CITY OF STOCKTON

Water Master Plan Update

JANUARY 2021

CITY OF STOCKTON
MUD
MUNICIPAL UTILITIES DEPARTMENT

WEST YOST

HDR

Resolution No. 2021-02-23-1501

STOCKTON CITY COUNCIL

RESOLUTION ADOPTING THE 2021 WATER MASTER PLAN UPDATE FOR THE MUNICIPAL UTILITIES DEPARTMENT

The City of Stockton Municipal Utilities Department in conjunction with West Yost Associates, has prepared and submitted the Water Master Plan Update dated January 2021; and

In accordance with the Envision Stockton 2040 General Plan Update, the Water Master Plan Update serves as a planning document for water infrastructure requirements in the near-term (2030) and future (2040) of the North and South Stockton Water Service Areas; and

The Water Master Plan Update identifies short and long-term Capital Improvement Program for water infrastructure projects, including a focused pipeline rehabilitation-and-repair program and optimization and rehabilitation of existing facilities; now, therefore,

BE IT RESOLVED BY THE CITY COUNCIL OF THE CITY OF STOCKTON, AS FOLLOWS:

1. That this Water Master Plan Update is in conformance with the Envision Stockton 2040 General Plan Update.

2. That the Water Master Plan Update, dated January 2021, is adopted, a copy of which is attached as Exhibit 1 and incorporated by this reference.

3. The City Manager is hereby authorized to take such other appropriate actions to carry out the purpose and intent of this Resolution.

PASSED, APPROVED, and ADOPTED February 23, 2021.

KEVIN J. LINCOLN II
Mayor of the City of Stockton

ATTEST:

ELIZA R. GARZA, CMC
City Clerk of the City of Stockton

FINAL REPORT | JANUARY 2021

Water Master Plan Update

PREPARED FOR

City of Stockton
Municipal Utilities Department

Water Master Plan Update

Prepared for

City of Stockton
Municipal Utilities Department

Project No. 129-60-20-41

Project Manager: Elizabeth Drayer, PE	01-27-21 Date
QA/QC Review: Polly Boissevain, PE	01-27-21 Date

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LIST OF ACRONYMS AND ABBREVIATIONS

AACE	Association for the Advancement of Cost Engineering
AC	Asbestos Cement
ADD	Average Day Demand
afy	Acre Feet Per Year
AMI	Advanced Metering Infrastructure
AWWA	American Water Works Association
AWWA M32	American Water Works Association Manual of Practice 32
BAT	Best Available Technology
CACWD	Calaveras County Water District
Cal Water	California Water Service
CIP	Capital Improvement Program
City	City of Stockton
COSMUD	City of Stockton Municipal Utilities Department
CSJWCD	Central San Joaquin Water Conservation District
CVP	Central Valley Project
CWC	California Water Code
DDW	Division of Drinking Water
Delta	Sacramento-San Joaquin Delta
DJWWTP	Dr. Joe Waidhofer Water Treatment Plant
DSC	Debt Service Coverage
DU	Dwelling Unit
DWR	Department of Water Resources
DWSP	Delta Water Supply Project
DWSP SWSF	Delta Water Supply Project Surface Water Supply Fee
DWTP	Delta Water Treatment Plant
EGWC	Emergency Groundwater Storage Credit
ENR CCI	Engineering News Record Construction Cost Index
EPA	Environmental Protection Agency
EPS	Extended Period Simulation
FMS	Fourteen-Mile Slough
fps	Feet Per Second
ft/kft	Feet Per Thousand Feet
FTE	Full-Time Equivalent
FY	Fiscal Year
GAC	Granular Activated Carbon
GIS	Geographic Information System
gpcd	Gallons Per Capita Per Day
gpd	Gallon Per Day
gpm	Gallons Per Minute
GPU	General Plan Update
GSP	Groundwater Sustainability Plan

GWA	Eastern San Joaquin Groundwater Authority
HDR	High Density Residential
IPS	Intake Pump Station
lf	Linear Feet
M	Million
MDD	Maximum Day Demand
MDR	Medium Density Residential
MFR	Multi-Family Residential
MG	Million gallons
mgd	Million Gallons Per Day
MWELO	Model Water Efficiency Landscape Ordinance
NFPA	National Fire Protection Association
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NRW	Non-Revenue Water
NW	Northwest
O&M	Operations and Maintenance
PHD	Peak Hour Demand
psi	Pounds Per Square Inch
PVC	Polyvinyl Chloride
R&R	Rehabilitation and Replacement
SB	Senate Bill
SCADA	Supervisory Control and Data Acquisition
SEWD	Stockton East Water District
SFR	Single Family Residential
SGMA	Sustainable Groundwater Management Act
SOI	Sphere of Influence
SOI/MSR	April 2020 Sphere of Influence Plan/Municipal Service Review Report
SSS	South Stockton System
SWRCB	State Water Resources Control Board
TCP	1,2,3-Trichloropropane
TSWC	Treated Surface Water Supply Credit
USACE	United States Army Corps of Engineers
USBR	United States Bureau of Reclamation
UWMP	Urban Water Management Plan
WID	Woodbridge irrigation District
WR	Weston Ranch
WUF	Water Use Factor

WATER MASTER PLAN UPDATE PURPOSE AND OBJECTIVES

The purpose of this Water Master Plan Update for the City of Stockton (City) is to evaluate the existing water system infrastructure and address potential impacts of near-term and long-term planned growth to develop a comprehensive guide for the City's water system capital improvement program. The City's Municipal Utilities Department (COSMUD) operates the City's water system which serves customers in both North Stockton (serving primarily residential customers) and South Stockton (serving a mix of residential and industrial customers). Central Stockton is served by a separate water system operated by the California Water Service (Cal Water). Within Central Stockton, COSMUD operates the Walnut Plant System comprised of residential customers and the Diamond Walnut processing facility; however, the Walnut Plant System has not been evaluated as part of this Water Master Plan Update. This Water Master Plan Update only addresses the COSMUD North Stockton and South Stockton water service areas.

The City's last Water Master Plan was completed in 2008. Since that time, the City has experienced growth, constructed a surface water treatment plant, and completed an update to its General Plan (the Envision Stockton 2040 General Plan), which provides the framework for future development in the City through 2040. The Delta Water Treatment Plant was completed in 2012 which provides the City with a new treated surface water supply in North Stockton to supplement its other water supplies. Since the completion of the 2008 Water Master Plan, the State endured five years of drought starting in 2012, including the driest four consecutive years in California history. These unprecedented conditions led to statewide mandated water conservation, significant surface water supply reductions and curtailments and legislation establishing new statewide water efficiency standards.

All of these factors have led to a need to reassess the City's water needs, priorities and strategies and reevaluate the need for water system infrastructure improvements to ensure a safe and reliable water supply to support the City's existing and future residents and businesses.

The primary objectives of this Water Master Plan Update, along with the chapters in which these topics are discussed, are as follows:

- Describe the existing COSMUD water system and facilities (Chapter 2)
- Evaluate historical and existing water demands to understand recent water use trends, per capita water use and water use by customer type (Chapter 3)
- Develop future water demand projections for near-term (2030) and future (2040) conditions based on future planned development in the COSMUD water service areas and updated unit water use factors developed based on recent water use trends (Chapter 3)
- Review the City's existing water supplies and the opportunities and constraints associated with each supply source (Chapter 4)
- Review existing City and industry water system standards and refine performance and planning criteria under which the COSMUD water system will be evaluated and recommendations for future facilities will be formulated (Chapter 5)
- Update and calibrate the City's water system hydraulic model to provide an updated, accurate tool for evaluating various water system demand and operational scenarios (Chapter 6)

- Evaluate the need for new water system facilities (including pipelines, supply facilities, storage facilities and pumping facilities) to meet existing, near-term (2030) and future (2040) water demands within the COSMUD water service areas (Chapters 7 and 8)
- Develop a capital improvement program and financial plan for implementation of recommended water system improvements (Chapters 9 and 10)

PROJECTED FUTURE LAND USE

Future growth and land uses within the City are defined in the Envision Stockton 2040 General Plan (2040 GPU), which summarizes anticipated development within sixteen Study Areas located throughout the City. These areas have been specifically identified as being most likely to develop by 2040. In addition to these Study Areas, the City has identified, or is actively working with several project proponents to identify, future development areas that are either within existing City Limits or outside of City Limits but within the General Plan Sphere of Influence. The April 2020 Sphere of Influence Plan/Municipal Service Review Report (SOI/MSR) defines the anticipated level of development and municipal service needs for near-term (2030) development. Approximately 31,442 planned residential dwelling units are planned in the COSMUD water service area, which is about 77 percent of the total planned residential dwelling units City-wide. The locations of the Study Areas and proposed future development areas are shown on Figure ES-1.

For the purposes of this Water Master Plan Update, it was assumed that the Mariposa Road Community will be developed by 2040, based on the most recent land use plan, and be served entirely by COSMUD. This future development is one of the largest drivers for future growth within the COSMUD South Stockton water service area. In addition, although this development area is located within both the COSMUD water service area and the Cal Water service area, for the purposes of this Water Master Plan Update, it was conservatively assumed that the COSMUD would serve the entire Mariposa Road Community area. As described further below and in Chapter 8, any recommended future water system improvements associated with the Mariposa Road Community should be reviewed and confirmed prior to facility design and construction based on future confirmed development plans.

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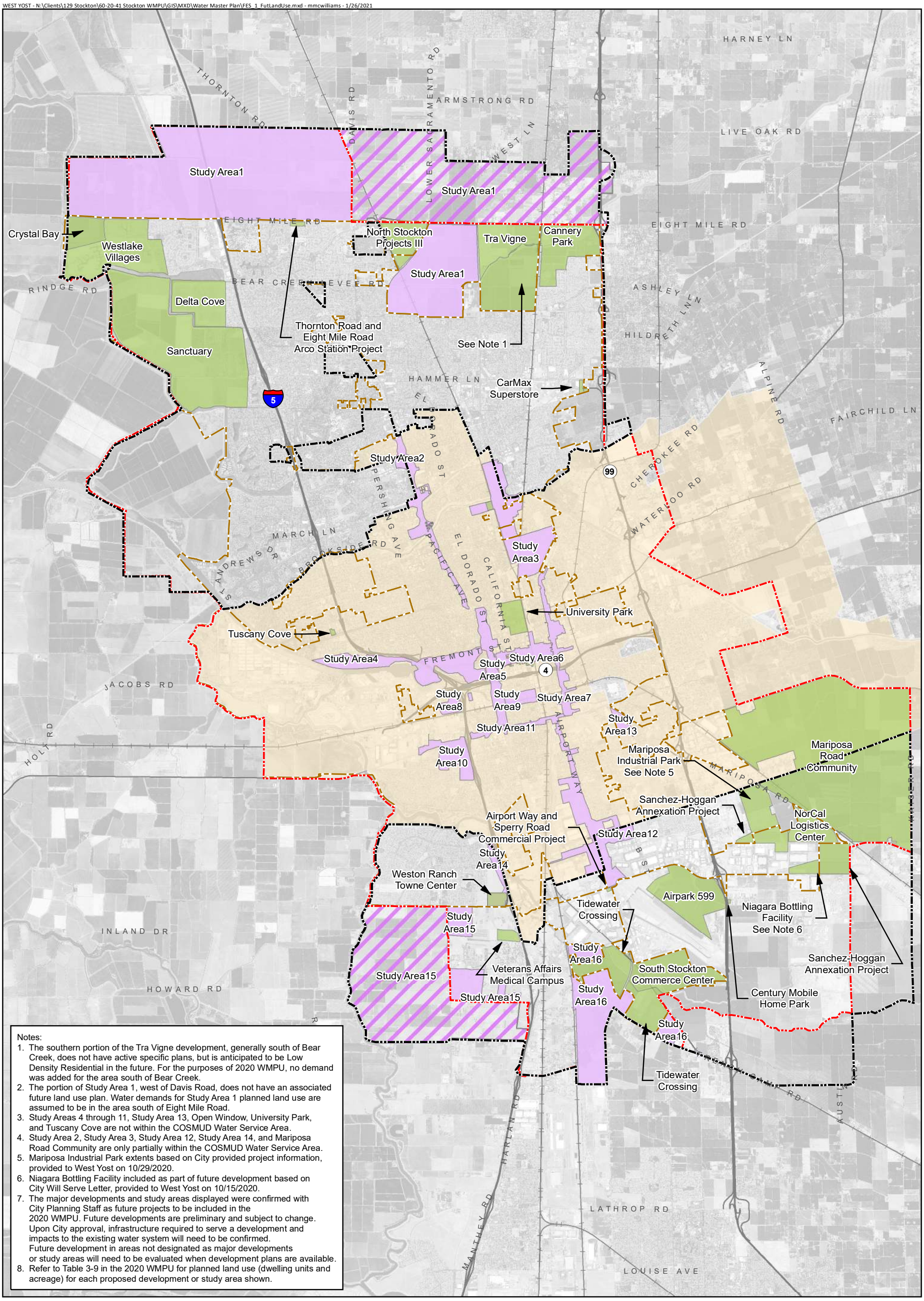

Notes:

1. The southern portion of the Tra Vigne development, generally south of Bear Creek, does not have active specific plans, but is anticipated to be Low Density Residential in the future. For the purposes of 2020 WMPU, no demand was added for the area south of Bear Creek.
2. The portion of Study Area 1, west of Davis Road, does not have an associated future land use plan. Water demands for Study Area 1 planned land use are assumed to be in the area south of Eight Mile Road.
3. Study Areas 4 through 11, Study Area 13, Open Window, University Park, and Tuscany Cove are not within the COSMUD Water Service Area.
4. Study Area 2, Study Area 3, Study Area 12, Study Area 14, and Mariposa Road Community are only partially within the COSMUD Water Service Area.
5. Mariposa Industrial Park extents based on City provided project information, provided to West Yost on 10/29/2020.
6. Niagara Bottling Facility included as part of future development based on City Will Serve Letter, provided to West Yost on 10/15/2020.
7. The major developments and study areas displayed were confirmed with City Planning Staff as future projects to be included in the 2020 WMPU. Future developments are preliminary and subject to change. Upon City approval, infrastructure required to serve a development and impacts to the existing water system will need to be confirmed. Future development in areas not designated as major developments or study areas will need to be evaluated when development plans are available.
8. Refer to Table 3-9 in the 2020 WMPU for planned land use (dwelling units and acreage) for each proposed development or study area shown.

Study Area Within City's Sphere of Influence

Study Area Outside of City's Sphere of Influence

Major Development

Cal Water Service Area

COSMUD Water Service Area

City of Stockton Limits

City of Stockton Sphere of Influence

N

0 0.75 1.5

Miles

WEST YOST

Figure ES-1

Summary of Future Developments

City of Stockton
Water Master Plan Update

Table ES-1 summarizes the future planned development within the COSMUD water service area by land use designation consistent with the 2040 GPU and SOI/MSR Report. North Stockton will experience the largest increase in residential development. The largest planned development is the Sanctuary Project in North Stockton. It will consist of single-family, multi-family, park, and commercial land uses. In addition to the Mariposa Road Community, South Stockton will see an increase in commercial and industrial development in the near-term and in the future with several planned projects.

Table ES-1. Future Planned Development within the COSMUD Water Service Area[(a)]

Future Land Use Designation	Units	Near-Term (2030) Total Development	Future (2040) Total Development
North Stockton			
Single Family Residential	DU	2,100	16,700
Multi Family Residential	DU	500	4,212
Commercial	Acres	23	167
Industrial	Acres	0	0
Parks	Acres	41	451
South Stockton			
Single Family Residential	DU	0	8,955[(b)]
Multi Family Residential	DU	0	1,575[(b)]
Commercial	Acres	55	273
Industrial	Acres	1,354	1,753
Parks	Acres	9	224

(a) Based on the Study Areas and future development plans identified in the 2040 General Plan and April 2020 SOI/MSR Report and confirmed with the City's Community Development Department in July 2020 (see Table 3-9 for additional information).

(b) All of Single Family and most of Multi Family is associated with Mariposa Road Community.

PROJECTED FUTURE WATER PRODUCTION REQUIREMENTS

Water demands were projected for near-term (2030) and future (2040) conditions for the COSMUD water service areas using the adopted water use factors applied to the proposed future development. Future water production requirements were then estimated by adding the future water demand projections and future non-revenue water to the existing baseline production.

Table ES-2. summarizes the existing baseline production for the overall COSMUD water service area and shows that the total existing baseline production for this Water Master Plan Update is 31,495 acre-feet per year (afy), or 28.1 million gallons per day (mgd). This can be compared to the existing baseline production from the 2008 Water Master Plan which was 36,380 afy, or about 32.5 mgd. This indicates that existing baseline production for this Water Master Plan Update, which includes a 10 percent demand rebound factor to account for post-drought water use increases, is about 13 percent lower than the 2008 Water Master Plan baseline production, reflecting improved water use efficiencies and on-going water conservation by the COSMUD water customers since the 2008 Water Master Plan.

Table ES-2. Existing Baseline Production (5-year Average from 2015 to 2019) with Demand Rebound			
Water Service Area	Existing Average Historical Production (2015 – 2019), afy [(a)]	Demand Rebound (10 percent of Average Historical Production), afy	Existing Baseline Production, afy
North Stockton	23,450	2,345	25,795
South Stockton	5,182	518	5,700
Total, afy	**28,632**	**2,863**	**31,495**
Total, mgd	**25.6**	**2.6**	**28.1**
(a) Includes Non-Revenue Water			

As shown in Table ES-3, by 2030, the water production requirement is projected to increase by approximately 20 percent systemwide. North Stockton's production requirement is projected to increase by 3.3 percent and South Stockton's production requirement is projected to increase by 93.5 percent from the existing baseline production.

Table ES-3. Projected Water Production Requirement for Near-Term (2030) Conditions			
Parameter	North Stockton, afy	South Stockton, afy	Total COSMUD, afy
Existing Baseline Production (refer to Table ES-2.)	25,795	5,700	31,495
Additional Near-Term Demand by 2030 (refer to Table 3-15)	781	4,903	5,684
Future Non-Revenue Water (8%)	68	426	494
Total Production Requirement, afy	**26,644**	**11,029**	**37,673**
Total Production Requirement, mgd	**23.8**	**9.8**	**33.6**
Percent Increase from Existing Baseline Production	**3.3%**	**93.5%**	**19.6%**

As shown in Table ES-4, by 2040, the water production requirement is projected to increase by approximately 53 percent systemwide. North Stockton's production requirement is projected to increase by 27 percent and South Stockton's production requirement is projected to increase by 171 percent from the existing baseline production. The large increase in South Stockton's projected production requirement is due to the assumption that the Mariposa Road Community will be fully built by 2040 and served completely by COSMUD.

Table ES-4. Projected Water Production Requirement for Future (2040) Conditions			
Parameter	North Stockton, afy	South Stockton, afy	Total COSMUD, afy
Existing Baseline Production (refer to Table ES-2.)	25,795	5,700	31,495
Additional Future Demand by 2040 (refer to Table 3-16)	6,457	8,949	15,405
Future Non-Revenue Water (8%)	561	778	1,340
Total Production Requirement, afy	**32,813**	**15,427**	**48,240**
Total Production Requirement, mgd	**29.3**	**13.8**	**43.1**
Percent Increase from Existing Baseline Production	**27.2%**	**170.6%**	**53.2%**

As shown above, the total future 2040 water production requirement presented in this Water Master Plan Update is 48,240 afy (43.1 mgd). This is compared to the total future 2035 water production requirement from the 2008 Water Master Plan which was estimated to be 110,000 afy (98.2 mgd). This represents a 56 percent drop, which is partially attributed to a decrease in existing water production from 2008 to 2019 (35.6 mgd in 2008 vs. 27.4 mgd in 2019), as well as a drop in unit water use factors due to improved water use efficiency (described in Chapter 3). However, the majority of the drop in the projected water production requirement can be attributed to the significant reduction in expected development by 2040, both in terms of the area to be developed and the projected population. Based on the planned future development identified in the Envision Stockton 2040 General Plan Update and April 2020 MSR/SOI Report, the anticipated gross development area by 2040 is 77 percent less than the 2008 Water Master Plan future gross development area. Associated with this reduced development area, there is approximately a 25 percent decrease in projected City-wide population from the 2035 General Plan to the Envision Stockton 2040 General Plan Update.

Figure ES-2 compares the City-wide population projections in the 2035 General Plan, the Envision Stockton 2040 General Plan Update and the 2015 UWMP, as well as the COSMUD water production requirements from the 2008 Water Master Plan, 2015 UWMP and this Water Master Plan Update. As shown, water production requirements have dropped significantly since the 2008 Water Master Plan was prepared. As shown on Figure ES-2, the water production requirements in the 2015 UWMP and this Water Master Plan Update generally align as similar population projections were assumed.

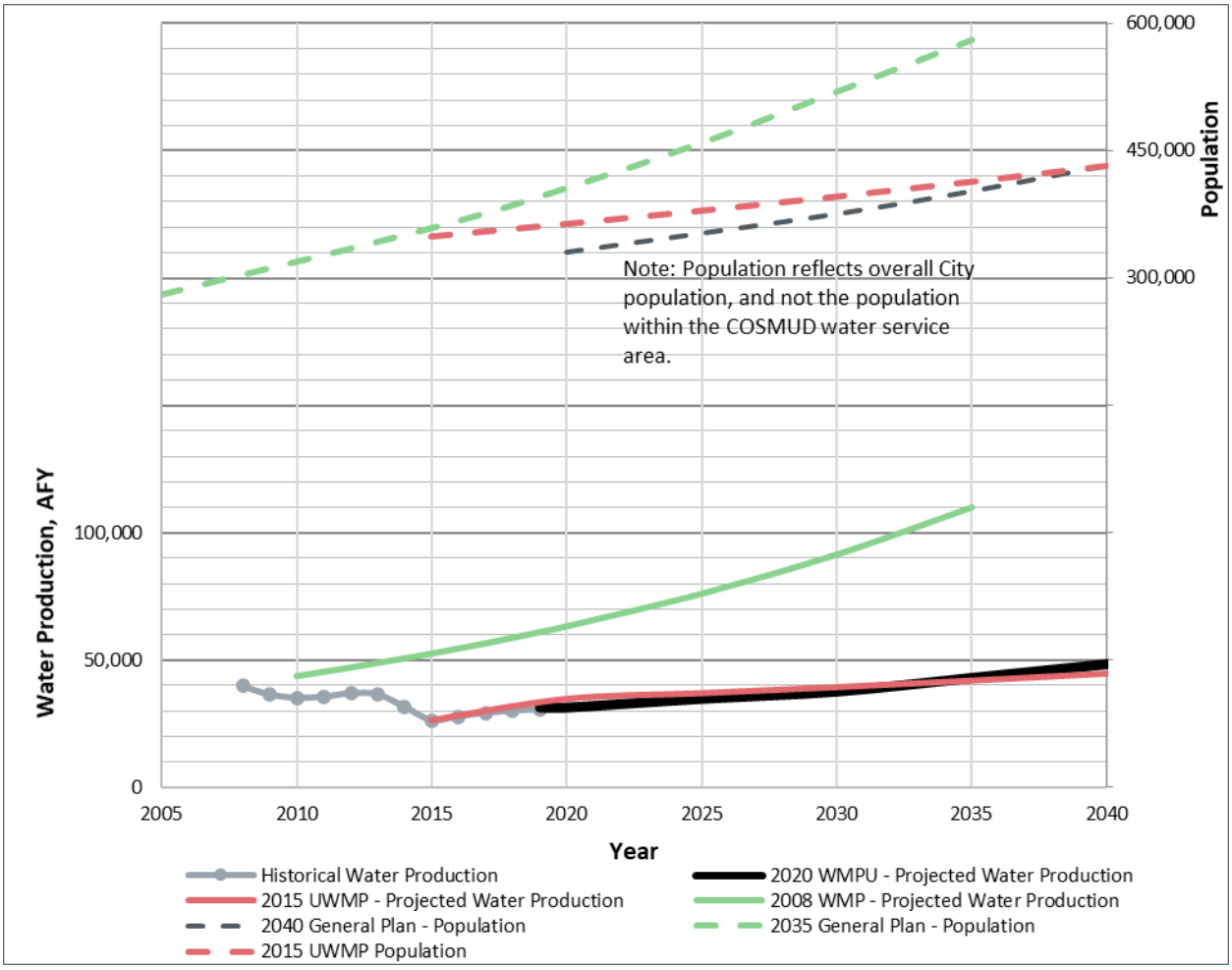

Figure ES-2. Comparison of Previous and Current Population and Water Production Requirements

The drop in future water production requirements from the 2008 Water Master Plan is reflected by less extensive recommendations for future water system improvements as described in Chapter 8 of this Water Master Plan Update.

RECOMMENDED EXISTING AND FUTURE WATER SYSTEM IMPROVEMENTS

Chapter 9 presents the recommended capital improvement program (CIP) for the COSMUD existing, near-term (2030) and future (2040) water system, based on the evaluations described in Chapters 7 and 8. A summary of the recommended improvement projects, along with estimates of probable construction costs is provided for each proposed improvement project. It also identifies which costs should be allocated to existing water customers and which costs should be allocated to future development. Discussion of the proposed financial plan to fund the recommended improvement projects, including a discussion of the Water Rate Study which has been prepared in parallel with this Water Master Plan Update, is provided in Chapter 10.

The following sections summarize the recommended existing, near-term (2030) and future (2040) water system improvements. Recommendations in this Water Master Plan Update were developed to:

- Replace aging and smaller diameter pipelines as part of a focused rehabilitation and repair (R&R) program to improve system operations and reliability
- Optimize the use and rehabilitation of existing facilities (e.g., existing inactive groundwater wells) to meet future needs without adversely impacting existing water rates
- Coordinate existing and near-term improvements with the on-going Water Rate Study to ensure that recommendations can be adequately funded
- Identify future water system improvements required to support and be funded by future development

It should be noted that the recommended water system improvements described in this Water Master Plan Update are significantly less extensive than those recommended in the 2008 Water Master Plan due to the following:

- Lower water demand projections associated with the reduced growth rate included in the Envision Stockton 2040 General Plan
- Lower existing demand conditions (and subsequent maximum day and peak hour demands) due to due to recent and continuing water use efficiencies
- The proposed rehabilitation of existing inactive wells instead of the construction of new wells in South Stockton
- The availability of the Delta Water Treatment Plant (DWTP) to supply treated surface water in North Stockton water service area as the primary water supply, supplemented by groundwater supplies
- The ability to maximize the use of Stockton East Water District (SEWD) supplies in both South Stockton and North Stockton with the construction of the North Stockton Pipeline Hypochlorite Facility

Figure ES-3 presents overall recommendations for existing, near-term (2030) and future (2040) for the COSMUD North Stockton and South Stockton water service areas. Figure ES-4 presents the Priority 1 and 2 pipelines and age for the COSMUD pipelines for the recommended Priority 3 pipeline Rehabilitation and Replacement (R&R) Program.

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North Stockton

Delta Water Treatment Plant
WTP
Well #29
Well #30
Well #18
Well #33
Well #31
Northwest
Northeast
Well #19
Well #32
Well #15
Well #10R
Well #21
Well #03R
Well #28
Well #27
14 Mile Slough
Stockton East Water District
WTP

ARMSTRONG RD
LIVE OAK RD
WEST LN
EIGHT MILE RD
SACRAMENTO RD
THORNTON RD
RINGE RD
ASHLEY LN
HILDRETH LN
HAMMER LN
LOWER SACRAMENTO RD
ELDORADO ST
SWAIN RD
PERSHING AVE
PACIFIC AVE
EL DORADO ST
MARCH LN
ANDREWS DR
BROOKSIDE RD
SAN JOAQUIN RIVER
CALAVERAS RIVER
HOLT RD
CHEROKEE RD
WATERLOO RD
ALPINE RD
FREMONT ST
MINER AVE

N
0 3,500 7,000
Scale in Feet

South Stockton

WTP
Stockton East Water District
New Well
Mariposa
Well SSS10
Well SSS9
Well SSS8
Well SSS2
Well SSS3
Weston Ranch
5
99

SAN JOAQUIN ST
CENTER ST
SUTTER ST
DR MARTIN LUTHER KING JR BLVD
MINER AVE
FREMONT ST
SAN JOAQUIN RIVER
NAVY DR
EIGHTH ST
EL DORADO ST
POCKET RD
MARIPOSA RD
NEWCASTLE RD
AUSTIN RD
JACKSTONE RD
HOWARD RD
TARLTAN RD
AIRPORT WAY

N
0 3,000 6,000
Scale in Feet

Notes:
1. Near-term (2030) and future (2040) development pipelines are based on previous development plans. Pipe layout and sizing will be finalized by developers/project proponents as development plans are finalized.
2. As discussed in the chapter, a groundwater study is recommended to identify which specific wells should be rehabilitated. For the purposes of this figure, Wells 15 and 28 have been identified, as these are the only standby wells. Other wells (i.e. inactive wells) may be recommended to be rehabilitated.
3. Other improvements not shown include: Improvements to the IPS and pipelines, Priority 3 Pipeline Improvements, DWTP Campus Improvements, Groundwater Recharge Basins, Metering/AMI Improvements.

Pipelines
- Existing
- Existing System Improvements
- Near-Term (2030) Improvements
- Future (2040) Improvements
- Future Development Pipelines

Wells
- New or Rehabilitated Near-Term (2030)
- New or Rehabilitated Future (2040)
- Active Existing
- Backup Power Near-Term (2030)
- Backup Power Future (2040)

- Existing Reservoir & Pump Station
- Future (2040) Reservoir & Pump Station
- Water Treatment Plant
- COSMUD Service Boundary

Figure ES-3

Future System With Improvements

City of Stockton
Water Master Plan Update

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North Stockton

Delta Water Treatment Plant
WTP
Northwest
14 Mile Slough
Well #29
Well #18
Well #30
Well #16
Well #9
Well #7
Well #15
Well #1
Well #4
Well #11
Well #19
Well #24
Well #31
Well #32
Well #10R
Well #20
Well #21
Well #26
Well #03R
Well #25
Well #28
Well #27
Stockton East Water District
WTP
ARMSTRONG RD
LIVE OAK RD
WEST LN
EIGHT MILE RD
RINGE RD
THORNTON RD
ASHLEY LN
HILDRETH LN
HAMMER LN
SWAIN RD
PESHING AVE
EL DORADO ST
PACIFIC AVE
MARCH LN
ANDREWS DR
BROOKSIDE RD
CHEROKEE RD
WATERLOO RD
ALPINE RD
HOLT RD
SAN JOAQUIN RIVER
CALAVERAS RIVER
FREMONT ST
MINER AVE
N
0 3,500 7,000
Scale in Feet

South Stockton

WTP
Stockton East Water District
SUTTER ST
SAN JOAQUIN ST
MINER AVE
FREMONT ST
DR MARTIN LUTHER KING JR BLVD
SAN JOAQUIN RIVER
NAVY DR
EIGHTH ST
EL DORADO ST
POCKET LN
MARIPOSA RD
99
5
Well SSS9
Well SSS8
Well SSS2
Well SSS3
Well SSS1
BUST
AUSTIN RD
NEWCASTLE RD
JACKSTONE RD
Weston Ranch
HOWARD RD
TARLTAN RD
AIRPORT WAY
N
0 3,000 6,000
Scale in Feet

Notes:
1. Priority 1 and 2 pipelines are recommended to be completed by 2030.
2. Priority 3 pipelines are recommended to be completed over a 40 year replacement cycle. These pipelines can be further prioritized based on age (as shown) and/or leak history. Pipelines installed after the 1980s are recommended to be further evaluated by condition to determine if replacement is really needed. For the purposes of developing a CIP, these pipelines have been included in Priority 3 improvements.

- Priority 1 and 2 Pipelines

Priority 3 Pipelines by Decade of Installation

- 1950s or Earlier or Unknown
- 1960s - 1970s
- 1980s or Later
- Existing Pipelines
- COSMUD Service Boundary
- Water Treatment Plant
- Existing Reservoir & Pump Station

Wells

- Active
- Inactive
- Standby

Figure ES-4

Recommended Pipeline Rehabilitation Program

City of Stockton
Water Master Plan Update

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Recommended Existing System Improvements

Chapter 7 provides a summary of the evaluation of the existing COSMUD water system and its ability to meet recommended water system planning and design criteria described in Chapter 5. In general, the analysis recommends the following:

- **Pipelines.** Development of a Rehabilitation and Replacement (R&R) Program is recommended for both the North Stockton and South Stockton water service areas. The intent of this program is to replace older and undersized pipelines on a proactive and programmatic basis before they fail and require more expensive emergency repair and replacement, as well as to improve flows throughout the system. This should also include mains running through private property or through levies, or those that have known tree root damage. Pipelines were generally prioritized into the following areas:
  - Priority 1: Pipelines in this category address areas where existing available fire flow capacity is less than 50 percent of the recommended criteria.
  - Priority 2: Pipelines in this category address areas where existing available fire flow capacity is between 50 and 75 percent of the recommended fire flow criteria.
  - Priority 3: This category contains the remaining smaller diameter pipelines (generally pipelines less that 8-inch diameter[1]).

  An asset management plan should be developed so recommended pipeline improvements can be further refined by considering likelihood of failure (e.g., age, condition, leak history, etc.) and consequence of failure (e.g., disruption of water service to critical facilities, potential for damage to adjacent land use and facilities, etc.) to further refine and define program priorities and implementation.
- **Supply (Wells).** It is recommended that the COSMUD design and construct Well SSS10, as well as equip the well with backup power to address the existing storage capacity deficit.

As discussed in Chapter 7, much of the COSMUD water distribution system is older and was designed to earlier fire flow standards in place at the time the pipelines were constructed. Approximately 28 percent of the COSMUD system was installed in the 1970s or earlier, totaling approximately 164 miles of pipeline in the North Stockton and South Stockton water service areas. Due to the age of the pipelines, it is recommended that the COSMUD begin a comprehensive pipeline R&R program. As presented above, it is recommended that the program be prioritized as shown on Figure ES-4 to address areas where existing available fire flow is less than recommended criteria in place for future development.

[1] As noted in Chapter 7, smaller diameter (less than 8-inch diameter) are allowed per COSMUD standard specifications provided that all capacity requirements are met. For the purposes of this Water Master Plan Update and for budgeting purposes, it is assumed that all small diameter pipelines are replaced with 8-inch diameter pipelines.

Recommended Near-Term (2030) System Improvements

Chapter 8 provides a summary of the evaluation of the COSMUD water system and its ability to support near-term (2030) demands while meeting recommended water system planning and design criteria described in Chapter 5. In general, the analysis recommended the following:

- **Supply (Wells)**. To address storage needs resulting from projected near-term (2030) demands and to address existing aging groundwater supply facilities, improvements to the following well facilities are recommended:
  - In North Stockton, rehabilitate two existing wells to address older/aging well facilities and maintain groundwater supply reliability.
  - In South Stockton, equip existing Wells SSS3 and SSS9 with backup power to access groundwater storage during emergencies and mitigate the projected storage deficit.
  - In South Stockton, rehabilitate existing Well SSS2, and equip with backup power, to access groundwater storage during emergencies and mitigate the projected storage deficit.

Improvements in North Stockton address older/aging infrastructure and should be allocated to existing water customers. Improvements in South Stockton are triggered by increased demands associated with future development and should be allocated to future development and paid through connection fees.

In addition to the above listed capacity related improvements, other improvements were identified through discussions with COSMUD staff. These projects are included to improve system and/or water supply reliability and are summarized below. These improvements are assumed to be funded by existing water customers.

- **Groundwater Study.** A comprehensive groundwater supply study is recommended to investigate existing facility conditions, capacity and water quality/regulatory trends. The outcome of the study would identify recommendations for rehabilitation of wells in North Stockton and South Stockton, including identifying appropriate wellhead treatment (at each location or centralized at a reservoir site).
- **Intake Pump Station and Pipeline Upgrade.** Ground settlement at the Intake Pump Station (IPS) site has required the interim repair and adjustment of station infrastructure and the 54-inch raw water pipeline that supplies the DWTP. It is recommended that the COSMUD perform additional studies to develop a long-term strategy including appropriate design features and construct improvements to station infrastructure and the raw water pipeline.
- **DWTP Campus Improvements.** COSMUD plans to develop an overall DWTP Campus to centralize treatment and distribution staff. These campus improvements would result in both management and operational efficiencies.
- **Groundwater Storage Bank Study.** A groundwater storage bank/recharge basins study is recommended to address future supply reliability by expanding/augmenting its conjunctive use portfolio, allowing for the flexibility of banking unused supply for use at a later time.
- **Advanced Metering Infrastructure (AMI) Study.** An AMI Study, design, and implementation project is recommended to improve metering technology to allow for enhanced demand tracking, management, and water loss identification.

Recommended Future (2040) System Improvements

Chapter 8 provides a summary of the evaluation of the COSMUD water distribution system and its ability to support future (2040) demands while meeting recommended water system planning and design criteria described in Chapter 5. In general, the analysis recommended the following:

- **Storage and Pumping.** To address future storage needs associated with future development, the following is recommended:
  - In North Stockton, a new 4.0 MG Northeast Reservoir and associated 12.0 mgd pump station
  - In South Stockton, a new 3.5 MG Mariposa Road Community Reservoir and associated 12.0 mgd pump station
- **Supply (Wells).** To offset storage reservoir size and/or address the projected storage deficit, access groundwater storage during emergencies, and improve water supply reliability, the following are recommended:
  - In North Stockton, construct and equip the planned Well 33 with backup power
  - In South Stockton, construct and equip a new well within the Mariposa Road Community development area, with backup power.
  - In South Stockton, rehabilitate existing Well SSS8 and equip with backup power
- **Pipelines.** To address high velocities observed in transmission pipelines downstream of the DWTP, it is recommended that 5,800 linear feet (lf) of 36-inch diameter pipelines be constructed.

Since the above listed recommendations are triggered by future demands, they should be allocated to future development and funded by connection fees.

BASIS OF RECOMMENDATIONS

The evaluations described in this Water Master Plan Update and the recommended capital improvement plan presented are based on several key assumptions which are described throughout this report. These assumptions include the timing, type and extent of future development projects within the COSMUD North Stockton and South Stockton water service areas. The current assumptions for future planned development, used for this Water Master Plan Update, are described in Chapter 3. Should these assumptions change (e.g., development timing is expedited or delayed, future planned land uses are changed, or the extent of development is changed or does not occur at all) the timing, need and sizing for water system improvements may be affected. Before COSMUD proceeds with the design and construction of recommended water system improvements, future development plans and associated water system facility capacity needs should be reviewed and confirmed.

In particular, as described in this Water Master Plan Update, the Mariposa Road Community is a large potential future development area in South Stockton. The development area's previous entitlement has expired, and therefore it is not known if this project area will be developed or if it will be developed as previously planned. For the purposes of this Water Master Plan Update, it was assumed that the Mariposa Road Community will be developed by 2040, based on the most recent land use plan, and be served entirely by COSMUD. This future development area is one of the largest drivers for future growth within the COSMUD South Stockton water service area. In addition, although this development area is physically located within both the COSMUD water service area and the Cal Water service area, for the purposes of

this Water Master Plan Update, it was conservatively assumed that the COSMUD would serve the entire Mariposa Road Community area. As described in Chapter 8, and as summarized above, future water system improvements have been identified to serve the future Mariposa Road Community area. However, before COSMUD proceeds with the design and construction of water system improvements for the Mariposa Road Community, actual development plans and associated facility capacity needs should be reviewed and confirmed.

1.1 WATER MASTER PLAN UPDATE PURPOSE

The purpose of this Water Master Plan Update for the City of Stockton (City) is to evaluate the existing water system infrastructure and address potential impacts of near-term and long-term planned growth to develop a comprehensive guide for the City's water system capital improvement program. The City's Municipal Utilities Department (COSMUD) operates the City's water system which serves customers in both North Stockton (serving primarily residential customers) and South Stockton (serving a mix of residential and industrial customers). Central Stockton is served by a separate water system operated by the California Water Service (Cal Water). Within Central Stockton, COSMUD operates the Walnut Plant System comprised of residential customers and the Diamond Walnut processing facility; however, the Walnut Plant System has not been evaluated as part of this Water Master Plan Update. This Water Master Plan Update only addresses the COSMUD North Stockton and South Stockton water service areas.

The City's last Water Master Plan was completed in 2008. Since that time, the City has experienced growth, constructed a surface water treatment plant, and completed an update to its General Plan (the Envision Stockton 2040 General Plan), which provides the framework for future development in the City through 2040. The Delta Water Treatment Plant was completed in 2012 which provides the City with a new treated surface water supply to supplement its other water supplies.

Since the completion of the 2008 Water Master Plan, the State endured five years of drought starting in 2012, including the driest four consecutive years in California history. These unprecedented conditions led to statewide mandated water conservation, significant surface water supply reductions and curtailments and legislation establishing new statewide water efficiency standards.

All of these factors have led to a need to reassess the City's water needs, priorities and strategies and reevaluate the need for water system infrastructure improvements to ensure a safe and reliable water supply for the City's existing and future residents and businesses.

1.2 WATER MASTER PLAN OBJECTIVES AND PRIORITIES

The primary objectives of this Water Master Plan Update for the City of Stockton are to:

- Describe the existing COSMUD water system and facilities
- Evaluate historical and existing water demands to understand recent water use trends, per capita water use and water use by customer type
- Develop future water demand projections for near-term (2030) and future (2040) conditions based on future planned development in the COSMUD water service areas and updated unit water use factors developed based on recent water use trends
- Review the City's existing water supplies and the opportunities and constraints associated with each supply source
- Review City and industry water system standards and refine performance and planning criteria under which the COSMUD water system will be evaluated and recommendations for future facilities will be formulated
- Update and calibrate the City's water system hydraulic model to provide an updated, accurate tool for evaluating various water system demand and operational scenarios

- Evaluate the need for new water system facilities (including pipelines, supply facilities, storage facilities and pumping facilities) to meet existing, near-term (2030) and future (2040) water demands within the COSMUD water service areas
- Develop a capital improvement program and financial plan for implementation of recommended water system improvements

This Water Master Plan Update has been prepared to be consistent with the mission of the City's Municipal Utilities Department:

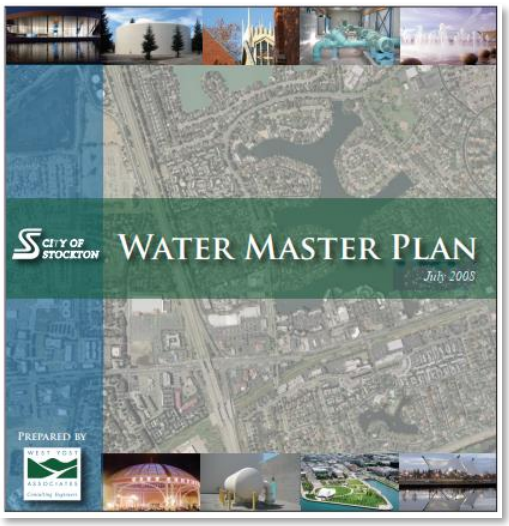
The City of Stockton Municipal Utilities Department's mission is to provide high-quality drinking water on demand; collect, treat, and dispose of wastewater; and collect and dispose of stormwater, all in accordance with applicable regulations and responsible business practices.

Based on discussions with City staff, key priorities for the Water Master Plan Update include the following:

- Develop a Water Master Plan that reflects the strength and robustness of the City's water system and facilities
- Clearly define long-term water supply and infrastructure needs so that water system infrastructure is neither undersized nor oversized
- Develop an updated hydraulic model that accurately represents the water distribution system, identifies deficiencies, allows for accurate assessment of needed infrastructure to serve proposed future development projects, and that can be easily updated to evaluate future changes
- Develop an updated Capital Improvement Plan that is consistent with projected water demands and proposed future development that can be used to inform water rates and connection fees
- Develop a Water Master Plan that is a user-friendly reference tool for both City staff and the development community

1.3 PREVIOUS AND ON-GOING STUDIES

1.3.1 2008 Water Master Plan



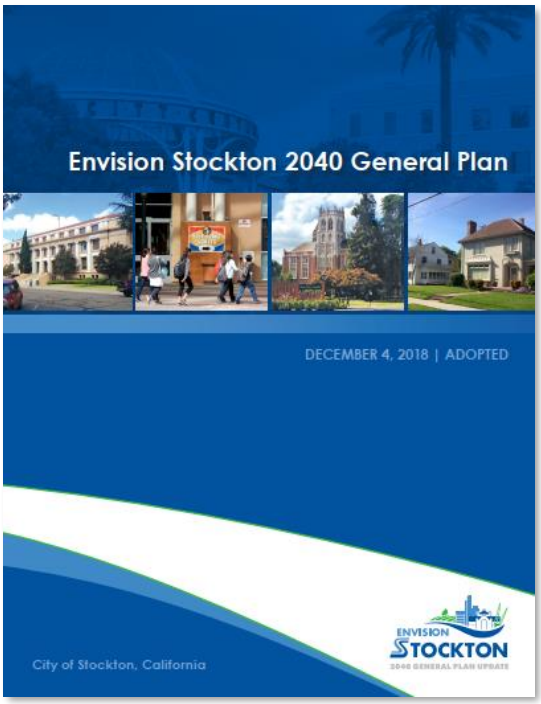
The City's previous Water Master Plan was completed in 2008 and was developed to support future development in accordance with the City's 2035 General Plan. The 2008 Water Master Plan addressed the following issues:

- The need for supplemental water supplies to meet existing and future water demands and to increase supply reliability;
- The continued use of groundwater as a supply source;
- The need for additional transmission mains, distribution pipelines, interconnections, pumping capacity, wells and storage facilities to meet the needs of existing customers and future development; and,
- The need to implement a planned capital improvement program to meet the needs of the existing water system and to accommodate future growth.

