based on previous master plan reports and current analysis of industry standards, it is recommended that emergency storage capacity criteria be one maximum day demand for the Main Zone. Other new and existing pressure zones will be evaluated individually.

4.2.3 Pumping Facilities

The following criterion applies to the City's pumping facilities:

- Firm Capacity: maximum day demand for zone served, over 16-hour window to account for outages and maintenance; firm capacity to be measured with largest pump out of service
- No. of pumps: two duty, one standby

Firefighting capabilities are not designed into the pump stations, but rather are provided either by zonal storage capacity or via a separate external source connection. Standard design practice is to have at least two duty pumps at each booster pump station. Additional reliability is designed into the design criteria which limit pumping capacity to a 16-hour window in order to account for outages, mechanical problems and issues of this nature. Although standby power is not required at each station, it may be desirable to consider provisions for emergency standby power.

4.3 Evaluation Criteria

Evaluation criteria set the minimum conditions that must be met when the potable water system is operating and includes system pressures, flow velocities, headloss and pipeline sizing. Table 8 lists the evaluation criteria established for the City's potable water system.

Table 8 Potable Water System Evaluation Criteria

Item	Criteria
Minimum pressure	• 35 psi under ADD, MDD and PHD • 20 psi at fire hydrant under fire flow event
Maximum allowable pressure	• 80 psi under MDD (services with greater static pressure require a pressure regulator)
Maximum pipeline velocity	• 4 to 7 fps target under ADD or MDD • 7 fps under PHD • 10 fps under fire demand
Maximum pipeline head loss	• 10 feet per 1000 feet under PHD or MDD + fire flow
Minimum pipeline sizing	• 8-inches for residential installations • 12-inches for commercial/industrial installations

4.3.1 Distribution System Pressures

Per the Standards, the maximum allowable main line pressure as measured at a hydrant and at a faucet is 80 psi. The minimum allowable pressure as measured at a faucet is 35 psi, to be measured from the top floor of a multi-story structure. Pressure regulators are required on all services that exceed 80 psi.

Therefore, the hydraulic modeling evaluation will utilize the following pressure criteria to determine system adequacy:

- Maximum pressure at all times = 80 psi
- Minimum pressure at ADD, MDD and PHD = 35 psi
- Minimum pressure at fire hydrant during fire event = 20 psi
- It should be noted that where developments are proposed with multi-story buildings, the minimum pressure in the City's main should be 35 psi plus the height of the highest fixture above street level.

4.3.2 Pipeline Flow, Velocity and Headloss

Distribution system pipelines are generally sized to carry the greater of the peak hour demand or the maximum day demand plus fire flow.

Other criteria related to the distribution system piping include maximum and minimum velocity and the maximum allowable friction head loss. These guidelines are established to aid in appropriately sizing and locating water distribution system improvements. The Standards do not specifically address minimum or maximum velocity. However, previous master plan reports have assumed a normal range of operating velocity between 4 and 7 feet per second (fps), with a maximum of 7 fps at PHD and 10 fps during MDD+FF. There is no minimum velocity requirement in water system design, except that stagnant flow in dead ends is discouraged as water quality suffers.

As long as the maximum velocity and pressure criteria are not violated, high head loss by itself is not an important factor. However, a pipe segment with high head loss may serve as a warning that the pipe is nearing the limit of its carrying capacity and may not have excess capacity to perform under stringent conditions. It is normally good practice to limit head loss to no greater than 10 feet per 1,000 feet under PHD or MDD+FF conditions per industry standards. Under similar industry standards, head loss should be limited to approximately 3 feet per 1,000 feet under ADD conditions. For this master planning effort PHD has been used to identify pipes with limited carrying capacity. Fire flow analyses are performed as needed and directed by the City using the model prepared.

4.3.3 Distribution System Pipelines

The Standards require the following minimum pipe sizes for new facilities:

- Water mains must be sized to meet minimum NFPA Fire Code requirements.
- For residential areas, mains shall be a minimum of 8-inches diameter.
- For commercial and industrial areas, mains shall be a minimum of 12-inches diameter and looped.

Any proposed new or replacement pipelines identified by the distribution system hydraulic analysis or for system improvement will adhere to these guidelines.

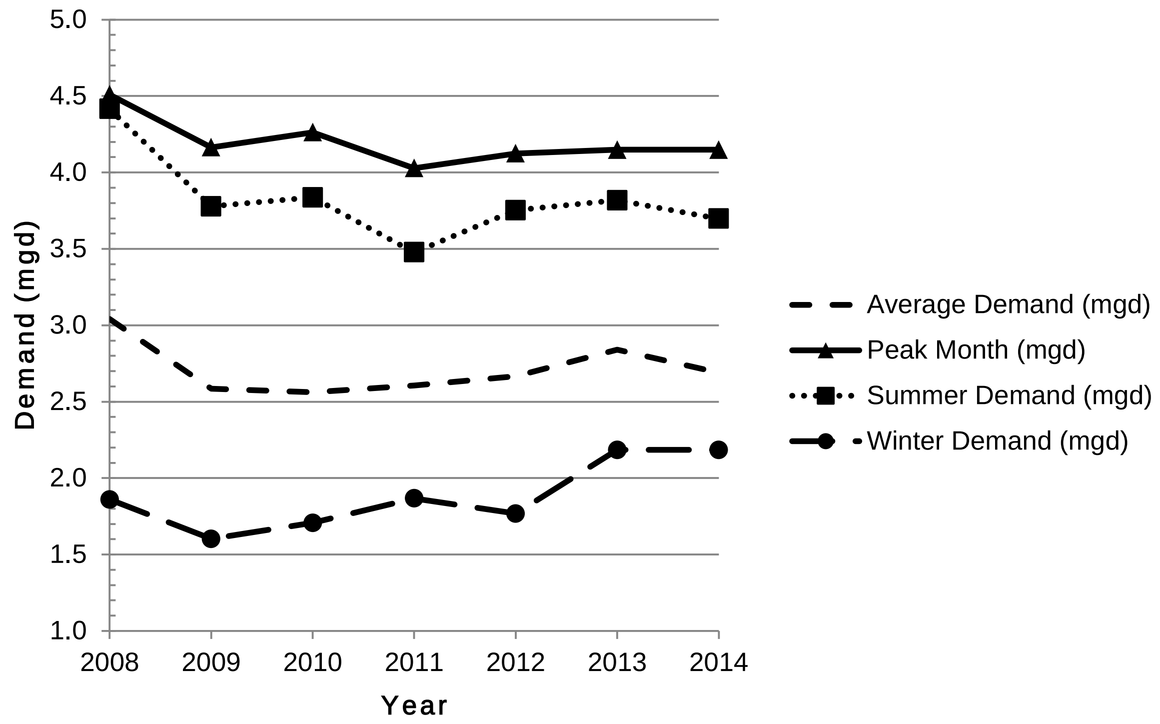
The distribution system should be adequately looped to minimize dead ends and promote good water circulation. Ideally, there should be at least two paths for water delivery at all locations in the system. Looping is especially important for those areas that do not have storage facilities in the immediate vicinity.

Isolation valves should be located to allow shutdown of pipe segments for routine maintenance and emergency repairs to impact the fewest customers. The City Standards call for isolation valves no farther than 1,000 feet apart.

5. Potable Water Demands

5.1 Methodology

Water billing records for the period January 2008 through July 2014 were reviewed for average and seasonal consumption trends, which are displayed in Figure 6. Winter demands represent the months of December, January and February, while summer demands represent the months of July, August and September. The peak month for each year was August. The City's population has not increased significantly since 2008/2009 and the average demand has remained fairly steady over this period. Potable water demands for the master plan are therefore based on actual billing records for the period August 2013 through July 2014 to capture the latest population and conservation trends as they relate to potable water demands.



NOTE: Data points for 2014 are for the 12-month period from August 2013 through July 2014.

Figure 6 Historical Recycled Water Usage in American Canyon

The billing data provided includes meter identifiers, parcel numbers, descriptions, and geocodes for each City meter. This information was entered into GIS and spatially distributed. Where parcels that are clearly developed were not assigned to a meter, the most logical meter was selected and entered into the data set. The utility land use classifications were also mapped into GIS based on the City's most recent Land Use Map. By overlaying the map of the utility land use categories with the meters assigned to parcels, potable water demands could be developed by meter, by parcel and by utility land use classification.

For the existing conditions scenario, average day demands (ADD) were assigned to the nearest nodes in the hydraulic model. Unaccounted for water was distributed proportionally to ADD at each node and for modeling purposes, is represented as a second demand. Global peaking factors are then applied to the ADD to generate maximum day demands (MDD) and peak hour demands (PHD) for each node in the model.

For the General Plan buildout scenario, the existing potable water demands are updated to account for planned development projects, anticipated conversion of potable water demands to recycled water demands, and buildout of undeveloped parcels in accordance with the City's zoning map. Development projects in the planning and approval phase as of December 2014 were identified by the City including estimated water demands for each project. Potable offsets from an expanded recycled water system are identified in the City's *Recycled Water System Master Plan (2016)* prepared concurrently with this master plan. Potable water demands are modified accordingly to incorporate the new demands from development and the offsets from an expanded recycled water system. Potable demands for undeveloped parcels are projected based on unit demand factors estimated from average water demands by utility land use category and after accounting for an expanded recycled water system. In aggregate, these modified demands represent the buildout scenario.

5.2 Existing Potable Water Demands

Based on actual billing records from August 2013 through July 2014, the City's total potable water production, purchases and demands for the existing conditions scenario are presented in Table 9. The difference between the metered demands and the water produced/purchased is denoted as "unaccounted for water".

Table 9 Existing Water Production vs. Demands

Description	Average Flow (mgd)
Water Produced and Purchased	3.15
Unaccounted For Water	0.55
Average Day Demand (ADD)	2.60

The average day demand shown in Table 9 does not account for meters that were in use for only a portion of the time period recorded. For the purposes of master planning, all meter readings were therefore adjusted to reflect the average daily demand for the days when the meters were in use and this is the basis for demand data presented. Also, it is important to note that the existing demands include parcels that only have potable water service, and parcels that receive both potable and recycled water service, and therefore the total potable water use can vary depending on the availability of recycled water service.

The existing ADD by utility land use category is provided in Table 10 and presented on a "per acre" basis. These demands are for potable water only and do not include recycled water demands that may be used by the same customer set. They represent the average of the ADD per acre for each parcel within each utility land use category.

Table 10 Existing Average Day Demands (ADD) by Utility Land Use Classification

Utility Land Use Classification	Total Parcels with Demands (acres)	ADD (gpd/acre)
Single-family	869	1,815
Multi-family	92	2,550
Commercial	138	1,444
Industrial 1.	1,452	699
Institutional/Governmental	374	1,010
Landscape	66	1,575
Open Space	-	-
Watson Ranch 2.	11	70
Recreational	-	-
Agricultural 3.	241	2

1. The three largest Industrial accounts are Coca Cola, Mezzetta and Wallaby Yogurt. After excluding these three accounts Industrial ADD would be 460 gpd/acre.
2. Includes existing residence on two of the Watson Ranch parcels.
3. Includes the residence and landscaping on the Green Island Vineyard parcel, but not the vineyards, which are irrigated with recycled water.

The City has identified a trend with demands from residential subdivisions where newer neighborhoods use more water per dwelling unit than older neighborhoods. Six newer neighborhoods are identified to compare water demands in these locations to the average of the older neighborhoods. Results are presented in Table 11.

Table 11 Comparison of Demands in Newer vs. Older Neighborhoods

Residential Neighborhood (SF)	ADD (gpd/meter)	ADD (gpd/acre)
Vintage Ranch	421	2,290
Waterton	366	1,652
The Preserve II	366	1,979
Montevino	363	1,566
La Vigne	337	2,079
America	333	1,715
Average Newer Neighborhoods	364	1,880
Average Older Neighborhoods	263	1,518

On average, single family homes in newer neighborhoods used 39 percent more water (ADD) than single family homes in older neighborhoods, for the time period studied. The City has noted that some older homes lack irrigation systems and the newer homes are larger than the older homes and can accommodate larger and/or multi-generational families. The City has adopted new conditions for approval of development that will result in water consumption rates in future developments to be more in line with the older neighborhoods (266 gpd/unit).

5.3 Future Potable Water Demands

Future demands are based on planned development projects, anticipated conversion of potable water demands to recycled water demands, and buildout of undeveloped parcels in accordance with the City's zoning map. Anticipated development includes the Montalcino Resort, completion of the Watson Ranch and Napa Valley Ruins & Gardens project, buildout of the Highway 29 Priority Development Area, completion of known development projects currently in the planning and approval process, and buildout of undeveloped parcels. Future demands are estimated by using unit demand factors that are derived from existing demands by utility land use classification, adjusted to account for recycled water demands, and modified as appropriate to reflect water conservation measures put into effect by the City. Figures 7 - 9 show the locations of the projects and parcels contributing to future water demands.

5.3.1 Unit Demands by Utility Land Use Classification

- Unit demand factors for future development are presented in Table 12 and represent total water use (potable and recycled water). These demand factors are applied in all cases of new development except for development projects in the planning and approval stages, where projected demands have already been established with the City. In cases where recycled water is available the indoor use demand would apply to potable water, and the maximum irrigation demand would apply to recycled water. Single Family demands include irrigation demands and recycled water will not be used at private residences. Where developments have access to recycled water the demand factors presented in Table 12 should be reduced to account for the use of recycled water as appropriate.

Table 12 Unit Demand Factors for Future Development (Total Water Use)

Utility Land Use Classification	ADD (gpd/unit)	ADD (gpd/acre)	ADD Indoor Use (gpd/acre)	Max Month Irrigation (gpd/acre)
Single-Family [1.]	266	1,680	1,415	530
Multi-Family [2.]	160	3,965	2,800	2,330
Commercial [3.]	-	1,445	900	1,075
Industrial [4.]	-	650	370	530
Institutional/Governmental [5.]	-	1,010	170	1,615
Landscape [6.]	-	1,575	-	3,570
Open Space [7.]	-	-	-	-
Watson Ranch [8.]	-	-	-	-
Recreation [9.]	-	1,575	-	3,570
Agriculture [10.]	-	-	-	-

1. Unit demands are based on City's building requirements and are consistent with Watson Ranch Specific Plan – Admin Draft, Nov 2014.
2. Unit demands are based on City's building requirements and are consistent with Watson Ranch Specific Plan – Admin Draft, Nov 2014.
3. Unit demands are based on average of existing demands for ADD including recycled water used for irrigation.
4. ADD per City zoning ordinance. Indoor use based on average existing indoor use, and maximum irrigation includes process water.
5. ADD and indoor use are based on average of existing demands including recycled water used for irrigation.
6. ADD based on average of existing demands including recycled water.
7. Open Space does not receive any water.
8. Watson Ranch demands are per the *Watson Ranch Specific Plan – Administrative Draft*, Nov 2014.
9. Parcels designated as Recreation are assumed to have similar demands as Landscaping.
10. Agricultural parcels will not receive potable water.

- Unit demand factors are applied on a per acre basis to undeveloped parcels based on utility land use classifications. For projects with a proposed specific number of Single Family or Multi-Family dwelling units, the unit demands are applied on a per unit basis. ***Where irrigation demand is met with recycled water, the indoor use unit factor is used to estimate potable water demand; this would not apply to Single Family units since recycled water will not be used for this land use classification.***

5.3.2 Watson Ranch

Watson Ranch is a mixed-use project which consists of approximately 300 acres east of the railroad tracks, north of Vintage Ranch and south of Watson Lane, as shown in Figure 7. Future potable water demands for this development were estimated using information provided by the City and the *Watson Ranch Specific Plan – Administrative Draft (Nov 2014)* as a guideline. Recycled water will be used for irrigation and is not included with the demands presented below; these demands are included in the RWMP. Table 13 provides a summary of the estimated potable water ADD by utility land use classification.

Table 13 Estimated Potable Water ADD for Watson Ranch

Utility Land Use Classification	Units	Acres	ADD (gpd)	ADD (gpd/acre)
Single-Family	1,030	163	273,980	1,680
Multi-Family	223	9	35,680	3,965
Commercial	-	37	22,821	617
Institutional/Governmental	-	10	3,600	360
Total			**336,081**	

The estimated ADD presented in Table 13 assumes that irrigation demand for single family homes would be met with potable water and all other irrigation demands would be met with recycled water, which accounts for the difference in ADD between Tables 12 and 13. Estimated ADD was assigned to parcels for the model based on percent of total area for the project.

5.3.3 Highway 29 Priority Development Area (PDA)

The Highway 20 Priority Development Area (PDA) consists of development along the Highway 29 Commercial Corridor, as shown in Figure 7. Future development within the PDA was estimated by identifying undeveloped parcels and then calculating ADD for those parcels based on utility land use classification and corresponding unit demand factors from Table 12. A summary of existing and future demands for the PDA is provided in Table 14. The future ADD is for potable water only and assumes the use of recycled water for irrigation on parcels where recycled water will be available. Also, developments that have already been conditioned use potable demands provided by the City rather than unit demand factors.

Table 14 Estimated Potable Water ADD for Highway 29 PDA

Utility Land Use Classification	Existing Demand		Future Demand	
	Acres	ADD (gpd)	Acres	ADD (gpd)
Multi-Family	8	3,899	10	34,686
Commercial	108	102,815	35	36,394
Industrial	14	70	9	5,056
Institutional/Governmental	7	496	8	2,648
Landscape	14	2,203	4	6,458
Total	**151**	**109,483**	**66**	**85,242**

5.3.4 Other Known Development Projects

The City provided estimated future demands for several known development projects currently in the planning and approval stage. These projects are shown in Figure 8 and the estimated ADD as of December 2014 is presented in Table 15.

Table 15 Estimated Potable Water ADD for Other Known Projects

Other Known Development Projects	Acres	ADD (gpd)
Napa Logistics I & II	218	35,178
Napa Junction III (A-C)	17	32,967
Village at Vintage Ranch	8	30,620
Napa Airport Corporate Center	49	4,700
Napa Valley Gateway Park	7	22,000
Napa Junction I & II RW Conversion [1.]	39	(27,390)
Canyon Estates	70	12,000
Valley View Senior Housing [2.]	3	17,700
255/256 Lombard Road	19	580
Montalcino Resort	300	60,670
Total		

1. Convert irrigation demand from potable water to recycled water.

2. Estimated based on 3 acres of Multi-Family demand.

5.3.5 Undeveloped Parcels

Undeveloped parcels as of July 2014 that are not otherwise included in another development project were assumed to be developed for the buildout scenario. For these parcels, the acreage was multiplied by the unit demand factor for the appropriate utility land use classification in order to estimate the ADD. Where recycled water will be available, the ADD was adjusted downward to exclude irrigation demand. Table 16 presents the estimated ADD for undeveloped parcels by utility land use classification. Three industrial parcels were estimated to be partially developed, and so the future demand was adjusted to account for this.

