CITY OF SAN JUAN BAUTISTA

2020

WATER MASTER PLAN

DRAFT NO. 1

August 2020

AKEL
ENGINEERING GROUP, INC.

AKEL
ENGINEERING GROUP, INC.

Smart Planning Our Water Resources

August 19, 2020

City of San Juan Bautista
311 2nd St
San Juan Bautista, CA 95045

Attention: Don Reynolds
City Manager

Subject: 2020 Water Master Plan – Draft No. 1

Dear Don:

We are pleased to submit Draft No. 1 for the City of San Juan Bautista Water Master Plan. This master plan is a standalone document, though it was prepared as part of the integrated infrastructure master plans for the water and wastewater master plans. This master plan documents the following:

- Existing distribution system facilities, acceptable hydraulic performance criteria, and projected water demands consistent with the Urban Planning Area.
- Development and validation of the City's GIS-based hydraulic water model.
- Capacity evaluation of the existing water system with improvements to mitigate existing deficiencies and to accommodate future growth.
- Capital Improvement Program (CIP) with an opinion of probable construction costs and suggestions for cost allocations to meet AB 1600.

We extend our thanks to you, Don Reynolds, City Manager, and other City staff whose courtesy and cooperation were valuable components in completing this study.

Sincerely,

AKEL ENGINEERING GROUP, INC.

Tony Akel, P.E.
Principal

Enclosure: Report

7433 N. FIRST STREET, SUITE 103 • FRESNO, CALIFORNIA 93720 • (559) 436-0600 • FAX (559) 436-0622
www.akeleng.com

Acknowledgements

City Council

Mary Vasquez Edge, Mayor

Leslie Q. Jordan, Vice Mayor

Dan DeVries, Council Member

César E. Flores, Council Member

John Freeman, Council Member

Management Personnel

Don Reynolds, City Manager

Karl Bjarke, Project Manager

Julie Behzad, City Engineer

Miles Farmer, Cypress Water Services

Danny Gonzales, All Clear Water Services

Other City Engineering, Planning, and Operations Staff

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CHAPTER 1 - INTRODUCTION

This chapter provides a brief background of the City of San Juan Bautista's (City) domestic water system, the need for this master plan, and the objectives of the study. Unit conversions, abbreviations, and definitions are also provided in this chapter.

1.1 BACKGROUND

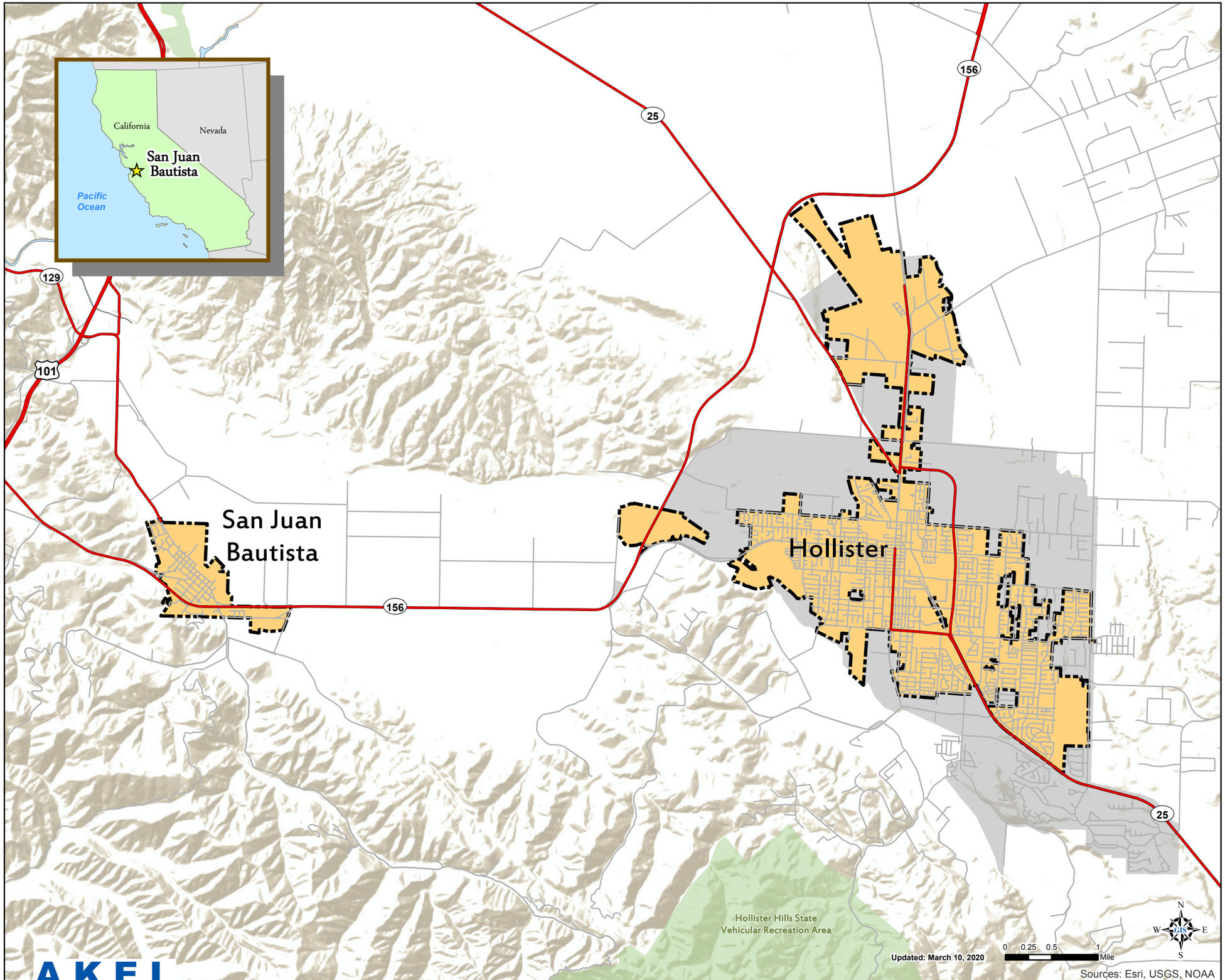
The City of San Juan Bautista (City) is located approximately 8 miles west of Hollister, 11 miles south of Gilroy and 13 miles southeast of Watsonville (**Figure 1.1**). The City provides potable water service to 2,100 residents, as well as a number of commercial, industrial, and public establishments. The City owns and operates a domestic water distribution system that consists of 2 active groundwater wells, 1 storage tank with a volume of 1.25 million gallons, and more than 10 miles of distribution pipelines.

1.2 SCOPE OF WORK

The City authorized Akel Engineering Group to prepare this 2020 Water Master Plan (WMP) and a concurrent Wastewater Master Plan in November of 2019. The 2020 WMP evaluates the City's water system and recommends capacity improvements necessary to service the needs of existing users and for servicing the future growth of the City. This 2020 WMP is intended to serve as a tool for planning and phasing the construction of future domestic water system infrastructure for the projected buildout of the City's service area. The area and horizon for the master plan is based on the City's General Plan. Should planning conditions change, and depending on their magnitude, adjustments to the master plan recommendations might be necessary.

This master plan included the following tasks:

- Summarizing the City's existing domestic water system facilities
- Documenting growth planning assumptions and known future developments
- Developing domestic water system performance criteria
- Projecting future domestic water demands
- Developing and validating a new hydraulic model using received drawings and Geographic Information Systems (GIS) data
- Evaluating the domestic water facilities to meet existing and projected demand requirements and fire flows
- Performing a capacity analysis for major distribution mains



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Legend

- Major Highways
- City Limits
- Urbanized Area
- Protected Open Space
- Rivers/Streams
- Waterbodies

PRELIMINARY

Figure 1.1
Regional Location Map
Water Master Plan
City of San Juan Bautista

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- Performing a fire flow analysis
- Recommending a capital improvement program (CIP) with an opinion of probable costs
- Performing a capacity allocation analysis for cost sharing purposes
- Developing a 2020 Water Master Plan report

1.3 INTEGRATED APPROACH TO MASTER PLANNING

The City implemented an integrated master planning approach and contracted the services of Akel Engineering Group to prepare the following documents:

- 2020 Water Master Plan
- 2020 Wastewater Master Plan

While each of these reports is published as a standalone document, they have been coordinated for consistency with the City's General Plan. Additionally, each document has been cross referenced to reflect relevant analysis results with the other documents.

1.4 RELEVANT REPORTS

The City has completed several special studies intended to evaluate localized growth. These reports were referenced and used during this capacity analysis. The following lists relevant reports that were used in the completion of this master plan, as well as a brief description of each document:

- **City of San Juan Bautista 2035 General Plan, November 2015**. The 2035 General Plan represents the official adopted goals and policies of the City of San Juan Bautista, and addresses planning issues within the community such as historic preservation, economic development, and development of public facilities. This includes establishing a plan for municipal elements such as land use, housing, and economic development.

- **State Water Resources Control Board Sanitary Survey of Water System Facilities, March 2019**. This letter confirmed the findings of an inspection conducted in October 2018 by the State Water Resources Control Board on the water system facilities operated by the City.

- **State Water Resources Control Board Water Permit, June 2020**. This permit, issued to the City on June 12, 2020, approved the City's operation of the water system. IT also documents the City's existing system information, operations, and supply conditions as reported by an inspection conducted in September 2019.

1.5 REPORT ORGANIZATION

The Water Master Plan report contains the following chapters:

Chapter 1 - Introduction. This chapter provides a brief background of the City's domestic water system, the need for this master plan, and the objectives of the study. Unit conversions, abbreviations, and definitions are also provided in this chapter.

Chapter 2 - Planning Areas Characteristics. This chapter presents a discussion of the planning area characteristics for this master plan and defines the land use classifications.

Chapter 3 - System Performance and Design Criteria. This chapter presents the City's performance and design criteria, which was used in this analysis for identifying current system capacity deficiencies and for sizing proposed distribution mains, storage reservoirs, and wells.

Chapter 4 - Existing Domestic Water Facilities. This chapter provides a description of the City's existing domestic water system facilities including the existing wells, distribution mains, storage reservoir, and booster pump stations.

Chapter 5 - Water Demands and Supply Characteristics. This chapter summarizes existing domestic water demands and projects the future domestic water demands.

Chapter 6 - Hydraulic Model Development. This chapter describes the development and validation of the City's domestic water distribution system hydraulic model. The hydraulic model was used to evaluate the capacity adequacy of the existing system and to plan its expansion to service anticipated future growth.

Chapter 7 - Evaluation and Proposed Improvements. This section presents a summary of the domestic water system evaluation and identifies improvements needed to mitigate existing deficiencies, as well as improvements needed to expand the system and service growth.

Chapter 8 - Capital Improvement Program. This chapter provides a summary of the recommended domestic water system improvements to mitigate existing capacity deficiencies and to accommodate anticipated future growth. The chapter also presents the cost criteria and methodologies for developing the capital improvement program. Finally, a capacity allocation analysis, usually used for cost sharing purposes, is also included.

1.6 ACKNOWLEDGEMENTS

Obtaining the necessary information to successfully complete the analysis presented in this report, and developing the long-term strategy for mitigating the existing system deficiencies and for accommodating future growth, was accomplished with the strong commitment and very active input from dedicated team members including:

- Don Reynolds, City Manager
- Karl Bjarke, Project Manager
- Julie Behzad, City Engineer
- Nicholas Bryan, Head of Operations

- Miles Farmer
- Danny Gonazales

As part of the preparation of this Water Master Plan, Stantec Inc. prepared reports evaluating treatment strategies for both water supply sources and collected wastewater flows.

1.7 UNIT CONVERSIONS AND ABBREVIATIONS

Engineering units were used in reporting flow rates and volumes pertaining to the design and operation of various components of the domestic water distribution system. Where it was necessary to report values in smaller or larger quantities, different sets of units were used to describe the same parameter. Values reported in one set of units can be converted to another set of units by applying a multiplication factor. A list of multiplication factors for units used in this report is shown on **Table 1.1**.

Various abbreviations and acronyms were also used in this report to represent relevant water system terminologies and engineering units. A list of abbreviations and acronyms is included in **Table 1.2**.

1.8 GEOGRAPHIC INFORMATION SYSTEMS

This master planning effort made extensive use of Geographic Information Systems (GIS) technology, for completing the following tasks:

- Develop the physical characteristics of the hydraulic model (pipes and junctions, wells, and storage reservoirs)
- Allocate existing water demands, as extracted from the water billing records, and based on each user's physical address.
- Calculate and allocating future water demands, based on future developments' water use
- Extract ground elevations along the distribution mains from available contour maps and digital elevation models
- Generate maps and exhibits used in this master plan

Table 1.1 Unit Conversions

Water Master Plan

City of San Juan Bautista

PRELIMINARY

Volume Unit Calculations		
To Convert From:	**To:**	**Multiply by:**
acre feet	gallons	325,851
acre feet	cubic feet	43,560
acre feet	million gallons	0.3259
cubic feet	gallons	7.481
cubic feet	acre feet	2.296×10^{-5}
cubic feet	million gallons	7.481×10^{-6}
gallons	cubic feet	0.1337
gallons	acre feet	3.069×10^{-6}
gallons	million gallons	1,000,000
million gallons	gallons	1×10^{-6}
million gallons	cubic feet	133,672
million gallons	acre feet	3.069

Flow Rate Calculations		
To Convert From:	**To:**	**Multiply By:**
ac-ft/yr	mgd	8.93×10^{-4}
ac-ft/yr	cfs	1.381×10^{-3}
ac-ft/yr	gpm	0.621
ac-ft/yr	gpd	892.7
cfs	mgd	0.646
cfs	gpm	448.8
cfs	ac-ft/yr	724
cfs	gpd	646300
gpd	mgd	1×10^{-6}
gpd	cfs	1.547×10^{-6}
gpd	gpm	6.944×10^{-4}
gpd	ac-ft/yr	1.12×10^{-3}
gpm	mgd	1.44×10^{-3}
gpm	cfs	2.228×10^{-3}
gpm	ac-ft/yr	1.61
gpm	gpd	1,440
mgd	cfs	1.547
mgd	gpm	694.4
mgd	ac-ft/yr	1,120
mgd	gpd	1,000,000

Table 1.2 Abbreviations and Acronyms

Water Master Plan

City of San Juan Bautista

PRELIMINARY

Abbreviation	Expansion	Abbreviation	Expansion
2020 WMP	2020 Water Master Plan	gpdc	Gallons per day per capita
AACE International	Association for the Advancement of Cost Engineering	gpm	Gallons per minute
AC	Acre	GSA	Groundwater Sustainability Agency
ACP	Asbestos Cement Pipe	HGL	Hydraulic grade line
ADD	Average Day Demand	hp	Horsepower
Akel	Akel Engineering Group, Inc.	HWL	High water level
CCI	Construction Cost Index	in	Inch
CDPH	California Department of Public Health	LAFCO	Local Agency Formation Commission
cfs	Cubic feet per second	LF	Linear feet
CI	Cast Iron Pipe	MDD	Maximum day demand
CIB	Capital Improvement Budget	MG	Million gallons
CIP	Capital Improvement Program	MGD	Million gallons per day
City/CoSB	City of San Juan Bautista	MMD	Maximum month demand
DDW	Division of Drinking Water	NFPA	National Fire Protection Association
DIP	Ductile Iron Pipe	PHD	Peak hour demand
DU	Dwelling Unit	PRV	Pressure reducing valve
EDU	Equivalent Dwelling Unit	psi	Pounds per square inch
ENR	Engineering News Record	ROW	Right of Way
EPA	Environmental Protection Agency	SCADA	Supervisory Control and Data Acquisition
EPS	Extended Period Simulation	SOI	Sphere of Influence
fps	Feet per second	SWRCB	State Water Resources Control Board
ft	Feet	TBD	To be determined
FY	Fiscal Year	ULL	Urban Limit Line
GIS	Geographic Information Systems	WMP	Water Master Plan
gpd	Gallons per day	WTP	Water Treatment Plant

CHAPTER 2 - PLANNING AREA CHARACTERISTICS

This chapter presents a discussion of the planning area characteristics for this master plan and defines the land use classifications.

2.1 STUDY AREA DESCRIPTION

The City of San Juan Bautista is located in San Benito County, approximately 11 miles south of Gilroy and 13 miles southeast of Watsonville. The City's closest neighbor, the City of Hollister, is located 8 miles to the east. State Route 156 bisects the boundary of the City in the east-west direction. The City limits currently encompass 0.79 square miles, with an approximate population of 2,100 residents.

The City's service area is generally bound to the north by Prescott Road, to the east by Mission Vineyard Road, to the southwest by State Route 156, and to the south by Old San Juan Hollister Road. The topography is generally flat, with slopes increasing from north to south toward the Gabilan Mountain Range. **Figure 2.1** displays the assumed sphere of influence boundary as documented in the General Plan. This boundary has not yet been adopted by City staff but was used for planning purposes as part of this master plan.

