CITY OF MORGAN HILL

December 2021

City of Morgan Hill

Water System Master Plan

FINAL

AKEL
ENGINEERING GROUP, INC.

CITY OF MORGAN HILL

2021

CITY OF MORGAN HILL

WATER SYSTEM MASTER PLAN UPDATE

Final

REGISTERED PROFESSIONAL ENGINEER
ANTOINE A AKEL
C 041682
CIVIL
STATE OF CALIFORNIA
12/16/21

December 2021

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Smart Planning Our Water Resources

December 16, 2021

City of Morgan Hill
17575 Peak Avenue
Morgan Hill, CA 95037-4128

Attention: James Sylvain
Deputy Director of Utilities Services

Subject: 2021 Water System Master Plan Update – Final

Dear James:

We are pleased to submit this report for the City of Morgan Hill Water System Master Plan Update. The master plan documents the following:

- Existing distribution system facilities, acceptable hydraulic performance criteria, and projected water demands consistent with the Urban Planning Area
- 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, Chris Ghione, Public Services Director; Clint Byrum, Utilities Operations 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.
Senior Principal

Enclosure: Report

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CITY OF MORGAN HILL

Acknowledgements

City Council

Rich Constantine, Mayor

John McKay, Mayor Pro Tempore

Gino Borgioli

Yvonne Martinez Beltran

Rene Spring

City Project Team

Christina Turner, City Manager

Chris Ghione, Public Services Director

James Sylvain, Deputy Director for Utilities Services

Clint Byrum, Utilities Operations Manager

Other City Engineering, Planning, and Operations Staff

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APPENDICES

EXECUTIVE SUMMARY

This executive summary presents a brief background of the City's water distribution system, the planning area characteristics, the system performance and design criteria, the hydraulic model, and a capital improvement program.

The hydraulic model was used to evaluate the capacity adequacy of the existing distribution system and for recommending improvements to mitigate existing deficiencies, as well as servicing future growth. The prioritized capital improvement program accounts for growth throughout the City of Morgan Hill.

ES.1 STUDY OBJECTIVES

One of Morgan Hill's key elements of the City's highest priority for public safety, is to ensure that the City's water system infrastructure is adequate at supplying its residents with safe clean drinking water needs, as a core service for its residents. The City of Morgan Hill recognizes the importance of planning, developing, and financing the water system infrastructure and retained the services of Akel Engineering Group to develop and complete the 2017 Water System Master Plan (2017 WSMP). The 2017 WSMP identified the capacity adequacy of the existing water facilities including pipelines, storage reservoirs, booster stations, and supply wells to service existing customers as well as anticipated future developments. The 2017 WSMP included a schedule of capital improvements, and associated costs, and which are required to support future developments as they occur.

Morgan Hill is also very pro-active in maintaining its Water System Master Plan current, reflecting recent trends in water use and conservation, changes to the general plan land use, and for consistency with the recently completed 2020 Urban Water management Plan (2020 UWMP). The City retained the services of Akel Engineering Group to complete this 2021 Water System Master Plan Update (2021 WSMP).

The 2021 WSMP Update evaluates the City's water system and recommends capacity improvements required to service the needs of existing users and for servicing future growth within the City. This 2021 WSMP Update is intended to serve as a tool for planning and phasing the construction of future domestic water system infrastructure for the currently projected buildout of the City of Morgan Hill. The service area and horizon for the master plan are stipulated in 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
- Updating the domestic water system performance criteria
- Projecting future domestic water demands
- Updating the 2017 hydraulic model
- Evaluating the domestic water facilities to meet existing and projected demand requirements and fire flows
- Performing a capacity analysis for distribution mains
- Performing a fire flow analysis
- Recommending a capital improvement program (CIP) with an estimation of probable construction costs
- Performing a capacity allocation analysis for cost sharing purposes
- Integrating potential future recycled water reuse alternatives
- Developing a 2021 Water System Master Plan report

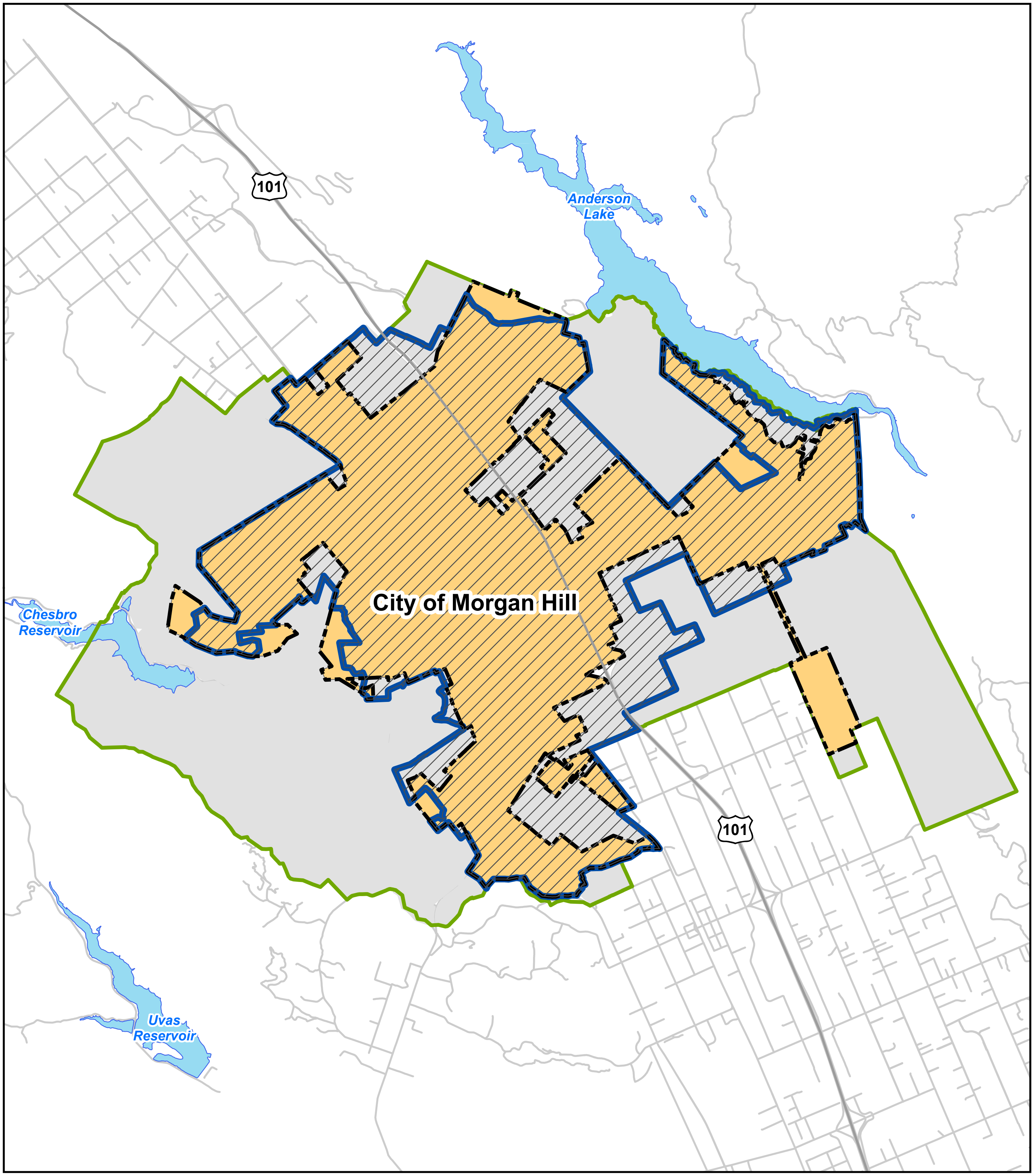
ES.2 STUDY AREA

The City of Morgan Hill is located in Santa Clara County, approximately 22 miles southeast of the City of San Jose and 24 miles northwest of the city of Hollister. The City's closest neighbor, the City of Gilroy, is located 8 miles to the southeast. U.S. Route 101 bisects the eastern boundary of the City in the north-south direction. The City limits currently encompass 6,992 acres, with an approximate population of 48,000 residents in 2021.

The City is generally bound to the north by Tilton Avenue, to the east by Anderson Lake, to the southeast by Foothill Avenue, to the west by Sunnyside Drive, and to the south by Middle Avenue. The unincorporated community of San Martin is located to the south of the City. The City's topography is generally flat in the center of the City with increasing slopes on the east and west. **Figure ES.1** displays the planning area showing city limits, the Urban Growth Boundary of the City and the City's Sphere of Influence Boundary.

ES.3 SYSTEM PERFORMANCE AND DESIGN CRITERIA

This report documents the City's performance and design criteria that were used for evaluating the domestic water system. The system performance and design criteria are used to establish guidelines for determining future water demands, evaluating existing domestic water facilities, and for sizing future facilities. **Table ES.1** documents the system performance and design criteria for the domestic water system. This criterion was used in the capacity evaluation and for sizing recommended improvements.



Legend

- City Limits
- City Limits Area
- Urban Service Area
- Urban Growth Boundary
- Sphere of Influence Boundary
- General Plan Area
- Roads
- Highways
- Lakes

Updated: November 30, 2021

0 0.25 0.5 1 Mile

N W E S GIS

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ES. 1
Planning Area

Water System Master Plan
City of Morgan Hill

CITY OF MORGAN HILL

Table ES.1 Planning and Design Criteria Summary

Water System Master Plan

City of Morgan Hill

Design Parameter	Criteria	
Supply	Supply to Meet Maximum Day Demands with Firm Capacity	
	Firm Capacity excludes two largest wells for possible maintenance and emergency	
	Two largest wells are currently Diana #2 and Nordstrom at approximately 2,500 gpm (3.5 MGD)	
	Assume Future Well Capacities at 800 gpm each and deepter design depth.	
Storage	Total Required Storage = Operational + Fire + Emergency	
	Operational Storage	25% of Maximum Day Demand
	Emergency Storage	25% of Maximum Day Demand
	Fire Storage	Residential = 0.18 MG (1,500 gpm for 2 hours)
		Commercial = 0.30 MG (2,500 gpm for 2 hours)
		Industrial = 0.63 MG (3,500 gpm for 3 hours)
Pump Stations	Meet Maximum Day Demand with largest unit out of service	
	Hydropneumatic systems to meet Maximum Day Demand plus fire flow	
Pressure Reducing Valves	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 (during Maximum Day)	40 psi
	Minimum Pressure (during Peak Hour)	35 psi
	Minimum Pressure for New Development[1] (during Peak Hour)	40 psi
	Minimum Residual Pressure (during Fires)	20 psi
Demand Peaking Factors	Maximum Month Demand	1.75 x Average Day Demand
	Maximum Day Demand	2.00 x Average Day Demand
	Peak Hour Demand	3.00 x Average Day Demand
Fire Flows	Residential	1,500 gpm for 2 hours
	Commercial	2,500 gpm for 2 hours
	Industrial	3,500 gpm for 3 hours
Urban Water Use Targets	2020 Target (20% Conservation)	159 gpdc
2020 Urban Water Management Plan	2020 Actual Water Use	150 gpdc

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12/3/2021

Note:

1. Source: California Department of Public Health Title 22, Chapter 16, Article 8 "Distribution System Operation"

ES.4 EXISTING WATER SYSTEM OVERVIEW

The City's municipal water system consists of 16 active groundwater wells, a total of 10.5 million gallons in storage, distribution mains, and fire hydrants. The City's topography is generally flat in the center of the City with increasing slopes on the east and west; based on this topography, the water distribution system is comprised of 21 pressure zones, with 12 storage tanks regulating system operation.

The City's existing domestic water distribution system is shown in **Figure ES.2**, 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.

ES.5 EXISTING AND FUTURE DOMESTIC WATER DEMANDS

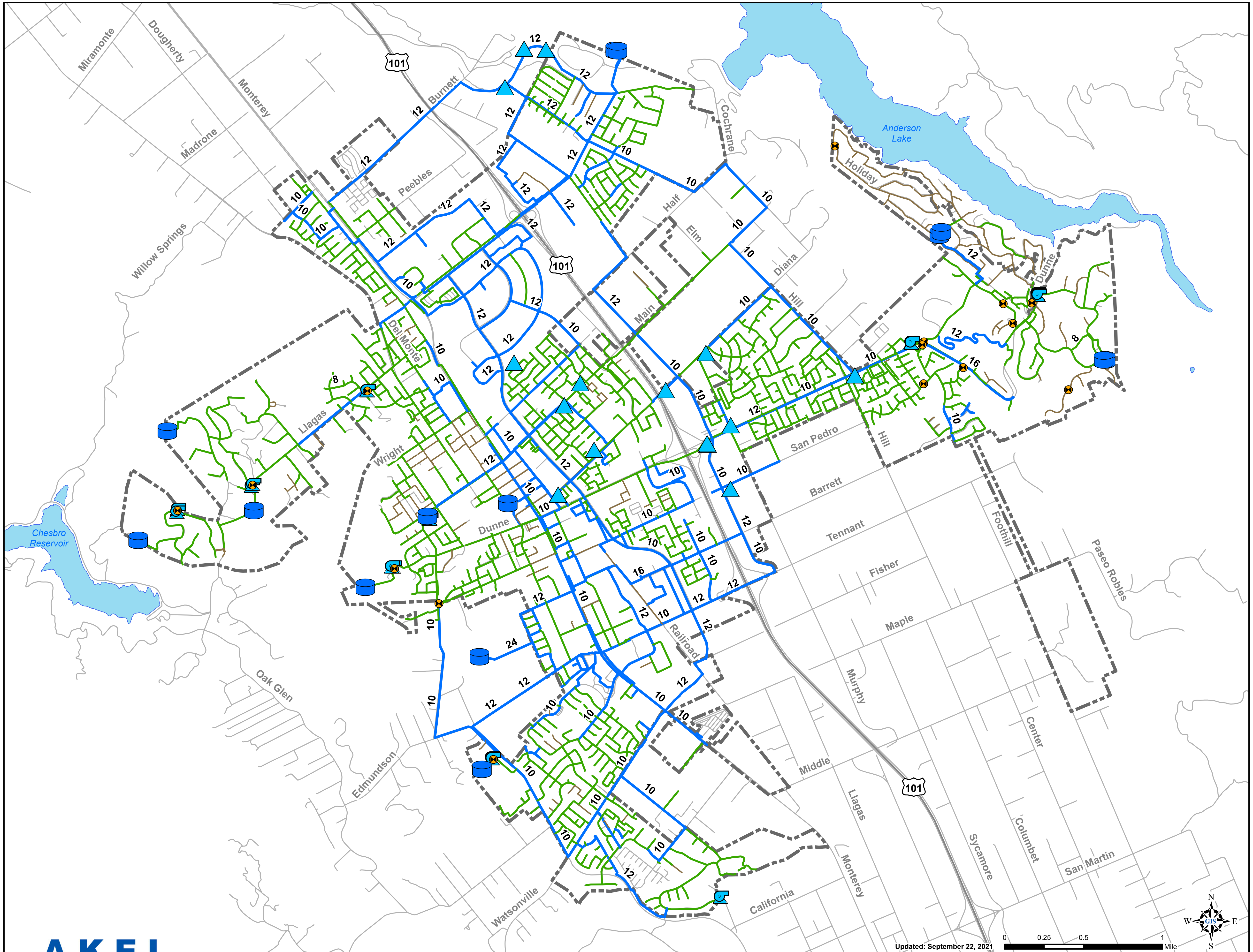
The City's existing average day domestic water demand was documented at 7.0 mgd. **Table ES.2** documents the future land use categories, and their corresponding domestic water demands. The average day domestic water demands from existing and future developments is estimated at 9.4 mgd, and parallels the 2038 water demand projections documented in the 2020 Urban Water Management Plan. These demands were used in sizing the future infrastructure facilities, including transmission mains, storage reservoirs, and booster stations. Demands were also used for allocating and reserving capacities in the existing or proposed facilities.

ES.6 HYDRAULIC MODEL DEVELOPMENT

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. Prior to the 2017 WSMP, the City's hydraulic model was developed using Innovyze's H2OMAP, which utilizes a GIS interface and uses the effective EPANET hydraulic engine for processing the hydraulic calculations. In the 2017 WSMP, Akel Engineering Group Inc redeveloped the hydraulic model using InfoWater, a GIS-based hydraulic model also by Innovyze. The model has an intuitive graphical interface and is directly integrated with ESRI's ArcGIS (GIS). As part of this master plan, the hydraulic model was updated to InfoWater Pro based on the data received from City staff to reflect the recent water main construction as well as changes to water facilities.

ES.7 PRESSURE EVALUATION

The calibrated hydraulic model was used for evaluating the system pressures throughout the distribution system during peak hour demand, maximum day demands, and maximum day demands in conjunction with fire flows. Criteria for pressure and fire flows were also summarized



Legend

Existing System

- Tanks
- Booster Stations
- Wells
- Valves

Pipes by Diameter

- 6" or Less
- 8"
- 10" or Greater
- Roads
- City Limits

ES. 2
Existing System
Water System Master Plan
City of Morgan Hill

City of Morgan Hill

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Table ES.2 Average Daily Demands at Buildout of Project Area

Water System Master Plan
City of Morgan Hill

Land Use Classifications	Water Demands at 100% Occupancy													
	Existing Development within City Limits			Future Development within City Limits			Total Development within City Limits		Total Development Outside City Limits		Total	
	Existing Development within City Limits (net acre)	Water Unit Factor (gpd/net acre)	Existing Average Daily Demand (gpd)	Future Development (net acre)	Future Water Unit Factor (gpd/net acre)	Future Development Average Daily Demand (gpd)	Development (net acre)	Total Development Average Daily Demand (gpd)	Development (net acre)	Total Development Average Daily Demand (gpd)	Development (net acre)	Average Daily Demand (gpd)
Residential												
Single Family												
Residential Estate	508	560	284,420	198	560	110,769	706	395,189	321	179,976	1,027	575,166
Residential Detached Low	1,049	1,050	1,101,152	102	1,050	106,639	1,150	1,207,791	239	250,528	1,389	1,458,319
Residential Detached Medium	1,298	1,700	2,207,096	141	1,700	239,155	1,439	2,446,251	411	699,255	1,850	3,145,506
Residential Detached High	34	2,140	73,204	0	2,140	737	35	73,941	20	41,858	54	115,799
Multi-Family												
Residential Attached Low	394	1,900	748,663	61	1,900	115,287	455	863,951	2	4,117	457	868,068
Residential Attached Medium	112	2,300	258,522	40	2,300	92,218	152	350,740	7	16,903	160	367,644
Residential Attached High	6	3,130	18,154	0	3,130	1,512	6	19,666	0	0	6	19,666
Subtotal	3,401		4,691,212	542		666,317	3,943	5,357,529	1,000	1,192,638	4,943	6,550,167
Non-Residential												
General Commercial	24	1,800	43,161	0	1,800	0	24	43,161	0	0	24	43,161
Commercial	261	1,350	352,009	129	1,350	174,292	390	526,301	4	4,995	394	531,296
Commercial / Industrial[1]	501	1,120	561,296	230	1,120	257,950	731	819,245	220	246,298	951	1,065,543
Mixed Use	93	1,350	125,991	6	1,350	8,242	99	134,233	0	0	99	134,233
Mixed Use Flex	70	1,390	96,621	35	1,390	48,619	104	145,240	8	11,421	113	156,661
Sports-Recreation-Leisure	0	1,680	0	0	1,680	0	0	0	251	421,974	251	421,974
Public Facility	302	400	120,658	12	400	4,694	313	125,352	46	18,556	360	143,908
Subtotal	1,250		1,299,735	412		493,797	1,663	1,793,532	529	703,244	2,192	2,496,776
Other (Demand Generating)												
Landscape Irrigation[2]	201	1,680	338,263	0	1,680	0	201	338,263	0	0	201	338,263
Subtotal	201		338,263	0		0	201	338,263	0	0	201	338,263
Other (Non-Demand Generating)												
Open Space	605	0	0	581	0	0	1,186	0	2,737	0	3,922	0
Subtotal	605		0	581		0	1,186	0	2,737	0	3,922	0
Totals	**5,458**		**6,329,210**	**1,535**		**1,160,114**	**6,992**	**7,489,325**	**4,267**	**1,895,882**	**11,259**	**9,385,206**

AKEL ENGINEERING GROUP, INC.

11/29/2021

Note:
1. "Commercial / Industrial" combines land use types "Commercial / Institutional" and "Industrial"
2. Area of Landscape Irrigation does not include single family residential irrigation use.

in the System Performance and Design Criteria chapter. Since the hydraulic model was calibrated for extended period simulations, the analysis duration was established at 24 hours for analysis.

The hydraulic model indicates that the City's existing distribution system performed reasonably well during the pressure evaluation, with few exceptions noted in the Evaluation and Proposed Improvements chapter.

ES.8 SUPPLY AND STORAGE EVALUATION

The water supply source, in this case groundwater, must meet the maximum day demands for existing conditions and to meet the demands of future growth. Additionally, the groundwater supply capacity must include a redundancy of 2 additional largest wells, which are counted as standby to account for equipment malfunction and to account for reduced supply capacities during droughts. The supply analysis recommends initiating the design and construction of 3 new wells, to be completed by year 2025. Three additional wells will also be needed by year 2038.

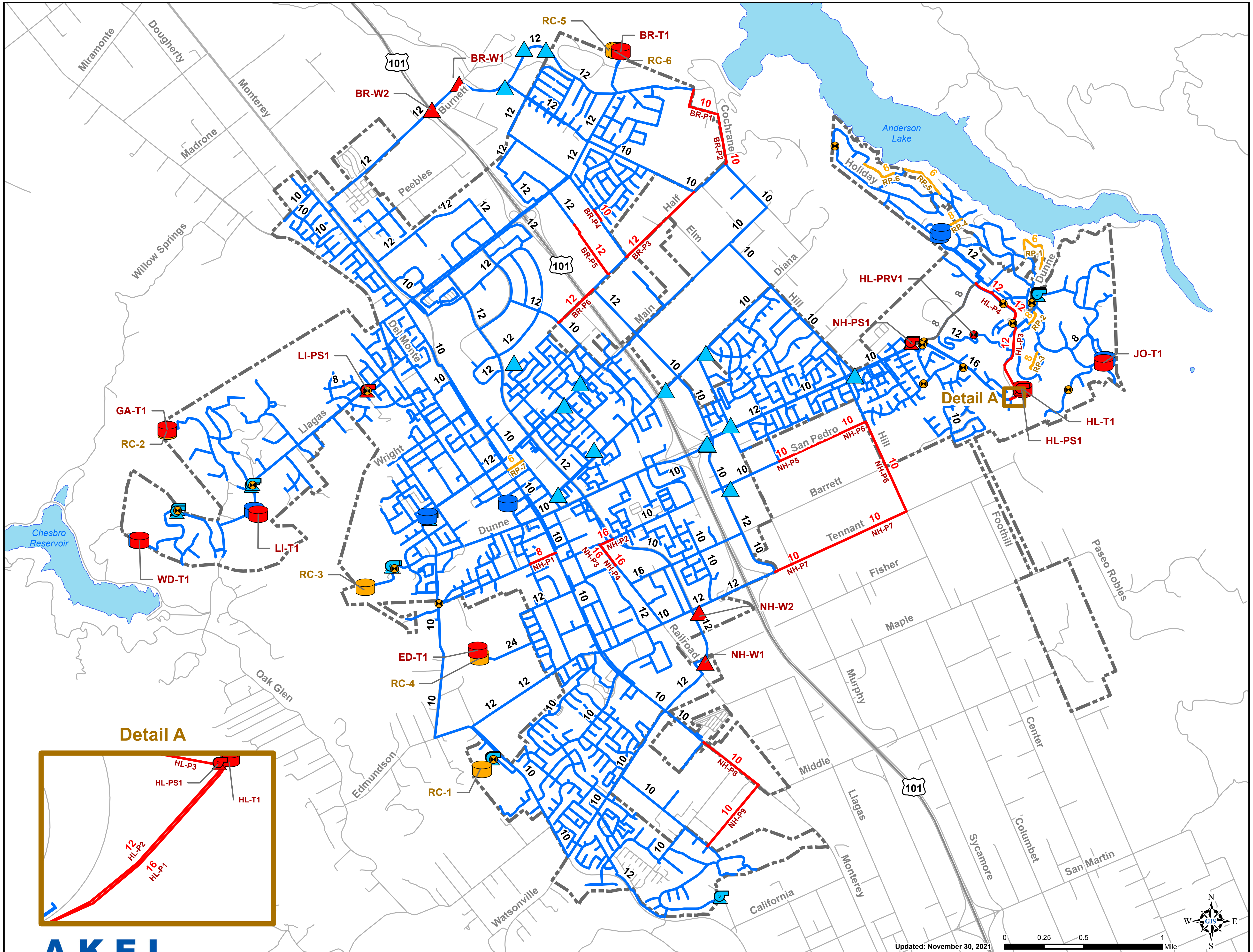
It should be noted that with climate change increasing the likelihood of continued periods of extended drought in the future, it is prudent to construct additional deeper wells to maintain adequate water supply, while simultaneously aggressively exploring recycled water opportunities and supporting enhancements to California's water supply system.

Existing storage requirements were identified for each existing pressure zone and included the operation, fire, and emergency storage components. The total City-wide required storage for existing domestic water demands is calculated at 9.67 MG. Buildout storage requirements were identified based on the anticipated future growth and existing domestic water demands, in each existing and future pressure zone, and will require a total 12.07 MG of operational and emergency storage capacity.

ES.9 CAPITAL IMPROVEMENT PROGRAM

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 ES.3** and are graphically represented on **Figure ES.3**.

The estimated construction costs include the baseline costs plus **40 percent** contingency allowance to account for unforeseen events and unknown field conditions. 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). The costs in this Water System Master Plan were benchmarked using a 20-City national average Engineering News Record (ENR) Construction Cost Index (CCI) of 12,464, reflecting a date of October 2021. In total, the CIP includes approximately 8.43 miles of pipeline improvements, six new wells, seven new storage reservoirs, four new booster stations, a new pressure reducing valve station, as well as other plan updates and currently planned projects, with a project cost totaling over $108.1 million.



Legend

Capacity Improvements

- Tanks
- Wells
- Booster Stations
- Valves
- Pipes

Condition Improvements

- Tanks
- Pipes

Existing System

- Tanks
- Booster Stations
- Wells
- Valves
- Pipes
- Pipes to be Abandoned
- Roads
- City Limits

Note:
2 New additional wells will be needed in the Nob Hills Zone, and to be sited at a later date.

Figure ES. 3
Capital Improvement Program
Water System Master Plan
City of Morgan Hill

AKEL ENGINEERING GROUP, INC.

CITY OF MORGAN HILL

Table ES.3 Capital Improvement Program
Water System Master Plan
City of Morgan Hill

Improv. No.	Pressure Zone	Alignment	Limits	Pipeline Improvements		Infrastructure Costs				Baseline Constr. Costs	Estimated Const. Costs[1]	Capital Improv. Costs[2]	Suggested Expenditure Budget	Construction Trigger	Suggested Cost Allocation		Cost Sharing	
				Existing Diameter (in)	New/Parallel/ Replace	Diameter (in)	Length (ft)	Unit Cost ($)	Infr. Cost ($)	($)	($)	($)			Existing Users	Future Users	Existing Users	Future Users
1. Planned Capacity Improvements (Short-Term and Long-Term)																		
1.1 Pipeline Capacity Improvements																		
Boy's Ranch Pressure Zone																		
BR-P1	Boy's Ranch	ROW	Cochrane Rd to Half Rd	-	New	10	1,600	246	392,822	392,822	549,951	714,936	2030-2034	As development occurs	0%	100%	0	714,936
BR-P2	Boy's Ranch	Cochrane Rd	Half Rd to approx 1,700' n/o Half Rd	-	New	10	1,700	246	417,374	417,374	584,323	759,620	2030-2034	As development occurs	0%	100%	0	759,620
BR-P3	Boy's Ranch	Half Rd	Mission View Dr to Peet Rd	-	New	12	3,150	271	852,980	852,980	1,194,172	1,552,424	2030-2034	As development occurs	0%	100%	0	1,552,424
BR-P4	Boy's Ranch	Mission View Dr	Between Cochrane Rd and 2,100' nw/o Cochrane Rd	8	Replace	10	450	246	110,481	110,481	154,674	201,076	2022-2024	Immediate	100%	0%	201,076	0
BR-P5	Boy's Ranch	Mission View Dr	Half Rd to 2,100' nw/o Half Rd	-	New	12	2,100	271	568,653	568,653	796,115	1,034,949	2030-2034	As development occurs	0%	100%	0	1,034,949
BR-P6	Boy's Ranch	Half Rd	Serene Dr to Conduit Rd	-	New	12	1,650	271	446,799	446,799	625,519	813,174	2030-2034	As development occurs	0%	100%	0	813,174
									Subtotal - Boys Ranch Pressure Zone	**2,789,110**	**3,904,753**	**5,076,179**					**201,076**	**4,875,104**
Nob Hill Pressure Zone																		
NH-P1	Nob Hill	Spring Ave	Del Monte Ave to Monterey Rd	4	Replace	8	950	213	202,368	202,368	283,316	368,310	2022-2024	As development occurs	100%	0%	368,310	0
NH-P2	Nob Hill	San Pedro Ave	Butterfield Blvd to Railroad Ave	10	Replace	16	550	327	179,713	179,713	251,598	327,077	2025-2029	As development occurs	100%	0%	327,077	0
NH-P3	Nob Hill	Railroad Ave	San Pedro Ave to approx 600' n/o Mast St	10	Replace	16	350	327	114,363	114,363	160,108	208,140	2025-2029	As development occurs	0%	100%	0	208,140
NH-P4	Nob Hill	Railroad Ave	Approx 600' n/o Mast St to Mast St	6	Replace	16	600	327	196,050	196,050	274,470	356,811	2025-2029	As development occurs	0%	100%	0	356,811
NH-P5	Nob Hill	San Pedro Ave	1,100' ne/o Murphy Ave to Hill Rd	-	New	10	3,200	246	785,644	785,644	1,099,902	1,429,873	2035-2038	As development occurs	0%	100%	0	1,429,873
NH-P6	Nob Hill	Hill Rd	San Pedro Ave to Tennant Ave	-	New	10	3,300	246	810,196	810,196	1,134,274	1,474,556	2035-2038	As development occurs	0%	100%	0	1,474,556
NH-P7	Nob Hill	Tennant Ave	Hill Rd to Condit Rd	-	New	10	4,850	246	1,190,742	1,190,742	1,667,039	2,167,151	2035-2038	As development occurs	0%	100%	0	2,167,151
NH-P8	Nob Hill	Monterey Rd	John Wilson Way to E Middle Ave	-	New	10	2,350	246	576,958	576,958	807,741	1,050,063	2035-2038	As development occurs	0%	100%	0	1,050,063
NH-P9	Nob Hill	ROW	Monterey Rd to Olive Ave	-	New	10	2,700	246	662,887	662,887	928,042	1,206,455	2035-2038	As development occurs	0%	100%	0	1,206,455
									Subtotal - Nob Hill Pressure Zone	**4,718,921**	**6,606,489**	**8,588,436**					**695,387**	**7,893,048**
Holiday Pressure Zones																		
HL-P1	Holiday 1	Dunne Ave	Flaming Oak Ln to Proposed E Dunne Tank	-	New	16	550	327	179,713	179,713	251,598	327,077	2022-2024	E. Dunne Pump Station 2 and 3 Abandonement	40%	60%	130,831	196,246
HL-P2	Holiday 1	Dunne Ave	Proposed E Dunne Tank to Flaming Oak Ln	-	New	12	550	271	148,933	148,933	208,506	271,058	2022-2024	E. Dunne Pump Station 2 and 3 Abandonement	40%	60%	108,423	162,635
HL-P3	Holiday Lake	Dunne Ave	Proposed E Dunne Tank to Lori Ln	-	New	12	2,450	271	663,429	663,429	928,801	1,207,441	2025-2029	Holiday Pump Station Construction	0%	100%	0	1,207,441
HL-P4	Holiday Lake	Oak Leaf Dr	Lori Ln to 650' nw/o Lori Ln	-	New	12	2,300	271	622,811	622,811	871,935	1,133,516	2025-2029	Holiday Pump Station Construction	0%	100%	0	1,133,516
									Subtotal - Holiday Pressure Zones	**1,614,885**	**2,260,840**	**2,939,091**					**239,254**	**2,699,837**
									Subtotal - Pipeline Capacity Improvements	**9,122,916**	**12,772,082**	**16,603,706**					**1,135,717**	**15,467,989**

Table ES.3 Capital Improvement Program

Water System Master Plan
City of Morgan Hill

Improv. No.	Pressure Zone	Alignment	Limits	Pipeline Improvements: Existing Diameter (in)	Pipeline Improvements: New/Parallel/Replace	Infrastructure Costs: Diameter (in)	Infrastructure Costs: Length (ft)	Infrastructure Costs: Unit Cost ($)	Infrastructure Costs: Infr. Cost ($)	Baseline Constr. Costs ($)	Estimated Const. Costs[1] ($)	Capital Improv. Costs[2] ($)	Suggested Expenditure Budget	Construction Trigger	Suggested Cost Allocation: Existing Users	Suggested Cost Allocation: Future Users	Cost Sharing: Existing Users	Cost Sharing: Future Users
1.2 Storage Reservoir Capacity Improvements						Proposed Storage Capacity (MG)												
BR-T1	Boy's Ranch	Demolish existing 0.55 MG Boy's Ranch tank and replace with 1.20 MG tank			Replace		1.20		2,441,927	2,441,927	3,418,697	4,444,306	2030-2034	420 EDUs	60%	40%	2,666,584	1,777,723
GA-T1	Glen Ayre	Demolish existing 0.10 MG Glen Ayre tank and replace with 0.25 MG tank			Replace		0.25		635,918	635,918	890,286	1,157,371	2025-2029	Immediate	90%	10%	1,041,634	115,737
ED-T1	Nob Hill	Existing Edmundson tank site			New		0.90		2,289,306	2,289,306	3,205,029	4,166,537	2030-2034	2,350 EDUs	0%	100%	0	4,166,537
LI-T1	Llagas	Existing Llagas tank site			New		0.20		508,735	508,735	712,229	925,897	2025-2029	Immediate	15%	85%	138,885	787,013
JO-T1	Jackson Oaks 1	Existing Jackson tank site			New		0.20		508,735	508,735	712,229	925,897	2025-2029	Immediate	100%	0%	925,897	0
WD-T1	Woodland	Demolish existing 0.03 MG Woodland tank and replace with 0.25 MG tank			Replace		0.25		635,918	635,918	890,286	1,157,371	2025-2029	Immediate	80%	20%	925,897	231,474
HL-T1	Holiday 1	Dunne Ave approx 500' ne/o Flaming Oak Ln			New		0.85		2,162,122	2,162,122	3,026,971	3,935,063	2022-2024	E. Dunne Pump Station 1, 2, and 3 Abandonement	70%	30%	2,754,544	1,180,519
									Subtotal - Storage Reservoir Capacity Improvements	**9,182,661**	**12,855,726**	**16,712,443**					**8,453,441**	**8,259,003**
1.3 Groundwater Well Capacity Improvements						Proposed Pump Capacity (gpm)												
BR-W1	Boy's Ranch	Burnett Ave	Approx 6,000' ne/o Monterey Ave		New		800 gpm		2,769,252	2,769,252	3,876,953	5,040,038	2025-2029	As development occurs	0%	100%	0	5,040,038
BR-W2	Boy's Ranch	Burnett Ave	Approx 5,000' ne/o Monterey Ave		New		800 gpm		2,769,252	2,769,252	3,876,953	5,040,038	2035-2038	As development occurs	0%	100%	0	5,040,038
NH-W1	Nob Hill	Butterfield Blvd	400' E of Railroad Ave and Fisher Ave		New		800 gpm		2,769,252	2,769,252	3,876,953	5,040,038	2022-2024	Immediate	100%	0%	5,040,038	0
NH-W2	Nob Hill	Butterfield Blvd	Butterfield Blvd and Tennant Ave		New		800 gpm		2,769,252	2,769,252	3,876,953	5,040,038	2022-2024	Immediate	11%	89%	565,783	4,474,255
NH-W3	Nob Hill	Well Site to be determined at a later date.			New		800 gpm		2,769,252	2,769,252	3,876,953	5,040,038	2025-2029	As development occurs	0%	100%	0	5,040,038
NH-W4	Nob Hill	Well Site to be determined at a later date.			New		800 gpm		2,769,252	2,769,252	3,876,953	5,040,038	2030-2034	As development occurs	0%	100%	0	5,040,038
									Subtotal - Groundwater Well Capacity Improvements	**16,615,511**	**23,261,715**	**30,240,230**					**5,605,822**	**24,634,408**
1.4 Pump Station Capacity Improvements						Proposed Capacity (gpm)												
NH-PS1	Nob Hill	Dunne Ave and Magnolia Wy			New		3 @ 900 gpm		1,539,329	1,539,329	2,155,061	2,801,579	2022-2024	E. Dunne Pump Station 1, 2, and 3 Abandonement	60%	40%	1,680,947	1,120,632
BR-PS1	Boy's Ranch	Current Condit Valve Site			New		1 @ 1,500 gpm		100,000	100,000	100,000	100,000	2022-2024	Immediate	80%	20%	80,000	20,000
LI-PS1	Llagas 2	Llagas Road and Carriage Drive			Replace		1 @ 450 gpm		300,000	300,000	420,000	546,000	2025-2029	Immediate	40%	60%	218,400	327,600
HL-PS1	Holiday 1	Dunne Ave approx 500' ne/o Flaming Oak Ln			New		4 @ 550 gpm		1,317,915	1,317,915	1,845,081	2,398,606	2025-2029	Holiday Tank Construction	40%	60%	959,442	1,439,163
									Subtotal - Pump Station Capacity Improvements	**3,257,244**	**4,520,142**	**5,846,185**					**2,938,790**	**2,907,395**
1.5 Pressure Reducing Valve Capacity Improvements						Proposed Size (in)												
HL-PRV1	Holiday 1	Thomas Gr approx 1,100' w/o Gnarled Oak Ln			New		3		55,977	55,977	78,367	101,878	2025-2029	Holiday Tank Construction	55%	45%	56,033	45,845
									Subtotal - Pressure Reducing Valve Capacity Improvements	**55,977**	**78,367**	**101,878**					**56,033**	**45,845**

Table ES.3 Capital Improvement Program

Water System Master Plan
City of Morgan Hill

Improv. No.	Pressure Zone	Alignment	Limits	Pipeline Improvements		Infrastructure Costs				Baseline Constr. Costs	Estimated Const. Costs[1]	Capital Improv. Costs[2]	Suggested Expenditure Budget	Construction Trigger	Suggested Cost Allocation		Cost Sharing	
				Existing Diameter (in)	New/Parallel/ Replace	Diameter (in)	Length (ft)	Unit Cost ($)	Infr. Cost ($)	($)	($)	($)			Existing Users	Future Users	Existing Users	Future Users
2. Planned Condition Improvements																		
2.1 Known Pipeline Renewal and Replacement (2022-2024)																		
RP-1	Holiday Lake	Shady Ln	From Holiday Dr to Holiday Dr	6	Replace	6	2,550	189	482,844	482,844	675,981	878,776	2022-2024	Immediate	100%	0%	878,776	0
RP-2	Jackson Oaks	Hill Top Ct	From Jackson Oaks Dr to approx 550' ne/o Jackson Oaks Dr	8	Replace	8	550	213	117,161	117,161	164,025	213,232	2022-2024	Immediate	100%	0%	213,232	0
RP-3	Jackson Oaks	Oak View Ct	From Jackson Oaks Dr to approx 700' s/o Jackson Oaks Dr	8	Replace	8	700	213	149,114	149,114	208,759	271,387	2022-2024	Immediate	100%	0%	271,387	0
RP-4	Holiday Lake	Holiday Tank Site	From Holiday Lake Tanks to Manzanita Dr	8	Replace	8	800	213	170,415	170,415	238,582	310,156	2022-2024	Immediate	100%	0%	310,156	0
RP-5	Holiday Lake	Manzanita Dr	From Holiday Dr to end of Manzanita Dr	6	Replace	6	1,650	189	312,428	312,428	437,400	568,620	2022-2024	Immediate	100%	0%	568,620	0
RP-6	Holiday Lake	Raccoon Ct	From Holiday Ct to end of Manzanita Dr	6	Replace	6	1,700	189	321,896	321,896	450,654	585,851	2022-2024	Immediate	100%	0%	585,851	0
RP-7	Nob Hill	First St	From Monterey Rd to Depot St	6	Replace	6	600	189	113,610	113,610	159,054	206,771	2022-2024	Immediate	100%	0%	206,771	0
RP-8	Hydropneumatic Zone	Oak Canyon Dr	From Jackson Oaks Hydropneumatic tank to Jackson Oaks Dr	8	Replace	8	600	213	127,812	127,812	178,936	232,617	2022-2024	Immediate	100%	0%	232,617	0
									Subtotal - Known Pipeline R&R	**1,795,280**	**2,513,392**	**3,267,409**					**3,267,409**	**0**
2.2. Recommended Annual Pipeline Condition Renewal and Replacement (10-year)																		
RR-2022-2024	0.5% System Pipeline Renewal and Replacement (excluded known pipeline R&R)				Replace				1,669,505	1,669,505	2,337,308	3,038,500	2022-2024		100%	0%	3,038,500	0
RR-2025	0.5% System Pipeline Renewal and Replacement				Replace				1,172,053	1,172,053	1,640,874	2,133,136	2025-2029		100%	0%	2,133,136	0
RR-2026	0.5% System Pipeline Renewal and Replacement				Replace				1,180,615	1,180,615	1,652,861	2,148,719	2025-2029		100%	0%	2,148,719	0
RR-2027	0.5% System Pipeline Renewal and Replacement				Replace				1,189,177	1,189,177	1,664,848	2,164,302	2025-2029		100%	0%	2,164,302	0
RR-2028	0.5% System Pipeline Renewal and Replacement				Replace				1,197,739	1,197,739	1,676,835	2,179,885	2025-2029		100%	0%	2,179,885	0
RR-2029	0.5% System Pipeline Renewal and Replacement				Replace				1,206,301	1,206,301	1,688,822	2,195,469	2025-2029		100%	0%	2,195,469	0
RR-2030	0.5% System Pipeline Renewal and Replacement				Replace				1,214,864	1,214,864	1,700,809	2,211,052	2030-2034		100%	0%	2,211,052	0
RR-2031	0.5% System Pipeline Renewal and Replacement				Replace				1,223,426	1,223,426	1,712,796	2,226,635	2030-2034		100%	0%	2,226,635	0
									Subtotal - Annual Pipeline R&R	**10,053,680**	**14,075,152**	**18,297,698**					**18,297,698**	**0**
2.3 Reservoir Condition Improvements							Existing Storage Capacity (MG)											
RC-1	Encino	Re-coat and retrofit existing Encino Tank			Repair		0.60		330,000	-		330,000	2022	Immediate	100%	0%	330,000	0
RC-2	Glen Ayre	Re-coat and retrofit existing Glen Ayre Tank			Repair		0.10		55,000	-		55,000	2022	Immediate	100%	0%	55,000	0
RC-3	El Toro	Re-coat and retrofit existing El Toro Tank			Repair		0.50		275,000	-		275,000	2023	Immediate	100%	0%	275,000	0
RC-4	Edmundson	Re-coat and retrofit existing Edmundson Tank			Repair		4.25		2,337,500	-		2,337,500	2024	Immediate	100%	0%	2,337,500	0
RC-5	Boy's Ranch # 3	Re-coat and retrofit existing Boy's Ranch # 3 Tank			Repair		1.03		563,750	-		563,750	2025	Immediate	100%	0%	563,750	0
RC-6	Boy's Ranch # 2	Re-coat and retrofit existing Boy's Ranch # 2 Tank			Repair		0.55		302,500	-		302,500	2026	Immediate	100%	0%	302,500	0
									Subtotal - Storage Reservoir Condition Improvements			**3,863,750**					**3,863,750**	**0**
2.4 5-Year Improvement Projects																		
5YR-1	Well Rehabilitation									-	-	1,500,000	2022-2026		100%	0%	1,500,000	0
5YR-2	Booster Rehabilitation									-	-	1,400,000	2023-2024		100%	0%	1,400,000	0
5YR-3	Generators Replacement (Jackson Booster Station)									-	-	1,000,000	2022-2024		100%	0%	1,000,000	0
									Subtotal - 5-Year Improvement Projects			**3,900,000**					**3,900,000**	**0**

Table ES.3 Capital Improvement Program
Water System Master Plan
City of Morgan Hill

Improv. No.	Pressure Zone	Alignment	Limits	Pipeline Improvements: Existing Diameter (in)	Pipeline Improvements: New/Parallel/ Replace	Infrastructure Costs: Diameter (in)	Infrastructure Costs: Length (ft)	Infrastructure Costs: Unit Cost ($)	Infrastructure Costs: Infr. Cost ($)	Baseline Constr. Costs ($)	Estimated Const. Costs[1] ($)	Capital Improv. Costs[2] ($)	Suggested Expenditure Budget	Construction Trigger	Suggested Cost Allocation: Existing Users	Suggested Cost Allocation: Future Users	Cost Sharing: Existing Users	Cost Sharing: Future Users
3. Comprehensive Plan Updates																		
PLN-1	Water System Master Plan Updates (Years 2026, 2031, 2036)								237,000	-	-	711,000	2026, 2031, 2036		65%	35%	462,150	248,850
PLN-2	Water Assessment Management Plan (Year 2026, 2031, 2036)								119,000	-	-	357,000	2026, 2031, 2036		65%	35%	232,050	124,950
PLN-3	Urban Water Management Plan Updates (Year 2026, 2031, 2036)								119,000	-	-	357,000	2026, 2031, 2036		65%	35%	232,050	124,950
PLN-4	Water Rate Study Updates (Years 2026, 2031, 2036)								119,000	-	-	357,000	2026, 2031, 2036		65%	35%	232,050	124,950
									Subtotal - Comprehensive Plan Updates			**1,782,000**					**1,158,300**	**623,700**
4. Calendar Year Budget Expansion[3]																		
CY7.5	Calendar Year Budget Expansion (2026-2035)								750,000	-	-	7,500,000	2026-2035		0%	100%	0	7,500,000
									Subtotal - CY Budget Expansion			**7,500,000**					**0**	**7,500,000**
5. Total Improvement Costs																		
									Pipeline (Capacity)	**9,122,916**	**12,772,082**	**16,603,706**					**1,135,717**	**15,467,989**
									Storage Reservoirs (Capacity)	**9,182,661**	**12,855,726**	**16,712,443**					**8,453,441**	**8,259,003**
									Groundwater Wells (Capacity)	**16,615,511**	**23,261,715**	**30,240,230**					**5,605,822**	**24,634,408**
									Pump Stations (Capacity)	**3,257,244**	**4,520,142**	**5,846,185**					**2,938,790**	**2,907,395**
									Pressure Reducing Valves (Capacity)	**55,977**	**78,367**	**101,878**					**56,033**	**45,845**
									Known Pipeline R&R	**1,795,280**	**2,513,392**	**3,267,409**					**3,267,409**	**0**
									Annual Pipeline R&R	**10,053,680**	**14,075,152**	**18,297,698**					**18,297,698**	**0**
									Storage Reservoirs (Condition)	**-**	**-**	**3,863,750**					**3,863,750**	**0**
									5-year Improvement Projects	**-**	**-**	**3,900,000**					**3,900,000**	**0**
									Comprehensive Plan Updates	**-**	**-**	**1,782,000**					**1,158,300**	**623,700**
									CY Budget Expansion	**-**	**-**	**7,500,000**					**0**	**7,500,000**
									Total Improvement Costs	**50,083,269**	**70,076,577**	**108,115,300**					**48,676,960**	**59,438,340**

AKEL ENGINEERING GROUP, INC.

