City San Luis Obispo
Final Potable Water Distribution System Operations Master Plan
December 2015

Prepared by

WALLACE GROUP®

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CITY OF SAN LUIS OBISPO
FINAL POTABLE WATER DISTRIBUTION SYSTEM OPERATIONS MASTER PLAN
DECEMBER 2015

<u>City Council</u>
Mayor Jan Howell Marx
Vice Mayor John Ashbaugh
Council Member Dan Carpenter
Council Member Carlyn Christianson
Council Member Dan Rivoire

REGISTERED PROFESSIONAL ENGINEER
KARI E. WAGNER
66026
CIVIL
STATE OF CALIFORNIA

Prepared By:

Kari Wagner, P.E. 66026
Senior Civil Engineer

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List of Tables and Figures

List of Acronyms

AC	Asbestos Cement
ADD	Average Day Demand
AFY	Acre-Feet per Year
AWWA	American Water Works Association
"C" Factor	Hazen-Williams roughness coefficient
cfs	cubic feet per second
CI	Cast Iron
CICL	Cast Iron Concrete Lined
CIP	Capital Improvement Program
City	City of San Luis Obispo
DI	Ductile Iron
ENR	Engineering News-Record
FRM	Fluid Resource Management
GIS	Geographic Information System
gal	Gallon
gpcd	gallons per capita per day
gpm	gallons per minute
hp	horse power
LUCE	Land Use and Circulation Element
MG	million gallon
mgd	million gallons per day
MPIP	Master Plan Improvement Program or Project
N/A	Not Available
NFPA	National Fire Protection Agency
NOAA NMFS	National Oceanic and Atmospheric Administration's National Marine Fisheries Service
PF	Peaking Factor
PHD	Peak Hour Demand
Plan or WMP	Water Master Plan
PRV	Pressure Reducing Valve
PVC	Poly-Vinyl Chloride
SCADA	Supervisory Control and Data Acquisition
SWRCB-DDW	State Water Resources Control Board – Division of Drinking Water
UAW	Unaccounted-for-Water
UFC	Uniform Fire Code
WLCC	Water Loss Control Committee
WRRF	Water Resource Recovery Facility
WTP	Water Treatment Plant

List of References

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12. Personal Communication with Wade Horton, Deputy Director, Water Division; and Noah Evans, Water Distribution Supervisor.
13. Pump Curves provided by City of San Luis Obispo
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17. Physical Evaluation of Pump Stations conducted by Fluid Resource Management December 2012.

1: Introduction

The City of San Luis Obispo (City) supplies water service and fire suppression to its customers throughout the City. As older infrastructure is replaced and new development projects are constructed, it is the City's goal to construct water improvements to meet the current and ultimate needs of the City. In order to facilitate this goal, and to adequately plan for the capital resources needed to meet this goal, the City commissioned a comprehensive Water Master Plan (Plan or WMP) that evaluates all aspects of the water distribution system and its ability to meet current and long-term needs of the City.

Purpose of the Project

Preparation of the Plan will assist the City in prioritizing both current and future water system needs and set forth a mechanism for addressing those needs. The Plan does the following:

1. Addresses existing deficiencies within the water distribution system based on today's standards and requirements;
2. Addresses deficiencies within the water distribution system to meet future build-out needs; and
3. Provides a prioritized list of recommendations with associated hard and soft costs to complete the projects.
4. Aligns with the Utilities Department Strategic Long-Range Plan and core purpose "To provide essential services that support the community's health, well-being, and quality of life."

Authorization and Scope of Work

On April 1, 2013, the City authorized Wallace Group to prepare a comprehensive Water Master Plan. The Water Master Plan was prepared in accordance with Wallace Group's proposal dated March 26, 2013. A summarized scope of work is as follows:

1. Kick-Off Meeting and Facility Review: Coordinate and attend a kick-off meeting with key Team members and City staff. Immediately following the meeting, conduct an initial field investigation of the City's water tanks and pump stations to understand layouts and system operations.
2. Existing Data Collection: Obtain from City staff relevant documents that will assist in the preparation of the WMP including water usage and land use data.
3. GIS Data Review: Obtain GIS data from the City, including the water distribution system, water pressure zones, and parcel data. Utilize the data for preparation of exhibits that will be part of the Water Master Plan Update Report. Review the data received and identify discrepancies or additional information needed in order to accurately model the water distribution system.
4. Future Land Use Review: Review the draft Land Use Element and conduct a preliminary review of the future development and how it will be served by the City. Work with City staff to identify the future development areas that will impact the Water Master Plan.
5. Water Use Demand Factors: Update the water use demand factors for the City's service area, including refinement of the per capita demands, non-residential demands (commercial, industrial, institutional), production and sales, production versus sales (un-accounted for water),

maximum day demand, peak hour demand, summer versus winter demand and other demand factors for each zone.

6. Future Water Demands: Project future water demands for each zone based on the land use designations provided by the City using the population and growth projections provided by the City, and the per capita demand calculated.
7. Design Criteria: Provide recommendations for updating the City's water system design criteria in light of new or changed requirements and regulations (particularly SWRCB-DDW requirements, formerly CDPH), fire flow requirements, hydrant spacing, valve spacing, pipeline velocities and headlosses, minimum fire flow residual pressure, overall water system pressures (high and low), minimum pipe diameters, dead-end mains, etc. These criteria will be the basis of our evaluation of the hydraulic performance of the City's water system components.
8. Water Storage Requirements: Evaluate water storage needs in regards to recommended operational, emergency, and fire protection storage for both existing and future needs. Review storage requirements individually for each pressure zone and from a system-wide approach, considering water storage transfer capabilities (redundancy) between zones.
9. Hydraulic Model Development: Prepare a new water model in WaterCAD, which will be used to evaluate the existing and future conditions of the water distribution system. Contour data will be from the City's 2007 ½-meter contour lidar data. The model will be populated with the water demands by zone.
10. Fire Flow Testing: Identify locations to conduct fire flow testing, which will be used to calibrate the water model.
11. Water Model Calibration and Existing Water Distribution System Evaluation: Utilize the water model prepared and the Fire Flow Testing to calibrate the water model to match existing conditions. Model each of the zones under current conditions for average day demand with tanks full, peak hour demand with tanks ½ full, and fire flow conditions with tanks ¾ full.
12. Future Buildout Water Distribution System Evaluation: Evaluate the impacts of development on the existing water distribution system based on two iterations of future Land Use scenarios.
13. Water Master Plan Update Report: Prepare a master plan improvement program (MPIP), phased in Priority 1, 2 and 3 categories for recommended improvements, which can be used by the City to fiscally plan over the next 15 to 20 years. The projects will be ranked for priority. The costs for these improvements will be prepared based on Engineer's Estimates of Probable Costs, referencing the current ENR Indices. A draft and final technical report summarizing all aspects of this Water Master Plan Update will be prepared.

Acknowledgements

Wallace Group thanks and gratefully acknowledges the following for their efforts, involvements, input and assistance in preparing this Water Master Plan:

City of San Luis Obispo City Council:

Mayor Jan Howell Marx
Vice Mayor John Ashbaugh
Council Member Dan Carpenter
Council Member Carlyn Christianson
Council Member Dan Rivoire

City of San Luis Obispo City Staff:

Katie Lichtig	City Manager
Carrie Mattingly	Utilities Director
Aaron Floyd	Deputy Director - Water
Wade Horton	Deputy Director – Water (Through December 2014)
Jennifer Metz	Utilities Project Manager
Dave Hix	Deputy Director - Wastewater
Don Thomas	Water Distribution System Supervisor
Dean Furukawa	Water Treatment Plant Supervisor
Noah Evans	Water Supply Supervisor
Mychal Boerman	Water Distribution Operator
Ryan Dale	Water Distribution Operator
Jerry Davis	Water Distribution Operator
Marcus Henderson	Water Distribution Operator
Casey Nance	Water Distribution Operator
Mike Tate	Water Distribution Operator
Travis Tutt	Water Distribution Operator

The following Wallace Group key team members were involved in the preparation of this Water Master Plan:

Rob Miller, PE	Principal Engineer
Steven G. Tanaka, PE	Director of Water Resources
Kari Wagner, PE	Senior Civil Engineer
Valerie Huff, PE	Senior Civil Engineer
Brett Hadley, PE	Civil Engineer

A special thank-you to Rincon Consultants Inc. for assisting with the graphics for this report.

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2: Water Distribution System Overview

Chapter 2 describes the features of the City's water distribution system. Given that the water distribution system is complex in nature, this chapter provides a general overview of the system. The details regarding the various water system features are then presented in subsequent chapters. All tables and figures are located at the end of this chapter.

Water Distribution System Background

The City owns and operates a complex water distribution system that is comprised of sixteen distribution zones, ten potable water storage tanks, two reservoirs, five hydro-pneumatic tanks, eight pump stations, and 18 pressure reducing valves (PRVs). The City's water distribution system has been "piecemealed" over the years, which has led to a high number of zones for the relatively small distribution system, which in-turn requires the numerous pump stations and tanks. The pump stations and tanks are a significant portion of the Water Division's annual operation's budget to cover the cost of powering and maintaining these facilities. In addition, the high number of zones also increases the complexity of the day-to-day and emergency operations. Therefore, this master plan will look at opportunities to eliminate tanks and pump stations, and consolidate pressure zones.

Water Distribution Zones

The City's existing distribution system consists of sixteen distribution zones with elevations ranging from approximately 100 feet to 590 feet above sea level. The distribution zones are listed as follows:

1. Alrita
2. Andrews
3. Bishop
4. Downtown
5. Edna Saddle
6. Ferrini
7. Foothill
8. High Pressure
9. Highland
10. Patricia
11. Reservoir #1
12. Reservoir Canyon
13. Rosemont
14. Serrano
15. Slack
16. Terrace Hill

Each distribution zone is analyzed separately and is described in the following subsections. Each subsection provides a summary of the relative size of the zone and the land uses that are served within the zone. This information assists in providing a visual of the area served and supports the hydraulic design parameters used throughout this report. A list of each of the distribution zones and their defining features are presented in Table 2-1 and are illustrated in Figure 2-1. Figures 2-2a and 2-2b provide a graphic representation of the hydraulic profile of the distribution system. This figure illustrates how each tank and pump station hydraulically interact with one another and their relationship to the distribution zone(s) they serve. The hydraulic profile was developed based on information contained within the City's 2000 Water Master Plan and the City's GIS database.

Alrita Zone

The Alrita Zone is a small boosted zone, less than ten acres, and includes 13 residential parcels located at the upper end of Alrita Street. The Alrita Zone is served by the Alrita Pump Station that is fed by the Bishop Zone. The Alrita Pump Station has two 100 gpm pumps, one 1,500 gpm pump, and two, 2,500 gallon hydro-pneumatic tanks.

Andrews Zone

The Andrews Zone is a small sub-zone of the High Pressure Zone, served via the San Luis/Cazadero PRV. The zone is located northeast of San Luis High School off of San Luis Drive and Cazadero Street. The zone is approximately 60 acres and serves 174 residential parcels. Reservoir #2 provides the Andrews Zone with its storage requirements. If pressures drop in the Andrews Zone, water can be back-fed, via a check valves located at Andrews and Monterey Streets from the Reservoir #1 Zone. Reservoir #1 provides back-up storage to the Andrews Zone during low pressure conditions or in the event the pipeline between the Andrews Zone and the High Pressure Zone is out of service.

Bishop Zone

The Bishop Zone is approximately 385 acres and serves both residential and commercial properties along Johnson Avenue from Lizzie Street to Tanglewood Drive. The High Pressure Zone feeds the Bishop Zone and the 667,000 gal Bishop Tank. The Bishop Tank provides storage for the Bishop Zone. If pressure drops in the Bishop Zone, the fire pump at the Bishop Pump station can provide additional flow from the High Pressure Zone to the Bishop Zone. The Bishop Zone also provides supply to both the Alrita Zone (via Alrita PS) and is a backup supply to the Terrace Hill Zone, via Kentwood/Johnson PRV.

Downtown Zone

The Downtown Zone is the City's third largest zone covering approximately 850 acres. The Downtown Zone encompasses the City's core downtown region, which contains both residential and commercial properties. The Downtown Zone does not have its own storage, thus relying on supply from the Foothill Zone via the PRV located at Chorro/Foothill and the two PRVs at Peach/Broad. The Downtown Zone also receives supply from the Terrace Hill Zone via the PRV located at Broad/Caudill, but typically, this PRV is normally closed and is required to be manually opened by City Staff. The Downtown Zone provides supply to the Edna Saddle Zone through the Madonna/Higuera PRV.

Edna Saddle Zone

The Edna Saddle Zone is the City's largest zone spanning over 2,300 acres serving residential and commercial properties. The Edna Saddle Zone encompasses all properties south of the intersection of Madonna Road and South Higuera. This includes all properties along Los Osos Valley Road corridor, Madonna Road corridor, and South Higuera corridor. The Edna Saddle Zone also serves properties along Broad Street from just north of Industrial Way to the airport. The Edna Saddle Zone is served by the 3.8 MG Edna Saddle Tank. The supply comes through the Madonna/Higuera PRV from the Downtown Zone, which receives its supply from the Foothill Zone. In addition, the Edna Saddle Zone receives water supplies from the City's two potable wells, Wells PB#1 and FS#4.

Ferrini Zone

The Ferrini Zone is entirely residential and has a service area of approximately 40 acres. The small service area receives its supply from the Foothill Zone via the Ferrini Pump Station. The Ferrini Tank (0.16 MG) provides storage for the Ferrini Zone as well as the Highland Zone. The Ferrini Pump Station has two, 1,060 gpm pumps.

Foothill Zone

The Foothill Zone serves both residential and commercial properties and spans 470 acres. The Foothill Zone also serves Sierra Vista Hospital, which is an essential City facility. The Foothill Zone includes properties around Foothill Boulevard and properties on Santa Rosa Avenue north of Highway 101. The Foothill Zone receives its supply from the City's Water Treatment Plant (WTP) via the two Clear Well Tanks, which have a total storage of 3.9 MG. The Foothill Zone and WTP Clear Well Tanks also provide supply to all other zones within the City through either pump stations or PRVs.

High Pressure Zone

The High Pressure Zone spans over 320 acres of residential and commercial properties, including Cal Poly. In addition, the High Pressure Zone serves French Hospital, which is an essential City facility. The High Pressure Zone is broken into two regions. The first region includes the lower lying properties northeast of California Avenue and Highway 101. The second region includes the parcels located directly between San Luis High School and Bishop Street, west of Johnson Avenue. The two regions are tied together via a waterline on California Avenue. The High Pressure Zone receives its supply from Reservoir #2 via the Transfer Pump Station. Reservoir #2 has a total storage of 7.07 MG. The Transfer Pump Station has four 1,500 gpm pumps.

Highland Zone

The Highland Zone is entirely residential and is approximately 80 acres. It is located northwest of the Patricia and Foothill Zones. The Highland Zone is served by the Ferrini Zone through two PRVs: Patricia and Skyline/Mirasol. The Highland Zone does not have its own storage, thus relying on the 160,000 gal Ferrini Tank to provide storage for the zone.

Patricia Zone

The Patricia Zone serves residential and commercial properties. The zone is located west of the Foothill Zone and covers approximately 120 acres. The Patricia Zone is served by the Serrano Zone through the La Entrada/Catalina PRV. The Patricia Zone does not have its own storage, thus relying on the 100,000 gal Serrano Tank to provide storage for the zone.

Reservoir #1 Zone

Reservoir #1 Zone serves both residential and commercial properties. The zone is approximately 230 acres. Reservoir #1 Zone encompasses properties along California Avenue between Highway 101 and San Luis High School, and from Toro Street to the Monterey Avenue/Highway 101 on-ramp. The Reservoir #1 Zone is supplied by Reservoir #1, which is fed via the High Pressure Zone via four PRVs: Grand, California/Monterey, Ella/Binns, and San Luis/Johnson. The 7.50 MG Reservoir #1 provides

storage to the Reservoir #1 Zone. Reservoir #1 also provides storage for Reservoir Canyon Zone and is a backup supply to the Andrews Zone.

Reservoir Canyon Zone

The Reservoir Canyon Zone is a small zone that serves two residential parcels outside city limits, along Highway 101 at the north end of the City. The zone is supplied by the Reservoir Canyon Pump Station. The pump station is fed from Reservoir #1 in the Reservoir #1 Zone. The pump station boosts water pressure through three hydro-pneumatic tanks. The zone is a fully boosted zone. The Reservoir Canyon Pump Station contains two 3 hp pumps. The purpose of the Reservoir Canyon Pump Station is to sustain pressure and maximum day flow to the Reservoir Canyon Zone. This pump station does not provide fire flow service, nor does the City maintain a tank that provides fire flow service to the homes within this zone per the City's agreement with the customers located within this zone.

Rosemont Zone

The Rosemont Zone is approximately ten acres and serves nine parcels located at the top end of Highland Drive. The Rosemont Zone is supplied by the Highland Zone via the Rosemont Pump Station, which has two 10 hp pumps. The Rosemont Zone also has 35,000 gallons of storage at the Rosemont Tank.

Serrano Zone

The Serrano Zone serves residential properties at the upper elevations of Serrano Drive, Serrano Heights, Luneta Drive, and La Entrada Avenue. It is approximately 85 acres in size. The Serrano Zone is supplied by the Foothill Zone via the Bressi Pump Station. The Bressi Pump Station contains two 40 hp (500 gpm each) pumps. The Serrano Tank provides the Serrano Zone and Patricia Zone with 100,000 gallons of storage.

Slack Zone

The Slack Zone serves residential properties along Slack Street and the hillside north of Highway 101 at the north end of the City. The zone is approximately 90 acres. The Slack Zone is supplied by the McCollum Pump Station. The pump station is fed from the High Pressure Zone and pumps to the 70,000 gallon Slack Street Tank. The McCollum Pump Station contains two pumps, 200 gpm and 600 gpm.

Terrace Hill Zone

Terrace Hill Zone is the second largest zone, spanning over 1,030 acres. The zone includes residential and commercial properties along Broad Street from Caudill Street to the south end of the City and east of Broad Street to Southwood Drive. Terrace Hill Zone is supplied primarily by the High Pressure Zone via the Terrace Hill PRV with a backup supply from the Bishop Zone via the Kentwood/Johnson PRV. The Terrace Hill Zone also has two storage tanks: Terrace Hill Tank (719,000 gallon) and Islay Tank (399,000 gallon).

Operation and Maintenance Problem Areas

Water Distribution Staff identified known problem areas throughout the water distribution system. These problem areas typically revolve around age or material of the water mains that result in breaks and require emergency repairs. Based on discussions with staff, Table 2-2 provides an overview of the projects identified due to operation and maintenance issues, organized by zone.

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Table 2-1. Distribution Zone Summary

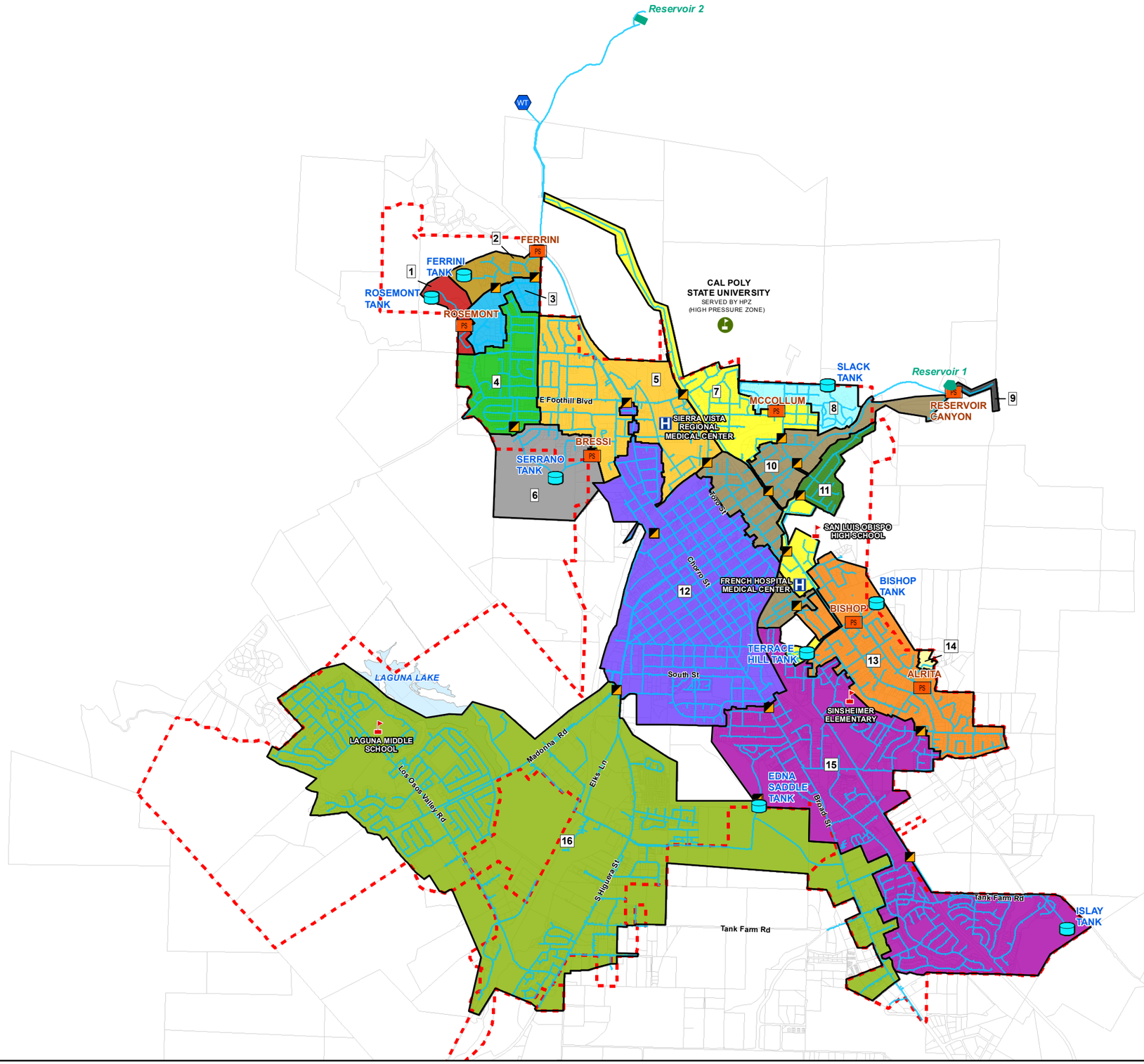
Distribution Zone	Supply				Tank		Service Area (acres)	# of Parcels	Zone Elevation (ft) Low/High	Pressure (psi) High/Low
	Well In	Feeder Zone	Pump Station	Pressure Reducing Valve(s)	Name	Size (gallons)				
Alrita (Boosted Zone)	---	Bishop	Alrita	---	Alrita Hydro-pneumatic Tank	2@2,500	<10	13	407/491	84/47
Andrews	---	Reservoir #1	---	Andrews/Monterey Check Valve	---	---	60	174	266/354	72/34
Bishop	---	High Pres.	Bishop (Fire only)	---	Bishop	750,000	385	1,043	301/475	109/34
Downtown	---	Foothill Terrace Hill	---	Chorro/Foothill Peach/Broad (2) Broad/Caudill (N/C)	---	---	850	2,880	155/269	93/44
Edna Saddle	Well PB#1, Well FS #4	Foothill via Downtown	---	Madonna/Higuera	Edna Saddle	4,000,000	2,300	3,312	102/226	104/50
Ferrini	---	Foothill	Ferrini	---	Ferrini	160,000	40	80	320/417	114/72
Foothill	---	WTP (Clear Wells)	---	Foothill/Railroad (N/C)	WTP Clear Wells (2)	5,000,000	470	1,364	190/334	103/42
High Pressure	---	WTP/Foothill	Transfer	---	Reservoir #2	7,440,000	320	662	245/416	134/60
Highland	---	Ferrini	---	Patricia Skyline/Mirasol	---	---	80	140	327/497	95/22
Patricia	---	Serrano	---	La Entrada/Catalina	---	---	120	369	279/358	75/41
Reservoir #1	---	High Pressure	---	Grand California/Monterey Ella/Binns San Luis/Johnson	Reservoir #1	7,500,000	230	555	227/360	89/37
Reservoir Canyon (Boosted Zone)	---	Reservoir #1	Reservoir Canyon	---	Res. Canyon Hydro-pneumatic Tanks (3)	700	10	2	385/420	N/A
Rosemont	---	Highland	Rosemont	---	Rosemont	40,000	10	9	542/607	76/48
Serrano	---	Foothill	Bressi	---	Serrano	100,000	85	146	319/523	106/76
Slack	---	High Pressure	McCollum	---	Slack Street	70,000	90	250	322/470	101/37
Terrace Hill	---	High Pressure Bishop	---	Terrace Hill Kentwood/Johnson	Terrace Hill Islay	640,000 380,000	1,030	2,975	164/344	108/31

Table 2-2. Proposed Operation and Maintenance Master Plan Improvement Projects

Pressure Zone	Waterline Replacement Identified in CIP		Existing Pipe Material	Existing Pipe Diameter	City's Budgeted CIP Year
	Street Name	Project Limits			
Bishop	Flora	Viewmont to Sydney	CICL/AC	6	2017-18
	Iris	Johnson to Fixlini	CI	6	
	Sydney	Augusta to Johnson	AC	6	
	Sydney	Flora to end	AC/PVC	6	
	Bishop	@ Augusta (tie over services and abandon 4" ACP)	--	--	
	Gerda	Augusta to Dead End	AC	4	
Downtown	Pacific	Nipomo to Higuera	CI	10	2015-16
	Mountain View	Hill to Broad	N/A	6	2016-17
	Hill	Lincoln to 525 Hill	AC	4	2016-17
	West	Chorro to Lincoln	AC	6	2016-17
	Lincoln	Venable to West	AC/CI	6/8	2016-17
	Lincoln	Chorro to Mountain View	CI	8	2016-17
	Chorro	Broad to Upham	DI/CI	8/6	2016-17
	Mill	Santa Rosa to Pepper	CI/CI	8/6	
	Higuera	Johnson to Toro	CI	8	
	Santa Rosa	Leff to Pacific	CI	6/8	
	Marsh	California to Santa Rosa	CI	8	
	Woodbridge	Lawton to Broad	CI/DI	6/8	
	Funston	Meadow to Broad	CI/DI	8	
Edna	Oceanaire	Madonna to Cayucos	CICL	8/6/12	2017-18
Foothill	Casa	Murray to Deseret	AC/CI	12	2015-16
	Stenner		CI	8	2015-16
	Murray	Santa Rosa to Hathway	CI	12	2015-16
	Ferrini	Foothill to Felton	CI	6	
	S. Tassajara	Foothill to Ramona	AC	6	
	Santa Lucia	Cerro Romauldo to Tolosa	AC	6	
	Tolosa	Santa Lucia to Tassajara	AC	6	
	La Canada	Tolosa to Cerro Romauldo	AC	6/4	
	Stenner	From WTP to Ferrini PS	Concrete	30/27	

Pressure Zone	Waterline Replacement Identified in CIP		Existing Pipe Material	Existing Pipe Diameter	City's Budgeted CIP Year
	Street Name	Project Limits			
Foothill, Continued	La Entrada	Foothill to San Jose	AC	12	
	Craig	Patricia to Jeffrey	AC	8/6	
	Christina	Warren to Craig	AC	8	
	Boysen	Santa Rosa to N. Chorro	PVC/AC	8/6	2017-18
	Chorro	Ferrini to Foothill	CI	18/6	
	Chorro	Mission to Foothill PRV	CI	14/12	
	Lincoln	West to Chorro	CI	8	
	Murray	Santa Rosa to 1262 Murray	CI	12	
High Pressure	Hathway	Longview to Fredricks	CI/CICL	6	
	Hope	Grand to dead end	CI/DI	6/4	
	Taft	Kentucky to end (in Hwy 101 off-ramp)	CI	6	
	Highland 2	@ Mt. Bishop Road: Railroad Undercrossing	CI	24	
Patricia	Rosita	Foothill to Cerro Romauldo	AC	4	
Reservoir 1	16" Waterline Replacement (Phase 1)		--	--	
	California	Mill to San Luis Drive	CI	16	2013-14
	San Luis Drive	California to Johnson	CI	16	
	Johnson	San Luis Drive to Lizzie	CI	16	
	16" Waterline Replacement (Phase 2)		--		
	Johnson	Iris to Bishop	CI/PVC	16	2014-15
	Bishop	Johnson to Augusta	DI/AC/CI	16	
	Pacific	Johnson to Pepper	CI	4	
	Peach	Johnson to Toro	CI	6	
Serrano	S. Tassajara	Luneta to Dead End	AC	4	
Slack	San Miguel	212 San Miguel to Santa Ynez	CI	8	2016-17
	Buena Vista	McCollum to Santa Ynez	CI/PVC	4/8	2016-17
	Loomis	Buena Vista to San Miguel	CI	8	
Terrace Hill	Reba	Augusta to Dead End	AC	4	
	Greta	Sydney to Augusta	AC	8	
	Railroad Easement	Orcutt to Boulevard Del Campo	CI	16	

AC – Asbestos Cement
CI – Cast Iron
CICL – Cast Iron, Concrete Line
DI – Ductile Iron
N/A – Not Available
PVC – Poly-Vinyl Chloride



WATER DISTRIBUTION ZONES

FIGURE 2-1

CITY OF SAN LUIS OBISPO
POTABLE WATER
DISTRIBUTION SYSTEM
OPERATIONS MASTER PLAN

LEGEND

DISTRIBUTION ZONE

- 1 ROSEMONT
- 2 FERRINI
- 3 HIGHLAND
- 4 PATRICIA
- 5 FOOTHILL
- 6 SERRANO
- 7 HIGH PRESSURE
- 8 SLACK
- 9 RESERVOIR CANYON
- 10 RESERVOIR 1
- 11 ANDREWS
- 12 DOWNTOWN
- 13 BISHOP
- 14 ALRITA
- 15 TERRACE HILL
- 16 EDNA SADDLE
- WATER MAIN
- RESERVOIR
- PARCELS
- CITY LIMITS
- STORAGE TANK
- PS PUMP STATION
- PRESSURE REDUCING VALVE
- WT WATER TREATMENT PLANT

0 1,750 3,500 Feet

1 inch = 3,500 feet

city of san luis obispo

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612 CLARION COURT
SAN LUIS OBISPO, CA 93401
T 805 544-4011 F 805 544-4294
www.wallacegroup.us

PROJECT NOTES: MAP PREPARED BY RINCON CONSULTANTS, INC. GIS DATA PROVIDED BY CITY OF SAN LUIS OBISPO.
JOB NO: 0061-0072
CREATED BY: KH
DATE: APRIL 2015

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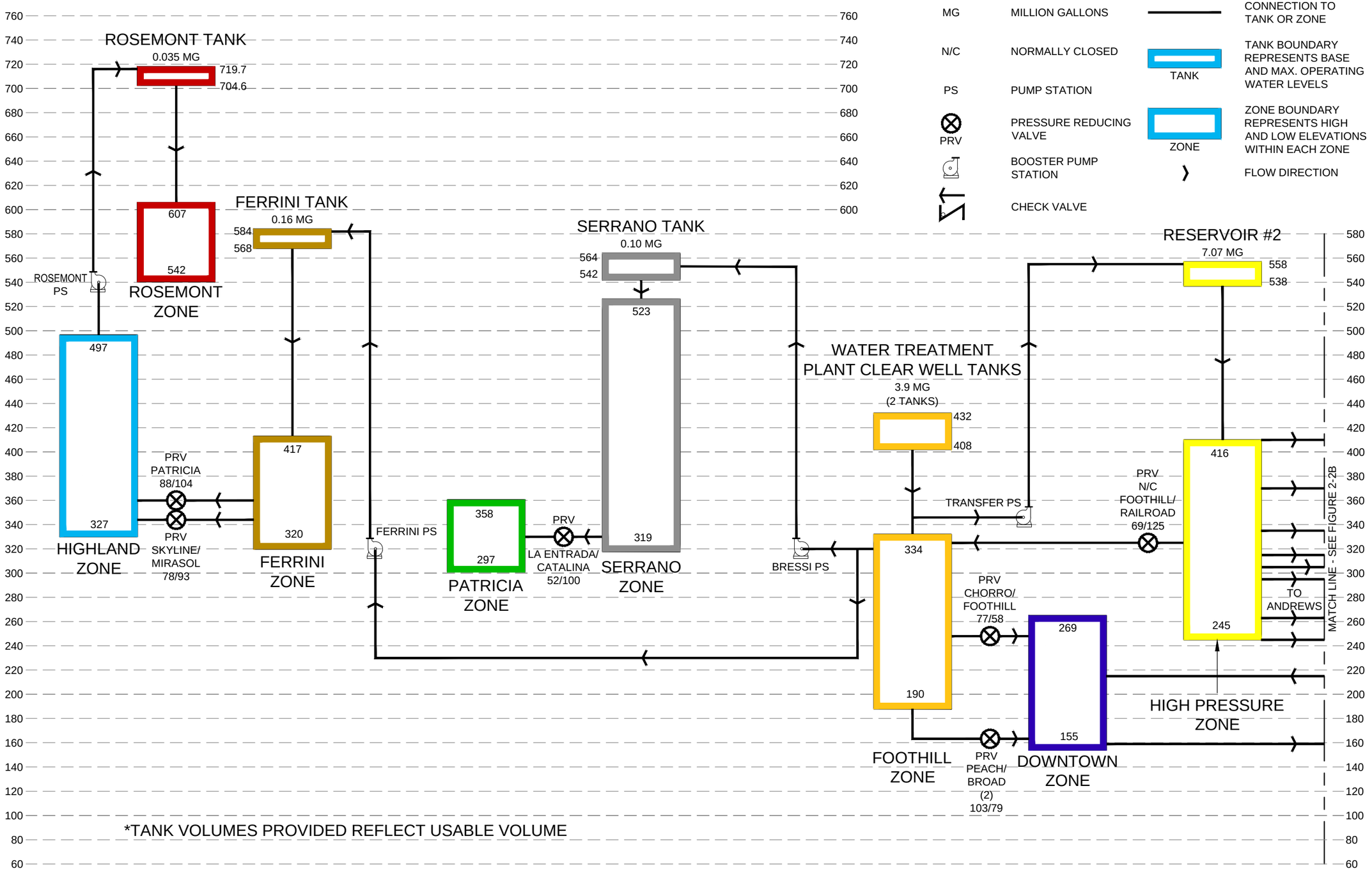

*TANK VOLUMES PROVIDED REFLECT USABLE VOLUME

LEGEND:

MG	MILLION GALLONS
N/C	NORMALLY CLOSED
PS	PUMP STATION
PRV	PRESSURE REDUCING VALVE
	BOOSTER PUMP STATION
	CHECK VALVE
	CONNECTION TO TANK OR ZONE
TANK	TANK BOUNDARY REPRESENTS BASE AND MAX. OPERATING WATER LEVELS
ZONE	ZONE BOUNDARY REPRESENTS HIGH AND LOW ELEVATIONS WITHIN EACH ZONE
	FLOW DIRECTION

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FIGURE 2-2A
CITY OF SAN LUIS OBISPO
WATER SYSTEM HYDRAULIC PROFILE

JOB No. :	0061-0072
DRAWING :	Figure 2-2.dwg
DRAWN BY:	JSW
DATE :	04/14/2015
SCALE :	NONE

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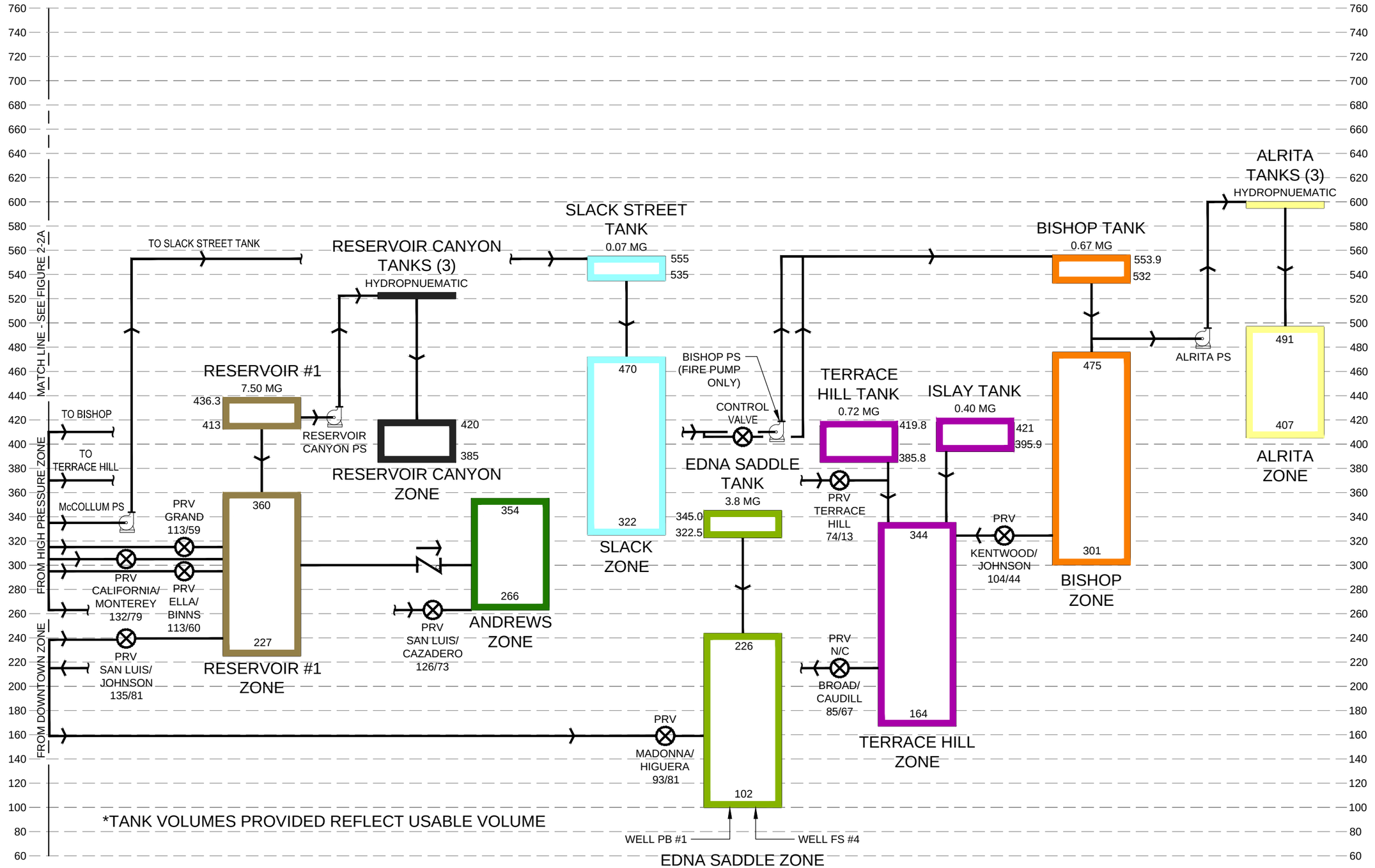

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FIGURE 2-2B
CITY OF SAN LUIS OBISPO
WATER SYSTEM HYDRAULIC PROFILE

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3: Study Area Characteristics

Chapter 3 describes the study area characteristics germane to this Water Master Plan for the City. Included in this chapter is a description of the various land uses in the service area, future development projections by distribution zone, and existing and future population projections. Future development is based on the 2014 Land Use and Circulation Element (LUCE) Update. All tables and figures are located at the end of this chapter

Land Use

The City of San Luis Obispo is located in the heart of San Luis Obispo County. Founded in 1772 and incorporated in 1856, San Luis Obispo is one of California's oldest communities and now serves as the County's hub for commercial and government services. Figure 3-1 illustrates the City limits, water service area, the Urban Reserve Line (URL), and Land Use Designations. Table 3-1 summarizes the total acreage for each of the Land Use Designations within the City's service area boundary per the City's 2013 GIS database.

Future Development

The City's Community Development Department provided a summary of the future housing development anticipated within each of the distribution zones. The majority of the City's growth areas are included in the Margarita, Orcutt, and Airport Area Specific Plan areas. The General Plan Housing Element provides a detailed summary of capacity for future residential development within urban growth boundaries. As a part of the Housing Element, the City completed a detailed review of existing land use to identify parcels with development potential based on General Plan land use, allowable densities, and conditions such as slope and lot orientation. Table 3-2 provides a summary of potential future residential development in each distribution zone, as provided by the City from the existing Housing Element (2010). These development projections include the three major Specific Plan Areas: Orcutt, Margarita, and Airport. Figure 3-1 illustrates the specific planning areas.

Population

The City maintains an estimate of the population every year and reports the population in their annual Water Resources Status Report. The 2013 Water Resources Status Report, prepared by City of San Luis Obispo's Utilities Department, reports the population for the City as follows:

- **2010:** 44,948 persons
- **2011:** 45,418 persons
- **2012:** 45,308 persons

Per the 2013 Water and Wastewater Development Impact Fee Study, prepared by the City of San Luis Obispo's Utilities Department, it is estimated that the build-out population within the urban reserve line is 53,700 persons, which is based on the vacant housing units throughout the City. The City updated in 2014 the Land Use and Circulation Element (2014 LUCE) that provided an estimated Urban Reserve capacity of 57,200 persons. This population was estimated by increasing the current population by 1%

every year to Year 2035. For the purposes of this Master Plan, the population used will be based on the 2013 estimates since this estimate is based on the number of vacant parcels throughout the City and not a general increase.

Three additional factors impact the population of the City. First, while California Polytechnic State University (Cal Poly) has its own water supply source, the City treats and distributes water to the University located just outside of City limits. Cal Poly maintains a student enrollment between 18,260 and 19,780 students with a projected enrollment at 20,912 students by the year 2020[1]. The campus also maintains 1,250 faculty members. Second, the City is the civic, economic and cultural hub of the Central Coast. With the major regional employers, the City has an estimated daytime population of more than 70,000 persons[2]. Last, the City is a popular tourist destination due to its proximity to beaches and wilderness areas, historic downtown, and its overall vitality. The City's tourism is at its peak during the summer; However, Cal Poly is also out of session at this time, thus reducing the overall daily population served by the City during the summer months.

Table 3-1. Existing Land Use Designations

General Plan Land Use	Total Acreage
Agriculture	78
Business Park	322
Community Commercial	64
General Retail	354
High Density Residential	234
Interim Open Space	184
Low Density Residential	2,050
Medium Density Residential	827
Medium High Density Residential	280
Neighborhood Commercial	43
Office	231
Open Space	56
Park	218
Public	910
Recreation	53
Residential Neighborhood	5
Rural Residential	648
Services & Manufacturing	1,050
Suburban Residential	403
Tourist Commercial	128

Source: City of San Luis Obispo's GIS Database (2013)

[1] Per Table 4 of the Administrative Draft Initial Study and Mitigated Negative Declaration for Student Housing South. Prepared for California Polytechnic State University, San Luis Obispo. Prepared by SWCA Environmental Consultants, dated August 2013

[2] Source: 2014 City of San Luis Obispo Local Hazard Mitigation Plan

Table 3-2. Housing Units by Zone

Distribution Zone	Future Additional Housing Units		
	Parcel Capacity	Approved, not yet Constructed	Total
Alrita	8	0	8
Andrews	24	0	24
Bishop	143	0	143
Downtown	524	193	717
Edna Saddle	1,346	394	1,740
Ferrini	2	0	2
Foothill	134	4	138
High Pressure	156	0	156
Highland	1	0	1
Patricia	5	0	5
Reservoir #1	59	0	59
Reservoir Canyon	0	0	0
Rosemont	4	0	4
Serrano	28	0	28
Slack	18	0	18
Terrace Hill	1,311	231	1,542
TOTALS	**3,763**	**822**	**4,585**

Source: City of San Luis Obispo's Housing Element (2010) with additional housing identified from the LUCE

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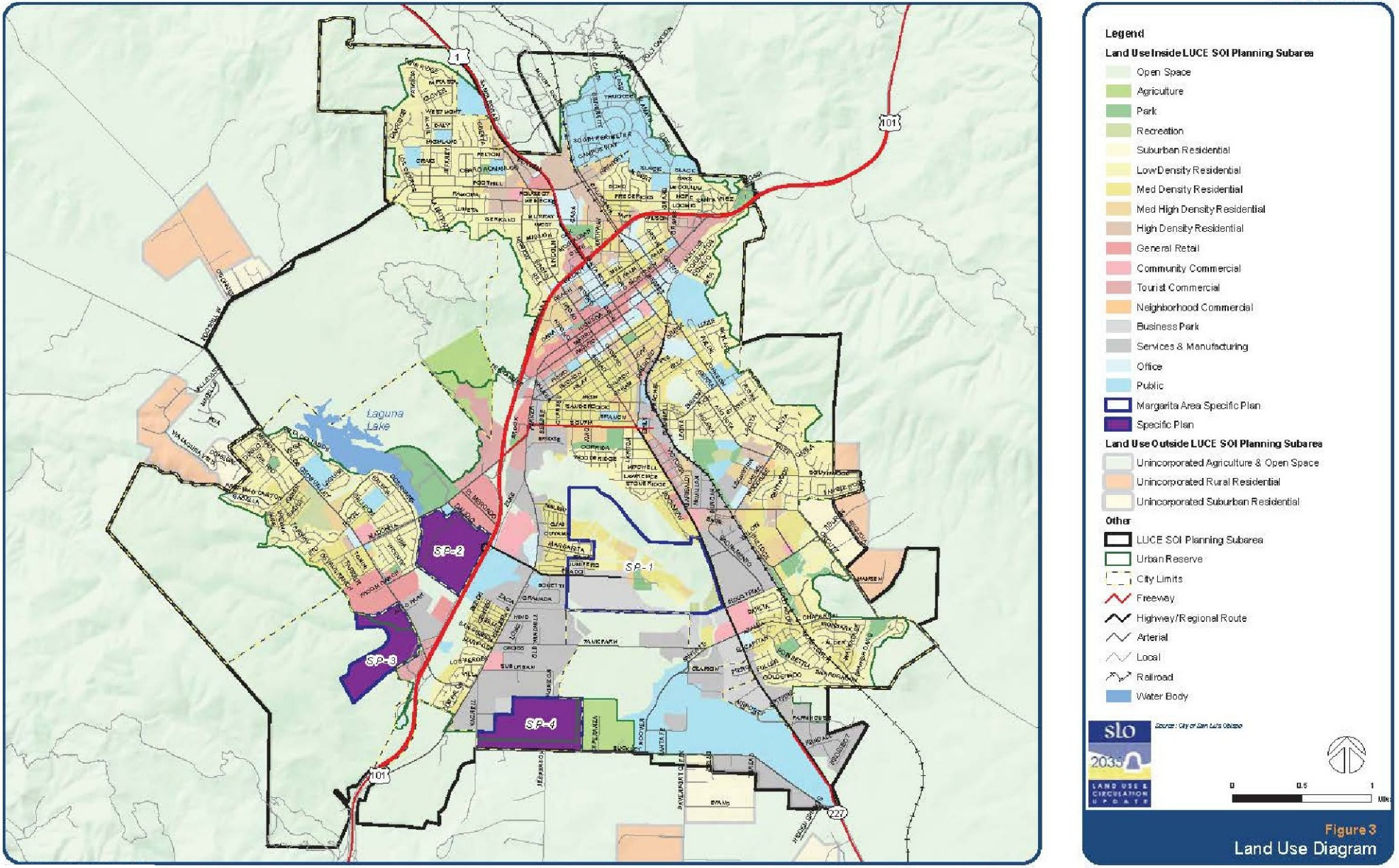

Figure 3-1 LAND USE DIAGRAM

CITY OF SAN LUIS OBISPO
POTABLE WATER
DISTRIBUTION SYSTEM
OPERATIONS MASTER PLAN

SOURCE: CITY OF SAN LUIS OBISPO 2014 LUCE UPDATE

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4: Water Demand

Chapter 4 describes the existing and projected water demands for the City. The water demand forecasts will form the basis for identifying existing and future system needs and analyzing deficiencies. All tables and figures are located at the end of this chapter.

General water demand and production definitions used in this report are defined as follows:

Water Consumption – The amount of water consumed (as measured directly through customer meters).
Water Production – The amount of water produced by the City's water supply sources.
Unaccounted-for-Water (UAW) – the difference between the quantity of water produced and the amount of water consumed (as measured directly through customer meters). It is comprised of apparent losses and real losses.
Apparent losses – The losses due to inaccuracies associated with customer metering as well as data handling errors and unauthorized consumption.
Real losses - The physical water losses from the distribution system and tanks, up to the point of the meter. Real losses are typically from leaks, breaks, and overflows.

Historical Water Demand

Water production data was provided by the City for the Years 2010, 2011 and 2012. The historical production of potable water is summarized in Table 4-1.

Unaccounted for Water

The City has conducted water audits using the American Water Works Association (AWWA) Water Loss Control Committee (WLCC) Free Water Audit Software to determine the City's UAW due to apparent and real losses. Based on the City's water audit, the total water losses (real and apparent losses combined) are as follows:

Fiscal Year 2009-2010: 12.3%
Fiscal Year 2010-2011: 10.6%
Fiscal Year 2011-2012: 10.7%

The AWWA Manual 32 states municipal water system losses typically range between 10 and 15 percent of total water produced. The City's UAW average is 11.2% for Fiscal Years 09/10 through 11/12, which is within an acceptable range for water losses. The total annual cost to produce water that did not generate revenue in 2009-2010 was $610,000 per the City's Water Audit. Water losses should be minimized where possible since it requires the City's resources to produce water, but is usually not being accounted for and thus revenue is not being collected.

Water Demand Categories

The production noted in Table 4-1 includes all customers within the City, including Cal Poly. The City has substantial commercial and residential growth anticipated for the future. In order to gain a better understanding of the water demands for future growth, the total production has been further broken down into the following categories:

1. Residential: Includes residential single family, residential multi-family, mobile home parks, and care facilities, including assisted living facilities
2. Commercial: Includes commercial, restaurants, hospitals, light industrial, and landscape
3. Hotel/Motel: Includes hotels and motels
4. School: Includes all schools, excluding Cal Poly
5. Cal Poly

Table 4-2 provides a summary of the average daily demands broken into the categories listed above from meter records for calendar year 2010 – 2012, with 11.2% factor for UAW, and the estimated quantity or unit for each category. Table 4-2 also provides a use factor for the categories provided, which can further be used to estimate water demands for future growth.

Hydraulic Demand Parameters

Water system demands are important characteristics of water systems, as these parameters are used to size pumping, storage, and distribution system facilities. Each community's water system exhibits unique characteristics that must be calculated and identified in order to better evaluate existing and future water distribution system requirements. The hydraulic demand parameters used to evaluate the City's water distribution system are as follows:

Average Day Demand (ADD)

The ADD is the average water production needed to meet the daily demand, which is calculated over the year. This demand is generally determined by production records. Table 4-1 provides a summary of the ADD for 2010 through 2012, which equates to 5,823 AFY or 5.20 mgd.

Maximum Day Demand (MDD)

The MDD is the maximum daily production of water needed to meet the peak day demand of the year. Typically, MDD occurs during the summer as a result of increased irrigation demand, coupled with the height of the tourist season. However, with Cal Poly out of session during the summer, maximum day demand does not typically occur during the summer for the City. Thus, per the City production records between 2010 and 2012, the maximum day production was 7.96 mgd, which occurred on October 4, 2012. This equates to a peaking factor of 1.5.

Peak Hour Demand (PHD)

The PHD of the system is critical in sizing water mains and pumping facilities. During PHD, customers will generally experience low service pressures in areas with undersized mains and/or lack of looped distribution water mains. The PHD is generally determined by calculating the specific demand within the day, by monitoring tank levels and pumping records. In many municipal systems, the exact calculation of this parameter is difficult to ascertain.

The City does not maintain hourly production records, which would be used to determine PHD. Therefore, to determine a reasonable peaking factor for PHD, the following sources were evaluated:

1. 2000 Water Master Plan
2. California Code of Regulations, Title 22

3. Metcalf & Eddy design handbook "Wastewater Engineering, Treatment and Reuse, Fifth Edition", 2014

2000 Water Master Plan

The 2000 Water Master Plan identified a PHD factor of 2.75. This peaking factor is similar to the City's peak hour dry wastewater flow factor of 2.5 per the 2010 City Engineering Standards. The City Standards do not include peaking factors for water demand; therefore they could not be evaluated.