Since the completion of the 2008 Water Master Plan, the City completed the Delta Water Treatment Plant, which provides the City with a new treated surface water supply. Also, the City has updated its General Plan to provide guidance for future development within the City's Sphere of Influence.

As noted above, this Water Master Plan Update is a comprehensive update that refines unit water demand factors based on recent and projected water use trends and patterns to develop future demand projections, reflects the construction of the City's Delta Water Treatment Plant, updates the City's water system hydraulic model to evaluate system capacity, and reflects updates to future development plans to provide an evaluation of future water system needs. As described in Chapter 3 of this Water Master Plan Update, future water demands in the COSMUD water service areas are projected to be significantly lower than the water demand projections included in the 2008 Water Master Plan, primarily due to reduced growth projections within the City as reflected in the Envision Stockton 2040 General Plan. This results in significantly less extensive recommendations for water system improvements to support future water demands as compared to the 2008 Water Master Plan.

1.3.2 Envision Stockton 2040 General Plan



In March 2016, the City commenced an update of the 2035 General Plan. The updated plan, the Envision Stockton 2040 General Plan, was adopted in December 2018. The 2040 General Plan process included a comprehensive evaluation of the City's planning boundaries, including the City's Sphere of Influence (SOI). A key objective of the update was the establishment of a strategy for urban growth that both reflected the community's vision and supported the City's Climate Action Plan. This objective was achieved through extensive community outreach and engagement, resulting in a land use plan that emphasizes infill development in the City's core and supports employment and economic development citywide.

The 2040 General Plan land use map depicts proposed land use for Stockton within the SOI to accommodate the growth projected by the San Joaquin Council of Governments (SJCOG). Between 2020 and 2040, SJCOG projects that Stockton's population will grow by 102,898 to a total of 432,627 (equating to an annualized growth rate of 1.44 percent). This projection reflects growth rates that are lower than what occurred in the early 2000s and what was previously anticipated in the 2035 General Plan which had projected a population of 580,000 by 2035.[2]

Other highlights of the 2040 General Plan are summarized below:

- The General Plan increases allowable residential densities and intensity of development downtown and in the surrounding greater downtown area. Infill policies are prevalent, particularly for downtown and South Stockton.
- Compared to the previous 2035 General Plan, the land use plan reduces by almost 8,000 acres (12 square miles) the amount of agricultural land that could be developed with urban land uses.
- Compared to the previous 2035 General Plan, the projected Citywide population at buildout of the General Plan has been reduced by 25 percent.
- The General Plan features a new policy to create an Ag Belt between Stockton and Lodi in collaboration with Lodi, the County, and property owners.
- The General Plan provides guidance for reevaluating the City's public infrastructure, such as roadways and water and sewer distribution systems, which will help the City to determine whether the capital and ongoing maintenance cost of infrastructure can be supported by development projects.

[2] Stockton General Plan 2035 Goals & Policies Report, Community Development Objectives (page B-2), December 2007.

As part of the General Plan preparation, Utility Master Plan Supplements were prepared to assess the needed utility infrastructure improvements to support the planned development envisioned in the General Plan. As part of the Potable Water Master Plan Supplement[3], water demand projections were prepared and water system infrastructure capacity was evaluated for the land use alternatives considered, and recommendations were developed for updating backbone infrastructure plans to reflect the adopted land use plan (additional discussion of the water demand projections developed for the Utility Master Plan Supplements is provided in Chapter 3). The 2040 General Plan Update also included the preparation of an Infrastructure Financing Strategy to address these infrastructure needs.

The City's General Plan is built on a number of goals and policies that are related to the provision of safe and reliable water supplies. Included in the Safety Element of the City's General Plan is Goal SAF-3: Clean Water. Access to safe water is a fundamental human need for both physical and social health. Maintaining clean water supplies requires constant vigilance, significant expenditures, and sometimes changes in behavior, especially as the impacts of human activities become more pervasive. Water supply, quality, and distribution are vital to Stockton's ability to serve its population now and in the future. Regulatory pressures, droughts, and saline intrusion affecting groundwater supplies have already strained the region's water supplies. As a result, the City has focused attention on the availability of existing surface water supplies and is cooperating with other agencies in the region to manage groundwater resources at a sustainable yield.

Table 1-1 summarizes the General Plan goals, policies and actions related to water service within the City.

Table 1-1. General Plan Goals, Policies and Actions Related to Water Service

General Plan Policy	General Plan Action
Land Use Element: Goal LU-5: Protected Resources Protect, maintain, and restore natural and cultural resources	
Policy LU-5.1: Integrate nature into the city and maintain Stockton's urban forest	Action LU-5.1C: Require landscape plans to incorporate native and drought-tolerant plants in order to preserve the visual integrity of the landscape, conserve water, provide habitat conditions suitable for native vegetation, and ensure that a maximum number and variety of well-adapted plants are maintained.
Policy LU-5.2: Protect natural resource areas, fish and wildlife habitat, scenic areas, open space areas, agricultural lands, parks, and other cultural/historic resources from encroachment or destruction by incompatible development.	Action LU-5.2H: Comply with applicable water conservation measures.
	Action LU-5.2I: Coordinate with water agencies and non-profit organizations to promote public awareness on water quality and conservation issues and consistency in water quality impacts analyses.
Policy LU-5.4: Require water and energy conservation and efficiency in both new construction and retrofits.	Action LU-5.4A: Require all new development, including major rehabilitation, renovation, and redevelopment, to adopt best management practices for water use efficiency and demonstrate specific water conservation measures.

[3] Stockton General Plan Update – Potable Water Master Plan Supplement, prepared by West Yost Associates, December 12, 2017.

Table 1-1. General Plan Goals, Policies and Actions Related to Water Service

General Plan Policy	General Plan Action
Land Use Element: Goal LU-6: Effective Planning Provide for orderly, well-planned and balanced development	
Policy LU-6.1: Carefully plan for future development and proactively mitigate potential impacts	Action LU-6.1B: Monitor the rate of growth to ensure that it does not overburden the City's infrastructure and services and does not exceed the amounts analyzed in the General Plan EIR.
	Action LU-6.1D: Require that all utility connections outside the city limit be for land uses that are consistent with the General Plan.
	Action LU-6.1E: Do not approve new development unless there is infrastructure in place or planned and funded to support the growth.
	Action LU-6.1F: Evaluate and implement adjustments to the Public Facilities Fee structure to encourage development in areas where infrastructure is already present and ensure that non-infill development pays its fair share of anticipated citywide capital facilities and operational costs.
Policy LU-6.3: Ensure that all neighborhoods have access to well-maintained public facilities and utilities that meet community service needs.	Action LU-6.3A: Require development to mitigate any impacts to existing sewer, water, stormwater, street, fire station, park, or library infrastructure that would reduce service levels.
	Action LU-6.3B: Ensure that public facilities, infrastructure, and related land area and other elements are designed, and right-of-way is acquired, to meet 2040 planned development requirements to avoid the need for future upsizing or expansion, unless planned as phased construction.
	Action LU-6.3C: Coordinate, to the extent possible, upgrades and repairs to roadways with utility needs, infrastructure upgrades, and bicycle and pedestrian improvements (i.e., "dig once").
Safety Element: Goal SAF-3: Clean Water Sustain clean and adequate water supplies	
Policy SAF-3.1: Secure long-term renewable contracts and related agreements to ensure that surface water rights will be available to meet projected demand.	Action SAF-3.1A: Actively participate in appropriate forums designed to discuss and solve regional water supply and quality issues.
Policy SAF-3.2: Protect the availability of clean potable water from groundwater sources.	Action SAF-3.2A: Continue to cooperate with San Joaquin County and Cal Water to monitor groundwater withdrawals and ensure that they fall within the target yield for the drinking water aquifer.
Policy SAF-3.3: Encourage use of recycled ("gray") water for landscaping irrigation to reduce demand on potable supplies.	Action SAF-3.3A: Require new development to install non-potable water infrastructure for irrigation of large landscaped areas where feasible.
	Action SAF-3.3B: Investigate and implement Code amendments to allow installation of dual plumbing and/or rainwater capture systems to enable use of recycled water and/or captured rainwater generated on- site.

1.3.3 Water Cost of Service Rate Study

In parallel with this Water Master Plan Update, HDR is preparing an update of the City's Water Cost of Service Rate Study. Water rate studies typically review and analyze updated cost information from administration, production, distribution, maintenance of existing and future capital project improvements and regulatory requirements. In addition, debt service coverage and purchase water costs are also included. The new cost of service rate study will determine if a water rate increase is warranted based on new cost information.

This Water Master Plan Update provided a list of recommended water system improvements which will be considered in the Water Cost of Service Rate Study as appropriate. As described in Chapter 9, water system improvements are recommended to meet both existing and future system needs. System improvements needed to meet existing system needs are allocated to existing users and are to be funded through water rates. System improvements needed to expand the production and distribution system to meet future system needs to serve future planned development are allocated to future users and are to be funded through water service connection fees. Water service connection fees are not a part of the Water Cost of Service Rate Study.

HDR has prepared a summary of the proposed financial plan to fund water system improvements. This is provided in Chapter 10 of this Water Master Plan Update.

1.3.4 2020 Urban Water Management Plan

The Urban Water Management Planning Act requires every urban water supplier in California that either provides over 3,000 acre-feet of water annually, or serves more than 3,000 urban connections, to prepare and adopt an Urban Water Management Plan (UWMP) that includes specified content, including an urban water shortage contingency analysis. The adopted UWMP must be submitted to the California Department of Water Resources (DWR) and other entities. Urban water suppliers are required to submit an UWMP every five years. The 2020 UWMP is due to DWR on July 1, 2021.

Work performed for this Water Master Plan Update will inform the development of the City's 2020 UWMP, including water demand projections and projected water supplies.

1.3.5 Wastewater Master Plan Update

In parallel with this Water Master Plan Update, an update to the City's Wastewater Master Plan is also being prepared by West Yost. Where applicable, work on both master plans has been coordinated to ensure that the two plans are consistent in their assumptions, projections and recommendations where appropriate. In particular, it is important is to ensure that water demand projections and wastewater flow projections are coordinated so that both systems can be appropriately planned to meet the needs of the City's residents and businesses.

1.4 REPORT ORGANIZATION

This Water Master Plan Update is organized into the following chapters:

Chapter 1: Introduction	Describes the purpose, objectives and priorities for the Water Master Plan Update, its relationship to other on-going studies, report organization and acknowledgments
Chapter 2: Existing Water System	Provides background information on the existing COSMUD water service areas, water supplies and water system facilities
Chapter 3: Water Demands	Presents historical, current and projected future water demands based on planned future development in accordance with the City's Envision 2040 General Plan
Chapter 4: Water Supply	Provides an overview of the existing COSMUD water supply sources and plans to optimize available water supplies for the future
Chapter 5: Design/System Performance Criteria	Defines the recommended performance and operational criteria for the COSMUD water system, including supply, storage and pumping capacity, fire flow requirements, minimum and maximum system pressures, and maximum pipeline velocity and head loss
Chapter 6: Hydraulic Model Update and Calibration	Describes the update, refinement and calibration of the COSMUD existing water distribution system hydraulic model used to analyze the COSMUD distribution system performance
Chapter 7: Existing Water System Analysis	Describes the evaluation of the existing COSMUD water system in comparison to the criteria developed in Chapter 5 and provides recommendations for existing system improvements
Chapter 8: Future Water System Analysis	Describes the evaluation of the COSMUD water system and its ability to meet projected future water demands in comparison to the criteria developed in Chapter 5 and provides recommendations for future system improvements
Chapter 9: Recommended Water System Capital Improvement Program	Provides a detailed summary of recommended capital improvements for the COSMUD water system to meet existing and projected future demands
Chapter 10: Financial Plan	Provides an overview of funding options to implement the recommended capital improvements for the COSMUD water system

The following appendices to this Water Master Plan Update contain additional technical information, assumptions and calculations:

Appendix A: Hydrant Testing and Hydrant Pressure Recorder Placement Plan for Model Calibration	Outlines the hydrant testing that was performed in June 2020 and the associated collection of water distribution system pressure data using hydrant pressure recorders to obtain data needed to calibrate the COSMUD water system hydraulic model to actual system conditions as described in Chapter 6
Appendix B: Hydraulic Model Calibration Results – North Stockton	Presents results from the hydraulic model calibration process for the North Stockton water system comparing model-predicted results to field-collected data as described in Chapter 6
Appendix C: Hydraulic Model Calibration Results – South Stockton	Presents results from the hydraulic model calibration process for the South Stockton water system comparing model-predicted results to field-collected data as described in Chapter 6
Appendix D: Cost Estimating Assumptions	Describes cost estimating assumptions used to estimate construction costs for recommended water system improvements as described in Chapter 9
Appendix E: Financial Plan Worksheets	Provides the worksheets prepared by HDR in support of the financial plan presented in Chapter 10 and the water rate study being prepared in parallel with this Water Master Plan Update

1.5 ACKNOWLEDGMENTS

The development of this Water Master Plan Update would not have been possible without the focused involvement and assistance of City staff. In particular, the following staff provided comprehensive information, significant input and important insights throughout development of this Water Master Plan Update:

John Abrew	Director of Municipal Utilities Department
Ariana Adame	Planning Manager, Community Development Department
Gemma Biscocho	Senior Civil Engineer, Engineering Division (Project Manager for Water Master Plan Update)
Juan Chavez	Engineering Services Manager, Engineering Division
Lance Cook	Water Systems Superintendent, Water Field Office
Matt Diaz	Planning Manager/Advanced Planning, Community Development Department
Ali Gharegozloo	Principal Engineer, Engineering Division
Eric Houston	Chief Plant Operator, Water Treatment Plant

Stephen Kenning	Assistant Director of Municipal Utilities Department
Mel Lytle	Assistant Director of Municipal Utilities Department
Mitchell Maidrand	Deputy Director of Municipal Utilities Department, Water Resources Division
Jeff Marasovich	CMMS/SCADA Systems Manager
Michael McDowell	Deputy Director of Planning and Engineering, Community Development Department
Ann Okubo	Associate Civil Engineer, Engineering Division
Rudy Quinones	Water Systems Supervisor, Water Field Office
Travis Small	Plant Operations Supervisor, Water Treatment Plant
Danny Trejo	Program Manager III, Water Resources Division

This chapter describes the COSMUD existing water system, which generally serves the northern and southern areas of Stockton. System information is based on a review of previous studies, design reports, maps, plans, operating records, and discussions with the COSMUD staff. Key sections of this chapter include:

- Existing Water Service Areas
- Existing Water Supplies
- Existing Water System Facilities

2.1 EXISTING WATER SERVICE AREAS

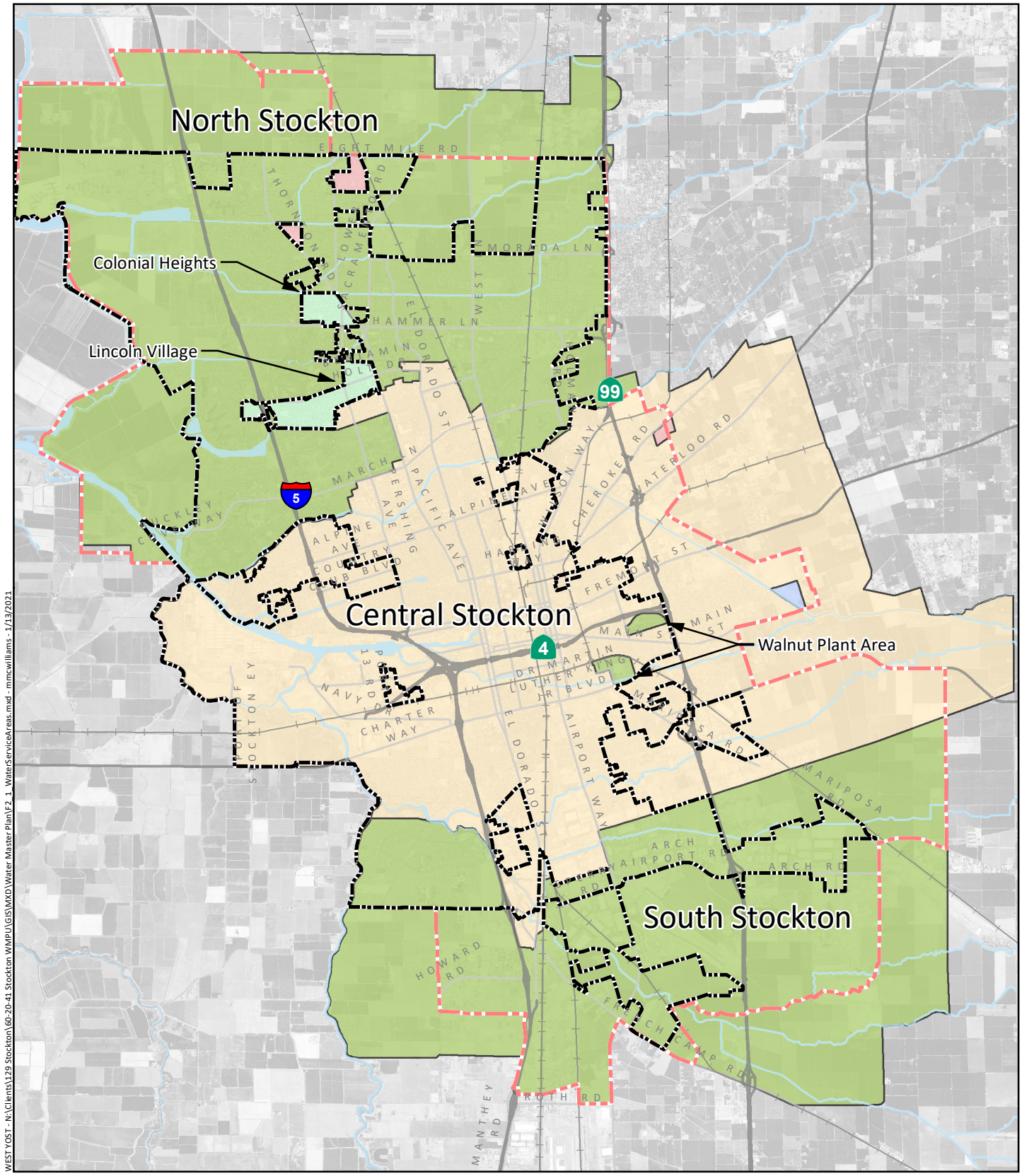
The City is located in the Central Valley of California and is the County seat for San Joaquin County. California State Highway 99 and Interstate 5 run north and south through the City on the east and west boundaries, respectively, and California State Highway 4 (the Crosstown Freeway) connects the two. The San Joaquin River flows from the south and terminates at the Delta area of Central Stockton.

As shown on Figure 2-1, the City of Stockton can be generally divided into three distinct water service areas:

- North Stockton: Served by the COSMUD, with the exception of several small developed areas ("islands") served by San Joaquin County[4].
- Central Stockton: Served by the California Water Service (Cal Water).
- South Stockton: Served by the COSMUD.

This Water Master Plan Update only addresses the areas served by the COSMUD within the General Plan SOI, which includes most of North and South Stockton. In general, the North Stockton water service area is primarily residential and is bounded by Eight Mile Road to the north, Cascade and Columbia Railroad to the east, the Calaveras River to the south and the City limits to the west. Since the completion of the previous Water Master Plan, residential developments off of Eight Mile Road have continued to develop. The South Stockton water service area is largely comprised of residential (on the west side) and industrial and agricultural land uses. The South Stockton water service area is generally bounded by French Camp Slough to the north, City limits to the east and south, and the San Joaquin River to the west.

[4] Two of the County islands in North Stockton (Colonial Heights and Lincoln Village) receive water that is delivered by the COSMUD.



City of Stockton Limits
City of Stockton Sphere of Influence
California Water Service Area
San Joaquin County (served by COSMUD)
San Joaquin County
City of Stockton Municipal Utilities Department
Stockton East Water District

N

0 1 2
Miles

Figure 2-1

Water Service Areas

City of Stockton
Water Master Plan Update

WEST YOST

2.2 EXISTING WATER SUPPLIES

The COSMUD water service areas are served by an existing water supply portfolio comprised of a conjunctive use system, which includes:

- Surface water from the San Joaquin River that is diverted at the Intake Pump Station on Empire Tract located in Sacramento-San Joaquin Delta (Delta) and treated at the City's Delta Water Treatment Plant (DWTP), with supplemental surface water from the Mokelumne River diverted and conveyed by Woodbridge Irrigation District (WID), and treated at the City's DWTP, when the City's supplies from San Joaquin River are curtailed
- Treated surface water from the Stockton East Water District (SEWD) conveyed from the New Melones (Stanislaus River) and New Hogan (Calaveras River) Reservoirs
- Groundwater pumped by the COSMUD from City-owned and operated wells in the underlying Eastern San Joaquin Groundwater Subbasin

Details regarding these water supply sources are provided in Chapter 4. The water supply and treatment facilities are described as follows.

2.2.1 Surface Water Supply

The City's surface water supply is from three primary sources: surface water diverted from the San Joaquin River treated at the City's DWTP, surface water from the Mokelumne River diverted and conveyed by Woodbridge Irrigation District and treated at the City's DWTP, and treated surface water from SEWD.

Due to differing disinfection processes that present water quality issues related to low chlorine residual and disinfection byproducts, COSMUD provides water from the DWTP only in its North Stockton water distribution system. Water from SEWD can be conveyed to both North and South Stockton distribution systems. At the time of preparation of this Water Master Plan Update, the COSMUD is in the process of implementing the North Stockton Pipeline Hypochlorite Facility that would allow SEWD supplies to be conveyed to the North Stockton system and combined with DWTP-produced water supply (this project is discussed further in Chapter 4).

2.2.1.1 Delta Water Treatment Plant

The San Joaquin River provides the largest portion of the City's potable water supply. When the City received its water rights permit in 2006, the City implemented the Delta Water Supply Project (DWSP) to construct its DWTP north of Stockton, the Intake Pump Station (IPS) at the southwest tip of Empire Tract, and associated water supply infrastructure. The DWTP was completed in 2012. Since that time, the COSMUD has diverted water from the San Joaquin River via the IPS and treats the water at the DWTP for an increasing portion of its water supply.

The DWTP has a current treatment capacity of 30 million gallons per day (mgd). In 2019, it produced 68 percent of the COSMUD water supply. The DWTP treatment process includes ozone oxidation and disinfection and membrane filtration with chlorine added as a residual disinfectant. Treated water is stored in a 4-million-gallon (MG) storage tank and aqueous ammonia is added to provide a chloramine residual before distribution to the North Stockton water service area.

As described further in Chapter 4, the City's water supply from the San Joaquin River is curtailed annually from February 15 to June 15 due to environmental restrictions. During this period, the COSMUD obtains raw water from WID to augment its water supply. WID conveys raw water through its Wilkinson Canal and Pixley Lateral Pipeline to the DWTP for treatment.

2.2.1.2 Stockton East Water District

SEWD is a wholesale water supplier that provides treated potable water to the urban water retailers within the Stockton Metropolitan Area, including COSMUD, Cal Water, and two small maintenance districts in San Joaquin County. SEWD's Dr. Joe Waidhofer Water Treatment Plant (DJWWTP) has a current capacity of 60 mgd and is located in Central Stockton. In 2019, SEWD produced approximately 20 percent of the COSMUD water supply.

The SEWD receives water from New Melones (Stanislaus River) and New Hogan (Calaveras River) Reservoirs. Diverted water is temporarily stored in three small earthen reservoirs at the DJWWTP. The South, North and Intake reservoirs contain 30, 24, and 26 MG of raw water when full, respectively. The treatment process is comprised of coagulation, flocculation, sedimentation, filtration, and disinfection. Granular activated carbon (GAC) is used for removing organic contaminants and controlling taste and odor problems, while chlorine gas is used for disinfection. Recently, SEWD has proposed to change the DJWWTP disinfection process from chlorine gas to liquid sodium hypochlorite. Treated water is then pumped into the distribution system manifold from a 20 MG underground finished water reservoir. The manifold splits the flow in the South Stockton Aqueduct, the Cal Water distribution system, and the North Stockton Aqueduct.

The COSMUD supplies SEWD treated water to its South Stockton water service area. At the time of preparation of this Water Master Plan Update, the COSMUD has commenced construction of the North Stockton Pipeline Hypochlorite Facility that would allow SEWD water supplies to be conveyed to the North Stockton system and combined with the DWTP-produced water supply. This project is discussed in further detail in Chapter 4 (Section 4.2.1).

2.2.2 Groundwater Supply

The COSMUD operates groundwater wells in both the North and South Stockton water service areas. Both water service areas generally rely on treated surface water year-round for their primary supply, but it is supplemented with groundwater to meet increased water demands primarily in the summer months or during dry years when available surface water supplies may be limited. Wells are also depended on for emergency supply in the event of surface water supply interruptions.

2.3 EXISTING WATER SYSTEM FACILITIES

As described above, the COSMUD operates a water distribution system that contains two water service areas: North Stockton and South Stockton. The two water service areas are connected to one another by the Stockton Aqueduct; however, water supplies in the two water service areas do not currently comingle due to the higher pressure from SEWD in South Stockton which prevents water from North Stockton from flowing into the South Stockton area. The lowest ground surface elevation (at mean sea level) is on the western side of the system and the highest elevation (36 feet above mean sea level) is on the eastern side of the system.

2.3.1 Groundwater Wells

There are currently twelve (12) operational (i.e., active or standby) groundwater wells in North Stockton with design capacities ranging from 800 to 3,200 gallons per minute (gpm). The ten (10) active wells have a total production capacity of 29.1 mgd and the two (2) standby wells have a total production capacity of 4.5 mgd, for a total available capacity of approximately 33.6 mgd. The North Stockton system also includes ten (10) inactive wells, which are currently not permitted by the Division of Drinking Water (DDW). Although the total active well capacity is 29.1 mgd, actual groundwater production is less due the fact that the DWTP provides the majority of the supply in North Stockton. Table 2-1 summarizes the information on the North Stockton wells.

There are currently four (4) operational (i.e., active or standby) groundwater wells in South Stockton. The design capacities range from 1,400 to 2,800 gpm. The two (2) active wells have a total production capacity of 6.9 mgd, and the two (2) standby wells have a production capacity of 3.3 mgd. The South Stockton system also has one (1) inactive well, which is currently not permitted for use. Similar to North Stockton, although the total active well capacity is 6.9 mgd, actual groundwater production is less due to the fact that the SEWD DJWWTP provides the majority of the supply in South Stockton. Table 2-2 summarizes the information on the South Stockton wells which are designated as South Stockton System (SSS) wells.

Table 2-1. North Stockton Well Facilities

Well Number	Location	Installed HP	Pumping Capacity, gpm[(a)]	Year Drilled	Depth, ft	Well Status	Well Age, years	Backup Power Installed
1	Rivara Road	40	648	1954	268	Inactive	66	No
3R	West Lane	200	2,000	--	--	Active	--	Yes
4	Villa Dorado Park	75	1,050	1965	602	Inactive	55	No
7	Galloway Drive	40	550	1963	238	Inactive	57	No
9	Don Carlos Drive	50	540	1955	290	Inactive	65	No
10R	Valverde Park	200	2,000	--	--	Active	--	No
11	Inglewood	75	1,100	1958	317	Inactive	62	No
15[(a)]	Mosher Slough and WPRR	150	1,805	1975	600	Standby	45	No
16	Lower Sacramento Road	200 (gas)	2,000	1976	600	Inactive	44	No
18	Hickock Drive	60	800	1956	211	Active	64	No
19	1233 Sutherland	200	2,000	1978	500	Active	42	No
20[(a)]	West Lane/ Summerview Drive	200 (gas)	1,800	1978	545	Inactive	42	No
21	Cortez Park	200	2,000	1978	500	Active	42	No
24	Saffron Way	150	1,040	1982	495	Inactive	38	No
25	Panella Park	200 (gas)	1,600	1984	570	Inactive	36	No
26	Hammer and EBMUD	N/A	1,970	1987	450	Inactive	33	No
27	Bonaire Circle	200	2,000	1985	575	Active	35	No
28	Wild Grape Drive	120	1,295	1997	560	Standby	23	No
29	Autumn Oak Place	200	3,200	2000	500	Active	20	Yes
30	Grider Way	200	2,200	2003	540	Active	17	Yes
31	Ivano Lane	200	2,000	2004	410	Active	16	Yes
32	North State Route 99 (West Frontage Road)	200	2,000	2004	480	Active	16	Yes
Total Active Well Pumping Capacity, gpm			**20,200**					
			mgd	**29.1**				
Total Standby Well Pumping Capacity, gpm			**3,100**					
			mgd	**4.5**				

Source: Status and backup power are based on City of Stockton's Permit Amendment dated January 7, 2020 (active wells are highlighted in green) and other information is based on the City of Stockton's 2008 Water Master Plan.

(a) Well capacities based on the most recent capacity reported on *"Well Rehabilitation List Status 103020.xlsx"*, provided to West Yost on October 30, 2020.

Table 2-2. South Stockton Well Facilities

Well Number	Location	Installed HP	Pumping Capacity, gpm[(a)]	Year Drilled	Depth, ft	Well Status	Well Age, years	Backup Power Installed
SSS 1[(a)]	4728 Quantas Lane	200	1,000	1984	600	Inactive	36	No
SSS 2[(a)]	4605 W Highway 99 Frontage Road	100	1,295	1953	172	Standby	67	No
SSS 3	4748 Frontier Way	200	2,000	1989	625	Active	31	Yes
SSS 8[(a)]	4120 Pock Lane	250	1,010	2000	410	Standby	20	No
SSS 9	B Street	200	2,800	2004	372	Active	16	No
Total Active Well Pumping Capacity, gpm			**4,800**					
mgd			**6.9**					
Total Standby Well Pumping Capacity, gpm			**2,305**					
mgd			**3.3**					

Source: Status and backup power are based on City of Stockton's Permit Amendment dated January 7, 2020 (active wells are highlighted in green) and other information is based on the City of Stockton's 2008 Water Master Plan

(a) Well capacities based on the most recent capacity reported on *"Well Rehabilitation List Status 103020.xlsx"*, provided to West Yost on October 30, 2020.

2.3.2 Storage Reservoirs and Reservoir Pump Stations

The North Stockton water system has a total available storage capacity of 16.2 MG. Three 3.4 MG storage reservoirs are located at the Northwest (NW) Reservoir site and two 3 MG storage reservoirs are located near Fourteen-Mile Slough (FMS). The South Stockton water system has a total available storage capacity of 6 MG, with two 3 MG storage reservoirs located at Weston Ranch (WR). Table 2-3 summarizes the information for each storage facility. Each reservoir has an altitude valve which opens to fill the reservoir based on reservoir levels. Generally, these valves are equipped with sustaining features that allow the altitude valve to maintain a minimum upstream pressure, thereby avoiding low system pressures during fill cycles.

Table 2-3. City of Stockton Water Storage Reservoirs

Reservoir Name	Tank	Reservoir Type	Reservoir Material	Year Installed	Diameter, feet	Overflow Elevation, feet	Bottom Elevation, ft	Nominal Storage Capacity, MG
North Stockton								
Northwest	1	Cylindrical	Steel	1996	120	45.9	4.9	3.4
	2	Cylindrical	Steel	1996	120	45.9	4.9	3.4
	3	Cylindrical	Steel	2008	120	45.9	4.9	3.4
Fourteen-Mile Slough	1	Cylindrical	Steel	1995	120	35	0	3.0
	2	Cylindrical	Steel	1995	120	35	0	3.0
South Stockton								
Weston Ranch	1	Cylindrical	Steel	1995	135	44	15	3.0
	2	Cylindrical	Steel	2010	135	44	15	3.0
							Total Storage Capacity, MG	**22.2**

There is a pump station at each of the reservoir sites to pump the stored water from the at-grade reservoirs into the distribution system during higher system demands. Table 2-4 summarizes the information for each reservoir pump station. As shown on Table 2-4, the North Stockton area has a total and firm pumping capacity of 39,750 gpm (57.2 mgd) and 31,450 gpm (45.3 mgd), respectively. The South Stockton area has a total and firm pumping capacity of 12,000 gpm (17.3 mgd) and 9,000 gpm (13.0 mgd), respectively.

Table 2-4. City of Stockton Reservoir Pump Stations

Pump Station Location	Pump No.	Nominal Capacity, gpm	Horsepower	Total Capacity, gpm	Firm Capacity[(a)] gpm
North Stockton					
Northwest 10001 North I-5 Frontage Road	1	5,000	200	25,200	20,200
	2	3,800	150		
	3	3,800	127		
	4	3,800	127		
	5	3,800	150		
	6	5,000	200		
Fourteen-Mile Slough 5656 Feather River Drive	1	3,300	150	14,550	11,250
	2	3,300	150		
	3	2,650	125		
	4	2,650	125		
	5	2,650	125		
South Stockton					
Weston Ranch 750 French Camp Road	1	3,000	125	12,000	9,000
	2	3,000	125		
	3	3,000	125		
	4	3,000	125		

(a) Firm capacity is the total installed capacity with the largest pump out of service.

2.3.3 Transmission and Distribution Pipelines

The COSMUD water transmission system consists of 16- to 48-inch diameter pipelines. The North Stockton water service area is connected to the SEWD DJWWTP via a 48-inch diameter pipeline and connected to the DWTP via a 42-inch diameter pipeline. The South Stockton water service area is connected to the SEWD DJWWTP via the 42-inch diameter pipeline. The COSMUD water distribution system consists of pipelines with diameters less than 16 inches. Most of the service laterals branch off of 8-inch and 12-inch diameter pipelines. Table 2-5 provides a summary of distribution system pipelines by pipe diameter. As shown on Table 2-5, about 60 percent of the distribution system is comprised of pipelines which are 8-inches in diameter or less. Figure 2-2 shows the existing water distribution system.

Table 2-5. City of Stockton Distribution System Pipeline Diameters[(a)]

Pipeline Diameter	Length of Pipeline		Percent in Water System
Inches	feet	miles	
North Stockton			
4 or less	67,736	12.8	2.2
6	309,182	58.6	10.0
8	1,156,797	219.1	37.5
10 to 12	616,959	116.8	20.0
Greater than 12 but less than 24	102,600	19.4	3.3
24 or greater	171,447	32.5	5.6
Unknown	16,441	3.1	0.5
North Stockton Subtotal	**2,441,164**	**462.3**	**79.2%**
South Stockton			
4 or less	7,386	1.4	0.2
6	35,779	6.8	1.2
8	249,737	47.3	8.1
10 to 12	127,325	24.1	4.1
Greater than 12 but less than 24	128,966	24.4	4.2
24 or greater	83,814	15.9	2.7
Unknown	7,770	1.5	0.3
South Stockton Subtotal	**640,777**	**121.7**	**20.8%**
Total	**3,081,941**	**584**	**100.0%**

(a) Data summarized from the City of Stockton's GIS pipeline feature class provided April 2020. Only pipelines with an FEA Code for "encased city line" or "city line" are included. Pipelines with an unspecified/blank diameter or a diameter of zero are included in the Unknown category.

WEST YOST - N:\Clients\129 Stockton\60-20-41 Stockton WMPU\GIS\MXD\Water Master Plan\F2_2_ExistingSystem.mxd - bvera - 11/18/2020

Delta Water Treatment Plant
WTP
Well #29
Northwest
Well #18
Well #30
Well #31
Well #19
Well #24
Well #32
Well #16
Well #9
Well #15
Well #20
Well #10R
Well #7
Well #21
Well #26
Well #1
Well #4
Well #03R
Well #11
Well #25
14 Mile Slough
Well #28
Well #27
Stockton East Water District
WTP
Well SSS9
Well SSS8
Well SSS2
Well SSS3
Well SSS1
Weston Ranch
0 0.6 1.2
Miles

WTP Water Treatment Plant	**Pipelines**
Storage Tank and Pump Station	Less than 12 inches
Active Well	12 - 14 inches
Inactive Well	16 - 22 inches
Standby Well	24 inches or greater

COSMUD Water Service Boundary	
California Water Service	
San Joaquin County (served by COSMUD)	
San Joaquin County	
Stockton East Water District	

Figure 2-2

Existing Water System

City of Stockton
Water Master Plan Update

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Age and material of pipeline is not well documented in the City's GIS system. In previous studies, pipeline install dates were estimated based on construction of nearby buildings. This information was correlated back to the COSMUD water system to gain an estimate of the age of water system pipelines, assuming that both systems were constructed around the same time. Table 2-6 and Figure 2-3 summarize pipelines by approximate installation decade ranges. Based on conversations with COSMUD Operations staff, pipeline materials predominantly consist of asbestos cement (AC) and polyvinyl chloride (PVC). Based on the City's GIS, there are also small amounts of cast iron, ductile iron, concrete lined and coated, and steel pipelines. In general, pipelines constructed before the mid-1980s generally consist of AC. Around the mid-1980s and thereafter, COSMUD transitioned to primarily PVC.

Table 2-6. City of Stockton Distribution System Pipeline Installation Year[(a)]

Decade of Pipeline Installation	Length of Pipeline		Percent of Water System
	feet	miles	
North Stockton			
1950s or earlier	109,632	20.7	3.6
1960s	161,722	30.6	5.2
1970s	535,088	101.3	17.4
1980s	320,196	60.6	10.4
1990s	353,192	66.9	11.5
2000s	672,891	127.4	21.8
2010s	37,837	7.2	1.2
Unknown	250,606	47.5	8.1
North Stockton Subtotal	**2,441,164**	**462.3**	**79.2%**
South Stockton			
1960s	8,816	1.7	0.3
1970s	51,879	9.8	1.7
1980s	11,202	2.1	0.4
1990s	219,430	41.6	7.1
2000s	184,289	34.9	6.0
2010s	13,087	2.5	0.4
Unknown	152,075	28.8	4.9
South Stockton Subtotal	**640,777**	**121**	**20.8%**
Total	**3,081,941**	**584**	**100.0%**

(a) Data summarized from the City of Stockton's GIS pipeline feature class and the PipelineInstallDate.dbf file, provided April 2020. Only pipelines with an FEA Code for "encased city line" or "city line" are included. Pipelines with an installation year of zero are shown in the Unknown category.

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NORTH STOCKTON

Delta Water Treatment Plant

WTP

Northwest

14 Mile Slough

Stockton East Water District

WTP

0 3,500 7,000

Scale in Feet

SOUTH STOCKTON

Stockton East Water District

WTP

Weston Ranch

0 3,000 6,000

Scale in Feet

Notes:
1. Pipeline information is from StocktonWaterSystem.gdb and PipelineInstallDate.dbf provided by the City in April 2020.

- Water Treatment Plant
- Storage Tank and Pump Station
- No Date Available
- 1940s or earlier
- 1950s
- 1960s
- 1970s
- 1980s
- 1990s
- 2000s
- 2010s
- COSMUD Water Service Boundary
- California Water Service
- San Joaquin County (served by COSMUD)
- San Joaquin County
- Stockton East Water District

Figure 2-3

System Pipelines by Decade of Installation

City of Stockton
Water Master Plan Update

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This chapter describes the COSMUD historical, current and projected near-term and future water demands. The projected near-term and future demands are based on refined water use factors and planned future development from the City's recently updated 2040 General Plan Update (GPU) along with other specific planned development projects the City has identified. Projected near-term and future water demands will be used to evaluate the future water production required and the adequacy of the COSMUD available water supplies and capacity of the COSMUD water system to reliably deliver water to its customers.

The following sections of this chapter present the COSMUD historical and current water demands, along with planned future development, projected water demands, and future water production required for the near-term (2030) and future (2040) timeframes:

- Historical Water Production and Use
- Historical Peak Water Use
- Existing and Future Land Use and Growth Projections
- Water Use Factors
- Future Water Demands and Required Water Production
- Comparison to the 2008 WMP, the 2015 UWMP and the 2018 Utility Master Plan Supplements

3.1 HISTORICAL WATER PRODUCTION AND USE

The following sections summarize the historical water production for the COSMUD water service areas which include generally North and South Stockton and the Walnut Plant water service area in Central Stockton that is surrounded and served by the California Water Service (Cal Water) through a wheeling agreement.

3.1.1 Historical Annual Water Production

Historically, the COSMUD has obtained purchased water from SEWD and groundwater produced by the COSMUD groundwater wells. In 2012, the DWTP was completed and began delivering treated surface water to the COSMUD North Stockton water service area. After introducing surface water from DWTP in the North Stockton water service area, the COSMUD slowly reduced its supplies from SEWD until June 2016, at which point it solely depended on DWTP and local groundwater supplies in the North Stockton water service area, and utilized supplies from SEWD only in the South Stockton water service area. The primary reason for the use of DWTP supplies in North Stockton and SEWD supplies in South Stockton is due to differing disinfection processes that present water quality issues related to low chlorine residual and the potential for formation of disinfection byproducts. This is described further in Chapter 4.

Table 3-1 summarizes the annual water production for the COSMUD North and South Stockton water service areas, as well as the Walnut Plant Area located in Central Stockton[5]. In North and South Stockton, a surface water to groundwater mix of approximately 74 and 26 percent, respectively, was supplied from 2006 to 2010. When the DWTP came online in 2012, the COSMUD began utilizing more surface water, approximately 90 percent of the overall production, but the supply mix dropped back down to about 76 percent surface water due to the drought. The five-year average surface water supply has averaged approximately 86 percent. The reliance on groundwater has decreased since 2012 with the availability of additional surface water supplies treated at the DWTP.

Figure 3-1 displays the monthly water production from 2006 through 2019 for the COSMUD North Stockton water service area. Prior to 2012, North Stockton relied on water supply from SEWD and groundwater wells. Since 2012, North Stockton has transitioned to relying on water supply from the DWTP supplemented by groundwater wells. The highest average day water production occurred in 2007 with a total of 28.4 mgd. The lowest average day water production occurred in 2015 with a total of 19.6 mgd. In 2019, the average day water production was 21.9 mgd. Water production decreased from 2007 to 2015, attributed to the 2008 economic downturn, the recent drought, and water conservation measures implemented due to the drought. Since 2015, there appears to be a rebound in water production in North Stockton from pre-drought conditions, but water demands are still below pre-drought conditions.

Figure 3-2 displays the monthly water production from 2006 through 2019 for the COSMUD South Stockton water service area. South Stockton is supplied by SEWD, supplemented by groundwater. The DWTP does not supply South Stockton since it is not hydraulically connected. The highest average day water production occurred in 2007 and 2008 with a total of 7.1 mgd. The lowest average day water production occurred in 2015 with a total of 3.8 mgd produced, at the height of the drought. In 2019, the average day water production was 5.3 mgd. The same trends occurred in South Stockton as in North Stockton, and there was a steady decrease in water production from 2007 through 2015 and then a rebound from 2015 to 2019.

Figure 3-3 displays the monthly water production from 2006 through 2019 for the COSMUD Central Stockton water service area. The Walnut Plant Area in Central Stockton relies exclusively on water purchased from SEWD and wheeled through the Cal Water system. The Walnut Plant Area is hydraulically isolated from the North and South Stockton water service areas. The highest average day water production occurred in 2006 with a total of 0.4 mgd. The Walnut Plant Area has since experienced an overall decrease in water demand. In 2019, the average day water production was 0.2 mgd.

Figure 3-4 displays the monthly water production from 2006 through 2019 for the entire COSMUD water service area. The highest average day production, systemwide, occurred in 2007 with a total of 35.8 mgd produced for the COSMUD. The lowest average day production occurred in 2015 with only 23.5 mgd produced. Since 2015, the average day production has been increasing and in 2019, 27.4 mgd of water was produced for the COSMUD.

[5] As noted in Chapter 1, the Walnut Plant Area has not been evaluated in this Water Master Plan Update. However, discussion of water production for the Walnut Plant Area has been included here as it is part of the total COSMUD water production.