11/30/2021

Notes:

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.
3. The City's portion of the total CY expansion cost is estimated at $23M, it will be split in three ways with Water, Sewer, and Public Facilities.

ES.10 RECYCLED WATER FEASIBILITY EVALUATION

There is currently no recycled water delivered within the City's service area. However, City Staff have been persistently exporting feasible opportunities where recycled water can be implemented in the future. This chapter provides a summary of the recommendations and cost estimates extracted from the October 2020 Draft report of the Countywide Water Reuse Master Plan (2020 CoRe Plan), completed by Santa Clara Valley Water District (Valley Water). Between the three identified options, Option 1 (importing recycled water supplies from South Bay Water Recycling via 6 miles pipeline) seems to have the lowest implementation costs and the highest recycled yield by year 2040. However, this option may be the least feasible from a political perspective (with North County entities required to approve sending recycled water to the South County) and implementation would be outside the control of both Morgan Hill and Valley Water. Additionally, new technology (such as Treated Water Augmentation) will likely provide for additional alternatives in the near future.

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. Abbreviations and definitions are also provided in this chapter.

1.1 BACKGROUND

The City of Morgan Hill (City) is located approximately 22 miles southeast of the City of San Jose, and 8 miles northwest of the City of Gilroy (**Figure 1.1**). The City provides potable water service to more than 48,000 residents, as well as a myriad of commercial, industrial, and institutional establishments. The City operates a domestic water distribution system that consists of 16 groundwater wells, 12 storage tanks equating to 10.5 million gallons in storage, and over 188 miles of distribution pipelines.

Morgan Hill recognizes the importance of planning, developing, and financing the water system infrastructure and retained the services of Akel Engineering Group to develop and complete the 2017 Water System Master Plan (2017 WSMP). This master plan identified capacity deficiencies in the existing water system and recommended improvements to alleviate existing deficiencies and serve future developments in the Urban Growth Boundary.

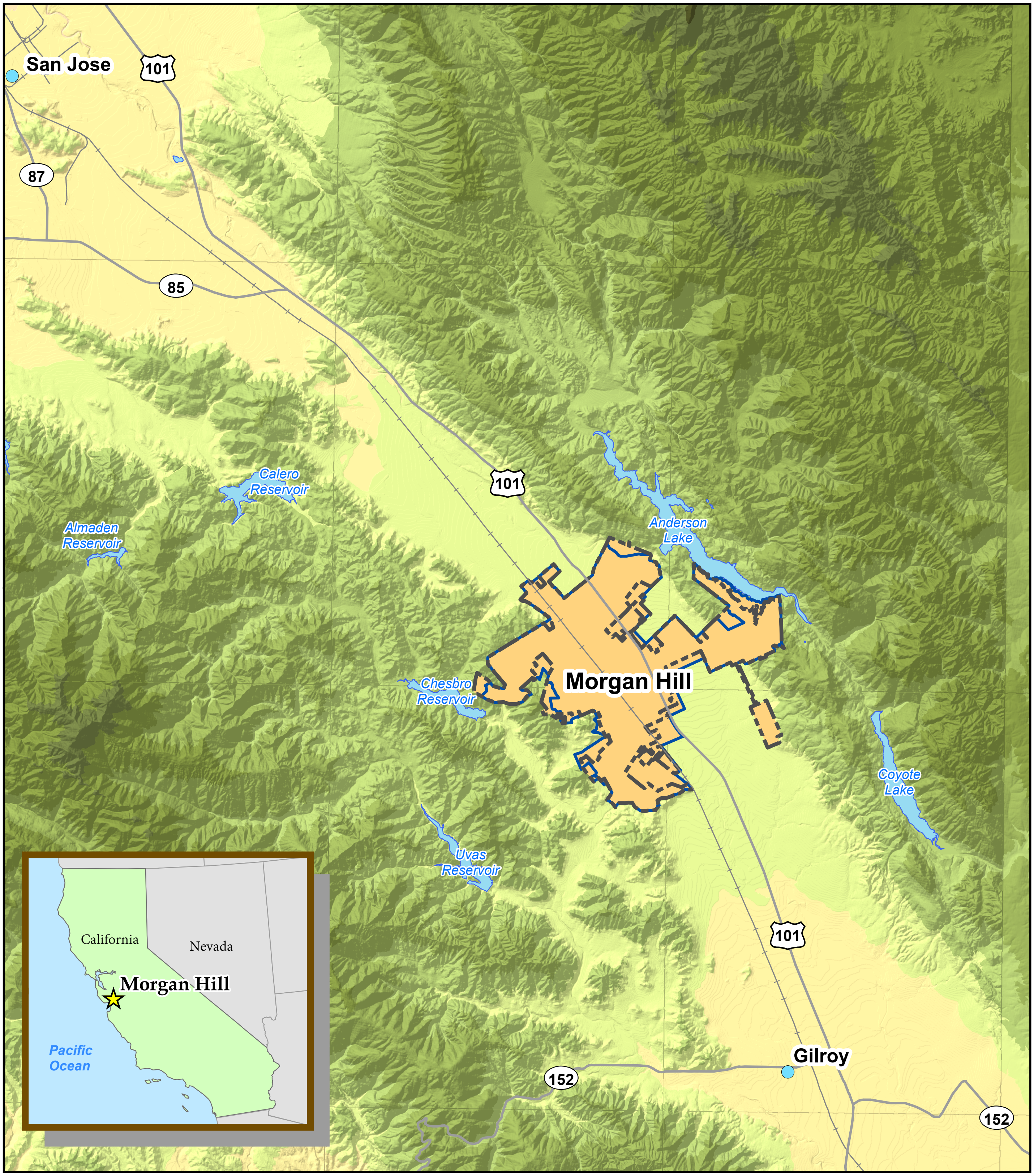
In order to address changes to land use and to water use trends, and for consistency with the projections of the 2020 Urban Water Management Plan, Morgan Hill retained the services of Akel Engineering Group to complete this 2021 Water System Master Plan Update (2021 WSMP).

1.2 SCOPE OF WORK

The 2021 WSMP Update evaluates the City's water system and recommends capacity improvements required to service the needs of existing users and for servicing future growth within the City. This 2021 WSMP Update is intended to serve as a tool for planning and phasing the construction of future domestic water system infrastructure for the currently projected buildout of the City of Morgan Hill. The service area and horizon for the master plan are stipulated in 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
- Updating the domestic water system performance criteria



Legend

- Cities
- Study Area
- City Limits
- Urban Growth Boundary
- Highways
- Railroads
- Lakes

Elevation (ft)

- 100 - 250
- 251 - 500
- 501 - 1,000
- 1,001 - 2,000
- 2,001 - 3,000
- 3,001 - 4,000
- > 4,000

N W E S GIS

0 0.5 1 2 Miles

Updated: October 15, 2021

AKEL ENGINEERING GROUP, INC.

File Path: P:\xGIS\GIS_Projects\Morgan_Hill\Water\210714-MP_Update\MH_Fig1-1RLM_101521.mxd

Figure 1.1
Regional Location Map

Water System Master Plan
City of Morgan Hill

CITY OF MORGAN HILL

- Projecting future domestic water demands
- Updating the 2017 hydraulic model
- Evaluating the domestic water facilities to meet existing and projected demand requirements and fire flows
- Performing a capacity analysis for distribution mains
- Performing a fire flow analysis
- Recommending a capital improvement program (CIP) with an estimation of probable construction costs
- Performing a capacity allocation analysis for cost sharing purposes
- Integrating potential future recycled water reuse alternatives
- Developing a 2021 Water System Master Plan report

1.3 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 Morgan Hill Water System Master Plan, October 2017 (2017 WSMP).** This report documents the planning and performance criteria, evaluates the water system, recommends improvements, and provides an estimate of costs.

- **City of Morgan Hill 2035 General Plan, July 2016 (2035 General Plan).** The City's 2035 General Plan provides future land use planning, and growth assumptions for the planning areas. Additionally, this report establishes the planning horizon for improvements in this master plan.

- **Recycled Water Feasibility Evaluation, March 2016 (2016 RWFE).** The Recycled Water Feasibility Evaluation (RWFE) identified potential recycled water users through a market assessment. As part of the RWFE, infrastructure required to convey recycled water from the South County Regional Wastewater Authority (SCRWA) WWTP in Gilroy to the potential users in Morgan Hill was identified. However, there are currently no plans to construct infrastructure for the purpose of providing recycled water to any of the identified potential users.

- **Valley Water Countywide Water Reuse Master Plan, October 2020 (2020 CoRe Plan).** Valley Water issued the Final Draft Valley Water Countywide Water Reuse Master Plan (CoRe Plan). CoRe Plan included several recycled water reuse options for augmenting the recycled water supplies in the City of Morgan Hill, including constructing a recycled water treatment plant, advanced water purification facilities (AWPF).

- **2020 Urban Water Management Plan (2020 UWMP).** The 2020 Urban Water Management Plan (UWMP) establishes a benchmark per capita water usage and targets in order to achieve higher levels of water conservation for the sustainability of water supply sources. This includes adopting an updated water shortage contingency plan, defining supply sources, addressing supply reliability, and projecting sustainable supply yields and future demands.

1.4 REPORT ORGANIZATION

The water system 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. 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. The planning area is divided into several planning sub-areas, as established by the City's Planning Division.

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, pressure zones, distribution mains, storage reservoirs, and booster pump stations.

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

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.

Chapter 7 - Evaluation and Proposed Improvements. This chapter presents a summary of the domestic water system capacity evaluation and identifies improvements needed to mitigate existing capacity 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.

Chapter 9 – 2020 CoRe Plan Alternatives for Future Recycled Water. This chapter summarizes three potential recycled water alternatives for the City of Morgan Hill, extracted from the Valley Water's Countywide Reuse Master Plan completed October 2020 (2020 CoRe Plan). Each identified alternative included an estimated total capital cost, operations and maintenance (O&M) costs, life-cycle costs, and projected capacities.

1.5 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:

- Chris Ghione, Public Services Director
- James Sylvain, Deputy Director of Utilities Services
- Clint Byrum, Utilities Operations Manager

1.6 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**.

1.7 GEOGRAPHIC INFORMATION SYSTEMS

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

- Update 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.

Table 1.1 Unit Conversions

Water System Master Plan Update
City of Morgan Hill

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	1×10^{-6}
million gallons	gallons	1,000,000
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 System Master Plan
City of Morgan Hill

Abbreviation	Expansion	Abbreviation	Expansion
2002 WSMP	2002 Water System Master Plan	GIS	Geographic Information Systems
2017 WSMP	2017 Water System Master Plan	gpd	gallons per day
AACE International	Association for the Advancement of Cost Engineering	gpdc	gallons per day per capita
AC	acre	gpm	gallons per minute
ACP	Asbestos Cement Pipe	hp	horsepower
ADD	average day demand	HGL	hydraulic grade line
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	City of Morgan Hill	MMD	maximum month demand
County	Santa Clara County	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	SCRWA	South County Regional Wastewater Authority
FRC	Facility Reserve Charge	SOI	Sphere of Influence
ft	feet	TBD	to be determined
fps	feet per second	ULL	Urban Limit Line
FY	Fiscal Year	WSMP	Water System Master Plan

- Calculate and allocating future water demands, based on future developments water use
- Generate maps and exhibits used in this master plan.

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. The planning area is divided into several planning sub-areas, as established by the City's Planning Division.

2.1 STUDY AREA DESCRIPTION

The City of Morgan Hill is located in Santa Clara County, approximately 22 miles southeast of the City of San Jose and 24 miles northwest of the city of Hollister. The City's closest neighbor, the City of Gilroy, is located 8 miles to the southeast. U.S. Route 101 bisects the eastern boundary of the City in the north-south direction. The City limits currently encompass 6,992 acres, with an approximate population of 48,000 residents in 2021.

The City is generally bound to the north by Tilton Avenue, to the east by Anderson Lake, to the southeast by Foothill Avenue, to the west by Sunnyside Drive, and to the south by Middle Avenue. There are several creeks flowing through and along the boundaries of the City, including: Fisher Creek, West Little Llagas Creek, and Llagas Creek. The topography is generally flat in the valley portion of the city, with increasing slopes in east and west side of the city due to the Santa Cruz Mountain to the west and the Diablo Range to the east. The unincorporated community of San Martin is located to the south of the City. **Figure 2.1** displays the planning area showing City Limits, the Urban Growth Boundary of the City, and the City's Sphere of Influence Boundary.

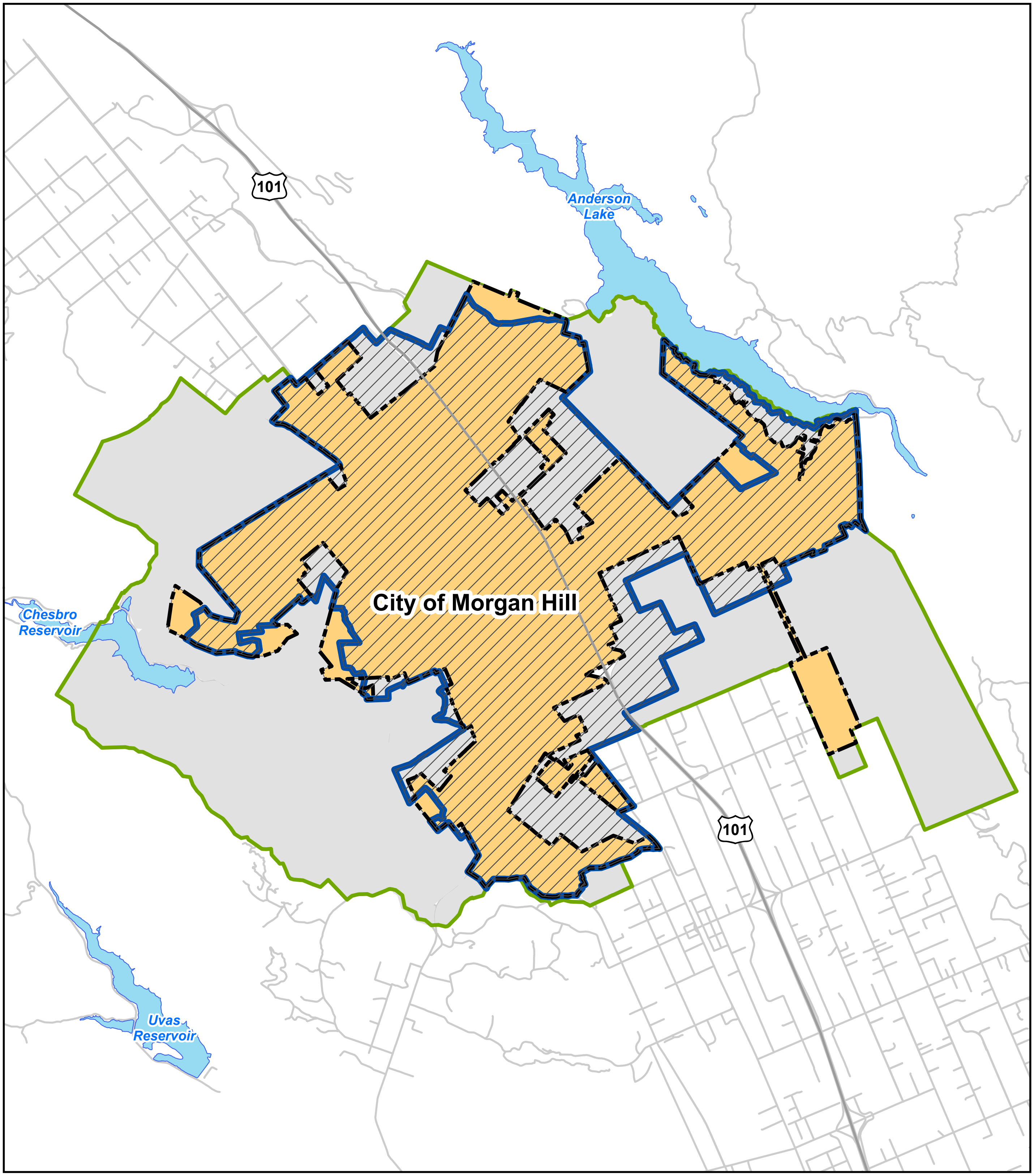
The City operates and maintains a domestic water system that covers the majority of the area within the City Limits and a small number of adjacent unincorporated areas within the City's Urban Service Area. Currently, the water demands are provided from groundwater wells located throughout the City.

2.2 WATER SERVICE AREA AND LAND USE

The City's current water system services residential and non-residential lands primarily within the City limits, as summarized on **Table 2.1**. This service area includes:

- 5,458 net acres of developed lands inside the service area.
- 1,535 net acres of undeveloped lands inside the service area.

The existing land use map was based on information received from Placeworks staff, the planning firm responsible for preparing the 2035 General Plan, and is shown on **Figure 2.2**. The existing land use statistics were based on 2017 WSMP land use inventory, vacant parcels inventory identified by City Staff, 2021 Morgan Hill water system GIS information provided by City Staff. Outside the City limits, the estimated development area is approximately 6,491 net acres of



Legend

- City Limits
- City Limits Area
- Urban Service Area
- Urban Growth Boundary
- Sphere of Influence Boundary
- General Plan Area
- Roads
- Highways
- Lakes

Updated: November 30, 2021

0 0.25 0.5 1 Mile

N W E S GIS

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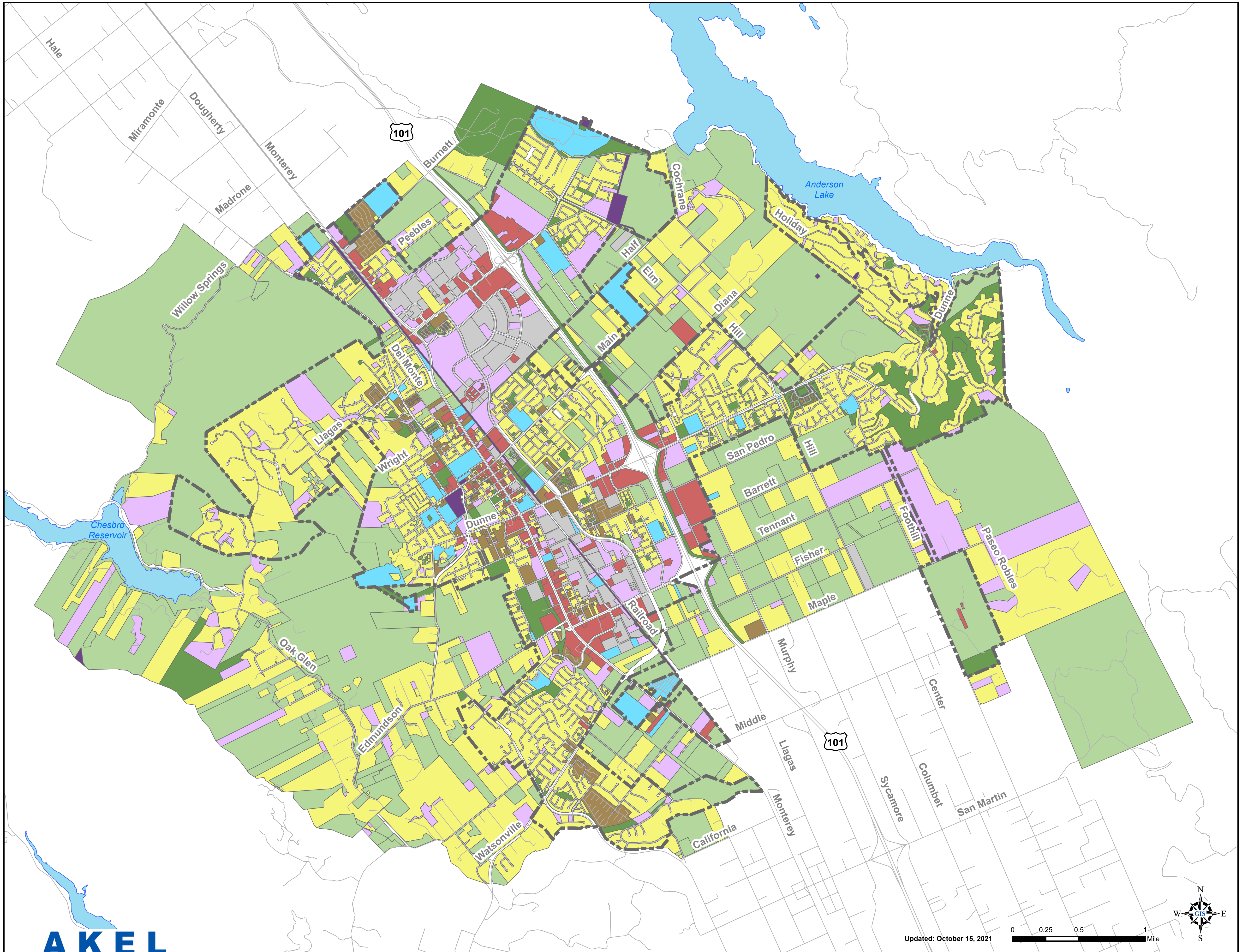
Figure 2.1
Planning Area

Water System Master Plan
City of Morgan Hill

CITY OF MORGAN HILL



Legend

Existing Land Use

- Agriculture
- Parks
- Single-Family
- Multi-Family
- Commercial
- Industrial
- Public/Institutional
- Vacant
- Other
- Roads
- City Limits
- Lakes

Figure 2.2
Existing Land Use
Water System Master Plan
City of Morgan Hill

CITY OF MORGAN HILL

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Table 2.1 Existing and Future Water Service Areas

Water System Master Plan
City of Morgan Hill

Land Use Classification	Existing Service Area (City Limits) Developed (net acres)	Existing Service Area (City Limits) Undeveloped (net acres)	Development Outside City Limits[1] Developed (net acres)	Development Outside City Limits[1] Undeveloped (net acres)
Residential				
Rural County	0.0	0.0	3,966.1	2,435.4
Residential Estate	507.9	197.8	227.6	93.7
Single Family Low	1,048.7	101.6	169.0	69.6
Single Family Medium	1,298.3	140.7	294.0	117.3
Single Family High	34.2	0.3	7.2	12.4
Subtotal - Single Family Residential	2,889.1	440.4	4,663.9	2,728.5
Multi-Family Low	394.0	60.7	2.2	0.0
Multi-Family Medium	112.4	40.1	0.0	7.3
Multi-Family High	5.8	0.5	0.0	0.0
Subtotal - Multi-Family Residential	512.2	101.3	2.2	7.3
Subtotal - Residential	**3,401.3**	**541.6**	**4,666.1**	**2,735.8**
Non-Residential				
General Commercial	24.0	0.0	0.0	0.0
Commercial	260.7	129.1	3.7	0.0
Commercial / Industrial[2]	501.2	230.3	145.4	74.5
Mixed Use	93.3	6.1	0.0	0.0
Mixed Use Flex	69.5	35.0	8.2	0.0
Sports-Recreation-Leisure	0.0	0.0	212.3	38.8
Public Facility	301.6	11.7	46.4	0.0
Subtotal - Non-Residential	**1,250.4**	**412.2**	**416.0**	**113.4**
Other				
Landscape Irrigation	201.3	0.0	0.0	0.0
Open Space	604.6	581.0	1,409.3	1,327.7
Subtotal - Other	**805.9**	**581.0**	**1,409.3**	**1,327.7**
Total	**5,457.6**	**1,534.8**	**6,491.4**	**4,176.9**

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Note:

1. Development Outside of City Limits is encompassed by the General Plan Area.
2. "Commercial / Industrial" combines land use types "Commercial / Institutional" and "Industrial"

developed lands and 4,177 net acres of undeveloped lands within the General Plan Area (**Table 2.1**).

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 and shown on **Figure 2.3**. At the buildout of the General Plan Area, the City's water system is anticipated to service 4,943 acres of residential land use and 2,393 acres of non-residential land use for a total water service area of 7,337 acres.

2.3 HISTORICAL AND FUTURE GROWTH

The City is a growing community, with over 2 percent of the Santa Clara County population residing within the City limits. Between 1970 and 1980 the City saw dramatic growth, with the population increasing from 5,579 to 16,924 at an average annual growth rate of approximately 18 percent. This rapid growth led to the City's adoption of a growth management system, known as the Residential Development Control System (RDCS), which regulates growth by limiting the number of new homes approved annually. Following the implementation of the RDCS the average annual growth rate between 1980 and 2000 fell to approximately 4.7 percent. From 2000 to present the City has observed an average annual growth rate of approximately 1.6 percent.

Although the General Plan Update anticipates a 2035 population of 58,200, this master plan used slightly higher population projections in order to trigger the design and construction of necessary water infrastructure, and prior to the arrival of the new population. The population projections in this water system master plan are also consistent with the projections listed in the Morgan Hill 2020 Urban Water Management Plan. The current and projected service area population is summarized in **Table 2.2**.

Historically, the City's RDCS set a maximum number of annual housing allotments that would not be exceeded and can only be reduced. Furthermore, if the number of allotments was reduced in a given year, they could not be added to a future year. However, with the passage of SB 330 in 2019 and subsequent passage of SB 8 in 2021, the RDCS system will be eliminated through 2030. The recent Urban Water Management Plan has taken this into consideration and projected increased levels of growth for the near term.

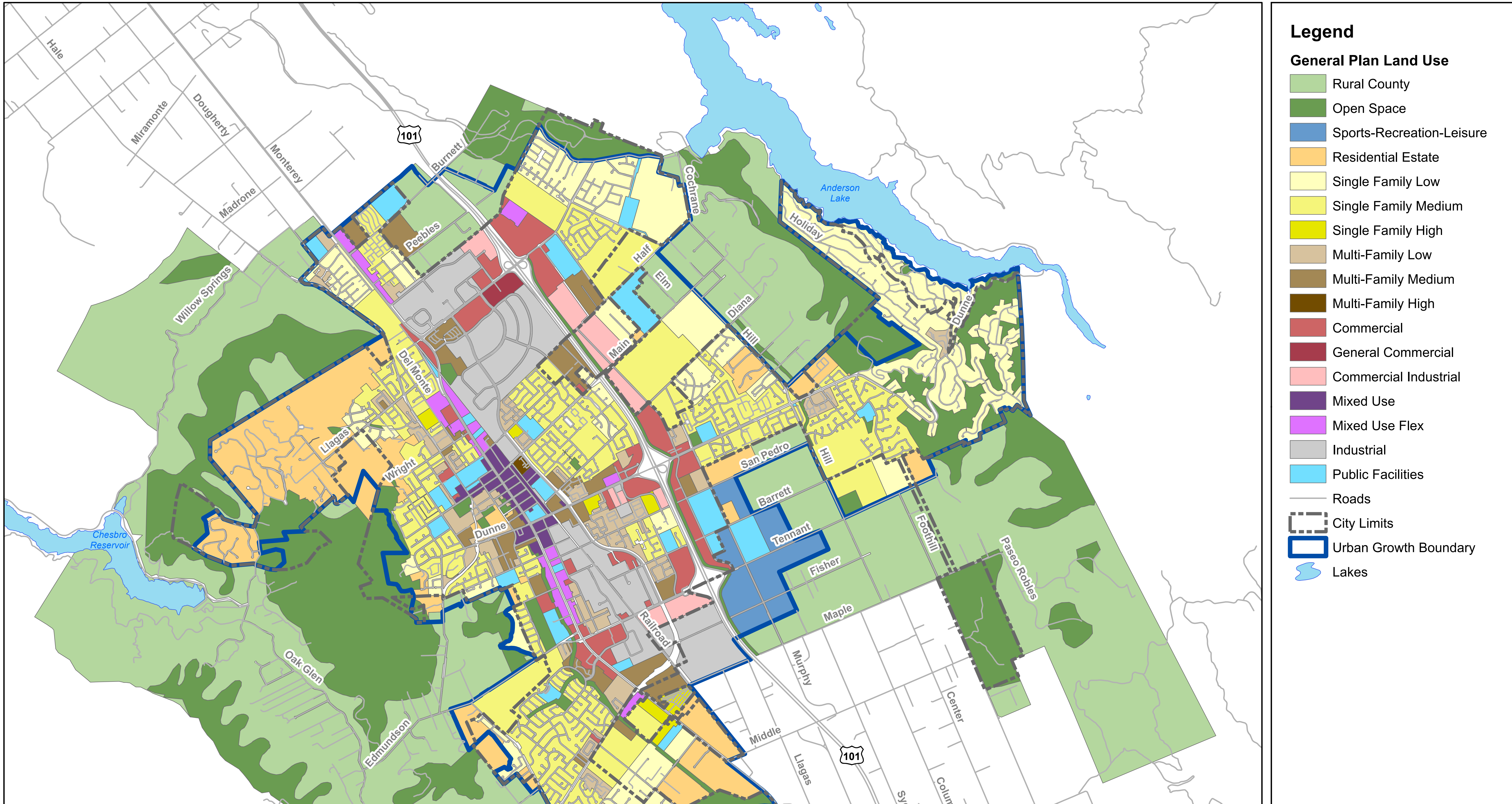

Figure 2.3
General Plan Land Use
Water System Master Plan
City of Morgan Hill

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CITY OF MORGAN HILL

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Table 2.2 Historical and Projected Population
Water System Master Plan
City of Morgan Hill

Year	Population[1,2,3]	Percent Growth (%)
Historical		
2000	33,586	-
2001	33,914	1.0%
2002	34,210	0.9%
2003	34,109	-0.3%
2004	34,618	1.5%
2005	35,011	1.1%
2006	35,535	1.5%
2007	36,467	2.6%
2008	37,107	1.8%
2009	37,653	1.5%
2010	37,882	0.6%
2011	38,456	1.5%
2012	39,432	2.5%
2013	40,486	2.7%
2014	41,562	2.7%
2015	42,382	2.0%
2016	43,502	2.6%
2017	44,047	1.3%
2018	44,780	1.7%
2019	45,745	2.2%
2020	46,454	1.5%
Projected		
2020 Urban Water Management Plan		
2021	47,412	2.1%
2022	48,370	2.0%
2023	49,328	2.0%
2024	50,286	1.9%
2025	51,243	1.9%
2026	52,201	1.9%
2027	53,159	1.8%
2028	54,117	1.8%
2029	55,075	1.8%
2030	56,033	1.7%
2031	56,772	1.3%
2032	57,521	1.3%
2033	58,279	1.3%
2034	59,048	1.3%
2035	59,827	1.3%
2036	60,616	1.3%
2037	61,415	1.3%
2038	62,225	1.3%
2039	63,046	1.3%
2040	63,877	1.3%
2041	64,662	1.2%
2042	65,446	1.2%
2043	66,231	1.2%
2044	67,015	1.2%
2045	67,800	1.2%

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1. Historical Populations per California Department of Finance estimates.
2. Historical values (2000 - 2015) received from City staff August 17, 2016.
3. Historical values (2016 - 2020) received from City staff March 29, 2021
4. Projected populations based on the following:
   - Year 2021-2030: City of Morgan Hill average 10-year historical growth rate of 2.1% per year.
   - Year 2030-2040: Extrapolated using average annual growth of 1.3%, based on previous General Plan projections

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

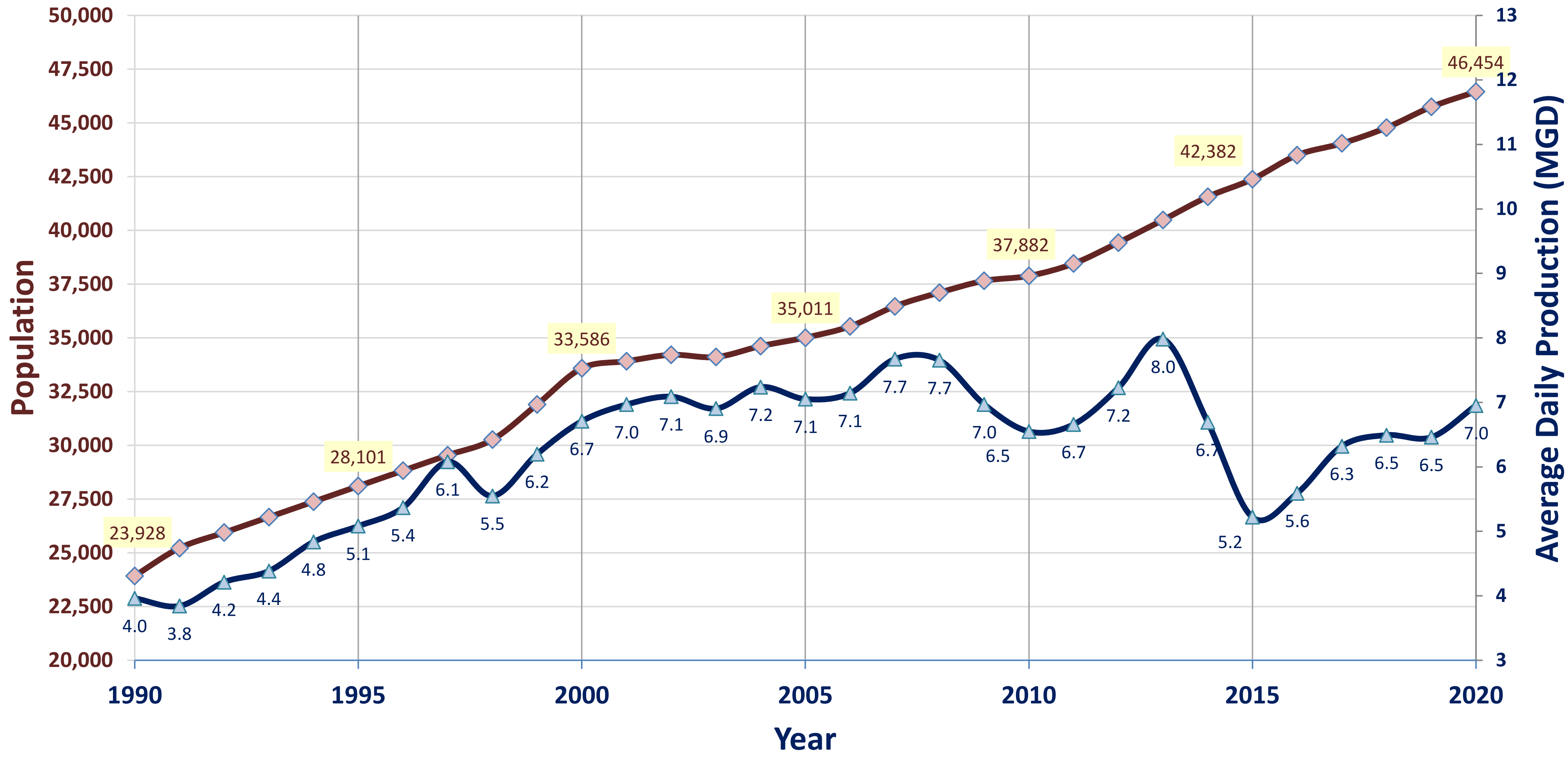
The historical domestic water consumption per capita was calculated to determine the average water use per capita per day. This was accomplished by dividing the City's historical water production, from groundwater production records and the previous master plan, by the historical population for the respective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

The City's historical per capita consumption factors, for the period 1990-2020, are listed in **Table 3.1**. The City's per capita consumption has generally varied since 1990, with a maximum per capita consumption of 210 gallons per day per capita (gpcd) in 2007 and a minimum of 123 gpcd in 2015. This recent decrease in per capita consumption is largely attributed to the City's effort of implementing water conservation measures in response to the state-wide drought. The City's 2020 actual per capita consumption was 150 gpcd, which met the 2020 water use target (159 gpcd). **Table 3.2** lists three years (2018-2020) of monthly water production in the City for the years.

Consistent with the 2017 WSMP, 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 also documented. **Figure 3.1** illustrated the historical population, between 1990 and 2020, and compares it to the average daily water production, in million gallons per day (MGD). The figure indicates that while population continues to increase, the over all production shows clear reductions, and mostly due to successful water conservation efforts. **Figure 3.2** displays a comparison between the per capita water use, in gallons per capita per day (gpdc), and the average daily water production, in MGD.

3.2 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



LEGEND

Population

Average Daily Production (MGD)

June 18, 2021

Figure 3.1

Historical Population vs. Average Daily Production

Water System Master Plan

City of Morgan Hill

CITY OF MORGAN HILL

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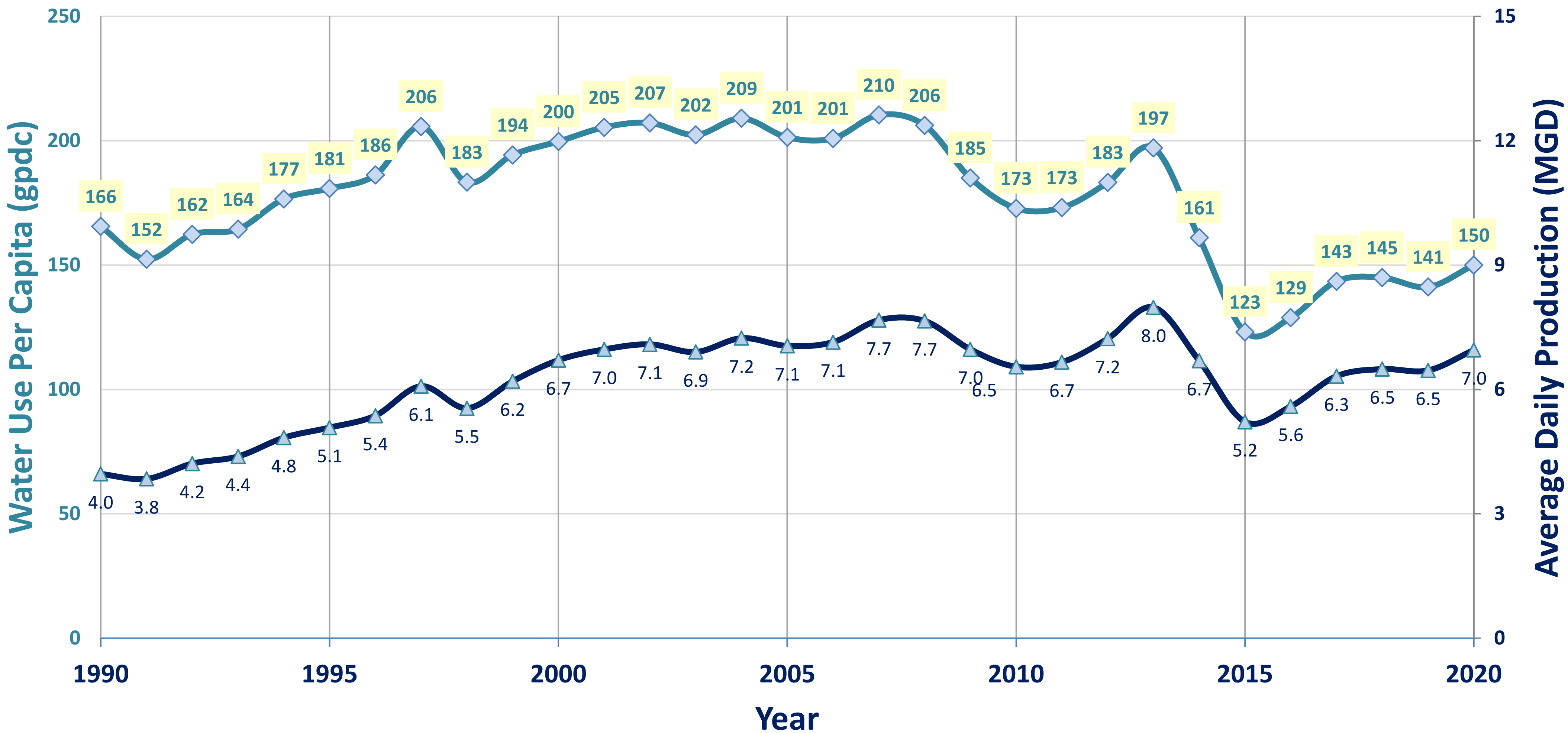

LEGEND

Per Capita Consumption (gpdc)

Average Daily Production (MGD)

June 18, 2021

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Figure 3.2

Water Use Per Capita vs. Average Daily Production

Water System Master Plan

City of Morgan Hill

Table 3.1 Historical Water Production and Maximum Day Peaking Factors (1990-2020)

Water System Master Plan

City of Morgan Hill

Year	Population[1, 2]	% Increase	Historical Water Production: Annual Production[3,4,5] (AF)	Annual Production (MGY)	Annual Production (gpm)	% Increase	Monthly Production[5,6]: Average[4] (MGM)	Monthly Maximum[2] (MGM)	Month of Occur.	Max-to-Avg Ratio	Daily Production[7]: Average[4] (MGD)	Daily Maximum[2] (MGD)	Max-to-Avg Ratio	Average Daily Water Use per Capita (gpdc)
1990	**23,928**	**1%**	4,437	1,446	2,751		121	n/a	-	-	4.0	-	-	166
1991	25,220	5%	4,303	1,402	2,668	-3%	117	n/a	-	-	3.8	-	-	152
1992	25,940	3%	4,718	1,538	2,925	10%	128	n/a	-	-	4.2	-	-	162
1993	26,661	3%	4,910	1,600	3,044	4%	133	212	August	1.59	4.4	6.8	1.55	164
1994	27,381	3%	5,417	1,765	3,358	10%	147	222	August	1.51	4.8	7.0	1.45	177
1995	**28,101**	**3%**	5,690	1,854	3,528	5%	155	255	August	1.65	5.1	7.1	1.40	181
1996	28,822	3%	6,012	1,959	3,727	6%	163	255	July	1.56	5.4	9.0	1.68	186
1997	29,542	2%	6,807	2,218	4,220	13%	185	276	July	1.49	6.1	10.7	1.76	206
1998	30,262	2%	6,214	2,025	3,852	-9%	169	282	August	1.67	5.5	10.3	1.86	183
1999	31,900	5%	6,942	2,262	4,304	12%	189	294	July	1.56	6.2	10.3	1.66	194
2000	**33,586**	**5%**	7,512	2,448	4,657	8%	204	304	August	1.49	6.7	10.6	1.58	200
2001	33,914	1%	7,802	2,543	4,837	4%	212	335	July	1.58	7.0	11.7	1.68	205
2002	34,210	1%	7,939	2,587	4,922	2%	216	343	July	1.59	7.1	11.8	1.66	207
2003	34,109	0%	7,731	2,519	4,793	-3%	210	355	July	1.69	6.9	12.9	1.86	202
2004	34,618	1%	8,105	2,641	5,025	5%	220	338	July	1.54	7.2	11.3	1.56	209
2005	**35,011**	**1%**	7,897	2,573	4,896	-3%	214	347	August	1.62	7.1	11.6	1.64	201
2006	35,535	1%	7,999	2,607	4,959	1%	217	376	July	1.73	7.1	13.5	1.89	201
2007	36,467	3%	8,592	2,800	5,326	7%	233	378	July	1.62	7.7	11.7	1.53	210
2008	37,107	2%	8,571	2,793	5,313	0%	233	341	July	1.47	7.7	12.3	1.60	206
2009	37,653	1%	7,804	2,543	4,838	-9%	212	321	August	1.51	7.0	12.2	1.75	185
2010	**37,882**	**1%**	7,333	2,390	4,546	-6%	199	336	July	1.69	6.5	12.7	1.94	173
2011	38,456	2%	7,457	2,430	4,623	2%	203	320	August	1.58	6.7	12.2	1.83	173
2012	39,432	3%	8,093	2,637	5,017	9%	220	344	July	1.57	7.2	13.1	1.81	183
2013	40,486	3%	8,938	2,913	5,541	10%	243	364	July	1.50	8.0	13.7	1.71	197
2014	41,562	3%	7,495	2,443	4,647	-16%	204	301	July	1.48	6.7	12.0	1.79	161
2015	**42,382**	**2%**	5,845	1,905	3,623	-22%	159	206	July	1.30	5.2	8.5	1.62	123
2016	43,502	3%	6,279	2,046	3,893	7%	171	266	July	1.56	5.6	9.7	1.74	129
2017	44,047	1%	7,078	2,307	4,388	13%	192	300	July	1.56	6.3	10.7	1.69	143
2018	44,780	2%	7,271	2,369	4,507	3%	197	288	August	1.46	6.5	10.7	1.65	145
2019	45,745	2%	7,234	2,358	4,485	-1%	196	294	August	1.50	6.5	12.3	1.90	141
2020	**46,454**	**2%**	7,808	2,545	4,841	8%	212	310	July	1.46	7.0	13.5	1.95	150
Historical Maximum Peaking Factors[8]														
10-Year Maximum (2011-2020)			8,938	2,913	5,541	13%	243	364	-	1.58	8.0	13.7	1.95	197
5-Year Maximum (2016-2020)			7,808	2,545	4,841	13%	212	310	-	1.56	7.0	13.5	1.95	150
3-Year Maximum (2018-2020)			7,808	2,545	4,841	8%	212	310	-	1.50	7.0	13.5	1.95	150
Last Year's Maximum (2020)			7,808	2,545	4,841	8%	212	310	-	1.46	7.0	13.5	1.95	150
Recommended Demand Peaking Factor														
2002 Water System Master Plan Criteria										1.75			2.00	200
2017 Water System Master Plan Criteria										1.75			2.00	179
2021 Water System Master Plan Criteria										**1.75**			**2.00**	159

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Notes:

1. Source: South County Regional Wastewater Authority, Wastewater Flow Projections, Table 8
2. Source: City of Morgan Hill Public Works Water Production
3. Source: City of Morgan Hill, 2010 Urban Water Management Plan
4. Average production is based on the total annual production for that year.
5. 2016 Yearly and Monthly production received from city staff 3/31/21
6. 2020 Yearly and Monthly production received from city staff 5/4/21
7. 2016 - 2020 Daily production received from city staff 6/15/21
8. The Peaking Factors conform to the Titles 17 & 22 of the California Code of Regulations, Section 64554, subsection b (California Waterworks Standards)

Table 3.2 Historical Monthly Water Production (2018-2020)

Water System Master Plan
City of Morgan Hill

Month	2018 Daily Production Average Day (MGD)	2018 Monthly Production (MGM)	2018 Monthly Percent of Annual (%)	2018 Peaking Factor Month to Avg Factor	2019 Daily Production Average Day (MGD)	2019 Monthly Production (MGM)	2019 Monthly Percent of Annual (%)	2019 Peaking Factor Month to Avg Factor	2020 Daily Production Average Day (MGD)	2020 Monthly Production (MGM)	2020 Monthly Percent of Annual (%)	2020 Peaking Factor Month to Avg Factor
January	3.66	116	5%	0.59	3.62	115	5%	0.58	3.46	111	4%	0.52
February	4.29	123	5%	0.62	3.76	107	5%	0.55	4.61	138	5%	0.65
March	3.78	110	5%	0.56	3.73	118	5%	0.60	4.67	150	6%	0.71
April	4.63	142	6%	0.72	5.53	170	7%	0.86	5.26	157	6%	0.74
May	7.38	242	10%	1.22	6.77	215	9%	1.09	7.74	244	10%	1.15
June	8.55	261	11%	1.32	8.33	240	10%	1.22	8.95	276	11%	1.30
July	9.12	288	12%	1.46	8.99	285	12%	1.45	9.83	310	12%	**1.46**
August	9.15	288	12%	**1.46**	9.32	294	12%	**1.50**	9.69	306	12%	1.44
September	8.35	254	11%	1.29	8.54	255	11%	1.30	9.01	276	11%	1.30
October	7.28	237	10%	1.20	7.93	251	11%	1.28	8.26	261	10%	1.23
November	6.13	186	8%	0.94	6.45	194	8%	0.99	5.57	171	7%	0.81
December	3.88	123	5%	0.62	3.62	115	5%	0.58	4.50	144	6%	0.68
Total		**2,369**				**2,358**				**2,545**		
Average Value	**6.49**	**197**			**6.46**	**196**			**6.95**	**212**		
Maximum Value		**288**		**1.46**		**294**		**1.50**		**310**		**1.46**

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Notes:

1. Daily production records received from city staff 6/15/21
2. Monthly production records for 2018 and 2019 received from city staff 3/31/21
3. Monthly production records for 2020 received from city staff 5/4/21

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 a sole 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 the maximum day demands with provisions for 1) one standby well for redundancy, and 2) an additional standby well needed for drought planning, and when overall well capacities are reduced due to the drought. Thus, the firm capacity of the supply wells, as defined in the this master plan, consists of excluding the two largest wells. When planning for future supply wells, this master plan assumes their capacities to average at approximately 800 gallons per minute (gpm) each. The design capacity criteria for water supply are documented on **Table 3.3**.