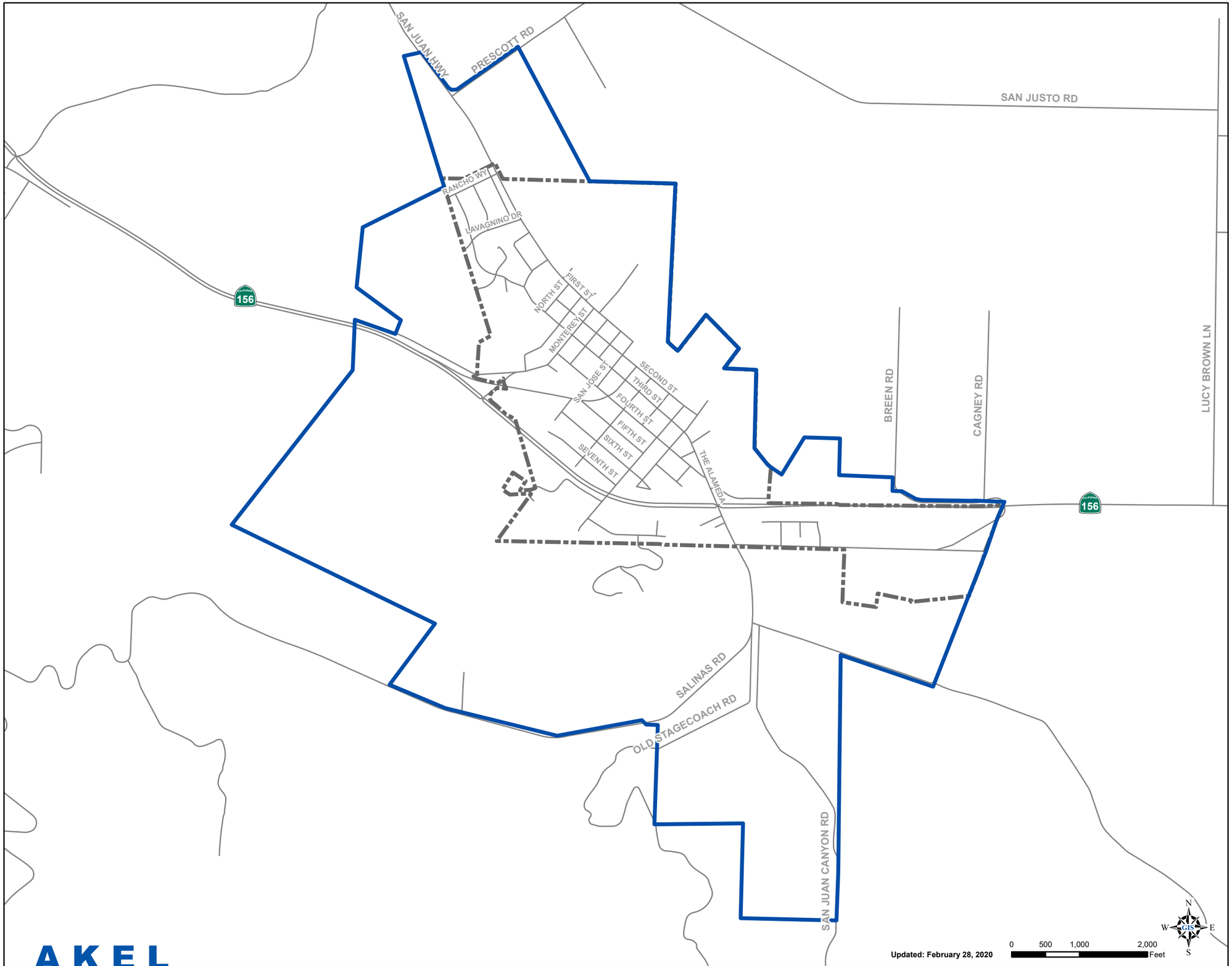
The City operates and maintains a domestic water system that covers the majority of the developable area within the Planning Boundary. Currently, the water demands are provided from groundwater wells located in the southeast portion of the service area.

2.2 WATER SERVICE AREA AND LAND USE

The City's water system services residential and non-residential lands primarily within the City limits, as summarized on **Table 2.1** and shown graphically on **Figure 2.2**. Areas within the City's potential water service area include:

- 814 acres of developed lands including residential, non-residential, and other non-demand generating areas.
- 34 acres of undeveloped lands inside the service area.

The existing land use statistics were based on land use information received from City staff. Several existing residential and commercial areas were reclassified as "Mixed-Use" in the General Plan; however, for the purposes of estimating water demand, these acreages were assumed to retain their existing land use, such as residential or commercial. It should be noted that two industrial users, Earthbound Farm and True Leaf Farms, operate private water and wastewater facilities; these users are not serviced by the City's water system but do convey wastewater flows to the wastewater treatment plant. For planning purposes, the acreage from these two developments are included in **Table 2.1**.



Legend

- City Limits
- Sphere of Influence Boundary
- Streets

PRELIMINARY

Figure 2.1
Planning Boundaries
Water Master Plan
City of San Juan Bautista

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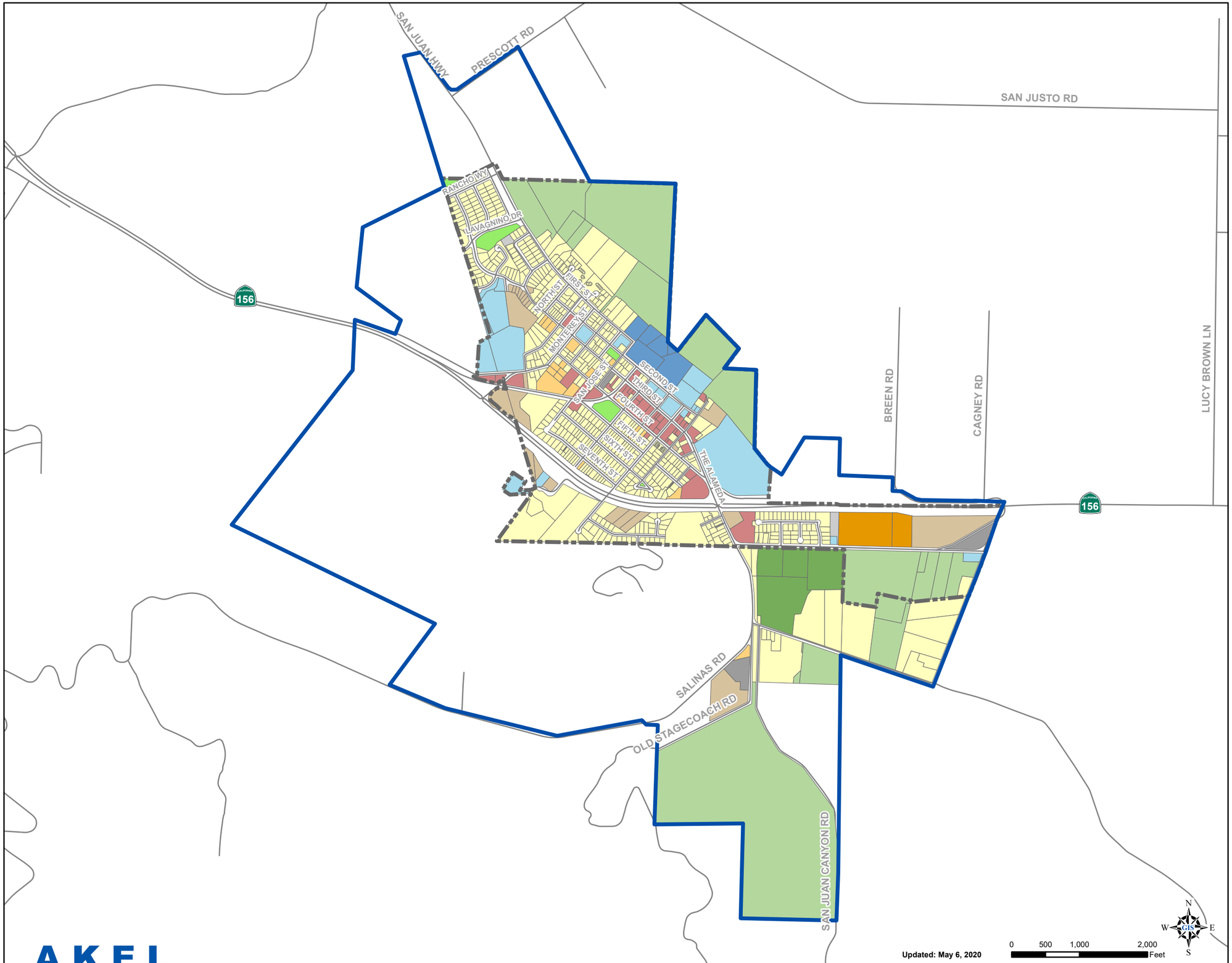

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Legend

Existing Land Use

- Low Density Residential
- Medium Density Residential
- High Density Residential
- Commercial
- Public Facility
- Mission
- Industrial
- Agriculture
- Open Space
- Williamson Act Land
- Vacant
- Other
- Streets
- City Limits
- Sphere of Influence Boundary

PRELIMINARY

Figure 2.2
Existing Land Use
Water Master Plan
City of San Juan Bautista

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Table 2.1 Existing and Future Land Use

Water Master Plan
City of San Juan Bautista

PRELIMINARY

Land Use Classification	Existing Development			Future Development				Total Development
					New Development			
	Existing Development	Existing Lands - Redeveloping	Subtotal Existing Development - Unchanged	New Lands - Redevelopment	Inside City Limits	Outside City Limits	New Development	
Residential								
Residential	255.2	-37.8	217.4	59.0	14.8	6.0	20.9	297.2
Subtotal Residential	**255.2**	**-37.8**	**217.4**	**59.0**	**14.8**	**6.0**	**20.9**	**297.2**
Non-Residential								
Agriculture	273.2	-178.1	95.1	0.0	1.5	0.0	1.5	96.7
Commercial	19.7	-1.3	18.4	117.0	6.1	0.0	6.1	141.5
Industrial	134.7	0.0	134.7	34.7	0.0	0.0	0.0	169.4
Mixed-Use	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Public Facility	58.4	-0.9	57.5	10.5	2.4	0.0	2.4	70.3
Subtotal Non-Residential	**486.0**	**-180.3**	**305.7**	**162.2**	**10.0**	**0.0**	**10.0**	**477.9**
Other								
Open Space	5.3	-3.1	2.2	0.0	3.0	0.0	3.0	5.3
Vacant	34.1	-34.1	0.0	0.0	0.0	0.0	0.0	0.0
Williamson Act Land	65.3	0.0	65.3	0.0	0.0	0.0	0.0	65.3
Other	1.6	0.0	1.6	0.0	0.0	0.0	0.0	1.6
Subtotal- Other	**106.4**	**-37.2**	**69.1**	**0.0**	**3.0**	**0.0**	**3.0**	**72.2**
Total	**847.6**	**-255.4**	**592.2**	**221.2**	**27.9**	**6.0**	**33.9**	**847.3**

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Notes:

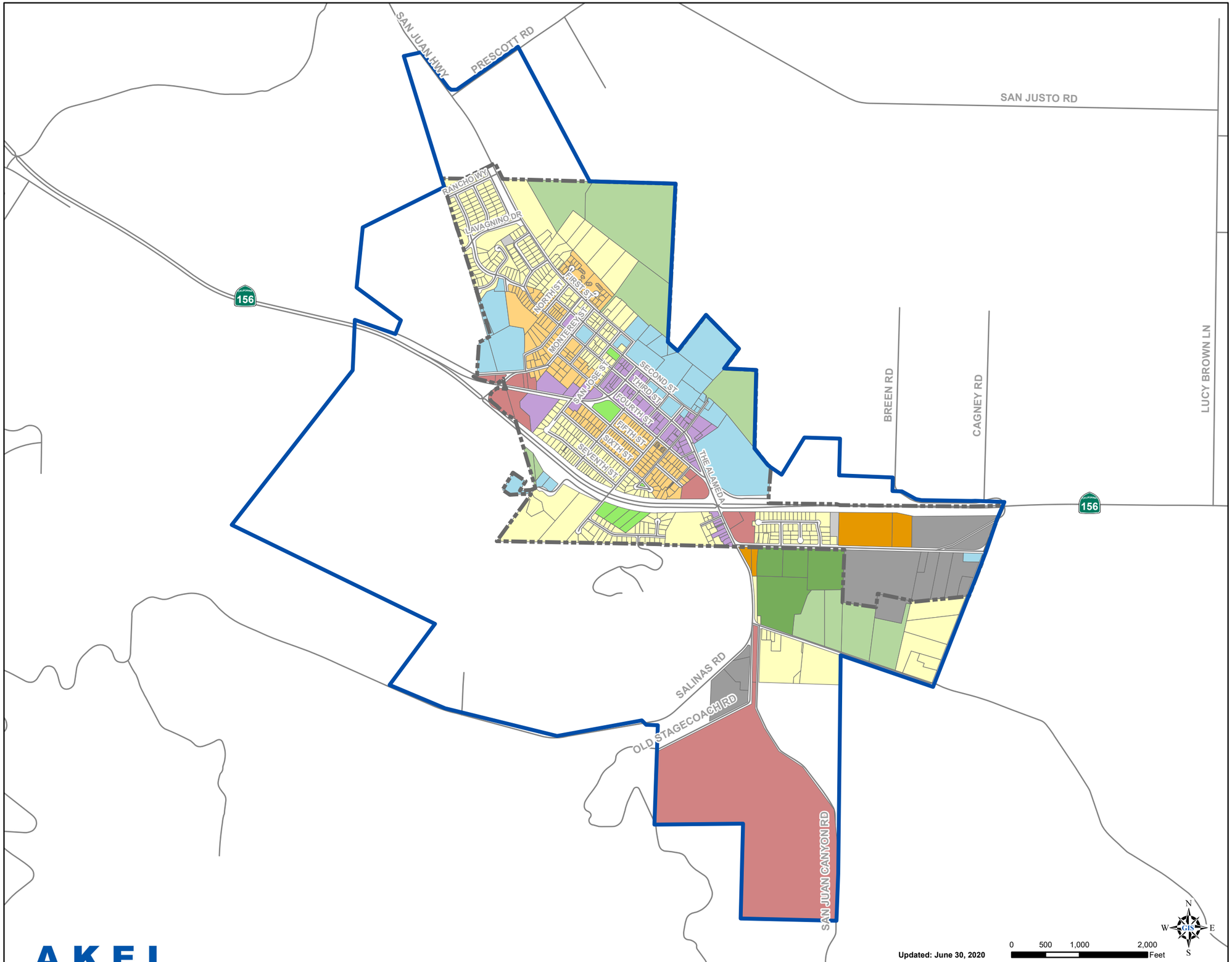
1. Source: GIS information downloaded from San Benito County Website (11/05/2019).

The buildout of the City's Sphere of Influence includes approximately 300 acres of residential land use, 480 acres of non-residential land use, and 70 acres of other open space land uses as documented in **Table 2.1** and shown graphically in **Figure 2.3**. The land use designations utilized in this master plan are consistent with the Land Use Element of the City's General Plan, and as received from the City's planning division.

2.3 HISTORICAL POPULATION AND FUTURE GROWTH

The City of San Juan Bautista is a growing community, with over 8% of the San Benito County population residing within the City's service area limits. Records obtained from California Department of Finance estimate the 2019 population at approximately 2,081 people. From 2015 to present the City's service area has observed an average annual growth rate of approximately 1.9 percent.

The General Plan anticipates a 2035 population of 3,500 and this 2020 WMP is consistent with the General Plan projections. The current and projected service area population is summarized in **Table 2.2**.