Table 3-1. Historical Water Production[(a)]

	North Stockton						South Stockton						Total					
Year	SEWD, af	DWSP, af	Groundwater, af	Total, af	Surface Water Percent of Total, af	Groundwater Percent of Total, af	SEWD, af	Groundwater, af	Total, af	Surface Water Percent of Total, af	Groundwater Percent of Total, af	Walnut Plant Area (SEWD), af	SEWD, af	DWSP, af	Groundwater, af	Total, af	Surface Water Percent of Total, af	Groundwater Percent of Total, af
2006	18,010	0	11,309	29,320	61%	39%	4,079	2,009	6,088	67%	33%	407	22,496	0	13,319	35,815	63%	37%
2007	20,461	0	11,326	31,787	64%	36%	7,101	876	7,977	89%	11%	311	27,873	0	12,202	40,075	70%	30%
2008	21,364	0	10,280	31,644	68%	32%	7,157	841	7,998	89%	11%	256	28,776	0	11,121	39,897	72%	28%
2009	21,985	0	6,810	28,795	76%	24%	6,845	698	7,542	91%	9%	241	29,072	0	7,508	36,579	79%	21%
2010	22,730	0	5,034	27,764	82%	18%	6,820	439	7,260	94%	6%	236	29,786	0	5,473	35,260	84%	16%
2011	22,001	0	5,797	27,798	79%	21%	7,483	211	7,694	97%	3%	234	29,718	0	6,008	35,727	83%	17%
2012	17,546	9,559	3,219	30,325	89%	11%	6,360	175	6,535	97%	3%	240	24,146	9,559	3,394	37,100	91%	9%
2013	10,564	15,463	3,772	29,799	87%	13%	6,288	314	6,602	95%	5%	291	17,143	15,463	4,085	36,692	89%	11%
2014	9,391	9,598	6,842	25,831	74%	26%	5,165	386	5,551	93%	7%	220	14,777	9,598	7,228	31,603	77%	23%
2015	2,211	14,059	5,641	21,911	74%	26%	3,241	978	4,219	77%	23%	182	5,634	14,059	6,619	26,312	75%	25%
2016	139	18,922	3,569	22,629	84%	16%	4,822	179	5,002	96%	4%	214	5,175	18,922	3,748	27,845	87%	13%
2017	2	20,843	2,852	23,696	88%	12%	5,190	114	5,304	98%	2%	241	5,433	20,843	2,965	29,241	90%	10%
2018	0	21,229	3,206	24,435	87%	13%	5,426	30	5,456	99%	1%	212	5,639	21,229	3,236	30,103	89%	11%
2019	0	20,809	3,770	24,579	85%	15%	5,920	8	5,928	100%	0%	176	6,096	20,809	3,778	30,684	88%	12%
Average	**11,886**	**9,320**	**5,959**	**27,165**	**78%**	**22%**	**5,850**	**518**	**6,368**	**92%**	**8%**	**247**	**17,983**	**9,320**	**6,478**	**33,781**	**81%**	**19%**
5-Year Average	**470**	**19,172**	**3,807**	**23,450**	**84%**	**16%**	**4,920**	**262**	**5,182**	**94%**	**6%**	**205**	**5,595**	**19,172**	**4,069**	**28,837**	**86%**	**14%**

(a) Source: Data for 2009-2019 (City Monthly Month_Year.xlsx) provided by City staff in May 2020.

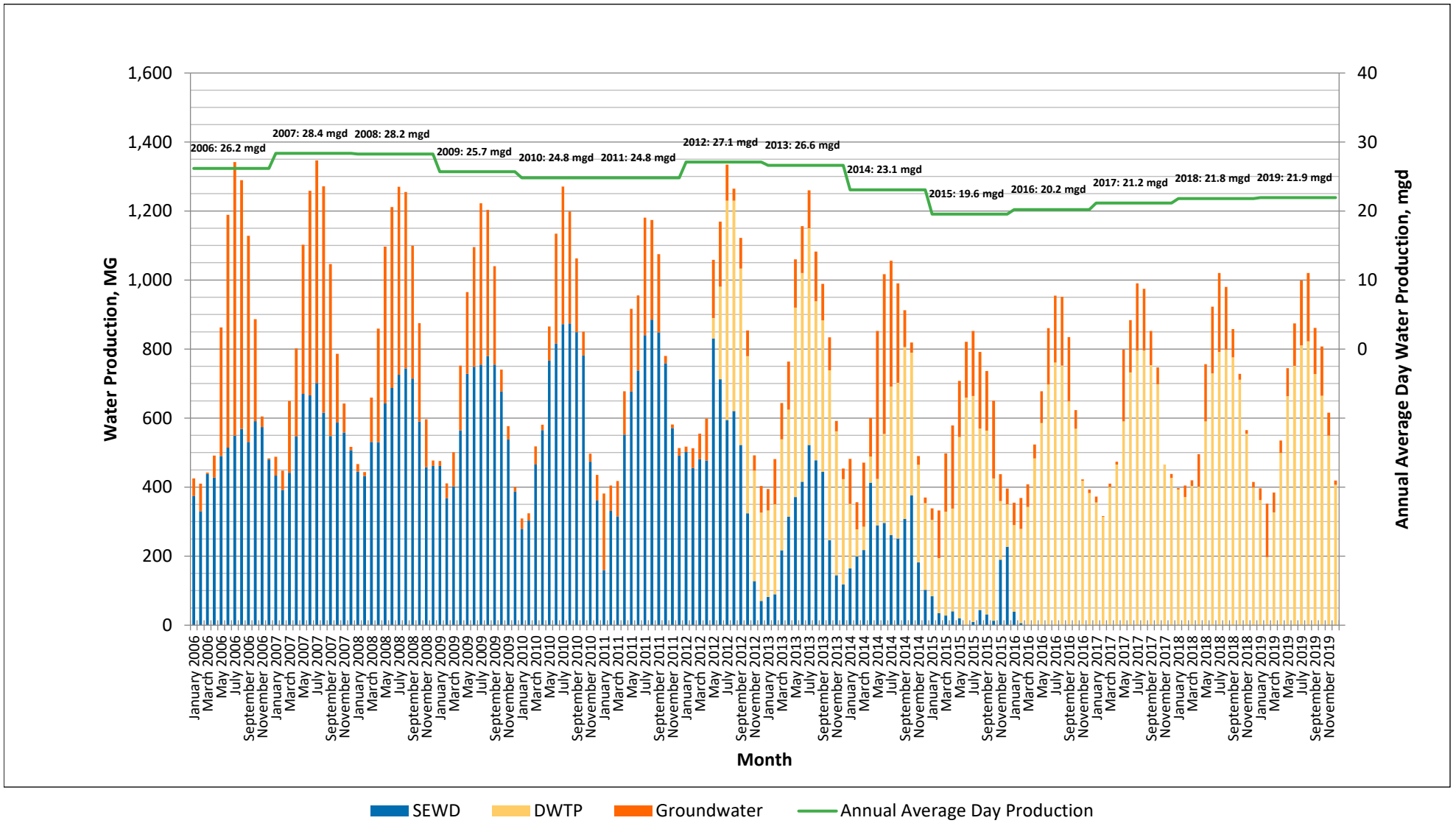

Figure 3-1

Historical Monthly Water Production for North Stockton

City of Stockton
Water Master Plan Update

Notes:

1. Source: Data for 2009-2019 (City Monthly Month_Year.xlsx) provided by City staff in May 2020.
2. Abbreviations: MG = million gallons; mgd = million gallons per day; SEWD = Stockton East Water District; DWTP = Delta Water Treatment Plant.

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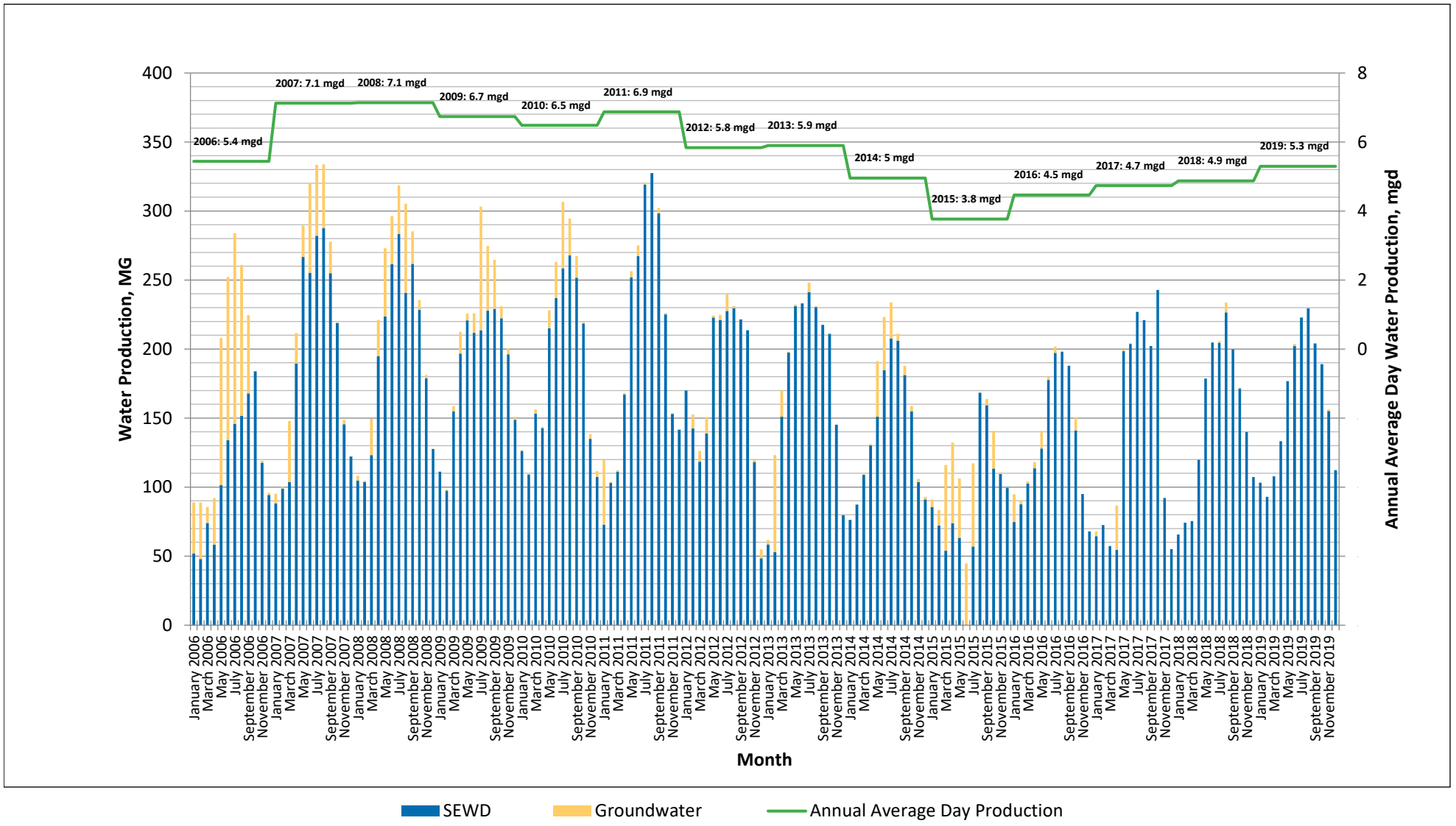


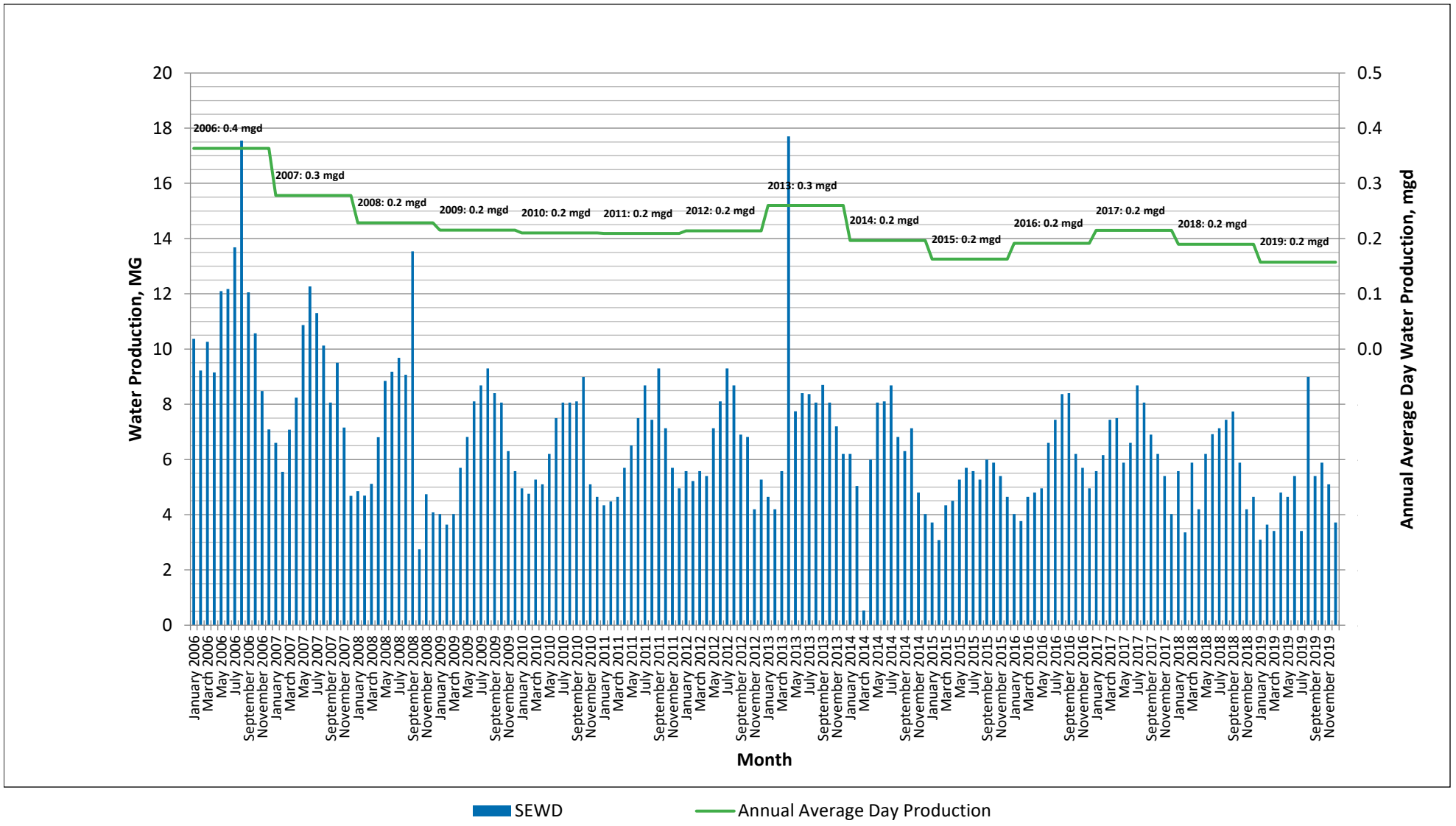
Notes:

1. Source: Data for 2009-2019 (City Monthly Month_Year.xlsx) provided by City staff in May 2020.
2. Abbreviations: MG = million gallons; mgd = million gallons per day; SEWD = Stockton East Water District.

Figure 3-2

Historical Monthly Water Production for South Stockton

City of Stockton
Water Master Plan Update



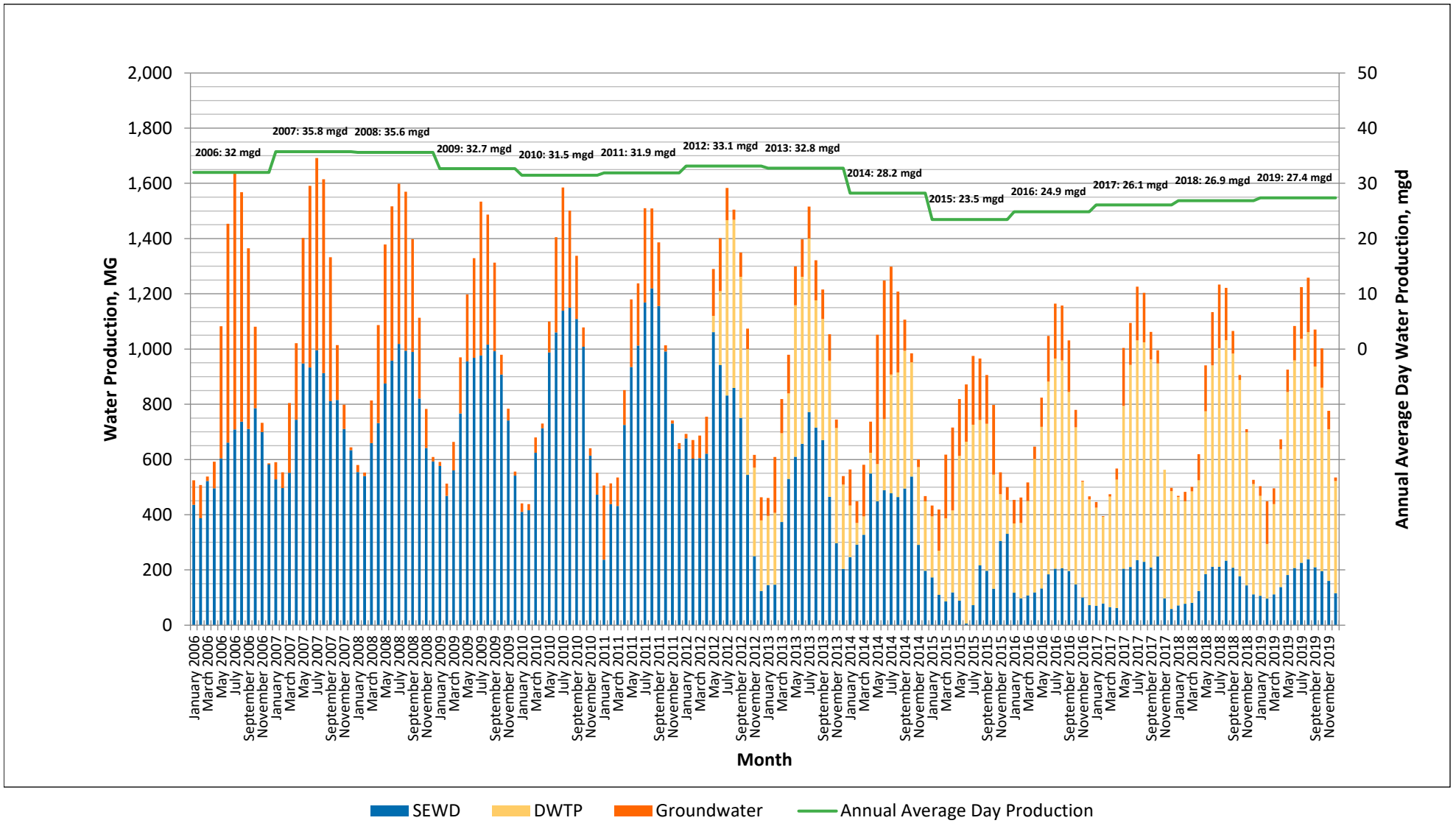
Notes:

1. Source: Data for 2009-2019 (City Monthly Month_Year.xlsx) provided by City staff in May 2020.
2. Abbreviations: MG = million gallons; mgd = million gallons per day; SEWD = Stockton East Water District.

Figure 3-3

Historical Monthly Water Production for the Walnut Plant Area

City of Stockton
Water Master Plan Update



Notes:

1. Source: Data for 2009-2019 (City Monthly Month_Year.xlsx) provided by City staff in May 2020.
2. Abbreviations: MG = million gallons; mgd = million gallons per day; SEWD = Stockton East Water District; DWTP = Delta Water Treatment Plant; COSMUD = City of Stockton Municipal Utility District.

Figure 3-4

Historical Monthly Water Production for COSMUD

City of Stockton
Water Master Plan Update

Table 3-2 summarizes the historical water production by water service area. It compares the baseline water production established in the 2008 WMP to the historical average production (2006 to 2019) and the most recent 5-year average production (2015 through 2019). In general, the COSMUD has experienced a decrease in water production compared to the 2008 WMP baseline production. As discussed later in this chapter, due to the trend in water production increasing from 2015 through 2019, a 10 percent rebound factor will be applied to the 5-year average production from 2015 through 2019 to establish the existing baseline production.

Table 3-2. Historical COSMUD Water Production Comparison[a]

Timeline	North Stockton, afy	South Stockton, afy	Total, afy
2008 WMP Baseline Production[b]	30,380	6,000	36,380
Historical Average Production (2006 to 2019)	27,165	6,368	33,533
5-Year Average Production (2015 through 2019)	23,450	5,182	28,632
Percent Difference between the Recent 5-Year Average Production and the 2008 WMP Baseline Production	**-23%**	**-14%**	**-21%**

(a) Does not include production for the Walnut Plant Area which is minimal and was not evaluated in this Water Master Plan Update.
(b) From Table 3-9 of the 2008 WMP; reflects average of 2004 and 2005 production.
afy = acre feet per year

3.1.2 Per Capita Water Use

Historical per capita water use for the COSMUD water service areas from 2006 to 2019 is presented in Table 3-3 and on Figure 3-5. The per capita water use shown is based on total water production for the COSMUD water service areas (representing all water uses, including all residential and non-residential uses) divided by the COSMUD water service area population. The COSMUD per capita water use has decreased from a maximum of 209 gallons per capita per day (gpcd) in 2007 and 2008 to 153 gpcd in 2019. Recent water use has decreased significantly as indicated by the average per capita water use for the last five years (2015 to 2019), which is equal to 147 gpcd. This lower per capita water use is primarily a response to increased water conservation efforts during and since the recent drought.

In November 2009, Senate Bill X7-7 (SB X7-7), the Water Conservation Act of 2009, was signed into law as part of a comprehensive water legislation package. The Water Conservation Act addressed both urban and agricultural water conservation and set a goal of achieving a 20 percent statewide reduction in urban per capita water use by December 31, 2020. To meet the urban water use target requirement, each retail supplier was required to adopt an interim per capita water use target for 2015 and a final per capita water use target for 2020. The City's adopted targets were 172 gpcd for 2015 and 165 gpcd for 2020.[6] As shown in Table 3-3, the City's 2015 per capita water use was 138 gpcd, well below and in compliance with the City's 2015 goal of 172 gpcd. Although 2020 production data was not available for incorporation into this Water Master Plan Update, it is anticipated that the City's 2020 per capita water use will be in compliance with the City's 2020 goal. Additional discussion regarding the City's compliance with SB X7-7 is provided in the City's 2015 Urban Water Management (UWMP).

[6] City of Stockton, 2015 Urban Water Management Plan, Table 4-1.

Table 3-3. Historical Water Production, Population and Per Capita Water Use

Year	Average Day Water Production, mgd[a]	COSMUD Water Service Area Population[b]	Per Capita Water Use, gpcd
2006	32.0	172,895	185
2007	35.8	170,944	209
2008	35.6	170,017	209
2009	32.7	170,153	192
2010	31.5	178,387	176
2011	31.9	172,941	184
2012	33.1	172,347	192
2013	32.8	171,816	191
2014	28.2	171,183	165
2015	23.5	170,417	138
2016	24.9	172,706	144
2017	26.1	174,995	149
2018	26.9	177,284	152
2019	27.4	179,573	153

(a) Source: Production data are from the consumption, production, and meter data tables in WaterTable.xlsx, provided by the City in May 2020.

(b) Source: Population numbers from 2009 to 2015 are from the City's 2015 UWMP for the COSMUD water service area only. Population numbers from 2016 to 2019 were linearly interpolated, using the 2020 population estimate provided in the 2015 UWMP.

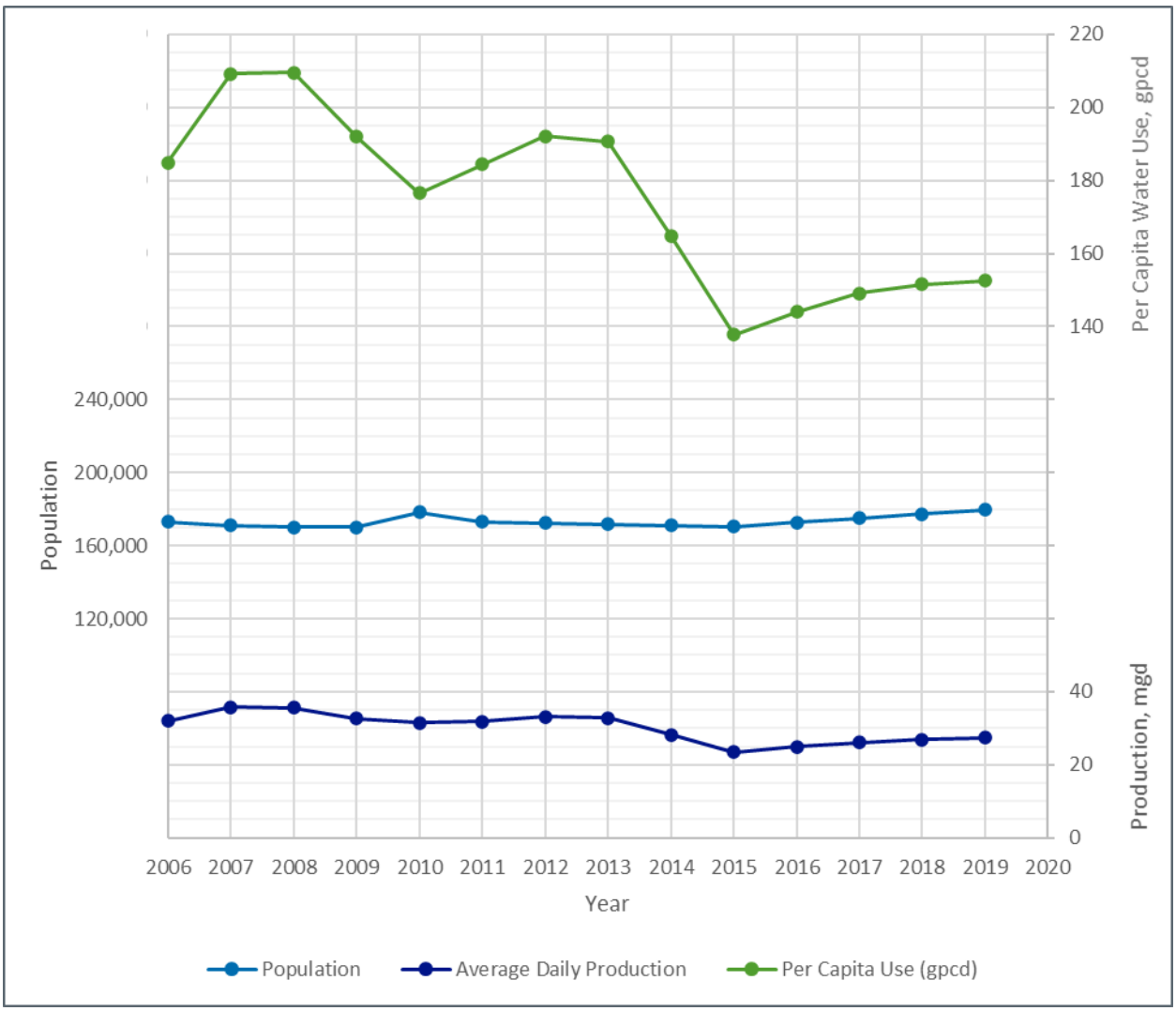


Figure 3-5. Comparison of Historical Per Capita Demand, Average Day Production and Population

3.1.3 Historical Water Consumption

The COSMUD tracks its water consumption through customer meter records. As of 2019, the COSMUD has approximately 49,200 metered water use accounts that serve various customer types. Table 3-4 summarizes the number of customers by meter type. As shown in Table 3-4, the predominant customer type in the COSMUD water service area is residential (either single family or multi-family), which accounts for approximately 95 percent of the total number of water meters. The COSMUD also serves residential customers that are located in unincorporated pockets of San Joaquin County that lie within the COSMUD water service area. Non-residential metered accounts make up approximately 5 percent of the total metered accounts.

Table 3-4. COSMUD Customer Types as of December 2019[(a)]

Customer Type	Number of Meters	Customer Type as a Percent of Total Accounts
Residential		
Single Family and Multi-Family	46,739	95%
Non-Residential		
Industrial	19	<1%
Commercial and Institutional	1,487	3%
Irrigation	912	2%
Non-Residential Subtotal	2,418	5%
Total	**49,157**	**100%**

(a) Source: Data is from the consumption, production, and meter data tables in the WaterTable.xlsx, provided by the City in May 2020.

Table 3-5 summarizes the COSMUD water consumption by customer type from 2017 through 2019. Residential customers account for an average of 69 percent of the total consumption, but make up approximately 95 percent of the total metered accounts as described above. Non-residential customers account for about 31 percent of the total consumption, but make up only 5 percent of the total metered accounts.

Table 3-5. COSMUD Consumption by Customer Type[a]

Customer Type	Consumption, af		
	2017	2018	2019
Residential			
Single Family	14,698	15,077	14,930
Metered to SJ County	1,573	1,422	1,671
Multi Family	2,729	2,772	2,799
Residential Subtotal	19,000	19,272	19,400
Residential Percent of Total	70.4%	69.5%	68.9%
Non-Residential			
Commercial/Institutional	4,265	4,569	4,811
Irrigation	2,816	3,037	3,137
Other (Industrial)	785	790	713
Hydrants Meters/Jumpers	117	45	88
Non-Residential Subtotal	7,984	8,440	8,748
Non-Residential Percent of Total	29.6%	30.5%	31.1%
Residential & Non-Residential Total	26,984	27,712	28,148

(a) Source: Data is from the consumption, production, and meter data tables in the WaterTable.xlsx, provided by the City in May 2020.
(b) San Joaquin County meters are assumed to be residential.

3.1.4 Non-Revenue Water

Non-Revenue water (NRW) is the difference between the quantity of water produced and the quantity of water consumed or metered. Customer water use typically does not equal the total water production because of unmeasured system losses. These "lost" flows, previously referred to as unaccounted for water, are now referred to as NRW. Water utilities strive to minimize the amount of NRW; however, it is difficult to eliminate entirely. There are various reasons why the total customer water use is less than the total amount of water produced by the City. The most common reasons for NRW are due to system losses such as leakage, errors in measurement, and unmetered usage as discussed in detail below:

- Leakage: Leakage is frequently the largest component of NRW and includes losses from distribution and transmission mains, customer service laterals up to the meter, and tanks. The amount of leakage varies from system to system, but there is a general correlation between the age of a system and the amount of NRW. Other factors affecting leakage include system pressure (the higher the pressure, the more leakage), frequency of main and service pipe breaks, and the extent of leakage detection and control policies.

- Errors in Measurement: Flow measurements are not always exact, and thus metered customer usage may contain inaccuracies. Some flow meters under-register actual usage at low flow rates, especially as they age.
- Unmetered Usage: COSMUD may have unauthorized, unmetered connections or other types of unmetered water use. Not all unmetered usage is due to water theft, as fire hydrants, blow-offs, and other maintenance appurtenances are typically not metered.

An estimate of NRW is required for water system planning to project future water production needs, as a system will always have some amount of water loss. NRW ranging from 5 to 10 percent is typical for many water utilities. At the time this Water Master Plan Update was being prepared, the State Water Resources Control Board was in the process of developing water loss performance standards to minimize water waste through system leaks. This is consistent with recommendations from the American Water Works Association (AWWA) which call for the development of system-specific loss targets and key performance indicators for assessing water loss.[7] Adoption of a proposed regulation is anticipated by July 2021.[8]

Table 3-6 summarizes the non-revenue water for the COSMUD system from 2017 through 2019 by comparing water production to water consumption. Based on the 2017, 2018 and 2019 water consumption versus water production, the NRW is approximately 8 percent of the water production. The NRW will be accounted for when projecting the future water production required for near-term (2030) and future (2040) conditions.

Table 3-6. Non-Revenue Water[(a)]

Year	Production, afy	Consumption, afy	NRW, afy[(b)]	NRW as a Percent of Production
2017	29,241	26,984	2,256	7.7%
2018	30,103	27,712	2,390	7.9%
2019	30,684	28,148	2,534	8.3%

(a) Source: Production data are from the consumption, production, and meter data tables in WaterTable.xlsx, provided by COSMUD in May 2020.
(b) Water loss is equal to production minus consumption.

3.2 PEAK WATER USE

Water system facilities are generally sized to meet peak demand conditions. The peaking conditions of most concern for facility sizing (e.g., supply, pumping and storage) are typically Maximum Day plus Fire Flow demand or Peak Hour demand. This section reviews historical peak water use for the COSMUD water service areas, and includes discussion of the maximum day demand, peak hour demand and hourly variations of demand during the maximum demand day.

[7] Key Performance Indicators for Non-Revenue Water, AWWA Water Loss Control Committee Report, November 2019.
[8] SWRCB Fact Sheet on Water Loss Performance Standards, November 18, 2020.

3.2.1 Maximum Day and Peak Hour Demand

Table 3-7 summarizes the average, maximum day, and peak hour demands and the corresponding peaking factors from 2018 and 2019. Only 2018 and 2019 were considered, as this is most representative of recent water use trends after the recent drought. 2020 data was not available for evaluation in this Water Master Plan Update and would likely not be representative of normal system conditions due to the impacts of stay-at-home orders and business closures in response to the COVID-19 pandemic. West Yost reviewed the COSMUD-provided SCADA data to identify historical maximum day and peak hour demands for the respective water service areas. Separate peaking factors for the North Stockton and South Stockton water service areas were calculated as these areas currently operate hydraulically separate from one another. In the 2008 WMP, peaking factors were developed on a systemwide basis since SEWD supplied both water service areas.

Table 3-7. Summary of Historical Maximum Day and Peak Hour Peaking Factors

Year	Average Day Demand (ADD), mgd	Maximum Day Demand (MDD), mgd	Peak Hour Demand (PHD), mgd	Maximum Day Peaking Factor (MDD/ADD)	Peak Hour Peaking Factor (PHD/ADD)
North Stockton					
2018	21.8	33.3	50.2	1.5	2.3
2019	21.9	30.8	48.1	1.4	2.2
South Stockton					
2018	4.9	8.7	16.0	1.8	3.3
2019	5.3	9.0	14.8	1.7	2.7

3.2.2 Recommended Demand Peaking Factors

Table 3-8 summarizes the recommended peaking factors for this WMP. These peaking factors will be subsequently used to evaluate and size distribution system pipelines, storage and reservoir pumping facilities, as well as define water supply needs and capacity requirements.

For planning purposes, the maximum day peaking factors for North Stockton and South Stockton are recommended to be 1.6 and 1.7, respectively. The recommended peaking factors for North and South Stockton are similar to the previous systemwide peaking factor of 1.7 used in the 2008 WMP. For North Stockton, while the historical maximum day peaking factors have been slightly less than the recommended factor of 1.6, the 1.6 factor is recommended as it is anticipated that water use might continue to rebound somewhat. For South Stockton, the historical peaking factor of 1.7 is considered to be appropriate even though the 2018 factor was calculated to be 1.8.

The peak hour peaking factors for North Stockton and South Stockton vary, as the land uses are distinctly different between the two water service areas. The recommended peak hour peaking factor for North Stockton is 2.5 times average day and the recommended peak hour peaking factor for South Stockton is 3.3 times average day. In the 2008 WMP, the peak hour demand was not calculated due to insufficient data. The adopted peak hour peaking factor in the 2008 WMP was estimated to be 3.5 times average day, systemwide, based on a single data point. The reduction in the North Stockton peak hour peaking factor is attributed to lower overall water use, particularly irrigation water use. The slight reduction in the South Stockton peak hour peaking factor reflects a decrease in large industrial customers in South Stockton.

Table 3-8. Recommended Demand Peaking Factors	
Demand Condition	Peaking Factor[(a)]
Maximum Day Demand	
North Stockton	1.6 times Average Day Demand
South Stockton	1.7 times Average Day Demand
Peak Hour Demand	
North Stockton	2.5 times Average Day Demand
South Stockton	3.3 times Average Day Demand

3.2.3 Maximum Day and Peak Hour Diurnal Demand

The maximum day demand (including the peak hour) diurnal was developed by reviewing SCADA data from 2018 and 2019. The diurnal pattern was then subsequently adjusted so that it is consistent with the peaking factors that are summarized above in Table 3-8. Figure 3-6 shows the maximum day with peak hour diurnal pattern developed as part of this Water Master Plan Update. This diurnal pattern is separate from the diurnal pattern developed for the model calibration (discussed in Chapter 6) and is subsequently used in Chapters 7 and 8 for the existing and future distribution system evaluations, respectively.

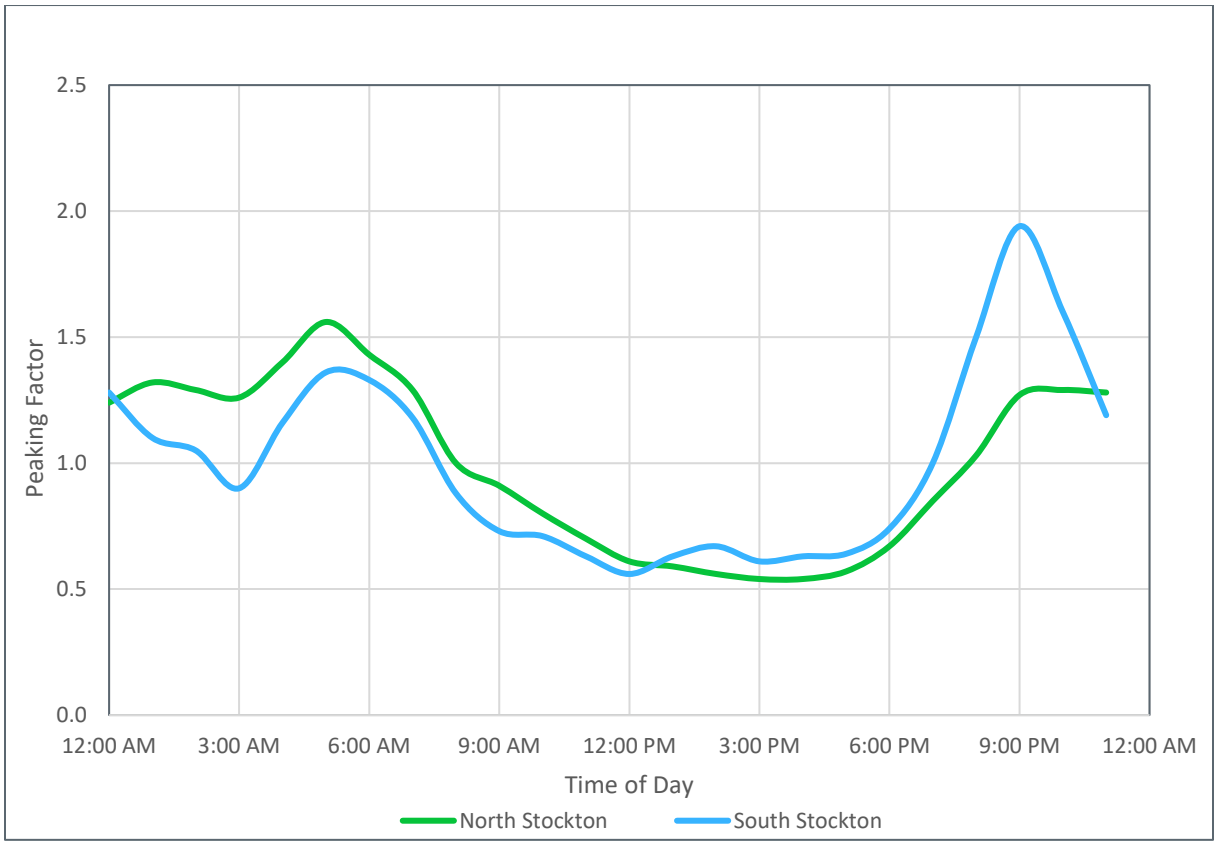


Figure 3-6. North Stockton and South Stockton Maximum Day Diurnal Patterns

3.3 EXISTING AND FUTURE LAND USE AND GROWTH PROJECTIONS

The following sections discuss the existing and projected future land use for the COSMUD water service area.

3.3.1 Existing Land Use

Generally speaking, North Stockton is primarily comprised of residential land uses and South Stockton is mostly comprised of industrial and commercial uses with some residential uses (with most residential uses being located in the Weston Ranch development area).

Water use for developed parcels within the COSMUD water service area is captured by the metered water consumption data. This water consumption data (described in Section 3.1.3) was spatially located by linking metered billing/consumption data to the COSMUD meter shapefile. This data was used to update the water system hydraulic model, which is discussed in Chapter 6.

3.3.2 Projected Future Land Use

Future growth and land uses are defined in the City's 2040 GPU, which summarizes anticipated development within sixteen Study Areas. These areas have been specifically identified as being most likely to develop by 2040. In addition to these Study Areas, the City has identified, or is actively working with several project proponents to identify, future development areas that are either within existing City Limits or outside of City Limits but within the General Plan Sphere of Influence (SOI). The April 2020 Sphere of Influence Plan/Municipal Service Review Report (SOI/MSR Report) defines the anticipated level of development and municipal service needs for near-term (2030) development. The 2040 GPU and SOI/MSR Report provide for a total of 40,900 new residential dwelling units city-wide. Projects contained in the SOI/MSR Report were assumed to be completed in the near-term (by 2030), and other planned projects were assumed to be built in the future (by 2040). Near-term (2030) and future (2040) projects are indicated in Table 3-9.

West Yost compared the planned development projects listed in both the 2040 GPU and the SOI/MSR Report to the future planned developments listed on the City's Planning webpage to determine if projected land use has changed since the completion of the 2040 GPU. Future development plans and land uses were reviewed and confirmed with City Community Development Department staff in July 2020. Table 3-9 provides a summary of planned future development projects within the entire City area, and identifies those projects that are within the COSMUD water service area along with their land use type and projected dwelling units and/or acreage and estimated time of completion (near-term vs. future). New project information obtained from the City's Planning webpage review is noted in the table footnotes. Projected residential acreages and dwelling units and non-residential acreages summarized in this table are net new or incremental. Figure 3-7 shows the approximate locations and boundaries for the projects that are listed in Table 3-9.