California Code of Regulations, Title 22

Another source for water system peaking factors is California Code of Regulations Title 22. Per Title 22, peaking factors should be calculated for the system as a whole and individually for each pressure zone. Table 4-3 includes a summary of Section 64554 "New and Existing Source Capacity" minimum requirements for peaking factors from Title 22. The peaking factors can be established using two different methods, monthly water records or annual water records, depending on the available information.

Metcalf & Eddy Design Handbook

An industry standard for peaking factors is the Metcalf & Eddy design handbook "Wastewater Engineering, Treatment and Resource Recovery, Fifth Edition", 2014. This engineering reference recommends a peak hour (wastewater) factor of 4.0 for systems serving a population of 5,000 persons or less. This peaking factor may be most appropriate for the individual pressure zones that serve a population of 5,000 persons or less as peaking factors typically increase as the service population decreases, due to the likelihood for a greater percentage of the population to be using water at the same time.

PHD Peaking Factor Analysis Conclusion

Based on the review of the three peaking factor sources, it is recommended to derive the PHD factor by correlating the Metcalf & Eddy wastewater peaking factors serving a population of 5,000 or less, and the Title 22 for larger systems or zones. Based on the City's current total average water use of 104 gpcd (does not include Cal Poly Ag or Domestic water use) per the City's 2013 Water Resources Status Report (excluding recycled water usage), a system (in this case, an individual distribution zone) serving 5,000 persons would have an average daily use of 361 gpm. Therefore, a peaking factor of 4.0 is recommended for zones with an average flow less than or equal to 361 gpm.

Peaking Factor Summary

Recommended peaking factors are summarized in Table 4-4. Table 4-5 provides a summary of the water system demands that will be used as the basis for evaluation of the City's water distribution system.

Future Water Demands

Table 4-2 summarizes the water demand factors for each land use category. The water demand factors used in Table 4-2 will be used to estimate future needs. In addition, the peaking factors identified in Table 4-4 will also be used for future needs. Table 4-6 provides the estimated future demands for the City per the 2014 LUCE Update. Table 4-7 provides a breakdown of the future water system demands by

zone per the 2014 LUCE Update. The future demands are based on the proposed zone consolidations identified and discussed in Chapter 8.

Table 4-1. Summary of Historical Water Production

Year	Total Production (ac-ft)*
2010	5,888
2011	5,676
2012	5,904
Average	**5,823**

* Total production of surface water and groundwater. Does not include Recycled Water use. Includes domestic production for Cal Poly.

Table 4-2. Existing Water Demand Factors

Use Category	Consumption (gpd)	Quantity or Units[1]		Demand Factor
Residential	3,299,040	45,225	Persons	73 gpcd
Commercial	1,225,440	12,800,801	Square feet	0.10 gpd/sf
Hotel/Motel	180,000	2,183	Rooms	82 gpd/rm
School	38,880	4,213	Students	9 gpd/student
Cal Poly	617,760	18,650	Students	33 gpd/student

[1] Quantities, excluding residential and Cal Poly population, obtained from the City's 2008 Land Use comparison for the City's General Plan. Residential population based on average population between 2010-2012 per the 2013 Water Resources Status Report. Cal Poly population based on the average student population between 2010-2012 per the Administrative Draft Initial Study and Mitigated Negative Declaration for Student Housing South.

Table 4-3. Title 22 Minimum Water System Peaking Factors

Data Source Available	Multiply By	PHD Factor
Monthly Water Use Records	Highest month divided by number of days in month to obtain average daily use. Multiply average daily use by peaking factor.	2.25
Annual Water Use	Total annual water use divided by 365 days to obtain average daily use. Multiply average daily use by peaking factor.	3.375

Table 4-4. Recommended Water System Peaking Factors by Zone

Zone	ADD (gpm)	Peaking Factors		Zone	ADD (gpm)	Peaking Factors	
		MDD	PHD			MDD	PHD
Alrita	2	1.5	4.0	Highland	33	1.5	4.0
Andrews	30	1.5	4.0	Patricia	67	1.5	4.0
Bishop	205	1.5	4.0	Reservoir 1	179	1.5	4.0
Downtown	573	1.5	3.375	Reservoir Canyon	<1	1.5	4.0
Edna Saddle	994	1.5	3.375	Rosemont	1	1.5	4.0
Ferrini	21	1.5	4.0	Serrano	19	1.5	4.0
Foothill	416	1.5	3.375	Slack	40	1.5	4.0
High Pressure	604	1.5	3.375	Terrace Hill	538	1.5	3.375

Table 4-5. Existing Water System Demands[1]

Zone	ADD	MDD	PHD	Zone	ADD	MDD	PHD
Alrita	2	3	8	Highland	33	50	131
Andrews	30	45	120	Patricia	67	101	267
Bishop	205	308	818	Reservoir 1	179	605	717
Downtown	573	860	1,933	Reservoir Canyon	<1	1	3
Edna Saddle	994	1,491	3,354	Rosemont	1	2	5
Ferrini	21	32	86	Serrano	19	65	76
Foothill	416	624	1,405	Slack	40	60	160
High Pressure	604	906	2,039	Terrace Hill	538	807	1,817

[1]All values expressed in gallons per minute (gpm).

Table 4-6. Future Water Demand Factors per the 2014 LUCE Update

Use Category	Quantity or Units[1]		Use Factor	Consumption (gpd)
Residential	53,700	Persons	73 gpcd	3,920,100
Commercial	33,187,865	Square feet	0.10 gpd/sf	3,318,790
Hotel/Motel	3,220	Rooms	82 gpd/rm	264,040
School	4,975	Students	9 gpd/student	44,775
Cal Poly	20,910	Students	33 gpd/student	690,030
Total				8,237,735

[1] Residential and Cal Poly populations identified in Chapter 3. School quantity based on 9% of overall residential population, equivalent to existing student to population ratio. Commercial and Hotel/Motel quantities obtained from City Staff, WSC Consulting, and land use data from City's traffic model.

Table 4-7. Future Water System Demands per the 2014 LUCE Update[1]

Zone	ADD	MDD	PHD	Zone	ADD	MDD	PHD
Alrita	2	3	8	High Pressure	1,127	1,691	3,798
Andrews	33	50	132	Reservoir Canyon	<1	1.5	4
Downtown	731	1,097	2,463	Rosemont	2	3	8
Edna Saddle	2,551	3,827	8,597	Terrace Hill	601	902	2,026
Foothill	671	1,007	2,261				

[1]All values expressed in gallons per minute (gpm).

5: Water Supply Overview

Chapter 5 provides an overview of the City's water supply. More detailed information about the City's water supply and the redundancy and reliability of the water supplies is located in 2010 Urban Water Management Plan Update.

Introduction

The City has adopted a multi-source water supply strategy and obtains water from four sources: Salinas Reservoir (Santa Margarita Lake), Whale Rock Reservoir, Nacimiento Reservoir, and local ground water. The City also augments its potable water demands through a recycled water program, delivering recycling water to various customers for landscape irrigation.

Salinas Reservoir

The Salinas Dam was built in 1941 by the War Department to supply water to Camp San Luis Obispo and, secondarily, to meet the water needs of the City. The Salinas Reservoir (Santa Margarita Lake) captures water from a 112 square mile watershed and can currently store up to 23,843 acre-feet. In 1947, the Salinas Dam and delivery system was transferred from the regular Army to the U.S. Army Corps of Engineers. Since the late 1940's, the San Luis Obispo County Flood Control and Water Conservation District has operated this water supply for the City under a lease from the U.S. Army Corps of Engineers. Water from the reservoir is pumped through the Cuesta Tunnel (a one mile long tunnel through the mountains of the Cuesta Ridge) and then flows by gravity to the City's Water Treatment Plant on Stenner Creek Road. The City is permitted to store up to 45,000 acre-feet, which would require a spillway gate to increase the storage capacity.

Whale Rock Reservoir

The Whale Rock Reservoir provides water to the City, California Polytechnic State University, and the California Men's Colony as well as the town of Cayucos. The Whale Rock Reservoir is a 38,967 acre-foot reservoir[3] created by the construction an earthen dam on Old Creek near the town of Cayucos. The dam was designed and constructed by the State Department of Water Resources beginning in October 1958 and completed in April 1961. The Whale Rock Dam captures water from a 20.3 square mile watershed and water is delivered to the three agencies through 17.6 miles of 30-inch pipeline and two pumping stations.

Nacimiento Reservoir

The Nacimiento Reservoir provides flood protection and is a source of supply for groundwater recharge for the Salinas Valley. It is owned and operated by the Monterey County Water Resources Agency. Since 1959, the San Luis Obispo County Flood Control and Water Conservation District has had an entitlement

[3] Source: Whale Rock Reservoir Bathymetric Survey and Volumetric Study, May 2013

to 17,500 AFY of water from the reservoir for use in San Luis Obispo County. Approximately 1,750 AFY have been designated for uses around the lake, leaving 15,750 AFY for allocation to other areas within the County of San Luis Obispo. The County began construction in 2007 on a 45-mile pipeline project to deliver water from the Nacimiento Reservoir to five participating agencies and cities. The City has a contractual entitlement to 3,380 AFY of water from the project. The construction of the pipeline and delivery facilities was completed in December 2010 and water deliveries to the City began in January 2011.

Groundwater

The City currently operates two potable water wells, which produce approximately 2% of the City's current water supply. In addition, the City operates two non-potable wells at Laguna Lake Golf course for irrigation, and one non-potable well at the City Corporation Yard for construction water. In addition, a fourth non-potable well was added in 2013 to serve the Calle Joaquin AG Reserve.

Recycled Water

The City's Water Resource Recovery Facility (WRRF) currently receives approximately 3.5 mgd wastewater flows. The City treats municipal wastewater to tertiary 2.2 standards. The City has a recycled water distribution system that delivers recycled water to a number of customers in the southern area of the City, including Laguna Golf Course, Laguna Middle School, Laguna Lake Park, Damon Garcia Sports Complex, and commercial centers such as Irish Hills Plaza. In 2012, recycled water irrigation deliveries amounted to 168 AF. The County Regional Airport is planned to be served by the City's water recycling system in future years.

San Luis Obispo Creek Discharge. The City must maintain stream flow to San Luis Obispo Creek in compliance with the National Oceanic and Atmospheric Administration's National Marine Fisheries Service (NOAA NMFS) Biological Opinion, at a minimum average daily flow of 2.5 cfs (1.6 mgd or 1,800 AFY). This discharge requirement is expected to remain at this flow rate for the foreseeable future.

6: Water Storage

Chapter 6 describes the existing and projected water storage requirements for the City. All tables for Chapter 6 are located at the end of this chapter.

Existing Water Storage Facilities

The City owns and operates ten tanks, two reservoirs, and five hydro-pneumatic tanks. The locations of these facilities are identified on Figure 2-1. Table 6-1 summarizes each of the water storage facilities and the primary and secondary distribution zones they serve.

Existing Storage Analysis

It is recommended that sufficient useable storage volume be maintained for emergency, fire, and operational needs within the City's tanks and reservoirs in each individual zone. For the purposes of this report, the groundwater wells will not be considered in the storage analysis. In addition, storage from neighboring zones is not considered unless water can be transferred between zones without the use of a booster station or a manually operated valve (i.e. through a normally closed isolation valve). However, a zone that is supplied by a hydraulically controlled valve or a booster station that has its own permanent on-site backup generator can use the supply source storage as a backup storage facility.

Un-useable Storage

Un-useable storage is the volume of water that is below the top of the outlet pipe to the bottom of the tank. This water cannot be used without the use of a sump pump and therefore is not included in the overall volume of the tank.

Emergency Storage

Emergency storage is intended to provide for conditions such as extended power outages, pump failures, and similar problems. Most water planners accept that during emergencies, supply per capita may be reduced to minimum levels. Typically, on that basis, an emergency storage volume of 50 gpcd for three days is accepted as a reasonable value. Table 6-2 provides a summary of the emergency storage recommendations for the existing population for the City.

Fire Storage

Fire storage is the volume of water needed to control an anticipated fire in a building or group of buildings. The determination of this storage is based upon the most stringent zoning within a distribution zone, and the required fire flow and duration in that zone per the City Fire Department and the Uniform Fire Code (UFC). The flow rate and duration of the required fire flow varies greatly with the type of development and whether or not the buildings have sprinkler systems. The required fire flow for each distribution zone, based on land use is provided in Table 6-3. A summary of the fire flow requirements by zoning is provided in Table 8-4.

Operational Storage

Operational storage is the amount of water needed to equalize the daily supply and demand. Without this storage, water production facilities would be required to be sized large enough to meet the instantaneous peak demands of the system. With adequate operational storage, booster stations can operate at the daily average rate, while storage facilities meet the hourly peaks. AWWA M-32 recommends operational storage of 20 to 25 percent of average day demand, or up to 15 percent of the maximum day demand. Based on the more stringent criteria for the City being 25 percent of average day demand, the recommended operational storage for existing conditions is summarized for each zone in Table 6-4.

Storage Summary

The useable storage recommended for each distribution zone as noted previously is based on a summation of the emergency, fire, and operational storage recommendations as shown in the adjacent figure.

Table 6-5 provides a summary of the storage recommendations for existing conditions. As noted in Table 6-5, the City has sufficient storage overall; However, several of the tanks are deficient in providing adequate storage within the zones that they serve. The following tanks are deficient under existing conditions:

1. Rosemont Tank serving Rosemont Zone: 146,860 gallon deficit
2. Ferrini Tank serving Ferrini and Highland Zones: 138,440 gallon deficit
3. Serrano Tank serving Serrano and Patricia Zones: 388,460 gallon deficit
4. Slack Street Tank serving Slack Zone: 317,900 gallon deficit*
5. Terrace Hill and Islay Tanks serving Terrace Hill Zone: 1,039,180 gallon deficit*
6. Bishop Tank serving Bishop and Alrita Zones: 672,520 gallon deficit*

**Tank deficits accommodated by shared storage – see Shared Storage discussion below*

Shared Storage

Often times, higher elevation zones are capable of back-feeding into lower zones, thus providing additional storage to the lower elevation zones that may have storage deficits. This is not an optimal solution for day-to-day operations; however, this option does allow redundancy and helps provide protection to lower elevation zones specifically under emergency or fire flow conditions. Under emergency or fire conditions, higher elevation zones that are fed by a booster station are not considered in this analysis since power to a booster station is not reliable under emergency conditions. If a booster station has a permanent generator with an automatic transfer switch, then a higher elevation tank (fed by this booster station) can be used as a redundant, back up tank. The following tanks can provide additional storage to the zones that currently have a storage deficit:

1. Reservoir #2 to Slack Zone: The elevation of Reservoir #2 can provide gravity pressure to the Slack Zone under emergency conditions, thus not having to rely on the McCollum Booster Station. See Chapter 8 on discussions regarding the elimination of the McCollum Pump Station.
2. Reservoir #2 to Terrace Hill Zone: Reservoir #2 supplies the Terrace Hill Zone via gravity through the Terrace Hill PRV and the Kentwood/Johnson PRV. This connection provides sufficient storage redundancy to meet the needs of the Terrace Hill Zone.
3. Reservoir #2 to Bishop Zone: The elevation of Reservoir #2 provides gravity pressure to the Bishop Zone under normal day-to-day conditions. See Chapter 8 on discussions regarding the elimination of the Bishop Pump Station.

Existing Storage Recommendation Overview

Based on the Table 6-5 and the discussion on shared storage, the Rosemont Tank, Ferrini Tank, and the Serrano Tank are deficient in storage to meet the existing needs of the distribution zones they serve. The following projects are recommended to meet storage needs:

1. Storage 1: Construct an additional 400,000 gallon tank in the Serrano Zone for a total of 500,000 gallons (Note – This tank could be eliminated by zone consolidation, see the next section, Future Storage Analysis, and Chapter 8).
2. Storage 2: Construct an additional 150,000 gallon tank in the Rosemont Zone for a total of 190,000 gallons.
3. Storage 3: Construct an additional 150,000 gallon tank in the Ferrini Zone for a total of 300,000 gallons (Note – This tank could be eliminated by zone consolidation, see the next section, Future Storage Analysis, and Chapter 8).

Future Storage Analysis

As noted under existing conditions, for the purposes of this report, the groundwater wells will not be considered in the storage analysis. The following discusses the storage needs to meet future demands. Chapter 8 of this report proposes significant changes to the water distribution zones, thus impacting the storage requirements within the zones. The following analysis of the storage requirements under future conditions includes consideration of the proposed zone consolidations as well as the future demands anticipated for each of the new zones. The proposed zone consolidations will result in the following recommended changes to the tanks:

1. Eliminate the Ferrini Tank.
2. Eliminate the Serrano Tank.
3. Eliminate the Slack Tank.
4. Reservoir #1 and the Clear Wells will operate together. This results in a reduction of useable storage in Reservoir #1 from 7.5 MG to 5.1 MG. It is assumed that the water surface elevation of Reservoir #1 would lag behind the Clear Wells by 1-2 foot. The total storage between these three reservoirs is 9.1 MG.
5. Reservoir #2 and Bishop Tank will operate together.

Emergency Storage

Table 6-6 provides a summary of the emergency storage recommendations for future population for the City. The future emergency storage recommendations are based on the proposed zone consolidations identified and discussed in Chapter 8.

Fire Storage

Table 6-7 provides a summary of the fire storage recommendations for the future land uses within each distribution zone. The future fire storage recommendations are based on the proposed zone consolidations identified and discussed in Chapter 8.

Operational Storage

Based on the more stringent criteria for the City, being 25 percent of average day demand, the recommended operational storage for future conditions is summarized for each zone in Table 6-8. The future operational storage recommendations are based on the proposed zone consolidations identified and discussed in Chapter 8.

Storage Summary

The recommended useable storage for each distribution zone is based on a summation of the emergency, fire, and operational storage recommendations under future conditions. Table 6-9 provides a summary of the storage recommendations. As noted in Table 6-9, the City has sufficient storage overall; however, several of the tanks are deficient in providing adequate storage within the zones that they serve. The following tanks are deficient under future conditions:

1. Rosemont Tank serving Rosemont Zone: 147,220 gallon deficit
2. Edna Saddle Tank serving Edna Saddle Zone: 216,860 gallon deficit*
3. Terrace Hill and Islay Tanks serving Terrace Hill Zone: 1,309,360 gallon deficit*
   **Tank deficits accommodated by shared storage – see Shared Storage discussion below*

Shared Storage

As noted previously, higher elevation zones are capable of back-feeding into lower zones, thus providing additional storage to the lower elevation zones that may have storage deficits. The following tanks can provide additional storage to the zones that currently have a storage deficit:

1. **Clear Wells to Edna Saddle Zone:** The deficit in the Edna Saddle Zone is minor. In addition, the Edna Saddle Zone is fed via gravity through the Madonna/Higuera PRV from the Downtown Zone, which receives its water supply via gravity through PRVs from the Foothill Zone. These connections provide sufficient storage redundancy to meet the storage needs of the Edna Saddle Zone.
2. **Reservoir #2 and Bishop Tank to Terrace Hill Zone:** With the proposed consolidations, Reservoir #2 and Bishop Tank will supply the Terrace Hill Zone by gravity via the Terrace Hill PRV and the Kentwood/Johnson PRV. In addition, a new PRV that will serve the Orcutt Specific Plan Area (see Chapter 7). These connections provide sufficient storage redundancy to meet the storage needs of the Terrace Hill Zone.

Future Storage Recommendation Overview

Based on results presented in Table 6-9 and the discussion on shared storage, the only tank that does not meet future storage needs is the Rosemont Tank. The following project is recommended to meet future storage needs:

1. **Rosemont Tank Replacement:** : Construct an additional 150,000 gallon tank in the Rosemont Zone for a total of 190,000 gallons or install a fire pump at the proposed Fel-Mar pump station with a permanent stand by generator to provide additional fire support to the Rosemont Zone.

Operation and Maintenance Storage Recommendations

The City is fortunate to have an abundance of storage, with the majority of the storage at the Clear Wells, Reservoir #1 and Reservoir #2. Under existing conditions, the City has more than 9.0 MG of excess storage and under future conditions, with the proposed zone consolidations and the removal of three tanks, the City still has more than 9.0 MG of excess storage. Based on discussions with City staff and understanding current California Department of Public Health water quality requirements, turnover (the amount of time for all the water to be used in the tank) within each tank is a high priority for the City. If the water remains in the reservoirs or tanks for too long, the water becomes stagnant and requires additional chlorine treatment, which is an added expense to the City and provides challenges in meeting Stage 2 Disinfection Byproducts water quality regulations. The following are recommendations based on discussions with the City and identifying optimal solutions to operating the City's water distribution system and storage facilities:

1. **Reservoir #2/Bishop Tank Control Valve:** A concern with consolidating the High Pressure and the Bishop Zones is the inability to turn over the Bishop Tank. Since Reservoir #2 is so large and the operating range is only a couple of feet, the Bishop Tank has the potential to not turnover sufficiently to maintain good water quality. Therefore, it is recommended to install an actuator controlled isolation valve on the 16-inch water main in San Luis Drive on the south side of the California Boulevard and San Luis Drive intersection. The isolation valve would be closed during the day, allowing Bishop Tank to exclusively feed the High Pressure and Alrita Zones downstream of the regulating valve. The regulating valve would be opened at night to allow the tank to re-fill. In the event of an emergency or sudden loss of pressure, the regulating valve would open and supply more water to the downstream side of the High Pressure Zone. These operations would increase turn-over in the tank thereby improving water quality.
2. **Reservoir #2 Replacement:** Reservoir #2 is a single large (7.07 MG) reservoir. The reservoir was constructed in the early 1940's, making the reservoir over 70 years old. The reservoir is equipped with a floating cover that is currently in need of replacement and doesn't meet current health standards. Because the reservoir is a single entity, the entire storage volume must be taken out-of-service for maintenance operations. In order to take the reservoir out of service, the High Pressure Zone must be fed by the Transfer Pump Station. As noted in Chapter 7, the Transfer Pump Station has deficiencies in serving the High Pressure Zone under emergency conditions. ***It is recommended to construct two new 2.5 MG tanks at the Reservoir #2 site. The overflow elevation should remain at 558 ft and the base elevation is***

recommended to match the Bishop Tank at 529.5 ft. A preliminary engineering study will need to be conducted prior to design to identify the optimal location to construct the two new tanks. The new tanks will allow for a portion of the storage to be taken out of service while still providing sufficient storage to meet the needs of the zone for a short period of time. The decreased storage will also assist the City in achieving better turnover in the reservoir.

3. **Reservoir #1 Replacement:** Similar to Reservoir #2, Reservoir #1 was constructed as one large (7.5 MG) reservoir. Reservoir #1 was constructed around the same time as Reservoir #2, and is also equipped with a floating cover that does not meet current health standards. If the reservoir is in need of maintenance, the entire reservoir must be taken out-of-service. The loss of this reservoir is not as critical as Reservoir #2 since the zone can be served by gravity through PRVs from the High Pressure Zone. In addition, under the proposed zone consolidation, Reservoir #1 would be served by the Foothill Zone (sourced from the Clear Wells), thus the reservoir can be taken out of service and the zone can still be reliably served. Under the proposed zone consolidation, Reservoir #1's storage is being reduced from 7.5 MG to 5.13 MG due to elevation differences between Reservoir #1 and the Clear Wells. This reduction in storage will assist the City in achieving better turnover in the reservoir. ***It is recommended as a long-term master plan improvement project to replace Reservoir #1 with two 1.5 MG tanks, operating at the same hydraulic grade as the Clear Wells. Alternatively, the City may construct a new additional tank at the Clear Well site and reduce the storage at Reservoir #1 site. This should be evaluated during preliminary engineering phase for the construction of Reservoir #1.*** Therefore, the overall storage within the Foothill Zone would be 6.97 MG (3.97 MG at the Clear Wells and 3 MG at Reservoir #1). This is still 2.0 MG more storage than what is needed in the Foothill Zone. If Clear Well #1 is taken out of service (the largest of all four tanks), the remaining three tanks can still adequately serve the zone's emergency, fire, and operational needs.
4. **Seismic and Mixing System Upgrades:** Several of the tanks that are to remain in service do not meet current CDPH regulations for inlet/outlet configuration and/or earthquake safety. Rosemont, Edna Saddle, Terrace Hill and Islay should have seismic evaluations completed. Flexible couplings or double ball expansion joints should be installed where appropriate. The inlet/outlet should either be re-configured to meet current CDPH regulations or install a Tideflex Mixing System or similar unit inside the tank to promote mixing and eliminate stagnation within zones of the tank. These upgrades will bring the tanks into compliance with current CDPH requirements. **Note – If the Rosemont Tank is replaced with a new 190,000 gal tank, these recommendations should be incorporated into the new tank design.*

Regulatory Compliance

While not directly evaluated as part of this Master Plan, the City's ongoing ability to meet the requirements of the Stage 2 Disinfectants and Disinfection Byproduct Rule (Stage 2 DBPR) will need to be considered in all future decisions related to the operation, maintenance and development of the water system. The areas for specific ongoing consideration and future evaluation are:

Source Water

From a water supply perspective, the City is very fortunate to have 3 surface water sources (Salinas Reservoir, Nacimiento Lake, Whale Rock Reservoir). Each of these sources are unique and have different treatment characteristics. Given the multiple combinations and blend proportions possible, this is a current and an ongoing treatment priority. In specific consideration to compliance with the Stage 2 DBPR, the City will need to continue their evaluation of each source (seasonal, intake level effect on disinfectant byproduct (DBP) precursors, costs, etc.) and blending properties.

Treatment

Originally built in 1963, the City's Water Treatment Plant (WTP) has most recently been upgraded in 1994 and 2008. In 1994, ozone was incorporated as the primary disinfectant, replacing chlorine, to minimize the formation of DBPs during the treatment process. In 2008, ballasted flocculation was added to raise the entire plant rating to full conventional surface water treatment levels. WTP staff has performed extensive coagulant testing to improve DBP precursor removal. Continued testing and evaluation still needs to be performed to optimize the WTP's contribution to meeting this regulation. If sufficient DBP precursor removal is not achieved, then alternative filtration methods (GAC, membrane, etc.) may need to be considered.

Disinfection

As mentioned above, the City has already incorporated ozone as its primary disinfectant. If DBP compliance continues to be an issue, then the City could consider switching from their current use of sodium hypochlorite as a secondary disinfectant to chloramination or some other alternative disinfectant. The use of alternative disinfectants have significant safety and operational considerations and is recommended as a lower priority option at this time.

Distribution System

A significant portion of compliance with the Stage 2 DBPR is dependent on the water distribution system infrastructure and operation. This is achieved through minimization of water age, primarily through proper tank sizing, optimization of distribution system operations and possibly, installation of DBP removal systems in key tanks. Tank sizing is a key component of this master plan and is discussed more thoroughly in Chapter 6. In-tank DBP removal systems can be a very effective compliance component depending on DBP specie proportion. ***It is recommended that the City pursue further evaluation of the effectiveness of the DBP removal systems in their case. Key tanks to evaluate are Clear Wells #1 and/or #2, Reservoir #2, Edna Saddle and Bishop Tank but all tanks should be considered***. Operation of the distribution system has a direct effect on water age and must be evaluated further by the City to meet and maintain compliance. It is recommended that the City evaluate their system operation and incorporate improved operational capability into their current SCADA upgrade project.

Overall Storage Recommendations

With the proposed zone consolidations and the ability to share storage between zones, the City's storage supplies are more than sufficient to meet the future needs of the City. The following are the storage recommendations based on emergency, fire, and operational needs as well as long term operations and maintenance needs.

1. **Rosemont Tank Replacement:** Construct an additional 150,000 gallon tank in the Rosemont Zone for a total of 190,000 gallons or install a fire pump at the proposed Fel-Mar pump station with a permanent stand by generator to provide additional fire support to the Rosemont Zone.
2. **Reservoir #2/Bishop Tank Control Valve:** Install an actuator controlled isolation valve on the 16-inch water main in San Luis Drive, on the south side of the California Boulevard and San Luis Drive intersection.
3. **Reservoir #2 Replacement:** Construct two new 2.5 MG tanks or reservoirs at the Reservoir #2 site.
4. **Reservoir #1 Replacement:** Construct two new 1.5 MG tanks, operating at the same hydraulic grade as the Clear Wells.
5. **Seismic and Mixing System Upgrades:** Conduct seismic evaluations and install flexible couplings or double ball expansion joints and mixing systems at Rosemont, Edna Saddle, Terrace Hill and Islay.
6. **DPB Removal System:** Evaluate the effectiveness of DBP Removal Systems at Clear Wells #1 and/or #2, Reservoir #2, Edna Saddle and Bishop Tank.

Table 6-1. Summary of the Existing Water Storage Facilities[1]

Water Storage Facility	~Year Installed	Primary Zone Served	Secondary Zone(s) Served	Material	Diameter (ft)	Base Elevation[6] (ft)	Top of Outlet Pipe Elevation (ft)	Approximate Overflow Elevation (ft)	Total Volume (MG)[2]	Useable Volume (MG)[3]
Alrita Hydro-pneumatic	2007	Alrita	---	Steel	5	487	N/A	N/A	2,500 gal	2,500 gal
Bishop	2005	Bishop	---	Steel	72	529.5	532	553.9	0.74	0.67
Edna Saddle	1974	Edna Saddle	---	Steel	170	322.5	322.5	345.0	3.82	3.82
Clear Well 1	2008	Foothill	Downtown	Steel	131	403.5	408.6	432.0	2.87	2.40
Clear Well 2	2007			Steel	107	403.5	408.6	432.0	1.92	1.57
Ferrini	1985	Ferrini	Highland	Steel	42	568	Unknown	584	0.16	0.16
Reservoir #2	1942	High Pressure	Andrews	Concrete	~ Top 190x340	N/A	538	558	N/A	7.07
Reservoir #1	N/A	Reservoir #1	---	Concrete	Irregular Shaped	N/A	413	436.3	N/A	7.50[4]
Reservoir Canyon Hydro-pneumatic	N/A	Reservoir Canyon	---	Steel	N/A	N/A	N/A	N/A	255 gal	255 gal
Rosemont	1994	Rosemont	---	Steel	21	704.6	704.6	719.7	0.039	0.035
Serrano	1967	Serrano	Patricia	Steel	27	542	542	564	0.10	0.10
Slack Street	1955	Slack	---	Steel	24	535	535	555	0.07	0.07
Islay[5]	1996	Terrace Hill	Downtown	Concrete	52	N/A	395.9	421	N/A	0.38
Terrace Hill	1959			Steel	60	385.8	385.8	419.8	0.72	0.72

N/A = Not Available

1. Wallace Group completed survey to obtain the Base elevations, Top of Outlet Pipe elevations, and Overflow elevations for Bishop, Edna Saddle, Clear Well 1 & 2, Reservoir #1 & #2, Rosemont, Islay, and Terrace Hill. All other data was provided by the City.
2. Total Volume is based on the volume of water between the overflow elevation and the base elevation of the tank or reservoir.
3. Useable Volume is based on the volume of water between the overflow elevation and the top of outlet pipe elevation of the tank or reservoir.
4. The useable volume for Reservoir #1 is assumed based on previous documents. No record drawings are available for Reservoir #1. The top of outlet and the overflow were surveyed. The side slopes to the irregular shaped structure is unknown. Using a 3:1 slope, the reservoir capacity is approximately 8.49 MG, which is 1.0 MG more than previous documents. To be conservative, the lower volume will be used for all calculations.
5. The overflow elevation of Islay is one foot higher than Terrace Hill. The Islay Tank is unable to fill and therefore, the useable volume of Islay is reduced by 1 ft.
6. Basis of Bearings: Horizontal positions are based on the City of San Luis Obispo horizontal control network 2007 points No. 8211 and 8092. Basis of Elevations: The orthometric heights (elevations) were based on the City of San Luis Obispo Benchmark system 2007 and referenced by BM#367.

Table 6-2. Existing Emergency Storage Recommendations

Tanks/Reservoirs	Zone(s) Served	Estimated Existing Population	Storage Recomm. (gallons)
Rosemont	Rosemont	10	1,500
Ferrini	Ferrini	660	99,000
	Highland		
Serrano	Serrano	1,050	157,500
	Patricia		
Clear Wells	Foothill	11,900	1,785,000
	Downtown		
Reservoir #2	High Pressure	7,370	1,105,500
Reservoir #1	Reservoir #1	2,550	382,500
	Reservoir Canyon		
	Andrews		
Slack Street	Slack	490	73,500
Edna Saddle	Edna Saddle	12,100	1,815,000
Terrace Hill and Islay	Terrace Hill	6,570	985,500
Bishop	Bishop	2,520	378,000
	Alrita		
Total		45,220	6,783,000

Table 6-3. Existing Fire Storage Recommendations

Tanks/Reservoirs	Zone(s) Served	Most Stringent Zoning	Existing		
			Fire Flow (gpm)	Duration (hours)	Storage (gallons)
Rosemont	Rosemont	Residential (low)	1,500	2	180,000
Ferrini	Ferrini	Residential (low)	1,500	2	180,000
	Highland				
Serrano	Serrano	Schools	2,500	2	300,000
	Patricia				
Clear Wells	Foothill	Hospital: Unsprinklered	6,000	4	1,440,000
	Downtown				
Reservoir #2	High Pressure	Cal Poly	5,000	4	1,200,000
Reservoir #1	Reservoir #1	Hotels	4,000	4	960,000
	Reservoir Canyon				
	Andrews				
Slack Street	Slack	Schools	2,500	2	300,000
Edna Saddle	Edna Saddle	Hotels	4,000	4	960,000
Terrace Hill and Islay	Terrace Hill	Industrial	4,000	4	960,000
Bishop	Bishop	Industrial	4,000	4	960,000
	Alrita				
Total					7,440,000

Table 6-4. Existing Operational Storage Recommendations

Tanks/Reservoirs	Zone	Estimated Existing ADD (gpm)	Existing Storage Recomm. (gallons)
Rosemont	Rosemont	1	360
Ferrini	Ferrini	54	19,440
	Highland		
Serrano	Serrano	86	33,960
	Patricia		
Clear Wells	Foothill	989	356,040
	Downtown		
Reservoir #2	High Pressure	604	217,440
Reservoir #1	Reservoir #1	210	75,600
	Reservoir Canyon		
	Andrews		
Slack Street	Slack	40	14,400
Edna Saddle	Edna Saddle	994	357,840
Terrace Hill and Islay	Terrace Hill	538	193,680
Bishop	Bishop	207	74,520
	Alrita		
Total		3,723	1,340,280

Table 6-5. Existing Storage Summary

Tanks/Reservoirs	Zone(s) Served	Storage Summary (gals)			Storage Recommended (gals)	Total Available (gals)	Storage Surplus/Deficit (gals)
		Emergency	Fire	Operational			
Rosemont	Rosemont	1,500	180,000	360	181,860	35,000	-146,860
Ferrini	Ferrini	99,000	180,000	19,440	298,440	160,000	-138,440
	Highland						
Serrano	Serrano	157,500	300,000	33,960	488,460	100,000	-388,460
	Patricia						
Clear Wells	Foothill	1,785,000	1,440,000	356,040	3,581,040	3,970,000	388,960
	Downtown						
Reservoir #2	High Pressure	1,105,500	1,200,000	217,440	2,522,940	7,490,000	4,967,060
Reservoir #1	Reservoir #1	382,500	960,000	75,600	1,418,100	7,500,000	6,081,900
	Reservoir Canyon						
	Andrews						
Slack Street	Slack	73,500	300,000	14,400	387,900	70,000	-317,900
Edna Saddle	Edna Saddle	1,815,000	960,000	357,840	3,132,840	3,820,000	687,160
Terrace Hill and Islay	Terrace Hill	985,500	960,000	193,680	2,139,180	1,100,000	-1,039,180
Bishop	Bishop	378,000	960,000	74,520	1,412,520	740,000	-672,520
	Alrita						
Total		**6,783,000**	**7,440,000**	**1,340,280**	**15,563,280**	**24,985,000**	**9,421,720**

Table 6-6. Future Emergency Storage Recommendations

Tanks/Reservoirs	Zone(s) Served	Estimated Future Population	Storage Recomm. (gallons)
Rosemont	Rosemont	10	1,500
Clear Wells and Reservoir #1	Foothill	19,670	2,950,500
	Andrews		
	Reservoir Canyon		
	Downtown		
Reservoir #2 and Bishop	High Pressure	11,410	1,711,500
	Alrita		
Edna Saddle	Edna Saddle	14,390	2,158,500
Terrace Hill and Islay	Terrace Hill	8,220	1,233,000
Total		53,700	8,055,000

Table 6-7. Future Fire Storage Recommendations

Tanks/Reservoirs	Zone(s) Served	Most Stringent Zoning	Future		
			Required Fire Flow (gpm)	Required Duration (hours)	Required Storage (gallons)
Rosemont	Rosemont	Residential (low)	1,500	2	180,000
Clear Wells and Reservoir #1	Foothill	Hospital: Unsprinklered	6,000	4	1,440,000
	Andrews				
	Reservoir Canyon				
	Downtown				
Reservoir #2 and Bishop	High Pressure	Cal Poly	5,000	4	1,200,000
	Alrita				
Edna Saddle	Edna Saddle	Hotels	4,000	4	960,000
Terrace Hill and Islay	Terrace Hill	Industrial	4,000	4	960,000
Total					4,740,000

Table 6-8. Future Operational Storage Recommendations

Tanks/Reservoirs	Zone(s) Served	Estimated Future ADD (gpm)	Storage Recomm. (gallons)
Rosemont	Rosemont	2	720
Clear Wells and Reservoir #1	Foothill	1,436	516,960
	Andrews		
	Reservoir Canyon		
	Downtown		
Reservoir #2 and Bishop	High Pressure	1,129	406,440
	Alrita		
Edna Saddle	Edna Saddle	2,551	918,360
Terrace Hill and Islay	Terrace Hill	601	216,360
Total		5,719	2,058,840

Table 6-9. Future Storage Summary

Tanks/Reservoirs	Zone(s) Served	Storage Summary (gals)			Storage Recommended (gals)	Total Available (gals)[1]	Storage Surplus/Deficit (gals)
		Emergency	Fire	Operational			
Rosemont	Rosemont	1,500	180,000	720	182,220	35,000	-147,220
Clear Wells and Reservoir #1	Foothill	2,950,500	1,440,000	516,960	4,907,460	6,970,000	2,062,540
	Andrews						
	Reservoir Canyon						
	Downtown						
Reservoir #2 and Bishop	High Pressure	1,711,500	1,200,000	406,440	3,317,940	5,667,000	2,349,060
	Alrita						
Edna Saddle	Edna Saddle	2,158,500	960,000	918,360	4,036,860	3,820,000	-216,860
Terrace Hill and Islay	Terrace Hill	1,233,000	960,000	216,360	2,409,360	1,100,000	-1,309,360
Total		**8,055,000**	**4,740,000**	**2,058,840**	**14,853,840**	**17,592,000**	**2,738,160**

[1] Total available storage based on zone consolidations and tank recommendations including reduction in storage at Reservoir # 1 and #2

7: Water Pump Stations

Chapter 7 describes the existing pump stations and provides a physical and hydraulic evaluation of the pump stations. This chapter also provides a summary of the recommended capital improvements for the pump stations. All tables are located at the end of this chapter.

Summary of Pump Station Recommendations

Due to the proposed consolidation of the water distribution zones, the proposed master plan improvement projects for the pump stations are reduced significantly than if the zone consolidation did not occur. The following is a summary of each of the pump stations and any proposed master plan improvement projects based on the recommendations to consolidate zones. If the zone consolidations to not occur, the recommendations previously provided in the Chapter should be completed.

1. No upgrades are recommended at the Alrita Pump Station.
2. The Bishop Pump Station is proposed to be eliminated.
3. The Bressi Pump Station is proposed to be eliminated.
4. The Ferrini Pump Station is proposed to be eliminated.
5. The McCollum Pump Station is proposed to be eliminated.
6. Replace/upgrade the entire Reservoir Canyon pump station with a new pump station. Install a larger hydro pneumatic tank or an additional smaller redundant tank, new electrical panel and controls with alarms, new piping, new pumps, new building. Install fencing around the building to maintain security.
7. Eliminate the Rosemont Pump Station and construct new pump station at the old Fel-Mar Pump Station to feed the Rosemont Tank. The old Fel-Mar pump station was located on Fel-Mar Drive at Al-Hil Drive. The new pump station should be capable of filling the recommended future Rosemont Tank within eight hours. Construct 1,500 feet of new 8-inch PVC from the new Fel-Mar Pump Station on Fel Mar Drive to 80 Highland Drive.
8. Upgrade the Transfer Pump Station electrical system and transfer switch to allow for up to three pumps to be operated with an on-site stand by generator. Install a new standby generator to run a minimum of three pumps in parallel (not all starting at one time).

Pump Stations

The City owns and operates eight pump stations. Five of the eight pump stations are used to fill storage tanks within a distribution zone. Two of the pump stations are hydro-pneumatic pump stations, providing pressure continuously to their respective zones. The last pump station is to provide fire flow only (Bishop PS). Table 7-1 summarizes the function of each of the pump stations. Table 7-2 summarizes the design characteristics of each of the pump stations. Appendix A provides the manufacturers' pump curves, if available.

Alrita Pump Station

The Alrita Pump Station is located in the Alrita Zone. The pump station is fed from the Bishop Zone to the small Alrita Zone via two 100 gpm pumps, one 1,500 gpm fire pump and two hydro-pneumatic

tanks. The purpose of the Alrita Pump Station is to sustain flow and pressure on-demand, and to provide fire flow to the Alrita Zone.

Bishop Pump Station

The Bishop Pump Station is located in the Bishop Zone. The Bishop Pump Station contains one 700 gpm fire pump. Under normal conditions of the Bishop Zone, the Bishop Pump Station does not operate. The City eliminated the booster pumps from day-to-day operation, which allows Reservoir #2 in the High Pressure Zone to feed the 750,000 gallon Bishop Tank by gravity through a PRV. The fire pump is still on standby to operate if needed to provide additional flow and pressure during low pressure or fire flow conditions. Both the Bishop Pump Station and Bishop Tank provide fire flow service to the Bishop Zone.

Bressi Pump Station

The Bressi Pump Station is located in the Serrano Zone. The pump station is fed from Clearwells 1 and 2 in the Foothill Zone and pumps to the 100,000 gallon Serrano Tank. The Bressi Pump Station contains two 500 gpm pumps. The purpose of the Bressi Pump Station is to fill the Serrano Tank.

Ferrini Pump Station

The Ferrini Pump Station is located in the Ferrini Zone. The pump station is fed from Clearwells 1 and 2 in the Foothill Zone and pumps to the 160,000 gallon Ferrini Tank. The Ferrini Pump Station contains two 1,060 gpm pumps. The purpose of the Ferrini Pump Station is to fill the Ferrini Tank.

McCollum Pump Station

The McCollum Pump Station is located in the Slack Zone. The pump station is fed from Reservoir #2 in the High Pressure Zone and pumps to the 70,000 gallon Slack Street Tank. The McCollum Pump Station contains two pumps, 200 gpm and 600 gpm. The purpose of the McCollum Pump Station is to fill the Slack Street Tank.

Reservoir Canyon Pump Station

The Reservoir Canyon Pump Station is located in the Reservoir Canyon Zone, which is not within the City limits. The pump station is fed from Reservoir #1 in the Reservoir #1 Zone. The pump station boosts water pressure through three hydro-pneumatic tanks, which then serves the Reservoir Canyon Zone. The zone is a fully boosted zone. The Reservoir Canyon Pump Station contains two pumps (capacity of pumps is unknown). The purpose of the Reservoir Canyon Pump Station is to sustain pressure and maximum day flow to the Reservoir Canyon Zone. This pump station does not provide fire flow service, nor does the City maintain a tank that provides fire flow service to the homes within this zone per the City's agreement with the customers located within this zone.

Rosemont Pump Station

The Rosemont Pump Station is located in the Rosemont Zone. The pump station is fed from the Highland Zone and pumps to the 40,000 gallon Rosemont Tank. The Rosemont Pump Station contains two 110 gpm pumps. The purpose of the Rosemont Pump Station is to fill the Rosemont Tank.

Transfer Pump Station

The Transfer Pump Station is located at the Water Treatment Plant adjacent to the Clear Well Tanks. The pump station is fed from the Clear Wells and pumps to Reservoir #2 (7.44 mg). The Transfer Pump Station contains four 1,500 gpm pumps. The purpose of the Transfer Pump Station is to fill Reservoir #2, assist during peak demand if needed and maintain pressure and flow if Reservoir #2 is out of service.

Hydraulic Evaluation

To evaluate the ability of each pump station to meet system demands and design parameters, a hydraulic constraints evaluation was conducted. The hydraulic evaluation included an analysis of the pump station to meet the respective design intent and the National Fire Protection Agency (NFPA) 22, Standard for Water Tanks for Private Fire Protection, 2008 Edition recommendation for a tank to be filled within eight hours by its supply source. Although the NFPA standard is not a requirement for a public water system, this standard is a good check to determine if a pump station is adequately sized during an emergency condition. To allow for redundancy, it is recommended that this analysis evaluate the pump station with the largest pump out of service.

As determined previously, each of the pump stations were installed for various design parameters, which are summarized as follows:

1. Alrita: Sustain flow and pressure under all demand conditions and provide fire flow
2. Bishop: Fire Flow Support, respond to low pressure conditions within Bishop Zone
3. Bressi: Assist during Peak Hour and Fill Serrano Tank
4. Ferrini: Assist during Peak Hour and Fill Ferrini Tank
5. McCollum: Assist during Peak Hour and Fill Slack Street Tank
6. Reservoir Canyon: Sustain pressure and provide Peak Hour Demand
7. Rosemont: Assist during Peak Hour and Fill Rosemont Tank
8. Transfer Pump Station: Assist during Peak Hour, Fill Reservoir #2 and maintain pressure and flow if Reservoir #2 is out of service

Alrita Pump Station

The Alrita Pump Station provides continuous pressure and flow to the small Alrita Zone under all demand conditions. The existing and future peak hour demand served by the Alrita Pump Station is 8 gpm. The Alrita Pump Station has two domestic 100 gpm pumps, which alternate to provide daily flow and pressure to the zone. This exceeds the existing peak hour demand. Thus, the Alrita Pump Station is adequately sized to meet existing conditions.

Since the Alrita Zone is a fully boosted zone and is not supplied by gravity flow from a tank, the Alrita Pump Station is required to provide fire flow to the Alrita Zone. The fire flow requirement within the Alrita Zone is 1,500 gpm. The Alrita Zone has a dedicated fire pump that provides 1,500 gpm fire flow to the Alrita Zone during fire flow or high demand conditions. Since the Alrita Zone does not have dedicated storage, the NFPA 22 criterion does not apply to this zone.

No upgrades to the Alrita Pump Station are required due to hydraulic deficiencies.

Bishop Pump Station

The Bishop Pump Station provides fire flow support to the Bishop Zone. Fire flow is also supported by gravity flow from the Bishop Tank. The fire pump provides an additional fire flow into the distribution system if pressures drop.

Based on the hydraulic model, with a few upgrades to the water distribution system and zone connections, fire flow requirements can be adequately met without assistance from the Bishop Pump Station. ***Thus, it is recommended that the Bishop Pump Station be eliminated (See Chapter 8).***

Bressi Pump Station

The Bressi Pump Station is used to assist during peak hour demand and to fill the Serrano Tank (100,000 gallons). The existing peak hour demand served by the Bressi Pump Station is 76 gpm. The Bressi Pump Station has two 500 gpm pumps that alternate to fill Serrano Tank. This exceeds the existing peak hour demand. Thus, the Bressi Pump Station is adequately sized to meet existing peak hour demand.

With only one pump in service, under average day demand (19 gpm), the Bressi Tank would be filled in 3.4 hours [(100,000 gallons/(500-19 gpm))/60 min/hour = 3.4 hours]. The Bressi Pump Station meets the NFPA 22 recommendation to fill the Serrano Tank within eight hours.

No upgrades to the Bressi Pump Station are required due to hydraulic deficiencies. ***It should be noted that Chapter 8 proposes to consolidate the Serrano Zone with the High Pressure Zone, thus eliminating the Bressi Pump Station.***

Ferrini Pump Station

The Ferrini Pump Station is used to assist during peak hour demand and to fill the Ferrini Tank (160,000 gallons). The existing peak hour demand served by the Ferrini Pump Station is 86 gpm. The Ferrini Pump Station has two 1,060 gpm pumps that alternate to fill the Ferrini Tank. However, based on recent pump tests, the actual flow capability of one pump was only 800 gpm. This is still more than the existing peak hour demand. Thus, the Ferrini Pump Station is adequately sized to meet existing peak hour demand.

With only one pump in service, under average day demand (21 gpm), the Ferrini Tank would be filled in 3.4 hours [(160,000 gallons/(800-21 gpm))/60 min/hour = 3.4 hours]. The Ferrini Pump Station meets the recommendation to fill the Ferrini Tank within eight hours.

Even though the pump station is capable of meeting the hydraulic requirements noted above, the most recent pump tests note the available pumping capacity is only 800 gpm, not 1,060 gpm as designed. It is recommended that a pump test be completed on both pumps. If it is determined that the pumping capacity is significantly less than 1,060 gpm, the pumps should be re-built with new impellers to bring the pumps back to original design performance capability.

However, it should be noted that Chapter 8 proposes to consolidate the Ferrini Zone with the High Pressure Zone, thus eliminating the Ferrini Pump Station.

McCollum Pump Station

The McCollum Pump Station is used to fill the Slack Street Tank (70,000 gallons). It is fed by the High Pressure Zone and Reservoir #2. There is little elevation difference between the Slack Street Tank and Reservoir #2. The McCollum Pump Station provides a small boost (15 psi) to fill the Slack Street Tank. The McCollum Pump Station is used to assist during peak hour demand and to fill the Slack Street Tank. The existing peak hour demand served by the McCollum Pump Station is 160 gpm. The McCollum Pump Station has two pumps, 200 and 600 gpm that alternate to fill Slack Tank. Both pumps are capable of providing more than the existing peak hour demand. Thus, the McCollum Pump Station is adequately sized to meet existing peak hour demand.

With only one pump in service, under average day demand (40 gpm), the Slack Street Tank would be filled in 7.3 hours [(70,000 gallons/(200-40 gpm))/60 min/hour = 7.3 hours]. With only the smaller pump in service, the McCollum Pump Station still meets the NFPA 22 recommendation of filling the Slack Street Tank within eight hours.

It should be noted that based on the hydraulic model, with some upgrades to the water distribution system, Chapter 8 proposes to consolidate the Slack Zone with the High Pressure Zone, thus eliminating the McCollum Pump Station. These upgrades are required to be completed prior to the McCollum Pump Station being removed.

Reservoir Canyon Pump Station

The Reservoir Canyon Pump Station provides domestic flow to two residential properties. The zone is a fully boosted zone and is served by three hydro pneumatic tanks. The hydro pneumatic tanks appear to be undersized due to the frequent pump cycling observed by the operators and noted during a site visit in 2012. The pumps provide sufficient flow to fill the hydro pneumatic tanks quickly.

It is recommended to install a larger hydro pneumatic tank or an additional smaller redundant tank to reduce the cycling of the pumps.

Rosemont Pump Station

The Rosemont Pump Station is used to assist during peak hour demand and to fill the Rosemont Tank (40,000 gallons). The existing peak hour demand served by the Rosemont Pump Station is 5 gpm. The Rosemont Pump Station has two 100 gpm pumps that alternate to fill the Rosemont Tank. This exceeds the existing peak hour demand. Thus, the Rosemont Pump Station is adequately sized to meet existing peak hour demand.

With only one pump in service, under average day demand (1 gpm), the Rosemont Tank would be filled in 6.7 hours [(40,000 gallons/(100-1 gpm))/60 min/hour = 6.7 hours]. The Rosemont Pump Station meets the NFPA 22 recommendation to fill the Rosemont Tank within eight hours.

Although the Rosemont Pump Station does not have any hydraulic deficiencies, it should be noted that the Rosemont Pump Station only has 2-3 psi suction pressure under normal operating conditions. Chapter 8 discusses the impacts this low suction pressure has on the Highland Zone and the Highland Zone's ability to meet fire flow requirements. Based on this hydraulic constraint, it is recommended

that the Rosemont Pump Station be eliminated and a new station be constructed at the old Fel-Mar Pump Station site to feed the Rosemont Tank. The new pump station should be sized to fill the recommended new Rosemont Tank in less than eight hours.

