Recycled Water Master Plan

City of American Canyon

May 2016

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

Project No. 02536 - 8411338

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1. Executive Summary

The City of American Canyon depends on recycled water as an integral piece of its overall water supply portfolio. Since the Water Reclamation Facility (WRF) was constructed in 2000 the City has been focused on building its recycled water distribution infrastructure in accordance with the City's *2005 Recycled Water Implementation Plan* and Prop 50 Grant. Over the past 15 years the City has made significant strides in constructing the primary components of a distribution system including a pump station at the WRF, a 1.0 million gallon (mg) elevated storage tank, and 13 miles of distribution pipelines. The City currently has 8 private recycled water customers and 12 public recycled water customers.

Now that the primary components of a distribution system have been constructed the City is interested in expanding the system to maximize connections and demands while creating loops within the pipe network for a more robust system with improved pressure distribution. The City's ultimate goal is to maximize water reuse for applications allowed under the State's Title 22 regulations and reserve potable water for drinking water supply and other appropriate indoor uses.

This shift in focus from infrastructure to customer connections that will take place going forward is illustrated in Table 1, which presents the available recycled water supply versus demand under existing and buildout conditions. In 2013 the City's annual recycled water demands were about 14 percent of the total supply available at the WRF from all sources, excluding rain dependent infiltration and inflow. For projected buildout conditions the annual demands are anticipated to be about 43 percent of the annualized dry weather flows and, during the summer, the maximum month average day demands (MMADD) are projected to require 85 percent of the WRF's recycled water production.

Table 1 Recycled Water Supply and Demand Summary

Scenario	Annual Supply (af/yr)1.	Annual Demand (af/yr)	Dry Weather Avg Day Supply (gpd)1.	Max Month Avg Day Demand (gpd)
Existing Conditions	1,750	248	1,562,000	442,007
Buildout Conditions	2,819	1,199	2,517,000	2,141,304

1. Based on total Average Dry Weather Flow (ADWF) received at Water Reclamation Facility.

Although Table 1 shows the projected buildout demands for the MMADD within the estimated flow through the WRF, the City may identify additional recycled water customers over time. If supply is getting tight the City could require best management practices (BMPs) for irrigation based on weather station data and agronomic rates to optimize irrigation rates. Customers using recycled water can sometimes over-irrigate believing that conservation is not required for this particular water supply, and BMPs can improve customer conservation. Also, the City should consider establishing restrictions to when recycled water is used depending on the type of use (e.g. – landscape irrigation) within each customer's use permit. This would help to optimize performance of the system as demands increase with time.

In order to serve the projected buildout demand the City will need to expand the existing pipe network, connect existing potable water customers with recycled water needs, condition new developments to install on-site recycled water infrastructure, and upgrade existing facilities to handle the increased demands. Fifteen capital improvement projects have been identified that will upgrade the City's recycled water system to serve projected buildout demands.

Table 2 summarizes the projects that the City should implement in the near-term (0 to 10 years) to maximize recycled water use from existing potable water customers with one exception, RW1, which will serve the Napa Logistics Phase 1 & 2 development expected to go to construction in 2016. These projects are prioritized because converting existing customers to recycled water will reduce potable water demands. The near-term projects have a total estimated implementation cost of $8.48 million and are shown in Figure 1.

Table 2 Recycled Water System Near-Term Capital Improvements (0 – 10 Yrs)

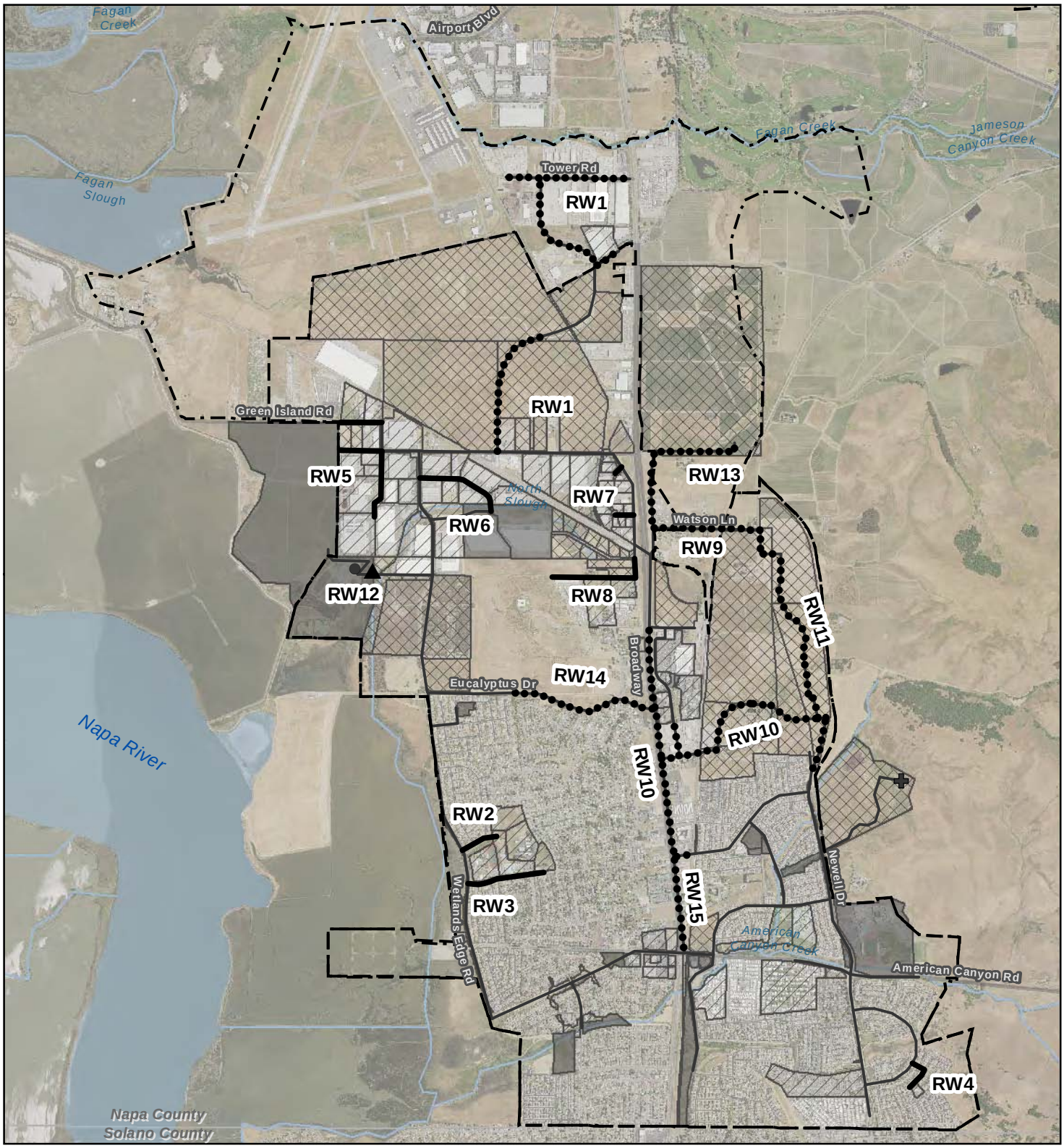
CIP Project	Driver	Estimated Cost
RW1 Tower / Devlin / South Kelly Road	Development	$4,170,000
RW2 Spikerush Circle	Convert customers to RW	$310,000
RW3 Benton Way	Convert customers to RW	$590,000
RW4 Pelleria Drive	Convert customers to RW	$320,000
RW5 Jim Oswald Way / Mezzetta Court	Convert customers to RW	$1,210,000
RW6 Hanna Drive	Convert customers to RW	$760,000
RW7 Dodd / Klamath Court	Convert customers to RW	$240,000
RW8 Lombard / Hess Road	Convert customers to RW	$880,000
Total Near-Term CIP		**$8,480,000**

Capital improvement projects that can be implemented over the long-term (11 to 20 years) are largely driven by development of Watson Ranch and converting northern vineyards from raw water to recycled water. These increased demands will also require upgrades to the pump station at the WRF and new transmission mains that create loops in the pipe network for improved hydraulic performance. Table 3 summarizes the long-term capital projects that in aggregate have an estimated implementation cost of $13.34 million. The projects are shown in Figure 1. Project descriptions for all of the recommended capital improvement projects are provided in Appendix C.

Table 3 Recycled Water System Long-Term Capital Improvements (11 – 20 Yrs)

CIP Project	Driver	Estimated Cost
RW9 Watson Lane	Development	$1,350,000
RW10 Main / South Napa Junction Road	Development	$2,990,000
RW11 Newell Drive	Development	$2,050,000
RW12 Pump Station Upgrade	System Capacity	$800,000
RW13 Paoli Loop Road / Northern Vineyards	Convert raw water customers to RW	$1,400,000
RW14 Eucalyptus Drive	System Performance	$1,280,000
RW15 Broadway / Donaldson Way	System Performance	$3,470,000
Total Long Term CIP		**$13,340,000**

It is also important to note that the City will need to continue to convert existing potable water customers to recycled water use to achieve the maximum potential of the recycled water program. In working with the City staff to identify potential candidates for conversion, a total of 111 afy of potable water demand could be converted to recycled water from the existing infrastructure without implementing any of the capital improvement projects. An additional 138 afy could be converted with the buildout of the recommended projects.



City Limits

Recycled Water Service Area

Existing RW Pipe

RW Reservoir

RW Tank

CIP Projects

Near Term

Long Term

RW Pump Station

Existing Customer

New Connections to RW System

Future Connections to RW System

Paper Size 8.5" x 11" (ANSI A)

0 1,500 3,000

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
Recycled Water Master Plan

Job Number 8411338
Revision 2
Date 29 Apr 2016

Recommended Recycled Water Capital Improvement Projects

Figure 1

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

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2. Introduction

2.1 Background

The City owns and operates a complimentary water and wastewater utility infrastructure that includes water reclamation and water reuse within the City limits. The current area served with recycled water is approximately 5 square miles with an overall potential service area of over 14 square miles, including potential customers within Napa County just outside City limits along the northern boundary. The City currently serves public schools, public parks, industrial, commercial and agricultural users.

The City's WRF produces "disinfected tertiary" treated recycled water as defined in the California Code of Regulations, Title 22, Division 4, Chapter 3 and the City operates its water reuse facilities under Order 96-011, the General Water Reuse Permit for the San Francisco Bay Region. In 2003 the City completed a *Recycled Water Facilities Plan* (Facilities Plan) that recommended a plan to construct a recycled water distribution system with elevated storage that would ultimately serve a projected demand of 1,492 acre-feet per year from 82 customers.

In 2005 the City connected its first recycled water customer, Green Island Vineyards, and also completed its *Recycled Water Implementation Plan* (Implementation Plan). The Implementation Plan was based on the previously completed Facilities Plan but refined the recommended recycled water system. The Implementation Plan recommended system improvements to serve a projected demand of approximately 1,000 acre-feet per year (afy) to 53 identified users. The City successfully obtained a Proposition 50 Recycled Water Construction Grant to develop the recycled water system based on this Implementation Plan.

In 2010, the City amended its grant agreement with the State Water Board and eliminated a number of agricultural users from its proposed program, choosing to focus instead on urban demand, which has the benefit of reducing potable water demand. This 2010 amendment also recognized that some planned development, identified in the 2005 Recycled Water Implementation Plan, had not occurred. The amended agreement provided for a minimum delivery of 666 afy to 45 customers. The hydraulic capacity of the City's pump station, storage tank and existing transmission facilities, allows the system to be "built-out" to a capacity of 1,000 afy by completing a loop in the distribution system and extending mains to serve new customers.

Demand is currently about 248 afy, which is lower than what was originally anticipated but the City has constructed a significant portion of the distribution and storage requirements to serve a much greater demand. As of 2015 the distribution system consists of approximately 10 miles of active water main, 4 fire hydrants and 50 valves. The principal mains in the system range in size from 8 to 16 inches in diameter. The system also includes a pump station located at the WRF and a 1.0 mg storage tank located in the hills east of Newell Drive. The pump station has a design capacity of 1,300 gallons per minute (gpm).

2.2 Scope

The purpose of this master planning effort is to update the City's plan for implementing its water reuse program and identify required capital improvement projects to complete the distribution and storage infrastructure necessary to support planned growth. Specifically this master plan achieves the following objectives:

- Leverage the in-place infrastructure to maximize connections and opportunities;
- Create loops within the pipe network for a more robust system with improved pressure distribution;
- Identify existing potable water customers with a recycled water need and define infrastructure improvements necessary to serve them recycled water (near-term potable water offsets);
- Identify recycled water customers at buildout;
- Identify future infrastructure improvements needed to serve recycled water customers at buildout; and
- Identify existing potable water customers with a recycled water need that could be served from future infrastructure improvements (long-term potable water offsets).

2.3 References

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

- Construction Plans for Wastewater Treatment Facilities, HydroScience Engineers (January 2000)
- Recycled Water Facilities Plan, HydroScience Engineers (December 2003)
- Recycled Water Implementation Plan, Winzler & Kelly (December 2005)
- Construction Plans for Potable and Recycled Water Storage Tanks, Winzler & Kelly (June 2008)
- Final Urban Water Management Plan 2010, Winzler & Kelly (September 2011)
- Potable water Master Plan, GHD (May 2016)

3. Planning and Evaluation Criteria

3.1 Background

Planning and evaluation criteria establish the parameters needed to set design standards for proposed improvements and to evaluate existing and future operating conditions. There are no established industry standards for recycled water systems and so the following criteria are based on best practices that suit the requirements of American Canyon's recycled water program.

3.2 Planning Criteria

Planning criteria establish the minimum design standards for infrastructure improvements in the recycled water distribution system relating to the pressure zone, storage requirements, pumping requirements, and pipelines. Table 4 lists the planning criteria established for the City's recycled water system.

Table 4 Recycled Water System Planning Criteria

Description	Planning Criteria
Pressure Zone:	
• Maximum meter elevation	Elev. 108 (NAVD88)1.
• Minimum meter elevation	Elev. 10 (NAVD88)
Storage:	
• Operational storage volume	1/3 maximum month average day demand
• Emergency storage volume	15% maximum month average day demand
Pumping:	
• Peak pumping capacity	Maximum month average day demand
• Pump reliability	Maximum month average day demand with largest unit out of service
Pipelines:	
• Minimum pipe diameter	4 inches ID
• Minimum pressure rating	200 psi

1. Meter No. 10 at Donaldson Way and Newell Drive is at Elevation 110.

The pressure zone criteria are set by the existing water surface elevations in the 1.0 mg elevated storage tank and the recycled water pump station sump at the WRF. Maximum meter elevation is the elevation served with 40 pounds per square inch (psi) static pressure at the meter when the 1.0 mg elevated storage tank has 2 feet of water above the bottom. The minimum meter elevation is 3 feet above the typical water surface in the recycled water pump station sump. These elevations will allow the system to operate within the pressure range described in the evaluation criteria.

Operational storage is provided by the existing 1.0 mg elevated storage tank. Under the buildout conditions the operational storage augments the pump station by providing additional supply to the distribution system during peak diurnal demands. When peak demand falls below the capacity from the pump station, the operational storage is replenished. The City's existing 1.0 mg elevated storage tank is more than adequate to provide operating storage for the projected buildout demands.

Emergency storage in the recycled water system is needed for critical demands, such as dual-plumbed buildings and process water, but not for irrigation demands. It is assumed that any disruption to service would be restored within a day or two. The emergency storage criterion is estimated from the percentage of demand from industrial customers. The City's new 1.5 mg storage tank located at the WRF will provide more than adequate emergency storage for critical demands during an extended outage of 1 to 2 days.

The recycled water pump station needs capacity to match the maximum month average day demand for a 24-hour period in order to ensure that the operational storage is replenished each day. The pump station should be able to meet this criterion with the largest pumping unit out of service for reliability purposes.

Piping standards are consistent with previous documents that established these standards for pipelines already constructed and in use. There is no need to change these criteria for this master plan update because they suit the range of pressures and flow rates anticipated for the built out recycled water system.

3.3 Evaluation Criteria

Evaluation criteria set the minimum conditions that must be met when the recycled water system is operating and includes system pressures, flow velocities, and operating scenarios. Table 5 lists the evaluation criteria established for the City's recycled water system.

Table 5 Recycled Water System Evaluation Criteria

Description	Evaluation Criteria
System Pressures:	
• Minimum dynamic pressure in system	10 psi
• Minimum dynamic pressure at meter	40 psi
• Maximum dynamic pressure at meter	115 psi
• Maximum dynamic pressure in system	125 psi
Flow velocities:	
• Maximum flow velocity in pipelines	7 fps
• Typical flow velocities	2–5 fps
• Design Hazen-Williams "C" Value	130

Dynamic modeling of the system is performed over a 24-hour period to simulate pump cycling, tank fill and draw, and predict performance against the stated evaluation criteria. Extended period simulations are assumed to begin at midnight.

4. Market Assessment and Demands

4.1 Methodology

Monthly recycled water meter records were reviewed for the period beginning January 2008 and ending July 2014. Over this time period the amount of recycled water demand annually increased as the City added new pipelines and new customers to the network as indicated in Figure 2. A total of 215 acre-feet (af) of recycled water was delivered in 2013 and the maximum month demand of 36 af was twice the average demand for the year. Data for the most recent 12 months, August 2013 through July 2014, is used as the baseline for establishing demands for the model since it is the most recent representation of recycled water use in the City from the data set provided. Data from potable water and irrigation meters were also reviewed for the same time period to identify irrigation accounts that are candidates for conversion to recycled water.

The 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 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, water demands could be developed by meter, by parcel and by utility land use classification.

For the existing conditions scenario only current recycled water customers, including demand at the wastewater treatment facilities, is entered into the hydraulic model for evaluation. For the buildout scenario, future demands will build off existing demands with the addition of new customers from future development and the conversion of existing demands from potable water to recycled water.

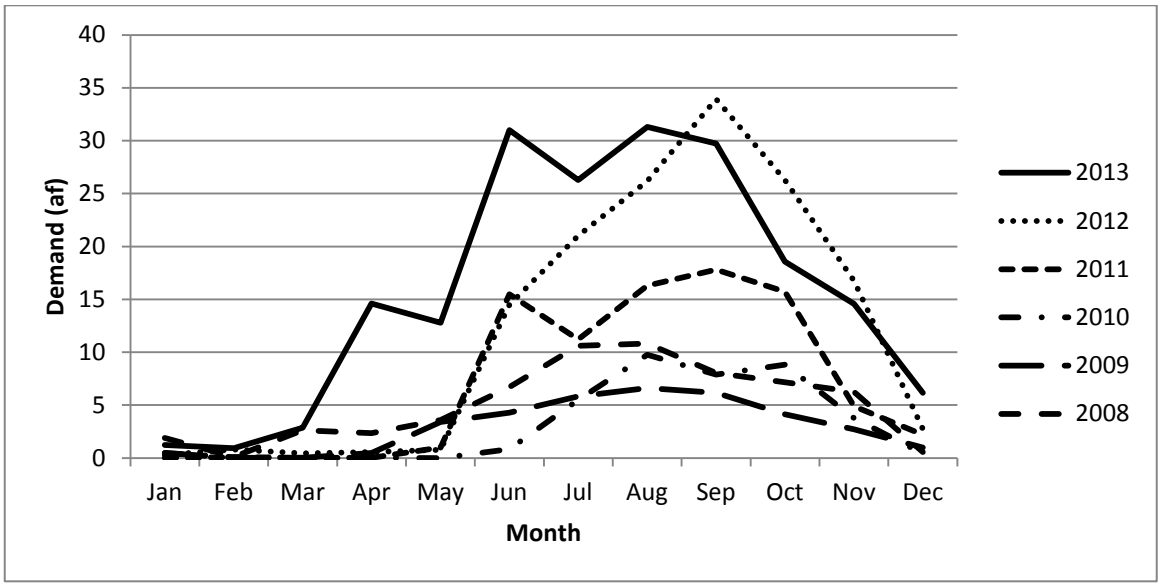

Figure 2 Historical Recycled Water Usage in American Canyon

4.1.1 Hourly Peaking Factors

Recycled water systems are characterized by substantial variations in demand during a 24-hour period. Customers are sorted into four categories for modeling peak hour demands and each category has a unique diurnal water usage pattern. Table 6 presents the four user categories and the assumed diurnal use pattern for establishing peak hour demands. Hydraulic modeling of the recycled water distribution system entails extended period simulations over a 24-hour period with each meter having a demand during the specific hours noted for its use category.

Table 6 Recycled Water Usage Categories

User Category	Hours of Use	Time of Day	Peaking Factor[1]
Landscape Irrigation - Existing	4 hrs.	0300 – 0700	6.0
Landscape Irrigation - Buildout	10 hrs.	0100 – 0700 2100 – 2400	2.4
Vineyard Irrigation	6 hrs.	0700 - 1300	4.0
Industrial	12 hrs.	0500 – 1700	2.0
Institutional/Governmental	24 hrs.	0100 – 2400	1.0

1. Peaking factor equals peak hour demand divided by maximum month average day demand.

This master plan used two different landscape irrigation diurnal curves, as shown in Figure 3 and Figure 4. In the existing condition, it was assumed that the landscape irrigation users (with the exception of the WRF and American Canyon High School) had their recycled water demand occur for 4 hours during the early morning, resulting in a peaking factor of 6.0. For the buildout condition, it is assumed that the recycled water demand for the landscape irrigation customers would occur over a 10-hour period during the night and morning, resulting in a peaking factor of 2.4.