Table 3-9. Future Incremental Development Summary

Study Area or Development Name[u]	Water Service Provider	Percentage Within COSMUD Water Service Area	COSMUD Area	Percent Developed by 2030	Future Incremental Development							
					Single Family (Dwelling Units)	Single Family (Developable Gross Acres)	Multi-Family Family (Dwelling Units)	Multi-Family Family (Developable Gross Acres)	Parks (Developable Gross Acres)	Commercial (Developable Gross Acres)	Industrial (Developable Gross Acres)	Total Area (Developable Gross Acres)
Study Areas												
Study Area 1 - Eight Mile Road Area	COSMUD	100%	North	13%	1,379.0	232.1	1,197.7	73.2	157.0	0.6	0.0	462.9
Study Area 2 - Pacific Avenue Corridor	COSMUD Cal Water	5%	North	0%	0.0	0.0	5.5	0.2	0.0	0.2	0.0	0.4
Study Area 3 - West Lane and Alpine Road Area[e]	COSMUD Cal Water	10%	North	0%	7.7	6.0	68.0	2.2	0.0	0.6	0.0	8.8
Study Area 4 - Port/Waterfront	Cal Water	0%	--	0%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Study Area 5 - El Dorado/Center Corridors	Cal Water	0%	--	0%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Study Area 6 - Miner/Weber Corridors	Cal Water	0%	--	0%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Study Area 7 - Wilson Way Corridor	Cal Water	0%	--	0%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Study Area 8 - I-5/Highway 4 Interchange	Cal Water	0%	--	0%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Study Area 9 - Railroad Corridor at California Street	Cal Water	0%	--	0%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Study Area 10 - I-5 and Charter Way Area	Cal Water	0%	--	0%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Study Area 11 - Charter Way/MLK Jr Blvd Corridor	Cal Water	0%	--	0%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Study Area 12 - Airport Way Corridor	COSMUD Cal Water	20%	South	0%	0.0	0.0	21.5	0.9	0.0	2.0	2.6	5.6
Study Area 13 - Mariposa and Charter Area	Cal Water	0%	--	0%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Study Area 14 - East Weston Ranch	COSMUD Cal Water	100%	South	0%	0.0	0.0	0.0	0.0	0.0	14.8	0.0	14.8
Study Area 15 - South of French Camp Road	COSMUD	100%	South	0%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Study Area 16 - E French Camp Rd Area	COSMUD	100%	South	0%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
				Subtotal (Study Areas)	**1,386.7**	**238.1**	**1,292.6**	**76.5**	**157.0**	**18.3**	**2.6**	**492.5**
Approved/Pending Development Projects Within City Limit												
Westlake Villages	COSMUD	100%	North	0%	2,630.0	680.0	0.0	0.0	12.8	0.0	0.0	692.8
Delta Cove	COSMUD	100%	North	0%	1,164.0	132.7	381.0	47.6	57.7	2.6	0.0	240.6
North Stockton Projects III	COSMUD	100%	North	0%	2,220.0	355.0	0.0	0.0	0.0	0.0	0.0	355.0
Cannery Park	COSMUD	100%	North	0%	981.0	272.0	210.0	16.0	0.0	104.0	0.0	392.0
Nor Cal Logistics Center[f]	COSMUD	100%	South	100%	0.0	0.0	0.0	0.0	0.0	0.0	325.0	325.0
Crystal Bay	COSMUD	100%	North	0%	951.0	19.4	392.0	78.7	10.0	0.0	0.0	108.1
Sanctuary	COSMUD	100%	North	0%	5,452.0	1,026.0	1,618.0	67.4	193.0	35.5	0.0	1,321.9
Tidewater Crossing[g]	COSMUD	100%	South	50%	0.0	0.0	0.0	0.0	17.2	20.3	792.0	829.5
Open Window	Cal Water	0%	--	0%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Weston Ranch Town Center	COSMUD	100%	South	0%	0.0	0.0	0.0	0.0	0.0	41.5	0.0	41.5
Airport Way and Sperry Road Commercial Project[h]	COSMUD	100%	South	100%	0.0	0.0	0.0	0.0	0.0	2.0	0.0	2.0
Tuscany Cove[i]	Cal Water	0%	--	0%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CarMax Superstore Project[j]	COSMUD	100%	North	100%	0.0	0.0	0.0	0.0	0.0	10.6	0.0	10.6
Thornton and Eight Mile Road Development[k]	COSMUD	100%	North	100%	0.0	0.0	0.0	0.0	0.0	2.1	0.0	2.1
University Park[l]	Cal Water	0%	--	0%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
				Subtotal (Approved/Pending Projects Within City Limit)	**13,398.0**	**2,485.1**	**2,601.0**	**209.7**	**290.7**	**218.6**	**1,117.0**	**4,321.0**
Approved/Pending Development Projects Outside City Limit but Within Sphere of Influence												
Mariposa Road Community[m]	COSMUD Cal Water	100%	South	0%	8,955.0	939.0	1,553.0	585.0	206.3	150.0	0.0	1,880.3
Airpark 599[n]	COSMUD	100%	South	100%	0.0	0.0	0.0	0.0	0.0	5.4	259.7	265.1
Tra Vigne[o]	COSMUD	100%	North	100%	1,165.0	260.7	340.0	11.7	20.4	10.4	0.0	303.2
Mariposa Industrial Park[p]	COSMUD	100%	South	100%	0.0	0.0	0.0	0.0	0.0	0.0	203.5	203.5
Sanchez-Hoggan Annexation Project[q]	COSMUD	100%	South	100%	0.0	0.0	0.0	0.0	0.0	0.0	169.8	169.8
Century Mobile Home Park[r]	COSMUD	100%	South	100%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Veterans Affairs Medical Campus[s]	COSMUD	100%	South	100%	0.0	0.0	0.0	0.0	0.0	37.0	0.0	37.0
Niagara Bottling Plant[t]	COSMUD	100%	South	100%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
				Subtotal (Approved/Pending Projects Outside City Limit but Within Sphere of Influence)	10,120.0	1,199.7	1,893.0	596.7	226.7	202.8	632.9	2,858.9
Remaining Development Outside of Study Areas and Outside of Approved/Pending Projects	COSMUD	50%	North	100%	750.6	635.2	0.0	0.0	0.0	0.0	0.0	635.2
				Grand Total 2040 (Buildout)	**25,655.3**	**4,558.2**	**5,786.6**	**882.9**	**674.3**	**439.7**	**1,752.5**	**8,307.6**
				Grand Total 2030 (Near-Term)	**2,099.7**	**927.0**	**499.9**	**21.5**	**49.9**	**77.8**	**1,353.9**	**2,430.1**

(a) Developable gross acres is defined as the existing or planned total developable area associated with the stated land use types (e.g., Single Family, Multi Family, Commercial, Industrial) and does not represent the Total Area. Therefore, developable gross area does not include other area associated with other land use types such open space, mixed use, roads, etc.
(b) Existing Dwelling Units/Developable Gross Acres is defined as the count of units or sum of area that is currently developed.
(c) Net New Dwelling Units/Developable Gross Acres is defined as the total incremental new units/area of the associated land use type that is planned to be added (or removed if it is being redeveloped).
(d) 2040 Dwelling Units/Developable Gross Acres is defined as the total anticipated unit count or area of the associated land use type that is expected by 2040. This is calculated by summing Existing with Net New.
(e) Updated per Calaveras Estates IV Initial Study/Mitigated Negative Declaration report (IS/MND) (October 2017). Project is contained within Study Area 3.
(f) Updated per NorCal Logistics Draft Environmental Report (February 2015). Developable gross acres for industrial land use, 325 acres, includes the Niagara Bottling Plant.
(g) Exhibit C-2 City of Stockton Rezone (VVH Engineers, February 2019). A large portion of Tidewater Crossing is now the South Stockton Commerce Center.
(h) Updated per Airport Way and Sperry Road Commercial Project IS/MND (January 2018).
(i) Updated per Tuscany Cove IS/MND (March 2018).
(j) Updated per CarMax Auto Superstore DEIR (November 2018).
(k) Updated per Thornton Road and Eight Mile Road Arco Station Project IS/MND (October 2017).
(l) Update per University Park Master Development Plan (December 2003).
(m) Not updated, values reflect the previous planning efforts described in the 2018 Placeworks Utility Supplement. The development's entitlement has expired. For the purposes of this water master plan, it is assumed that the Mariposa Road Community will be served entirely by COSMUD for water.
(n) Updated per land use plan as of 10/15/2019, assuming all phases (Phases 1 through 3) are built.
(o) Updated per Tra Vigne EIR Table 2-2 (April 2018) and Exhibit 4.1 (NorthStar Engineering Group, September 2019).
(P) Updated per Annexation Application (Septermber 2020).
(q) Updated per Sanchez-Hoggan Annexation DEIR (March 2020).
(r) Century Mobile Home Park Consolidation with the City of Stockton Water Main Extension Project (Blackwater Engineers, March, 2015)
(s) Updated per Veterans Affairs Clinic Off-Site Improvement Project DEIR (September 2019).
(t) Niagara Bottling Plant acreage not known. Project proponents have requested a maximum capacity of 1,800 gpm, assumed to be non-peaked. See footnote f.
(u) The major developments and study areas listed in Table 3-7 were confirmed with City Planning Staff as future projects to be included in the 2020 WMPU. The future developments are preliminary and subject to change. Upon City approval, infrastructure required to serve a development and impacts to the existing water system will need to be confirmed. Future development in areas not designated as major developments or study areas will need to be evaluated when development plans are available. Refer to Figure 3-7 for the approximate location of each future development and study area.

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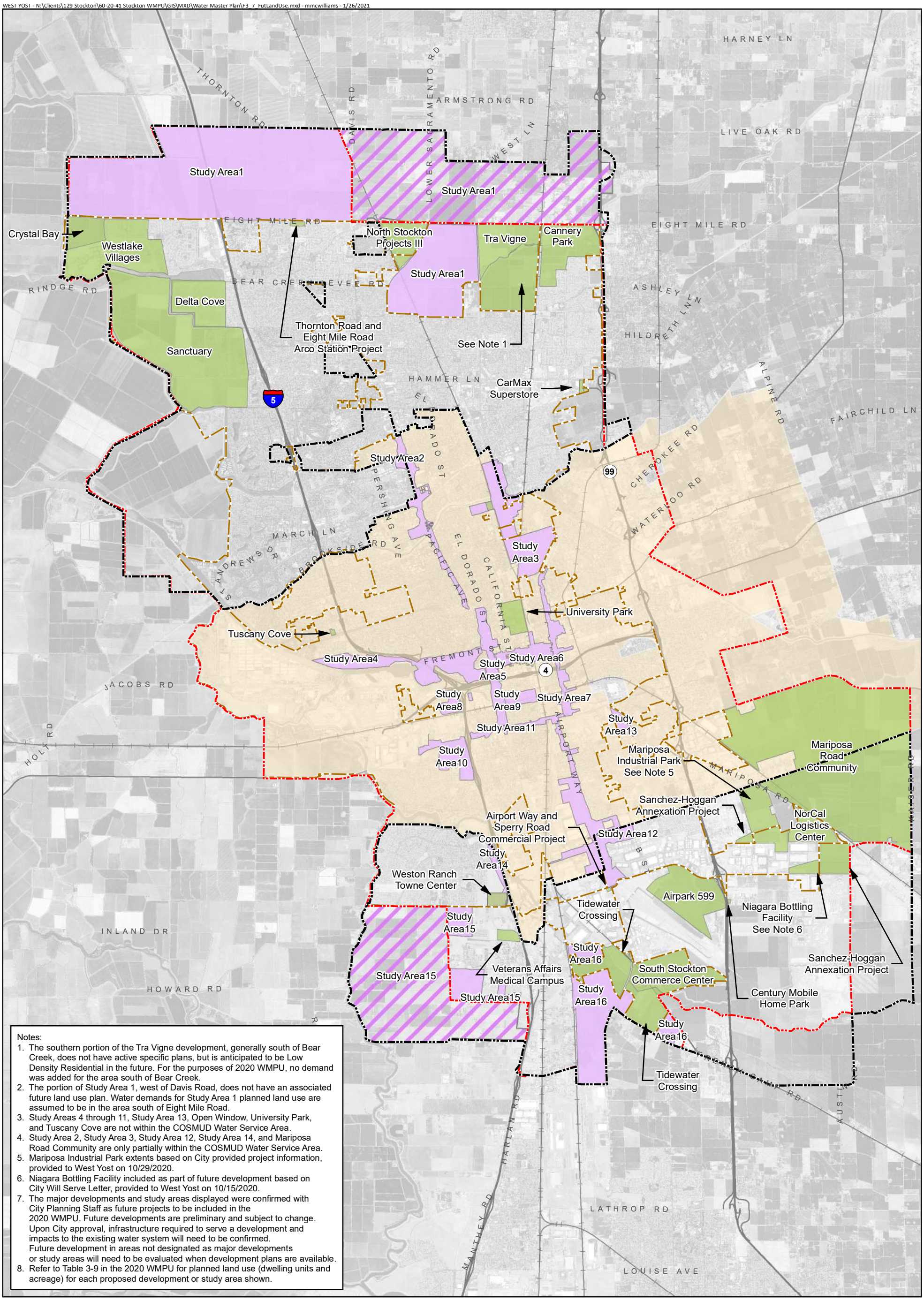

Notes:
1. The southern portion of the Tra Vigne development, generally south of Bear Creek, does not have active specific plans, but is anticipated to be Low Density Residential in the future. For the purposes of 2020 WMPU, no demand was added for the area south of Bear Creek.
2. The portion of Study Area 1, west of Davis Road, does not have an associated future land use plan. Water demands for Study Area 1 planned land use are assumed to be in the area south of Eight Mile Road.
3. Study Areas 4 through 11, Study Area 13, Open Window, University Park, and Tuscany Cove are not within the COSMUD Water Service Area.
4. Study Area 2, Study Area 3, Study Area 12, Study Area 14, and Mariposa Road Community are only partially within the COSMUD Water Service Area.
5. Mariposa Industrial Park extents based on City provided project information, provided to West Yost on 10/29/2020.
6. Niagara Bottling Facility included as part of future development based on City Will Serve Letter, provided to West Yost on 10/15/2020.
7. The major developments and study areas displayed were confirmed with City Planning Staff as future projects to be included in the 2020 WMPU. Future developments are preliminary and subject to change. Upon City approval, infrastructure required to serve a development and impacts to the existing water system will need to be confirmed. Future development in areas not designated as major developments or study areas will need to be evaluated when development plans are available.
8. Refer to Table 3-9 in the 2020 WMPU for planned land use (dwelling units and acreage) for each proposed development or study area shown.

Study Area Within City's Sphere of Influence
Study Area Outside of City's Sphere of Influence
Major Development
Cal Water Service Area
COSMUD Water Service Area
City of Stockton Limits
City of Stockton Sphere of Influence

N
0 0.75 1.5
Miles

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Figure 3-7

Summary of Future Developments

City of Stockton
Water Master Plan Update

Since COSMUD only serves the North Stockton and South Stockton areas, with Cal Water providing water service to the Central Stockton area, West Yost determined which future planned developments will be served by COSMUD, and which future planned developments are only partially within the COSMUD water service area. Approximately 31,442 planned residential dwelling units are planned in the COSMUD water service area, which is about 76 percent of the total planned residential dwelling units City-wide.

It should be noted that portions of Study Areas located outside the General Plan SOI (e.g., portions of Study Areas 1 and 15) have not been evaluated in this Water Master Plan Update. Similarly, areas within the General Plan SOI which are not designated as Study Areas or planned development projects have not been evaluated in this Water Master Plan Update as development of these areas was not anticipated in the 2040 GPU. Any future development in these areas will need to be evaluated when land use plans are developed to determine the impacts on the COSMUD water system and identify any required water system improvements.

The Mariposa Road Community in South Stockton is a large future development area that will likely consist of a mix of single family residential, multi-family residential, parks, and commercial land uses. The development area's previous entitlement has expired, and therefore it is not guaranteed that this project area will actually be developed, or be developed as previously planned. For the purposes of this Water Master Plan Update, it was assumed that the Mariposa Road Community will be developed by 2040, based on the most recent land use plan, and be served entirely by COSMUD. This future development is one of the largest drivers for future growth within the COSMUD South Stockton water service area. In addition, although this development area is located within both the COSMUD water service area and the Cal Water service area, for the purposes of this Water Master Plan Update, it was conservatively assumed that the COSMUD would serve the entire Mariposa Road Community area. As described further in Chapter 8, any recommended future water system improvements associated with the Mariposa Road Community should be reviewed and confirmed prior to facility design and construction based on future confirmed development plans.

Table 3-10 summarizes the future planned development within the COSMUD water service area by land use designation. North Stockton will experience the largest increase in residential development. The largest planned development is the Sanctuary Project in North Stockton. It will consist of single-family, multi-family, park, and commercial land uses. In addition to the Mariposa Road Community, South Stockton will see an increase in commercial and industrial development in the near-term and in the future with planned projects such as the NorCal Logistics Center and the South Stockton Commerce Center.

As noted in Table 3-9, the Niagara Bottling Plant Project is included in the industrial acreage for the NorCal Logistics Center; however, the water demands for this project are specific to the proposed operations of the project and have been estimated separately. Updated plans for this facility have not been formally submitted to the COSMUD; however, project proponents have specified a desired water capacity of 1,800 gpm. This value was used in the water demand projections discussed in subsequent sections.

Table 3-10. Future Planned Development within the COSMUD Water Service Area[a]

Future Land Use Designation	Units	Near-Term (2030) Total Development	Future (2040) Total Development
North Stockton			
Single Family Residential	DU	2,100	16,700
Multi Family Residential	DU	500	4,212
Commercial	Acres	23	167
Industrial	Acres	0	0
Parks	Acres	41	451
South Stockton			
Single Family Residential	DU	0	8,955[b]
Multi Family Residential	DU	0	1,575[b]
Commercial	Acres	55	273
Industrial	Acres	1,354	1,753
Parks	Acres	9	224

(a) Based on the Study Areas and future development plans identified in the 2040 General Plan and April 2020 SOI/MSR Report and confirmed with the City's Community Development Department in July 2020 (see Table 3-9 for additional information).

(b) All of the Single Family Residential and most of the Multi Family Residential is associated with the Mariposa Road Community.

DU = Dwelling Unit

3.4 WATER USE FACTORS

To develop land use-based water demand projections, water use factors are applied to the projected land uses (refer to Section 3.3.2 Projected Future Land Use). To develop water use factors, COSMUD staff provided West Yost with the following data:

- 2018 - 2020 water meter records with Location IDs
- Spatially-located water meter locations with Location IDs and APNs
- City of Stockton 2040 General Plan (2040 GPU) land use maps in GIS format
- City of Stockton April 2020 Sphere of Influence Plan/Municipal Service Review Report

Water use factors were then determined by using the following methodology:

- Annual water meter records were first linked to the spatially-located water meter locations by using the Location ID
- Spatially-located water meter locations were then linked to the parcel file with the City's 2040 GPU land use designations by using the APN

This process provided the means to calculate water use factors for each land use designation defined in the 2008 WMP by using the total water use data from the water meter records that have been linked to parcels assigned with a 2040 GPU land use designation and dividing that by the corresponding linked acreage. The area-based water use factors (WUFs) were then compared with the water use factors

reported in the 2008 WMP for most land use designations. It should be noted that the 2008 WMP only developed area-based WUFs. Current land use information, specifically for residential land uses, is projected in terms of dwelling units. Therefore, area-based WUFs for residential land uses were developed for the sole purpose of comparison to the 2008 WMP factors.

In addition, land use designations defined in the 2008 WMP do not entirely align with the current, simplified land use designations contained in the 2040 GPU. Similar to the area-based factors above, WUFs were developed using the 2008 WMP and 2035 GP report for the purposes of comparison. Recommended factors were developed to coordinate with the designations contained in the 2040 GPU. The following subsections provide additional details on how unit water use factors were developed for the residential and non-residential land use designations.

3.4.1 Residential Water Use Factors

Single family residential and multi-family residential WUFs were developed using the 2018 and 2019 consumption data and compared to the water use factors developed in the 2008 WMP.

Single family residential (SFR) land uses were assumed to include low density residential and condominium land uses (defined previously in the 2008 WMP). The calculated area-based SFR WUF (2.2 afy/ac) was found to have decreased by approximately 11 percent from the 2008 WMP SFR WUF (2.5 afy/ac). The dwelling unit-based SFR WUF was also calculated using the approximate number of single family residential dwelling units in the COSMUD water service area (as estimated by meter size) and was determined to be 242 gallon per day (gpd)/DU. This number was calculated by summing up all 2018 and 2019 consumption for meters with a City Rate Class Code of Single Family, and dividing it by the number of dwelling units in each respective year.

Multi-family residential (MFR) land uses typically include medium-density (MDR) and high-density (HDR) residential land uses such as apartments, duplexes and triplexes. MFR WUFs were calculated for medium-density and high-density residential land uses with the 2040 GPU land use designations to compare with the 2008 WMP MFR WUF. Based on initial calculations, it was found that the MFR WUFs were significantly higher than the 2008 WMP MFR WUFs and more than the SFR WUFs. However, it is unclear if the 2018 and 2019 consumption data included irrigation water use for multi-family residential accounts. Also, the number of actual dwelling units per MFR account is unclear. Therefore, the MFR WUF was alternatively developed using the State of California's indoor water use goal of 50 gpcd[9] by 2030 and the average number of people per household (estimated to be 3.5 persons [10]). Therefore, the recommended water use factor for multi-family residential is 175 gpd/DU.

The recommended MFR WUF does not specifically include outdoor irrigation, as the landscaped areas and types of plantings are project specific and not yet known. This water demand component, however, is not anticipated to be large as landscaped areas associated with multi-family residential developments are typically quite small, and the number of planned multi-family residential dwelling units is particularly small when compared to the number of single family residential dwelling units. As development plans are submitted to the City for multi-family residential projects, it is recommended that the City review specific

[9] Per Assembly Bill 1668 and Senate Bill 606.

[10] The SOI/MSR Report assumed 3.23 persons per household based on the State of California, Department of Finance population and housing estimates. This value was rounded to 3.5 for purposes of estimating the multi-family residential water use factor.

project details and include irrigation uses based on the proposed landscape plans. The recommended factor for this irrigation component is 2.26 afy/ac, as summarized in Table 3-11 below.

3.4.2 Non-Residential Water Use Factors

Calculated non-residential WUFs were found to have significantly decreased from those defined in the 2008 WMP. For the purposes of this WMP, WUFs for these land use types (i.e., Commercial, Industrial) were taken from the 2008 WMP, and reduced by 30 percent, consistent with water use decreases observed in 2018 and 2019. Resulting WUFs are as follows:

- Commercial: 1.62 afy/ac
- Industrial: 1.40 afy/ac

3.4.3 Irrigation Water Use Factors

The 2018 and 2019 water consumption data did not specify meters for irrigation use or quantify irrigated landscape areas. Based on a spatial review of meters adjacent to parks, the majority of the meters at these locations had an assigned rate class of commercial. Due to the uncertainty of how much water is actually used for irrigation and what the irrigated areas are, the irrigation water use factor was developed using the 2015 Model Water Efficiency Landscape Ordinance (MWELO). New development projects for residential, commercial, industrial and institutional projects requiring a permit, plan check or design review that have 500 square feet or more of landscape are required to comply with the MWELO. The standards to be set shall incorporate the principles of the MWELO, which takes into account evapotranspiration adjustment factors, landscape areas, maximum applied water allowance, reference evapotranspiration, and special landscape area.

Table 3-11 summarizes the maximum allowed potable water use for irrigation for residential (multi-family) and non-residential (e.g., parks) land uses using the MWELO guidelines. These factors should be utilized to estimate irrigation water demands when detailed land use plans which specify landscaping plans are available.

Table 3-11. Maximum Allowable Water Use Factor for Irrigation[(a)]

Land Use	Maximum ETAF[(b)]	Water Use Factor, afy/ac
Residential	0.55	2.26
Non-Residential	0.45	1.85
Special Landscape Areas[(c)]	1.00	4.12

(a) Based on the California Code of Regulations, Title 23 Waters, Division 2 DWR, Chapter 2.7 Model Water Efficient Landscape Ordinance (MWELO), updated 2015.

(b) ETAF = Evapotranspiration Adjustment Factor = (Plant Factor based on Hydrozone Area)/(Irrigation Efficiency)

(c) Special Landscape Areas are areas dedicated solely to edible plants, recreational areas, areas irrigated with recycled water, or water features using recycled water.

3.4.4 Recommended Water Use Factors

Table 3-12 summarizes the recommended water use factors by land use designation. In general, the water use factors have decreased between 10 percent and 30 percent from the 2008 WMP. These refined water use factors are appropriate for use in projecting future water demands as discussed in the following sections.

Table 3-12. Recommended Water Use Factors

Future Land Use Designation	Dwelling Unit Based WUF, gpd/DU	Area-Based WUF, afy/acre
Single Family Residential	242	-
Multi-Family Residential	175	-
Commercial	-	1.62
Industrial	-	1.40
Parks	-	1.85

3.5 FUTURE WATER DEMANDS AND REQUIRED WATER PRODUCTION

Water demands were projected for near-term (2030) and future (2040) conditions for the COSMUD water service areas using the adopted water use factors applied to the future proposed development. Future water production requirements were then estimated by adding the future water demand projections and future non-revenue water to the existing baseline production. The specific steps used in the development of this projection method and the results are discussed below for both near-term (2030) and future (2040) conditions.

3.5.1 Existing Baseline Production

The average annual water production for the North and South Stockton water service areas from 2015 through 2019 (most recent data) was used to establish the existing baseline production. The average annual water production from 2015 through 2019 for the COSMUD water service areas was 25.6 mgd, or 28,632 afy (refer to Table 3-2).

When comparing 2015 use to 2019 use (refer to Table 3-1), there has been about 16 percent increase in water use. Mandatory conservation measures implemented by the City during the recent drought significantly reduced water use, but since the end of the drought the mandatory conservation measures have been relaxed and water use as increased (rebounded) somewhat. Allowing for some continued rebound is recommended as it provides an additional buffer in existing baseline production requirements and helps ensure sufficient supply capacity. A 10 percent demand rebound factor is recommended and will be added to existing water production to establish the existing baseline production.

Table 3-13 summarizes the existing baseline production for the overall COSMUD water service area and shows that the total existing baseline production for this Water Master Plan Update is 31,495 afy, or 28.1 mgd. This can be compared to the existing baseline production from the 2008 WMP which was 36,380 afy, or about 32.5 mgd. This indicates that existing baseline production for this WMP, with the rebound factor included, is about 13 percent lower than the 2008 WMP baseline production, reflecting

improved water use efficiencies and on-going water conservation by the COSMUD water customers since the 2008 WMP.

Table 3-13. Existing Baseline Production (5-year Average from 2015 to 2019) with Demand Rebound

Water Service Area	Existing Average Historical Production (2015 – 2019), afy	Demand Rebound (10 percent of Average Historical Production), afy	Existing Baseline Production, afy
North Stockton	23,450	2,345	25,795
South Stockton	5,182	518	5,700
Total	**28,632**	**2,863**	**31,495**

3.5.2 Additional Water Demand for Planned Future Development

Based on the projected future growth (Table 3-9) and the updated water use factors (Table 3-12), water demands for near-term (2030) and future (2040) conditions were estimated. Table 3-14 summarizes the additional projected water demand from planned future development for the near-term (2030) and future (2040) timeframes.

Table 3-14. Future Additional Water Demand

Water Service Area	Additional Demand by 2030 (Near-Term)		Additional Demand by 2040 (Future)[(a)]	
	mgd	afy	mgd	afy
North Stockton	0.7	781	5.8	6,457
South Stockton	4.4	4,903	8.0	8,949
Total	**5.1**	**5,684**	**13.8**	**15,405**

(a) The additional demand by 2040 (Future) includes the additional demand by 2030 (Near-Term).

It should be noted that the Niagara Bottling Plant Project accounts for about 60 percent of the additional near-term South Stockton demand, and the Mariposa Road Community accounts for approximately 38 percent of South Stockton's future additional water demand at 2040.

3.5.3 Water Production Requirements for Near-Term (2030) Conditions

Table 3-15 summarizes the projected production requirements within the COSMUD water service area by the near-term (2030) timeframe. The projected near-term (2030) production requirement includes the existing baseline production, the additional near-term (2030) demand and future non-revenue water.

By 2030, the water production requirement is projected to increase by approximately 20 percent systemwide. North Stockton's production requirement is projected to increase by 3.3 percent and South Stockton's production requirement is projected to increase by 93.5 percent and from the existing baseline production.

Table 3-15. Projected Water Production Requirement for Near-Term (2030) Conditions			
Parameter	North Stockton, afy	South Stockton, afy	Total COSMUD, afy
Existing Baseline Production (refer to Table ES-2.)	25,795	5,700	31,495
Additional Near-Term Demand by 2030 (refer to Table 3-14)	781	4,903	5,684
Future NRW (8%)	68	426	494
Total Production Requirement, afy	**26,644**	**11,029**	**37,673**
Total Production Requirement, mgd	**23.8**	**9.8**	**33.6**
Percent Increase from Existing Baseline Production	**3.3%**	**93.5%**	**19.6%**

3.5.4 Water Production Requirements for Future (2040) Conditions

Table 3-16 summarizes the projected production requirements within the COSMUD water service area by the future (2040) timeframe. The projected future (2040) production requirement includes the existing baseline production, the additional future (2040) demand and future non-revenue water.

By 2040, the water production requirement is projected to increase by approximately 53 percent systemwide. South Stockton's production requirement is projected to increase by 171 percent and North Stockton's production requirement is projected to increase by 27 percent from the existing baseline production. The large increase in South Stockton's projected production requirement is due to the assumption that the Mariposa Road Community will be fully built by 2040 and served completely by COSMUD[11].

Table 3-16. Projected Water Production Requirement for Future (2040) Conditions			
Parameter	North Stockton, afy	South Stockton, afy	Total COSMUD, afy
Existing Baseline Production (refer to Table ES-2.)	25,795	5,700	31,495
Additional Future Demand by 2040 (refer to Table 3-14)	6,457	8,949	15,405
Future NRW (8%)	561	778	1,340
Total Production Requirement, afy	**32,813**	**15,427**	**48,240**
Total Production Requirement, mgd	**29.3**	**13.8**	**43.1**
Percent Increase from Existing Baseline Production	**27.2%**	**170.6%**	**53.2%**

[11] As further described in Chapter 8, the future manner and extent of the development of the Mariposa Road Community is uncertain at this time. As such, any future recommended capital improvements required to serve the Mariposa Road Community should be confirmed when development plans are confirmed.

3.6 COMPARISON TO THE 2008 WMP, THE 2015 UWMP AND THE 2018 UTILITY MASTER PLAN SUPPLEMENTS

This section compares the projections developed for this Water Master Plan Update to previous projections included in the 2008 Water Master Plan, the 2015 UWMP, and the 2018 Utility Master Plan Supplements prepared in support of the Envision Stockton 2040 General Plan.

The total future (2040) water production requirement presented in this Water Master Plan Update is 48,240 afy (43.1 mgd) (see Table 3-16). This is compared to the total future 2035 water production requirement from the 2008 Water Master Plan which was estimated to be 110,000 afy (98.2 mgd). This represents a 56 percent drop, which is partially attributed to a decrease in existing water production from 2008 to 2019 (35.6 mgd in 2008 vs. 27.4 mgd in 2019), as well as a drop in unit water use factors due to improved water use efficiency (described above in Section 3.4). However, the majority of the drop in the projected water production requirement can be attributed to the significant reduction in expected development by 2040, both in terms of the area to be developed and the projected population. Based on the planned future development identified in the Envision Stockton 2040 General Plan Update and April 2020 MSR/SOI Report, the anticipated gross development area by 2040 is 77 percent less than the 2008 Water Master Plan future gross development area. Associated with this reduced development area, there is approximately a 25 percent decrease in projected City-wide population from the 2035 General Plan to the Envision Stockton 2040 General Plan Update.

Figure 3-8 compares the City-wide population projections in the 2035 General Plan, the Envision Stockton 2040 General Plan Update and the 2015 UWMP, as well as the COSMUD water production requirements from the 2008 Water Master Plan, 2015 UWMP and this Water Master Plan Update. As shown, water production requirements have dropped significantly since the 2008 Water Master Plan was prepared. As shown on Figure 3-8, the water production requirements in the 2015 UWMP and this Water Master Plan Update generally align as similar population projections were assumed.

In support of the Envision Stockton 2040 General Plan, Utility Master Plan Supplements were prepared to project future water system infrastructure needs. In the Potable Water Master Plan Supplement, future water demands (water production requirements) were estimated based on the 2040 General Plan land use assumptions and were estimated to be 39.9 mgd for 2040. Although a different methodology was used for the Master Plan Supplement projections, the projection is similar to the 43.1 mgd projected for 2040 in this Water Master Plan Update.

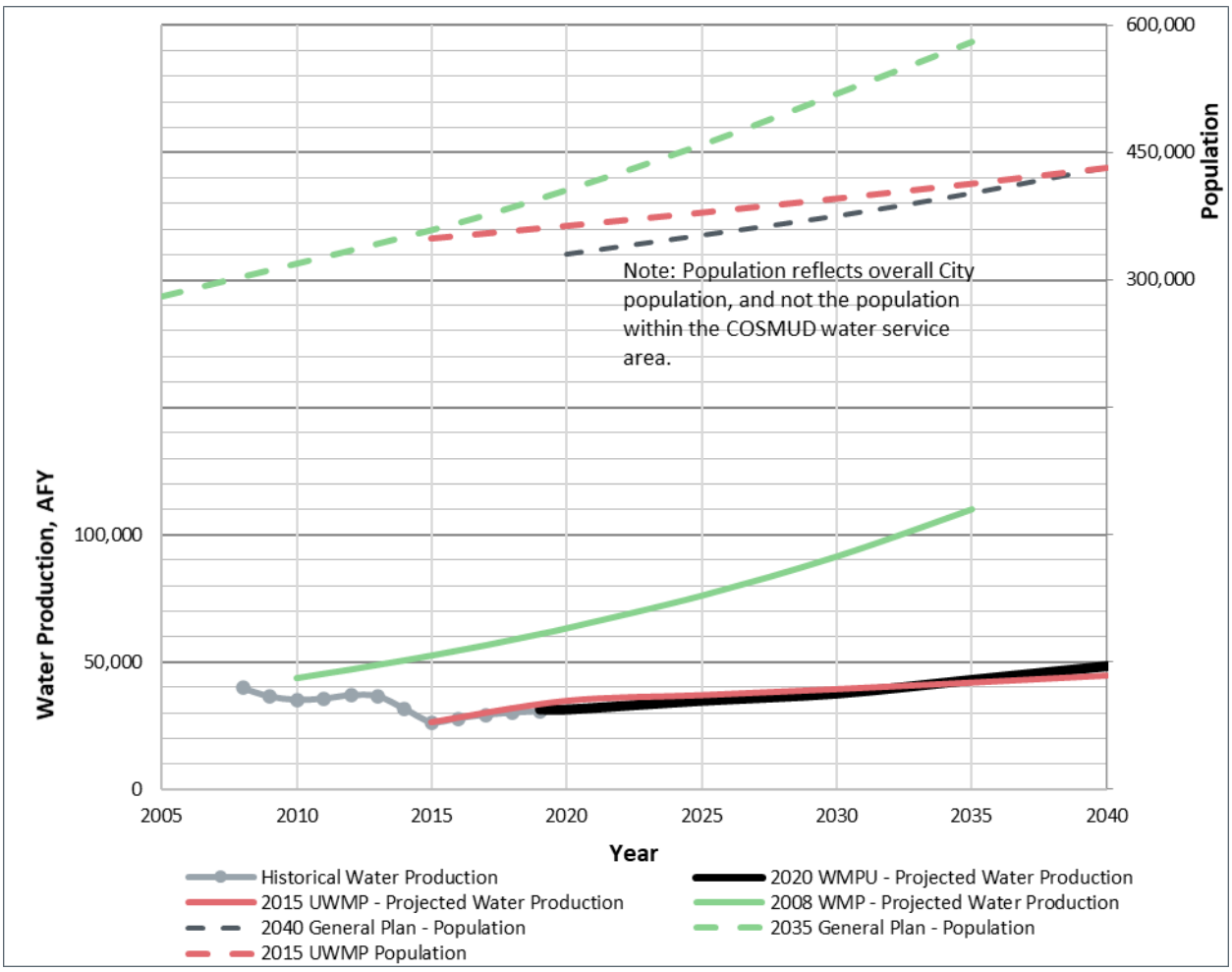


Figure 3-8. Comparison of Previous and Current Population and Water Production Requirements

The drop in future water production requirements from the 2008 Water Master Plan is reflected by less extensive recommendations for future water system improvements as described in Chapter 8 of this Water Master Plan Update.

This chapter provides an overview of the City's water supplies which include both surface water supplies and groundwater supplies. The availability and reliability of the City's water supplies are evaluated in the City's 2020 Urban Water Management Plan, which was prepared concurrent with this Water Master Plan Update.

4.1 WATER SUPPLY OVERVIEW

The City's existing water supply portfolio consists of the following sources:

- Surface water from the San Joaquin River that is diverted at the Intake Pump Station on Empire Tract located in the Sacramento-San Joaquin Delta (Delta) and treated at the City's DWTP, with supplemental surface water from the Mokelumne River diverted and conveyed by WID, and treated at the City's DWTP, when the City's San Joaquin River supplies are curtailed
- Treated surface water from the SEWD conveyed from the New Melones (Stanislaus River) and New Hogan (Calaveras River) Reservoirs
- Groundwater pumped by COSMUD from City-owned and operated wells from the underlying Eastern San Joaquin Groundwater Subbasin

Due to differing disinfection processes that present water quality issues related to low chlorine residual and the potential for formation of disinfection byproducts, COSMUD provides water from the DWTP only in its North Stockton water distribution system. Water from SEWD can be conveyed to both the North Stockton and South Stockton distribution systems. SEWD also supplies the City's Walnut Plant service area in Central Stockton. Cal Water conveys SEWD supply to the Walnut Plant service area via a wheeling agreement with COSMUD. Water supplies from local groundwater wells are used to supply both the COSMUD North Stockton and South Stockton water service areas.

At time of preparation of this Water Master Plan Update, COSMUD is in the process of implementing the North Stockton Pipeline Hypochlorite Facility that will allow SEWD supplies to be conveyed to the North Stockton system and combined with the DWTP-produced water supply. The project is discussed in further detail in Section 4.3.4.

As described in Chapter 3, COSMUD water demands are projected to increase from 30,684 afy in 2019 to 48,240 afy by 2040. At the same time, COSMUD plans to reduce or offset its groundwater use in accordance with groundwater sustainability objectives. Future COSMUD water supply consists of utilizing permit and contract surface water supplies together with the conjunctive use of groundwater resources.

Details about the City's water supply sources are described in the following sections.

4.2 SURFACE WATER SUPPLY FROM THE SAN JOAQUIN RIVER

Water supply from the San Joaquin River is a recent addition to the City's water supply portfolio and currently provides about 68 percent of its total water supply.[12] The City diverts water from the San Joaquin River via the IPS at the southwest tip of Empire Tract and treats the water at its DWTP north of Stockton. The location of the DWTP and its associated intake facility is shown on Figure 4-1. Since the completion of the DWTP in 2012, the Delta has become a major source of water supply for COSMUD. Water supply from the DWTP is currently used in the COSMUD North Stockton system, along with local groundwater.

4.2.1 Water Right Permit

The City's 1996 water right application with the State Water Resources Control Board (State Water Board) requested an ultimate diversion of 125,900 afy to address the City's projected long-term demands through 2050. The State Water Board divided the water right application into two separate applications, Application 30531A and 30531B.

Application 30531A proposed diversions of up to 33,600 afy from the Delta and the Place of Use is confined to the City's 1990 General Plan boundary. Through this application, the City was granted a water right permit under California Water Code Section 1485. The City's water right permit from the State Water Board was issued on March 8, 2006 under Water Right Permit 21176. Application 30531B, proposed diversions of up to 92,300 afy, is currently unpermitted. The City plans to continue the application process for this application to help meet the City's future water demands.

Under California Water Code (CWC) Section 1485, Water Right Permit 21176 allows the City to divert from the San Joaquin River as much water as the City's wastewater treatment plant discharges into the San Joaquin River under an indirect potable reuse strategy. The quantity permitted under Water Right Permit 21176 is not restricted as long as the same amount of wastewater is discharged into the San Joaquin River. However, it should be noted that Section 1485 water is subject to pumping restrictions in some months due to environmental restrictions.

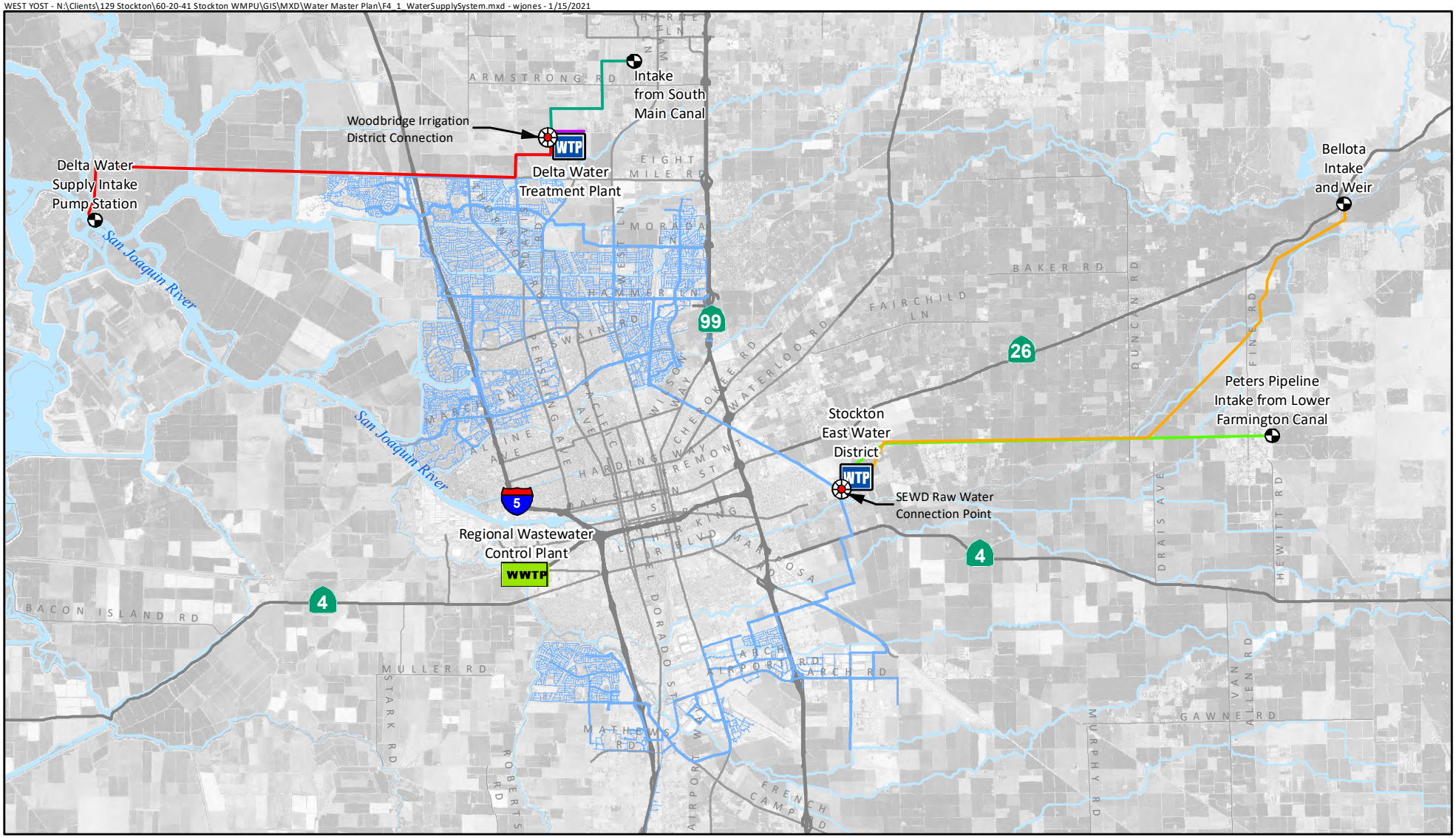
The City's supply from the San Joaquin River is curtailed annually from February 15th to June 15th due to U.S. Department of Fish and Wildlife Service, California Department of Fish and Wildlife and National Marine Fisheries Service (NMFS)[13] restrictions. When water diversion is curtailed, the City obtains supplemental water supply from Woodbridge Irrigation District as described below in Section 4.2.3.

4.2.2 Delta Water Treatment Plant

Subsequent to the State Water Board water right permit issuance for Application 30531A, COSMUD proceeded with Phase 1 of its DWTP project with an initial capacity of 30 mgd. The DWTP and its associated intake facility on the San Joaquin River were completed and commenced operation in 2012. Since completion of the DWTP, the City has exercised its water rights to divert water through its intake facility on the San Joaquin River.

[12] Based on 2019 Water Production (see Table 3-1).

[13] The National Marine Fisheries Service (NMFS) is also known as National Oceanic and Atmospheric Administration (NOAA) Fisheries.



- Wilkerson Lateral
- Pixley Pipeline
- DWTP Raw Water Pipeline
- Bellota Raw Water Pipeline
- Peters Raw Water Pipeline
- Distribution System Pipelines

- WTP — Water Treatment Plant
- WWTP — Regional Wastewater Control Plant
- Raw Water Connection to WTP
- Raw Water Intake

Notes:
1. Locations and alignments are approximate and based on the Stockton East Water District Urban Water Management Plan and available information on the Delta Water Supply Project.

N

0 1.5 3
Miles

WEST YOST

Figure 4-1

Water Supply System

City of Stockton
Water Master Plan Update

4.2.3 Supplemental Raw Water Supply from Woodbridge Irrigation District

In 2008, the City executed a 40-year purchase agreement with WID for 6,500 afy for municipal and industrial water use. WID provides raw water supply to both COSMUD and the City of Lodi. In addition to providing raw water to the two cities, WID provides irrigation supply to agricultural users in its service area. WID's water supply is from the Mokelumne River.

This water augments supply to the DWTP if the San Joaquin River water is not available due to environmental restrictions. The water is conveyed to the DWTP through WID's Wilkerson Canal and Pixley lateral pipeline for treatment and conveyance to the water distribution system, as shown on Figure 4-1.

The City's 2008 contract with WID includes a provision for an increase in water supply as WID-served agricultural lands in the northern part of the City are annexed to the City for municipal and industrial use. Under this contract, an additional 6,500 afy of WID supply will become available to COSMUD at a rate of 3.0 afy per acre annexed. WID supply may potentially increase from 6,500 afy to 13,000 afy by 2025.[14]

4.2.4 COSMUD Water Supply from the DWTP

The COSMUD North Stockton water service area currently receives water from the DWTP and groundwater supplies. In 2019, the City treated 20,809 af from the San Joaquin River and WID at the DWTP, providing about 68 percent of the entire COSMUD water demands.[15]

For purposes of this Water Master Plan Update, and the water system capacity evaluation and hydraulic analyses described in Chapters 7 and 8, it has been assumed that treated water supplies from the DWTP will be available up to the capacity of the DWTP to meet existing and projected water demands in the North Stockton water service area, together with groundwater supplies. This assumption is based on the nature of the City's Water Right Permit 21176 (e.g., the indirect potable reuse strategy) and the availability of supplemental water supply from the Woodbridge Irrigation District when water diversion from the San Joaquin River is curtailed. Additional surface water curtailments are possible in dry years and can be offset with additional groundwater use and/or demand reduction through implementation of the City's Water Shortage Contingency Plan as described in the City's Urban Water Management Plan. One of the key objectives of the Water Master Plan is to identify needed infrastructure improvements to meet the projected water demands, without demand reduction. Additional discussion regarding this assumption is provided in Chapters 7 and 8.

[14] City of Stockton 2015 Urban Water Management Plan, Section 4.

[15] 2019 Water Production (see Table 3-1).

4.3 WATER SUPPLY FROM THE STOCKTON EAST WATER DISTRICT

SEWD is a wholesale water supplier that provides treated potable water to the urban water retailers within the Stockton Metropolitan Area, including COSMUD, Cal Water, and two small maintenance districts in San Joaquin County (Urban Contractors). The COSMUD point of connection to SEWD is shown on Figure 4-1. SEWD also supplies irrigation water to agricultural users in San Joaquin County. SEWD receives and treats surface water from New Melones Reservoir and New Hogan Reservoir, through agreements with the United States Bureau of Reclamation (USBR). SEWD has filed several water right applications to divert excess wet weather flow from the Calaveras River, Little Johns Creek, and other tributaries. The applications are currently undergoing the permitting process with the State Water Board. Although SEWD has groundwater wells, it has not historically pumped groundwater for municipal and industrial use, except during drought and low reservoir levels, and does not plan to do so on a regular basis in the future unless an emergency presents a need.[16]

4.3.1 Water Supply Contract

To alleviate severe groundwater overdraft in the region, SEWD constructed the DJWWTP with a capacity of 30 mgd and entered into an agreement (Original Contract) with the Urban Contractors to share the cost and deliveries of the DJWWTP in the mid-1970's. Since that time, additional planning studies demonstrated the need for additional supplemental water supply to meet the future needs of the Stockton Metropolitan Area and the Original Contract was amended in 1987 (Second Amended Contract) to expand SEWD infrastructure and share water deliveries and costs. The DJWWTP has a current capacity of 62 mgd and is located just east of Central Stockton.