Transfer Pump Station

The Transfer Pump Station is used to assist during peak hour demand and to fill the Reservoir #2 (7.44 mg). The Transfer Pump Station has four pumps, each capable of providing 1,500 gpm with a total capacity of 3,610 gpm if three pumps run in parallel. The pumps alternate filling Reservoir #2. This pump station was upgraded in 2007 with the construction of the Clearwell Tanks. The existing peak hour demand is 2,039 gpm. The capacity of the pump station exceeds the existing peak hour demand. Thus, the Transfer Pump Station is adequately sized to meet existing peak hour demand.

With three pumps in service, under average day demand (604 gpm), Reservoir #2 would be filled in 41 hours [(7,440,000 gallons/(3,610-604 gpm))/60 min/hour = 41 hours]. However, Reservoir #2's actual storage needs are only 2,520,000 (see Table 6-5). With the reduced storage requirements, Reservoir #2 would be filled in 13.9 hours [(2,520,000/(3,610-604 gpm))/60 min/hour = 13.9]. The Transfer Pump Station does not meet the NFPA 22 recommendation to fill Reservoir #2 within eight hours.

To conduct any maintenance on Reservoir #2, the City must rely on the Transfer Pump Station to serve all demand conditions, including peak hour and fire flow, in the High Pressure Zone. The Transfer Pump Station is unable to meet the fire flow requirements (5,000 gpm) in the High Pressure Zone. In addition, under emergency power outage conditions, the Transfer Pump Station is only capable of running one pump from an emergency generator. The High Pressure Zone is in a vulnerable state if Reservoir #2 is not in operation. It is recommended to complete the following two upgrades to eliminate this vulnerable state:

1. ***Construct two new tanks at Reservoir #2 site to allow either tank to be taken out of service for maintenance (See Chapter 6 for sizing recommendations).***
2. ***Upgrade the Transfer Pump Station electrical system to allow for up to three pumps to be operated with an on-site stand by generator. Install a new standby generator to run a minimum of three pumps in parallel (not all starting at one time).***
3. ***Complete an evaluation on the pumps to determine if the capacity of the pumps could be increased to allow the pump station to meet fire flow requirements if Reservoir #2 were out of service.***

Physical Evaluation

A physical evaluation of five of the eight pump stations was conducted by Fluid Resource Management (FRM) in November 2012. The pump stations included in this evaluation were: Bishop, Bressi, Ferrini, McCollum, and Reservoir Canyon. At the City's request, Alrita, Rosemont and the Transfer Pump Station were not included in the physical evaluation. FRM's report is provided in Appendix B in addition to photos of each pump station. The City Operations Staff also provided input on the physical condition of each pump station during a site visit in 2012 with Wallace Group and City Operation's staff. A

description of the facilities and findings of the condition of each of the five water pump stations is outlined below.

Bishop Pump Station

The Bishop Pump Station was constructed around 1951. The pump station is located in a parking lot of a medical complex. The following observations have been noted regarding the Bishop Pump Station:

1. The jockey pump was pulled from service and only a fire pump remains in service. The fire pump is only used to assist under fire flow or low pressure conditions. The pump station is typically bypassed.
2. Although the building is well constructed, the front face of the building has large pane windows, is not fenced, and is subject to vandalism. There is no roll-up door for easy operator access to the fire pump.
3. There is no flow meter installed.
4. Based on input from the City Operations staff, the suction and discharge piping is pitted and rusted within the pump station. The piping cross-section has deteriorated. Piping has a potential to fail.
5. The electrical is in poor condition and does not meet current electrical code.
6. The pump station room has poor ventilation.
7. No SCADA is installed in the pump station.
8. If upgrades are to be made to the pump station, there is piping within the pump station that is not used since the domestic pump was taken out of service. This piping can be removed; however, it is not detrimental to pump station and can remain in-tack.

The following are recommendations for upgrades to the Bishop Pump Station should it remain in service.

1. The window panes along front face of building should be replaced with a roll-up door to restrict people from viewing into the pump station, provide larger opening for ease of maintenance/servicing/repair, and to reduce vandalism. An alternative option would be to place fencing around the facility to restrict public access to the building, but this would not provide easy access to the operators. The alternative option would be less expensive.
2. Install new vents and a roof vent.
3. Install a flow meter.
4. Replace/upgrade the electrical and control panels and all wiring within the pump station. Bring electrical system up to current code.
5. Install SCADA equipment and programming per the City's SCADA consultant recommendations.
6. Replace all suction and discharge piping for fire pump within the building and underneath the building.
7. Remove unused piping and re-configure suction and discharge piping for the fire pump within the pump station.

As noted previously, the Bishop Pump Station is recommended to be eliminated; therefore no improvements are necessary for this pump station (See Chapter 8).

Bressi Pump Station

The Bressi Pump Station was constructed around 1967. The pump station is located on a hillside with animals grazing around the facility. The following observations were noted regarding the Bressi Pump Station:

1. The building is located off of the main road by approximately 50 feet. The first fence is used to keep cattle in. The cattle fence gate is difficult for the operators to open. Although the operators are able to drive between the two fences, there is no access driveway between the cattle fence and the booster station building. The pump station building is surrounded by a 6-ft high fence with a 12-ft gate.
2. The building is in good condition. There is no roll-up door for easy operator access to the pumps.
3. The discharge piping goes under the pump station and is in unknown condition. Based on input from City Operations Staff, the buried piping is in poor condition due to age.
4. Based on input from the City Operation's staff, the suction and discharge piping is pitted and rusted within the pump station. The piping cross-section has deteriorated. Piping has a potential to fail.
5. The electrical panel and wiring is in poor condition. The system has a water pressure line connected to the MCC panel, which is a safety hazard.
6. The booster station is controlled by hanging probes in the Serrano Tank. The wiring is a direct bury from the tank to the booster station. The probes are antiquated and replacement parts are difficult to ascertain.
7. No SCADA is installed in the pump station.
8. No flow meter is installed.

The following are recommendations for upgrades to the Bressi Pump Station should it remain in service.

1. Replace/upgrade the electrical and control panels and all wiring within the pump station. Bring electrical system up to current code.
2. Install SCADA equipment and programming per the City's SCADA consultant recommendations.
3. Install a flow meter.
4. Install new pressure transducers for pump control by tapping into exposed piping connected to the tank thus eliminating the difficulty in accessing submerged transducers inside the tank.
5. Replace suction and discharge piping within the pump station and underneath the building.
6. Install a farm gate for access through the existing cattle fence.

As noted previously, the Bressi Pump Station is recommended to be eliminated; therefore no improvements are necessary for this pump station (See Chapter 8).

Ferrini Pump Station

The Ferrini Pump Station was constructed around 1985. The pump station is located along the west side of Highway 1 opposite of Stenner Creek Road. The following observations were noted regarding the Ferrini Pump Station:

1. The pump station is surrounded by standard chain link fencing. The cows use the fence as an itching post and have bent and damaged several posts and the fence.
2. There is no flow meter installed.
3. There is no roll-up door for easy operator access to the pumps.
4. The electrical panel and wiring is in poor condition.
5. The discharge piping is constructed under the slab of the building. The pipe is restrained through the slab. This construction method does not provide easy repair to the piping; however, the piping appears to be in good condition at this time.

The following are recommendations for upgrades to the Ferrini Pump Station should it remain in service.

1. Repair the damaged fencing/fence posts around the pump station. Recommend constructing a fence with higher durability.
2. Replace/upgrade the electrical and control panels and all wiring within the pump station. Bring electrical system up to current code.
3. Install SCADA equipment and programming per the City's SCADA consultant recommendations.
4. Install a flow meter.

As noted previously, the Ferrini Pump Station is recommended to be eliminated; therefore no improvements are necessary for this pump station (See Chapter 8).

McCollum Pump Station

The McCollum Pump Station was constructed around 1955. The pump station is situated tightly between two residential properties. The following observations were noted regarding the McCollum Pump Station:

1. The Cla-Val is installed in a vault outside the building. The vault lid is not traffic rated. It is often times driven over. The Cla Val is operational as a control valve, used to maintain levels within the Slack Street Tank.
2. There is a man-door used to access the booster station building. The door is located in a walkway with a small retaining wall 4 feet off the door. The man-door opens towards the street and limits access due to inadequate space between the opened door and the retaining wall.
3. There is no fencing around the pump station for protection. Windows located in the front of the building allow people to view inside the building and are subject to vandalism.
4. The electrical panel and wiring is in poor condition.
5. Suction and discharge header piping inside the pump station is in fair condition.
6. Suction and discharge piping enters/exists the building under the foundation. The condition of the piping is unknown.
7. There is no flow meter installed.

The following are recommendations for upgrades to the McCollum Pump Station should it remain in service.

1. Install a roll-up door on the front side of the pump station building and re-hang the man-door so the hinges are on the opposite side.
2. Install a traffic rated lid on the Cla-Val vault.
3. Install fencing around the building. This may not be feasible due to proximity to the sidewalk and street and residential character.
4. Install SCADA equipment and programming per the City's SCADA consultant recommendations.
5. Install a flow meter.

As noted previously, the McCollum Pump Station is recommended to be eliminated; therefore no improvements are necessary for this pump station (See Chapter 8).

Reservoir Canyon Pump Station

Reservoir Canyon Pump Station was constructed around 1995. The pump station is located on the southbound side of Highway 101, just north of Miossi Road. This pump station serves two properties outside City limits. The properties are served by a fully boosted system (on demand) with three hydro-pneumatic tanks supplied by the Reservoir Canyon Pump Station. The pump station only supplies domestic demand. The following observations were noted regarding the Reservoir Canyon Pump Station:

1. The steel building is situated behind a fence line along Highway 101.
2. The steel building is small, but functional. The building is subject to vandalism and is rusting. The door is easy to break into.
3. Based on input from the City Operation's staff and field observations, the piping is copper and in poor condition. Operations Staff has made several repairs to leaking pipes.
4. The three hydro pneumatic tanks are small. Pumps run/cycle often.
5. There are no alarms on the pumps. Operations staff receive calls from the residents when the system loses pressure, which occurs on average, monthly.
6. Electrical wiring is damaged by rodents. Electrical wiring is in poor condition.
7. The pumps are located on the floor, subject to water and flooding.

Based on the observations, the following recommendations are provided for the Reservoir Canyon Pump Station:

1. Replace/upgrade the entire pump station with a new pump station. Install a larger hydro pneumatic tank or an additional smaller redundant tank, new electrical panel and controls with alarms, new piping, new pumps, new building.
2. Install fencing around the building to maintain security.

Table 7-1. Pump Station Characteristics Summary

Pump Station	Function	Number of Pumps	Discharge HGL[1] (ft)	TDH at Design Capacity[2] (ft)	Pumping Capacity (gpm)	Permanent Back-up Generator On-Site	Portable Generator Capabilities
Alrita	Boosts water from Bishop Zone to Alrita Boosted Zone	3	600	87	100 each (2) 1,500 (1)	No	Yes
Bishop	To assist in providing Fire Flow from High Pressure Zone to Bishop Zone	1	555	16	700	No	No
Bressi	Boosts water from Foothill Zone to Serrano Tank	2	564	195	500 each	No	No
Ferrini	Boosts water from Foothill Zone to Ferrini Tank	2	583	216	1,060 each	No	No
McCollum	Boost water from High Pressure Zone to Slack Street Tank	2	555	45	200 and 600	No	No
Reservoir Canyon	Boosts water from Reservoir #1 Zone to Reservoir Canyon Boosted Zone	2	430	Unknown	Unknown	No	No
Rosemont	Boosts water from Highland Zone to Rosemont Tank	2	718	309	110 each	No	Yes
Transfer	Boosts water from the Foothill Zone/Water Treatment Plan to Reservoir #2	4	557	131	1,500 each	No	Yes

1 HGL – Hydraulic Grade Line
2 TDH – Total Dynamic Head

Table 7-2. Pump Station Summary

Pump Station	**Alrita**		**Bishop**	**Bressi**	**Ferrini**
Date of Installation/ Upgrades	2007		~1951	~1967	~1985
Pump Type	**Booster Pump #1 & #2**	**Fire Pump**	**Fire Pump**	**Pump #1 & #2**	**Pump #1 & #2**
RPM	3600	1800	1800	1765	1775
Phase	3	3	3	3	3
HP	2	75	50	40	75
Voltage	N/A	N/A	480	480	480
Pump Make & Model	Berkley CB 1 ¼ TPHS-2	Berkley B6JPBM	Peerless 6AD14	Aurora 411 BF	Weinman 5L1
Impeller Dia., (Inches)	N/A	12.75	11.65	N/A	N/A
Suction/Discharge Dia. (Inches)	N/A	N/A	8/6	3/4	6/5
Design Flow (gpm)	55	1250		500	1,060
Head (ft)	85	155		182	185
Hydro pneumatic Tank	Yes		No	No	No

Table 7-2 Continued. Pump Station Summary

Pump Station	**McCollum**		**Reservoir Canyon**	**Rosemont**	**Transfer**
Date of Installation/ Upgrades	~1955		~1995	2013	2006
Pump Type	**Pump #1**	**Pump #2**	**Pump #1 & #2**	**Pump #1 & #2**	**Pump #1, #2, #3 & #4**
RPM	3450	3450	3450	N/A	1780
Phase	3	3	3	N/A	3
HP	15	40	3	N/A	75
Voltage	480	480	230	N/A	480
Pump Make & Model	Aurora 411 BF 4x10B	Aurora 411 BF 2x10	Jacuzzi 3DB1-1/2	Paco	Fairbanks Morse 12N, 3 Stage, Model #7100AW
Impeller Dia., (Inches)	N/A	N/A	N/A	6.4	9.1”
Suction/Discharge Dia. (Inches)	6/4	N/A	2/1.5	N/A	12/10
Design Flow (gpm)	200	600	N/A	147	1,500 gpm
Head (ft)	170	170	N/A	154	131
Hydro pneumatic Tank	No		Yes, 85 gallons	No	No

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8: Water Distribution System Analysis

Chapter 8 describes the existing water distribution system, water model development and calibration, design criteria, and overall system performances. All tables and figures are located at the end of this chapter.

Water Distribution System

The City owns and operates a complex water distribution system that is comprised of 145 miles of water mains that span over 10.7 square miles to serve the City's customers. The existing water distribution system and corresponding pressure/service zones are shown in Figure 2-1. Figures 8-1 through 8-19 illustrate the existing water distribution. An inventory of the existing water main network by diameter is summarized in Table 8-1. Table 8-2 provides a summary of the existing water main inventory by material. Understanding material type is valuable as material types impact the water main's life expectancy.

Pressure Reducing Valves

When water system pressures become too high, pressure reducing valves (PRVs) are installed to reduce the system pressure to safe operating levels for customers within the water distribution zone. The City has eighteen PRVs located within the water distribution system. Some valves are active, while other valves are inactive or normally closed. Table 8-3 provides a summary of all of the active and inactive PRVs and their hydraulic grade line settings.

Water System Design Requirements

A hydraulic model was developed and calibrated to analyze each zone under existing and future conditions. The design requirements used to evaluate and identify deficiencies in the water distribution system relate primarily to the flow and pressure delivered by the system to the customers. SWRCB-DDW (previously CDPH) regulates the requirements for minimum system pressures within a water distribution system. Per the existing Waterworks Standards, Chapter 16, Section 64602, last updated March 9, 2008 by the CDPH:

a) Each distribution system shall be operated in a manner to assure that the minimum operating pressure in the water main at the user service line connection, throughout the distribution system, is not less than 20 pounds per square (psi) inch at all times.
b) Each new distribution system that expands the existing system service connections by more than 20 percent or that may otherwise adversely affect the distribution system pressure shall be designed to provide a minimum operating pressure throughout the new distribution system of not less than 40 psi at all times excluding fire flow.

Ideally, normal operating (static) pressures should be within the range of 40 to 80 psi. This is the range that most people find comfortable and will serve most fire sprinkler systems. For the existing system, the design criteria for this water master plan is to recommend average day, maximum day, and peak

hour pressures to be no less than 40 psi. This falls in line with Waterwork's intention for new water distribution systems or existing systems to be expanded.

It should be noted that prior to this CDPH update in 2008, the required system pressure under all conditions except fire flow was 30 psi. As noted in b) above, unless the City expands the system, the system pressure is "grand-fathered in" to a service pressure of 30 psi. When completing the water model analysis, the water system was analyzed to maintain 40 psi throughout the entire distribution system. A few locations throughout the City are unable to meet this minimum system pressure of 40 psi due to elevation difference between the customer service and the tank that serves the home. The Water Master Plan will evaluate the cost/benefit ratio of altering the system to improve system pressures or to maintain the system status quo.

Pressures higher than 80 psi are acceptable within the distribution system, but should be reduced to 80 psi or lower at the service connection to prevent water hammer effects or leakage through washers and seats within a home. Reducing system pressure also helps to conserve water within the home. The City has several areas within the distribution system that have pressures higher than 80 psi due to elevation differences within a distribution zone. ***It is recommended that all customers with service pressures above 80 psi have individual pressure reducing valves behind the water meter (homeowner owned) prior to entering the customers home or irrigation system.***

It is also recommended to maintain water pressure within the distribution system at or below a maximum ceiling of 150 psi. Residual pressures throughout the entire distribution system under fire flow conditions shall be maintained at a minimum of 20 psi.

The flow requirements examined in the hydraulic model include average day demand, peak hour demand, and fire flow plus maximum day demand. The various flow scenarios are summarized as follows:

Average Day Demand (ADD): This flow condition is used to evaluate the system subject to the most common conditions. The existing demands were assigned throughout the distribution system by zone, based on the demands noted in Chapter 4. The tanks were modeled full (two feet below overflow) during this scenario to identify the typical high conditions the City's customers will experience on a daily basis. In addition, all wells and booster stations turned off, excluding the hydro-pneumatic zones. The hydro-pneumatic tanks were modeled at the high pressure operating range with the booster pumps off.

Peak Hour Demand (PHD): This demand condition is used to identify system deficiencies at the maximum domestic use. A peaking factor per Table 4-4 of this report was applied to average day demand to obtain peak hour demand. The tanks were modeled at ½ full during this scenario to identify the typical low conditions the City's customers will experience on a daily basis. In addition, all wells and booster stations turned off, excluding the hydro-pneumatic zones. The hydro-pneumatic tanks were modeled at the low pressure operating range with the booster pumps off.

Fire Flow (FF) Plus Maximum Day Demand (MDD): This demand condition is used to identify system deficiencies under fire flow conditions. A peaking factor per Table 4-4 of this report was applied to average day demand to obtain maximum day demand. The tanks were modeled at ¾ full during this scenario. This tank level is most common throughout the day. In addition, all wells and booster stations turned off, excluding the hydro-pneumatic zones. The hydro-pneumatic zones were modeled with a combination of booster pumps on to represent the maximum fire flow available within the respective hydro-pneumatic zones. This excludes the Reservoir Canyon Zone as the City is not required to provide fire flow demand to this zone. Residential, commercial, industrial, and school fire flow requirements were established based on the City Fire Department's requirements as well as the current Uniform Fire Code (UFC), which have become more stringent over time. In accordance with UFC requirements, no more than 1,000 gpm was extracted from any single hydrant. In addition, only one fire flow City-wide is modeled at any one time.

Based on a discussion with the City Fire Department (Rodger Maggio on July 19, 2013), Table 8-4 provides a summary of the fire flow requirements that were utilized to identify hydraulic deficiencies throughout the water distribution system and determine fire storage recommendations (see Tables 6-3 and 6-7). The fire flow requirements are based on land use.

The following parameters will be employed to identify conditions for each run of the model:

1. Domestic pressures below 40 psi for ADD, MDD, and PHD
2. Pipeline velocities exceeding five feet per second (fps) at ADD, MDD, and PHD are identified. In general, velocities higher than five fps create excessive pressure losses.
3. Pipeline velocities exceeding 10 fps during fire flow conditions plus MDD are identified. Pipelines near the source of the fire are identified if velocities exceeded 15 fps.
4. During fire flow model runs, service pressures below 20 psi at any node within the distribution system were identified.

The hydraulic parameters and design criteria for the evaluation of the City's water system are summarized in Table 8-5.

Water Model Development

In order to evaluate the performance of the existing water system, identify deficiencies in the network, and recommend improvements, a computer based hydraulic model was developed using computer program WaterCAD by Bentley Systems Inc. Elevation, pipe diameter, and pipe material for the distribution system was obtained using the City's GIS database. The City also provided an existing water model, water billing records, pump station data, and record drawings.

Table 8-6 provides a summary of the Hazen-Williams roughness coefficients ("C" factor) for the water mains used in the hydraulic model. The table provides a low and high "C" Factor. The low value represents older water mains, while the higher value represents newer water mains. The "C" Factor was adjusted for various water mains as part of the calibration process.

Model Calibration

The hydraulic model was calibrated using field hydrant testing that was conducted between June 6, 2013 and June 10, 2013. The results of the fire hydrant testing are provided in Appendix C.

Each zone was analyzed in the model by simulating the field fire flow tests and comparing the resulting modeled pressures with those observed in the field. Adjustments to pipe friction factors (Hazen-Williams coefficient) were made in to calibrate each zone. Zones that had a designated supply tank and that could be hydraulically isolated from the system were calibrated individually. Zones that did not have a designated tank and were hydraulically dependent on other zones were calibrated in concert with their corresponding supply zones. Each zone was calibrated to within +/- 5 psi of the fire hydrant tests conducted.

Existing System Performance

The performance of the City's water distribution system was evaluated under existing conditions based on the current pressure zone configuration. The model was evaluated under ADD, PHD, and Fire Flow plus MDD to identify where the deficiencies are within each zone. As noted previously, there are several opportunities to consolidate distribution zones, thus simplifying operations, reducing pumping needs, and eliminating facilities that will soon require significant upgrades. **The water system upgrades provided below are based on the proposed zone consolidations.** If the City chooses not to consolidate the distribution zones, additional CIPs may be required and some of the proposed CIPs may no longer be necessary. Additional analysis should be completed to quantify the impacts of not consolidating the zones. The following recommended CIPs are based on the zone consolidation; therefore they are listed under their proposed zone. The following is summary of the recommended zone consolidations:

1. **Bishop zone:** consolidate with High Pressure Zone
2. **Ferrini Zone:** consolidate with High Pressure Zone
3. **Highland Zone:** consolidate with High Pressure Zone
4. **Patricia Zone:** consolidate with High Pressure and Foothill Zone
5. **Reservoir #1 Zone:** consolidate with Foothill Zone
6. **Serrano Zone:** consolidate with Foothill Zone
7. **Slack Zone:** consolidate with Foothill Zone

The resulting consolidations will reduce the pressure zones from 16 down to 9.

Alrita Zone

Under existing conditions, the Alrita Zone is capable of meeting all demand conditions, thus no upgrades are required.

Andrews Zone

The Andrews Zone is fed via a PRV from the High Pressure Zone. There are also two connections to the Reservoir 1 Zone via a check valve that would allow Reservoir 1 to back feed into the Andrews Zone under emergency conditions. The following projects are recommended for the Andrews Zone:

Cazadero PRV: The highest elevation homes in the Andrews Zone experience sub-40 psi system pressures during ADD. To increase service pressures in the Andrews Zone it is recommended to increase the pressure setting at the San Luis/Cazadero PRV from 64 psi to 80 psi. This will increase overall system pressures allowing the customers at the highest elevations to meet the minimum pressures of 40 psi while all other homes remain under 80 psi.

San Luis Drive 2: The head loss through the existing 8-inch water main on San Luis Drive impacts the available fire flow to the higher elevation areas in the Andrews Zone. The available fire flow is less than 75% of the required fire flow. To increase fire flow, it is recommended to upgrade 850 feet of existing 8-inch water main to 12-inch PVC on San Luis Drive from California Boulevard to Cazadero Street.

Downtown Zone

The Downtown Zone is fed via three PRVs from the Foothill Zone. The Downtown Zone does not have its own storage. This zone provides fire flow to the downtown commercial area and hotels. There are a couple of areas within the Downtown Zone that experience system pressures under 40 psi. There are also several customers within the Downtown Zone that have service pressures over 80 psi. ***These services are recommended to have individual Private PRVs.***

The following projects are recommended for the Downtown Zone.

Woodbridge Zone Change: The water main on Woodbridge Street from Broad Street to Victoria Avenue is a dead-end 8-inch PVC main that is unable to provide the required 4,000 gpm fire flow. It is recommended to expand the Terrace Hill Zone to include this water main and create additional looping to increase available fire flow. The zone change would require installation of a new gate valve on the existing 12-inch water main in Broad Street, on the north side of the Broad Street and Woodbridge Street intersection. Closing this gate valve and opening the normally closed gate valve on the south side of the intersection would create a new loop in the Terrace Hill zone along Broad, Caudill, Victoria, and Woodbridge Streets. This project also requires decommissioning the normally closed Broad/Caudill PRV. This PRV is currently not in use.

Dana: Dana is a long dead-end water main and meets between 50-75% of the fire flow requirements. There are two options that mitigate the problem. Option 1 is to upgrade 1,150 feet of 8-inch water main to 10-inch PVC on Dana Street from Nipomo Street southwest to the end of the water main. Option 2 is to construct approximately 250 feet of new 8-inch water main under Brizzolara Creek to connect to the existing water main in Brizzolara Street. Option 2 would likely need to be constructed using trenchless technology to minimize disturbance to the creek. This option requires more environmental coordination, but eliminates a long dead-end water main thereby decreasing long-term water quality concerns.

The following is a list of the 4-inch water mains that should be upgraded to 8-inch PVC:

Lincoln: Upgrade 1,520 feet of water main on Lincoln Street from Chorro Street to West Street, excluding the existing 8-inch water main from Center Street to Venable Street.

Higuera: Upgrade 480 feet of water main on Higuera Street from Toro Street to Johnson Avenue.

Sendero: Upgrade 430 feet of water main on Sendero Street from Corrida Drive to Woodbridge Street.

Edna Saddle Zone

The Edna Saddle Zone is the largest zone and serves residential, commercial, industrial and hotels. The following projects are recommended for the Edna Saddle Zone:

Industrial Way Zone Change: The water main on Industrial Way in the Edna Saddle Zone is a long dead-end 8-inch water main and is unable to provide the required 4,000 gpm fire flow. It is recommended to extend the Edna Saddle Zone to include all the water mains between Industrial Way and Tank Farm Road, which would provide looping needed to obtain the required fire flow on Industrial Way. This zone change can be accomplished by opening the normally closed valve on the west side of the Industrial Way and Sacramento Drive intersection, and closing the normally open valve on the north side of the Industrial Way and Sacramento Drive intersection.

Calle Joaquin: The available fire flow at the south end of Calle Joaquin is between 50-75% of the required fire flow for this commercial area. It is recommended to upgrade 3,040 feet of 8-inch water main to 12- inch PVC on Calle Joaquin, from Los Osos Valley Road southwest to the end of the waterline. This project is required even if the proposed development to the north of Calle Joaquin is constructed with new loops back to the existing water main on Calle Joaquin.

Broad: The commercial properties along Broad Street from Tank Farm Road south to the Airport do not meet the required fire flow (between 75-100%). It is recommended to upgrade 1,700 feet of 10- and 12-inch cast iron water main to 12-inch PVC on Broad Street from Tank Farm Road to Fuller Street.

Madonna Shopping Center: The Madonna Shopping Center has large commercial development served with fire hydrants off of long dead-end water mains. The available fire flow is between 50-75% of the required fire flow for the commercial center. Two upgrades are recommended for this shopping center:

- Construct 690 feet of new 12-inch PVC from the end of the 8-inch water main on Dalidio Drive east to the 12-inch water main at the south end of the commercial development.
- Construct 380 feet of new 12-inch PVC behind the Madonna Plaza shopping center (Ralph's and Kohls) from the end of the existing 12-inch water main to the existing 12-inch water main in Madonna Road.

Foothill Zone

The Foothill Zone provides water service to residential and commercial development, which requires fire flow between 1,500 gpm and 4,000 gpm. Most significantly, the Foothill Zone also serves Sierra Vista Hospital, which requires 6,000 gpm fire flow. Due to elevation, there are several customers that experience between 30 and 40 psi under normal operating conditions in the Foothill Zone.

It is recommended that Reservoir 1 Zone be consolidated with the Foothill Zone. This change would allow the Reservoir 1 tank to fill by gravity from the Clear Wells, decreasing pumping and therefore energy usage at the Transfer Pump Station. Consolidating the two zones would reduce the useable capacity in Reservoir 1.

The following projects are recommended for the Foothill Zone:

Hathway/Montalban PRV: As noted in Chapter 8, it is recommended to consolidate the Foothill Zone and Reservoir 1 Zone. To complete this consolidation, the Hathway/Montalban PRV must be relocated to the south side of Highway 101, to connect the two zones and allow the PRV to continue to provide water to the Downtown Zone.

Bishop Peak Elementary: Bishop Peak Elementary School requires 2,500 gpm fire flow. The existing water main is capable of providing less than 50% of this required fire flow. The water main that serves the elementary school is 6- and 8-inch asbestos cement. It is recommended to replace 580 feet of existing 8-inch with 8-inch PVC on Jaycee Drive, and to construct 770 feet of new 8-inch PVC water main from Jaycee Drive into the parking lot of Bishop Peak Elementary School, and connect back to Craig Way. In addition, it is recommend to replace 260-feet of existing 6-inch with 12-inch PVC on Craig Way from Patricia Street to Jaycee Drive.

Westmont: To increase fire flows that are currently less than 50% of the required fire flow, it is recommended to construct 500 feet of new 8-inch PVC water main from the end of Westmont Avenue at Jeffrey Drive to Stanford Drive. The project area is currently undeveloped. Therefore, the new water main may require an easement, or if future development is proposed at this location the new water main should follow proposed road alignments.

Highland: To increase fire flows that are currently less than 50% of the required fire flow, it is recommended to upgrade 2,800 feet of 6- and 8-inch water main to 12-inch PVC on Highland Drive from Santa Rosa Street (Highway 1) to Patricia Drive.

La Entrada 2: Homes on La Entrada Avenue receive less than 50% of the required fire flow. It is recommended to upgrade 1,100 feet of 6-inch water main to 8-inch PVC on La Entrada Avenue from the La Entrada/Catalina PRV at Catalina Drive to Foothill Boulevard. It is also recommended to abandon the 8-inch water mains that run through backyard easements just east of La Entrada from Foothill Boulevard to Ramona Drive and from Del Mar Court to La Entrada Avenue. To maintain looping, the water main in the backyard easement between Ramona and Del Mar Court should remain.

Murray: Sierra Vista Hospital is an essential facility and requires a fire flow of 6,000 gpm. Several water mains surrounding the hospital are under-sized and provide less than 50% of the required fire flow. The following upgrades are recommended to be completed:

- Upgrade 700 feet of 6- and 8-inch to 12-inch PVC on Murray Street from Santa Rosa Street to Casa Street.

- Upgrade 900 feet of 4- and 6-inch to 12-inch PVC on Casa Street, north of Murray Street and connecting to the existing 10-inch main just south of Deseret Place.

Chorro: The Foothill Zone has four dead end mains as a result of closed gate valves used to separate the Foothill Zone from the Downtown Zone. The dead end mains are located on Meinecke Avenue and Murray Street at the intersection with Chorro Street. It is recommended to construct new water main at these intersections to connect the Foothill Zone across Chorro Street, and abandon the portion of water main that connects to the Downtown Zone. Approximately 100 feet of new 8-inch PVC is required for this project.

Swazey Zone Boundary Change: The Terrace Hill Zone serves the homes on Swazey Street and Rachel Street via a long dead-end 8-inch water main, which is unable to provide the required 1,500 gpm fire flow. It is recommended to modify the zone boundary and include Swazey Street and Rachel Street into the Foothill Zone. This change significantly decreases the length of the dead-end main, thereby increasing available fire flow. The zone change requires the installation of a new gate valve on the existing 8-inch water main in Rachel Street, midway between Jennifer Street and Florence Avenue. Closing this new valve and opening the normally closed gate valve at the Swazey Street and Jennifer Street intersection will bring Swazey Street and the north half of Rachel Street into the new Foothill zone (existing Reservoir 1 zone).

Olive: There are several hotels on Olive Street that currently receive between 50-75% fire flow capacity due to the long dead-end 8-inch water main that serves these properties. There are two options for this upgrade. Option 1 is to upgrade 800 feet of 8-inch to 12-inch PVC on Olive Street, from Santa Rosa Street (Highway 1) to the last fire hydrant on Olive Street. Option 2 is to construct 800 feet of new 8-inch PVC water main in a new easement through the parking lots behind the Rodeway Inn and the restaurants and connect back to Santa Rosa Street. The new 8-inch water main option eliminates a long dead-end water main and thereby decreases water quality concerns. The 8-inch option also minimizes construction on Olive Street, which is the access to the on-ramp to Highway 101 South.

Garfield: The commercial properties on Garfield currently receive between 50-75% fire flow required. It is recommended to upgrade 310 feet of 8-inch to 12-inch PVC on Garfield Street from Henderson Street to Monterey Street.

Rosita: The customers in this area receive between 50-75% of the required fire flow. It is recommended to upgrade 400 feet of 4-inch to 8-inch PVC on Rosita Street from Cerro Romauldo to Foothill Boulevard.

The following is a list of the 4-inch water mains that should be upgraded to 8-inch PVC:

Craig & Christina: Upgrade 1,360 feet of water main on Craig Way from Patricia Drive to Jeffrey Drive and on Christina Way from Craig Way to Warren Way.

La Canada: Upgrade 850 feet of 4-inch and 6-inch water main on La Canada Drive from Cerro Romauldo to Tolosa Way.

Johnson 2: Upgrade 370 feet of water main on Johnson Avenue from Peach Street to Mill Street.

Mill 2: Upgrade 520 feet of pipe on Mill Street from Johnson Avenue to Pepper Street.

High Pressure Zone

The High Pressure Zone has several zones being consolidated into this zone, including the Slack, Bishop, Serrano, Patricia, Highland, and Ferrini Zones. There are several water main upgrades that are required before the consolidation occurs. The following projects are recommended for the High Pressure Zone:

Longview: The existing Slack Zone has several long dead-end mains. It is recommended to install a new gate valve on the existing 6-inch water main in Longview Lane, on the north side of the Longview and Slack Street intersection. Closing this new gate valve and also closing the existing valve on the south side of the Longview Lane and Albert Drive intersection while opening the normally closed valve on the east side of the Longview Lane and Slack Street intersection will create a new loop in the Slack zone between Slack Street, Longview Lane, and Albert Drive. This change will create a new dead-end main in the High Pressure Zone on Longview Lane. However, additional recommended projects will allow for the consolidation of the Slack Zone and High Pressure zone, therefore this new dead-end main would be a temporary condition.

Fredericks: *This project is required to be completed prior to eliminating the McCollum Pump Station in the Slack Zone*. The Slack Zone receives less than 50% of its fire flow capacity. The following projects are recommended, to replace old tuberculated cast iron pipe with new PVC:

- Upgrade 330 feet of 12-inch cast iron to 12-inch PVC on Hathway Avenue from California Boulevard to Fredericks Street.
- Upgrade 2,490 feet of 12-inch cast iron to 12-inch PVC on Fredericks Street from Hathway Avenue to Grand Avenue.

McCollum: The existing Slack Zone has several areas that receive less than 50% of the required fire flow. It is recommended to upgrade 850 feet of 4- and 6-inch water main to 8-inch PVC on McCollum Street, from Albert Drive to Grand Avenue.

Bishop Consolidation: The Bishop Zone parallels the High Pressure Zone on Johnson Avenue near Lizzie Street. It is recommended to connect the two zones at the intersection of Johnson Avenue and Lizzie Street, Iris Street, Ella Street and Fixlini Street. Also, connect the two zones at the intersection of Lizzie Street at Fixlini Street. All connections should be 8-inch PVC. The total length of new 8-inch water main is approximately 200 feet. *This project should be completed prior to removing the Bishop Pump Station from service.*

Stenner Creek: To consolidate the High Pressure Zone with the Ferrini Zone, it is recommended to construct 2,800 feet of new 12-inch PVC on Stenner Creek Road from Mount Bishop Road to Highway 1, past the Ferrini Pump Station, and up the hill to Montrose Drive. This project will

upgrade the existing 10-inch ductile iron water main between the Ferrini Pump Station and Montrose Drive.

Serrano Consolidation: To consolidate the High Pressure Zone with the Serrano Zone, it is recommended to construct 7,200 feet of 12-inch PVC from Highway 1 at Foothill Boulevard to Hermosa Way at Luneta Drive. Portions of this alignment include upgrading existing 4- and 8-inch cast iron and asbestos cement mains to new 12-inch PVC. The exact alignment for this transmission main can be determined by the City at the time of final design. In addition, it is recommended to construct 400 feet of new 8-inch PVC on Luneta Drive from Rafael Way to Tassajara Drive to create a new loop in the Foothill zone. Following construction of the new water mains, the existing normally closed valves that separate the Foothill Zone from the Serrano zone on Rafael Way and Tassajara Drive should be opened.

Patricia: To consolidate the north half of the Patricia Zone with the High Pressure Zone and the Foothill Zone, it is recommended to construct the following:

- Install 1,080 feet of new 12-inch PVC on Cerro Romauldo from Patricia Drive to Los Cerros Drive.
- Install 1,130 feet of new 12-inch PVC on Patricia Drive from Cerro Romauldo to Highland Drive.
- Install 270 feet of new 8-inch PVC on Patricia Drive from Highland Drive to Fel-Mar Drive.
- Upgrade 280 feet of 6-inch to 8-inch PVC on Highland Drive from Fel-Mar Drive to 113 Highland Drive.

In addition to the above water main upgrades, all normally closed gate valves north of Foothill Boulevard should be opened to consolidate the Patricia and Foothill zones. With the construction of the new water mains, the homes at the Cerro Romauldo and Los Cerros Drive intersection should be tied over to the new High Pressure zone with new Private PRVs on the service lines. With these recommended upgrades the remaining Patricia Zone south of Foothill Boulevard will continue to be supplied water through the La Entrada/Catalina PRV. To isolate the Patricia Zone it is required to close the existing gate valves on the south side of Foothill Boulevard at La Entrada Avenue and at the waterline that runs in a backyard easement between Foothill Boulevard and Ramona Drive.

La Entrada 1: To consolidate the south half of the Patricia Zone with the High Pressure and Foothill zones, and to provide sufficient fire flow to the consolidated zones, it is recommended to complete the following projects:

- Upgrade 880 feet of 6- and 8-inch water main to 12-inch PVC on La Entrada Ave from Hermosa Way to San Jose Court.
- Install 1,420 feet of new 12-inch PVC on La Entrada from San Jose Court to Foothill Boulevard, across Foothill Boulevard, and continuing up Patricia Drive to Cerro Romauldo.

With this zone consolidation it is recommended for the La Entrada/Catalina PRV to remain in service, to provide redundancy for the Foothill Zone. However, the PRV setting will need to be adjusted to 35 psi.

Slack: The existing Slack Zone has several areas that receive less than 50% of the required fire flow. It is recommended to upgrade 640 feet of 6-inch water main to 8-inch PVC on Slack Street from Henderson Avenue to the Slack Street Tank.

Hillcrest: In order to increase fire flow to the expanded High Pressure Zone and to eliminate a long dead-end water main, it is recommended to construct 220 feet of new 8-inch PVC from the existing 8-inch water main at the end of Hillcrest Place to connect to the 16-inch water main on California Boulevard.

El Paseo: The homes at the end of El Paseo and El Cerrito have pressures less than 30 psi and receive fire flows between 75-100% of the required fire flow. It is recommended to complete the following upgrades:

- Upgrade 290 feet of 8-inch to 10-inch PVC on El Paseo Court from Flora Street to El Cerrito.
- Upgrade 670 feet of 8-inch ductile iron to 8-inch PVC on El Cerrito Court from El Paseo Court to the end of the water main (end of cul-de-sac).

Boulevard Del Campo: Due to elevation, the homes on Boulevard Del Campo have less than 30 psi and receive less than 50% of the required fire flow. It is recommended to expand the High Pressure zone to include these homes, to increase service pressure and available fire flow. To make this zone change, it is recommended to construct approximately 550 feet of new 8-inch PVC water main from Bishop Street south along Boulevard Del Camp to Fletcher Avenue, and connect the existing service lines and fire hydrants to the new water main. The new water main from Boulevard Del Campo to Bishop Street will require a new backyard easement. The existing water main serving the Terrace Hill Zone will remain in place.

Wilding: The homes on Skylark Lane receive fire flow less than 50% of the required fire flow. To increase pressures and available fire flow, it is recommended to upgrade 600 feet of 6-inch to 8-inch PVC on Wilding Lane from 2000 Wilding Lane to Skylark Lane. This project includes replacement of the existing main that is located in a backyard easement between Wilding Lane and Skylark Lane.

Al-Hil: The available fire flow to residential customers in this area is less than 50% of the required fire flow. The following projects are recommended to increase fire flow and improve reliability of the new High Pressure Zone:

- Upgrade 480 feet of 8-inch cast iron to 8-inch PVC on Patricia Drive from Patricia Court to Clover Drive.
- Upgrade 500 feet of 8-inch cast iron to 12-inch PVC in the backyard easement between Patricia Drive and Al-Hil Drive

Clover: The available fire flow to residential customers in this area is less than 50% of the required fire flow. The following projects are recommended:

- Upgrade 690 feet of 8-inch cast iron to 8-inch PVC on Clover Drive from Patricia Drive to Pasatiempo Drive.
- Upgrade 440 feet of 8-inch cast iron to 8-inch PVC on Pasatiempo Drive from Mira Sol Drive to Clover Drive.

Laurel: The commercial properties on Laurel Lane receive between 50-75% of the required fire flow. It is recommended to upgrade 1,000 feet of 6-inch to 8-inch PVC on Laurel Lane from Johnson Avenue to 1248 Laurel Lane (zone break). It is also recommended to install a new fire hydrant at the zone break to meet the City's fire hydrant spacing requirements.

Alrita: The homes at the end of Alrita Street have pressures less than 40 psi. To improve system pressures, it is recommended to upgrade 420 feet of 8-inch cast iron to 8-inch PVC on Alrita Street from Flora Street to Bahia Court.

Flora: There are multiple services within the High Pressure Zone (old Bishop Zone) with service pressure less than 40 psi due to elevations within the Zone. Under fire flow conditions, these homes receive between 75-100% of the fire flow requirements. It is recommended to upgrade 820 feet of 12-inch cast iron to 14-inch PVC on Flora Street from Bishop Street to Bishop Tank. This project will increase fire flow and minimize head loss between the Bishop Tank and the distribution system.

Foothill: The east end of Foothill Boulevard requires 2,000 gpm to serve existing high density residential development. Under existing conditions, the water main provides between 75-100% of the required fire flow. It is recommended to upgrade 670 feet of 6-inch to 8-inch PVC on Foothill Boulevard from Crandall Way east to the end of the line.

The following is a list of the 4-inch water mains that should be upgraded to 8-inch PVC:

Loomis: Upgrade 620 feet of pipe on Loomis Street from Buena Vista Avenue to Santa Ynez Avenue.

Reservoir Canyon Zone

Under existing conditions, the water distribution system is capable of meeting average day, maximum day and peak hour demands. The City does not provide fire flow to this zone. No distribution system projects are required.

Rosemont Zone

Under existing conditions, the Rosemont Zone is capable of meeting all demand conditions, thus not requiring any upgrades. However, due to constraints in the Highland Zone, it is recommended to construct a new pump station at the old Fel-Mar Pump Station site and abandon the Rosemont Pump Station (See Chapter 7). With the construction of the Fel-Mar Pump Station it is recommended to modify the Highland and Rosemont Zone boundaries, extending the Rosemont Zone boundary to serve additional homes along Highland Drive. The new Rosemont Zone will extend to approximately 80 Highland Drive.

Terrace Hill Zone

The following projects are recommended for the Terrace Hill Zone:

Bishop: The Terrace Hill Zone has high industrial fire flow requirements throughout the distribution zone. All demand from the Terrace Hill Tank flows through a 16-inch cast iron water main which provides between 50-75% of the required fire flow. To increase fire flow it is recommended to construct a new loop in the system, comprised of 580 feet of new 8-inch PVC water main on Bishop Street from Terrace Hill Tank to Florence Avenue.

Mutsuhito: To increase fire flow to the industrial buildings on Broad Street, which currently receive between 50-75% fire flow, it is recommended to complete the following upgrades:

- Upgrade 840 feet of 8-inch water main to 12-inch PVC on Mutsuhito Avenue from Broad Street to Garibaldi Avenue.
- Construct 500 feet of new 12-inch PVC in a new easement through the parking lot between Garibaldi Avenue and McMillan Avenue, connecting to the existing water main in McMillan Avenue.

Greta: Upgrade 530 feet of 4-inch water main to 8-inch PVC on Greta Place from Augusta Place to Sydney Street.

Future System Performance

The performance of the City's water distribution system was evaluated under future demand conditions, including the Specific Plan areas. The model was evaluated under ADD, PHD, and Fire Flow plus MDD. The water distribution system was modeled with all of the proposed projects that were identified as existing deficiencies completed. With the proposed upgrades complete and in place to correct existing deficiencies, the City's water distribution system did not have any additional projects that were required to meet future distribution system needs.

Since the timeframe for the construction of future development is unknown, it is recommended that as development is proposed, an evaluation be completed to identify which of the recommended projects are required to be completed to adequately serve the proposed development. This may dictate the priority and timing of a recommended CIP project in the future. In addition, it should be noted the improvements to the existing water distribution system provide significant benefit to future development, ensuring that the water distribution system is capable of providing required fire flow and system pressures to future development.

Specific Plan Areas

The Specific Plan Areas (Airport Area, Orcutt Area, San Luis Ranch, Margarita) were modeled with assumptions on the water main layout and the proposed land uses based on project information available at the time of this report. Figure 8-20 provides an overview of the assumed water main layout based on the road network, and the recommended pipe diameters based on the required fire flow for the proposed Specific Plan Areas. The ancillary piping network serving the Specific Plan Areas should be a minimum of 8-inch diameter and are recommended being looped, minimizing any long dead-end

water mains. As more detailed design for each Specific Plan Area is available, the water model should be updated to confirm water main layout and pipe diameter, to ensure that the proposed water distribution system is able to provide sufficient pressure and fire flow.

Table 8-1. Existing Water Main Inventory by Diameter

Diameter (inches)	Length	
	Feet	Miles
4	9,350	1.8
6	107,850	20.4
8	365,900	69.3
10	69,400	13.1
12	123,150	23.3
14	9,100	1.7
16	29,800	5.6
18	7,750	1.5
20	18,050	3.4
24	18,500	3.5
27	4,500	0.9
30	3,350	0.6
Total	**766,700**	**145.2**

Table 8-2. Existing Water Main Inventory by Material

Material	Length	
	Feet	Miles
PVC	328,200	62.2
Cast Iron	208,500	39.5
Ductile Iron	109,000	20.6
Asbestos Cement	96,700	18.3
Concrete Cylinder Pipe	20,550	3.9
Steel	3,750	0.7
Total	**766,700**	**145.2**

Table 8-3. Existing Pressure Reducing Valves and Control Valves

PRV Name	Elevation (ft)	Valve Diameter (in)	Hydraulic Grade: From (ft)	Pressure: From (psi)	Zone: From	Hydraulic Grade: To (ft)	Pressure: To (psi)	Zone To	Status
Pressure Reducing Valves									
La Entrada/Catalina PRV	333	8	470	100	Serrano	453	52	Patricia	Active
Chorro/Foothill PRV	251	14	417	77	Foothill	385	58	Downtown	Active
Peach/Broad PRV #2	190	14	417	103	Foothill	361	79	Downtown	Active
Peach/Broad PRV #1	190	14	417	103	Foothill	361	79	Downtown	Active
Broad/Caudill PRV	217	12	406	85	Terrace Hill	359	67	Downtown	Inactive
Kentwood/Johnson PRV	313	6	687	104	Bishop	406	44	Terrace Hill	Active
Terrace Hill PRV	384	16	548	74	High Pressure	407	13	Terrace Hill	Active
San Luis Drive/Cazadero PRV	264	6	549	126	High Pressure	430	73	Andrews	Active
California/Monterey PRV	250	12	550	132	High Pressure	429	79	Reservoir #1	Active
Grand/Wilson PRV	296	10	550	113	High Pressure	429	59	Reservoir #1	Active
Ella/Binns PRV	294	8	548	113	High Pressure	429	60	Reservoir #1	Active
Skyline/Mira Sol PRV	368	8	580	93	Ferrini	547	78	Highland	Active
Patricia PRV	344	6	580	104	Ferrini	547	88	Highland	Active
Foothill/Railroad PRV	268	14	550	125	High Pressure	418	69	Foothill	Inactive
San Luis Drive/Johnson PRV	245	6	549	135	High Pressure	429	81	Reservoir #1	Active
Madonna/Higuera	157	16	358	93	Downtown	345	81	Edna Saddle	Active
Hathway/Montalbon	230	10	428	86	Foothill	372	61	Downtown	Active
Hathway/Murray	246	8	428	79	High Pressure	428	79	Foothill	Inactive
Control Valves									
Bullock/Industrial	201	12	Isolates the Islay Zone from the Terrace Hill Zone						

Table 8-4. Fire Flow Requirements by Zoning

Zoning	Fire Flow (gpm)	Duration (hours)	Notes
Residential (low and medium density)	1,500	2	
Residential (high density)	2,000	2	
Neighborhood Commercial	1,500	2	Commercial businesses within residential neighborhoods
Commercial	2,500	2	All other commercial not identified in Neighborhood or Big Box
Big Box Commercial	4,000	4	Large square footage commercial buildings (Home Depot, Costco, Target, Madonna Center)
Industrial	4,000	4	
Hotels	4,000	4	Large hotels (Embassy Suites, Marriot, etc)
Hospital: Unsprinklered	6,000	4	Sierra Vista Hospital
Hospital: Sprinklered	2,375	4	French Hospital
Churches	2,500	2	
Schools	2,500	2	
Cal Poly[1]	5,000	4	

1 This Water Master Plan will evaluate the City's ability to provide 5,000 gpm to Cal Poly's meter. This Water Master Plan will not evaluate the water distribution system on campus, which is operated and maintained by Cal Poly.