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Legend

General Plan Land Use

- Low Density Residential
- Medium Density Residential
- High Density Residential
- Commercial
- Mixed Use
- Public Facility
- Industrial
- Agriculture
- Open Space
- Williamson Act Land
- Other
- Streets
- City Limits
- Sphere of Influence Boundary

PRELIMINARY

Figure 2.3
General Plan Land Use
Water Master Plan
City of San Juan Bautista

Table 2.2 Historical and Projected Population

Water Master Plan

City of San Juan Bautista

PRELIMINARY

Year	Population	Annual Growth(%)
Historical[1]		
2000	1,549	-
2001	1,566	1.1%
2002	1,579	0.8%
2003	1,594	0.9%
2004	1,690	6.0%
2005	1,688	-0.1%
2006	1,683	-0.3%
2007	1,779	5.7%
2008	1,835	3.1%
2009	1,852	0.9%
2010	1,862	0.5%
2011	1,873	0.6%
2012	1,881	0.4%
2013	1,895	0.7%
2014	1,914	1.0%
2015	1,930	0.8%
2016	1,943	0.7%
2017	1,981	2.0%
2018	1,986	0.3%
2019	2,081	4.8%
Projected[2]		
2020	2,158	3.7%
2021	2,239	3.7%
2022	2,322	3.7%
2023	2,409	3.7%
2024	2,499	3.7%
2025	2,593	3.7%
2026	2,671	3.0%
2027	2,751	3.0%
2028	2,834	3.0%
2029	2,919	3.0%
2030	3,007	3.0%
2031	3,097	3.0%
2032	3,190	3.0%
2033	3,285	3.0%
2034	3,384	3.0%
2035	3,485	3.0%
2036	3,591	3.0%
2037	3,700	3.0%
2038	3,812	3.0%
2039	3,928	3.0%
2040	4,047	3.0%
2041	4,170	3.0%
2042	4,296	3.0%
2043	4,426	3.0%
2044	4,561	3.0%
2045[3]	4,699	3.0%

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Note :

1. Historical Populations per California Department of Finance estimates.
2. Unless noted otherwise, projected population extracted from San Juan Bautista 2035 General Plan and normalized to historical population:
   - Year 2021 - 2024: Exponential interpolation between 2020 and 2025.
   - Year 2026 - 2029: Exponential interpolation between 2025 and 2030.
   - Year 2031 - 2034: Exponential interpolation between 2030 and 2035.
3. 2045 population based on land use holding capacity of future residential development and maximum residential land use densities designated by the General Plan.

CHAPTER 3 - SYSTEM PERFORMANCE AND DESIGN CRITERIA

This chapter presents the City's performance and design criteria, which was used in this analysis for identifying current system capacity deficiencies and for sizing proposed distribution mains, storage reservoirs, and wells.

3.1 HISTORICAL WATER USE TRENDS

The historical domestic water consumption per capita was calculated to determine the average water use per capita per day. This was accomplished by dividing the City's historical water production from groundwater production records by the historical population for the respective year.

This master plan forecasts domestic water demands for residential and non-residential land uses based on net acreages. However, to generalize trends in the City's water use, per capita water use was documented.

The City's historical per capita consumption factors, based on available data between 2009-2017, are listed in Table 3.1. It should be noted that there were data gaps in the records for 2010, 2011, and 2013. The City's per capita consumption has generally varied since 2009, with a maximum per capita consumption of 301 gallons per day per capita (gpdc) in 2014 and a minimum of 230 gpdc in 2011. Table 3.2 lists three years (2015-2017) of monthly water production in the City for the years.

3.2 SEASONAL DEMANDS AND PEAKING FACTORS

Domestic water demands within municipal water systems vary with the time of day and month of the year. It is necessary to quantify this variability in demand so that the water distribution system can be evaluated and designed to provide reliable water service under these variable demand conditions.

Water use conditions that are of particular importance to water distribution systems include the average day demand (ADD), the maximum month demand (MMD), the maximum day demand (MDD), and the peak hour demand (PHD).The average day demand represents the annual water demand, divided by 365 days, since it is expressed in daily units.

3.2.1 Maximum Month Demand

The maximum month demand (MMD) is the highest demand that occurs within a calendar month during a year. The City's MMD usually occurs during the summer months between May and July. The MMD is used primarily in the evaluation of supply capabilities.

Table 3.1 Historical Water Production and Maximum Day Peaking Factors

Water Master Plan

City of San Juan Bautista

PRELIMINARY

Year	Population[1]	Annual Change	Historical Water Production[2]									Average Per Capita Water Use
			Annual Production			Maximum Month Production				Maximum Day Production		
						Maximum Monthly Production		Month of Occurrence	Max to Avg Ratio	Total	Max to Avg Ratio	
		(%)	(MG/year)	(mgd)	(gpm)	(MG/month)	(mgd)			(MGD)		(gpdc)
2009	1,852	0.9%	115	0.32	219	15.00	0.50	July	1.59	0.53	1.07	288
2010	1,862	0.5%										
2011	1,873	0.6%										
2012	1,881	0.4%	87	0.24	166	10.84	0.36	July	1.51	0.43	1.20	230
2013	1,895	0.7%										
2014	1,914	1.0%	96	0.26	183	10.84	0.35	May	1.33	0.58	1.65	301
2015	1,930	0.8%	73	0.20	139	8.54	0.28	July	1.42	0.57	1.99	293
2016	1,943	0.7%	76	0.21	145	8.31	0.28	July	1.32	0.57	2.06	294
2017	1,981	2.0%	89	0.24	169	10.83	0.36	July	1.48	0.58	1.62	294
2018	1,986	0.3%										
2019	2,081	4.8%										
Historical Maximum Peaking Factors												
5-year Maximum			96	0.26	183	10.84	0.36	July	1.51	0.58	2.06	301
3-year Maximum			96	0.26	183	10.84	0.35	May	1.42	0.58	2.06	301
2017 Maximum			76	0.21	145	8.31	0.28	July	1.32	0.57	2.06	294
Recommended Criteria												
Recommended Criteria											**2.00**	

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Notes:

1. Historical Populations per California Department of Finance estimates.
2. Historical production per annual water readings received from City staff on May 5, 2020. Historical production data was not available for 2010, 2011, or 2013.

Table 3.2 Historical Monthly Water Production (2015-2017)

Water Master Plan

City of San Juan Bautista

PRELIMINARY

Month	2015				2016				2017			
	Daily Production	Monthly		Peaking Factor	Daily Production	Monthly		Peaking Factor	Daily Production	Monthly		Peaking Factor
	Average Day (mgd)	Production (MGM)	Percent of Annual (%)	Month to Avg Factor	Average Day (mgd)	Production (MGM)	Percent of Annual (%)	Month to Avg Factor	Average Day (mgd)	Production (MGM)	Percent of Annual (%)	Month to Avg Factor
January	0.12	3.8	5%	0.62	0.15	4.6	6%	0.72	0.14	4.3	6%	0.68
February	0.17	4.7	6%	0.78	0.16	4.5	6%	0.71	0.17	4.7	6%	0.74
March	0.19	6.0	8%	0.99	0.17	5.3	7%	0.83	0.15	4.7	6%	0.75
April	0.21	6.2	8%	1.01	0.17	5.2	7%	0.82	0.17	5.1	7%	0.80
May	0.19	6.0	8%	0.99	0.21	6.7	9%	1.05	0.26	8.2	11%	1.29
June	0.21	6.2	8%	1.01	0.27	8.2	11%	1.30	0.34	10.2	13%	1.61
July	0.28	8.5	12%	**1.40**	0.28	8.3	11%	1.31	0.36	10.8	14%	**1.70**
August	0.25	7.6	10%	1.26	0.27	8.4	11%	**1.31**	0.33	10.3	14%	1.63
September	0.26	7.7	11%	1.27	0.27	8.1	11%	1.27	0.34	10.3	13%	1.62
October	0.21	6.4	9%	1.06	0.20	6.3	8%	0.99	0.25	7.7	10%	1.21
November	0.17	5.0	7%	0.82	0.20	5.9	8%	0.93	0.21	6.2	8%	0.98
December	0.16	4.9	7%	0.81	0.16	4.9	6%	0.78	0.20	6.3	8%	0.99
Total		**73.1**				**76.3**				**89.0**		
Average Value	**0.20**	**6.1**			**0.21**	**6.4**			**0.24**	**7.4**		
Maximum Value		**8.5**		**1.40**		**8.4**		**1.31**		**10.8**		**1.70**

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Notes:

1. Source: 2015, 2016, and 2017 Production Extracted from Groundwater Production records provided by District staff May 5, 2020.

Available historical monthly water production records, obtained for the period between 2009 and 2017 (**Table 3.1**), indicate the maximum month to average month ratio ranging between 1.32 and 1.59. Over the reviewed period, this ratio neither showed significant increasing or decreasing trends. Therefore, an MMD factor of 1.5 was deemed representative of City trends. The following equation is recommended for estimating the maximum month demand, given the average day demand:

Maximum Month Demand = **1.5** x Average Day Demand

3.2.2 Maximum Day Demand

The maximum day demand (MDD) is the highest demand that occurs within a 24-hour day during a year. The City's MDD, which usually occurs during the summer months, is typically used for the evaluation and design of storage facilities, distribution mains, pump stations, and pressure reducing valves. The MDD, when combined with fire flows, is one of the highest demands that these facilities should be able to service while maintaining acceptable pressures within the system.

The maximum day demands were obtained from the City's water production records. Groundwater well production records indicate the date of occurrence and magnitude of the maximum day demand for each calendar year, as listed in **Table 3.1**. The maximum day to average day demand ratios for the period between 2009 and 2017 ranged from 1.07 to 2.06 and occurred in May, July, or September.

Through an analysis of these maximum day demands it was determined that a ratio of 2.0 would be used in this master plan. The following equation is then used to estimate the maximum day demand, given the average day demand:

Maximum Day Demand = **2.0** x Average Day Demand

3.2.3 Peak Hour Demand

The peak hour demand (PHD) is another high demand condition that is used in the evaluation and design of water distribution systems. The peak hour demand is the highest demand that occurs within a one-hour period during a year. The peak hour demand is considered to be the largest single measure of the maximum demand placed on the distribution system. The PHD is often compared to the MDD plus fire flow to determine the largest demand imposed on the system for the purpose of evaluating distribution mains.

A peak hour to maximum day ratio of 1.75 was applied to the maximum day demand to yield the peak hour demand ratio of 3.5. The peak hour demand can then be calculated using the average day demand and the following equation:

Peak Hour Demand = **3.5** x Average Day Demand

3.3 SUPPLY CRITERIA

In determining the adequacy of the domestic water supply facilities, the source must be large enough to meet the varying water demand conditions, as well as provide sufficient water during potential emergencies such as power outages and natural or created disasters.

Ideally, a water distribution system should be operated at a constant water supply rate with consistent supply from the water source. On the day of maximum demand, it is desirable to maintain a water supply rate equal to the maximum day rate. Water required for peak hour demands or for fire flows would come from storage.

As the City is currently using groundwater wells as the only source of supply, groundwater should be viewed as a sustainable resource. The existing storage in the system is expected to supply water during peak period usage, while supply wells should be capable of meeting maximum day demand with the largest supply well out of service. Design criteria for water supply are documented on **Table 3.3**.

3.4 STORAGE CRITERIA

The intent of domestic water storage is to provide supply for operational equalization and fire protection. Operational or equalization storage provides the difference in quantity between the customer's peak hour demands and the system's available reliable supply.

3.4.1 Typical Storage Criteria

Typical storage criteria consist of three main elements: operational, emergency, and fire flow.

Operational Storage

Operational or equalization storage capacity is necessary to reduce the variations imposed on the supply system by daily demand fluctuations. Peak hour demands may require up to 2 times the amount of maximum day supply capacity. With storage in place, this increase in demand can be met by the operational storage rather than by increasing production from the supply sources.

Equalization storage also stabilizes system pressures for enhancing the service. Equalization storage requirements typically range from 25 percent to 50 percent of maximum day demand. The City criterion requires that 25 percent of the maximum day demand be reserved for operational storage.

Emergency Storage

Emergency storage is the volume of water stored to meet demand during emergency situations such as pipe failures, distribution main failures, pump failures, power outages, natural disasters, or other cases in which the supply sources are not able to meet the demand condition.

Table 3.3 Recommended Planning and Design Criteria Summary

Water Master Plan

City of San Juan Bautista

PRELIMINARY

Design Parameter	Criteria[1]	
Supply		
	Supply to meet Maximum Day Demand with largest unit out or service	
Storage		
Total Required Storage	Total Required Storage = Operational + Fire + Emergency	
Operational Storage	25% of Maximum Day Demand	
Emergency Storage	50% of Maximum Day Demand	
Fire Storage	Residential	0.18 MG (1,500 gpm for 2 hours)
	Commercial/Public Facility	0.30 MG (2,500 gpm for 2 hours)
	Industrial	0.54 MG (3,000 gpm for 3 hours)
Distribution Mains		
	Distribution mains should be designed to satisfy the following criteria:	
Maximum Pipeline Velocity	5 ft/s during Peak Hour Demand	
	10 ft/s during Maximum Day Demand + Fire Flow	
Minimum Pipeline Size:	8-inch	
Pump Stations		
	Pump stations shall meet Maximum Day Demand with largest unit out of service.	
PRVs		
	PRVs should be designed to meet the greater of:	
	Peak Hour Demand, or Maximum Day Demand + Fire Flow	
Service Pressures		
Maximum Pressure	100 psi	
Minimum Pressure		
Maximum Day Demand	40 psi	
Peak Hour Demand	40 psi	
Fire Flows	20 psi	
Demand Peaking Factors		
Maximum Month Demand	1.5 x Average Day Demand	
Maximum Day Demand	2.0 x Average Day Demand	
Peak Hour Demand	3.5 x Average Day Demand	
Fire Flows		
Residential	1,500 gpm for 2 hours	
Commercial/Public Facility	2,500 gpm for 2 hours	
Industrial	3,000 gpm for 3 hours	

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Notes:

1. Unless noted otherwise, criteria shown are recommended based on Akel Engineering Group experience.

The amount of water reserved for emergencies is determined by policies adopted by the City and is based on an assessment of the costs and benefits including the desired degree of system reliability, risk during an emergency situation, economic considerations, and water quality concerns.

In California, the amount of emergency storage reserve in municipal water systems is usually between 50 percent and 100 percent of the maximum day demand. The City criterion requires that 50 percent of the maximum day demand be reserved for emergency storage.

Fire Storage

Fire storage is also needed to maintain acceptable service pressures within a pressure zone, in the event of a fire flow, which may occur during the maximum day demand. The recommended fire storage capacity varies by land use type, and is usually higher for commercial and industrial areas. Fire flow provisions were calculated based on the governing (highest) land use type within a reservoir service area as follows:

- Residential: 1,500 gpm for 2 hours = 0.18 MG
- Commercial/Public Facility: 2,500 gpm for 2 hours = 0.30 MG
- Industrial: 3,000 gpm for 3 hours = 0.54 MG

Total Storage Requirement

The total storage is the summation of operational (equalization), fire, and emergency storage requirements as follows:

$$Qs = 25\% \text{ MDD (equalization)} + 50\% \text{ MDD (emergency)} + \text{fire flow (varies)}$$

where:

Qs is the Total Required Storage, in gallons

MDD is the Maximum Day Demand, in gallons

3.5 PRESSURE CRITERIA

Acceptable service pressures within distribution systems vary depending on city criteria and pressure zone topography. It is essential that the water pressure in a consumer's residence or place of business be maintained within an acceptable range. Low pressures below 30 psi can cause undesirable flow reductions when multiple faucets or water using appliances are used at once.

Excessively high pressures can cause faucets to leak and valve seats to wear out prematurely. Additionally, high service pressures can cause unnecessarily high flow rates, which can result in

wasted water and high utility bills. The criteria for pressures in the domestic water system include the following:

- Maximum pressure, usually experienced during low demands and winter months
- Minimum pressure, usually experienced during peak hour demands and summer months
- Minimum pressure during fire flows and during the maximum day demand

The American Water Works Association Manual on Computer Modeling and Water Distribution System (AWWA M-32) indicates that maximum pressures are usually in the range of 90-110 pounds per square inch (psi). In some communities, the maximum pressure may be limited to 80 psi to mitigate the impact on internal plumbing. In this case, the distribution system is usually sized for the higher pressures, and individual pressure-reducing valves are installed on service lines where the pressure may be exceeded.

The minimum acceptable pressure is usually in the range of 40-50 psi, which generally provides for sufficient pressures for second story fixtures. When backflow preventers are required, they may reduce the pressures by approximately 5-15 psi. The recommended minimum pressure during fire flows is 20 psi, as established by the National Fire Protection Association (NFPA).

The City's pressure criteria are summarized as follows:

- **Maximum Pressure:** 100 psi
- **Minimum Pressure:**
    - Maximum Day Demand: 40 psi
    - Peak Hour Demand: 40 psi
    - Maximum Day Demand + Fire Flow: 20 psi

3.6 UNIT FACTORS

Domestic water demand unit factors are coefficients commonly used in planning level analysis to estimate future average daily demands for areas with predetermined land uses. The unit factors are multiplied by the number of dwelling units or gross acreages for residential categories, and by the gross acreages for non-residential categories, to yield the average daily demand projections.

The total domestic water demand was calculated from 2019 water consumption data. The demand was adjusted to balance with current production records, and to account for distribution main losses and vacancies in existing land uses. In the absence of 2019 production records, a system-wide distribution main loss of eleven percent was assumed based on Akel Engineering Group experience in similar projects. The demand unit factor was then calculated using the total water production and total number of residential and non-residential land use acreages. The

existing unit factor analysis is shown on **Table 3.4**, with the determined unit factors listed on **Table 3.5**.