It should be noted that to support more resiliency to the water supply system during drought periods, and if feasible, future groundwater wells should consider a deeper design depths than current wells.

3.3 STORAGE CRITERIA

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

3.3.1 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 Planning and Design Criteria Summary

Water System Master Plan

City of Morgan Hill

Design Parameter	Criteria	
Supply	Supply to Meet Maximum Day Demands with Firm Capacity	
	Firm Capacity excludes two largest wells for possible maintenance and emergency	
	Two largest wells are currently Diana #2 and Nordstrom at approximately 2,500 gpm (3.5 MGD)	
	Assume Future Well Capacities at 800 gpm each and deeper design depth.	
Storage	Total Required Storage = Operational + Fire + Emergency	
	Operational Storage	25% of Maximum Day Demand
	Emergency Storage	25% of Maximum Day Demand
	Fire Storage	Residential = 0.18 MG (1,500 gpm for 2 hours)
		Commercial = 0.30 MG (2,500 gpm for 2 hours)
		Industrial = 0.63 MG (3,500 gpm for 3 hours)
Pump Stations	Meet Maximum Day Demand with largest unit out of service	
	Hydropneumatic systems to meet Maximum Day Demand plus fire flow	
Pressure Reducing Valves	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 (during Maximum Day)	40 psi
	Minimum Pressure (during Peak Hour)	35 psi
	Minimum Pressure for New Development[1] (during Peak Hour)	40 psi
	Minimum Residual Pressure (during Fires)	20 psi
Demand Peaking Factors	Maximum Month Demand	1.75 x Average Day Demand
	Maximum Day Demand	2.00 x Average Day Demand
	Peak Hour Demand	3.00 x Average Day Demand
Fire Flows	Residential	1,500 gpm for 2 hours
	Commercial	2,500 gpm for 2 hours
	Industrial	3,500 gpm for 3 hours
Urban Water Use Targets	2020 Target (20% Conservation)	159 gpdc
2020 Urban Water Management Plan	2020 Actual Water Use	150 gpdc

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12/3/2021

Note:

1. Source: California Department of Public Health Title 22, Chapter 16, Article 8 "Distribution System Operation"

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.

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 pressure zone and land use type, and is usually higher for commercial and industrial areas. Fire flow provisions for each pressure zone 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: 2,500 gpm for 2 hours = 0.30 MG
- Industrial: 3,500 gpm for 3 hours = 0.63 MG

Total Storage Requirement

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

Qs = 25% MDD (equalization) + fire flow (varies) + 25% MDD (emergency)

where:

Qs is the Total Required Storage, in gallons

MDD is the Maximum Day Demand, in gallons

3.4 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, Existing Development: 35 psi
  - Peak Hour Demand, Future Development: 40 psi
  - Maximum Day Demand + Fire Flow: 20 psi

3.5 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 consumption data. The demand was adjusted to balance with current production records, and to account for transmission main losses and vacancies in existing land uses. The demand unit factor was then calculated using the total water production and total number of residential and non-residential land use acreages.

This analysis generally indicates that existing residential land uses have higher consumptive use factors than that of non-residential land uses. The existing unit factor analysis is shown on **Table 3.4**. In order to account for continued water conservation efforts and future water conservation target implemented by the City, the unit factors for developing these demands were adjusted to be consistent with projected demands established in the City's 2017 WSMP.

3.6 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), the peak hour demand (PHD), and the winter demand.

The average day demand represents the annual water demand, divided by 365 days, since it is expressed in daily units. The winter demand typically represents the low month water demands and is used for simulating water quality analysis.

3.6.1 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 in the summer months in either July or August. The MMD is used primarily in the evaluation of supply capabilities.

Historical monthly water production records, obtained for the period between 1990 and 2020 (**Table 3.1**), indicate the maximum month to average month ratio ranging between 1.30 and 1.73. Over the reviewed period, this ratio neither showed significant increasing or decreasing trends. Therefore, an MMD factor of 1.75 was deemed representative of City trends. This is the same peaking factor that was used in the 2017 WSMP. The following equation is recommended for estimating the maximum month demand, given the average day demand:

Maximum Month Demand = **1.75** x Average Day Demand

3.6.2 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.

Table 3.4 Water Demand Unit Factor Analysis

Water System Master Plan

City of Morgan Hill

Land Use Classification	Development within City Limits: Number of D.U.[1]	Development within City Limits: Existing (net acre)	Average Daily Water Demand Unit Factors — Consumption: Annual Consumption (gpd)	Consumption: Balance to Consumption (gpd/DU)	Consumption: Balance to Consumption (gpd/net acre)	Production: Unaccounted-For-Water Rate[5] (%)	Production: Balance to Production (gpd/net acre)	Production: Balance to Production (gpd)	Production at 100% Occupancy: Vacancy Rate[1] (%)	Production at 100% Occupancy: Accounting for Vacancy (100% Occupancy) (gpd/DU)	Accounting for Vacancy (100% Occupancy) (gpd/net acre)	Accounting for Vacancy (100% Occupancy) (gpd)	Water Unit Factor: Factor Based on Existing Characteristics (gpd/net acre)	Water Unit Factor: Recommended Factor (Account for Future Water Conservation) (gpd/net acre)
Residential														
Residential Estate		508	294,257		579	12%	651	330,550	4.2%		678	344,483	700	560
Residential Detached Low		1,049	1,100,022		1,049	12%	1178	1,235,697	4.2%		1,228	1,287,781	1,250	1,050
Residential Detached Medium		1,298	2,183,447		1,682	12%	1889	2,452,749	4.2%		1,969	2,556,132	1,975	1,700
Residential Detached High		34	7,868		230	12%	258	8,839	4.2%		269	9,211	275	2,140
Subtotal Single Family Residential	10,687	2,889	3,585,594	336	1,241	12%	1394	4,027,834	4.2%	393	1,453	4,197,607	1,475	1,266
Residential Attached Low		394	732,368		1,859	12%	2088	822,697	4.2%		2,176	857,373	2,200	1,900
Residential Attached Medium		112	333,822		2,970	12%	3336	374,995	4.2%		3,477	390,801	3,500	2,300
Residential Attached High		6	15,312		2,640	12%	2966	17,201	4.2%		3,091	17,926	3,100	3,130
Subtotal Multi-Family Residential	2,283	512	1,081,502	474	2,111	12%	2372	1,214,892	4.2%	555	2,472	1,266,100	2,475	1,856
Non-Residential														
General Commercial		24	39,638		1,653	12%	1857	44,527	14.3%		2,123	50,895	2,125	1,800
Commercial		261	324,478		1,244	12%	1398	364,499	14.3%		1,598	416,622	1,600	1,350
Commercial / Industrial[2]		501	501,922		1,002	12%	1125	563,828	14.3%		1,286	644,455	1,300	1,120
Mixed Use		93	111,155		1,191	12%	1338	124,865	14.3%		1,529	142,721	1,550	1,350
Mixed Use Flex		70	90,131		1,297	12%	1457	101,248	14.3%		1,665	115,726	1,675	1,390
Public Facility		302	123,565		410	12%	460	138,806	14.3%		526	158,655	550	400
Subtotal Non-Residential		1,250	1,190,890		952	12%	1070	1,337,772	14.3%		1,223	1,529,074	1,225	1,038
Other (Demand Generating)														
Landscape Irrigation		201	348,121		1,729	12%	1942	391,058			1,942	391,058	1,950	1,680
Other (Non-Demand Generating)														
Other		605	0		0	12%	0	0			0	0	0	0
Total	**12,970**	**5,458**	**6,206,107**					**6,971,556**				**7,383,838**		

11/29/2021

Notes:

1. Source: Dwelling Unit counts and Residential Vacany rates, Department of Finance, Table E-5.
2. "Commercial / Industrial" combines land use types "Commercial / Institutional" and "Industrial"
3. Total water demand was based on 2019 Water Billing Records and water demand distribution was based on the 2012 Water Billing Records. These demands were verified and do not vary greatly from year to year.
4. Water production distribution was based on the 2020 Urban Water Supplier Monthly Reports.

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 1990 and 2020 ranged from 1.40 to 1.95 and occurred in July or August.

Through an analysis of these maximum day demands it was determined that a ratio of 2.0 would be used in this master plan, which is consistent with the peaking factor used in the 2017 WSMP. 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

3.6.3 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.

An industry standard peak hour to maximum day ratio of 1.5 was applied to the maximum day demand to yield the peak hour demand ratio of 3.0. This is consistent with the peaking factor used in the 2017 WSMP. The peak hour demand can then be calculated using the average day demand and the following equation:

Peak Hour Demand = **3.0** x Average Day Demand

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 and institutional areas were calculated at 2,500 gpm for two hours.
- **Category 3.** Fire flows for industrial areas were calculated at 3,500 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.

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 15 feet per second. 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, pressure zones, distribution mains, storage reservoirs, and booster pump stations.

4.1 EXISTING WATER SYSTEM OVERVIEW

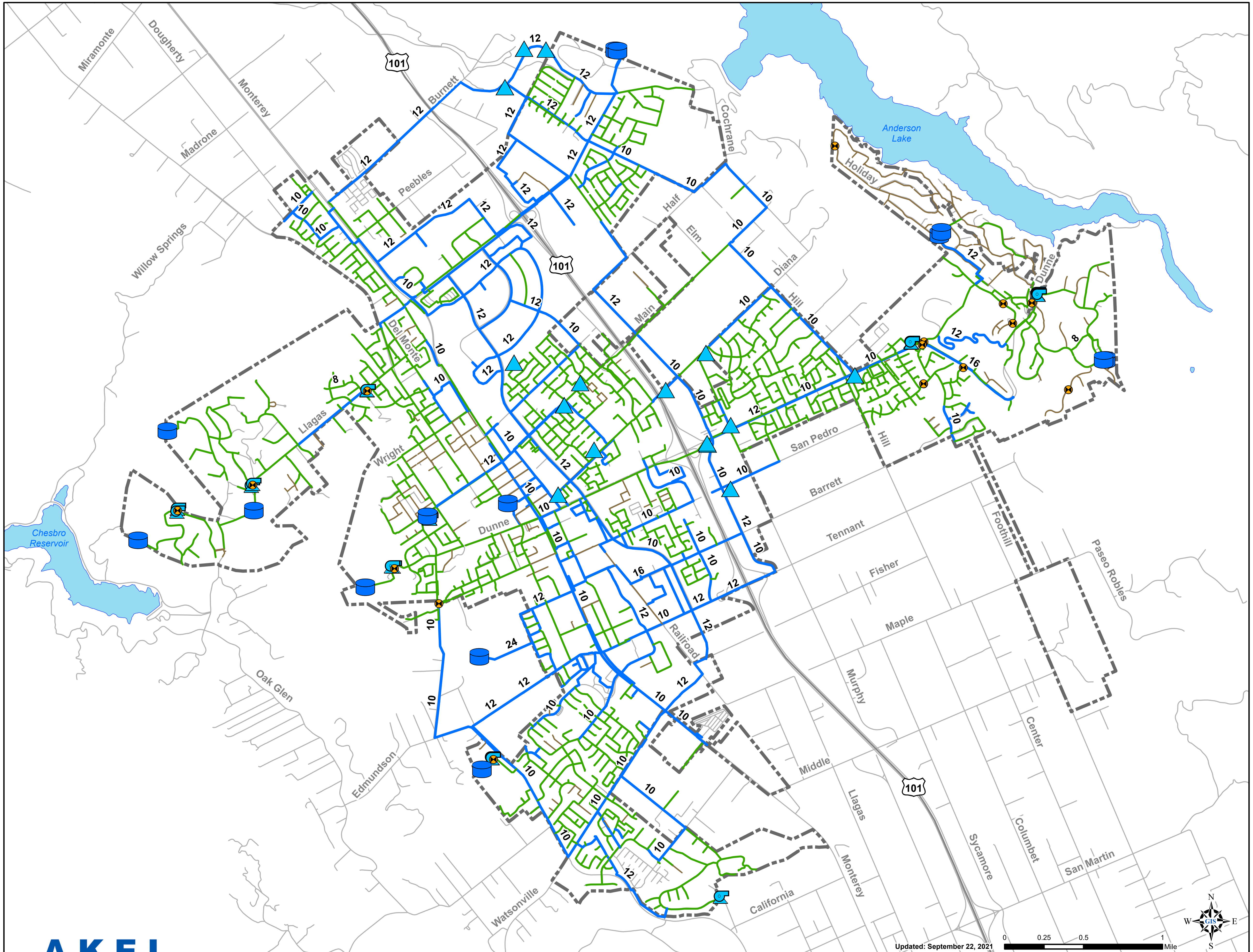
The City's municipal water system consists of 16 active groundwater wells, 12 storage tanks totaling 10.5 million gallons in storage, distribution mains, and fire hydrants. The City's existing domestic water distribution system is shown in **Figure 4.1**, which displays the existing system by pipe size. This figure provides a general color coding for the distribution mains, as well as labeling the existing wells and the storage reservoirs.

The City's topography is generally flat in the center of the City with increasing slopes on the east and west; based on this topography, the water distribution system is comprised of 21 pressure zones, which are graphically displayed in **Figure 4.2**.

4.2 SOURCE OF SUPPLY

The City currently uses groundwater as the sole source of supply. There are 16 active groundwater wells in the City that are used for supply (**Figure 4.3**). 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. With climate change increasing the likelihood of continued periods of extended drought in the future, it is prudent to construct additional deeper wells to maintain adequate water supply, while simultaneously aggressively exploring recycled water opportunities and supporting enhancements to California's water supply system. **Table 4.1** lists the City's current total tested supply at approximately 16.16 million gallons per day (MGD). Consistent with the system performance and design criteria, the firm capacity was calculated as the capacity with the largest well out of service. The firm capacity of the well supply is estimated at 12.63 MGD.

It should be noted that the Butterfield and Diana #3 well are located near the boundary of the Nob Hill and Boys Ranch pressure zone; based on the existing pipe and valve configuration this well is capable of supplying either zone depending on the operational requirements of City staff. Under typical operating conditions it provides supply to the Nob Hill pressure zone. The two options for



Legend

Existing System

- Tanks
- Booster Stations
- Wells
- Valves

Pipes by Diameter

- 6" or Less
- 8"
- 10" or Greater
- Roads
- City Limits

Figure 4.1
Existing System
Water System Master Plan
City of Morgan Hill

CITY OF MORGAN HILL

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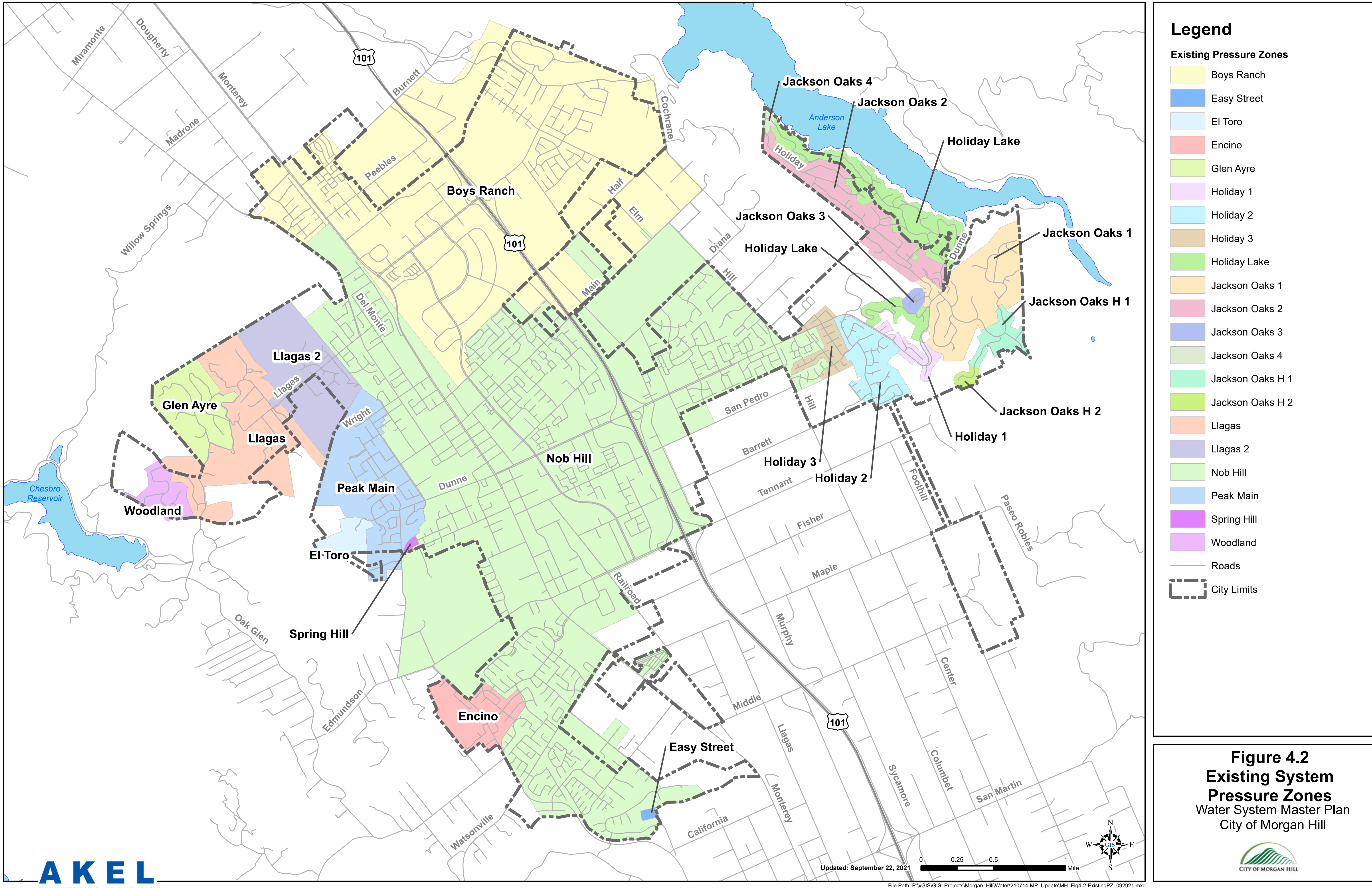
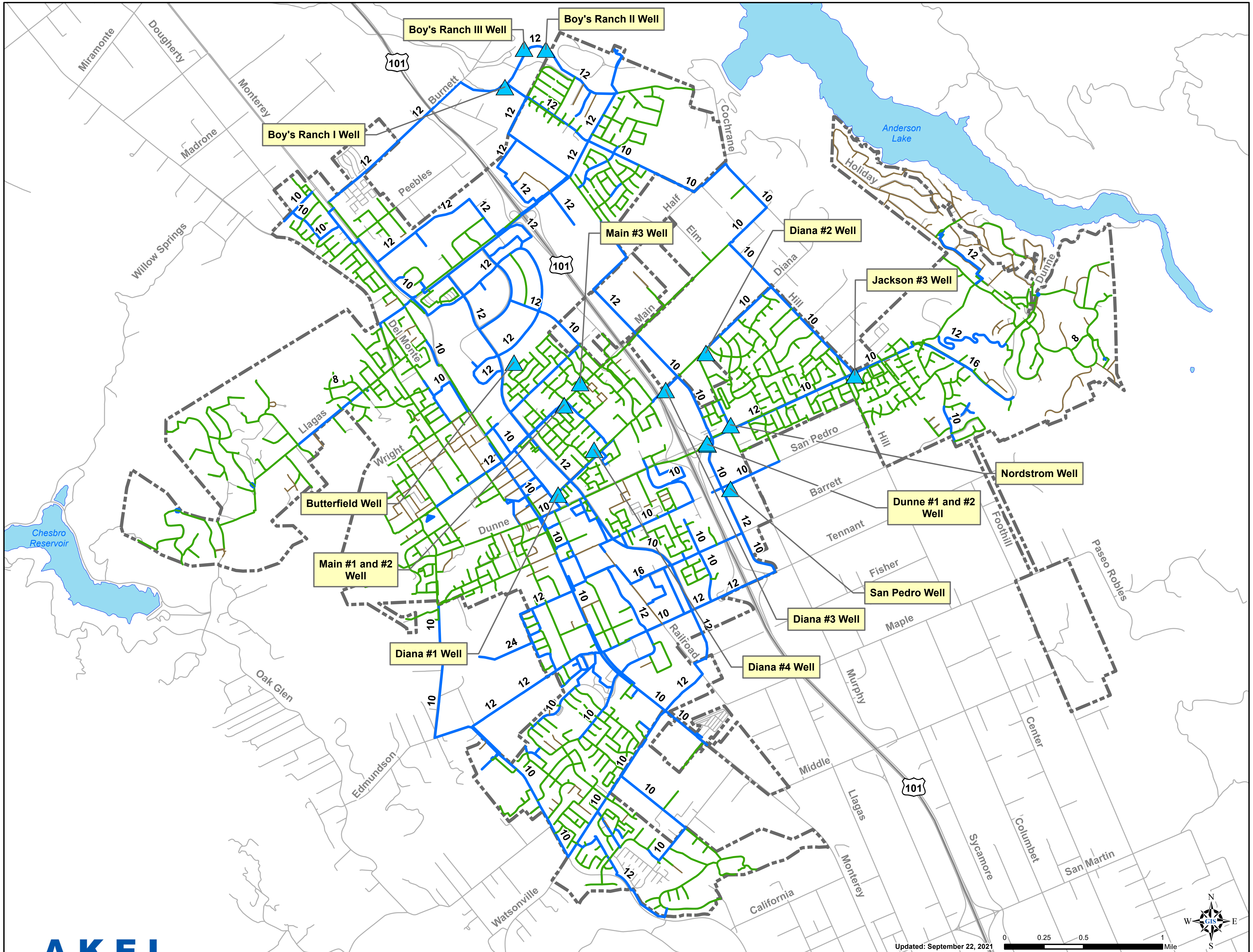


Figure 4.2
Existing System Pressure Zones
Water System Master Plan
City of Morgan Hill

CITY OF MORGAN HILL



Legend

Existing System

Wells

Pipes by Diameter

6" or Less

8"

10" or Greater

Roads

City Limits

Figure 4.3
Existing Wells
Water System Master Plan
City of Morgan Hill

CITY OF MORGAN HILL

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Table 4.1 Existing Groundwater Supply Capacity
Water System Master Plan
City of Morgan Hill

Supply Well	Design Capacity				Additional Information			
	Rated		Tested[1]		Date Drilled[2]	HP[1]	Head[1]	Ground Elevation[2]
	(gpm)	(MGD)	(gpm)	(MGD)	(ft)	(HP)	(ft)	(ft)
Boy's Ranch Pressure Zone (HWL = 563 feet)								
Boys Ranch # 1	875	1.26	**801**	1.15	1982	150	379	381
Boys Ranch # 2	800	1.15	**550**	0.79	2015	60	435	389
Boys Ranch # 3	735	1.06	**612**	0.88	2014	60	411	384
Nob Hill Pressure Zone (HWL = 516 feet)								
Butterfield	500	0.72	**609**	0.88	2004	60	294	359
Diana # 1	800	1.15	**884**	1.27	2013	100	253	344
Diana # 2	1,200	1.73	**1,373**	1.98	1986	150	307	374
Diana # 3	500	0.72	**370**	0.53	1998	60	349	366
Diana # 4	960	1.38	**520**	0.75	2009	75	256	357
Dunne # 1	350	0.50	**315**	0.45	1965	40	323	358
Dunne # 2	550	0.79	**497**	0.72	1997	75	336	358
Jackson # 3	600	0.86	**679**	0.98	2015	100	343	371
Main # 1[3]	700	1.01	**744**	1.07	Pre 1950	125	255	359
Main # 2	925	1.33	**1,010**	1.45	2002	125	260	359
Main # 3	500	0.72	**669**	0.96	2015	60	242	367
Nordstrom	950	1.37	**1,081**	1.56	1999	125	333	362
San Pedro	600	0.86	**508**	0.73	2002	75	344	352
Total and Firm Supply Capacity								
Total Supply Capacity	11,545	16.62	**11,222**	**16.16**				
Firm Capacity (Excluding two largest supply wells)	9,395	13.53	**8,768**	**12.63**				

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11/29/2021

Notes:

1. Source: "2021 Well Efficiency Report", received from City staff on October 18, 2021.
2. Source: Existing Groundwater Supply Capacity table provided by City Stuff on July 21, 2021.
3. Main #1 tested well capacity data extrated from 2020 Well Efficiency Report, received from City staff on July 29, 2021.

supplementing the Boy's Ranch pressure zone with water from the Nob Hill zone are further discussed in Chapter 7.

4.3 PRESSURE ZONES

The City's current water system serves land ranging from approximately 320 feet above sea level to more than 1,100 feet. To adequately provide water in this service area requires the creation of multiple pressure zones that operate with varying pressures between 45 and greater than 100 psi. **Figure 4.2** shows the boundaries and names for these pressure zones.

The City's supply, and a majority of the service connections, are located in the Nob Hill and Boys Ranch pressure zones. Several gate valve interconnections between the Nob Hill and Boys Ranch pressure zones exist, which allow water to transfer between the zones; under typical operating conditions these gate valves remain closed.

4.4 WATER DISTRIBUTION PIPELINES

Groundwater is pumped into the City's distribution system via more than 187 miles of pipeline. As the City's sole source of supply is groundwater, which is distributed throughout the domestic water system, there are no dedicated transmission systems in the City. The pipelines are generally 24-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 4.2**. For each pipe diameter, the inventory lists the length in feet, as well as the total length in units of miles. **Table 4.3** documented the pipe roughness coefficients used in this analysis.

4.5 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 existing storage reservoirs are geographically shown in **Figure 4.4**.

The City's existing storage reservoirs are summarized in **Table 4.4**, along with their volumes, construction year and type, height, diameter, bottom elevations, and overflow height and elevations. These reservoirs are also shown on the hydraulic profile schematic (**Appendix A**), with key hydraulic data including the hydraulic water level (HWL), tank capacities, tank pad elevation, groundwater wells and their capacities.

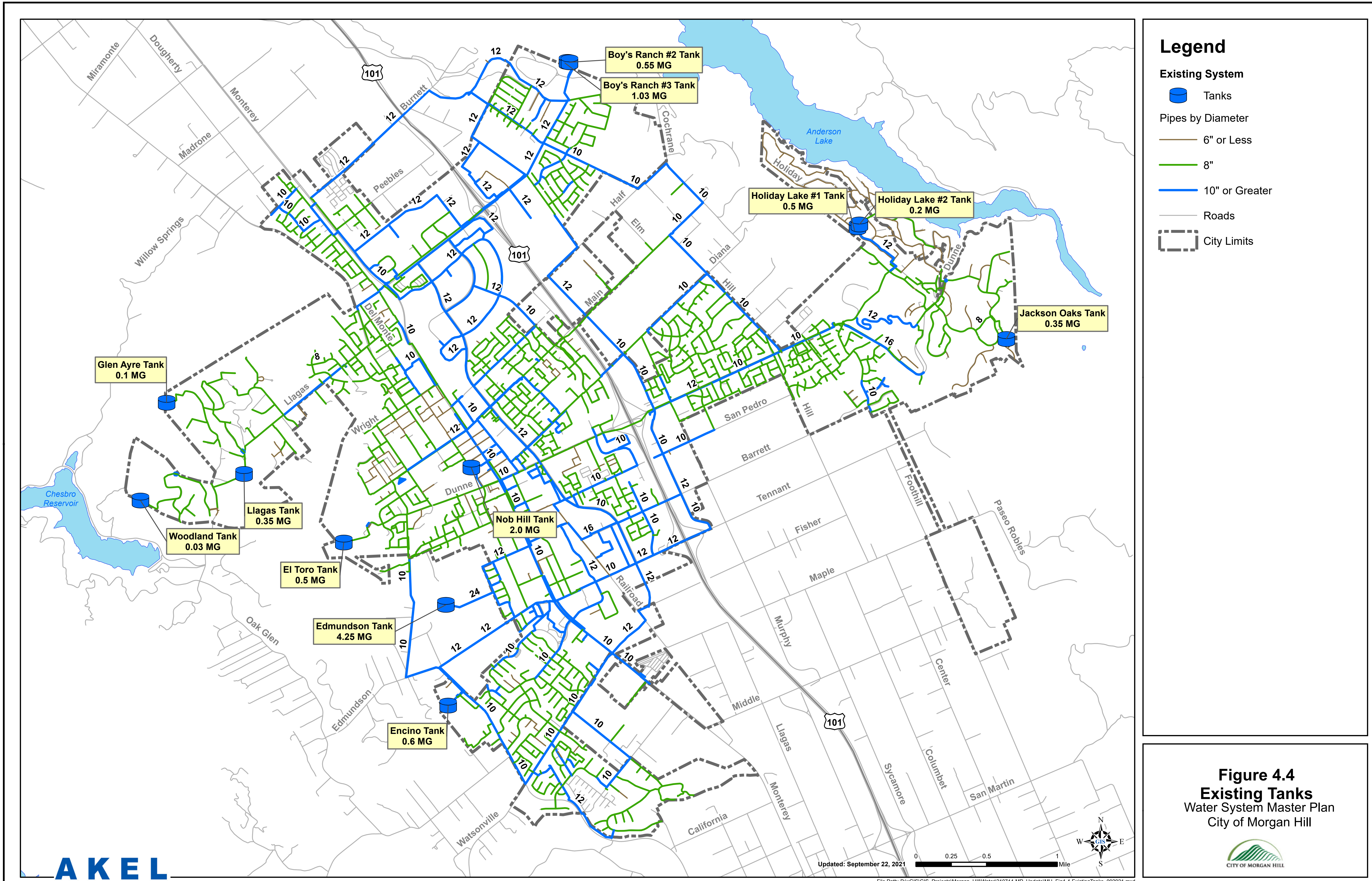

Figure 4.4
Existing Tanks
Water System Master Plan
City of Morgan Hill

Table 4.2 Existing Modeled Pipe Inventory
Water System Master Plan
City of Morgan Hill

Pipe Size	Length	
(in)	(feet)	(miles)
2	1,172	0.2
4	9,156	1.7
6	91,394	17.3
8	583,702	110.5
10	165,408	31.3
12	121,577	23.0
14	4,437	0.8
16	12,308	2.3
24	2,062	0.4
Total	**991,216**	**187.7**

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11/10/2021

Table 4.3 Pipe Roughness Coefficients
Water System Master Plan
City of Morgan Hill

Pipe Material	Age (years)					
	0	10	20	30	40	50
Asbestos Cement	125	125	125	125	125	125
Cast Iron	120	110	100	90	85	80
Ductile Iron	130	125	120	115	110	105
Plastic (PVC)	145	145	140	140	135	135
Steel	130	120	110	100	90	80

Note: 5/12/2021

1. At age=0, the roughness coefficients are commonly used values for new pipes. Roughness coefficients decrease with age at a rate that depends on pipe material. For planning purposes, the hydraulic analysis assumed an average pipe age of 15-20 years for both existing and future scenarios.
2. Pipes with an unknown material or age were assigned a roughness coefficient of 111 or 121.

Table 4.4 Existing Storage Reservoirs

Water System Master Plan

City of Morgan Hill

Reservoir	Pressure Zone	Volume[1] (MG)	Date of Construction	Construction Type	Height (ft)	Diameter (ft)	Bottom Elevation (ft)	Overflow Height (ft)	Overflow Elevation (ft)
Boy's Ranch # 2	Boy's Ranch Zone	0.55	1977	Steel	32.0	54	533	30	563
Boy's Ranch # 3	Boy's Ranch Zone	1.03	2005	Steel	32.0	74	533	30	563
Edmundson	Nob Hill Zone	4.25	2002	Steel	49.0	125	473	46	519
El Toro	El Toro Zone	0.50	1966	Steel	37.5	48	983	37	1,020
Encino	Encino Zone	0.60	1974	Steel	21.0	70	640	20	660
Glen Ayre	Glen Ayre Zone	0.10	1980	Steel	15.0	34.3	900	14	914
Holiday Lake # 1	Holiday Lake Zone	0.50	1980	Concrete	12.0	92	960	11	971
Holiday Lake # 2	Holiday Lake Zone	0.20	1962	Concrete	12.0	60	960	11	971
Jackson Oaks	Jackson Oaks Zone No. 1	0.35	1970	Steel	32.0	44	1,170	30	1,200
Llagas	Llagas Zone	0.35	1965	Steel	27.2	48	700	26	726
Nob Hill	Nob Hill Zone	2.00	1980	Steel	45.5	90	473	41	513
Woodland	Woodland Zone	0.03	1968	Steel	17.0	18	1,079	17	1,096
Total		**10.5**							

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7/21/2021

Note:

1. Source: City of Morgan Hill, Email received 07/21/2021

4.6 BOOSTER STATIONS

Water is conveyed from the lower supply pressure zones to the higher pressure zones via a series of booster pump stations (**Figure 4.5**). There are a total of 13 booster stations in the City and **Table 4.5** lists their ground elevation, source and destination pressure zones, total pump capacities, and additional station information.

4.7 PRESSURE REDUCING VALVES

Some pressure zones are served from higher pressure zones through pressure reducing valves (PRVs), which are summarized on **Table 4.6** depicted in **Figure 4.6**. PRVs constructed at pressure zone intersections, allow the conveyance of water from higher pressure zones to the lower pressure zones in the City. Additionally, some PRVs provide a source of emergency supply to lower pressure zones in the case of booster station failure or other operational issue. The City currently operates 15 pressure reducing valves throughout its water system.

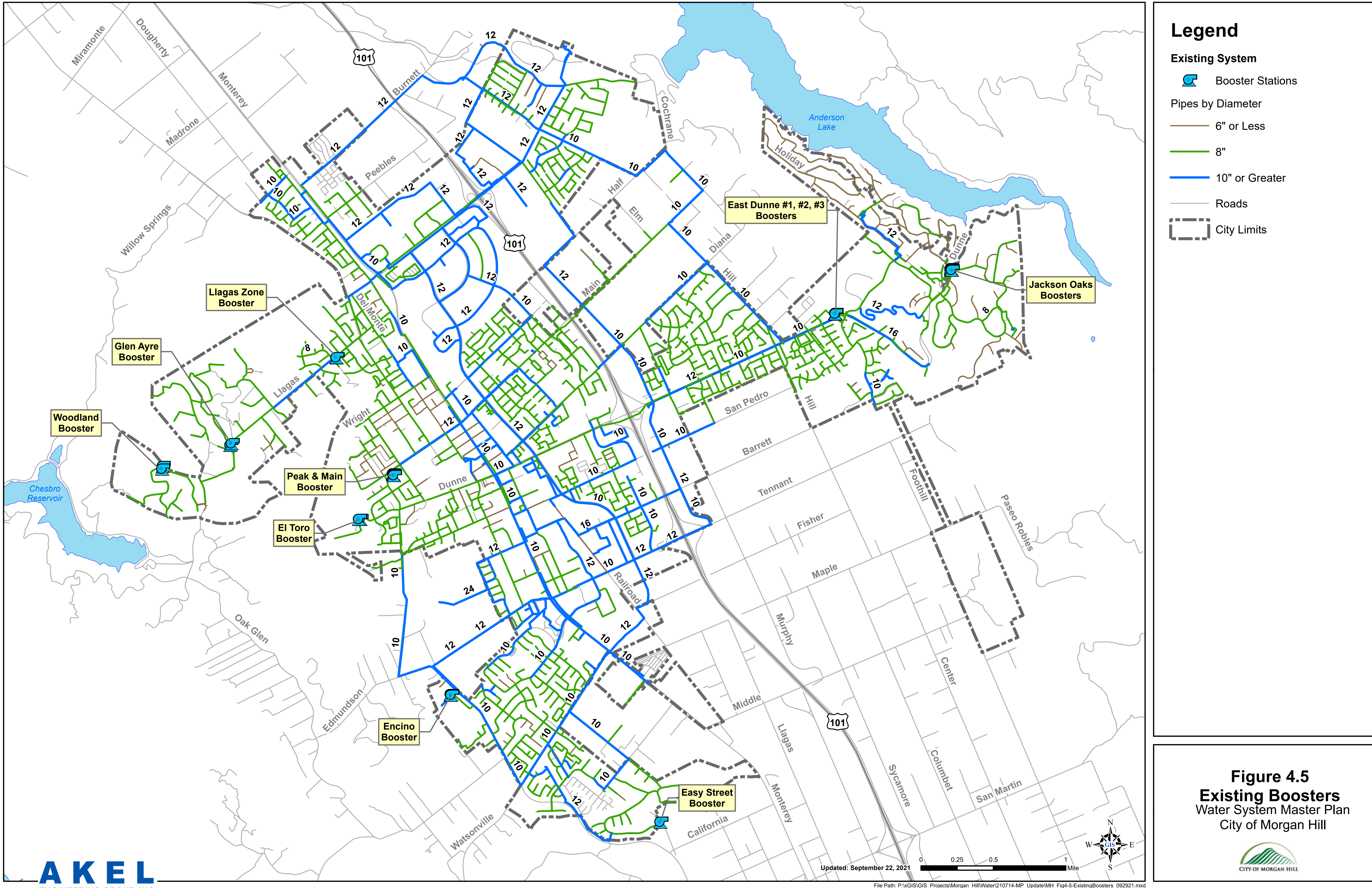
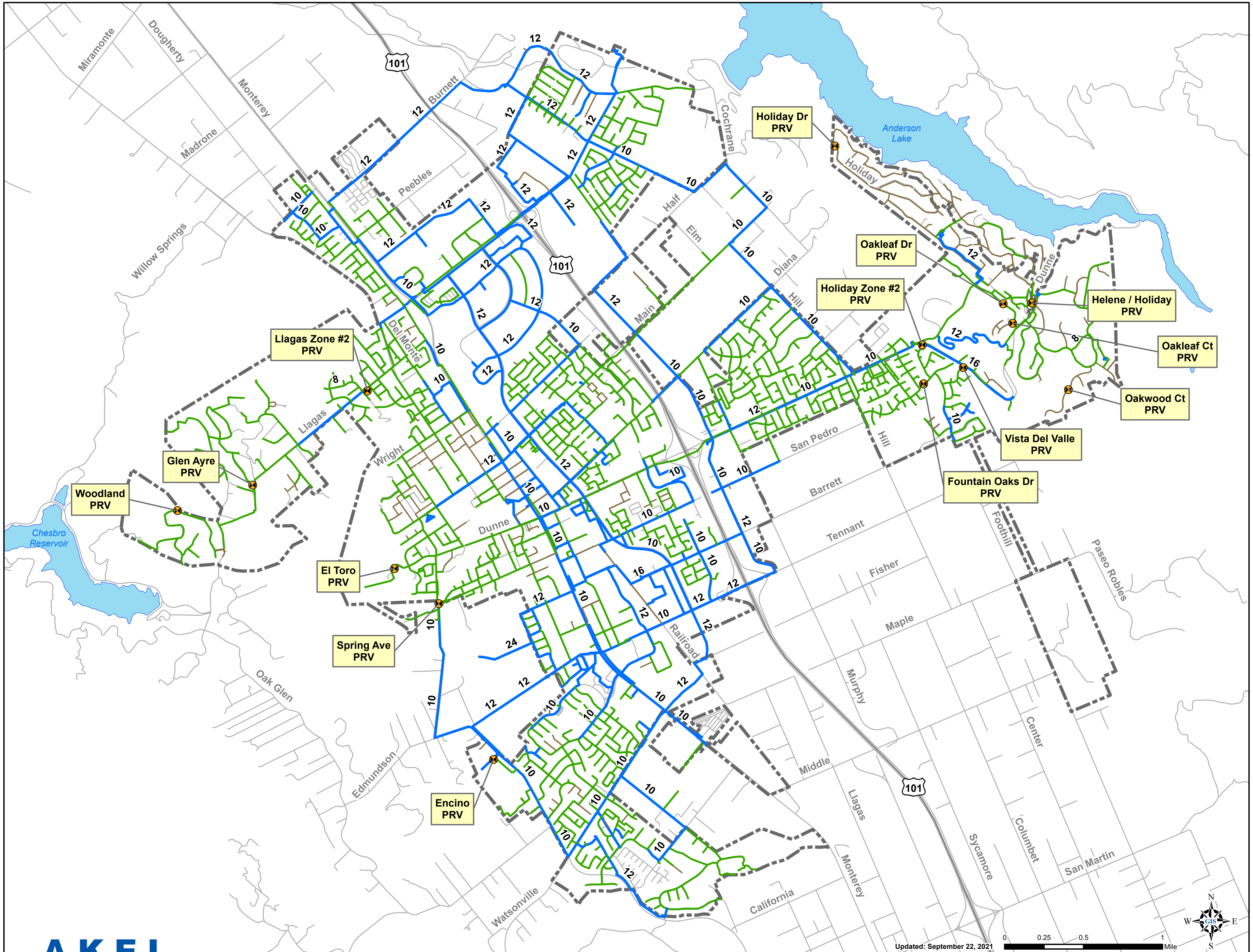


Figure 4.5
Existing Boosters
Water System Master Plan
City of Morgan Hill



Legend

Existing System

- Valves

Pipes by Diameter

- 6" or Less
- 8"
- 10" or Greater
- Roads
- City Limits

Figure 4.6
Existing PRVs
Water System Master Plan
City of Morgan Hill

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CITY OF MORGAN HILL

Table 4.5 Existing Booster Stations

Water System Master Plan
City of Morgan Hill

Booster Station	Ground Elevation (ft)	Pressure Zones: Source Pressure Zone	Pressure Zones: Destination Pressure Zone	Pressure Zones: Destination HWL (ft)	Booster Station Information: Total Pump Capacity[1] (gpm)	Total Pump Capacity[1] (mgd)	Design Head[2] (ft)	Pump Station Horsepower (hp)	No. of Pumps	Individual Pumps Information: Firm capacity	Pump No.	Individual Horsepower (hp)	Design Capacity (gpm)	Design Head (ft)	Pump Test[3] Capacity (gpm)	Pump Test[3] Head (ft)
East Dunne # 1	430	Nob Hill	Holiday Lake Zone	911	1,800	2.59	400	375	3	1200	1A	125	600	400	583	487.4
											1B	125	600	400	717	438.9
											1C	125	600	400	554	432
East Dunne # 2	430	Nob Hill	Holiday Zone #1	864	400	0.58	340	50	2	200	2A	25	200	340	180	335
											2B	25	200	340	186	335
East Dunne # 3	430	Nob Hill	Holiday Zone #2	568	925	1.33	100	40	2	425	3A	20	425	100	669	106.3
											3B	20	500	100	653	110.9
Easy Street	335	Nob Hill	Easy Street Zone	535	n/a	n/a	250	1.5	1		A	1.5	n/a	250	n/a	75-110-psi
El Toro	520	Peak and Main	El Toro	1,020	380	0.55	340	80	2	190	A	40	190	340	215	353.4
											B	40	190	340	244	362.7
Encino Booster	415	Nob Hill	Encino	660	900	1.30	150	50	2	450	A	25	450	150	469	152.5
											B	25	450	150	460	152.5
Glen Ayre Booster	660	Llagas	Glen Ayre Zone	908	330	0.48	200	30	2	165	A	15	165	200	179	173.3
											B	15	165	200	191	173.3
					Domestic Service Pumps											
Hydropneumatic Booster	1,170	Jackson Oaks	Hydropneumatic Zone	1,380	210	0.30	220	22.5	3	140	A	7.5	70	220	20	161.7
											B	7.5	70	220	13	161.7
											C	7.5	70	220	18	161.7
San Pedro					**Fire Flow Pump**											
					1,500	2.16	170	75	1		A	75	375	170	16	191.7
Jackson Oaks Booster	830	Holiday Lake	Jackson Oaks Zone	1,200	970	1.40	250	150	3	620	A	50	350	250	552	256.4
											B	50	320	250	567	254.1
											C	50	300	250	518	270.3
Llagas Booster	365	Nob Hill	Llagas Zone	726	750	1.08	250	80	2	300	A	50	450	250	504	254.1
											B	30	300	250	281	240.2
Peak and Main Booster	370	Nob Hill	Peak and Main Zone	660	2,050	2.95	200	160	4	1350	A	50	700	200	720	191.7
											B	50	650	200	672	191.7
											C	30	350	200	268	180.2
											D	30	350	200	473	180.2
Woodland Booster	620	Llagas	Woodland Zone	1,086	430	0.62	320	90	2	140	A	50	290	320	249	353.4
											B	40	140	320	170	348.8

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9/27/2021

Notes:

1. Source: Water System Schematic dated 4/2003.
2. Source: City of Morgan Hill 2002 Water System Master Plan.
3. Source: Booster Efficiency Report received from City Staff on 07/29/2021.