Table 16 Estimated Potable Water ADD for Undeveloped Parcels

Undeveloped Parcels	Acres	ADD (gpd)
Single Family	54	91,039
Industrial	793	448,320
Watson Lane Annexation [1.]	11	12,427
Total	**858**	**551,786**

1. Two parcels at north end of Watson Ranch are not included in the Specific Plan.

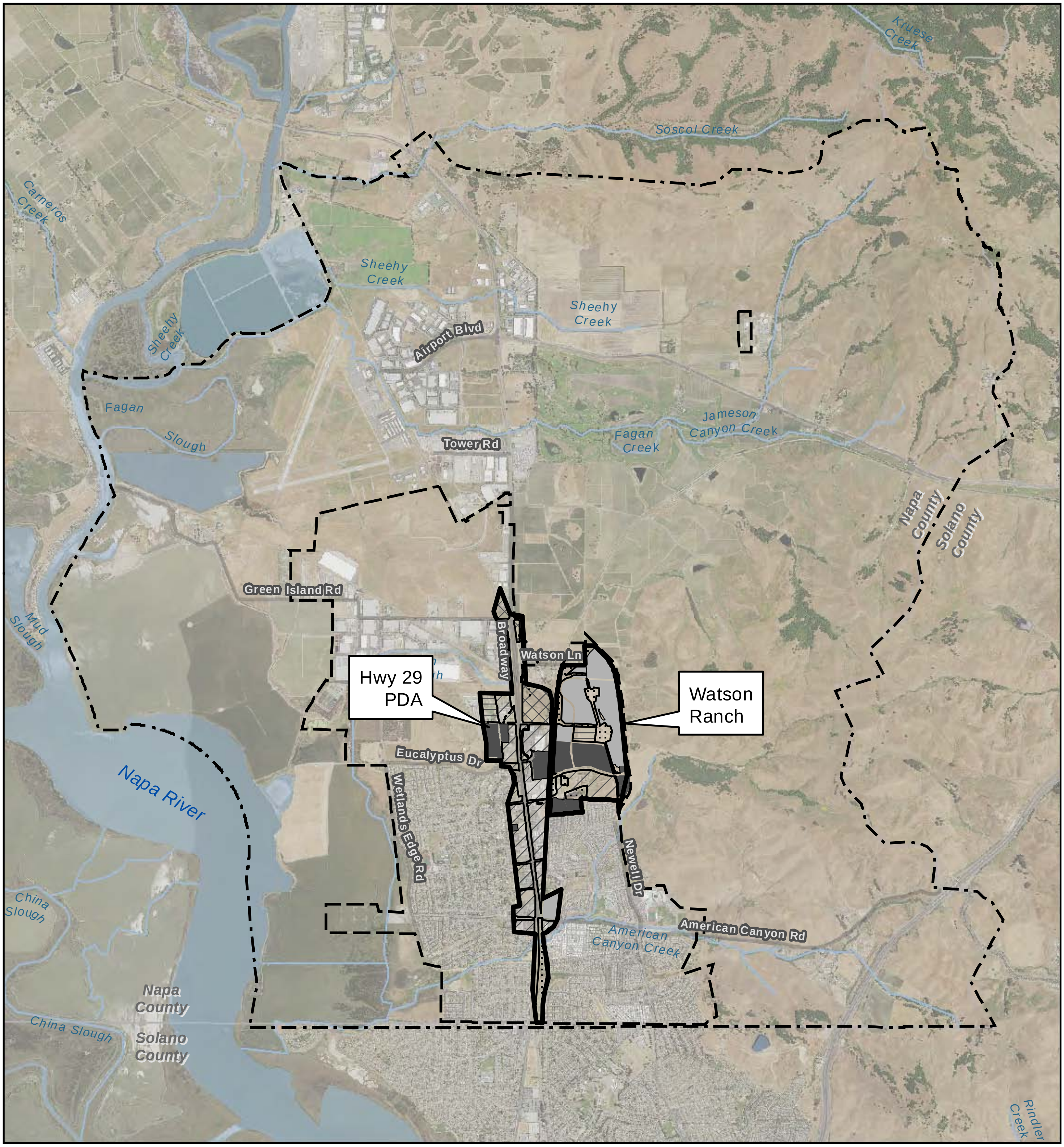
5.4 Summary of Potable Water Demands

A summary of the existing and buildout potable water demands is presented in Table 17. According to the UWMP the population of the City under buildout conditions will be 30,426. This equates to a per capita demand of 124 gpd ADD without including unaccounted for water losses or recycled water demands.

Table 17 Summary of Potable Water Demands

Utility Land Use Classification	Existing Demands		Buildout Demands	
	Acres Served	ADD (gpd) [1.]	Acres Served	ADD (gpd) [1.]
Single-Family	869	1,435,814	965	1,509,838
Multi-Family	92	121,407	135	228,242
Commercial	138	183,139	174	189,807
Industrial	1,452	923,090	2,229	1,434,714
Institutional/Governmental	374	85,924	368	47,330
Landscape	66	62,033	48	39,084
Open Space	0	0	0	0
Watson Ranch	11	435	302	336,081
Recreation	0	0	0	0
Agricultural	241	432	241	432
Total	**3,243**	**2,812,274**	**4,462**	**3,785,528**

1. Demands adjusted to ADD for days meters were in operation.



City Limits
Water Service Boundary
Commercial
Industrial
Institutional/Governmental
Landscape
Multi-Family
Single-Family

Paper Size 8.5" x 11" (ANSI A)
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Feet
Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: NAD 1983 StatePlane California II FIPS 0402 Feet

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GHD

City of American Canyon

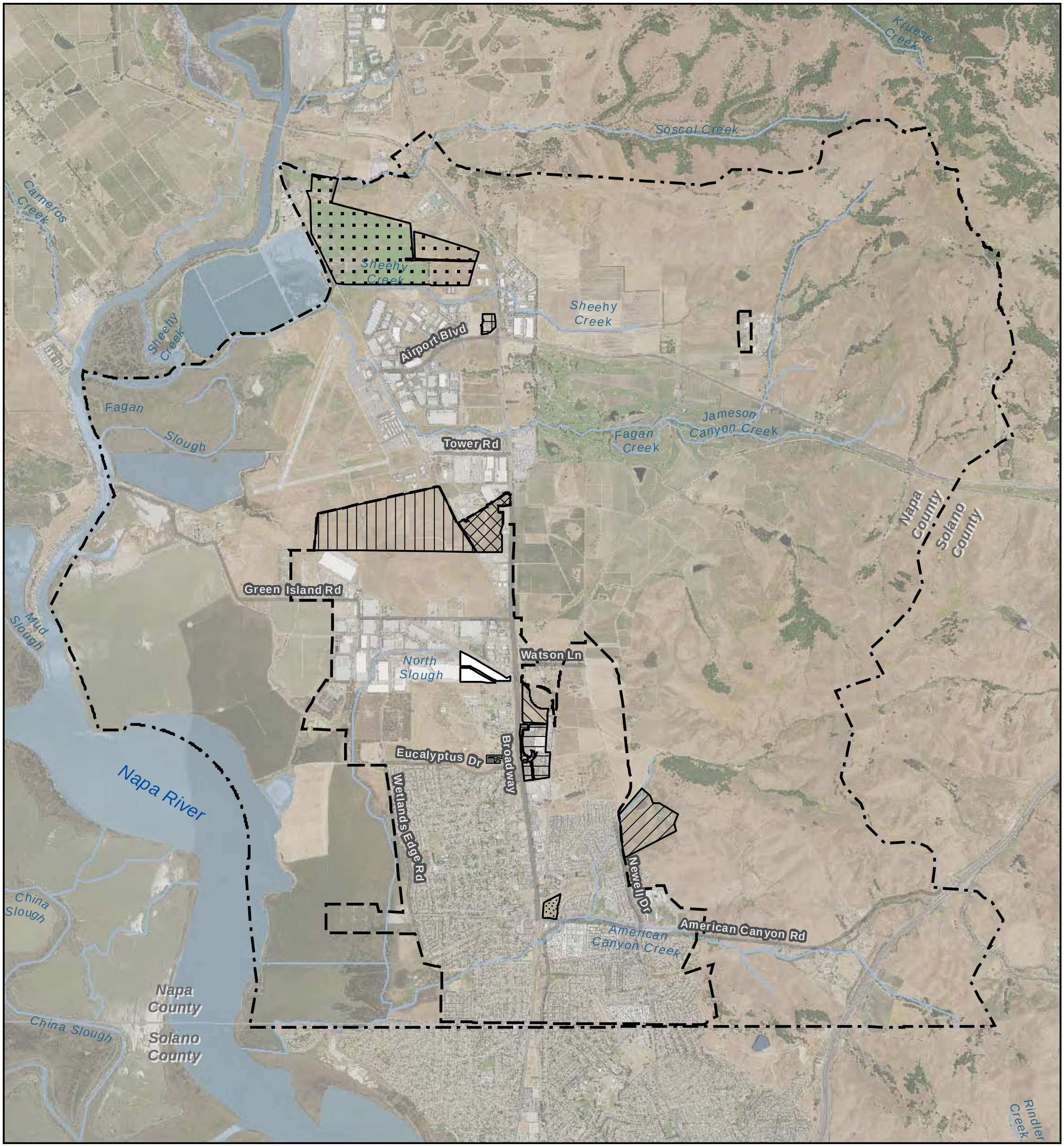
City of American Canyon
Potable Water Master Plan

Watson Ranch and PDA Developments

Job Number 8411338
Revision 2
Date 25 Apr 2016

Figure 7

Data source: USDA, Imagery, 2014; County of Napa, Roads, 2015; GHD, PW System and Customers, 2015. Created by:afisher2



City Limits	Canyon Estates	Napa Logistics I & II
Water Service Boundary	Napa Airport Corporate Center	Napa Valley Gateway (various undeveloped parcels)
Montalcino	Napa Junction I & II	Valley View
255/256 Lombard	Napa Junction III	Village at Vintage Ranch

Paper Size 8.5" x 11" (ANSI A)

0 2,500 5,000

Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: NAD 1983 StatePlane California II FIPS 0402 Feet

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GHD

City of American Canyon
Potable Water Master Plan

Job Number 8411338
Revision 2
Date 29 Apr 2016

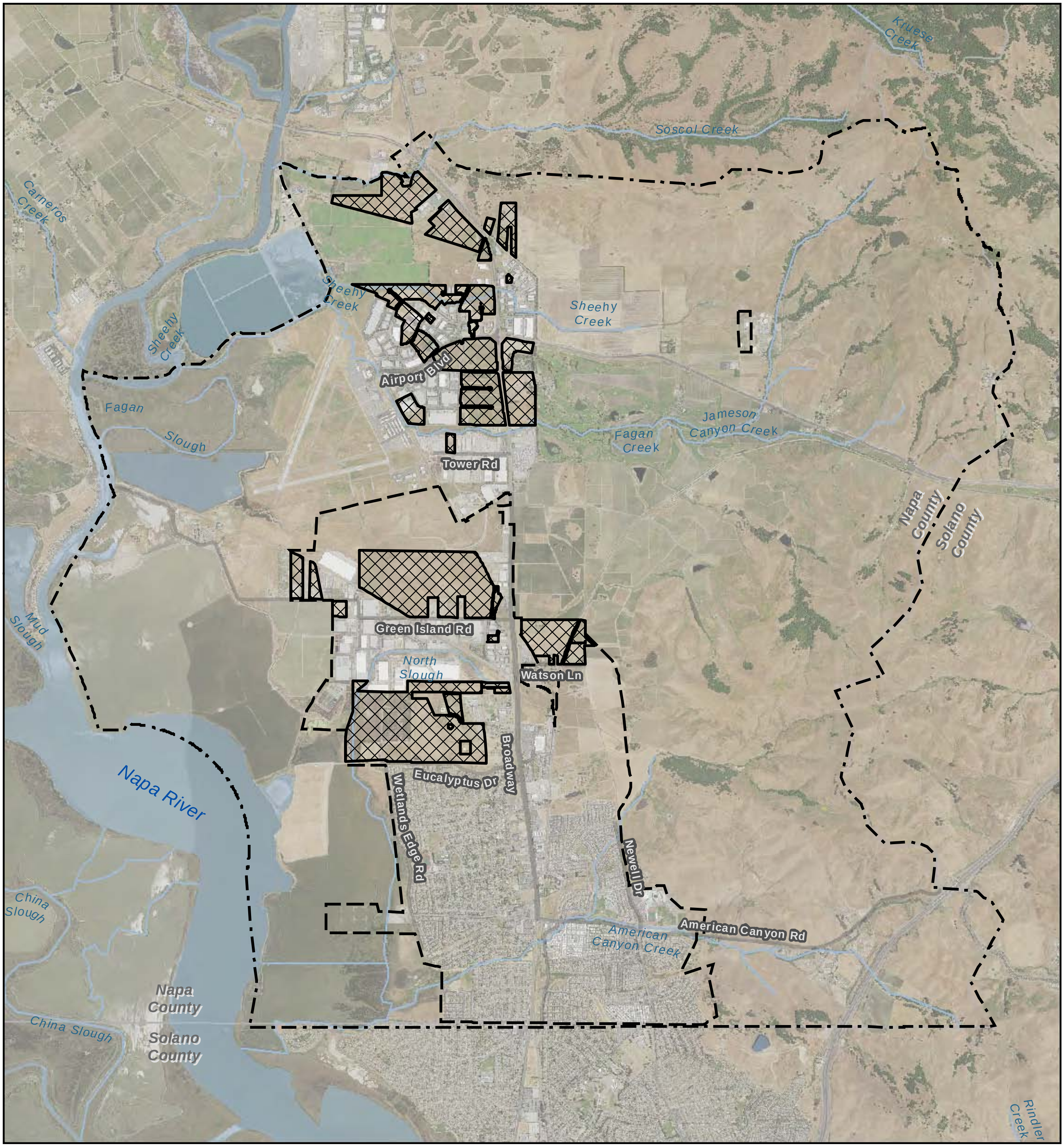
Other Known Development Projects

Figure 8

2235 Mercury Way Suite 150 Santa Rosa CA 95407 USA T 707 523 1010 F 707 527 8679 E santarosa@ghd.com W www.ghd.com

N:\US\Santa Rosa\Projects\02536 - American Canyon\02536-8411338 Master Plan Updates\08-GIS\Maps\Figures\Water\Master Plan\Final\Fig 8 - Other Known Development Projects.mxd

Data source: USDA, Imagery, 2014; County of Napa, Roads, 2015; GHD, PW System and Customers, 2015. Created by:afisher2



City Limits

Water Service Boundary

Undeveloped Parcels

Paper Size 8.5" x 11" (ANSI A)

0 2,500 5,000

Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: NAD 1983 StatePlane California II FIPS 0402 Feet

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GHD

City of American Canyon

City of American Canyon
Potable Water Master Plan

Job Number 8411338
Revision 2
Date 29 Apr 2016

Undeveloped Parcels

Figure 9

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N:\US\Santa Rosa\Projects\02536 - American Canyon\02536-8411338 Master Plan Updates\08-GIS\Maps\Figures\Water\Master Plan\Final\Fig 9 - Undeveloped Parcels.mxd

Data source: USDA, Imagery, 2014; County of Napa, Roads, 2015; GHD, PW System and Customers, 2015. Created by:afisher2

6. Hydraulic Evaluation

A hydraulic model of the City's potable water system was utilized for this master plan to evaluate the existing and proposed buildout conditions. The hydraulic evaluation identifies existing deficiencies that must be addressed for the existing system and future expansion needs to accommodate planned growth.

6.1 System Description

The City provides treated water to its customers by treating raw surface water delivered from the State Water Project via the North Bay Aqueduct (NBA) to its Water Treatment Plant (WTP) located near Highway 12 on Kirkland Ranch Road. The WTP has a maximum capacity of 5.5 million gallons per day (mgd) with an average daily demand of approximately 3 mgd. Treated water is delivered by gravity to the 2.5 mg water storage tank located at the plant, and flows from the tank to the distribution system. Additionally, the City receives treated water from the cities of Vallejo and Napa through four interconnections. The Montevino and American Canyon High School interconnections serve domestic and fire flow demands; while the La Vigne and Napa interconnections provide demands during fire flow conditions only.

The potable water distribution system consists of approximately 82 miles of water mains, three storage tanks, two booster pump stations, 831 fire hydrants and 2,080 valves. The principal water transmission mains in the distribution system range in size from 14 to 20-inches. The distribution system in the older sections of the City range in size from 2 to 6 inches with the newer areas served by pipes 8 to 12 inches in diameter. Distribution system pipelines are constructed primarily of PVC, asbestos cement, and cast iron. The water distribution system currently contains five pressure zones: Main (Zone 1), Oat Hill #2 (Zone 2), Kirkland (Zone 3), Montevino (Zone 4), La Vigne and the American Canyon High School (Zone 5).

The distribution system facilities for the American Canyon potable water system are described in this section. The distribution system piping and major facilities are shown in figures included in Appendix A and a schematic of the water system is shown in Figure 10.

6.1.1 Potable Water Supply

The City obtains its potable water supply from three sources: 1) raw water from the State Water Project, via the North Bay Aqueduct, through a contract with the Napa County Flood Control and Water Conservation District (NCFCWCD); 2) treated water from the City of Vallejo; and 3) treated water from the City of Napa.

The primary water source is the North Bay Aqueduct. The NCFCWCD delivers raw untreated water from the State Water Project to the cities of Napa, American Canyon, Calistoga and the Town of Yountville. The historical and projected City of American Canyon water entitlements from the NBA are shown in Table 18. The City is currently entitled to receive 5,200 acre-feet per year (afy) of raw water from the NBA, although it is rare to receive one's full allotment from the State Water Project in any given year.

Table 18 North Bay Aqueduct Water Entitlements

Year	Entitlement (afy)
2007	4,800
2008	4,850
2009	4,900
2010	5,200
2011 to 2025	5,200

The City owns and operates the WTP located near Highway 12 and Kirkland Ranch Road, which treats the raw surface water from the NBA. The plant consists of two separate facilities. The original plant was constructed in 1976, and is a 2.6 mgd conventional treatment plant, consisting of coagulation, flocculation, sedimentation, dual media gravity filtration, chlorination and corrosion control treatment. The City later constructed a 3.0 mgd Zenon ultrafiltration membrane plant, consisting of coagulation, flocculation, membrane filtration, chlorination and corrosion control treatment. The combined treated water from both plants is delivered by gravity to the 2.5 million gallon water storage tank located at the plant, and flows from the tank to the distribution system.

It is preferable to have more than one source of water supply for a water system to provide flexibility should one source be unavailable. While the primary water supply source for the City water system is raw water from the NBA through a contract with the NCFCWCD, the system does have four separate connections to neighboring water sources for emergency backup supply: three interconnections with the City of Vallejo and a single interconnection with the City of Napa.

The City's initial 1995 contract for delivery of treated water from Vallejo was for a maximum daily capacity of 1.0 mgd (capped at 18 million gallons per month). The current maximum allotment from Vallejo is 2,075 afy, and is scheduled to increase in subsequent years to 2,641 afy by 2016 and 3,207 afy by 2021, which is the maximum allotment allowed.

The details of the four current interconnections with the City of Vallejo and the City of Napa are summarized below:

Montevino Interconnection

The Vallejo Montevino Interconnection consists of an 8-inch pipeline in Condor Court. This interconnection serves domestic and fire flows to approximately 65 residential customers at the higher elevations along Highridge Drive along the southern border of the City, east of Highway 29. The Montevino area is separated from the main distribution system by a normally closed valve in Highridge Drive, just west of Hillcrest Court. Demands are served directly off the Vallejo system, and there are no flow monitoring or flow control facilities at this connection.

La Vigne Interconnection

The Vallejo LaVigne Interconnection consists of a 12-inch diameter pipeline connecting to the Vallejo 14-inch transmission main along Flosden Road near the southern intersection of Via Bellagio. The valve will open when the surrounding area pressure drops below a preset low pressure. A flow meter is installed at the interconnection piping. The area is separated from the main distribution system by normally closed valves in two locations at Via Bellagio and Flosden Road. Flows are monitored at the connection. This interconnection is also referred to as the Vallejo Bypass.

American Canyon High School Interconnection

The Vallejo American Canyon High School Interconnection consists of a 12-inch diameter pipeline connecting to the Vallejo 14-inch transmission main along Newell Drive at the intersection of Silver Oak Trail. It was installed in 2010 to serve the new high school until the new higher pressure zone storage tank and pipeline could be put into service by the City. As of the date of this master plan update, the upper zone facilities have not been constructed and the interconnection agreement will continue to remain in place. Flows are monitored at the connection.

City of Napa Interconnection

The City of Napa Interconnection is located at the north end of the water service area, near the airport, and north of the intersection of Devlin Road and Sheehy Court. This interconnection consists of a metered 12-inch diameter pipeline and is operated when a predetermined low pressure setting is reached at the point of connection.

6.1.2 Pipelines

The transmission system consists of 14- through 20-inch pipelines delivering water from the WTP to the central part of Zone 1. Parallel transmission mains (one 14-inch welded steel and one 18-inch ductile iron) run along Highway 29 to serve the southern portion of Zone 1. The 14-inch steel transmission main is old and in deteriorated condition. Some portions of this transmission main have been replaced with PVC. A 16-inch main connects the main transmission main with Oat Hill #1 Tank.

The majority of the distribution system piping is comprised of 6-, 8-, 10- and 12-inch diameter pipelines that distribute water from the transmission mains. Distribution system pipelines are constructed primarily of ductile iron, PVC, asbestos cement, and steel.