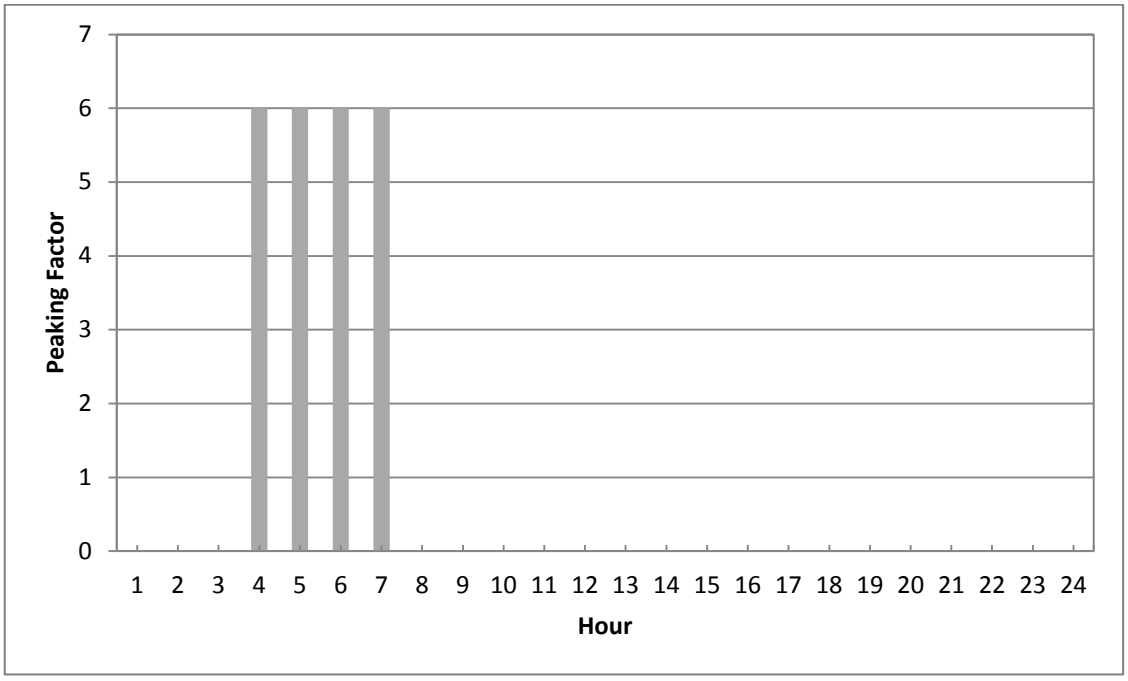

Figure 3 4-Hour Diurnal Curve for Irrigation Existing Conditions

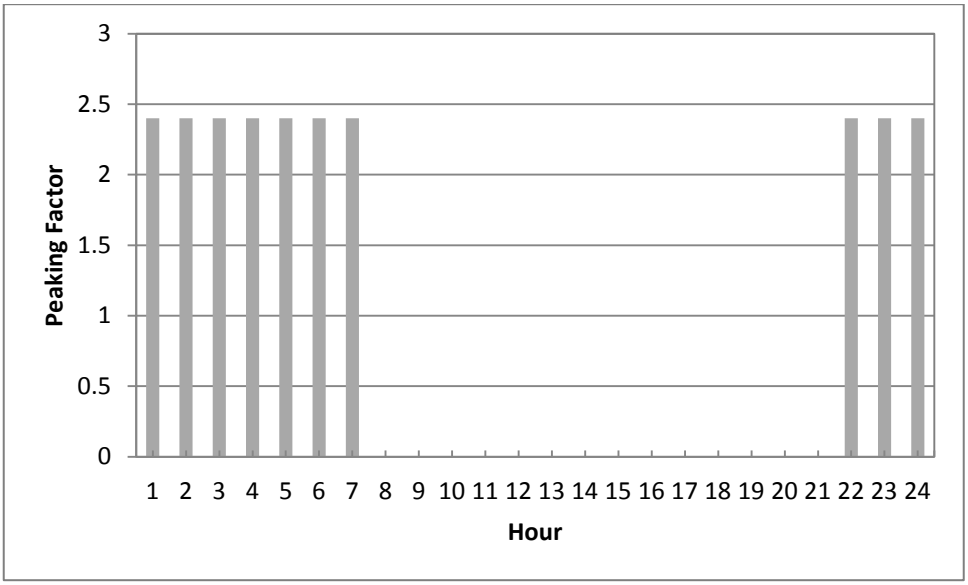

Figure 4 10-Hour Diurnal Curve for Irrigation at Buildout

As shown in Figure 5, vineyard/agricultural irrigation users had their recycled water demand occur during a 6-hour period between the hours of 7:00 and 13:00, resulting in a peaking factor of 4.0. In the buildout condition, it is assumed that an agricultural storage pond will be constructed. The vineyard/agricultural irrigation users will utilize this storage supply in the future and the peaking factor will be reduced to 1.0.

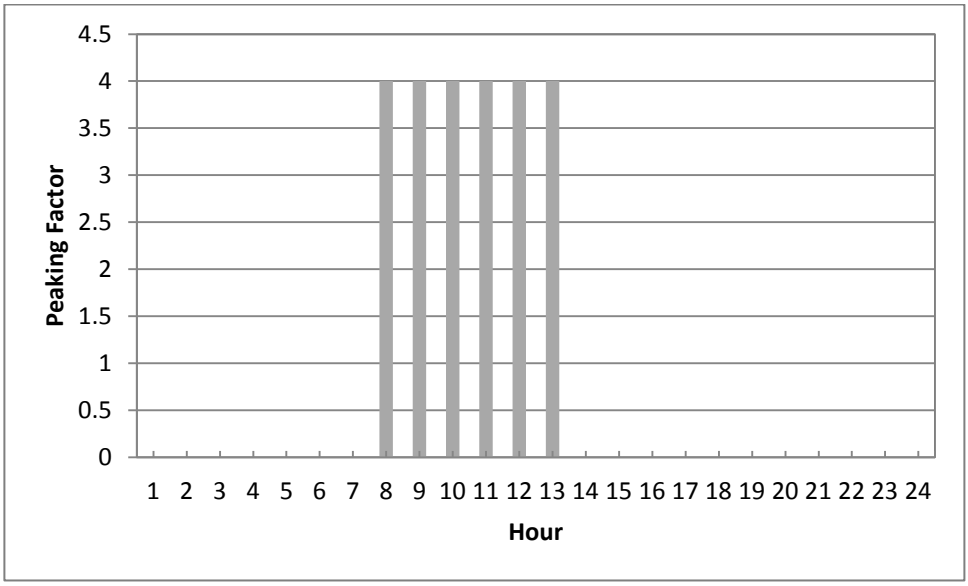

Figure 5 6-Hour Diurnal Curve for Agricultural Users

The use of recycled water at industrial facilities can include purposes such as processing, cooling, construction dust control, commercial laundries, car washes, concrete mixing and toilet flushing. For this master plan, the industrial users identified will utilize the recycled water for irrigation, toilet flushing, and other allowable process water applications. The demand is assumed to occur over a 12-hour period during typical working hours. Figure 6 presents the diurnal curve for industrial users.

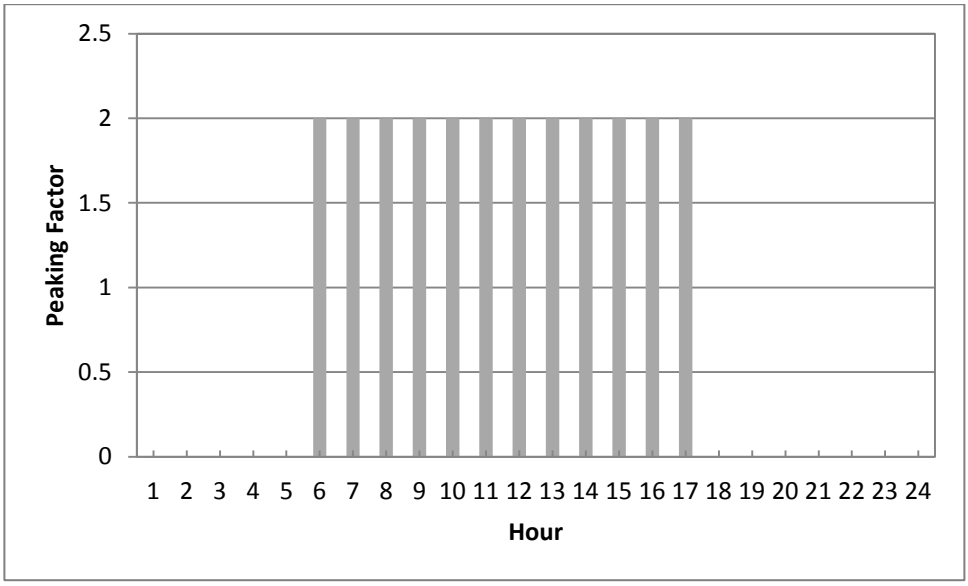

Figure 6 12-Hour Diurnal Curve for Industrial Users

The fourth user category is Institutional/Governmental and in the existing condition consists of the WRF and American Canyon High School. As shown in Figure 7, it is assumed that recycled water demand will occur over the entire 24-hour period, resulting in a peaking factor of 1.0.

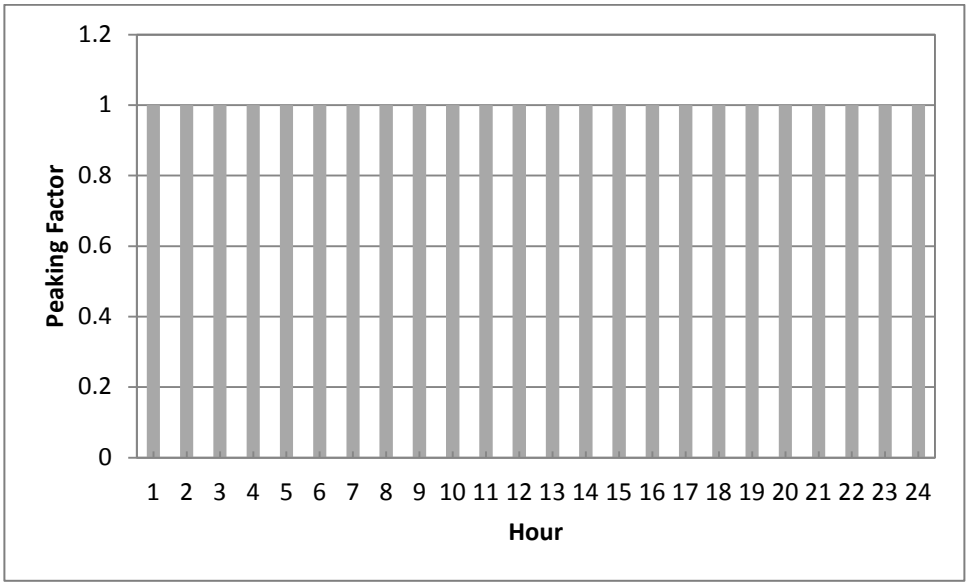

Figure 7 24-Hour Diurnal Curve for Institutional/Governmental Users

4.2 Existing Recycled Water Demands

Meter data provided by the City was analyzed and used to establish existing recycled water demands for the system. Table 7 presents the existing needs that are used for hydraulic modeling of the recycled water distribution system. The recycled water users are listed based on recorded demands in descending order and are numbered to provide an identifier for each existing customer. Meters for the Broadway greenbelt and the 1.0 million gallon storage tank site did not have demands recorded and are not included in this table. Also, recycled water meters for 111 Klamath Court and 110 Dodd Court are not yet receiving recycled water and so they are considered future

customers. Figure 8 shows a map of the existing recycled water distribution system and existing parcels served with recycled water.

Table 7 Existing Recycled Water Customers and Needs

ID	Parcel	Description/Address	Utility Land Use Classification	Annual Demand (af/yr)	Max Month Avg Day (gpd)[1.]
E1	059040084000	American Canyon HS	Inst/Gov	76.89	137,290[2.]
E2	058030041000	Green Island Vineyard	Agricultural	68.14	121,657
E3	058340002000	Kimberly Park	Landscape	14.20	25,358
E4	058030055000	WRF	Inst/Gov	14.00	24,998
E5	059110029000	Veterans Memorial Park	Landscape	10.01	17,879
E6	059302010000	Newell Greenbelt	Landscape	9.24	16,502
E7	058461011000	Northampton Park	Landscape	8.80	15,710
E8	Road ROW	Kensington Greenbelt	Landscape	7.84	13,997
E9	058613009000	Gadwall Park	Landscape	7.61	13,589
E10	Road ROW	Donaldson/Newell	Landscape	5.20	9,276
E11	Road ROW	Wetlands Edge Rd	Landscape	4.86	8,683
E12	059401002000	Shenandoah Park	Landscape	3.95	7,056
E13	058411019000	Elliott Rec Area	Landscape	3.84	6,857
E14	059110055000	218 American Canyon Rd	Commercial	3.21	5,736
E15	058420051000	677 Hanna Drive	Industrial	2.79	4,987
E16	Road ROW	Shenandoah Greenbelt	Landscape	2.61	4,666
E17	058420052000	644 Hanna Drive	Industrial	1.90	3,391
E18	059401001000	Donaldson/Vinegate Greenbelt	Inst/Gov	1.75	3,118
E19	Road ROW	Donaldson/Tuscan Greenbelt	Landscape	0.49	873
E20	059110054000	Walgreens	Commercial	0.22	384
			Totals	**247.56**	**442,007**

1. Maximum month average day demands are based on meter readings from August 2013 through July 2014.
2. Existing demand is high due to leaks in irrigation system. Assume future demand will be half as much after fixing leaks.

4.3 Future Recycled Water Demands

Future demands will come from connecting new customers to the existing recycled water distribution system, from connecting additional customers as the network is expanded, and from conditioning new development for use of recycled water where it is available. Future demands also include conversion of existing vineyards north of Watson Ranch from raw water provided by the City to recycled water. Future demands are based on the following assumptions:

- The distribution network will be expanded as indicated in this master plan;
- Irrigation demands for parcels within 100 feet of an existing or future recycled water line would convert from potable to recycled water per Administrative Policy 2011-02; and
- All utility land use classifications would be subject to recycled water use except Single Family.

4.3.1 New Connections to Existing Recycled Water System

The City has identified several existing potable water customers that could be connected to the existing recycled water pipe network, converting potable water demands for landscape irrigation to recycled water. These potential customers and the estimated potable offsets are listed in Table 8. The estimated irrigation needs are listed in descending order based on metered demands and are numbered to provide an identifier for each new customer. Figure 9 identifies the parcels where these existing customers could be converted over to recycled water by connecting to the existing system.

Table 8 New Connections to Existing Recycled Water System

ID	Parcel	Description/Address	Utility Land Use Classification	Annual Demand (af/yr)[1.]	Max Month Avg Day (gpd)[2.]
N1	059040058000	475 Silver Oak Trail	Inst/Gov	24.61	43,936
N2	059040059000	485 Silver Oak Trail	Inst/Gov	15.11	26,980
N3	058330011000	1000 Green Island Rd	Industrial	7.05	12,592
N4	059351010000	7011 Main St	Commercial	6.26	11,172
N5	059351007000	Eucalyptus Drive	Multi-Family	6.14	10,957
N6	058463023000	101 W American Canyon Rd	Commercial	4.61	8,228
N7	058420036000	1201 Commerce Blvd	Industrial	4.20	7,500
N8	058420049000	1166 Commerce Blvd	Industrial	3.88	6,923
N9	058394011000	Open Space	Landscape	3.84	6,853
N10	058461012000	941 Danrose Dr	Multi-Family	3.23	5,760
N11	058420045000	1175 Commerce Blvd	Industrial	3.19	5,694
N12	059110034000	-	Landscape	3.17	5,658
N13	058515023000	West Side of Elliott	Landscape	2.89	5,164
N14	058290009000	100 W American Canyon Rd	Commercial	2.80	5,000
N15	058040018000	205 Wetlands Edge Rd	Inst/Gov	2.30	4,102
N16	057160030000	303 Green Island Rd	Industrial	1.73	3,095
N17	058401001000	West Side of Elliott	Landscape	1.72	3,067
N18	057160024000	100 Dodd Court	Industrial	1.66	2,968
N19	059110021000	3000 Broadway	Multi-Family	1.56	2,790
N20	058030061000	1155 Commerce Blvd	Industrial	1.36	2,420
N21	057130030000	Green Island Rd at SR29	Industrial	1.21	2,168
N22	058420033000	1245 Commerce Blvd	Industrial	0.90	1,605
N23	058411018000	Linwood	Landscape	0.57	1,022
N24	Road ROW	American Canyon Rd	Landscape	0.55	989
N25	058420043000	1275 Commerce Blvd	Industrial	0.46	820
N26	058070025000	1208 Green Island Rd	Industrial	0.36	640
N27	057160020000	100 Klamath Ct	Industrial	0.13	232
N28	057160006000	4901 Paoli Loop Rd	Industrial	0.12	208

ID	Parcel	Description/Address	Utility Land Use Classification	Annual Demand (af/yr)[1.]	Max Month Avg Day (gpd)[2.]
N29	057160023000	4711 Paoli Loop Rd	Industrial	0.09	169
N30	057130001000	650 Green Island Rd	Industrial	0.08	150
N31	058420039000	880 Hanna Dr	Industrial	0.08	150
N32	058030054000	55 Mezzetta Ct	Industrial	0.08	136
N33	058330015000	1111 Green Island Rd	Industrial	0.03	48
N34	057160029000	405 Green Island Rd	Industrial	0.02	38
N35	058420042000	820 Hanna Dr	Industrial	0.02	27
			Totals	**111.10**	**198,240**

1. Annual demands are metered annual demands.
2. Maximum month average day demands are metered max month demands.

4.3.2 New Connections to Expanded Recycled Water System

There are potential new connections of existing potable water customers with irrigation demands that can be converted to recycled water as the pipe network is expanded. These potential potable offsets are shown in Table 9. The potential connections are listed based on estimated irrigation demands in descending order and are numbered to provide an identifier for each potential customer, continuing the number list from Table 8. Figure 10 identifies the parcels where these existing customers could be converted over to recycled water by connecting to the expanded system.

Table 9 New Connections to Expanded Recycled Water System

ID	Parcel	Description/Address	Utility Land Use Classification	Annual Demand (af/yr)[1.]	Max Month Avg Day (gpd)[2.]
N36	058040024000	Community Park I	Landscape	15.46	27,578
N37	058431001000	Community Park II	Landscape	13.50	24,107
N38	058040032000	300 Benton Way	Inst/Gov	9.34	16,671
N39	058030049000	105 Mezzetta Ct	Industrial	9.06	16,182
N40	059110031000	2555 Flosden Rd	Multi-Family	8.91	15,906
N41	058320008000	185 Lombard Rd	Commercial	8.77	15,661
N42	059110007000	260 American Canyon Rd	Multi-Family	8.73	15,584
N43	059352002000	5001 Main St	Commercial	6.14	10,957
N44	059352001000	5085 Main St	Commercial	6.14	10,957
N45	059351016000	6050 Main St	Commercial	6.14	10,957
N46	059351012000	5500 Eucalyptus Dr	Multi-Family	6.14	10,957
N47	058290010000	3331 Broadway	Commercial	5.46	9,750
N48	058320014000	280 Hess Dr	Inst/Gov	5.41	9,660
N49	058030053000	205 Jim Oswald Way	Industrial	3.46	6,173
N50	059253001000	Pellecia Park	Landscape	3.39	6,057

ID	Parcel	Description/Address	Utility Land Use Classification	Annual Demand (af/yr)[1.]	Max Month Avg Day (gpd)[2.]
N51	057160013000	140 Dodd Court	Industrial	3.38	6,028
N52	058420044000	110 Mezzetta Ct	Industrial	2.80	5,000
N53	058040026000	100 Benton Way	Inst/Gov	2.69	4,802
N54	058040009000	430 Donaldson Way	Inst/Gov	2.54	4,536
N55	057090077000	75 Kelly Rd South	Industrial	8.95	3,813
N56	058420040000	700 Hanna Dr	Industrial	1.12	1,995
N57	058420035000	801 Hanna Dr	Industrial	0.95	1,696
N58	057160026000	111 Klamath Ct	Industrial	0.89	1,596
N59	058083017000	4381 Broadway	Inst/Gov	0.66	1,176
N60	057160025000	110 Dodd Ct	Industrial	0.59	1,062
N61	059110008000	300 American Canyon Rd	Multi-Family	0.50	890
N62	057160017000	165 Klamath Ct	Industrial	0.47	848
N63	059150016000	2 Bethany Dr	Multi-Family	0.47	831
N64	058320015000	300 Napa Junction Rd	Inst/Gov	0.37	661
N65	057160016000	180 Klamath Ct	Industrial	0.28	508
N66	058420034000	833 Hanna Dr	Industrial	0.26	461
N67	058030050000	125 Mezzetta Ct	Industrial	0.25	449
N68	057160019000	120 Klamath Ct	Industrial	0.22	386
N69	057160027000	115 Klamath Ct	Industrial	0.17	305
N70	057160015000	160 Klamath Ct	Industrial	0.16	284
N71	058070024000	1330 Green Island Rd	Industrial	0.13	237
N72	058030052000	75 Mezzetta Ct	Industrial	0.04	66
N73	057160028000	125 Klamath Ct	Industrial	0.03	47
N74	058420041000	760 Hanna Dr	Industrial	-	3
			Totals	**138. 10**	**246,482**

1. Annual demands are metered annual demands.
2. Maximum month average day demands are metered max month demands.

4.3.3 Future Development with Recycled Water Needs

The City is conditioning new developments to use recycled water for irrigation where it is practical. Where proposed developments are in the planning and approval stages, the City has provided estimated recycled water needs. For future developments on undeveloped parcels recycled water needs are based on unit demand factors by utility land use classifications. These unit demand factors are based on the unit demand factors for irrigation established for potable water in the City's *2016 Potable Water Master Plan* and are shown in Table 10.