Table 4.6 Existing Pressure Reducing Valves

Water System Master Plan

City of Morgan Hill

PRV	Location	Size (in)	Pressure Zone	
			Upstream	Downstream
El Toro	El Toro Booster	6	El Toro	Peak and Main
Encino	Encino Booster	8	Encino	Nob Hill
Fountain Oak	2270 Fountain Oaks No. 1	8	Holiday 2	Holiday 3
Glen Ayre	Glen Ayre Booster Pump	4	Glen Ayre	Llagas
Helene/Holiday	Jackson Oaks 1 to Jackson Oaks 2	6	Jackson Oaks 1	Jackson Oaks 2
Holiday Dr	Jackson Oaks 4	4	Jackson Oaks 2	Jackson Oaks 4
Holiday Zone #1	Holiday Lake to Holiday 1	6	Holiday Lake	Holiday 1
Holiday Zone #2	Holiday Lake to Holiday 2	6	Holiday Lake	Holiday 2
Llagas Zone #2	Llagas Booster	6	Llagas	Nob Hill
Oak Leaf Ct	Jackson Oaks 3	4	Jackson Oaks 1	Jackson Oaks 3
Oak Leaf Dr	17015 Oakleaf Drive	8	Jackson Oaks 1	Jackson Oaks 2
Oakwood Ct	3420 Oakwood Court	6	Jackson Oaks Hydro 1	Jackson Oaks Hydro 2
Spring Ave	Spring Ave and De Witt Ave	6	Peak and Main	Spring Hill
Vista Del Valle	2885 Vista Del Valle No. 1	4	Holiday 1	Holiday 2
Woodland	Woodland Booster Pump	6	Woodland	Llagas

CHAPTER 5 – DOMESTIC WATER DEMANDS

This chapter summarizes existing domestic water demands, identifies potential recycled 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 2012 water billing consumption records as well as total annual production in 2020. The existing water demands in this analysis are adjusted to match the annual production records and account for system losses.

The existing demand distribution, by pressure zone, was obtained from the water billing records. Using GIS, each customer account was geocoded to its physical location within its existing pressure zone. The accounts were then sorted by pressure zone 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 7.0 mgd to reflect the total 2020 production and account for transmission main losses. The existing domestic water demands, for each pressure zone, are summarized on **Table 5.1**.

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 Urban Growth Boundary. **Table 5.2** organizes the future land use categories and their corresponding domestic water demands. It should be noted that the existing domestic water demands in **Table 5.2** 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 9.4 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. **Table 5.3** summarizes the buildout water demand for each pressure zone.

Table 5.1 Existing Demands by Pressure Zone

Water System Master Plan

City of Morgan Hill

Pressure Zone	Average Day Demand (gpm)	Existing Water Demands	
		Maximum Day[1] (gpm)	Peak Hour[2] (gpm)
Central Pressure Zones			
Boy's Ranch	918	1,835	2,753
Nob Hill	2,938	5,876	8,815
Subtotal	3,856	7,712	11,567
West Side Pressure Zones			
Easy Street	3	5	8
El Toro	1	3	4
Encino	82	164	246
Glen Ayre	34	68	101
Llagas	76	151	227
Llagas #2	62	123	185
Peak and Main	179	358	538
Spring Hill	4	8	13
Woodland	12	23	35
Subtotal	452	904	1,356
East Side Pressure Zones			
Holiday Lake Zone	90	180	271
Holiday Zone #1	17	34	51
Holiday Zone #2	109	219	328
Holiday Zone #3	58	117	175
Jackson Oaks HPZ #1	24	48	73
Jackson Oaks HPZ #2	7	14	20
Jackson Oaks Zone #1	108	216	324
Jackson Oaks Zone #2	106	212	318
Jackson Oaks Zone #3	8	16	24
Jackson Oaks Zone #4	5	10	15
Subtotal	533	1,066	1,600
Total Demand	**Average Day**	**Maxmium Day**	**Peak Hour**
Total	4,841	9,682	14,523

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10/1/2021

Notes :

1. Maximum Day Demand = 2.0 x Average Day Demand
2. Peak Hour Demand = 3.0 x Average Day Demand

Table 5.2 Average Daily Demands at Buildout of Project Area
Water System Master Plan
City of Morgan Hill

Land Use Classifications	Water Demands at 100% Occupancy													
	Existing Development within City Limits			Future Development within City Limits			Total Development within City Limits		Total Development Outside City Limits		Total	
	Existing Development within City Limits (net acre)	Water Unit Factor (gpd/net acre)	Existing Average Daily Demand (gpd)	Future Development (net acre)	Future Water Unit Factor (gpd/net acre)	Future Development Average Daily Demand (gpd)	Development (net acre)	Total Development Average Daily Demand (gpd)	Development (net acre)	Total Development Average Daily Demand (gpd)	Development (net acre)	Average Daily Demand (gpd)
Residential												
Single Family												
Residential Estate	508	560	284,420	198	560	110,769	706	395,189	321	179,976	1,027	575,166
Residential Detached Low	1,049	1,050	1,101,152	102	1,050	106,639	1,150	1,207,791	239	250,528	1,389	1,458,319
Residential Detached Medium	1,298	1,700	2,207,096	141	1,700	239,155	1,439	2,446,251	411	699,255	1,850	3,145,506
Residential Detached High	34	2,140	73,204	0	2,140	737	35	73,941	20	41,858	54	115,799
Multi-Family												
Residential Attached Low	394	1,900	748,663	61	1,900	115,287	455	863,951	2	4,117	457	868,068
Residential Attached Medium	112	2,300	258,522	40	2,300	92,218	152	350,740	7	16,903	160	367,644
Residential Attached High	6	3,130	18,154	0	3,130	1,512	6	19,666	0	0	6	19,666
Subtotal	3,401		4,691,212	542		666,317	3,943	5,357,529	1,000	1,192,638	4,943	6,550,167
Non-Residential												
General Commercial	24	1,800	43,161	0	1,800	0	24	43,161	0	0	24	43,161
Commercial	261	1,350	352,009	129	1,350	174,292	390	526,301	4	4,995	394	531,296
Commercial / Industrial[1]	501	1,120	561,296	230	1,120	257,950	731	819,245	220	246,298	951	1,065,543
Mixed Use	93	1,350	125,991	6	1,350	8,242	99	134,233	0	0	99	134,233
Mixed Use Flex	70	1,390	96,621	35	1,390	48,619	104	145,240	8	11,421	113	156,661
Sports-Recreation-Leisure	0	1,680	0	0	1,680	0	0	0	251	421,974	251	421,974
Public Facility	302	400	120,658	12	400	4,694	313	125,352	46	18,556	360	143,908
Subtotal	1,250		1,299,735	412		493,797	1,663	1,793,532	529	703,244	2,192	2,496,776
Other (Demand Generating)												
Landscape Irrigation[2]	201	1,680	338,263	0	1,680	0	201	338,263	0	0	201	338,263
Subtotal	201		338,263	0		0	201	338,263	0	0	201	338,263
Other (Non-Demand Generating)												
Open Space	605	0	0	581	0	0	1,186	0	2,737	0	3,922	0
Subtotal	605		0	581		0	1,186	0	2,737	0	3,922	0
Totals	**5,458**		**6,329,210**	**1,535**		**1,160,114**	**6,992**	**7,489,325**	**4,267**	**1,895,882**	**11,259**	**9,385,206**

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11/29/2021

Note:
1. "Commercial / Industrial" combines land use types "Commercial / Institutional" and "Industrial"
2. Area of Landscape Irrigation does not include single family residential irrigation use.

Table 5.3 Buildout Demands by Pressure Zone

Water System Master Plan
City of Morgan Hill

Pressure Zone	Average Day Demand (gpm)	Buildout Water Demands	
		Maximum Day[1] (gpm)	Peak Hour[2] (gpm)
Central Pressure Zones			
Boy's Ranch	1,334	2,668	4,002
Nob Hill	3,998	7,996	11,993
Subtotal	5,332	10,663	15,995
West Side Pressure Zones			
Easy Street	2	5	7
El Toro	1	3	4
Encino	87	175	262
Glen Ayre	32	64	95
Llagas	98	196	294
Llagas #2	96	191	287
Peak and Main	189	378	567
Spring Hill	4	8	11
Woodland	12	25	37
Subtotal	522	1,043	1,565
East Side Pressure Zones			
Holiday Lake Zone	92	184	276
Holiday Zone #1	28	55	83
Holiday Zone #2	233	467	700
Holiday Zone #3	60	121	181
Jackson Oaks HPZ #1	26	52	78
Jackson Oaks HPZ #2	6	12	18
Jackson Oaks Zone #1	101	202	304
Jackson Oaks Zone #2	97	194	291
Jackson Oaks Zone #3	7	14	21
Jackson Oaks Zone #4	5	9	14
Subtotal	655	1,311	1,966
Total Demand	**Average Day**	**Maxmium Day**	**Peak Hour**
Total	6,508	13,017	19,525

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Notes :

1. Maximum Day Demand = 2.0 x Average Day Demand
2. Peak Hour Demand = 3.0 x Average Day Demand

5.4 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 3.0, 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 Urban Growth Boundary are 18.7 mgd and 28.1 mgd, respectively, as summarized in **Table 5.3**.

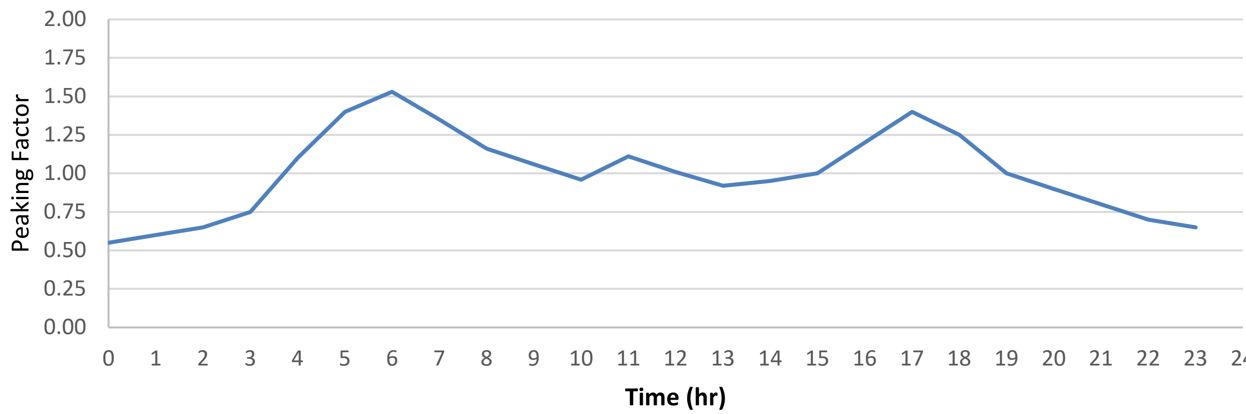
5.5 DIURNAL DEMAND PATTERNS

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 are unit factors that are applied to the demand, and which reflect the variable hourly fluctuation. This diurnal fluctuation affects the hourly water levels in storage reservoirs and amount of hourly flow through distribution mains and pump stations.

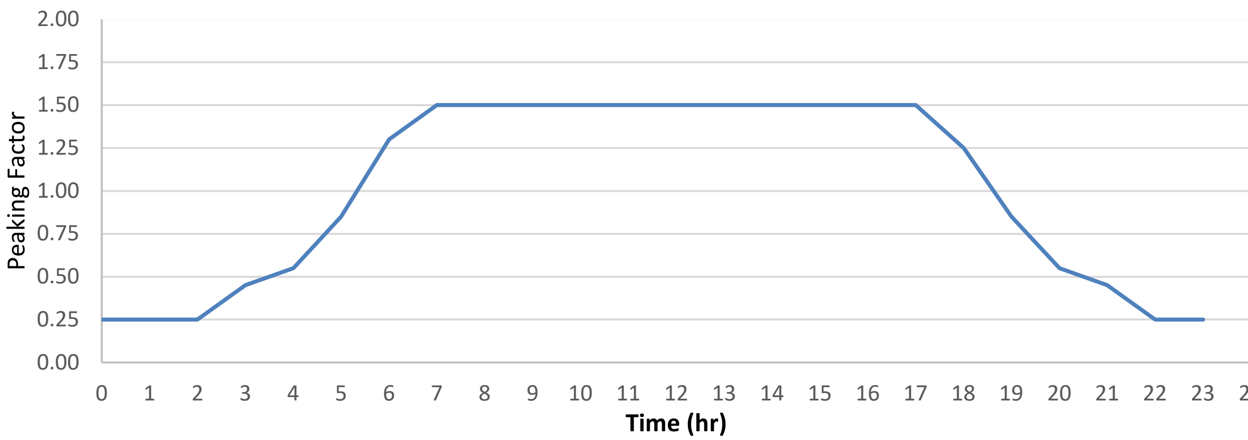
Three different diurnal curves (**Figure 5.1**) were used to model the demand patterns of 1) residential, 2) commercial, industrial, and other non-residential, and 3) irrigation use accounts. In the absence of data that can be used to develop these curves, they were based on industry acceptable demand patterns for these corresponding land use types. The diurnal patterns were confirmed during the calibration effort of the City's hydraulic model and corresponding SCADA information.

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. The irrigation demands are highest at night and lowest during the day.

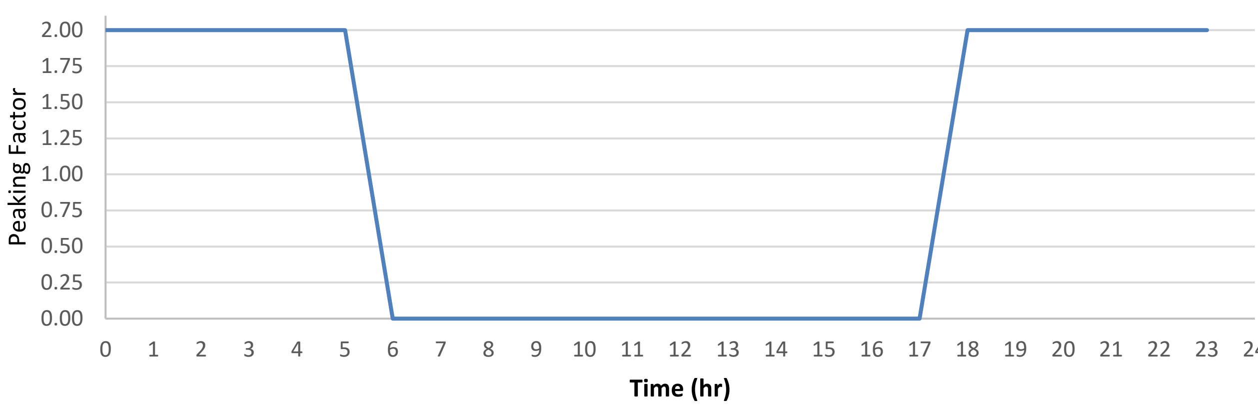
Residential



Commercial



Irrigation



LEGEND

Water Demand

May 12, 2021

Figure 5.1

Diurnal Curves

Water System Master Plan

City of Morgan Hill

CITY OF MORGAN HILL

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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.

The City's previous model was developed using Innovyze's (previously MWHSoft) InfoWater, GIS based-based hydraulic model. As part of this master plan, the hydraulic model has been updated to the GIS-based hydraulic model InfoWater Pro 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 Skeletonization

Skeletonizing the model refers to the process where pipes not essential to the hydraulic analysis of the system are stripped from the model. Skeletonizing the model is useful in creating a system that accurately reflects the hydraulics of the pipes within the system, while reducing complexities of large systems, which will reduce the time of analysis while maintaining accuracy, but will also comply with limitations imposed by the computer program.

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 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 maintained by staff in GIS, as well as the previously developed hydraulic model and subsequent updates.

After reviewing the available data sources, the hydraulic model was updated and verified by City staff. Using the existing GIS version of the system, as well as the existing hydraulic model, this project updated the domestic water system in GIS. Resolving discrepancies in data sources was accomplished by graphically identifying identified discrepancies and submitting it to engineering and public works staff for review and comments. City comments were incorporated in the verified model.

6.3.4 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 Urban Growth Boundary 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 CALIBRATION

Calibration is intended to instill a level of confidence in the pressures and flows that are simulated. Calibration generally consists of comparing model predictions to field measured results and making necessary adjustments.

6.4.1 Calibration Plan and SCADA

In order to calibrate the hydraulic model pressure SCADA data was collected for monitored locations throughout the water distribution system, including tanks, wells, and booster stations. City staff provided 1-hour pressure data for each groundwater well and booster station as well as 1-hour water level data for the City's storage reservoirs, for a portion of the month of June to July 2021. The locations that were included in the calibration for tanks, booster stations, and wells were identified on **Figure 6.1**.

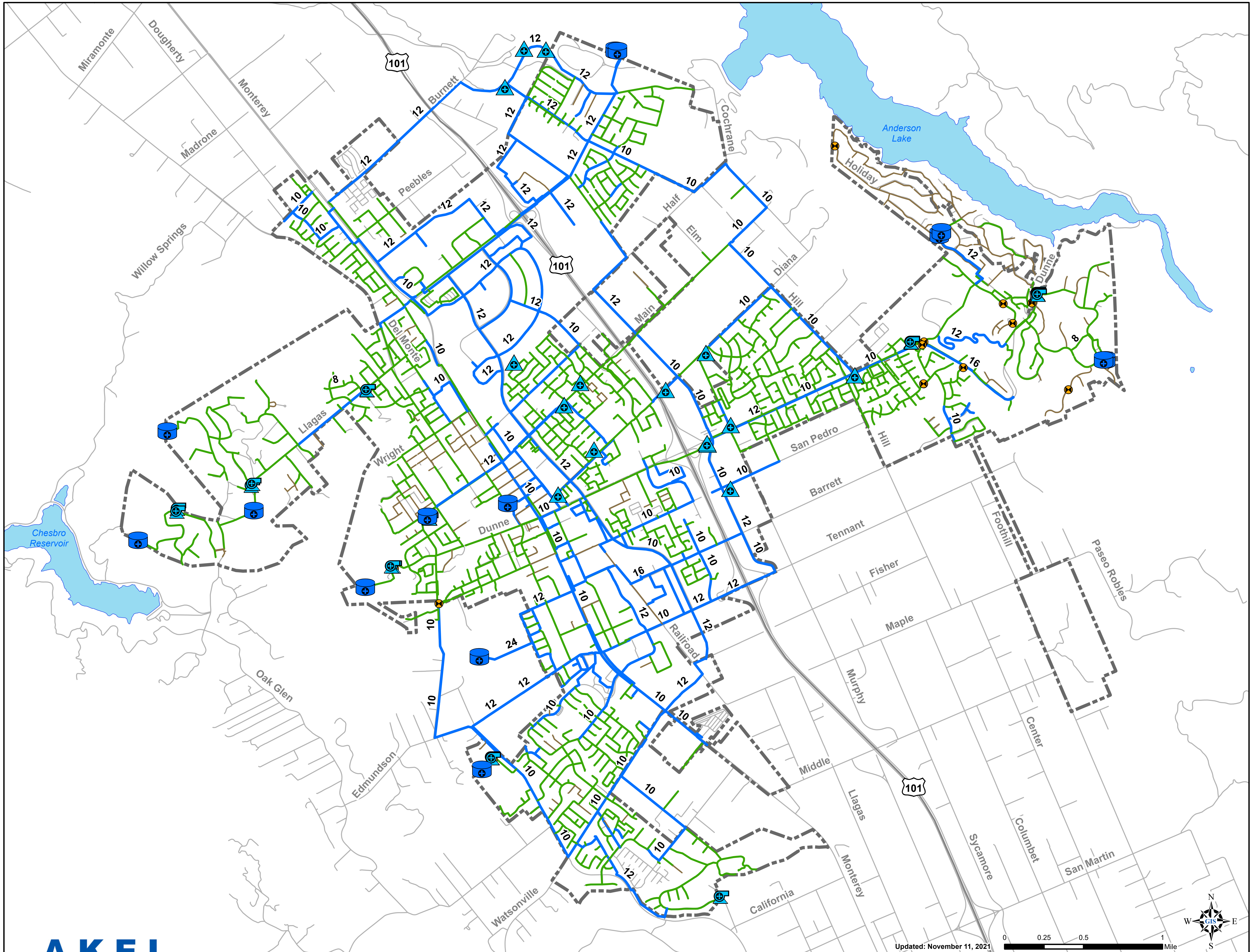
6.4.2 EPS Calibration

Calibration can be performed for steady state conditions or for extended period simulations (EPS). In steady state calibration, the model is compared to field monitoring results consisting of a single value, such as a single hydrant test. EPS calibration consists of comparing model predictions to diurnal operational changes in the water system.

The calibration process for the hydraulic model was extensive, and involved an iterative process which resulted with satisfactory comparisons between the field measurements and the hydraulic model predictions at each well site and the water tank. The calibration results were graphically summarized for each site and included in **Appendix B**.

6.4.3 Use of the Calibrated Model

The calibrated 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 prove its value to 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.



Legend

Existing System

- Tanks and calibration Sites
- Booster Stations and Calibration Sites
- Wells and Calibration Sites
- Valves

Pipes by Diameter

- 6" or Less
- 8"
- 10" or Greater
- Roads
- City Limits

Figure 6.1
Hydraulic Model Calibration Program
Water System Master Plan
City of Morgan Hill

CITY OF MORGAN HILL

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CHAPTER 7 - EVALUATION AND PROPOSED IMPROVEMENTS

This chapter 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 calibrated 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. Since the hydraulic model was calibrated for extended period simulations, 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.

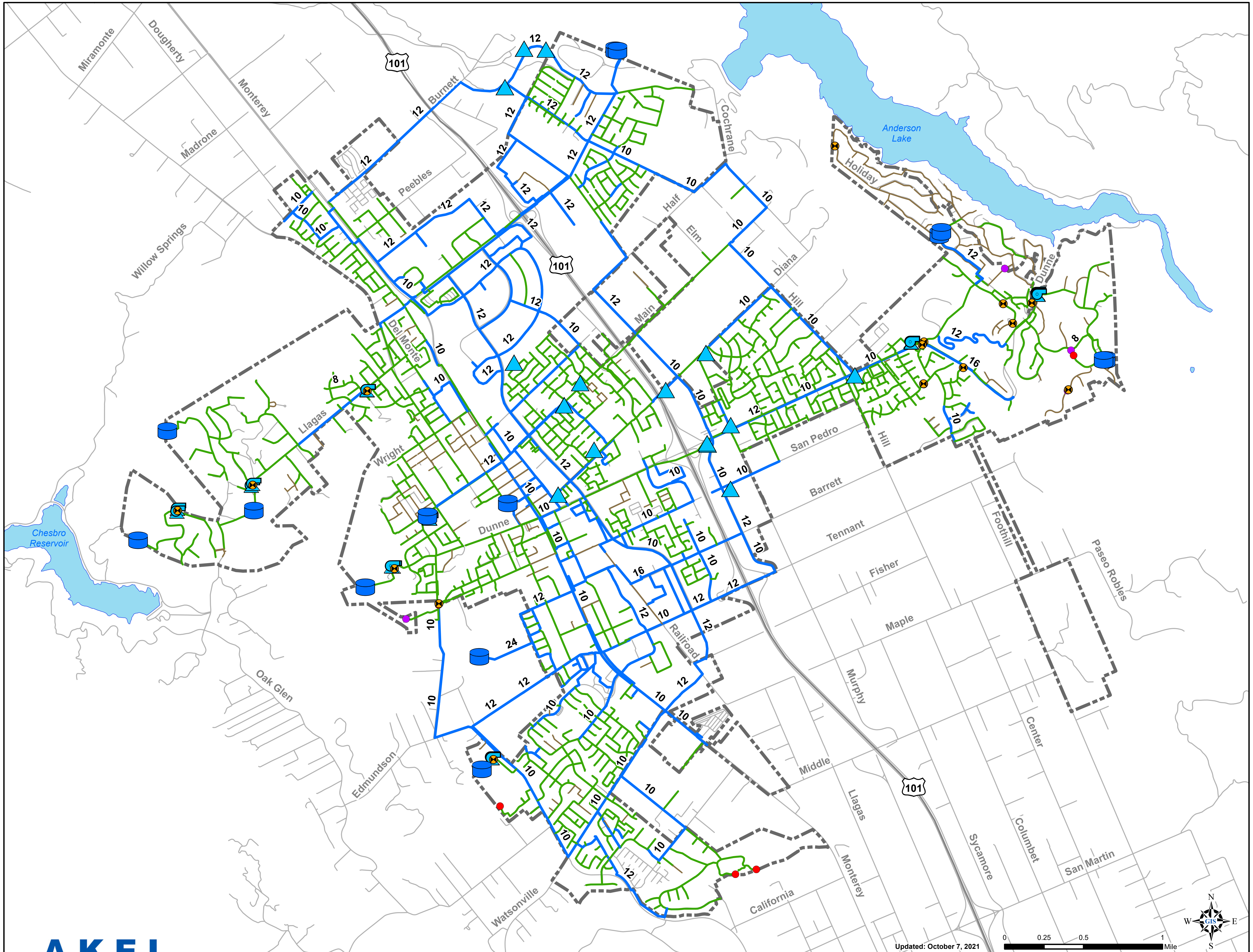
7.2 LOW PRESSURES ANALYSIS

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 demands the minimum pressure requirement is 40 psi, while during the peak hour demand, the minimum pressure requirement is 35 psi. The hydraulic analysis indicated the City's existing system performed reasonably well during under maximum day (**Figure 7.1**) and peak hour (**Figure 7.2**) operating conditions.

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. The areas of high pressure are shown graphically on **Figure 7.3**. Areas of high pressure may be more susceptible to pipeline breaks and ruptures. The City's maximum desired pressure criterion is 100 psi. The areas experiencing high pressures are briefly described as follows:

- **Woodland Pressure Zone:** Development near Rocky Ridge Road and Rolling Hills Road, east of the Woodland Reservoir, experience maximum pressures between 150 and 225 psi. These developments are served by the Woodland storage reservoir, which has a base elevation of approximately 1,080 feet and serves developments with elevations as low as 630 feet.
- **Llagas Pressure Zone:** Development along Llagas Road, east of Enderson Court, experience maximum pressures between 100 and 150 psi. These developments are



Legend

Minimum System Pressures

- 2 - 35 psi
- 35 - 40 psi

Existing System

- Existing System
- Booster Stations
- Wells
- Valves

Pipes by Diameter

- 6" or Less
- 8"
- 10" or Greater
- Roads
- City Limits

Master Plan Criteria:
Minimum Pressure 40 psi at MDD

Figure 7.1
Minimum System Pressures (Maximum Day Demand)

Water System Master Plan
City of Morgan Hill

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CITY OF MORGAN HILL

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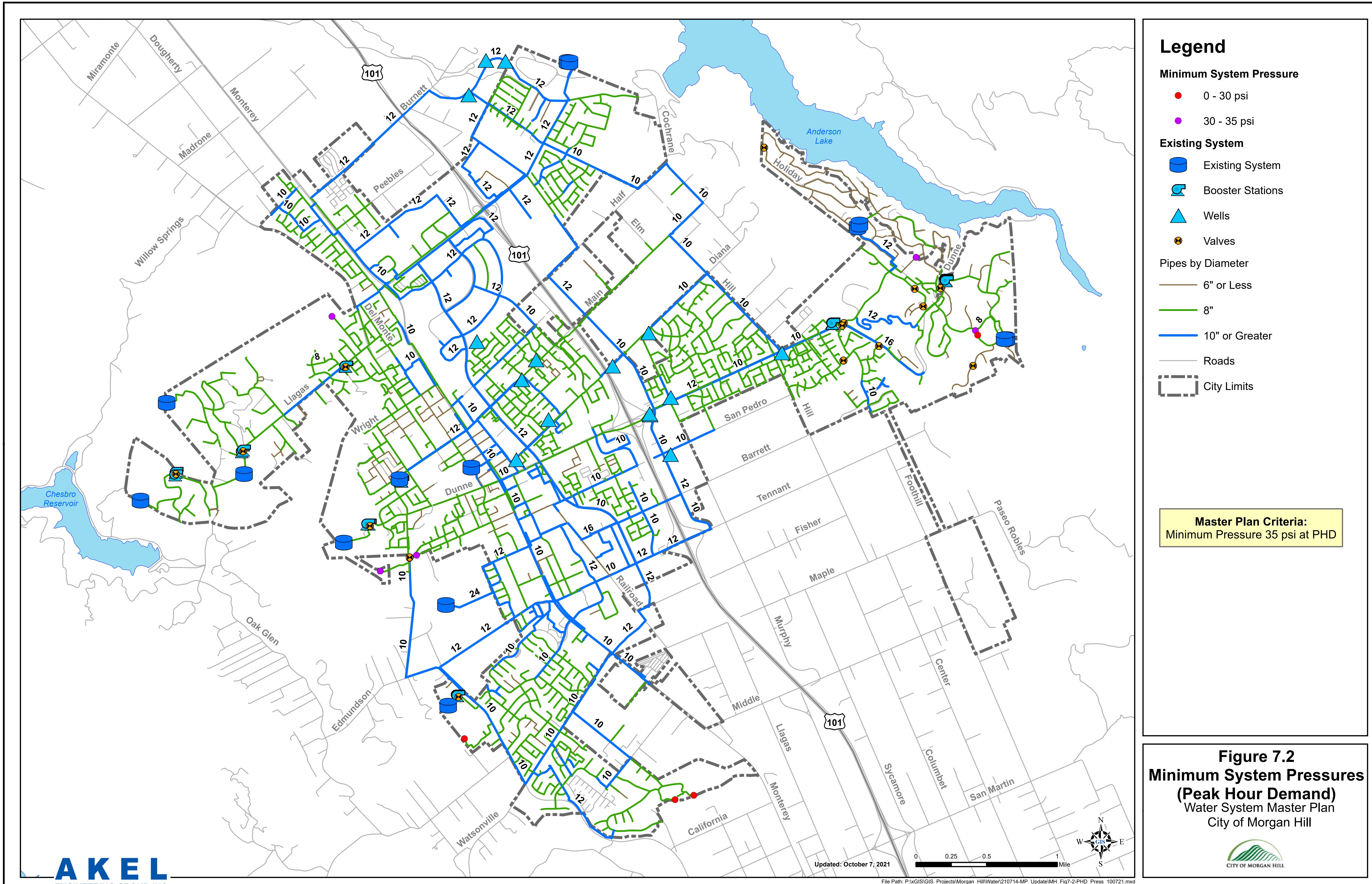
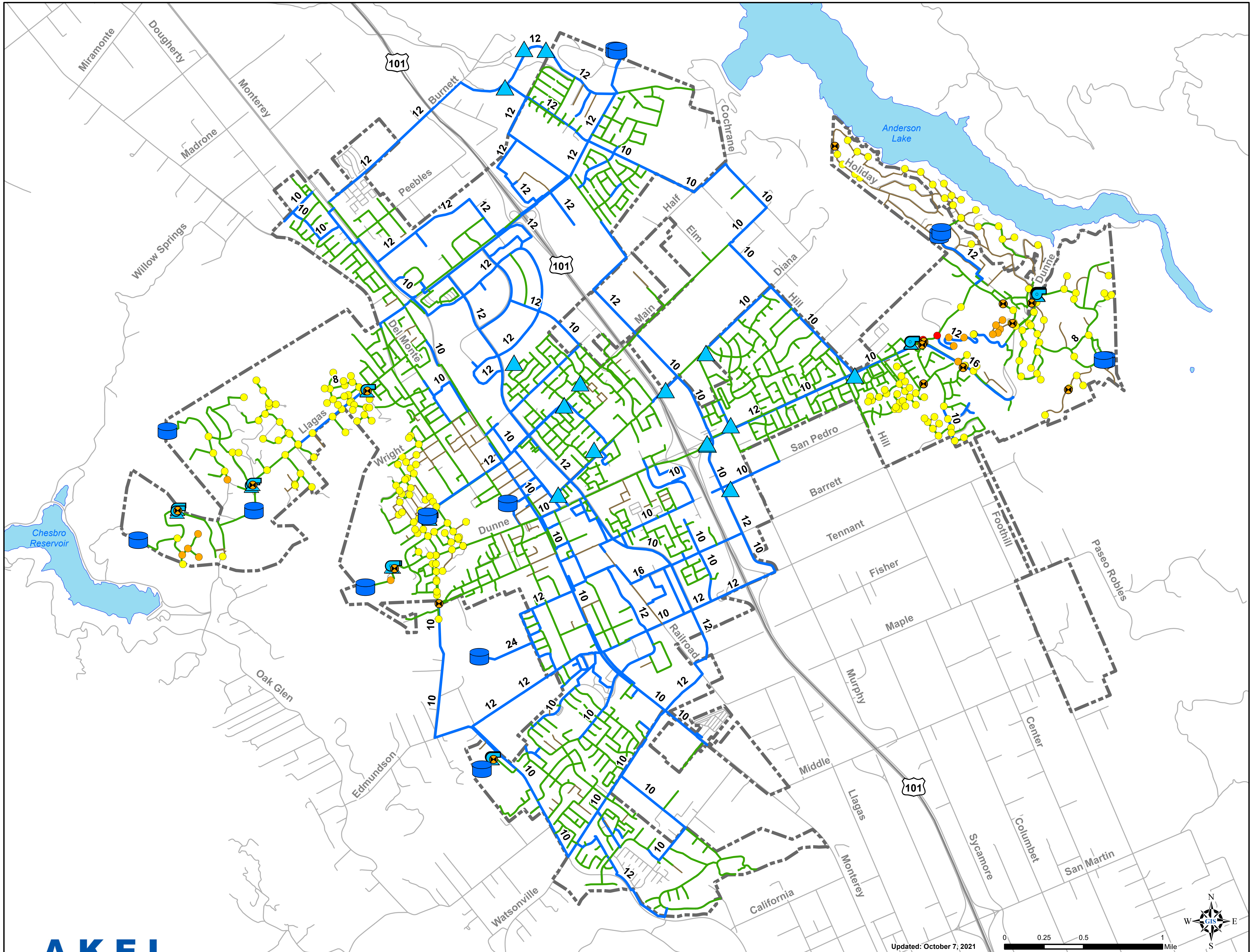


Figure 7.2
Minimum System Pressures (Peak Hour Demand)
Water System Master Plan
City of Morgan Hill



Legend

Maximum System Pressures

- Greater than 200 psi
- 150 - 200 psi
- 100 - 150 psi

Existing System

- Existing System
- Booster Stations
- Wells
- Valves

Pipes by Diameter

- 6" or Less
- 8"
- 10" or Greater
- Roads
- City Limits

Figure 7.3
Maximum System Pressures
Water System Master Plan
City of Morgan Hill

CITY OF MORGAN HILL

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File Path: P:\xGIS\GIS_Projects\Morgan_Hill\Water\210714-MP_Update\MH_Fig7-3-MaxPress_100721.mxd served by the Llagas storage reservoir, which has a base elevation of 700 feet and serves developments with elevations as low as 360 feet.

- **Holiday Lake Pressure Zone:** Development along Thomas Grade east of Dunne Avenue experience maximum pressures between 150 and 225 psi. These developments are served by the Holiday Lake Reservoirs, which have a base elevation of 960 feet and serve developments with elevations as low as 500 feet.

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, as shown in **Figure 7.4**. The criterion for fire flows was also summarized in the System Performance and Design Criteria chapter.

The hydraulic model indicates that the City's existing distribution system performed adequately during the fire flow analysis. Areas where the City's water system did not meet the fire flow criteria, and specifically meeting a minimum residual pressure criteria of 20 psi, are shown on **Figure 7.5**. It should be noted that a majority of the service connections in the eastern foothills are unable to meet the pressure criteria requirements under fire flow conditions. A majority of the distribution system serving this area is comprised of 6-inch and 8-inch water pipelines with minimal looping. It is recommended that as pipeline replacements occur in the eastern foothills, 4-inch and 6-inch pipelines be upsized to 8-inch pipelines to reduce the headloss and velocity impacts. Additionally, where the cost is not prohibitive, it is recommended that looped connections be constructed for reliability.

Improvements to mitigate specific fire flow deficiencies are discussed below and include a corresponding coded identifier, which is consistent with the capital improvements chapter:

- **NH-P1.** Replace approximately 950 feet of 4-inch water main from Del Monte Avenue to Monterey Road along Spring Avenue with 8-inch water main.
- **BR-P5:** Replace an 8-inch pip with a new 10-inch pipeline in Mission View Drive between Cochrane Road and 2,100 feet northwest of Cochrane Road.

7.5 WATER SUPPLY REQUIREMENTS

The City's existing domestic water system supply capacity is identified in this section. The section also identifies the additional supply capacity required to meet the City's System Performance and Design Criteria.

7.5.1 Existing Supply Requirements

Existing supply requirements were identified for the City and are summarized on **Table 7.1**. The City's existing water supply requirement was based on the existing land use and recommended

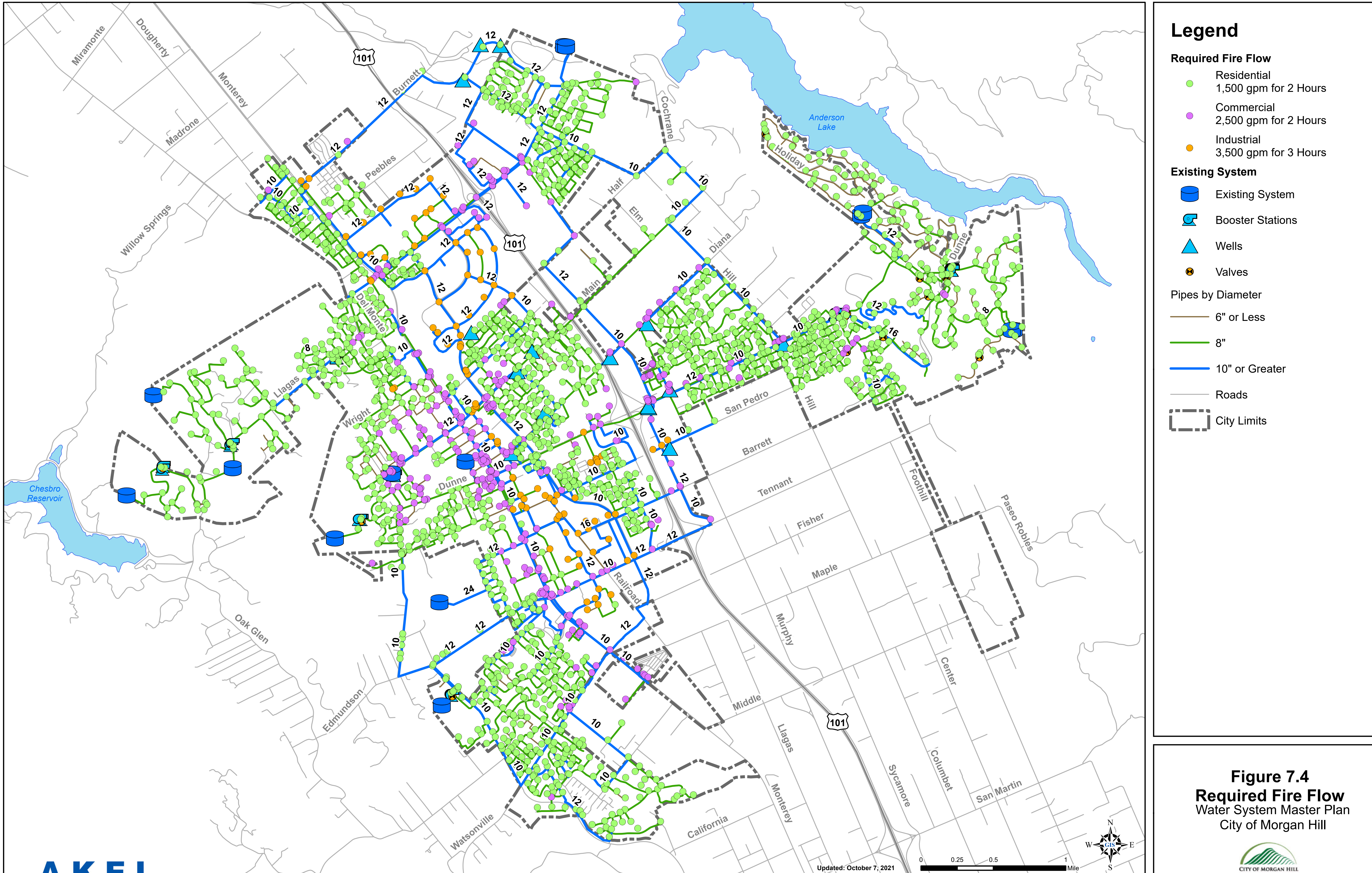

Figure 7.4
Required Fire Flow
Water System Master Plan
City of Morgan Hill

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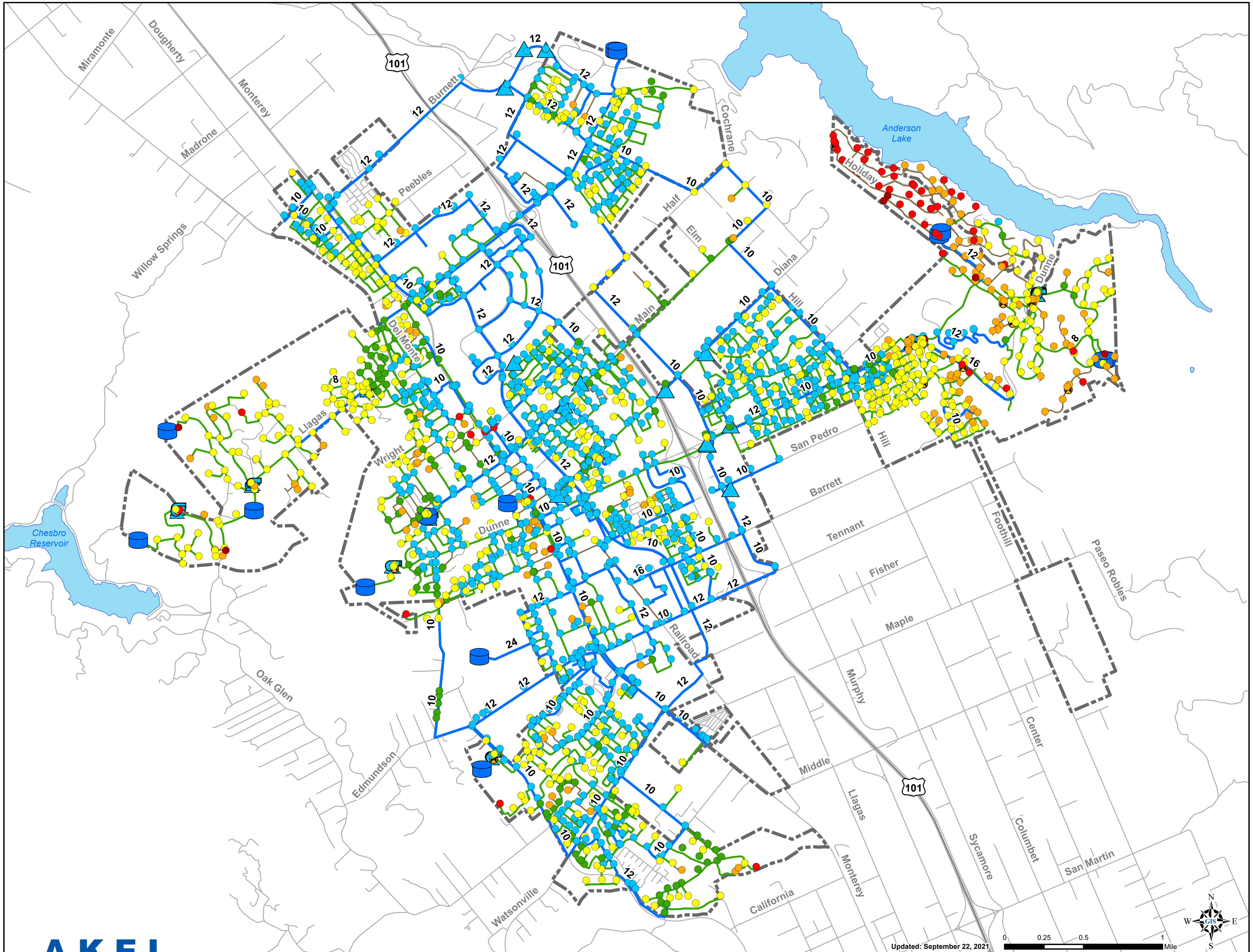
CITY OF MORGAN HILL



Legend

Available Fire Flow

- Greater than 3,500 gpm
- 2,500 - 3,500 gpm
- 1,500 - 2,500 gpm
- 1,000 - 1,500 gpm
- 500 - 1,000 gpm
- Less than 500 gpm

Existing System

- Existing System
- Booster Stations
- Wells
- Valves

Pipes by Diameter

- 6" or Less
- 8"
- 10" or Greater
- Roads
- City Limits

Note:
It should be noted that available fire flow values shown are based on a residual pressure of 20 psi and a critical flow velocity of 15 ft/s

Figure 7.5
Available Fire Flow Analysis
Water System Master Plan
City of Morgan Hill

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Table 7.1 Supply Capacity Analysis
Water System Master Plan
City of Morgan Hill

Demand and Supply	Year 2020 (MGD)	2025 (MGD)	2030 (MGD)	2035 (MGD)	Buildout (2038) (MGD)
Projected Demands					
Projected Population[1]	46,454	51,243	56,033	59,827	62,225
Average Day Demands[2]	7.0	7.7	8.5	9.0	9.4
Maximum Day Demands	13.9	15.5	16.9	18.1	18.8
Peak Hour Demands	20.9	23.2	25.4	27.1	28.2
Supply vs. Demand Analysis					
Available Supply					
Available Total Supply	16.16	-	-	-	-
Available Firm Supply	12.63	-	-	-	-
Required Supply					
Meet Maximum Day Demand with Firm Supply	13.9	15.5	16.9	18.1	18.8
Surplus / Deficiency					
With Existing Firm Supply	-1.3	-2.9	-4.3	-5.4	-6.2
With Recommended Total Supply	-1.3	0.6	0.3	0.3	0.7
Recommended New Supply					
Recommended Staged Upgrade		3 New Wells	1 New Well	1 New Well	1 New Well
Assumed Typ. Future Well Capacity at 1.15 MGD		3.5	1.2	1.2	1.2
Recommended Total Supply	12.6	16.1	17.2	18.4	19.5

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Notes:
1. Source: City of Morgan Hill 2020 UWMP Table 3-2.
2. Average Day Demands based on City of Morgan Hill 2020 UWMP Demand projections and buildout demand in Table 5.3 .

water demand factor is approximately 16.16 mgd, standby well is 1.98 mgd, and required capacity is approximate 14.0 mgd. The existing firm supply capacity is approximately 14.18 mgd, which results in a supply surplus of 0.18 mgd.