The City provided the pipeline model from the 2010 hydraulic analysis as the basis for the current model, and it does not include all pipes in the City's distribution system. For example, 2-inch mains are excluded. The modelled distribution system totals over 82 miles of pipelines. A summary of the modelled distribution system pipelines is provided in Table 19.

6.1.3 Pressure Zones

The water service area is comprised of five separate pressure zones as shown in Figure 11, and the interconnections with the Vallejo water system are shown in Figure 12.

Zone 1 - Main Zone

Over 94 percent of the current water demand is within the Zone 1 distribution system. Zone 1 serves customers from approximately elevation 10 to 135 feet above sea level. The zone is fed by the 2.5 million gallon WTP water storage tank. Storage capacity to Zone 1 is also provided by the 2.0 mg Oat Hill #1 water storage tank.

At the time of the modelling effort, there was an existing subzone, Zone 1A, consisting of approximately 500 customers below approximately 40 feet elevation, generally in the southwest corner of the City. It was supplied by two pressure reducing valve stations: 1) at Highway 29 near Banbury Way; and 2) at the intersection of Elliot Drive and Folland Drive. Both pressure reducing valve stations had a hydraulic grade level (HGL) setting of 135 ft. One of the pressure reducing valve stations is no longer operational and the City has taken the second unit out of operation, so these customers are now served from Zone 1. A table of the modelled pressures for the Zone 1A customers with the pressure reducing valve stations removed has been included with the hydraulic results for reference.

Table 19 Pipeline Lengths by Diameter and Pipe Material

Diameter (in)	Length (lf)
4	8,224
6	73,285
8	167,972
10	26,833
12	87,965
14	14,696
16	19,289
18	28,276
20	5,170
Total	**431,710**
Pipe Material	**Length (lf)**
Ductile Iron	198,913
PVC	180,558
Steel	18,042
Cast Iron	615
Asbestos	36,367
Other	212

Zone 2 - Industrial Park

Zone 2 serves the higher elevations above Oat Hill #1 Tank, above approximately 130 feet above sea level. Currently, there is only one industrial customer in this zone. Zone 2 is served by the 200 gpm Oat Hill Pump Station and 0.2 mg Oat Hill #2 Tank.

Zone 3 - Kirkland Zone

Zone 3 consists of six customers in the vicinity of the WTP. Zone 3 is fed by small booster pumps and a 4,000 gallon hydropneumatic tank located at the plant clearwell. Normal service pressures range from 80 to 100 psi.

Zone 4 - Montevino Zone

Zone 4 consists of approximately 65 residential customers located on the southern City limits border (Montevino Subdivision) at elevations between 115 and 170 feet above sea level. Zone 4 is fed by a dedicated interconnection with the City of Vallejo. A closed valve on Highridge Drive just west of Hillcrest Court separates this zone from Zone 1.

Zone 5 - La Vigne Zone

Zone 5 consists of approximately 260 customers located in the southeast section of the service area (La Vigne Subdivision), east of Flosden Road at elevations between 100 and 180 feet above sea level. Domestic water demands to Zone 5 are fed by a booster pump station located just off Sarcedo Way, taking water from Zone 1. Fire flows are provided by an interconnection with the City of Vallejo, through the Vallejo Flosden Connection. Zone 5 is separated from Zone 1 by normally closed valves at two locations: 1) Via Bellagio North at Flosden Road; and 2) Via Bellagio South at

Flosden Road. The Vallejo Flosden Connection is also interconnected with the City's Zone 1 with a manually operated valve which can be opened in emergencies.

A subzone, Zone 5A, consists of approximately 200 customers at the lower elevations in the northern area of the LaVigne Zone. It is supplied by a pressure reducing valve station located on the west side of Via Bellagio halfway between its connections with Flosden Road. The pressure reducing valve station has a pressure setting of 64 psi.

American Canyon High School Zone

American Canyon High School is located at an elevation that cannot be served by the existing Zone 1 facilities. Therefore, the school is being served by a dedicated interconnection with the City of Vallejo, located at the school driveway across from Silver Oak Trail along Newell Drive. The pipeline loops through the school property and terminates at American Canyon Road, it is not connected to the Zone 1 distribution system at this location. Ultimately, the school will be served by a High Pressure Zone storage and distribution facilities.

6.1.4 Pumping and Storage

Pumping

The distribution system currently has two booster pump stations to lift water from a lower zone to a higher pressure zone; 1) La Vigne Pump Station, and 2) Oat Hill Pump Station. Both pump stations are intended to only boost potable water demands and are not sized (nor is storage capacity available in that zone) for fire flows. Therefore, the two existing pump stations will have different planning and evaluation criteria than a new pump station that may be considered.

The LaVigne Pump Station is located just off Sacredo Way in the southwest corner of the Zone 5 – LaVigne Zone. It pumps domestic demands from Zone 1 to Zone 5, drawing water from a 12-inch pipeline in Flosden Road. In the hydraulic model, the pumps were sized to reflect pressure reading field results at 50 Sacredo Way in December 2014, which resulted in a pump capacity flow input of 200 gpm with a rated head of 45 ft.

The Oat Hill Pump Station is located along Medeiros Lane and pumps water from Zone 1 to the Oat Hill #2 Tank which serves the Zone 2 – Industrial Park. There are two pumps at this pump station that are rated for 200 gpm each. The pumps operate in alternating fashion and are controlled by the water level in the Oat Hill #2 Tank. For additional flow beyond what Oat Hills Pump Station can provide, the Fire Department can connect to a Fire Department Pumper Connection located outside the pump house.

Storage

The Zone 1 - Main Zone has two water storage tanks, WTP Tank and Oat Hill #1 Tank, allowing flexibility in case one tank is taken off-line temporarily. The WTP Tank serves as the primary source of water for Zone 1, feeding Zone 1 demands by gravity. The WTP Tank was constructed in 2002 and is a 2.5 MG welded steel tank with a 110 ft inside diameter. It has a bottom elevation of 223.96 ft with an overflow height of 34.5 ft.

The Oat Hill #1 Tank is connected to the Zone 1 distribution system off Medeiros Lane west of Highway 29. Oat Hill #1 Tank was constructed in 1976 and is fed by a 16-inch pipeline in Medeiros Lane. It is a 2.0 MG welded steel tank with a 106.5 ft inside diameter. It has a bottom elevation of 197.46 ft and an overflow height of 31 ft.

Zone 2 is served only by the Oat Hill #2 Tank, which is fed by the Oat Hill Pump Station. Oat Hill #2 was constructed in 1984 and is a 200,000 gallon welded steel tank with an inside diameter of 38 ft. It has a bottom elevation of 291.46 ft and an overflow height of 23 ft. Zone 2 does not have backup storage capacity should the Oat Hill Tank #2 be taken out of service. Additionally, the existing storage tank cannot supply the recommended full fire flow capacity of 420,000 gallons. It is possible that fire flow could be served from the nearest hydrant within Zone 1 - Main Zone.

Zone 3 (5 connections) is served by a direct connection from the WTP with a 4,000 gallon hydropneumatic tank to maintain pressure. The other two higher elevation pressure zones, Zone 4 and Zone 5, do not have dedicated storage capacity. These zones are currently served by the City of Vallejo and will eventually be served by the City's high pressure zone and associated storage.

The storage requirements of the City's potable water system were evaluated based on the planning criteria presented in Section 4. A summary of this evaluation is presented in Table 20. For the existing condition, there is a current storage shortfall of 4.0 MG. At buildout, the storage shortfall increases to a total of 6.8 MG, with 5.5 MG for the Zone 1 – Main Zone and 1.3 MG for the high pressure zones, Zone 4 and Zone 5.

Table 20 Storage Requirements

Year	Total MDD (mgd)	Existing Storage (mg)	Required Storage (mg)	Storage Shortfall (mg)
Existing Conditions	6.5	4.5	8.5	4.0
Buildout Conditions – Zone 1	7.7	4.5	10.0	5.5
Buildout Conditions – High Pressure Zones	0.7	0.0	1.3	1.3

6.2 Hydraulic Model

Hydraulic models have previously been prepared for the 1996 and 2003 Water Master Plans. The hydraulic model has most recently been calibrated in the 2010 *Analysis and Calibration of the American Canyon City Water Model*. The calibrated model was provided in WaterCAD by Bentley model and was revised as necessary based on existing conditions and system improvements. Although multiple software packages are available, the use of WaterCAD by Bentley was continued for this master plan update to model and analyze the performance of the City's potable water system due to its ease of use; ability to use the product as a stand-alone application or work within AutoCAD or MircoStation; and the built-in conversion utilities from CAD, GIS and database files.

6.2.1 Model Inputs

The following general modeling input data has been utilized in the creation of the original model and has been continued with the update of the current model:

- Hazen-Williams Roughness Coefficient, "C-value": 130 for all new pipes; 85-150 for existing pipes generally based on age and pipe material (existing model input was used unless a revision was necessary based on verification).
- Elevations were extracted from a topographic GIS shapefile based on information from Napa County. The elevation for each junction was assigned by linearly interpolating between the 5 foot contours in the GIS shapefile.
- Junctions were placed at all pipe junctions and at key locations of larger demands.

- Pipe lengths were based on GIS mapping or as-built mapping (record drawings).
- Steady-state model runs were made under the demand scenarios described in Section 4.2.1 for both current and future buildout demands.
- Minimum pipe diameter modeled is 6-inches, except where a smaller diameter pipe completes a loop.
- Pipe diameters are of nominal size.
- Water demands are expressed in gallons per minute (gpm) and were assigned to junctions based on the analysis presented in Section 5.

6.3 System Performance

The performance of the City's potable water distribution system was analyzed using steady state simulations under ADD, MDD, MDD+FF and PHD scenarios for the existing and buildout conditions. The goal of the hydraulic analysis is to identify system improvements that would be required to address current and future system demands.

6.3.1 Existing Conditions

The existing potable water distribution system was analyzed using four demand scenarios (ADD, MDD, MDD+FF and PHD) with the current demands, as discussed in Section 5.2. The existing modeled pipes and junctions were evaluated using the maximum pressure, minimum pressure and maximum velocity criteria presented in Section 4. Each demand scenario was modeled with the storage tanks at the initial elevations as follows: WTP at 242.16 ft and Oat Hill #1 at 222.46 ft. The hydraulic model results for the existing conditions are included in Appendix A.

In general, the velocities in the existing pipelines for the entire distribution system were below the recommended maximum of 7 fps, with the sole exception of the Oat Hill 16-inch transmission main in Medeiros Lane. In the PHD scenario, the velocity in the transmission main is 7.43 fps.

Junction pressures exceeded the recommended maximum of 80 psi in four distinct areas in the ADD and MDD scenarios: 1) Zone 1 residential customers along Wetlands Edge Road with elevations between 11 ft and 37 ft; 2) Zone 1 commercial and industrial customers along Commerce Boulevard and Green Island Road with elevations between 26 ft and 37 ft; 3) Zone 1 commercial and industrial customers south of the airport with elevations between 29 ft and 42 ft; and 4) Zone 1 commercial and industrial customers north of Airport Boulevard with elevations between 20 ft and 44 ft. The maximum pressures in the ADD scenario did not exceed 91 psi, and maximum pressures in the MDD scenario did not exceed 89 psi. The City has installed pressure regulators on individual services and should verify that customers in areas with pressures noted above 80 psi have working devices installed.

In all scenarios, junction pressures below the recommended minimum of 35 psi were found in the vicinity of the WTP, which is acceptable since water flows into the Zone 1 distribution system using gravity. In the PHD scenario, pressures below the minimum were also discovered in the southeast corner of Zone 5 – LaVigne Zone. The lowest pressure of 8.1 psi is located in the cul-de-sac of Palestrina Court which has an elevation of 171 ft.

In the MDD+FF scenario, there were several junctions throughout the City's potable water distribution system that were not capable of meeting the required fire flow demands and therefore had pressures below the required 20 psi residual pressure. The locations of these junctions are shown in Figure A.4 in Appendix A.

6.3.2 Buildout Conditions

The existing potable water distribution system was analyzed using four demand scenarios (ADD, MDD, MDD+FF and PHD) with the future demands, as discussed in Section 5. The existing modeled pipes and junctions were evaluated using the maximum pressure, minimum pressure and maximum velocity criteria presented in Section 4. Each demand scenario was modeled with the initial elevations of the storage tanks for WTP at 242.16 ft and Oat Hill #1 at 222.46 ft. The hydraulic model results for the buildout conditions are included in Appendix B.

Similar to the existing conditions hydraulic results, the only pipeline that exceeded the recommended maximum velocity of 7 fps is the Oat Hill 16-inch transmission main in Medeiros Lane. In the buildout conditions PHD scenario, the velocity in the transmission main is 8.76 fps.

There were no additional areas, besides the four identified in the existing conditions, where the pressures exceeded the recommended maximum of 80 psi. There is no improvement project recommended at this time.

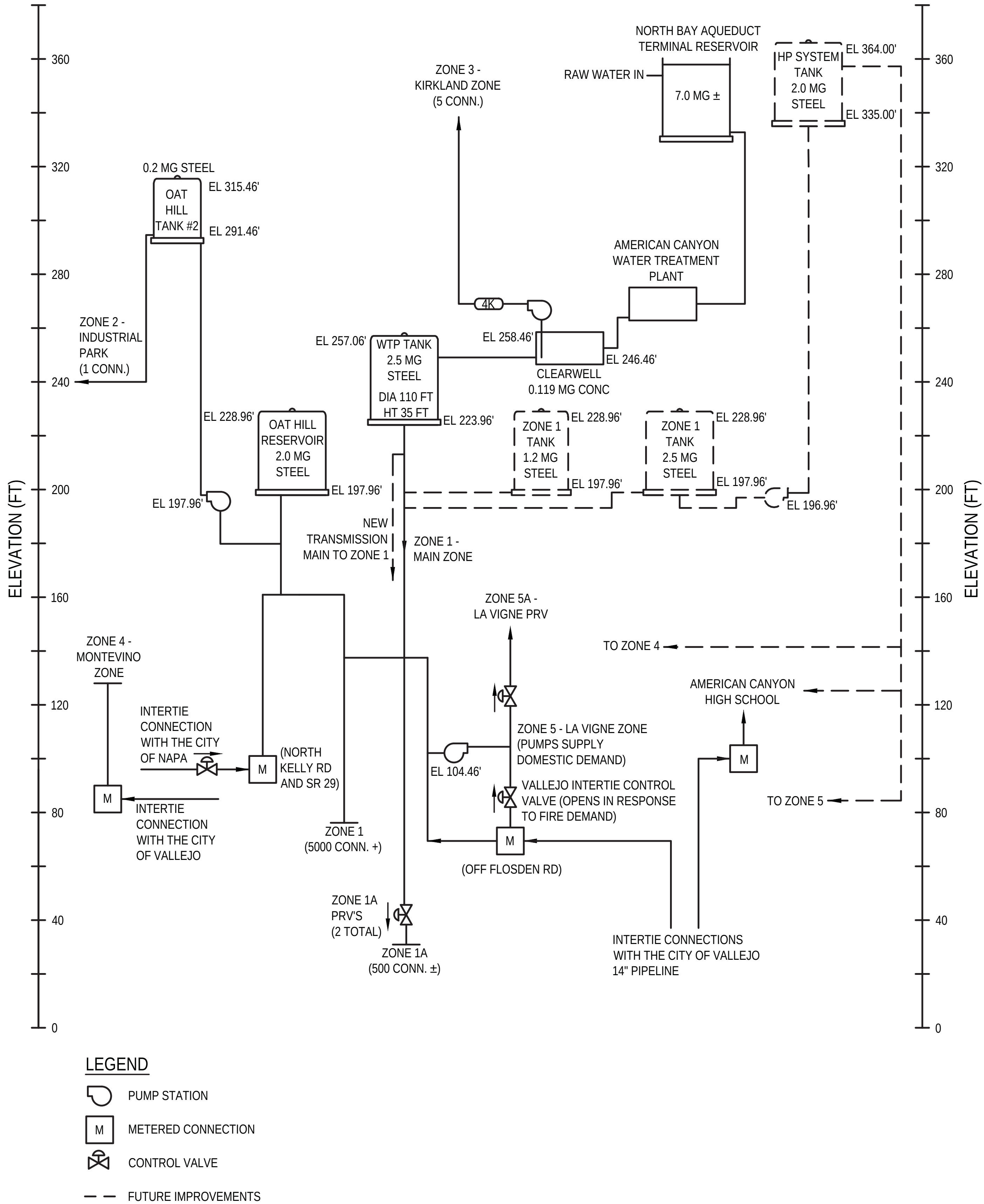
In the PHD scenario, junction pressures below the recommended minimum of 35 psi were generally found in four areas: 1) immediately downstream of the WTP; 2) southeast corner of Zone 5 – LaVigne Zone where elevations range from 113 ft to 171 ft; 3) area immediately north of the Montevino subdivision in Zone 1 where elevations range from 105 ft to 121 ft; and 4) northeast corner of the Vintage Ranch subdivision in Zone 1 where elevations range from 106 ft to 134 ft. As discussed above, the low pressures in the vicinity of the WTP are acceptable as water flows into Zone 1 through the transmission main via gravity. For the other areas, the minimum pressures are typically located along dead-end pipelines. Since these pipelines are within cul-de-sac streets, there aren't many options to loop the system in these areas which would increase pressures. Increasing the system reliability with an additional transmission main from the WTP and creating additional loops within the larger distribution system mains will help raise overall system pressures in these areas.

For the most part, the MDD+FF scenario for the buildout conditions identified the same locations that were not capable of meeting the required fire flow demands. The locations of these junctions are shown in Figure B.4 in Appendix B.

6.3.3 Improvement Conditions

The recommended projects to address the identified deficiencies in the existing potable water distribution system are described in Section 7. To demonstrate these projects ability to eliminate these deficiencies, an additional improvement conditions model was analyzed using buildout demands after the recommended improvements are implemented. The improvement conditions model is used to verify the adequacy of the recommended projects to meet the City's performance criteria. The proposed modeled pipes and junctions were evaluated using the maximum pressure, minimum pressure and maximum velocity criteria. Each demand scenario was modeled with the initial elevations of the storage tanks for WTP at 242.16 ft and Oat Hill #1 at 222.46 ft. The results of the four improvement demand scenarios are included in Appendix C to demonstrate the adequacy of the recommended projects at resolving the deficiencies within the distribution system.

As illustrated by the figures and results tables in Appendix C, the velocity deficiencies in the Oat Hill transmission main along with the low pressure concerns for customers in the City's potable water distribution system have been alleviated with the recommended improvement projects. Additionally, all areas of the main distribution system within the City limits are able to meet the required fire flow demands in the improvement conditions MDD+FF scenario.