Table 10 Unit Demand Factors for Future Development

Utility Land Use Classification	Max Month Avg Day (gpd/acre)
Single-family	-
Multi-family	2,330
Commercial	1,075
Industrial	530
Institutional/Governmental	1,615
Landscape	3,570
Recreation	3,570

Watson Ranch

Future recycled water demands for Watson Ranch are estimated using the *Watson Ranch Specific Plan – Administrative Draft, Table 2-3* (November 2014) as a guideline. Table 11 provides a summary of the estimated recycled water demand by utility land use classification.

Table 11 Estimated Recycled Water Demands for Watson Ranch

Utility Land Use Classification	Annual Demand (af/yr)[1.]	Max Month Avg Day (gpd)[2.]
Single-family	-	-
Multi-family	6.32	11,290
Commercial	5.26	9,400
Landscape	238.95	426,624
Institutional/Governmental	2.69	4,800
Total	**253.24**	**452,114**

1. Annual demands are taken from Table 2-3 from the *Watson Ranch Specific Plan.*

2. Maximum month average day demands are based on annual demands times a peaking factor of 2.

The estimated recycled water demand presented in Table 11 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. Estimated demand was assigned to parcels based on percent of total area for the project. Figure 11 shows the Watson Ranch project with land use classifications.

Highway 29 Priority Development Area (PDA)

Recycled water demands in the PDA include three existing recycled water customers, four customers that could be connected to the existing recycled water system, and another five that could be connected to the expanded network. Figure 12 shows the location of each existing and potential customer in the PDA with their unique identifier as shown in Tables 7 - 9.

Other Known Development Projects

The City provided estimated future demands for several known development projects currently in the planning and approval stage. Estimated recycled water demands for these projects as of December 2015 are presented in Table 12. The estimated demands for other known development projects are listed based on demands in descending order and are numbered to provide an identifier for each customer. The location of these projects is shown in Figure 13.

Table 12 Estimated Future Demands for Other Known Development Projects

ID	Project	Utility Land Use Classification	Annual Demand (af/yr)[1.]	Max Month Avg Day (gpd)[2.]
F1	Napa Logistics I & II	Industrial	73.48	131,199
F2	Canyon Estates	Single Family[3.]	13.44	24,000
F3	Napa Junction III (A – C)	Industrial	9.91	17,700
F4	Napa Airport Corporate Center	Industrial	6.27	11,200
F5	Village at Vintage Ranch	Single Family[3.]	5.60	10,000
F6	255/256 Lombard Road	Industrial	19.18	2,680 [4.]
		Total	**110.30**	**196,779**

1. Annual demands are based on latest available project information as of December 2015.
2. Maximum month average day demands are based on annual demands times a peaking factor of 2.
3. Although the parcel land use classification is Single Family, these parcels will have dedicated landscape irrigation meters.
4. Assumes 1,320 gpd indoor use and 680 gpd outdoor use average day demand. Outdoor use is doubled for maximum month average day demand.

Undeveloped Parcels

Undeveloped parcels 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 to estimate the recycled water demand. Table 13 presents the estimated demands for undeveloped parcels by utility land use classification. The estimated demands for undeveloped parcels are listed based on demands in descending order and are numbered to provide an identifier for each customer. The location of these undeveloped parcels is shown in Figure 14.

Table 13 Estimated Demands for Undeveloped Parcels

ID	Parcel	Utility Land Use Classification	Annual Demand (af/yr)[1.]	Max Month Avg Day (gpd)[2.]
F7	058030066000	Recreation	79.98	142,800
F8	058030065000	Recreation	71.68	127,985
F9	057090008000	Industrial	33.55	59,906
F10	058030067000	Recreation	30.21	53,943
F11	057130005000	Industrial	28.58	51,028
F12	058030064000	Recreation	22.45	40,091
F13	057130003000	Industrial	1.69	3,016
F14	057130002000	Industrial	1.52	2,708
F15	058330016000	Industrial	1.03	1,834
F16	058330017000	Industrial	1.01	1,802
F17	058030060000	Industrial	0.84	1,500
F18	058030023000	Industrial	6.04	1,495
F19	057160014000	Industrial	0.68	1,214
F20	057130029000	Industrial	0.08	138
		Total	**275. 30**	**491,166**

1. Annual demands are one half of the maximum month average day demands applied over a 12 month period.
2. Maximum month average day demands are based on the unit demand factors presented in Table 10 times parcel acreage.

4.3.4 Vineyard Conversions

According to the *Final Urban Water Management Plan 2010* (Table 3.13) the City will deliver 105 acre-feet per year of recycled water to vineyards currently using the City's raw water for irrigation. The vineyards are located east of Highway 29 and north of Watson Ranch and are currently served by the Hess, Sutter Home and NBA #2 raw water meters. A future pipe will extend north from Watson Ranch and create a loop with the existing pipe in Paoli Loop Road east of Highway 29. According to the *Recycled Water Implementation Plan, 2005* these vineyards will receive water in a future seasonal storage pond located at the south end of the Hess vineyards. The location of these vineyards is shown on Figure 14.

4.4 Summary of Demands

A summary of the existing and buildout recycled water demands for all parcels are presented in Table 14. The projected maximum month average day demand at buildout is 2.14 MGD.

Table 14 Summary of Recycled Water Demands

Utility Land Use Classification	Exist Annual Demand (af/yr)	Buildout Annual Demand (af/yr)	Annual Potable Offset (af/yr) [1.]
Single-family	-	22.83 [2.]	9.37
Multi-family	-	41.83	26.29
Commercial	3.42	49.74	46.31
Industrial	4.69	209.89	53.08
Institutional/Governmental	101.88 [3.]	127.38 [3.]	63.94
Landscape	69.42	119.53	50.11
Open Space	-	-	-
Watson Ranch	-	253.24	-
Recreation	-	204.32	-
Agricultural	68.13	173.15	-
Total	**247.56**	**1,201.91**	**249.10**

1. Estimated potable water offsets are for existing potable water customers at buildout.
2. Although the parcel land use classification is Single Family, there are three parcels that will have dedicated landscape irrigation meters for common areas.
3. Buildout demand for Institutional/Governmental assumes the American Canyon High School will halve existing demand by fixing suspected leaks in irrigation system.

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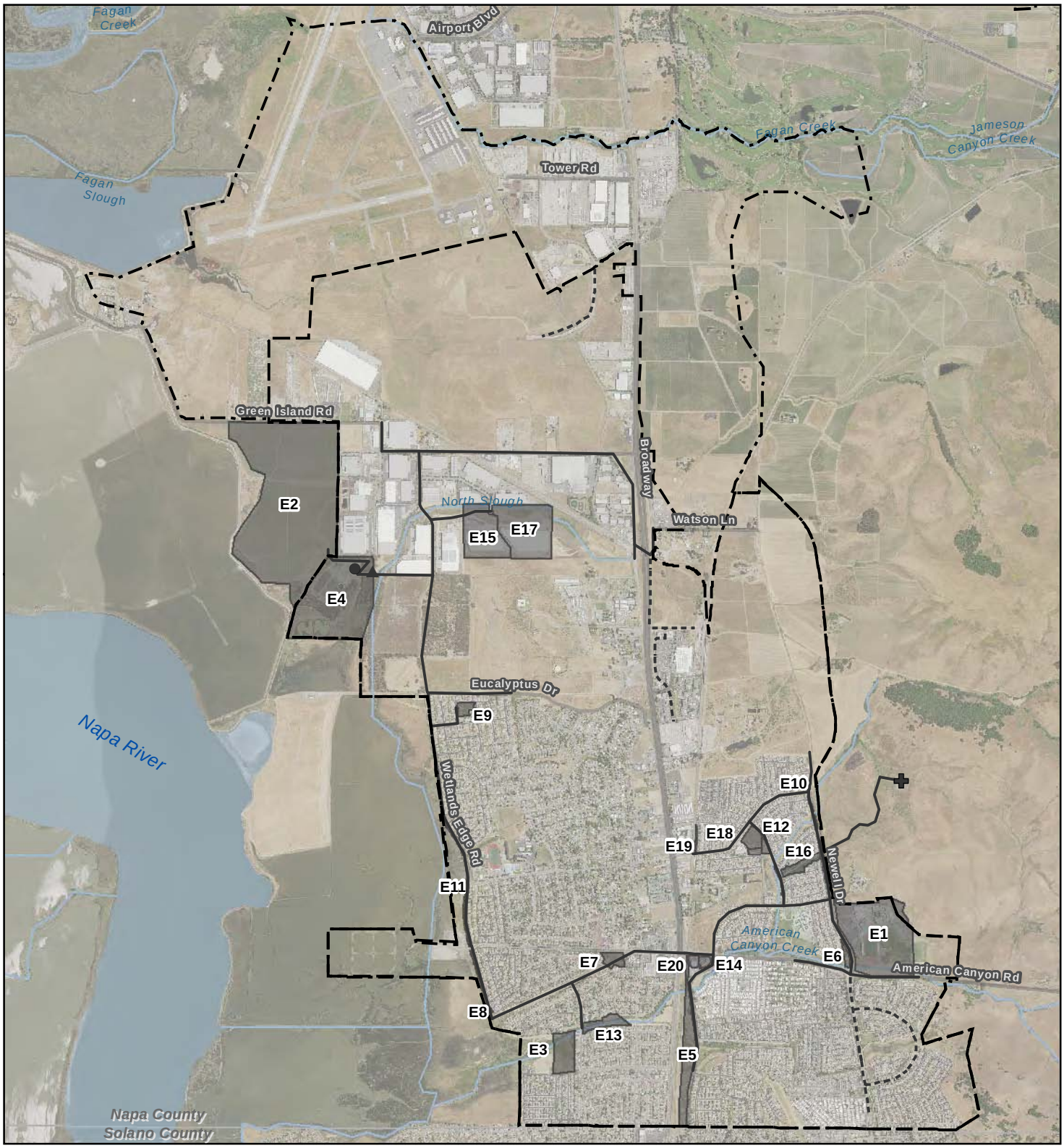

City Limits

Recycled Water Service Area

Existing RW Pipe

Existing RW Pipe (not currently used)

RW Reservoir

RW Tank

RW Pump Station

E2 Existing Customer

Paper Size 8.5" x 11" (ANSI A)

0 1,500 3,000

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
Recycled Water Master Plan

Existing Recycled Water System and Existing Customers

Job Number 8411338
Revision 2
Date 27 Apr 2016

Figure 8

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N:\US\Santa Rosa\Projects\02536 - American Canyon\02536-8411338 Master Plan Updates\08-GIS\Maps\Figures\RW\Master Plan\Final\Fig 8 - Existing RW and Customers.mxd

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

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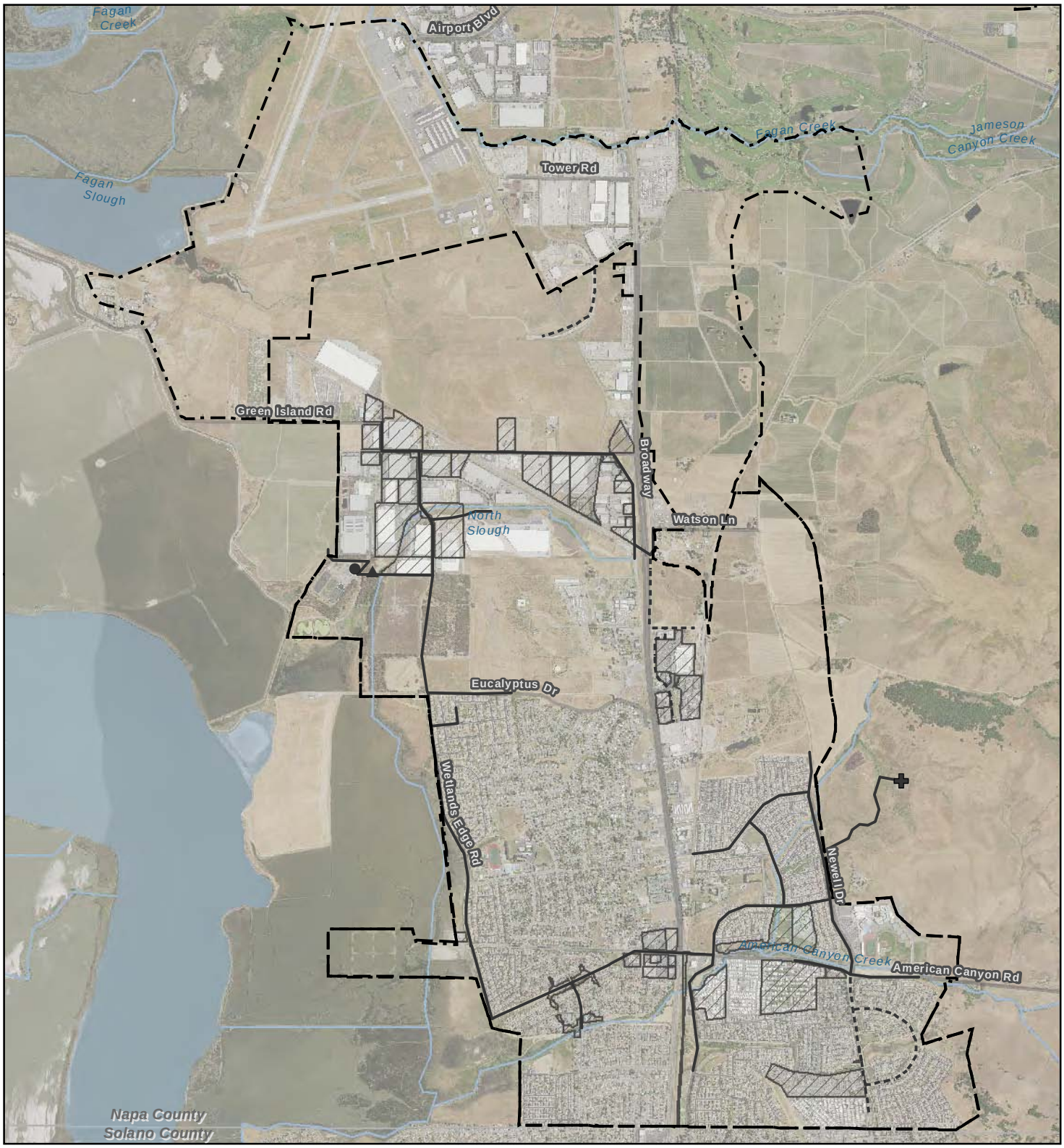

City Limits

Recycled Water Service Area

Existing RW Pipe

Existing RW Pipe (not currently used)

RW Reservoir

RW Tank

RW Pump Station

Parcels Served with New Connections

Paper Size 8.5" x 11" (ANSI A)

0 1,500 3,000

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
Recycled Water Master Plan

Job Number 8411338
Revision 1
Date 29 Apr 2016

Existing Recycled Water System and New Connections

Figure 9

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N:\US\Santa Rosa\Projects\02536 - American Canyon\02536-8411338 Master Plan Updates\08-GIS\Maps\Figures\RW\Master Plan\Final\Fig 9 - Existing RW and New Connections.mxd

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

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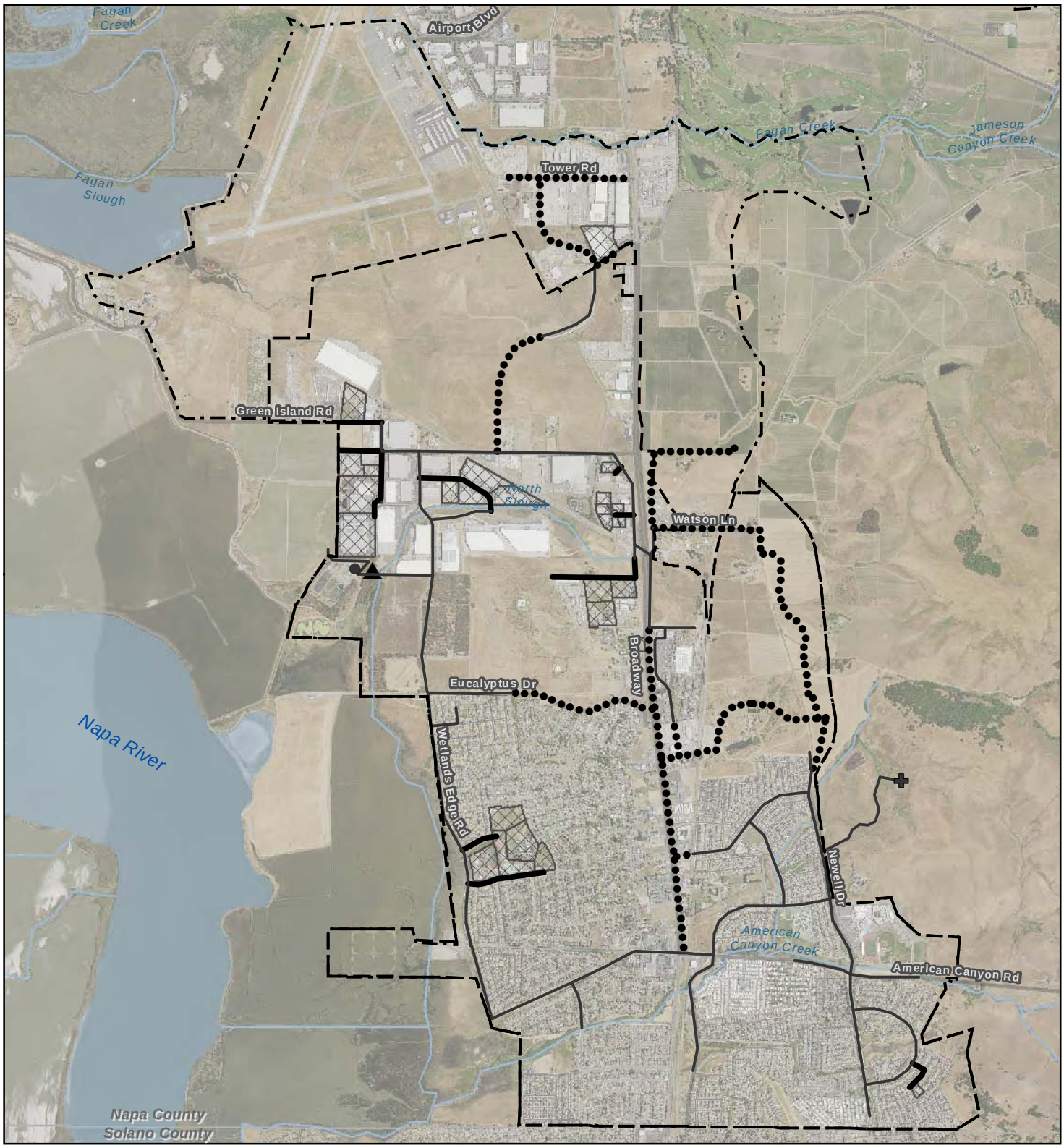

City Limits

Recycled Water Service Area

Existing RW Pipe

RW Tank

RW Reservoir

Parcels Served with New Connections

CIP Projects

Near Term

Long Term

RW Pump Station

Paper Size 8.5" x 11" (ANSI A)

0 1,500 3,000

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
Recycled Water Master Plan

Job Number 8411338
Revision 2
Date 29 Apr 2016

Buildout Recycled Water System and New Connections to Expanded System

Figure 10

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N:\US\Santa Rosa\Projects\02536 - American Canyon\02536-8411338 Master Plan Updates\08-GIS\Maps\Figures\RW\Master Plan\Final\Fig 10 - Buildout RW and Future Customers.mxd