7.5.2 Future Supply Requirements

Future supply requirements, in 5-year increments, were identified for the City and are also summarized on **Table 7.1**. As shown on **Table 7.1** the City's supply requirement exceeds the City's existing firm supply capacity and three new wells are required to be constructed as of year 2025. Following the construction of these new wells, the City will need to construct a new well to meet the future supply requirement in the year of 2030, 2035 and 2038, when the future supply requirement will exceed the City's future firm supply capacity. The proposed groundwater wells are described as follows:

- **BR-W1:** Construct a new 800 gpm groundwater well on Burnett Avenue. This facility will be located approximately 6,000 feet northeast of Monterey Avenue.
- **BR-W2:** Construct a new 800 gpm groundwater well on Burnett Avenue. This facility will be located approximately 5,000 feet northeast of the Monterey Avenue.
- **NH-W1:** Construct a new 800 gpm groundwater well on Butterfield Avenue. This facility will be located approximately 400 feet east of the intersection of Railroad Avenue and Fisher Avenue.
- **NH-W2:** Construct a new 800 gpm groundwater well on Butterfield Avenue. This facility will be located approximately the intersection of Butterfield Boulevard and Tennant Avenue.

Two additional wells will be needed in the Nob Hill pressure zone, and to be sited at the later date.

7.6 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.

7.6.1 Existing Storage Requirements

Existing storage requirements were identified for each pressure zone and are summarized in **Table 7.2**. The table lists the existing domestic water demands and identifies the operation, fire, and emergency storage for each pressure zone. This table also lists the total required storage for existing domestic water demands at 9.67 MG.

7.6.2 Buildout Storage Requirements

Buildout storage requirements were identified based on the buildout of the 2035 General Plan and summarized by pressure zone on **Table 7.3**. The table lists the future domestic water demands and identifies the operations, fire, and emergency storage for each pressure zones. The table also lists the total required storage for buildout domestic water demands at 12.07 MG.

Table 7.2 Existing Storage Requirements

Water System Master Plan
City of Morgan Hill

Pressure Zone	Existing Water Demands		Existing Water Storage Requirements				
	Average Day Demand (MGD)	Maximum Day Demand (MGD)	Operational at 25% MDD (MG)	Emergency at 25% MDD (MG)	Fire Protection (MG)	Operational + Emergency (MG)	Total, By Pressure Zone (MG)
Central Zones (Nob Hill and Boy's Ranch Pressure Zones)							
Boy's Ranch Zone	1.32	2.64	0.66	0.66	0.63	1.32	1.95
Nob Hill Zone[1]	4.23	8.47	2.12	2.12	0.63	4.23	4.86
Subtotal	5.56	11.11	2.78	2.78	1.26	5.56	6.82
West Side Pressure Zones							
El Toro Zone[2]	0.27	0.53	0.13	0.13	0.18	0.27	0.45
Encino Zone	0.12	0.24	0.06	0.06	0.18	0.12	0.30
Glen Ayre Zone	0.05	0.10	0.02	0.02	0.18	0.05	0.23
Llagas Zone	0.20	0.40	0.10	0.10	0.18	0.20	0.38
Woodland Zone	0.02	0.03	0.01	0.01	0.18	0.02	0.20
Subtotal	0.65	1.29	0.32	0.32	0.90	0.65	1.55
East Side Pressure Zones							
Holiday Lake Zone	0.13	0.26	0.06	0.06	0.18	0.13	0.31
Holiday 1,2,3 Zones	0.27	0.53	0.13	0.13	0.18	0.27	0.45
Jackson Oaks Zone[3]	0.37	0.74	0.19	0.19	0.18	0.37	0.55
Subtotal	0.77	1.54	0.38	0.38	0.54	0.77	1.31
Total Existing Storage Requirements							
	6.97	**13.94**	**3.49**	**3.49**	**2.70**	**6.97**	**9.67**

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Notes:

1. Nob Hill Zone includes Easy Street Zone demands.
2. El Toro Zone includes Peak and Main Zone and Spring Hill Zone demands.
3. Jackson Oaks Zone includes Jackson Oaks 1,2,3,4 Zones and Jacksons Oaks HPZ 1,2.

Table 7.3 Buildout Storage Requirements

Water System Master Plan
City of Morgan Hill

Pressure Zone	Buildout Water Demands		Buildout Water Storage Requirements				
	Average Day Demand (MGD)	Maximum Day Demand (MGD)	Operational at 25% MDD (MG)	Emergency at 25% MDD (MG)	Fire Protection (MG)	Operational + Emergency (MG)	Total, By Pressure Zone (MG)
Central Zones (Nob Hill and Boy's Ranch Pressure Zones)							
Boy's Ranch Zone	1.92	3.84	0.96	0.96	0.63	1.92	2.55
Nob Hill Zone[1]	5.76	11.52	2.88	2.88	0.63	5.76	6.39
Subtotal	7.68	15.36	3.84	3.84	1.26	7.68	8.94
West Side Pressure Zones							
El Toro Zone[2]	0.28	0.56	0.14	0.14	0.18	0.28	0.46
Encino Zone	0.13	0.25	0.06	0.06	0.18	0.13	0.31
Glen Ayre Zone	0.05	0.09	0.02	0.02	0.18	0.05	0.23
Llagas Zone	0.28	0.56	0.14	0.14	0.18	0.28	0.46
Woodland Zone	0.02	0.04	0.01	0.01	0.18	0.02	0.20
Subtotal	0.75	1.50	0.37	0.37	0.90	0.75	1.65
East Side Pressure Zones							
Holiday Lake Zone	0.13	0.26	0.07	0.07	0.18	0.13	0.31
Holiday 1,2,3 Zones	0.46	0.93	0.23	0.23	0.18	0.46	0.64
Jackson Oaks Zone[3]	0.35	0.70	0.17	0.17	0.18	0.35	0.53
Subtotal	0.94	1.89	0.47	0.47	0.54	0.94	1.48
Total Additional Storage Requirements for Future							
	9.37	**18.74**	**4.69**	**4.69**	**2.70**	**9.37**	**12.07**

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1. Nob Hill Zone includes Easy Street Zone demands.
2. El Toro Zone includes Peak and Main Zone and Spring Hill Zone demands.
3. Jackson Oaks Zone includes Jackson Oaks 1,2,3,4 Zones and Jacksons Oaks HPZ 1,2.

7.6.3 Recommended New Storage Facilities

The existing and future storage requirements, shown on **Tables 7.2** and **Table 7.3**, were facility improvements that were identified and listed on **Table 7.4**. The table lists existing storage facilities for each zone, identifies existing storage capacity deficiencies, and identifies future storage capacity requirements to meet the needs from future growth.

Based on the storage analysis shown on **Table 7.4**, the Woodland and Glen Ayre pressure zones are deficient under existing conditions; replacement tanks are recommended for each pressure zone that are sized to meet the storage requirements for existing and future demands. Based on direction from City staff a new tank is to be constructed in the future to provide for the storage requirements of pressure zones Holiday 1, Holiday 2, and Holiday 3, which are approximately 0.64 MG.

The proposed storage reservoirs, summarized on **Table 7.5** and graphically shown on **Figure 7.6**, are described as follows:

- **BR-T1:** Construct a new 1.2 MG storage reservoir at the existing Boys Ranch Tank site. This improvement includes the demolition of the existing Boys Ranch 1 storage reservoir, which has an existing storage capacity of 0.55 MG.
- **GA-T1:** Construct a new 0.25 MG storage reservoir at the existing Glen Ayre Tank site. This improvement includes the demolition of the existing Glen Ayre Tank. This improvement is intended to mitigate an existing storage deficiency as well as provide storage for future demands.
- **ED-T1:** Construct a new 0.90 MG storage reservoir at the existing Edmundson tank site to provide additional storage for future demands.
- **WD-T1:** Construct a new 0.25 MG storage reservoir at the existing Woodland Tank site. This improvement includes the demolition of the existing Woodland Tank. This improvement is intended to mitigate an existing storage deficiency as well as provide storage for future demands.
- **HL-T1:** Construct a new 0.85 MG storage reservoir near Dunne Avenue approximately 500 feet northeast of Flaming Oak Lane. This tank is intended to provide for the storage requirements of existing pressure zones Holiday 1, Holiday 2, and Holiday 3 following the abandonment of existing booster stations East Dunne Number 2 and East Dunne Number 3.
- **LI-T1:** Construct a new 0.2 MG storage reservoir near existing Llagas Tank Site. This tank is intended to provide for the storage requirements of pressure zones Llagas 1, Llagas 2, existing and future demands.
- **JO-T1:** Construct a new 0.2 MG storage reservoir near the existing Jackson Oak Tank site. This tank is intended to provide for the storage requirements of Jackson Oak pressure zone’s existing demand.

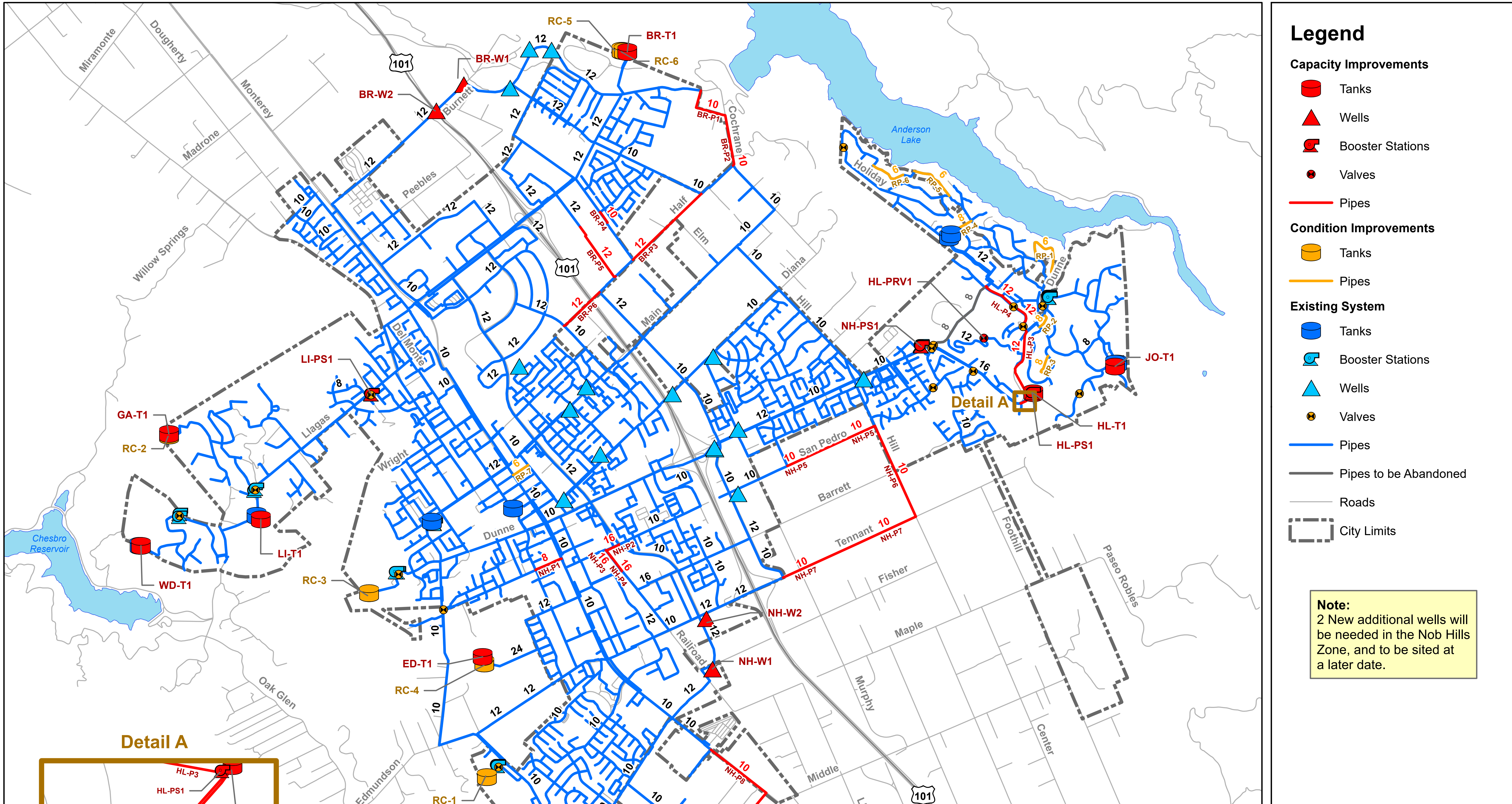

Figure 7.6
Proposed Improvements
Water System Master Plan
City of Morgan Hill

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Table 7.4 Storage Capacity Evaluation by Pressure Zone

Water System Master Plan

City of Morgan Hill

Pressure Zone	Existing Demands		Existing Water Storage Requirements			Existing Storage Reservoirs													Storage Balance for Existing Demands	Buildout Demands		Buildout Water Storage Requirements			Proposed New Storage Reservoirs								Total Storage	Existing and Future Storage Balance
	Average Day Demand (MGD)	Maximum Day Demand (MGD)	Operational + Emergency (MG)	Fire Protection (MG)	Total (MG)	Boy's Ranch 2 (MG)	Boy's Ranch 3 (MG)	Nob Hill (MG)	Edmunson (MG)	El Toro (MG)	Encino (MG)	Glen Ayre (MG)	Llagas (MG)	Woodland (MG)	Holiday Lake 1 (MG)	Holiday Lake 2 (MG)	Jackson Oaks (MG)	Total (MG)	(MG)	Average Day Demand (MGD)	Maximum Day Demand (MGD)	Operational + Emergency (MG)	Fire Protection (MG)	Total (MG)	Boy's Ranch 4 BR-T1 (MG)	Edmundson 2 ED-T1 (MG)	Glen Ayre 2 GA-T1 (MG)	Llagas 2 LI-T2 (MG)	Woodland 2 WD-T1 (MG)	E Dunne HL-T1 (MG)	Jackson Oaks 2 JO-T2 (MG)	Total - Proposed (MG)	(MG)	(MG)
Central Zones (Nob Hill and Boy's Ranch Pressure Zones)																																		
Boy's Ranch Zone	1.32	2.64	1.32	0.63	1.95	0.55	1.03											1.58	-0.37	1.92	3.84	1.92	0.63	2.55	1.60							1.60	2.63	0.08
Nob Hill Zone[1]	4.23	8.47	4.23	0.63	4.86			2.00	4.25									6.25	1.39	5.76	11.52	5.76	0.63	6.39		0.90						0.90	7.15	0.76
Subtotal	5.56	11.11	5.56	1.26	6.82													7.83	1.01	7.68	15.36	7.68	1.26	8.94								2.50	9.78	0.84
West Side Pressure Zones																																		
El Toro Zone[2]	0.27	0.53	0.27	0.18	0.45					0.50								0.50	0.05	0.28	0.56	0.28	0.18	0.46								0.00	0.50	0.04
Encino Zone	0.12	0.24	0.12	0.18	0.30						0.60							0.60	0.30	0.13	0.25	0.13	0.18	0.31								0.00	0.60	0.29
Glen Ayre Zone	0.05	0.10	0.05	0.18	0.23							0.10						0.10	-0.13	0.05	0.09	0.05	0.18	0.23			0.25					0.25	0.25	0.02
Llagas Zone	0.20	0.40	0.20	0.18	0.38								0.35					0.35	-0.03	0.28	0.56	0.28	0.18	0.46				0.20				0.20	0.55	0.09
Woodland Zone	0.02	0.03	0.02	0.18	0.20									0.03				0.03	-0.17	0.02	0.04	0.02	0.18	0.20					0.25			0.25	0.25	0.05
Subtotal	0.65	1.29	0.65	0.90	1.55													1.58	0.03	0.75	1.50	0.75	0.90	1.65								0.70	2.15	0.50
East Side Pressure Zones																																		
Holiday Lake Zone	0.13	0.26	0.13	0.18	0.31										0.50	0.20		0.70	0.39	0.13	0.26	0.13	0.18	0.31								0.00	0.70	0.39
Holiday 1,2,3 Zones	0.27	0.53	0.27	0.18	0.45													0.00	-0.45	0.46	0.93	0.46	0.18	0.64						0.65		0.65	0.65	0.01
Jackson Oaks Zone[3]	0.37	0.74	0.37	0.18	0.55												0.35	0.35	-0.20	0.35	0.70	0.35	0.18	0.53							0.20	0.20	0.55	0.02
Subtotal	0.77	1.54	0.77	0.54	1.31													1.05	-0.26	0.94	1.89	0.94	0.54	1.48								0.85	1.90	0.42
Total	**6.97**	**13.94**	**6.97**	**2.70**	**9.67**													**10.46**	**0.79**	**9.37**	**18.74**	**9.37**	**2.70**	**12.07**								**4.05**	**13.83**	1.76

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Notes:
1. Nob Hill Zone includes East Street Zone demands.
2. El Toro Zone includes Peak and Main Zone and Spring Hill Zone demands.
3. Jackson Oaks Zone includes Hydropneumatic Zone demands.
4. The tanks planned to be abandoned were highlighted in grey and were not included in the future capacity analysis.

Table 7.5 Proposed Storage Reservoirs

Water System Master Plan
City of Morgan Hill

Reservoir	Pressure Zone	Volume (MG)	Height (ft)	Diameter (ft)	Bottom Elevation (ft)	Overflow Height (ft)	Overflow Elevation (ft)
Boy's Ranch 4	Boy's Ranch	**1.20**	32	80	533	30	563
Edmundson 2	Nob Hill	**0.90**	32	70	473	30	503
East Dunne	Holiday 1, 2, and 3	**0.85**	24	80	780	23	803
Glen Ayre 2	Glen Ayre Zone	**0.25**	15	50	900	14	914
Jackson Oaks 2	Jackson Oaks Zone 1	**0.20**	32	33	1,170	30	1,200
Llagas 2	Llagas Zone	**0.20**	27.2	36	700	8	708
Woodland 2	Woodland Zone	**0.25**	15	50	1,079	14	1,093
Total		**3.85**					

7.7 PUMP STATION CAPACITY ANALYSIS

The City's existing pump station capacity is identified in this section. Additionally, this section identifies the existing and future pump station capacity requirements and compares it with the existing pump station facilities in each zone and makes recommendations for new pump station facilities.

7.7.1 Existing Pump Station Capacity Requirements

Existing pump station requirements were identified for each existing pump station and are summarized on **Table 7.6**. The table lists the existing pump station capacities and identifies the required capacity, based on the City criteria. The existing pump station capacity analysis indicates the City's current pump stations have fairly adequate capacity to meet existing requirements.

7.7.2 Future Pump Station Capacity Requirements

Future pump station requirements were identified for each existing pump station and are summarized on **Table 7.7**. This table identifies the future pump station capacity requirements based on the buildout demands. At the buildout of the master plan the existing pump stations East Dunne Number 1, East Dunne Number 2, and East Dunne Number 3 are going to be abandoned and replaced with a new pump station; this proposed pump station will serve a proposed Holiday (E Dunne) tank. Additionally, a new pump station is recommended at the proposed Holiday (E Dunne) tank site to serve the existing Holiday Lake tanks. The proposed pump stations, summarized on **Table 7.8** and shown graphically on **Figure 7.6**, are described as follows:

- **NH-PS1:** Replace existing pump stations East Dunne Number 1, East Dunne Number 2, and East Dunne Number 3 with one new pump station. This pump station is planned to have three 900 gpm pumps for a total pump station capacity of 2,700 gpm. It should be noted that the construction of this pump station will trigger the construction of a PRV on Thomas Grade Lane, approximately 1,100 feet west of Gnarled Oak Lane. This PRV improvement is listed as HL-PRV1 in **Table 7.9**.
- **HL-PS1:** Construct a new pump station at the proposed Holiday tank site. This pump station is planned to have four 550 gpm pumps for a total pump station capacity of 2,200 gpm.
- **LI-PS1:** Replace existing 300 gpm pump with one new 450 gpm pump. This pump station is planned to have two 450 gpm pumps for a total station capacity of 450 gpm.

Per City's direction, Boy's Ranch Pressure Zone experienced supply sufficiency issues several times during the summer season. In order to enhance domestic water supply reliability in Boy's Ranch Pressure Zone, City Staff and project group evaluated two modified operation options to move water from Nob Hill pressure zone to Boy's Ranch pressure zone during critical condition.

Table 7.6 Existing Pump Station Capacity Evaluation
Water System Master Plan
City of Morgan Hill

Pump Station	Elevation (ft)	Source Pressure Zone	Destination Pressure Zone	Pump Station Capacity Analysis: Total Capacity (gpm)	Firm Capacity (gpm)	Required Existing Capacity[1] (gpm)	Deficiency (gpm)
Existing Pump Stations							
East Dunne # 1	430	Nob Hill	Holiday Lake Zone	1,800	1,200	697	-
East Dunne # 2	430	Nob Hill	Holiday Zone #1	400	200	34	-
East Dunne # 3	430	Nob Hill	Holiday Zone #2	925	425	336	-
El Toro	520	Peak and Main	El Toro	380	190	3	-
Encino Booster	415	Nob Hill	Encino	900	450	164	-
Glen Ayre Booster	660	Llagas	Glen Ayre Zone	330	165	68	-
Hydropneumatic Booster	1170	Jackson Oaks	Hydropneumatic Zone	1,710	1,640	62	-
Jackson Oaks Booster	830	Holiday Lake	Jackson Oaks Zone	970	620	516	-
Llagas Booster	365	Nob Hill	Llagas Zone	750	300	365	65
Peak and Main Booster	370	Nob Hill	Peak and Main Zone	2,050	1,350	370	-
Woodland Booster	620	Llagas	Woodland Zone	430	140	23	-

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10/11/2021

Note:

1. Required firm pump station capacity equal to Maximum Day Demand. Required firm hydropneumatic pump station capacity also required to include 1,500 gpm fire flow.

Table 7.7 Buildout Pump Station Capacity Evaluation

Water System Master Plan
City of Morgan Hill

Pump Station	Elevation (ft)	Source Pressure Zone	Destination Pressure Zone	Pump Station Capacity Analysis: Total Capacity (gpm)	Firm Capacity (gpm)	Required Buildout Capacity[1] (gpm)	Deficiency (gpm)
Existing Pump Stations							
East Dunne # 1	430	Nob Hill	Holiday Lake Zone	*Pump Station to be Abandoned*			
East Dunne # 2	430	Nob Hill	Holiday Zone #1	*Pump Station to be Abandoned*			
East Dunne # 3	430	Nob Hill	Holiday Zone #2	*Pump Station to be Abandoned*			
El Toro	520	Peak and Main	El Toro	380	190	3	-
Encino Booster	415	Nob Hill	Encino	900	450	175	-
Glen Ayre Booster	660	Llagas	Glen Ayre Zone	330	165	64	-
Hydropneumatic Booster	1170	Jackson Oaks	Hydropneumatic Zone	1,710	1,640	64	-
Jackson Oaks Booster	830	Holiday Lake	Jackson Oaks Zone	970	620	484	-
Peak and Main Booster	370	Nob Hill	Peak and Main Zone	2,050	1,350	388	-
Woodland Booster	620	Llagas	Woodland Zone	430	140	25	-
Purposed Permanent Pump Stations							
East Dunne[2]	430	Nob Hill	Holiday 1	2,700	1,800	1,311	-
Holiday Lake[2]	780	Holida Zone No. 1	Holiday Lake Zone	2,200	1,650	668	-
Llagas Booster	365	Nob Hill	Llagas Zone	900	450	476	25
Purposed Mobile Pump Station							
Condit	380	Nob Hill	Boy's Ranch	1,500	0	-	-

Notes:
1. Required firm pump station capacity equal to Maximum Day Demand. Required firm hydropneumatic pump station capacity to also include fire flow.
2. Future capacity of East Dunne and Holiday Lake pump stations consistent with "Holiday Lake Zone Improvements" prepared by Akel Engineering Group July 2015.

Table 7.8 Proposed Pump Stations

Water System Master Plan
City of Morgan Hill

Name	Elevation	Source Pressure Zone	Destination Pressure Zone	Pump Station Capacity		No. of Pumps	Pump Status	Design Capacity
				Total	Firm			
	(ft)			(gpm)	(gpm)	(gpm)	(gpm)	(gpm)
New Permanent Pump Stations								
East Dunne[1,2]	430	Nob Hill	Holiday Zone No. 1	2,700	1,800	3	Duty	900
							Duty	900
							Standby	900
Holiday Lake[2]	780	Holiday Zone No. 1	Holiday Lake	2,200	1,650	4	Duty	550
							Duty	550
							Duty	550
							Standby	550
New Mobile Pump Station								
Condit	380	Nob Hill	Boy's Ranch	1,500	0	1	Duty	1,500
Existing Pump Station Improvement								
Llagas	365	Nob Hill	Llagas	900	450	2	Duty	450
							Standby	450

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11/11/2021

Notes:

1. East Dunne Pump Station to replace existing East Dunne Pump Stations 1, 2, and 3.
2. Future capacity of East Dunne and Holiday Lake pump stations consistent with "Holiday Lake Zone Improvements" prepared by Akel Engineering Group July 2015.

Table 7.9 Proposed Capacity Improvements

Water System Master Plan

City of Morgan Hill

Improv. No.	Pressure Zone	Alignment	Limits	Existing Diameter (in)	Pipeline Improvements New/Parallel /Replace	Diam. (in)	Length (ft)
Pipeline Capacity Improvements							
Boy's Ranch Pressure Zone							
BR-P1	Boy's Ranch	ROW	Cochrane Rd to Half Rd	-	New	10	1,600
BR-P2	Boy's Ranch	Cochrane Rd	Half Rd to approx 1,700' n/o Half Rd	-	New	10	1,700
BR-P3	Boy's Ranch	Half Rd	Mission View Dr to Peet Rd	-	New	12	3,150
BR-P4	Boy's Ranch	Mission View Dr	Between Cochrane Rd and 2,100' nw/o Cochrane Rd	8	Replace	10	450
BR-P5	Boy's Ranch	Mission View Dr	Half Rd to 2,100' nw/o Half Rd	-	New	12	2,100
BR-P6	Boy's Ranch	Half Rd	Serene Dr to Conduit Rd	-	New	12	1,650
Nob Hill Pressure Zone							
NH-P1	Nob Hill	Spring Ave	Del Monte Ave to Monterey Rd	4	Replace	8	950
NH-P2	Nob Hill	San Pedro Ave	Butterfield Blvd to Railroad Ave	10	Replace	16	550
NH-P3	Nob Hill	Railroad Ave	San Pedro Ave to approx 600' n/o Mast St	10	Replace	16	350
NH-P4	Nob Hill	Railroad Ave	Approx 600' n/o Mast St to Mast St	6	Replace	16	600
NH-P5	Nob Hill	San Pedro Ave	1,100' ne/o Murphy Ave to Hill Rd	-	New	10	3,200
NH-P6	Nob Hill	Hill Rd	San Pedro Ave to Tennant Ave	-	New	10	3,300
NH-P7	Nob Hill	Tennant Ave	Hill Rd to Condit Rd	-	New	10	4,850
NH-P8	Nob Hill	Monterey Rd	John Wilson Way to E Middle Ave	-	New	10	2,350
NH-P9	Nob Hill	ROW	Monterey Rd to Olive Ave	-	New	10	2,700
Holiday Pressure Zones							
HL-P1	Holiday 1	Dunne Ave	Flaming Oak Ln to Proposed E Dunne Tank	-	New	16	550
HL-P2	Holiday 1	Dunne Ave	Proposed E Dunne Tank to Flaming Oak Ln	-	New	12	550
HL-P3	Holiday Lake	Dunne Ave	Proposed E Dunne Tank to Lori Ln	-	New	12	2,450
HL-P4	Holiday Lake	Oak Leaf Dr	Lori Ln to 650' nw/o Lori Ln	-	New	12	2,300

Storage Reservoir Capacity Improvements				**Proposed Storage Capacity** (MG)
BR-T1	Boy's Ranch	Demolish existing 0.55 MG Boys Ranch tank and replace with 1.20 MG tank	Replace	1.20
GA-T1	Glen Ayre	Demolish existing 0.10 MG Glen Ayre tank and replace with 0.25 MG tank	Replace	0.25
ED-T1	Nob Hill	Existing Edmundson tank site	New	0.90
Ll-T1	Llagas	Existing Llagas tank site	New	0.20
JO-T1	Jackson Oaks 1	Existing Jackson tank site	New	0.20

Table 7.9 Proposed Capacity Improvements

Water System Master Plan

City of Morgan Hill

Improv. No.	Pressure Zone	Alignment	Limits	Existing Diameter (in)	Pipeline Improvements New/Parallel /Replace	Diam. (in)	Length (ft)
WD-T1	Woodland	Demolish existing 0.03 MG Woodland tank and replace with 0.25 MG tank			New	0.25	
HL-T1	Holiday 1	Dunne Ave approx 500' ne/o Flaming Oak Ln			New	0.85	
Groundwater Well Capacity Improvements					**Proposed Pumping Capacity** (gpm)		
BR-W1	Boy's Ranch	Burnett Ave	Approx 6,000' ne/o Monterey Ave		New	800	
BR-W2	Boy's Ranch	Burnett Ave	Approx 5,000' ne/o Monterey Ave		New	800	
NH-W1	Nob Hill	Butterfield Blvd	400' E of Railroad Ave and Fisher Ave		New	800	
NH-W2	Nob Hill	Butterfield Blvd	Butterfield Blvd and Tennant Ave		New	800	
NH-W3	Nob Hill	Well site to be determined at a later date.			New	800	
NH-W4	Nob Hill	Well site to be determined at a later date.			New	800	
Pump Station Capacity Improvements					**Proposed Capacity** (gpm)		
NH-PS1	Nob Hill	Dunne Ave and Magnolia Wy			New	3 @ 900 gpm	
BR-PS1	Boy's Ranch	Current Condit Valve Site			New	1 @ 1,500 gpm	
HL-PS1	Holiday 1	Dunne Ave approx 500' ne/o Flaming Oak Ln			New	4 @ 550 gpm	
Ll-PS1	Llagas 2	Llagas Road and Carriage Drive			New	1 @ 450 gpm	
Pressure Reducing Valve Capacity Improvements					**Proposed Size** (in)		
HL-PRV1	Holiday 1	Thomas Gr approx 1,100' w/o Gnarled Oak Ln			New	3	

- **Option 1**: Expand the Boy's Ranch Boundary to from Main Avenue to Diana Avenue by installing zone interties along Condit Road and near Diana Well 3. This modified operation can let Diana Well 3 supply the Boy's Ranch pressure zone instead of Nob Hill pressure zone. Zone interties to be closed and modified pressure zone are shown on **Figure 7.7**.

- **Option 2**: Install a portable booster pump station (**BR-PS1**) at the existing Condit Valve site to boost water from Nob Hill pressure zone to Boy's Ranch pressure zone. The proposed portable booster pump station and Condit Valve site are shown on **Figure 7.8**.

7.8 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 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 pressure zone, improvement type, and sequence in the improvement schedule. The pipeline improvements are summarized on **Table 7.9** and described in detail on the following pages.

7.8.1 Boys Ranch Pressure Zone

This section documents pipeline improvements within the Boys Ranch Pressure Zone.

- **BR-P1:** Construct a new 10-inch pipeline in future right-of-way between Cochrane Road and Coyote Road.

- **BR-P2:** Construct a new 10-inch pipeline in Cochrane Road between Half Road and approximately 1,700 feet north of Half Road.

- **BR-P3:** Construct a new 12-inch pipeline in Half Road between Avenida de los Padres and approximately 450 feet south of Avenida de los Padres.

- **BR-P4:** Replace existing 8-inch pipeline with a new 10-inch pipeline in Mission View Drive between Cochrane Road and 2,100 feet northwest of Cochrane Road.

- **BR-P5:** Construct a new 12-inch pipeline in De Paul Road between Half Road and 2,100 feet northwest of Half Road.

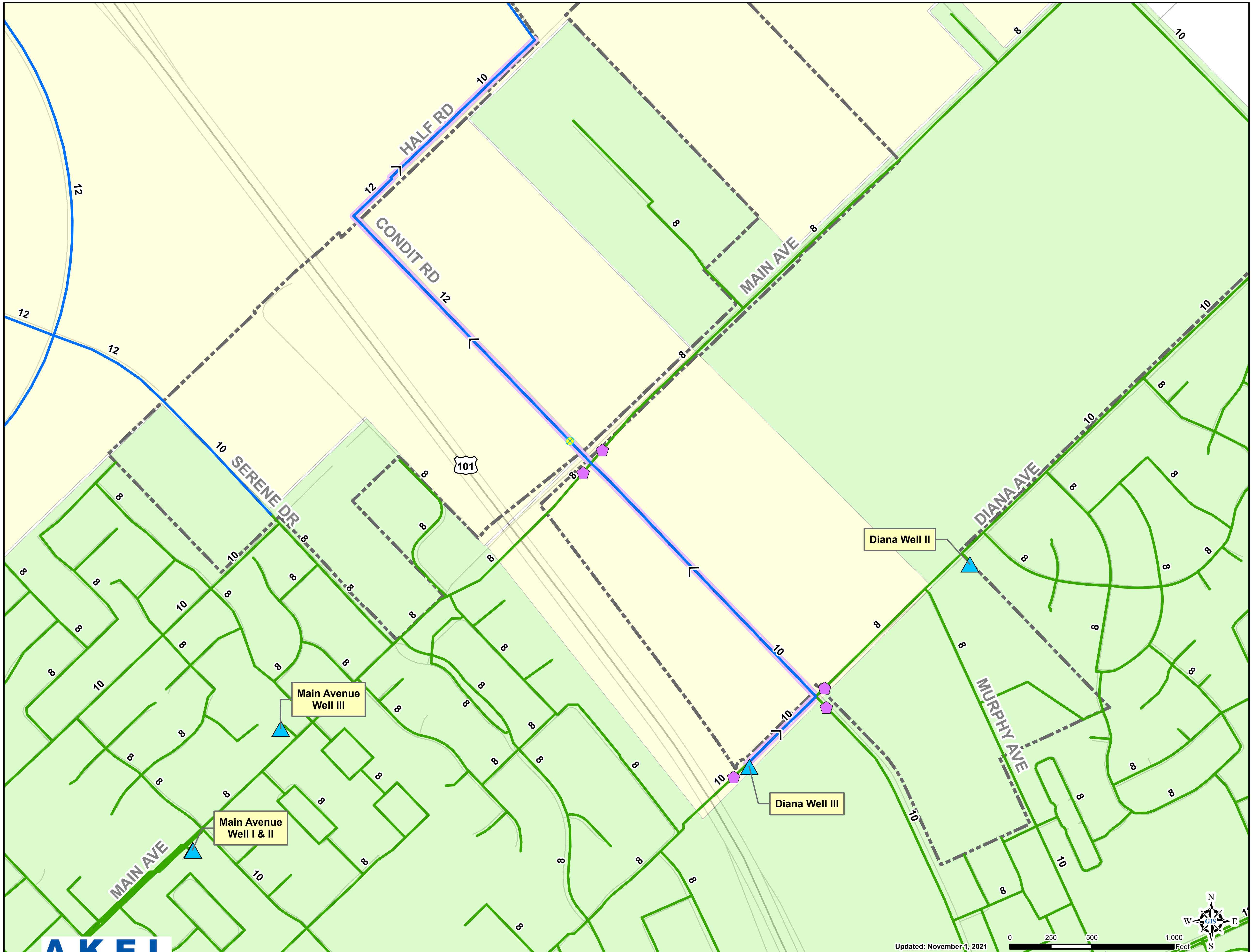
- **BR-P6:** Construct a new 12-inch pipeline in Half Road between Serene Road and Condit Road.

7.8.2 Nob Hill Pressure Zone

This section documents pipeline improvements within the Nob Hill Pressure Zone.

- **NH-P1:** Replace existing 4-inch pipeline with a new 8-inch pipeline in Spring Avenue between Del Monte Avenue and Monterey Road.

- **NH-P2:** Replace existing 10-inch pipeline with a new 16-inch pipeline in San Pedro Avenue between Butterfield Boulevard and Railroad Avenue.



Legend

Existing System

- Wells
- Condit Valve
- Zone Interties (Closed)
- New Flow Direction

Pipes by Pressure Zone

- Boys Ranch
- Nob Hill

Existing Pressure Zones

- Boys Ranch
- Nob Hill
- Roads
- City Limits

Note:
Expand Boy's Ranch Pressure Zone to include Diana #3 Well

Figure 7.7
Schematic for Switching Diana #3 to Boys Ranch

Water System Master Plan
City of Morgan Hill

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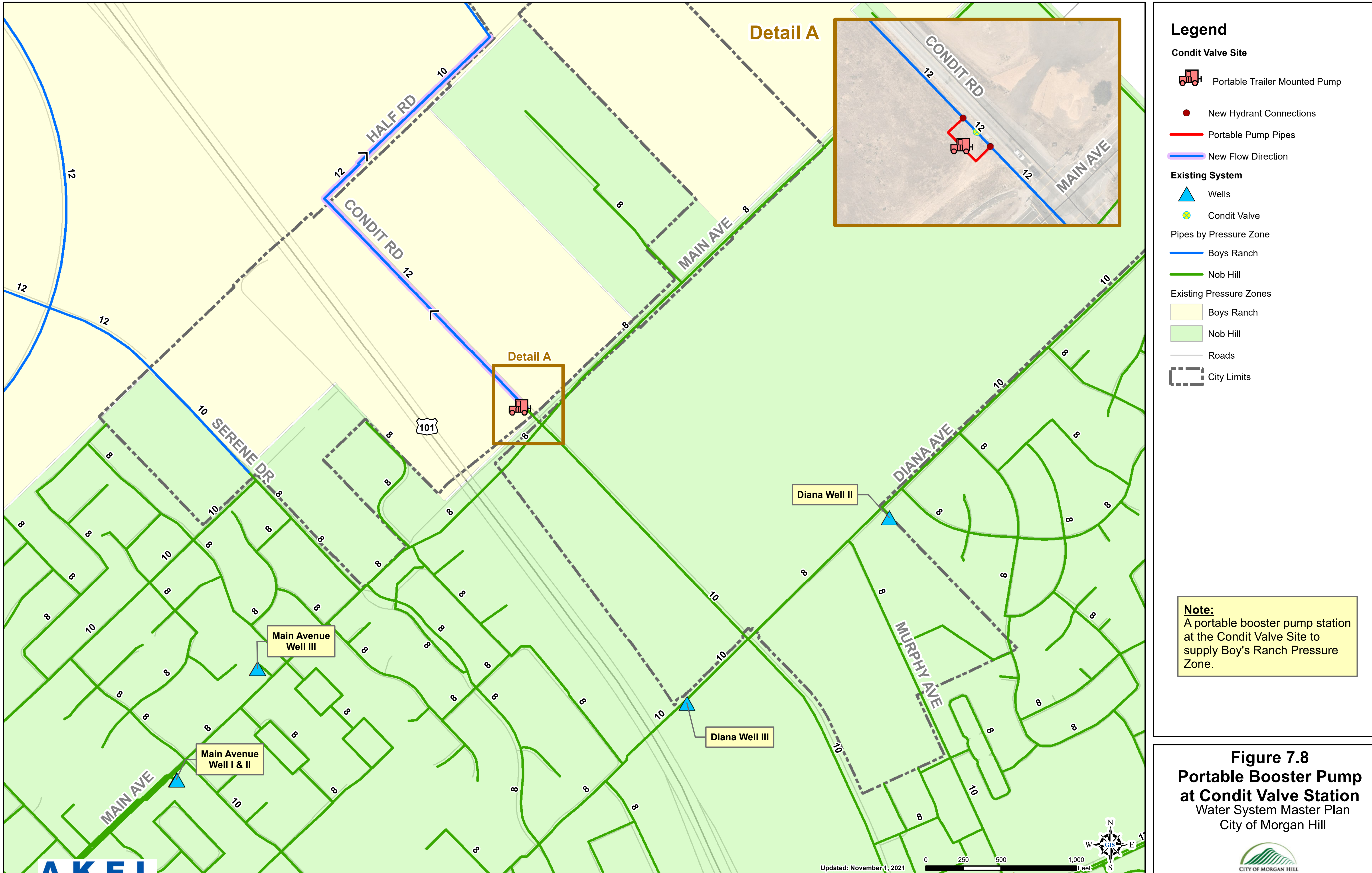

Figure 7.8
Portable Booster Pump at Condit Valve Station
Water System Master Plan
City of Morgan Hill

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- **NH-P3:** Replace existing 10-inch pipeline with a new 16-inch pipeline in Railroad Avenue between San Pedro Avenue and approximately 600 feet north of Mast Street.
- **NH-P4:** Replace existing 6-inch pipeline with a new 16-inch pipeline in Railroad Avenue between S600 feet north of Mast Street and Mast Street.
- **NH-P5:** Construct a new 10-inch pipeline in San Pedro Avenue between Peppertree Drive and Hill Road.
- **NH-P6:** Construct a new 10-inch pipeline in Hill Road between San Pedro Avenue and Tennant Avenue.
- **NH-P7:** Construct a new 10-inch pipeline in Tennant Avenue between Hill Road and Condit Road.
- **NH-P8:** Construct a new 10-inch pipeline in Monterey Road between John Wilson way and Middle Avenue.
- **NH-P9:** Construct a new 10-inch pipeline in right of way between Monterey Road and Olive Avenue.

7.8.3 Holiday Pressure Zones

This section documents pipeline improvements within the Holiday Pressure Zone.