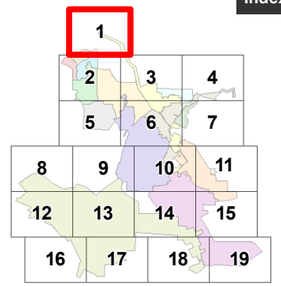
Table 8-5. Summary of Hydraulic Parameters and Design Criteria

Hydraulic Parameters and Design Criteria	Value	Standard
Fire Flow Requirements	See Table 8-4	Uniform Fire Code and City of San Luis Obispo Fire Department and City Standards
Maximum Day Demand Factor	1.5 times ADD	City of San Luis Obispo Water Treatment Plant Records (October 4, 2012)
Peak Hour Demand Factor	Varies by Zone, See Table 4-4 (3.375 or 4.0 times ADD)	Title 22 and Metcalf & Eddy design handbook "Wastewater Engineering, Treatment and Resource Recovery, Fifth Edition", 2014
Minimum System Pressure at ADD, MDD, and PHD	40 psi	California Department of Public Health
Maximum System Pressure at ADD, MDD, and PHD	150 psi (80 psi at water service recommended. Install service PRV if above 80 psi)	
Minimum System Pressure at FF plus MDD	20 psi	
Maximum Pipeline Velocity at ADD, MDD, and PHD	<5 fps	
Maximum Pipeline Velocity at FF	< 10 fps (<15 fps near source of fire)	
Fire Hydrant Spacing	Residential: Maximum 500-feet, except at dead-end streets, it shall be no more than 400-feet Commercial: Maximum 250-feet	2011 City Standards
Pipe Diameter	All new water mains must be 8-inch or greater.	2011 City Standards
Valving	No shut down of greater than 500 feet in high-value districts or greater than 800 feet in other sections.	2011 City Standards

Table 8-6. Modeled Hazen-William's "C" Factors

Material	"C" Factor	
	Low	High
Asbestos Cement	130	130
Concrete Cylinder Pipe	130	130
Cast Iron	70	70
Ductile Iron	70	120
PVC	140	140
Steel	90	90

Index Map



EXISTING WATER DISTRIBUTION SYSTEM

FIGURE 8-1

CITY OF SAN LUIS OBISPO
POTABLE WATER
DISTRIBUTION SYSTEM
OPERATIONS MASTER PLAN

WATER MAINS

- Unknown
- 2"
- 4"
- 6"
- 8"
- 10"
- 12"
- 14"
- 16"
- 18"
- 20"
- 24" and greater

- STORAGE TANKS
- PUMP STATION
- PRESSURE REDUCING
- CHECK VALVES
- SYSTEM VALVES
- ISOLATION VALVES
- PRODUCTION WELL

0 250 500 Feet

1 inch = 500 feet

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HIGHWAY 1
PASEO DE CABALLO
STENNER CREEK
FERRINI
STATE HIGHWAY 1
MOUNT BISHOP
PINNACLES
High Pressure Zone
Ferrini Zone
TWIN RIDGE
MONTROSE

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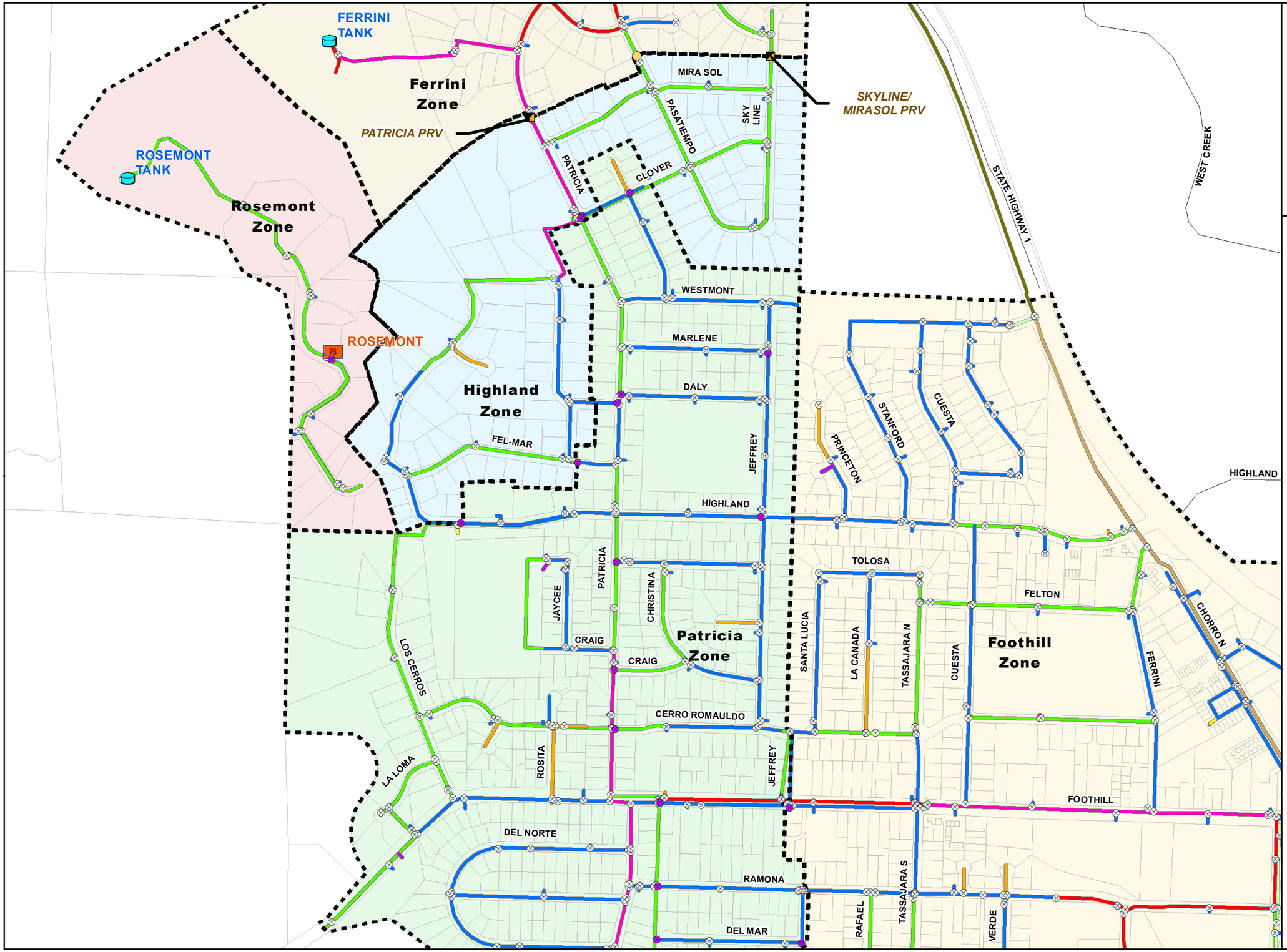

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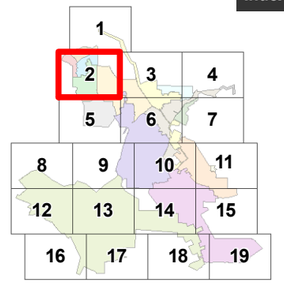

EXISTING WATER DISTRIBUTION SYSTEM

FIGURE 8-2

CITY OF SAN LUIS OBISPO
POTABLE WATER
DISTRIBUTION SYSTEM
OPERATIONS MASTER PLAN

WATER MAINS

- Unknown
- 2"
- 4"
- 6"
- 8"
- 10"
- 12"
- 14"
- 16"
- 18"
- 20"
- 24" and greater

- STORAGE TANKS
- PUMP STATION
- PRESSURE REDUCING
- CHECK VALVES
- SYSTEM VALVES
- ISOLATION VALVES
- PRODUCTION WELL

N

0 250 500 Feet

1 inch = 500 feet

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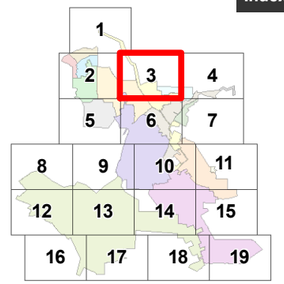

EXISTING WATER DISTRIBUTION SYSTEM

FIGURE 8-3

CITY OF SAN LUIS OBISPO
POTABLE WATER
DISTRIBUTION SYSTEM
OPERATIONS MASTER PLAN

WATER MAINS

- Unknown
- 2"
- 4"
- 6"
- 8"
- 10"
- 12"
- 14"
- 16"
- 18"
- 20"
- 24" and greater

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- CHECK VALVES
- SYSTEM VALVES
- ISOLATION VALVES
- PRODUCTION WELL

0 250 500 Feet
1 inch = 500 feet

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CAL POLY STATE UNIVERSITY

PINNACLES
EAST CREEK
FEED MILL
EUCALYPTUS
POLY CANYON
TRUCKEE
HIGHLAND
WEST CREEK
HIGHLAND
ORCHARD
NAVY
DEXTER
UNIVERSITY
VIA CARTA
MOUNTAIN
KLAMATH
PERIMETER
TRUCKEE
CUESTA
PERIMETER
TAHOE
MOUNTAIN
GRAND
DEER
COLLEGE
CUESTA
PACHECO
DEER
CRANDALL
LONGVIEW
BOYSEN
FOOTHILL/RAILROAD PRV
N/C
Foothill Zone
CHORRO
CHORRO/FOOTHILL PRV
FOOTHILL
FOOTHILL
HATHWAY
High Pressure Zone
CALIFORNIA
HATHWAY
SLACK
Slack Zone
GRAND
HENDERSON
MCCOLLUM
MCCOLLUM
PS
ROUGEOT
Downtown Zone
MEINECKE
FREDERICKS
HOPE

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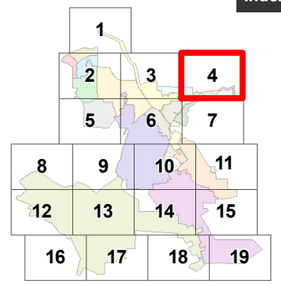

EXISTING WATER DISTRIBUTION SYSTEM

FIGURE 8-4

CITY OF SAN LUIS OBISPO
POTABLE WATER
DISTRIBUTION SYSTEM
OPERATIONS MASTER PLAN

WATER MAINS

- Unknown
- 2"
- 4"
- 6"
- 8"
- 10"
- 12"
- 14"
- 16"
- 18"
- 20"
- 24" and greater

- STORAGE TANKS
- PUMP STATION
- PRESSURE REDUCING
- CHECK VALVES
- SYSTEM VALVES
- ISOLATION VALVES
- PRODUCTION WELL

0 250 500 Feet

1 inch = 500 feet

SLACK TANK

MIOSSI

MIOSSI

RESERVOIR 1

RESERVOIR CANYON

PS

FOX HOLLOW

Slack Zone

Reservoir 1 Zone

Reservoir Canyon Zone

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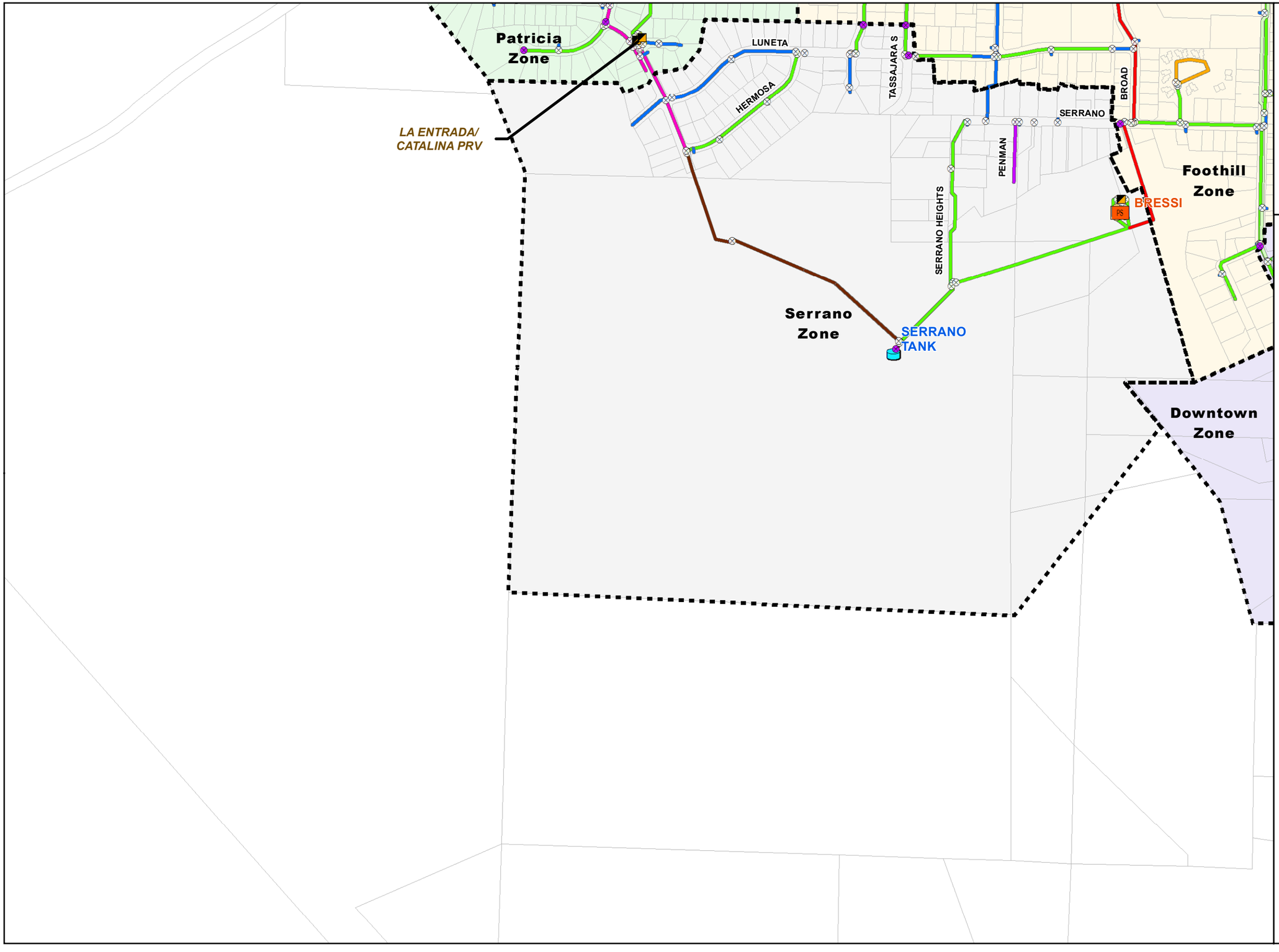

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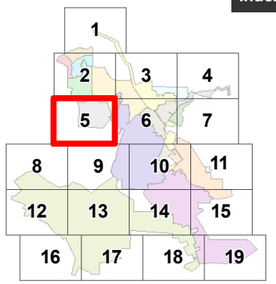

EXISTING WATER DISTRIBUTION SYSTEM

FIGURE 8-5

CITY OF SAN LUIS OBISPO
POTABLE WATER
DISTRIBUTION SYSTEM
OPERATIONS MASTER PLAN

WATER MAINS

- Unknown
- 2"
- 4"
- 6"
- 8"
- 10"
- 12"
- 14"
- 16"
- 18"
- 20"
- 24" and greater

- STORAGE TANKS
- PUMP STATION
- PRESSURE REDUCING
- CHECK VALVES
- SYSTEM VALVES
- ISOLATION VALVES
- PRODUCTION WELL

N

0 250 500 Feet

1 inch = 500 feet

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Index Map

1
2 3 4
5 6 7
8 9 10 11
12 13 14 15
16 17 18 19

EXISTING WATER DISTRIBUTION SYSTEM

FIGURE 8-6

CITY OF SAN LUIS OBISPO
POTABLE WATER
DISTRIBUTION SYSTEM
OPERATIONS MASTER PLAN

WATER MAINS

- Unknown
- 2"
- 4"
- 6"
- 8"
- 10"
- 12"
- 14"
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- 18"
- 20"
- 24" and greater

- STORAGE TANKS
- PUMP STATION
- PRESSURE REDUCING
- CHECK VALVES
- SYSTEM VALVES
- ISOLATION VALVES
- PRODUCTION WELL

N

0 250 500 Feet

1 inch = 500 feet

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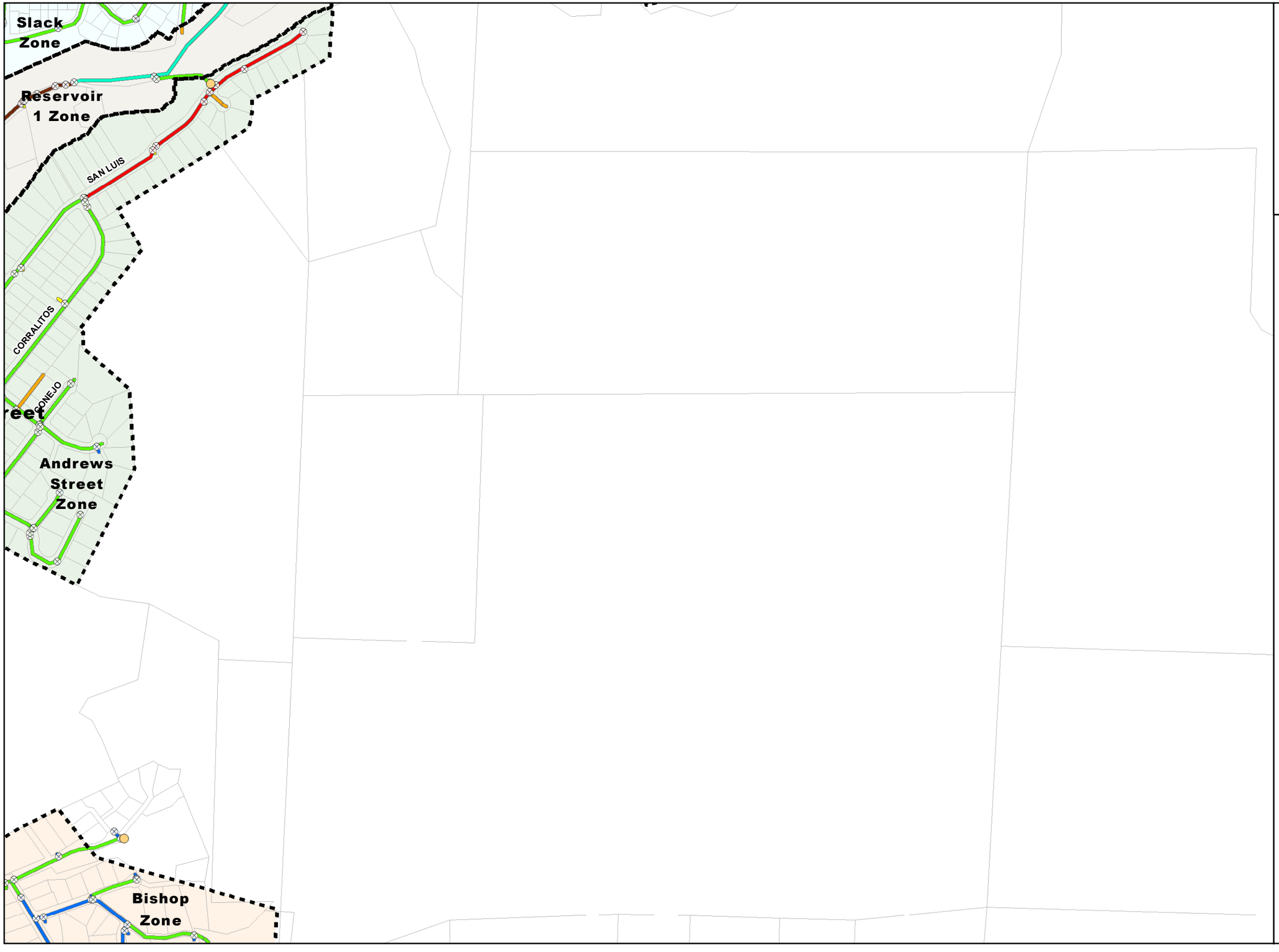

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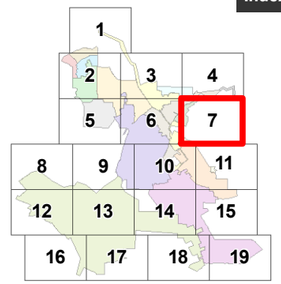

EXISTING WATER DISTRIBUTION SYSTEM

FIGURE 8-7

CITY OF SAN LUIS OBISPO
POTABLE WATER
DISTRIBUTION SYSTEM
OPERATIONS MASTER PLAN

WATER MAINS

- Unknown
- 2"
- 4"
- 6"
- 8"
- 10"
- 12"
- 14"
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- 20"
- 24" and greater

- STORAGE TANKS
- PUMP STATION
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- CHECK VALVES
- SYSTEM VALVES
- ISOLATION VALVES
- PRODUCTION WELL

N

0 250 500 Feet

1 inch = 500 feet

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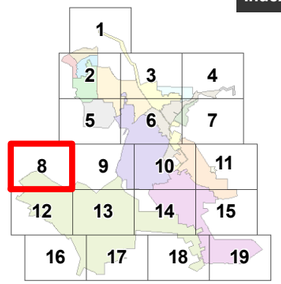

EXISTING WATER DISTRIBUTION SYSTEM

FIGURE 8-8

CITY OF SAN LUIS OBISPO
POTABLE WATER
DISTRIBUTION SYSTEM
OPERATIONS MASTER PLAN

WATER MAINS

- Unknown
- 2"
- 4"
- 6"
- 8"
- 10"
- 12"
- 14"
- 16"
- 18"
- 20"
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- PUMP STATION
- PRESSURE REDUCING
- CHECK VALVES
- SYSTEM VALVES
- ISOLATION VALVES
- PRODUCTION WELL

N

0 250 500 Feet

1 inch = 500 feet

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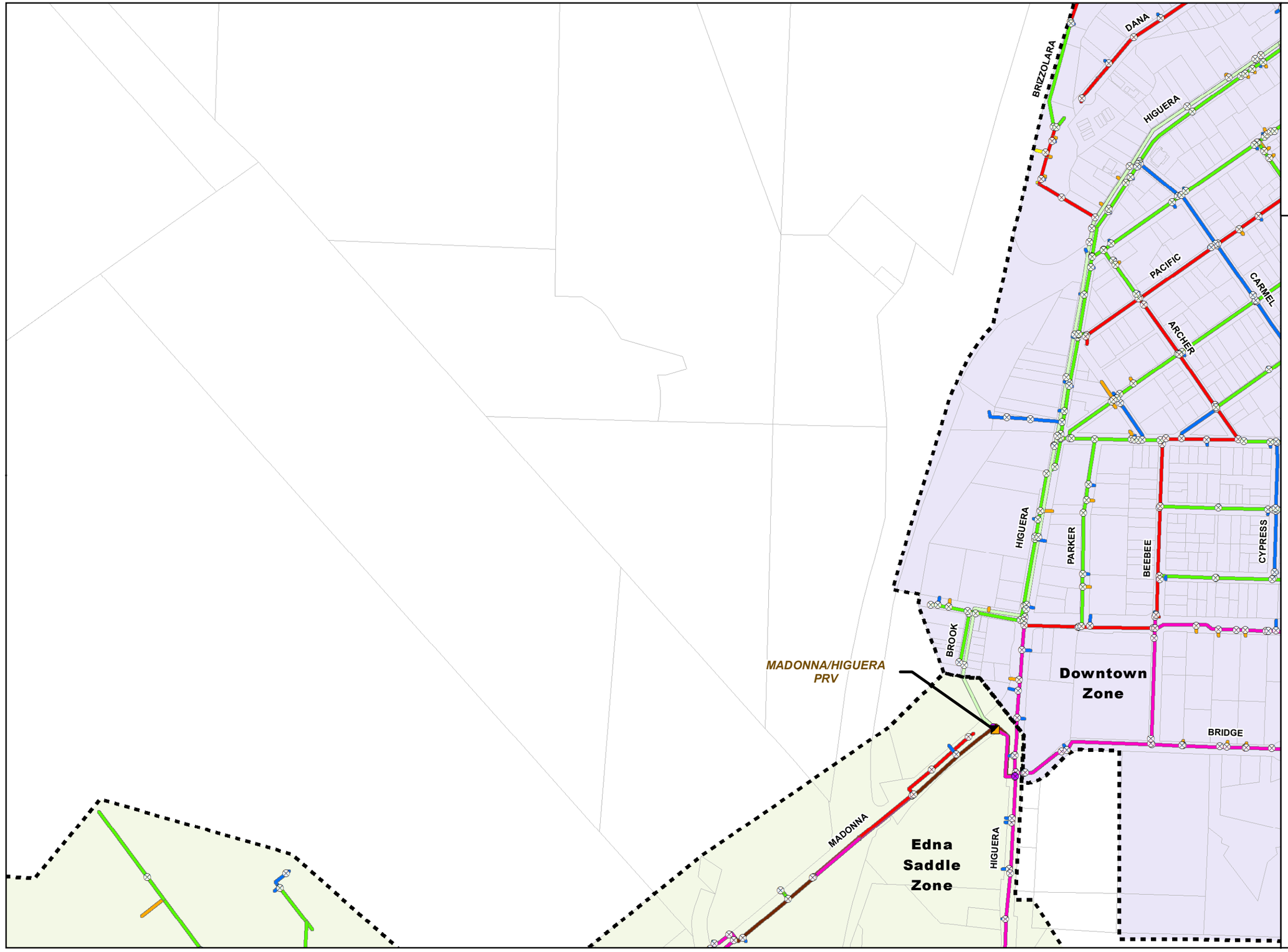

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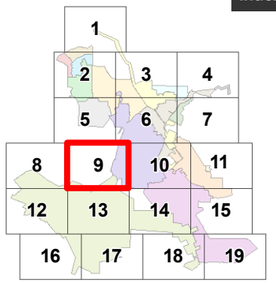


EXISTING WATER DISTRIBUTION SYSTEM

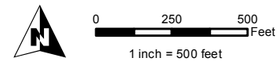
FIGURE 8-9

CITY OF SAN LUIS OBISPO
POTABLE WATER
DISTRIBUTION SYSTEM
OPERATIONS MASTER PLAN

WATER MAINS

- Unknown
- 2"
- 4"
- 6"
- 8"
- 10"
- 12"
- 14"
- 16"
- 18"
- 20"
- 24" and greater

- STORAGE TANKS
- PUMP STATION
- PRESSURE REDUCING
- CHECK VALVES
- SYSTEM VALVES
- ISOLATION VALVES
- PRODUCTION WELL



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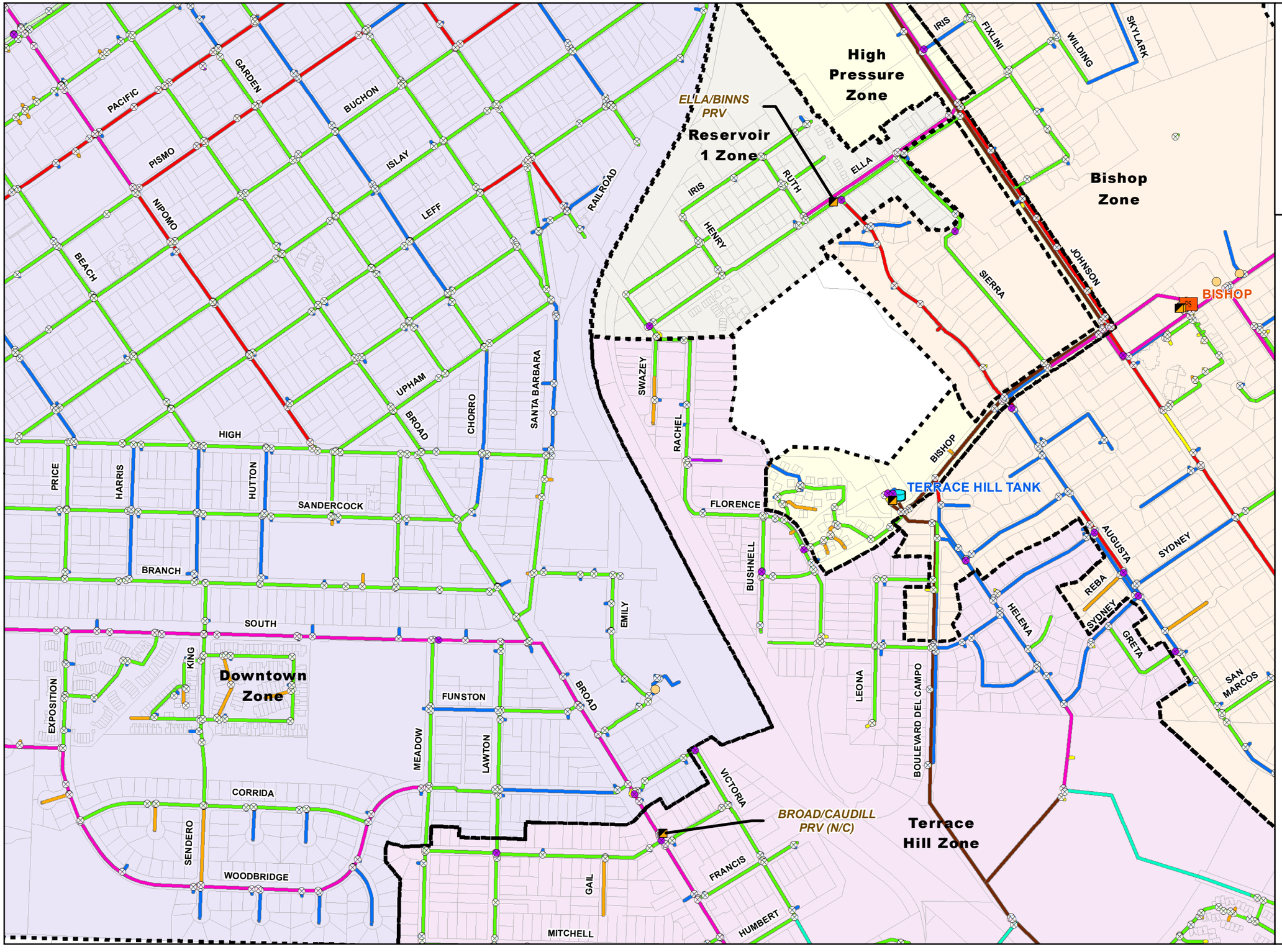

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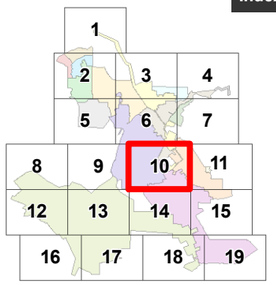

EXISTING WATER DISTRIBUTION SYSTEM

FIGURE 8-10

CITY OF SAN LUIS OBISPO
POTABLE WATER
DISTRIBUTION SYSTEM
OPERATIONS MASTER PLAN

WATER MAINS

- Unknown
- 2"
- 4"
- 6"
- 8"
- 10"
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- CHECK VALVES
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- PRODUCTION WELL

0 250 500 Feet

1 inch = 500 feet

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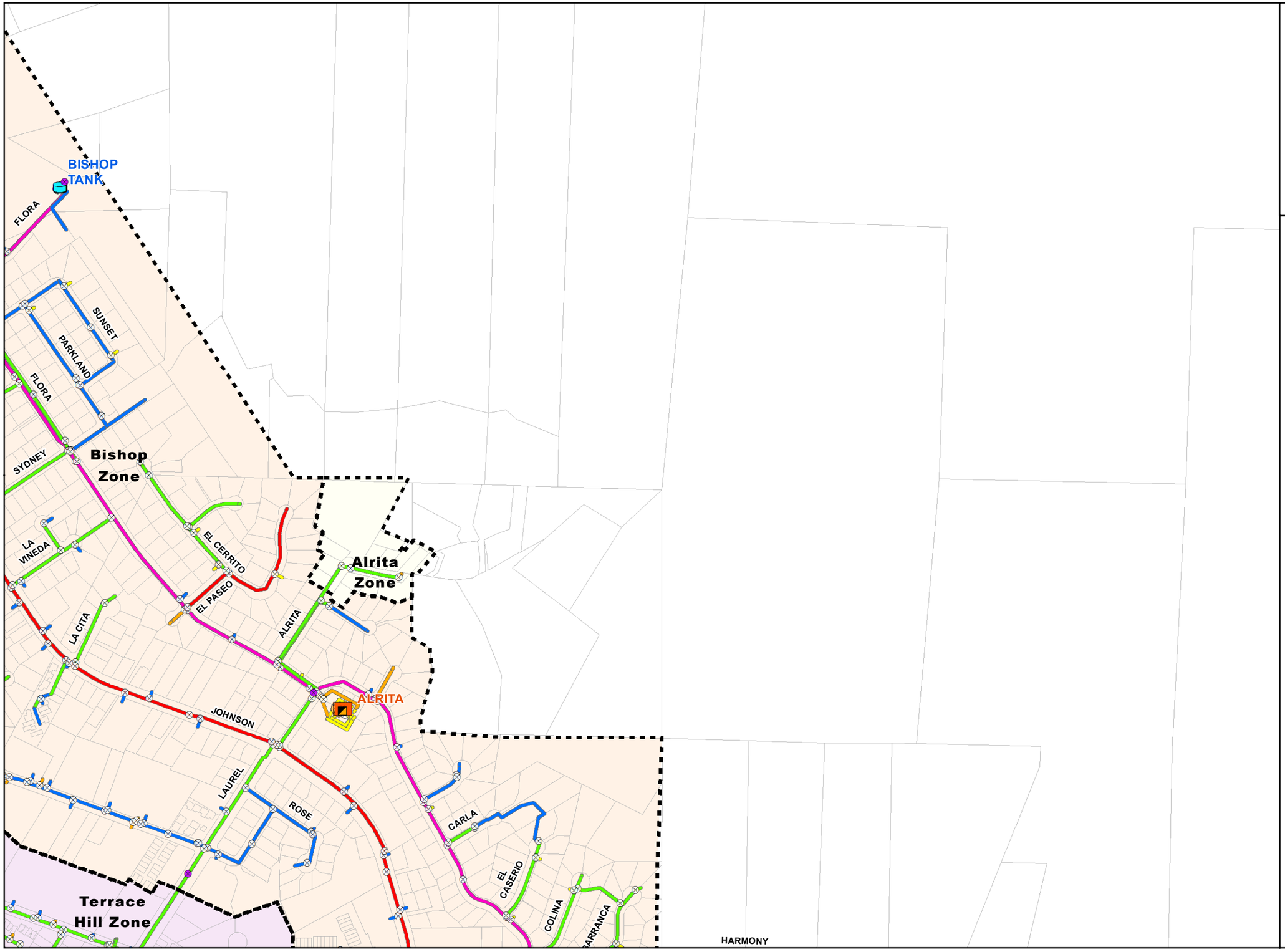

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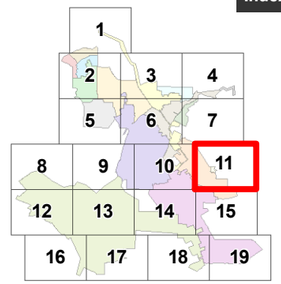

EXISTING WATER DISTRIBUTION SYSTEM

FIGURE 8-11

CITY OF SAN LUIS OBISPO
POTABLE WATER
DISTRIBUTION SYSTEM
OPERATIONS MASTER PLAN

WATER MAINS

- Unknown
- 2"
- 4"
- 6"
- 8"
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- PRESSURE REDUCING
- CHECK VALVES
- SYSTEM VALVES
- ISOLATION VALVES
- PRODUCTION WELL

N

0 250 500 Feet

1 inch = 500 feet

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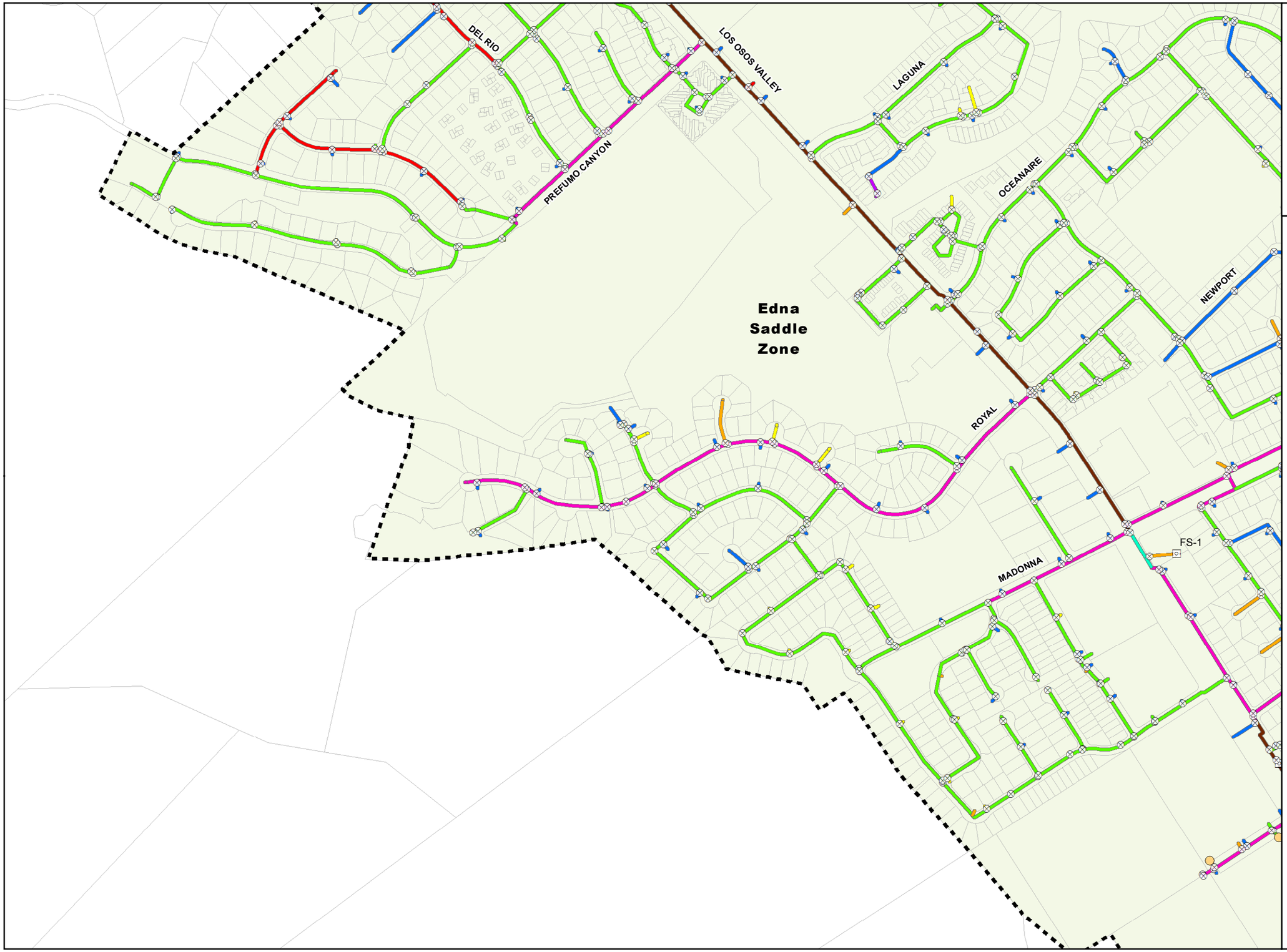

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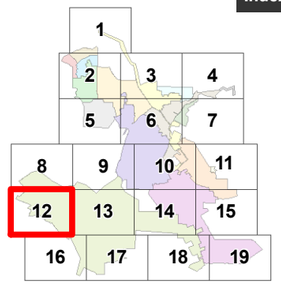

EXISTING WATER DISTRIBUTION SYSTEM

FIGURE 8-12

CITY OF SAN LUIS OBISPO
POTABLE WATER
DISTRIBUTION SYSTEM
OPERATIONS MASTER PLAN

WATER MAINS

- Unknown
- 2"
- 4"
- 6"
- 8"
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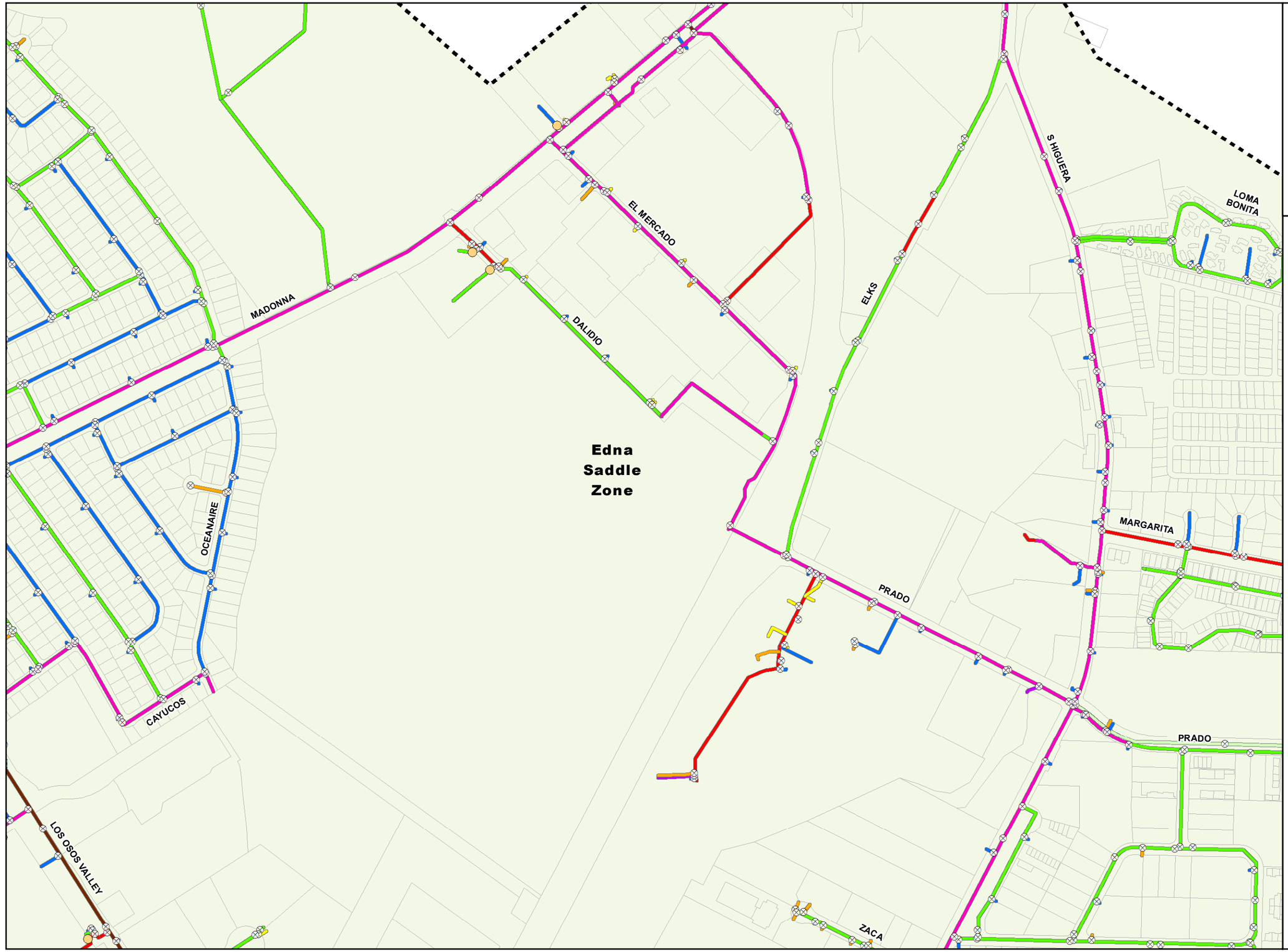

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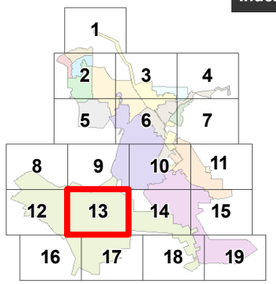

EXISTING WATER DISTRIBUTION SYSTEM

FIGURE 8-13

CITY OF SAN LUIS OBISPO
POTABLE WATER
DISTRIBUTION SYSTEM
OPERATIONS MASTER PLAN

WATER MAINS

- Unknown
- 2"
- 4"
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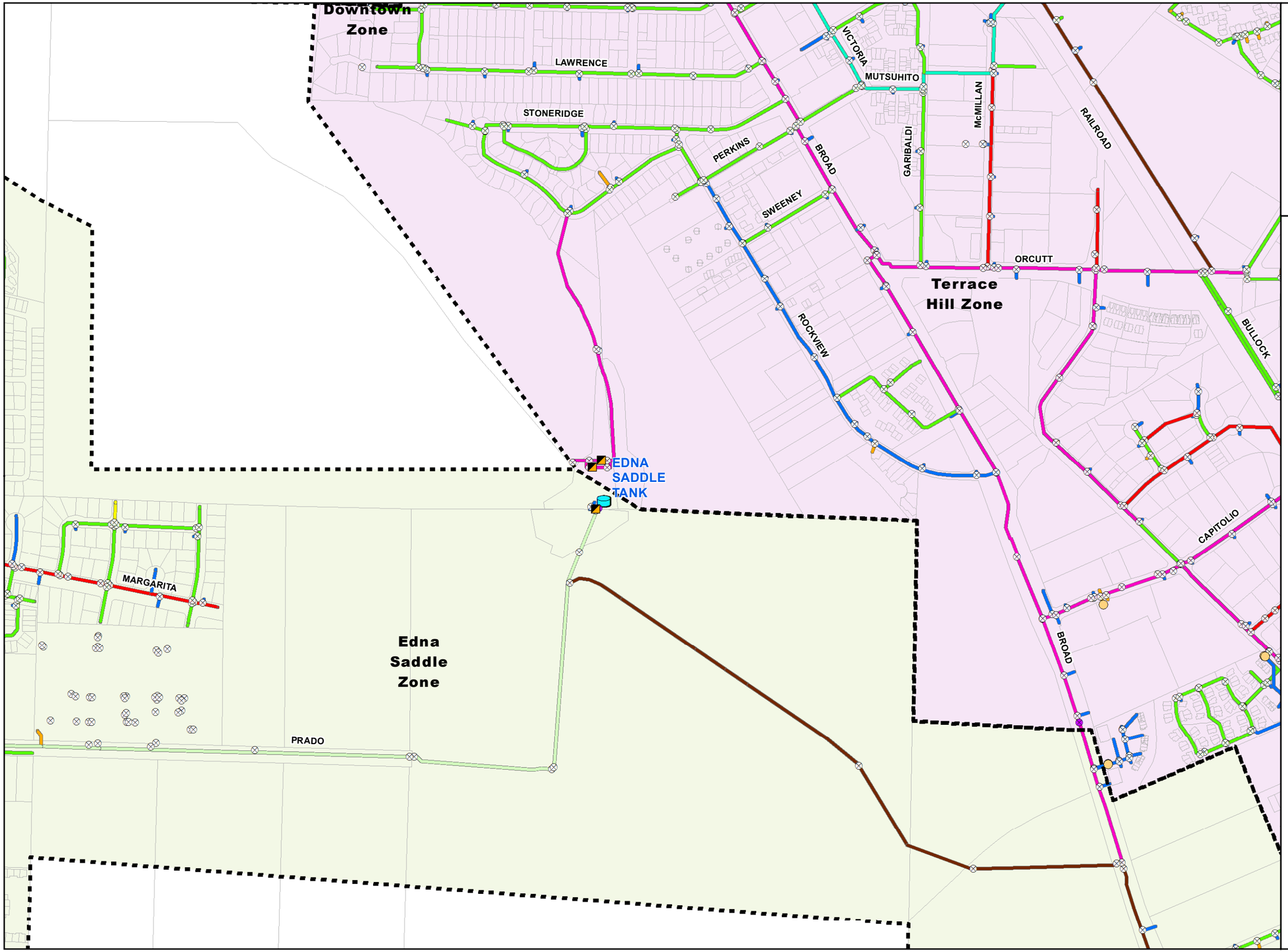

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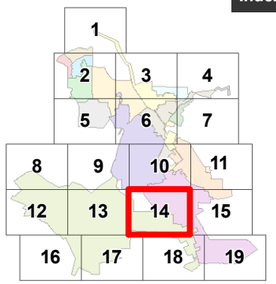

EXISTING WATER DISTRIBUTION SYSTEM

FIGURE 8-14

CITY OF SAN LUIS OBISPO
POTABLE WATER
DISTRIBUTION SYSTEM
OPERATIONS MASTER PLAN

WATER MAINS

- Unknown
- 2"
- 4"
- 6"
- 8"
- 10"
- 12"
- 14"
- 16"
- 18"
- 20"
- 24" and greater

- STORAGE TANKS
- PUMP STATION
- PRESSURE REDUCING
- CHECK VALVES
- SYSTEM VALVES
- ISOLATION VALVES
- PRODUCTION WELL

N

0 250 500 Feet

1 inch = 500 feet

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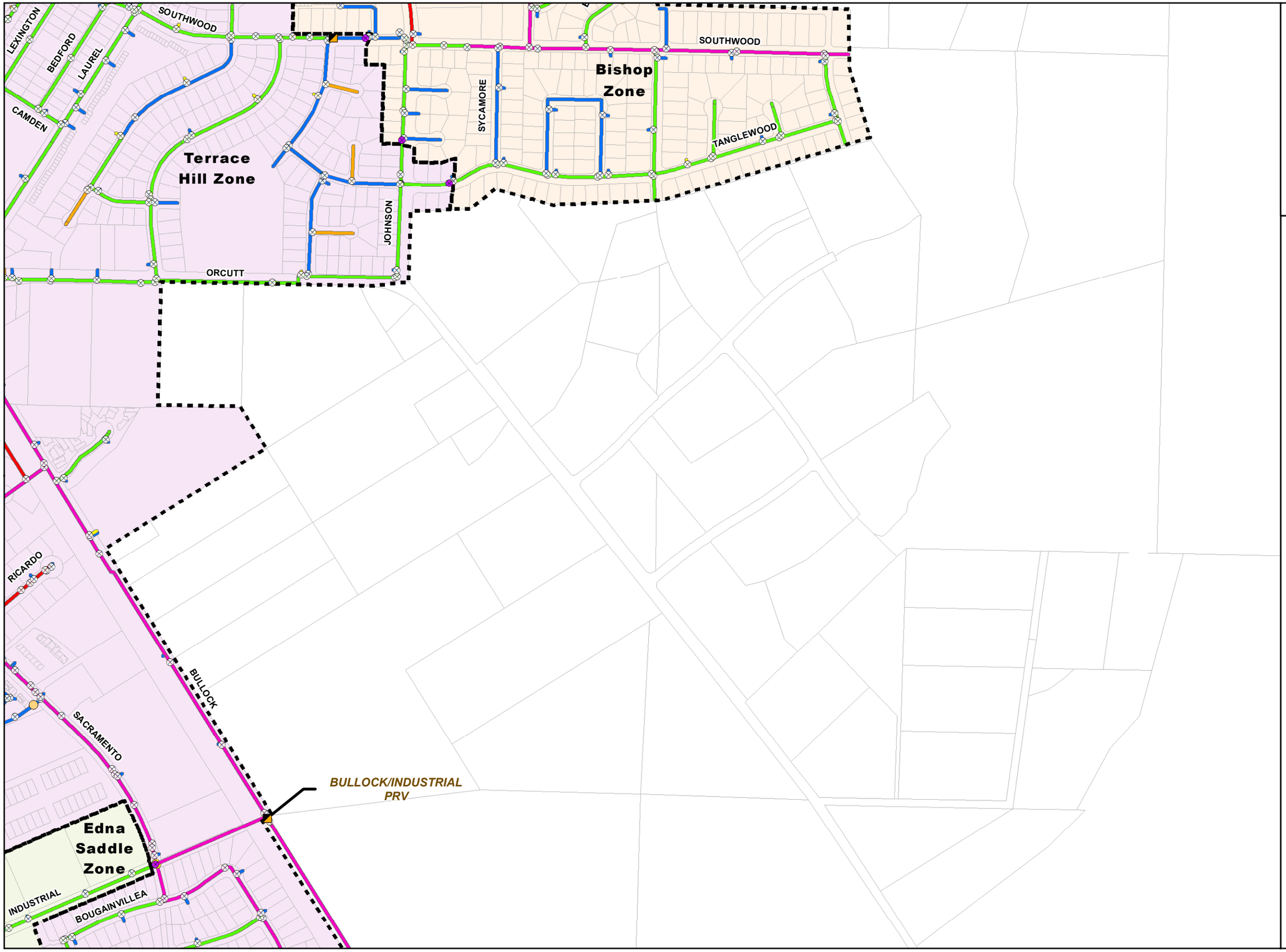

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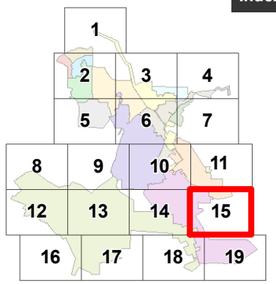

EXISTING WATER DISTRIBUTION SYSTEM

FIGURE 8-15

CITY OF SAN LUIS OBISPO
POTABLE WATER
DISTRIBUTION SYSTEM
OPERATIONS MASTER PLAN

WATER MAINS

- Unknown
- 2"
- 4"
- 6"
- 8"
- 10"
- 12"
- 14"
- 16"
- 18"
- 20"
- 24" and greater