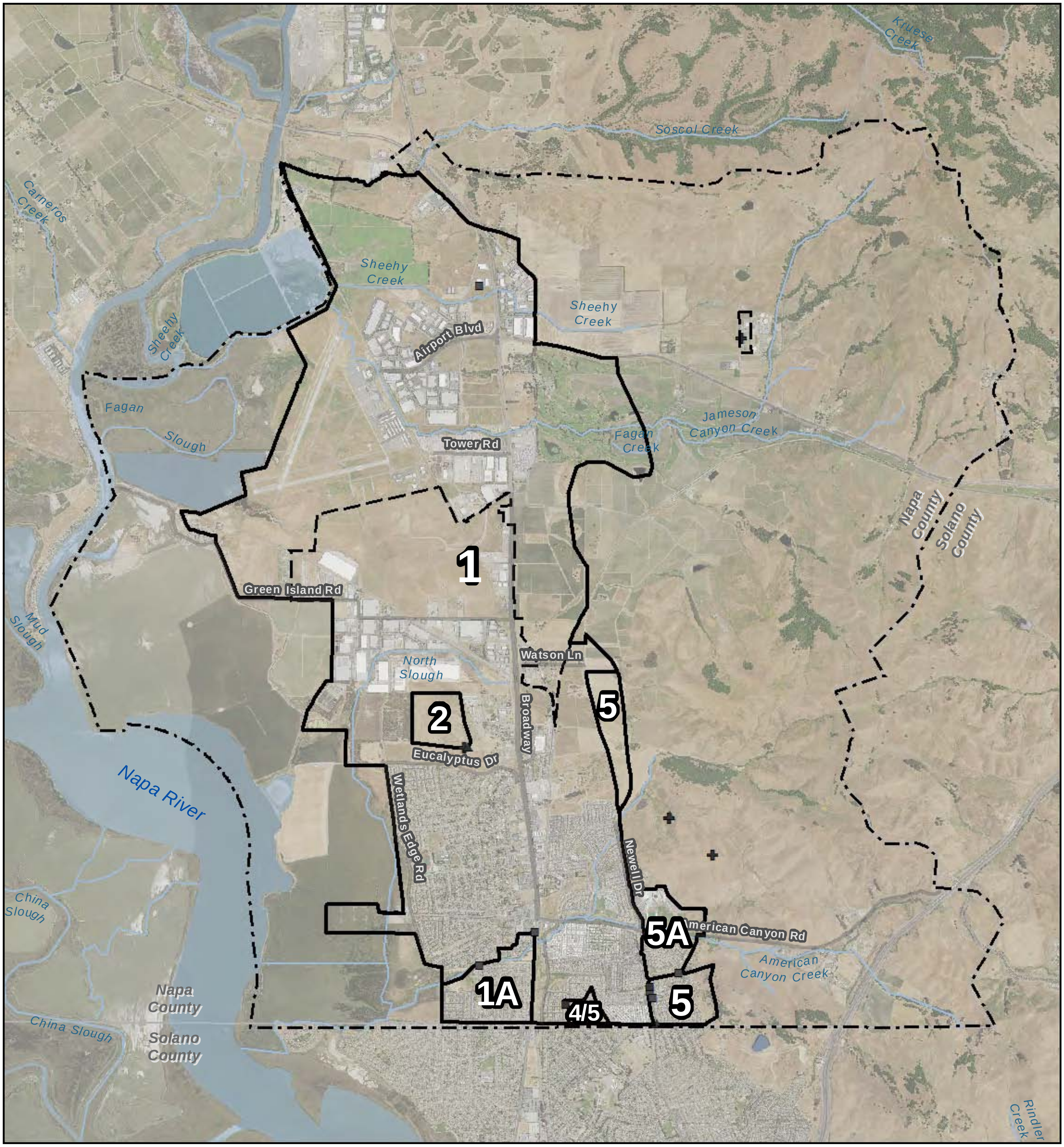
GHD

City of American Canyon
Potable Water Master Plan

Potable Water System Schematic

Job Number 8411338
Revision 0
Date 16 Mar 2015

Figure 10



City Limits

Water Service Boundary

Pressure Zones & ID

▲ Pump Station

■ Pressure Regulating Station

✚ Tank

Paper Size 8.5" x 11" (ANSI A)
0 2,500 5,000
Feet
Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: NAD 1983 StatePlane California II FIPS 0402 Feet

N

City of American Canyon
Potable Water Master Plan

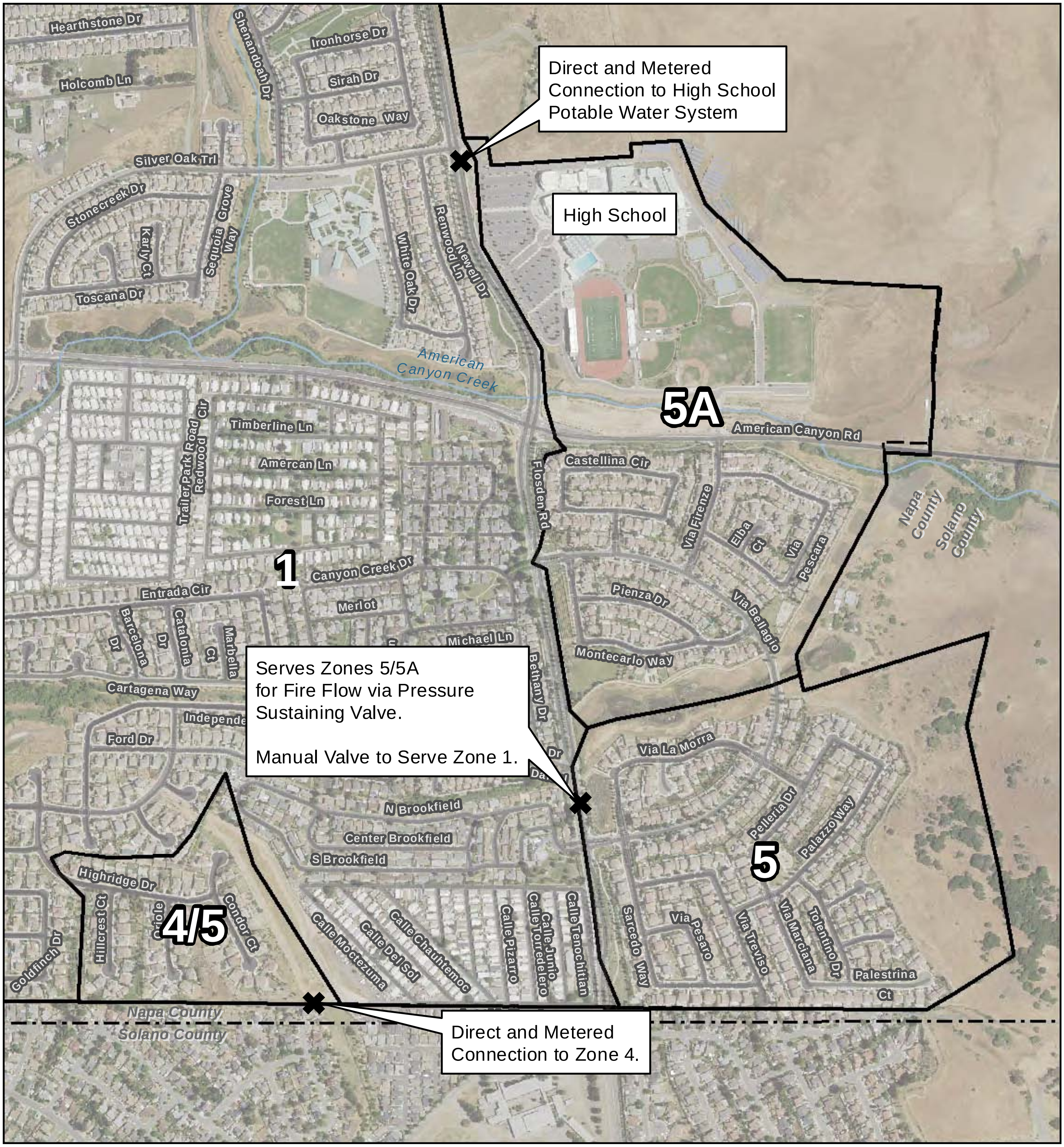
Job Number 8411338
Revision 0
Date 02 May 2016

Pressure Zones

Figure 11

2235 Mercury Way Suite 150 Santa Rosa CA 95407 USA T 707 523 1010 F 707 527 8679 E santarosa@ghd.com W www.ghd.com
N:\US\Santa Rosa\Projects\02536 - American Canyon\02536-8411338 Master Plan Updates\08-GIS\Maps\Figures\Water\Master Plan\Final\Fig 11 - Pressure Zones.mxd

Data source: USDA, Imagery, 2014; County of Napa, Roads, 2015; GHD, PW System and Customers, 2015. Created by:afisher2



City Limits

Water Service Boundary

Pressure Zones & ID

Interconnection

Paper Size 8.5" x 11" (ANSI A)

0 400 800

Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: NAD 1983 StatePlane California II FIPS 0402 Feet

N

GHD

City of American Canyon

City of American Canyon
Potable Water Master Plan

Vallejo
Interconnections

Job Number	8411338
Revision	0
Date	02 May 2016

Figure 12

2235 Mercury Way Suite 150 Santa Rosa CA 95407 USA T 707 523 1010 F 707 527 8679 E santarosa@ghd.com W www.ghd.com

N:\US\Santa Rosa\Projects\02536 - American Canyon\02536-8411338 Master Plan Updates\08-GIS\Maps\Figures\Water\Master Plan\Final\Fig 12 - Interconnections.mxd

Data source: USDA, Imagery, 2014; County of Napa, Roads, 2015; GHD, PW System and Customers, 2015. Created by:afisher2

7. Recommended Improvement Projects

Recommended improvement projects are primarily focused on upsizing existing pipelines to improve hydraulics, constructing new water storage tanks to address storage shortfalls, constructing a new high pressure zone, and extending the current distribution system to serve recent and future developments. These improvements will enable the City to serve all of its customers directly, without relying on service from the City of Vallejo except as an emergency backup supply.

7.1 Improvements to Address Existing Deficiencies

The potable water system evaluation identified a number of deficiencies with the current distribution network including insufficient water storage capacity, pipeline deterioration, and pipelines that are undersized for the current conditions and fire flow requirements. Capital improvement projects that will enable the City to address the existing system deficiencies are described below.

- W1 consists of the construction of a new 2.5 mg potable water tank north of American Canyon High School to address the current water storage capacity shortfall in Zone 1 (Main Zone).
- W2 consists of annual replacement of water mains including replacing 2- and 4-inch with new 8-inch mains, replacing leaking and deteriorated mains around the City and replacing all non-PVC mains. For this CIP project a total of 240,665 lf of new water main with sizes between 8-inch and 20-inch is budgeted to replace existing mains deemed deficient due to size, leaks or material.
- W3 consists of replacing leaking 1-inch water service lines between the main and the meter. This CIP assumes replacement of 90 services around the City.
- W4 consists of creating a new high pressure zone to serve the American Canyon High School and LaVigne and Montevino subdivisions, and reducing the interconnection from the City of Vallejo to an emergency backup supply. The project includes the construction of a 2.0 mg potable water storage tank, a 30 horsepower water booster pump station, a pressure regulating station, upsizing an 8-inch main to 12-inches, and slip lining the existing 14-inch Vallejo pipeline with 6,870 lf of 12-inch main.
- W8 consists of the replacement of approximately 3,450 lf of 14-inch and 16-inch transmission mains adjacent to Hwy 29 near Hwy 12 to address pipeline deterioration and leaks.
- W9 consists of upsizing approximately 1,920 lf of 16-inch water pipelines in Medeiros Lane with 18-inch water pipelines to remove hydraulic restrictions and address deterioration concerns.
- W11 consists of upsizing approximately 1,640 lf of 6-inch water pipelines near the intersection of Hess Road and Napa Junction Road to 12-inch water pipelines to increase the pressure and flows to meet future commercial and industrial fire flow requirements.
- W13 includes upsizing approximately 1,000 lf of 6-inch water pipelines in South Napa Junction Road, including the SR29 crossing, with 12-inch water pipelines to increase system reliability and balance pressures across Zone 1. The project also includes approximately 1,740 lf of 12-inch water pipelines in Main Street and Broadway to complete a parallel transmission main along the east side of Highway 29 near South Napa Junction Road.

A summary of the recommended improvement projects to address current deficiencies is presented in Table 21 and Figure 11 shows the locations of each of these projects.

Table 21 Recommended Improvement Projects to Address Current Deficiencies

Project ID	Description	Driver
W1	Zone 1 Storage	Additional storage for main zone
W2	Annual Water Main Replacements	Upsize 2- and 4-inch mains, replace leaking and deteriorated mains, replace non-PVC mains across City
W3	Annual Water Service Replacements	Replace leaking services across City
W4	High Pressure Zone System	Construct high pressure zone to serve high school and neighborhood, and reduce Vallejo interconnection to emergency backup supply
W8	Replace Transmission Mains Near SR29	Replace deteriorating and leaking transmission mains
W9	Replace Oat Hill Transmission Main	Replace deteriorated and undersized main from Oat Hill Tank #1
W11	Fire Flows in Hess Drive	Upsize main to increase fire flow capacity
W13	Watson Ranch Main Zone	Upsize SR29 crossing at South Napa Junction Road to improve hydraulics

7.2 Improvements to Serve Planned Growth

Improvements to the potable water distribution system to accommodate planned growth are focused on improving reliability and hydraulic performance in Zone 1 under buildout conditions, serving the Watson Ranch development and other known development projects such as the industrial customers in the northern portion of the City, and addressing future potable water storage needs.

The improvement projects recommended to serve the future customers are W5, W6, W7, W10, and W12. The following is a description of these improvement projects:

- W5 consists of the construction of approximately 2,930 lf of 12-inch water pipelines in the future Devlin Road extension to increase system reliability at buildout and provide potable water to future developments southeast of Napa County Airport.
- W6 consists of the construction of approximately 720 lf of 8-inch and 8,340 lf of 12-inch water pipelines to serve the Watson Ranch development within the main pressure zone.
- W7 consists of slip lining an existing 14-inch abandoned water main owned by the City of Vallejo with a 12-inch high pressure transmission main approximately 5,810 lf in length. The high pressure main runs in the future Newell Drive alignment from the access road to the east side water storage tanks to the northern end of the Watson Ranch development. If the existing Vallejo pipeline cannot be slip lined, than this portion of the project would need to be installed by trench and cover methods, including a bridge crossing over a drainage.
- W10 consists of constructing a new 12-inch water transmission main approximately 18,960 lf in length from the WTP to the southeast area of the City to increase system reliability and balance water pressure in Zone 1 under buildout conditions. Approximately 9,460 lf of this

main will be slip lined into the abandoned 14-inch water main owned by the City of Vallejo. If the existing Vallejo pipeline cannot be slip lined, than this portion of the project would need to be installed by trench and cover methods.

- W12 consists of the construction of a new 1.2 mg potable water tank at the WTP to address future storage capacity shortfall in the main zone.
- A summary of the recommended improvement projects for future customers is presented in Table 22 and Figure 12 shows the locations of each of these projects.

Table 22 Recommended Improvement Projects for Planned Growth

Project ID	Description	Driver
W5	Devlin Road Extension	Accommodate development in the industrial area south of the airport
W6	Watson Ranch Main Zone	Accommodate development in the west side of Watson Ranch
W7	Watson Ranch High Pressure Zone	Accommodate development in the east side of Watson Ranch
W10	New Transmission Main from WTP	Improve system reliability and pressure distribution across the main zone
W12	Zone 1 Storage at WTP	Provide additional storage to serve buildout conditions in main zone

8. Capital Improvements Plan

The CIP is intended to provide a roadmap for the construction or replacement of water infrastructure to address the current and future potable water demands within the City. Thirteen projects are recommended and have been prioritized to meet the more critical needs first, whether to correct existing system deficiencies or accommodate pending development projects, and then address longer term issues and future planned growth over an extended timeframe. Project assumptions, cost estimations, and project prioritizations for the potable water CIP are discussed below. The detailed project descriptions and cost estimates for each CIP project are included in this report as Appendix D and Appendix E, respectively.

8.1 Estimates of Probable Cost

The estimates of probable cost in this CIP should be considered as order-of-magnitude estimates for planning purposes only. The total project cost consists of the construction cost, design and technical effort, construction management effort, and a contingency fund. Land acquisition and/or City degradation fees are not included in the cost estimates.

Construction costs are based on a Class 5 (planning-level) estimate of probable cost as defined by the Association for the Advancement of Cost Engineering, International (AACE). AACE defines the "Class 5" estimate as follows:

> *Generally prepared on very limited information, where little more than proposed plan type, its location, and the capacity are known, and for strategic planning purposes such as but not limited to market studies, assessment of viability, evaluation of alternate schemes, project screening, location and evaluation of resource needs and budgeting, long-range capital planning, etc. Some examples of estimating methods used would include cost/capacity curves and factors, scale-up factors, and parametric and modeling techniques. Typically, very little time is expended in the development of this estimate. The typical expected accuracy ranges for this class estimate are -20% to -50% on the low side and +30% to +100% on the high side.*

Construction costs are based on the July 2015 Engineering News Record Construction Cost Index (ENR CCI) for San Francisco, CA (11,155).

8.1.1 Construction Cost

Construction costs associated with potable water projects typically include the efforts and materials for the following items:

- Mobilization and demobilization
- Temporary traffic control
- Potholing to identify existing utilities
- Shoring and trench safety
- Trench dewatering
- Handling, treatment and disposal of contaminated soil and groundwater
- Construction or replacement of distribution system and supporting infrastructures

A summary of the unit costs associated with each item is presented in Table 23. The unit cost estimates are based on previous project experience and contractor/supplier-provided information.

Adjustments to the cost estimates can be made in the future by applying a ratio of the future ENR CCI to the value used herein.

Estimated unit costs for pipelines includes pipe material, trenching (at minimum cover), installation, backfill, fittings and appurtenances, connections, pavement restoration, testing, and traffic control. Water pipelines are assumed to be Class 200 PVC for pipes 12-inch and smaller, and AWWA C200 tape-wrapped welded steel pipe for all other pipelines.

Unit costs were developed for construction of water storage tanks ranging in size from 1 to 5 million gallons. The costs are for a typical above grade welded steel tank on a ring wall foundation, with cathodic protection facilities and limited grading and access impacts. A unit cost of $1.00/gallon is used for a 1 MG capacity tank, and a unit cost of $0.80/gallon is used for tanks greater than 1 MG capacity

Table 23 Construction Unit Costs

Item	Unit Cost
Mobilization and demobilization	6% of construction costs
Temporary traffic control	5% of construction costs
Potholing to identify existing utilities	$12/lf
Shoring and trench safety	$20/lf
Trench dewatering	$40/lf
Handling, treatment and disposal of contaminated soil and groundwater	$10/lf
Construction or replacement of distribution system and supporting infrastructures	
• 8” Class 200 PVC Water Pipe	$121/lf
• 12” Class 200 PVC Water Pipe	$164/lf
• 12” HDPE Slip Lined Water Pipe	$120/lf
• 14” Welded Steel Water Pipe	$213/lf
• 16” Welded Steel Water Pipe	$239/lf
• 18” Welded Steel Water Pipe	$264/lf
• 20” Welded Steel Water Pipe	$290/lf
• Replace Existing 1” Water Service	$5,000/unit
• 2.0 MG Welded Steel Water Tank	$1,800,000 lump sum
• 2.5 MG Welded Steel Water Tank	$2,200,000 lump sum
• 3.0 MG Welded Steel Water Tank	$2,760,000 lump sum
• Preliminary Design Study for Tank Siting	$100,000 lump sum
• 30 HP Water Booster Pump Station	$300,000 lump sum
• Access Road	$20/lf
• Pressure Regulating Stations	$70,000/unit

8.1.2 Design and Technical Effort

Design and technical efforts include the costs for the following items:

- Completing the pipeline and infrastructure designs
- Land surveys
- Geotechnical surveys
- Environmental review
- Permitting (excluding permits associated with land acquisition)

The costs for the design and technical efforts are estimated to be approximately 25% of the construction cost based on previous project experience.

8.1.3 Construction Management Effort

Construction management efforts include the costs for the following items:

- Site inspections
- Project management
- Engineering services during construction

The costs for the construction management efforts are estimated to be approximately 12% of the construction cost based on previous project experience.

8.1.4 Contingency

The actual project costs can vary greatly due to a number of possible external factors, including but not limited to climate, market conditions, government policy and material pricing. An additional 25 percent of the construction cost is added to the overall cost as a contingency to ensure appropriate levels of financing for the CIP.

8.2 Prioritized Capital Improvements Plan

The CIP will be implemented in stages based on the priority assigned to each project. The projects are prioritized according to the condition of the existing infrastructure, the existing and future potable water demands, the anticipated timing of developments within the City, and the complexity of the project. The total estimated cost for the potable water system CIP is $141,720,000. The estimates for each CIP project are rounded to the nearest $1,000.