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

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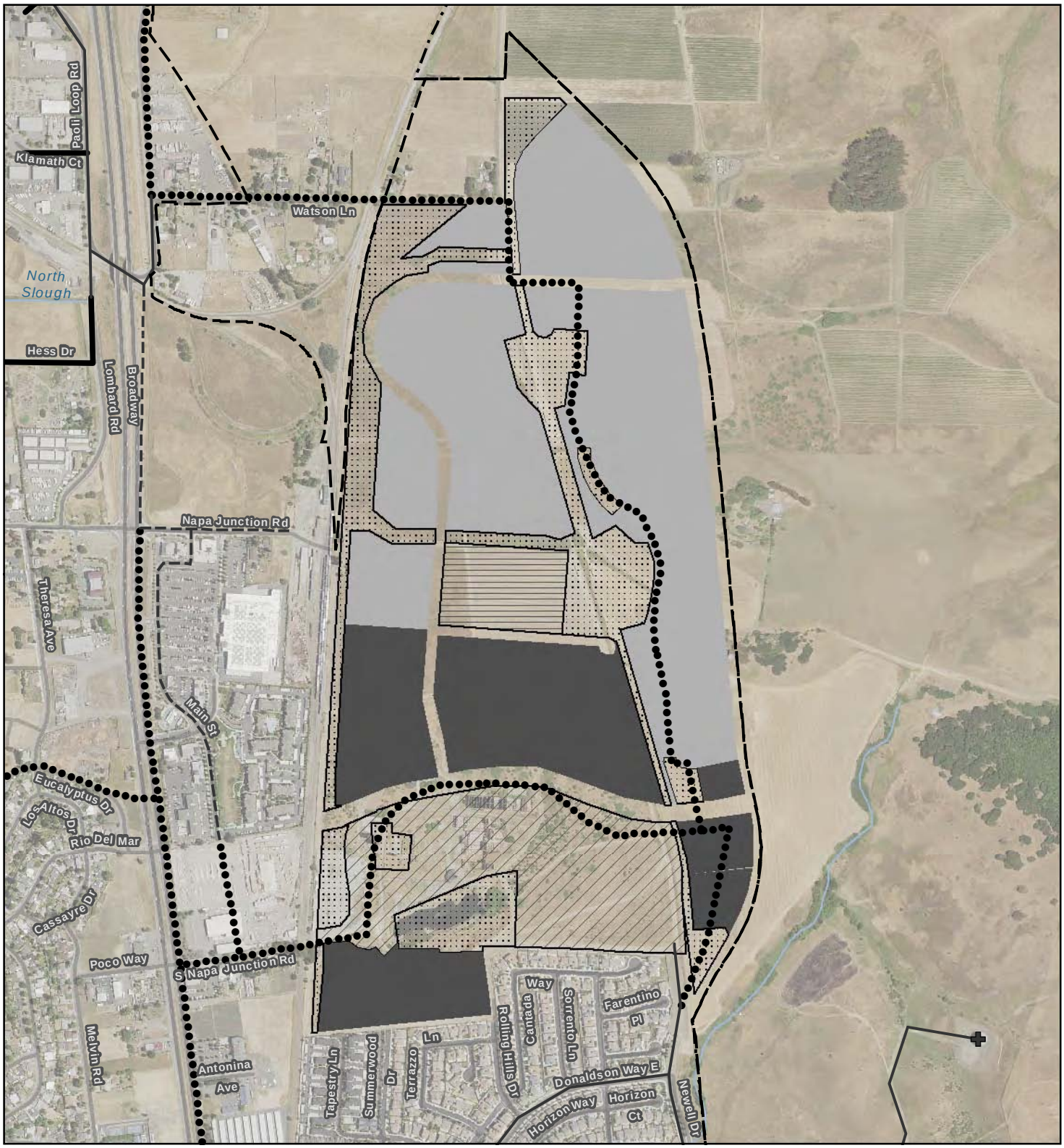

City Limits
Recycled Water Service Area
Existing RW Pipe
Existing RW Pipe (not currently used)
RW Tank
RW Reservoir
Commercial
Institutional/Governmental
Landscape
Multi-Family
Single-Family

CIP Projects
Near Term
Long Term
RW Pump Station

Paper Size 8.5" x 11" (ANSI A)
0 450 900
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
Recycled Water Master Plan

Job Number 8411338
Revision 1
Date 28 Apr 2016

Buildout Recycled Water System and Watson Ranch Development

Figure 11

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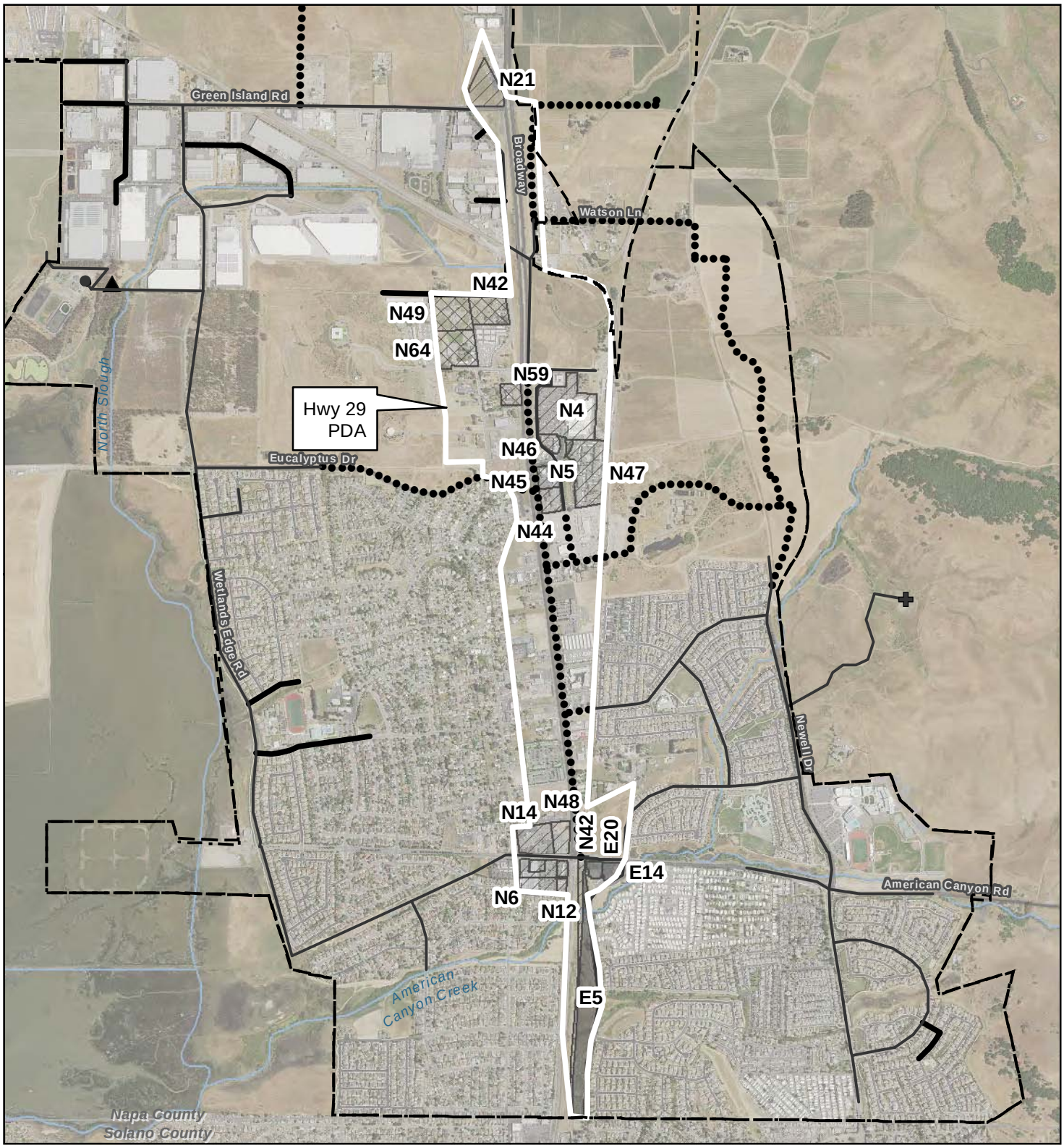

City Limits

Recycled Water Service Area

Existing RW Pipe

RW Tank

RW Reservoir

Existing Customer

Parcels Served with New Connections

Convert Exist PW Customer to RW Customer, Existing Pipe

Convert Exist PW Customer to RW Customer, Future Pipe

CIP Projects

Near Term

Long Term

RW Pump Station

Paper Size 8.5" x 11" (ANSI A)

0 1,000 2,000

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
Recycled Water Master Plan

Job Number 8411338
Revision 1
Date 04 May 2016

Buildout Recycled Water System and New Connections in PDA

Figure 12

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N:\US\Santa Rosa\Projects\02536 - American Canyon\02536-8411338 Master Plan Updates\08-GIS\Maps\Figures\RW\Master Plan\Final\Fig 12 - Buildout RW and PDA Customers.mxd

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

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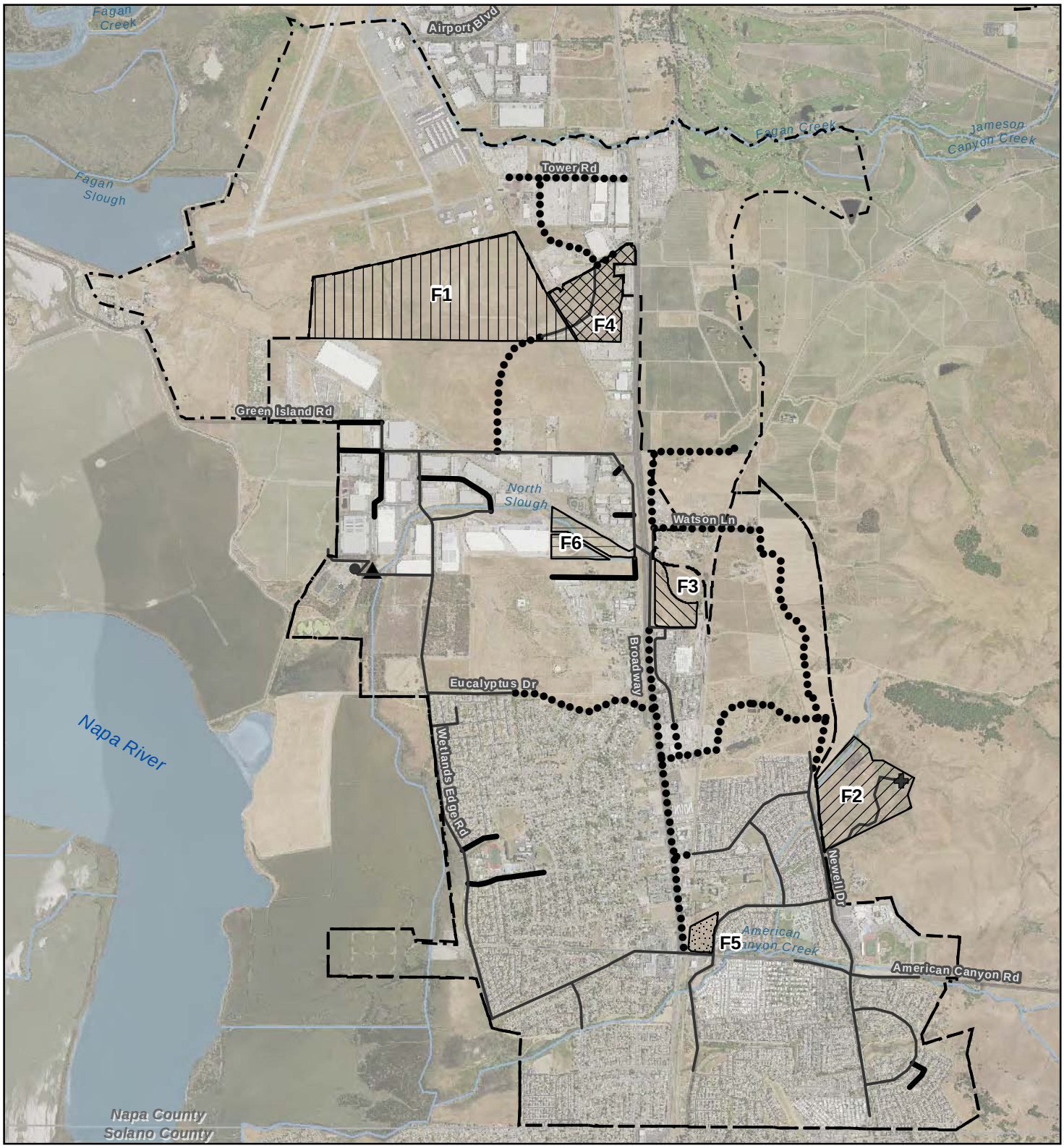

City Limits
Recycled Water Service Area
Existing RW Pipe
RW Tank
RW Reservoir
255/256 Lombard
Canyon Estates
Napa Airport Corporate Center
Napa Junction III
Napa Logistics I & II
Village at Vintage Ranch

CIP Projects
Near Term
Long Term
RW Pump Station

Paper Size 8.5" x 11" (ANSI A)
0 1,500 3,000
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
Recycled Water Master Plan

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Revision 1
Date 28 Apr 2016

Buildout Recycled Water System and Other Known Development Projects

Figure 13

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N:\US\Santa Rosa\Projects\02536 - American Canyon\02536-8411338 Master Plan Updates\08-GIS\Maps\Figures\RW\Master Plan\Final\Fig 13 - Buildout RW and Other Known Developments.mxd

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

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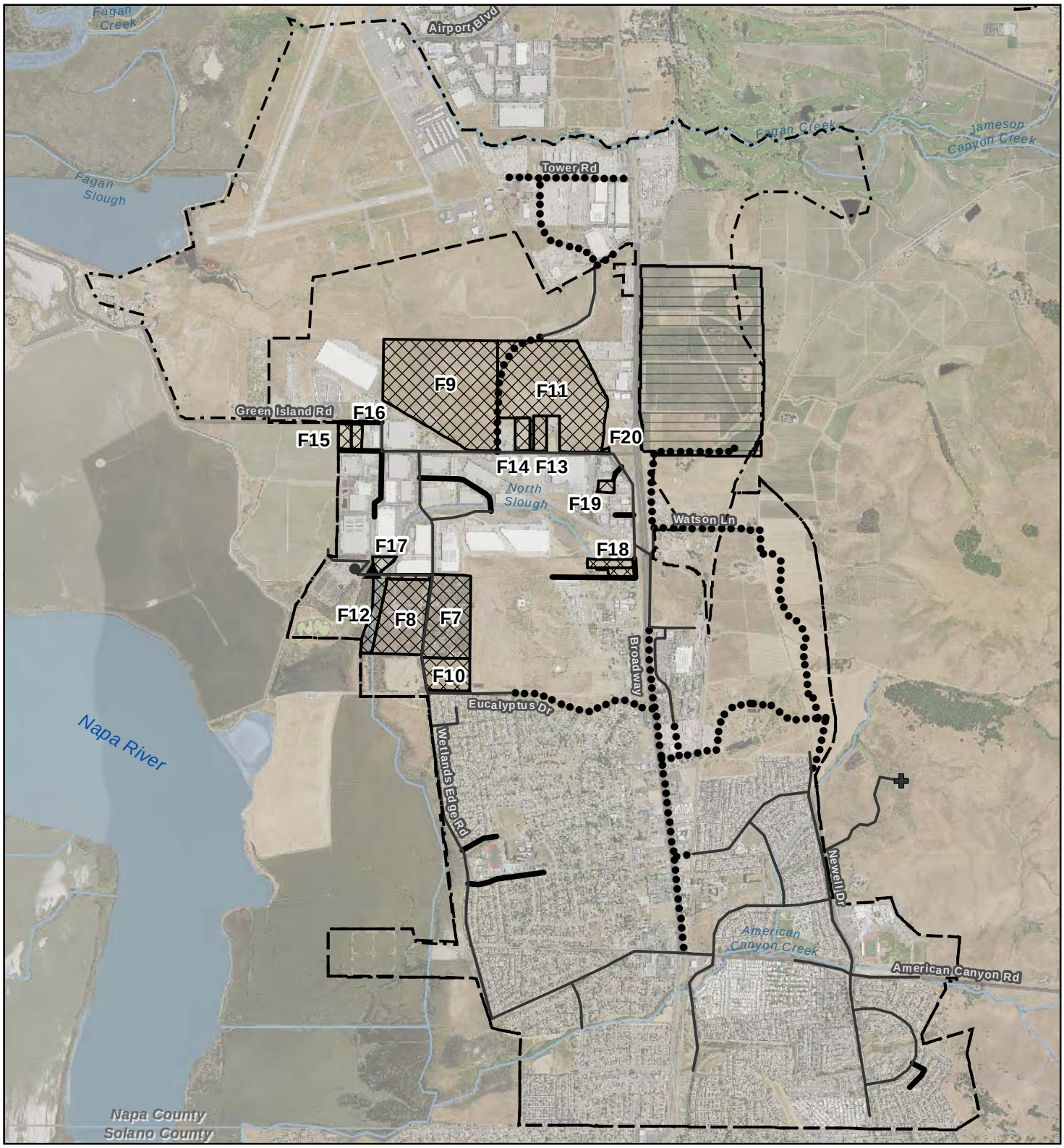

City Limits

Recycled Water Service Area

Existing RW Pipe

RW Tank

RW Reservoir

Undeveloped Parcels

Vineyards Converted from Raw Water

CIP Projects

Near Term

Long Term

RW Pump Station

Paper Size 8.5" x 11" (ANSI A)

0 1,500 3,000

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
Recycled Water Master Plan

Job Number 8411338
Revision 1
Date 04 May 2016

Buildout Recycled Water System and Undeveloped Parcels and Vineyards

Figure 14

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N:\US\Santa Rosa\Projects\02536 - American Canyon\02536-8411338 Master Plan Updates\08-GIS\Maps\Figures\RW\Master Plan\Final\Fig 14 - Buildout RW and Undeveloped Parcels and Vineyards.mxd

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

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5. Hydraulic Evaluation

A hydraulic model of the City's recycled water distribution system has been developed for this master plan to evaluate the existing and proposed buildout conditions. The hydraulic evaluation identifies issues that must be resolved for continued system operation and for the preparation of future system expansions.

5.1 System Description

The City's recycled water distribution system is depicted in Figure 15 including existing pipelines and proposed pipelines at buildout. Two critical pipeline segments have not been constructed, preventing the system from operating at peak capacity: one along Highway 29 between North Napa Junction Road and Paoli Loop Road and the second in Main Street and through the proposed Watson Ranch development towards Newell Drive. Construction of these two segments can close loops and immediately increase the hydraulic capacity of the system.

The total existing system length is approximately 13 miles and ranges in size from 4-inches to 20-inches. Of the 13 miles of existing pipelines, approximately 13,800 LF are not currently in operation. A summary of the existing recycled water distribution system is shown in Table 15

Table 15 Existing Recycled Water Distribution System Pipelines

Diameter	Length (lf)
4-inch	1,360
6-inch	23,450
8-inch	17,990
12-inch	16,980
16-inch	6,500
20-inch	2,860
Total	**69,140**

5.1.1 Recycled Water Supply

The City's wastewater is collected through gravity pipelines at a series of pump stations and then pumped to the WRF, which is located at 151 Mezzetta Court. There are two force mains delivering wastewater to the plant. One comes from the southern end of the City, the Main Basin, and the other comes from the north end of the City, the Industrial Basin. The Industrial Basin wastewater has a much higher salinity level than the Main Basin wastewater due to its combination of industrial and domestic users. The City's approach for reclamation is to segregate the Industrial Basin flow from the Main Basin flow, thereby increasing the reuse potential of the effluent. As a result, the wastewater from the two basins is treated separately at the WRF using separate headworks and treatment trains.

The WRF is designed to treat a buildout flow rate of 2.5 MGD at average dry weather flow conditions and 5.0 MGD at peak wet weather flow conditions. The WRF process train includes an emergency overflow basin, headworks facilities, anoxic basins, aeration tanks with membrane facilities, metering facilities, and disinfection facilities. In order to meet the projected buildout demands the City will need to reuse 100 percent of its treated water during peak demands in the summer months.

There are two disinfection facilities at the WRF: ultraviolet (UV) disinfection and chlorine contact tank. The UV disinfection facility has the capacity to disinfect all the treated wastewater for discharge to the North Slough during the wet season. The chlorine contact tank is sized to treat all of the flow for reclamation using a sodium hypochlorite solution. The City will need to continue to produce "disinfected tertiary" recycled water as defined under Title 22 to meet the recycled water customers' needs.

5.1.2 Pumping and Storage

The recycled water distribution system includes a pump station located at the City's WRF and a 1.0 mg storage tank located east of Newell Drive. The pump station has a total design capacity of 1,300 gpm and consists of two 50 horsepower (hp) pumps that are rated for 650 gpm at 226 feet of head. The 1.0 mg elevated storage tank has a base elevation 197.96 ft with an overflow height of 26 ft. It is an above ground welded steel tank with an 81 ft inside diameter.

The pumping and storage requirements of the City's system were evaluated based on the planning criteria presented in Table 4. A summary of this evaluation is presented in Table 16. For the existing condition, the existing facilities meet the pumping and storage requirements. However, at buildout, there will be a pumping capacity shortfall.

To mitigate the deficit in pumping capacity, the pumps at the WRF pump station can be replaced. An upgrade of the pump station is discussed further in Section 6.

Table 16 Pumping and Storage Requirements

Scenario	Maximum Month Demand (gpm)	Required Pumping Capacity (gpm)	Required Storage (mg)	Existing Storage (mg)
Existing System	307	307	0.15	1.00
Planned Buildout[1.]	1,750	1,750	0.84	1.00

1. Based on maximum available supply from WRF of 2,517,000 gpd.

5.2 Hydraulic Model

Although multiple software packages are available, WaterCAD by Bentley was used to model and analyze performance of the City's recycled water system. WaterCAD was chosen because it is an easy to use modeling application for water distribution systems; users can use this product as a stand-alone application or work within AutoCAD or MicroStation; and the program also offers conversion utilities from CAD, GIS and databases files.

5.2.1 Model Setup

The City's hydraulic model combines information on the physical and operational characteristics of the recycled water system, and performs calculations to solve a series of mathematical equations to simulate flows in pipes. The City provided detailed information that was used for the hydraulic model setup. Key information included:

- As-built drawings for selected recycled water pipelines
- WRF hourly recycled water production data
- WRF as-built drawings
- Pump curves for the recycled water pump station

- As-built drawings for the elevated 1.0 mg recycled water storage tank
- Billing records for existing recycled water and potable water customers

The model setup process consisted of three steps. First, the GIS database was created for the recycled water system's components. Secondly, the GIS database was imported into the modeling software. Each system component was mapped with the correct corresponding model component. The associated physical and operational data for each component (pipe, junction, pump, reservoir, and tank) is stored in an attribute table. Subsequently, the existing recycled water demands were allocated to the model junctions. This information is used by the model to simulate flows and pressures within the system as predicted by the software's mathematical equations. Finally, the hydraulic model parameters are input and the model is debugged to run without errors or warnings.