- **HL-P1:** Construct a new 16-inch pipeline in Dunne Avenue between Flaming Oak Lane and Proposed East Dunne Tank.
- **HL-P2:** Construct a new 12-inch pipeline in Dunne Avenue between Proposed East Dunne Tank and Flaming Oak Lane.
- **HL-P3:** Construct a new 12-inch pipeline in Dunne Avenue between Proposed Holiday 1 Pressure Zone and Oak Leaf Drive.
- **HL-P4:** Construct a new 12-inch pipeline in Oak Leaf Drive between Dunne Avenue and 650 feet west of Lori Drive.
- **HL-P5:** Replace existing 8-inch pipeline with a new 12-inch pipeline in Lake View Drive between Oak Leaf Drive and Holiday Lake Tanks.

7.9 PIPELINE REPAIR AND REPLACEMENT

During the preparation of this master plan, City staff identified sections of pipeline intended to be replaced due to either deteriorated condition or for operational considerations (**Table 7.10**). It should be noted that, for planning purposes, the operational improvements generally involve replacing deficient pipes in kind. However, if feasible and based on site-specific constraints, it is recommended that 6-inch pipes be upsized to 8-inches. The operational improvements are summarized below:

- **RP-1:** Replace existing 6-inch pipeline with a new 6-inch pipeline in Shady Lane between Holiday Drive and Holiday Drive.

Table 7.10 Planned Pipeline Repair and Replacement

Water System Master Plan
City of Morgan Hill

Improv. No.	Pressure Zone	Alignment	Limits	Existing Diameter (in)	Pipeline Improvements New/Parallel/ Replace[1]	Pipeline Improvements Diam.[2] (in)	Pipeline Improvements Length (ft)
RP-1	Holiday Lake	Shady Ln	From Holiday Dr to Holiday Dr	6	Replace	6	2,550
RP-2	Jackson Oaks	Hill Top Ct	From Jackson Oaks Dr to approx 550' ne/o Jackson Oaks Dr	8	Replace	8	550
RP-3	Jackson Oaks	Oak View Ct	From Jackson Oaks Dr to approx 700' s/o Jackson Oaks Dr	8	Replace	8	700
RP-4	Holiday Lake	Holiday Tank Site	From Holiday Lake Tanks to Manzanita Dr	8	Replace	8	800
RP-5	Holiday Lake	Manzanita Dr	From Holiday Dr to end of Manzanita Dr	6	Replace	6	1,650
RP-6	Holiday Lake	Raccoon Ct	From Holiday Ct to end of Manzanita Dr	6	Replace	6	1,700
RP-7	Nob Hill	First St	From Monterey Rd to Depot St	6	Replace	6	600
RP-8	Hydropneumatic Zone	Oak Canyon Dr	From Jackson Oaks Hydropneumatic tank to Jackson Oaks Dr	8	Replace	8	600

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Note:

1. Repair and replacement improvements include pipelines requiring replacement due to deteriorated condition or other operational issue, as identified by City staff.
2. Where feasible, it is recommended that 6-inch pipelines be upsized to 8-inch pipelines.

- **RP-2**: Replace existing 8-inch pipeline with a new 8-inch pipeline in Hill Top Court between Jackson Oaks Drive and approximately 550 feet northeast of Jackson Oaks Drive.
- **RP-3:** Replace existing 8-inch pipeline with a new 8-inch pipeline in Oak View Court between Jackson Oaks Drive and approximately 700 feet northeast of Jackson Oaks Drive.
- **RP-4:** Replace existing 8-inch pipeline with a new 8-inch pipeline on the Holiday Tank site between the existing Holiday Lake tanks and Manzanita Drive.
- **RP-5:** Replace existing 6-inch pipeline with a new 6-inch pipeline in Manzanita Drive between Holiday Drive and the end of Manzanita Drive.
- **RP-6:** Replace the existing 6-inch pipeline with a new 6-inch pipeline in Raccoon Court between Holiday Court and the end of Raccoon Court.
- **RP-7:** Replace the existing 6-inch pipeline with a new 6-inch pipeline in First Street between Monterey Road and Depot Street.
- **RP-8:** Replace the existing 8-inch pipeline with a new 8-inch pipeline from the Jackson Oaks hydropneumatic tank and Jackson Oaks Drive.

The water industry recommends pipe renewal and replacement annual goals be set at, or near, 1.0% of the system pipeline total length, and in order to achieve the 100-year pipeline replacement cycle. In the case of Morgan Hill, and due to budget constraints, City staff suggested that a goal of 0.5 % be set through year 2030. It should be noted that the 0.5% annual goal for replacement translates into a 200-year pipeline replacement cycle. The estimated pipeline replacement costs are further documented and discussed in Chapter 8.4.

7.10 RESERVOIR RE-COATING AND RETROFITTING

During the preparation of this master plan, City staff identified 6 reservoirs intended to be re-coated and retrofitted due to either deteriorated condition or other operational issues (**Table 7.11**). The operational improvements are summarized below:

- **RC-1:** Re-coat the 0.6 MG Encino reservoir in Encino Zone in fiscal year of 2022.
- **RC-2:** Re-coat the 0.1 MG Glen Ayre reservoir in Glen Ayre Zone in fiscal year of 2022.
- **RC-3:** Re-coat the 0.5 MG El Toro reservoir in El Toro Zone in fiscal year of 2023.
- **RC-4:** Re-coat the 4.25 MG Edmundson reservoir in Nob Hill Zone in fiscal year of 2024.
- **RC-5:** Re-coat the 1.03 MG Boy's Ranch # 3 reservoir in Boy's Ranch Zone in fiscal year of 2025.
- **RC-6:** Re-coat the 0.55 MG Boy's Ranch # 2 reservoir in Boy's Ranch Zone in fiscal year of 2026.

Table 7.11 Reservoir Re-Coating and Retrofitting

Water System Master Plan
City of Morgan Hill

Improv. No.	Reservoir	Pressure Zone	Volume (MG)	Planned Fiscal Year
RC-1	Encino	Encino Zone	0.60	2022
RC-2	Glen Ayre	Glen Ayre Zone	0.10	2022
RC-3	El Toro	El Toro Zone	0.50	2023
RC-4	Edmundson	Nob Hill Zone	4.25	2024
RC-5	Boy's Ranch # 3	Boy's Ranch Zone	1.03	2025
RC-6	Boy's Ranch # 2	Boy's Ranch Zone	0.55	2026

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Note:

1. Reservoir re-coating improvements due to deteriorated condition or other operational issue, as identified by City staff on Oct 18, 2021.

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). Pump Station costs are based on an equation that replaces the pump curve.

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 System Master Plan Update were benchmarked using a 20-City national average ENR CCI of 12,464, reflecting a date of October 2021.

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 **40 percent** contingency allowance to account for unforeseen events and unknown field conditions, as well as market uncertainty and unpredictable inflation.

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 System Master Plan
City of Morgan Hill

Pipelines	
Pipe Size (in)	**Cost**[2] ($/lineal foot)
6	$189
8	$213
10	$246
12	$271
16	$327
18	$352
20	$403
24	$440
30	$487
36	$574

Pump Stations

Estimated Pumping Station Project Cost = $2.456*10^{(0.7583*\log(Q)+3.1951)}$ where Q is in gpm

Estimated Upsize Existing Pump (50hp) = $ 300,000

Portable Trailer Mounted pump = $ 100,000

Pressure Reducing Stations	
Size (in)	**Cost** ($)
3" valve	$55,977
6" valve	$91,598

Storage Reservoirs ($/gallon)	
≤1.0 MG	$2.54
1.1 MG-3.0 MG	$2.03
3.1 MG - 5.0 MG	$1.46
> 5 MG	$1.09
Re-coating	$0.55

Groundwater Wells	
800 gpm Capacity	$2,769,252

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Notes:

1. Construction costs estimated using October 2021 ENR CCI of 12,464.
2. Pipeline unit costs based on water main construction estimates provided by City staff.

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 7.6**. The estimated construction costs include the baseline costs plus **40 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 CIP Table Organization

In addition to separating the costs between existing and future users, the improvements in Table 8.2 are organized within the following 5 main sections:

1. Planned Capacity Improvements (Short-Term and Long-Term). These capacity improvements include pipelines, storage reservoirs, groundwater wells, pump stations, and PRVs.

2. Planned Condition Improvements. The condition improvements include currently planned Renewal and Replacement projects (2022-2024) by City staff, as well as recommended annual pipeline condition renewal budgets through 2031. This section also includes planned reservoir condition improvements and other 6-year improvement projects.

3. Comprehensive Plan Updates. The comprehensive plan updates include several plans that are important for the management, planning, and funding the water system.

Table 8.2 Capital Improvement Program

Water System Master Plan
City of Morgan Hill

Improv. No.	Pressure Zone	Alignment	Limits	Pipeline Improvements		Infrastructure Costs				Baseline Constr. Costs	Estimated Const. Costs[1]	Capital Improv. Costs[2]	Suggested Expenditure Budget	Construction Trigger	Suggested Cost Allocation		Cost Sharing	
				Existing Diameter (in)	New/Parallel/ Replace	Diameter (in)	Length (ft)	Unit Cost ($)	Infr. Cost ($)	($)	($)	($)			Existing Users	Future Users	Existing Users	Future Users
1. Planned Capacity Improvements (Short-Term and Long-Term)																		
1.1 Pipeline Capacity Improvements																		
Boy's Ranch Pressure Zone																		
BR-P1	Boy's Ranch	ROW	Cochrane Rd to Half Rd	-	New	10	1,600	246	392,822	392,822	549,951	714,936	2030-2034	As development occurs	0%	100%	0	714,936
BR-P2	Boy's Ranch	Cochrane Rd	Half Rd to approx 1,700' n/o Half Rd	-	New	10	1,700	246	417,374	417,374	584,323	759,620	2030-2034	As development occurs	0%	100%	0	759,620
BR-P3	Boy's Ranch	Half Rd	Mission View Dr to Peet Rd	-	New	12	3,150	271	852,980	852,980	1,194,172	1,552,424	2030-2034	As development occurs	0%	100%	0	1,552,424
BR-P4	Boy's Ranch	Mission View Dr	Between Cochrane Rd and 2,100' nw/o Cochrane Rd	8	Replace	10	450	246	110,481	110,481	154,674	201,076	2022-2024	Immediate	100%	0%	201,076	0
BR-P5	Boy's Ranch	Mission View Dr	Half Rd to 2,100' nw/o Half Rd	-	New	12	2,100	271	568,653	568,653	796,115	1,034,949	2030-2034	As development occurs	0%	100%	0	1,034,949
BR-P6	Boy's Ranch	Half Rd	Serene Dr to Conduit Rd	-	New	12	1,650	271	446,799	446,799	625,519	813,174	2030-2034	As development occurs	0%	100%	0	813,174
									Subtotal - Boys Ranch Pressure Zone	**2,789,110**	**3,904,753**	**5,076,179**					**201,076**	**4,875,104**
Nob Hill Pressure Zone																		
NH-P1	Nob Hill	Spring Ave	Del Monte Ave to Monterey Rd	4	Replace	8	950	213	202,368	202,368	283,316	368,310	2022-2024	As development occurs	100%	0%	368,310	0
NH-P2	Nob Hill	San Pedro Ave	Butterfield Blvd to Railroad Ave	10	Replace	16	550	327	179,713	179,713	251,598	327,077	2025-2029	As development occurs	100%	0%	327,077	0
NH-P3	Nob Hill	Railroad Ave	San Pedro Ave to approx 600' n/o Mast St	10	Replace	16	350	327	114,363	114,363	160,108	208,140	2025-2029	As development occurs	0%	100%	0	208,140
NH-P4	Nob Hill	Railroad Ave	Approx 600' n/o Mast St to Mast St	6	Replace	16	600	327	196,050	196,050	274,470	356,811	2025-2029	As development occurs	0%	100%	0	356,811
NH-P5	Nob Hill	San Pedro Ave	1,100' ne/o Murphy Ave to Hill Rd	-	New	10	3,200	246	785,644	785,644	1,099,902	1,429,873	2035-2038	As development occurs	0%	100%	0	1,429,873
NH-P6	Nob Hill	Hill Rd	San Pedro Ave to Tennant Ave	-	New	10	3,300	246	810,196	810,196	1,134,274	1,474,556	2035-2038	As development occurs	0%	100%	0	1,474,556
NH-P7	Nob Hill	Tennant Ave	Hill Rd to Condit Rd	-	New	10	4,850	246	1,190,742	1,190,742	1,667,039	2,167,151	2035-2038	As development occurs	0%	100%	0	2,167,151
NH-P8	Nob Hill	Monterey Rd	John Wilson Way to E Middle Ave	-	New	10	2,350	246	576,958	576,958	807,741	1,050,063	2035-2038	As development occurs	0%	100%	0	1,050,063
NH-P9	Nob Hill	ROW	Monterey Rd to Olive Ave	-	New	10	2,700	246	662,887	662,887	928,042	1,206,455	2035-2038	As development occurs	0%	100%	0	1,206,455
									Subtotal - Nob Hill Pressure Zone	**4,718,921**	**6,606,489**	**8,588,436**					**695,387**	**7,893,048**
Holiday Pressure Zones																		
HL-P1	Holiday 1	Dunne Ave	Flaming Oak Ln to Proposed E Dunne Tank	-	New	16	550	327	179,713	179,713	251,598	327,077	2022-2024	E. Dunne Pump Station 2 and 3 Abandonement	40%	60%	130,831	196,246
HL-P2	Holiday 1	Dunne Ave	Proposed E Dunne Tank to Flaming Oak Ln	-	New	12	550	271	148,933	148,933	208,506	271,058	2022-2024	E. Dunne Pump Station 2 and 3 Abandonement	40%	60%	108,423	162,635
HL-P3	Holiday Lake	Dunne Ave	Proposed E Dunne Tank to Lori Ln	-	New	12	2,450	271	663,429	663,429	928,801	1,207,441	2025-2029	Holiday Pump Station Construction	0%	100%	0	1,207,441
HL-P4	Holiday Lake	Oak Leaf Dr	Lori Ln to 650' nw/o Lori Ln	-	New	12	2,300	271	622,811	622,811	871,935	1,133,516	2025-2029	Holiday Pump Station Construction	0%	100%	0	1,133,516
									Subtotal - Holiday Pressure Zones	**1,614,885**	**2,260,840**	**2,939,091**					**239,254**	**2,699,837**
									Subtotal - Pipeline Capacity Improvements	**9,122,916**	**12,772,082**	**16,603,706**					**1,135,717**	**15,467,989**

Table 8.2 Capital Improvement Program

Water System Master Plan
City of Morgan Hill

Improv. No.	Pressure Zone	Alignment	Limits	Pipeline Improvements		Infrastructure Costs				Baseline Constr. Costs	Estimated Const. Costs[1]	Capital Improv. Costs[2]	Suggested Expenditure Budget	Construction Trigger	Suggested Cost Allocation		Cost Sharing	
				Existing Diameter (in)	New/Parallel/ Replace	Diameter (in)	Length (ft)	Unit Cost ($)	Infr. Cost ($)	($)	($)	($)			Existing Users	Future Users	Existing Users	Future Users
1.2 Storage Reservoir Capacity Improvements							**Proposed Storage Capacity** (MG)											
BR-T1	Boy's Ranch	Demolish existing 0.55 MG Boy's Ranch tank and replace with 1.20 MG tank			Replace		1.20		2,441,927	2,441,927	3,418,697	4,444,306	2030-2034	420 EDUs	60%	40%	2,666,584	1,777,723
GA-T1	Glen Ayre	Demolish existing 0.10 MG Glen Ayre tank and replace with 0.25 MG tank			Replace		0.25		635,918	635,918	890,286	1,157,371	2025-2029	Immediate	90%	10%	1,041,634	115,737
ED-T1	Nob Hill	Existing Edmundson tank site			New		0.90		2,289,306	2,289,306	3,205,029	4,166,537	2030-2034	2,350 EDUs	0%	100%	0	4,166,537
Ll-T1	Llagas	Existing Llagas tank site			New		0.20		508,735	508,735	712,229	925,897	2025-2029	Immediate	15%	85%	138,885	787,013
JO-T1	Jackson Oaks 1	Existing Jackson tank site			New		0.20		508,735	508,735	712,229	925,897	2025-2029	Immediate	100%	0%	925,897	0
WD-T1	Woodland	Demolish existing 0.03 MG Woodland tank and replace with 0.25 MG tank			Replace		0.25		635,918	635,918	890,286	1,157,371	2025-2029	Immediate	80%	20%	925,897	231,474
HL-T1	Holiday 1	Dunne Ave approx 500' ne/o Flaming Oak Ln			New		0.85		2,162,122	2,162,122	3,026,971	3,935,063	2022-2024	E. Dunne Pump Station 1, 2, and 3 Abandonement	70%	30%	2,754,544	1,180,519
Subtotal - Storage Reservoir Capacity Improvements										**9,182,661**	**12,855,726**	**16,712,443**					**8,453,441**	**8,259,003**
1.3 Groundwater Well Capacity Improvements							**Proposed Pump Capacity** (gpm)											
BR-W1	Boy's Ranch	Burnett Ave	Approx 6,000' ne/o Monterey Ave		New		800 gpm		2,769,252	2,769,252	3,876,953	5,040,038	2025-2029	As development occurs	0%	100%	0	5,040,038
BR-W2	Boy's Ranch	Burnett Ave	Approx 5,000' ne/o Monterey Ave		New		800 gpm		2,769,252	2,769,252	3,876,953	5,040,038	2035-2038	As development occurs	0%	100%	0	5,040,038
NH-W1	Nob Hill	Butterfield Blvd	400' E of Railroad Ave and Fisher Ave		New		800 gpm		2,769,252	2,769,252	3,876,953	5,040,038	2022-2024	Immediate	100%	0%	5,040,038	0
NH-W2	Nob Hill	Butterfield Blvd	Butterfield Blvd and Tennant Ave		New		800 gpm		2,769,252	2,769,252	3,876,953	5,040,038	2022-2024	Immediate	11%	89%	565,783	4,474,255
NH-W3	Nob Hill	Well Site to be determined at a later date.			New		800 gpm		2,769,252	2,769,252	3,876,953	5,040,038	2025-2029	As development occurs	0%	100%	0	5,040,038
NH-W4	Nob Hill	Well Site to be determined at a later date.			New		800 gpm		2,769,252	2,769,252	3,876,953	5,040,038	2030-2034	As development occurs	0%	100%	0	5,040,038
Subtotal - Groundwater Well Capacity Improvements										**16,615,511**	**23,261,715**	**30,240,230**					**5,605,822**	**24,634,408**
1.4 Pump Station Capacity Improvements							**Proposed Capacity** (gpm)											
NH-PS1	Nob Hill	Dunne Ave and Magnolia Wy			New		3 @ 900 gpm		1,539,329	1,539,329	2,155,061	2,801,579	2022-2024	E. Dunne Pump Station 1, 2, and 3 Abandonement	60%	40%	1,680,947	1,120,632
BR-PS1	Boy's Ranch	Current Condit Valve Site			New		1 @ 1,500 gpm		100,000	100,000	100,000	100,000	2022-2024	Immediate	80%	20%	80,000	20,000
Ll-PS1	Llagas 2	Llagas Road and Carriage Drive			Replace		1 @ 450 gpm		300,000	300,000	420,000	546,000	2025-2029	Immediate	40%	60%	218,400	327,600
HL-PS1	Holiday 1	Dunne Ave approx 500' ne/o Flaming Oak Ln			New		4 @ 550 gpm		1,317,915	1,317,915	1,845,081	2,398,606	2025-2029	Holiday Tank Construction	40%	60%	959,442	1,439,163
Subtotal - Pump Station Capacity Improvements										**3,257,244**	**4,520,142**	**5,846,185**					**2,938,790**	**2,907,395**
1.5 Pressure Reducing Valve Capacity Improvements							**Proposed Size** (in)											
HL-PRV1	Holiday 1	Thomas Gr approx 1,100' w/o Gnarled Oak Ln			New		3		55,977	55,977	78,367	101,878	2025-2029	Holiday Tank Construction	55%	45%	56,033	45,845
Subtotal - Pressure Reducing Valve Capacity Improvements										**55,977**	**78,367**	**101,878**					**56,033**	**45,845**

Table 8.2 Capital Improvement Program
Water System Master Plan
City of Morgan Hill

Improv. No.	Pressure Zone	Alignment	Limits	Pipeline Improvements: Existing Diameter (in)	Pipeline Improvements: New/Parallel/ Replace	Infrastructure Costs: Diameter (in)	Infrastructure Costs: Length (ft)	Infrastructure Costs: Unit Cost ($)	Infrastructure Costs: Infr. Cost ($)	Baseline Constr. Costs ($)	Estimated Const. Costs[1] ($)	Capital Improv. Costs[2] ($)	Suggested Expenditure Budget	Construction Trigger	Suggested Cost Allocation: Existing Users	Suggested Cost Allocation: Future Users	Cost Sharing: Existing Users	Cost Sharing: Future Users
2. Planned Condition Improvements																		
2.1 Known Pipeline Renewal and Replacement (2022-2024)																		
RP-1	Holiday Lake	Shady Ln	From Holiday Dr to Holiday Dr	6	Replace	6	2,550	189	482,844	482,844	675,981	878,776	2022-2024	Immediate	100%	0%	878,776	0
RP-2	Jackson Oaks	Hill Top Ct	From Jackson Oaks Dr to approx 550' ne/o Jackson Oaks Dr	8	Replace	8	550	213	117,161	117,161	164,025	213,232	2022-2024	Immediate	100%	0%	213,232	0
RP-3	Jackson Oaks	Oak View Ct	From Jackson Oaks Dr to approx 700' s/o Jackson Oaks Dr	8	Replace	8	700	213	149,114	149,114	208,759	271,387	2022-2024	Immediate	100%	0%	271,387	0
RP-4	Holiday Lake	Holiday Tank Site	From Holiday Lake Tanks to Manzanita Dr	8	Replace	8	800	213	170,415	170,415	238,582	310,156	2022-2024	Immediate	100%	0%	310,156	0
RP-5	Holiday Lake	Manzanita Dr	From Holiday Dr to end of Manzanita Dr	6	Replace	6	1,650	189	312,428	312,428	437,400	568,620	2022-2024	Immediate	100%	0%	568,620	0
RP-6	Holiday Lake	Raccoon Ct	From Holiday Ct to end of Manzanita Dr	6	Replace	6	1,700	189	321,896	321,896	450,654	585,851	2022-2024	Immediate	100%	0%	585,851	0
RP-7	Nob Hill	First St	From Monterey Rd to Depot St	6	Replace	6	600	189	113,610	113,610	159,054	206,771	2022-2024	Immediate	100%	0%	206,771	0
RP-8	Hydropneumatic Zone	Oak Canyon Dr	From Jackson Oaks Hydropneumatic tank to Jackson Oaks Dr	8	Replace	8	600	213	127,812	127,812	178,936	232,617	2022-2024	Immediate	100%	0%	232,617	0
									Subtotal - Known Pipeline R&R	**1,795,280**	**2,513,392**	**3,267,409**					**3,267,409**	**0**
2.2. Recommended Annual Pipeline Condition Renewal and Replacement (10-year)																		
RR-2022-2024	0.5% System Pipeline Renewal and Replacement (excluded known pipeline R&R)				Replace				1,669,505	1,669,505	2,337,308	3,038,500	2022-2024		100%	0%	3,038,500	0
RR-2025	0.5% System Pipeline Renewal and Replacement				Replace				1,172,053	1,172,053	1,640,874	2,133,136	2025-2029		100%	0%	2,133,136	0
RR-2026	0.5% System Pipeline Renewal and Replacement				Replace				1,180,615	1,180,615	1,652,861	2,148,719	2025-2029		100%	0%	2,148,719	0
RR-2027	0.5% System Pipeline Renewal and Replacement				Replace				1,189,177	1,189,177	1,664,848	2,164,302	2025-2029		100%	0%	2,164,302	0
RR-2028	0.5% System Pipeline Renewal and Replacement				Replace				1,197,739	1,197,739	1,676,835	2,179,885	2025-2029		100%	0%	2,179,885	0
RR-2029	0.5% System Pipeline Renewal and Replacement				Replace				1,206,301	1,206,301	1,688,822	2,195,469	2025-2029		100%	0%	2,195,469	0
RR-2030	0.5% System Pipeline Renewal and Replacement				Replace				1,214,864	1,214,864	1,700,809	2,211,052	2030-2034		100%	0%	2,211,052	0
RR-2031	0.5% System Pipeline Renewal and Replacement				Replace				1,223,426	1,223,426	1,712,796	2,226,635	2030-2034		100%	0%	2,226,635	0
									Subtotal - Annual Pipeline R&R	**10,053,680**	**14,075,152**	**18,297,698**					**18,297,698**	**0**
2.3 Reservoir Condition Improvements							Existing Storage Capacity (MG)											
RC-1	Encino	Re-coat and retrofit existing Encino Tank			Repair		0.60		330,000	-		330,000	2022	Immediate	100%	0%	330,000	0
RC-2	Glen Ayre	Re-coat and retrofit existing Glen Ayre Tank			Repair		0.10		55,000	-		55,000	2022	Immediate	100%	0%	55,000	0
RC-3	El Toro	Re-coat and retrofit existing El Toro Tank			Repair		0.50		275,000	-		275,000	2023	Immediate	100%	0%	275,000	0
RC-4	Edmundson	Re-coat and retrofit existing Edmundson Tank			Repair		4.25		2,337,500	-		2,337,500	2024	Immediate	100%	0%	2,337,500	0
RC-5	Boy's Ranch # 3	Re-coat and retrofit existing Boy's Ranch # 3 Tank			Repair		1.03		563,750	-		563,750	2025	Immediate	100%	0%	563,750	0
RC-6	Boy's Ranch # 2	Re-coat and retrofit existing Boy's Ranch # 2 Tank			Repair		0.55		302,500	-		302,500	2026	Immediate	100%	0%	302,500	0
									Subtotal - Storage Reservoir Condition Improvements			**3,863,750**					**3,863,750**	**0**
2.4 5-Year Improvement Projects																		
5YR-1	Well Rehabilitation									-	-	1,500,000	2022-2026		100%	0%	1,500,000	0
5YR-2	Booster Rehabilitation									-	-	1,400,000	2023-2024		100%	0%	1,400,000	0
5YR-3	Generators Replacement (Jackson Booster Station)									-	-	1,000,000	2022-2024		100%	0%	1,000,000	0
									Subtotal - 5-Year Improvement Projects			**3,900,000**					**3,900,000**	**0**

Table 8.2 Capital Improvement Program

Water System Master Plan
City of Morgan Hill

Improv. No.	Pressure Zone	Alignment	Limits	Pipeline Improvements		Infrastructure Costs				Baseline Constr. Costs	Estimated Const. Costs[1]	Capital Improv. Costs[2]	Suggested Expenditure Budget	Construction Trigger	Suggested Cost Allocation		Cost Sharing	
				Existing Diameter (in)	New/Parallel/ Replace	Diameter (in)	Length (ft)	Unit Cost ($)	Infr. Cost ($)	($)	($)	($)			Existing Users	Future Users	Existing Users	Future Users
3. Comprehensive Plan Updates																		
PLN-1	Water System Master Plan Updates (Years 2026, 2031, 2036)							237,000		-	-	711,000	2026, 2031, 2036		65%	35%	462,150	248,850
PLN-2	Water Assessment Management Plan (Year 2026, 2031, 2036)							119,000		-	-	357,000	2026, 2031, 2036		65%	35%	232,050	124,950
PLN-3	Urban Water Management Plan Updates (Year 2026, 2031, 2036)							119,000		-	-	357,000	2026, 2031, 2036		65%	35%	232,050	124,950
PLN-4	Water Rate Study Updates (Years 2026, 2031, 2036)							119,000		-	-	357,000	2026, 2031, 2036		65%	35%	232,050	124,950
									Subtotal - Comprehensive Plan Updates			**1,782,000**					**1,158,300**	**623,700**
4. Calendar Year Budget Expansion[3]																		
CY7.5	Calendar Year Budget Expansion (2026-2035)							750,000		-	-	7,500,000	2026-2035		0%	100%	0	7,500,000
									Subtotal - CY Budget Expansion			**7,500,000**					**0**	**7,500,000**
5. Total Improvement Costs																		
									Pipeline (Capacity)	**9,122,916**	**12,772,082**	**16,603,706**					**1,135,717**	**15,467,989**
									Storage Reservoirs (Capacity)	**9,182,661**	**12,855,726**	**16,712,443**					**8,453,441**	**8,259,003**
									Groundwater Wells (Capacity)	**16,615,511**	**23,261,715**	**30,240,230**					**5,605,822**	**24,634,408**
									Pump Stations (Capacity)	**3,257,244**	**4,520,142**	**5,846,185**					**2,938,790**	**2,907,395**
									Pressure Reducing Valves (Capacity)	**55,977**	**78,367**	**101,878**					**56,033**	**45,845**
									Known Pipeline R&R	**1,795,280**	**2,513,392**	**3,267,409**					**3,267,409**	**0**
									Annual Pipeline R&R	**10,053,680**	**14,075,152**	**18,297,698**					**18,297,698**	**0**
									Storage Reservoirs (Condition)	**-**	**-**	**3,863,750**					**3,863,750**	**0**
									5-year Improvement Projects	**-**	**-**	**3,900,000**					**3,900,000**	**0**
									Comprehensive Plan Updates	**-**	**-**	**1,782,000**					**1,158,300**	**623,700**
									CY Budget Expansion	**-**	**-**	**7,500,000**					**0**	**7,500,000**
									Total Improvement Costs	**50,083,269**	**70,076,577**	**108,115,300**					**48,676,960**	**59,438,340**

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11/30/2021

Notes:
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.
3. The City's portion of the total CY expansion cost is estimated at $23M, it will be split in three ways with Water, Sewer, and Public Facilities.

4. Calendar Year Budget Expansion. City staff identified the CY expansion budget schedule at $7.5M. The overall City's portion of the total expansion cost is estimated at $23M, and was split three ways into the Water, Sewer and Public Facilities funds. This is expansion is attributed to the impact fees/new development.

5. Total Improvement Costs. This constitutes the total costs of the previous 4 sections.

8.4 SUGGESTED PIPELINE REPLACEMENT BUDGET

The suggested pipeline replacement budget alternatives are shown on **Figure 8.1**, and includes the estimated costs for replacing pipelines phased by 5-year fiscal periods through the year 2038. The industry recommended goal of pipeline annual R&R budgets is at 1.0% of system pipeline length for 100-year pipeline replacement cycle. However, due to the City's public work budget limitation, costs are estimated based on 0.5% per year for 200-year pipe replacement cycle per City staff's direction. The estimated costs are starting from a base rate of $1.9 million per year, with a pipe replacement rate of 0.5% of system length per year, the future costs in 2038 are expected to be approximately $2.1 million per year.

8.5 SUGGESTED EXPENDITURE BUDGET

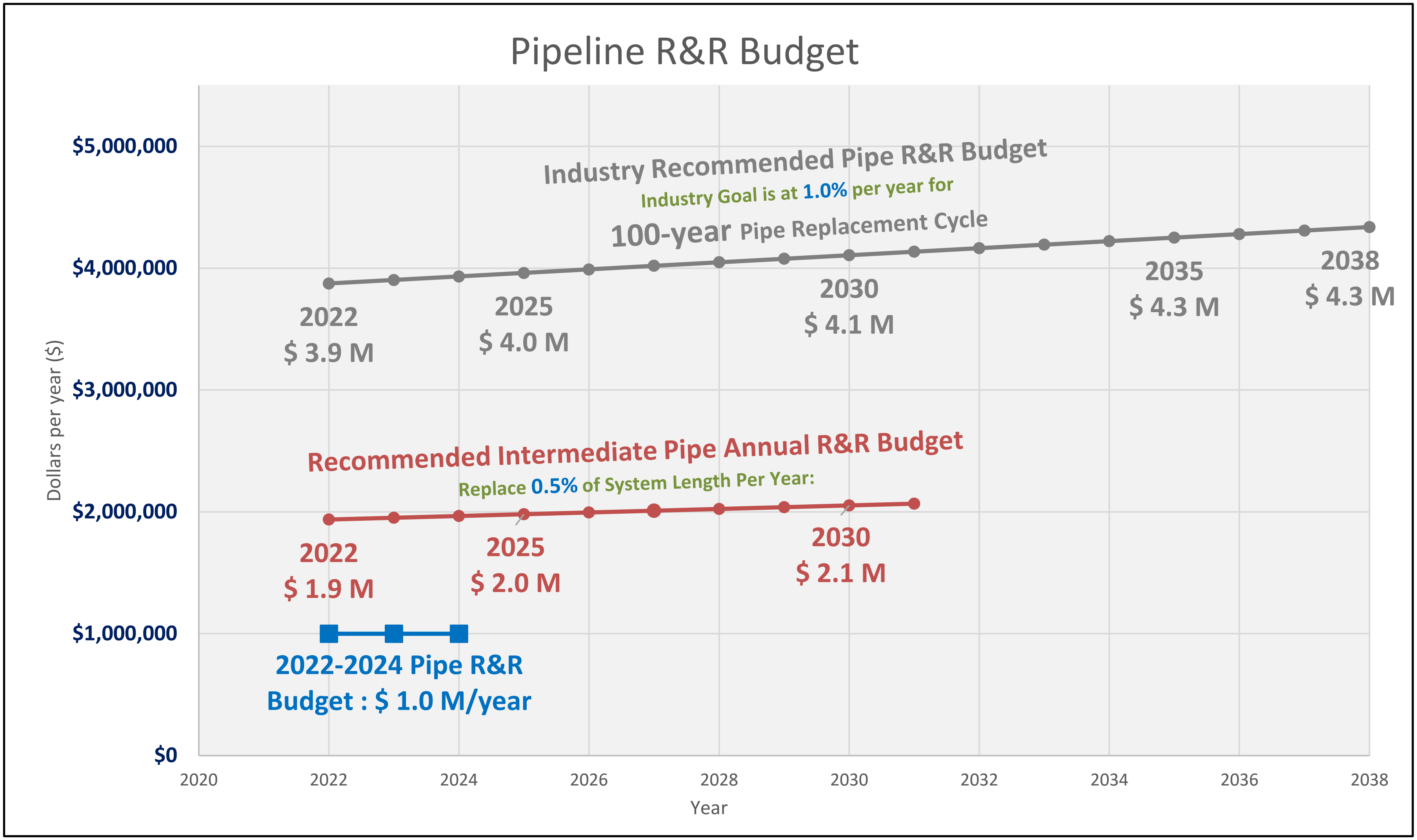
This section discusses the suggested expenditure budget for the capital improvement plan horizon as well as the recommended sequence of construction for capital improvement planning.

8.5.1 6-Year Capital Improvement Costs and Phasing

The capital improvement program costs and phasing for the next six fiscal years (FY) are summarized on **Table 8.3**; this plan includes the total costs for pipelines, tanks, booster stations, and valves to be constructed. The improvements listed are also categorized by improvement classification, indicating whether the improvement is intended to expand or replace the existing water distribution system infrastructure.

8.5.2 Suggested Expenditure Budget

The suggested expenditure budget is shown on **Table 8.4**, and includes the total costs for pipelines, tanks, pump stations, valves, and wells phased by 3-year fiscal period through the year 2024, by 5-year fiscal period through year 2034 and by 4-year fiscal period through year 2038. Costs are categorized through the General Plan horizon of 2038 for near-term, intermediate term, and long-term planning.



LEGEND

- Industry Recommended Pipe R&R Budget
- Recommended Intermediate Pipe R&R Budget
- 2022-2024 Pipe R&R Budget

Assumptions:

1. System Growth: 1.5 miles of new construction per year (based on historical construction)
2. All costs in 2021 dollars
3. Weighted average pipeline unit cost = $224/foot
4. 30% contengency added for estimated construction cost
5. 30% contengency added for capital improvement cost

AKEL ENGINEERING GROUP, INC.

November 11, 2021

Figure 8.1

Pipeline Renewal & Replacement Budget

Water System Master Plan

City of Morgan Hill

CITY OF MORGAN HILL

Table 8.3 6-year Improvement Phasing
Water System Master Plan
City of Morgan Hill

CIP ID	Project Description	Year Range	Expansion	Repair & Replacement	FY 2022	FY 2023	FY 2024	FY 2025	FY 2026	FY 2027	FY 2021-2026 Total
					Fiscal Year Improvement Phasing						
Pipeline Improvements											
Capacity Improvements											
NH-P1	Fire Flow Improvement	2022	0%	100%	368,310						368,310
HL-P1	Holiday Tank Inflow	2024	100%	0%			327,077				327,077
HL-P2	Holiday Tank Outflow	2024	100%	0%			271,058				271,058
HL-P3	Holiday Lake Boosting Pipeline	2025	100%	0%				1,207,441			1,207,441
HL-P4	Holiday Lake Boosting Pipeline	2026	100%	0%					1,133,516		1,133,516
BR-P4	Fire Flow Improvement	2023	0%	100%		201,076					201,076
	Subtotal - Pipeline Capacity Improvements				**368,310**	**201,076**	**598,135**	**1,207,441**	**1,133,516**	**0**	**3,508,478**
Repair and Replacement											
RP-1	Holiday Lake Improvement	2024	0%	100%			878,776				878,776
RP-2	Jackson Oaks Improvement	2024	0%	100%			213,232				213,232
RP-3	Jackson Oaks Improvement	2024	0%	100%			271,387				271,387
RP-4	Holiday Lake Improvement	2024	0%	100%			310,156				310,156
RP-5	Holiday Lake Improvement	2024	0%	100%			568,620				568,620
RP-6	Holiday Lake Improvement	2024	0%	100%			585,851				585,851
RP-7	Nob Hill Improvement	2022	0%	100%	206,771						206,771
RP-8	Hydropneumatic Improvement	2022	0%	100%	232,617						232,617
RR-2022-2024	0.5% System Pipeline R&R (excluded known pipeline R&R)	2022-2024	0%	100%	1,012,833	1,012,833	1,012,833				3,038,500
RR-2025	0.5% System Pipeline R&R	2025	0%	100%				2,133,136			2,133,136
RR-2026	0.5% System Pipeline R&R	2026	0%	100%					2,148,719		2,148,719
RR-2027	0.5% System Pipeline R&R	2027	0%	100%						2,164,302	
	Subtotal - Pipeline Condition Improvements				**1,452,221**	**1,012,833**	**3,840,855**	**2,133,136**	**2,148,719**	**2,164,302**	**12,752,067**
	Subtotal - Pipeline Improvements				**1,820,532**	**1,213,909**	**4,438,990**	**3,340,577**	**3,282,235**	**2,164,302**	**16,260,545**
Tanks											
Capacity Improvements											
HL-T1	East Dunne Tank	2023	100%	0%		3,935,063					3,935,063
GA-T1	Glen Ayre 2 Tank	2027	100%	0%						1,157,371	1,157,371
LI-T1	Llagas 2 Tank	2025	100%	0%				925,897			925,897
JO-T1	Jackson Oaks 2 Tank	2026	100%	0%					925,897		925,897
WD-T1	Woodland 2 Tank	2027	0%	100%						1,157,371	1,157,371
	Subtotal - Storage Reservoir Capacity Improvements				**0**	**3,935,063**	**0**	**925,897**	**925,897**	**2,314,743**	**8,101,600**
Reservoir Re-Coating and Retrofitting											
RC-1	Encino	2022	100%	0%	330,000						330,000
RC-2	Glen Ayre	2022	100%	0%	55,000						55,000
RC-3	El Toro	2023	100%	0%		275,000					275,000
RC-4	Edmundson	2024	100%	0%			2,337,500				2,337,500
RC-5	Boy's Ranch # 3	2025	100%	0%				563,750			563,750
RC-6	Boy's Ranch # 2	2026	100%	0%					302,500		302,500
	Subtotal - Storage Reservoir Condition Improvements				**385,000**	**275,000**	**2,337,500**	**563,750**	**302,500**	**0**	**3,863,750**
	Subtotal - Storage Reservior Improvements				**385,000**	**4,210,063**	**2,337,500**	**1,489,647**	**1,228,397**	**2,314,743**	**11,965,350**
Groundwater Wells											
BR-W1	Boy's Ranch New Well	2025	100%	0%				5,040,038			5,040,038
NH-W1	Nob Hill New Well	2022	100%	0%	5,040,038						5,040,038
NH-W2	Nob Hill New Well 2	2023	100%	0%		5,040,038					5,040,038
NH-W3	Nob Hill New Well 3	2027	100%	0%						5,040,038	5,040,038
	Subtotal - Groundwater Well Improvements				**5,040,038**	**5,040,038**	**0**	**5,040,038**	**0**	**5,040,038**	**20,160,153**
Pump Stations											
NH-PS1	Nob Hill to Holiday 1	2022	100%	0%	2,801,579						2,801,579
BR-PS1	Nob Hill to Boys Ranch	2022	100%	0%	100,000						100,000
HL-PS1	Holiday 1 to Holiday Lake	2025	100%	0%				2,398,606			2,398,606
LI-PS1	Nob Hill to Llagas 1	2026	100%	0%					546,000		546,000
	Subtotal - Pump Station Improvements				**2,901,579**	**0**	**0**	**2,398,606**	**546,000**	**0**	**5,846,185**
Pressure Reducing Valves											
HL-PRV1	Thomas Grade PRV	2025	100%	0%				101,878			101,878
	Subtotal - Pressure Reducing Valve Improvements				**0**	**0**	**0**	**101,878**	**0**	**0**	**101,878**
5-Year Improvement Projects											
5YR-1	Well Rehabilitation	2022-2026	0%	100%	300,000	300,000	300,000	300,000	300,000		1,500,000
5YR-2	Booster Rehabilitation	2023-2024	0%	100%		800,000	600,000				1,400,000
5YR-3	Generators Replacement	2022-2024	0%	100%		250,000	500,000	250,000			1,000,000
	Subtotal - 5-Year Improvement Projects				**300,000**	**1,350,000**	**1,400,000**	**550,000**	**300,000**	**0**	**3,900,000**
Comprehensive Plan Updates											
PLN-1	Water System Master Plan Updates	2026							237,000		237,000
PLN-2	Water Assessment Management Plan Updates	2026							119,000		119,000
PLN-3	Urban Water Management Plan Updates	2026							119,000		119,000
PLN-4	Water Rate Study Updates	2026							119,000		119,000
	Subtotal - Comprehensive Plan Updates				**0**	**0**	**0**	**0**	**594,000**	**0**	**594,000**
Calendar Year Budget Expansion											
CY7.5	Calendar Year Budget Expansion	2022-2027							750,000	750,000	1,500,000
	Subtotal - Pressure Reducing Valve Improvements				**0**	**0**	**0**	**0**	**750,000**	**750,000**	**1,500,000**
Total Improvement Costs											
	Fiscal Year Total				$10,447,149	$11,814,010	$8,176,490	$12,920,746	$6,700,632	$10,269,083	$60,328,110
	Cumulative Total				$10,447,149	$22,261,159	$30,437,649	$43,358,395	$50,059,027	$60,328,110	**$60,328,110**

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Table 8.4 Suggested Expenditure Budget

Water System Master Plan

City of Morgan Hill

Project Type	Suggested Expenditure Budget[1]			
	General Plan Horizon			
	Near-Term	Intermediate Term	Long-Term	
	2022-2024 (3 years)	2025-2029 (5 years)	2030-2034 (5 years)	2035-2038 (4 years)
Pipe	$7,473,431	$14,054,496	$9,312,790	$7,328,097
Tank	$6,932,563	$5,032,787	$8,610,843	
Well	$10,080,077	$10,080,077	$5,040,038	$5,040,038
Pump Station	$2,901,579	$2,944,606		
Valve		$101,878		
5-Year Improvement Projects	$3,050,000	$850,000		
Comprehensive Plan Updates		$594,000	$594,000	$594,000
Calendar Year Budget Expansion		$3,000,000	$3,750,000	$750,000
Total	**$30,437,649**	**$36,657,843**	**$27,307,672**	**$13,712,136**
Cumulative Cost	$30,437,649	$67,095,492	$94,403,164	$108,115,300

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Note:

1. This expenditure budget is suggested, and is dependent on the City's rate of growth. The City is not bound by this budget and may implement capital improvement projects as funding is available.

8.5.3 Sequence of Construction

Suggested expenditure budget phasing is intended to provide general guidance for implementing the capital improvement projects listed in this master plan. The sequence of construction on **Table 8.4** for the near term and intermediate term improvements accounts for projects that City staff have identified as having immediate benefit. Additional improvements may be constructed as development occurs and the phasing and implementation of a sequence of construction is subject to the approval of the City Engineer.

CHAPTER 9 - ALTERNATIVES FOR FUTURE RECYCLED WATER

This chapter summarizes three potential recycled water alternatives for the City of Morgan Hill, extracted from the Valley Water's Countywide Reuse Master Plan completed October 2020 (2020 CoRe Plan). Each identified alternative included an estimated total capital cost, operations and maintenance (O&M) costs, life-cycle costs, and projected capacities.

9.1 BACKGROUND AND PREVIOUS RELEVANT STUDIES

There is currently no recycled water delivered within the City's service area; however, City staff have been persistently exploring potential feasible opportunities where recycled water can be implemented in the future. This chapter provides a summary of the recommendations extracted from the October 2020 Draft report of the Countywide Water Reuse Master Plan, completed by Santa Clara Valley Water District (Valley Water). This section lists previous relevant studies which explored the opportunities and potential costs in adding recycled water to the water supply portfolio in Morgan Hill.

Morgan Hill is continuing to look at other conceptual alternatives, including the use of recycled water from SCRWA to support increasing water supply resiliency. Newer technologies related to treated water augmentation may bring options for the City in the future.