In order to account for variation in demand across different areas of the same land use classification, several land use types were divided into sub-classifications. It should be noted that the revised classifications resulted in adjusted acreages for each land use type when compared to **Table 2.1**, however total existing service area acreage remained the same. The determinations were decided on a case-by-case basis based on lot size, demands, or other development information as described below:

- **Low Density Residential.** Low density residential land use was separated based on lot size, with lots under 1.0 acres designated as single family residential and lots of 1.0 acres or more as rural residential.
- **Medium/High Density Residential.** The only land classified as high density residential is the Mission Farm RV Park. Thus, medium/high density residential land use was separated into medium density residential and Mission Farm RV Park to properly characterize demand unit factors for each.
- **Industrial.** Industrial land use excludes two users that are located outside of the City's service area: Earthbound Farm and True Leaf Farms. These users operate private facilities and are not serviced by the City's water system, and have been listed separately.
- **Public Facility.** Several parcels designated as public facility land use do not typically have associated domestic water demands. As such, these "non-demand generating" parcels have been listed separately.

3.7 FIRE FLOWS

Fire flows are typically based on land use, with the potential for increased fire flow based on the building type. The following are the criteria for fire flows:

- **Category 1.** Fire flows for residential areas were calculated at 1,500 gpm for two hours.
- **Category 2.** Fire flows for commercial areas and public facilities were calculated at 2,500 gpm for two hours.
- **Category 3.** Fire flows for industrial areas were calculated at 3,000 gpm for three hours.

3.8 TRANSMISSION AND DISTRIBUTION MAIN CRITERIA

Transmission and distribution mains are usually designed to convey the maximum expected flow condition. In municipal water systems, this condition is usually the greater of either the peak hour demand or the maximum day demand plus fire flow. The hydrodynamics of pipe flow create two additional parameters that are taken into consideration when evaluating or sizing water mains: head loss and velocity.

Table 3.4 Water Demand Unit Factor Analysis

Water Master Plan

City of San Juan Bautista

PRELIMINARY

Land Use Classification	Existing Development within Service Area	Existing Average Daily Water Demand Unit factors									
		Consumption[1]			Production (Consumption + 11% losses)[2]		Production at 100% Occupancy			Recommended Water Unit Factor	
		Unadjusted Water Unit Factors	Annual Consumption		Unadjusted Water Unit Factors	Production (w/o Vacancy rate)	Vacancy Rate[3,4]	Projected Production at 100% Occupancy		Recommended Factor[5]	Balance Using Recommended Unit Factor
	(acres)	(gpd/acres)	(gpd)	(gpm)	(gpd/acres)	(gpd)	(%)	(gpd/acres)	(gpd)	(gpd/acres)	(gpd)
Residential											
Low Density Residential - Rural[6]	74	89	6,577	5	99	7,301	9.0%	108	7,958	110	8,127
Low Density Residential - Single Family[6]	161	691	111,215	77	767	123,448	9.0%	836	134,559	840	135,267
Medium Density Residential	8	836	6,717	5	928	7,455	9.0%	1,011	8,126	1,500	12,057
High Density Residential - Mission Farm RV Park[7]	12	169	2,064	1	187	2,291	9.0%	204	2,498	210	2,568
Subtotal - Residential	255		126,573	88		140,496			153,141		158,019
Non-Residential											
Agriculture	273	0	0	0	0	0	0.0%	0	0	0	0
Commercial	20	1,506	29,662	21	1,672	32,924	6.0%	1,772	34,900	1,780	35,054
Industrial[8,9]	45	382	17,121	12	425	19,004	6.0%	450	20,144	1,100	49,245
Mixed-Use[10]	0	0	0	0	0	0	0.0%	0	0	0	0
Public Facility[11]	43	85	3,679	3	95	4,083	0.0%	95	4,083	100	4,311
Non-Demand Generating Public Facility	15	0	0	0	-	-	-	-	-	-	-
Earthbound Farm	60	371	22,414	16	-	-	-	-	-	-	-
True Leaf Farms	30	18	522	0	-	-	-	-	-	-	-
Subtotal - Non-Residential	486		73,397	51		56,012			59,128		88,610
Other											
Open Space	5	0	0	0	0	0	0.0%	0	0	0	0
Vacant	34	0	0	0	0	0	0.0%	0	0	0	0
Other	2	0	0	0	0	0	0.0%	0	0	0	0
Williamson Act Land	65	0	0	0	0	0	0.0%	0	0	0	0
Subtotal - Other	106		0	0		0			0		0
Totals											
	848		**199,970**	**139**		**196,508**			**212,268**		**246,629**

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Note:

1. 2019 Water Consumption provided by City staff on January 13, 2020.
2. In order to account for water system losses and other unmetered consumption, production was assumed to be equal to consumption increased by 11% based on Akel Engineering Group experience.
3. Residential vacancy rates sourced from San Benito County 2017-2022 Comprehensive Economic Development Strategy.
4. Commercial and Industrial vacancy rates sourced from San Benito County 2010 General Plan.
5. Recommended Medium Density Residential Water Demand factor based on General Plan development densities and Akel Engineering Group experience.
6. Existing acreage and consumption for low density residential land use was divided into two separate sub-types based on lot size; generally low density residential lots over 1.0 acres were considered Rural while lots under 1.0 acres were considered Single Family.
7. Unit factors for Mission Farm RV Park were calculated separately from medium / high density residential land use to account for higher population density than is typical.
8. Existing acreage of industrial land use excludes two users outside of the City's service area: Earthbound Farm & True Leaf Farms. These users operate private facilities and are not serviced by the City's water system and are listed separately.
9. Unit factor for Industrial land use is recommended based on Akel Engineering Group experience.
10. Existing acreage of mixed-use land use was consolidated with it's predominant land use designation.
11. Existing acreage of public facility land use excludes parcels without an associated water billing record.

Table 3.5 Water Demand Unit Factors

Water Master Plan

City of San Juan Bautista

PRELIMINARY

Land Use Type	Water Demand Unit Factor (gpd/acre)
Low Density Residential - Rural	110
Low Density Residential - Single Family	840
Medium Density Residential	1,500
High Density Residential - Mission Farm RV Park	210
Commercial	1,780
Industrial	1,100
Public Facility	100

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Head loss is a loss of energy within pipes that is caused by the frictional effects of the inside surface of the pipe and friction within the moving fluid itself. Head loss creates a loss in pressure which is undesirable in water distribution systems. Head loss, by itself, is not an important factor as long as the pressure criterion has not been violated. However, high head loss may be an indicator that the pipe is nearing the limit of its carrying capacity and may not have sufficient capacity to perform under stringent conditions.

Since high flow velocities can cause damage to pipes and lead to high head loss, it is desirable to keep the velocity below a predetermined limit. The criterion for maximum pipeline velocity used in this master plan is 5 feet per second during peak hour demand, and 10 feet per second during maximum day demand and fire flow conditions. This criterion also ensures that the head loss is kept below an acceptable limit, as the head loss in a pipe is a function of the flow velocity.

CHAPTER 4 - EXISTING DOMESTIC WATER FACILITIES

This chapter provides a description of the City's existing domestic water system facilities including the existing wells, distribution mains, storage reservoirs, and booster pump stations. The City's existing domestic water facilities are documented on **Table 4.1**, and described in the following sections.

4.1 EXISTING WATER SYSTEM OVERVIEW

The City's municipal water system consists of two active groundwater wells, one storage tank with a 1.25 million gallons storage volume, distribution mains, and fire hydrants. The City's topography is generally flat with slopes increasing from north to south; based on this topography, the water distribution system is comprised of a single pressure zone.

The City's existing domestic water distribution system is shown in **Figure 4.1**, which displays the existing system by pipe size. This figure provides a general color coding for the distribution mains, as well as labeling the existing wells and the storage reservoir.

4.2 SOURCE OF SUPPLY

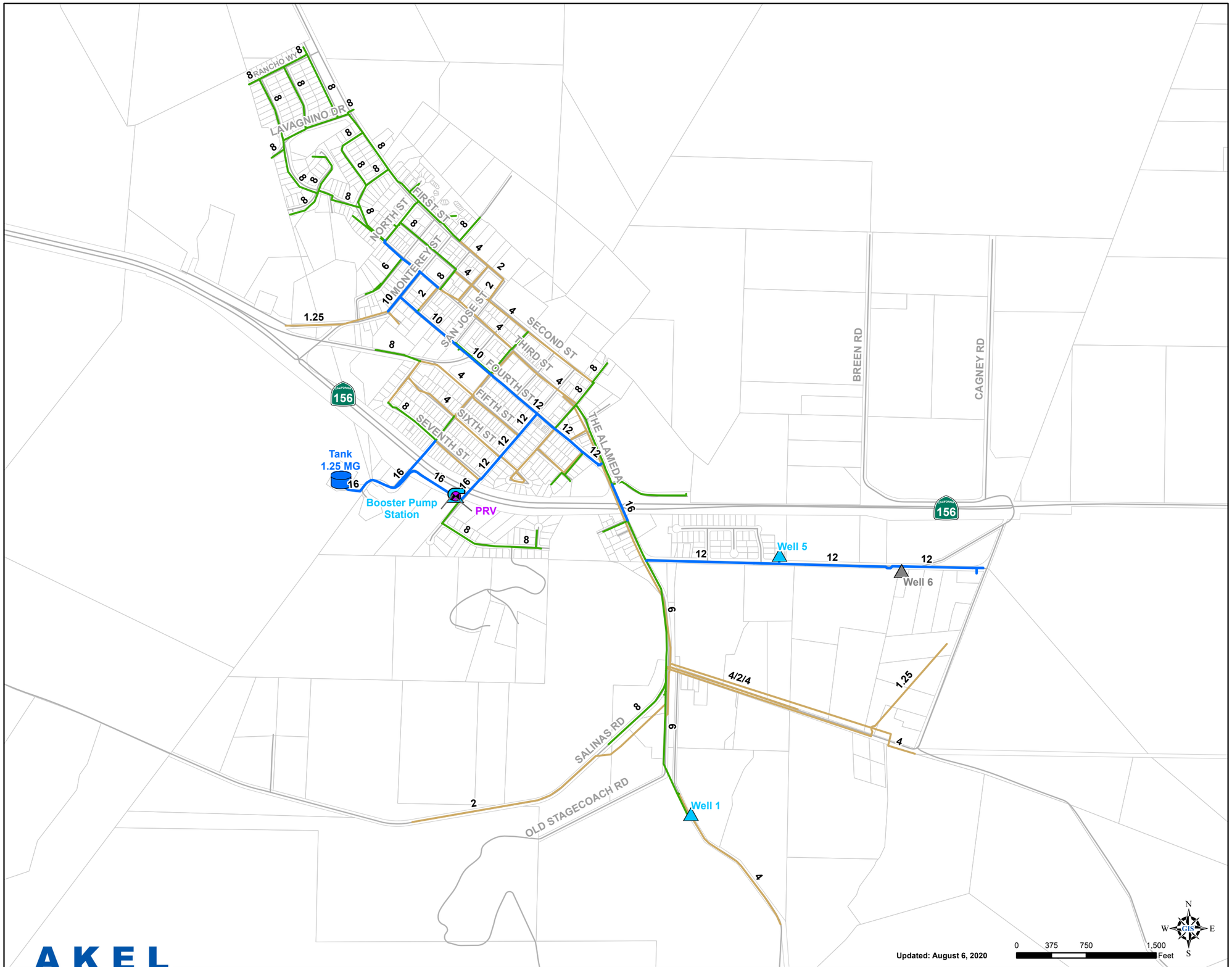
The City currently uses groundwater as the sole source of supply. There are two active groundwater wells in the City that are used for supply: Well 1 and Well 5 (**Figure 4.1**). During the preparation of this master plan, City operations staff provided well capacity ratings. It should be noted that, over time, well efficiencies may vary based on equipment conditions and groundwater levels. In periods of prolonged drought, well efficiency ratings may decrease due to a decline in groundwater levels. The opposite may occur in wet periods as well efficiencies may increase as the groundwater levels recover. As such, the City should monitor the well efficiencies on a frequent basis to adequately manage the groundwater supply. If periods of prolonged drought persist, it may be necessary to construct additional wells to maintain adequate supply capacity.

Based on the well capacities shown on **Table 4.1** the City's current total rated supply is approximately 0.86 mgd. Consistent with the system performance and design criteria the firm capacity is calculated as the capacity with the largest well out of service. The firm capacity of the well supply is estimated at 0.25 mgd.

4.3 WATER DISTRIBUTION PIPELINES

The City's distribution system consists of more than 9 miles of pipeline. The pipelines are generally 16-inches and smaller, and convey water to the consumers' service connections.

An inventory of existing modeled pipes, extracted from the GIS-based hydraulic model and used in this analysis, is included in **Table 4.1**. For each pipe diameter, the inventory lists the length in feet, as well as the total length in units of miles.



File Path: P:\xGIS\GIS_Projects\San_Juan_Bautista\Water\191112-MP\SJB_Fig4-1_ExistingSystem_080620.mxd

Legend

Existing System

- Tank
- Wells
- Inactive Well
- Pump Stations
- PRV

Pipes by Diameter

- 4" or Less
- 6" - 8 "
- 10" or Greater
- Streets
- Parcels

PRELIMINARY

Figure 4.1
Existing System
Water Master Plan
City of San Juan Bautista

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Table 4.1 Existing System Inventory

Water Master Plan

City of San Juan Bautista

PRELIMINARY

Existing Water Facilities					
Facility Name	**Facility Information**				
	Groundwater Wells[1,2,3,4]				
	Elevation	**Well Depth**	**Head**	**Pump Flow**	**Status**
Well 1 (San Juan Canyon Rd)	249 ft	128 ft	105 ft	175 gpm	Active
Well 5 (Old San Juan Hollister Rd w/o Mission Farm RV Park)	206 ft	450 ft	149 ft	425 gpm	Active
	Storage Reservoirs[4]				
	Elevation	**Diameter**	**Height**	**High Set Point**	**Design Capacity**
Reservoir 1 (Lausen Dr)	395 ft	95 ft	26 ft	26 ft	1.25 MG
	Booster Stations[2]				
	Elevation	**No. of Pumps**	**Total Capacity**	**Firm Capacity**	**Horsepower**
Pump 1 (Lausen Dr)	245 ft	3	150 gpm	100 gpm	5 hp
	Pressure Reducing Valves[2]				
	Elevation	**Outlet Pipe Diameter**	**Setting**		
PRV 1 (Lausen Dr)	245 ft	16"	55		
	Existing Modeled Pipe, by Diameter[4,5,6,7]				
Diameter (in)	**Total Length** (LF)	(mi)	**% of Total System**		
Unknown Diameter	2,566	0.5	4%		
0.75"	97	0.0	0%		
2"	6,936	1.3	10%		
4"	22,238	4.2	33%		
6"	6,480	1.2	10%		
8"	17,643	3.3	26%		
10"	1,819	0.3	3%		
12"	7,261	1.4	11%		
16"	2,366	0.4	4%		
Total	67,405	12.8	100%		

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Notes:

1. Source: 2017 San Juan Bautista Water Forum Water Source Handout
2. Source: State Water Resources Control Board Permit provided July 16, 2020.
3. Wells 2, 3, 4, and 6 were brought offline and are not displayed in this table.
4. Source: Construction drawings received from City April 6, 2020.
5. Source: Harris ArcGIS Web Map received from City September 26, 2019
6. Source: Water Distribution Map drawings received from City March 15, 2018
7. Source: 2017 San Juan Bautista Water Forum Water Delivery / Infrastructure Handout

4.4 STORAGE RESERVOIRS

Storage reservoirs are typically incorporated in the water system to provide water supply for operation during periods of high demand, for meeting fire flow requirements, and for other emergencies, as defined in the City's planning criteria.

The City's sole existing storage reservoir is included in **Table 4.1**, along with its volume, height, diameter, and bottom elevation. Due to the storage reservoir's base elevation a pressure reducing valve is used to control the flow of water to the distribution system and reduce the delivery pressures. Additionally, there is a booster pump located near the storage reservoir that is used to fill the tank as necessary; information for the booster pump can be found in **Table 4.1**.

4.5 PRESSURE REDUCING VALVES

System pressures are regulated through use of a pressure reducing valve (PRV), which is shown on **Table 4.1**. Constructed PRVs allow for the conveyance of water across large elevation changes throughout City. Additionally, the PRV provides a source of emergency supply in the case of groundwater well pump failure or other operational issues. The City currently operates a single pressure reducing valve near the storage reservoir, which is used reduce the pressure of water discharged from the tank to maintain acceptable pressures throughout the system.

CHAPTER 5 – DOMESTIC WATER DEMANDS

This chapter summarizes existing domestic water demands and projects the future domestic water demands.

5.1 EXISTING DOMESTIC WATER DEMANDS

The existing water demands used for this master plan were based on the City's 2019 water billing consumption records as well as total annual production. The existing water demands in this analysis are adjusted to match the annual production records and account for system losses.

The existing demand distribution was obtained from the water billing records. Using GIS, each customer account was geocoded to its physical location within the system. The accounts were then sorted by land use type and the total demand in each zone was calculated.