5.2.2 Model Inputs

As described above, once the pipes, junctions, pumps, reservoirs and tanks have been created in the model, the attribute data associated with each element is assigned. The attribute information required for each model component is summarized below:

Pipes

Pipes are used to represent the pipe segments in the actual transmission or distribution water pipelines. The required model inputs include: physical location, length (linear feet), diameter (inches), Hazen-Williams "C" valve (130 per Table 5) and connectivity within the other model elements.

Junctions

Junctions are used to represent both the junction between two or more adjoining pipes and the ends of each dead-end pipe. They are also used to represent customer demands. Ground elevations in feet are required for each junction. These 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. The elevations in the model are based on the North American Vertical Datum of 1988 (NAVD88). Demand values (gallons per minute) and diurnal curves are assigned to junctions based on the analysis presented in Section 4.

Pumps

Pumps are node elements that add head to the system as water passes through. The data needed for pumps includes hydraulic performance curves and control algorithms. The City provided the curves for the existing pumps and a standard three-point pump definition was added to the model. The following flow (gallons per minute) versus head (feet) points must be defined: shutoff, design and maximum operating.

Reservoirs

Reservoirs are a type of storage node where the water surface elevation does not change as water flows into or out of it during an extended period simulation. The hydraulic grade line elevation is the only required model input. For the City's recycled water system, the WRF is represented by a reservoir.

Tanks

Tanks are also a type of storage node. However, the water surface elevation of a tank will change as water flows into or out of it during an extended period simulation. The model inputs required for a tank include: physical location, base elevation (feet), minimum elevation (feet), initial elevation (feet), maximum (overflow) elevation (feet), and the diameter (feet).

Operational Controls

Once all the elements of the distribution system are modeled, the operational controls can be input into the model. These controls are used to make the elements interact in a way that mimics actual recycled water distribution system operations.

According to discussions with City staff, the recycled water system is level controlled. The pump station at the WRF is controlled by the level in the 1.0 mg elevated storage tank east of Newell Drive. The system is also controlled by the production of recycled water at the WRF. Currently, the City typically makes recycled water about 22 hours per day, using the time between 8:00 to 10:00 for routine maintenance on the plant. Since there is no existing storage available at the WRF site, the pumps do not operate during that time. In the immediate future, a 1.5 mg recycled water storage reservoir will be completed at the plant immediately upstream of the pump station and the pumps will be able to operate 24 hours a day as long as there is stored water in the new reservoir.

5.3 System Performance

The performance of the City's recycled water distribution system was analyzed using 24-hour extended period MMADD simulations. The goal of the hydraulic analysis is to identify system improvements required for efficient system operation and increased system utilization in future expansions.

5.3.1 Existing Conditions

The existing recycled water distribution system was analyzed using two scenarios that have different initial conditions for the pump station and storage tank. These two scenarios also used two separate maximum month demand conditions which excluded the vineyard demand. The hydraulic model results for the existing conditions are included in Appendix A.

Scenario 1 – Initial Conditions Pumps On and Tank Half Full

This scenario modeled conditions where the pumps are set up to operate during off-peak hours. The initial operating conditions included the pumps turned on and the storage tank half full (initial elevation set to 210.96 ft). The two maximum month demand conditions modeled included:

- With vineyard demand
- Without vineyard demand

The velocities in the pipelines for Scenario 1 are all within the maximum allowable velocity of 7 fps per the evaluation criteria presented in Table 5. The minimum pressures in the system and at meter locations also meet the evaluation standards. However, there are several locations in the system where the maximum pressures exceed 115 psi at meters and 125 psi in the system. The high pressures are experienced on the west side of the system along Commerce Boulevard, Wetlands Edge Road, Eucalyptus Drive, Green Island Road and Paoli Loop Road.

The pressures exceed the recommended maximum between the hours of 0100 and 0800, when the pumps are on and the demand is high.

Scenario 2 – Initial Conditions Pumps Off and Tank Full

This scenario modeled conditions where the pumps are set up to operate off of tank level. The initial operating conditions included the pumps turned off and the storage tank full (initial elevation set to the high water level 223.46 ft). The two maximum month demand conditions modeled included:

- With vineyard demand
- Without vineyard demand

Similarly, the velocities in the pipelines for Scenario 2 are all within the maximum allowable velocity and the minimum pressures in the system and at meter locations also meet the evaluation standards. However, like Scenario 1, there are several locations in the system where the maximum pressures exceed 115 psi at meters and 125 psi in the system. The high pressures are experienced in the same locations along the west side of the system. The pressures exceed the recommended maximum between the hours of 1000 and 1800, when the pumps are operating to fill the tank.

The high pressures experienced in the system for the existing conditions are due to the low number of customers and the low maximum month demand compared to the capacity of the pump station. Converting existing potable water demands used for irrigation to recycled water would help alleviate the high pressures in the system.

5.3.2 Buildout Conditions

Currently, there is approximately 13,800 lf of recycled water pipelines that have already been constructed in the system but are not in operation. Therefore, the buildout conditions assume the already constructed pipelines are active and that the 12-inch transmission main from Newell drive, west on South Napa Junction Road, and north along Highway 29 to Paoli Loop Road is complete. The buildout distribution system consists of approximately 22 miles of pipeline.

- Existing but not in operation – 13,792 lf
- Buildout system - 116,379 lf

The buildout conditions will also include projected future demands on the system as detailed in Section 4. The same two model scenarios from the existing conditions have been analyzed to determine the system performance.

The pressures and velocities within the entire buildout distribution system meet the standards of the evaluation criteria in both Scenario 1 and Scenario 2. The improvement projects that are recommended for the buildout system are described in the next section. These projects are required to connect future customers and complete the system loop.

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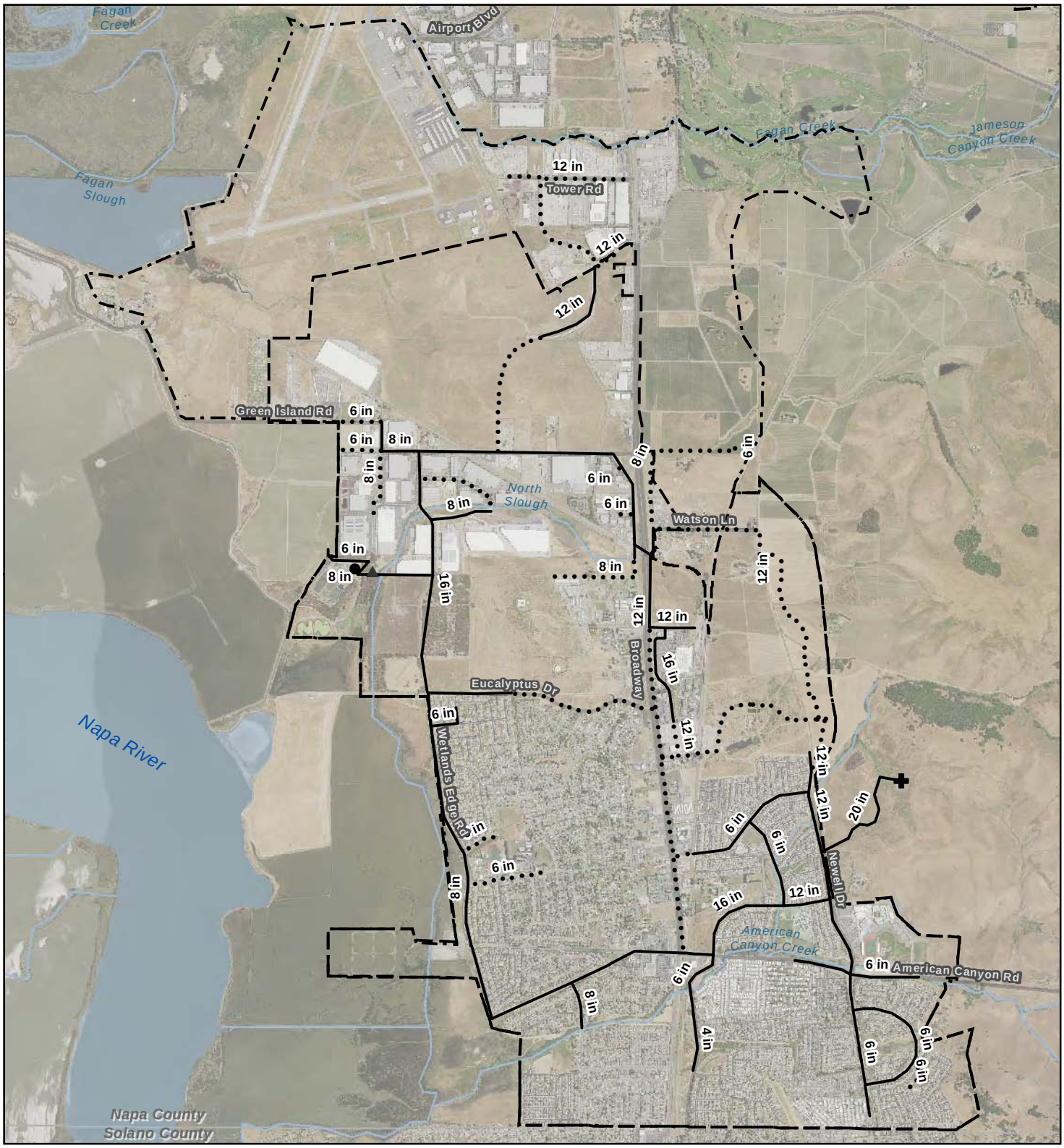

City Limits
Recycled Water Service Area
RW Reservoir
RW Tank
RW Pump Station
Existing RW Pipe
Future RW Pipe

Paper Size 8.5" x 11" (ANSI A)
0 1,500 3,000
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
Recycled Water Master Plan

Buildout Recycled Water Distribution System

Job Number 8411338
Revision 2
Date 04 May 2016

Figure 15

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\RW\Master Plan\Final\Fig 15 - RW System.mxd

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

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6. Recommended Improvement Projects

The City is expanding the recycled water system to connect as many existing and future customers as practical to fully develop this water supply to supplement the potable water supply. The recommended improvement projects are primarily focused on creating potable water offsets from existing potable water customers and meeting the recycled water demands for future customers. Targeted demands include irrigation of existing parks, schools and community spaces throughout the City, dual plumbing and process water supplies for the industrial area near Napa County Airport, and irrigation supplies for future planned communities such as the Watson Ranch development.

6.1 Recommended Improvements to Maximize New Connections

Table 8 in Section 4 identified several existing potable water customers that are within 100 feet of an existing recycled water main and could be converted to recycled water for irrigation and other outdoor or process demands. These customers include parks, schools, community spaces and private industrial/commercial businesses throughout the City that are currently using potable water for irrigation and industrial processes that could otherwise use recycled water. The City should pursue conversion of these demands as soon as practical.

Table 9 in Section 4 identified several existing potable water customers that could be served recycled water by extending the distribution mains, thereby creating additional potable offsets for the City. The following recommended improvement projects will help the City connect existing potable water customers to an expanded recycled water system, thereby offsetting existing potable water demands with recycled water.

- RW2 consists of the construction of approximately 800 LF of 6-inch recycled water pipelines in Spikerush Circle to convert irrigation of American Canyon Community Park from potable water to recycled water;
- RW3 consists of the construction of approximately 1,670 LF of 6-inch recycled water pipelines in Benton Way to convert irrigation demands at the Middle School, Community Services and park from potable water to recycled water;
- RW4 consists of the construction of approximately 790 LF of 6-inch recycled water pipelines in Brunello Drive and Pelleria Drive to convert irrigation of La Vigne Community Park from potable water to recycled water; RW5 consists of the construction of approximately 2,390 LF of 6-inch and 8-inch recycled water pipelines in Jim Oswald Way and Mezzetta Court to serve existing industrial customers;
- RW5 consists of the construction of approximately 1,800 LF of 6-inch recycled water pipelines in Green Island Road and Jim Oswald Way, and approximately 1,500 LF of recycled water pipeline in Mezzetta Court serving industrial customers;
- RW6 consists of the construction of approximately 1,950 LF of 8-inch recycled water pipelines in Hanna Drive to serve existing industrial customers;
- RW7 consists of the construction of approximately 600 LF of 6-inch recycled water pipelines in Dodd Court and Klamath Court to serve existing industrial customers; and
- RW8 consists of the construction of approximately 2,230 LF of 8-inch recycled water pipelines in Lombard Road and Hess Road to convert existing irrigation demands from potable water to recycled water at the City ball fields and an existing commercial nursery.

A summary of the these recommended improvement projects for expanding the recycled water system and connecting new customers is presented in Table 17.

Table 17 Recommended Improvement Projects to Maximize New Connections

Project ID	Proposed Pipe Size	Targeted Customer
RW2	6-inch	American Canyon Community Park
RW3	6-inch	American Canyon Middle School, Community Services and Park
RW4	6-inch	La Vigne Community Park
RW5	6 & 8-inch	Industrial customers near Jim Oswald Way and Mezzetta Court
RW6	8-inch	Industrial customers along Hanna Drive
RW7	6-inch	Industrial customers along Paoli Loop Road
RW8	8-inch	City ball field and commercial nursery along Hess Road

6.2 Recommended Improvements to Serve Future Development

Improvements to the recycled water distribution system for serving future customers are focused on serving the Watson Ranch development, serving other known development projects such as the industrial customers in the northern portion of the City and residential customers in the southeast, serving future customers at the locations of undeveloped parcels throughout the City, and serving northern vineyards from a future private seasonal storage pond. The recommended improvement projects also aimed at increasing overall system reliability and distribution pressure for the buildout condition. These improvements will provide recycled water for irrigation, toilet flushing and some industrial process applications that would otherwise be added to the potable water demand.

The following recommended improvement projects will help the City connect future development to an expanded recycled water system, thereby minimizing potable water demands for irrigation and other uses where recycled water is allowed under Title 22 of the California Code of Regulations.

- RW1 consists of the construction of approximately 8,910 LF of 12-inch recycled water pipelines in the future Devlin Road extension, Devlin Road, Tower Road and South Kelly Road to serve the future industrial customers identified as Napa Logistics I & II and Napa Airport Corporate Center;
- RW9 consists of the construction of approximately 2,840 LF of 12-inch recycled water pipelines in Watson Lane to serve the future Watson Ranch development and the undeveloped parcels north of Watson Lane;
- RW10 consists of the construction of approximately 6,380 LF of 12-inch recycled water pipelines in Main Street, South Napa Junction Road and Newell Drive to serve the future Watson Ranch and Canyon Estates developments;
- RW11 consists of the construction of approximately 4,360 LF of 12-inch recycled water pipelines within the future Watson Ranch development to support that future customer;
- RW12 consists of an upgrade of the existing WRF Pump Station with the replacement of the three existing 50 HP pumps with three 75 HP (2 duty, 1 standby) vertical turbine pumps which will support the connections of future recycled water customers when the total maximum month demand exceeds 1,300 gpm (1,872,000 gpd), which is the capacity of the existing WRF Pump Station;

- RW13 consists of the construction of approximately 3,600 LF of 6-inch and 8-inch recycled water pipelines in Paoli Loop Road and Green Island Road to serve the future agricultural seasonal storage pond for the irrigation of vineyards that currently receive raw water from the City;
- RW14 consists of the construction of approximately 3,280 LF of 8-inch recycled water pipelines in Eucalyptus Drive which will increase reliability and balance pressures across the distribution system as buildout is approached; and
- RW15 consists of the construction of approximately 7,510 LF of 6-inch and 12-inch recycled water pipelines in Broadway and along the east side of Highway 29 which will increase reliability and balance pressures across the distribution system as buildout is approached.

A summary of the recommended improvement projects to serve future development is presented in Table 18.

Table 18 Recommended Improvement Projects for Future Development

Project ID	Proposed Pipe Size	Targeted Customer
RW1	12-inch	Industrial customers near Napa County Airport
RW9	12-inch	Watson Ranch development and undeveloped parcels north of Watson Lane
RW10	12-inch	Watson Ranch development and Canyon Estates
RW11	12-inch	Watson Ranch development
RW12	N/A	All future development
RW13	6 & 8-inch	Vineyard conversions
RW14	8-inch	Improve system reliability and distribution for existing and future customers
RW15	6 & 12-inch	Improve system reliability and distribution for existing and future customers

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7. Capital Improvements Plan

The Capital Improvements Plan (CIP) is intended to provide a roadmap for completing construction of the recycled water infrastructure to maximize water reuse in the City. Fifteen discrete projects are recommended and have been prioritized to maximize connection of existing potable water customers first, and to accommodate planned development as it occurs over a longer period of time. Project assumptions, cost estimations, and project prioritizations for these projects are discussed below. The detailed project descriptions and cost estimates for each CIP project are included in this report as Appendix C and Appendix D, respectively.

7.1 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).

7.1.1 Construction Cost

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

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

A summary of the unit costs associated with each item is presented in Table 19. 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.

Table 19 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/linear foot (LF)
Shoring and trench safety	$20/LF
Trench dewatering	$40/LF
Handling, treatment and disposal of contaminated soil and groundwater	$10/LF
Conversion of the existing potable water network to the recycled water network	Case-by-case cost evaluation needed
Construction of the new distribution system and supporting infrastructures	
• 6” Class 200 PVC Recycled Water Pipe	$98/LF
• 8” Class 200 PVC Recycled Water Pipe	$121/LF
• 10” Class 200 PVC Recycled Water Pipe	$142/LF
• 12” Class 200 PVC Recycled Water Pipe	$164/LF
• Pump Station Upgrade	$300,000 lump sum

7.1.2 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.

7.1.3 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.

7.1.4 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.

7.2 Prioritized Capital Improvements Plan

The CIP will be implemented in stages based on the priority assigned to each project. The projects are prioritized based on benefit to the City, the anticipated timing of developments within the City, and the complexity and cost of the project. The CIP projects presented in Table 20 are prioritized using the above criteria, in which Project RW1 has the highest priority and Project RW15 has the lowest priority. The total project cost for the recycled water system Capital Improvements Plan is $21,510,000. The estimates for each CIP project are rounded to the nearest $10,000.

In general, projects that will connect existing potable water customers will be implemented first, while projects that will reduce future water demand will be implemented as development occurs. Project RW1 will serve the proposed Napa Logistics project on Devlin Road and is the top priority because the development will begin construction in 2016. Projects RW1 through RW8 are considered near-term CIP projects and should be completed within the next 10 years. Projects RW9 through RW15 are considered long-term projects that could be completed 11 to 20 years from now, or as development occurs. The locations of each of the near-term and long-term projects are shown on Figures 16 and 17.

Table 20 Recycled Water System Capital Improvements Plan

CIP Project	Project Cost
RW1 Tower / Devlin / South Kelly Road	$4,170,000
RW2 Spikerush Circle	$310,000
RW3 Benton Way	$590,000
RW4 Pelleria Drive	$320,000
RW5 Jim Oswald Way / Mezzetta Court	$1,210,000
RW6 Hanna Drive	$760,000
RW7 Dodd / Klamath Court	$240,000
RW8 Lombard / Hess Road	$880,000
RW9 Watson Lane	$1,350,000
RW10 Main / South Napa Junction Road	$2,990,000
RW11 Newell Drive	$2,050,000
RW12 Pump Station Upgrade	$800,000
RW13 Paoli Loop Road / Northern Vineyards	$1,400,000
RW14 Eucalyptus Drive	$1,280,000
RW15 Broadway / Donaldson Way	$3,470,000
Total Project Cost	**$21,820,000**

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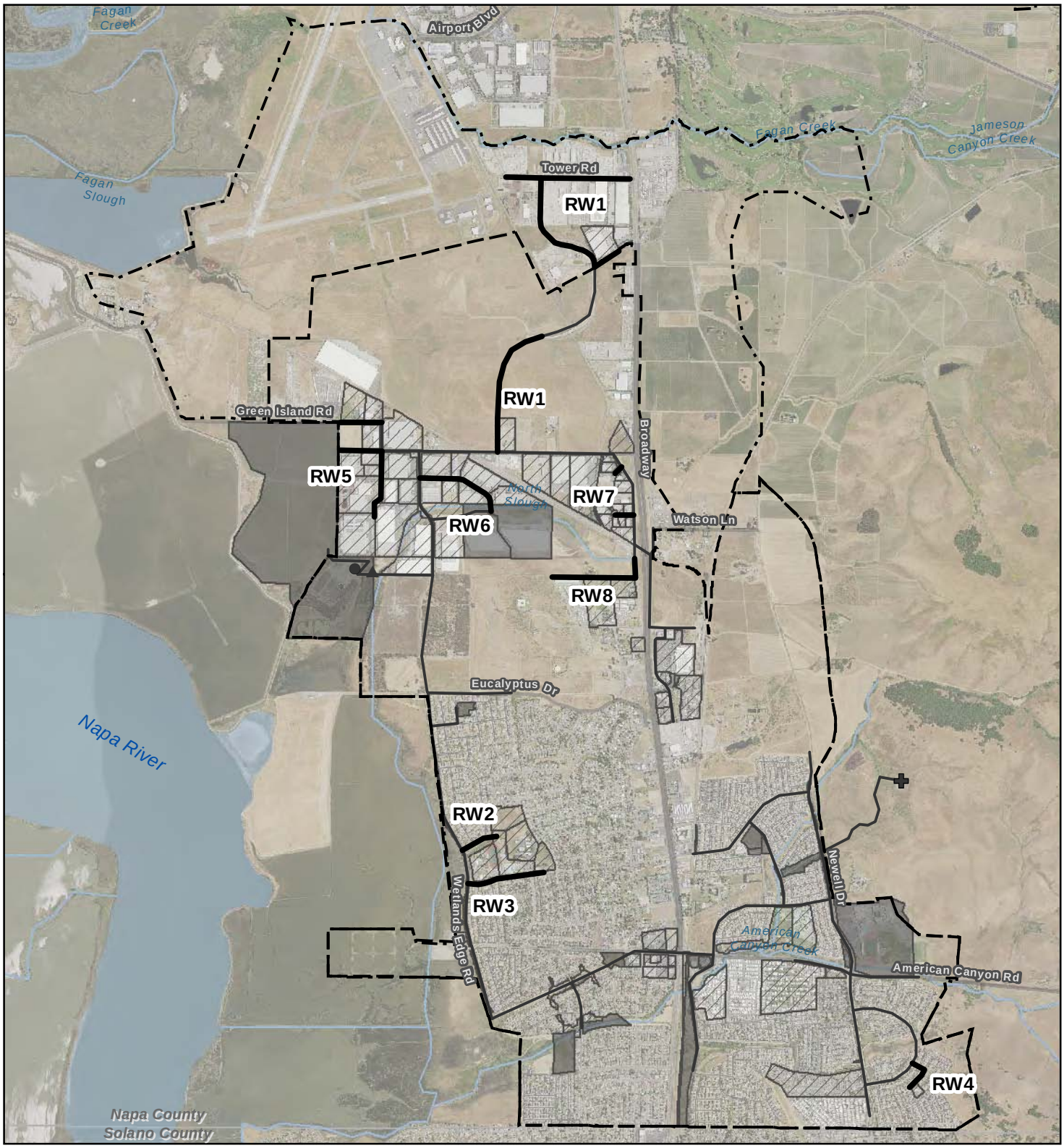