- STORAGE TANKS
- PUMP STATION
- PRESSURE REDUCING
- CHECK VALVES
- SYSTEM VALVES
- ISOLATION VALVES
- PRODUCTION WELL

N

0 250 500 Feet

1 inch = 500 feet

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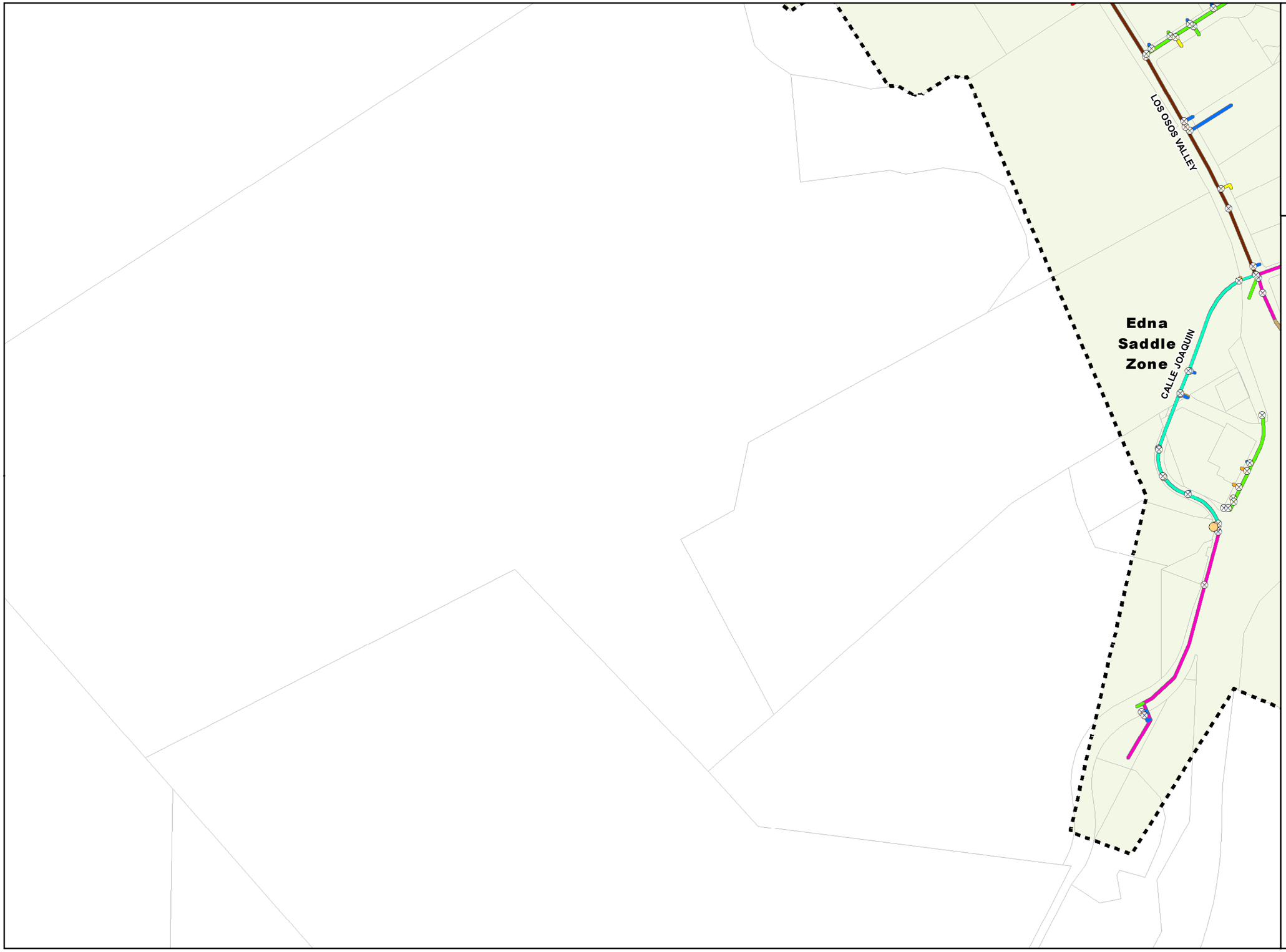

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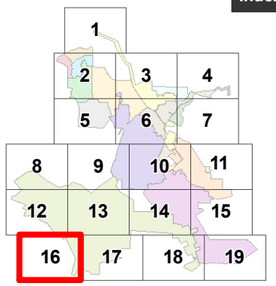

EXISTING WATER DISTRIBUTION SYSTEM

FIGURE 8-16

CITY OF SAN LUIS OBISPO
POTABLE WATER
DISTRIBUTION SYSTEM
OPERATIONS MASTER PLAN

WATER MAINS

- Unknown
- 2"
- 4"
- 6"
- 8"
- 10"
- 12"
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- 18"
- 20"
- 24" and greater

- STORAGE TANKS
- PUMP STATION
- PRESSURE REDUCING
- CHECK VALVES
- SYSTEM VALVES
- ISOLATION VALVES
- PRODUCTION WELL

N

0 250 500 Feet

1 inch = 500 feet

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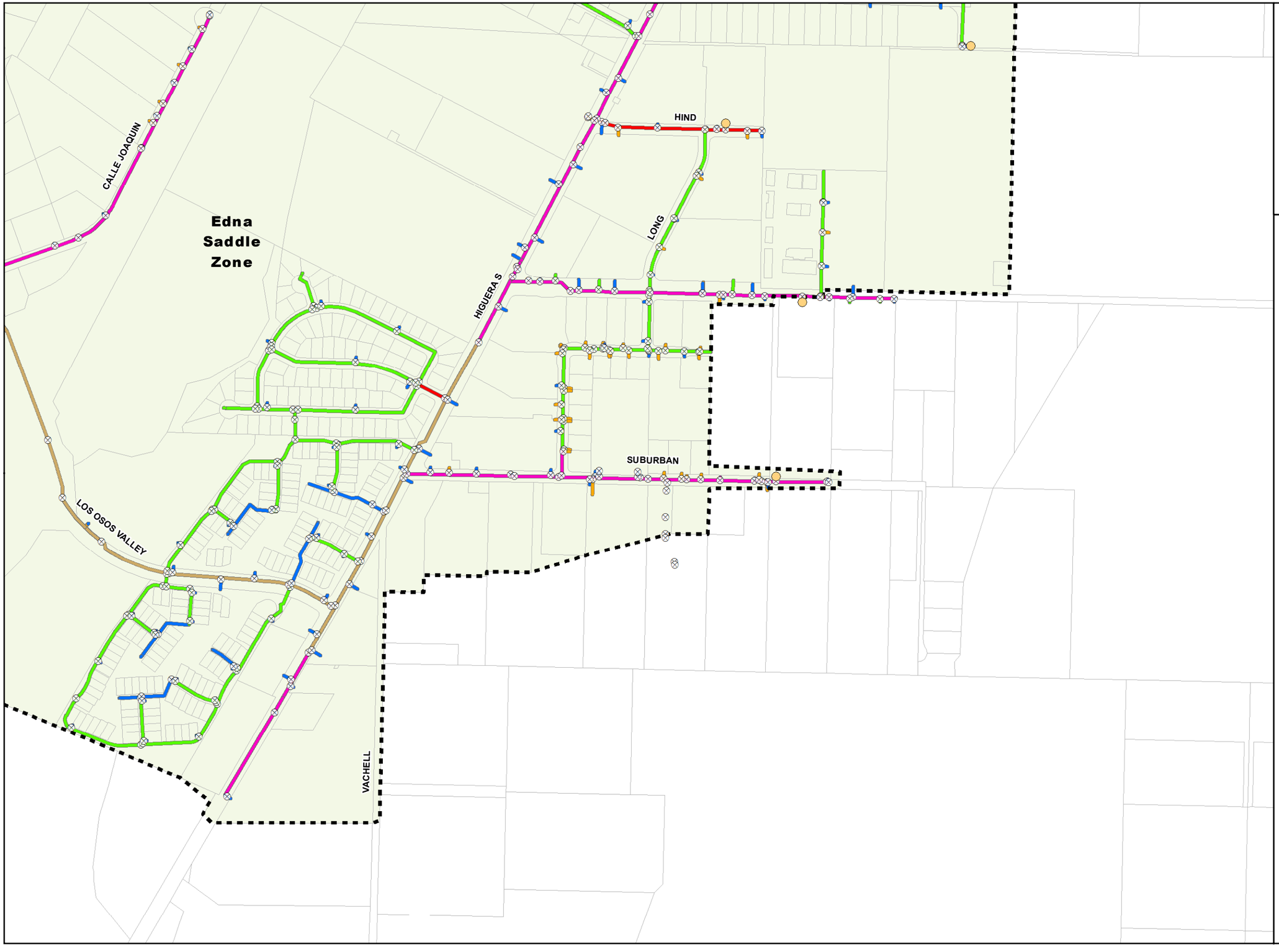
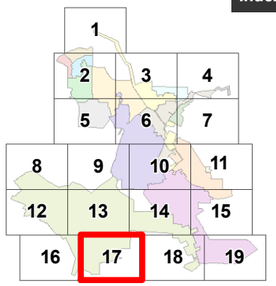


Index Map



EXISTING WATER DISTRIBUTION SYSTEM

FIGURE 8-17

CITY OF SAN LUIS OBISPO
POTABLE WATER
DISTRIBUTION SYSTEM
OPERATIONS MASTER PLAN

WATER MAINS

- Unknown
- 2"
- 4"
- 6"
- 8"
- 10"
- 12"
- 14"
- 16"
- 18"
- 20"
- 24" and greater

- STORAGE TANKS
- PUMP STATION
- PRESSURE REDUCING
- CHECK VALVES
- SYSTEM VALVES
- ISOLATION VALVES
- PRODUCTION WELL

N

0 250 500 Feet

1 inch = 500 feet

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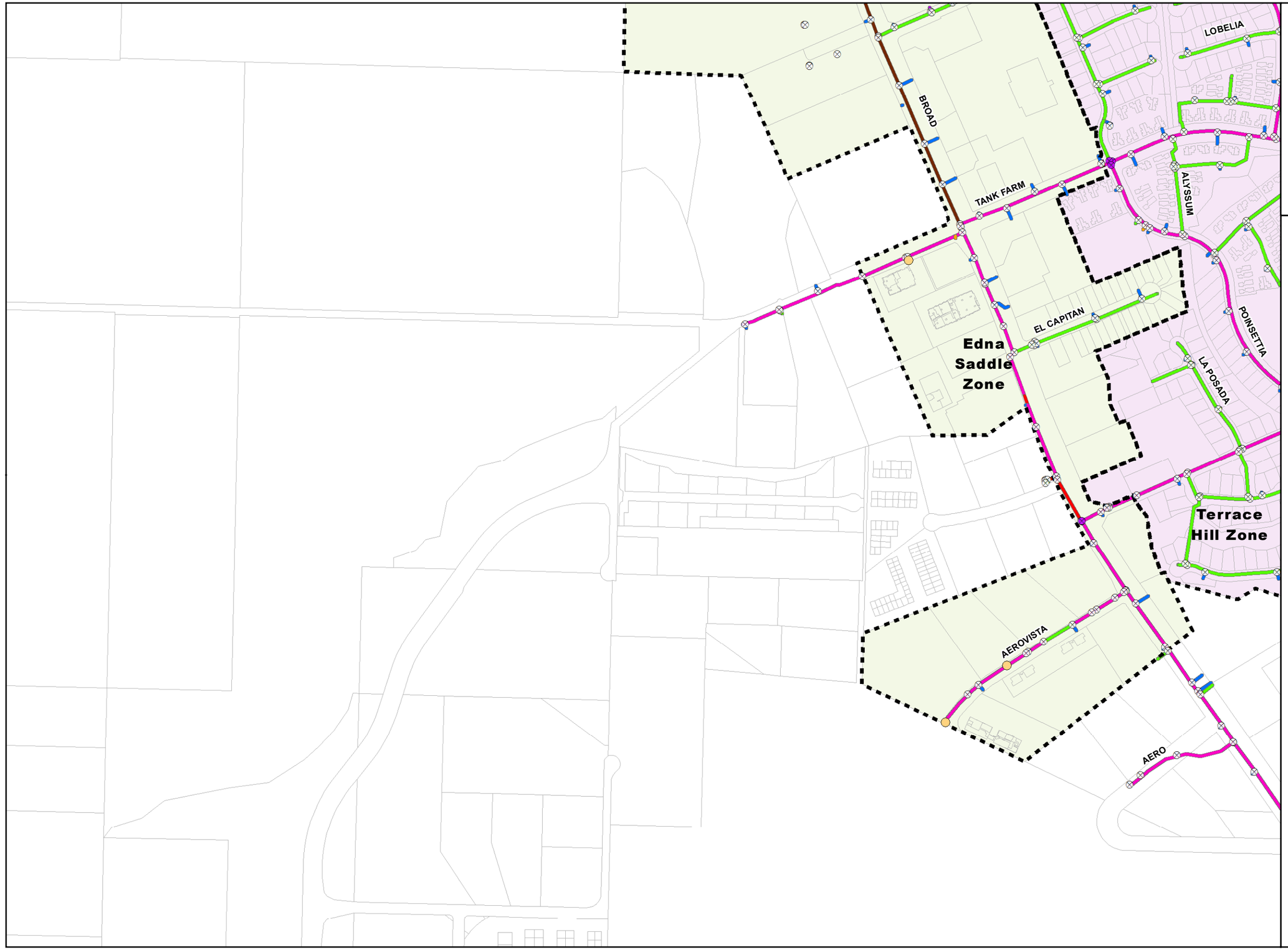
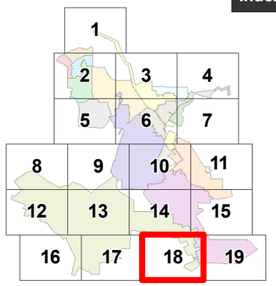


Index Map



EXISTING WATER DISTRIBUTION SYSTEM

FIGURE 8-18

CITY OF SAN LUIS OBISPO
POTABLE WATER
DISTRIBUTION SYSTEM
OPERATIONS MASTER PLAN

WATER MAINS

- Unknown
- 2"
- 4"
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- 8"
- 10"
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- 20"
- 24" and greater

- STORAGE TANKS
- PUMP STATION
- PRESSURE REDUCING
- CHECK VALVES
- SYSTEM VALVES
- ISOLATION VALVES
- PRODUCTION WELL

0 250 500 Feet

1 inch = 500 feet

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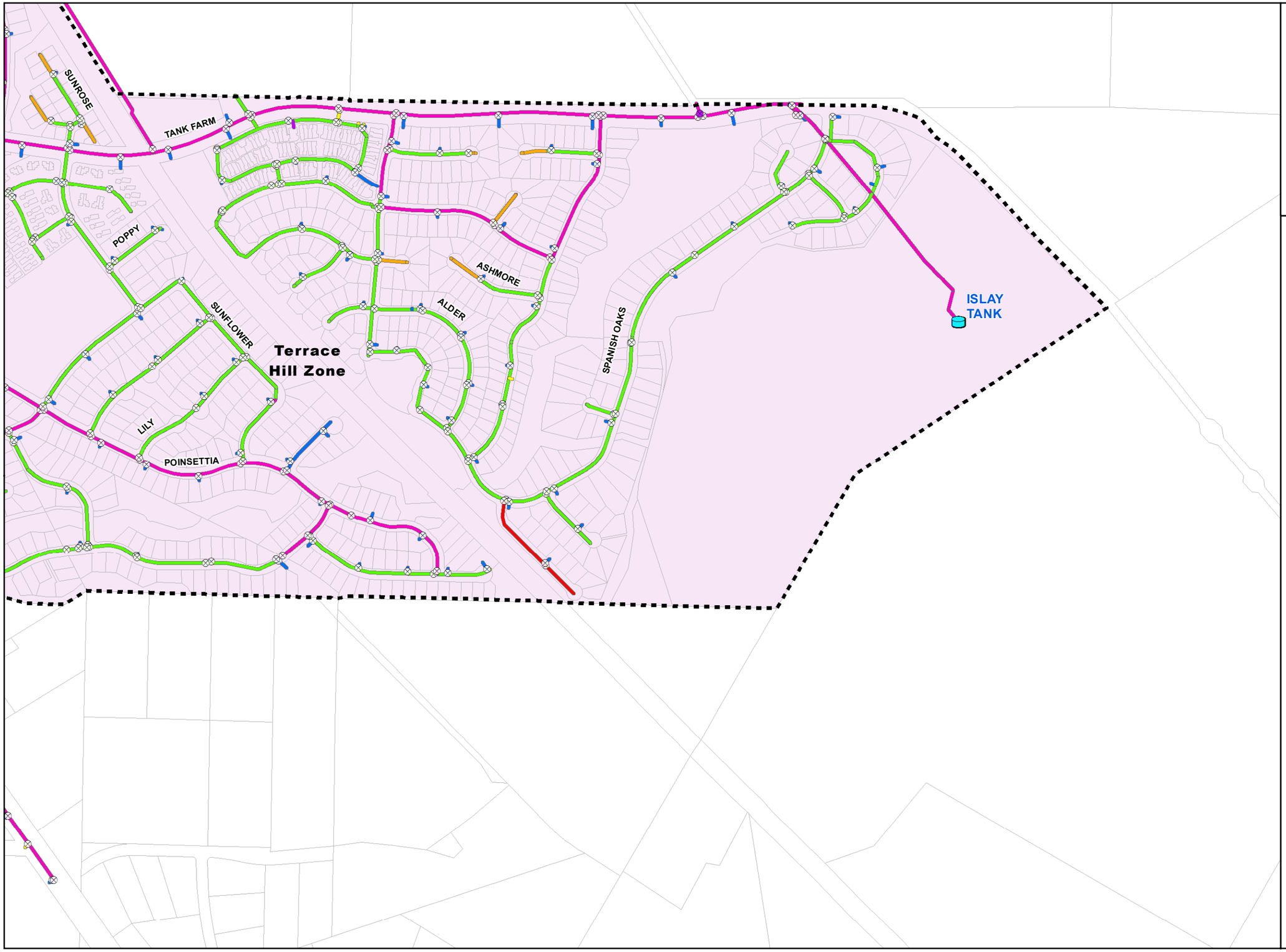

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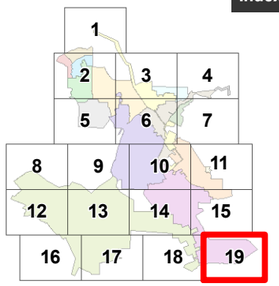

EXISTING WATER DISTRIBUTION SYSTEM

FIGURE 8-19

CITY OF SAN LUIS OBISPO
POTABLE WATER
DISTRIBUTION SYSTEM
OPERATIONS MASTER PLAN

WATER MAINS

- Unknown
- 2"
- 4"
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- STORAGE TANKS
- PUMP STATION
- PRESSURE REDUCING
- CHECK VALVES
- SYSTEM VALVES
- ISOLATION VALVES
- PRODUCTION WELL

N

0 250 500 Feet

1 inch = 500 feet

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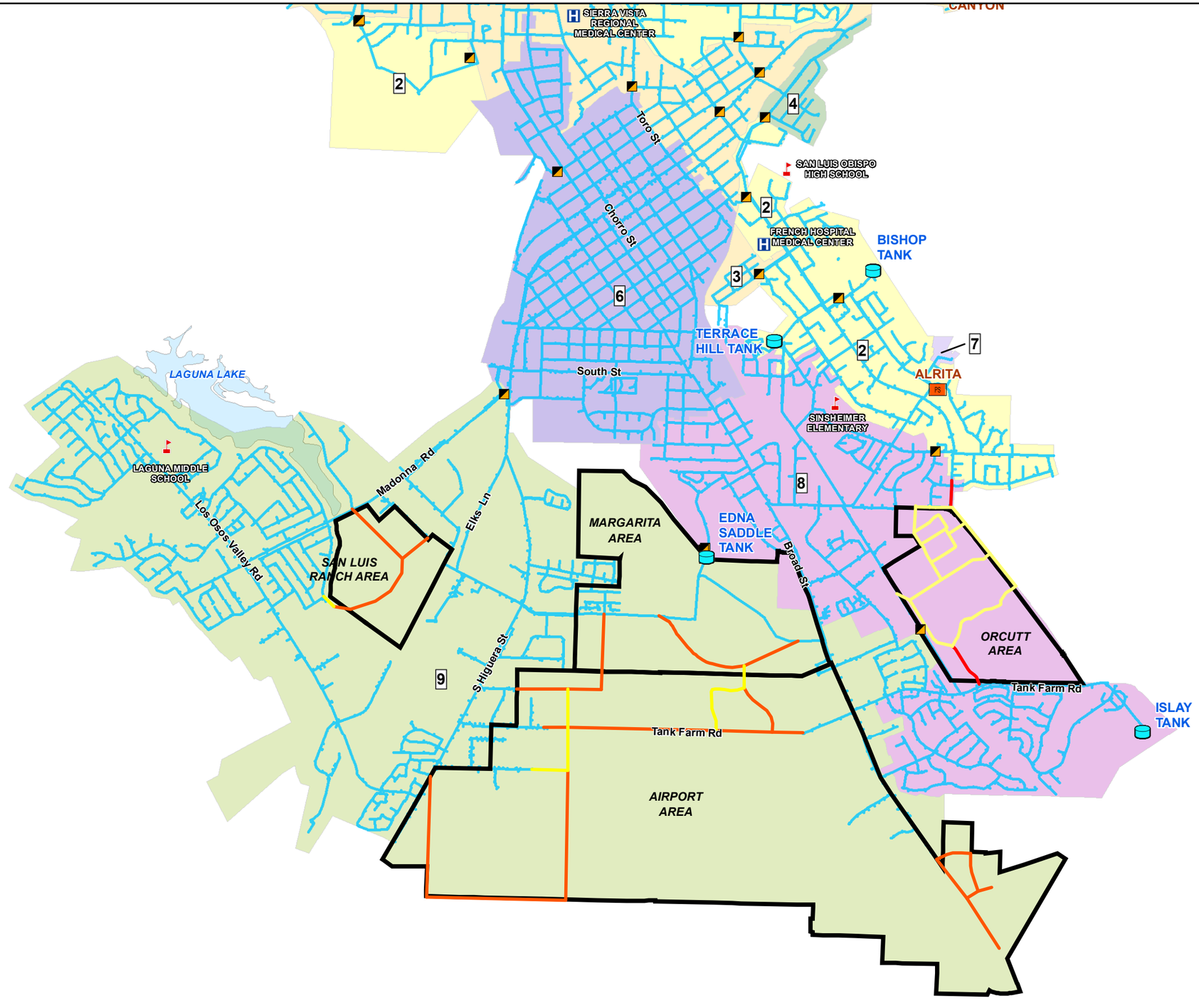
MODELED SPECIFIC PLAN AREA WATER DISTRIBUTION SYSTEM

FIGURE 8-20

CITY OF SAN LUIS OBISPO
POTABLE WATER
DISTRIBUTION SYSTEM
OPERATIONS MASTER PLAN



LEGEND

- SPECIFIC PLAN AREAS

DISTRIBUTION ZONE

- 1 ROSEMONT
- 2 HIGH PRESSURE
- 3 FOOTHILL
- 4 ANDREWS
- 5 RESERVOIR CANYON
- 6 DOWNTOWN
- 7 ALRITA
- 8 TERRACE HILL
- 9 EDNA SADDLE
- EXISTING WATER MAIN

FUTURE WATER MAIN

- 8" DIAMETER
- 12" DIAMETER
- RESERVOIR
- STORAGE TANK
- PS PUMP STATION
- PRESSURE REDUCING VALVE
- WT WATER TREATMENT PLANT

0 1,250 2,500 Feet

1 inch = 2,500 feet

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9: Summary of Recommendations

This chapter summarizes the City's recommended master plan improvement projects to meet existing and future needs, and the master plan improvement program to assist in the financial planning aspects of implementing the recommended improvements. The improvements are described as first, second and third priorities. All tables and figures are located at the end of this chapter.

Recommended Master Plan Improvement Projects

Based on the hydraulic model, along with recommendations for storage and booster station upgrades and upgrades due to operational needs, a series of master plan improvement projects have been identified. The projects have been classified into three categories: First, Second, and Third Priority. First priority projects are a result of significant health and safety concerns, including substandard pressures and fire flows during any demand situation. These projects are recommended to be completed within five years. Second priority projects address sections of the City's water system that are experiencing slightly substandard pressures and/or fire flows, but are not as critical as first priority projects. These projects are recommended to be completed within 10 years. Third priority projects include upgrades that are not critical in nature, but are recommended during routine future replacements. These projects are recommended to be completed within 15 years. As development projects occur throughout the City, any proposed First, Second or Third priority projects should be identified and completed to address these deficiencies prior to the proposed development being constructed. Also, the proposed land uses, distribution system layout, demands and fire flow requirements should be re-evaluated for each project in the planning stage to confirm assumptions made for the purpose of this Water Master Plan are accurate and confirm that no additional upgrades will be required.

Recommended Consolidations

This master plan has proposed several zone consolidations. The following provides a summary of the reasons these consolidations are proposed:

High Pressure/Bishop: The High Pressure and Bishop Zones essentially operate together under current conditions, but have the backup of the Bishop Pump Station. As the system operates currently, the Bishop Zone has areas that don't meet fire flow demands and there are water quality concerns with the Bishop Tank. By making upgrades to the water distribution system, connecting the High Pressure and Bishop Zones in more than one location, the fire flow availability is increased throughout the Bishop Zone. By installing the control valve, this will allow the Bishop Tank to solely feed the Bishop Zone, thus forcing the tank to turnover easier than if the tank were required to float with Reservoir #2. However, if needed, the control valve can provide additional flow if pressures drop too low in the Bishop Zone.

High Pressure/Slack Zone: The Slack Street Tank operates at essentially the same elevation as Reservoir #2. The McCollum Pump Station provides very little pressure increase to boost into the Slack Zone. With some essential piping upgrades in the Slack Zone, this pump station can be eliminated and sufficient fire flow can still be met throughout the zone. This consolidation eliminates the Slack Tank

and McCollum PS. Both facilities currently need repairs and upgrades to meet current standards and are an on-going operations and maintenance expense.

High Pressure/Serrano/Ferrini/Patricia: The Serrano and Ferrini Tanks are at similar elevations to Reservoir #2, but are currently fed from the Foothill Zone (Clearwells). With piping upgrades, these zones can be consolidated, thus eliminating the Ferrini PS, Bressi PS, Ferrini Tank and Serrano Tank. All four of these facilities require repairs and upgrades to meet current standards and are an on-going operations and maintenance expense. To ensure that areas within the current zones do not have too high of pressures, some customers were consolidated with the Foothill Zone. This consolidation does increase the demand on Reservoir #2 and the Transfer PS.

Reservoir #1/Foothill: Reservoir # 1 and the Clear Wells are at similar elevations. With the zone consolidation, the available storage in Reservoir #1 would be reduced, but would still have sufficient storage to meet the needs of the zone. The demand within Reservoir #1 Zone is minimal compared to the Foothill Zone. The two zones already have a connecting water main, but a valve re-configuration would be required. There are concerns about the size and integrity of the connecting water main as this water main is located under Highway 101. However, the consolidated zone has sufficient redundancy with the existing PRVs that are available to provide backup supply from the High Pressure Zone, as it is currently operated. Consolidating these two zones eliminates the need to pump water from the Clear Wells (Transfer PS) to Reservoir #2 to then dissipate that energy through PRVs to supply the Reservoir #1 Zone. With the increased demand on Reservoir #2 and the Transfer PS from the High Pressure/Serrano/Ferrini consolidation, this consolidation will reduce the demand back down to its current conditions.

First Priority Master Plan Improvement Projects

First Priority Projects have the highest health and safety deficiencies within the distribution system. Typically, these deficiencies are identified due to fire flow capacities that are less than 50% of the required fire flow. First priority projects were determined using the following criteria:

- Pressures below 30 psi during ADD, MDD, PHD
- Velocities greater than 5 fps during ADD, MDD, PHD
- Fire flows that cannot meet a minimum of 50% of the required fire flow:
    - Residential single and multi-family areas - 750 GPM
    - Commercial, Office Professional, and school - 1,250 GPM
    - Hospitals: Unsprinklered - 3,000 gpm
    - Hospitals: Sprinklered - 1,200 gpm
    - Big Box Commercial, Industrial, and Hotel - 2,000 gpm
    - Cal Poly - 2,500 gpm
- Operational and maintenance projects that were identified by the City due to continuous maintenance repairs for line breaks
- Water mains that were greater than 75 years old

Second Priority Master Plan Improvement Projects

Second Priority Projects have the second highest health and safety deficiencies within the distribution system. Typically, these deficiencies are identified due to fire flow capacities that are between 50% and 75% of the required fire flow. Second priority projects were determined using the following criteria:

- Pressures below 40 psi during ADD, MDD, PHD
- Fire flows that cannot meet between 50% and 75% of the required fire flow:
    - Residential single and multi-family - 1,125 GPM
    - Commercial, Office Professional, and school - 1,875 GPM
    - Hospitals: Unsprinklered - 4,500 gpm
    - Hospitals: Sprinklered - 1,775gpm
    - Big Box Commercial, Industrial, and Hotel - 3,000 gpm
    - Cal Poly - 3,750 gpm
- Operational and maintenance projects identified by the City where water mains are between 50 and 75 years old

Third Priority Master Plan Improvement Projects

Third Priority Projects have minor deficiencies within the distribution system. Typically, these deficiencies are identified due to fire flow capacities that are between 75% and 100% of the required fire flow. In addition, third priority projects are those projects that are recommended because the water main doesn't meet current day standards such as minimum pipe diameter or material. Third priority projects were determined using the following criteria:

- Fire flows that cannot meet between 75% and 100% of the required fire flow:
    - Residential single and multi-family - 1,500 GPM
    - Commercial, Office Professional, and school - 2,500 GPM
    - Hospitals: Unsprinklered - 6,000 gpm
    - Hospitals: Sprinklered - 2,375 gpm
    - Big Box Commercial, Industrial, and Hotel - 4,000 gpm
    - Cal Poly area - 5,000 gpm
- Operational and maintenance projects that were identified by the City that were less than 50 years old
- Water mains that do not meet current design standards (i.e. 4-inch water mains) that were not identified as hydraulic deficiencies

Master Plan Improvement Project Ranking and Costs

First, Second, and Third Priority Master Plan Improvement Projects were ranked to determine what priority the recommended projects should be constructed. The ranking was based on severity of the deficiency, the size of the community the deficiency impacts, the proximity to the urban/wildlife interface and cost. Figures 9-1 through 9-19 illustrate the location of each of the proposed Maser Plan Improvement Projects. Tables 9-1, 9-2, and 9-3 provide a summary of all the recommended Master Plan Improvement Projects in order of ranking for first, second, and third priority projects, respectively.

These Tables also provide estimates of the construction and "soft" costs for each project. The project costs are based on engineering judgment, confirmed bid prices for similar work in the Central Coast area, consultation with vendors and contractors, established budgetary unit prices for the work, and other reliable sources. The cost estimates are approximate and should be used for planning purposes only. Actual project costs will vary depending upon economic conditions at time of construction. These costs are based on Year 2014 dollars (McGraw-Hill ENR Construction Cost Index of 9992) and need to be escalated to the year or years scheduled for the construction. Table 9-4 provides a summary of the cost per lineal foot used to develop the construction costs for the water main upgrade projects.

Table 9-4. Unit Cost for Construction of Water Mains

Size (Inches)	Replacement Material	Replacement Cost per Linear Foot (Year 2015)
2	Copper	$100
6	DI	$135
10	DI	$240
16	DI	$325
2	PE	$90
3	PVC	$125
4	PVC	$150
6	PVC	$170
8	PVC	$185
10	PVC	$225
12	PVC	$265
14	PVC	$285
16	PVC	$315
18	PVC	$350
20	PVC	$375
24	PVC	$400
27	PVC	$410
30	PVC	$425
18	RCP	$275
21	RCP	$350
24	RCP	$375
24	STEEL	$350

[1] All pipes are pressure class 150 unless otherwise stated.

Source: Cost Table provided by the City of San Luis Obispo

Table 9-1. First Priority Master Plan Improvement Projects

Project #	Title	Description	Existing Zone	Proposed Zone	Quantity	Length (Ft)	Exist Diameter (in)	New Diameter (in)	Street	Location	Construction Cost ($)		Subtotal ($)	Total Project Cost ($)**
1-1	**Cazadero PRV**	Increase pressure setting at San Luis/Cazadero PRV from 64 psi to 80 psi	Andrews	Andrews	1	--	--	--	San Luis Drive	Cazadero Street	0	LS	$0	**$0**
1-2	**Industrial Way Zone Change**	Modify zone boundary at the end of Industrial Way and on Tank Farm Road	Terrace Hill	Edna Saddle	1	--	--	--	Industrial Way	Sacramento Drive	0	LS	$0	**$0**
1-3	**Longview**	Install new gate valve on water main on Longview and open valves to create loop in Slack Zone	High Pressure	Slack Zone	1	--	--	--	Longview Lane	Slack Street	$5,000	LS	$5,000	**$7,000**
High Pressure/Bishop Zone Consolidation														
1-4	**Bishop Consolidation**	Connect water mains between Bishop and High Pressure Zones	Bishop	High Pressure	5	--	--	8	Johnson and Lizzie	At the intersection of Johnson/Lizzie, Iris, Ella, Fixlini and the intersection of Lizzie/Fixlini	15,000	LS	$75,000	**$105,000**
1-5	**Bishop Control Valve**	Install a control valve to regulate flow to Bishop Tank	High Pressure	High Pressure	1	--	--	--	San Luis Street	California Blvd	0	LS	$0	**$0**
1-6	**Bishop PS**	Decommission Bishop PS	Bishop	--	1	--	--	--	Johnson Ave	Parking lot at Bishop Street	50,000	LS	$50,000	**$70,000**
1-7	**Woodbridge Zone Change**	Install new gate valve on Broad Street, open zone valves and decommission Broad/Caudill PRV	Downtown	Terrace Hill	1	--	--	--	Broad Street	Woodbridge Street	10,000	LS	$10,000	**$14,000**
1-8	**Swazey Zone Change**	Install new gate valve on Rachel and open zone valve to expand Reservoir 1 Zone	Terrace Hill	Reservoir 1/Foothill	1	--	--	--	Rachel Street	Between Florence Ave and Jennifer Street	5,000	LS	$5,000	**$7,000**
1-9	**Hathway/Montalban PRV**	Decommission the inactive PRV and open valves to consolidate Foothill and Reservoir 1 Zones.	Reservoir 1/Foothill	Foothill	1	--	--	--	Hathway Ave	Phillips Lane	0	LS	$0	**$0**
1-10	**Fel-Mar PS**	Install new pump station capable of filling the recommended future Rosemont Tank. Option to install fire pump and eliminate upsizing of Rosemont Tank (see Project 1-34)	Rosemont	Rosemont	1	--	--	--	Fel-Mar Drive	Al-Hil Drive (Old Fel-Mar PS)	750,000	LS	$750,000	**$1,050,000**
		Install new 8-inch PVC	--	Rosemont	--	1,500	--	8	Fel-Mar Drive	New Fel-Mar PS to 80 Highland Drive	$185	LF	$277,500	**$388,500**
1-11	**Rosemont PS**	Decommission Rosemont PS once Fel-Mar PS is operational	Rosemont	Rosemont	1	--	--	--	Highland Drive	Rosemont PS	50,000	LS	$50,000	**$70,000**
1-12	**Reservoir #2**	Construct two new 2.5 MG tanks	High Pressure	High Pressure	5 MG	--	--	--	Stenner Creek Road	Reservoir #2 site	$1.25	GAL	$6,250,000	**$8,750,000**
High Pressure/Serrano Zone Consolidation														
1-13	**Serrano Consolidation**	New transmission main from High Pressure Zone to Serrano Zone	Serrano	High Pressure	--	7,200	6&8	12	Several, see CIP map	Highway 1 at Foothill Blvd to Hermosa Way at Luneta Drive. Exact alignment is flexible.	$265	LF	$1,908,000	**$2,671,200**
			--	Foothill	--	400	--	8	Luneta Drive	Rafael Way to Tassajara Drive	$185	LF	$74,000	**$103,600**
1-14	**Bressi PS & Serrano Tank**	Decommission Bressi PS, Serrano Tank and ancillary piping	Serrano	High Pressure	1	--	--	--	Bressi Place	Bressi PS and Serrano Tank. Piping from Serrano Tank to end of La Entrada Ave and Broad Street at Serrano Heights.	100,000	LS	$100,000	**$140,000**

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Table 9-1. First Priority Master Plan Improvement Projects

Project #	Title	Description	Existing Zone	Proposed Zone	Quantity	Length (Ft)	Exist Diameter (in)	New Diameter (in)	Street	Location	Construction Cost ($)		Subtotal ($)	Total Project Cost ($)**
High Pressure/Ferrini Zone Consolidation														
1-15	**Stenner Creek**	New transmission main from High Pressure Zone to Ferrini Zone	Ferrini	High Pressure	1	2,800	--	12	Stenner Creek Road	Mount Bishop Road, past the Ferrini PS, up the hill to Montrose Drive	$265	LF	$742,000	**$1,038,800**
1-16	**Ferrini PS & Tank**	Decommission Ferrini PS, Tank, and ancillary piping including Skyline/Mirasol and Patricia PRVs	Ferrini	High Pressure	1	--	--	--	Felsman Loop and Hwy 1	Ferrini PS & Tank	125,000	LS	$125,000	**$175,000**
High Pressure/Patricia Zone Consolidation Part 1														
1-17	**Patricia**	Consolidate the north half of the Patricia Zone into the High Pressure Zone and Foothill Zone. Open all closed zone valves north of Foothill to consolidate Patricia/Foothill. Close gate valves on south side of Foothill Blvd to isolate Patricia South.	Patricia	High Pressure and Foothill	--	1,080	--	12	Cerro Romauldo	Patricia Drive to Los Cerros Drive	$265	LF	$286,200	**$400,680**
					--	1,130	--	12	Patricia Drive	Cerro Romauldo to Highland Drive	$265	LF	$299,450	**$419,230**
					--	270	--	8	Patricia Drive	Highland Drive to Fel-Mar Drive	$185	LF	$49,950	**$69,930**
					--	280	6	8	Highland Drive	Fel-Mar Drive to 113 Highland Drive	$185	LF	$51,800	**$72,520**
High Pressure/Patricia Zone Consolidation Part 2														
1-18	**La Entrada 1**	Consolidate the south half of the Patricia Zone into the High Pressure Zone and Foothill Zone.	Patricia	High Pressure and Foothill	--	880	6&8	12	La Entrada Ave	Hermosa Way to San Jose Court	$265	LF	$233,200	**$326,480**
					--	1,420	--	12	La Entrada Ave	San Jose Court to Foothill Blvd., and continue up Patricia Drive to Cerro Romauldo	$265	LF	$376,300	**$526,820**
1-19	**La Entrada 2**	Extend the Foothill Zone	Patricia	Foothill	--	1,100	6	8	La Entrada Ave	Catalina Drive to Foothill Blvd.	$185	LF	$203,500	**$284,900**
		Abandon waterline in backyard easements			1	--	--	--	Backyard easement	Foothill Blvd. to Ramona, and Catalina to Del Mar.	10,000	LS	$10,000	**$14,000**
1-20	**Murray**	Provide fire flow to Sierra Vista Hospital	Foothill	Foothill	--	700	6&8	12	Murray Street	Santa Rosa Street to Casa Street	$265	LF	$185,500	**$259,700**
					--	900	4&6	12	Casa Street	Murray Street and to just south of Deseret Place	$265	LF	$238,500	**$333,900**
1-21	**Bishop Peak Elementary**	Provide fire flow to Bishop's Elementary	Foothill	Foothill	--	260	6	12	Craig Way	Patricia Street to Jaycee Drive	$265	LF	$68,900	**$96,460**
					--	770	--	8	Jaycee Drive	Through parking lot of Bishop's Elementary to connect to Craig Way	$185	LF	$142,450	**$199,430**
					--	580	8	8	Jaycee Drive	Craig Way to dead-end	$185	LF	$107,300	**$150,220**
High Pressure/Slack Zone Consolidation														
1-22	**Fredericks**	Consolidate the Slack and High Pressure Zone	High Pressure	High Pressure	--	330	12	12	Hathway Ave	California Blvd to Fredricks Street	$265	LF	$87,450	**$122,430**
					--	2,490	12	12	Fredricks Street	Hathway Ave to Grand Ave	$265	LF	$659,850	**$923,790**
1-23	**McCollum**	Provide fire flow to Slack Zone	Slack	High Pressure	--	850	4&6	8	McCollum Street	Albert Drive to Grand Ave	$185	LF	$157,250	**$220,150**
1-24	**McCollum PS**	Decommission McCollum PS	Slack	High Pressure	1	--	--	--	McCollum Street	McCollum PS	50,000	LS	$50,000	**$70,000**
1-25	**El Paseo**	Increase pressures and fire flows	Bishop	High Pressure	--	290	8	10	El Paseo Court	Flora Street to El Cerrito	$225	LF	$65,250	**$91,350**
					--	670	8	8	El Cerrito Court	El Paseo Court to end of the water main	$185	LF	$123,950	**$173,530**
1-26	**Boulevard Del Campo**	Zone change to Increase pressures and fire flows. Connect existing water services and fire hydrants to new water main.	Terrace Hill	High Pressure	--	650	--	8	Boulevard Del Campo	Bishop Street to Fletcher Ave	$185	LF	$120,250	**$168,350**

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Table 9-1. First Priority Master Plan Improvement Projects

Project #	Title	Description	Existing Zone	Proposed Zone	Quantity	Length (Ft)	Exist Diameter (in)	New Diameter (in)	Street	Location	Construction Cost ($)		Subtotal ($)	Total Project Cost ($)**
1-27	**Westmont**	Increase fire flows	Foothill	Foothill	--	500	--	8	End of Westmont Ave	Jeffrey Drive to Stanford Drive	$185	LF	$92,500	**$129,500**
1-28	**Hillcrest**	Increase fire flows, eliminate long dead-end water main	High Pressure	High Pressure	--	220	--	8	Hillcrest Place	Hillcrest Place to California Blvd.	$185	LF	$40,700	**$56,980**
1-29	**Slack**	Increase fire flows	Slack	High Pressure	--	640	6	8	Slack Street	Henderson Ave to Slack Street Tank	$185	LF	$118,400	**$165,760**
1-30	**Highland**	Increase fire flows	Foothill/Patricia	Foothill	--	2,800	6&8	12	Highland Drive	Highway 1 to Patricia Drive	$265	LF	$742,000	**$1,038,800**
1-31	**Chorro**	Eliminate dead-end mains, improve circulation and fire flow	Foothill	Foothill	--	100	--	8	Chorro Street	At the intersections of Chorro Street and Meinecke Ave and Chorro Street and Murray Street	$185	LF	$18,500	**$25,900**
1-32	**Transfer PS**	Upgrade electrical system and transfer switch	High Pressure	High Pressure	1	--	--	--	Water Treatment Plant	Transfer PS	450,000	LS	$450,000	**$630,000**
1-33	**Wilding**	Increase fire flows	Bishop	High Pressure	--	600	6	8	Wilding Lane	From 2000 Wilding Lane to Skylark Lane	$185	LF	$111,000	**$155,400**
1-34	**Rosemont Tank**	Construct new 150,000 gallon tank or install a fire pump at the new Fel-Mar PS (See project 1-10)	Rosemont	Rosemont	0.15 MG	--	--	--	Rosemont Tank	Rosemont Tank Site	$1	GAL	$150,000	**$210,000**
1-35	**Iris**	Operation & Maintenance	Bishop	High Pressure	--	320	6	8	Iris Street	Johnson Ave to Fixlini Street	$185	LF	$59,200	**$82,880**
1-36	**Pacific**	Operation & Maintenance	Downtown	Downtown	--	1,900	10	12	Pacific Street	Nipomo Street to Higuera Street	$265	LF	$503,500	**$704,900**
1-37	**Chorro 2**	Operation & Maintenance	Downtown	Downtown	--	1,000	6 & 8	8	Chorro Street	Broad Street to Upham Street	$185	LF	$185,000	**$259,000**
1-38	**Marsh**	Operation & Maintenance	Downtown and Reservoir 1	Downtown and Foothill	--	2,100	8	8	Marsh Street	California Blvd to Santa Rosa Street	$185	LF	$388,500	**$543,900**
1-39	**Hathway**	Operation & Maintenance	High Pressure	High Pressure	--	2,000	6	8	Hathway Ave	Longview Lane to Fredericks Street	$185	LF	$370,000	**$518,000**
1-40	**Sierra Way**	Operation & Maintenance	Bishop	High Pressure	--	1,500	6 & 8	8	Sierra Way	Ella Street to Bishop Street	$185	LF	$277,500	**$388,500**
1-41	**Mountain View**	Operation & Maintenance	Downtown	Downtown	--	360	6	8	Mountain View Street	Hill Street to Broad Street	$185	LF	$66,600	**$93,240**
1-42	**California**	Operation & Maintenance	High Pressure	High Pressure	--	1,500	16	16	California Blvd	Mill Street to San Luis Drive	$325	LF	$487,500	**$682,500**
1-43	**San Luis Drive**	Operation & Maintenance	High Pressure	High Pressure	--	1,400	16	16	San Luis Drive	California Blvd to Johnson Ave	$325	LF	$455,000	**$637,000**
1-44	**Johnson**	Operation & Maintenance	High Pressure	High Pressure	--	850	16	16	Johnson Ave	San Luis Drive to Lizzie Street	$325	LF	$276,250	**$386,750**

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Table 9-1. First Priority Master Plan Improvement Projects

Project #	Title	Description	Existing Zone	Proposed Zone	Quantity	Length (Ft)	Exist Diameter (in)	New Diameter (in)	Street	Location	Construction Cost ($)		Subtotal ($)	Total Project Cost ($)**
1-45	**San Miguel**	Operation & Maintenance	Slack	High Pressure	--	620	6 & 8	8	San Miguel Avenue	Santa Ynez Ave to Buena Vista Ave	$185	LF	$114,700	**$160,580**
1-46	**Lincoln**	4-inch Upgrade with fire flow deficiencies	Downtown	Downtown	--	1,520	4	8	Lincoln Stret	Chorro Street to West Street	$185	LF	$281,200	**$393,680**
1-47	**Higuera**	4-inch Upgrade with fire flow deficiencies	Downtown and Reservoir 1	Downtown and Foothill	--	480	4	8	Higuera Street	Toro Street to Johnson Ave	$225	LF	$108,000	**$151,200**
1-48	**Craig & Christina**	4-inch Upgrade with fire flow deficiencies	Patricia	Foothill	--	1,360	4	8	Craig Way and Christina Way	On Craig Way from Patricia Drive to Jeffrey Drive and on Christina Way from Warren Way to Craig Way	$185	LF	$251,600	**$352,240**
1-49	**La Canada**	4-inch Upgrade with fire flow deficiencies	Foothill	Foothill	--	850	4 & 6	8	La Canada Drive	Tolosa Way to Cerro Romauldo	$185	LF	$157,250	**$220,150**
1-50	**Buena Vista**	4-inch Upgrade with fire flow deficiencies	Slack	High Pressure	--	440	4	8	Buena Vista Drive	South of McCollum Street to north of Santa Ynez Ave	$185	LF	$81,400	**$113,960**
1-51	**Tank Upgrades**	Conduct seismic evaluations and install flexible couplings or double ball expansion joints and mixing systems at Rosemont, Edna Saddle, Terrace Hill and Islay	Various	--	--	--	--	--	--	Rosemont, Edna Saddle, Terrace Hill and Islay Tanks	$60,000	LS	$60,000	**$84,000**
1-52	**DPB Removal Syste**	Evaluate the effectiveness of DBP Removal Systems at Clear Wells #1 and/or #2, Reservoir #2, Edna Saddle and Bishop Tank	Various	--	--	--	--	--	--	Clear Wells #1 and/or #2, Reservoir #2, Edna Saddle and Bishop Tanks	$60,000	LS	$60,000	**$84,000**
1-53	**Highland 2**	Replace 24" water main under Railroad Crossing at Mt. Bishop	High Pressure	High Pressure	--	400	24	24	Highland Drvie	@ Mt. Bishop under the RR Crossing	$375	LF	$150,000	**$210,000**
													TOTAL FIRST PRIORITY PROJECT COSTS	**$26,672,030**

**** Total includes construction cost plus preliminary engineering, design engineering, administration construction management and inspection costs. Construction costs were developed based on engineering judgment, confirmed bid prices for similar work in the Central Coast area, consultation with vendors and contractors, established budgetary unit prices for the work, and other reliable sources.**

All CIP costs are expressed in April 2015 dollars, using McGraw-Hill ENR Construction Cost Index of 9992, and will need to be escalated to the year or years scheduled for the work.