The City's existing average day domestic water demand, as extracted from the water billing records, were lower than the total demands listed in the annual production records due to system losses that occurred between the groundwater wells and customer service connections. The total domestic water demands were increased proportionally to 0.26 mgd to reflect the total 2014 production and account for transmission main losses.

5.2 FUTURE DOMESTIC WATER DEMANDS

Future demands were projected using the unit factors for residential and non-residential land uses and included the developments within the Sphere of Influence. **Table 5.1** documents the future land use categories and their corresponding domestic water demands. It should be noted that the existing domestic water demands in **Table 5.1** were calculated using the recommended water unit factors, which take into account future water conservation practices, and are intended to represent the water use of the existing users at the buildout of the master plan horizon. The total average day domestic water demands from existing and future developments is calculated at 0.57 mgd.

These demands were used in sizing the future infrastructure facilities, including distribution mains, storage reservoirs, and booster stations. Demands were also used for allocating and reserving capacities in the existing or proposed facilities.

5.3 MAXIMUM DAY AND PEAK HOUR DEMANDS

The maximum day and peak hour demands for the existing and future demands were calculated using the average day demands and City peaking factor criteria. The maximum day to average day ratio of 2.0, and peak hour to average day ratio of 3.5, were applied to the average day demands to obtain estimates of the higher demand conditions. The maximum day and peak hour demand estimates for the buildout of the Planning Area are 1.1 mgd and 2.0 mgd, respectively.

Table 5.1 Future Water Demand

Water Master Plan

City of San Juan Bautista

PRELIMINARY

Land Use Classification	Water Unit Factor (gpd/acre)	Total Water Demand: Existing Unchanged[1,2] (acres)	Total Water Demand: Redeveloped Area[1,2] (acres)	Total Water Demand: New Development (acres)	Buildout of Service Area: Total Area (acres)	Buildout of Service Area: Average Water Demand (gpd)
Residential						
Low Density Residential - Rural	110	72.9	0.0	0.0	72.9	8,015
Low Density Residential - Single Family	840	125.1	22.6	16.0	163.6	137,411
Medium Density Residential	1,500	7.2	36.5	4.9	48.6	72,866
Mission Farm RV Park	210	12.2	0.0	0.0	12.2	2,568
Subtotal - Residential		**217.4**	**59.0**	**20.9**	**297.2**	**220,860**
Non-Residential						
Commercial	1,780	18.4	117.0	6.1	141.5	251,871
Industrial[3]	1,100	44.8	34.7	0.0	79.4	87,371
Public Facility[4]	100	42.2	10.5	2.4	55.1	5,507
Subtotal - Non-Residential		**105.3**	**162.2**	**8.5**	**276.0**	**344,748**
Total						
Future Demands		**322.7**	**221.2**	**29.3**	**573.2**	**565,608**

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Notes:

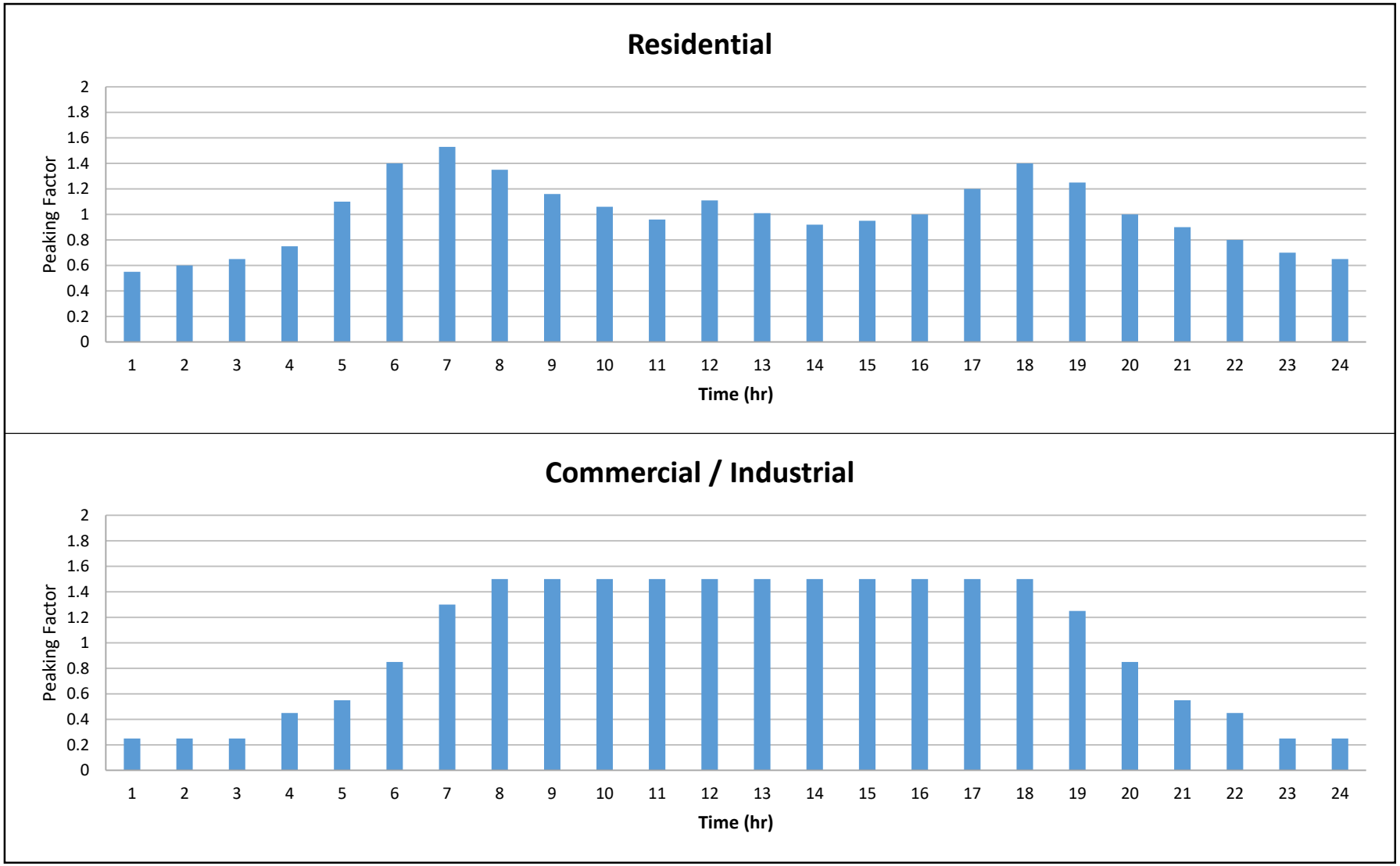
1. Land Use areas based on parcel shapefile downloaded from San Benito County Website (11/05/2019).
2. Developed and Undeveloped areas based on parcel shapefile received from City Staff January 16,2020.
3. Industrial acreages shown exclude Earthbound Farms and True Leaf Farm.
4. Public facility acreages shown exclude non-demand generating parcels.

5.4 DIURNAL DEMAND PATTERNS

Water demands vary with the time of day and by account type according to the land use designation. These fluctuations were accounted for in the modeling effort and evaluation of the water distribution system. The diurnal demand patterns affect the water levels in storage reservoirs and amount of flow through distribution mains.

Two different diurnal curves (**Figure 5.1**) were used to model the demand patterns of 1) residential, 2) commercial, public facility, and industrial use accounts. In the absence of data that can be used to develop these curves, they were based on industry standard demand patterns for these corresponding land use types, and which were originally developed by AWWA.

Each diurnal curve has a unique pattern that creates maximum and minimum flow conditions at different times of the day. Residential demands peak in the morning and evening and are at a minimum during the night hours. Non-residential demands, which include commercial, institutional, and industrial demands, are also at a minimum during the night; however, they remain at a constant maximum from the hours of 8 AM to 5 PM.



LEGEND

PRELIMINARY

Water Demand

Notes:

1. Diurnal patterns are based on AEG experience and reflect typical water system operations.

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June 30, 2020

Figure 5.1
Diurnal Patterns
Water Master Plan
City of San Juan Bautista

CHAPTER 6 - HYDRAULIC MODEL DEVELOPMENT

This chapter describes the development and calibration of the City's domestic water distribution system hydraulic model. The hydraulic model was used to evaluate the capacity adequacy of the existing system and to plan its expansion to service anticipated future growth.

6.1 OVERVIEW

Hydraulic network analysis has become an effectively powerful tool in many aspects of water distribution planning, design, operation, management, emergency response planning, system reliability analysis, fire flow analysis, and water quality evaluations. The City's hydraulic model was used to evaluate the capacity adequacy of the existing system and to plan its expansion to service anticipated future growth.

6.2 MODEL SELECTION

The City's hydraulic model combines information on the physical characteristics of the water system (pipelines, groundwater wells, and storage reservoir) and operational characteristics (how they operate). The hydraulic model then performs calculations and solves series of equations to simulate flows in pipes and calculate pressures at nodes or junctions.

There are several network analysis software products that are released by different manufacturers, which can equally perform the hydraulic analysis satisfactorily. The selection of software depends on user preferences, the distribution system's unique requirements, and the costs for purchasing and maintaining the software.

As part of this master plan the hydraulic model has been developed into the GIS-based hydraulic model InfoWater by Innovyze. The model has an intuitive graphical interface and is directly integrated with ESRI's ArcGIS (GIS).

6.3 HYDRAULIC MODEL DEVELOPMENT

Developing the hydraulic model included skeletonization, digitizing and quality control, developing pipe and node databases, and water demand allocation.

6.3.1 Digitizing and Quality Control

The City's existing domestic water distribution system was digitized in GIS using several sources of data and various levels of quality control. The data sources included the City's existing system as documented in GIS drawings and schematics provided by City staff.

After reviewing the available data sources, the hydraulic model was built and verified by City staff. Using the available water system data this master plan developed the domestic water system in

GIS. Resolving discrepancies in data sources was accomplished by graphically identifying discrepancies and submitting it to City staff for review and comments. City comments were incorporated in the verified model.

6.3.2 Pipes and Nodes

Computer modeling requires the compilation of large numerical databases that enable data input into the model. Detailed physical aspects, such as pipe size, pipe elevation, and pipe lengths, contribute to the accuracy of the model.

Pipes and nodes represent the physical aspect of the system within the model. A node is a computer representation of a place where demand may be allocated into the hydraulic system, while a pipe represents the distribution and transmission aspect of the water demand. In addition, reservoir dimensions and capacities, and groundwater well capacity and design head, were also included in the hydraulic model.

6.3.3 Demand Allocation

Demand allocation consists of assigning water demand values to the appropriate nodes in the model. The goal is to distribute the demands throughout the model to best represent actual system response. The existing demand distribution was obtained from the water billing records. Using GIS, each customer account was geocoded and spatially joined within its existing pressure zone. The accounts were then sorted by pressure zone and the total demand in each zone was calculated.

Domestic water demands from each anticipated future development, as presented in a previous chapter, were also allocated to the model for the purpose of sizing the required future facilities. The demands from the greater Planning Area were allocated based on proposed land use and the land use acreages. As many of the areas were very large in size, demands were allocated evenly to the demand nodes within each area. Infill areas, redevelopment areas, and vacant lands were also included in the future demand allocation.

6.4 MODEL OPERATIONAL VALIDATION

The operational characteristics of the water system hydraulic model were documented and submitted to City staff for review. Well flow and operations, tank level fluctuations, and City-wide maximum and minimum pressures were documented and City staff provided feedback to ensure the model appropriately represents the operational characteristics of the existing water system. Due to a lack of SCADA implementation, the existing system is currently based on Operator control and the hydraulic model was setup to generally reflect the current operational strategy. In the future, if SCADA control is implemented, it is recommended that the hydraulic model be updated.

The validated hydraulic model was used as an established benchmark in the capacity evaluation of the existing water distribution system. The model was also used to identify improvements

necessary for mitigating existing system deficiencies and for accommodating future growth. This valuable investment will continue to aid the City as future planning issues or other operational conditions surface. It is recommended that the model be maintained and updated with recent construction to preserve its integrity.

CHAPTER 7 - EVALUATION AND PROPOSED IMPROVEMENTS

This section presents a summary of the domestic water system evaluation and identifies improvements needed to mitigate existing deficiencies, as well as improvements needed to expand the system and service growth.

7.1 OVERVIEW

The developed hydraulic model was used for evaluating the distribution system for capacity deficiencies during peak hour demand and during maximum day demands in conjunction with fire flows. The analysis duration was established at 24 hours for analysis.

The criteria used for evaluating the capacity adequacy of the domestic water distribution system facilities (transmission mains, storage reservoirs, and booster stations) was discussed and summarized in the System Performance and Design Criteria chapter.

7.2 LOW PRESSURES ANALYSIS

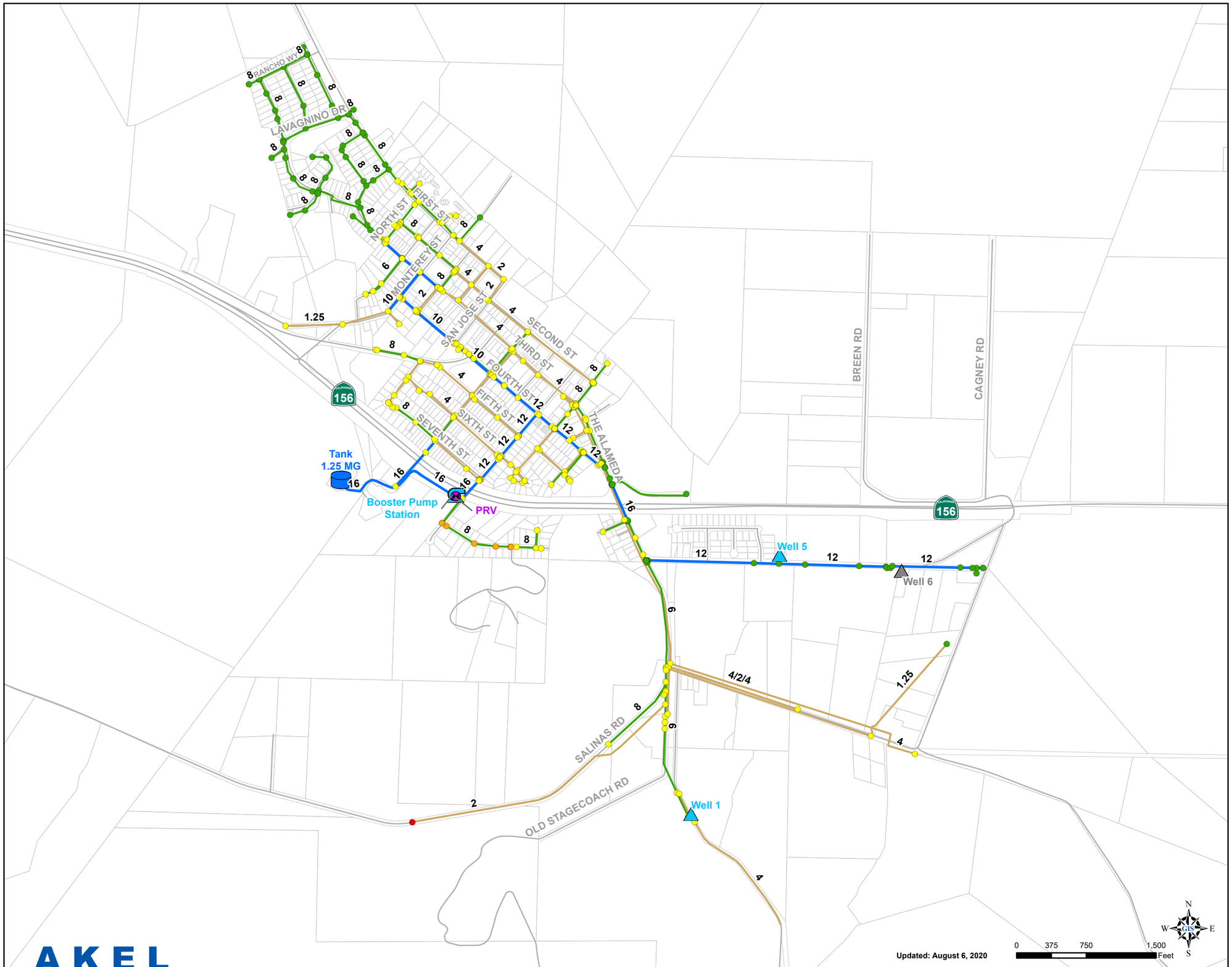
The hydraulic model was also used to determine if the existing domestic water distribution system meets the City's System Performance and Design Criteria for maximum day and peak hour pressures, as discussed in a previous chapter. During maximum day and peak hour demands, the minimum pressure requirement is 40 psi. The hydraulic analysis indicated the City's existing system performed reasonably well during under peak hour operating conditions, with some exceptions as shown on **Figure 7.1**.