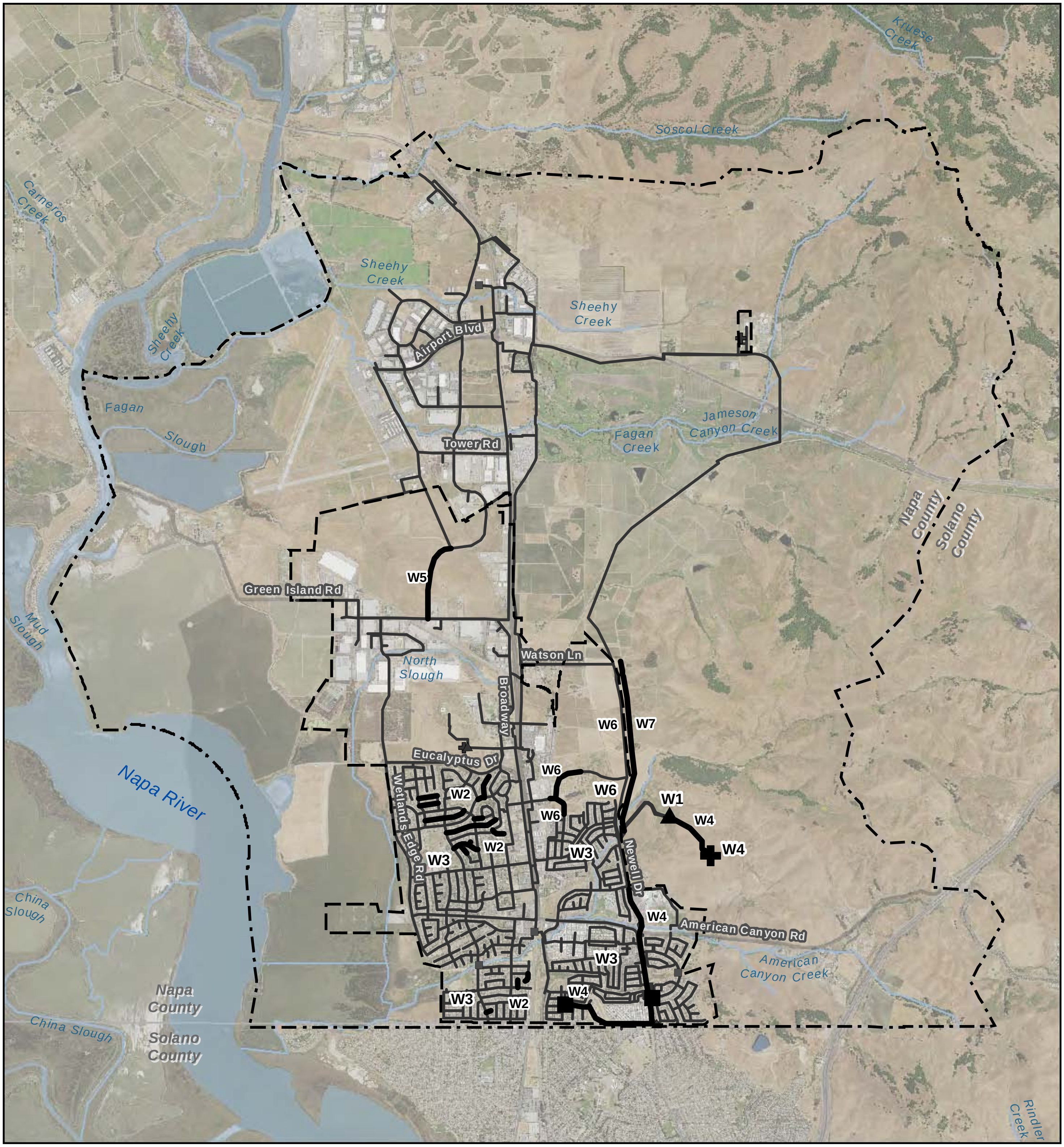
The order of the project implementation may change in the future due to changes in water demand, infrastructure deterioration, land development, and funding availability. Based on current priorities CIP projects W1 through W7 are considered near-term priorities and should be completed over the next 10 years. CIP projects W8 through W12 are of a lower priority and could be completed 11 to 20 years from now. Project W13 has a lower priority but is included with the near-term projects because of its relationship to other near-term projects. The locations of the recommended near-term and long-term CIP projects are shown in Figures 13 and 14.

CIP projects are funded from two sources, water capacity fees and water rates. Water capacity fees are paid by new development to offset their impact on the system. This “Water Capacity” revenue is then used to construct capacity improvements required to meet the needs of new growth. Water rates, the monthly service charges levied by the water utility, pays for all operating expenses as well as debt covenants and replacement and rehabilitation of capital assets. This “Water Operations” revenue is used to cover operating expenses including the cost of water, power and chemicals, salaries and benefits for water utility staff, and timely replacement and rehabilitation of water infrastructure. Table 24 lists the near and long-term CIP projects and estimated costs and funding sources.

Table 24 Potable Water System Capital Improvements Plan

CIP Project	Funding Source	Project Cost
Near-Term Projects		
W1 Zone 1 Storage	Water Operations and Water Capacity	$4,020,000
W2 Annual Water Main Replacements	Water Operations	$103,960,000 [1.]
W3 Annual Water Service Replacements	Water Operations	$810,000
W4 High Pressure Zone System	Water Operations	$10,240,000
W5 Devlin Road Extension	Water Capacity	$1,400,000
W6 Watson Ranch Main Zone	Water Capacity	$4,170,000
W7 Watson Ranch High Pressure Zone	Water Capacity	$2,240,000 [2.]
W13 Main Zone Reliability Improvements	Water Operations	$1,290,000
Long-Term Projects		
W8 Replace Transmission Mains Near SR29	Water Operations	$1,960,000
W9 Replace Oat Hill Transmission Main	Water Operations	$1,280,000
W10 New Transmission Main from WTP	Water Capacity	$7,250,000 [3.]
W11 Fire Flows in Hess Drive	Water Operations	$790,000
W12 Zone 1 Storage at WTP	Water Capacity	$2,310,000
	Total CIP	**$141,720,000**

1. Replacement of 2- and 4-inch mains and replacement of deteriorating pipelines would be near-term projects. Replacement of non-PVC mains would be long-term projects.
2. If slip lining abandoned 14-inch pipeline is not possible, cost will increase by $490,000 for a total project cost of $2,730,000.
3. If slip lining abandoned 14-inch pipeline is not possible, cost will increase by $800,000 for a total project cost of $8,050,000.



City Limits

Water Service Boundary

Existing System:

Pump Station

Pressure Regulating Station

Tank

Pipe

CIP Projects:

Near Term

Pump Station

Pressure Regulating Station

Paper Size 8.5" x 11" (ANSI A)
0 2,500 5,000
Feet
Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: NAD 1983 StatePlane California II FIPS 0402 Feet

N

GHD

CITY OF AMERICAN CANYON

City of American Canyon
Potable Water Master Plan

Job Number | 8411338
Revision | 2
Date | 02 May 2016

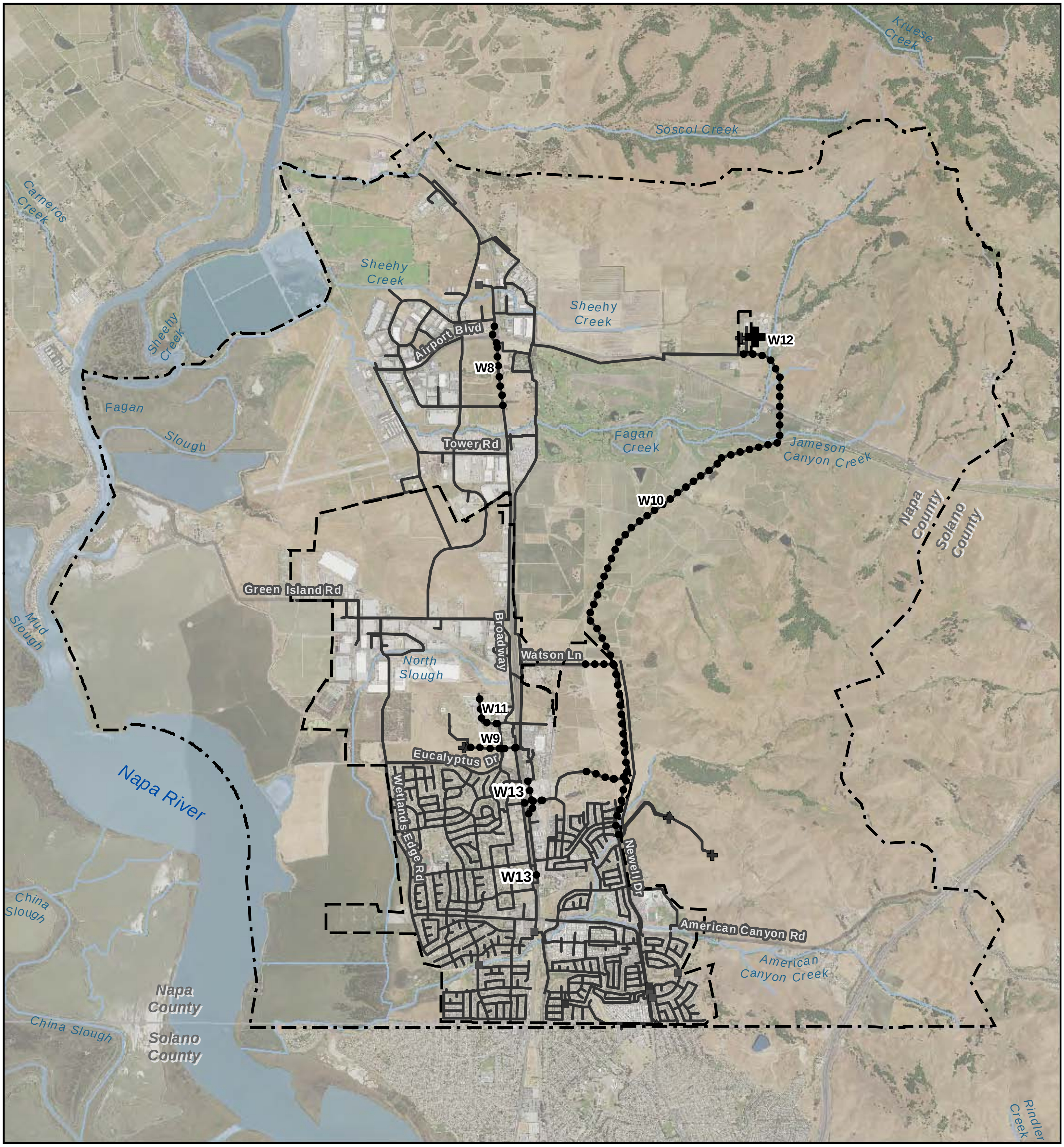
Recommended Near Term
Capital Improvement Projects

Figure 13

2235 Mercury Way Suite 150 Santa Rosa CA 95407 USA **T** 707 523 1010 **F** 707 527 8679 **E** santarosa@ghd.com **W** www.ghd.com

N:\US\Santa Rosa\Projects\02536 - American Canyon\02536-8411338 Master Plan Updates\08-GIS\Maps\Figures\Water\Master Plan\Final\Fig 13 - Recommended PW CIPs - Near Term.mxd

Data source: USDA, Imagery, 2014; County of Napa, Roads, 2015; GHD, PW System and Customers, 2015. Created by:afisher2



City Limits
Water Service Boundary

Existing System:

- Pump Station
- Pressure Regulating Station
- Tank

Pipe

CIP Projects

- Long Term
- Tank

Paper Size 8.5" x 11" (ANSI A)
0 2,500 5,000
Feet
Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: NAD 1983 StatePlane California II FIPS 0402 Feet

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City of American Canyon
Potable Water Master Plan

Job Number 8411338
Revision 2
Date 02 May 2016

Recommended Long Term
Capital Improvement Projects

Figure 14

2235 Mercury Way Suite 150 Santa Rosa CA 95407 USA T 707 523 1010 F 707 527 8679 E santarosa@ghd.com W www.ghd.com

N:\US\Santa Rosa\Projects\02536 - American Canyon\02536-8411338 Master Plan Updates\08-GIS\Maps\Figures\Water\Master Plan\Final\Fig 14 - Recommended PW CIPs - Long Term.mxd

Data source: USDA, Imagery, 2014; County of Napa, Roads, 2015; GHD, PW System and Customers, 2015. Created by:afisher2

Potable Water CIP Summary

Table 1: Summary of Recommended Potable Water CIP Projects

CIP Project	Water Operations	Water Capacity	Total Project
W1 Zone 1 Storage	$3,430,000	$590,000	$4,020,000
W2 Annual Water Main Replacements	$103,960,000	$0	$103,960,000
W3 Annual Water Service Replacements	$810,000	$0	$810,000
W4 High Pressure Zone System	$10,240,000	$0	$10,240,000
W5 Devlin Road Extension	$0	$1,400,000	$1,400,000
W6 Watson Ranch Main Zone	$0	$4,170,000	$4,170,000
W7 Watson Ranch High Pressure Zone	$0	$2,240,000	$2,240,000
W8 Replace Transmission Mains Near SR29	$1,960,000	$0	$1,960,000
W9 Replace Oat Hill Transmission Main	$1,280,000	$0	$1,280,000
W10 New Transmission Main from WTP	$0	$7,250,000	$7,250,000
W11 Fire Flows in Hess Drive	$790,000	$0	$790,000
W12 Zone 1 Storage at WTP	$0	$2,310,000	$2,310,000
W13 Main Zone Reliability Improvements	$1,290,000	$0	$1,290,000
Total Budget	**$123,760,000**	**$17,960,000**	**$141,720,000**

CIP – W1 Zone 1 Storage

There is a current water storage capacity shortfall of 4.1 MG. Therefore, it is recommended that along with the proposed 2.0 MG high pressure zone potable water tank (CIP W4), a new 2.5 MG Zone 1 potable water tank be constructed to meet the storage requirements necessary for buildout conditions.

The new 2.5 MG Zone 1 potable water tank will be located adjacent to the existing 1.0 MG recycled water tank east of Newell Drive and north of American Canyon High School. The 120-ft diameter welded steel water tank will be constructed at the same elevations as the existing Oat Hill #1 potable water tank – 197.96 ft and an overflow height of 31 ft.

The new tank will connect to the existing 18-inch water pipeline.

Figure 1 provides an illustration of project improvements.

Figure 1

Table 1: CIP – W1 Summary

CIP Component	Description
Proposed Improvements	• 2.5 MG Zone 1 Potable Water Tank – Welded Steel • Associated piping and appurtenances
Additional Project Considerations	• CEQA review and construction permits
Project Cost Total (1)	$3,430,000 – Water Operations $590,000 – Water Capacity $4,020,000 – Project Total

(1) Detailed information for the project cost is provided in Appendix E.

CIP – W2 Annual Water Main Replacements

The Annual Water Main Replacements project consists of three components: 1) replacement of 2-inch and 4-inch water mains with 8-inch to increase the reliability in the system as well as improve fire flow capabilities; 2) replacement of deteriorated water mains throughout the City; and 3) replacement of all non-PVC pipelines which will take place over a 20 year period. The City will prioritize the water main replacement program annually based on need and benefits.

As a minimum, the following reaches should be upsized to 8-inch mains:

<u>2-inch and 4-inch Water Main Replacements (8,520 LF Total)</u>

- Flamingo Court between the cul-de-sac and Rio del Mar – 800 LF
- Carmel Drive between Rio Grande Drive and Corsicana Drive – 670 LF
- Monterey Drive between Rio Grande Drive and Corsicana Drive – 670 LF
- Landana Street between Rio Grande Drive and Carolyn Drive – 1,500 LF
- Easement between Carolyn Drive and Alta Loma Drive – 310 LF
- Joan Drive between Donaldson Way and Alta Loma Drive – 1,850 LF
- Del Rey Court between Los Altos Drive and the cul-de-sac – 440 LF
- Amarillo Drive between Donaldson Way and Carolyn Drive – 990 LF
- Sierra Vista southeast of Amarillo Drive – 410 LF
- Alamo Court between the cul-de-sac and Amarillo Drive – 130 LF
- Corbini Drive between the cul-de-sac and Reed Drive – 300 LF
- Tyler Court between the cul-de-sac and Kimberly Drive – 300 LF

Figures 2A and 2B provide an illustration of the 2-inch and 4-inch water main replacements. This work is estimated to cost $3,220,000.

Figure 2A

Figure 2B

<u>Deteriorated Pipeline Replacements (40,030 LF Total)</u>

- Banbury Way between the cul-de-sac and Knightsbridge Way/Court – 910 LF of 8”
- Folland Drive between Elliot Drive and Corbin Drive – 1,815 LF of 8”
- Poco Way between Melvin Road and Broadway Street – 570 LF of 8”
- Northrup Lane – 360 LF of 6” with 8”; 645 LF of 8”
- Donaldson Way between Eucalyptus Drive and Broadway Street – 1,910 LF of 6” with 8”; 1,940 LF of 8”; 2,400 LF of 10”; 450 LF of 12”
- Eucalyptus Drive between Wetlands Edge Road and Theresa Avenue – 3,150 LF of 12”; 1,120 LF of 16”
- Hanna Drive between Commerce Boulevard and the cul-de-sac/drainage channel – 1,825 LF of 10”
- Heartford Way between Donaldson Way West and Crawford Way – 1,155 LF of 8”
- Marla Drive between Meadow Bay Drive to Blanco Street – 1,705 LF of 6” with 8”; 1,220 LF of 8”
- Northhampton Drive between San Marco Way and Danrose Drive – 2,890 LF of 6” with 8”
- James Road between Wilson Way and Thayer Way – 765 LF of 6” with 8”
- Joan Drive between Alta Loma Drive and Los Altos Drive – 200 LF of 8”
- Kilpatrick Street between Marla Drive and Elliot Drive – 735 LF of 6” with 8”
- Knightsbridge Way/Court– 170 LF of 6” with 8”; 3,005 LF of 8”
- Los Altos Drive – 4,700 LF of 6” with 8”
- Melvin Road between Wilson Way and Cassayre Drive– 1,795 LF of 8”
- Airport Road between Airport Boulevard and Tower Road – 3,415 LF of 8”
- Camino Durado – 1,180 LF of 8”

Replacement of deteriorated pipelines is estimated to cost $15,810,000.

Non-PVC Pipeline Replacements (191,020 LF Total)

- 6” with 8” Pipeline Replacements – 52,150 LF
- 8” Pipeline Replacements – 40,110 LF
- 10” Pipeline Replacements – 12,430 LF
- 12” Pipeline Replacements – 45,875 LF
- 14” Pipeline Replacements – 610 LF
- 16” Pipeline Replacements – 11,400 LF
- 18” Pipeline Replacements – 23,275 LF
- 20” Pipeline Replacements – 5,170 LF

Replacement of the remaining non-PVC pipelines is estimated to cost $84,930,000.

Table 2: CIP – W2 Summary

CIP Component	Description
Proposed Improvements	• 8” Class 200 PVC Water Pipeline – 132,960 LF • 10” Class 200 PVC Water Pipeline – 16,655 LF • 12” Class 200 PVC Water Pipeline – 49,475 LF • 14” Welded Steel Water Pipeline – 610 LF • 16” Welded Steel Water Pipeline – 12,520 LF • 18” Welded Steel Water Pipeline – 23,275 LF • 20” Welded Steel Water Pipeline – 5,170 LF
Additional Project Considerations	• CEQA review and construction permits
Project Cost Total [(1)]	$103,960,000 – Water Operations

(1) Detailed information for the project cost is provided in Appendix E.

CIP – W3 Annual Water Service Replacements

CIP W3 consists of the replacement of 90 existing 1” water services in various locations throughout the City to eliminate leaks.

Table 3: CIP – W3 Summary

CIP Component	Description
Proposed Improvements	• 90 – 1” water services
Additional Project Considerations	• CEQA review and construction permits
Project Cost Total (1)	$810,000 – Water Operations

(1) Detailed information for the project cost is provided in Appendix E.

CIP – W4 High Pressure Zones

The potable water demands for American Canyon High School and the Montevino Area are supplied through existing interconnections with the City of Vallejo. Additionally, the La Vigne area's fire flow demands are supplied by an existing interconnection with the City of Vallejo. The City would like to create a high pressure zone to supply these customers and use the Vallejo connection as an emergency backup only. In the future, the proposed Watson Ranch development will also require a connection to the high pressure zone.

CIP W4 consists of a 2.0 MG high pressure zone potable water tank at the 335-foot gradient level to directly serve American Canyon High School (Zone 3), La Vigne high pressure zone (Zone 5), Montevino high pressure zone (Zone 4) and the Watson Ranch High Pressure Zone (Zone 3). This tank will replace the functionality of the Vallejo interconnections. A new access road will also be constructed to the new high pressure zone potable water tank.