In April 2012, prior to the commencement of operation of the DWTP, the Urban Contractors entered into an allocation agreement to revise the provisions for water deliveries and cost sharing in the Second Amended Contract. That allocation agreement was replaced by an October 2019 Reconciliation Agreement between the Urban Contractors, which recognizes supply allocations, varying use and financial obligations between the Urban Contractors and SEWD. The Reconciliation Agreement is currently in effect.

4.3.2 New Hogan Reservoir

The New Hogan Reservoir has a water storage capacity of 317,000 af and receives its water supply primarily from rain runoff fed by the Calaveras River. SEWD is the water master and controls dam releases for irrigation and municipal use for itself and Calaveras County Water District (CACWD) during non-flood control periods. The United States Army Corps of Engineers (USACE) operates the dam for flood control.

Pursuant to an August 25, 1970 Allocation Contract between the USBR, SEWD, and CACWD, 56.5 percent of the yield from New Hogan Reservoir is allocated to SEWD, and the remaining 43.5 percent to CACWD, subject only to storage and release of water for flood control. The total annual supply available for both SEWD and CACWD is approximately 84,100 afy in normal water years. The contract also provides that any water not used by CACWD can be used by SEWD. At the current level of CACWD use, SEWD can rely on about 83,000 afy of supply from the New Hogan Project in normal water years under safe yield operation.

[16] SEWD, 2015 Urban Water Management Plan, Section 4.

However, if CACWD exercises its percentage entitlement (43.5 percent), SEWD's available supply from this source would be reduced.

4.3.3 New Melones Reservoir

The New Melones Reservoir has a water storage capacity of 2.4 million af and is a part of the Central Valley Project (CVP). It receives water primarily from rain and snowmelt runoff and is fed by the Stanislaus River. Pursuant to a December 1983 contract with USBR, SEWD and Central San Joaquin Water Conservation District (CSJWCD) are entitled to up to 155,000 af of water annually. SEWD is allocated up to 75,000 afy. Water allocation amounts are based on the March-September water forecast and the February end of month storage in the New Melones Reservoir each year, to be used for municipal, industrial or agricultural use. This water is subject to cutbacks based on the USBR's overall CVP operations.

4.3.4 COSMUD Water Supply from SEWD

The COSMUD South Stockton water service area currently receives water from SEWD and groundwater supplies. In 2019, COSMUD use of SEWD water was about 6,100 af, about 20 percent of the COSMUD total supply.[17]

Historically, SEWD was the sole source of treated surface water to COSMUD and provided a significant portion of the total water supply. The startup and operation of the DWTP in 2012 has provided the COSMUD with a new and reliable source of surface water under water right permit 21176 for current and future use within its service area. In addition, COSMUD will continue to rely on SEWD supplies for a portion of its water supply portfolio provided under the Second Amended Contract (expires in 2035), particularly as development continues in South Stockton.

For the North Stockton system, the planned construction of the North Stockton Pipeline Hypochlorite Facility in 2021, which is designed to improve chloramination disinfection processes, will allow for the integration of DWTP and SEWD water supplies. Once the system is operational, additional SEWD water deliveries into the North Stockton system, particularly in the summer months, will provide for a reduction in groundwater pumping and help manage the sustainability of local groundwater resources.

For the purposes of this Water Master Plan Update, and the water system capacity and hydraulic analyses described in Chapters 7 and 8, it has been assumed that treated water supplies from SEWD will be available to meet up to 70 percent of existing and projected water demands in the South Stockton water service area. This assumption is based on actual curtailments in SEWD deliveries during the recent drought. Remaining demands in the South Stockton water service area will be assumed to be met using groundwater supplies from existing and new groundwater wells. Surface water curtailments are possible in dry years and can be offset with additional groundwater use and/or demand reduction through implementation of the City's Water Shortage Contingency Plan as described in the City's Urban Water Management Plan. One of the key objectives of the Water Master Plan Update is to identify needed infrastructure improvements to meet the projected water demands, without demand reduction. Additional discussion regarding this assumption is provided in Chapters 7 and 8.

[17] Historical Water Production (see Table 3-1)

4.4 GROUNDWATER

As described in Chapter 2, the City currently has groundwater wells located in the North Stockton and South Stockton systems, as shown on Figure 2-2. These wells are used to pump groundwater to meet peak summer demands or during dry years when available surface water supplies may be limited.

4.4.1 Groundwater Basin Management

The groundwater basin underlying the City is the San Joaquin Valley Basin, Eastern San Joaquin Subbasin (DWR Basin No. 5-22.01) as shown on Figure 4-2. The Subbasin is defined by the areal extent of unconsolidated to semi-consolidated sedimentary deposits that are bounded by the Mokelumne River on the north and northwest; San Joaquin River on the west; Stanislaus River on the south; and consolidated bedrock on the east.

In 2014, the California legislature enacted the Sustainable Groundwater Management Act (SGMA) in response to continued overdraft of California's groundwater resources. The Subbasin is one of 21 basins and subbasins identified by the DWR as being in a state of critical overdraft. SGMA requires preparation of a groundwater sustainability plan to address measures necessary to attain sustainable conditions in the Subbasin. Sustainability is generally defined as long-term reliability of the groundwater supply and the absence of undesirable results from pumping.

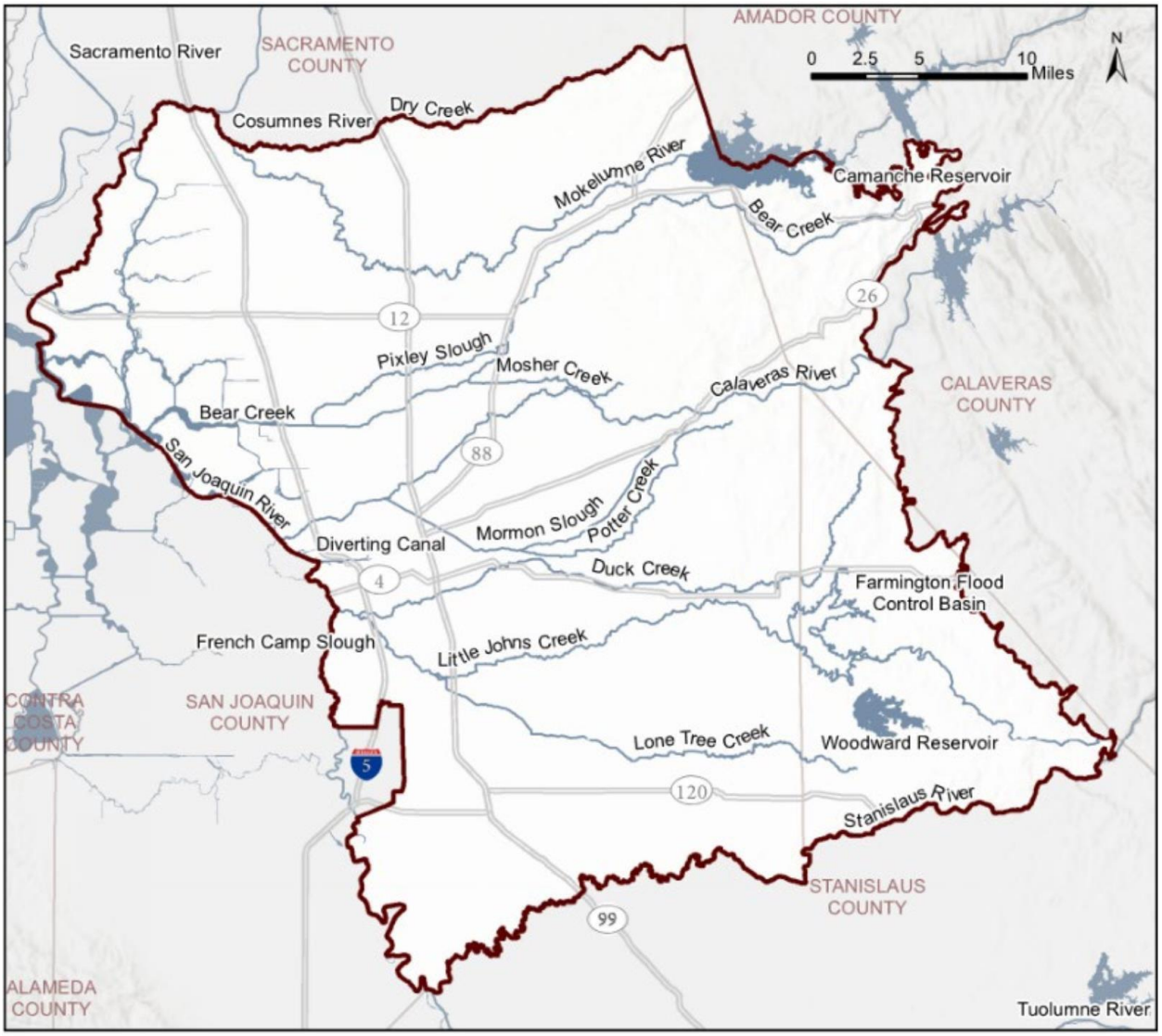


Figure 4-2. Eastern San Joaquin Groundwater Subbasin

The City has partnered with other users through the Eastern San Joaquin Groundwater Authority (GWA) to manage the groundwater basin. The City, along with fifteen other groundwater users and groundwater sustainability agencies, formed the GWA in 2017 in response to SGMA. In 2019, the GWA completed the Eastern San Joaquin Groundwater Subbasin Groundwater Sustainability Plan (GSP) to achieve groundwater sustainability in the Subbasin by 2040. In general, the GSP shows that groundwater elevations have declined since the 1950's. Water quality issues were detected on the west side of the Subbasin, some of which are from wells underlying the City. The GSP outlined the need to reduce overdraft conditions and identified 23 projects for potential development, along with management actions, that either replace groundwater use or supplement groundwater supplies to meet current and future water demands. The list of 23 potential projects included in the GSP represent a variety of project types including direct and in-lieu recharge, intra-basin water transfers, demand conservation, water recycling, and stormwater reuse to be undertaken by the member agencies. The GSP determined an estimated pumping

offset and/or recharge need of 78,000 afy subbasin-wide to achieve sustainability. This amount may be reevaluated after additional data are collected and analyzed.[18]

In the GSP project list, COSMUD may potentially implement advanced metering infrastructure to reduce groundwater demand. COSMUD also manages its groundwater demands by implementing demand management measures outlined in the City's Urban Water Management Plan. The demand management measures include: a water waste prevention ordinance, metering, conservation pricing, public education and outreach, programs to assess and manage distribution system real loss, water conservation program coordination and staffing support, water survey programs for residential customers, residential plumbing retrofit, conservation programs for commercial, industrial, and institutional accounts, and landscape conservation programs and incentives.

From 2020 to 2040, members of the GWA, including the City, will be monitoring and reporting their progress on implementing projects and studies and the impacts of their outreach. Evaluation will be conducted every five years.

COSMUD may also manage its groundwater demands by implementing additional conjunctive use projects outlined under the Stockton Delta Water Supply Project Program Environmental Impact Report (April 2005), which include aquifer storage and recovery, other conjunctive use projects outlined within the current Integrated Regional Water Management Plan – 2020 Addendum, and/or collaborative efforts with other Groundwater Sustainability Agencies.

4.4.2 COSMUD Groundwater Use

COSMUD uses groundwater conjunctively with its surface water supply sources, with groundwater generally used to meet increased water demands primarily in the summer months or during dry years when available surface water supplies may be limited. Wells are also depended on for emergency supply in the event of surface water supply interruptions.

Historically, the local groundwater basin provided 100 percent of the COSMUD water supply. However, with SEWD surface water deliveries beginning in the 1980s and the completion and dedication of the DWTP and associated water supply infrastructure, COSMUD reliance on groundwater has been significantly reduced. In 2019, COSMUD pumped only 3,778 af from the groundwater basin, about 12 percent of the COSMUD total water supply.[19]

In the future, COSMUD plans to use less groundwater in wet and average years. It plans to continue groundwater use to meet peak demand and in dry years to make up for reductions in surface water deliveries.

[18] Eastern San Joaquin Groundwater Authority, Eastern San Joaquin Groundwater Subbasin Groundwater Sustainability Plan, November 2019.

[19] Historical Water Production (see Table 3-1).

CHAPTER 5

The purpose of this chapter is to define the recommended performance and operational criteria for the COSMUD water distribution system. These criteria include required fire flow and flow duration, definition of high demand conditions, definition of “emergency events”, system pumping capacity, system storage capacity (including operational, fire flow, and emergency storage components), minimum and maximum system pressures, and maximum pipeline velocity and head loss.

Table 5-1 summarizes the recommended criteria and the following sections of this chapter present the recommended performance and operational criteria for sizing the COSMUD water system:

- Water System Reliability and Water Quality
- Fire Flow Requirements
- Water System Supply Capacity
- Critical Supply Facilities
- Pumping Facility Capacity
- Water Storage Capacity
- Water Transmission and Distribution Pipeline Sizing

Table 5-1. Summary of Recommended Potable Water System Performance and Operational Criteria

Component	Criteria	Remarks / Issues
Fire Flow Requirements (flow [gpm] @ duration [hours])		
Single Family Residential	2,000 gpm @ 2 hrs	Fire flows based on new development requirements. Existing development will be evaluated on a case by case basis, because of the historical varying standard.
Multi Family Residential	3,000 gpm @ 3 hrs	
Commercial/Office	2,500 gpm @ 4 hrs (with approved automatic sprinkler system)	
Industrial	4,500 gpm @ 4 hrs (with approved automatic sprinkler system)	
Institutional	4,500 gpm @ 4 hrs (with approved automatic sprinkler system)	
Water System Capacity		
Maximum Day Demand	Provide firm capacity equal to the maximum day demand	Met through a combination of surface water treatment plants, and groundwater wells only.
Maximum Day Demand plus Fire Flow	Provide firm capacity equal to maximum day demand plus fire flow	Met through a combination of surface water treatment plants, and groundwater wells, storage and booster pumping facilities.
Peak Hour Demand	Provide firm capacity equal to peak hour demand	Met through a combination of surface water treatment plants, and groundwater wells, storage and booster pumping facilities.
Pumping Facility Capacity		
Pumping Capacity	Provide the greater of maximum day concurrent with fire flow or peak hour demand	Assume firm pumping capacity. Sufficient pumping capacity should also be provided so that the maximum day demand can be supplied using firm pumping capacity with no assistance from storage reservoirs.
Backup Power	Equal to the firm capacity of the pumping facility	On-site generator for critical stations.[(a)] Plug in portable generator for less critical stations.
Surface Water Treatment Capacity		
Treated Surface Water Supply/Pumping Capacity	Provide capacity equal to maximum day demand	
Water Storage Capacity		
Operational	25 percent of maximum day demand	
Fire	Equal to the largest fire flow requirement and associated duration (e.g., Industrial)	2,000 gpm @ 2 hrs = 0.24 MG 2,500 gpm @ 4 hrs = 0.48 MG 3,000 gpm @ 3 hrs = 0.54 MG 4,500 gpm @ 4 hrs = 0.96 MG
Emergency	1 x average day demand	
Emergency Groundwater Credit (EGWC)	Equal to the 85 percent of active groundwater supply that can be reliably accessed (facilities equipped with auxiliary power)	The maximum combined storage credit is limited to the recommended emergency storage capacity.
Treated Surface Water Credit (TSWC)	Equal to the smaller of the available treated surface water supply sources	
Total Water Storage Capacity	Operational + Fire + Emergency - EGWC - TSWC	Total storage should be evaluated by pressure zone.
Water Transmission Line Sizing		
Diameter	18-inches in diameter or larger	Locate new transmission pipelines within designated utility corridors wherever possible.
Average Day Demand Condition		Criteria based on requirements for new development, existing transmission mains will be evaluated on case-by-case basis. Evaluation will include age, material type, velocity, head loss, and pressure.
Maximum Pressure [psi]	80 psi	
Minimum Pressure [psi]	45 psi	
Maximum Head loss [ft/1000 ft]	3 ft/kft	
Maximum Velocity [ft/sec]	3 fps	
Maximum Day Demand Condition		
Minimum Pressure [psi]	45 psi	
Maximum Head loss [ft/1000 ft]	3 ft/kft	
Maximum Velocity [ft/sec]	5 fps	
Peak Hour Demand Condition		
Minimum Pressure [psi]	45 psi	
Maximum Head loss [ft/1000 ft]	3 ft/kft	
Maximum Velocity [ft/sec]	5 fps	
Hazen Williams "C" Factor	130	For consistency in hydraulic modeling.
Pipeline Material	Ductile Iron, Concrete Cylinder, or Steel	
Water Distribution Line Sizing		
Diameter	Less than 18-inches in diameter	Must verify pipeline size with maximum day plus fire flow analysis. Locate new distribution pipelines within designated utility corridors wherever possible.
Maximum Day w/ Fire Flow Demand Condition		
Minimum Pressure [psi] (at fire node)	20 psi	
Maximum Head loss [ft/1000 ft]	10 ft/kft	
Maximum Velocity [ft/sec]	10 fps	
Peak Hour Demand Condition		
Minimum Pressure [psi]	45 psi	
Maximum Head loss [ft/1000 ft]	7 ft/kft	
Maximum Velocity [ft/sec]	7 fps	
Hazen Williams "C" Factor	130	For consistency in hydraulic modeling.
Pipeline Material	PVC	
Other Criteria		
Maximum Water Service Pressure	80 psi	Per California Plumbing Code, install PRV if service pressure is greater than 80 psi.

[(a)] A pumping facility is defined as critical if it provides service to pressure zone(s) and/or service area(s) without sufficient emergency storage and that meet the following criteria:
- The largest facility that provides water to a particular pressure zone and/or service area;
- A facility that provides the sole source of water to single or multiple pressure zones and/or service areas;
- A facility that provides water from a water treatment plant or supply turnout; or
- A facility that provides water from key groundwater supply wells (determined based on capacity, water quality and location).

5.1 WATER SYSTEM RELIABILITY AND WATER QUALITY

Attention to enhancing the reliability of the system under all conditions is an important part of maintaining high quality water service. Water system reliability is achieved through a number of system features including: (1) appropriately sized storage facilities; (2) redundant or "firm" pumping capacity, transmission/distribution, and supply facilities where required; and (3) alternative power supplies. Reliability and water quality are also improved by designing looped water distribution pipelines and avoiding dead-end distribution mains whenever possible. Looping pipeline configurations reduce the potential for stagnant water and the associated problems of poor taste and low chlorine residuals. In addition, proper valve placement is also necessary to maintain reliable and flexible system operation under both normal and abnormal operating conditions.

Water quality standards largely pertain to protecting public health and consistently delivering a satisfactory product to the customer. The U.S. Environmental Protection Agency (EPA) and the State Water Resources Control Board (SWRCB) DDW are the agencies responsible for establishing water quality standards. The EPA and the DDW prescribe regulations that limit the amount of certain contaminants in the water provided by a public water system. The COSMUD, as water purveyor, is responsible for ensuring that the applicable water quality standards and regulations are met at all times.

5.2 FIRE FLOW REQUIREMENTS

The COSMUD is the water purveyor for the northern, southern and Walnut Plant areas of the City, and the City of Stockton Fire Department (Fire Department) is concerned with the availability of adequate water supply during fires. The COSMUD is responsible for water supply and distribution, while the Fire Department establishes minimum water flows required for firefighting purposes.

Both the COSMUD and Fire Department conform to the 2019 California Fire Code and use Appendix B (and Appendix BB) of the code, Fire Flow Requirements for Buildings, to assist in establishing minimum fire flows and durations. The Stockton Municipal Code (Title 15 – Buildings and Construction, Section 15.08.080) specifies the following additional requirements with respect to automatic sprinkler systems:

> *An automatic sprinkler system shall be installed in all new construction, regardless of occupancy classification, where the total floor area is 6,000 square feet or more. This does not include occupancy classes of A-2/H, I,F-1 and S-1; these occupancies shall be protected as per the California Building and Fire Codes.*

When a municipal water system is designated to provide supply during a fire flow condition, it must meet minimum standards for fire flow rate and duration and residual pressure. Specifically, when delivering fire flow, the water system must concurrently meet maximum day demands and maintain at least 20 pounds per square inch (psi) residual pressure for all customer service locations in the distribution system.

Existing pipelines are assumed to meet fire flow standards that were in place at the time of construction, which are generally lower than current standards. Therefore, the evaluation of the COSMUD water system under existing demand conditions presents systemwide available fire flow only and does not recommend pipeline improvements to increase existing fire flow capacity. However, COSMUD can use these results as a guide for sizing pipeline improvements and to develop a rehabilitation and replacement program which prioritizes replacing existing smaller diameter (and typically older) pipelines to improve overall flows throughout the distribution system. This is discussed further in Chapters 7 and 9.

For the COSMUD, the recommended fire flow requirements for future development are generalized based on land use type, as presented in Table 5-2, since actual future building types are not yet known.

Table 5-2. Recommended Fire Flow Requirements for Future Development[a,b]

Land Use Designation	Non-Sprinklered			Sprinklered[c,d]		
	Fire Flow, gpm	Duration, hours	Recommended Storage, MG	Fire Flow, gpm	Duration, hours	Recommended Storage, MG[j]
Single Family Residential[e]	2,000	2	0.24	--	--	--
Multi Family Residential[f]	3,000	3	0.54	--	--	--
Commercial/Office[g]	4,000	4	0.96	2,500[i]	4	0.48
Industrial	8,000	4	1.92	4,500[i]	4	0.96
Institutional[h]	8,000	4	1.92	4,500[i]	4	0.96

(a) Construction type and fire flow calculation area are not generally known during the development of a master plan; consequently, fire flow requirements set forth in this table are based on previous estimates for these land use types and similar communities.

(b) Unique projects or projects with alternate materials may require higher fire flows and should be reviewed by the Fire Chief on a case-by-case basis (e.g., proposed commercial/industrial areas and schools).

(c) Specific fire flows were estimated from 2019 California Fire Code, Appendix B, and depend on construction type and fire area. These fire flow requirements are based on buildings being fully sprinklered.

(d) Normally allows for up to a 50 percent reduction in fire flow if a building is provided with an automatic sprinkler system. However, the CFC also requires that no fire flow be less than 1,000 gpm for single family residential or 1,500 gpm for all other building types. For a more conservative fire flow estimate, Single Family and Multiple Family Residential buildings were considered non-sprinklered for this Water Master Plan.

(e) Single Family Residential includes Residential Estate and Low Density Residential land uses.

(f) Multi Family Residential includes Medium and High Density Residential land uses.

(g) Commercial/Office includes Commercial or Administrative Professional.

(h) Institutional includes schools, hospitals, or other governmental buildings.

(i) Fire flow includes a 500 gpm demand for on-site sprinkler flow.

(j) Recommended storage volumes do not include the volume associated with 500 gpm sprinkler flow.

As described below, fire flows and the expected duration are also used to establish storage requirements.

5.3 WATER SYSTEM SUPPLY CAPACITY

Maximum day demand, maximum day demand plus fire flow, and peak hour demand conditions will be used to assess the adequacy of the COSMUD water supply and distribution system under existing and future conditions. Adopted peaking factors for maximum day and peak hour demands are discussed in Chapter 3. The following subsections discuss the assumptions and recommended criteria for each demand condition.

5.3.1 Maximum Day Demand

The COSMUD must be able to provide a firm supply capacity equal to the maximum day demand, which can be met by a combination of treated surface water supplied from the SEWD and DWTP and groundwater wells. Even though the City's water service areas have seven water storage tanks and associated pump stations, this storage is limited to meeting daily peak demands and only holds one average day of emergency storage and fire flows, and therefore cannot be counted on as a reliable source

to meet the maximum day demand requirements. In addition, California Code of Regulations requires that system supplies meet the maximum day demand.

Firm groundwater supply capacity assumes that 85 percent of the active COSMUD well capacity (not including standby wells) is available at any given time. An active well is defined as any well that is currently operational. Wells that are abandoned, deemed as standby,[20] or temporarily out of service due to mechanical breakdowns, routine maintenance, water quality or other operational issues, or wells that pump directly into tanks are not considered active.[21] This conservative planning-level assumption ensures the reliability and flexibility of the system to provide sufficient supply capacity to meet the maximum day demand, especially considering increasing regulation of groundwater pumping, and aging infrastructure.

5.3.2 Maximum Day Demand plus Fire Flow

In accordance with typical industry standards, the COSMUD water distribution system should have the capability to meet a system demand condition equal to the maximum day demand concurrent with a fire flow event while meeting the recommended system performance criteria (e.g., minimum and maximum system pressures), which are discussed in subsequent sections of this Chapter.

Maximum day demand plus fire flow should be met from a combination of supply sources (i.e., treated surface water from the SEWD and DWTP plus groundwater) and water storage reservoirs. The analysis of fire flow evaluations will be conducted assuming the largest pump at each pump station is offline. In addition, the COSMUD groundwater well system (well pumps) will be assumed to pump at firm capacity during a fire flow evaluation. It is also assumed that reservoir pump stations with only one pump, or without back-up power capability (either an on-site generator or adaptor for a plug-in generator), will not be available during fire flow evaluations. These conservative assumptions ensure the reliability and flexibility of the system to provide sufficient fire flow during emergency conditions.

5.3.3 Peak Hour Demand

Peak hour demand should be met from a combination of supply sources (i.e., treated surface water from the SEWD and DWTP plus groundwater) and water storage reservoirs. Assumptions regarding firm pumping capacity will also apply during a peak hour demand condition. During a peak hour demand condition, the COSMUD water system should be able to meet the recommended system performance criteria (i.e., minimum and maximum system pressures) discussed below in *Section 5.7 Water Transmission and Distribution Pipeline Sizing*.

[20] Standby wells could also be used to meet demands, in an emergency, but these have been conservatively assumed to not be available.

[21] Well status is based on the City of Stockton's Permit Amendment, dated January 7, 2020.

5.4 CRITICAL SUPPLY/PUMPING FACILITIES

Critical pumping facilities are defined as those facilities that provide service to a water service area(s) without sufficient emergency storage (see Emergency Storage section below) and that meet the following criteria:

- The largest pumping facility that provides water to a particular water service area
- A pumping facility that provides the sole source of water to single or multiple water service areas
- A pumping facility that provides water from a water treatment plant or supply turnout
- A pumping facility that provides water from key groundwater supply wells (determined based on capacity, water quality and location)
- All reservoir pump stations

All critical pumping facilities should be equipped with an on-site, back-up power generator. At less critical facilities, a plug-in adapter and transfer switch can be used to allow interconnection to a portable generator, which will be brought to the site by COSMUD staff during a prolonged power outage. In addition, portable generator connections will be configured at all reservoir pump stations.

5.5 PUMPING FACILITY CAPACITY

Sufficient water system pumping capacity (finished surface water pump stations, wells, or reservoir pump stations) should be provided to meet the greater of the following two demand conditions:

1. A maximum day demand concurrent with a fire flow event (e.g., larger industrial fire flow) with reservoir pump stations and well pumps assumed to operate at firm pumping capacity
2. A peak hour demand with reservoir pump stations and well pumps assumed to operate at firm pumping capacity

The highest demand requirement between these two demand conditions sets the water system pumping capacity requirement.

5.6 STORAGE FACILITY CAPACITY

The total treated water storage capacity required is based on the following three major components:

- Operational Storage
- Fire Flow Storage
- Emergency Storage

A discussion of these three storage components, along with a discussion of “credits” for groundwater supply available within each area and treated surface water supply is also discussed below. Also described are potential operational strategies for the COSMUD storage facilities based on seasonal water demand patterns (i.e., winter vs. summer) and the zone within the COSMUD distribution system to help optimize

system operations by facilitating tank turnover to minimize water quality issues (e.g., stale water, loss of disinfectant residual).

5.6.1 Operational Storage

Over any 24-hour period, water demands will vary. Higher water demands will typically occur during the early morning hours when people are irrigating landscape and getting ready to go to work or school. Water demands will then typically decline to some nominal baseline level (depending on the proximity to adjacent commercial/industrial areas) and will then begin to increase again depending on outside water needs (and corresponding temperature), until it reaches a higher water demand in the early evening hours as people return home from work or school. Throughout the year, the peaks of this cycle will vary according to customer needs; thereby, creating maximum day and peak hour demands.

Usually, water treatment plants, supply turnouts, and/or wells are operated at a constant rate over a 24-hour period (baseline) and augmented by additional flow from storage tanks and/or wells, during high demand periods, as needed. Storage tanks are normally refilled when demands drop below the baseline water production flow rate. The storage volume used to meet these peak demand periods is called operational storage.

Ideally, the operational storage requirement should be calculated based on the diurnal demand pattern within the water service area. If sufficient data is not available to develop a diurnal demand pattern, then the recommended volume of water to be stored as operational storage should be at least equal to 25 percent of the total volume of water needed to meet the water service area maximum day demand. For this Water Master Plan Update, it is recommended that the COSMUD plan for an operational storage volume equivalent to 25 percent of the maximum day demand.

5.6.2 Fire Flow Storage

As discussed above, fire flow requirements are based on the 2019 California Building Code, generalized to adjacent land uses. These requirements are based on flow (in gpm) for the building/land use type (e.g., commercial, residential, school, industrial), size of building (in square feet), and type of construction (e.g., wood frame, metal, masonry, installation of sprinklers). After a fire flow requirement is established, it is multiplied by the required fire flow duration to produce an estimate of the total volume of fire flow storage required. Table 5-2 presents the recommended fire flow criteria and associated required fire flow storage. As shown in Table 5-2 the largest fire flow event (assuming installation of sprinklers) requires a fire flow storage volume of 0.96 MG.

If unavailable by gravity storage, the fire flow must be supplied with a National Fire Protection Association (NFPA) rated fire pump. If an NFPA-rated fire pump is not used, a pump(s) and motor(s) combination with a backup power source of sufficient capacity to meet the required maximum fire flow and minimum residual pressure requirements as determined by the Fire Department's Fire Chief will be required.

5.6.3 Emergency Storage

A reserve of stored water is also required to meet demands during an emergency. An emergency is defined as an unforeseen or unplanned event that may degrade the quality or quantity of potable water supplies available to serve customers. There are three types of emergency events that a water utility typically prepares for:

- **Minor emergency**. A fairly routine, normal, or localized event that affects a few customers, such as a pipeline break, malfunctioning valve, hydrant break, or a brief power loss. Utilities plan for minor emergencies and typically have staff and materials available to address them.
- **Major emergency**. A disaster that affects an entire, or large, portion of a water system, lowers the quantity and quality of the water, or places the health and safety of the community at risk. Examples include water treatment plant failures, raw water contamination, or major power grid outages. Water utilities infrequently experience major emergencies.
- **Natural disaster**. A disaster caused by natural forces or events that create water utility emergencies. Examples include earthquakes, forest or brush fires, hurricanes, tornados or high winds, floods, and other severe weather conditions such as freezing or drought that damage or cause water system facilities to not be able to operate.

No specific standard exists for the amount of emergency storage that a utility should maintain. Determination of the required volume of emergency storage is a system-specific policy decision based on the assessment of the risk of failures and the desired degree of system reliability. The amount of required emergency storage is a function of several factors including the diversity of the supply sources, redundancy and reliability of the production facilities, and the anticipated length of the emergency outage. In developing an emergency storage requirement for the COSMUD, typical industry standards were used. For this Water Master Plan Update, it has been assumed that the emergency storage requirement will be based on maintaining a minimum quantity of emergency storage volume equivalent to one average day demand.

5.6.4 Emergency Groundwater Storage Credit

Based on the available COSMUD groundwater wells, groundwater storage can account for a portion of the recommended emergency storage. The following must be true to use the groundwater supply to offset the need to provide surface storage:

- Groundwater supply is of potable water quality and can be reliably accessed (i.e., wells are equipped with on-site emergency generator or a plug-in adapter and transfer switch)
- Groundwater supply is not already being relied upon to meet the COSMUD average day demand requirements
- Sufficient water distribution facilities are available to distribute this water to demand areas

It will be assumed that only the firm groundwater supply will be available for an emergency groundwater storage credit to offset the COSMUD emergency storage requirement. For planning purposes, it is assumed that 85 percent of the active and reliable COSMUD groundwater pumping capacity (i.e., capacity of active wells with on-site generators) is available to supplement required emergency storage for one average day. This conservative assumption accounts for wells out of service for reasons other than power loss (e.g., maintenance, or water quality).

5.6.5 Treated Surface Water Supply Credit

Because the COSMUD has two available surface water treatment plants, and the fact that their source water is independent of one another (Stanislaus and Calaveras Rivers vs. the San Joaquin and Mokelumne Rivers), the capacity of one of the water treatment plants can account for a portion of recommended

emergency storage. For the purposes of this Water Master Plan Update, it is assumed that the smaller of the two WTPs, will be available to offset a portion of the emergency storage requirement. The full credit only applies if North Stockton and South Stockton are operated as a single zone, with the ability to convey water from north to south and south to north. Currently, COSMUD operates the North Stockton and South Stockton systems independent from one another. Due to this limitation, the treated surface water supply credit can only be applied to North Stockton, and is limited to surplus SEWD supply capacity after South Stockton demands are met.

5.6.6 Total Storage Capacity Recommended

The recommended COSMUD potable water storage capacity should be the sum of the following components:

- Operational: Volume of water necessary to meet diurnal peaks observed throughout the day, assumed to be equivalent to at least 25 percent of the maximum day demand
- Fire Flow: Volume of water necessary to supply a single large fire flow event
- Emergency: Volume of water necessary to provide an average day demand
- Emergency Groundwater Storage Credit: Equal to the firm groundwater supply that can be reliably accessed (facilities equipped with auxiliary power); assumed to be 85 percent of the active groundwater pumping capacity
- Treated Surface Water Supply Credit: Equal to the excess capacity available in the smaller of the reliably available treated surface water supply sources (DWTP or SEWD)

The recommended storage volume requirements are established to identify infrastructure required to meet the stated operational and emergency conditions. The amount of total system storage and system peaking capacity required to meet these criteria will change over time as the COSMUD potable water demands increase.

5.6.7 Storage Operational Strategies

The operations of the COSMUD storage tanks can be varied seasonally to optimize tank operations and facilitate tank turnover to maintain water quality throughout the system. Based on the criteria discussed above, if water demands are evaluated seasonally (e.g., winter vs. summer), the required operational storage volumes for the winter months would be less than the required storage volumes for the summer months as the water demands are lower. Therefore, storage levels in the tanks could be maintained at lower levels in the winter months to facilitate better tank turnover or selected tanks could be removed from service during the low demand conditions, provided that fire-fighting ability is not compromised. Similarly, demand patterns in various parts of the COSMUD water system vary and required storage volumes can be tailored to the area served by each tank, in addition to the seasonal demand patterns.

5.7 WATER TRANSMISSION AND DISTRIBUTION PIPELINE SIZING

The following criteria will be used as guidelines for sizing new transmission and distribution pipelines. However, the existing COSMUD water system will be evaluated on a case–by-case basis. For example, if an existing pipeline experiences head loss in excess of the criteria described below during a maximum day demand plus fire flow event, this condition, by itself, does not necessarily indicate a problem as long as the minimum system pressure criterion is satisfied. Consequently, the existing COSMUD water system will

be evaluated using pressure as the primary criterion; and secondary criteria, such as velocity, head loss, age, and material type, will be used as indicators to locate where water system improvements may be needed.

New transmission and distribution pipelines to serve the future planning areas within the COSMUD water service areas should be located within designated utility corridors wherever possible. These designated utility corridors should be within public rights-of-way to minimize or eliminate the need for utility easements within private property.

5.7.1 Water Transmission System

Transmission pipelines are generally 18 inches in diameter or larger and should be designed based on the criteria described below for average day, maximum day, and peak hour demand conditions. The criteria reflect industry standards and West Yost's experience working with the existing COSMUD water system.

5.7.1.1 Average Day Demand

- Pressures should be maintained between a maximum of 80 psi and a minimum of 45 psi
- The maximum velocity within transmission pipelines should be 3 feet per second (fps)
- Head losses within the transmission system pipelines should be limited to 3 feet per thousand feet (ft/kft) of pipeline

5.7.1.2 Maximum Day Demand

- The minimum of allowable service pressure in the water transmission main should be 45 psi
- The maximum velocity within the transmission system pipelines should be 5 fps
- Head losses within the transmission system pipelines should be limited to 3 ft/kft of pipeline

5.7.1.3 Peak Hour Demand

- The minimum residual pressure during a peak hour demand should be 45 psi
- The maximum velocity within the transmission system pipelines should be 5 fps
- Head losses within the transmission system pipelines should be limited to 3 ft/kft of pipeline

5.7.2 Water Distribution System

Distribution pipelines are generally less than 18 inches in diameter and should be sized based on the criteria described below for maximum day demand plus fire flow and peak hour demand conditions. The criteria reflect industry standards and West Yost's experience working with the existing COSMUD water system.

5.7.2.1 Maximum Day Demand plus Fire Flow

- The minimum allowable residual pressure should be 20 psi at the flowing fire hydrant
- The maximum velocity within the distribution system pipelines should be 10 fps, or the head losses within the distribution system pipelines should be limited to 10 ft/kft of pipeline, whichever criteria is more conservative given the specific hydraulic/system condition

5.7.2.2 Peak Hour Demand

- The minimum residual pressure during a peak hour demand should be 45 psi
- The maximum velocity within the distribution system pipelines should be 7 fps, or the head losses within the distribution system pipelines should be limited to 7 ft/kft of pipeline, whichever criteria is more conservative given the specific hydraulic/ system condition

5.7.3 Other Recommended Criteria

It is generally recommended that maximum pressures at customer service locations do not exceed 80 psi. Should pressures exceed 80 psi at customer service locations, individual pressure regulating valves should be installed in accordance with California Plumbing Code requirements (Section 608.2 Excessive Water Pressure) to avoid potential damage to customer fixtures (e.g., water heaters, hoses).

This chapter describes the update, refinement, and calibration of the COSMUD existing water distribution system hydraulic model to reflect existing conditions. The COSMUD water system Geographic Information System (GIS) was used to confirm the configuration of water system facilities in the existing model. The hydraulic model was calibrated to a high degree of accuracy, per general guidelines established by the American Water Works Association Manual of Practice 32 (AWWA M32), and to a level that is acceptable for use for planning purposes or detailed design/operational studies. The resulting updated hydraulic model was subsequently used to evaluate the adequacy of existing and future COSMUD water systems to meet existing and future needs (see Chapters 7 and 8, respectively).

The hydraulic model updates, calibration, and verification efforts are described in the following sections of this chapter:

- Hydraulic Model Background
- Hydraulic Model Update Methodology
- Hydraulic Model Update
- Hydraulic Model C-Factor Calibration
- Hydraulic Model Extended Period Simulation (EPS) Calibration

6.1 HYDRAULIC MODEL BACKGROUND

The COSMUD computerized hydraulic model was originally developed in 1999 using the H_2ONET software. It was updated and dynamically calibrated in 2008 by West Yost as part of the 2008 Water Master Plan. At that time, it consisted of two separate models: one for North Stockton and one for South Stockton. Since the 2008 update, new developments have been constructed within the COSMUD water service area and the DWTP was constructed. The hydraulic model was updated to include the DWTP finished water reservoir and pump station. Since the DWTP is a significant new addition to the COSMUD water system, it was important to make sure the hydraulic model was calibrated with this new facility online. In addition, COSMUD is actively working on implementing the North Stockton Pipeline Hypochlorite Facility, which will allow SEWD water supplies to be conveyed from the SEWD DJWWTP to North Stockton. As part of this latest hydraulic model update, the two models for North Stockton and South Stockton were combined into one model to allow for the evaluation of coordinated operations of the North Stockton and South Stockton systems. Also, as described further in Chapter 7, the update of the COSMUD hydraulic model also allows for a systemwide fire flow evaluation to be performed to determine available fire flow capacity for adjacent land uses in the distribution system.

6.2 HYDRAULIC MODEL UPDATE METHODOLOGY

West Yost completed the following tasks to update the COSMUD hydraulic model:

- Used the existing COSMUD water distribution system maps (GIS) to update the existing hydraulic model
- Incorporated new facilities that were constructed and operating as of January 2020;
  - DWTP finished water reservoir and pump station
  - New Weston Ranch reservoir

- Verified that the existing hydraulic model system configuration (pipeline sizes, alignments, connections, and other facility sizes and locations) is representative of the current COSMUD water system
- Allocated 2019 existing water demands by using the COSMUD water meter information to properly distribute water demands within the hydraulic model
- Assigned elevations to junctions using the COSMUD high resolution raster file
- Confirmed roughness factors assigned in previous versions of the model using hydrant test results
- Dynamically calibrated the COSMUD water system hydraulic model to simulate pressures, levels and flows observed in the field and recorded by the COSMUD Supervisory Control and Data Acquisition (SCADA) system

To accomplish these tasks, West Yost worked closely with COSMUD staff to obtain and review the following available data:

- As-built information, where needed, such as for the DWTP, Westlake Villages, and the Veterans Affairs Off-Site Utility Improvements
- System operation plans
- Metered account water consumption data
- Historical SCADA system data
- Hydrant flow testing data
- Hydrant pressure data gathered by hydrant pressures recorders (HPRs)

The updated hydraulic model was calibrated under summer (maximum day) demand conditions using a developed diurnal demand pattern and an EPS model scenario. The calibration utilized SCADA and field data collected on June 23, 2020, which was the peak demand day concurrent with deployment of HPRs.

6.3 HYDRAULIC MODEL UPDATE

The following sections describe the findings of West Yost's model review and the specific updates made to the water distribution system hydraulic model.

6.3.1 Model Pipeline Configuration Update

West Yost compared the latest hydraulic model with the GIS geodatabase file provided by COSMUD staff to verify and, if needed, update the pipeline diameters and configurations of the existing model to be consistent with the GIS geodatabase. In addition, West Yost reviewed as-built information for development projects that were in construction or scheduled to be completed soon (e.g., Veterans Affairs facility improvements, etc.). Figure 6-1 summarizes the pipelines that were added or updated with more recent information (pipeline diameters, materials, etc.).

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North Stockton

Delta Water Treatment Plant
WTP
Northwest
14 Mile Slough
Well #29
Well #18
Well #30
Well #16
Well #9
Well #7
Well #15
Well #1
Well #4
Well #11
Well #19
Well #24
Well #31
Well #32
Well #10R
Well #20
Well #21
Well #26
Well #03R
Well #25
Well #28
Well #27
Stockton East Water District
WTP
ARMSTRONG RD
LIVE OAK RD
WEST LN
EIGHT MILE RD
RINGE RD
ASHLEY LN
HILDRETH LN
HAMMER LN
WAIN RD
PACIFIC AVE
EL DORADO ST
CHEROKEE RD
WATERLOO RD
ALPINE RD
HOLT RD
SAN JOAQUIN RIVER
CALAVERAS RIVER
FREMONT ST
MINER AVE
99
5
N
0 3,500 7,000
Scale in Feet

South Stockton

Stockton East Water District
WTP
Well SSS9
Well SSS8
Well SSS2
Well SSS3
Well SSS1
Weston Ranch
FREMONT ST
MINER AVE
SAN JOAQUIN RIVER
NAVY DR
DR MARTIN LUTHER KING JR BLVD
EIGHTH ST
MARIPOSA RD
POCKET RD
AUSTIN RD
NEWCASTLE RD
JACKTONE RD
HOWARD RD
AIRPORT WAY
99
5
N
0 3,000 6,000
Scale in Feet

- Updated Pipelines
- Existing Pipelines (Unaltered)
- COSMUD Water Service Boundary
- Water Treatment Plant
- Storage Tank & Booster Pump Station

Wells

- Active
- Inactive
- Standby

Figure 6-1

Summary of Model Pipeline Updates

City of Stockton
Water Master Plan Update

WEST YOST

6.3.2 Pipeline Roughness Characteristics

C-factors indicate the roughness (or smoothness) of the interior of a pipeline. The lower the C-factor, the rougher the pipeline interior and the higher the friction loss in the pipeline. Typically, C-factors are assigned to pipelines based on the characteristics of the pipeline (e.g., age, material type, and size). The COSMUD GIS geodatabase contains limited information on material and pipe age. During the last hydraulic model update, C-factors were assigned on the basis of anticipated material type and were subsequently adjusted based on approximate age (i.e., if one area was older with respect to another, C-factors were reduced slightly in the older area). For the purposes of this update, C-factors were not reassigned, but instead were assumed to be correct and later confirmed as part of the C-factor calibration process which was based on hydrant testing and data collected in the field. The results of that process are discussed further in the Hydraulic Model C-Factor Calibration section below.