7.3 HIGH PRESSURE ANALYSIS

The hydraulic model was also used to identify areas in the City's existing domestic water distribution system that experience high pressure under maximum day demand conditions. Areas of high pressure may be more susceptible to pipeline breaks and ruptures. The City's maximum desired pressure criterion is 100 psi. The hydraulic analysis indicated the City's existing system observes some periods of high pressures, primarily in the northern section of the city. The areas of high pressure are shown graphically on **Figure 7.2**.

7.4 FIRE FLOW ANALYSIS

The fire flow analysis consisted of using the maximum day demand in the hydraulic model and applying hypothetical fire flows. The magnitude and duration of each fire flow was based on the governing land use type within proximity to the fire location. The criterion for fire flows was also summarized in the System Performance and Design Criteria chapter. The available fire flow at the City's residual pressure criteria of 20 psi is summarized on **Figure 7.3**.



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Legend

Minimum Pressures

- Less than 20 psi
- 20 - 35 psi
- 35 - 55 psi
- 55 - 80 psi
- Greater than 80 psi

Existing System

- Tank
- Wells
- Inactive Well
- Pump Stations
- PRV

Pipes by Diameter

- 4" or Less
- 6" - 8 "
- 10" or Greater
- Streets
- Parcels

PRELIMINARY

Figure 7.1
Minimum Pressures
Water Master Plan
City of San Juan Bautista

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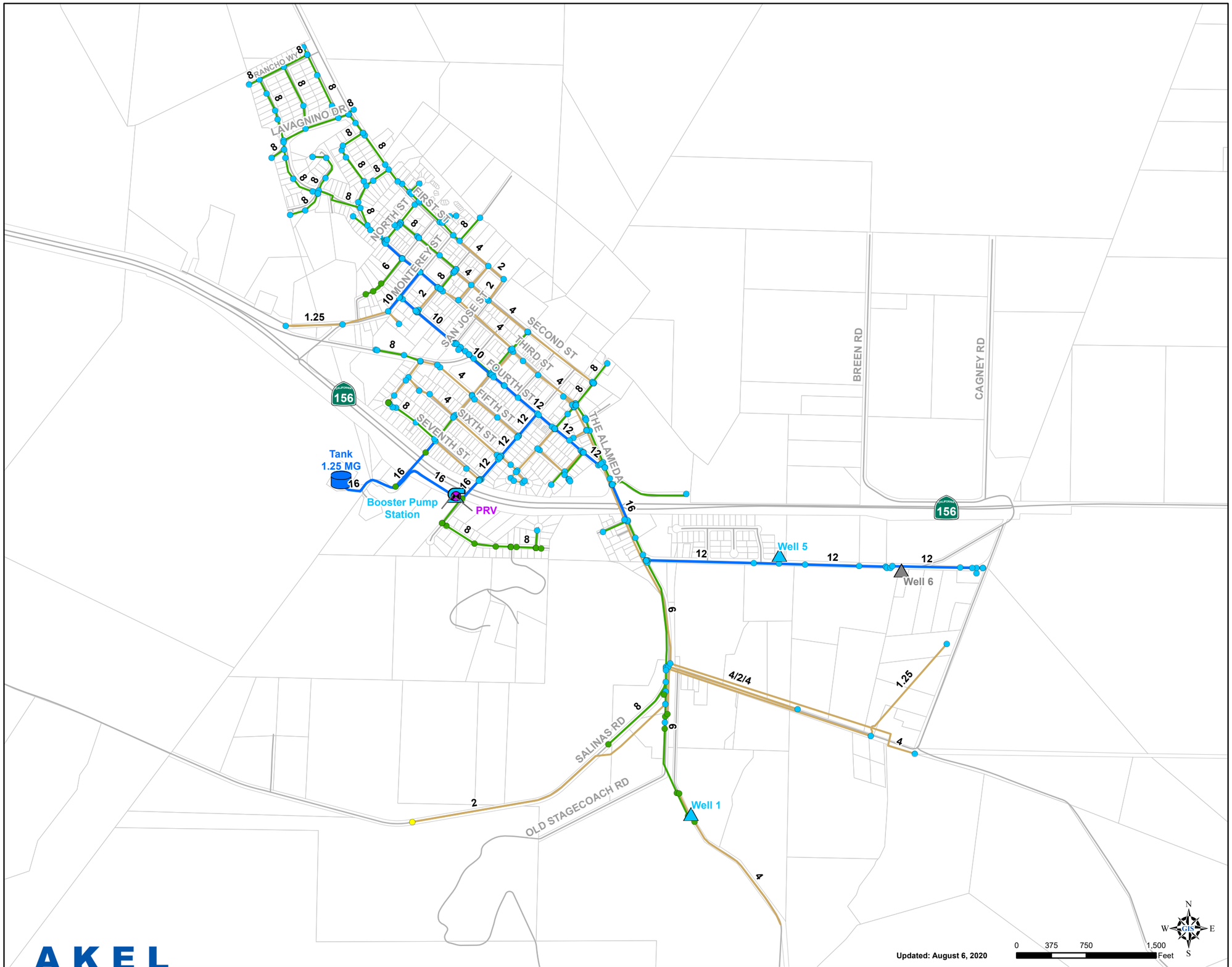

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Legend

Maximum Pressures

- Less than 20 psi
- 20 - 35 psi
- 35 - 55 psi
- 55 - 80 psi
- 80 - 101 psi

Existing System

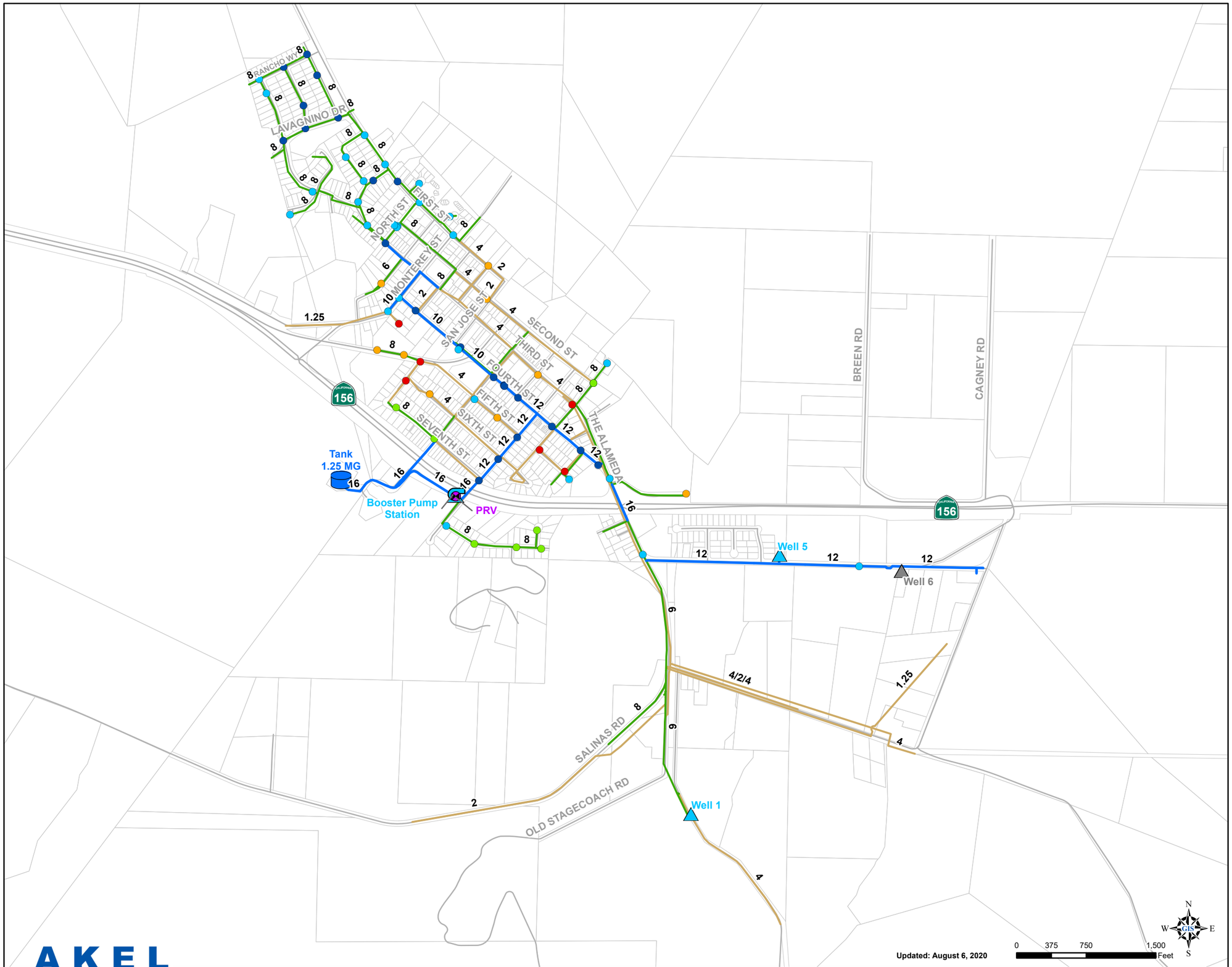
- Tank
- Wells
- Inactive Well
- Pump Stations
- PRV

Pipes by Diameter

- 4" or Less
- 6" - 8 "
- 10" or Greater
- Streets
- Parcels

PRELIMINARY

Figure 7.2
Maximum Pressures
Water Master Plan
City of San Juan Bautista



Legend

Available Flow (gpm)

- < 400
- 400 - 900
- 900 - 1,500
- 1,500 - 2,500
- >2,500

Existing System

- Tank
- Wells
- Inactive Well
- Pump Stations
- PRV

Pipes by Diameter

- 4" or Less
- 6" - 8 "
- 10" or Greater
- Streets
- Parcels

PRELIMINARY

Figure 7.3
Available Fire Flow
Water Master Plan
City of San Juan Bautista

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File Path: P:\xGIS\GIS_Projects\San_Juan_Bautista\Water\191112-MP\SJB_Fig7-3_AvailableFF_080620.mxd

Due to a high number of small-diameter distribution mains, the hydraulic model predicted that many of the existing service connections are unable to meet the pressure requirements under fire flow conditions. A majority of the distribution system serving this area is comprised of water pipelines under 8-inches in diameter. It is recommended that as pipeline repairs and replacements occur, pipelines under 8-inches be replaced with an 8-inch pipeline at minimum and validated by the hydraulic model. Additionally, and where feasible, it is recommended that looped connections be constructed for reliability.

Improvements to mitigate specific fire flow deficiencies are discussed below. Each improvement includes a coded identifier to correlate to the schedule of improvements and Capital Improvement Program.

- **P-6**: Replace approximately 50 feet of existing 4-inch water main with 8-inch water main along Third Street from approximately 30 feet south east of Tahualamist Street to Tahualamist Street.
- **P-9**: Replace approximately 525 feet of existing parallel 4-inch, 8-inch, and 10-inch water main with 12-inch water main along Fourth Street from San Jose Street to Polk Street.
- **P-10**: Replace approximately 100 feet of existing 0.75-inch water main with 8-inch water main along San Antonio Street from Seventh Street to approximately 100 feet north east of Seventh Street.
- **P-11**: Replace approximately 475 feet of existing 4-inch water main with 8-inch water main along San Antonio Street from approximately 460 feet south west of Muckelemi Street to Muckelemi Street.
- **P-12**: Replace approximately 700 feet of existing 4-inch water main with 8-inch water main along Muckelemi Street and Fifth Street from San Antonio Street to Polk Street.
- **P-13**: Replace approximately 300 feet of existing 4-inch water main with 8-inch water main along Polk Street from Fifth Street to Sixth Street.
- **P-14**: Replace approximately 325 feet of existing 4-inch water main with 12-inch water main along Polk Street from Fourth Street to Fifth Street.
- **P-15**: Replace approximately 675 feet of existing 4-inch water main with 12-inch water main along Fifth Street from Polk Street to Washington Street.
- **P-16**: Replace approximately 650 feet of existing 4-inch water main with 8-inch water main along Seventh Street from Polk Street to Washington Street.

7.5 WATER STORAGE REQUIREMENTS

The City's existing domestic water system storage capacity is identified in this section. Additionally, this section identifies the existing and future storage requirements to meet the storage capacity and compares it with the existing storage facilities in each zone and makes recommendations for new storage facilities.

7.5.1 Existing Storage Requirements

Existing storage requirements were identified for each pressure zone and are summarized in Table 7.1. The table lists the existing domestic water demands and identifies the operational, emergency, and fire storage for the system. This table also lists the total required storage for existing domestic water demands at 0.91 MG.

7.5.2 Future Storage Requirements

Future storage requirements were identified based on the buildout of the 2035 General Plan and summarized on Table 7.1. The table lists the future domestic water demands and identifies the operational, emergency, and fire storage required for future development. The table also lists the total required storage for future domestic water demands at 1.02 MG. As the existing storage requirements already include 0.54 MG of fire storage, future growth will increase storage requirements by 0.48 MG, for a total existing and buildout storage requirement of 1.39 MG.

7.5.3 Recommended New Storage Facilities

The existing and future storage requirements were compared with existing City storage facilities in each pressure zone and the required storage facility improvements were identified, shown on Tables 7.1. The table lists existing storage requirements identifies existing storage capacity deficiencies, and identifies future storage capacity requirements to meet the needs from future growth.

The results of the storage analysis indicate that the existing storage volume is sufficient under existing conditions but is unable to meet the requirements for both existing and future customers at the buildout of the General Plan. Therefore a new storage reservoir is recommended to mitigate this deficiency.

The proposed storage reservoirs, summarized on Table 7.3 and graphically shown on Figure 7.4, are described as follows:

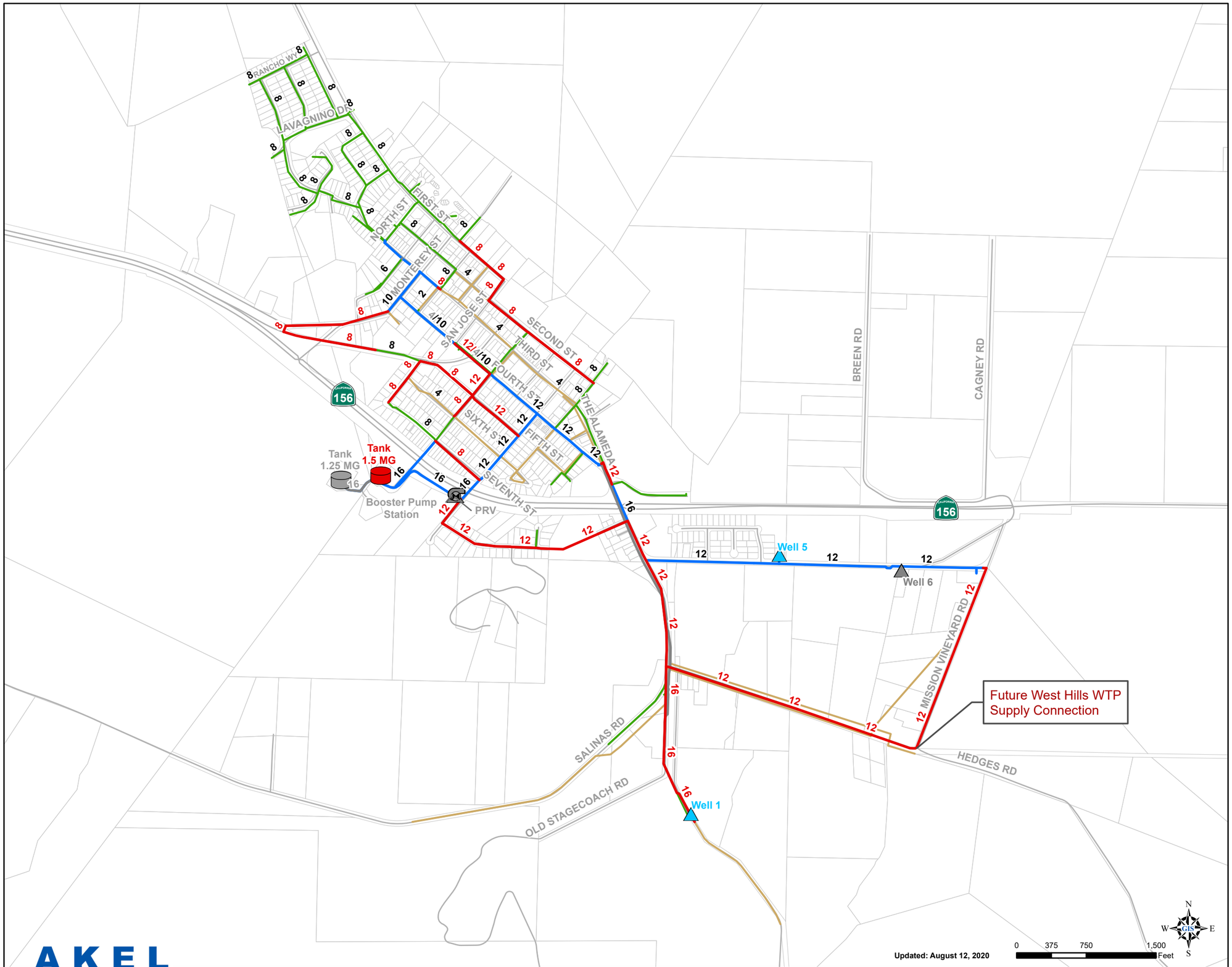
- **T-1A:** Construct a new 1.5 MG storage reservoir at the site of the inactive concrete reservoir.