The high pressure zone potable water tank will be supplied by the City's distribution system with a new water booster pump station consisting of three 30 HP vertical turbine pumps (2 duty, 1 standby) at 500 gpm each and 175 ft head. The booster pump station will be located adjacent to the existing recycled water tank and proposed Zone 1 potable water tank (see CIP W4). The tank will be supplied by the proposed Zone 1 potable water tank using the booster pump station connected to an 18-inch welded steel water pipeline. The proposed 18-inch water pipeline will connect to the existing 18-inch high pressure water pipeline that extends west towards Newell Drive.

There is an existing 14-inch pipeline owned by the City of Vallejo which is located within Newell Drive and Flosden Road. CIP W4 consists of slip lining approximately 6,870 LF of the existing 14-inch with 12-inch HDPE. The three high pressure zones (Zones 3, 4 and 5) will be supplied by the slip lined 12-inch HDPE water pipeline in Newell Drive from the existing access road to American Canyon Road and Flosden Road from American Canyon Road to 200 feet north of Corcoran Avenue. A pressure regulator will be required on the service to American Canyon High School and a new pressure reducing valve station is required at Flosden Road and Via Bellagio to supply water to the La Vigne Zone 5. The pressure reducing valve should have a setting of 80 psi.

New 12-inch Class 200 water pipeline will be installed in Avenida Yucatan extending west from the slip lined 12-inch pipeline in Flosden Road to connect to the existing Montevino Zone 4 distribution system in Condor Court. The existing 8-inch pipelines in Condor Court and Highridge Drive should be upsized to 12-inches. The existing zone valve in Highridge, located south of Mockingbird Drive, should be replaced with a pressure sustaining valve station with a setting of 82 psi.

Following the construction of the high pressure zone system, the existing La Vigne Pump Station could be abandoned. The existing Vallejo interconnections will be maintained as emergency backup supply only.

Figure 4 provides an illustration of project improvements.

Figure 4

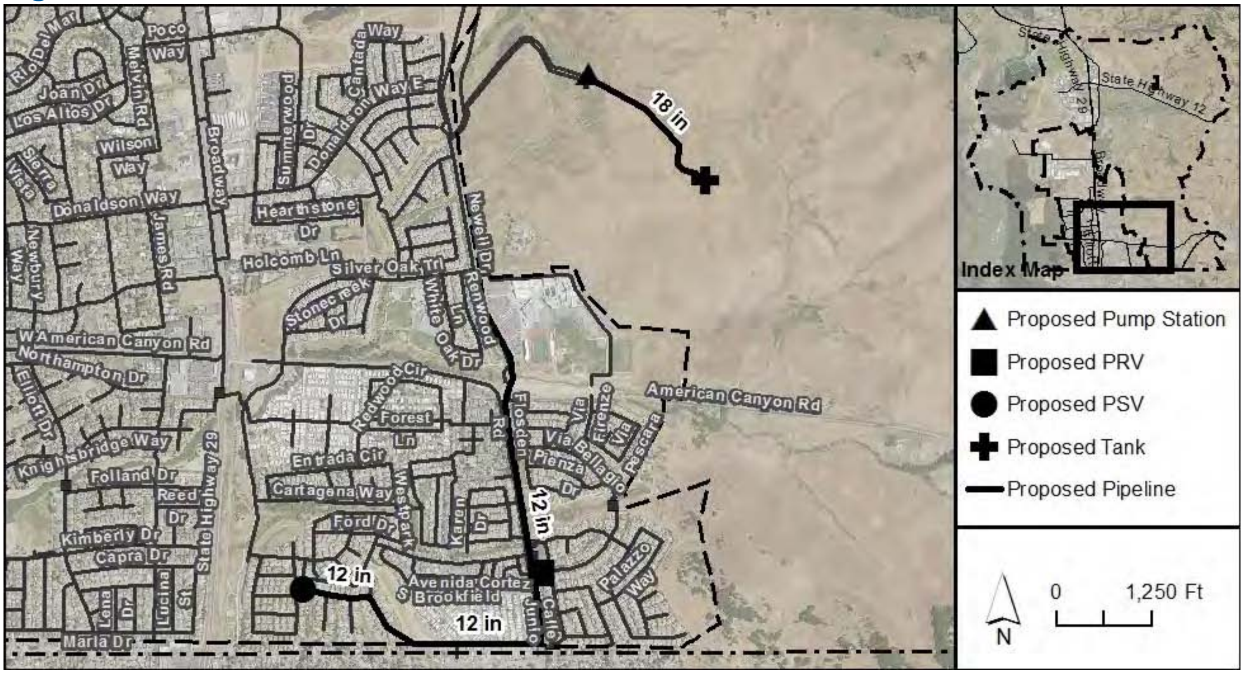

Table 4: CIP – W4 Summary

CIP Component	Description
Proposed Improvements	• 2.0 MG High Pressure Zone Potable Water Tank • Access Road • 30 HP Water Booster Pump Station • 18-inch Welded Steel Water Pipeline – 2,190 LF • 12-inch Class 200 PVC Water Pipelines – 3,880 LF • 12-inch HDPE Slip Lined Water Pipe – 6,870 LF • 2 – Pressure Regulating Stations • Abandon La Vigne Pump Station
Additional Project Considerations	• Easement / right-of-way considerations – Property for High Pressure Zone Potable Water Tank and 18-inch Pipeline • Property transfer and easements • CEQA review and construction permits
Project Cost Total [(1)]	$10,240,000 – Water Operations

(1) Detailed information for the project cost is provided in Appendix E.

CIP – W5 Devlin Road Extension

Completing the loop between Devlin Road and Green Island Road will increase the system reliability of the system at buildout and provide water to future developments in the industrial area. CIP W5 consists of approximately 2,930 LF of 12-inch pipeline in Devlin Road beginning at the Devlin Road Cul-de-Sac and extending southerly to Green Island Road.

Figure 5 provides an illustration of project improvements.

Figure 5

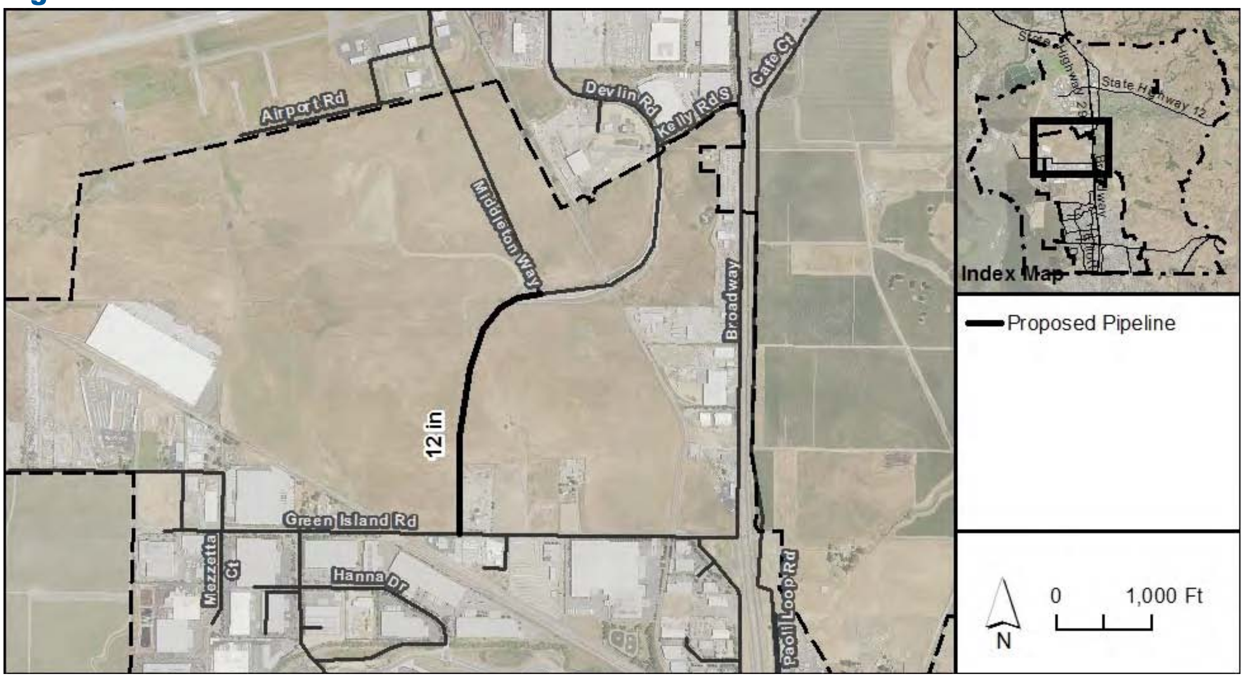

Table 5: CIP – W5 Summary

CIP Component	Description
Proposed Improvements	• 12" Class 200 PVC Water Pipeline – 2,930 LF
Additional Project Considerations	• CEQA review and construction permits • Easement / right-of-way considerations – Southern Pacific Railroad
Project Cost Total (1)	$1,400,000 – Water Capacity

(1) Detailed information for the project cost is provided in Appendix E.

CIP – W6 Watson Ranch Main Zone

The future Watson Ranch development requires an additional 8,340 LF of 12-inch pipeline and 720 LF of 8-inch pipeline throughout the development's Main Zone. These mains will be installed in the Future South Napa Junction Road from the railroad and will connect to the proposed 12-inch pipeline at Future Newell Drive. The proposed 12-inch pipeline in Future Newell Drive will extend north from Newell Drive, where it connects to an existing 12-inch pipeline, and connect to a new 12-inch pipeline at Watson Lane, as detailed in CIP W10. The Watson Ranch development will also connect to the existing system with an 8-inch pipeline at the Summerwood Drive Cul-de-Sac.

Figure 6 provides an illustration of project improvements.

Figure 6

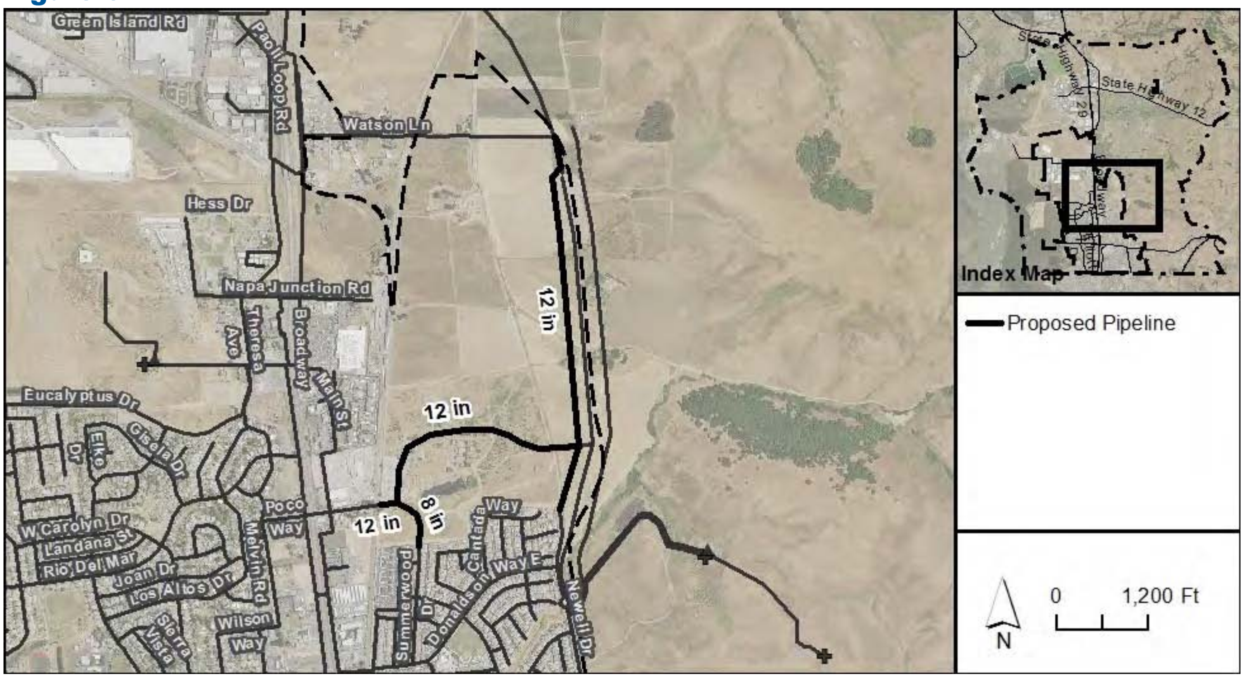

Table 6: CIP – W6 Summary

CIP Component	Description
Proposed Improvements	• 12-inch Class 200 PVC Water Pipeline – 8,340 LF • 8-inch Class 200 PVC Water Pipeline – 720 LF
Additional Project Considerations	• CEQA review and construction permits • Easement / right-of-way considerations – Southern Pacific Railroad and Caltrans
Project Cost Total (1)	$4,170,000 – Water Capacity

(1) Detailed information for the project cost is provided in Appendix E.

CIP – W7 Watson Ranch High Pressure Zone

The proposed Watson Ranch development will require a high pressure transmission main extending north in Newell Drive from the tank access road towards Watson Lane. There is an existing 14-inch pipeline owned by the City of Vallejo and CIP W7 consists of slip lining approximately 5,810 LF of the existing 14-inch with 12-inch HDPE. However, if the City is unable to slip line the City of Vallejo pipeline, a new 12-inch PVC pipe would be installed which would also consist of a bridge crossing. The new 12-inch pipeline alternative is estimated to cost an additional $490,000, increasing the total cost to $2,730,000.

Figure 7 provides an illustration of project improvements.

Figure 7

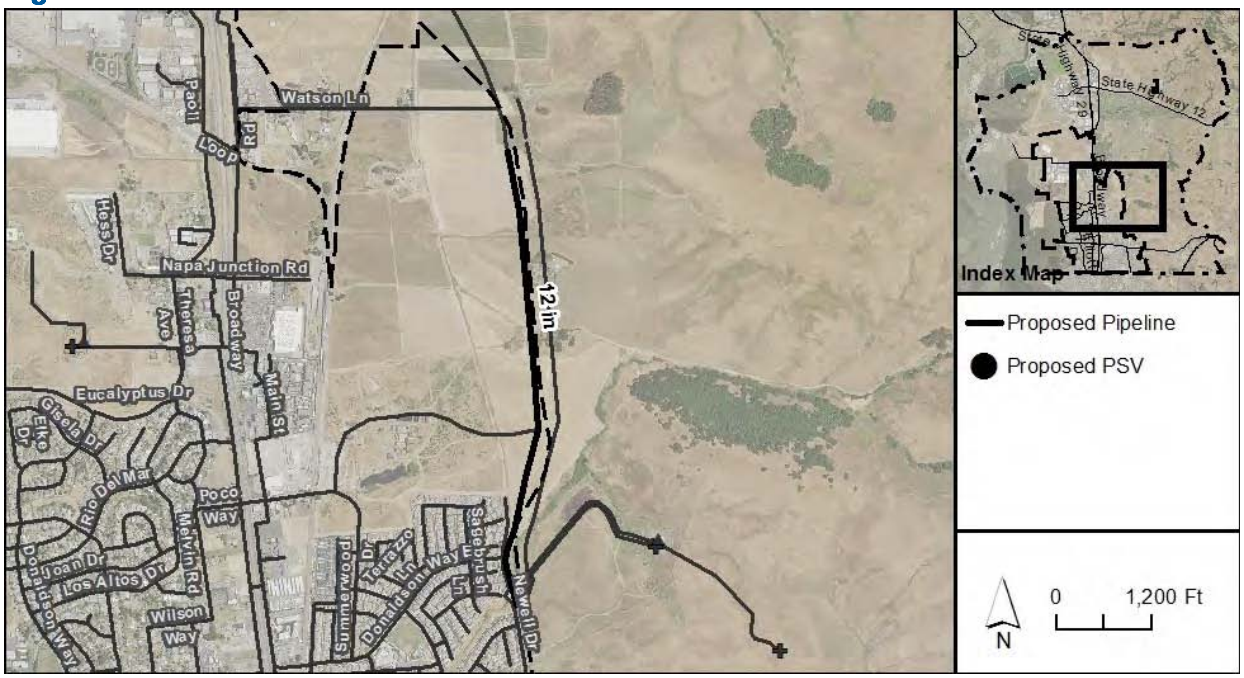

Table 7: CIP – W7 Summary

CIP Component	Description
Proposed Improvements	• 12-inch HDPE Slip Lined Water Pipe – 5,810 LF
Additional Project Considerations	• Property transfer and easements • CEQA review and construction permits
Project Cost Total (1)	$2,240,000 – Water Capacity

(1) Detailed information for the project cost is provided in Appendix E.

CIP – W8 Replace Transmission Mains Near SR29

CIP W8 consists of the replacement of approximately 3,450 LF of 14-inch and 16-inch pipelines adjacent to Hwy 29 beginning on the west side of the freeway at Airport Road and extending south to Airpark Road and the 16-inch portion includes the crossing at Hwy 29. These pipelines have deteriorated and are currently out of service.

Figure 8 provides an illustration of project improvements.

Figure 8

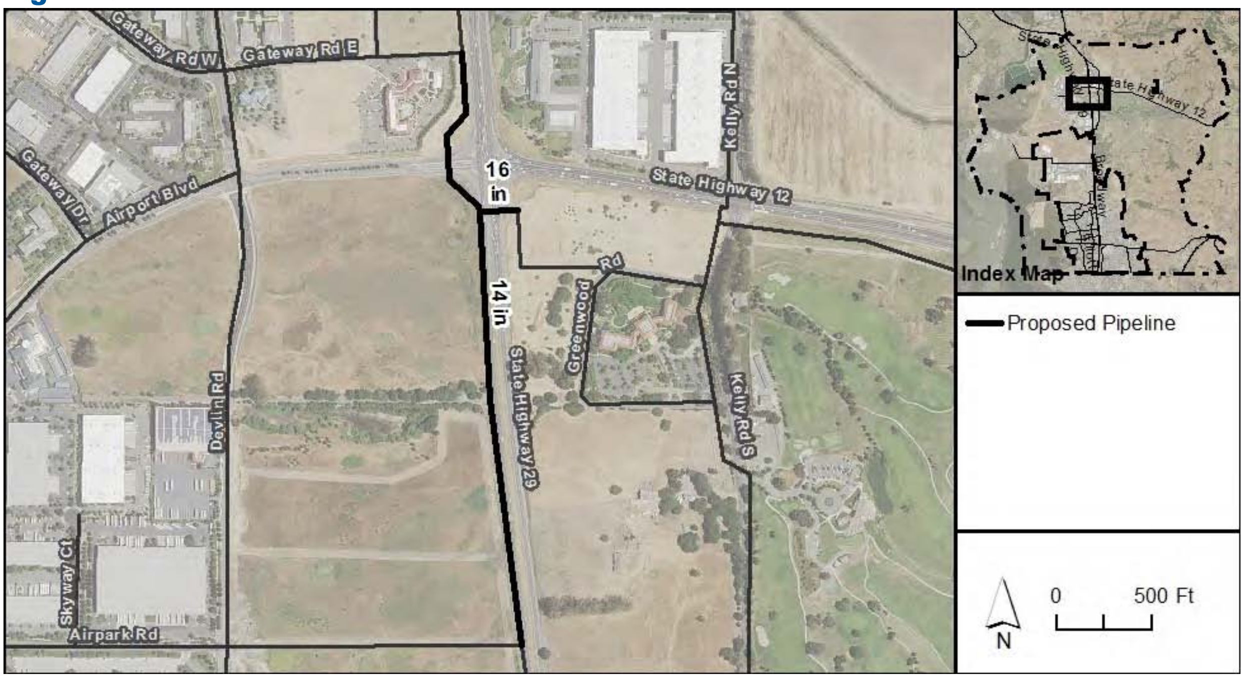

Table 8: CIP – W8 Summary

CIP Component	Description
Proposed Improvements	• 16-inch Welded Steel Water Pipeline – 210 LF • 14-inch Welded Steel Water Pipeline – 3,240 LF
Additional Project Considerations	• CEQA review and construction permits • Easement / right-of-way considerations – Caltrans
Project Cost Total (1)	$1,960,000 – Water Operations

(1) Detailed information for the project cost is provided in Appendix E.

CIP – W9 Replace Oat Hill Transmission Main

To increase hydraulic efficiency and address deterioration concerns, CIP W9 recommends the upsizing of the existing 1,920 LF 16-inch pipeline to 18-inches in Medeiros Lane which connects to the Oat Hill Tank #1 and extends east to Hwy 29. The existing connection at the bottom of the Oat Hill Tank #1 should be abandoned and a new connection at the side of the tank should be constructed along with the upsized main.