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Table 9-2. Second Priority Master Plan Improvement Projects

Project #	Title	Description	Existing Zone	Proposed Zone	Quantity	Length (Ft)	Exist Diameter (in)	New Diameter (in)	Street	Location	Construction Cost ($)		Subtotal ($)	Total Project Cost ($)**
2-1	**San Luis Drive 2**	Increase fire flows	Andrews & High Pressure	Andrews & High Pressure	---	850	8	12	San Luis Drive	California Blvd to Cazadero Street	$265	LF	$225,250	**$315,350**
2-2	**Flora**	Increase pressure and fire flows	Bishop	High Pressure	---	820	12	14	Flora Street	Bishop Street to Bishop Tank	$285	LF	$233,700	**$327,180**
2-3	**Alrita**	Increase pressure	Bishop	High Pressure	---	420	8	8	Alrita Street	Flora Street to Bahia Court	$185	LF	$77,700	**$108,780**
2-4	**Rosita**	4-inch Upgrade with fire flow deficiencies	Patricia	Foothill	---	400	4	8	Rosita Street	Cerro Romaulto to Foothill Blvd	$265	LF	$106,000	**$148,400**
2-5	**Al-Hil**	Increase fire flows	Highland	High Pressure	---	500	8	12	Backyard easement	Patricia Drive to Al-Hil Drive	$265	LF	$132,500	**$185,500**
					---	480	8	8	Patricia Drive	Patricia Court to Clover Drive	$265	LF	$127,200	**$178,080**
2-6	**Clover**	Increase fire flows	Highland	High Pressure	---	690	8	8	Clover Drive	Pasatiempo Drive to Patricia Drive	$265	LF	$182,850	**$255,990**
					---	440	8	8	Pasatiempo	Mira Sol Drive to Clover Drive	$265	LF	$116,600	**$163,240**
2-7	**Olive**	Increase fire flows	Foothill	Foothill	---	800	---	8	Olive Street	New easement from Santa Rosa Street to last fire hydrant	$265	LF	$212,000	**$296,800**
2-8	**Garfield**	Increase fire flows	Reservoir 1	Foothill	---	310	8	12	Garfield Street	Henderson Street to Monterey Street	$265	LF	$82,150	**$115,010**
2-9	**Dana**	Increase fire flows	Downtown	Downtown	---	250	---	8	Dana Street	Dana Street to Brizzolara Street	$265	LF	$66,250	**$92,750**
2-10	**Laurel Lane**	Increase fire flows	Bishop	High Pressure	---	1,000	6	8	Laurel Lane	Johnson Avenue to 1248 Laurel Lane	$265	LF	$265,000	**$371,000**
2-11	**Mutsuhito**	Increase fire flows	Terrace Hill	Terrace Hill	---	500	---	12	New easement in Parking Lot	McMillan Ave to Garbaldi Ave	$265	LF	$132,500	**$185,500**
					---	840	8	12	Mutsuhito Ave	Garibaldi Ave to Broad Street	$265	LF	$222,600	**$311,640**

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Table 9-2. Second Priority Master Plan Improvement Projects

Project #	Title	Description	Existing Zone	Proposed Zone	Quantity	Length (Ft)	Exist Diameter (in)	New Diameter (in)	Street	Location	Construction Cost ($)		Subtotal ($)	Total Project Cost ($)**
2-12	**Bishop**	Increase fire flows	Terrace Hill	Terrace Hill	---	580	---	8	Bishop Street	Terrace Hill Tank to Florence Avenue	$265	LF	$153,700	**$215,180**
2-13	**Calle Joaquin**	Increase fire flows	Edna Saddle	Edna Saddle	---	3,040	8	12	Calle Joaquin	Los Osos Valley Road to last fire hydrant	$265	LF	$805,600	**$1,127,840**
2-14	**Madonna**	Increase fire flows	Edna Saddle	Edna Saddle	---	690	---	12	Dalidio Drive	New loop to existing water main	$265	LF	$182,850	**$255,990**
					---	380	---	12	Shopping Center	New loop to Madonna Road	$265	LF	$100,700	**$140,980**
2-15	**Flora 2**	Operations & Maintenance	Bishop	High Pressure	---	1,050	12	12	Flora Street	2250 Flora Street to Sydney Street	$265	LF	$278,250	**$389,550**
2-16	**Sydney**	Operations & Maintenance	Bishop	High Pressure	---	660	6	8	Sydney Street	Augusta Street to Johnson Ave	$265	LF	$174,900	**$244,860**
2-17	**Sydney 2**	Operations & Maintenance	Bishop	High Pressure	---	500	6	8	Sydney Street	Flora Street to Dead-end	$265	LF	$132,500	**$185,500**
2-18	**Gerda**	Operations & Maintenance	Bishop	High Pressure	---	270	4	8	Gerda Street	Augusta Street to Dead-end	$265	LF	$71,550	**$100,170**
2-19	**Mill**	Operations & Maintenance	Downtown & Reservoir 1	Downtown & Foothill	---	1,020	6	8	Mill Street	Santa Rosa Street to Johnson Street	$265	LF	$270,300	**$378,420**
2-20	**Santa Rosa**	Operations & Maintenance	Downtown	Downtown	---	1,450	6	8	Santa Rosa Street	Pacific Street to Leff Street	$265	LF	$384,250	**$537,950**
2-21	**Woodbridge**	Operations & Maintenance	Downtown	Downtown	---	710	6 & 8	8	Woodbridge Street	Lawton Ave to Broad Street	$265	LF	$188,150	**$263,410**
2-22	**Funston**	Operations & Maintenance	Downtown	Downtown	---	800	8	8	Funston Street	Meadow Street to Broad Street	$265	LF	$212,000	**$296,800**
2-23	**Oceanaire**	Operations & Maintenance	Edna Saddle	Edna Saddle	---	1,880	6 & 8	8	Oceanaire Street	Madonna Road to Cayucos Drive	$265	LF	$498,200	**$697,480**
2-24	**Stenner**	Operations & Maintenance	Foothill	Foothill	---	580	8	8	Stenner Street	Murray Street to end of cul-de-sac	$265	LF	$153,700	**$215,180**
2-25	**Ferrini**	Operations & Maintenance	Foothill	Foothill	---	1,100	6	8	Ferrini Road	Felton Way to Foothill Blvd	$265	LF	$291,500	**$408,100**

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Table 9-2. Second Priority Master Plan Improvement Projects

Project #	Title	Description	Existing Zone	Proposed Zone	Quantity	Length (Ft)	Exist Diameter (in)	New Diameter (in)	Street	Location	Construction Cost ($)		Subtotal ($)	Total Project Cost ($)**
2-26	**Tassajara**	Operations & Maintenance	Foothill	Foothill	---	470	6	8	Tassajara Drive	Foothill Blvd to Ramona Drive	$265	LF	$124,550	**$174,370**
2-27	**Santa Lucia**	Operations & Maintenance	Foothill	Foothill	---	850	6	8	Santa Lucia Drive	Cerro Romauldo to Tolosa Way	$265	LF	$225,250	**$315,350**
2-28	**Tolosa**	Operations & Maintenance	Foothill	Foothill	---	540	6	8	Tolosa Way	Santa Lucia Drive to Tassajara Drive	$265	LF	$143,100	**$200,340**
2-29	**Boysen**	Operations & Maintenance	Foothill	Foothill	---	1,280	6 & 8	8	Boysen Ave	Santa Rosa Street to Chorro Street	$265	LF	$339,200	**$474,880**
2-30	**Chorro 3**	Operations & Maintenance	Foothill	Foothill	---	1,790	18	24	Chorro Street	Ferrini Road to Foothill Blvd	$400	LF	$716,000	**$1,002,400**
2-31	**Hope**	Operations & Maintenance	High Pressure	High Pressure	---	1,190	4 & 6	8	Hope Street	Grand Ave to Dead-end	$265	LF	$315,350	**$441,490**
2-32	**Stenner 2**	Operations & Maintenance	Foothill	Foothill	---	5,250	30	30	Stenner	From the WTP to Bressi PS	$450	LF	$2,362,500	**$3,307,500**
													TOTAL NEAR-TERM PROJECT COSTS	**$14,428,960**

**** Total includes construction cost plus preliminary engineering, design engineering, administration construction management and inspection costs. Construction costs were developed based on engineering judgment, confirmed bid prices for similar work in the Central Coast area, consultation with vendors and contractors, established budgetary unit prices for the work, and other reliable sources.**

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Table 9-3. Third Priority Master Plan Improvement Projects

Project #	Title	Description	Existing Zone	Proposed Zone	Quantity	Length (Ft)	Exist Diameter (in)	New Diameter (in)	Street	Location	Construction Cost ($)		Subtotal ($)	Total Project Cost ($)**
3-1	**Reservoir Canyon PS**	Replace the entire pump station	Reservoir Canyon	Reservoir Canyon	1	---	---	---	Highway 101	Adjacent to Reservoir 1	150,000	LS	$150,000	**$210,000**
3-2	**Reservoir #1**	Construct two new tanks, 1.5 MG each	Reservoir 1	Foothill	3 MG	---	---	---	Highway 101	Miossi Road	$1	GAL	$3,000,000	**$4,200,000**
3-3	**Foothill**	Increase fire flows	High Pressure	High Pressure	---	670	6	8	Foothill Blvd	Crandall Way to Dead-end	$185	LF	$123,950	**$173,530**
3-4	**Johnson 2**	Upgrade 4-inch main	Reservoir 1	Foothill	---	370	4	8	Johnson Ave	Peach Street to Mill Street	$185	LF	$68,450	**$95,830**
3-5	**Sendero**	Upgrade 4-inch main	Downtown	Downtown	---	430	4	8	Sendero Street	Corrida Drive to Woodbridge Street	$185	LF	$79,550	**$111,370**
3-6	**Broad**	Increase fire flows	Edna Saddle	Edna Saddle		1,700	10 & 12	12	Broad Street	Tank Farm Road to Fuller Street	$265	LF	$450,500	**$630,700**
3-7	**Mill 2**	Upgrade 4-inch main	Reservoir 1	Foothill	---	520	4	8	Mill Street	Johnson Ave to Pepper Street	$185	LF	$96,200	**$134,680**
3-8	**Loomis**	Upgrade 4-inch main	High Pressure	High Pressure	---	620	4	8	Loomis Street	Buena Vista Ave to Santa Ynez Ave	$185	LF	$114,700	**$160,580**
3-9	**Greta**	Upgrade 4-inch main	Terrace Hill	Terrace Hill	---	530	4	8	Greta Place	Sydney Street to Augusta Street	$185	LF	$98,050	**$137,270**
3-10	**Hill**	Operations & Maintenance	Downtown	Downtown	---	220	4	8	Hill Street	Lincoln Street to 525 Hill Street	$185	LF	$40,700	**$56,980**
3-11	**Chorro 4**	Operations & Maintenance	Foothill	Foothill	---	2,070	12 & 14	16	Chorro Street	Foothill Blvd to Mission Street	$325	LF	$672,750	**$941,850**
3-12	**Taft**	Operations & Maintenance	High Pressure	High Pressure	---	240	6	8	Taft Street	Kentucky Street to Dead-end	$185	LF	$44,400	**$62,160**

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Table 9-3. Third Priority Master Plan Improvement Projects

Project #	Title	Description	Existing Zone	Proposed Zone	Quantity	Length (Ft)	Exist Diameter (in)	New Diameter (in)	Street	Location	Construction Cost ($)		Subtotal ($)	Total Project Cost ($)**
3-13	**Pacific 2**	Operations & Maintenance	Reservoir 1	Foothill	---	480	4	8	Pacific Street	Johnson Ave to Pepper Street	$185	LF	$88,800	**$124,320**
3-14	**Peach**	Operations & Maintenance	Reservoir 1	Foothill	---	520	6	8	Peach Street	Toro Street to Johnson Ave	$185	LF	$96,200	**$134,680**
3-15	**Reba**	Operations & Maintenance	Bishop	High Pressure	---	270	4	8	Reba Street	Augusta Street to Dead-end	$185	LF	$49,950	**$69,930**
3-16	**Railroad**	Operations & Maintenance	Terrace Hill	Terrace Hill	---	2,700	16	16	Railroad Easement	Boulevard Del Campo to Orcutt Road	$325	LF	$877,500	**$1,228,500**
3-17	**West**	Operations & Maintenance	Downtown	Downtown	---	730	6	8	West Street	Chorro Street to Lincoln Street	$185	LF	$135,050	**$189,070**
3-18	**Monterey**	Operations & Maintenance	Reservoir 1	Foothill	---	1,030	10 & 12	12	Monterey Street	Johnson Ave to California Blvd	$265	LF	$272,950	**$382,130**
													TOTAL NEAR-TERM PROJECT COSTS	**$9,043,580**

**** Total includes construction cost plus preliminary engineering, design engineering, administration construction management and inspection costs. Construction costs were developed based on engineering judgment, confirmed bid prices for similar work in the Central Coast area, consultation with vendors and contractors, established budgetary unit prices for the work, and other reliable sources.**

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2-32 STENNER 2

1-15 STENNER CREEK

STENNER CREEK

1-16 FERRINI PS

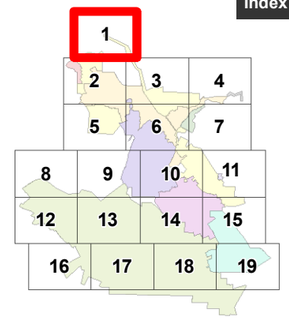
FERRINI

TWIN RIDGE

MONTROSE

High Pressure Zone

Index Map



CAPITAL IMPROVEMENT PROJECTS

FIGURE 9-1

CITY OF SAN LUIS OBISPO
POTABLE WATER
DISTRIBUTION SYSTEM
OPERATIONS MASTER PLAN

EXISTING WATER MAIN

PRIORITY 1 CIP
EXISTING WATER MAIN
PROPOSED WATER MAIN

PRIORITY 2 CIP
EXISTING WATER MAIN
PROPOSED WATER MAIN

Priority 3 CIP
EXISTING WATER MAIN

N

0 250 500 Feet

1 inch = 500 feet

city of san luis obispo

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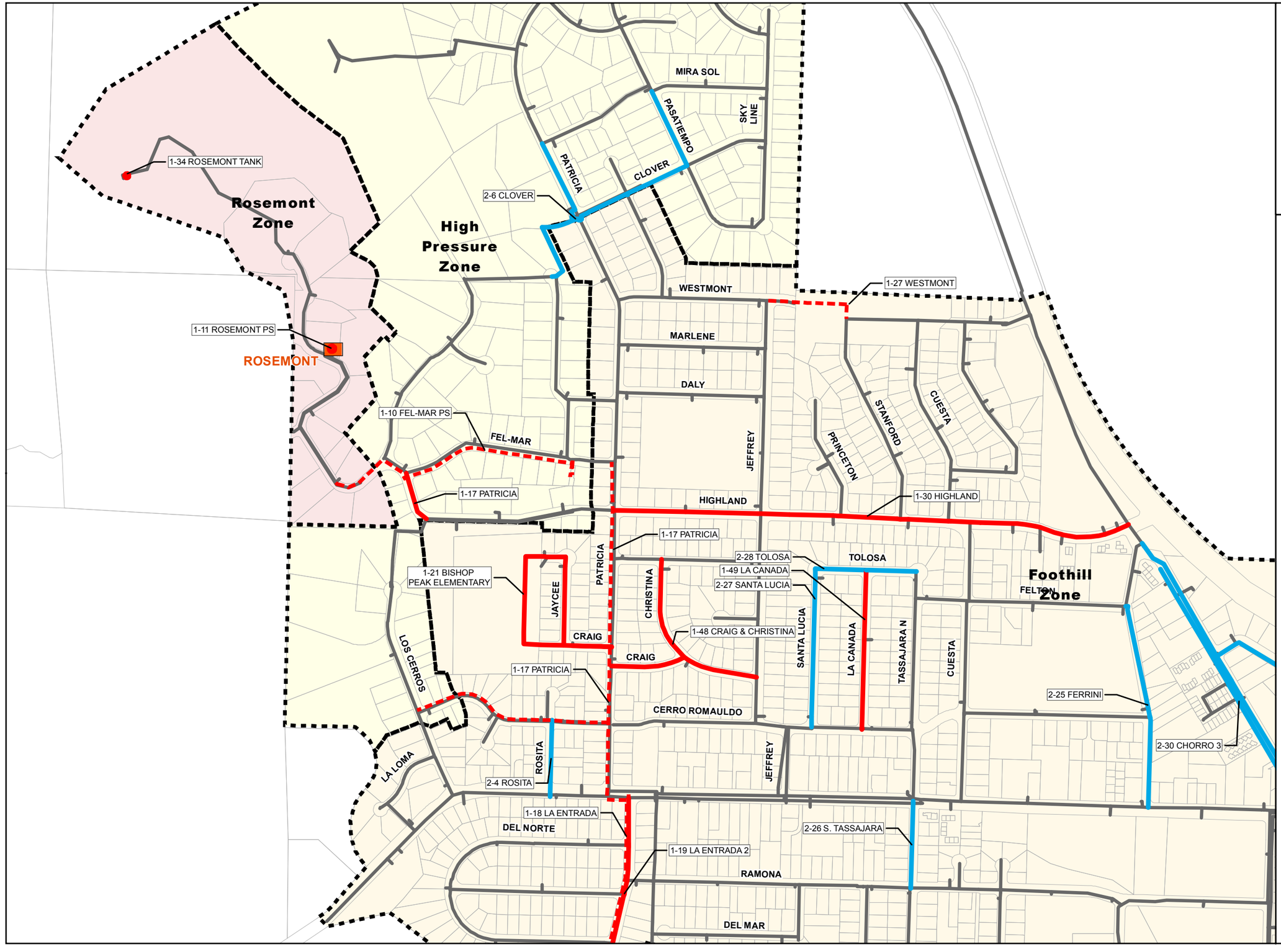

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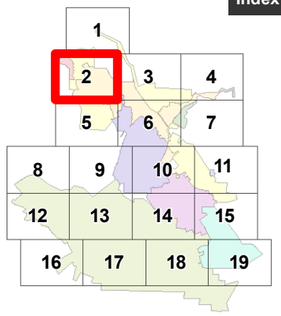

CAPITAL IMPROVEMENT PROJECTS

FIGURE 9-2

CITY OF SAN LUIS OBISPO
POTABLE WATER
DISTRIBUTION SYSTEM
OPERATIONS MASTER PLAN

EXISTING WATER MAIN

PRIORITY 1 CIP
EXISTING WATER MAIN
PROPOSED WATER MAIN

PRIORITY 2 CIP
EXISTING WATER MAIN
PROPOSED WATER MAIN

Priority 3 CIP
EXISTING WATER MAIN

0 250 500 Feet
1 inch = 500 feet

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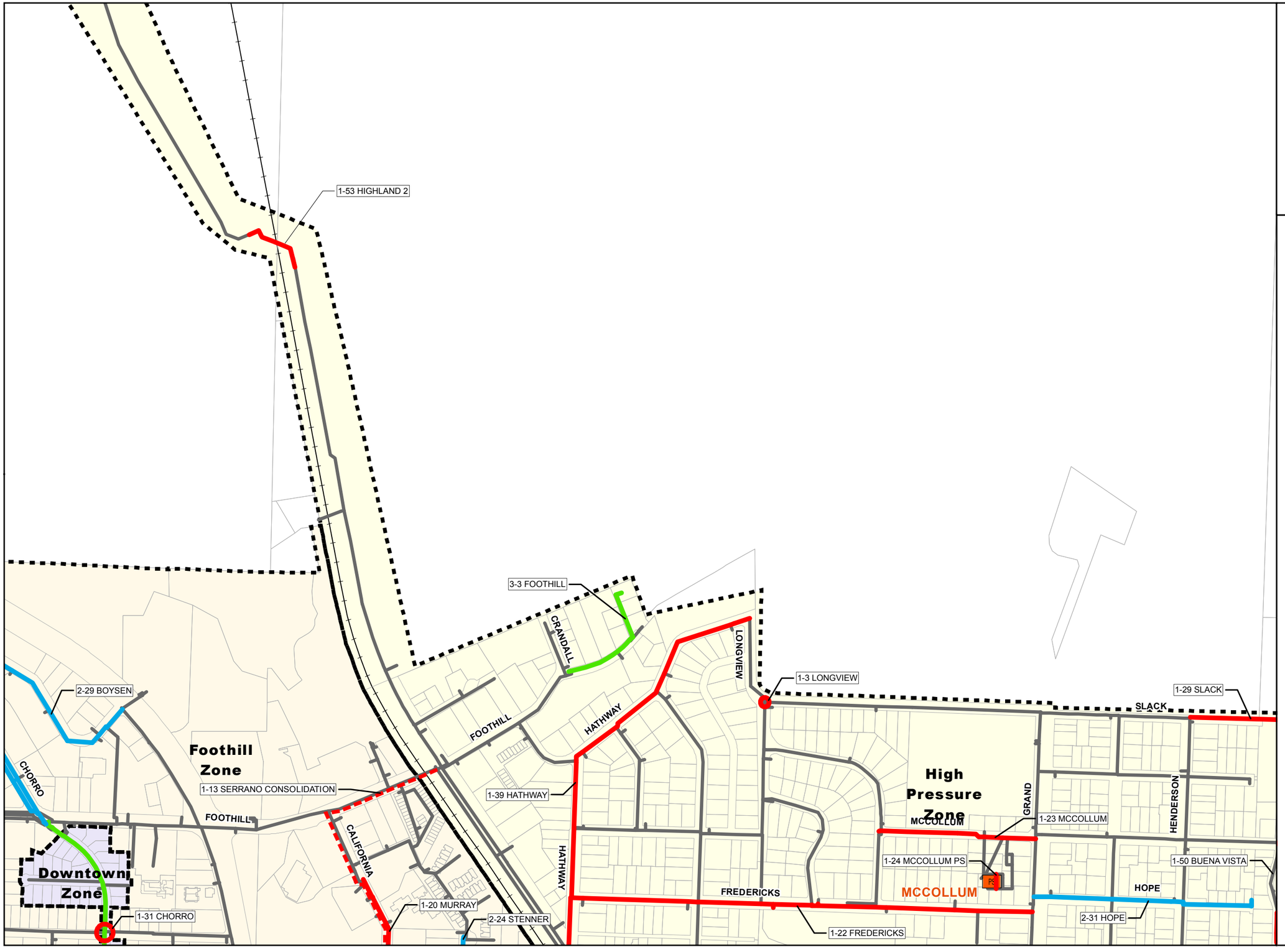

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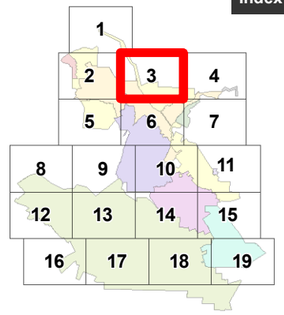

CAPITAL IMPROVEMENT PROJECTS

FIGURE 9-3

CITY OF SAN LUIS OBISPO
POTABLE WATER
DISTRIBUTION SYSTEM
OPERATIONS MASTER PLAN

EXISTING WATER MAIN

PRIORITY 1 CIP
EXISTING WATER MAIN
PROPOSED WATER MAIN

PRIORITY 2 CIP
EXISTING WATER MAIN
PROPOSED WATER MAIN

Priority 3 CIP
EXISTING WATER MAIN

0 250 500 Feet
1 inch = 500 feet

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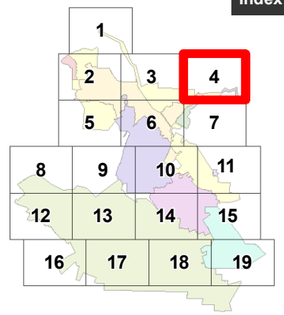
Index Map



CAPITAL IMPROVEMENT PROJECTS

FIGURE 9-4

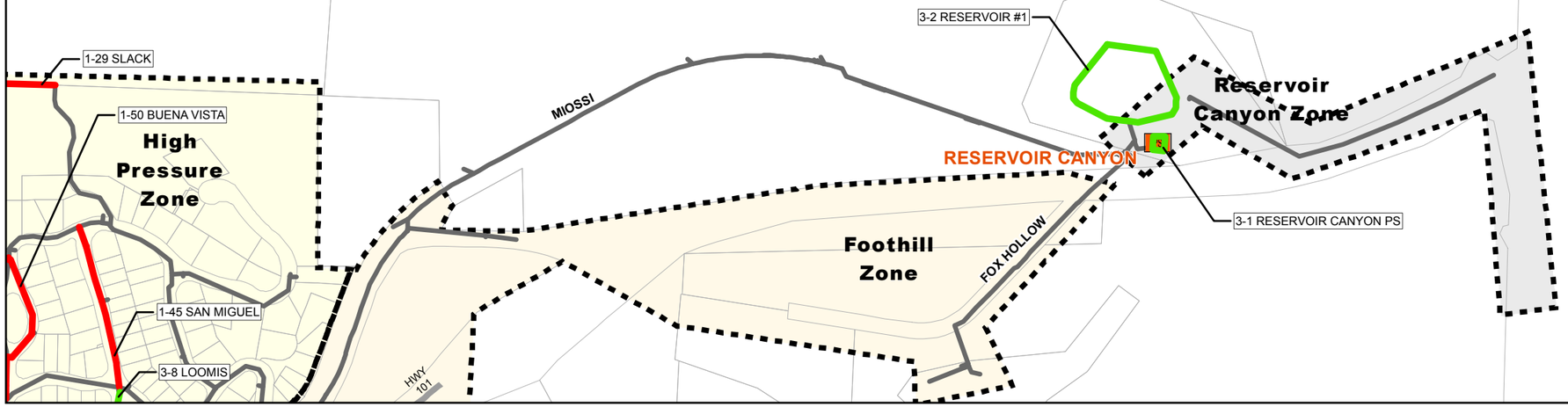
CITY OF SAN LUIS OBISPO
POTABLE WATER
DISTRIBUTION SYSTEM
OPERATIONS MASTER PLAN

EXISTING WATER MAIN

PRIORITY 1 CIP
EXISTING WATER MAIN
PROPOSED WATER MAIN

PRIORITY 2 CIP
EXISTING WATER MAIN
PROPOSED WATER MAIN

Priority 3 CIP
EXISTING WATER MAIN



0 250 500 Feet
1 inch = 500 feet

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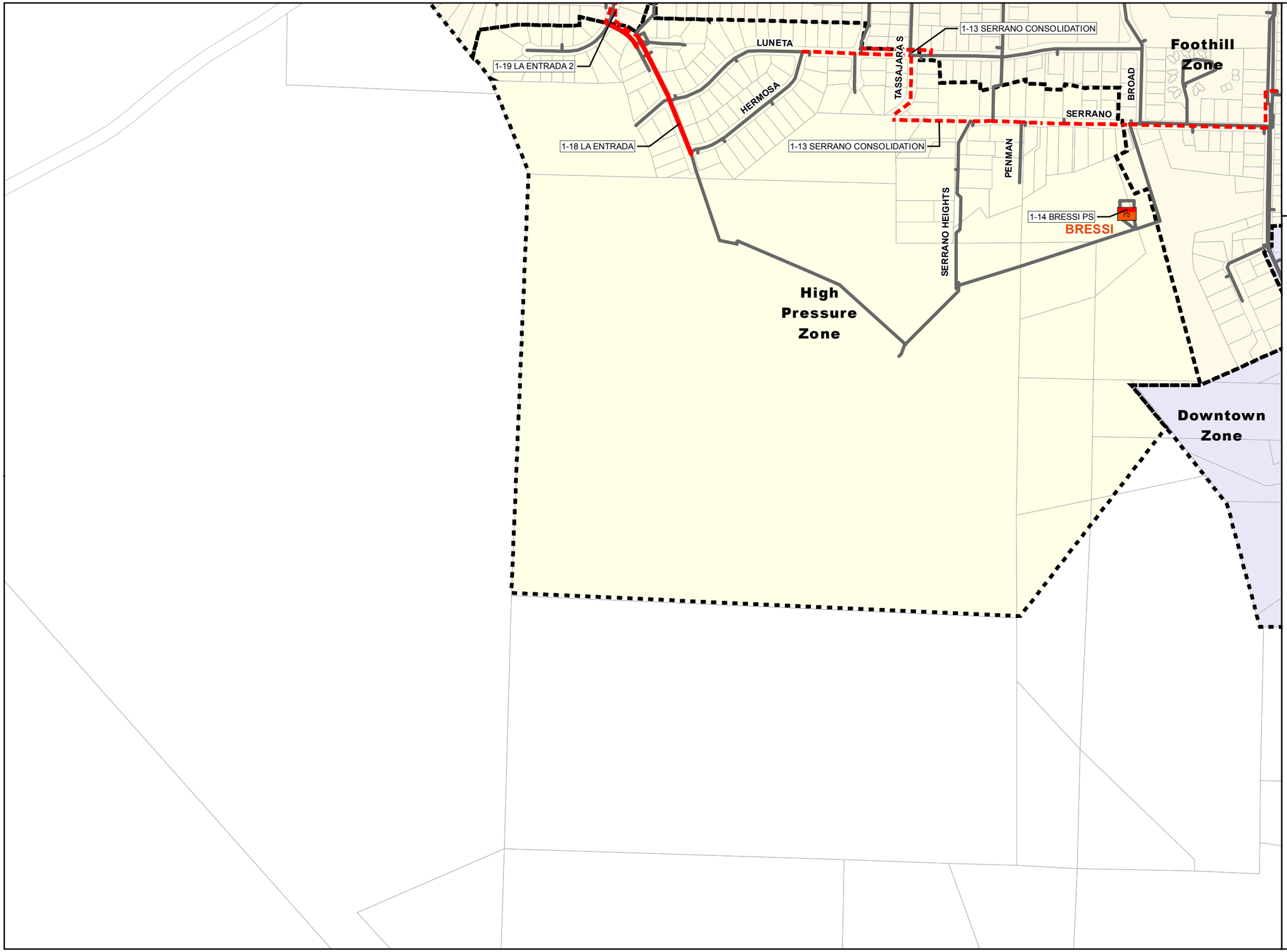
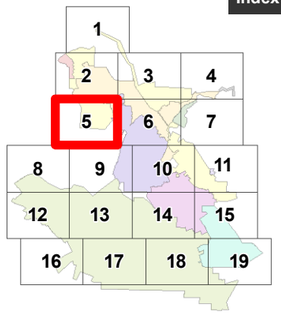


Index Map



CAPITAL IMPROVEMENT PROJECTS

FIGURE 9-5

CITY OF SAN LUIS OBISPO
POTABLE WATER
DISTRIBUTION SYSTEM
OPERATIONS MASTER PLAN

EXISTING WATER MAIN

PRIORITY 1 CIP
EXISTING WATER MAIN
PROPOSED WATER MAIN

PRIORITY 2 CIP
EXISTING WATER MAIN
PROPOSED WATER MAIN

Priority 3 CIP
EXISTING WATER MAIN

N

0 250 500 Feet

1 inch = 500 feet

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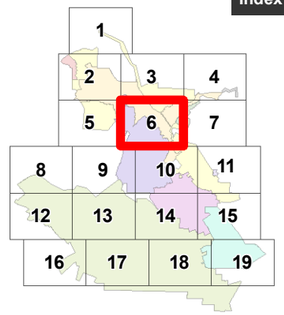
2-24 STENNER
STENNER
1-31 CHORRO
MURRAY
1-20 MURRAY
3-8 LOOMIS
3-12 TAFT
2-8 GARFIELD
3-17 WEST
Foothill Zone
HATHWAY
3-11 CHORRO 4
1-28 HILLCREST
1-9 HATHWAY/MONTALBON PRV
1-46 LINCOLN
LINCOLN
2-7 OLIVE
HWY 101
TORO
3-4 JOHNSON 2
CALIFORNIA
3-14 PEACH
PEPPER
1-1 CAZADERO PRV
Andrews Street Zone
SAN LUIS
MOUNTAIN VIEW
2-7 OLIVE
3-7 MILL 2
1-42 CALIFORNIA
1-41 MOUNTAIN VIEW
2-19 MILL
MILL
JOHNSON
CAZADERO
LINCOLN
BROAD
PEACH
MONTEREY
3-18 MONTEREY
2-1 SAN LUIS DRIVE 2
1-5 BISHOP CONTROL VALVE
3-10 HILL
HILL
1-43 SAN LUIS DRIVE
1-47 HIGUERA
PALM
SANTA ROSA
TORO
CHORRO
HIGUERA
3-13 PACIFIC 2
1-38 MARSH
High Pressure Zone
MARSH
COURT
PACIFIC
Downtown Zone
1-4 BISHOP CONSOLIDATION
NIPOMO
2-20 SANTA ROSA
PISMO
1-44 JOHNSON
1-4 BISHOP CONSOLIDATION

Index Map



CAPITAL IMPROVEMENT PROJECTS

FIGURE 9-6

CITY OF SAN LUIS OBISPO
POTABLE WATER
DISTRIBUTION SYSTEM
OPERATIONS MASTER PLAN

EXISTING WATER MAIN

PRIORITY 1 CIP
EXISTING WATER MAIN
PROPOSED WATER MAIN

PRIORITY 2 CIP
EXISTING WATER MAIN
PROPOSED WATER MAIN

Priority 3 CIP
EXISTING WATER MAIN

0 250 500 Feet
1 inch = 500 feet

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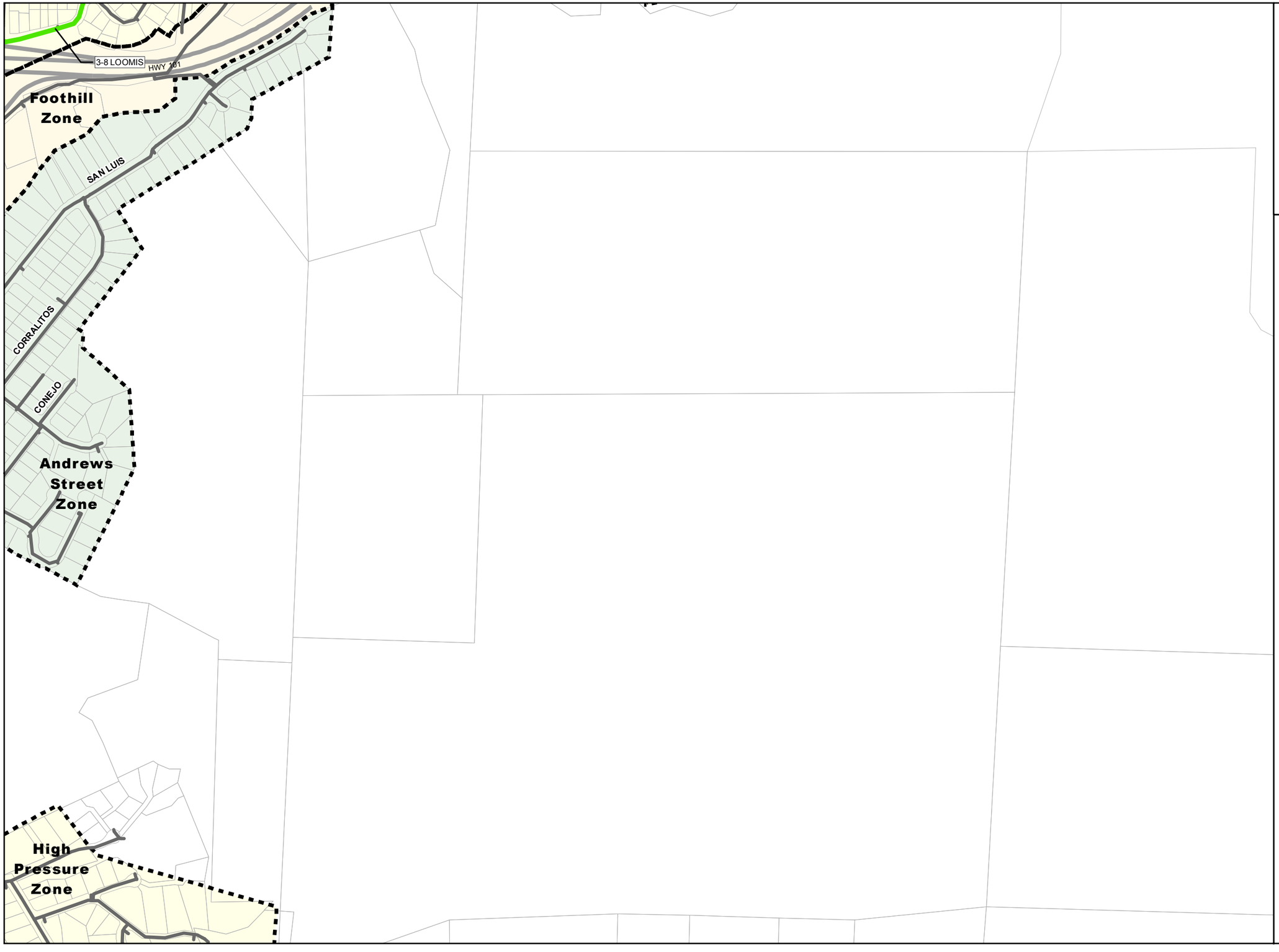

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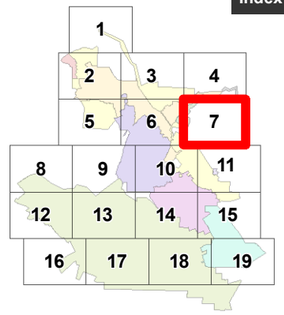

CAPITAL IMPROVEMENT PROJECTS

FIGURE 9-7

CITY OF SAN LUIS OBISPO
POTABLE WATER
DISTRIBUTION SYSTEM
OPERATIONS MASTER PLAN

EXISTING WATER MAIN

PRIORITY 1 CIP
EXISTING WATER MAIN
PROPOSED WATER MAIN

PRIORITY 2 CIP
EXISTING WATER MAIN
PROPOSED WATER MAIN

Priority 3 CIP
EXISTING WATER MAIN

N

0 250 500 Feet

1 inch = 500 feet

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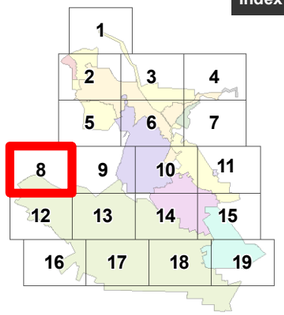

CAPITAL IMPROVEMENT PROJECTS

FIGURE 9-8

CITY OF SAN LUIS OBISPO
POTABLE WATER
DISTRIBUTION SYSTEM
OPERATIONS MASTER PLAN

EXISTING WATER MAIN

PRIORITY 1 CIP
EXISTING WATER MAIN
PROPOSED WATER MAIN

PRIORITY 2 CIP
EXISTING WATER MAIN
PROPOSED WATER MAIN

Priority 3 CIP
EXISTING WATER MAIN

Edna
Saddle
Zone

DIABLO
LOS OSOS VALLEY RD
VISTA DEL LAGO
DEL RIO AVE

0 250 500 Feet
1 inch = 500 feet

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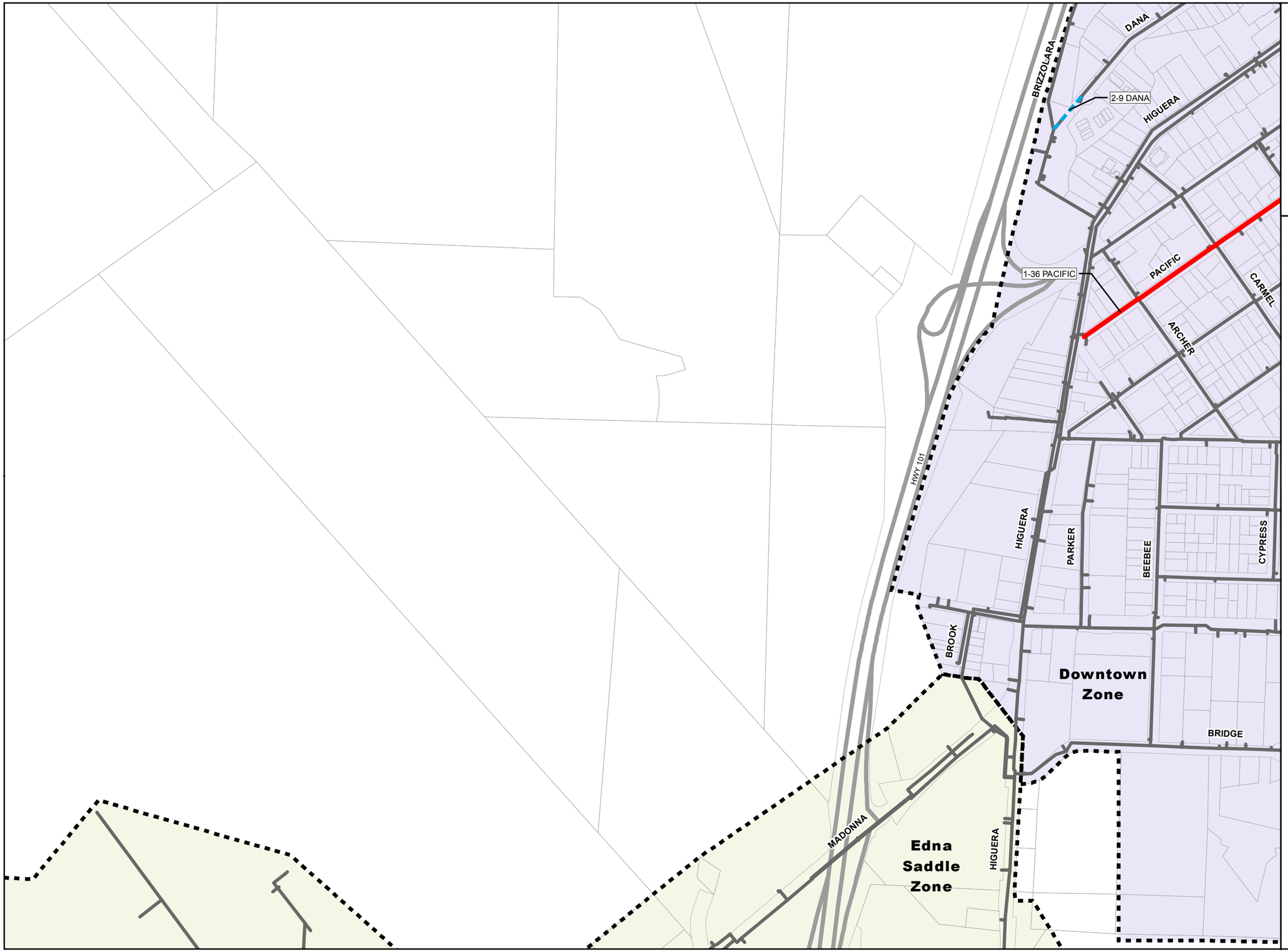

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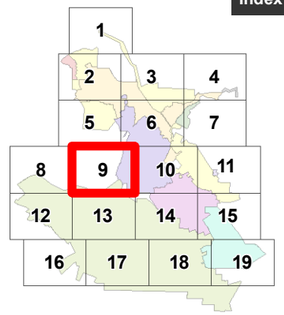

CAPITAL IMPROVEMENT PROJECTS

FIGURE 9-9

CITY OF SAN LUIS OBISPO
POTABLE WATER
DISTRIBUTION SYSTEM
OPERATIONS MASTER PLAN

EXISTING WATER MAIN

PRIORITY 1 CIP
EXISTING WATER MAIN
PROPOSED WATER MAIN

PRIORITY 2 CIP
EXISTING WATER MAIN
PROPOSED WATER MAIN

Priority 3 CIP
EXISTING WATER MAIN

0 250 500 Feet
1 inch = 500 feet

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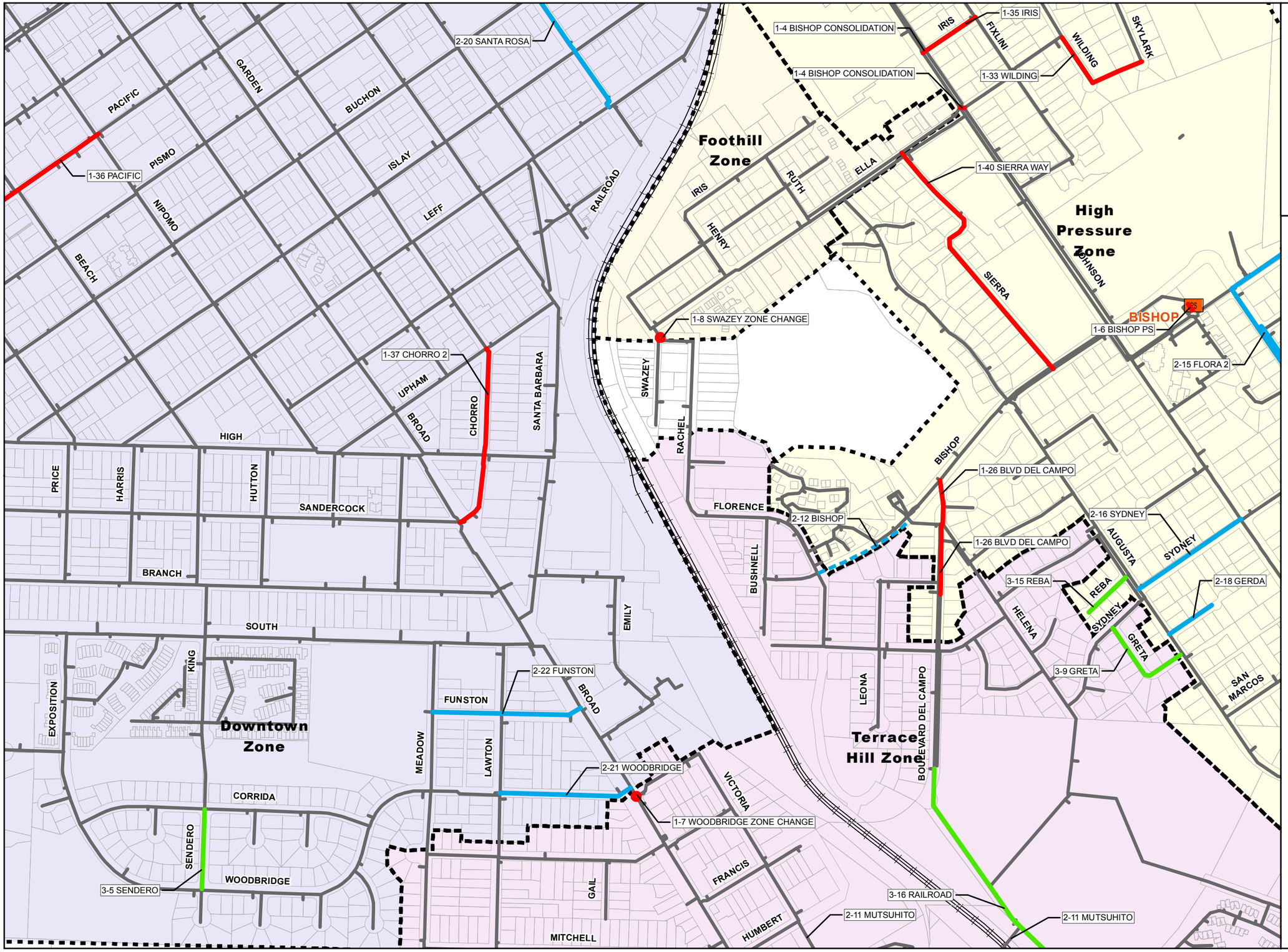
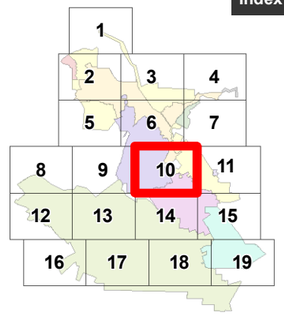


Index Map



CAPITAL IMPROVEMENT PROJECTS

FIGURE 9-10

CITY OF SAN LUIS OBISPO
POTABLE WATER
DISTRIBUTION SYSTEM
OPERATIONS MASTER PLAN

EXISTING WATER MAIN

PRIORITY 1 CIP
EXISTING WATER MAIN
PROPOSED WATER MAIN

PRIORITY 2 CIP
EXISTING WATER MAIN
PROPOSED WATER MAIN

Priority 3 CIP
EXISTING WATER MAIN

0 250 500 Feet
1 inch = 500 feet

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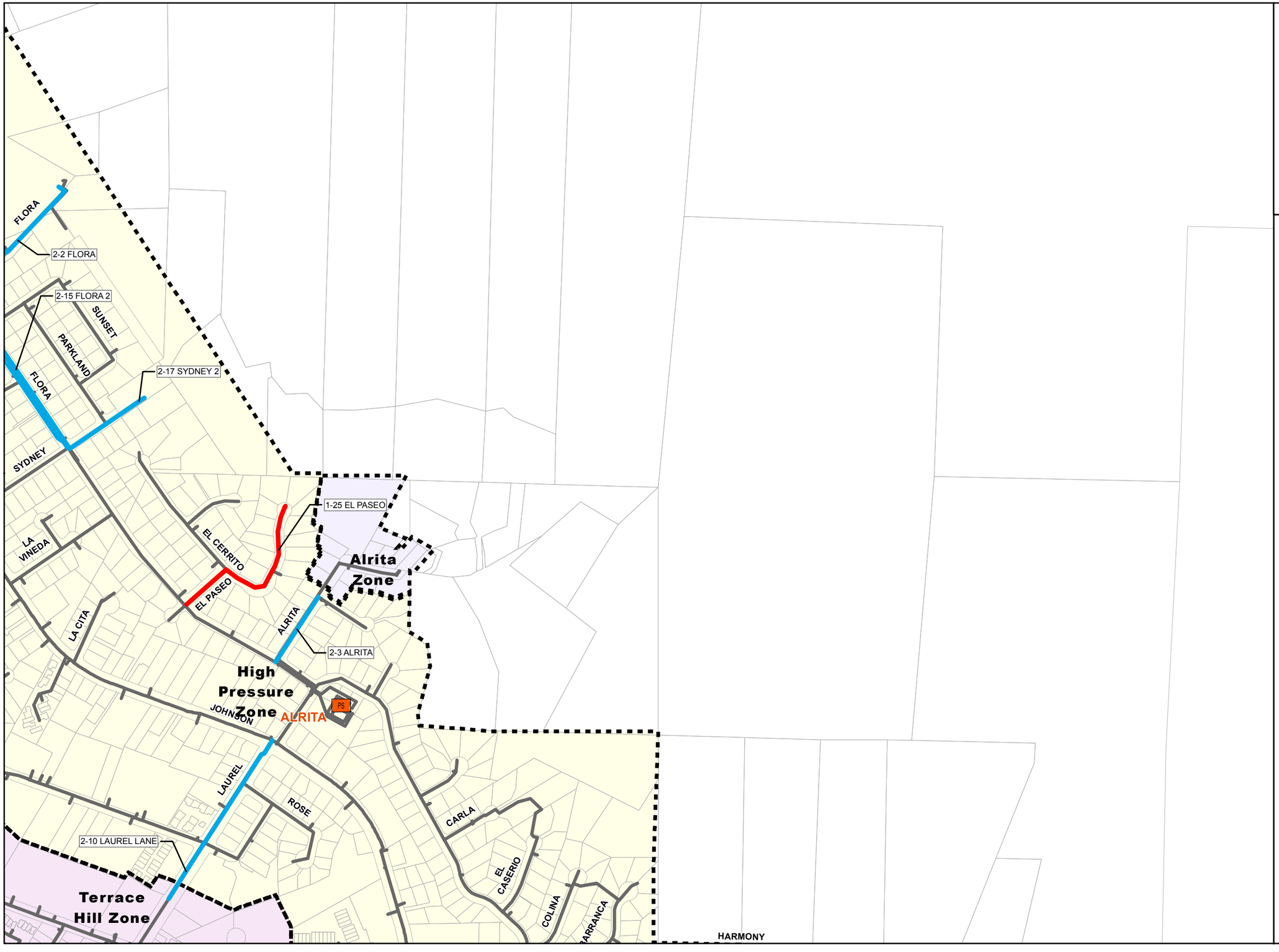

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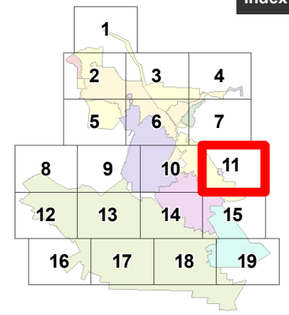

CAPITAL IMPROVEMENT PROJECTS

FIGURE 9-11

CITY OF SAN LUIS OBISPO
POTABLE WATER
DISTRIBUTION SYSTEM
OPERATIONS MASTER PLAN

EXISTING WATER MAIN

PRIORITY 1 CIP
EXISTING WATER MAIN
PROPOSED WATER MAIN

PRIORITY 2 CIP
EXISTING WATER MAIN
PROPOSED WATER MAIN

Priority 3 CIP
EXISTING WATER MAIN

0 250 500 Feet
1 inch = 500 feet

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DEL RIO

PREFUMO CANYON

LOS OSOS VALLEY

LAGUNA

OCEANAIRE

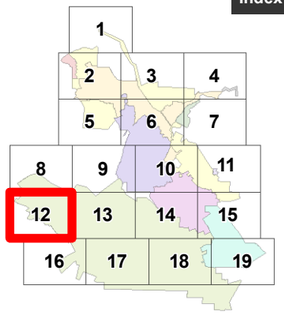
NEWPORT

ROYAL

MADONNA

Edna
Saddle
Zone

Index Map



CAPITAL IMPROVEMENT PROJECTS

FIGURE 9-12

CITY OF SAN LUIS OBISPO
POTABLE WATER
DISTRIBUTION SYSTEM
OPERATIONS MASTER PLAN

EXISTING WATER MAIN

PRIORITY 1 CIP
EXISTING WATER MAIN
PROPOSED WATER MAIN

PRIORITY 2 CIP
EXISTING WATER MAIN
PROPOSED WATER MAIN

Priority 3 CIP
EXISTING WATER MAIN

0 250 500 Feet
1 inch = 500 feet

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2-14 MADONNA

EL MERCADO

DALIDIO

2-14 MADONNA

MADONNA

2-23 OCEANAIRE

OCEANAIRE

CAYUCOS

LOS OSOS VALLEY

Edna Saddle Zone

HWY 101

ELKS

S HIGUERA

LOMA BONITA

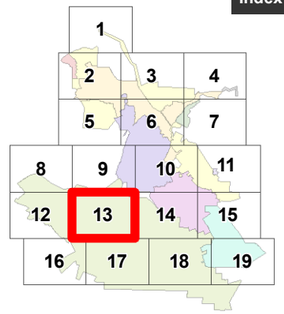
MARGARITA

PRADO

PRADO

ZACA

Index Map



CAPITAL IMPROVEMENT PROJECTS

FIGURE 9-13

CITY OF SAN LUIS OBISPO
POTABLE WATER
DISTRIBUTION SYSTEM
OPERATIONS MASTER PLAN

EXISTING WATER MAIN

PRIORITY 1 CIP
EXISTING WATER MAIN
PROPOSED WATER MAIN

PRIORITY 2 CIP
EXISTING WATER MAIN
PROPOSED WATER MAIN

Priority 3 CIP
EXISTING WATER MAIN

0 250 500 Feet
1 inch = 500 feet

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Downtown Zone

Terrace Hill Zone

Edna Saddle Zone

LAWRENCE

STONERIDGE

PERKINS

SWEENEY

BROAD

VICTORIA

MUTSUHITO

2-11 MUTSUHITO

GARIBALDI

McMILLAN

RAILROAD

3-16 RAILROAD

ORCUTT

ROCKVIEW

BULLOCK

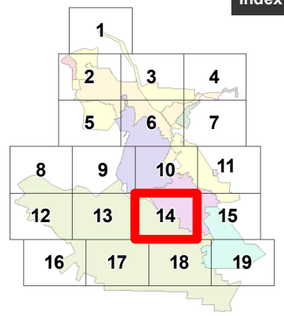
CAPITOLIO

MARGARITA

PRADO

3-6 BROAD

Index Map



CAPITAL IMPROVEMENT PROJECTS

FIGURE 9-14

CITY OF SAN LUIS OBISPO
POTABLE WATER
DISTRIBUTION SYSTEM
OPERATIONS MASTER PLAN

EXISTING WATER MAIN

PRIORITY 1 CIP
EXISTING WATER MAIN
PROPOSED WATER MAIN

PRIORITY 2 CIP
EXISTING WATER MAIN
PROPOSED WATER MAIN

Priority 3 CIP
EXISTING WATER MAIN

0 250 500 Feet
1 inch = 500 feet

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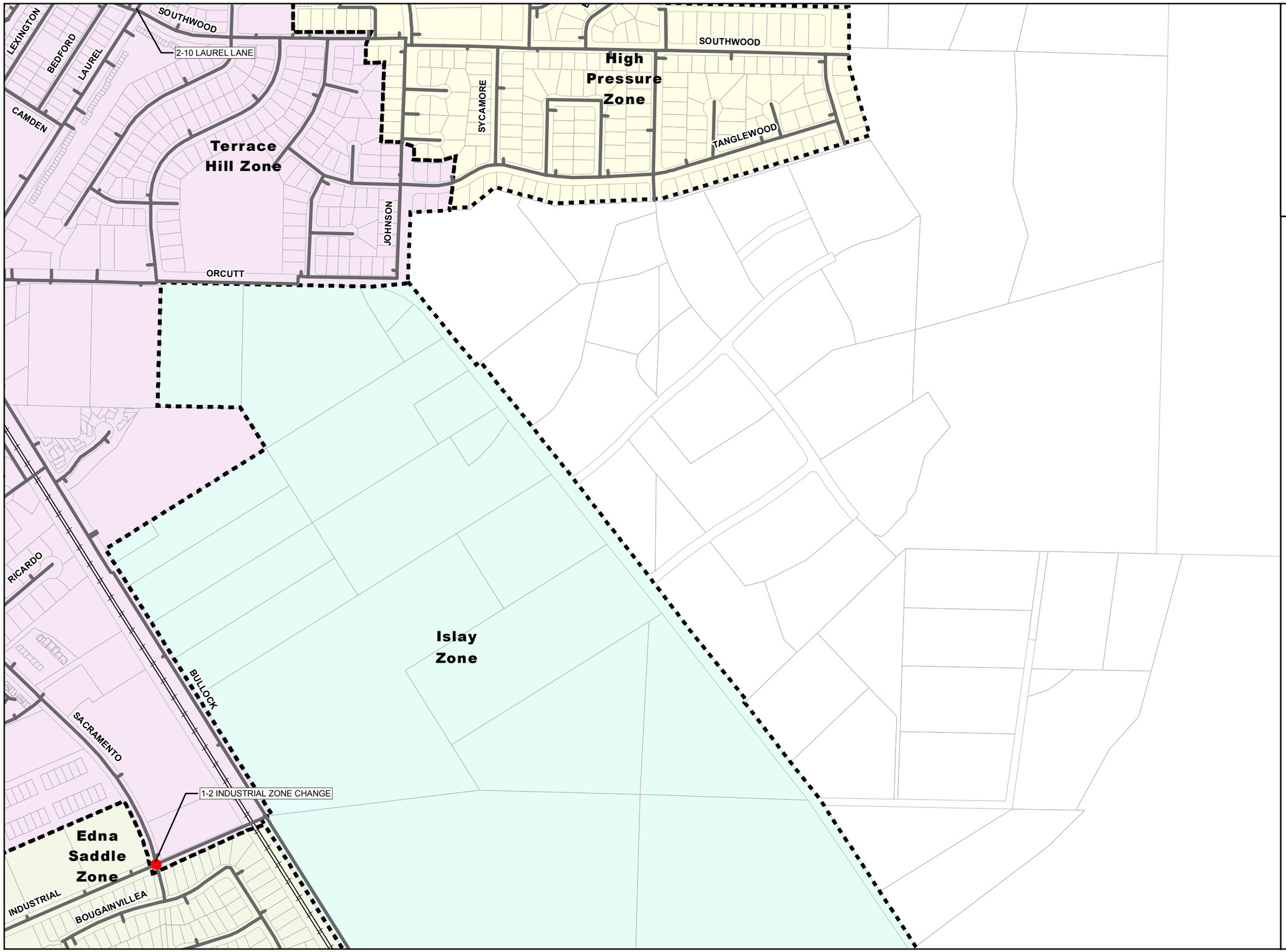
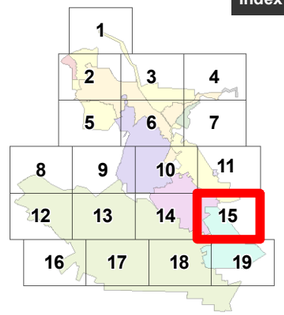