6.3.3 Water Demand Allocation

The COSMUD GIS geodatabase contains a feature class for spatially-located water meters. COSMUD staff also provided a spreadsheet containing customer account information and water consumption for 2018-2019. The consumption data was reviewed, and it was determined that the 2019 demands were the most representative to use for the hydraulic model, as this data set contained the latest customer accounts and recently completed developments and was slightly higher than 2018 consumption. Since water meters were already spatially located, approximately 99 percent of the 2019 metered water consumption was able to be linked to the spatially located water meters.

The water use data for 2019 was linked by location ID to the water meter feature class. Then the InfoWater Demand Allocator tool was used to automatically assign the spatially-located demand point to the pipeline closest to its position in the water system.[22] The demand allocation results were reviewed to confirm that the demands were allocated appropriately (i.e., demands not placed on large transmission pipelines). Special attention was paid to locations with parallel pipelines, since several locations include parallel transmission pipelines and distribution system pipelines.

6.3.4 Elevation Extraction

The node features in the hydraulic model require that elevations be assigned to calculate pressures in the system. It is important to use the most accurate elevation data available when assigning elevations to the hydraulic model. The COSMUD provided a raster file that contains elevations for most of the area within the City limits. The raster provided was used to assign elevations to the hydraulic model for junctions, using the Elevation Extractor tool in InfoWater. Elevations assigned in the hydraulic model range from a low of 7.5 feet below sea level in the northwest corner of the distribution system, along Westlake Drive, to a high of 51.5 feet above sea level east of the Stockton East Water District Treatment Plant.

[22] The allocator locates the nearest pipeline to assign demands, and then assigns demands to the junctions connected to the pipeline, based on their proximity to the meter.

6.3.5 Water System Facilities

After the pipelines and nodes were confirmed in the hydraulic model, major system facilities (i.e., groundwater wells, storage tanks and associated pump stations, and treatment plants) were reviewed in the model to confirm correct configuration. Tank elevations (i.e., base, inlet, and overflow) were confirmed at the various tank locations, based on available information. It should be noted that all tank sites were modeled with one tank that contains an equivalent diameter of all tanks present at that location.

Pump curves and pumping water elevations in the wells were also updated. Pumping water elevations at several North Stockton wells were adjusted (increased) by an average of 50 feet. This increase in groundwater levels can be attributed to North Stockton's switch to relying primarily on treated surface water rather than groundwater, thus groundwater levels have increased. Pump curves in the hydraulic model were compared to recent pump tests and, where appropriate, were updated using affinity laws to more closely align with operating points recorded during 2019 pump tests.

6.3.6 Hourly Pattern Development

COSMUD staff provided SCADA system data at 15-minute intervals from June 12, 2020 to June 25, 2020, which corresponds with the HPR monitoring period. The SCADA information included flows, tank levels, and pump discharge pressures for all of the facilities in North and South Stockton that were in operation during this monitoring period. To conduct the extended period calibration, West Yost compiled well and treatment plant production, and tank flows, to develop hourly diurnal patterns for both North and South Stockton. The diurnal pattern from June 23, 2020 was chosen for the extended period calibration because the demand on this day approximated a maximum day demand (approximately 44.4 mgd), and the fluctuations throughout the day (peak demand in both North and South Stockton) were the highest compared to the other days in the monitoring period. The following subsections provide the methodology used to develop the diurnal pattern for each water service area.

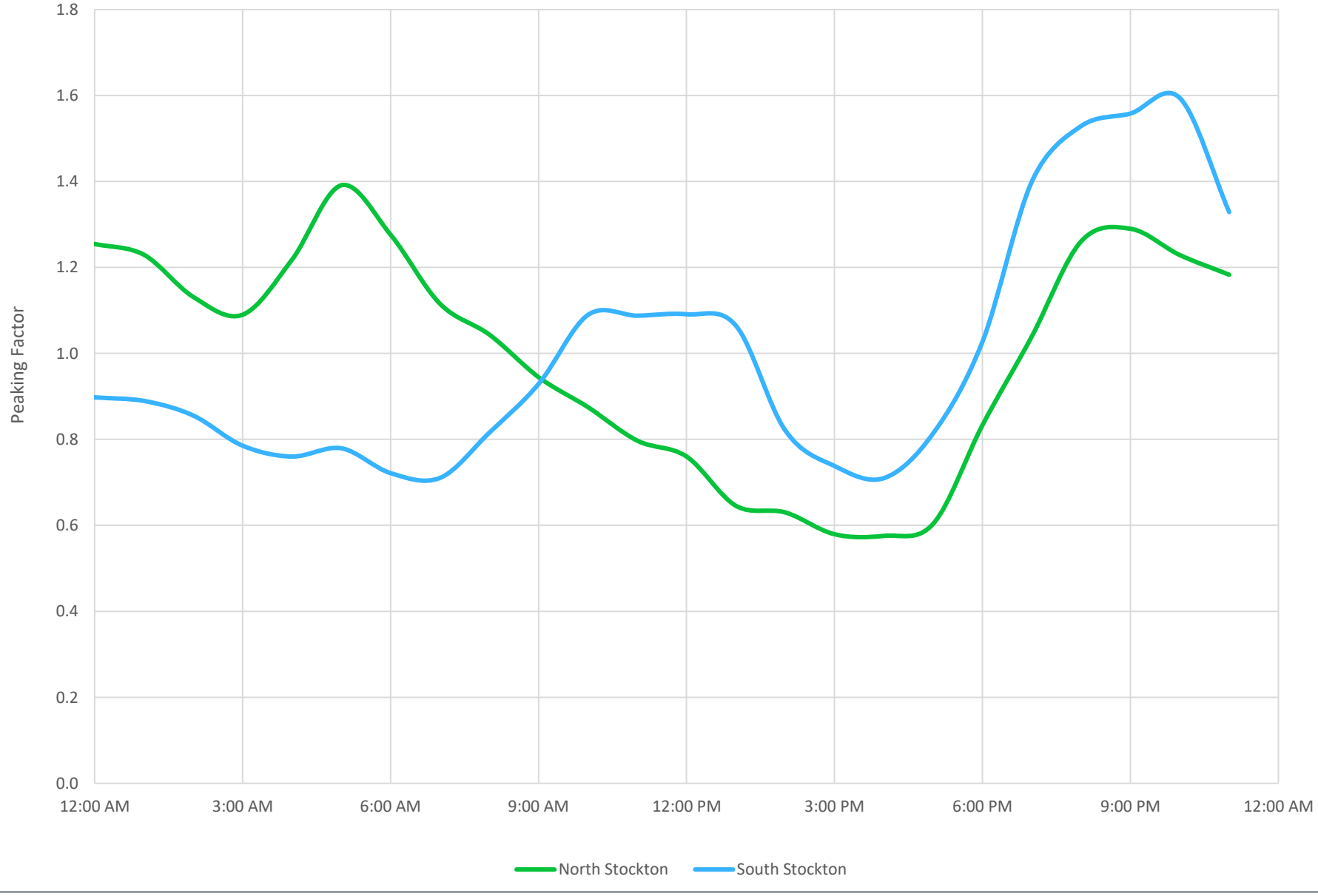
6.3.6.1 North Stockton

The North Stockton water service area is supplied predominantly from the DWTP, with some water also supplied from existing groundwater wells. The following is a summary of the facilities that supplied water to the North Stockton water service area during the time period monitored:

- Treatment Plants: Delta Water Treatment Plant
- Groundwater Wells: 3R, 29, 30, 31, 32
- Reservoir Pump Stations: Northwest Reservoir, Fourteen-Mile Slough Reservoir

Figure 6-2 presents the hourly diurnal pattern assumed for North Stockton. The demand in North Stockton on June 23, 2020 was approximately 36 mgd.

Figure 6-2. Diurnal Patterns during Calibration Day (June 23, 2020)



6.3.6.2 South Stockton

The South Stockton water service area is supplied from the SEWD DJWTP through the South Stockton Aqueduct. The following is a summary of the facilities that supplied water to the South Stockton water service area during the time period monitored:

- Treatment Plants: Stockton East Water District Water Treatment Plant
- Groundwater Wells: None
- Reservoir Pump Stations: Weston Ranch

Figure 6-2 contains hourly diurnal pattern assumed for South Stockton. The demand on June 23, 2020 averaged 8.4 mgd.

6.4 HYDRAULIC MODEL C-FACTOR CALIBRATION

The COSMUD hydraulic model was calibrated to confirm that the hydraulic model can accurately represent the operation of the water distribution system under stressed (i.e., fire flow) conditions. Calibration of the hydraulic model used COSMUD SCADA data and data gathered through hydrant tests and HPRs, as described in the following sections.

6.4.1 Development of Hydrant (C-Factor) Tests

After developing the hydraulic model, 7 locations (and 1 alternate location) were chosen for performing hydrant flow testing as shown on Figure 6-3. Selection of these hydrant test sites was based on specific pipeline size, age, and material type. Pipelines in the COSMUD water system range in size from 2 to 60 inches in diameter. Pipeline materials consist mainly of asbestos cement and PVC that were mostly installed in the 1960s through the 1990s.

C-factors were previously assigned as part of the 2008 Water Master Plan, based in large part on hydrant testing that was conducted at that time, knowledge of material types, and adjustments to C-factors based on age. For this Water Master Plan Update, hydrant tests were used to “spot-check” and confirm the previously assigned pipeline C-factors, and to calibrate the hydraulic model so that it closely represents actual observed pressure conditions in the field. West Yost provided COSMUD with a memorandum detailing the hydrant test procedures before performing the field testing (see Appendix A). Table 6-1 provides the field status of each hydrant test.

WEST YOST - N:\Clients\129 Stockton\60-20-41 Stockton WMPU\GIS\MXD\Water Master Plan\F6_3_HydrantTestOverallMap.mxd - wjones - 1/6/2021

North Stockton

Delta Water Treatment Plant
WTP
Well #29
Northwest
Well #18
Well #30
Well #16
Well #19
Well #24
Well #31
Well #32
Well #15
Well #21
Well #20
Well #10R
Well #7
Well #1
Well #4
Well #11
Well #25
Well #26
Well #28
Well #27
14 Mile Slough
1
2
3
4
5
6
7
8
99
5
ARMSTRONG RD
LIVE OAK RD
WEST LN
EIGHT MILE RD
RINDGE RD
ASHLEY LN
HILDRETH LN
ALPINE RD
CHEROKEE RD
WATERLOO RD
HOLT RD
WAIN RD
PESHINE
ANDREWS ST
MARCHINI
BROOKSIDE RD
PACIFIC AVE
EL DORADO ST
FREMONT ST
MINER AVE
SAN JOAQUIN RIVER
CALAVERAS RIVER
Stockton East Water District
WTP
N
0 3,500 7,000
Scale in Feet

South Stockton

Stockton East Water District
WTP
FREMONT ST
MINER AVE
SAN JOAQUIN ST
MARTIN LUTHER KING JR BLVD
SAN JOAQUIN RIVER
NAVY DR
EIGHTH ST
TURNPIKE RD
SUTTER ST
EL DORADO ST
POCKET
99
MARIPOSA RD
JACK TONE RD
Well SSS9
Well SSS8
Well SSS2
Well SSS3
Well SSS1
7
Weston Ranch
HOWARD RD
HARLAN RD
AIRPORT WAY
NEWCASTLE RD
N
0 3,000 6,000
Scale in Feet

COSMUD Water Service Boundary
Hydrant Test Location
Water Treatment Plant
Storage Tank & Booster Pump Station

Wells
- Active
- Inactive
- Standby

Pipelines
- Less than or Equal to 12-inch
- Greater than 12-inch

Figure 6-3

Hydrant Test Location Map

City of Stockton
Water Master Plan Update

WEST YOST

Table 6-1. Hydrant Test Locations and Status[(a)]					
Test No.	Diameter, inches	Pipeline Material Type	Approximate Age	Location	Field Status
1	8	Asbestos Cement	1980s	Along Angel Drive	Completed
2	6	Asbestos Cement	1960s	Santa Maria Way and San Lucas Avenue	Completed
3	6	Asbestos Cement	1960s	Bonnie Brook Drive and Oak Creek Drive	Completed
4	10	Asbestos Cement	1970s	Along Knickerbocker Drive	Completed
5	8	Asbestos Cement	1980s	Shameran Street and Sharkon Lane	Completed
6	6	Asbestos Cement	1980s	Along Fort Donelson Drive	Completed
7	8	PVC	1990s	Along Ishi Gotto Street	Completed
8 (Alternate)	8	PVC	1980s	Along Boulder Creek Circle	Completed
(a) Seven test locations and one alternative test location were all completed.					

Hydrant flow testing was performed on June 24, 2020. Each hydrant test involved flowing water through pipelines of a specific size and material type,[23] and measuring the pressure drops through the pipelines to determine friction losses. The hydrant test procedure consisted of monitoring discharge flow and pressure at the flowing hydrant, and pressure at other hydrants along the supply route to the flowing hydrant. Static pressures were measured while the flow hydrant was closed, and residual pressures were measured while the hydrant was flowing.

Each hydrant flow test performed was simulated using the hydraulic model of the COSMUD water system. The differences between observed static and residual pressures for the field hydrant test were calculated and compared to readings predicted by the model. The goal of the calibration effort was to achieve no more than 5 psi differential between the field hydrant test data and the model-predicted results, based on standard engineering practice for model calibration for water system master planning, and is similar to the general guidelines provided in AWWA M32 for developing hydraulic models for planning use.

Results from the hydrant tests are discussed in more detail in the following section.

[23] For each hydrant test, system valves were closed as necessary to isolate pipelines of a specific size and material type.

6.4.2 Hydrant (C-Factor) Test Results

The results of the simulated hydrant flow tests generally confirmed the water system pipeline configuration and the previously assigned C-factors continue to be representative of the existing pipeline roughness. C-factors did not need to be modified for any pipelines in the model. Table 6-2 summarizes the comparisons of field data and model results for the hydrant tests performed.

Only one hydrant test location (Hydrant Test 2 for a 6-inch AC pipeline installed in the 1960s) did not meet the ±5 psi tolerance limit established for calibration. At the observation hydrants furthest from the flowing hydrant (Hydrant 2D), field-observed differential pressures for Hydrant Test 2 were greater than the model-predicted values, and exceeded the tolerance limit of ±5 psi. Observation hydrants 2A, 2B and 2C, however, all calibrated to within the 5 psi tolerance limit. In addition, Hydrant Test 3, which was also a 6-inch diameter AC pipeline approximately built in 1960s, indicated that model-predicted differential pressures were within the 5 psi tolerance limit and confirmed the C-factor. It is suspected that there was a reading error or an incorrect pipeline diameter upstream of Hydrant 2D that resulted in the difference at this hydrant. Therefore, the existing C-factor for AC pipelines is still considered to be accurate.

6.4.3 Hydraulic Model C-Factor Calibration Findings and Conclusions

In summary, the results from the hydrant tests indicate that the hydraulic model is calibrated within a 5 psi pressure differential from field-observed data. Of the eight hydrant tests that were conducted, only one hydrant (Hydrant Test 2, D hydrant) did not meet the 5 psi pressure criterion. However, the C-factor for this pipeline was not adjusted because the remaining tests for pipelines with the same pipeline material and age showed alignment between the field-observed and model-predicted results.

The results indicate that the COSMUD hydraulic model can simulate fire flow or other large demand conditions within the COSMUD water system. Based on the results of the hydraulic model calibration, it can be concluded that the hydraulic model results provide a reasonable representation of the COSMUD water distribution system and can be used for planning purposes.

Table 6-2. Summary of Hydrant Test Calibration Results

Hydrant[(a)]	Field DataStatic Pressure, psi	Modeled Data					Comparison of Differential Pressures between Field and Modeled Data[(b)]
		Residual Pressure, psi	Differential Pressure, psi (Static - Residual)	Static Pressure, psi	Residual Pressure, psi	Differential Pressure, psi (Static - Residual)	
Hydrant Flow Test No. 1 [Angel Drive, Between Sutton Way and Otto Drive]							
1	54	14	N/A	54	N/A	N/A	N/A
1A	53	26	27	53	24	29	-2
1B	54	35	19	53	34	19	0
1C	56	46	10	53	47	6	4
1D	53	51	2	52	50	2	0
Hydrant Flow Test No. 2 [Santa Maria Way and San Lucas Avenue, Between Ponce De Leon Avenue and Don Borgia Way]							
2	53	4	N/A	50	N/A	N/A	N/A
2A	51	15	36	50	14	37	-1
2B	52	26	26	51	26	25	1
2C	55	35	20	51	35	15	5
2D	53	42	11	51	46	5	6
Hydrant Flow Test No. 3 [Bonnie Brook Drive and Oak Creek Drive, Between Westland Avenue and Meadow Avenue]							
3	52	1	N/A	51	N/A	N/A	N/A
3A	50	7	43	51	5	46	-3
3B	51	15	37	52	14	37	-1
3C	54	21	33	52	21	31	2
Hydrant Flow Test No. 4 [Knickerbocker Drive, Between New York Drive and Tam O Shanter Drive]							
4	50	20	N/A	49	N/A	N/A	N/A
4A	50	43	8	49	42	7	0
4B	50	45	5	49	43	6	-1
4C	53	49	4	49	45	4	0
4D	50	49	1	49	47	2	-1
Hydrant Flow Test No. 5 [Shameran Street and Sharkon Lane, Between Montauban Avenue and Hammertown Drive]							
5	50	14	N/A	50	N/A	N/A	N/A
5A	50	36	15	50	36	13	1
5B	48	40	8	50	47	3	5
5C	54	51	3	50	48	2	1
Hydrant Flow Test No. 6 [Fort Donelson Drive, Between Five Mile Drive and Palmouth Court]							
6	55	5	N/A	51	N/A	N/A	N/A
6A	50	17	33	51	17	34	-1
6B	52	32	21	52	32	19	1
6C	54	44	10	51	43	8	2
Hydrant Flow Test No. 7 [Ishi Gotto Street, Between Ken Street and Brick and Tile Circle]							
7	60	15	N/A	59	N/A	N/A	N/A
7A	59	24	35	59	25	34	1
7B	60	32	28	59	33	26	2
7C	62	40	22	58	39	19	3
7D	61	44	17	58	42	16	1
Hydrant Flow Test No. 8 [Boulder Creek Circle]							
8	52	9	N/A	49	N/A	N/A	N/A
8A	51	24	28	50	22	28	0
8B	52	29	23	50	28	22	1
8C	54	39	16	49	35	14	1
8D	51	47	5	49	45	4	0

(a) Location of hydrants can be found in the Hydrant Test Memorandum prepared by West Yost (Appendix A).
(b) The goal of the calibration effort is to achieve a differential pressure comparison within 5 psi for the observed hydrants, consistent with requirements in AWWA M32.

6.5 HYDRAULIC MODEL EXTENDED PERIOD SIMULATION (EPS) CALIBRATION

Calibrating a hydraulic model to replicate field operating conditions requires thorough knowledge of how the water system performs over a range of operating conditions. To ensure that the hydraulic model was correctly configured and capable of producing results that are consistent with those observed from the COSMUD SCADA system and collected in the field, a detailed EPS calibration process for summer conditions was conducted. The calibration was completed using SCADA and field data collected on June 23, 2020. For the EPS calibration, 16 HPRs were deployed to collect supplemental pressure data that was subsequently used to compare model-predicted results at various locations throughout the system, including high and low elevation locations, and locations that are hydraulically distant from supply points. The locations where the HPRs were set up in the system are shown on Figure 6-4.

The hourly diurnal patterns developed for each water service area, as described in the Hourly Pattern Development section above, were used in the calibration. The model was set up to replicate the system operations by applying controls to facilities based on specific conditions (i.e., pumps on or off based on tank level). Model-predicted results (i.e., facility flows and pressures, tank levels, and system pressures) were plotted and compared to the SCADA system data for the specific dates and field-collected HPR data to verify whether the COSMUD hydraulic model accurately predicts field conditions.

Model-predicted flows and levels were matched as closely as possible and aimed to be within 10 percent of field-recorded data. Pressure trends were checked to see whether results were within ±5 psi of field trends. Adjustments to the model were made, if needed, to better match field data when results from the hydraulic model did not trend well with the field data. Results from the calibration are discussed in the following sections.

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North Stockton

Delta Water Treatment Plant
WTP
HPR 01
HPR 12
HPR 07
HPR 11
HPR 02
HPR 08
HPR 09
HPR 06
HPR 03
HPR 05
HPR 10
HPR 04
Northwest
14 Mile Slough
Well #29
Well #18
Well #30
Well #16
Well #19
Well #24
Well #31
Well #9
Well #20
Well #10R
Well #32
Well #7
Well #15
Well #21
Well #1
Well #4
Well #11
Well #03R
Well #25
Well #26
Well #28
Well #27
ARMSTRONG RD
LIVE OAK RD
WEST LN
EIGHT MILE RD
RINGE RD
ASHLEY LN
HILDRETH LN
HAMMER LN
ALPINE RD
CHEROKEE RD
WATERLOO RD
DORADO ST
PACIFIC AVE
EL DORADO ST
PERSHING AVE
MARCH LN
BROOKSIDE RD
STANDREWS DR
SAN JOAQUIN RIVER
HOLT RD
FREMONT ST
MINER AVE
99
5
N
0 3,500 7,000
Scale in Feet

South Stockton

Stockton East Water District
WTP
HPR 13
HPR 15
HPR 16
HPR 14
Weston Ranch
Well SSS9
Well SSS8
Well SSS2
Well SSS3
Well SSS1
SAN JOAQUIN RIVER
NAVY DR
DR MARTIN LUTHER KING JR BLVD
EIGHTH ST
POCK LN
MARIPOSA RD
JACKSTONE RD
AUSTIN RD
NEWCASTLE RD
TARLTAN RD
AIRPORT WAY
HOWARD RD
99
5
N
0 3,000 6,000
Scale in Feet

COSMUD Water Service Boundary

HPR Location

WTP Water Treatment Plant

Storage Tank & Booster Pump Station

Wells

- Active
- Inactive
- Standby

Pipelines

- Less than or Equal to 12-inch
- Greater than 12-inch

Figure 6-4

Hydrant Pressure Recorder Map

City of Stockton
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WEST YOST

6.5.1 Hydraulic Model EPS Calibration Results

Graphs of the comparisons between model-simulated results and SCADA values, as well as comparisons between model-simulated results and HPR values for the calibration date of June 23, 2020, are provided in Appendix B and Appendix C for facilities in North and South Stockton, respectively. The following summarizes the comparison of hydraulic model results with field data for each water service area.

6.5.1.1 North Stockton

Figures B-1 through B-20 of Appendix B show results for the EPS calibration in North Stockton. In general, COSMUD provides a certain minimum supply for North Stockton from the DWTP. Differences between surface water supply and demand are met through a combination of storage and groundwater. Storage tanks typically drain in the morning and fill in the afternoon. The Northwest and Fourteen-Mile Slough Reservoirs follow a consistent fill and empty cycle to mitigate potential water quality issues.

Figure B-1 shows pressure and flow results for the DWTP. The DWTP, based on SCADA data, maintains a relatively constant pressure of approximately 50 psi and also maintains a relatively constant flow of approximately 20 mgd. In the hydraulic model, the DWTP was set to maintain a downstream pressure of 50 psi. Model-predicted flow from the DWTP did oscillate and is not as consistent as the SCADA data indicates. However, the average supply throughout the day does align well and model-predicted flows are generally within 10 percent of the SCADA-predicted range, which is acceptable per AWWA M32. Pressures are also well within the target tolerance of ±5 psi.

Figures B-2 and B-3 show the tank levels in the Northwest Reservoir and the Fourteen-Mile Slough Reservoir. The model-predicted tank levels generally trended similarly to the field-recorded data for both facilities, within 10 percent of each other.

Figures B-4 through B-8 summarize the flow and pressures from the various COSMUD groundwater wells in North Stockton that were operating that day. The model-predicted flows and pressures generally trended similarly to field-recorded data for both parameters, with flows within 10 percent and pressures within ±5 psi of field-recorded information. It should be noted that the pressure at Well 31 is underpredicted in the model. However, model-predicted pressures at the two nearby HPRs 2 and 7 were within the ±5 psi tolerance of HPR/field-recorded conditions. The low pressure at Well 31 could be due to the elevation of the pressure instrument, or a SCADA reading issue. However, this difference is acceptable because all other facilities calibrated well with respect to pressure and nearby HPRs are within range.

Figures B-9 through B-20 show that the pressure trends collected by the HPRs installed in North Stockton match the pressure results from the model simulation. All model-predicted pressure results are within approximately 5 psi of the field-recorded pressures.

6.5.1.2 South Stockton

Figures C-1 and C-2 show results for the SEWD Water Treatment Plant and Weston Ranch Reservoir, respectively. In general, SEWD provides supply for South Stockton and Weston Ranch is used and filled on an as-needed basis. No wells came on in South Stockton during the calibration day.

For SEWD, model-predicted flows and pressures generally trended similarly to field-recorded data, with flows within 10 percent and pressures within ±5 psi of field-recorded information.[24] At the Weston Ranch Reservoir, the model-predicted tank levels also trended similarly to field-recorded data, within 10 percent of each other.

Figures C-3 through C-6 show the pressure trends collected by the HPRs installed in South Stockton compared to the pressure results from the model simulation. In general, the field results match the model-predicted results, with the exception of HPR 13 and HPR 14 between 10:00 am and 1:00 pm. These HPRs are located on the west side of South Stockton, furthest from SEWD and were generally within residential land uses. It is possible that the diurnal demand characteristics in this area are different, therefore the model is predicting pressures lower than observed. While pressures during these times are consistently lower, they are still within ±5 psi tolerance. In addition, model-predicted pressure at HPRs 15 and 16 were well within 1 to 2 psi of field-recorded pressures.

6.5.2 Hydraulic Model EPS Calibration Findings and Conclusions

Based on the results of the hydraulic model EPS calibration, it can be concluded that the hydraulic model provides a reasonable representation of the COSMUD water distribution system and can be used for planning evaluations and design/operational analysis for a variety of flow conditions.

Additionally, COSMUD staff should continue to update and verify facilities data and pipeline system configurations in the hydraulic model as facilities are constructed or replaced to maintain a hydraulic model that will continue to accurately represent the COSMUD water distribution system.

[24] Based on discussions with City staff, SEWD elevation was adjusted based on HPR information to 27.5 ft msl.

This chapter presents the evaluation of the COSMUD existing water system, as shown on Figure 7-1 and described in Chapter 2, and its ability to meet the recommended performance and operational criteria described in Chapter 5 under various existing water demand conditions. This evaluation includes an analysis of water supply capacity, storage capacity, and pumping capacity, as well as the existing water distribution system's ability to meet recommended operational and design criteria under maximum day demand, peak hour demand, and maximum day demand plus fire flow scenarios.

West Yost conducted this evaluation using the updated hydraulic model described in Chapter 6, which includes some new water system facilities that the COSMUD is actively working on completing. Recommendations from this evaluation are used to develop a recommended capital improvement program, which is detailed in Chapter 9.

The following sections present the evaluation methodology and results from the existing water system evaluation:

- Existing Water Demands
- Existing Water Supply and Water System Facility Capacity Evaluation
- Existing Water Distribution System Performance Evaluation
- Summary of Findings and Recommendations for the Existing Water System

7.1 EXISTING WATER DEMANDS

The COSMUD existing baseline water demands are summarized in Table 7-1. The average day demand for the purposes of this Water Master Plan Update is 28.1 mgd (31,495 afy) and represents the average annual water production from 2015 through 2019 with an added 10 percent demand rebound factor, as described in Chapter 3. Maximum day and peak hour demands were calculated based on the adopted peaking factors of 1.6 and 2.5 times the average day demand, respectively, in North Stockton, and 1.7 and 3.3 times the average day demand, respectively, in South Stockton, as described in Chapter 3.

Table 7-1. Existing COSMUD Baseline Demands[a]

Service Area	Average Day Demand (ADD)[b]		Maximum Day Demand (MDD)[c]		Peak Hour Demand (PHD)[d]	
	gpm	mgd	gpm	mgd	gpm	mgd
North Stockton	15,992	23.0	25,587	36.8	39,980	57.6
South Stockton	3,534	5.1	6,007	8.7	11,661	16.8
Total	**19,526**	**28.1**	**31,594**	**45.5**	**51,641**	**74.4**

(a) Does not include water demands for the Walnut Plant Area which are minimal and not evaluated in this Water Master Plan Update.
(b) The average day demand is based on the average annual production from 2015 through 2019, scaled to include a 10 percent demand rebound factor as described in Chapter 3.
(c) The maximum day demand is calculated using a peaking factor of 1.6 in North Stockton and 1.7 in South Stockton, times the average day demand.
(d) The peak hour demand is calculated using a peaking factor of 2.5 in North Stockton and 3.3 in South Stockton, times the average day demand.

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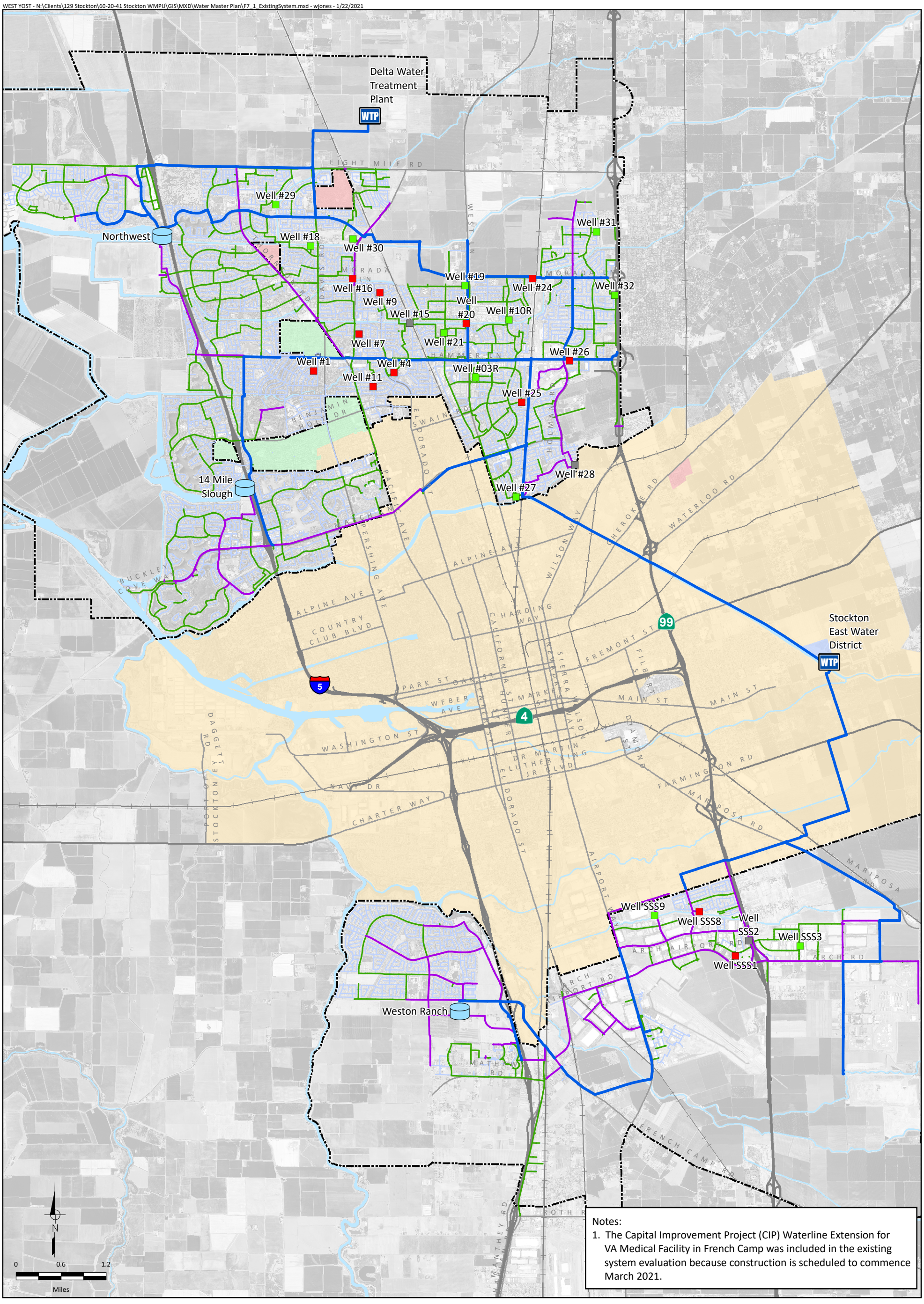

Notes:
1. The Capital Improvement Project (CIP) Waterline Extension for VA Medical Facility in French Camp was included in the existing system evaluation because construction is scheduled to commence March 2021.

WTP Water Treatment Plant

Storage Tank & Booster Pump Station

Wells
- Active
- Inactive
- Standby

Pipelines
- Less than 12 inches
- 12 - 14 inches
- 16 - 22 inches
- 24 inches or greater

- COSMUD Water Service Boundary
- California Water Service
- San Joaquin County (served by COSMUD)
- San Joaquin County
- Stockton East Water District

Figure 7-1

Existing Water System

City of Stockton
Water Master Plan Update

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7.2 EXISTING WATER SUPPLY AND WATER SYSTEM FACILITY CAPACITY EVALUATION

The following evaluations were conducted for the existing water system, with results discussed below:

- Supply Capacity Evaluation
- Pumping Capacity Evaluation
- Storage Capacity Evaluation

7.2.1 Supply Capacity Evaluation

As described in Chapter 5, the recommended supply capacity criterion requires the COSMUD to provide firm supply capacity equal to the maximum day demand. Table 7-2 summarizes existing firm supply capacity compared to existing maximum day demands in North Stockton and South Stockton. The COSMUD water supply is provided by both surface water and groundwater, and their respective firm capacities are summarized as follows.

- For North Stockton, 100 percent of DWTP capacity is assumed for firm surface water supply.
- For South Stockton, surface water supply from SEWD was assumed to be limited to approximately 70 percent of the South Stockton maximum day demand. This assumption was made to provide more flexibility under drought conditions when surface water supplies may be curtailed by assuming the use of additional groundwater supplies to meet the remaining 30 percent of the maximum day demand. Refer to Chapter 4 for more discussion regarding this assumption.
- The firm groundwater supply capacity is calculated as 85 percent of the production capacity of active wells (i.e., does not include standby or inactive wells) in North Stockton and South Stockton, respectively. Refer to Chapter 5 for more discussion regarding this assumption.

As shown in Table 7-2, there is a surplus of supply in North Stockton of 17.5 mgd and in South Stockton of 3.3 mgd, respectively. Additional supply capacity from a proposed new well, Well SSS10, is also included in Table 7-2. As discussed in the storage capacity evaluation below, there is a storage capacity deficit in South Stockton. To address the storage capacity deficit in the South Stockton water service area, Well SSS10 is recommended. Well SSS10 is already in the planning stages and it is recommended that the COSMUD continue with development of this well to address the storage capacity deficit, as well as provide additional supply capacity to the South Stockton water service area.

Table 7-2. Comparison of Available versus Required Supply Capacity

Available or Required Capacity	Notes/Basis	Capacity	
		gpm	mgd
North Stockton			
Supply			
Existing Firm Well Supply Capacity	[A] 85% of the capacity of active wells (Wells 3R, 10R, 18, 19, 21, 27, 29, 30, 31, 32)	16,916	24.4
Existing Surface Water Supply	[B] Full DWTP Capacity	20,833	30.0
Total Supply Capacity	[C] = [A] + [B]	37,749	54.4
Demand			
Existing Maximum Day Demand	[D] 1.6 times ADD (refer to Table 7-1)	25,587	36.8
North Stockton Supply Capacity Surplus (Deficit)	**[E] = [C] – [D]**	**12,162**	**17.5**
South Stockton			
Supply			
Existing Firm Well Supply Capacity	[F] 85% of the capacity of active wells (Wells SSS3 and SSS9)	4,118	5.9
Existing Surface Water Supply	[G] 70% of South Stockton MDD, 8.7 mgd (refer to Table 7-1)	4,205	6.1
Total Supply Capacity	[H] = [F] + [G]	8,323	12.0
Demand			
Existing Maximum Day Demand	[I] 1.7 times ADD (refer to Table 7-1)	6,007	8.7
South Stockton Supply Capacity Surplus (Deficit)	**[J] = [H] - [I]**	**2,316**	**3.3**
Additional Supply			
Additional Firm Supply Capacity with Well SSS10	[K] 85% of the assumed 2,000 gpm capacity	1,700	2.4
South Stockton Supply Capacity Surplus (Deficit) with Existing System Improvements	**[L] = [J] + [K]**	**4,016**	**5.8**

7.2.2 Pumping Capacity Evaluation

Existing pumping capacity was evaluated to assess its ability to deliver a reliable firm pumping capacity to the COSMUD existing water service areas to meet the greater of either the maximum day demand plus a large fire flow event or the peak hour demand (anywhere within the North or South Stockton water service areas), as described in Chapter 5. Pumping capacity is provided by a combination of supply facilities (i.e., treatment plants and groundwater wells) and reservoir pump stations. Firm pumping capacity provided by treatment plants and groundwater wells is evaluated in a manner identical to the supply capacity evaluation described above. For reservoir pump stations, a reduction in total pumping capacity is assumed to account for pumps that could be out of service due to various operational problems or maintenance at any given time. For both North Stockton and South Stockton, firm booster pumping capacity is defined as the total pump station capacity with the largest pump out of service.

Table 7-3 shows the firm pumping capacity compared to the peak hour demand in North Stockton and South Stockton and indicates there is a surplus of pumping capacity in both the North Stockton and South Stockton water service areas.

Table 7-3. Comparison of Available versus Required Pumping Capacity

Available or Required Capacity	Notes/Basis	Capacity	
		gpm	mgd
North Stockton			
Requirement			
Required Maximum Day Demand plus Fire Flow[(a)]	[A] MDD (refer to Table 7-1) plus a large industrial fire flow (4,500 gpm)	30,087	43.3
Existing Peak Hour Demand	[B] 2.5 times ADD (refer to Table 7-1)	39,980	57.6
Pumping Capacity Requirement	[C] = the greater of [A] or [B]	39,980	57.6
Capacity			
Existing Firm Pump Capacity at Reservoir Sites	[D] Total pump capacity with the largest pump offline at each reservoir site	31,450	45.3
Existing Firm Pump Capacity at Treatment Plants	[E] Limited to the existing capacity of the Delta Water Treatment Plant	20,833	30.0
Existing Firm Well Capacity	[F] 85% of the capacity of active wells (Wells 3R, 10R, 18, 19, 21, 27, 29, 30, 31, 32)	16,916	24.4
Total Existing Available Firm Pumping Capacity	[G] = [D] + [E] + [F]	69,199	99.6
North Stockton Existing Pumping Capacity Surplus (Deficit)	**[H] = [G] - [C]**	**29,219**	**42.1**
South Stockton			
Requirement			
Required Maximum Day Demand plus Fire Flow[(a)]	[I] MDD (refer to Table 7-1) plus a large industrial fire flow (4,500 gpm)	10,507	15.1
Existing Peak Hour Demand	[J] 3.3 times ADD (refer to Table 7-1)	11,661	16.8
Pumping Capacity Requirement	[K] = the greater of [I] or [J]	11,661	16.8
Capacity			
Existing Firm Pump Capacity at Reservoir Sites	[L] Total pump capacity with the largest pump offline at each reservoir site	9,000	13.0
Existing Firm Pump Capacity at Treatment Plants	[M] 70% of South Stockton MDD (refer to Table 7-1)	4,205	6.1
Existing Firm Well Capacity	[N] 85% of the capacity of active wells (Wells SSS3 and SSS9)	4,118	5.9
Total Existing Available Firm Pumping Capacity	[O] = [L] + [M] + [N]	17,323	24.9
South Stockton Existing Pumping Capacity Surplus (Deficit)	**[P] = [O] - [K]**	**5,662**	**8.2**
Improved Capacity			
Additional Firm Capacity with Well SSS10	[Q] 85% of the assumed 2,000 gpm capacity	1,700	2.4
South Stockton Pumping Capacity Surplus (Deficit) with Existing System Improvements	**[R] = [P] + [Q]**	**7,362**	**10.6**

(a) The large industrial fire flow does not include demand for on-site sprinkler flow.

7.2.3 Storage Capacity Evaluation

Water storage provides operational storage to balance differences in demands and supplies, emergency storage in case of a supply failure, and water to fight fires. The COSMUD water system has two sources of available storage: above-ground storage (i.e., storage reservoirs) and storage available in the groundwater basin. Together, these two sources of storage must be sufficient to meet the COSMUD operational, emergency, and fire flow storage criteria.

As introduced in Chapter 5, the COSMUD water storage capacity requirement is as follows:

- Operational storage equal to 25 percent of a maximum day demand
- Fire flow storage equal to the largest fire flow rate multiplied by its duration
- Emergency storage equal to one average day demand

Because the COSMUD water supply includes groundwater wells and treated surface water, the groundwater basin and treatment facilities can offset some of the required storage in the form of storage credits. A summary of available storage capacity and credits is provided below:

- Existing available storage is defined as the storage provided by all active reservoirs
- The Emergency Groundwater Storage Credit (EGWC) equals 85 percent of the active groundwater wells that can be reliably accessed (i.e., well facilities equipped with auxiliary power)
- The Treated Surface Water Supply Credit (TSWC) equals the smaller of the two treatment facilities available in North Stockton. There is no surface water credit available for South Stockton because water from DWTP cannot be transferred to South Stockton, providing no redundant treated surface water supply
- Combined, the EGWC and TSWC cannot exceed the emergency storage requirement

The existing water storage facilities, in conjunction with the available EGWC and TSWC, were evaluated to determine whether the COSMUD existing storage capacity provides the recommended operational, emergency, and fire flow storage for existing demands. Table 7-4 provides a comparison of available and required storage and indicates there is a storage capacity deficit in both the North Stockton and South Stockton areas of 3.4 MG and 2.3 MG, respectively.

As previously discussed, the COSMUD is actively working on the design and construction of the North Stockton Pipeline Hypochlorite Facility that would effectively allow SEWD water to be delivered in North Stockton. Once this project is in place, a TSWC would apply to North Stockton of 9.4 MG, maximizing total credits up to the emergency requirement in the North Stockton area and alleviating the storage capacity deficit. To alleviate the storage capacity deficit in South Stockton, it is recommended that the COSMUD continue to proceed with the design and construction of Well SSS10, and to ensure that that this well is equipped with backup power. The addition of backup power improves the reliability of Well SSS10 and allows it to be counted as part of the EGWC. As shown in Table 7-4, completion of these recommended projects mitigates the storage capacity deficit and results in a storage capacity surplus. No additional storage projects are recommended for existing system conditions.

Table 7-4. Comparison of Available versus Required Storage Capacity

Available or Required Capacity	Notes/Basis	Storage, mg
North Stockton		
Requirement		
Operational	[A] 25% of MDD (refer to Table 7-1)	9.2
Fire Flow	[B] One fire event: 4,000 gpm @ 4 hours (refer to Chapter 5)	1.0
Emergency	[C] One ADD (refer to Table 7-1)	23.0
Total Storage Requirement	[D] = [A] + [B] + [C}	33.2
Capacity		
Existing Available Storage Capacity	[E] Includes all active reservoirs	16.2
Treated Surface Water Supply Credit	[F] No credit taken, as North and South Stockton are currently hydraulically separate	0.0
Emergency Groundwater Storage Credit[(e)]	[G] 85% of the active wells equipped with backup power (Wells 3R, 29, 30, 31, 32)	13.6
Total Storage Capacity	[H] = [E] + [F] + [G]	29.8
North Stockton Existing Storage Capacity Surplus (Deficit)	**[I] = [H] - [D]**	**(3.4)**
Improved Capacity		
Treated Surface Water Supply Credit	[J] Once the North Stockton Pipeline Hypochlorite Facility is complete, the treated surface water supply credit can be used for North Stockton	9.4
North Stockton Existing Storage Capacity Surplus (Deficit) with Additional Treated Surface Water Supply Credit	**[K] = [I] + [J]**	**6.0**
South Stockton		
Requirement		
Operational	[L] 25% of MDD (refer to Table 7-1)	2.2
Fire Flow	[M] One fire event: 4,000 gpm @ 4 hours (refer to Chapter 5)	1.0
Emergency	[N] One ADD (refer to Table 7-1)	5.1
Total Storage Requirement	[O] = [L] + [M] + [N]	8.3
Capacity		
Existing Available Storage Capacity	[Q] Includes all active reservoirs	6.0
Treated Surface Water Supply Credit	[R] No credit taken, since North and South Stockton remain hydraulically separate	0.0
Emergency Groundwater Storage Credit[(e)]	[S] 85% of active wells equipped with backup power (none)	0.0
Total Storage Capacity	[T] = [Q] + [R] + [S]	6.0
South Stockton Existing Storage Capacity Surplus (Deficit)	**[U] = [T] - [O]**	**(2.3)**
Improved Capacity		
Additional Emergency Groundwater Storage Credit with Well SSS10	[V] 85% of the assumed 2,000 gpm capacity	2.4
South Stockton Storage Capacity Surplus (Deficit) with Existing System Improvements	**[W] = [U] + [V]**	**0.1**

7.3 EXISTING WATER DISTRIBUTION SYSTEM PERFORMANCE EVALUATION

The water distribution system performance evaluation identifies necessary improvements to the COSMUD water distribution system to support the COSMUD existing water demands while meeting the COSMUD recommended water system planning and design criteria, presented in Chapter 5. The following evaluations were performed to assess water distribution system performance under existing water demand conditions:

- Normal Operations – Maximum Day Demand with Peak Hour Scenario: This scenario evaluated service pressures during a peak hour on the maximum day demand condition
- Emergency Operations – Maximum Day Demand plus Fire Flow Scenario: This scenario evaluated system fire flow availability under a maximum day demand condition

The updated and calibrated water system hydraulic model, as discussed in Chapter 6, was used to evaluate existing water distribution system performance. The existing water system is expected to deliver maximum day with peak hour demand flows and maximum day demand plus fire flow within the acceptable pressure and velocity ranges as identified in the water system performance and operational criteria presented in Chapter 5.