9.1.1 2015 South County Recycled Water Master Plan Update

The Santa Clara Valley Water District (Valley Water), the South County Regional Wastewater Authority (SCRWA), the City of Morgan Hill (Morgan Hill), and the City of Gilroy (Gilroy) partnered to explore the continued use, promotion, and expansion of the recycled water in the region. The agencies retained the services of Stantec and Akel Engineering Group to complete the 2015 South County Recycled Water Master Plan Update (2015 SCRWMP) and which included a market assessment and developed project alternatives for expanding the existing recycled water system currently serving the City of Gilroy. One of the considered alternatives included extending a recycled water pipeline from the SCRWA wastewater plant northward to service the City of Morgan Hill.

9.1.2 2016 Recycled Water Feasibility Evaluation

With intent to provide more focus on the City of Morgan Hill recycled water needs, the City retained the services of Akel Engineering Group and Stantec to further explore opportunities in recycled water for Morgan Hill, and to prepare the 2016 Recycled Water Feasibility Evaluation (2016 RWFE). This study identified potential recycled water users through a market assessment, and included high level costs for the potential alternatives. As identified in the market assessment, the potential future users of recycled water in the City include landscape irrigation, agricultural irrigation, industrial processes, and potable reuse. As part of the 2016 RWFE, infrastructure required to convey recycled water from the South County Regional Wastewater Authority (SCWRA) Wastewater Treatment Plant (WWTP) in the City of Gilroy to the potential users was identified.

9.1.3 2020 Countywide Water Reuse Master Plan (2020 CoRe Plan)

This Countywide Water Reuse Master Plan (CoRe Plan) was published as a Final Draft in October 2020. This countywide plan explores opportunities for reliable local water, imported water, and recycled water within Valley Water's service area. This report is intended to identify opportunities to expand water reuse throughout Valley Water's service area, including the City of Morgan Hill. The report identified 3 alternatives (options) with potential costs and risk levels, and which are documented in this chapter.

9.2 CORE PLAN - REUSE OPTIONS

According the 2020 CoRe Plan, Valley Water coordinated with the City of Morgan Hill, the City of Gilroy, and SCRWA, to explore South County reuse project concepts and collaboratively developed a list of 8 potential opportunities. Further discussions between Valley Water, Morgan Hill, and Gilroy resulted in three feasible options for improving recycled water supply reliability in Morgan Hill, as documented in the CoRe plan. These three options are briefly described in this section, as well as a 4^{th} City-included option, along with their benefits and limitations.

9.2.1 2020 CoRe Plan Definitions

This section includes extracted relevant definitions from the CoRe Plan, and which are deemed useful for the discussed options.

- ***Enhance NPR, or NPR+*** *is recycled water for non-drinking reuse that has been blended with purified water to reduce concentration of salts and other dissolved solids to enable broader application of recycled water for non-potable end uses and protect groundwater quality.*

- ***Groundwater Recharge (GWR)****, as defined in context of IPR, is a process that involves using constructed facilities that spread water across infiltration basins or percolation ponds (surface spreading), or pump water directly into the subsurface through injection wells (subsurface injection) to increase water supply in a groundwater aquifer (natural underground water storage).*

- ***Non-potable Reuse (NPR)*** *refers to recycled water that is potable, but is safe to use for irrigation, industrial uses, or other non-potable water purposes.*

- ***Surface Water Augmentation (SWA)*** *involves adding purified water to a surface water reservoir to increase water supply.*

- ***Treated Water Augmentation (TWA)*** *involves introducing purified water directly into a potable (drinking) water distribution system of a water treatment plant.*

9.2.2 Option 1 – NPR+ from South Bay Water Recycling

This option includes importing recycled water supplies from South Bay Water Recycling (SBWR) via 6 miles of 18-inch pipeline extension along Monterey Road between Morgan Hill and the SBWR system to the north. This transmission main from SBWR would connect to a future recycled water distribution system in Morgan Hill. This option is documented on **Figure 9.1**.

- **Benefits.** According the 2020 CoRe Plan, *this option would improve water supply reliability for Morgan Hill by importing NPR+ supply from SBWR to serve non-potable demands in place of groundwater, which is currently the sole water source of Morgan Hill.*

- **Limitations.** The primary limitation of NPR+ is that the water it provides would primarily not be used by City water customers, and would instead be used by agricultural users. While this would enable agricultural users to take less groundwater out of the aquifer, thereby reserving it for urban customers, the benefit is indirect and less certain.

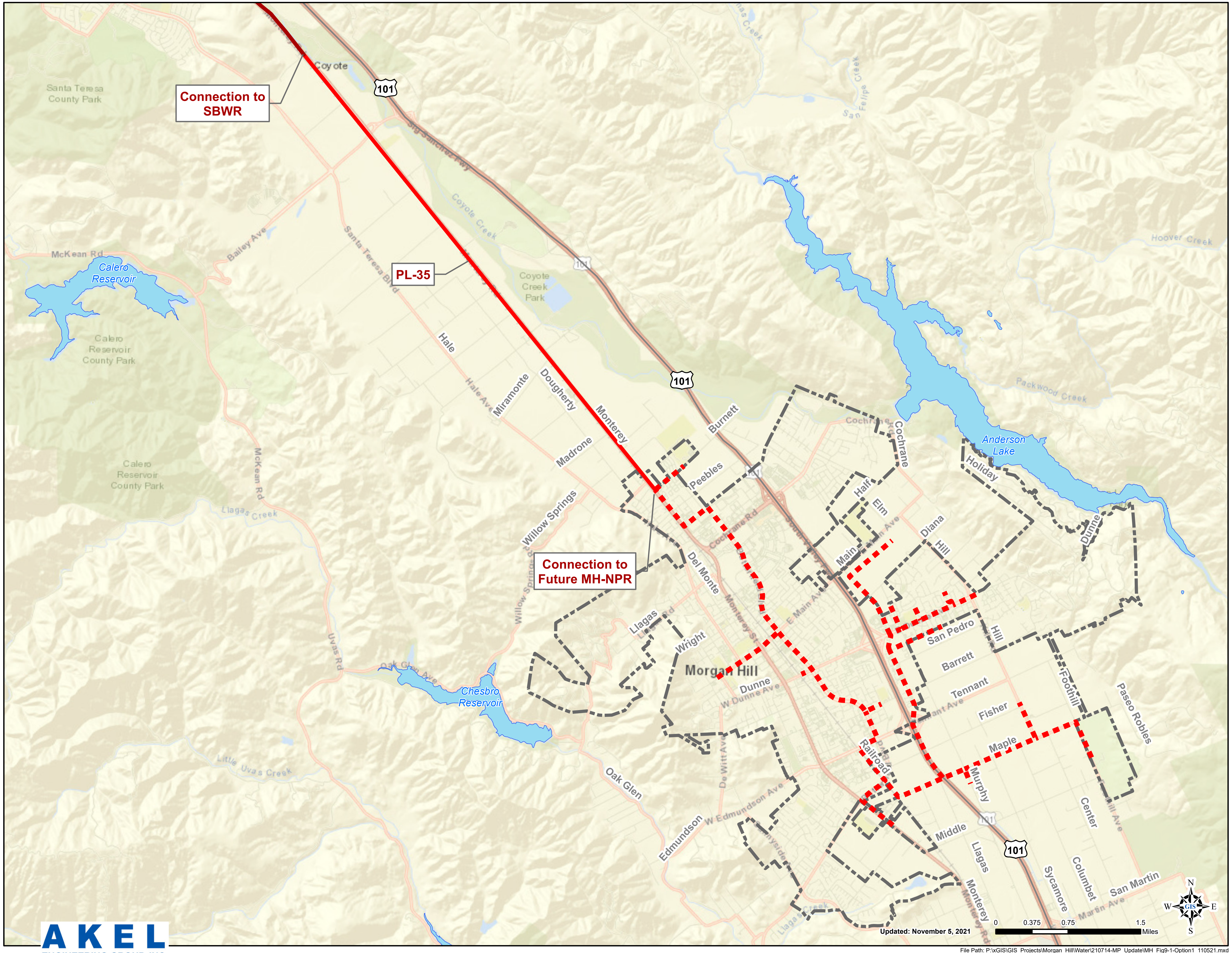
  According to the 2020 CoRe Plan, *an agreement to establish terms of exporting SBWR NPR+ supply from San Jose and neighboring areas to Morgan Hill would be needed, as the existing Silver Creek Agreement between Valley Water and San José expires in 2027. Long-term supply reliability is unconfirmed. Operational impacts to the SBWR system have not been evaluated, and a new reservoir may be needed to supply reliable summertime flows. Valley Water may need to revisit and update the 2011 Recycled Water Irrigation and Groundwater Study to reassess potential impacts of recycled water on the Llagas Subbasin prior to moving forward. Given shifting development trends in Morgan Hill, an updated NPR market assessment is needed*.

9.2.3 Option 2 – Satellite Advanced Water Purification Facility (AWPF) for Groundwater Recharge (GWR)

This option includes recharging the Llagas subbasin on San Pedro Ponds with purified water, which would be produced at a satellite WWTP treating the City's wastewater. This purified water would be conveyed to San Pedro ponds through 2.8 miles 16-inch pipelines along Maple Avenue and Hill Road. This option is shown on **Figure 9.2**.

- **Benefits.** According to the 2020 CoRe Plan, *this option would improve water supply reliability and drought resilience for Morgan Hill by recharging the Llagas Subbasin with purified water. Option 2 could be combined with Option 1*

- **Limitations.** According to the 2020 CoRe Plan, *high unit costs with uncertain value to improving South County water supply reliability. Limited wastewater available for satellite treatment in Morgan Hill and relied upon for meeting existing South County Recycled Water System (RWS) demands. Morgan Hill satellite facility would increase solids loads to SCRWA,*



Legend

Raw Water System

- Existing SBWR Pipeline
- Proposed RW Pipeline
- Morgan Hill RW System
- Highways
- Lakes
- City Limits

Source:
Countywide Water Reuse Master Plan (CoRe Plan), October 2020

Figure 9.1
Option 1
NPR+ from SBWR
Water System Master Plan
City of Morgan Hill

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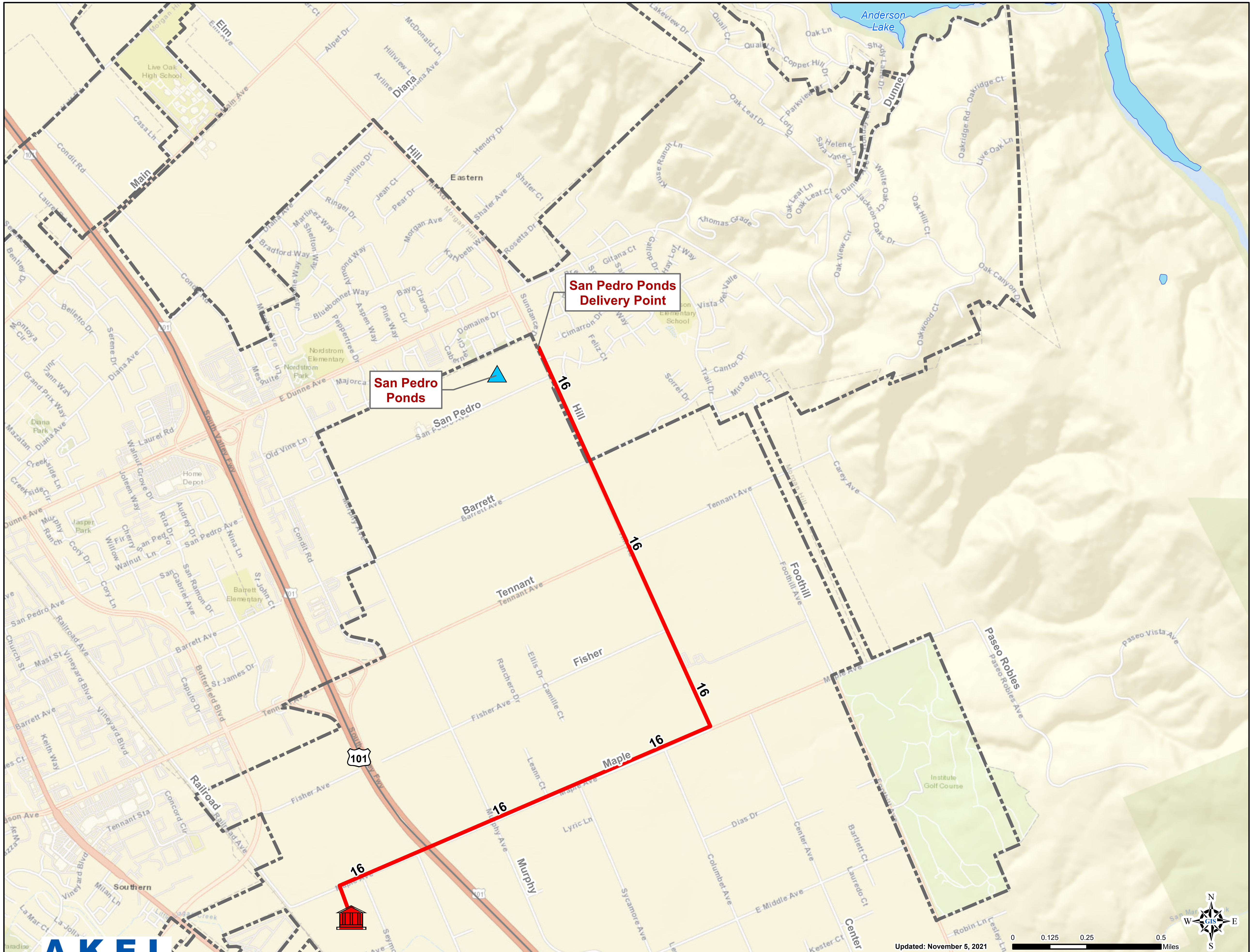


Legend

Water Purification System

- Water Purification Facility
- San Pedro Ponds
- Purified Water Pipelilne
- Highways
- Lakes
- City Limits

Source:
Countywide Water Reuse Master Plan (CoRe Plan), October 2020

Figure 9.2
Option 2
Satellite AWPF for GWR
Water System Master Plan
City of Morgan Hill

AKEL ENGINEERING GROUP, INC.

File Path: P:\xGIS\GIS_Projects\Morgan_Hill\Water\210714-MP_Update\MH_Fig9-2-Option2_110521.mxd

posing operational issues that may be substantial. If implemented in Morgan Hill, solids handling requires further study and may increase costs significantly.

Density and proximity of active private wells limit GWR locations in South County. San Pedro Ponds is assumed the delivery point; The 2020 CoRe Plan indicates that further evaluations are needed to confirm the viability of this option. Conditions and reliability of increasing raw water delivery to Llagas Subbasin and specific recharge facility also need to be confirmed. Assumed location in Gilroy gets inundated with stormwater (unsuitable for evaporation pond). Options 2 and 3 are mutually exclusive, as they rely on the same supply source.

9.2.4 Option 3 – Satellite Advanced Water Purification Facility (AWPF) for Surface Water Augmentation (SWA)

This option includes recharging the Llagas subbasin with water supplies provided by Valley Water, and which would be delivered to ponds within the City's service area. In exchange for these water supplies, the City would deliver purified water, produced at a to-be-constructed satellite WWTP, that would be delivered to the Valley Water Anderson Reservoir northeast of the City's service area. This option is shown on **Figure 9.3**.

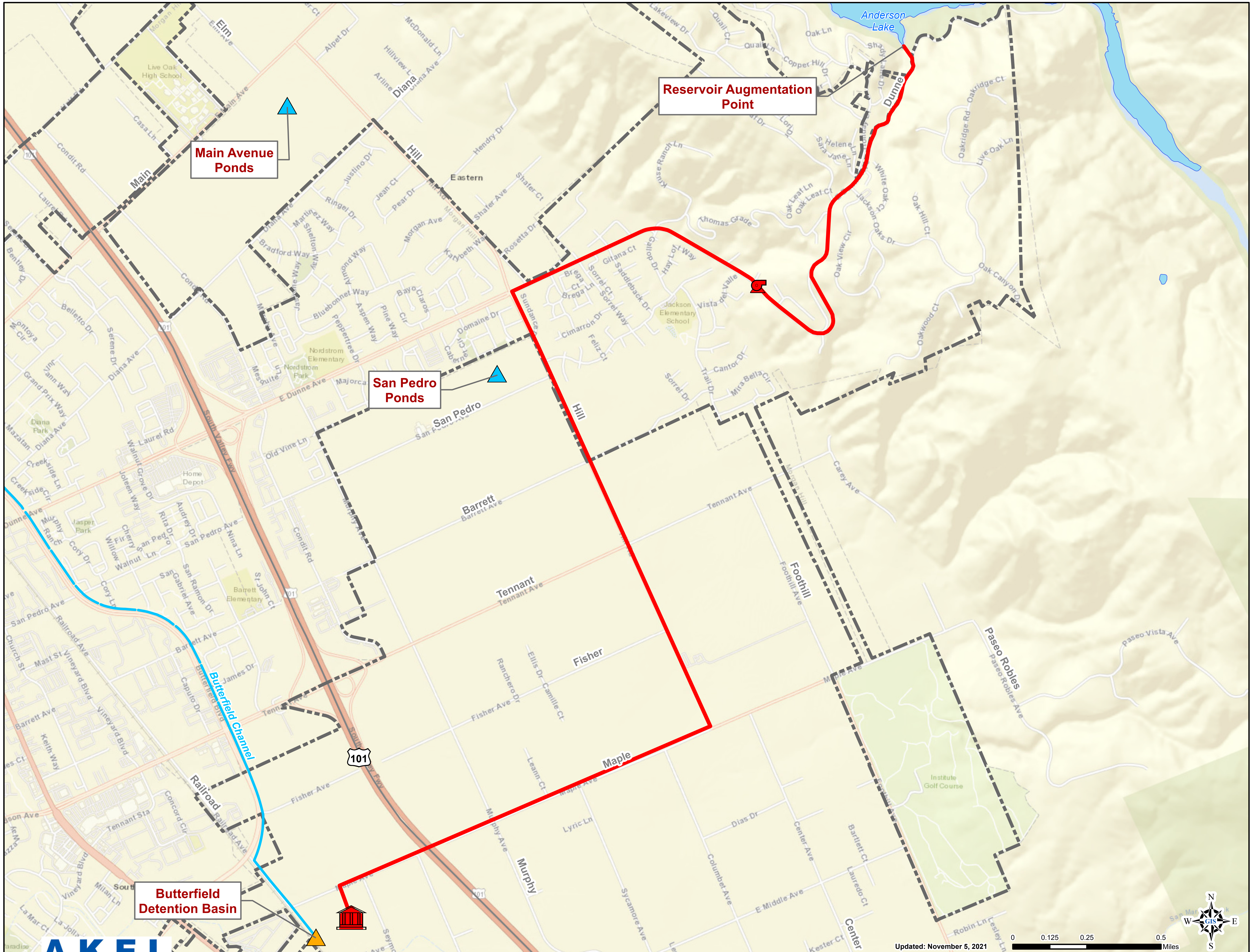
- ***Benefits.*** According to the 2020 CoRe Plan, *this option would improve water supply reliability and drought resilience for Morgan Hill by recharging the Llagas Subbasin with raw water supplied from Valley Water via the Santa Clara Conduit in exchange for an equivalent amount of purified water delivered to Anderson Reservoir for SWA. Option 3 could be combined with Option 1.*

- ***Limitations.*** According to the 2020 CoRe Plan, *high unit costs with uncertain value to improving South County water supply reliability. Limited wastewater available for satellite treatment in Morgan Hill and relied upon for meeting existing South County RWS demands. Morgan Hill satellite facility would increase solids loads to SCRWA, posing operational issues that may be substantial. If implemented in Morgan Hill, solids handling requires further study and may increase costs significantly*

  New permits from Regional Board(s) and/or State Water Resources Control Board's Division of Drinking Water needed for discharging purified water to Anderson Reservoir. Conditions and reliability of increasing raw water delivery to Llagas Subbasin and specific recharge facility need to be confirmed. Assumed location in Gilroy gets inundated with stormwater (unsuitable for evaporation pond).Options 2 and 3 are mutually exclusive, as they rely on the same supply source.

9.2.5 Option 4 – Satellite or SCRWA Advanced Water Purification Facility (AWPF) for Treated Water Augmentation (TWA)

While not explored in-depth in the CoRe Plan, Treated Water Augmentation (TWA) may provide the greatest opportunity for a secure recycled water source that can supply recycled water directly into the City's water system. Regulations and requirements are currently in development by the



Legend

Water Purification System

- Water Purification Facility
- Booster Station
- Detention Basin
- Recharge Ponds
- Purified Water Pipelilne
- Butterfield Channel
- Highways
- Lakes
- City Limits

Source:
Countywide Water Reuse Master Plan (CoRe Plan), October 2020

Figure 9.3
Option 3
Satellite AWPF for SWA
Water System Master Plan
City of Morgan Hill

AKEL ENGINEERING GROUP, INC.

File Path: P:\xGIS\GIS_Projects\Morgan_Hill\Water\210714-MP_Update\MH_Fig9-3-Option3_110521.mxd

State of California and will likely be available in the next few years. Should TWA prove to be a feasible path in the future, the City will consider moving in that direction. There are two likely options to deliver purified water to the Morgan Hill Water System: The first option consists of the development of a satellite wastewater treatment facility in combination with an Advanced Water Purification Facility (AWPF) that utilizes the City's wastewater. The second option consists of the construction of the AWPF at the South County Regional Wastewater Authority and pumping the treated water back to Morgan Hill.

9.3 CORE PLAN - COST ESTIMATES

As part of the 2020 CoRe Plan, Valley Water prepared preliminary cost estimates for the three Morgan Hill options. The costs document the capital, operations and maintenance (O&M), unit costs (levelized for annual yield and based on 30-year and 100-year life-cycle) to evaluate and compare elements and portfolios. The Morgan Hill options' cost estimates were extracted from the 2020 CoRe plan and summarized on **Table 9.1**.

Between the three identified options, Option 1 seems to have the lowest implementation costs with its unit costs estimated at $1,878/AF for the 100-year lifecycle and $2,431/AF for the 30-year lifecycle. In comparison, Option 2's unit costs are estimated at $6,629/AF for the 100-year lifecycle and $7,955/AF for the 30-year lifecycle. Option 3 has the highest costs with unit costs estimated at $7,292/AF for the 100-year lifecycle and $8,839/AF for the 30-year lifecycle. Cost estimate for options of TWA are not yet available.

While the Capital Improvement Program does not yet include recycled water, the City intends to work in partnership with Valley Water to determine the best path forward from a water supply and resiliency perspective in the next year. After identifying a feasible option, the City will partner with Valley Water and potentially others to develop a cost model for construction of recycled water improvements, which may subsequently be brought back to the Council to amend this Master Plan.

Table 9.1 Recycled Water Reuse Options

Water System Master Plan

City of Morgan Hill

Option No.	Brief Description	Portfolio	Capital Cost	Annual O&M Cost	Levelized Unit Costs 30-Year Lifecycle ($/AF)	Levelized Unit Costs 100-Year Lifecycle ($/AF)	Projected 2040 Yield (AFY)	Conveyance Pipeline
Option 1	**NPR+ from South Bay Water Recycling**	Delivers **2,900 AFY** of NPR+ from SBWR to a new Morgan Hill recycled water system	**$77M**	$2.9M	**$2,431**	**$1,878**	2,900	16.4 miles 16-inch diameter
Option 2	**Satellite Advanced Water Purification Facility (AWPF) Groundwater Recharge (GWR)**	Delivers **1,900 AFY** from a Morgan Hill 2.5-mgd satellite WWTP and 2.1-mgd AWPF to recharge facilities in Morgan Hill for GWR	**$138M**	$7.5M	**$7,955**	**$6,629**	1,900	2.8 miles 16-inch diameter
Option 3	**Satellite Advanced Water Purification Facility (AWPF) for Surface Water Augmentation (SWA)**	Delivers **1,900 AFY** from a Morgan Hill 2.5-mgd satellite WWTP and 2.1-mgd AWPF to Anderson Reservoir for SWA	**$160M**	$8.1M	**$8,839**	**$7,292**	1,900	5.6 miles 16-inch diameter

Note:

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1. Source: Countywide Water Reuse Master Plan (CoRe Plan), October 2020.
2. Cost estimate is upscaled from 2019 ENR CCI (11,281) to October 2021 ENR CCI of 12,464.

APPENDICES

APPENDIX A

Existing Water System Schematic

NOTES:

1. P.R.V = PRESSURE REDUCING VALVE SETTING SHOWN IS THAT OF ELEVATION OF STATIC HYDRAULIC GRADE LINE (SHGL)
2. AT CAPRI VALVE TWO PRV'S INSTALLED. NORMAL FLOW IS FROM BOY'S RANCH ZONE TO NOB HILL ZONE; HOWEVER ON LOW PRESSURE (I.E FIRE FLOW) SECOND VALVE ALLOWS FLOW FROM NOB HILL TO BOY'S RANCH.
3. DUE TO HIGH NITRATES DIANA WELL NO. 1 DOES NOT PUMP DIRECTLY INTO DISTRIBUTION SYSTEM BUT RATHER DIRECTLY TO NOB HILL RESERVOIR. MAIN WELL PUMPS INTO BOTH DISTRIBUTION SYSTEM AND NOB HILL LINE. DUE TO PIPE SIZES FLOW GOES PRIMARILY TO NOB HILL LINE. MAIN WELL STARTS, PRIOR TO DIANA 1 TO PREVENT FLOW FROM DIANA NO.1 TO SYSTEM. IF MAIN WELL IS DOWN, VALVE BETWEEN MAIN AND DIANNA CLOSED.
4. HOLIDAY LAKE RESERVOIR CONTROLS JACKSON WELL NO. 1. PRIOR TO START OF E.DUNNE BOOSTER, JACKSON WELL STARTS PUMP INTO BOTH NOB HILL ZONE AND HOLIDAY LAKE ZONE. FLOW GOES PRIMARILY TO HOLIDAY LAKE.

NO.	DESCRIPTION	DATE	BY

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Revisions

WORK ACCEPTED: INSPECTOR:
AS–BUILT CORRECTIONS
BY: DATE:

DRAWN: MARK
DESIGN:
CHECKED: RAY
APPROVED: DATE:
JAMES M. ASHCRAFT– CITY ENGINEER R.C.E. #28921 EXP. 3/31/07

HOR: NONE
VERT: NONE
JOB NUMBER:

City of Morgan Hill
Public Works Department
100 Edes Ct. Morgan Hill, CA 95037 (408)776–7337, Fax (408)779–6282

LAST UPDATE NOVEMBER 2021 BY AKEL ENGINEERING GROUP

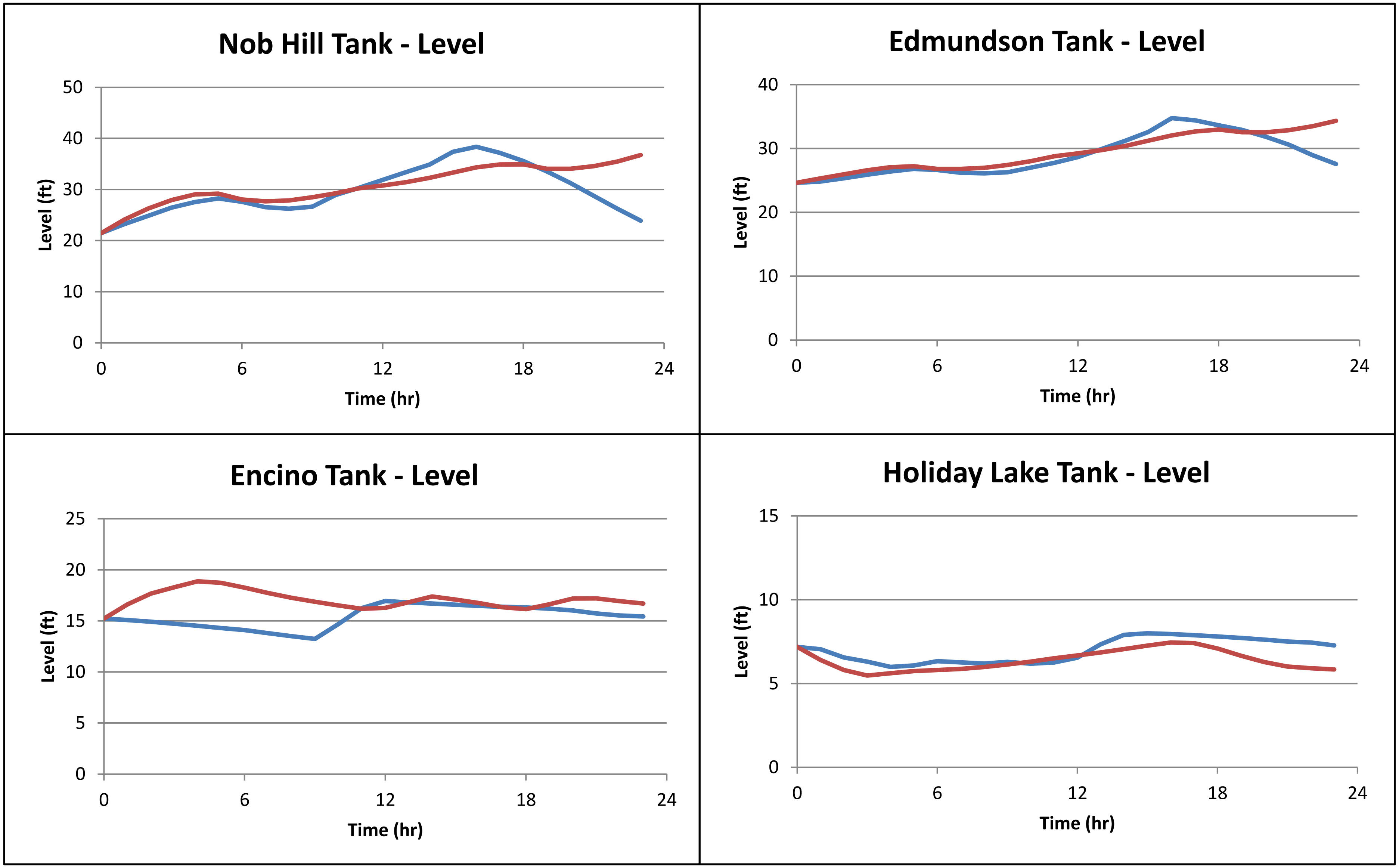
AKEL ENGINEERING GROUP, INC.

WATER SYSTEM SCHEMATIC

FILE NUMBER:
PRINT DATE: 3/19/08
SHEET NUMBER: 1 OF 1

APPENDIX B

Hydraulic Model Validation



LEGEND

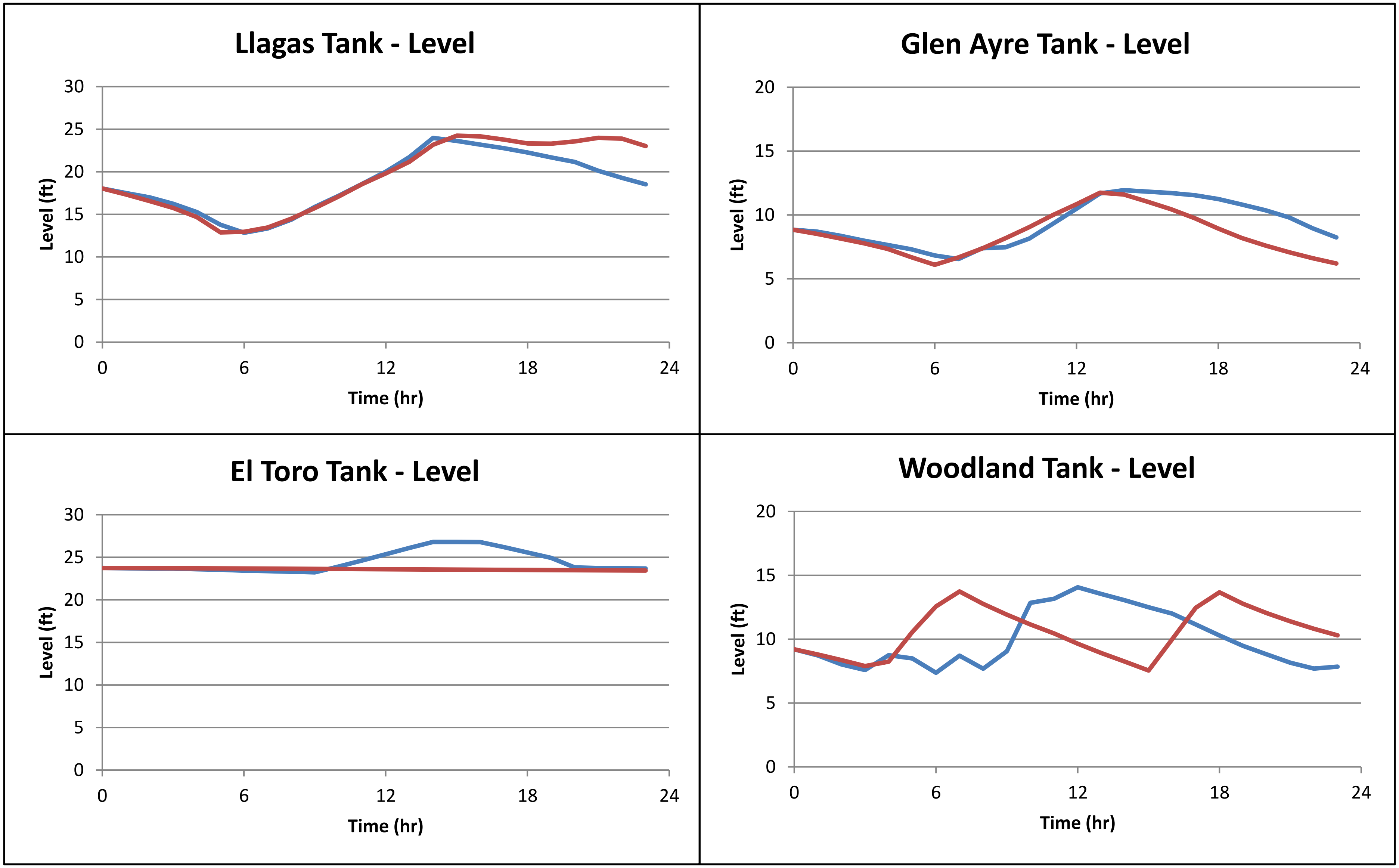
Telemetry Data
Model Data

AKEL ENGINEERING GROUP, INC.

21-Sep-21

Figure 1
Tank Validation
Water System Master Plan
City of Morgan Hill

CITY OF MORGAN HILL



LEGEND

- Telemetry Data
- Model Data

Figure 2

Tank Validation

Water System Master Plan
City of Morgan Hill

21-Sep-21

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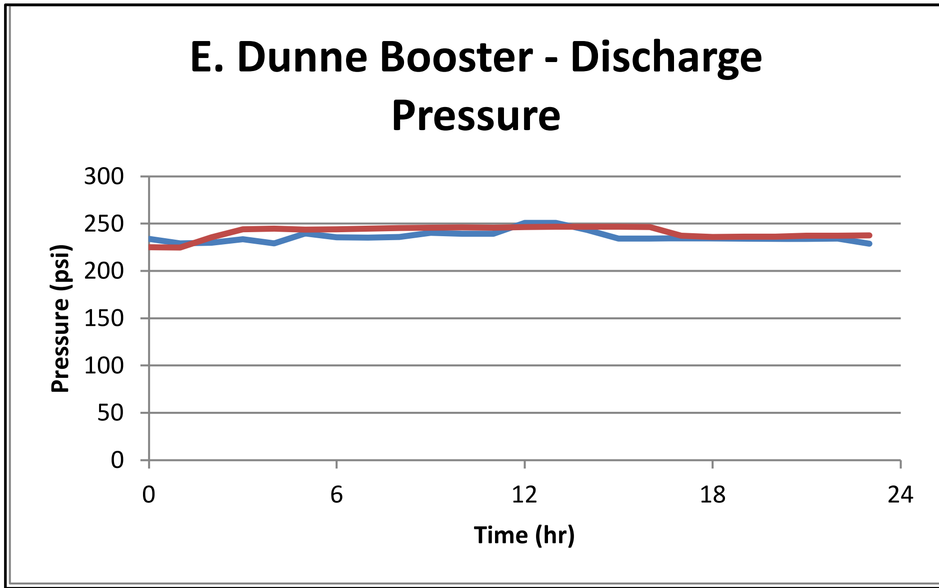
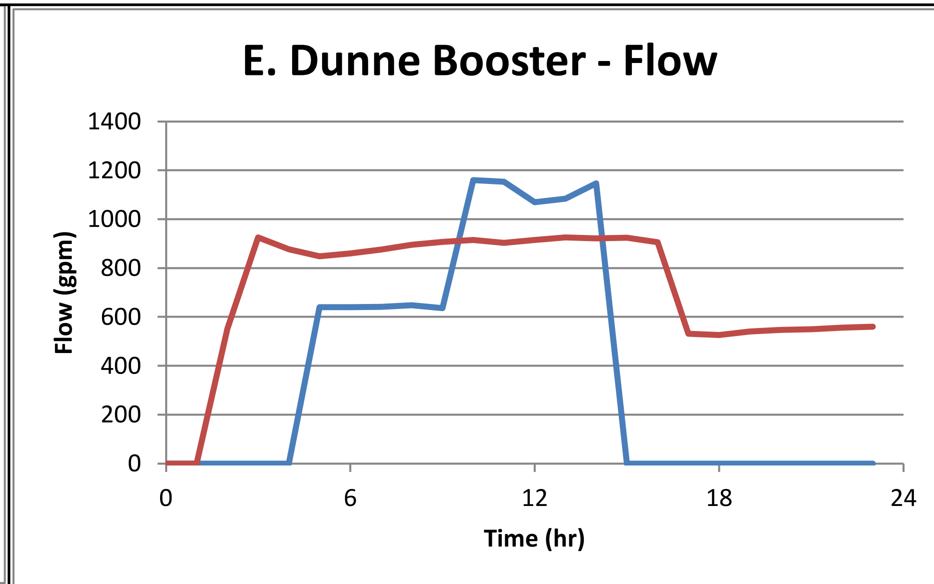
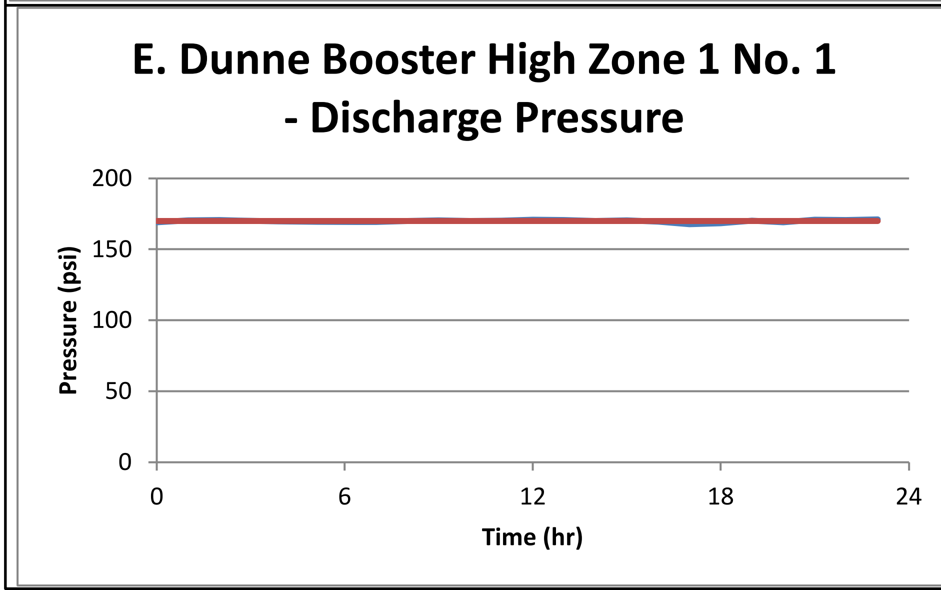
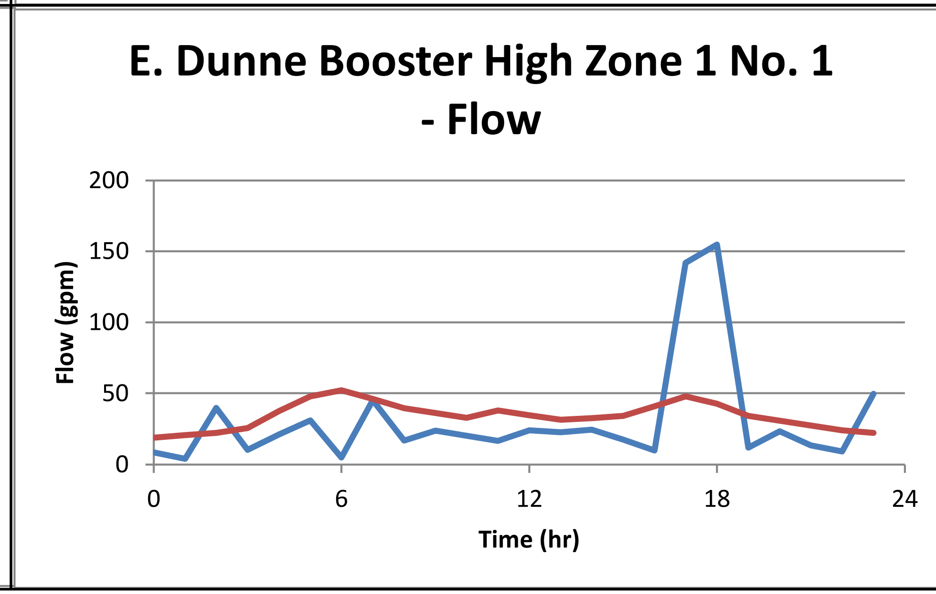
CITY OF MORGAN HILL









LEGEND

- Telemetry Data
- Model Data

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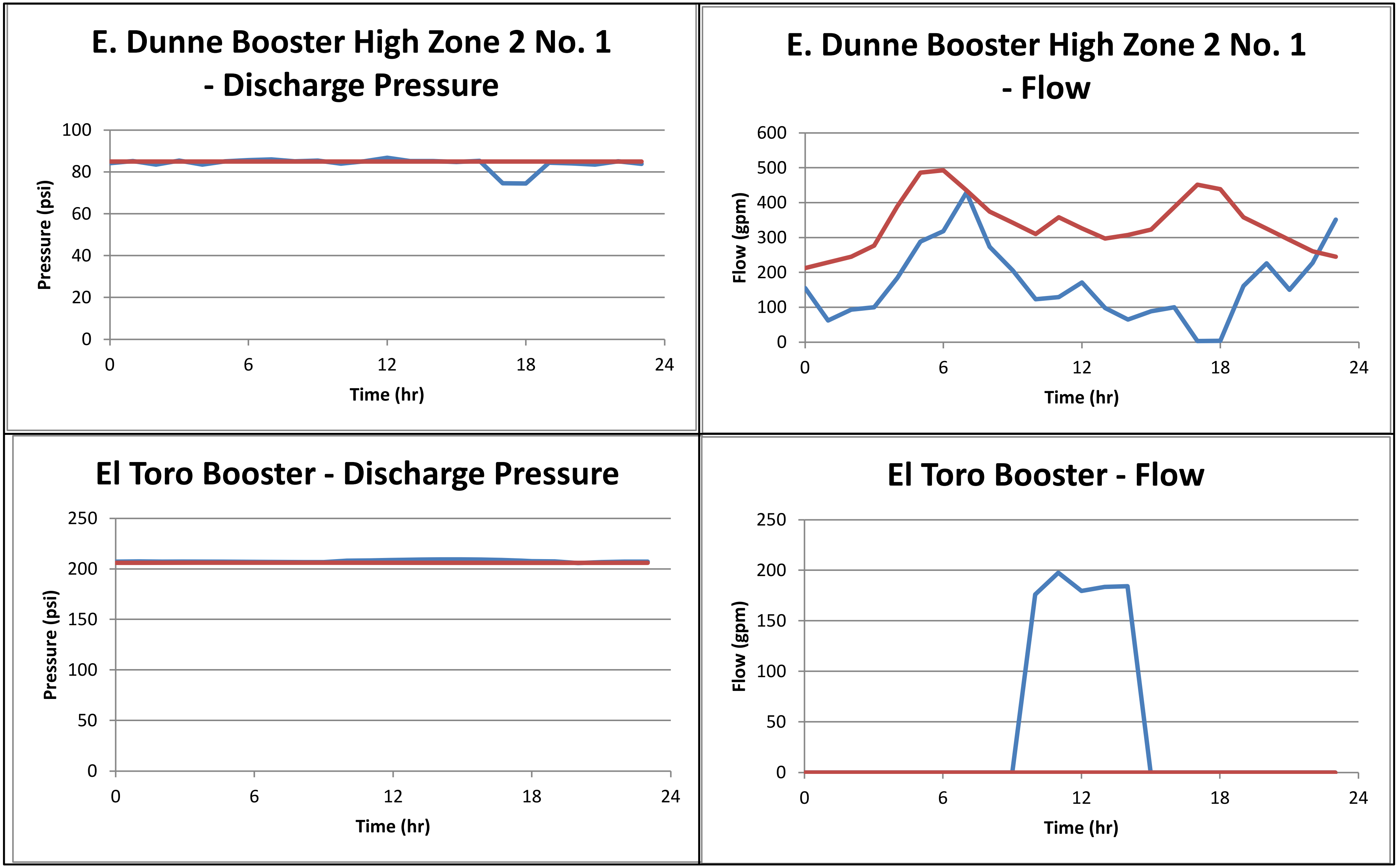
Figure 3