City Limits
Recycled Water Service Area
RW Reservoir
RW Tank
RW Pump Station
Existing RW Pipe
CIP Projects
Near Term
Existing RW Customer
Existing Potable Water Customer with RW Need

Paper Size 8.5" x 11" (ANSI A)
0 1,500 3,000
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
Recycled Water Master Plan

Job Number 8411338
Revision 2
Date 29 Apr 2016

Recycled Water System
Near Term Capital Improvements

Figure 16

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\RW\Master Plan\Final\Fig 16 - Recommended RW CIPs - Potable Offsets.mxd

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

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Recycled Water CIP Summary

Table 1: Summary of Recommended Recycled Water CIP Projects

CIP Project	Potable Offsets	Future Demand	Total Project
RW1 Tower / Devlin / South Kelly Road	$0	$4,170,000	$4,170,000
RW2 Spikerush Circle	$310,000	$0	$310,000
RW3 Benton Way	$590,000	$0	$590,000
RW4 Pelleria Drive	$320,000	$0	$320,000
RW5 Jim Oswald Way / Mezzetta Court / Green Island Road	$1,210,000	$0	$1,210,000
RW6 Hanna Drive	$760,000	$0	$760,000
RW7 Dodd / Klamath Court	$240,000	$0	$240,000
RW8 Lombard / Hess Road	$880,000	$0	$880,000
RW9 Watson Lane	$0	$1,350,000	$1,350,000
RW10 Main / South Napa Junction Road	$0	$2,990,000	$2,990,000
RW11 Newell Drive	$0	$2,050,000	$2,050,000
RW12 PS Upgrade	$0	$800,000	$800,000
RW13 Paoli Loop Road / Northern Vineyards	$0	$1,400,000	$1,400,000
RW14 Eucalyptus Drive	$0	$1,280,000	$1,280,000
RW15 Broadway / Donaldson Way	$0	$3,470,000	$3,470,000
Total Budget	**$4,310,000**	**$17,510,000**	**$21,820,000**

CIP – RW1 Tower Road, Devlin Road Extension and South Kelly Road

CIP RW1 consists of the construction of approximately 8,910 LF of 12-inch recycled water pipelines in the future Devlin Road extension, Devlin Road, Tower Road and South Kelly Road. The limits include: Future Devlin Road between the existing Devlin Road Cul-de-Sac and Green Island Road, Devlin Road between South Kelly Road and Tower Road, Tower Road between the Tower Road Cul-de-Sac and Highway 29 and South Kelly Road east of Devlin Road. These pipelines connect to the existing 12-inch pipelines in Devlin Road and Green Island Road.

This project will serve future customers in the industrial area including the Napa Logistics development. The project may provide some potable offsets where existing water customers can convert some of their demand to recycled water, and will minimize the water demands for future customers as the area builds out.

Figure 1 provides an illustration of project improvements.

Figure 1

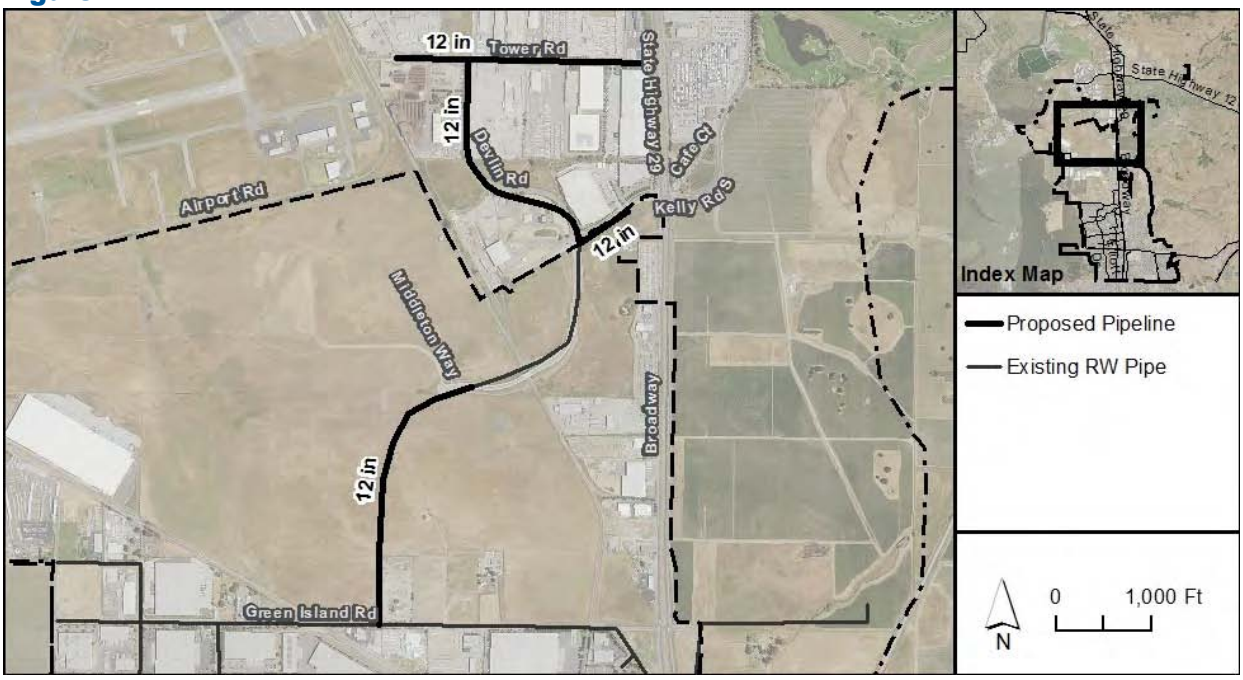

Table 1: CIP – RW1 Summary

CIP Component	Description
Proposed Improvements	• 12-inch Class 200 PVC Recycled Water Pipe – 8,910 LF
Additional Project Considerations	• CEQA review and construction permits
Project Cost Total [1]	$4,170,000 – Future Customers

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

CIP – RW2 Spikerush Circle

CIP RW2 consists of the construction of approximately 800 LF of 6-inch recycled water pipelines in Spikerush Circle from Wetlands Edge Road east towards the park. The proposed 6-inch pipeline will connect to an existing 8-inch recycled water pipeline in Wetlands Edge Road. This project will convert irrigation of American Canyon Community Park from potable water to recycled water.

Figure 2 provides an illustration of project improvements.

Figure 2

Table 2: CIP – RW2 Summary

CIP Component	Description
Proposed Improvements	• 6-inch Class 200 PVC Recycled Water Pipe – 800 LF
Additional Project Considerations	• CEQA review and construction permits
Project Cost Total [1]	$310,000 – Potable Offsets

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

CIP – RW3 Benton Way

CIP RW3 consists of the construction of approximately 1,670 LF of 6-inch recycled water pipelines in Benton Way from Wetlands Edge Road to Newbury Way. The proposed 6-inch pipeline will connect to an existing 8-inch recycled water pipeline in Wetlands Edge Road. This project will convert irrigation demands at the Middle School, Community Services and park from potable water to recycled water. These facilities are located along the north side of Benton Way.

Figure 3 provides an illustration of project improvements.

Figure 3

Table 3: CIP – RW3 Summary

CIP Component	Description
Proposed Improvements	• 6-inch Class 200 PVC Recycled Water Pipe – 1,670 LF
Additional Project Considerations	• CEQA review and construction permits
Project Cost Total [1]	$590,000 – Potable Offsets

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

CIP – RW4 Pelleria Drive

CIP RW4 includes construction of approximately 790 LF of 6-inch recycled water pipelines in Brunello Drive and Pelleria Drive. The proposed 6-inch pipeline will connect to an existing 6-inch recycled water pipeline in Via Bellagio. RW4 also includes improvements to the existing 6-inch pipeline in Via Bellagio for conversion to recycled water use which consists of signage and purple valve pots. The project will convert irrigation of La Vigne Community Park from potable water to recycled water.

Figure 4 provides an illustration of project improvements.

Figure 4

Table 4: CIP – RW4 Summary

CIP Component	Description
Proposed Improvements	• 6-inch Class 200 PVC Recycled Water Pipe – 790 LF • Recycled Water Conversion Requirements
Additional Project Considerations	• CEQA review and construction permits
Project Cost Total (1)	$320,000 – Potable Offsets

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

CIP – RW5 Jim Oswald Way, Mezzetta Court and Green Island Road

CIP RW5 consists of the construction of approximately 3,300 LF of 6-inch and 8-inch recycled water pipelines. In Jim Oswald Way, construct approximately 890 LF of 6-inch recycled water pipelines between the Cul-de-Sac and Mezzetta Court. In Mezzetta Court, construct approximately 1,500 LF of 8-inch recycled water pipelines between the Cul-de-Sac and Green Island Road. In Green Island Road, construct approximately 910 LF of 6-inch recycled water pipelines. The proposed 6-inch and 8-inch pipelines will connect to the existing 8-inch recycled water pipeline in Green Island Road. The project will serve existing industrial customers and allow for conversion of irrigation and some process water demands from potable water to recycled water.

Figure 5 provides an illustration of project improvements.

Figure 5

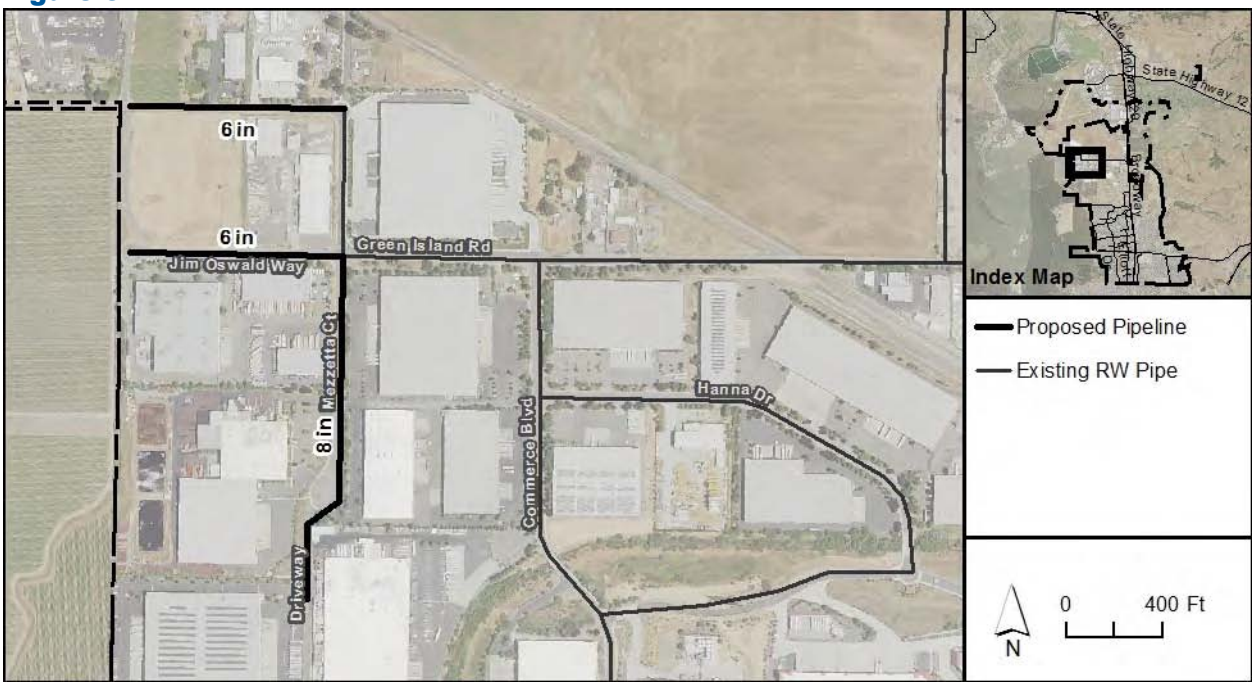

Table 5: CIP – RW5 Summary

CIP Component	Description
Proposed Improvements	• 6-inch Class 200 PVC Recycled Water Pipe – 1,800 LF • 8-inch Class 200 PVC Recycled Water Pipe – 1,500 LF
Additional Project Considerations	• CEQA review and construction permits
Project Cost Total [1]	$1,210,000 – Potable Offsets

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

CIP – RW6 Hanna Drive

CIP RW6 consists of the construction of approximately 1,950 LF of 8-inch recycled water pipelines in Hanna Drive between the Cul-de-Sac and Commerce Boulevard. The proposed 8-inch pipelines will connect to the existing 12-inch recycled water pipeline in Commerce Boulevard and the existing 8-inch pipeline in the Cul-de-Sac. The construction of this proposed pipeline will create a loop with the existing mains. The project will serve existing industrial customers and allow for conversion of irrigation and some process water demands from potable water to recycled water.

Figure 6 provides an illustration of project improvements.

Figure 6

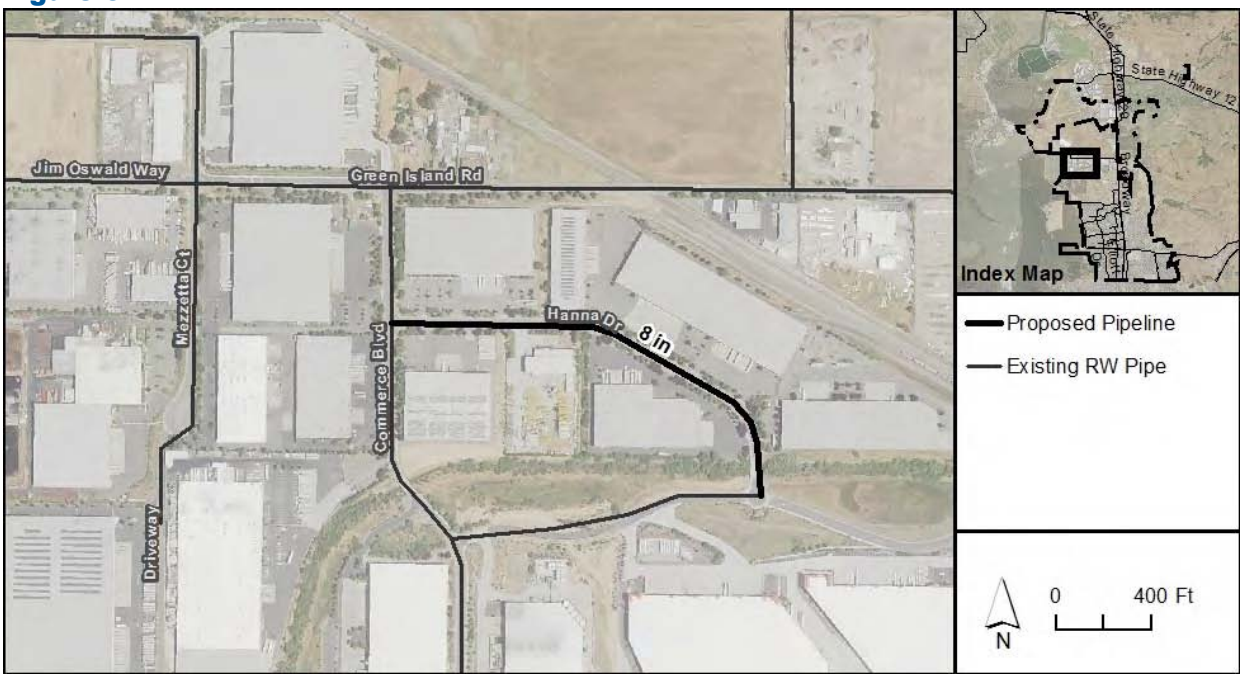

Table 6: CIP – RW6 Summary

CIP Component	Description
Proposed Improvements	• 8-inch Class 200 PVC Recycled Water Pipe – 1,950 LF
Additional Project Considerations	• CEQA review and construction permits
Project Cost Total (1)	$760,000 – Potable Offsets

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

CIP – RW7 Dodd Court and Klamath Court

CIP RW7 consists of the construction of approximately 600 LF of 6-inch recycled water pipelines. In Dodd Court, construct approximately 190 LF of 6-inch recycled water pipelines between the Cul-de-Sac and Paoli Loop Road. In Klamath Court, construct approximately 410 LF of 6-inch recycled water pipelines between the Cul-de-Sac and Paoli Loop Road. The proposed 6-inch pipelines will connect to the existing 12-inch recycled water pipeline in Paoli Loop Road. The project will serve existing industrial customers and allow for conversion of irrigation and some process water demands from potable water to recycled water.

Figure 7 provides an illustration of project improvements.

Figure 7

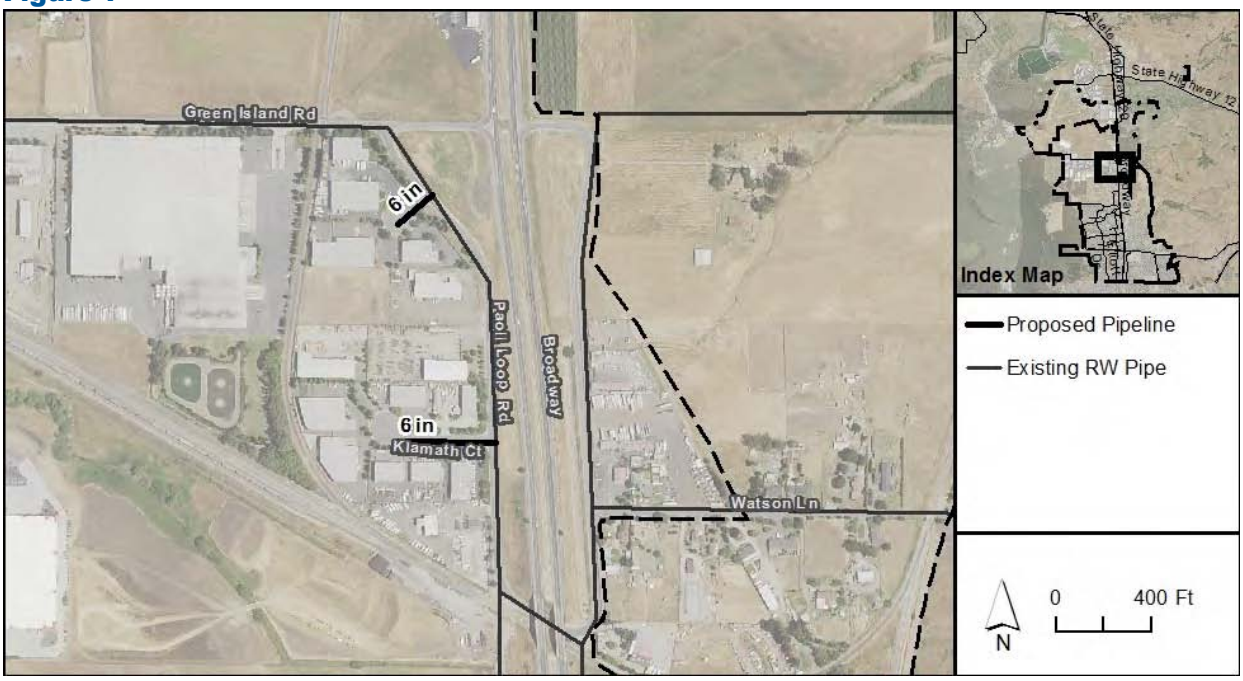

Table 7: CIP – RW7 Summary

CIP Component	Description
Proposed Improvements	• 6-inch Class 200 PVC Recycled Water Pipe – 600 LF
Additional Project Considerations	• CEQA review and construction permits
Project Cost Total [1]	$240,000 – Potable Offsets

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

CIP – RW8 Lombard Road and Hess Road

CIP RW8 consists of the construction of approximately 2,230 LF of 8-inch recycled water pipelines in Lombard Road and Hess Road. Construct approximately 430 LF of 8-inch recycled water pipelines in Lombard Road between the Cul-de-Sac and Hess Road and approximately 1,800 LF of 8-inch recycled water pipelines in Hess Road between the Cul-de-Sac and Lombard Road. The proposed 8-inch pipelines will connect to the existing 8-inch recycled water pipeline in Lombard Road. The project will convert existing irrigation demands from potable water to recycled water at the City ball fields and an existing commercial nursery.

Figure 8 provides an illustration of project improvements.