7.3.1 Normal Operations – Maximum Day Demand with Peak Hour

The normal operations scenario evaluates the hydraulics of the COSMUD water distribution system under maximum day with peak hour demand conditions (i.e., non-fire). An overview of the evaluation and a discussion of the results are presented in the following sections.

7.3.1.1 Evaluation Overview

An EPS was conducted using the hydraulic model to evaluate system performance under a maximum day with peak hour demand condition. The diurnal pattern previously presented in Chapter 3 was incorporated into the hydraulic model and evaluated for seven consecutive days; however, only results from the last three days of the simulation are presented, as these results are not affected by initial conditions. As shown in Table 7-1, the maximum day demand is calculated using a peaking factor of 1.6 times the average day demand in North Stockton and 1.7 times the average day demand in South Stockton. This results in a total system maximum day demand of 31,594 gpm (41.5 mgd) for the existing system. The peak hour demand is calculated using a peaking factor of 2.5 times the average day demand in North Stockton and 3.3 times the average day demand in South Stockton. This results in a total system peak hour demand of 51,641 gpm (74.4 mgd) for the existing system.

During a maximum day with peak hour demand scenario, a minimum pressure of 45 psi and a maximum pressure of 80 psi is targeted to be maintained at service connections throughout the entire system. In addition, for pipelines, it is recommended that the maximum velocity not exceed 5 fps. The existing system analysis assumes the maximum day and peak hour demand would be met by a combination of surface water treatment plants, active groundwater wells, and storage reservoirs via their associated reservoir pump stations.

7.3.1.2 Evaluation Results

Results from the maximum day with peak hour demand condition indicate the existing water system generally meets the COSMUD minimum and maximum pressure criterion at most customer service locations. Figure 7-2 presents the minimum instantaneous pressures observed during the EPS simulation. As shown on Figure 7-2, in general the northeast portion of the North Stockton water service area and a single dead-end customer off a 2-inch diameter pipeline and portions of the central area in the South Stockton water service area do not meet the minimum pressure requirement of 45 psi. However, as shown on Figure 7-3, which presents average system pressures for the maximum demand day, results from the simulation indicate that service connections throughout the entire distribution system meet the minimum pressure requirement of 45 psi, except for a few spots in the northeast portion of the North Stockton water service area and one dead-end pipeline in the South Stockton water service area.

Low pressures in the northeast portion of the North Stockton water service area are largely due to higher elevations and therefore improvements to mitigate low pressures, which occur for an hour or two a day, are cost prohibitive and not recommended. In addition, DTWP discharge pressure could be increased to increase system pressures in the north east portion of North Stockton. However, as shown on Figure 7-3, average pressures remain above 45 psi in the majority of the area. The single low-pressure location in South Stockton is a direct result of head losses (HL/1,000 feet is greater than 7 ft/kft criterion) along the long dead-end 2-inch diameter pipeline. It is recommended that this 2-inch diameter pipeline be replaced with a 4-inch diameter pipeline to mitigate head losses and improve pressures. As discussed in the following sections, it is recommended that this pipeline be replaced as part of the recommended Priority 3 pipeline rehabilitation and replacement program.

Discharge pipelines at groundwater well facilities and reservoir pump stations have maximum velocities that vary between 5.6 and 11 fps. While these velocities exceed maximum recommended velocities, improvements are not recommended at these locations as they are experienced for a short distance and do not impact the primary criterion, customer service pressure. Simulated velocity results for the maximum day with peak hour demand condition indicate that the remaining pipelines within the COSMUD water system meet the velocity criterion of 5 fps, and therefore no pipelines improvements are recommended for the maximum day with peak hour demand condition.

Figure 7-4 shows reservoir water level fluctuations in system reservoirs throughout the EPS. As shown on Figure 7-4, Northwest and Fourteen-Mile Slough Reservoirs follow a repetitive turnover cycle, cycling at least once a day. In South Stockton, Weston Ranch Reservoir level fluctuations are less cyclical. This is due to the delivery pressure from SEWD and the fact that operations in the South Stockton water service area are based on maximizing use of SEWD supplies. These model-simulated reservoir level trends match operational data provided by the COSMUD. Reservoir turnover at Weston Ranch could be improved if discharge set-points were set higher, but this would result in applying back-pressure to the SEWD and Cal Water systems. Current reservoir water level fluctuations, as shown on Figure 7-4, appear to be adequate.

WEST YOST - N:\Clients\129 Stockton\60-20-41 Stockton WMPU\GIS\MXD\Water Master Plan\F7_2_MDDMinResults.mxd - bvera - 1/18/2021

North Stockton

Delta Water Treatment Plant
WTP
Well #29
Northwest
Well #18
Well #30
Well #31
Well #19
Well #32
Well #10R
Well #21
Well #03R
14 Mile Slough
Well #27
Stockton East Water District
WTP
0 3,500 7,000
Scale in Feet

South Stockton

WTP
Stockton East Water District
*Well SSS9
Well SSS3
Weston Ranch
0 3,000 6,000
Scale in Feet

Notes:
1. Delta Water Treatment Plant pump station discharge pressure was set to 52 psi and Stockton East Water District pump station dishcarge pressure was set to 58 psi. Active wells turned on as needed, based on local pressure/time of day.

Minimum System Pressure
- Less than 40 psi
- Between 40 and 45 psi
- Between 45 and 50 psi
- Between 50 and 55 psi
- Greater than 55 psi

- Water Treatment Plant
- Well (Active)
- Storage Tank & Booster Pump Station
- COSMUD Water Service Boundary

Maximum Velocity
- Equal to or Less than 5 ft/s
- Greater than 5 ft/s

Figure 7-2

Existing System
Maximum Day Demand
Minimum System Pressure

City of Stockton
Water Master Plan Update

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WEST YOST - N:\Clients\129 Stockton\60-20-41 Stockton WMPU\GIS\MXD\Water Master Plan\F7_3_MDDAvgResults.mxd - bvera - 11/30/2020

North Stockton

Delta Water Treatment Plant
WTP
Well #29
Northwest
Well #18
Well #30
Well #31
Well #19
Well #32
Well #10R
Well #21
Well #03R
14 Mile Slough
Well #27
Stockton East Water District
WTP
0 3,500 7,000
Scale in Feet

South Stockton

WTP
Stockton East Water District
Well SSS9
Well SSS3
Weston Ranch
0 3,000 6,000
Scale in Feet

Notes:
1. Delta Water Treatment Plant pump station discharge pressure was set to 52 psi and Stockton East Water District pump station dishcarge pressure was set to 58 psi. Active wells turned on as needed, based on local pressure/time of day.

Average System Pressure
- Less than 40 psi
- Between 40 and 45 psi
- Between 45 and 50 psi
- Between 50 an 55 psi
- Greater than 55 psi

- Water Treatment Plant
- Storage Tank & Booster Pump Station
- Well (Active)
- COSMUD Water Service Boundary

Average Velocity
- Equal to or Less than 5 ft/s
- Greater than 5 ft/s

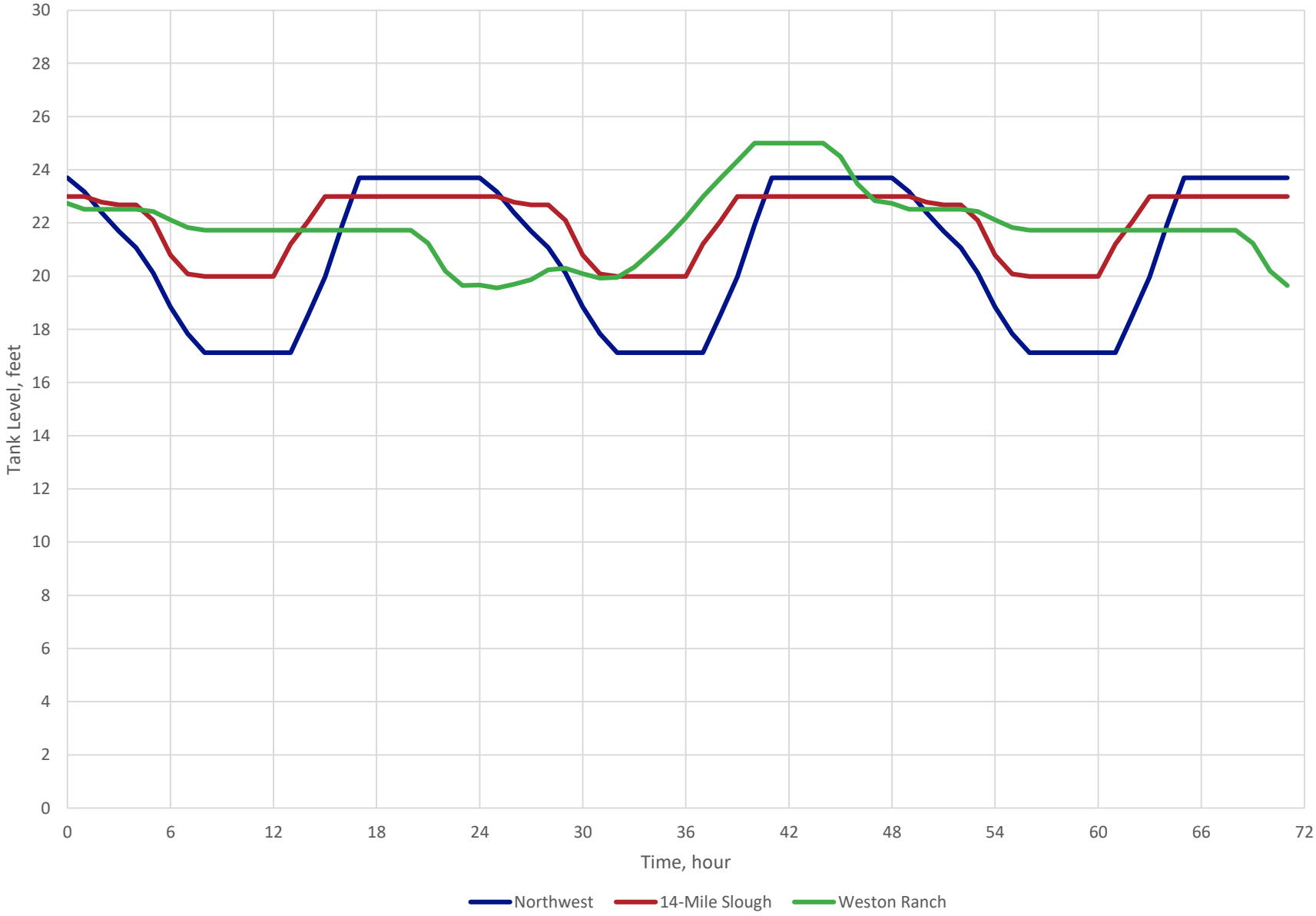
Figure 7-3

Existing System
Maximum Day Demand
Average System Pressure

City of Stockton
Water Master Plan Update

WEST YOST

Figure 7-4. Existing System Maximum Day Demand Reservoir Level Results



7.3.2 Emergency Operations – Maximum Day Demand Plus Fire Flow

The maximum day demand plus fire flow scenario evaluates the existing fire flow availability in the COSMUD distribution system under a maximum day demand condition. An overview of the evaluation and a discussion of the results are presented in the sections below.

7.3.2.1 Evaluation Overview

To evaluate the existing water system fire flow availability, InfoWater's fire flow module was used to determine the available fire flow at all junctions that represent hydrant locations throughout the system, while maintaining a minimum residual system pressure of 20 psi at all customer service locations. The analysis assumed that reservoir pump stations are operating at their firm pumping capacity. Maximum velocity is not considered in this evaluation because it is a secondary design criterion.

As discussed in Chapter 5, recommended fire flow criteria presented in Table 5-2 are established for future development and do not apply to existing system conditions. Much of the COSMUD water distribution system is older and designed to earlier fire standards in place at the time the pipelines were constructed. Therefore, the existing fire flow evaluation presents the systemwide available fire flow and how the existing system performs compared to recommended fire flow criteria. Since much of the COSMUD system is older, a rehabilitation and replacement (R&R) program is recommended to replace smaller diameter pipelines (which are typically older) over the next 40 years.

It should be noted that the 2008 WMP did not recommend any improvements for fire flow. The 2008 WMP evaluated fire flows at five key locations in both North Stockton and South Stockton (10 locations total), and since the primary criterion (pressure) was met at those locations, no improvements were recommended. For this Water Master Plan Update, a systemwide fire flow evaluation was performed to determine available fire flow capacity compared to adjacent land uses for the entire distribution system. While the primary criterion (pressure) continues to be met, at some locations available fire flow is less than the recommended fire flow criteria for new developments of similar land use types. As discussed above and in the following sections, an R&R program is recommended to replace older/smaller diameter pipelines, and it is recommended that replacement of older/smaller diameter pipelines in areas where available fire flow is less than recommended fire flow criteria be prioritized.

7.3.2.2 Fire Flow Evaluation Results

Figure 7-5 presents the available fire flow at each tested junction while maintaining a minimum residual pressure of 20 psi. Results presented on Figure 7-5 are representative of the system's capacity and do not represent available flow from a specific hydrant. Typically, fire flows exceeding 1,500 gpm are met by multiple hydrants.

As shown on Figure 7-5, there are many locations that do not meet the recommended fire flow criteria. The majority of the tested locations which do not meet current fire flow criteria are along older and/or small diameter pipelines, areas with larger fire flow requirements (i.e., 4,500 gpm), or areas with a lack of looping where high head losses (due to undersized mains) limit the ability to provide recommended fire flows while maintaining pressures greater than 20 psi. As noted previously, much of the COSMUD water distribution system is older and was designed to earlier fire standards in place at the time the pipelines were constructed.

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North Stockton

Delta Water Treatment Plant
WTP
Well #29
Well #18
Well #30
Northwest
Well #19
Well #31
Well #32
Well #10R
Well #21
Well #03R
Well #27
14 Mile Slough
Stockton East Water District
WTP
ARMSTRONG RD
LIVE OAK RD
WEST LN
EIGHT MILE RD
RINDGE RD
ASHLEY LN
HILDRETH LN
HAMMER LN
SWAIN RD
PACIFIC AVE
EL DORADO ST
ALPINE RD
CHEROKEE RD
WATERLOO RD
BROOKSIDE RD
FREMONT ST
MINER AVE
HOLT RD
SAN JOAQUIN RIVER
CALAVERAS RIVER
99
5
N
0 3,500 7,000
Scale in Feet

South Stockton

WTP
Stockton East Water District
Well SSS9
Well SSS3
Weston Ranch
FREMONT ST
MINER AVE
SAN JOAQUIN ST
DR MARTIN LUTHER KING JR BLVD
NAVY DR
EIGHTH ST
EL DORADO ST
POCKET RD
MARIPOSA RD
AUSTIN RD
NEWCASTLE RD
JACKSTONE RD
HOWARD RD
AIRPORT WAY
99
5
N
0 3,000 6,000
Scale in Feet

Notes:
1. Delta Water Treatment Plant pump station discharge pressure was set to 52 psi and Stockton East Water District pump station dishcarge pressure was set to 58 psi. Active wells turned on as needed, based on local pressure/time of day.
2. The available flow at each junction is the maximum flow available while maintaining 20 psi residual system pressue.

- Available flow is ≥100% of criteria
- Available flow ≥75% but <100% of criteria
- Available flow is ≥50% but <75% of criteria
- Available flow is <50% of criteria
- Water Treatment Plant
- Storage Tank & Booster Pump Station
- Well (Active)
- COSMUD Water Service Boundary

Pipeline

- Less than or Equal to 12-inch
- Greater than 12-inch

Figure 7-5

Existing System Maximum Day Demand Fire Flow Results

City of Stockton
Water Master Plan Update

WEST YOST

As discussed in Chapter 9, an R&R program is recommended to replace older pipelines that are less than 8-inches in diameter[25], and these pipelines would be replaced over a 40-year period. The first 10 years of the recommended program prioritizes areas where current available fire flow capacity is less than the recommended fire flow. This should also include mains running through private property or through levies, or those that have known tree root damage. Pipelines were prioritized into the following categories:

- **Priority 1**: This category addresses areas where existing available fire flow capacity is less than 50 percent of the recommended criteria.
- **Priority 2**: This category addresses areas where existing available fire flow capacity is between 50 and 75 percent of the recommended fire flow criteria.
- **Priority 3**: This category contains the remaining smaller diameter (i.e., less than 8-inches) pipelines.

An asset management plan should be developed so recommended pipeline improvements can be further refined by considering likelihood of failure (e.g., age, condition, leak history, etc.) and consequence of failure (e.g., disruption of water service to critical facilities, potential for damage to adjacent land use and facilities, etc.) to further refine and define program priorities and implementation. Table 7-5 summarizes the length of Priority 1, 2 and 3 pipelines to be replaced in North Stockton and South Stockton.

Table 7-5. Recommended Existing COSMUD Water System Pipeline Improvements

Replacement Pipeline Diameter (inches)	Feet of Pipeline		
	Priority 1	Priority 2	Priority 3
North Stockton			
8-inch	3,585	14,846	-
12-inch	4,364	4,018	330,008
Total	**7,949**	**18,864**	**330,008**
South Stockton			
8-inch	-	1,249	-
12-inch	4,923	5,445	35,445
Total	**4,923**	**6,694**	**35,445**

Figure 7-6 presents the recommended pipelines in Priority 1 and 2 categories of the recommended R&R program, which are intended to improve fire flow availability as presented in Figure 7-5. Figure 7-7 presents the fire flow results with Priority 1 and 2 R&R improvements assumed to be completed. As shown on Figure 7-7, the majority of the North Stockton and South Stockton water service areas exceeds 75 percent of the recommended fire flow criteria. Along Harland Road, in the South Stockton area, available flows remain below 50 percent of recommended fire flow criteria, even with the Priority 1 and 2 R&R improvements completed. However, a portion of this pipeline is planned to be improved (from a 12-inch diameter to a 16-inch diameter) and is part of the City's existing Capital Improvement Program (CIP). This improvement would improve fire flow availability to this area.

[25] Generally, 8-inch diameter pipelines are recommended as they meet the maximum velocity requirements for residential fire flow events. However, smaller diameter pipelines are allowed (per COSMUD standard specifications) provided that all capacity requirements are met and should be evaluated on a case-by-case basis. For the purposes of this Water Master Plan Update and for budgeting purposes, it is assumed that all small diameter pipelines are replaced with 8-inch diameter pipelines.

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North Stockton

Delta Water Treatment Plant
WTP
Well #29
Well #30
Well #18
Northwest
Well #31
Well #19
Well #32
Well #10R
Well #21
Well #03R
14 Mile Slough
Well #27
Stockton East Water District
WTP
0 3,500 7,000
Scale in Feet

South Stockton

Stockton East Water District
WTP
Well SSS9
Well SSS3
Weston Ranch
0 3,000 6,000
Scale in Feet

Pipelines
- Existing
- Improvement Priority 1
- Improvement Priority 2
- Water Treatment Plant
- Storage Tank & Booster Pump Station
- Well (Active)
- COSMUD Water Service Boundary

Figure 7-6

Existing System Pipeline Improvements

City of Stockton
Water Master Plan Update

WEST YOST

WEST YOST - N:\Clients\129 Stockton\60-20-41 Stockton WMPU\GIS\MXD\Water Master Plan\F7_7_FFResultsImp.mxd - bvera - 1/18/2021

North Stockton

Delta Water Treatment Plant
WTP
Well #29
Well #18
Well #30
Northwest
Well #33
Well #31
Well #19
Well #32
Well #10R
Well #21
Well #03R
Well #27
14 Mile Slough
Stockton East Water District
WTP
ARMSTRONG RD
LIVE OAK RD
WEST LN
EIGHT MILE RD
RINGE RD
HAMMER LN
ASHLEY LN
HILDRETH LN
ALPINE RD
CHEROKEE RD
WATERLOO RD
SWAIN RD
PERSHING AVE
EL DORADO ST
PACIFIC AVE
BROOKSIDE RD
FREMONT ST
MINER AVE
HOLT RD
SAN JOAQUIN RIVER
CALAVERAS RIVER
STANDRIDGE CUT
99
5
N
0 3,500 7,000
Scale in Feet

South Stockton

WTP
Stockton East Water District
SAN JOAQUIN RIVER
NAVY DR
FREMONT ST
MINER AVE
SAN JOAQUIN STREET
CENTER ST
DR MARTIN LUTHER KING JR BLVD
EIGHTH ST
EL DORADO ST
POCKET
MARIPOSA RD
AUSTIN RD
NEWCASTLE RD
JACKTONE RD
HOWARD RD
Well SSS10
Well SSS9
Well SSS3
Weston Ranch
99
5
N
0 3,000 6,000
Scale in Feet

Notes:
1. Delta Water Treatment Plant pump station discharge pressure was set to 52 psi and Stockton East Water District pump station dishcarge pressure was set to 58 psi. Active wells turned on as needed, based on local pressure/time of day.
2. The available flow at each junction is the maximum flow available while maintaining 20 psi residual system pressue.

- Available flow is ≥100% of criteria
- Available flow ≥75% but <100% of criteria
- Available flow is ≥50% but <75% of criteria
- Available flow is <50% of criteria
- Water Treatment Plant
- Storage Tank & Booster Pump Station
- Well (Active)
- COSMUD Water Service Boundary

Pipeline

- Less than or Equal to 12-inch
- Greater than 12-inch

Figure 7-7

Existing System Fire Flow Results With Priority 1 And 2 Improvements

City of Stockton
Water Master Plan Update

WEST YOST

7.4 SUMMARY OF FINDINGS AND RECOMMENDATIONS FOR THE EXISTING WATER SYSTEM

Findings and recommended improvements for the existing water system are summarized in Table 7-6 below. These recommendations are used to develop a recommended CIP, which is further described in Chapter 9.

Table 7-6. Summary of Recommended Existing System Improvements

Improvement Type	Existing System (2020)
North Stockton	
Supply	• No supply related improvements recommended.
Pumping	• No pumping improvements recommended.
Storage	• No storage improvements recommended, other than completing the North Stockton Pipeline Hypochlorite Facility which provides for a treated surface water supply credit to offset required storage.
Pipelines	• An R&R program is recommended to replace older, undersized pipelines. To prioritize the program, the existing fire flow availability, as compared to recommended fire flow criteria, was used to help prioritize R&R improvements. These improvements are shown on Figure 7-6, colored in red and orange, and are summarized in Table 7-5. • These projects could be further prioritized by targeting areas where the COSMUD has historically had leak and/or main break issues. These improvements are recommended to be implemented over the next ten years and be online by 2030. • Replacement of the remaining small diameter pipelines (i.e., pipelines not specifically identified for replacement) is also recommended. • It is recommended that an asset management plan be developed so recommended pipeline improvements can be further refined by considering likelihood of failure (e.g., age, condition, leak history, etc.) and consequence of failure (e.g., disruption of water service to critical facilities, potential for damage to adjacent land use and facilities, etc.) to further refine and define program priorities and implementation.
South Stockton	
Supply	• Construct the new Well SSS10 to mitigate existing storage capacity deficit and improve supply reliability.
Pumping	• No pumping improvements recommended.
Storage	• Construct the new Well SSS10 and equip with backup power to increase emergency groundwater storage credit by 2.4 MG. For the purposes of this Water Master Plan Update, it was assumed that this well would be able to supply 2,000 gpm.
Pipelines	• An R&R program is recommended to replace older, undersized pipelines. To prioritize the program, the existing fire flow availability, as compared to recommended fire flow criteria, was used to help prioritize R&R improvements. These improvements are shown on Figure 7-6, colored in red and orange, and are summarized in Table 7-5. • These projects could be further prioritized by targeting areas where the COSMUD has historically had leaks and/or main break issues. These improvements are recommended to be implemented over the next ten years and be online by 2030. • Replacement of the remaining small diameter pipelines (i.e., pipelines not specifically identified for replacement) is also recommended. • It is recommended that an asset management plan be developed so recommended pipeline improvements can be further refined by considering likelihood of failure (e.g., age, condition, leak history, etc.) and consequence of failure (e.g., disruption of water service to critical facilities, potential for damage to adjacent land use and facilities, etc.) to further refine and define program priorities and implementation.

This chapter presents the evaluation of the COSMUD water system, and its ability to support projected near-term (2030) and future (2040) demands (described in Chapter 3) while meeting the recommended performance and operational criteria (described in Chapter 5). As noted in Chapter 3, the future water demands projected in this Water Master Plan Update are significantly lower than those projected in the 2008 Water Master Plan, and thus the recommended water system improvements to support projected future demands are significantly less extensive than those recommended in the 2008 Water Master Plan.

This evaluation includes an analysis of water supply capacity, storage capacity, and pumping capacity, as well as the distribution system's ability to meet recommended operational and design criteria under near-term and future maximum day demand, peak hour demand, and maximum day demand plus fire flow scenarios. West Yost conducted this evaluation using the updated hydraulic model described in Chapter 6. The hydraulic model was subsequently updated to include recommended improvements developed as part of the existing water system evaluation (see Chapter 7) and assumes that improvements are completed by the future (2040) timeframe. In addition, West Yost incorporated COSMUD planned capital improvement projects as discussed in the sections below.

Evaluations, findings, and recommendations for addressing future needs identified in the COSMUD North and South Stockton water service areas (for both near-term and future demand conditions) are included in this chapter. Recommendations are used to develop a recommended CIP, which is described further in Chapter 9.

The following sections present the evaluation methodology and results from the future water system analysis:

- Future Water System Description
- Future Water Demands
- Future Water Supply and Water System Facility Capacity Evaluation
- Future Water Distribution System Performance Evaluation
- Summary of Findings and Recommendations for the Future Water System
- Other Planned or Recommended Improvements

8.1 FUTURE WATER SYSTEM DESCRIPTION

As discussed in Chapter 3, near-term (2030) and future (2040) water demand conditions are based on the Envision Stockton 2040 General Plan Update (2040 GPU) land use designations and the SOI/MSR. Both sources define the anticipated future development areas for the near-term (2030) and future (2040) time periods. To support these future development areas, water system infrastructure was extended to these areas to support the future demands. Sizing and layout of these facilities is preliminary and based on the previous 2008 WMP and/or more recent information if available, and is shown on Figure 8-1.

These pipelines serve as a basis for serving future development areas, and thus were included in the hydraulic model to simulate future conditions and allocate future demands. As future development plans are refined, infrastructure needs are expected to change and the COSMUD should require project proponents to confirm that proposed infrastructure meets all design criteria presented in Chapter 5.

Figure 8-1 shows the baseline water distribution system network planned for the near-term (2030) and future (2040), prior to identifying capacity improvements. Pipelines in dotted gray summarize pipeline extensions needed to serve near-term (2030) and future (2040) projected demands. Pipelines in green summarize Priority 1 and 2 R&R pipelines recommended in Chapter 7, as well as COSMUD planned capital improvement projects (with project IDs called out) that are identified in the adopted 2019-2024 Capital Improvement Plan. Facilities indicated in green and/or red were assumed to be online for the near-term (2030) time frame. Facilities in orange and/or gray (dashed lines) are assumed to be online for the future (2040) time frame. Additional facilities (e.g., Well 33, Northeast Reservoir) are not shown on this figure as their sizing is determined in the subsequent Facility Capacity sections of this chapter.

WEST YOST - N:\Clients\129 Stockton\60-20-41 Stockton WMPU\GIS\MXD\Water Master Plan\F8_1_NearTermFacilities.mxd - wjones - 1/26/2021

North Stockton

Study Area1
Delta Water Treatment Plant
WTP
Thornton and Eight Mile Road Arco Station Project
Crystal Bay
Westlake Villages
Northwest
Delta Cove
Sanctuary
North Stockton Projects III
Tra Vigne
Cannery Park
CIP #M18006
Well #33
Well #31
Well #29
Well #18
Well #30
Well #16
CIP #M18004
Well #9
Well #19
Well #24
Well #32
Well #20
Well #10R
Well #7
Well #15
Well #21
Well #26
Well #4
Well #03R
CarMax Superstore
Well #1
Well #11
Well #25
CIP #M18004
Study Area2
Well #28
14 Mile Slough
Well #27
Study Area3
Stockton East Water District
WTP
SAN JOAQUIN RIVER
CALAVERAS RIVER
EIGHT MILE RD
RINGE RD
THORNTON RD
HAMMER LN
WAIN RD
MARCH LN
BROOKSIDE RD
PACIFIC AVE
EL DORADO ST
PERSHING AVE
FREMONT ST
MINER AVE
ARMSTRONG RD
LIVE OAK RD
WEST LN
ASHLEY LN
HILDRETH LN
ALPINE RD
CHEROKEE RD
WATERLOO RD
HOLT RD
ANDREWS DR
99
5
N
0 3,500 7,000
Scale in Feet

South Stockton

Stockton East Water District
WTP
MINER AVE
FREMONT ST
SAN JOAQUIN STREET
CENTER ST
DR MARTIN LUTHER KING JR BLVD
SAN JOAQUIN RIVER
NAVY DR
EIGHTH ST
EL DORADO ST
AIRPORT WAY
POCKLINGTON RD
MARIPOSA RD
CIP #M18007
Mariposa Road Community
Mariposa Industrial Park
Well SSS10
NorCal Logistics Center
Sanchez-Hoggan Annexation Project
Niagara Bottling Facility
Study Area12
Well SSS8
Well SSS9
Well SSS2
Well SSS3
Well SSS1
Study Area14
Airport Way and Sperry Road Commercial Project
Airpark 599
Weston Ranch Towne Center
Weston Ranch
Veterans Affairs Medical Campus
CIP #M20004
CIP #M17016
Study Area15
Tidewater Crossing
South Stockton Commerce Center
Study Area16
Tidewater Crossing
NEWCASTLE RD
JACKSTONE RD
HOWARD RD
TRACY BLVD
99
5
N
0 3,000 6,000
Scale in Feet
CIP #M18002

CIP List:
1. CIP #M17016 includes the installation of an 8" diameter pipeline along Wolfe Rd & Mathews Rd.
2. CIP #M18002 includes replacement & installation of a 16" diameter pipelines along I-5 North of E. Roth Rd.
3. CIP #M18004 includes the decommissioning of Well Sites 1, 9, 11, and 16.
4. CIP #M18006 includes the equipping of Well No. 33.
5. CIP #M18007 includes installation of a 16" diameter water main on Zephyr Road.
6. CIP #M20004 includes a water line extension from Weston Ranch Reservoir to a point where the Veterans Affairs facility will connect for water service.

Notes:
1. Near-term (2030) and future (2040) development pipelines are based on previous development plans. Pipe layout and sizing will be finalized by developers/project proponents as develpment plans are finalized.

Pipelines
- Existing
- Existing System Improvements
- Near-Term (2030) Improvements
- Future (2040) Improvements
- Future Development Pipelines

Wells
- Proposed
- Active
- Inactive
- Standby
- Abandoned

- Water Treatment Plant
- Reservoir & Pump Station
- COSMUD Service Boundary
- City of Stockton Sphere of Influence
- Major Development (Near-Term & Future)
- Study Area Within City's Sphere of Influence
- Study Area Outside of City's Sphere of Influence

Figure 8-1

Near-Term and Future System

City of Stockton
Water Master Plan Update

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8.2 FUTURE WATER DEMANDS

Future demand conditions used in the water system evaluation are based on projected land uses and water use factors discussed in Chapter 3. Projected future demands were added to the existing baseline demands (described in Chapter 3 and Chapter 7) to develop projected near-term (2030) and future (2040) scenario water demands. The future water demands were spatially located in the hydraulic model based on the future development land use areas. The COSMUD future water demands for the near-term (2030) and future (2040) scenarios are summarized in Table 8-1 and Table 8-2, respectively.

Table 8-1. Projected Near-Term (2030) COSMUD Water System Demands

Service Area	Average Day Demand (ADD)[a]		Maximum Day Demand (MDD)[b]		Peak Hour Demand (PHD)[c]	
	gpm	mgd	gpm	mgd	gpm	mgd
North Stockton	16,518	23.8	26,429	38.1	41,296	59.5
South Stockton	6,838	9.8	10,364	14.9	18,425	26.5
Total	**23,356**	**33.6**	**36,794**	**53.0**	**59,721**	**86.0**

(a) The Average Day Demands are based on the existing baseline demands (refer to Table 7-1 in Chapter 7) plus the projected near-term demands (refer to Table 3-15 in Chapter 3).

(b) Maximum day demand calculated using a peaking factor of 1.6 in North Stockton and 1.7 in South Stockton, times the average day demand.

(c) Peak hour demand calculated using a peaking factor of 2.5 in North Stockton and 3.3 in South Stockton, times the average day demand.

As indicated in Table 8-1, the COSMUD near-term average day demands are expected to be 33.6 mgd, or a 20 percent increase over existing baseline demands (previously presented in Table 7-1 in Chapter 7). South Stockton water demands, in particular, are projected to increase by 92 percent by near-term (2030). Most of the increase is associated with the proposed Niagara Bottling Facility, which makes up for 54 percent of the projected demand increase in South Stockton.

Table 8-2. Projected Future (2040) COSMUD Water System Demands

Service Area	Average Day Demand (ADD)[a]		Maximum Day Demand (MDD)[b]		Peak Hour Demand (PHD)[c]	
	gpm	mgd	gpm	mgd	gpm	mgd
North Stockton	20,343	29.3	32,548	46.9	50,857	73.2
South Stockton	9,564	13.8	14,999	21.6	27,421	39.5
Mariposa Road Community	*2,081*	*3.0*	*3,538*	*5.1*	*6,867*	*9.9*
Remaining South Stockton	*7,483*	*10.8*	*11,461*	*16.5*	*20,554*	*29.6*
Overall Total	**29,907**	**43.1**	**47,548**	**68.5**	**78,278**	**112.7**

(a) The Average Day Demands are based on the existing baseline demands (refer to Table 7-1 in Chapter 7) plus the projected future (2040) demands (refer to Table 3-16 in Chapter 3).

(b) Maximum day demand calculated using a peaking factor of 1.6 in North Stockton and 1.7 in South Stockton, times the average day demand

(c) Peak hour demand calculated using a peaking factor of 2.5 in North Stockton and 3.3 in South Stockton, times the average day demand.

As indicated in Table 8-2, the COSMUD future (2040) average day demands are expected to be 43.1 mgd, or a 53 percent increase from existing baseline demands (previously presented in Table 7-1), and a 28 percent increase from near-term (2030) demands. Table 8-2 separates demands associated with the Mariposa Road Community since this future development area makes up a large portion of the future demand and the extent and timing of this development is uncertain. As discussed in the sections below, infrastructure was specifically sized to support the projected demands for Mariposa Road Community summarized in Table 8-2. Should future land use plans change for this future development area, associated infrastructure sizing will need to be reevaluated.

8.3 FUTURE WATER SUPPLY AND WATER SYSTEM FACILITY CAPACITY EVALUATION

To evaluate the capacity of COSMUD water system facilities to support near-term (2030) and future (2040) demands, the following evaluations were conducted:

- Supply Capacity Evaluation
- Pumping Capacity Evaluation
- Storage Capacity Evaluation

The Mariposa Road Community is anticipated to be developed by the future (2040) time frame. Elevations within this future development area are higher than the existing South Stockton water service area. Elevations range from 48 to 56 ft msl in this area, compared to a maximum elevation within the existing South Stockton area of 46 ft msl. This increase in elevation results in lower static pressures, as low as 44 psi, based on the current delivery pressure from SEWD (57 psi or about 166 ft hydraulic grade line). Dynamic pressures (i.e., peak demand conditions with head loss) would be sufficiently lower that they would not meet the recommended criterion for minimum pressure of 45 psi. Therefore, to serve this area it is recommended that a new pressure zone be established, along with associated infrastructure. In general, the following would be required to provide water service for this future development area:

- **New Storage Reservoir**. This reservoir would be supplied/filled by the existing South Stockton area pipelines.
- **New Reservoir Pump Station**. This reservoir pump station would pump water from the new storage reservoir and would discharge to the new pressure zone.
- **Groundwater Well**. To reduce the size of the new storage reservoir, a new well is also recommended for this future development area to increase the EGWC. While this well could also offset pumping requirements at the new reservoir pump station, the reservoir pump station is recommended to sized so that it has sufficient pumping capacity to supply the area in the event the new well is offline. This well also provides supply reliability to the future development area, and the South Stockton water service area, by diversifying the water supply for the area and reducing the dependency on SEWD.

- **Interconnections with existing South Stockton Area**. It is recommended that this future development area be interconnected with the existing South Stockton area at a few key locations. These interconnections should be identified as development plans progress and should generally include:
  - Pressure Reducing/Sustaining Valves allowing water from the new pressure zone to flow into the existing South Stockton area, in the event pressures drop (i.e., under fire flow conditions)
  - Check valves allowing water from the existing South Stockton area to flow into the new pressure zone in the event pressures drop in the new pressure zone (i.e., under fire flow conditions)

Sizing for the above listed facilities is based on the currently projected water demands for the Mariposa Community Road area, discussed in Chapter 3, and presented in the following sections. It is expected that land use plans for this area will change in the future. Therefore, projected water demands (and/or timing of future development) within the Mariposa Road Community will need to be reevaluated as future development plans are confirmed, and associated infrastructure sizing (and/or timing) will also need to be reevaluated.

8.3.1 Supply Capacity Evaluation

As described in Chapter 5, the recommended supply capacity criterion requires the COSMUD to provide enough firm supply capacity to equal the maximum day demand. Table 8-3 and Table 8-4 show the firm supply capacity compared to maximum day demand in North Stockton and South Stockton for the near-term (2030) and future (2040) demand conditions, respectively. The COSMUD water supply is provided by both surface water and groundwater, and their respective firm capacities are summarized as follows.

- For North Stockton, 100 percent of DWTP is assumed for firm surface water supply.
- For South Stockton, surface water supply from SEWD was assumed to be limited to approximately 70 percent of the South Stockton maximum day demand. The approach was undertaken to diversify the water supply portfolio and plan for additional redundant local supplies to meet the remaining 30 percent of a maximum day demand. While this assumption is more conservative than the firm capacity assumption, it provides more flexibility under drought conditions. Refer to Chapter 4 for more discussion regarding this assumption.
- The firm groundwater supply capacity is calculated as 85 percent of the production capacity of active wells (i.e., does not include standby or inactive wells) in North Stockton and South Stockton, respectively. Refer to Chapter 5 for more discussion regarding this assumption.

As shown in Table 8-3, there is a surplus of supply in both the North Stockton and South Stockton water service areas, and no additional supply is needed for near-term (2030) conditions. However, as discussed in Chapter 7, the new Well SSS10 is recommended to help meet the existing storage capacity deficit in South Stockton. Similarly, as discussed in the storage capacity evaluation below, there is a storage capacity deficit by the near-term (2030) time frame for which it is recommended that one of the existing standby wells in South Stockton (Well SSS2) be rehabilitated and equipped with backup power. Both the new Well SSS10 and recommended improvements to Well SSS2 provide an additional source of supply which is reflected in Table 8-3.

Table 8-3. Near-Term (2030) Comparison of Available versus Required Supply Capacity

Available or Required Capacity	Notes/Basis	Capacity	
		gpm	mgd
North Stockton			
Supply			
Existing Firm Well Supply Capacity	[A] 85 percent of the capacity of active wells (Wells 3R, 10R, 18, 19, 21, 27, 29, 30, 31, 32)	16,916	24.4
Existing Surface Water Supply	[B] Full DWTP Capacity	20,833	30.0
Total Supply Capacity	[C] = [A] + [B]	37,749	54.4
Demand			
Near-Term Maximum Day Demand	[D] 1.6 times ADD (refer to Table 8-1)	26,430	38.1
North Stockton Supply Capacity Surplus (Deficit)	**[E] = [C] – [D]**	**11,319**	**16.3**
South Stockton			
Supply			
Existing Firm Well Supply Capacity	[F] 85 percent of the capacity of active wells (SSS3, SSS9)	4,118	5.9
Existing Surface Water Supply	[G] 70 percent of South Stockton MDD, (refer to Table 8-11)	7,255	10.4
Total Supply Capacity	[H] = [F] + [G]	11,373	16.4
Demand			
Near-Term Maximum Day Demand	[I] 1.7 times ADD (refer to Table 8-1)	10,364	14.9
South Stockton Supply Capacity Surplus (Deficit)	**[J] = [H] - [I]**	**1,009**	**1.5**
Additional Supply			
Additional Firm Well Supply Capacity from Well SSS10	[K] 85 percent of the assumed 2,000 gpm capacity	1,700	2.4
South Stockton Supply Capacity Surplus (Deficit) with Existing System Improvements	**[L] = [J] + [K]**	**2,709**	**3.9**
Additional Firm Well Supply Capacity from Well SSS2	[M] 85 percent of the capacity of standby Well SSS2	1,101	1.6
South Stockton Supply Capacity Surplus (Deficit) with Near-Term System Improvements	**[N] = [L] + [M]**	**3,810**	**5.5**

Table 8-4 summarizes supply capacity evaluation for the future (2040) demand conditions. As shown in Table 8-4, there is surplus supply capacity in both the North Stockton and South Stockton water service areas. Similar to the near-term time frame, at future an additional well in South Stockton is recommended to be rehabilitated and equipped with backup power for the purposes of increasing storage capacity. Well SSS8 is recommended to be rehabilitated by the future (2040) timeframe. While Well SSS8 is not needed for supply purposes, it does provide an additional source of supply which is reflected in Table 8-4.

Table 8-4. Future (2040) Comparison of Available versus Required Supply Capacity

Available or Required Capacity	Notes/Basis	Capacity	
		gpm	mgd
North Stockton			
Supply			
Existing Firm Well Supply Capacity	[A] 85 percent of the capacity of active wells (Wells 3R, 10R, 18, 19, 21, 27, 29, 30, 31, 32)	16,916	24.4
Existing Surface Water Supply	[B] Full DWTP Capacity	20,833	30.0
Total Supply Capacity	[C] = [A] + [B]	37,749	54.4
Demand			
Future Maximum Day Demand	[D] 1.6 times ADD (refer to Table 8-2)	32,549	46.9
North Stockton Supply Capacity Surplus (Deficit)	[E] = [C] – [D]	**5,200**	**7.5**
Additional Supply			
Construction of Well 33	[F] 85 percent of the assumed 1,500 gpm capacity	1,275	1.8
North Stockton Supply Capacity Surplus (Deficit) with Future System Improvements	**[G] = [E] + [F]**	**6,475**	**9.3**
South Stockton			
Supply			
Existing Firm Well Supply Capacity	[H] 85 percent of the capacity of active wells (Wells SSS3 and SSS9)	4,118	5.9
Existing Surface Water Supply	[I] 70 percent of South Stockton MDD (refer to Table 8-2)	10,499	15.1
Total Supply Capacity	[J] = [H] + [I]	14,617	21.0
Demand			
Future Maximum Day Demand	[K] 1.7 times ADD (refer to Table 8-2)	14,999	21.6
South Stockton Supply Capacity Surplus (Deficit)	**[L] = [J] - [K]**	**(382)**	**(0.5)**
Additional Supply			
Additional Firm Well Supply Capacity from Existing and Near-Term System Improvements (Wells SSS10 and SSS2)	[M] 85 percent of the assumed 2,000 gpm capacity for Well SSS10 and existing capacity of Well SSS2	2,801	4.0
South Stockton Supply Capacity Surplus (Deficit) with Existing and Near-Term System Improvements	**[N] = [L] + [M]**	**2,419**	**3.5**
Additional Firm Well Supply Capacity to Improve Future System Storage / Improve Reliability (Rehabilitate Well SSS8)	[O] 85 percent of the capacity of standby Well SSS8	859	1.2
South Stockton Supply Capacity Surplus (Deficit) with Future System Improvements	**[P] = [N]+ [O]**	**3,278**	**4.7**

8.3.2 Pumping Capacity Evaluation

Pumping capacity was evaluated to assess the ability of the COSMUD to deliver a reliable firm capacity to meet the greater of either the maximum day demand plus a large fire flow event or the peak hour demand, as described in Chapter 5, under both near-term or future demand conditions. Pumping capacity is provided by a combination of supply facilities (i.e., treatment plants and groundwater wells) and reservoir pump stations. Firm pumping capacity provided by treatment plants and groundwater wells is evaluated in a manner identical to the supply capacity evaluation described above. For reservoir pump stations, a reduction in total pumping capacity is assumed to account for pumps that could be out of service due to various operational problems or maintenance at any given time. For both North Stockton and South Stockton, firm pumping capacity is defined as the total pump station capacity with the largest pump out of service.