Figure 9 provides an illustration of project improvements.

Figure 9

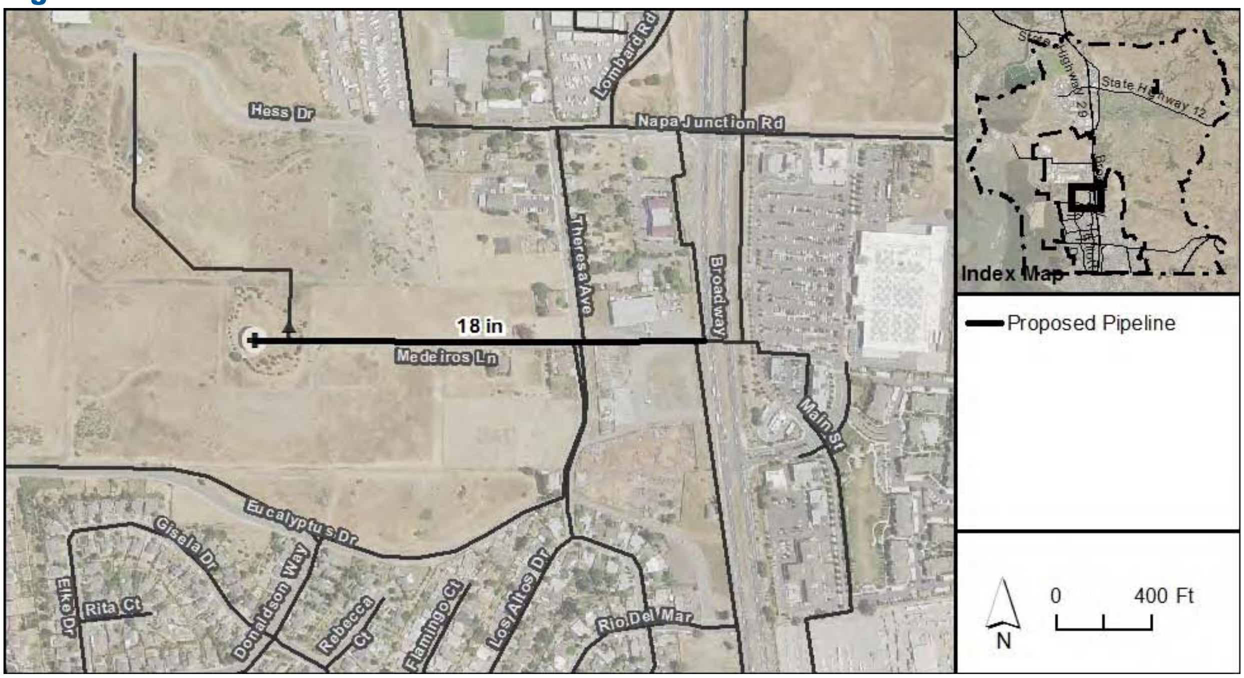

Table 9: CIP – W9 Summary

CIP Component	Description
Proposed Improvements	• 18-inch Welded Steel Water Pipeline – 1,920 LF
Additional Project Considerations	• CEQA review and construction permits
Project Cost Total (1)	$1,280,000 – Water Operations

(1) Detailed information for the project cost is provided in Appendix E.

CIP – W10 New Transmission Main from WTP and Watson Lane

Adding an additional transmission main from the City's water treatment plant to the southeast area of the City will increase the reliability of the water distribution system and help to balance water pressure in Zone 1 under buildout conditions. There is an existing 14-inch pipeline owned by the City of Vallejo which extends along the railroad alignment between Watson Lane and Highway 12. CIP W10 consists of slip lining approximately 9,460 LF of the existing 14-inch with 12-inch HDPE from the intersection of Watson Lane and Future Newell Drive northeast towards the water treatment plant. A new 12-inch pipeline, approximately 6,760 LF, should be constructed to cross the Southern Pacific Railroad tracks and head north to Kirkland Ranch Road to connect to the existing 16-inch pipeline. The crossing at the Southern Pacific Railroad should occur at an elevation lower than the WTP tank. A new crossing of Highway 12 is required and tie-ins between the slip lined portion of the new transmission main and the connections to water mains at either end. CIP W10 will also extend the existing 12-inch pipeline in Watson Lane easterly by approximately 1,010 LF. If the City is unable to slip line the City of Vallejo pipeline, a new 12-inch PVC pipeline will be constructed for the entire alignment. The new 12-inch pipeline alternative is estimated to cost an additional $800,000, increasing the total cost to $8,050,000.

Figure 10 provides an illustration of project improvements.

Figure 10

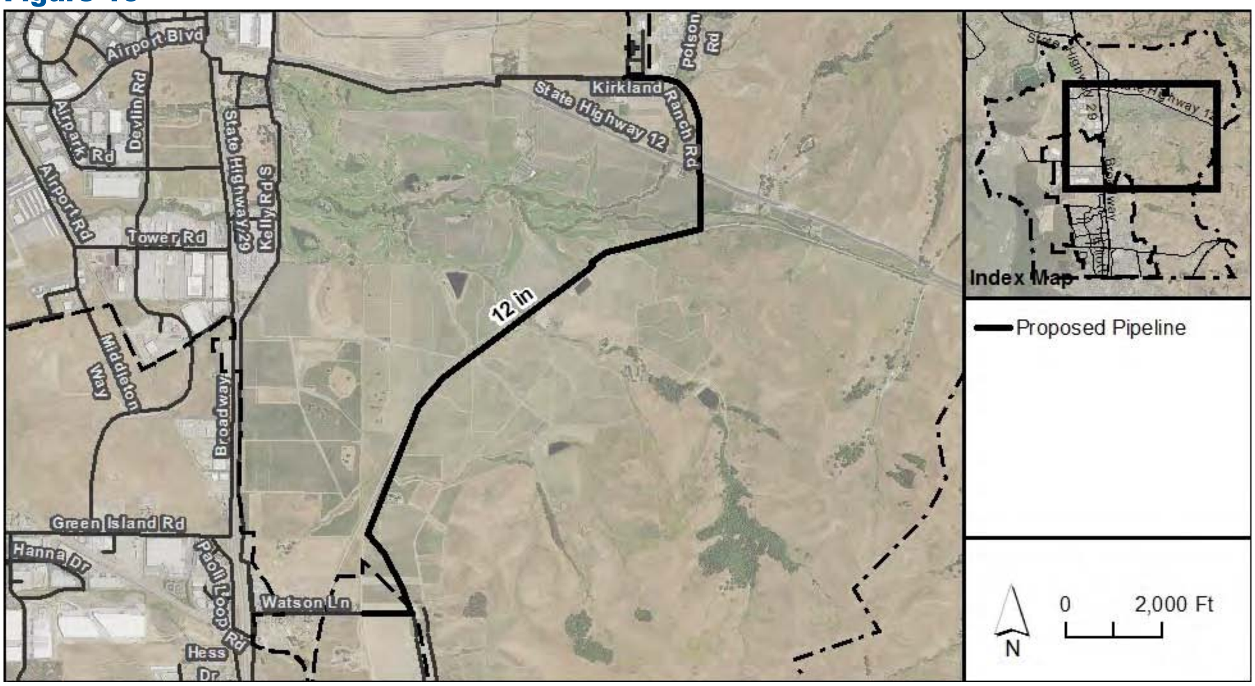

Table 10: CIP – W10 Summary

CIP Component	Description
Proposed Improvements	• 12-inch HDPE Slip Lined Water Pipe – 9,460 LF (southeast side of the railroad) • 12-inch Class 200 PVC Water Pipeline – 7,770 LF (north side of the railroad)
Additional Project Considerations	• Property transfer and easements • Easement / right-of-way considerations – Southern Pacific Railroad • CEQA review and construction permits

CIP Component	Description
Project Cost Total [1]	$7,250,000 – Water Capacity

(1) Detailed information for the project cost is provided in Appendix E.

CIP – W11 Fire Flows in Hess Drive

The junctions in Hess Road and Napa Junction Road are incapable of meeting a minimum 20 psi during a commercial and industrial fire flow of 3,500 gpm for two hours. To address this deficiency, CIP W11 consists of upsizing the existing 1,640 LF of 6-inch pipelines to 12-inch in Hess Road south to Napa Junction Road and in Napa Junction Road from Hess Road to Theresa Avenue. According to the City, the existing fire flow capacity is adequate to meet current requirements established by the Fire Marshall but the CIP project would increase fire flow capacity to meet future development in the area.

Figure 11 provides an illustration of project improvements.

Figure 11

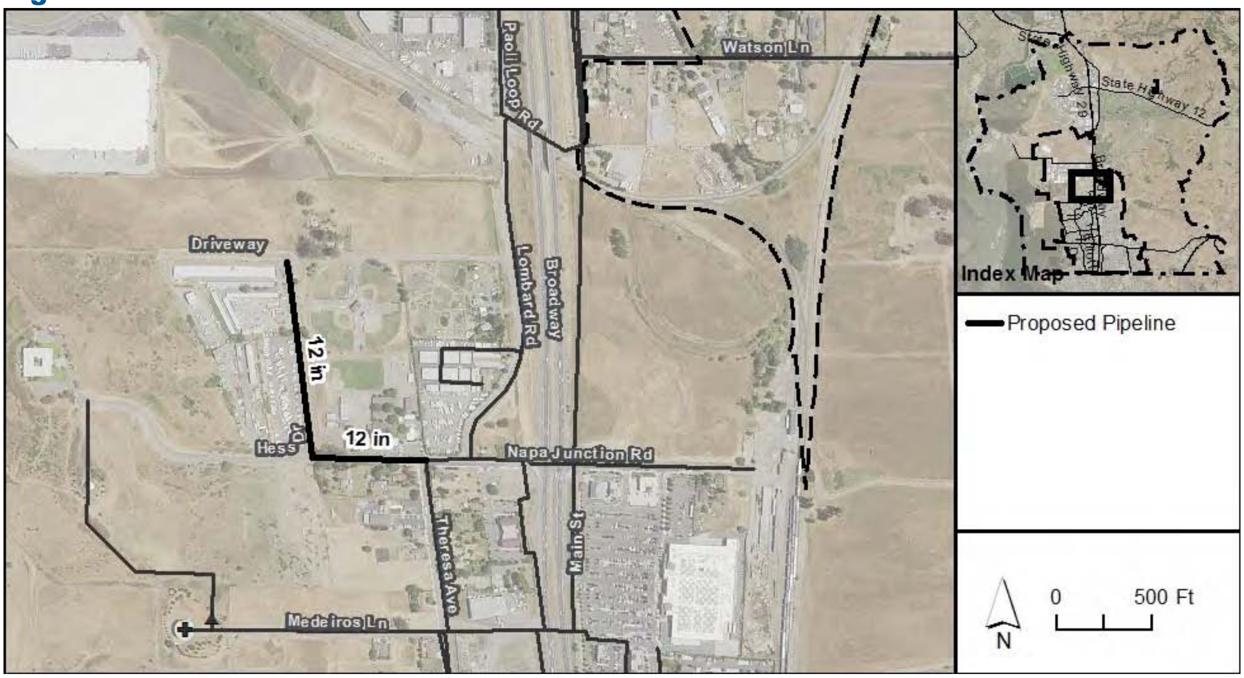

Table 11: CIP – W11 Summary

CIP Component	Description
Proposed Improvements	• 12” Class 200 PVC Water Pipeline – 1,640 LF
Additional Project Considerations	• CEQA review and construction permits
Project Cost Total (1)	$790,000 – Water Capacity

(1) Detailed information for the project cost is provided in Appendix E.

CIP – W12 Zone 1 Storage at WTP

To address the future storage shortfall, CIP W12 recommends a 1.2 MG Zone 1 Potable Water Tank be constructed at a base elevation of 197.96 ft and an overflow height of 31 ft. This tank would ideally be located at the Water Treatment Plant. CIP W12 includes the cost of a preliminary design study to provide siting alternatives for this storage tank in the future.

Figure 12 provides an illustration of project improvements.

Figure 12

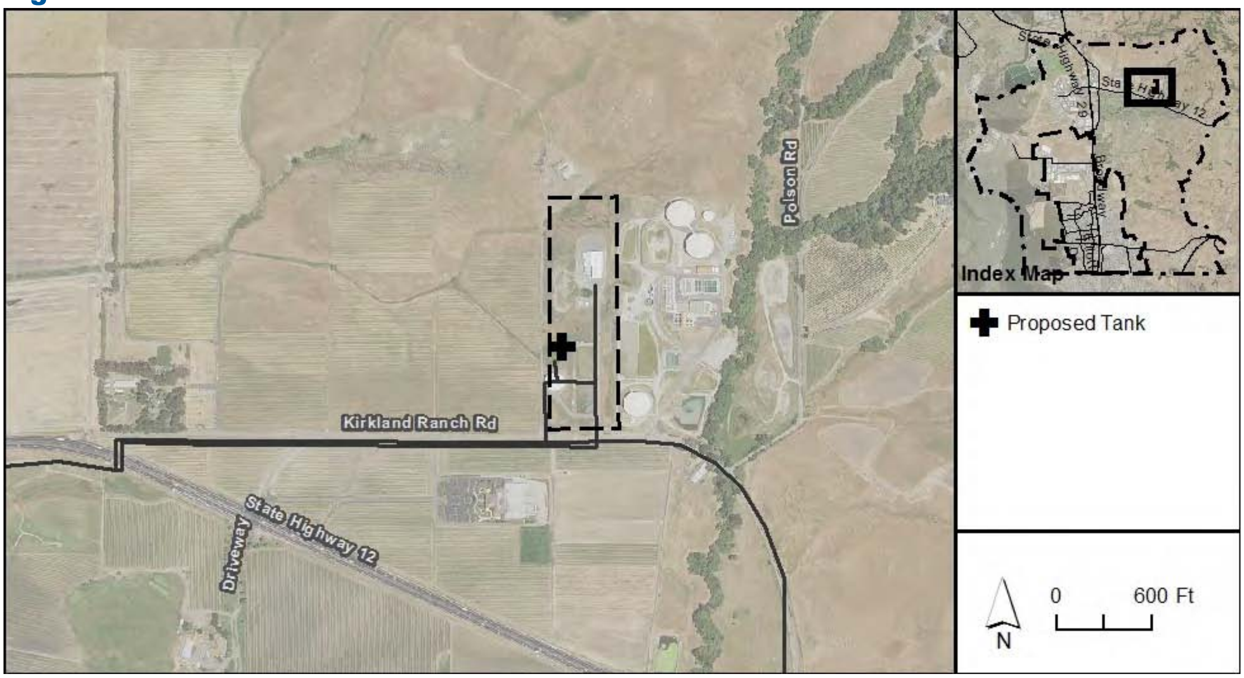

Table 12: CIP – W12 Summary

CIP Component	Description
Proposed Improvements	• 1.2 MG Zone 1 Potable Water Tank • Preliminary Design Study for Tank Siting
Additional Project Considerations	• Easement / right-of-way considerations – Property for Potable Water Tank • CEQA review and construction permits
Project Cost Total (1)	$2,310,000 – Water Capacity

(1) Detailed information for the project cost is provided in Appendix E.

CIP – W13 Main Zone Reliability Improvements

Since a majority of the water demands occur in the southern area of the City, an additional Hwy 29 crossing of a transmission main in the south is required to increase system reliability and to balance pressures across Zone 1. CIP W13 utilizes the location of an existing Hwy 29 crossing in South Napa Junction Road and upsizes approximately 1,000 LF of 6-inch to 12-inch from Hwy 29 to the Southern Pacific Railroad. An additional 1,740 LF of 12-inch pipelines will be installed in Main Street and Broadway to complete the parallel transmission main along the east side of Highway 29.

Figure 13 provides an illustration of project improvements.

Figure 13

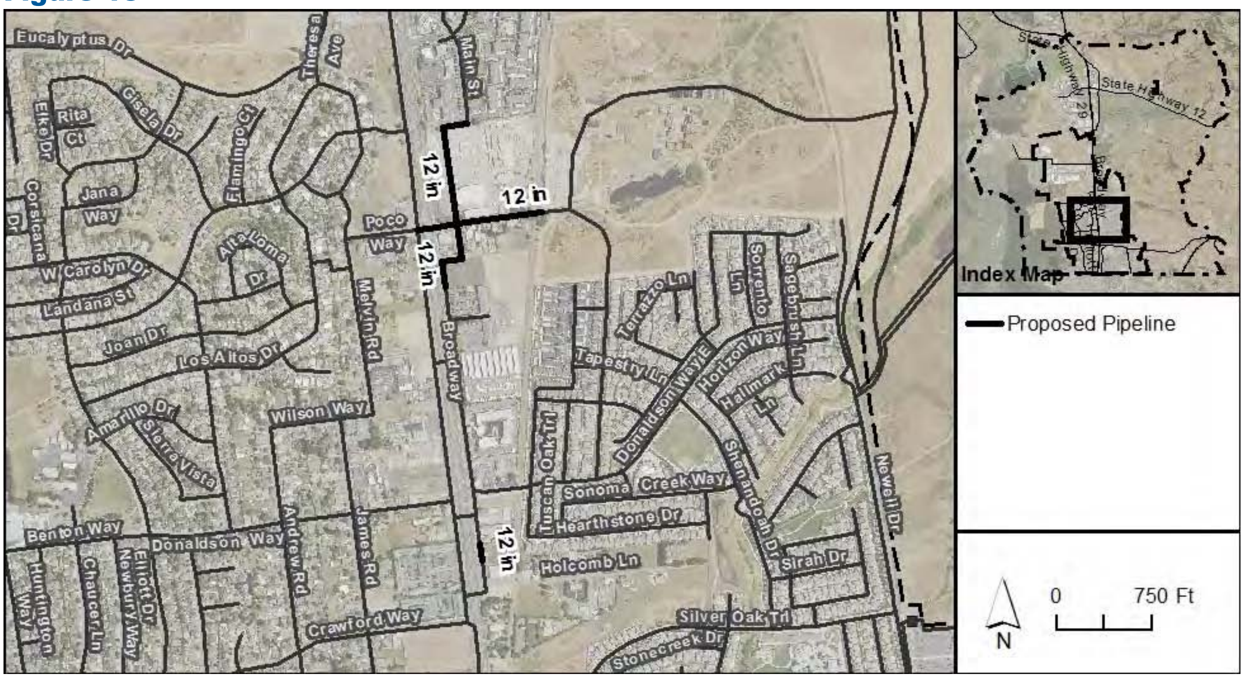

Table 13: CIP – W13 Summary

CIP Component	Description
Proposed Improvements	• 12-inch Class 200 PVC Water Pipeline – 2,740 LF
Additional Project Considerations	• CEQA review and construction permits • Easement / right-of-way considerations – Caltrans
Project Cost Total (1)	$1,290,000 – Water Operations

(1) Detailed information for the project cost is provided in Appendix E.

Appendix E – CIP Project Cost Estimates

Detailed breakdown of estimated costs for individual CIP projects

City of American Canyon
Water Distribution System Master Plan
Planning Level Opinion of Probable Cost

CIP Project; CIP-W1 Zone 1 Storage

ENR Construction Cost Index:		Date:
Jul-15	11,155.07	9/25/2015

Description	Diameter (in)	Quantity	Unit	Unit Cost	Total Cost
Mobilization and Demobilization (6%)		1	LS	$132,000	$132,000
2.5 MG Welded Steel Water Tank		1	LS	$2,200,000	$2,200,000
TOTAL ESTIMATE OF PROBABLE CONSTRUCTION COST					
Subtotal (Rounded)					$2,332,000
Construction Subtotal (Rounded)					$2,340,000
Contingency (25%) (Rounded)					$585,000
Total Estimate of Probable Construction Cost (Rounded) (1)					**$2,930,000**

Design, Survey, Geotechnical, Environmental Review, Permits (25% of Construction)	$732,500
Inspection/CM/ESDC (12% of Construction)	$351,600
Easement/Land Acquisition (1)	0
Project Total (Rounded)	**$4,020,000**

Notes:
(1) Does not include property acquisition, permit costs, or City degredation fees.