Figure 8

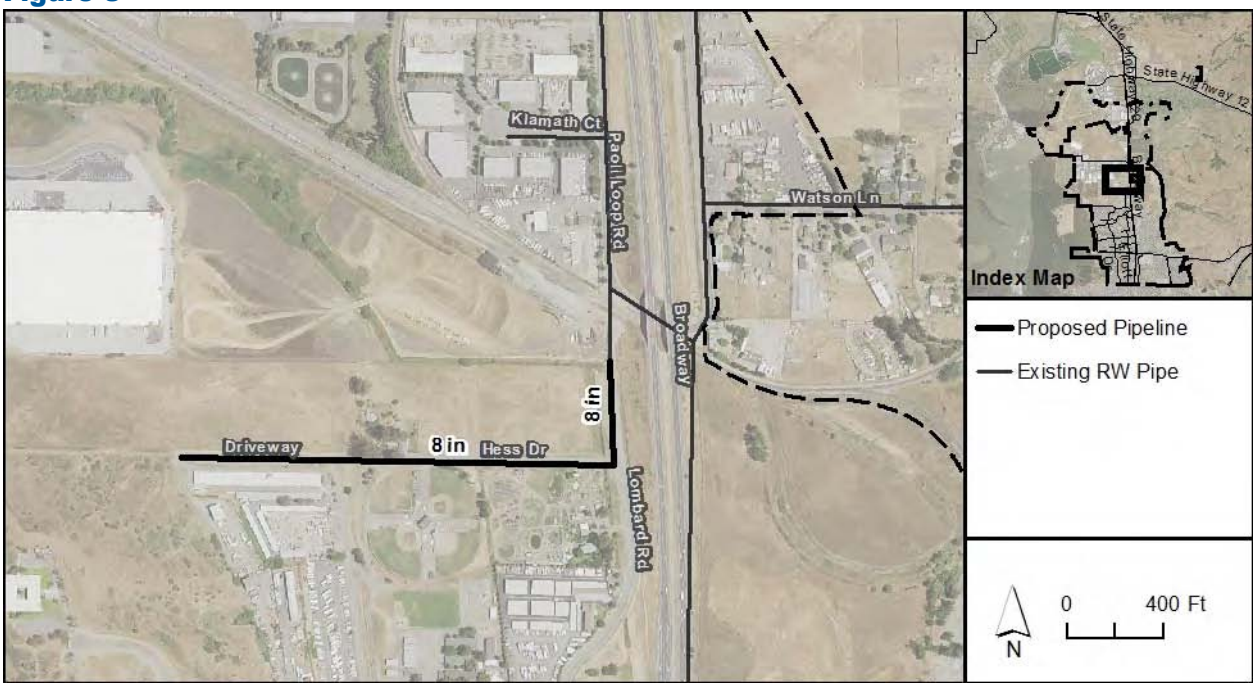

Table 8: CIP – RW8 Summary

CIP Component	Description
Proposed Improvements	• 8-inch Class 200 PVC Recycled Water Pipe – 2,230 LF
Additional Project Considerations	• CEQA review and construction permits
Project Cost Total [1]	$880,000 – Potable Offsets

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

CIP – RW9 Watson Lane

CIP RW9 consists of the construction of approximately 2,840 LF of 12-inch recycled water pipelines in Watson Lane east of Paoli Loop Road and connecting to the proposed pipelines in RW11 and RW12. The proposed 12-inch pipelines will also connect to the existing 8-inch recycled water pipeline in Paoli Loop Road. This project will support development of Watson Ranch and help create additional loops in the recycled water distribution system to provide more reliability and improved system pressures.

Figure 9 provides an illustration of project improvements.

Figure 9

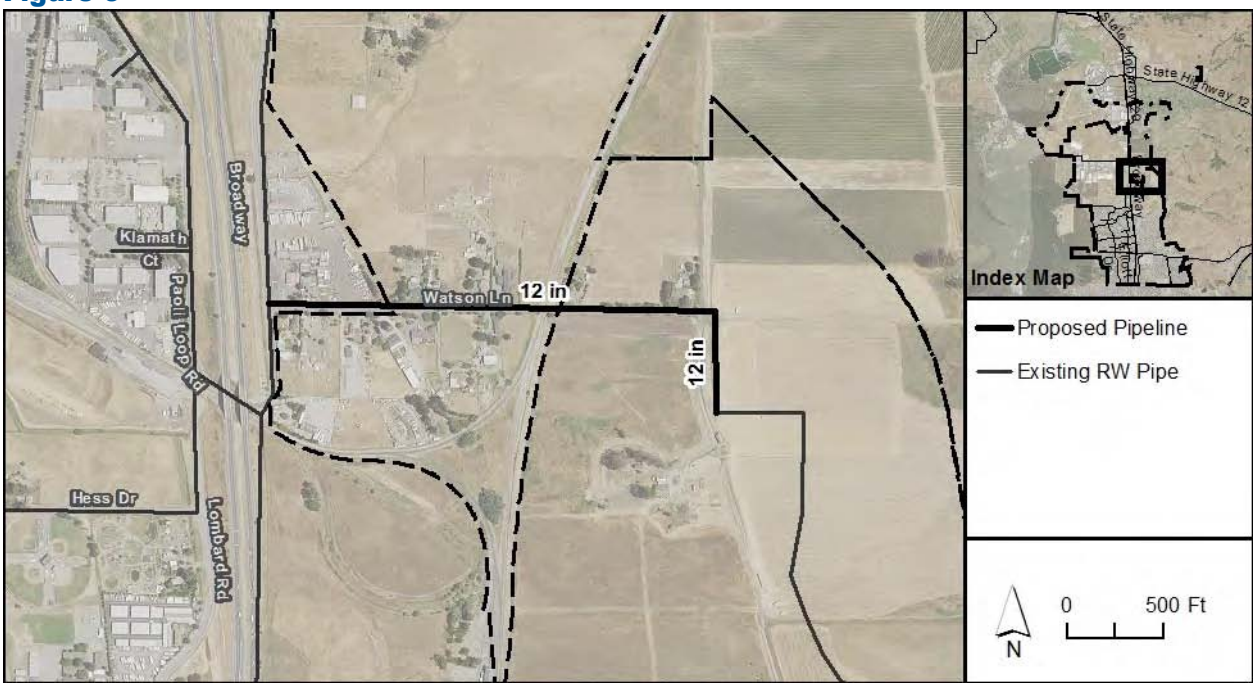

Table 9: CIP – RW9 Summary

CIP Component	Description
Proposed Improvements	• 12-inch Class 200 PVC Recycled Water Pipe – 2,840 LF
Additional Project Considerations	• CEQA review and construction permits
Project Cost Total [1]	$1,350,000 – Future Customers

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

CIP – RW10 Main Street and South Napa Junction Road

CIP RW10 consists of the construction of approximately 6,380 LF of 12-inch recycled water pipelines. The proposed recycled water pipelines will be constructed in Main Street between the existing 16-inch pipeline at the Cul-de-Sac and South Napa Junction Road, South Napa Junction Road between Highway 29 and the Cul-de-Sac, Future South Napa Junction Road through the future Watson Ranch development, and Future Newell Drive between the Cul-de-Sac and Future South Napa Junction Road. The proposed 12-inch pipelines will also connect to the existing 12-inch recycled water pipeline in Newell Drive and the proposed 12-inch pipeline in Broadway in RW16. This project will support development of Watson Ranch and help create additional loops in the recycled water distribution system to provide more reliability and improved system pressures.

Figure 10 provides an illustration of project improvements.

Figure 10

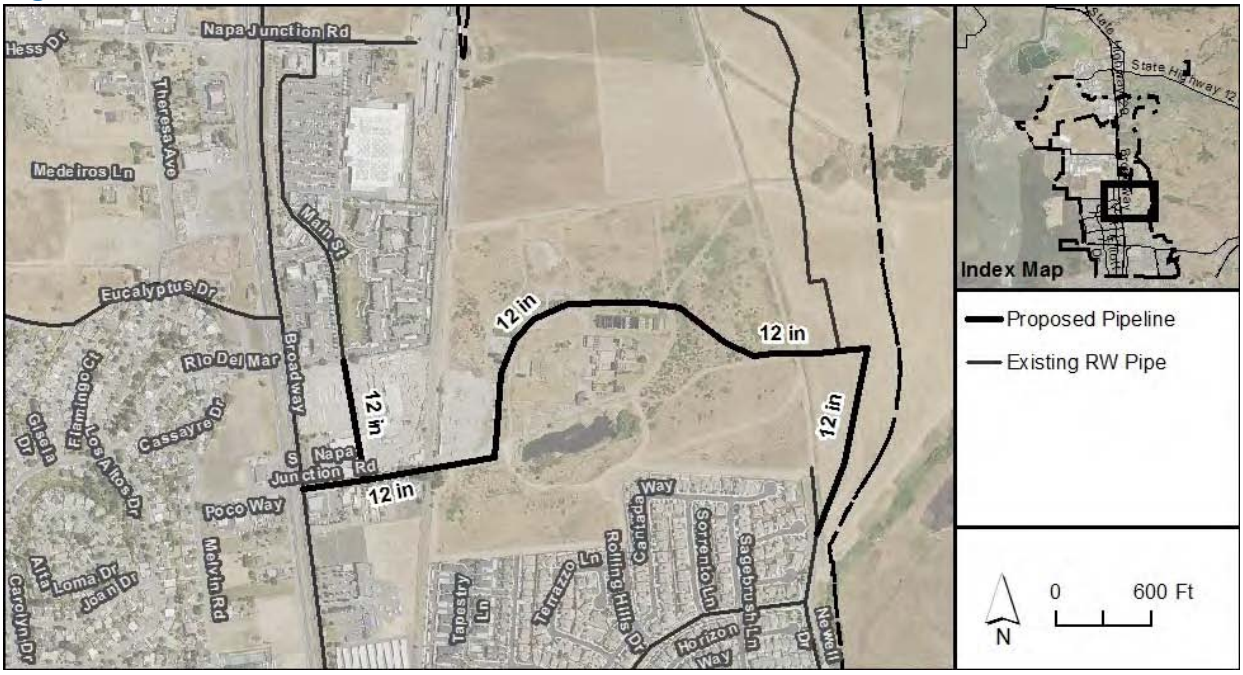

Table 10: CIP – RW10 Summary

CIP Component	Description
Proposed Improvements	• 12-inch Class 200 PVC Recycled Water Pipe – 6,380 LF
Additional Project Considerations	• CEQA review and construction permits
Project Cost Total [1]	$2,990,000 – Future Customers

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

CIP – RW11 Newell Drive

CIP RW11 consists of the construction of approximately 4,360 LF of 12-inch recycled water pipelines in the Future Local Street and Future Minor Collector Street that continues north from Future South Napa Junction Road. The proposed 12-inch pipelines will connect to the proposed pipelines in Watson Lane in RW9 and Future South Napa Junction Road in RW10. This project will support development of Watson Ranch and help create additional loops in the recycled water distribution system to provide more reliability and improved system pressures.

Figure 11 provides an illustration of project improvements.

Figure 11

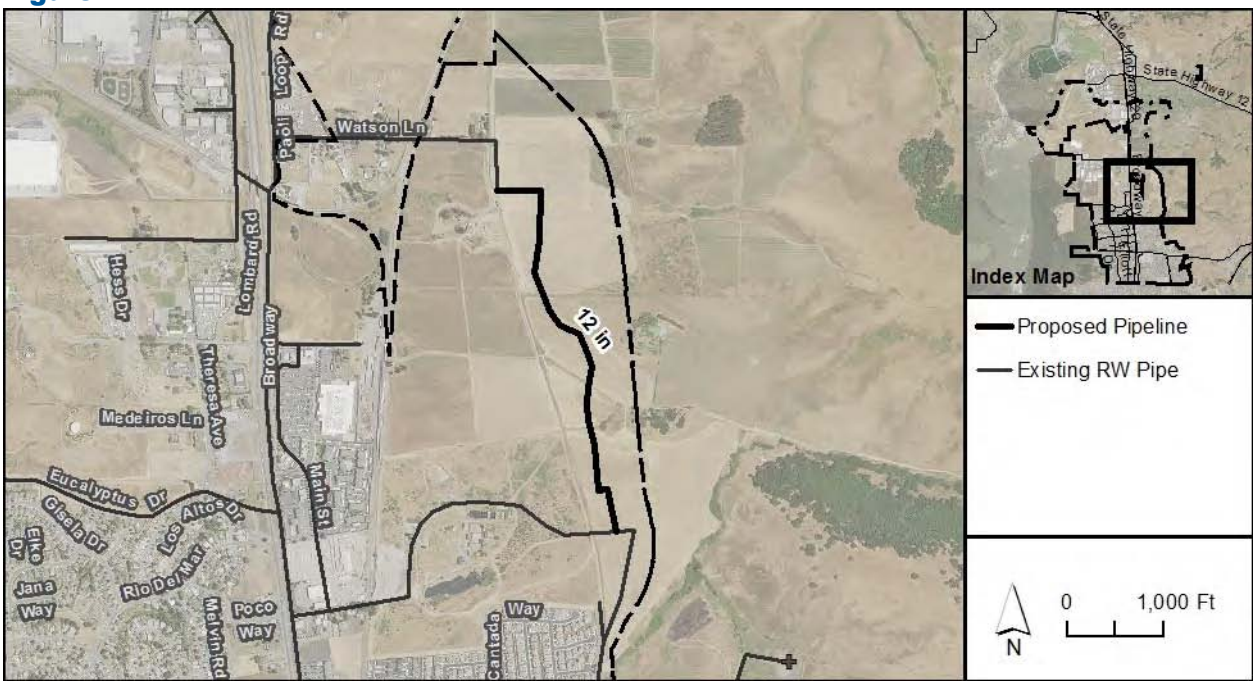

Table 11: CIP – RW11 Summary

CIP Component	Description
Proposed Improvements	• 12-inch Class 200 PVC Recycled Water Pipe – 4,360 LF
Additional Project Considerations	• CEQA review and construction permits
Project Cost Total (1)	$2,050,000 – Future Customers

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

CIP – RW12 Pump Station Upgrade

To support the connections of future recycled water customers, CIP RW12 consists of an upgrade of the existing Water Reclamation Plant Pump Station with the replacement of the three existing 50 HP vertical pumps with three 75 HP (2 duty, 1 standby) vertical turbine pumps. These future pumps are designed for 750 gpm at 228 ft of head. The pump station upgrade will also require the replacement of the associated piping and electrical gear.

Figure 12 provides an illustration of project improvements.

Figure 12

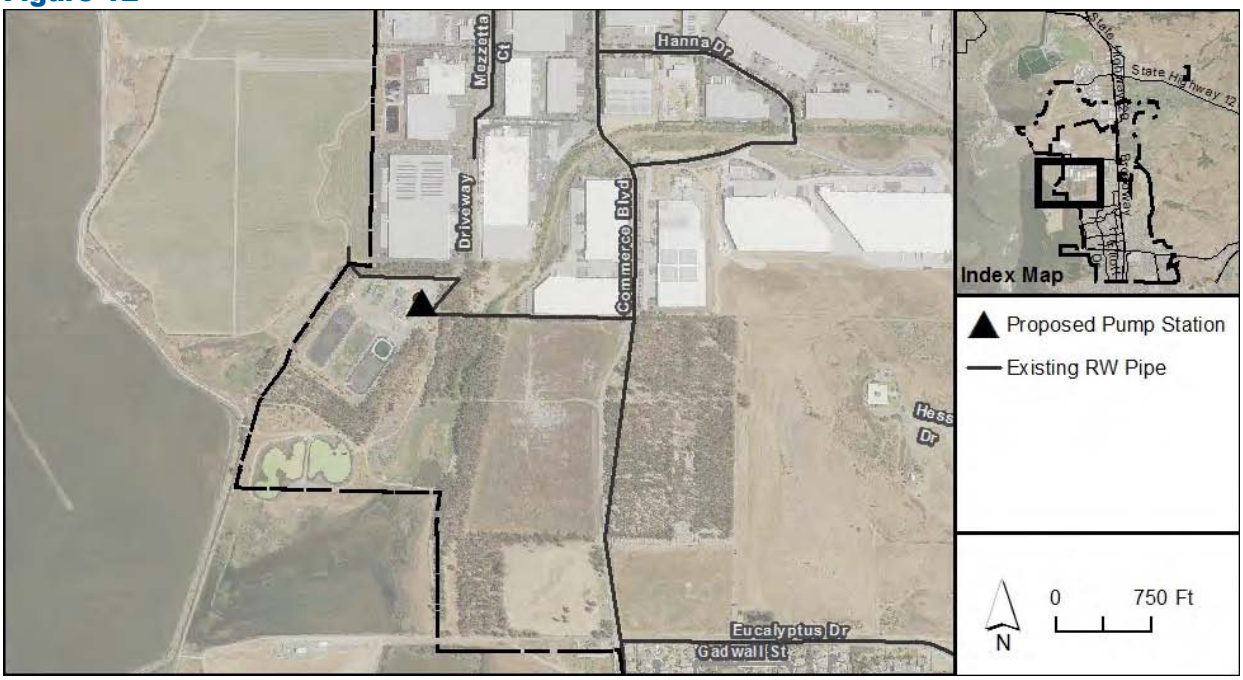

Table 12: CIP – RW12 Summary

CIP Component	Description
Proposed Improvements	• 3 – 75 HP Vertical Turbine Pumps • Associated piping and electrical gear
Additional Project Considerations	• CEQA review and construction permits
Project Cost Total (1)	$800,000 – Future Customers

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

CIP – RW13 Paoli Loop Road and Northern Vineyards

CIP RW13 consists of the construction of approximately 3,410 LF of 8-inch recycled water pipelines and approximately 190 LF of 6-inch recycled water pipelines. The proposed 8-inch pipeline in Paoli Loop Road will connect to an existing 8-inch recycled water pipeline at the intersection of Paoli Loop Road and Watson Lane and continue north approximately 1,660 LF towards Future Green Island Road. The proposed 8-inch pipeline will then continue easterly in Future Green Island Road for approximately 1,750 LF. The agricultural storage pond, provided by the vineyard customers, will be connected by an approximate 190 LF 6-inch recycled water pipeline.

The project supports future irrigation demand near the intersection of Paoli Loop Road and SR29, and also allows for delivering recycled water to an agricultural storage pond for irrigation of vineyards that are currently receiving raw water from the City.

Figure 13 provides an illustration of project improvements.

Figure 13

Table 13: CIP – RW13 Summary

CIP Component	Description
Proposed Improvements	• 8-inch Class 200 PVC Recycled Water Pipe – 3,410 LF • 6-inch Class 200 PVC Recycled Water Pipe – 190 LF
Additional Project Considerations	• Easement / right-of-way considerations – Property for vineyard storage pond • CEQA review and construction permits
Project Cost Total (1)	$1,400,000 – Future Customers

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

CIP – RW14 Eucalyptus Drive

CIP RW14 consists of construction of approximately 3,280 LF of 8-inch recycled water pipelines in Eucalyptus Drive east towards Highway 29 to connect to CIP RW15. This future pipeline connects to an existing 8-inch recycled water pipeline in Eucalyptus Drive approximately 1,800 LF east of Wetlands Edge Road. With completion of CIP RW15 this project creates two new loops on the west side of the distribution network with benefits including access to more future customers, increasing reliability of the network, and balancing pressures across the distribution system. The project improves system reliability and distribution pressures in the recycled water system as buildout is approached.

Figure 14 provides an illustration of project improvements.

Figure 14

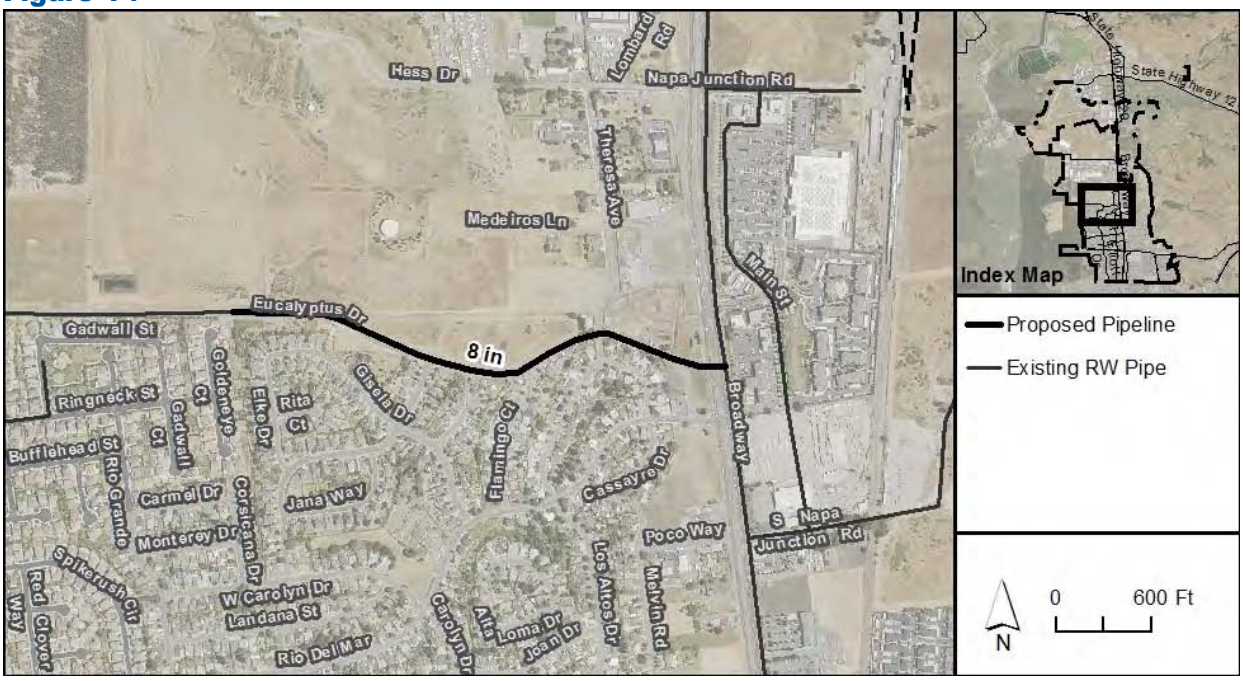

Table 14: CIP – RW14 Summary

CIP Component	Description
Proposed Improvements	• 8-inch Class 200 PVC Recycled Water Pipe – 3,280 LF
Additional Project Considerations	• CEQA review and construction permits
Project Cost Total [1]	$1,280,000 – Future Customers

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

CIP – RW15 Broadway and Donaldson Way

The construction of a 12-inch recycled water pipeline along the east side of Highway 29 increases the recycled water system reliability for existing and future customers by connecting to the existing 16-inch pipeline in Broadway to create a loop in the distribution system. CIP RW15 consists of the construction of approximately 7,080 LF of 12-inch recycled water pipeline in Broadway between Napa Junction Road and American Canyon Road and 430 LF of 6-inch recycled water pipelines in Donaldson Way between Broadway and Tuscan Oak Trail. The project improves system reliability and distribution pressures in the recycled water system as buildout is approached.