7.6 REGIONAL SUPPLY ALTERNATIVES

Section to be updated following the completion of the Regional Water Supply Alternatives Evaluation. A preliminary supply evaluation is included in Table 7.2 for planning purposes but will be updated following the completion of the Alternatives Evaluation.

7.7 PIPELINE IMPROVEMENTS TO SERVE FUTURE GROWTH

The buildout of the 2035 General Plan includes development outside of the extents of the existing domestic water distribution system. Distribution pipelines are recommended to serve future growth as well as increase the hydraulic reliability of the domestic water distribution system. Each



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Legend

Future Improvements

- Tank
- Pipes

To be Abandoned

- Tank
- Pump Station
- Inactive Well
- PRV
- Pipes

Existing System

- Well

Pipes by Diameter

- 4" or Less
- 6" - 8 "
- 10" or Greater
- Streets
- Parcels

PRELIMINARY

Figure 7.4
Future Improvements
Water Master Plan
City of San Juan Bautista

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Table 7.1 Buildout Storage Capacity Analysis

Water Master Plan

City of San Juan Bautista

PRELIMINARY

Storage Capacity Analysis		
Existing Water Storage Requirements[1,2]		
Existing Average Day Demand	0.25	MGD
Existing Maximum Day Demand	0.49	MGD
Operational + Emergency	0.37	MG
Fire Protection	0.54	MG
Total	**0.91**	**MG**
Buildout Water Storage Requirements[1,2,3]		
Buildout Average Day Demand	0.32	MGD
Buildout Maximum Day Demand	0.64	MGD
Operational + Emergency	0.48	MG
Fire Protection	0.54	MG
Total	**1.02**	**MG**
Water Storage Balance		
Total Existing and Buildout Storage Requirement[4]	**1.39**	**MG**
Existing Storage	**1.25**	**MG**
Existing Storage Balance	**-0.14**	**MG**
Recommended Improvement	Replace existing 1.25 MG tank with **new 1.5 MG storage tank**	
Future Storage	**1.50**	**MG**
Existing and Buildout Storage Balance	**0.11**	**MG**

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Notes:

1. Maximum Day Demand = 2.0 x Average Day Demand
2. Storage Requirements are derived as follows:
   - Operational = 25% of MDD
   - Emergency = 50% of MDD
   - Fire Protection = 3,000 gpm for 3 hours = 0.54 MG
3. Demands and Storage Requirements shown do not include existing demands.
4. Total Storage Requirements include operational (existing and future), emergency (existing and future), and fire protection requirements (0.54 MG).

Table 7.2 Supply Capacity Evaluation

Water Master Plan

City of San Juan Bautista

PRELIMINARY

Well No.	Supply Capacity Analysis	
	Existing Wells (gpm)	Assuming Well 6 Offline (gpm)
Supply Capacity Criteria		
Supply to meet Maximum Day Demand with largest unit out of service		
Existing Supply Capacity[1]		
Well 1	175	175
Well 5	425 - Standby	425 - Standby
Well 6	450	**Offline**
Total Capacity	1,050	600
Firm Capacity	600	175
Existing and Buildout Maximum Day Demands		
Existing[2,3,5]	**343**	**343**
Buildout[2,4,5]	**786**	**786**
Supply vs Demand Evaluation		
Available Firm Capacity	**600**	**175**
Capacity Surplus/Deficiency		
Existing Conditions	**257**	**-168**
Buildout Conditions	**-186**	**-611**
Recommended Additional Firm Supply		
New Firm Supply	**190**	**620**

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Notes:

1. Well capacities based on email provided by Stantec June 18, 2020.
2. Maximum Day Demand = 2.0 x Average Day Demand
3. Existing demand based on Metered Water Deliveries documented in 2019 Water Consumption Reports provided by City staff January 13, 2020.
4. Buildout demand based on land use parcels and developed unit factors, as shown in Table 5.1.

Table 7.3 Buildout Schedule of Improvements

Water Master Plan

City of San Juan Bautista

PRELIMINARY

Improv. No.	Improv. Type	Alignment	Limits	Improvement Details			
Pipeline Improvements				Existing Diameter (in)	New/ Replace	Diameter (in)	Length (ft)
P-1	Reliability	First St.	From Thomas Ln. to Jefferson St.	4	Replace	8	425
P-2	Reliability	First St.	From Jefferson St. to San Jose St.	2	Replace	8	225
P-3	Reliability	San Jose St.	From First St. to Second St.	2	Replace	8	300
P-4	Reliability	Second St.	From San Jose St. to Franklin St.	4	Replace	8	1,425
P-5	Reliability	Second St.	From Franklin St. to approx. 20' se/o Franklin St.	6	Replace	8	25
P-6	Fire Flow	Third St.	From approx. 30' se/o Tahualamist St. to Tahualamist St.	4	Replace	8	50
P-7	Development	Monterey St. / Larios Dr.	From approx. 200' sw/o Fourth St. to approx. 600' w/o Larios Dr.	1.25	Replace	8	1,125
P-8	Development	Muckelemi St.	From approx. 400' w/o Monterey St. to approx. 600' e/o Monterey St.	-	New	8	1,100
P-9	Fire Flow	Fourth St.	From San Jose St. to Polk St.	4,8,10	Replace	12	525
P-10	Fire Flow	San Antonio St.	From Seventh St. to approx. 100' ne/o Seventh St.	0.75	Replace	8	100
P-11	Fire Flow	San Antonio St.	From approx. 460' sw/o Muckelemi St. to Muckelemi St.	4	Replace	8	475
P-12	Fire Flow	Muckelemi St. / Fifth St.	From San Antonio St. to Polk St.	4	Replace	8	700
P-13	Fire Flow	Polk St.	From Fifth St. to Sixth St.	4	Replace	8	300
P-14	Fire Flow	Polk St.	From Fourth St. to Fifth St.	4	Replace	12	325
P-15	Fire Flow	Fifth St.	From Polk St. to Washington St.	4	Replace	12	675
P-16	Fire Flow	Seventh St.	From Polk St. to Washington St.	4	Replace	8	650
P-17	Reliability	The Alameda	From approx. 10' w/o The Alameda to approx. 10' e/o The Alameda	-	New	12	25
P-18	Capacity	The Alameda	From Fourth St. to Nyland Dr.	6	Replace	12	275
P-19	Reliability	Washington St.	From Lausen Dr. to Lang St.	6	Replace	12	350
P-20	Reliability	Lang St.	From Washington St. to Lang Ct.	8	Replace	12	1,150
P-21	Reliability	Lang St.	From Lang Ct. to approx. 290' w/o The Alameda	-	New	12	725
P-22	Reliability	Lang St.	From approx. 290' w/o The Alameda to The Alameda	8	Replace	12	300
P-23	Capacity	The Alameda / San Juan Canyon Rd.	From Lang St. to Mission Vineyard Rd.	6	Replace	12	1,675
P-24	Development	San Juan Canyon Rd.	From Mission Vineyard Rd. to approx. 620' s/o Old Stagecoach Rd.	4,6	Replace	16	1,775

Table 7.3 Buildout Schedule of Improvements

Water Master Plan

City of San Juan Bautista

PRELIMINARY

Improv. No.	Improv. Type	Alignment	Limits	Improvement Details			
P-25	Reliability	Mission Vineyard Rd	From San Juan Canyon Rd. to approx. 1,490' e/o San Juan Canyon Rd.	4	Replace	12	1,500
P-26	Reliability	Mission Vineyard Rd	From approx. 1,490' e/o San Juan Canyon Rd. to Hedges Rd.	-	New	12	1,375
P-27	Reliability	Mission Vineyard Rd	From Hedges Rd. to San Juan Hollister Rd.	-	New	12	2,125
Reservoir Improvements				**Existing Capacity** (MG)	**New/Replace**	**Capacity** (MG)	
T-1A	Capacity	Inactive Concrete Reservoir Site		1.25	Replace	1.5	

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pipeline improvement is assigned a uniquely coded identifier, which is intended to aid in defining the location of the improvement for mapping purposes. These identifiers reflect the sequence in the improvement schedule. The pipeline improvements, summarized on **Table 7.3** and shown graphically in **Figure 7.4**, are described in detail below.

- **P-1**: Replace approximately 425 feet of existing 4-inch water main with 8-inch water main along First Street from Thomas Lane to Jefferson Street. This improvement aims to increase the reliability of the domestic water system.
- **P-2**: Replace approximately 225 feet of existing 2-inch water main with 8-inch water main along First Street from Jefferson Street to San Jose Street. This improvement aims to increase the reliability of the domestic water system.
- **P-3**: Replace approximately 300 feet of existing 2-inch water main with 8-inch water main along San Jose Street from First Street to Second Street. This improvement aims to increase the reliability of the domestic water system.
- **P-4**: Replace approximately 1,425 feet of existing 4-inch water main with 8-inch water main along Second Street from San Jose Street to Franklin Street. This improvement aims to increase the reliability of the domestic water system.
- **P-5**: Replace approximately 25 feet of existing 6-inch water main with 8-inch water main along Second Street from Franklin Street to approximately 20 feet south east of Franklin Street. This improvement aims to increase the reliability of the domestic water system.
- **P-7**: Replace approximately 1,125 feet of existing 1.25-inch water main with 8-inch water main along Monterey Street and Larios Drive from approximately 200 feet south west of Fourth Street to approximately 600 feet west of Larios Drive. This improvement is intended to service future development.
- **P-8**: Construct approximately 1,100 feet of new 8-inch water main along Muckelemi Street from approximately 400 feet west of Monterey Street to approximately 600 feet east of Monterey Street. This improvement is intended to service future development.
- **P-17**: Construct approximately 25 feet of new 12-inch water main along within Right-Of-Way from approximately 10 feet west of The Alameda to approximately 10 feet east of The Alameda. This improvement aims to increase the reliability of the domestic water system.
- **P-18**: Replace approximately 275 feet of existing 6-inch water main with 12-inch water main along The Alameda from Fourth Street to Nyland Drive. This improvement is intended to mitigate a capacity deficiency as a result of future growth.
- **P-19**: Replace approximately 350 feet of existing 6-inch water main with 12-inch water main along Washington Street from Lausen Drive to Lang Street. This improvement aims to increase the reliability of the domestic water system.

- **P-20**: Replace approximately 1,150 feet of existing 8-inch water main with 12-inch water main along Lang Street from Washington Street to Lang Court. This improvement aims to increase the reliability of the domestic water system.
- **P-21**: Construct approximately 725 feet of new 12-inch water main along within Right-Of-Way from Lang Court to approximately 290 feet west of The Alameda. This improvement aims to increase the reliability of the domestic water system.
- **P-22**: Replace approximately 300 feet of existing 8-inch water main with 12-inch water main along Lang Street from approximately 290 feet west of The Alameda to The Alameda. This improvement aims to increase the reliability of the domestic water system.
- **P-23**: Replace approximately 1,675 feet of existing 6-inch water main with 12-inch water main along The Alameda and San Juan Canyon Road from Lang Street to Mission Vineyard Road. This improvement is intended to mitigate a capacity deficiency as a result of future growth.
- **P-24**: Replace approximately 1,775 feet of existing 4-inch and 6-inch water main with 16-inch water main along San Juan Canyon Road from Mission Vineyard Road to approximately 620 feet south of Old Stagecoach Road. This improvement is intended to service future development.
- **P-25**: Replace approximately 1,500 feet of existing 4-inch water main with 12-inch water main along Mission Vineyard Road from San Juan Canyon Road to approximately 1,490 feet east of San Juan Canyon Road. This improvement aims to increase the reliability of the domestic water system.
- **P-26**: Construct approximately 1,375 feet of new 12-inch water main along Mission Vineyard Road from approximately 1,490 feet east of San Juan Canyon Road to Hedges Road. This improvement aims to increase the reliability of the domestic water system.
- **P-27**: Construct approximately 2,125 feet of new 12-inch water main along Mission Vineyard Road from Hedges Road to San Juan Hollister Road. This improvement aims to increase the reliability of the domestic water system.

CHAPTER 8 – CAPITAL IMPROVEMENT PROGRAM

This chapter provides a summary of the recommended domestic water system improvements to mitigate existing capacity deficiencies and to accommodate anticipated future growth. The chapter also presents the cost criteria and methodologies for developing the capital improvement program. Finally, a capacity allocation analysis, usually used for cost sharing purposes, is also included.

8.1 COST ESTIMATE ACCURACY

Cost estimates presented in the CIP were prepared for general master planning purposes and, where relevant, for further project evaluation. Final costs of a project will depend on several factors including the final project scope, costs of labor and material, and market conditions during construction.

The Association for the Advancement of Cost Engineering (AACE International), formerly known as the American Association of Cost Engineers has defined three classifications of assessing project costs. These classifications are presented in order of increasing accuracy: Order of Magnitude, Budget, and Definitive.

- **Order of Magnitude Estimate.** This classification is also known as an “original estimate”, “study estimate”, or “preliminary estimate”, and is generally intended for master plans and studies.

  This estimate is not supported with detailed engineering data about the specific project, and its accuracy is dependent on historical data and cost indexes. It is generally expected that this estimate would be accurate within -30 percent to +50 percent.

- **Budget Estimate.** This classification is also known as an “official estimate” and generally intended for predesign studies. This estimate is prepared to include flow sheets and equipment layouts and details. It is generally expected that this estimate would be accurate within -15 percent to +30 percent.

- **Definitive Estimate.** This classification is also known as a “final estimate” and prepared during the time of contract bidding. The data includes complete plot plans and elevations, equipment data sheets, and complete specifications. It is generally expected that this estimate would be accurate within -5 percent to + 15 percent.

Costs developed in this study should be considered “Order of Magnitude” and have an expected accuracy range of **-30 percent** and **+50 percent**.

8.2 COST ESTIMATE METHODOLOGY

Cost estimates presented in this chapter are opinions of probable construction and other relevant costs developed from several sources including cost curves, Akel experience on other master planning projects, and input from City staff on the development of public and private cost sharing. Where appropriate, costs were escalated to reflect the more current Engineering News Records (ENR) Construction Cost Index (CCI).

This section documents the unit costs used in developing the opinion of probable construction costs, the Construction Cost Index, the land acquisition costs, and markups to account for construction contingency and other project related costs.

8.2.1 Unit Costs

The unit cost estimates used in developing the Capital Improvement Program are summarized on **Table 8.1**. Domestic water pipeline unit costs are based on length of pipes, in feet. Storage reservoir unit costs are based on capacity, per million gallons (MG).

The unit costs are intended for developing the Order of Magnitude estimate and do not account for site specific conditions, labor and material costs during the time of construction, final project scope, implementation schedule, detailed utility and topography surveys for reservoir sites, investigation of alternative routings for pipes, and other various factors. The capital improvement program included in this report accounts for construction and project-related contingencies as described in this chapter.

8.2.2 Construction Cost Index

Costs estimated in this study are adjusted utilizing the Engineering News Record (ENR) Construction Cost Index (CCI), which is widely used in the engineering and construction industries.

The costs in this Water Master Plan were benchmarked using a 20-City national average ENR CCI of 11,412, reflecting a date of April 2020.

8.2.3 Construction Contingency Allowance

Knowledge about site-specific conditions for each proposed project is limited at the master planning stage; therefore, construction contingencies were used. The estimated construction costs in this master plan include a **30 percent** contingency allowance to account for unforeseen events and unknown field conditions.

8.2.4 Project Related Costs

The capital improvement costs also account for project-related costs, comprising of engineering design, project administration (developer and City staff), construction management and

Table 8.1 Unit Costs

Water Master Plan
City of San Juan Bautista

PRELIMINARY

Pipelines	
Pipe Size (in)	**Cost**[1] ($/lineal foot)
8	$149
10	$172
12	$190
16	$229
18	$247
20	$282
24	$308
30	$341
36	$402
Storage Reservoirs	
	Cost[1] ($/gal stored)
≤1.0 MG	$2.33
1.1 MG-3.0 MG	$1.86
3.1 MG - 5.0 MG	$1.34
> 5 MG	$1.00

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Notes:

1. Construction costs were based on Akel Engineering Group experience adjusted to an ENR CCI of 11,412 (April 2020).

inspection, and legal costs. The project related costs in this master plan were estimated by applying an additional **30 percent** to the estimated construction costs.