City of American Canyon
Water Distribution System Master Plan
Planning Level Opinion of Probable Cost

CIP Project; CIP-W2 Annual Water Main Replacments

ENR Construction Cost Index:	
Jul-15	11,155.07

Date:
4/21/2016

Description	Diameter (in)	Quantity	Unit	Unit Cost	Total Cost
Mobilization and Demobilization (6%)		1	LS	$1,977,000	$1,977,000
Temporary Traffic Control (5%)		1	LS	$1,647,000	$1,647,000
Potholing		1	LS	$2,889,000	$2,889,000
Shoring and Trench Safety		1	LS	$4,814,000	$4,814,000
Dewatering		1	LS	$9,627,000	$9,627,000
Handling, Treatment, and Disposal of Contaminated Soil and GW		1	LS	$2,407,000	$2,407,000
8" Class 200 PVC Water Pipe	8	132,960	LF	$121	$16,088,160
10" Class 200 PVC Water Pipe	10	16,655	LF	$142	$2,365,010
12" Class 200 PVC Water Pipe	12	49,475	LF	$164	$8,113,900
14" Welded Steel Water Pipe	14	610	LF	$213	$129,930
16" Welded Steel Water Pipe	16	12,520	LF	$239	$2,992,280
18" Welded Steel Water Pipe	18	23,275	LF	$264	$6,144,600
20" Welded Steel Water Pipe	20	5,170	LF	$290	$1,499,300
TOTAL ESTIMATE OF PROBABLE CONSTRUCTION COST					
Subtotal (Rounded)					$60,695,000
Construction Subtotal (Rounded)					$60,700,000
Contingency (25%) (Rounded)					$15,175,000
Total Estimate of Probable Construction Cost (Rounded) (1)					**$75,880,000**

Design, Survey, Geotechnical, Environmental Review, Permits (25% of Construction)	$18,970,000
Inspection/CM/ESDC (12% of Construction)	$9,105,600
Easement/Land Acquisition (1)	0
Project Total (Rounded)	**$103,960,000**

Notes:
(1) Does not include property acquisition, permit costs, or City degredation fees.

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	ENR Construction Cost Index:		Date:
CIP Project; CIP-W3 Annual Water Service Replacements	Jul-15	11,155.07	3/18/2016

Description	Diameter (in)	Quantity	Unit	Unit Cost	Total Cost
Mobilization and Demobilization (6%)		1	LS	$24,000	$24,000
Temporary Traffic Control (5%)		1	LS	$20,000	$20,000
Potholing		1	LS	$22,000	$22,000
Shoring and Trench Safety		1	LS	$36,000	$36,000
Dewatering		1	LS	$72,000	$72,000
Handling, Treatment, and Disposal of Contaminated Soil and GW		1	LS	$18,000	$18,000
Replace Water Services		90	EA	$3,000	$270,000
TOTAL ESTIMATE OF PROBABLE CONSTRUCTION COST					
Subtotal (Rounded)					$462,000
Construction Subtotal (Rounded)					$470,000
Contingency (25%) (Rounded)					$118,000
Total Estimate of Probable Construction Cost (Rounded) [1]					**$590,000**

Design, Survey, Geotechnical, Environmental Review, Permits (25% of Construction)	$147,500
Inspection/CM/ESDC (12% of Construction)	$70,800
Easement/Land Acquisition [1]	0
Project Total (Rounded)	**$810,000**

Notes:
(1) Does not include property acquisition, permit costs, or City degradation fees.

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CIP Project; CIP-W4 High Pressure Zones

ENR Construction Cost Index:	
Jul-15	11,155.07

Date: 9/25/2015

Description	Diameter (in)	Quantity	Unit	Unit Cost	Total Cost
Mobilization and Demobilization (6%)		1	LS	$314,000	$314,000
Temporary Traffic Control (5%)		1	LS	$262,000	$262,000
Potholing		1	LS	$156,000	$156,000
Shoring and Trench Safety		1	LS	$259,000	$259,000
Dewatering		1	LS	$518,000	$518,000
Handling, Treatment, and Disposal of Contaminated Soil and GW		1	LS	$130,000	$130,000
18" Welded Steel Water Pipe	18	2,190	LF	$264	$578,160
12" Class 200 PVC Water Pipe	12	3,880	LF	$164	$636,320
12" HDPE Slip Lined Water Pipe	12	6,870	LF	$120	$824,400
30 HP Water Booster Pump Station		1	LS	$300,000	$300,000
2.0 MG Welded Steel Water Tank		1	LS	$1,800,000	$1,800,000
Access Road		2,190	LF	$20	$43,800
Pressure Regulating Stations	12	2	EA	$70,000	$140,000
TOTAL ESTIMATE OF PROBABLE CONSTRUCTION COST					
Subtotal (Rounded)					$5,962,000
Construction Subtotal (Rounded)					$5,970,000
Contingency (25%) (Rounded)					$1,493,000
Total Estimate of Probable Construction Cost (Rounded) [1]					**$7,470,000**

Design, Survey, Geotechnical, Environmental Review, Permits (25% of Construction)	$1,867,500
Inspection/CM/ESDC (12% of Construction)	$896,400
Easement/Land Acquisition [1]	0
Project Total (Rounded)	**$10,240,000**

Notes:
(1) Does not include property acquisition, permit costs, or City degredation fees.

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ENR Construction Cost Index:		Date:
Jul-15	11,155.07	9/25/2015

CIP Project; CIP-W5 Devlin Road Extension

Description	Diameter (in)	Quantity	Unit	Unit Cost	Total Cost
Mobilization and Demobilization (6%)		1	LS	$42,000	$42,000
Temporary Traffic Control (5%)		1	LS	$35,000	$35,000
Potholing		1	LS	$36,000	$36,000
Shoring and Trench Safety		1	LS	$59,000	$59,000
Dewatering		1	LS	$118,000	$118,000
Handling, Treatment, and Disposal of Contaminated Soil and GW		1	LS	$30,000	$30,000
12" Class 200 PVC Water Pipe	12	2,930	LF	$164	$480,520
TOTAL ESTIMATE OF PROBABLE CONSTRUCTION COST					
Subtotal (Rounded)					$801,000
Construction Subtotal (Rounded)					$810,000
Contingency (25%) (Rounded)					$203,000
Total Estimate of Probable Construction Cost (Rounded) [(1)]					**$1,020,000**

Design, Survey, Geotechnical, Environmental Review, Permits (25% of Construction)	$255,000
Inspection/CM/ESDC (12% of Construction)	$122,400
Easement/Land Acquisition [(1)]	0
Project Total (Rounded)	**$1,400,000**

Notes:
(1) Does not include property acquisition, permit costs, or City degredation fees.

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ENR Construction Cost Index:		Date:
Jul-15	11,155.07	3/18/2016

CIP Project; CIP-W6 Watson Ranch Main Zone

Description	Diameter (in)	Quantity	Unit	Unit Cost	Total Cost
Mobilization and Demobilization (6%)		1	LS	$121,000	$121,000
Temporary Traffic Control (5%)		1	LS	$105,000	$105,000
Potholing		1	LS	$109,000	$109,000
Shoring and Trench Safety		1	LS	$182,000	$182,000
Dewatering		1	LS	$363,000	$363,000
Handling, Treatment, and Disposal of Contaminated Soil and GW		1	LS	$91,000	$91,000
12" Class 200 PVC Water Pipe	12	8,340	LF	$164	$1,367,760
8" Class 200 PVC Water Pipe	8	720	LF	$121	$87,120
TOTAL ESTIMATE OF PROBABLE CONSTRUCTION COST					
Subtotal (Rounded)					$2,426,000
Construction Subtotal (Rounded)					$2,430,000
Contingency (25%) (Rounded)					$608,000
Total Estimate of Probable Construction Cost (Rounded) (1)					**$3,040,000**

Design, Survey, Geotechnical, Environmental Review, Permits (25% of Construction)	$760,000
Inspection/CM/ESDC (12% of Construction)	$364,800
Easement/Land Acquisition (1)	0
Project Total (Rounded)	**$4,170,000**

Notes:
(1) Does not include property acquisition, permit costs, or City degredation fees.

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CIP Project; CIP-W7 Watson Ranch

ENR Construction Cost Index:	
Jul-15	11,155.07

Date: 3/18/2016

Description	Diameter (in)	Quantity	Unit	Unit Cost	Total Cost
Mobilization and Demobilization (6%)		1	LS	$67,000	$67,000
Temporary Traffic Control (5%)		1	LS	$56,000	$56,000
Potholing		1	LS	$70,000	$70,000
Shoring and Trench Safety		1	LS	$117,000	$117,000
Dewatering		1	LS	$233,000	$233,000
Handling, Treatment, and Disposal of Contaminated Soil and GW		1	LS	$59,000	$59,000
12" HDPE Slip Lined Water Pipe	12	5,810	LF	$120	$697,200
TOTAL ESTIMATE OF PROBABLE CONSTRUCTION COST					
Subtotal (Rounded)					$1,300,000
Construction Subtotal (Rounded)					$1,300,000
Contingency (25%) (Rounded)					$325,000
Total Estimate of Probable Construction Cost (Rounded) (1)					**$1,630,000**

Design, Survey, Geotechnical, Environmental Review, Permits (25% of Construction)	$407,500
Inspection/CM/ESDC (12% of Construction)	$195,600
Easement/Land Acquisition (1)	0
Project Total (Rounded)	**$2,240,000**

Notes:
(1) Does not include property acquisition, permit costs, or City degredation fees.

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CIP Project; CIP-W7 Watson Ranch (Alternative)

ENR Construction Cost Index:		Date:
Jul-15	11,155.07	5/2/2016

Description	Diameter (in)	Quantity	Unit	Unit Cost	Total Cost
Mobilization and Demobilization (6%)		1	LS	$82,000	$82,000
Temporary Traffic Control (5%)		1	LS	$69,000	$69,000
Potholing		1	LS	$70,000	$70,000
Shoring and Trench Safety		1	LS	$117,000	$117,000
Dewatering		1	LS	$233,000	$233,000
Handling, Treatment, and Disposal of Contaminated Soil and GW		1	LS	$59,000	$59,000
12" Class 200 PVC Water Pipe	12	5,810	LF	$164	$952,840
TOTAL ESTIMATE OF PROBABLE CONSTRUCTION COST					
Subtotal (Rounded)					$1,583,000
Construction Subtotal (Rounded)					$1,590,000
Contingency (25%) (Rounded)					$398,000
Total Estimate of Probable Construction Cost (Rounded) (1)					**$1,990,000**

Design, Survey, Geotechnical, Environmental Review, Permits (25% of Construction)	$497,500
Inspection/CM/ESDC (12% of Construction)	$238,800
Easement/Land Acquisition (1)	0
Project Total (Rounded)	**$2,730,000**

Notes:
(1) Does not include property acquisition, permit costs, or City degredation fees.

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CIP Project; CIP-W8 Replace Transmission Mains Near SR29

ENR Construction Cost Index:		Date:
Jul-15	11,155.07	9/25/2015

Description	Diameter (in)	Quantity	Unit	Unit Cost	Total Cost
Mobilization and Demobilization (6%)		1	LS	$59,000	$59,000
Temporary Traffic Control (5%)		1	LS	$50,000	$50,000
Potholing		1	LS	$42,000	$42,000
Shoring and Trench Safety		1	LS	$69,000	$69,000
Dewatering		1	LS	$138,000	$138,000
Handling, Treatment, and Disposal of Contaminated Soil and GW		1	LS	$35,000	$35,000
16" Welded Steel Water Pipe	16	210	LF	$239	$50,190
14" Welded Steel Water Pipe	14	3,240	LF	$213	$690,120
TOTAL ESTIMATE OF PROBABLE CONSTRUCTION COST					
Subtotal (Rounded)					$1,134,000
Construction Subtotal (Rounded)					$1,140,000
Contingency (25%) (Rounded)					$285,000
Total Estimate of Probable Construction Cost (Rounded) (1)					**$1,430,000**

Design, Survey, Geotechnical, Environmental Review, Permits (25% of Construction)	$357,500
Inspection/CM/ESDC (12% of Construction)	$171,600
Easement/Land Acquisition (1)	0
Project Total (Rounded)	**$1,960,000**

Notes:
(1) Does not include property acquisition, permit costs, or City degredation fees.

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CIP Project; CIP-W9 Replace Oat Hill Transmission Main

ENR Construction Cost Index:		Date:
Jul-15	11,155.07	9/25/2015

Description	Diameter (in)	Quantity	Unit	Unit Cost	Total Cost
Mobilization and Demobilization (6%)		1	LS	$39,000	$39,000
Temporary Traffic Control (5%)		1	LS	$33,000	$33,000
Potholing		1	LS	$24,000	$24,000
Shoring and Trench Safety		1	LS	$39,000	$39,000
Dewatering		1	LS	$77,000	$77,000
Handling, Treatment, and Disposal of Contaminated Soil and GW		1	LS	$20,000	$20,000
18" Welded Steel Water Pipe	18	1,920	LF	$264	$506,880
TOTAL ESTIMATE OF PROBABLE CONSTRUCTION COST					
Subtotal (Rounded)					$739,000
Construction Subtotal (Rounded)					$740,000
Contingency (25%) (Rounded)					$185,000
Total Estimate of Probable Construction Cost (Rounded) [1]					**$930,000**

Design, Survey, Geotechnical, Environmental Review, Permits (25% of Construction)	$232,500
Inspection/CM/ESDC (12% of Construction)	$111,600
Easement/Land Acquisition [1]	0
Project Total (Rounded)	**$1,280,000**

Notes:
(1) Does not include property acquisition, permit costs, or City degredation fees.

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CIP Project; CIP-W10 New Transmission Main from WTP

ENR Construction Cost Index:		Date:
Jul-15	11,155.07	9/25/2015

Description	Diameter (in)	Quantity	Unit	Unit Cost	Total Cost
Mobilization and Demobilization (6%)		1	LS	$218,000	$218,000
Temporary Traffic Control (5%)		1	LS	$181,000	$181,000
Potholing		1	LS	$207,000	$207,000
Shoring and Trench Safety		1	LS	$345,000	$345,000
Dewatering		1	LS	$690,000	$690,000
Handling, Treatment, and Disposal of Contaminated Soil and GW		1	LS	$173,000	$173,000
12" HDPE Slip Lined Water Pipe	12	9,460	LF	$120	$1,135,200
12" Class 200 PVC Water Pipe	12	7,770	LF	$164	$1,274,280
TOTAL ESTIMATE OF PROBABLE CONSTRUCTION COST					
Subtotal (Rounded)					$4,224,000
Construction Subtotal (Rounded)					$4,230,000
Contingency (25%) (Rounded)					$1,058,000
Total Estimate of Probable Construction Cost (Rounded) (1)					**$5,290,000**

Design, Survey, Geotechnical, Environmental Review, Permits (25% of Construction)	$1,322,500
Inspection/CM/ESDC (12% of Construction)	$634,800
Easement/Land Acquisition (1)	0
Project Total (Rounded)	**$7,250,000**

Notes:
(1) Does not include property acquisition, permit costs, or City degredation fees.

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	ENR Construction Cost Index:		Date:
CIP Project; CIP-W10 New Transmission Main from WTP (Alternative)	Jul-15	11,155.07	5/2/2016

Description	Diameter (in)	Quantity	Unit	Unit Cost	Total Cost
Mobilization and Demobilization (6%)		1	LS	$243,000	$243,000
Temporary Traffic Control (5%)		1	LS	$202,000	$202,000
Potholing		1	LS	$207,000	$207,000
Shoring and Trench Safety		1	LS	$345,000	$345,000
Dewatering		1	LS	$690,000	$690,000
Handling, Treatment, and Disposal of Contaminated Soil and GW		1	LS	$173,000	$173,000
12" Class 200 PVC Water Pipe	12	17,230	LF	$164	$2,825,720
TOTAL ESTIMATE OF PROBABLE CONSTRUCTION COST					
Subtotal (Rounded)					$4,686,000
Construction Subtotal (Rounded)					$4,690,000
Contingency (25%) (Rounded)					$1,173,000
Total Estimate of Probable Construction Cost (Rounded) (1)					**$5,870,000**

Design, Survey, Geotechnical, Environmental Review, Permits (25% of Construction)	$1,467,500
Inspection/CM/ESDC (12% of Construction)	$704,400
Easement/Land Acquisition (1)	0
Project Total (Rounded)	**$8,050,000**

Notes:
(1) Does not include property acquisition, permit costs, or City degredation fees.

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CIP Project; CIP-W11 Fire Flows in Hess Drive

ENR Construction Cost Index:	
Jul-15	11,155.07

Date:
9/25/2015

Description	Diameter (in)	Quantity	Unit	Unit Cost	Total Cost
Mobilization and Demobilization (6%)		1	LS	$24,000	$24,000
Temporary Traffic Control (5%)		1	LS	$20,000	$20,000
Potholing		1	LS	$20,000	$20,000
Shoring and Trench Safety		1	LS	$33,000	$33,000
Dewatering		1	LS	$66,000	$66,000
Handling, Treatment, and Disposal of Contaminated Soil and GW		1	LS	$17,000	$17,000
12" Class 200 PVC Water Pipe	12	1,640	LF	$164	$268,960
TOTAL ESTIMATE OF PROBABLE CONSTRUCTION COST					
Subtotal (Rounded)					$449,000
Construction Subtotal (Rounded)					$450,000
Contingency (25%) (Rounded)					$113,000
Total Estimate of Probable Construction Cost (Rounded) (1)					**$570,000**

Design, Survey, Geotechnical, Environmental Review, Permits (25% of Construction)	$142,500
Inspection/CM/ESDC (12% of Construction)	$68,400
Easement/Land Acquisition (1)	0
Project Total (Rounded)	**$790,000**

Notes:
(1) Does not include property acquisition, permit costs, or City degredation fees.

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CIP Project; CIP-W12 Zone 1 Storage at WTP

ENR Construction Cost Index:		Date:
Jul-15	11,155.07	3/18/2016

Description	Diameter (in)	Quantity	Unit	Unit Cost	Total Cost
Mobilization and Demobilization (6%)		1	LS	$76,000	$76,000
1.2 MG Welded Steel Water Tank		1	LS	$1,160,000	$1,160,000
Preliminary Design Study for Tank Siting		1	LS	$100,000	$100,000
TOTAL ESTIMATE OF PROBABLE CONSTRUCTION COST					
Subtotal (Rounded)					$1,336,000
Construction Subtotal (Rounded)					$1,340,000
Contingency (25%) (Rounded)					$335,000
Total Estimate of Probable Construction Cost (Rounded) (1)					**$1,680,000**

Design, Survey, Geotechnical, Environmental Review, Permits (25% of Construction)	$420,000
Inspection/CM/ESDC (12% of Construction)	$201,600
Easement/Land Acquisition (1)	0
Project Total (Rounded)	**$2,310,000**

Notes:
(1) Does not include property acquisition, permit costs, or City degredation fees.

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CIP Project; CIP-W13 Main Zone Reliability Improvements

ENR Construction Cost Index:		Date:
Jul-15	11,155.07	4/21/2016

Description	Diameter (in)	Quantity	Unit	Unit Cost	Total Cost
Mobilization and Demobilization (6%)		1	LS	$39,000	$39,000
Temporary Traffic Control (5%)		1	LS	$33,000	$33,000
Potholing		1	LS	$33,000	$33,000
Shoring and Trench Safety		1	LS	$55,000	$55,000
Dewatering		1	LS	$110,000	$110,000
Handling, Treatment, and Disposal of Contaminated Soil and GW		1	LS	$28,000	$28,000
12" Class 200 PVC Water Pipe	12	2,740	LF	$164	$449,360
TOTAL ESTIMATE OF PROBABLE CONSTRUCTION COST					
Subtotal (Rounded)					$748,000
Construction Subtotal (Rounded)					$750,000
Contingency (25%) (Rounded)					$188,000
Total Estimate of Probable Construction Cost (Rounded) (1)					**$940,000**

Design, Survey, Geotechnical, Environmental Review, Permits (25% of Construction)	$235,000
Inspection/CM/ESDC (12% of Construction)	$112,800
Easement/Land Acquisition (1)	0
Project Total (Rounded)	**$1,290,000**

Notes:
(1) Does not include property acquisition, permit costs, or City degradation fees.

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