Index Map



CAPITAL IMPROVEMENT PROJECTS

FIGURE 9-15

CITY OF SAN LUIS OBISPO
POTABLE WATER
DISTRIBUTION SYSTEM
OPERATIONS MASTER PLAN

EXISTING WATER MAIN

PRIORITY 1 CIP
EXISTING WATER MAIN
PROPOSED WATER MAIN

PRIORITY 2 CIP
EXISTING WATER MAIN
PROPOSED WATER MAIN

Priority 3 CIP
EXISTING WATER MAIN

0 250 500 Feet
1 inch = 500 feet

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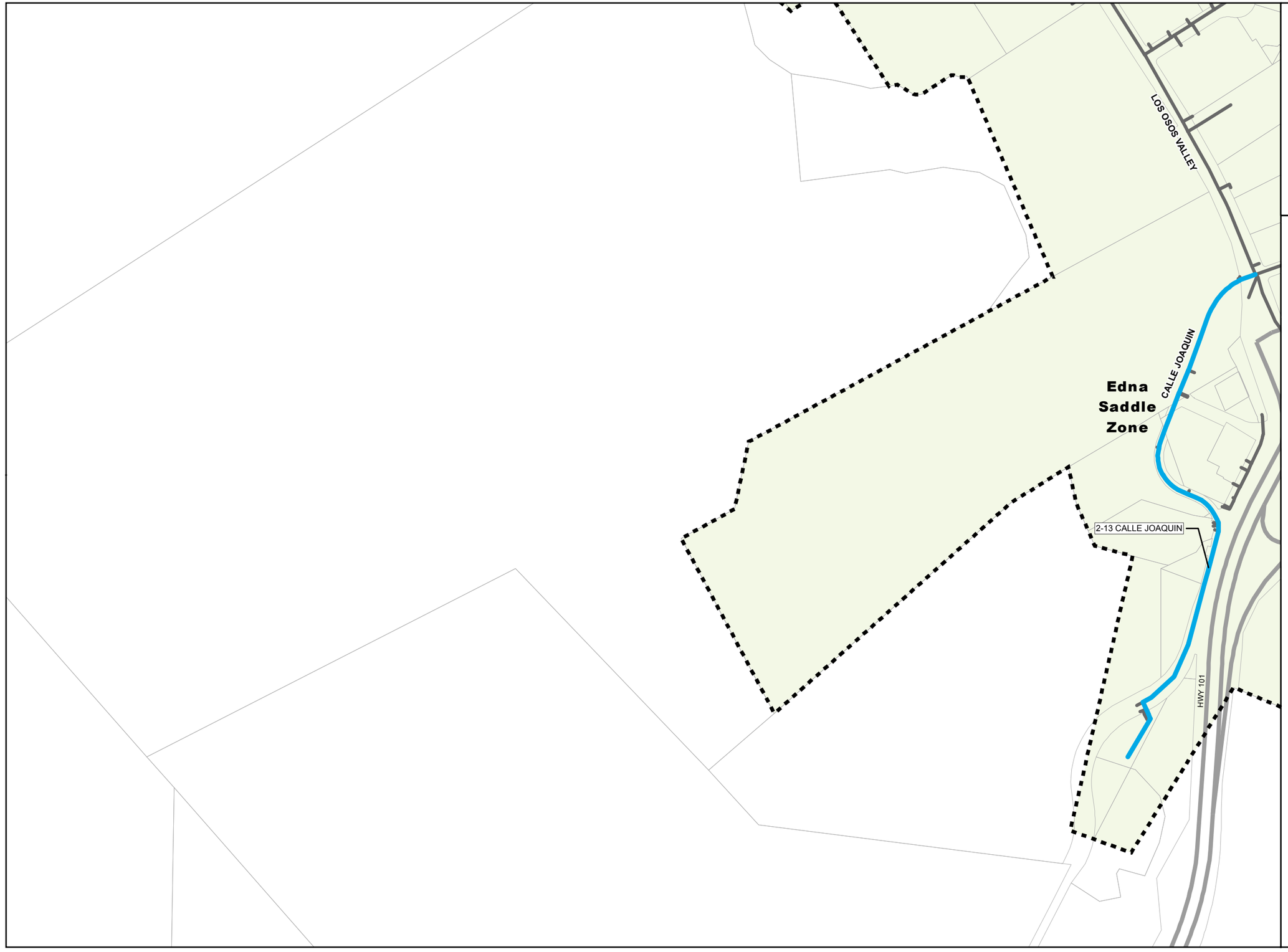

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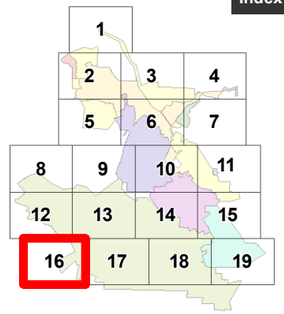

CAPITAL IMPROVEMENT PROJECTS

FIGURE 9-16

CITY OF SAN LUIS OBISPO
POTABLE WATER
DISTRIBUTION SYSTEM
OPERATIONS MASTER PLAN

EXISTING WATER MAIN

PRIORITY 1 CIP
EXISTING WATER MAIN
PROPOSED WATER MAIN

PRIORITY 2 CIP
EXISTING WATER MAIN
PROPOSED WATER MAIN

Priority 3 CIP
EXISTING WATER MAIN

N

0 250 500 Feet
1 inch = 500 feet

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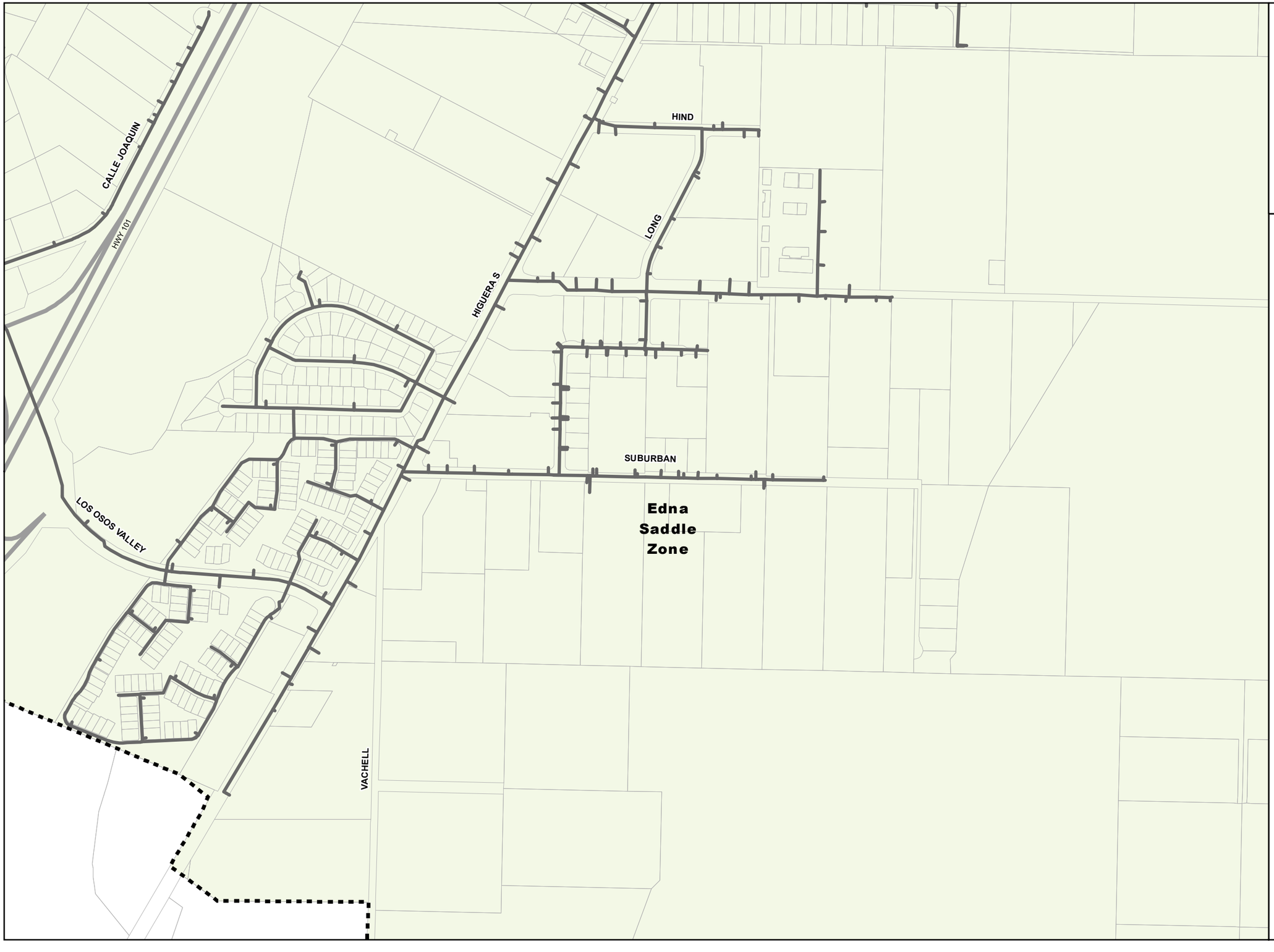

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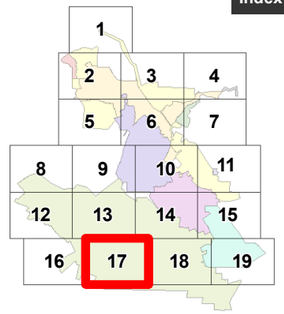

CAPITAL IMPROVEMENT PROJECTS

FIGURE 9-17

CITY OF SAN LUIS OBISPO
POTABLE WATER
DISTRIBUTION SYSTEM
OPERATIONS MASTER PLAN

EXISTING WATER MAIN

PRIORITY 1 CIP
EXISTING WATER MAIN
PROPOSED WATER MAIN

PRIORITY 2 CIP
EXISTING WATER MAIN
PROPOSED WATER MAIN

Priority 3 CIP
EXISTING WATER MAIN

N

0 250 500 Feet

1 inch = 500 feet

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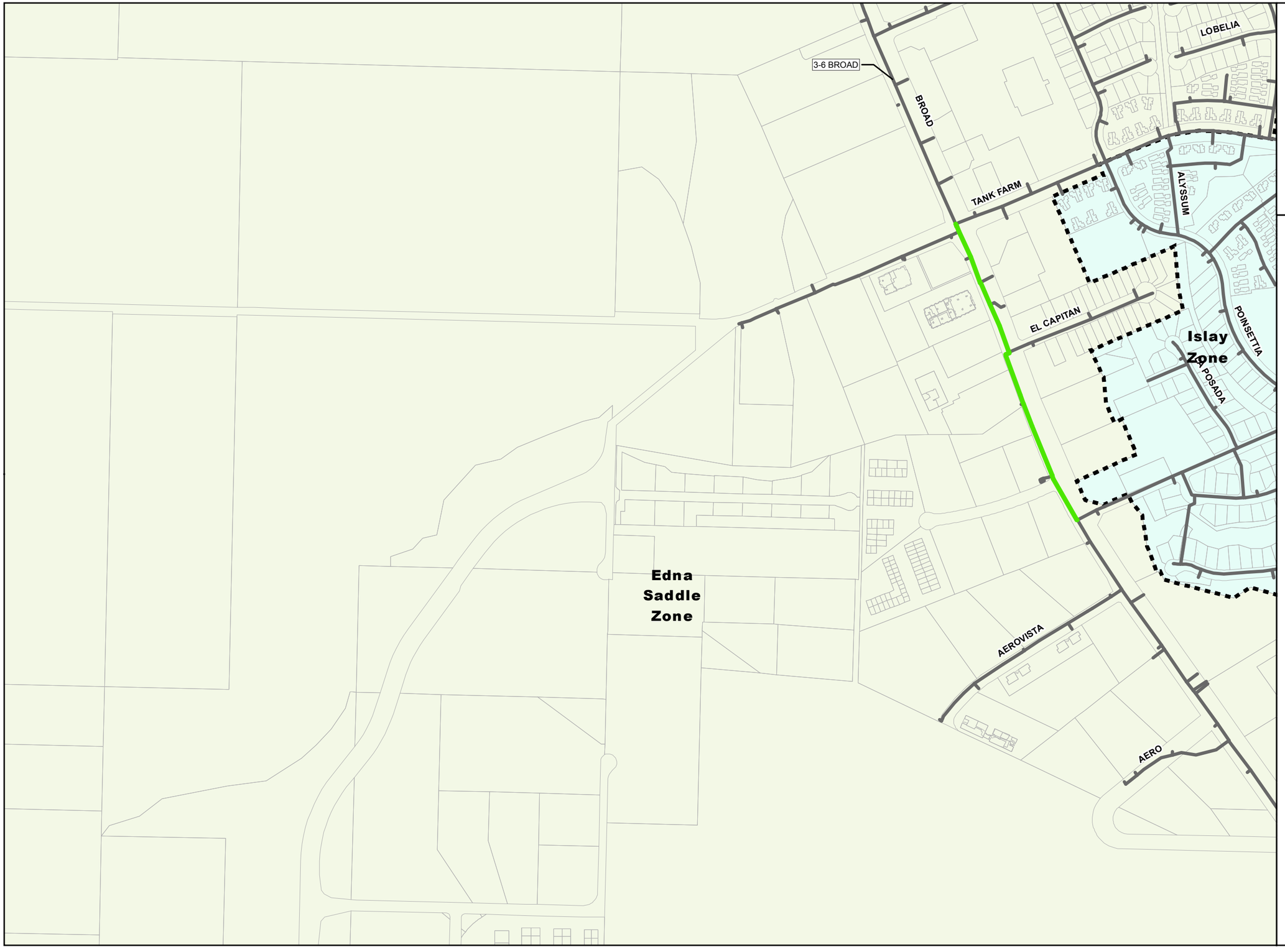
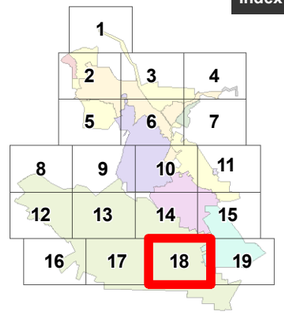


Index Map



CAPITAL IMPROVEMENT PROJECTS

FIGURE 9-18

CITY OF SAN LUIS OBISPO
POTABLE WATER
DISTRIBUTION SYSTEM
OPERATIONS MASTER PLAN

EXISTING WATER MAIN

PRIORITY 1 CIP
EXISTING WATER MAIN
PROPOSED WATER MAIN

PRIORITY 2 CIP
EXISTING WATER MAIN
PROPOSED WATER MAIN

Priority 3 CIP
EXISTING WATER MAIN

0 250 500 Feet
1 inch = 500 feet

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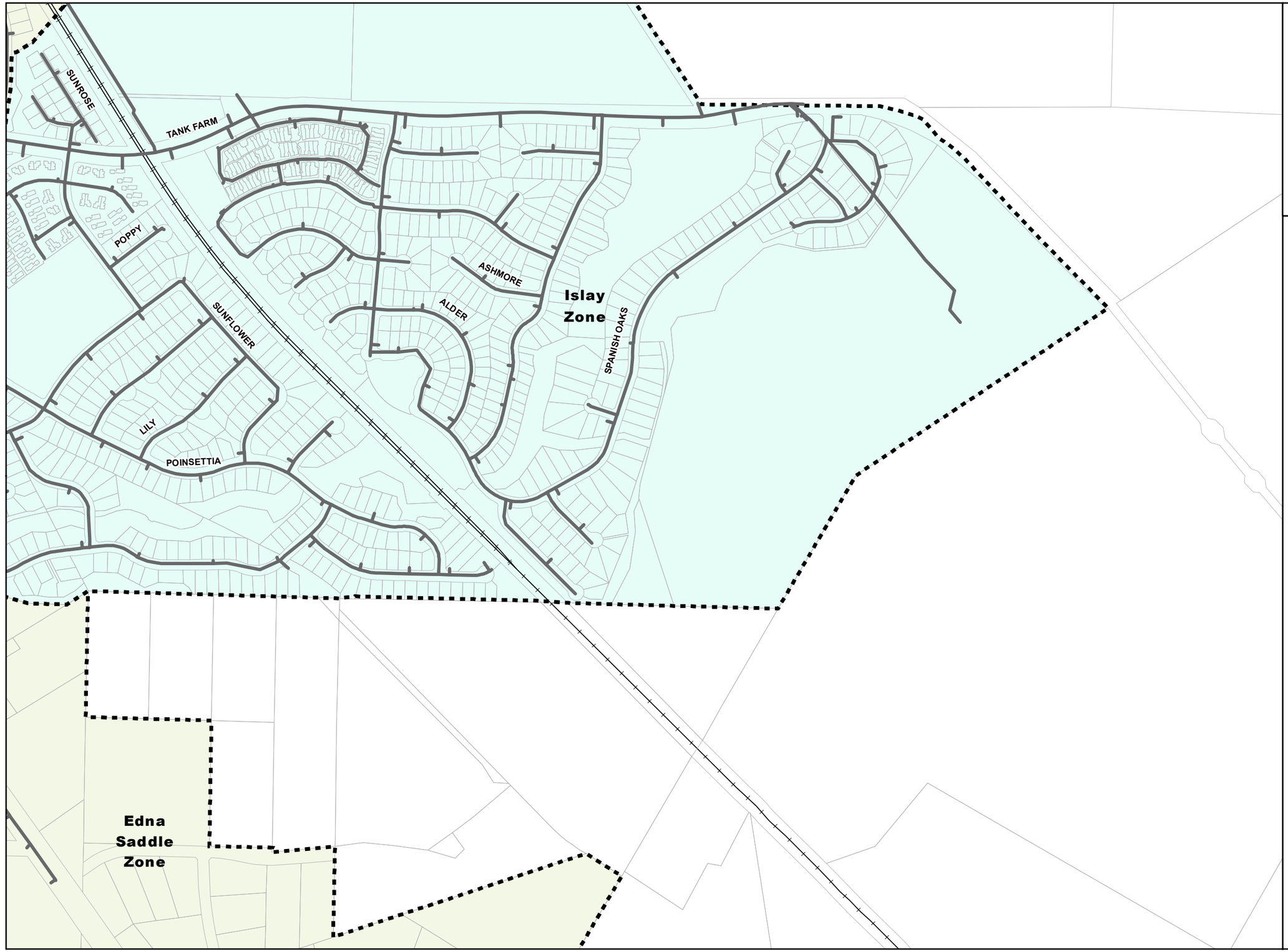
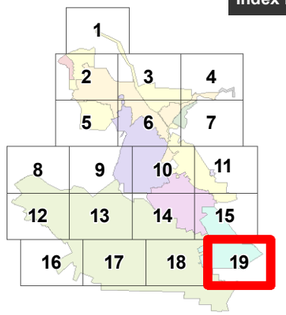


Index Map



CAPITAL IMPROVEMENT PROJECTS

FIGURE 9-19

CITY OF SAN LUIS OBISPO
POTABLE WATER
DISTRIBUTION SYSTEM
OPERATIONS MASTER PLAN

EXISTING WATER MAIN

PRIORITY 1 CIP
EXISTING WATER MAIN
PROPOSED WATER MAIN

PRIORITY 2 CIP
EXISTING WATER MAIN
PROPOSED WATER MAIN

Priority 3 CIP
EXISTING WATER MAIN

0 250 500 Feet
1 inch = 500 feet

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10: Future Water Distribution System Overview

Significant changes to the water distribution zones and the facilities that serve each zone are proposed throughout this report. This chapter provides an overview of the water distribution system once all of the zone consolidations occur. It is anticipated that the City will transition to this future scenario over a 5 to 10 year period. All tables and figures are located at the end of this chapter.

Water Distribution Zones

The proposed future water distribution system will consist of 9 zones. The distribution zones are listed as follows:

- Alrita
- Andrews
- Downtown
- Edna Saddle
- Foothill
- High Pressure
- Reservoir Canyon
- Rosemont
- Terrace Hill

A list of each of the distribution zones and their defining features are presented in Table 10-1 and are illustrated in Figure 10-1. Figures 10-2 provide a graphic representation of the hydraulic profile of the future water distribution system. This figure illustrates how each tank and pump station will hydraulically interact with one another and their relationship to the distribution zone(s) they will serve in the future. Figure 10-3 illustrates the location of water customers that will move from zone to another.

Specific Plan Areas

As part of this Water Master Plan, the Orcutt Area, Airport Area and the Margarita Area were more closely analyzed based on the proposed layouts at the time of the report. Appendix D provides the exhibits of the proposed layouts of the water distribution system based on the proposed street layout, development demands, and required fire flow.

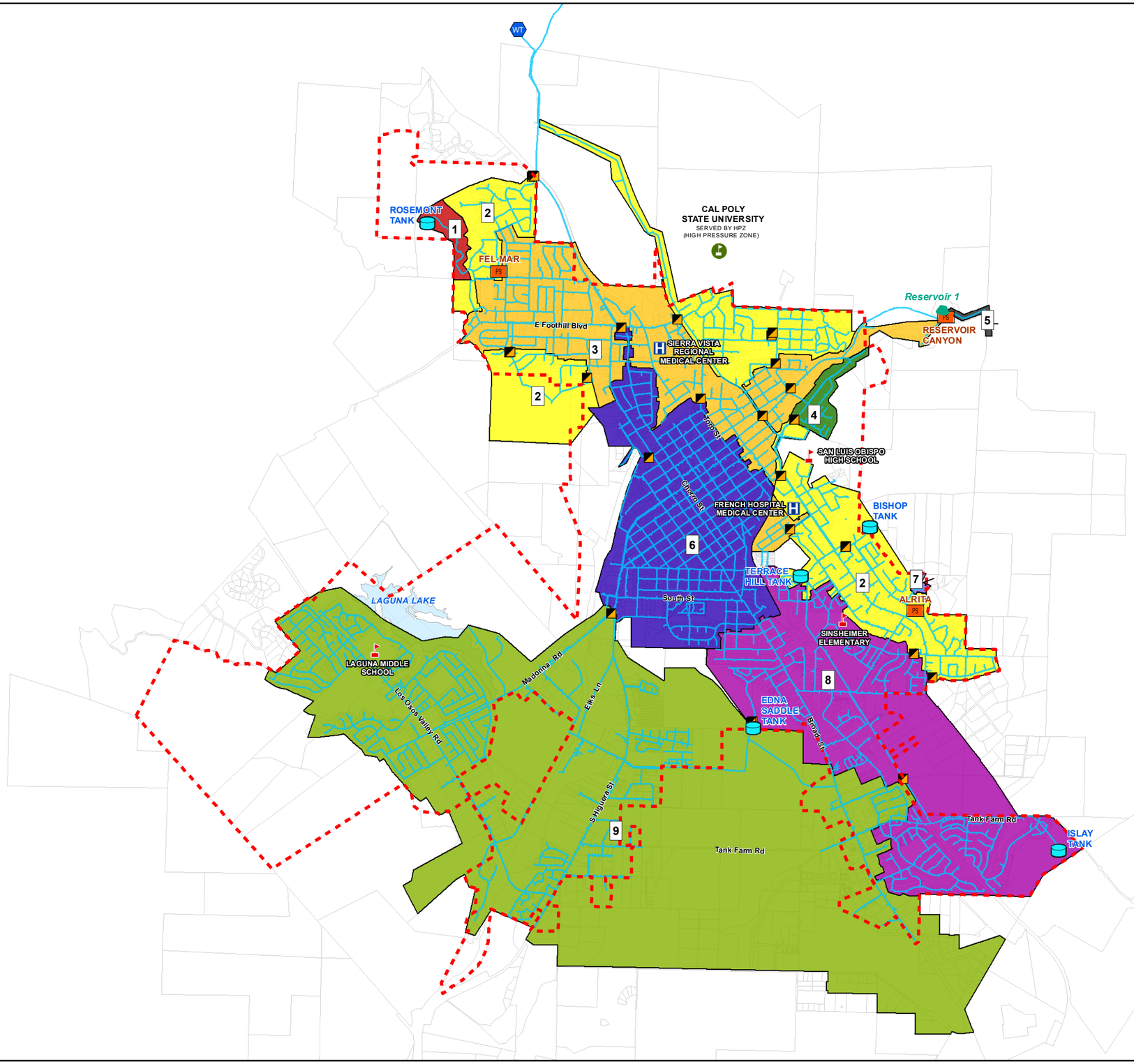
Table 10-1. Future Water Distribution Zone Summary

Distribution Zone	Supply			Tank		Service Area (acres)	# of Parcels
	Source	Pump Station	Pressure Reducing Valve(s)	Name	Size (gallons)		
Alrita (Boosted Zone)	High Pressure	Alrita	---	Alrita Hydro-pneumatic Tank	2@2,500	<10	13
Andrews	High Pressure	---	San Luis/Cazadero	---	---	60	174
Downtown	Foothill	---	Chorro/Foothill Peach/Broad (2)	---	---	870	2,882
Edna Saddle	Foothill via Downtown, Well PB#1, Well FS #4	---	Madonna/Higuera	Edna Saddle	4,000,000	3,925	3,771
Foothill	WTP (Clear Wells)	---	Foothill/Railroad (N/C) Grand California/Monterey Ella/Binns	WTP Clear Wells (2) Reservoir #1 (2)	5,000,000 3,000,000	840	2,420
High Pressure	WTP/Foothill	Transfer	---	Reservoir #2 (2) Bishop	5,000,000 750,000	1170	2265
Reservoir Canyon	Foothill	Reservoir Canyon	---	Res. Canyon Hydro-pneumatic Tank	4,000	10	2
Rosemont	High Pressure	Fel-Mar	---	Rosemont	40,000	18	19
Terrace Hill	High Pressure	---	Terrace Hill Kentwood/Johnson New Orcutt Specific Plan PRV	Terrace Hill Islay	1,100,000	1,230	2,788

FUTURE WATER DISTRIBUTION ZONES

FIGURE 10-1

CITY OF SAN LUIS OBISPO
POTABLE WATER
DISTRIBUTION SYSTEM
OPERATIONS MASTER PLAN



LEGEND

DISTRIBUTION ZONE

- 1 ROSEMONT
- 2 HIGH PRESSURE
- 3 FOOTHILL
- 4 ANDREWS
- 5 RESERVOIR CANYON
- 6 DOWNTOWN
- 7 ALRITA
- 8 TERRACE HILL
- 9 EDNA SADDLE
- WATER MAIN
- RESERVOIR
- PARCELS
- CITY LIMITS
- STORAGE TANK
- PS PUMP STATION
- PRESSURE REDUCING VALVE
- WT WATER TREATMENT PLANT

0 1,750 3,500 Feet

1 inch = 3,500 feet

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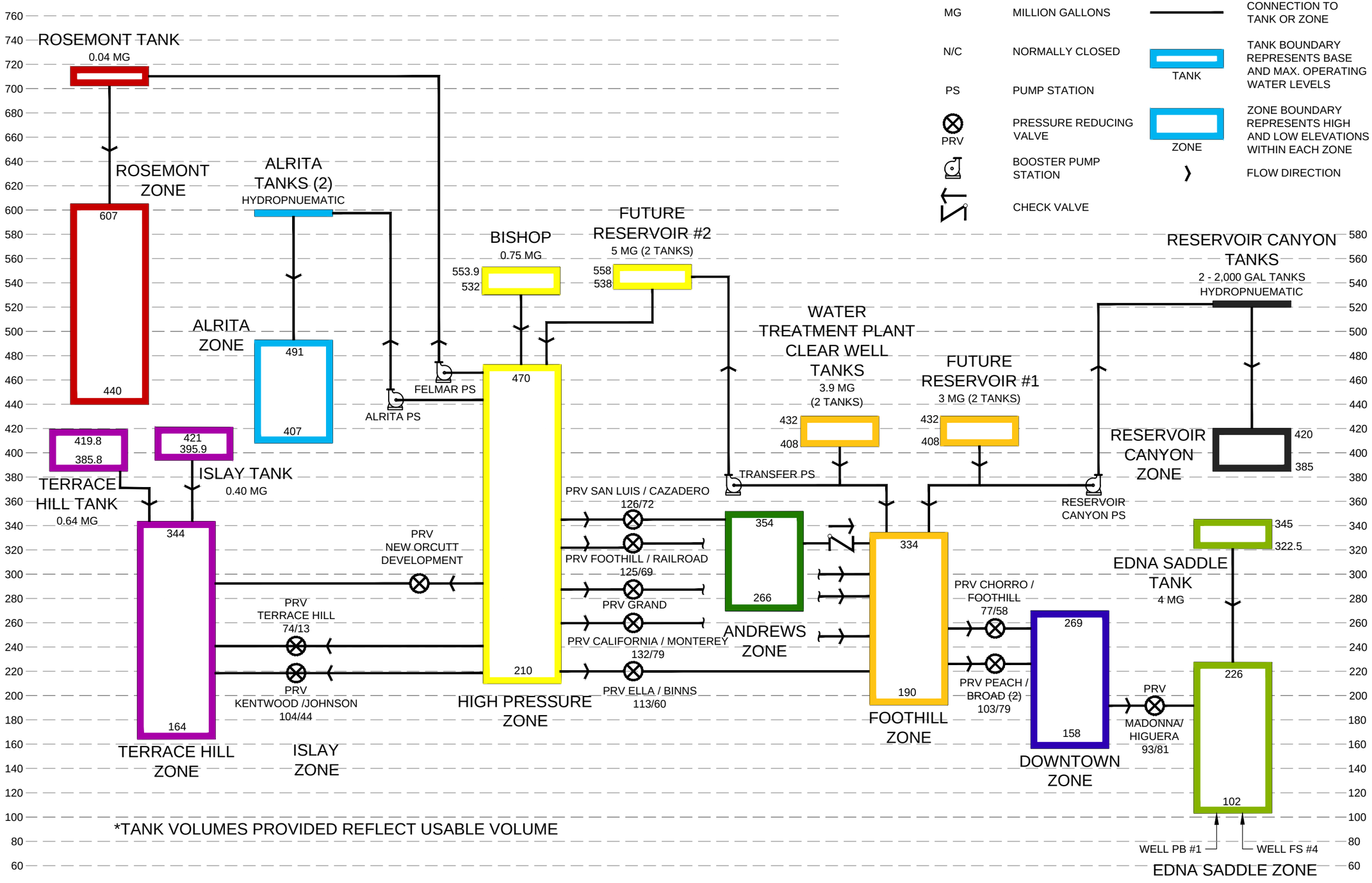

*TANK VOLUMES PROVIDED REFLECT USABLE VOLUME

LEGEND:

MG	MILLION GALLONS
N/C	NORMALLY CLOSED
PS	PUMP STATION
PRV	PRESSURE REDUCING VALVE
	BOOSTER PUMP STATION
	CHECK VALVE
	CONNECTION TO TANK OR ZONE
TANK	TANK BOUNDARY REPRESENTS BASE AND MAX. OPERATING WATER LEVELS
ZONE	ZONE BOUNDARY REPRESENTS HIGH AND LOW ELEVATIONS WITHIN EACH ZONE
	FLOW DIRECTION

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FIGURE 10-2
CITY OF SAN LUIS OBISPO
FUTURE WATER SYSTEM HYDRAULIC PROFILE

JOB No. :	0061-0072
DRAWING :	Figure 10-2.dwg
DRAWN BY:	JSW
DATE :	04/14/2015
SCALE :	NONE

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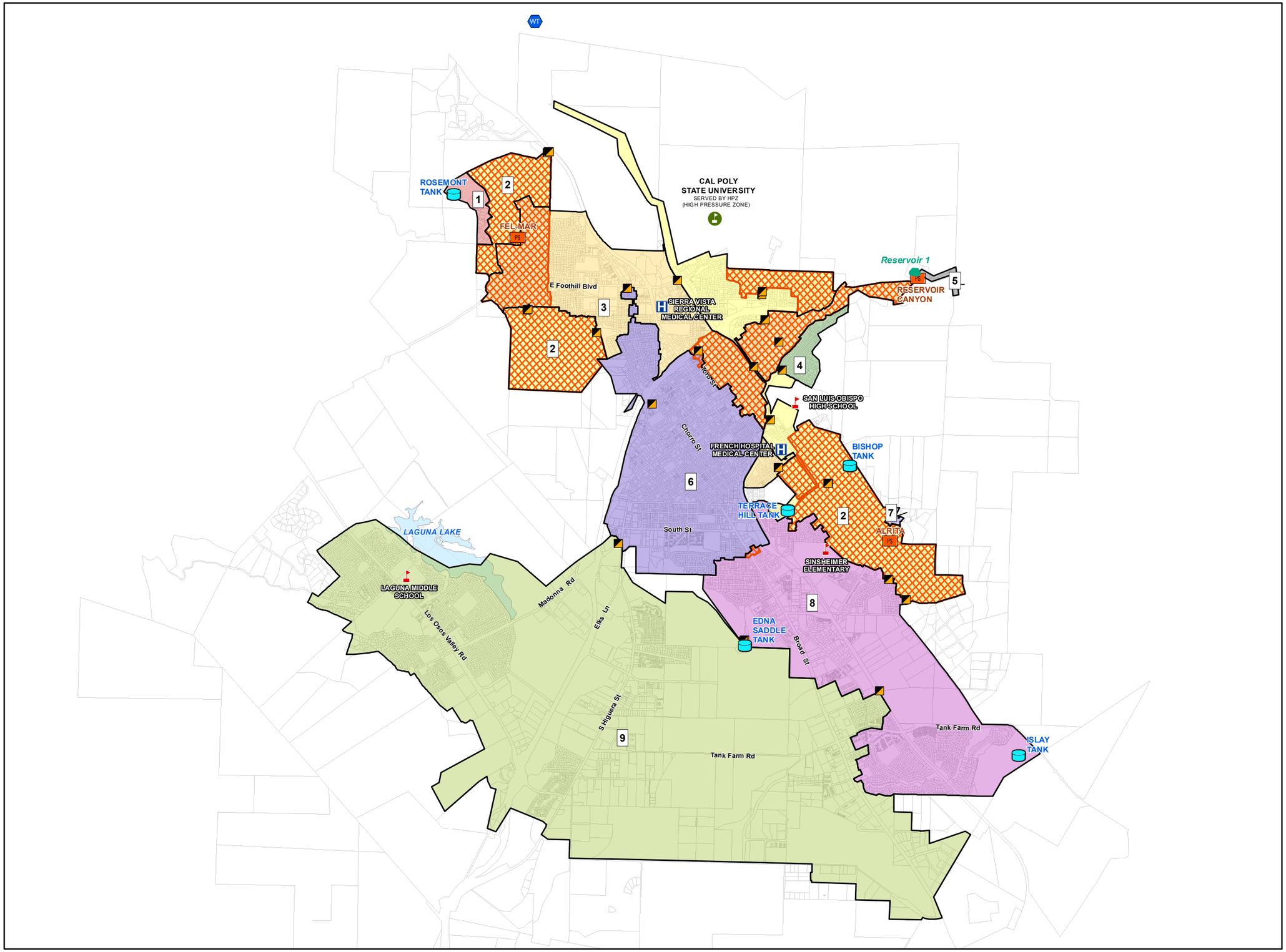

CUSTOMERS IMPACTED BY DISTRIBUTION ZONE CHANGES

FIGURE 10-3

CITY OF SAN LUIS OBISPO
POTABLE WATER
DISTRIBUTION SYSTEM
OPERATIONS MASTER PLAN

LEGEND

DISTRIBUTION ZONE

- 1 ROSEMONT
- 2 HIGH PRESSURE
- 3 FOOTHILL
- 4 ANDREWS
- 5 RESERVOIR CANYON
- 6 DOWNTOWN
- 7 ALRITA
- 8 TERRACE HILL
- 9 EDNA SADDLE
- IMPACTED CUSTOMERS
- RESERVOIR
- PARCELS
- WATER MAIN
- STORAGE TANK
- PUMP STATION
- PRESSURE REDUCING VALVE
- WATER TREATMENT PLANT

0 1,750 3,500 Feet

1 inch = 3,500 feet

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11: Appendix A: Pump Curves

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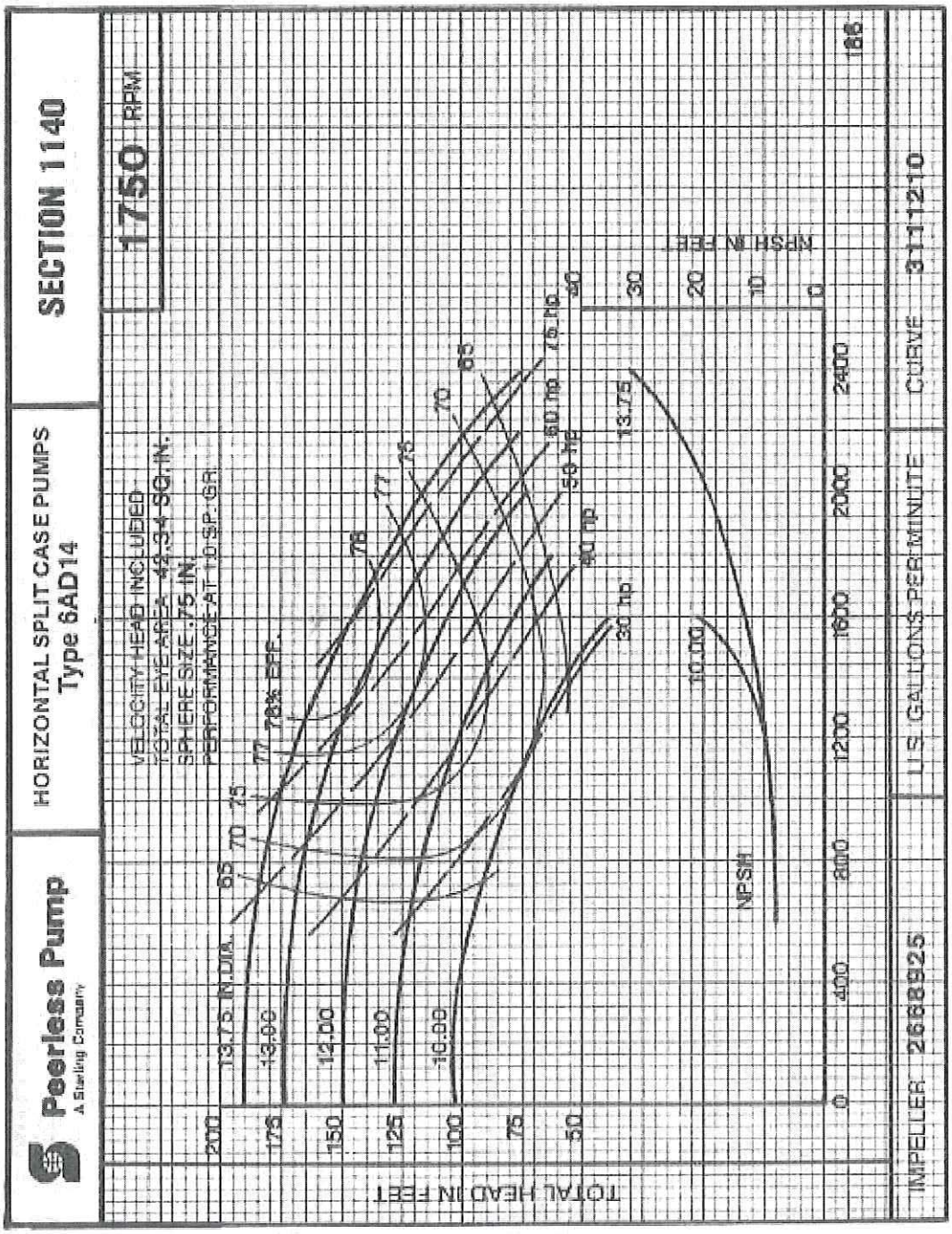
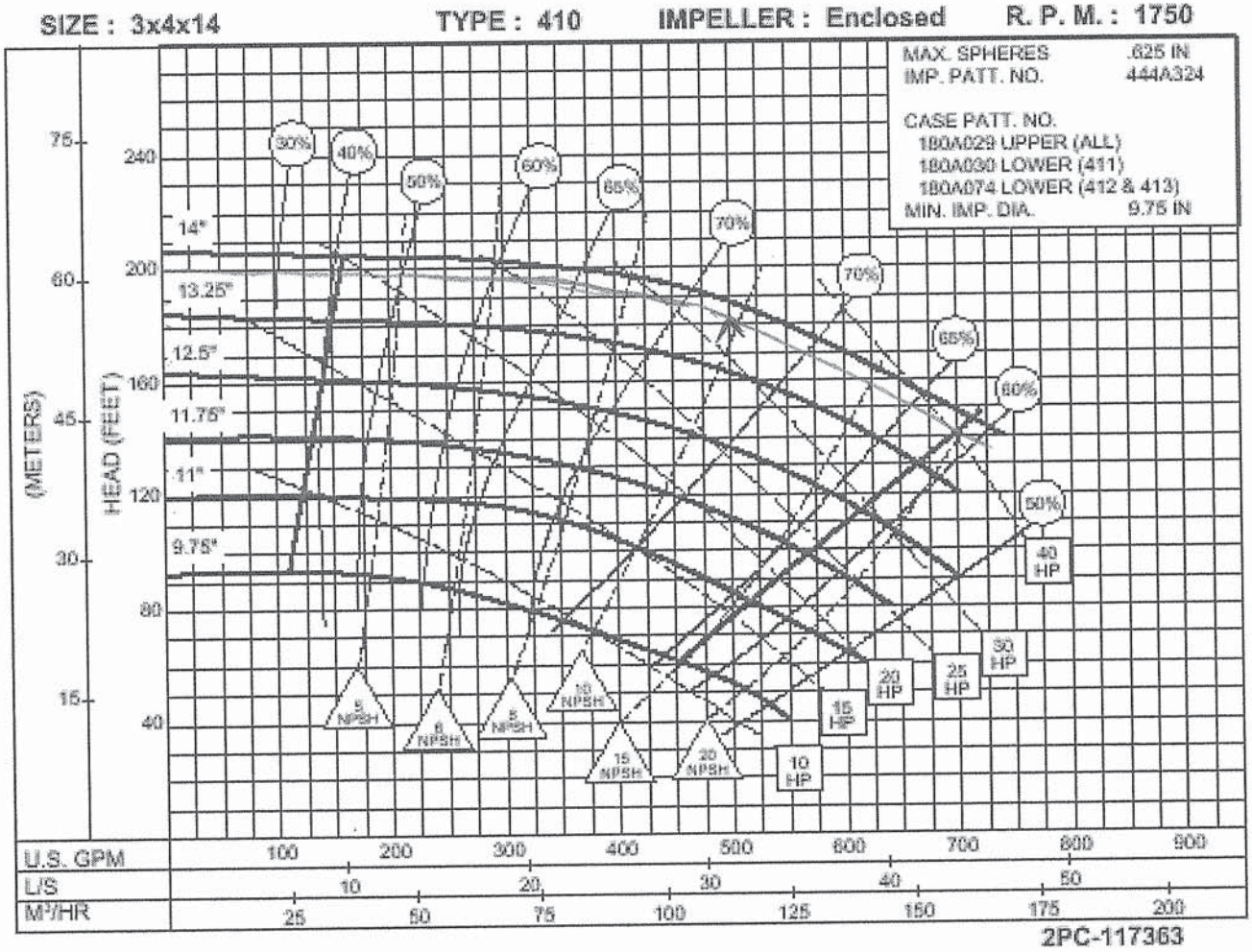
Bishop Pump Station