8.3 CAPITAL IMPROVEMENT PROGRAM

This section documents the capital improvement program, contingencies included in the costs, and the allocation of costs to meet the requirements of AB1600.

8.3.1 Capital Improvement Costs

The Capital Improvement Program costs for the projects identified in this master plan for mitigating existing system deficiencies and for serving anticipated future growth throughout the City are summarized on **Table 8.2**.

Each improvement was assigned a unique coded identifier associated with the improvement type and is summarized graphically on **Figure 8.1**. The estimated construction costs include the baseline costs plus **30 percent** contingency allowance to account for unforeseen events and unknown field conditions, as described in a previous section. Capital improvement costs include the estimated construction costs plus **30 percent** project-related costs (engineering design, project administration, construction management and inspection, and legal costs).

8.3.2 Recommended Cost Allocation Analysis

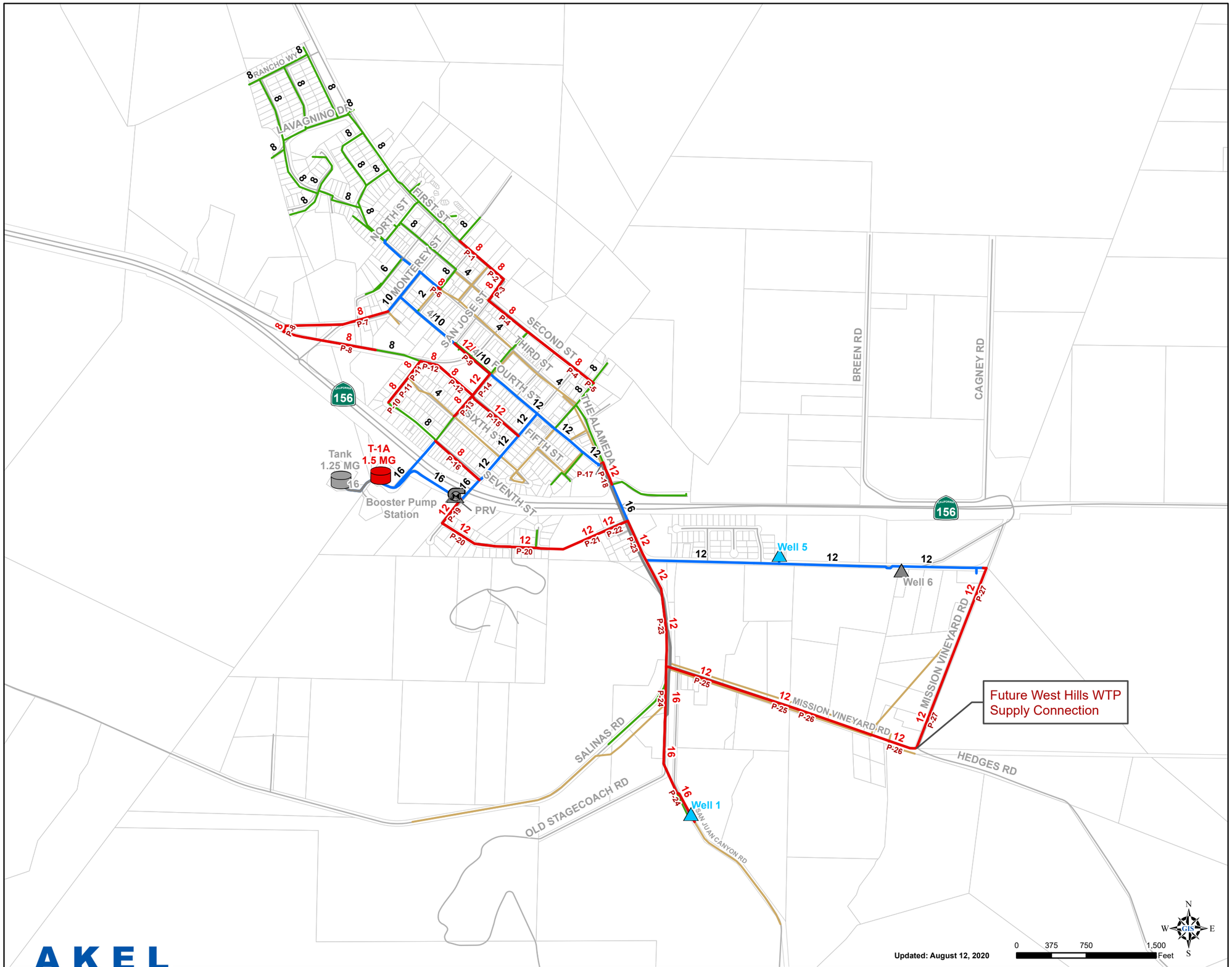
Cost allocation analysis is needed to identify improvement funding sources, and to establish a nexus between development impact fees and improvements needed to service growth. In compliance with the provisions of Assembly Bill AB 1600, the analysis differentiates between the project needs of servicing existing users and for those required to service anticipated future developments. The cost responsibility is based on model parameters for existing and future land use, and may change depending on the nature of development. **Table 8.2** lists each improvement, and separates the cost by responsibility between existing and future users.

8.3.3 Construction Triggers

As a part of this master planning process construction triggers were developed in an effort to plan the expansion of the water system in an orderly manner. The construction triggers for multiple improvements are based on mitigating an existing system deficiency, increasing hydraulic reliability, or continuing improvements currently planned by the City. Other improvements replace existing infrastructure that is not currently deficient but will violate master plan criteria with future development. The construction triggers quantify the amount of additional development that may occur before the improvement becomes necessary.

8.4 15-YEAR PIPELINE REPLACEMENT PLAN

This section discusses the suggested expenditure budget for the replacing all pipes below 8 inches in diameters as well as the recommended phasing of construction for the pipeline replacements.



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Legend

Future Improvements

- Tank
- Pipes

To be Abandoned

- Tank
- Pump Station
- Inactive Well
- PRV
- Pipes

Existing System

- Well

Pipes by Diameter

- 4" or Less
- 6" - 8 "
- 10" or Greater
- Streets
- Parcels

PRELIMINARY

Figure 8.1
Future Improvements
Water Master Plan
City of San Juan Bautista

Table 8.2 Buildout Capital Improvement Program

Water Master Plan

City of San Juan Bautista

PRELIMINARY

Improv. No.	Improv. Type	Alignment	Limits	Improvement Details				Infrastructure Costs		Baseline Construction Cost	Estimated Construction Cost[1]	Capital Improvement Cost[2]	Suggested Cost Allocation		Cost Sharing	
								Unit Cost	Infr. Cost				Existing Users	Future Users	Existing Users	Future Users
								($/unit)	($)	($)	($)	($)			($)	($)
Pipeline Improvements				Existing Diameter (in)	New/ Replace	Diameter (in)	Length (ft)									
P-1	Reliability	First St.	From Thomas Ln. to Jefferson St.	4	Replace	8	425	149	63,500	63,500	82,600	107,400	100%	0%	107,400	0
P-2	Reliability	First St.	From Jefferson St. to San Jose St.	2	Replace	8	225	149	33,600	33,600	43,700	56,900	100%	0%	56,900	0
P-3	Reliability	San Jose St.	From First St. to Second St.	2	Replace	8	300	149	44,800	44,800	58,300	75,800	100%	0%	75,800	0
P-4	Reliability	Second St.	From San Jose St. to Franklin St.	4	Replace	8	1,425	149	212,600	212,600	276,400	359,400	100%	0%	359,400	0
P-5	Reliability	Second St.	From Franklin St. to approx. 20' se/o Franklin St.	6	Replace	8	25	149	3,800	3,800	5,000	6,500	100%	0%	6,500	0
P-6	Fire Flow	Third St.	From approx. 30' se/o Tahualamist St. to Tahualamist St.	4	Replace	8	50	149	7,500	7,500	9,800	12,800	100%	0%	12,800	0
P-7	Development	Monterey St. / Larios Dr.	From approx. 200' sw/o Fourth St. to approx. 600' w/o Larios Dr.	1.25	Replace	8	1,125	149	167,900	167,900	218,300	283,800	0%	100%	0	283,800
P-8	Development	Muckelemi St.	From approx. 400' w/o Monterey St. to approx. 600' e/o Monterey St.	-	New	8	1,100	149	164,200	164,200	213,500	277,600	0%	100%	0	277,600
P-9	Fire Flow	Fourth St.	From San Jose St. to Polk St.	4,8,10	Replace	12	525	190	99,600	99,600	129,500	168,400	100%	0%	168,400	0
P-10	Fire Flow	San Antonio St.	From Seventh St. to approx. 100' ne/o Seventh St.	0.75	Replace	8	100	149	15,000	15,000	19,500	25,400	100%	0%	25,400	0
P-11	Fire Flow	San Antonio St.	From approx. 460' sw/o Muckelemi St. to Muckelemi St.	4	Replace	8	475	149	70,900	70,900	92,200	119,900	100%	0%	119,900	0
P-12	Fire Flow	Muckelemi St. / Fifth St.	From San Antonio St. to Polk St.	4	Replace	8	700	149	104,500	104,500	135,900	176,700	100%	0%	176,700	0
P-13	Fire Flow	Polk St.	From Fifth St. to Sixth St.	4	Replace	8	300	149	44,800	44,800	58,300	75,800	100%	0%	75,800	0
P-14	Fire Flow	Polk St.	From Fourth St. to Fifth St.	4	Replace	12	325	190	61,700	61,700	80,300	104,400	100%	0%	104,400	0
P-15	Fire Flow	Fifth St.	From Polk St. to Washington St.	4	Replace	12	675	190	128,100	128,100	166,600	216,600	100%	0%	216,600	0
P-16	Fire Flow	Seventh St.	From Polk St. to Washington St.	4	Replace	8	650	149	97,000	97,000	126,100	164,000	100%	0%	164,000	0
P-17	Reliability	The Alameda	From approx. 10' w/o The Alameda to approx. 10' e/o The Alameda	-	New	12	25	190	4,800	4,800	6,300	8,200	44%	56%	3,600	4,700
P-18	Capacity	The Alameda	From Fourth St. to Nyland Dr.	6	Replace	12	275	190	52,200	52,200	67,900	88,300	44%	56%	38,600	49,800
P-19	Reliability	Washington St.	From Lausen Dr. to Lang St.	6	Replace	12	350	190	66,400	66,400	86,400	112,400	44%	56%	49,100	63,400
P-20	Reliability	Lang St.	From Washington St. to Lang Ct.	8	Replace	12	1,150	190	218,100	218,100	283,600	368,700	44%	56%	160,800	208,000
P-21	Reliability	Lang St.	From Lang Ct. to approx. 290' w/o The Alameda	-	New	12	725	190	137,500	137,500	178,800	232,500	44%	56%	101,400	131,200
P-22	Reliability	Lang St.	From approx. 290' w/o The Alameda to The Alameda	8	Replace	12	300	190	56,900	56,900	74,000	96,200	44%	56%	42,000	54,300

Table 8.2 Buildout Capital Improvement Program

Water Master Plan

City of San Juan Bautista

PRELIMINARY

Improv. No.	Improv. Type	Alignment	Limits	Improvement Details				Infrastructure Costs		Baseline Construction Cost	Estimated Construction Cost[1]	Capital Improvement Cost[2]	Suggested Cost Allocation		Cost Sharing	
								Unit Cost	Infr. Cost				Existing Users	Future Users	Existing Users	Future Users
								($/unit)	($)	($)	($)	($)			($)	($)
Pipeline Improvements				Existing Diameter (in)	New/ Replace	Diameter (in)	Length (ft)									
P-23	Capacity	The Alameda / San Juan Canyon Rd.	From Lang St. to Mission Vineyard Rd.	6	Replace	12	1,675	190	317,700	317,700	413,100	537,100	44%	56%	234,200	303,000
P-24	Development	San Juan Canyon Rd.	From Mission Vineyard Rd. to approx. 620' s/o Old Stagecoach Rd.	4,6	Replace	16	1,775	229	406,200	406,200	528,100	686,600	0%	100%	0	686,600
P-25	Reliability	Mission Vineyard Rd	From San Juan Canyon Rd. to approx. 1,490' e/o San Juan Canyon Rd.	4	Replace	12	1,500	190	284,500	284,500	369,900	480,900	44%	56%	209,700	271,300
P-26	Reliability	Mission Vineyard Rd	From approx. 1,490' e/o San Juan Canyon Rd. to Hedges Rd.	-	New	12	1,375	190	260,800	260,800	339,100	440,900	44%	56%	192,300	248,700
P-27	Reliability	Mission Vineyard Rd	From Hedges Rd. to San Juan Hollister Rd.	-	New	12	2,125	190	403,000	403,000	523,900	681,100	44%	56%	297,000	384,200
				Subtotal - Pipeline Improvements					**3,527,600**	**3,527,600**	**4,587,100**	**5,964,300**			**2,998,700**	**2,966,600**
Reservoir Improvements				Existing Capacity (MG)	New/Replace	Capacity (MG)										
T-1A	Capacity	Inactive Concrete Reservoir Site		1.25	Replace	1.5		1.9	2,794,800	2,794,800	3,633,300	4,723,300	44%	56%	2,059,600	2,663,800
				Subtotal - Reservoir Improvements					**2,794,800**	**2,794,800**	**3,633,300**	**4,723,300**			**2,059,600**	**2,663,800**
Total Water System Improvement Costs																
				Pipeline Improvements					**3,527,600**	**3,527,600**	**4,587,100**	**5,964,300**			**2,998,700**	**2,966,600**
				Reservoir Improvements					**2,794,800**	**2,794,800**	**3,633,300**	**4,723,300**			**2,059,600**	**2,663,800**
				Total - Improvement Cost					**6,322,400**	**6,322,400**	**8,220,400**	**10,687,600**			**5,058,300**	**5,630,400**

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1. Baseline construction costs plus 30% to account for unforeseen events and unknown conditions.
2. Estimated construction costs plus 30% to cover other costs including: engineering design, project administration (developer and City staff), construction management and inspection, and legal costs.

8.4.1 15-Year Pipeline Replacement Costs and Phasing

The costs and phasing for the next fifteen fiscal years (FY) are summarized on **Table 8.3**; this plan includes the total costs for pipelines to be constructed, as well as cost escalation to account for inflation over time. The improvements listed are ordered by existing pipeline diameter, as smaller pipelines are assumed to be a greater risk to existing system reliability and are recommended for priority replacement.

Table 8.3 15-Year Pipeline Replacement Schedule

Water Master Plan

City of San Juan Bautista

PRELIMINARY

Year	Projected ENR CCI[1]	Improvement Details			Infrastructure Costs		Baseline Construction Cost	Estimated Construction Cost[4]	Capital Improvement Cost[5]
		Existing Diameter (in)	Total Length[2] (LF)	Total Length[2] (mi)	Unit Cost[3] ($/unit)	Infr. Cost ($)	($)	($)	($)
2021	11,731	1.25	1,325	0.25	153	203,300	203,300	264,300	343,600
2022	12,060	2	1,300	0.25	158	205,000	205,000	266,500	346,500
2023	12,397	2	1,300	0.25	162	210,700	210,700	274,000	356,200
2024	12,744	2	1,300	0.25	167	216,600	216,600	281,600	366,100
2025	13,100	2	1,300	0.25	171	222,700	222,700	289,600	376,500
2026	13,467	2	1,300	0.25	176	228,900	228,900	297,600	386,900
2027	13,844	4	1,150	0.22	181	208,200	208,200	270,700	352,000
2028	14,231	4	1,150	0.22	186	214,000	214,000	278,200	361,700
2029	14,629	4	1,150	0.22	191	220,000	220,000	286,000	371,800
2030	15,039	4	1,150	0.22	197	226,100	226,100	294,000	382,200
2031	15,459	4	1,150	0.22	202	232,500	232,500	302,300	393,000
2032	15,892	4	1,150	0.22	208	239,000	239,000	310,700	404,000
2033	16,337	4	1,150	0.22	214	245,700	245,700	319,500	415,400
2034	16,794	6	1,425	0.27	220	312,900	312,900	406,800	528,900
2035	17,264	6	1,425	0.27	226	321,700	321,700	418,300	543,800
		Total - 15-Year Replacement Improvements				3,507,300	3,507,300	4,560,100	5,928,600

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Notes:

1. Costs account for inflation consistent with previous 10 years of historical ENR CCI (2010 - 2020). ENR CCI values shown for documentation purposes only and are subject to review annually by City staff.
2. Pipe lengths shown do not include pipelines recommended for replacement in the Capital Improvement Program.
3. Unit costs are based on 8-inch diameter pipelines, the minimum required size per design criteria.
4. Baseline construction costs plus 30% to account for unforeseen events and unknown conditions.
5. Estimated construction costs plus 30% to cover other costs including: engineering design, project administration (developer and City staff), construction management and inspection, and legal costs.