Figure 15 provides an illustration of project improvements.

Figure 15

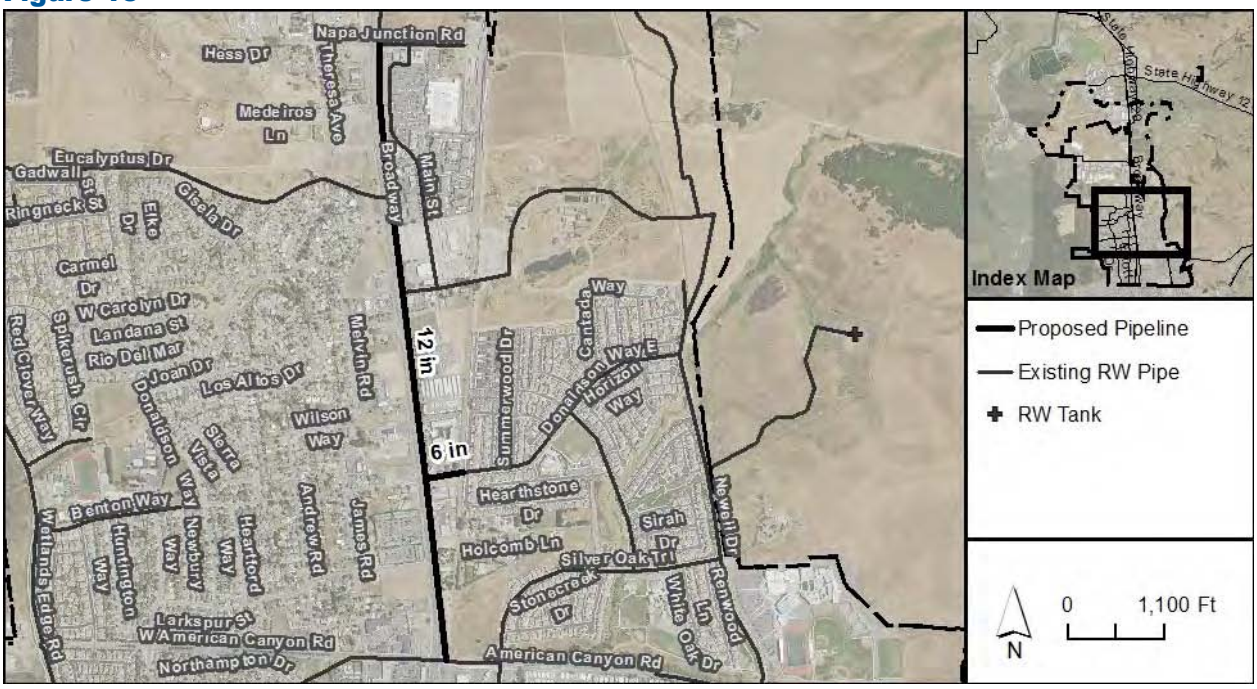

Table 15: CIP – RW15 Summary

CIP Component	Description
Proposed Improvements	• 12-inch Class 200 PVC Recycled Water Pipe – 7,080 LF • 6-inch Class 200 PVC Recycled Water Pipe – 430 LF
Additional Project Considerations	• Easement / right-of-way considerations – Caltrans • CEQA review and construction permits
Project Cost Total (1)	$3,470,000 – Future Need

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

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CIP Project; CIP-RW1 Tower/Devlin/South Kelly Road

Description	Diameter (in)	Quantity	Unit	Unit Cost	Total Cost
Mobilization and Demobilization (6%)		1	LS	$126,000	$126,000
Temporary Traffic Control (5%)		1	LS	$105,000	$105,000
Potholing		1	LS	$107,000	$107,000
Shoring and Trench Safety		1	LS	$179,000	$179,000
Dewatering		1	LS	$357,000	$357,000
Handling, Treatment, and Disposal of Contaminated Soil and GW		1	LS	$90,000	$90,000
12" Class 200 PVC Recycled Water Pipe	12	8,910	LF	$164	$1,461,240
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-RW2 Spikerush Circle

Description	Diameter (in)	Quantity	Unit	Unit Cost	Total Cost
Mobilization and Demobilization (6%)		1	LS	$9,000	$9,000
Temporary Traffic Control (5%)		1	LS	$7,000	$7,000
Potholing		1	LS	$10,000	$10,000
Shoring and Trench Safety		1	LS	$16,000	$16,000
Dewatering		1	LS	$32,000	$32,000
Handling, Treatment, and Disposal of Contaminated Soil and GW		1	LS	$8,000	$8,000
6" Class 200 PVC Recycled Water Pipe	6	800	LF	$98	$78,400
TOTAL ESTIMATE OF PROBABLE CONSTRUCTION COST					
Subtotal (Rounded)					$161,000
Construction Subtotal (Rounded)					$170,000
Contingency (25%) (Rounded)					$43,000
Total Estimate of Probable Construction Cost (Rounded) [1]					**$220,000**

Design, Survey, Geotechnical, Environmental Review, Permits (25% of Construction)	$55,000
Inspection/CM/ESDC (12% of Construction)	$26,400
Easement/Land Acquisition [1]	0
Project Total (Rounded)	**$310,000**

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

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CIP Project; CIP-RW3 Benton Way

Description	Diameter (in)	Quantity	Unit	Unit Cost	Total Cost
Mobilization and Demobilization (6%)		1	LS	$17,000	$17,000
Temporary Traffic Control (5%)		1	LS	$15,000	$15,000
Potholing		1	LS	$21,000	$21,000
Shoring and Trench Safety		1	LS	$34,000	$34,000
Dewatering		1	LS	$67,000	$67,000
Handling, Treatment, and Disposal of Contaminated Soil and GW		1	LS	$17,000	$17,000
6" Class 200 PVC Recycled Water Pipe	6	1,670	LF	$98	$163,660
TOTAL ESTIMATE OF PROBABLE CONSTRUCTION COST					
Subtotal (Rounded)					$335,000
Construction Subtotal (Rounded)					$340,000
Contingency (25%) (Rounded)					$85,000
Total Estimate of Probable Construction Cost (Rounded) [1]					**$430,000**

Design, Survey, Geotechnical, Environmental Review, Permits (25% of Construction)	$107,500
Inspection/CM/ESDC (12% of Construction)	$51,600
Easement/Land Acquisition [1]	0
Project Total (Rounded)	**$590,000**

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

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CIP Project; CIP-RW4 Pelleria Drive

Description	Diameter (in)	Quantity	Unit	Unit Cost	Total Cost
Mobilization and Demobilization (6%)		1	LS	$9,000	$9,000
Temporary Traffic Control (5%)		1	LS	$8,000	$8,000
Potholing		1	LS	$10,000	$10,000
Shoring and Trench Safety		1	LS	$16,000	$16,000
Dewatering		1	LS	$32,000	$32,000
Handling, Treatment, and Disposal of Contaminated Soil and GW		1	LS	$8,000	$8,000
Recycled Water Conversion Requirements		1	LS	$10,000	$10,000
6" Class 200 PVC Recycled Water Pipe	6	790	LF	$98	$77,420
TOTAL ESTIMATE OF PROBABLE CONSTRUCTION COST					
Subtotal (Rounded)					$171,000
Construction Subtotal (Rounded)					$180,000
Contingency (25%) (Rounded)					$45,000
Total Estimate of Probable Construction Cost (Rounded) [1]					**$230,000**

Design, Survey, Geotechnical, Environmental Review, Permits (25% of Construction)	$57,500
Inspection/CM/ESDC (12% of Construction)	$27,600
Easement/Land Acquisition [1]	0
Project Total (Rounded)	**$320,000**

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

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CIP Project; CIP-RW5 Jim Oswald Way/Mezzetta Court/Green Island Road

Description	Diameter (in)	Quantity	Unit	Unit Cost	Total Cost
Mobilization and Demobilization (6%)		1	LS	$36,000	$36,000
Temporary Traffic Control (5%)		1	LS	$30,000	$30,000
Potholing		1	LS	$40,000	$40,000
Shoring and Trench Safety		1	LS	$66,000	$66,000
Dewatering		1	LS	$132,000	$132,000
Handling, Treatment, and Disposal of Contaminated Soil and GW		1	LS	$33,000	$33,000
6" Class 200 PVC Recycled Water Pipe	6	1,800	LF	$98	$176,400
8" Class 200 PVC Recycled Water Pipe	8	1,500	LF	$121	$181,500
TOTAL ESTIMATE OF PROBABLE CONSTRUCTION COST					
Subtotal (Rounded)					$695,000
Construction Subtotal (Rounded)					$700,000
Contingency (25%) (Rounded)					$175,000
Total Estimate of Probable Construction Cost (Rounded) [1]					**$880,000**

Design, Survey, Geotechnical, Environmental Review, Permits (25% of Construction)	$220,000
Inspection/CM/ESDC (12% of Construction)	$105,600
Easement/Land Acquisition [1]	0
Project Total (Rounded)	**$1,210,000**

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

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CIP Project; CIP-RW6 Hanna Drive

Description	Diameter (in)	Quantity	Unit	Unit Cost	Total Cost
Mobilization and Demobilization (6%)		1	LS	$23,000	$23,000
Temporary Traffic Control (5%)		1	LS	$19,000	$19,000
Potholing		1	LS	$24,000	$24,000
Shoring and Trench Safety		1	LS	$39,000	$39,000
Dewatering		1	LS	$78,000	$78,000
Handling, Treatment, and Disposal of Contaminated Soil and GW		1	LS	$20,000	$20,000
8" Class 200 PVC Recycled Water Pipe	8	1,950	LF	$121	$235,950
TOTAL ESTIMATE OF PROBABLE CONSTRUCTION COST					
Subtotal (Rounded)					$439,000
Construction Subtotal (Rounded)					$440,000
Contingency (25%) (Rounded)					$110,000
Total Estimate of Probable Construction Cost (Rounded) [1]					**$550,000**

Design, Survey, Geotechnical, Environmental Review, Permits (25% of Construction)	$137,500
Inspection/CM/ESDC (12% of Construction)	$66,000
Easement/Land Acquisition [1]	0
Project Total (Rounded)	**$760,000**

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

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CIP Project; CIP-RW7 Dodd/Klamath Court

Description	Diameter (in)	Quantity	Unit	Unit Cost	Total Cost
Mobilization and Demobilization (6%)		1	LS	$7,000	$7,000
Temporary Traffic Control (5%)		1	LS	$6,000	$6,000
Potholing		1	LS	$8,000	$8,000
Shoring and Trench Safety		1	LS	$12,000	$12,000
Dewatering		1	LS	$24,000	$24,000
Handling, Treatment, and Disposal of Contaminated Soil and GW		1	LS	$6,000	$6,000
6" Class 200 PVC Recycled Water Pipe	6	600	LF	$98	$58,800
TOTAL ESTIMATE OF PROBABLE CONSTRUCTION COST					
Subtotal (Rounded)					$122,000
Construction Subtotal (Rounded)					$130,000
Contingency (25%) (Rounded)					$33,000
Total Estimate of Probable Construction Cost (Rounded) [1]					**$170,000**

Design, Survey, Geotechnical, Environmental Review, Permits (25% of Construction)	$42,500
Inspection/CM/ESDC (12% of Construction)	$20,400
Easement/Land Acquisition [1]	0
Project Total (Rounded)	**$240,000**

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

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CIP Project; CIP-RW8 Lombard/Hess Road

Description	Diameter (in)	Quantity	Unit	Unit Cost	Total Cost
Mobilization and Demobilization (6%)		1	LS	$26,000	$26,000
Temporary Traffic Control (5%)		1	LS	$22,000	$22,000
Potholing		1	LS	$27,000	$27,000
Shoring and Trench Safety		1	LS	$45,000	$45,000
Dewatering		1	LS	$90,000	$90,000
Handling, Treatment, and Disposal of Contaminated Soil and GW		1	LS	$23,000	$23,000
8" Class 200 PVC Recycled Water Pipe	8	2,230	LF	$121	$269,830
TOTAL ESTIMATE OF PROBABLE CONSTRUCTION COST					
Subtotal (Rounded)					$503,000
Construction Subtotal (Rounded)					$510,000
Contingency (25%) (Rounded)					$128,000
Total Estimate of Probable Construction Cost (Rounded) [1]					**$640,000**

Design, Survey, Geotechnical, Environmental Review, Permits (25% of Construction)	$160,000
Inspection/CM/ESDC (12% of Construction)	$76,800
Easement/Land Acquisition [1]	0
Project Total (Rounded)	**$880,000**

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

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CIP Project; CIP-RW9 Watson Lane

Description	Diameter (in)	Quantity	Unit	Unit Cost	Total Cost
Mobilization and Demobilization (6%)		1	LS	$40,000	$40,000
Temporary Traffic Control (5%)		1	LS	$34,000	$34,000
Potholing		1	LS	$35,000	$35,000
Shoring and Trench Safety		1	LS	$57,000	$57,000
Dewatering		1	LS	$114,000	$114,000
Handling, Treatment, and Disposal of Contaminated Soil and GW		1	LS	$29,000	$29,000
12" Class 200 PVC Recycled Water Pipe	12	2,840	LF	$164	$465,760
TOTAL ESTIMATE OF PROBABLE CONSTRUCTION COST					
Subtotal (Rounded)					$775,000
Construction Subtotal (Rounded)					$780,000
Contingency (25%) (Rounded)					$195,000
Total Estimate of Probable Construction Cost (Rounded) [1]					**$980,000**

Design, Survey, Geotechnical, Environmental Review, Permits (25% of Construction)	$245,000
Inspection/CM/ESDC (12% of Construction)	$117,600
Easement/Land Acquisition [1]	0
Project Total (Rounded)	**$1,350,000**

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

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CIP Project; CIP-RW10 Main/South Napa Junction Road

Description	Diameter (in)	Quantity	Unit	Unit Cost	Total Cost
Mobilization and Demobilization (6%)		1	LS	$90,000	$90,000
Temporary Traffic Control (5%)		1	LS	$75,000	$75,000
Potholing		1	LS	$77,000	$77,000
Shoring and Trench Safety		1	LS	$128,000	$128,000
Dewatering		1	LS	$256,000	$256,000
Handling, Treatment, and Disposal of Contaminated Soil and GW		1	LS	$64,000	$64,000
12" Class 200 PVC Recycled Water Pipe	12	6,380	LF	$164	$1,046,320
TOTAL ESTIMATE OF PROBABLE CONSTRUCTION COST					
Subtotal (Rounded)					$1,737,000
Construction Subtotal (Rounded)					$1,740,000
Contingency (25%) (Rounded)					$435,000
Total Estimate of Probable Construction Cost (Rounded) [1]					**$2,180,000**

Design, Survey, Geotechnical, Environmental Review, Permits (25% of Construction)	$545,000
Inspection/CM/ESDC (12% of Construction)	$261,600
Easement/Land Acquisition [1]	0
Project Total (Rounded)	**$2,990,000**

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

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CIP Project; CIP-RW11 Newell Road

Description	Diameter (in)	Quantity	Unit	Unit Cost	Total Cost
Mobilization and Demobilization (6%)		1	LS	$62,000	$62,000
Temporary Traffic Control (5%)		1	LS	$52,000	$52,000
Potholing		1	LS	$53,000	$53,000
Shoring and Trench Safety		1	LS	$88,000	$88,000
Dewatering		1	LS	$175,000	$175,000
Handling, Treatment, and Disposal of Contaminated Soil and GW		1	LS	$44,000	$44,000
12" Class 200 PVC Recycled Water Pipe	12	4,360	LF	$164	$715,040
TOTAL ESTIMATE OF PROBABLE CONSTRUCTION COST					
Subtotal (Rounded)					$1,190,000
Construction Subtotal (Rounded)					$1,190,000
Contingency (25%) (Rounded)					$298,000
Total Estimate of Probable Construction Cost (Rounded) [1]					**$1,490,000**

Design, Survey, Geotechnical, Environmental Review, Permits (25% of Construction)	$372,500
Inspection/CM/ESDC (12% of Construction)	$178,800
Easement/Land Acquisition [1]	0
Project Total (Rounded)	**$2,050,000**

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

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

ENR Construction Cost Index:	
Jul-15	11,155.07

Date: 3/17/2016

CIP Project; CIP-RW12 PS Upgrades

Description	Diameter (in)	Quantity	Unit	Unit Cost	Total Cost
Mobilization and Demobilization (6%)		1	LS	$15,000	$15,000
75 HP Vertical Turbine Pumps and Associated Piping		3	EA	$80,000	$240,000
Associated Electrical Upgrades		1	LS	$200,000	$200,000
TOTAL ESTIMATE OF PROBABLE CONSTRUCTION COST					
Subtotal (Rounded)					$455,000
Construction Subtotal (Rounded)					$460,000
Contingency (25%) (Rounded)					$115,000
Total Estimate of Probable Construction Cost (Rounded) [1]					**$580,000**

Design, Survey, Geotechnical, Environmental Review, Permits (25% of Construction)	$145,000
Inspection/CM/ESDC (12% of Construction)	$69,600
Easement/Land Acquisition [1]	0
Project Total (Rounded)	**$800,000**

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

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

ENR Construction Cost Index:	
Jul-15	11,155.07

Date: 9/18/2015

CIP Project; CIP-RW13 Paoli Loop Road and Northern Vineyards

Description	Diameter (in)	Quantity	Unit	Unit Cost	Total Cost
Mobilization and Demobilization (6%)		1	LS	$41,000	$41,000
Temporary Traffic Control (5%)		1	LS	$35,000	$35,000
Potholing		1	LS	$41,000	$41,000
Shoring and Trench Safety		1	LS	$72,000	$72,000
Dewatering		1	LS	$144,000	$144,000
Handling, Treatment, and Disposal of Contaminated Soil and GW		1	LS	$36,000	$36,000
8" Class 200 PVC Recycled Water Pipe	8	3,410	LF	$121	$412,610
6" Class 200 PVC Recycled Water Pipe	6	190	LF	$98	$18,620
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

City of American Canyon
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ENR Construction Cost Index:	
Jul-15	11,155.07

Date: 9/18/2015

CIP Project; CIP-RW14 Eucalytpus Drive

Description	Diameter (in)	Quantity	Unit	Unit Cost	Total Cost
Mobilization and Demobilization (6%)		1	LS	$38,000	$38,000
Temporary Traffic Control (5%)		1	LS	$32,000	$32,000
Potholing		1	LS	$40,000	$40,000
Shoring and Trench Safety		1	LS	$66,000	$66,000
Dewatering		1	LS	$132,000	$132,000
Handling, Treatment, and Disposal of Contaminated Soil and GW		1	LS	$33,000	$33,000
6" Class 200 PVC Recycled Water Pipe	8	3,280	LF	$121	$396,880
TOTAL ESTIMATE OF PROBABLE CONSTRUCTION COST					
Subtotal (Rounded)					$738,000
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.

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

ENR Construction Cost Index:	
Jul-15	11,155.07

Date: 9/18/2015

CIP Project; CIP-RW15 Broadway and Donaldson Way

Description	Diameter (in)	Quantity	Unit	Unit Cost	Total Cost
Mobilization and Demobilization (6%)		1	LS	$104,000	$104,000
Temporary Traffic Control (5%)		1	LS	$87,000	$87,000
Potholing		1	LS	$91,000	$91,000
Shoring and Trench Safety		1	LS	$151,000	$151,000
Dewatering		1	LS	$301,000	$301,000
Handling, Treatment, and Disposal of Contaminated Soil and GW		1	LS	$76,000	$76,000
12" Class 200 PVC Recycled Water Pipe	12	7,080	LF	$164	$1,161,120
6" Class 200 PVC Recycled Water Pipe	6	430	LF	$98	$42,140
TOTAL ESTIMATE OF PROBABLE CONSTRUCTION COST					
Subtotal (Rounded)					$2,014,000
Construction Subtotal (Rounded)					$2,020,000
Contingency (25%) (Rounded)					$505,000
Total Estimate of Probable Construction Cost (Rounded) (1)					**$2,530,000**

Design, Survey, Geotechnical, Environmental Review, Permits (25% of Construction)	$632,500
Inspection/CM/ESDC (12% of Construction)	$303,600
Easement/Land Acquisition (1)	0
Project Total (Rounded)	**$3,470,000**

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

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