3 x 4 x 14
SERIES 410
ENCLOSED IMPELLER

AURORA

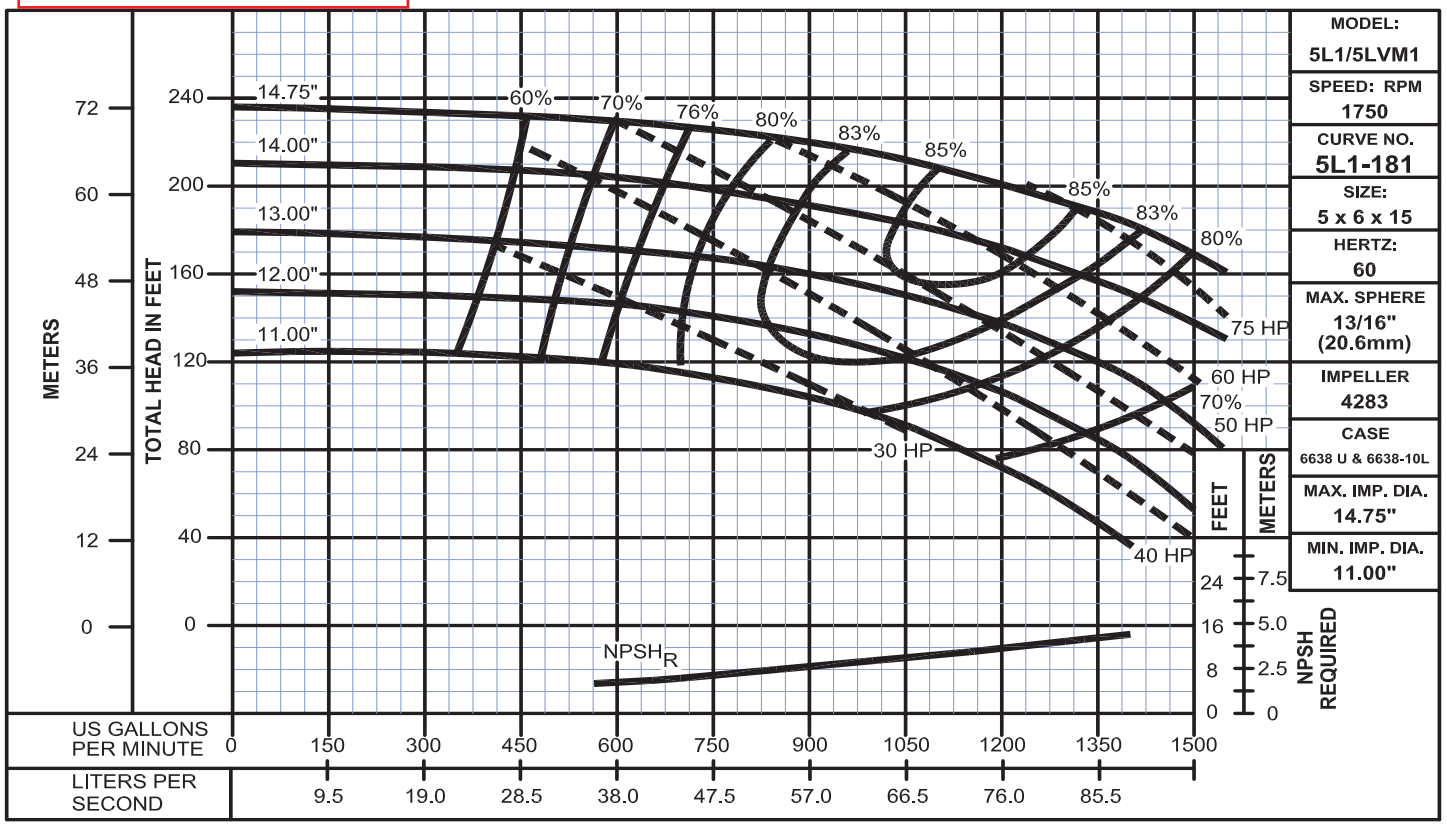
1750 RPM

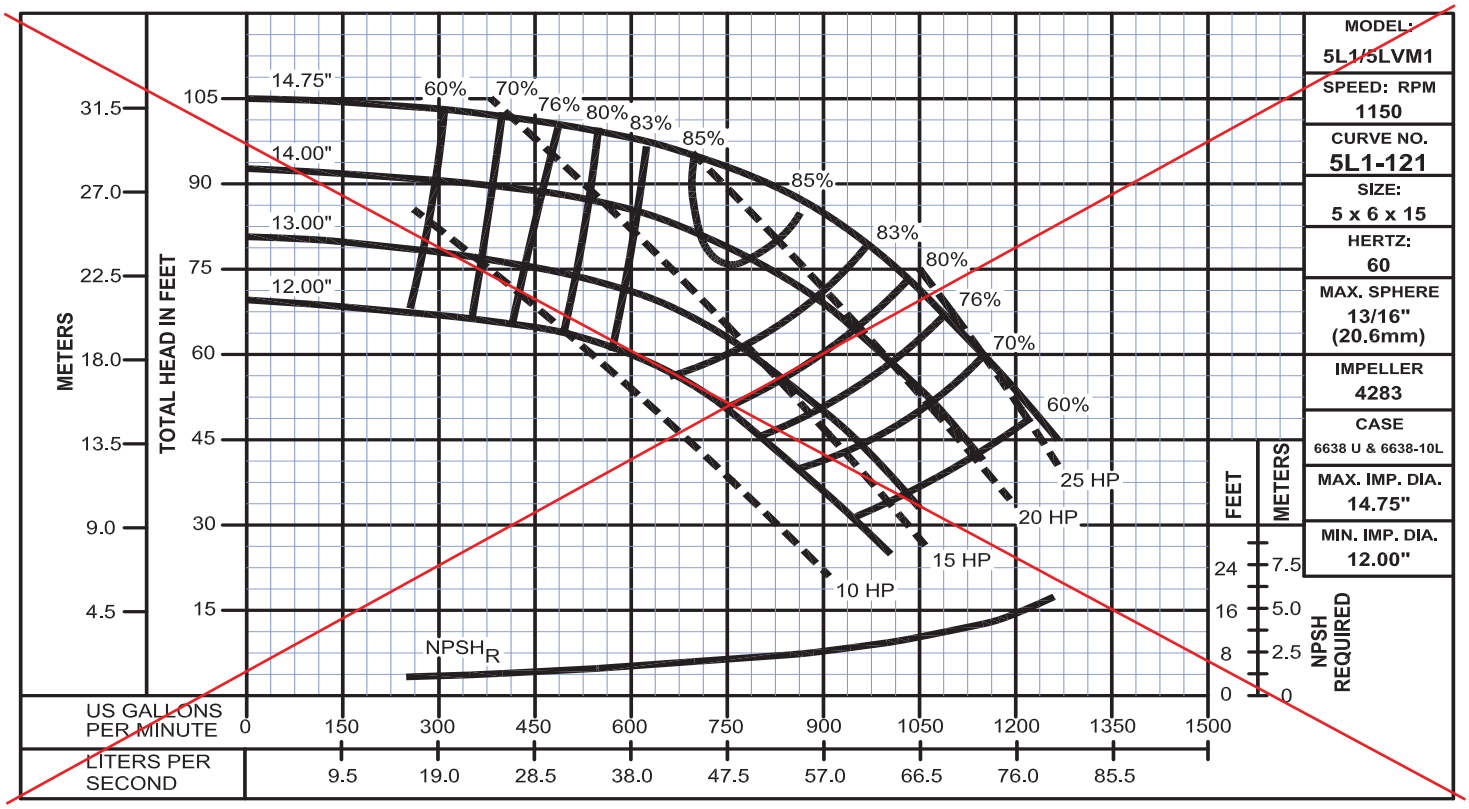


Bressi Pump Station

Split Case Pumps - Horizontally Mounted

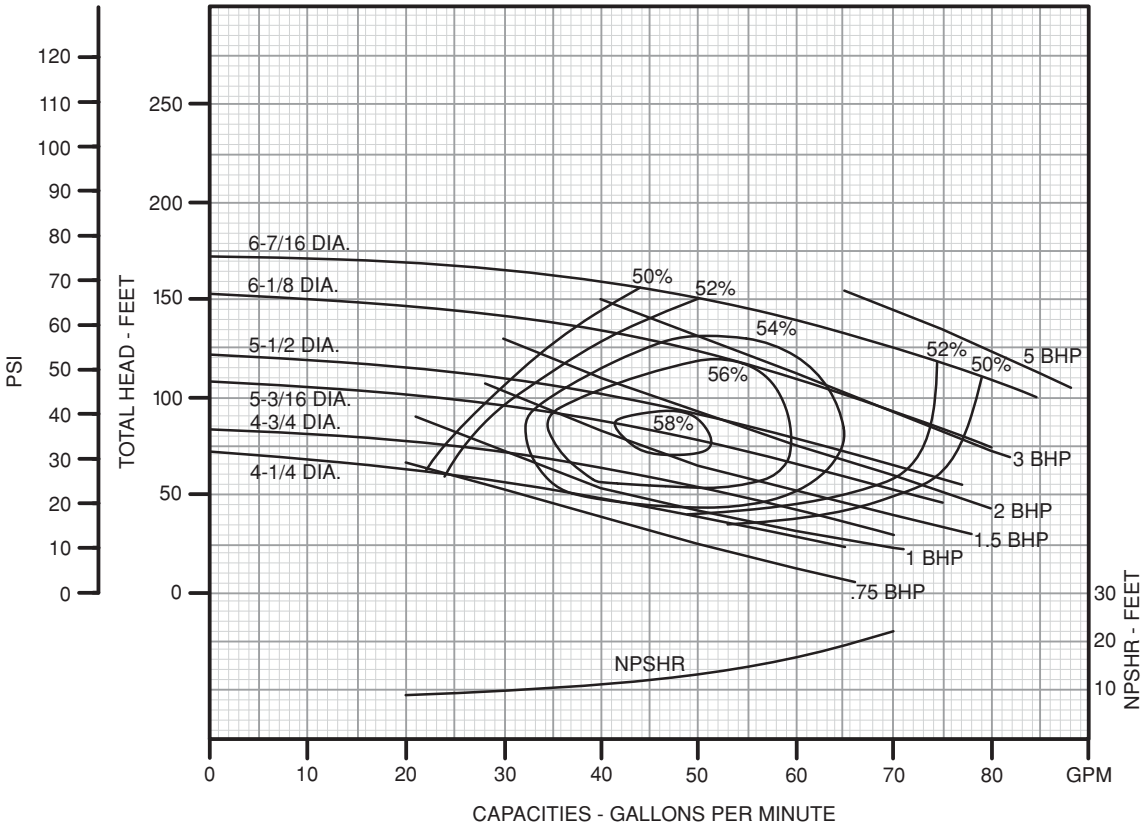
Ferrini Pump Station



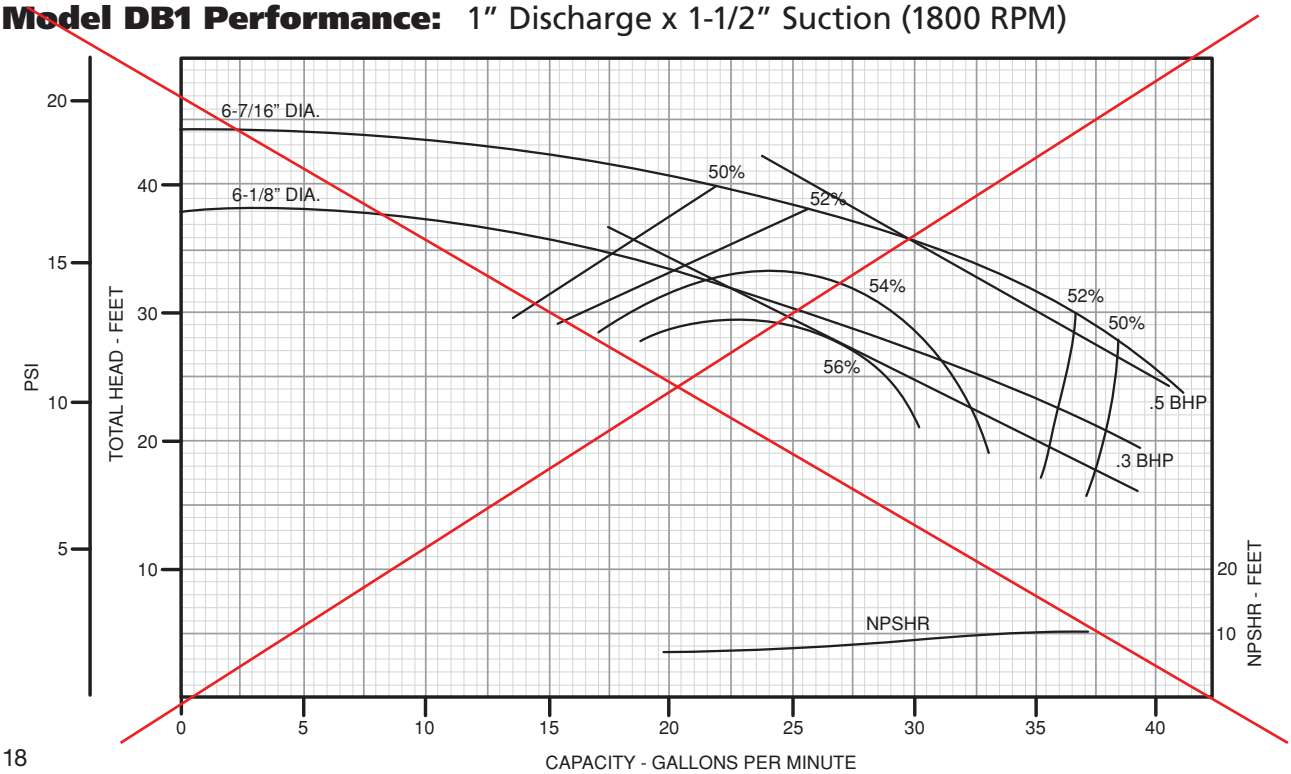


Close-Coupled D-Series

Model DB1 Performance: 1" Discharge x 1-1/2" Suction (3600 RPM)



Model DB1 Performance: 1" Discharge x 1-1/2" Suction (1800 RPM)



12: Appendix B: Pump Station Evaluation

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SITE NAME: **Bishop Pump Station**

PIPING CONDITION: Pitted Rusted/ Painted Loss of cross section

INCOMING VAC: A-B 493; B-C 493; A-C 499

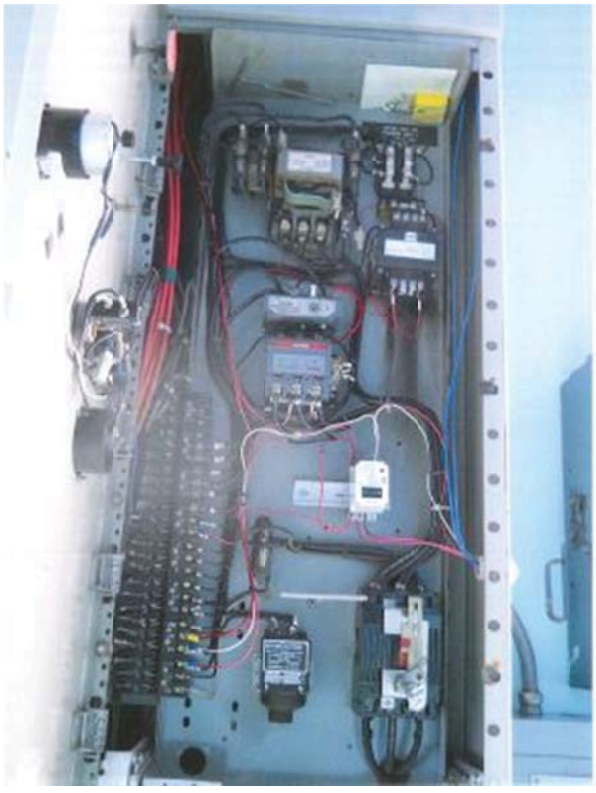
PURPOSE: Fill 386k storage tank

PUMP#1		PUMP#2	
GPM	0	**GPM**	Not listed on Tag
MOTOR		**MOTOR**	
Make:		Make:	Lincoln
Model:		RPM	1800
Serial#:		Ph.	3
HP:		HP:	50
Voltage		Voltage	460
Amperage:		Amperage:	62
Serv. Factor:		Serv. Factor:	1.15
PUMP		**PUMP**	
Make	N/A	Make	Peerless
Model:		Type	6AD14
Serial#:		Imp#:	2668925
Trim:		Diameter	11.65
I		Inlet	8"
		Outlet	6"
L1		**L1**	
FLA:	0	FLA:	34.8
MegΩ	420Ω	MegΩ	850mΩ
L2		**L2**	
FLA:	0	FLA:	36.1
MegΩ	.410Ω	MegΩ	850mΩ
L3		**L3**	
FLA:	0	FLA:	33.5
MegΩ	408Ω	MegΩ	850mΩ
Hours:	N/A	**Hours:**	154.3 (meter marked 12/17/09)
Notes:	Pump out of Service	Notes:	No Ground To Motor mΩ mmay be skewed Fills 386k Water Tank/ Fed from Resevoir 2 Static; 61psi Pump On ; 78psi Valve non-op for DH test

Bishop Pump Station - Exterior

Bishop Pump Station - Interior

Bishop Pump Station - Interior



SITE NAME: **Bressi Pump Station**

PIPING CONDITION: Pitted / Painted

INCOMING VAC: A-B 480; B-C 479; A-C 478

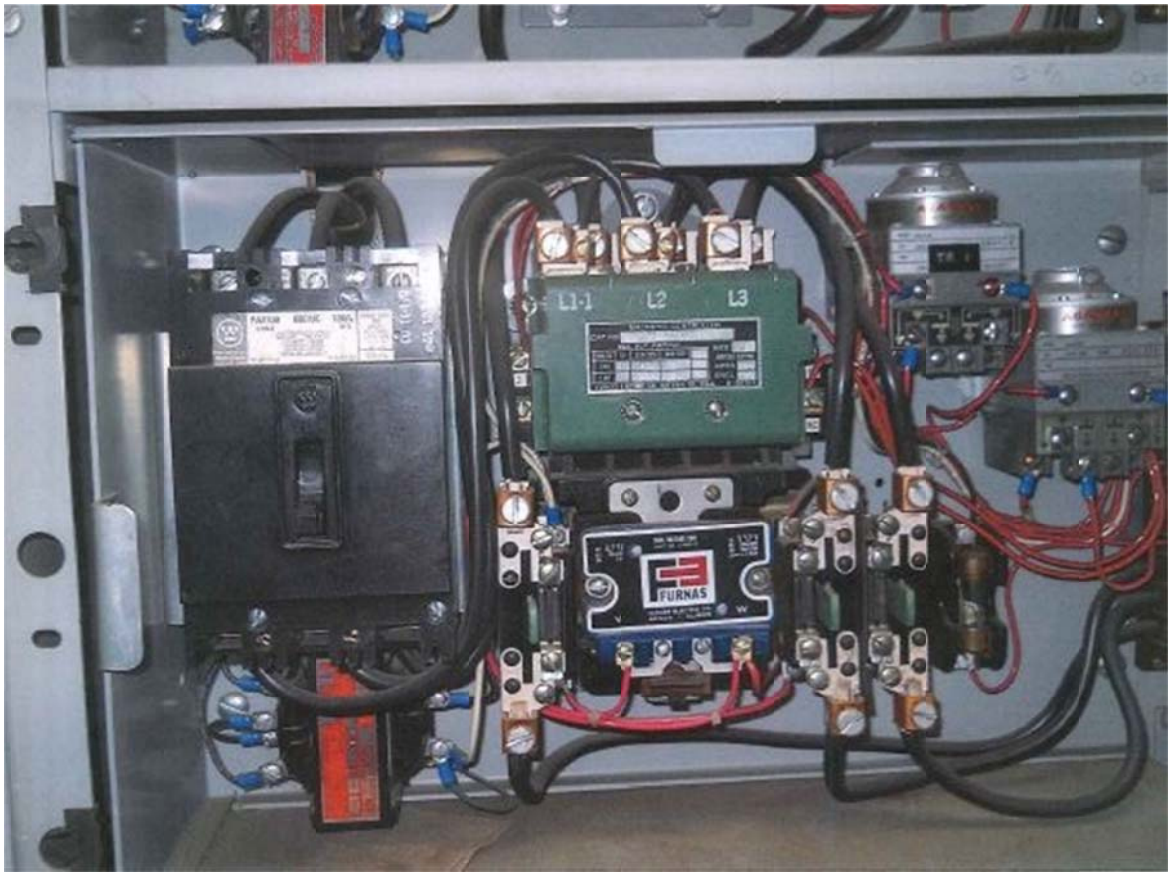
PURPOSE: Fill 100k storage tank

	PUMP#1	PUMP#2
GPM	500gpm @ 182 H.F	500gpm @ 182 H.F
MOTOR		
Make:	WEG	WEG
Model:	1765	
RPM		1765
Ph.	3	3
HP:	40	40
Voltage	460	460
Amperage:	48.2	48.2
Serv. Factor:	1.15	1.15
PUMP		
Make	N/A	Aurora
Type	411 BF	411 BF
Order#	03-948021-2	03-948021-1
Inlet	3"	3"
Outlet	4"	4"
L1		
FLA:	51.3	47.7
MegΩ	800Ω	850mΩ
L2	51.2	
FLA:	0	47.6
MegΩ	800Ω	850mΩ
L3	51.4	
FLA:	0	47.9
MegΩ	800Ω	850mΩ
Hours:	6916 (new meter 5/2/05)	10302.0.2 (meter marked 10/21/0
Notes:	No Ground To Motor mΩ mmay be skewed No Guage to measure for DH Test FLA @ DH 49.9	No Ground To Motor mΩ mmay b No Guage to measure for DH Tes FLA @ DH 46.1

Bressi Pump Station - Exterior

Bressi Pump Station - Interior

Bressi Pump Station - Interior



SITE NAME: **Ferrini Pump Station**

PIPING CONDITION: Copper

INCOMING VAC A-B 488; B-C 480; A-C 485

PURPOSE Fill

	PUMP#1	PUMP#2
GPM	1060GPM @ 185 F.H.	1060GPM @ 185 F.h.
MOTOR		
Make:	Lincoln	Lincoln
RPM	1775	1775
Ph.	3	3
HP:	75	75
Voltage	480	480
Amperage:	92.5	92.5
Serv. Factor:	1	1
PUMP		
Make	Weinman	Weinman
Model:	5L1	5L1
Order #:	14321	14321
Date of Mfr	1-Jul-66	1-Jul-66
Spec#	5L1-410-35020	5L1-410-35020
Suction	6.0"	6.0"
Discharge	5.0"	5.0"
L1		
FLA:	70.1	76
MegΩ	690Ω	800mΩ
L2		
FLA:	72.9	78.9
MegΩ	700Ω	690Ω
L3		
FLA:	73.4	75.8
MegΩ	710Ω	730mΩ
Hours:	3878.1	3852.7
Notes:	No Ground To Motor mΩ mmay be skewed 100psi Static- 120psi Pump on	No Ground To Motor mΩ mmay be skewed 100psi Static- 128psi- Pump on

Ferrini Pump Station - Exterior and Interior

Ferrini Pump Station - Interior

SITE NAME: McCollum **Pump Station**

PIPING CONDITION: Fair

INCOMING VAC A-B 499; B-C 504; A-C 500

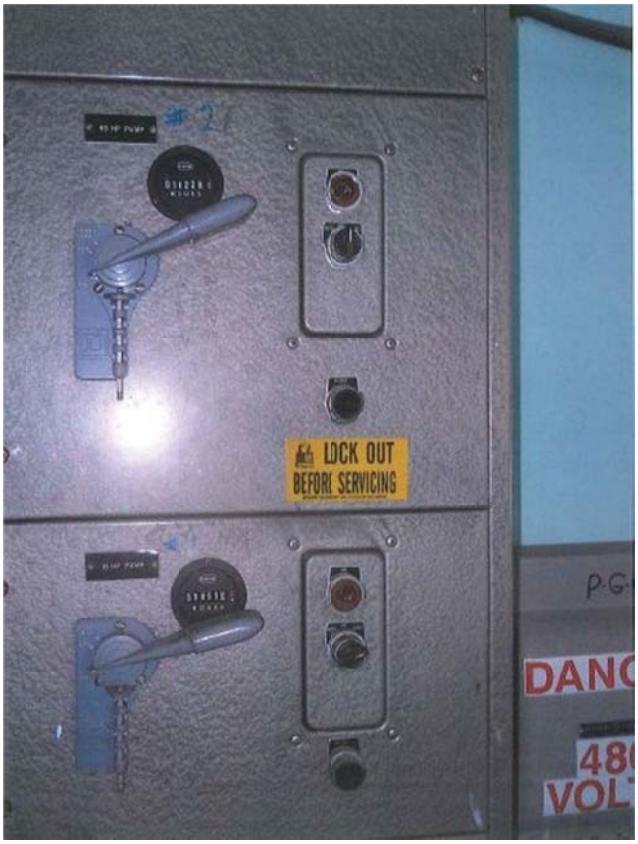
PURPOSE Fills 150k Storage Tank

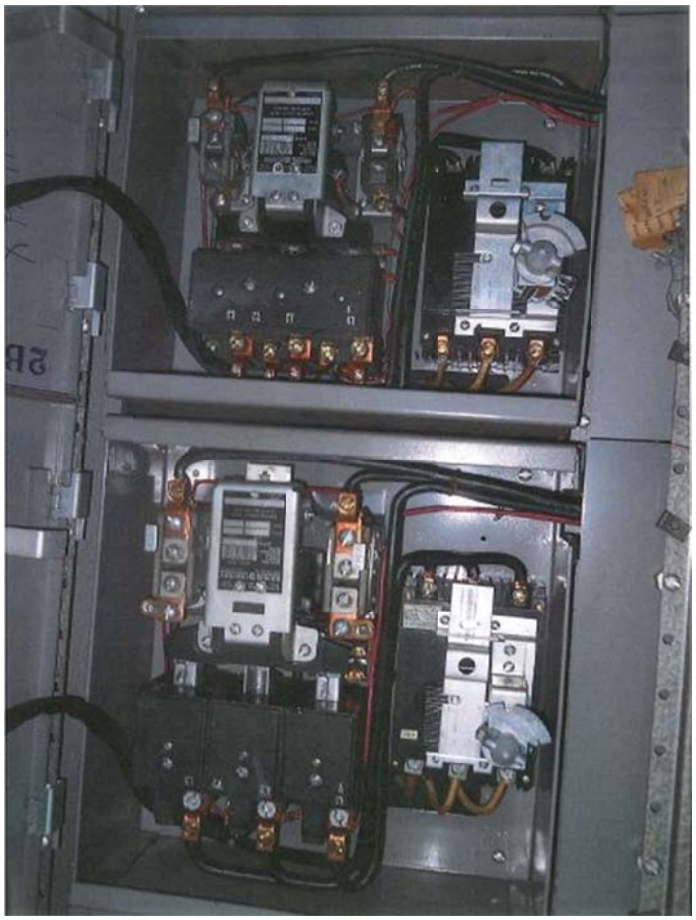
	PUMP#1	PUMP#2
GPM	200GPM @ 170HF	600GPM @170HF
MOTOR		
Make:	GE	GE
RPM	3450	3450
Ph.	3	3
HP:	15	40
Voltage	480	480
Amperage:	48.5	22
Serv. Factor:	N/A	1.15
PUMP		
Make	Aurora	Aurora
Model:	411 BF	411 BF
Order #:	5K1365MSI	5K4256A1
Type	4x10B	2x10
Diameter	N/A	N/A
Suction	6.0"	1.5"
Discharge	4.0"	1.0"
L1		
FLA:	51.1	22
MegΩ	800Ω	615mΩ
L2		
FLA:	50.9	23.3
MegΩ	800Ω	600mΩ
L3		
FLA:	51.8	22.9
MegΩ	799Ω	605mΩ
Hours:	55855.8	1422.7
Notes:	50 amps at DH of 115psi Diameter Size not listed on Tag No Ground To Motor mΩ mmay be skewed	20.9amps at DH of 118psi Diameter info not listed on Tag No Ground To Motor mΩ mmay be skewed

McCollum Pump Station - Exterior

McCollum Pump Station - Interior

McCollum Pump Station - Interior





SITE NAME: **Resevoir Pump Station**

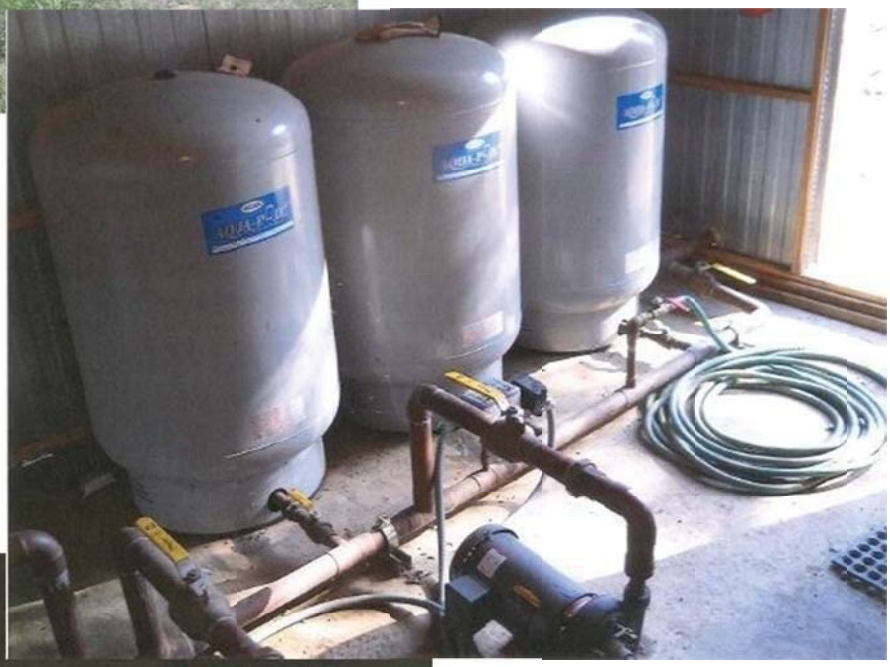
PIPING CONDITION: Copper

INCOMING VAC A-B 248; B-C 246; A-C 246

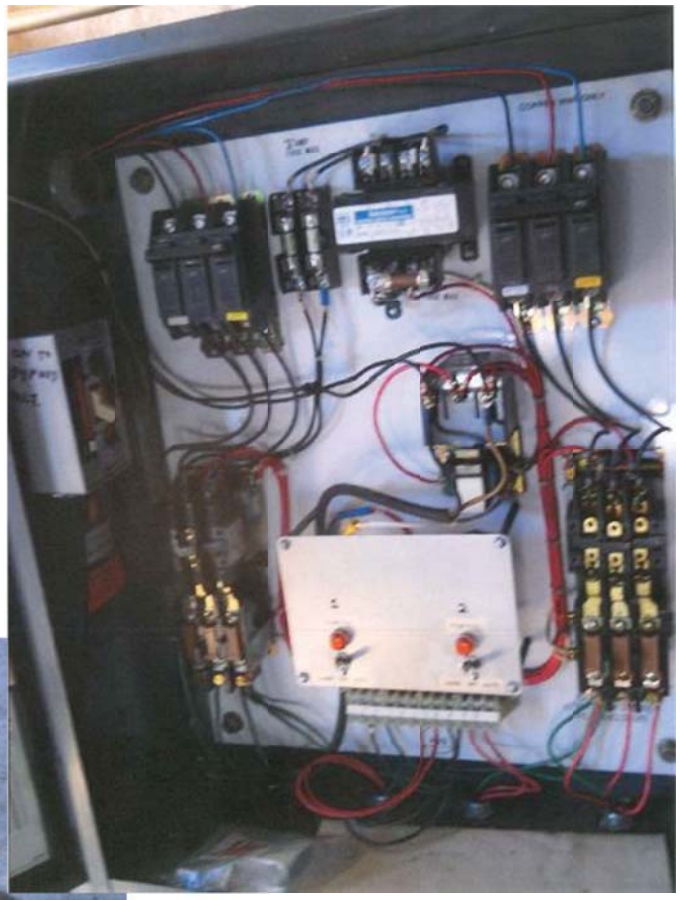
PURPOSE Supply water to 5 conectioins on Resevoir Cyn Rd.

	PUMP#1	PUMP#2
GPM	0	
MOTOR		
Make:	Emerson	Baldor
RPM	3450	3450
Ph.	3	3
HP:	3	3
Voltage	230	230
Amperage:	9.5	7.6
Serv. Factor:	N/A	1.15
PUMP		
Make	Jacuzzi	Jacuzzi
Model:	3DB1-T	3DB1-T
Order #:	93120384	93120384
Date of Mfr	15-Jan-98	30-Apr-98
Diameter	N/A	N/A
Suction	1.5"	1.5"
Discharge	1.0"	1.0"
L1		
FLA:	7.9	8.1
MegΩ	900Ω	900mΩ
L2		
FLA:	7.9	8.2
MegΩ	900Ω	900mΩ
L3		
FLA:	8.4	7.9
MegΩ	908Ω	900mΩ
Hours:	10295	9855.3
Notes:	5.4 amps at DH of 61psi Diameter Size not listed on Tag	6.5amps at DH of 65psi Diameter info not listed on Tag

Reservoir Canyon Pump Station - Exterior and Interior



Reservoir Canyon Pump Station - Interior



13: Appendix C: Fire Hydrant Test Results

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City of San Luis Obispo
Water Master Plan
Fire Flow Testing

Zone	Date	Time	Fire Hydrant No.	FH Flow (gpm)	FH Pressure (psi)	Closest Address	Temp (°F)	Weather	Tank	Tank Level (ft)	Pump Station	PS On/Off	PRV	Incoming/Outgoing/Closed	Upstream (psi)	Downstream (psi)	Fire Hydrant/Address	Pressure	Description	Notes
Ferrini	6/3/2013	9:57 AM	**H04-2**	1150	57.5	129 Anacapa	55	Overcast	Ferrini	12.6	Ferrini	Off	Patricia	Outgoing	100	85-90	129 Anacapa	80	Static	
									Rosemont	14	Rosemont	Off	Skyline/Marisol	Outgoing	93	91		76	Dynamic	
Ferrini	6/3/2013	10:15 AM	**H03-8**	1000	42.5	Corner of Skyline Dr & M	55	Overcast	Ferrini	12.6	Ferrini	Off	Patricia	Outgoing	100	85-90	391 Montrose Dr	80	Static	2nd attempt
									Rosemont	14	Rosemont	Off	Skyline/Marisol	Outgoing	93	91	391 Montrose Dr	70	Dynamic	
Highland	6/3/2013	10:40 AM	**H04-11**	900	35	Corner of Skyline & Pasa	59	Overcast	Ferrini	10	Ferrini	Off	Patricia	Incoming	97	82	621 Skyline Dr	44	Static	Uncertain if 621 Skyline had a PRV. FH Pressure ranged from 30-40 psi (832-961 gpm)
											Rosemont	Off	Skyline/Marisol	Incoming	90	69.5	621 Skyline Dr	42	Dynamic	
Highland	6/3/2013	11:00 AM	**H05-9**	889	35	134 Fel Mar	59	Overcast	Ferrini	10	Ferrini	Off	Patricia	Incoming	97	88	134 Fel Mar	77.5	Static	134 is at a slightly higher elevation that the FH. FH pressure ranged from 32-37 psi
											Rosemont	Off	Skyline/Marisol	Incoming	90	74	134 Fel Mar	56	Dynamic	
Rosemont	6/3/2013	11:15 AM	**G04-2**	720	22.5	1 Highland	61	Overcast	Rosemont		Rosemont	Off					Rosemont PS	64	Dynamic	Dynamic prssure was taken at the booster station outlet piping.
Patricia	6/3/2013	1:30 PM	**H04-14**	680	20	651 Westmont	63	Overcast	Serrano	21	Bressi	Off	La Entrada/Catalina	Incoming	80	52	241 Westmont	67.5	Static	FH pressure ranged from 17.5-22.5 psi. 241 Westmont Static pressure ranged from 65-70 psi.
																	241 Westmont	42	Dynamic	
Patricia	6/3/2013	2:13 PM	**H06-21**	630	17.5	203 Ramona	64	Overcast	Serrano		Bressi	Off	La Entrada/Catalina	Incoming	78	52	203 Ramona	64	Static	FH pressure ranged from 15-20 psi. 203 Ramona Static ranged from 64-65 psi and was a slightly higher elevation than H06-21.
																	203 Ramona	52	Dynamic	
Patricia	6/3/2013	2:38 PM	**G06-1**	720	23	327 Los Cerros	66	Overcast	Serrano		Bressi	Off	La Entrada/Catalina	Incoming	80	52	288 Los Cerros	42	Static	
																	288 Los Cerros	26	Dynamic	
Alrita	6/4/2013	9:08 AM	**N11-7**	420	7.5	1792 Alrita	57	Overcast	Bishop	13	Alrita	On	Valve from High Press Zo	Closed	0	0	1770 Alrita	58	Static	Tank level was received from SCADA. The Alrita PS would cycle on & off during testing resulting in a large range in FH flow (420-1075 gpm) &pressure values (7.5-50 psi) as well as 1770 Alrita.
				1075	50												1770 Alrita	10	Dynamic-PS Off	
																	1770 Alrita	75	Dynamic-PS On	
Bishop	6/4/2013	9:50 AM	**N12-21**	900	35	3310 Flora	61	Overcast	Bishop	12.4	Bishop	Off	Kentwood/Johnson	Outgoing	105	42	3290 Flora	68	Static	N12-21 replaced N12-26 since N12-26 was not working properly. FH N12-21 pressure ranged from 32.5-37.5 psi. 3290 Flora pressure ranged from 67-69 psi. During testing Alrita PS did not turn on.
											Alrita	Off					3290 Flora	53	Dynamic	
Bishop	6/4/2013	10:25 AM	**M10-17**	1000	45	2085 Fixlini	63	Overcast	Bishop	11.67	Bishop	Off	Kentwood/Johnson	Outgoing	105	42	2081 Fixlini	83	Static	2081 Fixini is a construction site. FH L10-19 was replaced with M10-17 to reduce potential traffic problems and mitigation on Johnson. Alrita PS was not running during testing. FH pressure concentrated on 45 psi mostly but would range from 35-50 psi.
											Alrita	Off					2081 Fixlini	74	Dynamic	
Serrano	6/4/2013	11:40 AM	**H07-4**	900	35	299 Luneta	64	Overcast	Serrano	19.5	Bressi	Off	La Entrada/Catalina	Outgoing	98	56	300 Luneta	95	Static	FH pressure ranged from 32./5-37 psi. 300 Luneta Dynamic pressure ranged from 56-58 psi. Serrano/Serrano Heights PRV no longer exists, it was removed.
													Serrano/Serrano Height	Off			300 Luneta	57	Dynamic	
Serrano	6/4/2013	12:30 PM	**I07-17**	1177	60	535 Serrano	64	Overcast	Serrano	16.5	Bressi	Off	La Entrada/Catalina	Outgoing	98	56	FH I07-10	83	FH-Static	FH I07-10 would have flooded a driveway, FH I07-17 was selected instead. The homes near I07-17 had PRVs so upstream hydrant and a downstream home readings were taken. The closest downstream hydrant was broken and the following FH was out of the zone.
													Serrano/Serrano Height	Off			FH I07-10	67	FH-Dynamic	
																	577 Serrano	102	Static	
																	577 Serrano	85	Dynamic	
Andrews	6/4/2013	2:15 PM	**L08-35**	800	32.5	1717 Conejo	68	Overcast	Reservoir #1	9.5			Andrews/Monterey	Not PRV- actually a check valve			1401 Cazadero	64	Static	Andrews/Monterey is not a PRV but a Check Valve. 1401 Cazadero and 1395 Cazadero were both measured because it was suspected that 1401 Cazadero had a PRV but when compared to 1395 that suspicion was removed.
									Reservoir #2	18.6			San Luis/Cazadero	Incoming	130	64	1401 Cazadero	56	Dynamic	
																	1395 Cazadero	65	Static	
																	1395 Cazadero	58	Dynamic	
Andrews	6/4/2013	2:40 PM	**M07-6**	1020	45	1909 San Luis Dr	70	Overcast	Reservoir #1	9.5			Andrews/Monterey	Not PRV- actually a check valve			1885 San Luis Drive	65	Static	M07-5 was replaced with M07-6 to avoid flooding a construction site. FH pressure ranged from 42.5-47.5 psi.
									Reservoir #2	18.7			San Luis/Cazadero	Incoming	130	66	1885 San Luis Drive	57	Dynamic	
High Pressure	6/5/2013	8:35 AM	**K06-29**	1560	105	290 California Blvd	54	Slightly Overcast	Reservoir #2	18.57	Bishop	Off	Terrace Hill	Outgoing	72	25	290 California Blvd	120	Static	**Hathoway/Murray PRV** was removed 12/13/2012. 290 California Blvd is at a slighly higher elevation (~2 ft) than FH. Terrace Hill PRV was isolated since it is fed by High Pressure zone. Pressure gauge goes up to 100 psi & pressure during test exceeded that, so it was estimated to be 105 psi. **Grand PRV:** Upstream measure from 615 Grand, Downstream from L07-6. **California/Monterey** PRV did not have an accesible place to obtain an upstream pressure reading. **Ella/Binns PRV**: Upstream from L10-17, Downstream from 1222 Ella St. San Luis/Johnson: Upstream from L09-3, downstream PRV. **Note:** The following PRVs are normally closed: **California/Monterey, Ella/Binns, & San Luis/Johnson.**
											Transfer	Off	Grand	Outgoing	112	56	290 California Blvd	116	Dynamic	
											McCollum	Off	California/Monterey**	Outgoing		73				
													Ella/Binns**	Outgoing	110	56				
													San Luis/Cazadero	Outgoing	130	72				
													San Luis/Johnson**	Outgoing	130	81				
													Foothill/Railroad	Off						
													Hathoway/Murray	Nonexistant						
													Terrace Hill	Off						
													Kentwood/Johnson	On						
High Pressure	6/5/2013	9:20 AM	**L06-12**	870	32.5	1990 Henderson	59	Slightly Overcast	Reservoir #2	18.35	Bishop	Off	Terrace Hill	Outgoing	72	25	1990 Henderson	91	Static	
											Transfer	Off	Grand	Outgoing	112	56	1990 Henderson	78	Dynamic	
											McCollum	Off	California/Monterey**	Outgoing		73				
													Ella/Binns**	Outgoing	110	56				
													San Luis/Cazadero	Outgoing	130	72				
													San Luis/Johnson**	Outgoing	130	81				
													Foothill/Railroad	Off						
													Hathoway/Murray	Nonexistant						
													Terrace Hill	Off						
													Kentwood/Johnson	Off						
High Pressure	6/5/2013	10:15 AM	**L10-17**	1000	45	1325 Ella	61	Clear-Sunny	Reservior #2	18.14	Bishop	Off	Terrace Hill	Outgoing	72	25	L10-36-Upstream	108	Static	The planned FH L10-35 is in the Reservoir #1 zone, L10-17 was tested instead. L10-17 pressure during testing ranged from 30-60 psi. The static pressure reading on FH L10-17 is 110 psi.
											Transfer	Off	Grand	Outgoing	112	56	L10-36-Upstream	100	Dynamic	
											McCollum	Off	California/Monterey**	Outgoing		73	L10-30-Downstream	97	Static	
													Ella/Binns**	Outgoing	110	56	L10-30-Downstream		Dynamic	
													San Luis/Cazadero	Outgoing	130	72				
													San Luis/Johnson**	Outgoing	130	81				
													Foothill/Railroad	Off						
													Hathoway/Murray	Nonexistant						
													Terrace Hill	Off						
													Kentwood/Johnson	Off						
High Pressure	6/5/2013	10:45 AM	**L09-26**	1350	77.5	1690 Fairview	64	Clear-Sunny	Reservior #2	17.93	Bishop	Off	Terrace Hill	Outgoing	72	25	1684 Fairview	126	Static	L10-36 was not tested due to the level of traffic mitigation that woul be needed and the Transfer Pump Station is going back on at 11:00 am. L09-26 pressure ranged from 75-80 psi during testing.
											Transfer	Off	Grand	Outgoing	112	56	1684 Fairview	94	Dynamic	
											McCollum	Off	California/Monterey**	Outgoing		73				

Yellow cells: Data was not available at time of fire hydrant testing

City of San Luis Obispo
Water Master Plan
Fire Flow Testing

Zone	Date	Time	Fire Hydrant No.	FH Flow (gpm)	FH Pressure (psi)	Closest Address	Temp (°F)	Weather	Tank	Tank Level (ft)	Pump Station	PS On/Off	PRV	Incoming/Outgoing/Closed	Upstream (psi)	Downstream (psi)	Fire Hydrant/Address	Pressure	Description	Notes
													Ella/Binns**	Outgoing	110	56				
													San Luis/Cazadero	Outgoing	130	72				
													San Luis/Johnson**	Outgoing	130	81				
													Foothill/Railroad	Off						
													Hathoway/Murray	Nonexistant						
													Terrace Hill	Off						
													Kentwood/Johnson	Off						
Slack Zone	6/5/2013	2:30 PM	**L06-6**	500	14	296 Albert	70	Clear-Sunny	Slack Street	17.27	McCollum	Off					382 Albert	68	Static	L06-6 pressure ranged from 13-15 psi during testing.
																	382 Albert	22	Dynamic	
Slack Zone	6/5/2013	2:48 PM	**M06-1**	960	40	201 Buenavista	70	Clear-Sunny	Slack Street	17.21	McCollum	Off					201 Buenavista	54	Static	
																	201 Buenavista	50	Dynamic	
Downtown	6/6/2013	8:30 AM	**J08-7**	1020	45	398 Chorro	54	Overcast-Foggy	Clear Well #1	20.54	Bressi	Off	Chorro/Foothill	Incoming	71	58	398 Chorro	50	Static	J08-7 pressure ranged from 42-47 psi during testing. PRV **Hathoway/Montalbon** is nonexistant. PRV **Broad/Caudill** is always closed unless it is manually activated, and since it is closed **Terrace Hill PRV** does not need to be closed (per conversation with Kari) since Terrace Hill zone can't feed the Downtown Zone with Broad/Caudill closed. PRV **Peach/Broad** is 2 PRVs in the same vault, in parallel.
									Clear Well #2	19.62	Transfer	Off	Madonna/Higuera	Outgoing	96	86	398 Chorro	46	Dynamic	
									Terrace Hill	19.12	Ferrini	Off	Peach/Broad (1)	Incoming	97	73				
									Islay	5.68			Peach/Broad (2)	Incoming	101	74				
									Edna Saddle	13.84			Broad/Caudill	Closed						
													Hathoway/Montalbon	Nonexistant						
													Terrace Hill	On						
													Broad/Caudill	Off						
Downtown	6/6/2013	9:15 AM	**I11-3**	1050	47.5	170 Brook	54	Overcast	Clear Well #1	21.42	Bressi	Off	Chorro/Foothill	Incoming	72	58	165 Brook St	70	Static	FH J11-30 was replaced with FH I11-3 to avoid the need for traffic mitigation on Higuera. I11-3 pressure ranged from 45-50 psi during testing.
									Clear Well #2	20.42	Transfer	Off	Madonna/Higuera	Outgoing	96	86	165 Brook St	56	Dynamic	
									Terrace Hill	19.13	Ferrini	Off	Peach/Broad (1)	Incoming	100	73				
									Islay	6.14			Peach/Broad (2)	Incoming	101	74				
									Edna Saddle	13.77			Broad/Caudill	Closed						
													Hathoway/Montalbon	Nonexistant						
													Terrace Hill	On						
													Broad/Caudill	Off						
Downtown	6/6/2013	9:43 AM	**K12-16**	1075	50	2320 Lawton	55	Overcast	Clear Well #1	22.08	Bressi	Off	Chorro/Foothill	Incoming	72	58	2311 Lawton	50	Static	
									Clear Well #2	21.1	Transfer	Off	Madonna/Higuera	Outgoing	96	86	2311 Lawton	43	Dynamic	
									Terrace Hill	19.13	Ferrini	Off	Peach/Broad (1)	Incoming	100	73				
									Islay	6.36			Peach/Broad (2)	Incoming	101	74				
									Edna Saddle	13.67			Broad/Caudill	Closed						
													Hathoway/Montalbon	Nonexistant						
													Terrace Hill	On						
													Broad/Caudill	Off						
Downtown	6/6/2013	10:15 AM	**L10-5**	760	25	1100 Leff St	55	Overcast	Clear Well #1	22.87	Bressi	Off	Chorro/Foothill	Incoming	72	58	1710 Santa Rosa	38	Static	
									Clear Well #2	21.87	Transfer	Off	Madonna/Higuera	Outgoing	96	86	1710 Santa Rosa	32	Dynamic	
									Terrace Hill	19.13	Ferrini	Off	Peach/Broad (1)	Incoming	100	73				
									Islay	6.7			Peach/Broad (2)	Incoming	101	74				
									Edna Saddle	13.62			Broad/Caudill	Closed						
													Hathoway/Montalbon	Nonexistant						
													Terrace Hill	On						
													Broad/Caudill	Off						
Foothill	6/6/2013	10:55 AM	**H05-16**	700	21	512 Jeffrey	59	Slightly Overcast	Clear Well #1	23.86	Bressi	Off	Chorro/Foothill	Outgoing	74	58	513 Jeffrey	40	Static	FH H05-16 pressure ranged from 20-22 psi during testing. **Foothill/Railroad PRV** is always closed unless it is manually activated. **Hathoway/Murray PRV** is nonexistant, it has been "cut out of the ground".
									Clear Well #2	22.83	Transfer	Off	Peach/Broad (1)	Outgoing	100	78	513 Jeffrey	22	Dynamic	
											Ferrini	Off	Peach/Broad (2)	Outgoing	102	78				
													Hathoway/Montalbon	Nonexistant						
													Foothill/Railroad	Off						
													Hathoway/Murray	Off						
Foothill	6/6/2013	11:20 AM	**I07-2**	800	28	82 Paloma	63	Clear-Sunny	Clear Well #1	24.58	Bressi	Off	Chorro/Foothill	Outgoing	74	58	88 Palomar	46	Static	
									Clear Well #2	23.47	Transfer	Off	Peach/Broad (1)	Outgoing	100	78	88 Palomar	39	Dynamic	
											Ferrini	Off	Peach/Broad (2)	Outgoing	102	78				
													Hathoway/Montalbon	Nonexistant						
													Foothill/Railroad	Off						
													Hathoway/Murray	Off						
Foothill	6/6/2013	11:45 AM	**K06-30**	930	38	103 Stenner	63	Clear-Sunny	Clear Well #1	25.15	Bressi	Off	Chorro/Foothill	Outgoing	74	58	115 Stenner	50	Static	K06-30 was tested instead of K07-10 to prevent the need for traffic mitigation when the Transfer Pump Station is scheduled to go back on at noon.
									Clear Well #2	24.05	Transfer	Off	Peach/Broad (1)	Outgoing	100	78	115 Stenner	42	Dynamic	
											Ferrini	Off	Peach/Broad (2)	Outgoing	102	78				
													Hathoway/Montalbon	Nonexistant						
													Foothill/Railroad	Off						
													Hathoway/Murray	Off						
Reservoir #1	6/6/2013	1:35 PM	**L07-15**	870	32.5	745 Grand	70	Clear-Sunny	Reservoir #1	8.28	Bishop	On	Grand	Incoming	115	51	735 Grand	42	Static	FH L07-15 pressure ranged from 30-35 psi during testing. **Grand PRV**: Upstream reading taken from 615 Grand, Downstream reading taken from L07-6.
											Transfer	On	California/Monterey**	Closed			735 Grand	36	Dynamic	
											McCollum	On	Ella/Binns**	Closed						
													San Luis/Johnson**	Closed						
													Andrews/Monterey	Check Valve-Closed						
Reservoir #1	6/6/2013	1:55 PM	**K08-5**	960	40	1270 Peach	70	Clear-Sunny	Reservoir #1	8.27	Bishop	On	Grand	Incoming	115	50	1302 Peach	39	Static	FH K08-5 pressure ranged from 30-40 psi during testing, but the majority of the time it was 40 psi.
											Transfer	On	California/Monterey**	Closed			1302 Peach	30	Dynamic	
											McCollum	On	Ella/Binns**	Closed						
													San Luis/Johnson**	Closed						
													Andrews/Monterey	Check Valve-Closed						
Edna Saddle	6/10/2013	8:35 PM	**F12-13**	1050	56	1295 Descanso	63	Overcast	Edna Saddle Reservoir	13.48	Well PB #1	Off	Madonna/Higuera	Incoming-Closed	100	85	1313 Descanso	60	Static	1313 Descanso is 1-2 feet higher in elevation than FH F12-13. Well FS #4 is always off.
											Well FS #4	Off					1313 Descanso	48	Dynamic	
Edna Saddle	6/10/2013	9:10 AM	**I17-24**	870	32	3991 South Higuera	64	Overcast	Edna Saddle Reservoir	13.08	Well PB #1	Off	Madonna/Higuera	Incoming-Closed	100	85	I17-22	74	Static	FH I17-24 was tested instead of H17-10. I17-24 and I-17-22 are at the same elevation. The FH was in a commercial area and the

City of San Luis Obispo
Water Master Plan
Fire Flow Testing

Zone	Date	Time	Fire Hydrant No.	FH Flow (gpm)	FH Pressure (psi)	Closest Address	Temp (°F)	Weather	Tank	Tank Level (ft)	Pump Station	PS On/Off	PRV	Incoming/Outgoing/Closed	Upstream (psi)	Downstream (psi)	Fire Hydrant/Address	Pressure	Description	Notes
											Well FS #4	Off					I17-22	66	Dynamic	upstream and downstream FHs couldn't be tested since the shop was short staffed that day. The FH I17-24 pressure ranged from 27-37 psi during testing but on average it centered on 32 psi.
Edna Saddle	6/10/2013	9:30 AM	**J14-12**	1200	62.5	3190 Alicita	64	Overcast	Edna Saddle Reservoir	12.93	Well PB #1 Well FS #4	Off Off	Madonna/Higuera	Incoming-Closed	100	85	3140 Alicita 3140 Alicita	65 56	Static Dynamic	FH J14-12 pressure ranged from 60-65 psi. 3140 Alicita is at a slightly higher elevation (1-3 feet) than the J14-12. FH J14-12 was tested instead of J14-4 to reduce need fro traffic mitigation on So. Higuera. 3140 Alicita Dynamic pressure ranged from 56-57 psi.
Edna Saddle	6/10/2013	10:10 AM	**H13-4**	1200	62	445 Madonna	64	Overcast	Edna Saddle Reservoir	12.58	Well PB #1 Well FS #4	Off Off	Madonna/Higuera	Incoming-Closed	100	85	H13-5 H13-5 H13-6 H13-6	65 55 86 75	Upstream-Static Upstream-Dynamic Downstream-Static Downstream-Dynamic	FH H13-4 was tested instead of J13-8 to reduce need for traffic mitigation on Madonna. FH H13-5 Dynamic pressure ranged from 52-57 psi.
Edna Saddle	6/10/2013	10:55 AM	**M17-3**	1100	53	858 El Capitan	66	Overcast	Edna Saddle Reservoir	12.26	Well PB #1 Well FS #4	Off Off	Madonna/Higuera	Incoming-Closed	100	85	M17-4 M17-4 M17-1 M17-1	54 48 71 64	Upstream-Static Upstream-Dynamic Downstream-Static Downstream-Dynamic	FH M17-3 was tested instead of M17-9 to reduce need for traffic mitigation on Broad St & Fierro. The water system on Fierro is private so there wouldn't be anywhere to obtain additional pressure readings. FH M17-3 pressure ranged from 52-54 psi
Terrace Hill	6/10/2013	1:15 PM	**L12-3**	860	32.5	1100 San Carlos	73	Clear-Sunny	Terrace Hill Islay Bishop Reservoir #2	19.26 7.37 12.93 17.38	Bishop Transfer	Off On	Kentwood/Johnson Terrace Hill Broad/Caudill Bollack/Industrial	Incoming Closed Closed On	105	42	1090 San Carlos 1090 San Carlos	31 30	Static Dynamic	FH 12-3 was tested instead of L12-5 to avoid destroying surrounding landscaping. **Terrace Hill PRV** was turned off so that the Transfer Pump Station could be left on (per conversation with Kari). FH L12-3 pressure ranged from 30-35 psi during testing.
Terrace Hill	6/10/2013	1:55 PM	**L13-18**	700	24	781 Mutsuhito	73	Clear-Sunny	Terrace Hill Islay Bishop Reservoir #2	19.26 7.38 12.66 17.49	Bishop Transfer	Off On	Kentwood/Johnson Terrace Hill Broad/Caudill Bollack/Industrial	Incoming Closed Closed On	105	40	779 Mutsuhito 779 Mutsuhito	46 45	Static Dynamic	FH L13-18 was tested instead of L13-23 to reduce need for traffic mitigation on Broad St. FH L13-18 pressure ranged from 18-32 psi during testing but on average it was primarily 24 psi.
Terrace Hill	6/10/2013	2:15 PM	**N17-4**	1272	62	4203 Poinsettia	73	Clear-Sunny	Terrace Hill Islay Bishop Reservoir #2	19.26 7.2 12.51 17.55	Bishop Transfer	Off On	Kentwood/Johnson Terrace Hill Broad/Caudill Bollack/Industrial	Incoming Closed Closed On	105	40	4215 Poinsettia 4215 Poinsettia	73 68	Static Dynamic	FH N17-4 pressure ranged from 58-68 psi during testing but on average it was primarily 62 psi.

At different times the pitot pressure gauge for the FH would be off from 4-10 psi. This was always taken into account and the numbers recorded already take this into account
The address where a static and dynamic pressure all had pressure readings taken from a hose bib and made sure that the home did not have a PRV.
All tank/reservoir readings were taken right before FHs were tested.

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14: Appendix D: Specific Plan Water Distribution System Layout Exhibits

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Figure: 1

Recommended Water Distribution System Improvements for Orcutt Area Developments

Legend

Valves

Size | Type | Status
12" | PRV | New
12" | PRV | Existing (To Be Abandoned)
8" | GV | Existing - Open
8" | GV | Existing - Closed

Waterlines

Size | Status
12" | Existing (To Be Abandoned)
12" | Existing
12" | New
8" | New
8" | Existing (To Be Abandoned)
8" | Existing
8" | New - Private or City Owned
Home PRV Recommended

N

1 inch = 350 feet

0 200 400 Feet

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