Booster Validation

Water System Master Plan
City of Morgan Hill

CITY OF MORGAN HILL



LEGEND

Telemetry Data

Model Data

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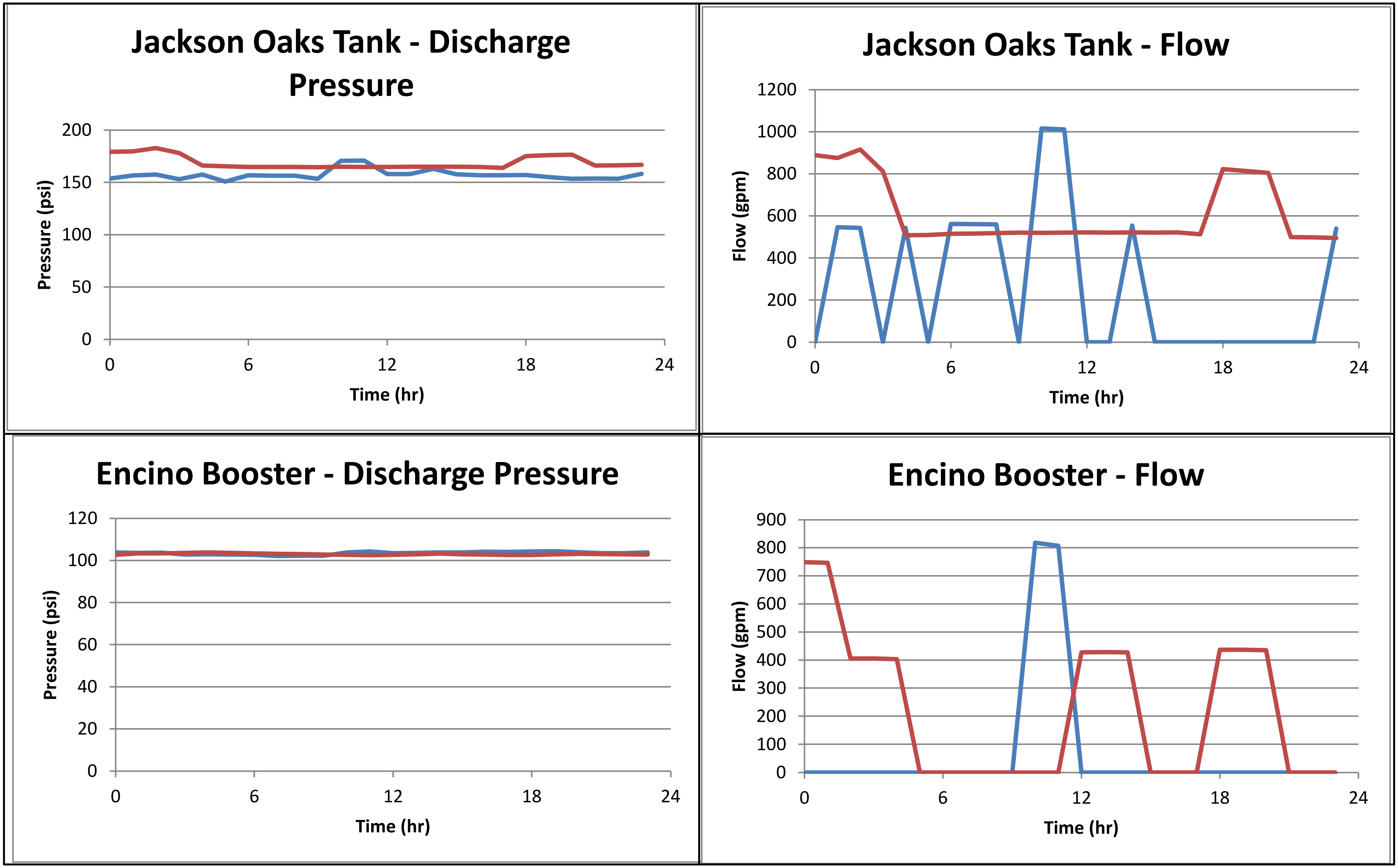
Figure 4

Booster Validation

Water System Master Plan

City of Morgan Hill

CITY OF MORGAN HILL



LEGEND

- Telemetry Data (blue line)
- Model Data (red line)

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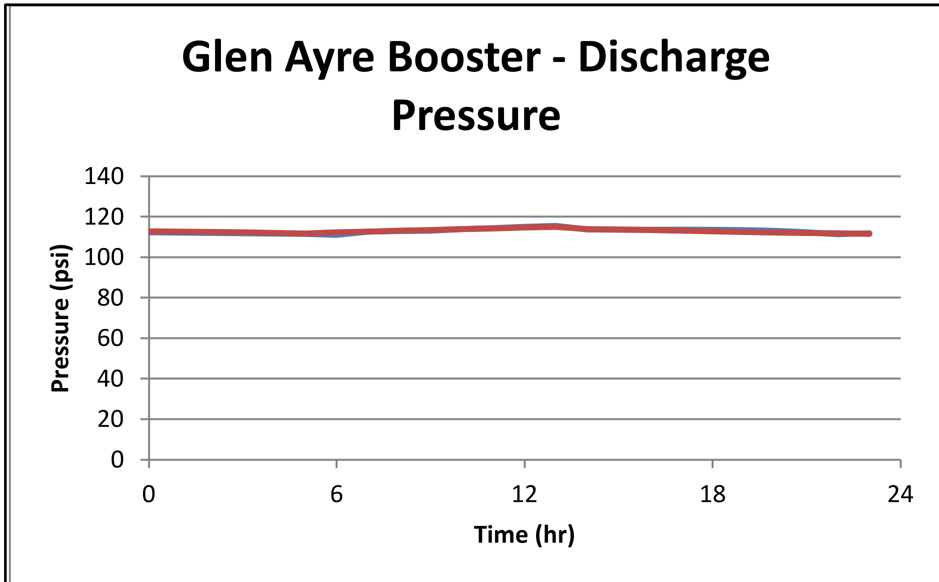
Figure 5

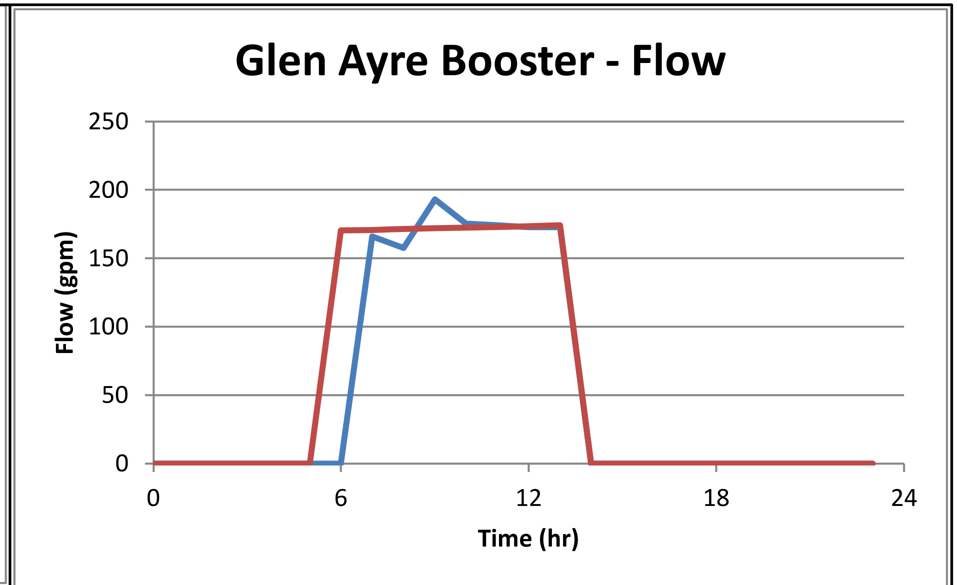
Booster Validation

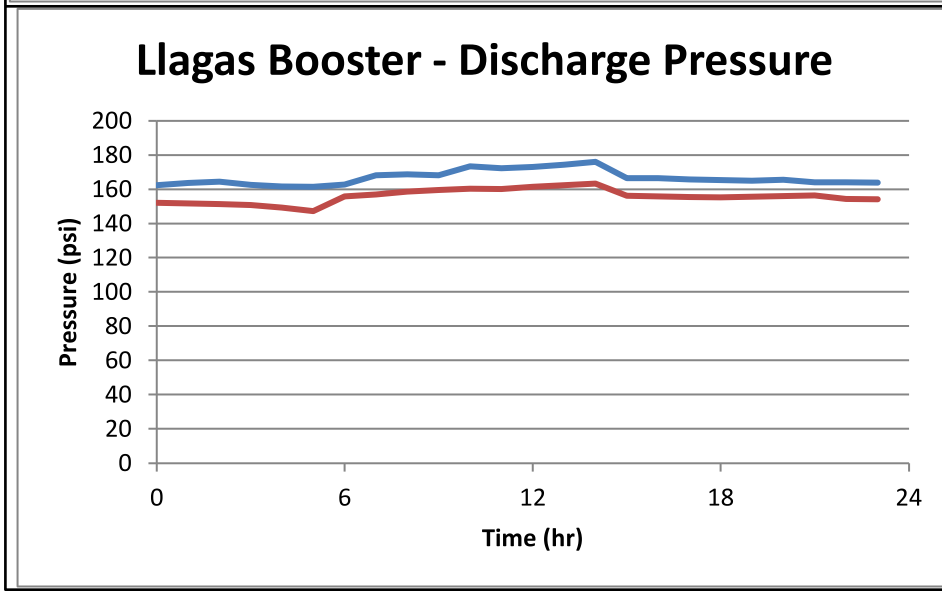
Water System Master Plan

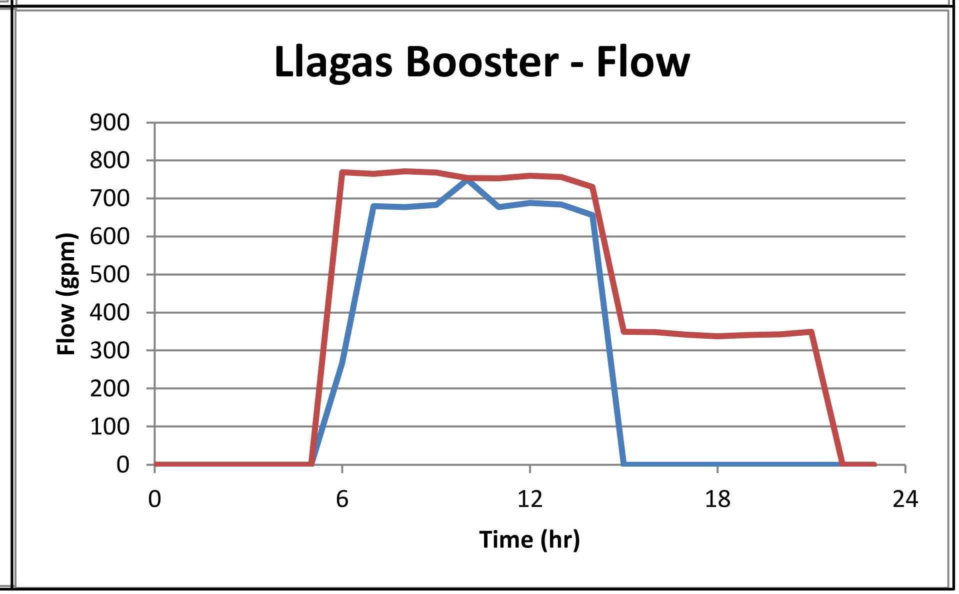
City of Morgan Hill

CITY OF MORGAN HILL









LEGEND

Telemetry Data

Model Data

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21-Sep-21

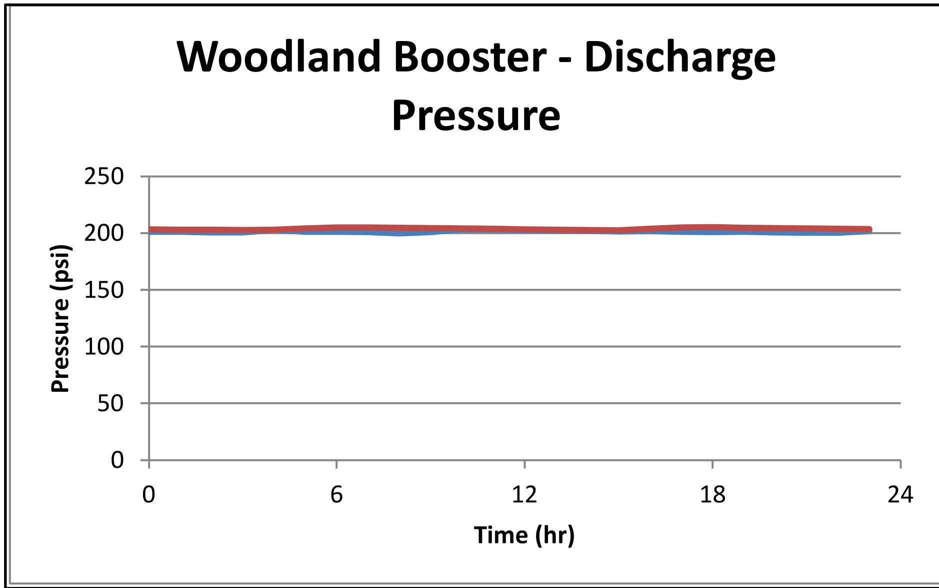
Figure 6

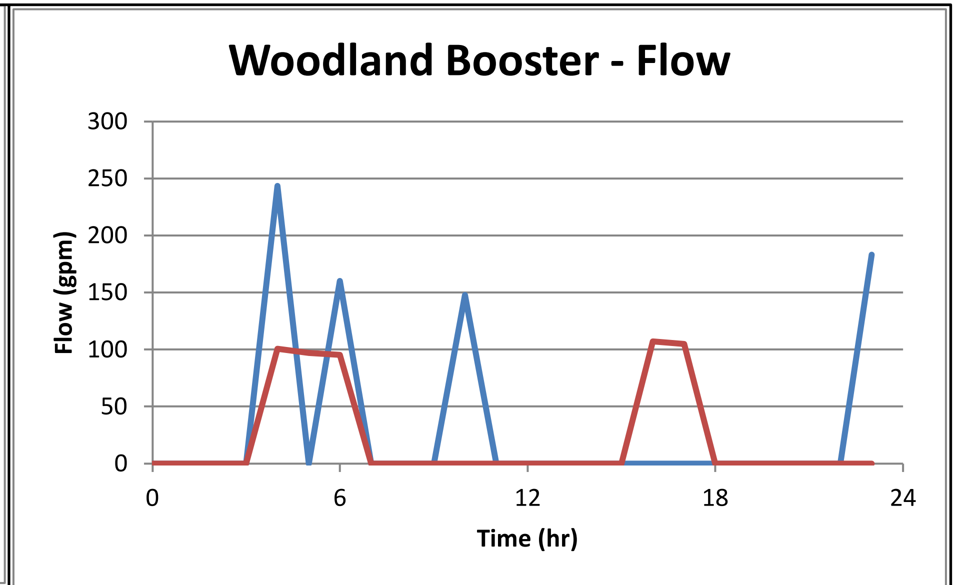
Booster Validation

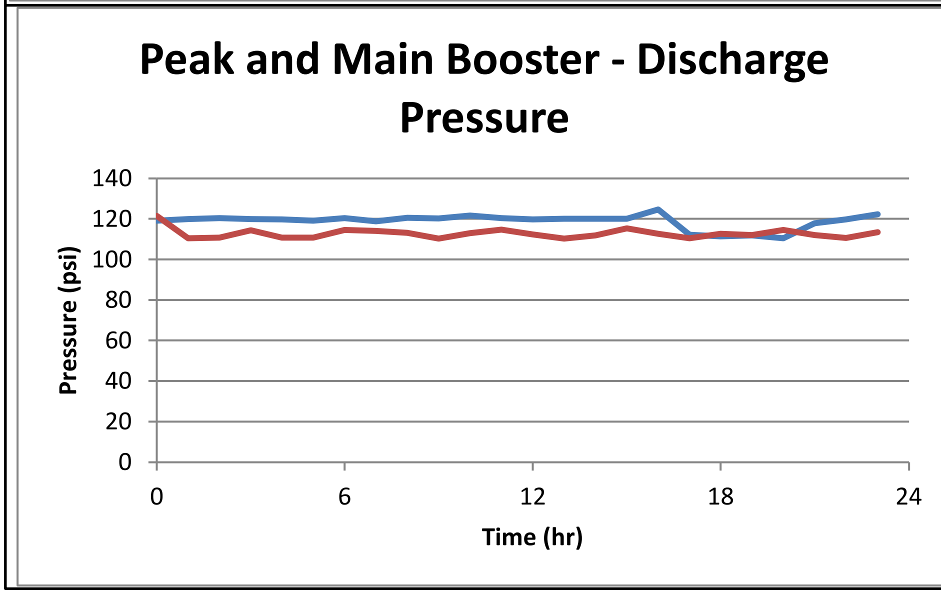
Water System Master Plan

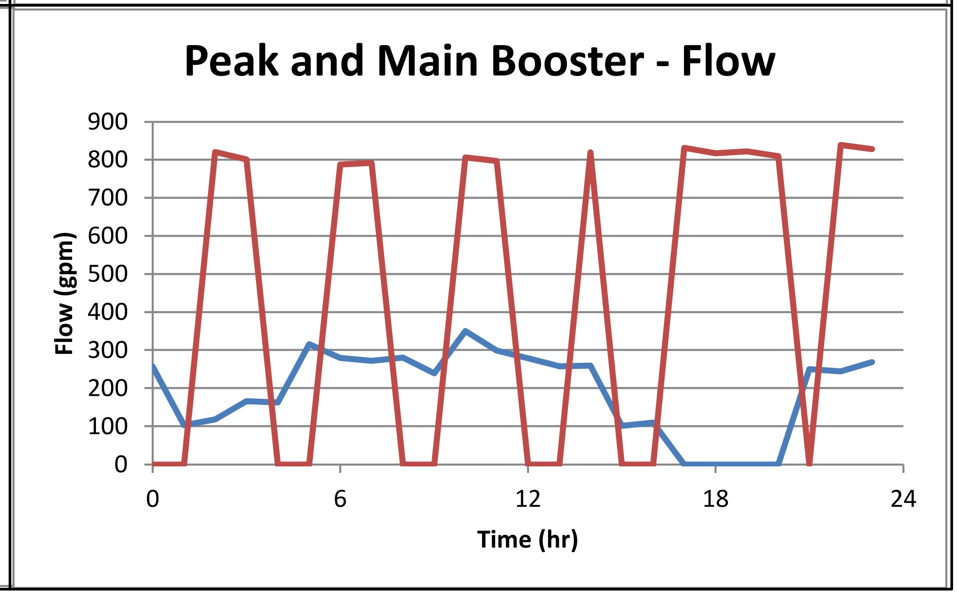
City of Morgan Hill

CITY OF MORGAN HILL









LEGEND

Telemetry Data

Model Data

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21-Sep-21

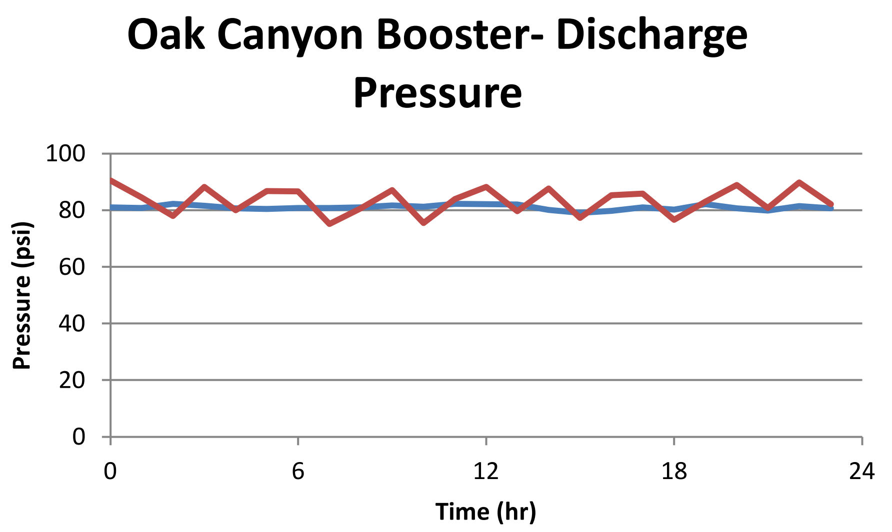
Figure 7

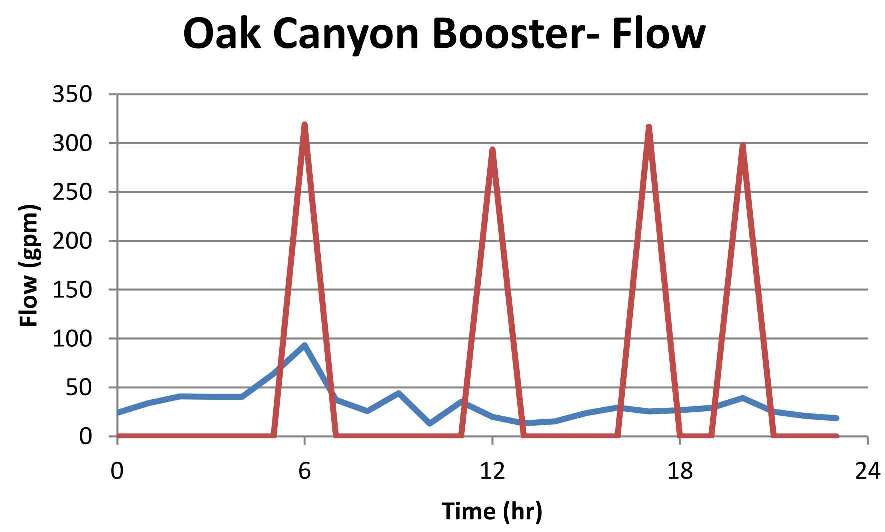
Booster Validation

Water System Master Plan

City of Morgan Hill

CITY OF MORGAN HILL





LEGEND

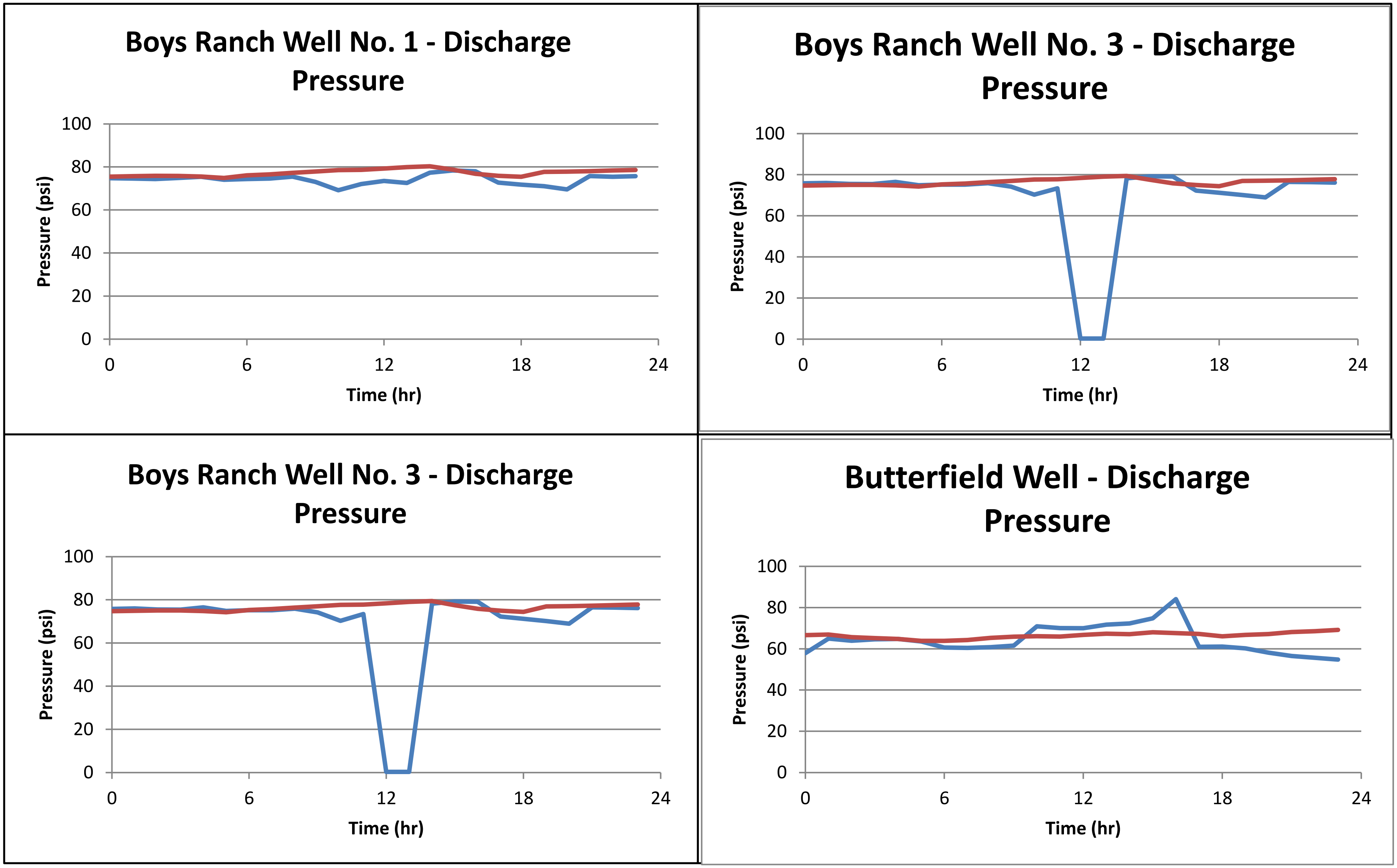
Telemetry Data
Model Data

AKEL
ENGINEERING GROUP, INC.

21-Sep-21

Figure 8
Booster Validation
Water System Master Plan
City of Morgan Hill

CITY OF MORGAN HILL



LEGEND

- Telemetry Data
- Model Data

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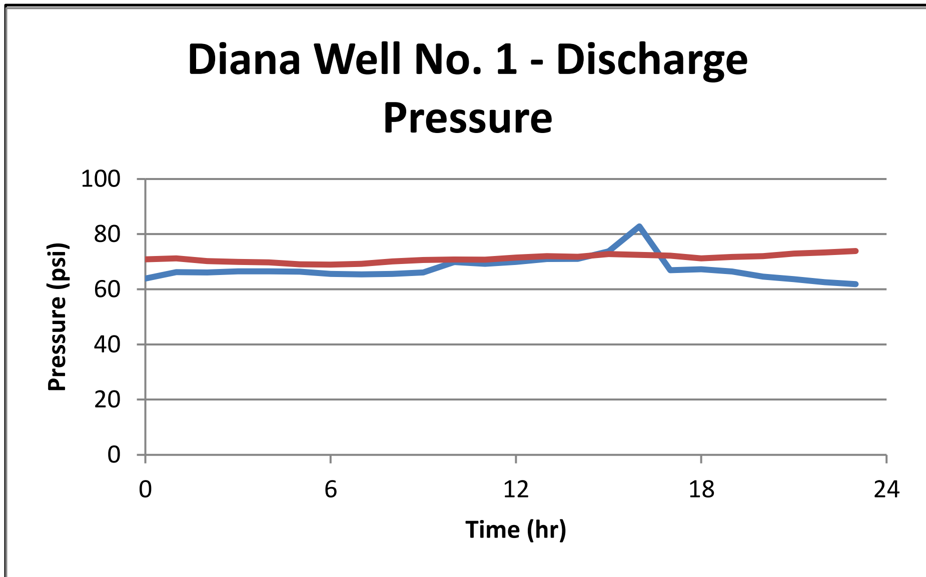
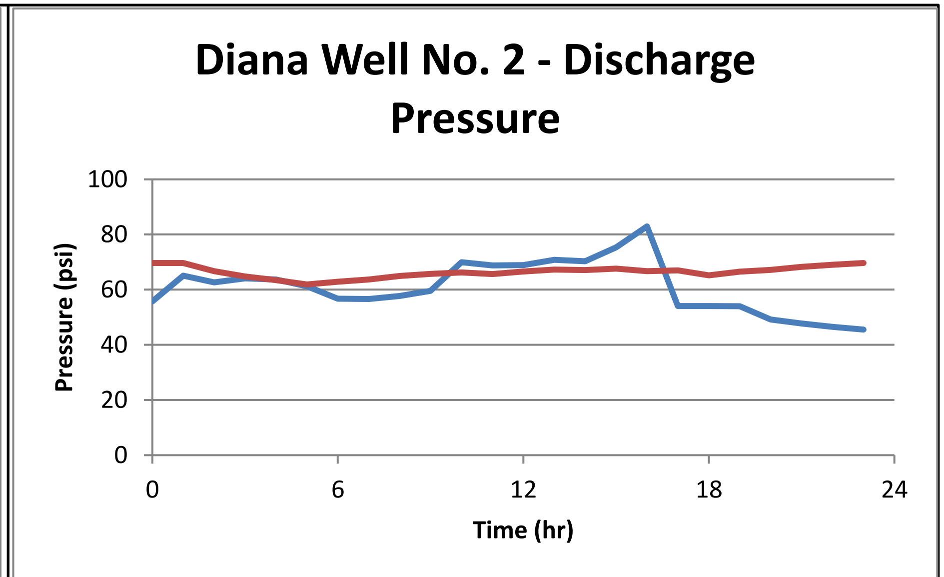
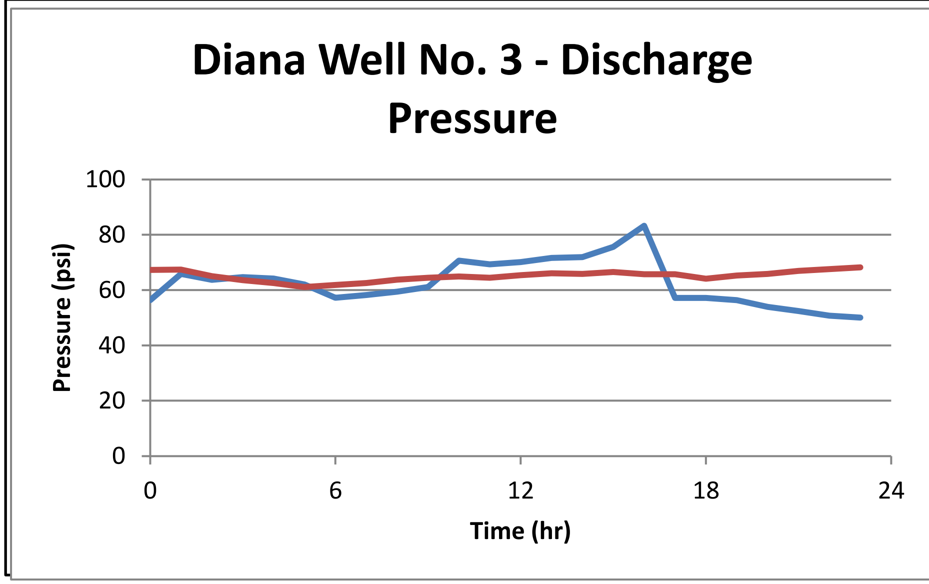
21-Sep-21

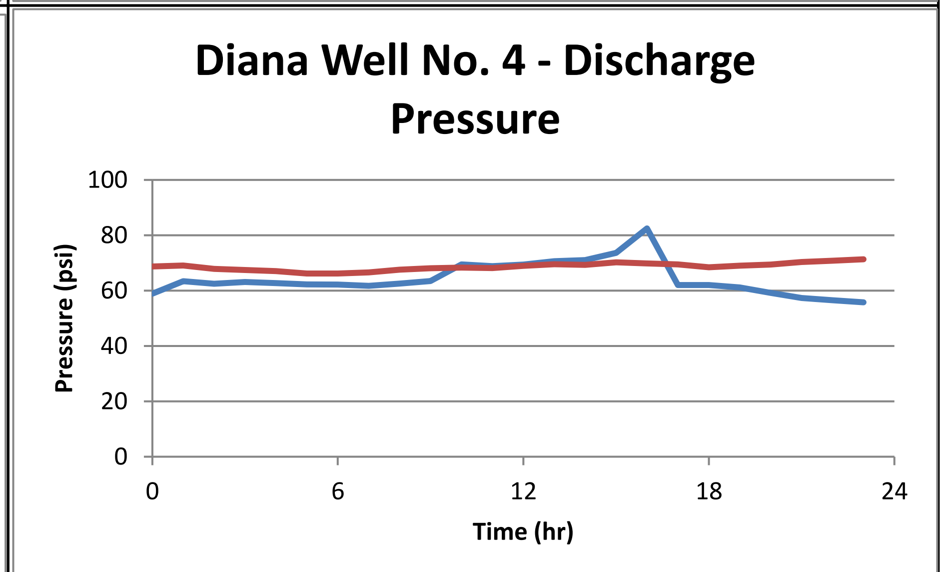
Figure 9
Well Validattion
Water System Master Plan
City of Morgan Hill

CITY OF MORGAN HILL









LEGEND

Telemetry Data
Model Data

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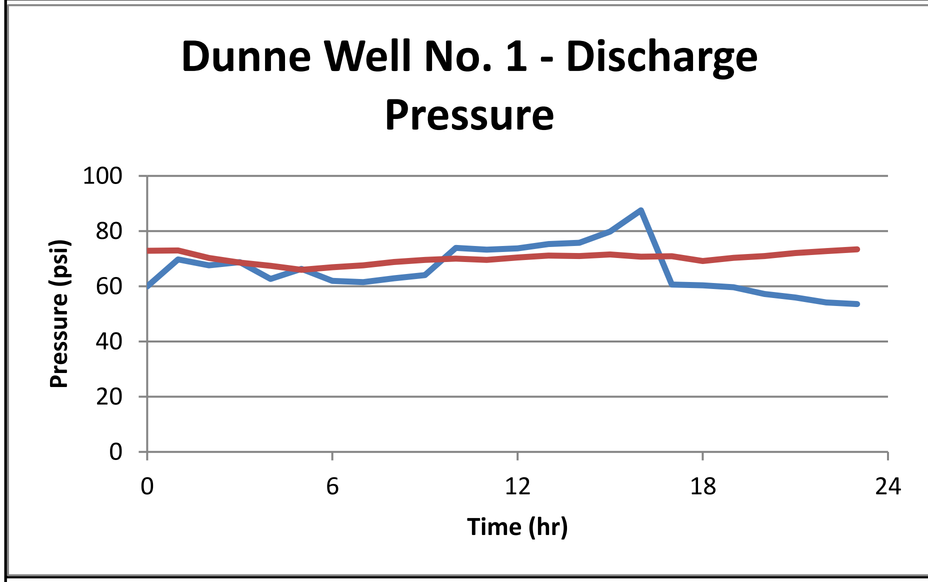
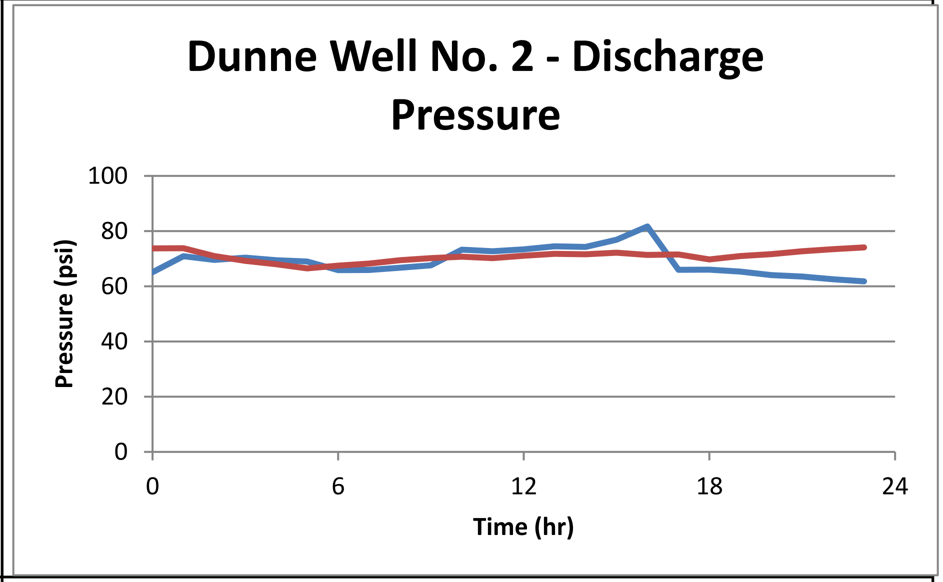
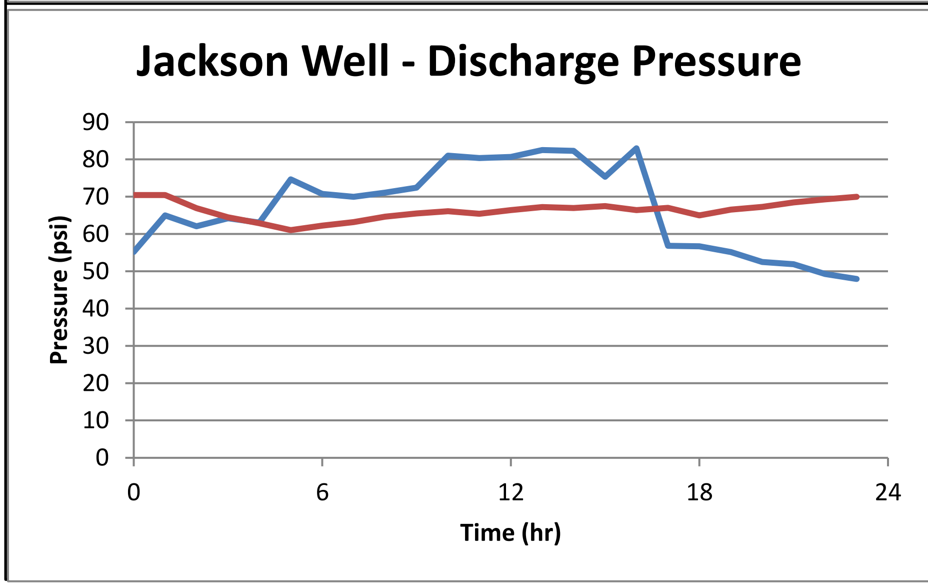
Figure 10

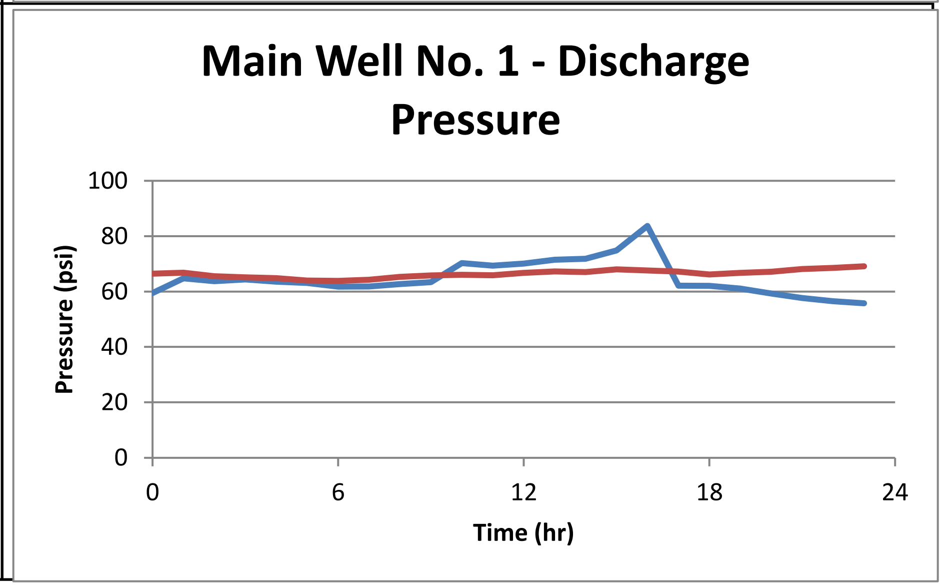
Well Validation

Water System Master Plan
City of Morgan Hill









LEGEND

- Telemetry Data
- Model Data

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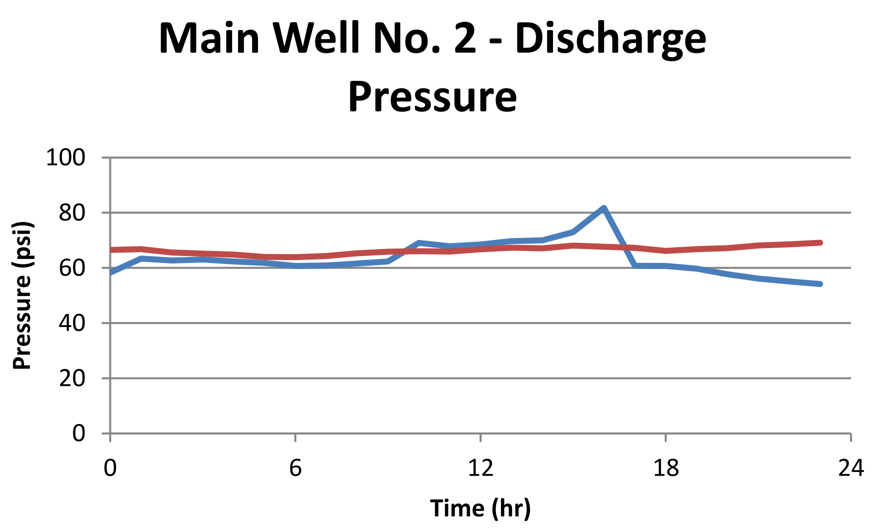
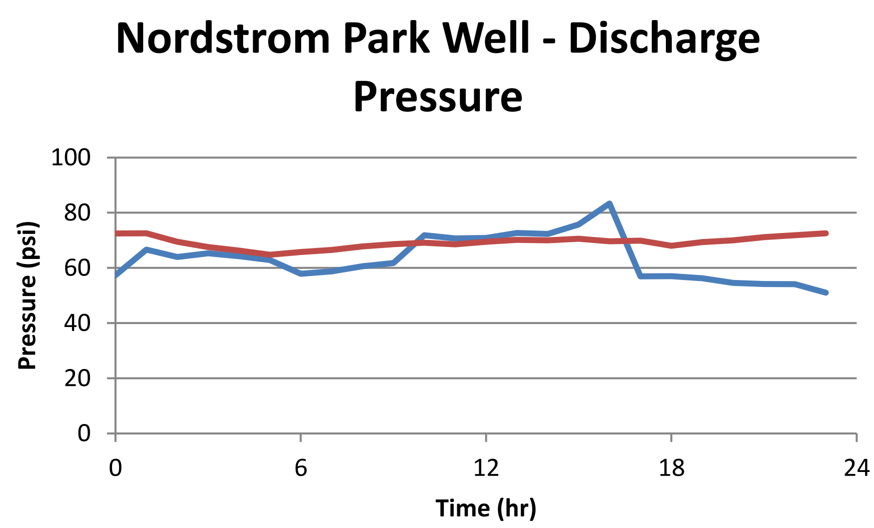
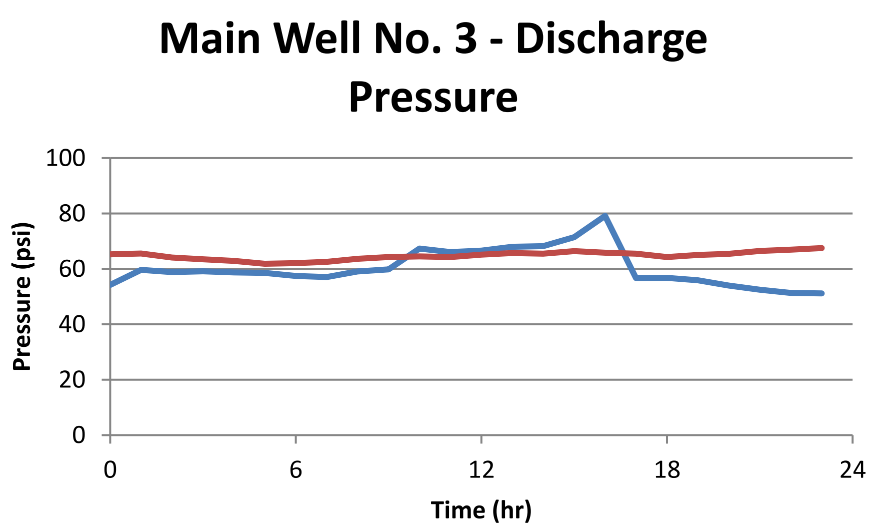
Figure 11
Well Validation

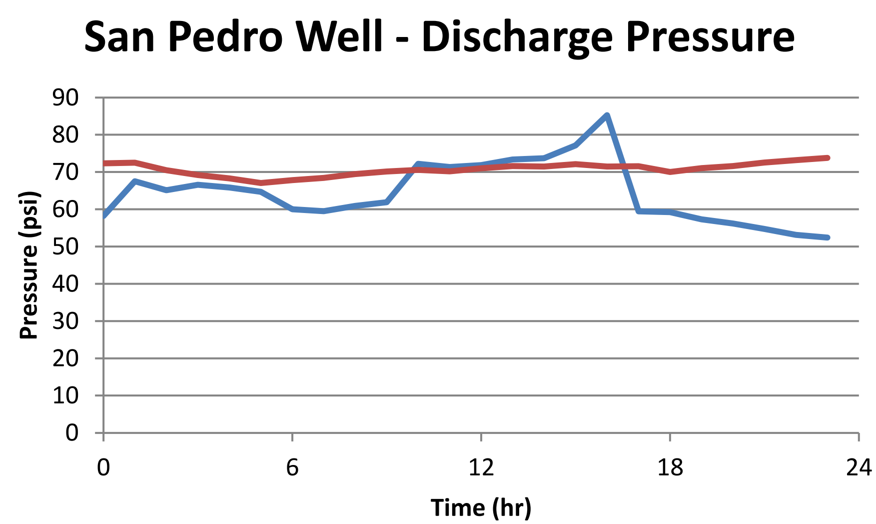
Water System Master Plan
City of Morgan Hill

CITY OF MORGAN HILL









LEGEND

Telemetry Data
Model Data

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Figure 12
Well Validation
Water System Master Plan
City of Morgan Hill

CITY OF MORGAN HILL