Table 8-5 and Table 8-6 show the firm pumping capacity compared to the peak hour demand in North Stockton and South Stockton for the near-term (2030) and future (2040) demand conditions, respectively. For both North Stockton and South Stockton, under both near-term and future demand conditions, there is a surplus of pumping capacity with the storage/well improvements recommended in the storage capacity evaluation section, as described below.

Table 8-6 shows the required pumping capacity associated with the Mariposa Road Community, separate from the remaining South Stockton area. Pumping capacity for this area was evaluated separately because this area would be a new pressure zone and would be supplied by associated facilities, as discussed previously. The controlling scenario for the pumping requirement to this area is the maximum day demand plus fire flow condition, or about 11.6 mgd. As previously discussed, while pumping capacity could be met through a combination of the recommended well and associated reservoir pump station, it is recommended that the reservoir pump station be sized to meet the full pumping requirement in the event the groundwater well is out of service. Therefore, it is recommended that the reservoir pump station be sized at a firm capacity of 12.0 mgd. With the reservoir pump station and well, however, there is a 2.3 mgd pumping capacity surplus.

Table 8-5. Near-Term (2030) Comparison of Available versus Required Pumping Capacity

Available or Required Capacity	Notes/Basis	Capacity	
		gpm	mgd
North Stockton			
Requirement			
Required Maximum Day Demand Plus Fire Flow[(a)]	[A] MDD (refer to Table 8-1) plus a large industrial Fire Flow (4,500 gpm)	30,930	44.5
Required Peak Hour Demand	[B] 2.5 times ADD (refer to Table 8-1)	41,296	59.5
Pumping Capacity Requirement	[C] = [A] + [B]	41,296	59.5
Capacity			
Existing Firm Pump Capacity at Reservoir Sites	[D] Total pump capacity with the largest pump offline at each reservoir site	31,450	45.3
Existing Firm Pump Capacity at Treatment Plants	[E] Limited to the existing capacity of the Delta Water Treatment Plant	20,833	30.0
Existing Firm Well Capacity	[F] 85 percent of the capacity of active wells (Wells 3R, 10R, 18, 19, 21, 27, 29, 30, 31, 32)	16,916	24.4
Total Existing Available Firm Capacity	[G] = [D] + [E] + [F]	69,199	99.6
North Stockton Existing Pumping Capacity Surplus (Deficit)	**[H] = [G] - [C]**	**27,903**	**40.2**
South Stockton			
Requirement			
Required Maximum Day Demand Plus Fire Flow[(a)]	[I] MDD (refer to Table 8-1) plus a large industrial Fire Flow (4,500 gpm)	14,864	21.4
Required Peak Hour Demand	[J] 3.3 times ADD (refer to Table 8-1)	18,425	26.5
Pumping Capacity Requirement	[K] = [I] + [J]	18,425	26.5
Existing Capacity			
Existing Firm Pump Capacity at Reservoir Sites	[L] Total pump capacity with the largest pump offline at each reservoir site	9,000	13.0
Existing Firm Pump Capacity at Treatment Plants	[M] 70 percent of South Stockton MDD (refer to Table 8-1)	7,255	10.4
Existing Firm Well Capacity	[N] 85 percent of the capacity of active wells (Wells SSS3 and SSS9)	4,118	5.9
Total Existing Available Firm Capacity	[O] = [L] + [M] + [N]	20,373	29.3
South Stockton Existing Pumping Capacity Surplus (Deficit)	**[P] = [O] - [K]**	**1,948**	**2.8**
Improved Capacity			
Additional Firm Well Supply Capacity from Well SSS10[(d)]	[Q] 85 percent of the assumed 2,000 gpm capacity	1,700	2.4
South Stockton Pumping Capacity Surplus (Deficit) with Existing System Improvements	**[R] = [P] + [Q]**	**3,648**	**5.3**
Additional Firm Well Supply Capacity from Well SSS2	[S] 85 percent of the capacity of existing standby Well SSS2	1,101	1.6
South Stockton Pumping Capacity Surplus (Deficit) with Near-Term System Improvements	**[T] = [R] + [S]**	**4,749**	**6.8**

(a) The large industrial fire flow does not include demand for on-site sprinkler flow.

Table 8-6. Future (2040) Comparison of Available versus Required Pumping Capacity

Available or Required Capacity	Notes/Basis	Capacity	
		gpm	mgd
North Stockton			
Requirement			
Required Maximum Day Demand Plus Fire Flow[(a)]	[A] MDD (refer to Table 8-2) plus a large industrial Fire Flow (4,500 gpm)	37,049	53.4
Required Peak Hour Demand	[B] 2.5 times ADD (refer to Table 8-2)	50,857	73.2
Pumping Capacity Requirement	[C] = [A] + [B]	50,857	73.2
Capacity			
Existing Firm Pump Capacity at Reservoir Sites	[D] Total pump capacity with the largest pump offline at each reservoir site	31,450	45.3
Existing Firm Pump Capacity at Treatment Plants	[E] Limited to the existing capacity of the Delta Water Treatment Plant	20,833	30.0
Existing Firm Well Capacity	[F] 85 percent of the capacity of active wells (Wells 3R, 10R, 18, 19, 21, 27, 29, 30, 31, 32)	16,916	24.4
Total Existing Available Firm Capacity	[G] = [D] + [E] + [F]	69,199	99.6
North Stockton Existing Pumping Capacity Surplus (Deficit)	**[H] = [G] - [C]**	**18,342**	**26.4**
Improved Capacity			
Construction of Well 33	[I] 85 percent of the assumed 1,500 gpm capacity	1,275	1.8
Construction of Northeast Reservoir Pump Station	[J] 12.0 MGD firm capacity, sized based on the ability to fully empty tank in 8 hours	8,333	12.0
North Stockton Supply Capacity Surplus (Deficit) with Future System Improvements	**[K] = [H] + [I] + [J]**	**27,951**	**40.2**
South Stockton			
Requirement			
Required Maximum Day Demand Plus Fire Flow[(a)]	[L] MDD (refer to Table 8-2) plus a large industrial Fire Flow (4,500 gpm)	19,499	28.1
Required Peak Hour Demand	[M] 3.3 times ADD (refer to Table 8-2)	24,092	34.7
Pumping Capacity Requirement	[N] = [L] + [M]	24,092	34.7
Existing Capacity			
Existing Firm Pump Capacity at Reservoir Sites	[O] Total pump capacity with the largest pump offline at each reservoir site	9,000	13.0
Existing Firm Pump Capacity at Treatment Plants	[P] 70 percent of South Stockton MDD (refer to Table 8-2)	10,499	15.1
Existing Firm Well Capacity	[Q] 85 percent of the capacity of active wells (Wells SSS3 and SSS9)	4,118	5.9
Total Existing Available Firm Capacity	[R] = [O] + [P] + [Q]	23,617	34.0
South Stockton Existing Pumping Capacity Surplus (Deficit)	**[S] = [R] - [N]**	**(474)**	**(0.7)**
Improved Capacity			
Added Firm Well Capacity to Improve Existing and Near-Term System	[T] Additional capacity of Well SSS10, assuming a pumping capacity of 2,000 gpm and rehabilitation of Well SSS2 (85 percent of total capacity assumed for firm capacity)	2,801	4.0
South Stockton Pumping Capacity Surplus (Deficit) with Existing and Near-Term System Improvements	**[U] = [S] + [T]**	**2,327**	**3.4**
Added Firm Well Capacity to Improve Future System Storage and Reliability	[V] Rehabilitation of Well SSS8 (85 percent of total capacity assumed for firm capacity)	859	1.2
South Stockton Pumping Capacity Surplus (Deficit) with Future System Improvements	**[W] = [U] + [V]**	**3,185**	**4.6**
Mariposa Road Community			
Requirement			
Required Maximum Day Demand Plus Fire Flow[(a)]	[X] Maximum Day Demand (refer to Table 8-2) plus a large industrial Fire Flow (4,500 gpm)	8,038	11.6
Required Peak Hour Demand	[Y] Existing Peak Hour Demand (refer to Table 8-2)	6,867	9.9
Mariposa Road Community Pumping Capacity Requirement	[Z] = [X] + [Y]	8,038	11.6
Improved Capacity			
Added Pumping Capacity associated with new 3.5 MG storage reservoir for Mariposa Road Community	[AA] 12.0 MGD firm capacity, sized based on the ability to fully empty tank in 8 hours	8,333	12.0
Additional Capacity from New Well	[AB] New well assumed to supply 1,500 gpm (85 percent of total capacity assumed for firm capacity)	1,275	1.8
Mariposa Road Community Pumping Capacity Surplus (Deficit) with Future System Improvements	**[AC] = [AA] + [AB] - [Z]**	**1,570**	**2.3**

(a) The large industrial fire flow does not include demand for on-site sprinkler flow.

8.3.3 Storage Capacity Evaluation

Water storage provides operational storage to balance differences in demands and supplies, emergency storage in case of a supply failure, and water to fight fires. The COSMUD water system has two sources of available storage: above-ground storage (i.e., storage reservoirs) and storage available in the groundwater basin. Together, these two sources of storage must be sufficient to meet the COSMUD operational, emergency, and fire flow storage criteria.

As introduced in Chapter 5, the COSMUD water storage capacity requirement is as follows:

- Operational storage equal to 25 percent of a maximum day demand
- Fire flow storage equal to the largest fire flow rate multiplied by its duration
- Emergency storage equal to one average day demand

Because the COSMUD water supply includes groundwater wells and treated surface water, the groundwater basin and treatment facilities can offset some of the required storage in the form of storage credits. A summary of available storage capacity and credits is provided below:

- Existing available storage is defined as the storage provided by all active reservoirs
- The Emergency Groundwater Storage Credit (EGWC) equals 85 percent of the active groundwater wells that can be reliably accessed (i.e., well facilities equipped with auxiliary power)
- The Treated Surface Water Supply Credit (TSWC) equals the smaller of the two treatment facilities available in North Stockton. There is no treated surface water credit available for South Stockton because water from DWTP cannot be transferred to South Stockton, providing no redundant treated surface water supply. Since the COSMUD aims to maximize its use of SEWD water in South Stockton, the maximum credit that can be taken is difference between the full SEWD capacity (i.e., 30 mgd) and South Stockton maximum day demands.
- Combined, the EGWC and TSWC cannot exceed the emergency storage requirement

Existing water storage facilities, in conjunction with the available EGWC and TSWC, were evaluated to determine whether the COSMUD existing storage capacity provides the recommended operational, emergency, and fire flow storage for existing demands. Table 8-7 and Table 8-8 provide a comparison of available and required storage capacity for near-term (2030) and future (2040) timeframes, respectively.

As shown in Table 8-7 below, for the near-term demand condition, there is a surplus of storage capacity in North Stockton[26] and a storage capacity deficit in South Stockton of 6.1 mgd, with Well SSS10 included as recommended in the existing system analysis. To alleviate the storage capacity deficit in South Stockton, it is recommended that existing and/or rehabilitated groundwater wells be equipped with backup power. The addition of backup power at wells maximizes the COSMUD ability to generate EGWCs. Existing Wells SSS3 and SSS9 do not currently have backup power and are recommended to be equipped

[26] In subsequent sections of this chapter it is recommended that two existing wells be either rehabilitated or replaced in North Stockton by the near-term time frame. A groundwater study is also recommended in subsequent sections of this chapter to identify which wells should be rehabilitated. Capacity increases associated from rehabilitation of these wells are not accounted for and would result in an increased storage capacity surplus.

with backup power to increase the EGWC for South Stockton. Equipping Wells SSS3 and SSS9 alone does not fully mitigate the projected storage deficit. Therefore, it is recommended that Well SSS2 be rehabilitated back to active status and equipped with backup power. Well SSS2 is currently out of service due to elevated concentrations of 1,2,3-Trichloropropane (TCP). To rehabilitate this well, it is assumed that a granular activated carbon treatment system would be installed since this has been deemed a best available technology (BAT) by California Division of Drinking Water for treatment for TCP[27].

As shown in Table 8-8 below, for the future demand condition there is a storage capacity deficit in North Stockton and a slight surplus in South Stockton. To alleviate the storage capacity deficit in North Stockton, it is recommended that COSMUD planned Well 33 be constructed and equipped with backup power. The remainder of the capacity deficit would be mitigated by the new Northeast Reservoir and Reservoir Pump Station. It is recommended that this reservoir and pump station be sized at 4.0 MG, which would be adequate to cover the storage capacity deficit if one of the existing northeast wells is out of service (i.e., Wells 10R, 31, 32, future Well 33), where pressures are lower during maximum day and peak hour conditions.

Although there is a small storage capacity surplus in South Stockton (0.1 mgd), it is recommended that Well SSS8 be rehabilitated back to active status and equipped with backup power. Table 8-7, for the near-term timeframe, assumes 100 percent of the existing pumping capacity of Well SSS2. However, since Well SSS2 will require wellhead treatment, it is likely that the full capacity of this well will not be recovered, resulting in a storage capacity deficit (since the EGWC will be reduced). Rehabilitating Well SSS8 will provide the COSMUD with additional flexibility in South Stockton if the recovered capacity at Well SSS2 is any less than 100 percent and would ensure that the needed storage capacity is met. In addition, having an additional local supply source also helps to diversify the COSMUD water supply, and further reduces the reliance on SEWD.

[27] The existing SSS2 well site is located in a parking lot outside of an industrial building, and therefore cannot accommodate the additional footprint associated with wellhead treatment. It is likely wellhead treatment be sited at the nearby SSS8, which is located at a park and can accommodate the additional footprint associated with wellhead treatment. Therefore, a dedicated pipeline from SSS2 to SSS8 will need to be constructed. This alternative is recommended to be further investigated as part of the recommended Groundwater Study, discussed in subsequent sections. For cost estimating purposes, a new well cost is assumed for this improvement and is discussed in further detail in Chapter 9.

Table 8-7. Near-Term (2030) Comparison of Available versus Required Storage Capacity

Available or Required Capacity	Notes/Basis	Storage, mg
North Stockton		
Requirement		
Operational	[A] 25 percent of MDD (refer to Table 8-1)	9.5
Fire Flow	[B] One fire event: 4,000 gpm @ 4 hours (refer to Chapter 5)	1.0
Emergency	[C] One ADD (refer to Table 8-1)	23.8
Total Storage Requirement	[D] = [A] + [B] + [C]	34.3
Capacity		
Existing Available Storage Capacity	[E] Includes all active reservoirs	16.2
Treated Surface Water Supply Credit	[F] Assumes North Stockton Pipeline Hypochlorite Facility is complete, so SEWD is connected to North Stockton. The smaller of the two WTPs (DWTP) can be used for the treated surface water supply credit	10.2
Emergency Groundwater Storage Credit	[G] 85 percent of the active wells equipped with backup power (Wells 3R, 29, 30, 31, 32)	13.6
Total Storage Capacity	[H] = [E] + [F] + [G]	40.0
North Stockton Existing Storage Capacity Surplus (Deficit)	**[I] = [H] - [D]**	**5.7**
South Stockton		
Requirement		
Operational	[J] 25 percent of MDD (refer to Table 8-1)	3.7
Fire Flow	[K] One fire event: 4,000 gpm @ 4 hours (refer to Chapter 5)	1.0
Emergency	[L] One ADD (refer to Table 8-1)	9.8
Total Storage Requirement	[M] = [J] + [K] + [L]	14.5
Capacity		
Existing Available Storage Capacity	[N] Includes all active reservoirs	6.0
Treated Surface Water Supply Credit	[O] No credit taken, since water from DWTP cannot be transferred to South Stockton	0.0
Emergency Groundwater Storage Credit	[P] 85 percent of the active wells equipped with backup power (none)	0.0
Total Storage Capacity	[Q] = [N] + [O] + [P]	6.0
South Stockton Existing Storage Capacity Surplus (Deficit)	**[R] = [Q] - [M]**	**(8.5)**
Improved Capacity		
Added Emergency Groundwater Storage Credit from Well SSS10	[S] 85 percent of the assumed 2,000 gpm capacity	2.4
South Stockton Storage Capacity Surplus (Deficit) with Existing System Improvements	**[T] = [R] + [S]**	**(6.1)**
Additional Emergency Groundwater Storage Credit from equipping Wells SSS3 and SSS9 with backup power	[U] 85 percent of the capacity of existing active Wells SSS3 and SSS9	5.9
Additional Emergency Groundwater Storage Credit from Rehabilitating Well SSS2	[V] 85 percent of the capacity of existing standby Well SSS2	1.6
South Stockton Storage Capacity Surplus (Deficit) with Near-Term System Improvements	**[W] = [T] + [U] + [V]**	**1.5**

Table 8-8. Future (2040) Comparison of Available versus Required Storage Capacity

Available or Required Capacity	Notes/Basis	Storage, mg
North Stockton		
Requirement		
Operational	[A] 25 percent of MDD (refer to Table 8-2)	11.7
Fire Flow	[B] One fire event: 4,000 gpm @ 4 hours (refer to Chapter 5)	1.0
Emergency	[C] One ADD (refer to Table 8-2)	29.3
Total Storage Requirement	[D] = [A] + [B] + [C]	42.0
Capacity		
Existing Available Storage Capacity	[E] Includes all active reservoirs	16.2
Treated Surface Water Supply Credit	[F] Assumes the North Stockton Pipeline Hypochlorite Facility is complete, so SEWD is connected to North Stockton. The smaller of the two WTPs (DWTP) can be used for the treated surface water supply credit	8.4
Emergency Groundwater Storage Credit	[G] 85 percent of the active wells equipped with backup power (Wells 3R, 29, 30, 31, 32)	13.6
Total Storage Capacity	[H] = [E] + [F] + [G]	38.2
North Stockton Existing Storage Capacity Surplus (Deficit)	**[I] = [H] - [D]**	**(3.8)**
Improved Capacity		
Construction of Well 33 with backup power[(e)]	[J] 85 percent of the capacity of new well (assumed to be 1,500 gpm)	1.8
Construction of Northeast Reservoir	[K] Recommended Northeast Reservoir 4 MG nominal capacity, in the event of a well in northeast area is offline	4.0
North Stockton Buildout Storage Capacity Surplus (Deficit) with Future System Improvements	**[L] = [I] + [J] + [K]**	**2.0**
South Stockton		
Requirement		
Operational	[M] 25 percent of MDD (refer to Table 8-2)	4.1
Fire Flow	[N] One fire event: 4,000 gpm @ 4 hours (refer to Chapter 5)	1.0
Emergency	[O] One ADD (refer to Table 8-2)	10.8
Total Storage Requirement	[P] = [M] + [N] + [O]	15.9
Capacity		
Existing Available Storage Capacity	[Q] Includes all active reservoirs	6.0
Treated Surface Water Supply Credit	[R] No credit taken, since North Stockton and South Stockton remain hydraulically separate	0.0
Emergency Groundwater Storage Credit[(e)]	[S] 85 percent of the active wells equipped with backup power (none)	0.0
Total Storage Capacity	[T] = [Q] + [R] + [S]	6.0
South Stockton Existing Storage Capacity Surplus (Deficit)	**[U] = [T] - [P]**	**(9.9)**
Improved Capacity		
Added Emergency Groundwater Storage Credit from Existing and Near-Term System Improvements (Well SSS10)[(e)]	[V] 85 percent of the assumed 2,000 gpm capacity	2.4
Additional Emergency Groundwater Storage Credit from equipping Wells SSS3 and SSS9 with backup power	[W] 85 percent of the capacity of existing Wells SSS3 and SSS9	5.9
Additional Emergency Groundwater Storage Credit from rehabilitating Well SSS2	[X] 85 percent of the capacity of existing standby Well SSS2	1.6
South Stockton Storage Capacity Surplus (Deficit) with Existing and Near-Term System Improvements	**[Y] = [U] + [V] + [W] + [X]**	**0.1**
Additional Emergency Groundwater Storage Credit from Well SSS8	[Z] 85 percent of the capacity of existing standby Well SSS8	1.2
South Stockton Storage Capacity Surplus (Deficit) with Future System Improvements	**[AA] = [Y] + [Z]**	**1.3**
Mariposa Road Community		
Requirement		
Operational	[AB] 25 percent of MDD (refer to Table 8-2)	1.3
Fire Flow	[AC] One fire event: 4,000 gpm @ 4 hours (refer to Chapter 5)	1.0
Emergency	[AD] One ADD (refer to Table 8-2)	3.0
Mariposa Road Community Total Storage Requirement	[AE] = [AB] + [AC] + [AD]	5.3
Improved Capacity		
New Storage Reservoir for Mariposa Road Community	[AF] Recommended Mariposa Reservoir 3.5 MG nominal capacity	3.5
Additional Well to improve supply reliability and to contribute to emergency groundwater storage credit	[AG] 85 percent of the assumed 1,500 gpm capacity	1.8
Mariposa Road Community Storage Capacity Surplus (Deficit)	**[AH] = [AF] + [AG] - [AE]**	**0.0**

8.4 FUTURE WATER DISTRIBUTION SYSTEM PERFORMANCE EVALUATION

The water distribution system performance evaluation identifies necessary improvements to the COSMUD water distribution system to support the COSMUD near-term (2030) and future (2040) water demands while meeting the COSMUD recommended water system planning and design criteria, presented in Chapter 5. The following evaluations were performed to assess water distribution system performance under existing water demand conditions:

- Normal Operations – Maximum Day Demand with Peak Hour Scenario: This scenario evaluated service pressures during a peak hour on the maximum day demand condition.
- Emergency Operations – Maximum Day Demand plus Fire Flow Scenario: This scenario evaluated system fire flow availability under a maximum day demand condition.

The water system hydraulic model, updated with the proposed improvements to the existing system from Chapter 7, was used to evaluate the near-term (2030) and future (2040) water system performance. Additional facilities (i.e., pipes and new wells) to provide service to projected future development areas were also included in the hydraulic model, as shown on Figure 8-1. In addition, recommended improvements identified in the facility capacity evaluation above were also incorporated into the hydraulic model. The water distribution system is expected to deliver maximum day with peak hour demand flows and maximum day demand plus fire flow, at near-term (2030) and future (2040) demand conditions, within the acceptable pressure and velocity ranges as identified in the water system performance and operational criteria presented in Chapter 5.

8.4.1 Normal Operations – Maximum Day Demand with Peak Hour

8.4.1.1 Evaluation Overview

An EPS was conducted using the hydraulic model to evaluate system performance under a maximum day with a peak hour demand condition for both near-term (2030) and future (2040) demand conditions. The diurnal pattern previously presented in Chapter 3 was incorporated into the hydraulic model for both demand conditions and evaluated for seven consecutive days; however, only results from the last three days of the simulations were used, as these results are not affected by initial conditions. Table 8-1 summarizes system demands for the near-term (2030) demand condition and Table 8-2 summarizes system demands for the future (2040) demand condition.

During both a maximum day demand scenario and a peak hour demand scenario, a minimum pressure of 45 psi and a maximum pressure of 80 psi must be maintained at service connections throughout the entire system. In addition, for pipelines, it is recommended that the maximum velocity not exceed 5 fps. The near-term and future system analyses assume the maximum day and peak hour demand would be met by a combination of surface water treatment plants, active groundwater wells, and storage reservoirs via their associated reservoir pump stations.

8.4.1.2 Near-Term (2030) System Evaluation Results

Results from the maximum day with peak hour demand condition for near-term (2030) demand conditions indicate that the water distribution system generally meets the COSMUD minimum and maximum pressure criteria at most customer service locations. Figure 8-2 presents the minimum pressures observed during the EPS simulation.

For North Stockton, SEWD is assumed to be supplying North Stockton via the North Stockton Pipeline Hypochlorite Facility as this project is anticipated to be complete by 2030. Discharge pressure at DWTP was increased to 58 psi to limit the supply from SEWD. As a result of SEWD supplying North Stockton and the increase of the DWTP discharge pressure, minimum pressure results for the near-term system generally improve as compared to the existing system evaluation. Minimum pressures in the northeast remain above 50 psi. Maximum pressures throughout the entire service area do not exceed 73 psi (observed in the northwest at low elevations).

For South Stockton, some locations south of Weston Ranch Reservoir and east of Well SSS3 do not meet the minimum pressure criterion but remain predominantly greater than 40 psi. Improvements to address this area are not recommended since all pipeline velocity and head loss gradients in the area meet recommended criteria. In addition, in the future (2040), the nearby Mariposa Road Community pressure zone would have interconnections in these areas with low pressure. These connections would help improve observed low pressures. Distribution system pressures vary from a high of 71 psi in the northwest corner of the South Stockton system to a low of 41 psi east of Well SSS3, with the exception of the customer service location at the end of a 2-inch diameter dead-end pipeline in central South Stockton, previously identified in the existing system analysis.

Discharge pipelines at groundwater well facilities and reservoir pump stations have maximum velocities that vary between 5.6 and 9 fps. While these velocities exceed maximum recommended velocities, improvements are not recommended at these locations as they are experienced for a short distance and do not impact the primary criterion, customer service pressure. Simulated velocity results for the maximum day with peak hour demand condition indicate that the remaining pipelines within the COSMUD water system meet the velocity criterion of 5 fps, and therefore no pipeline improvements are recommended for the maximum day with peak hour demand condition.

Figure 8-3 shows reservoir water level fluctuations in system reservoirs throughout the EPS. As shown on Figure 8-3, the Northwest and Fourteen-Mile Slough Reservoirs follow a repetitive turnover cycle, cycling at least once a day. In South Stockton, Weston Ranch Reservoir level fluctuations are more cyclical due to the increased demand by near-term (2030).

8.4.1.3 Future (2040) System Evaluation Results

Results from the maximum day with peak hour demand condition for the future (2040) demand conditions indicates that the water distribution system generally meets the COSMUD minimum and maximum pressure criteria for at most customer service locations. Figure 8-4 presents the minimum pressures observed during the EPS simulation.

For North Stockton, for this evaluation, it is assumed that SEWD will not supply North Stockton via the North Stockton Pipeline Hypochlorite Facility, and supply from DWTP will be maximized up to 29 mgd. The intent of this assumption was to identify pipeline restrictions downstream of DWTP if the COSMUD maximized surface water supplies from the DWTP. In addition, the new Northeast Reservoir and new Well 33 are assumed to be online, as recommended in the facility capacity evaluation sections. As shown

on Figure 8-4, minimum pressures are slightly less than near-term results, but still generally meet the minimum pressure criterion. A few locations do experience minimum pressures less than 45 psi, but local improvements are not recommended as velocity and head loss criteria in pipelines are met. However, the existing 42-inch diameter transmission pipelines downstream of the DWTP finished water pump station experience velocities greater than 5 fps (up to a maximum of 6.5 fps), the maximum velocity criterion for transmission mains. It is recommended that new 36-inch diameter transmission lines be constructed to provide additional conveyance capacity from the DWTP finished water pump station. Since these pipelines are needed to meet demands in the future and/or to maximize supply from DWTP, these pipelines should be completed by 2040 and are recommended to be coupled with development north of Bear Creek. Figure 8-5 shows minimum pressure results with these recommended pipelines incorporated.

For South Stockton, results generally look identical to the near-term (2030) minimum pressure results. The customer service location at the end of a 2-inch diameter dead-end pipeline in central South Stockton continues to experience low pressures, this was previously identified in Chapter 7. It is recommended that this pipeline be replaced as part of the Priority 3 rehabilitation and replacement program discussed in Chapter 7. The Mariposa Road Community area was configured to be served by a recommended new reservoir and associated reservoir pump station, and all pressure and velocity criteria is met under this configuration.

Discharge pipelines at groundwater well facilities and reservoir pump stations have maximum velocities that vary between 5.6 and 9 fps. While these velocities exceed maximum recommended velocities, improvements are not recommended at these locations as they are experienced for a short distance and do not impact the primary criterion, customer service pressure. Simulated velocity results for the maximum day with peak hour demand condition indicate that the remaining pipelines within the COSMUD water system meet the velocity criterion of 5 fps and therefore no pipelines additional improvements are recommended for the maximum day with peak hour demand condition, except for the recommended transmission mains to mitigate velocities observed downstream of the DWTP.

Figure 8-6 shows reservoir water level fluctuations in system reservoirs throughout the EPS. The Northwest, Fourteen-Mile Slough, and proposed Northeast Reservoirs follow a repetitive turnover cycle, cycling at least once a day. In South Stockton, the Weston Ranch and the Mariposa Road Community Reservoirs also follow a repetitive turnover cycle, cycling at least once a day.

WEST YOST - N:\Clients\129 Stockton\60-20-41 Stockton WMPU\GIS\MXD\Water Master Plan\F8_2_MDDMinResults_NTSys.mxd - wjones - 1/26/2021

North Stockton

Delta Water Treatment Plant
WTP
Well #29
Well #30
Well #18
Northwest
Well #31
Well #19
Well #32
Well #10R
Well #21
Well #03R
14 Mile Slough
Well #27
Stockton East Water District
WTP
0 3,500 7,000
Scale in Feet

South Stockton

WTP
Stockton East Water District
Well SSS10
Well SSS9
Well SSS3
Weston Ranch
0 3,000 6,000
Scale in Feet

Notes:
1. Delta Water Treatment Plant pump station discharge pressure was set to 58 psi and Stockton East Water District pump station discharge pressure was set to 58 psi. Active wells were turned on as needed, based on local pressure/time of day.

Minimum System Pressure
- Less than 40 psi
- Between 40 and 45 psi
- Between 45 and 50 psi
- Between 50 and 55 psi
- Greater than 55 psi

- Water Treatment Plant
- Reservoir & Pump Station
- Well (Active)
- COSMUD Water Service Boundary

Maximum Velocity
- Equal to or Less than 5 ft/s
- Greater than 5 & Less than 7 ft/s
- Greater than 7 ft/s

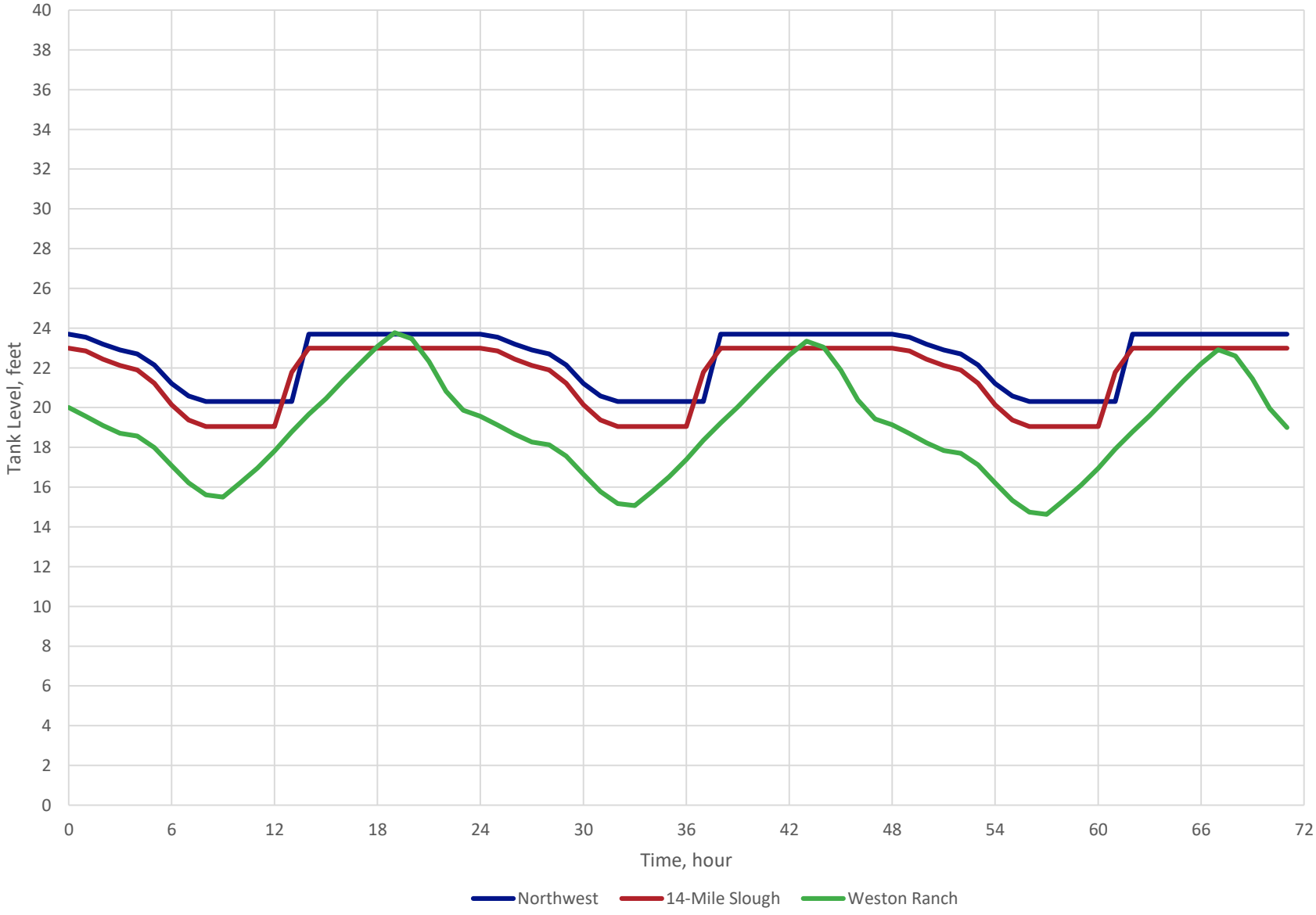
Figure 8-2

Near-Term (2030) System Maximum Day Demand Minimum System Pressure

City of Stockton
Water Master Plan Update

WEST YOST

Figure 8-3. Near Term (2030) Maximum Day Demand Reservoir Level Results



WEST YOST - N:\Clients\129 Stockton\60-20-41 Stockton WMPU\GIS\MXD\Water Master Plan\F8_4_MDDMinResults_BOSys.mxd - wjones - 1/26/2021

North Stockton

Delta Water Treatment Plant
WTP
Well #29
Well #30
Well #18
Northwest
Well #33
Well #31
Northeast
Well #19
Well #32
Well #10R
Well #21
Well #03R
Well #27
14 Mile Slough
Stockton East Water District
WTP
ARMSTRONG RD
LIVE OAK RD
EIGHT MILE RD
RINGE RD
ASHLEY LN
HILDRETH LN
ALPINE RD
CHEROKEE RD
WATERLOO RD
WAIN RD
DE RD
FREMONT ST
MINER AVE
HOLT RD
WEST LN
HAMMER LN
SAN JOAQUIN RIVER
CALAVERAS RIVER
N
0 3,500 7,000
Scale in Feet

South Stockton

Stockton East Water District
WTP
Mariposa
Well SSS10
Well SSS9
Well SSS3
Weston Ranch
SAN JOAQUIN RIVER
NAVY DR
EIGHTH ST
HOWARD RD
FREMONT ST
MINER AVE
DR MARTIN LUTHER KING JR BLVD
MARIPOSA RD
JACKSTONE RD
NEWCASTLE RD
AUSTIN RD
THORNTON RD
ARCH-AIRPORT WAY
N
0 3,000 6,000
Scale in Feet

Notes:
1. Delta Water Treatment Plant pump station discharge pressure was set to 60 psi and Stockton East Water District pump station discharge pressure was set to 58 psi. Active and proposed wells were turned on as needed, based on local pressure/time of day.

Minimum System Pressure
- Less than 40 psi
- Between 40 and 45 psi
- Between 45 and 50 psi
- Between 50 and 55 psi
- Greater than 55 psi

- Water Treatment Plant
- Reservoir & Pump Station
- Well (Active)
- COSMUD Water Service Boundary

Maximum Velocity
- Equal to or Less than 5 ft/s
- Greater than 5 ft/s & Less than 7 ft/s
- Greater than 7 ft/s

Figure 8-4

Buildout (2040) System
Maximum Day Demand
Minimum System Pressure

City of Stockton
Water Master Plan Update

WEST YOST

WEST YOST - N:\Clients\129 Stockton\60-20-41 Stockton WMPU\GIS\MXD\Water Master Plan\F8_5_MDDMinResults_BOSys_improv.mxd - wjones - 1/18/2021

North Stockton

Delta Water Treatment Plant
WTP
Well #29
Well #30
Well #18
Northwest
Well #33
Well #31
Northeast
Well #19
Well #32
Well #10R
Well #21
Well #03R
Well #27
14 Mile Slough
Stockton East Water District
WTP
ARMSTRONG RD
LIVE OAK RD
EIGHT MILE RD
RINGE RD
ASHLEY LN
HILDRETH LN
ALPINE RD
CHEROKEE RD
WATERLOO RD
WAIN RD
DE RD
HOLT RD
SAN JOAQUIN RIVER
CALAVERAS RIVER
EL DORADO ST
PACIFIC AVE
FREMONT ST
MINER AVE
99
5
N
0 3,500 7,000
Scale in Feet

South Stockton

WTP
Stockton East Water District
Mariposa
Well SSS10
Well SSS9
Well SSS3
Weston Ranch
FREMONT ST
MINER AVE
SAN JOAQUIN RIVER
NAVY DR
DR MARTIN LUTHER KING JR BLVD
EIGHTH ST
EL DORADO ST
POCKET RD
MARIPOSA RD
NEWCASTLE RD
AUSTIN RD
JACKSTONE RD
HOWARD RD
THORNTON RD
ARMOUR WAY
99
5
N
0 3,000 6,000
Scale in Feet

Notes:
1. Delta Water Treatment Plant pump station discharge pressure was set to 57 psi and Stockton East Water District pump station discharge pressure was set to 58 psi. Active and proposed wells were turned on as needed, based on local pressure/time of day.

Minimum System Pressure
- Less than 40 psi
- Between 40 and 45 psi
- Between 45 and 50 psi
- Between 50 and 55 psi
- Greater than 44 psi

- Water Treatment Plant
- Reservoir & Pump Station
- Well (Active)
- COSMUD Water Service Boundary

Maximum Velocity
- Equal to or Less than 5 ft/s
- Greater than 5 & Less than 7 ft/s
- Greater than 7 ft/s

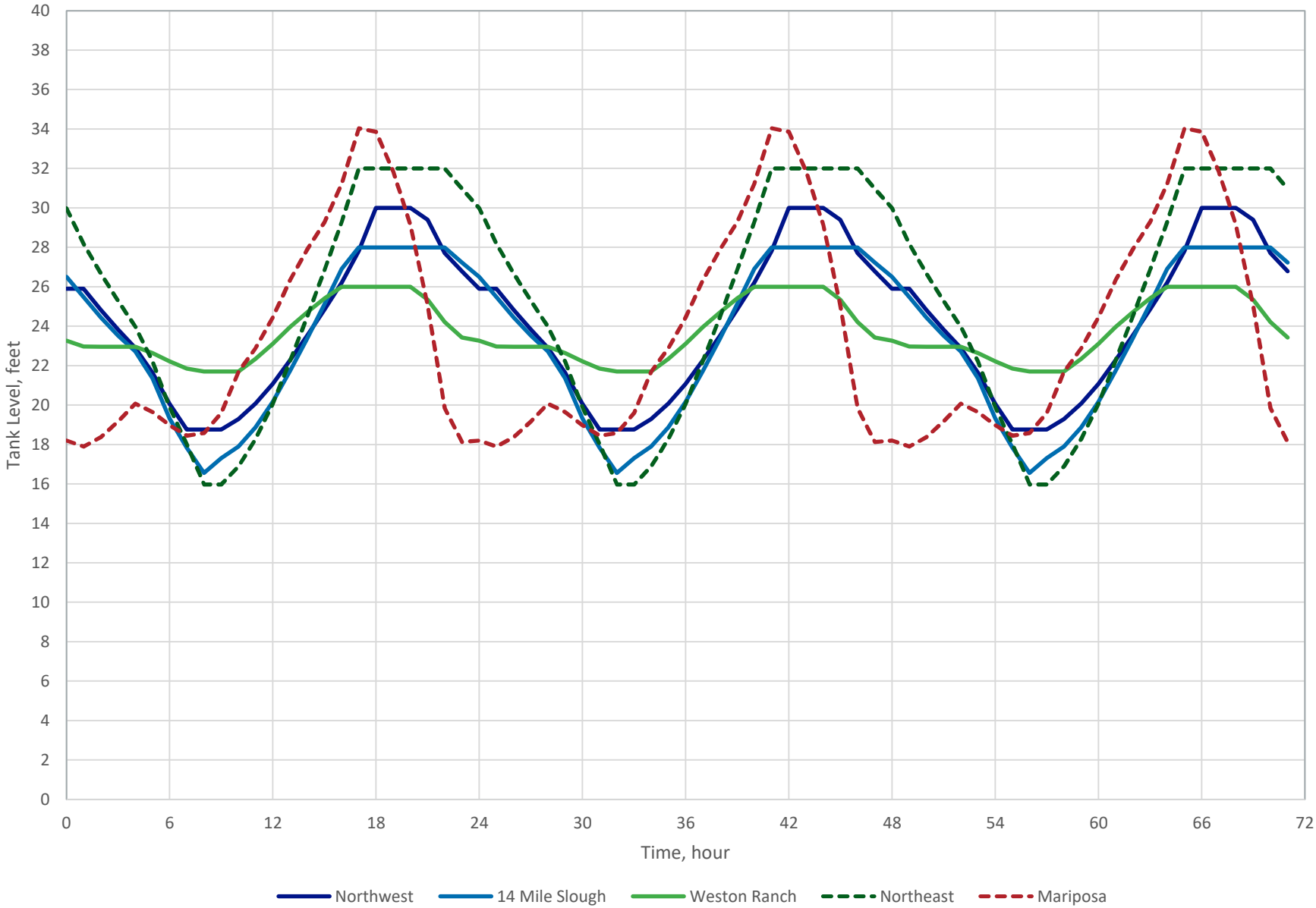
Figure 8-5

Buildout (2040) System
Maximum Day Demand
Minimum System Pressure
With Improvements

City of Stockton
Water Master Plan Update

WEST YOST

Figure 8-6. Future (2040) System Maximum Day Demand Reservoir Level Results



8.4.2 Emergency Operations – Maximum Day Demand Plus Fire Flow

The maximum day demand plus fire flow scenario evaluates the fire flow availability in the COSMUD distribution system under a maximum day demand condition, for both near-term (2030) and future (2040) time frames. An overview of the evaluation and a discussion of the results are presented in the sections below.

8.4.2.1 Evaluation Overview

To evaluate the near-term (2030) and future (2040) water system fire flow availability, InfoWater's fire flow module was used to determine the available fire flow at junctions that represent hydrant locations throughout the system, while maintaining a minimum residual system pressure of 20 psi at all customer service locations and in new development areas. The analysis assumed that reservoir pump stations are operating at their firm pumping capacity. Maximum velocity is only considered on pipelines within new developments to confirm sizing of new infrastructure. Pipelines in existing areas are evaluated without a maximum velocity constraint because these pipelines were sized to meet standards at the time of their construction.

As discussed in Chapter 5, recommended fire flow criteria presented in Table 5-2 are established for future development land use types. Much of the existing COSMUD water distribution system is older and designed to earlier fire standards in place at the time the pipelines were constructed. The fire flow evaluation presents the systemwide available fire flow compared to recommended fire flow criteria for existing water service areas for comparison purposes only. As previously mentioned in Chapter 7, because much of the COSMUD system is older, a R&R program is recommended to replace smaller diameter pipelines (which are typically older) over the next 40 years. As the COSMUD proceeds with the program, fire flow availability in these areas will improve. For new development areas, fire flow availability is evaluated to confirm sizing of recommended future system improvements for new developments. As development plans in future areas are refined, infrastructure is expected to change and the COSMUD should require project proponents to size infrastructure to meet all design criteria presented in Chapter 5.

8.4.2.2 Near-Term (2030) System Evaluation Results

Figure 8-7 presents available fire flow compared to adjacent land use at each tested hydrant location and along future development pipelines while meeting recommended criteria. Results presented on Figure 8-7 are representative of the system's capacity and do not represent available flow from a specific hydrant. Typically, fire flows exceeding 1,500 gpm are met by multiple hydrants.

As shown on Figure 8-7, with Priority 1 and 2 improvements, most existing tested locations meet or exceed the recommended fire flow criteria for that location, and a few locations meet at least 75 percent of the criteria. As the COSMUD implements Priority 3 improvements, the number of locations that were found to meet at least 75 percent of the criteria will further improve. All tested locations within future development areas meet the required fire flow.

In South Stockton, the long dead-end pipeline along South Harland Road does not meet the recommended fire flow. This pipeline is currently a 12-inch diameter pipeline, and the COSMUD is planning on replacing portions of this pipeline with 16-inch diameter pipelines. Even with these improvements, available fire flows still are not significantly improved. Further upsizing of this pipeline is not recommended as this would result in poor water quality in this area. As development within this area continues, potentially after 2040, the COSMUD should consider looping pipelines in this future development area to improve hydraulic capacity

and therefore fire flow. No additional infrastructure is recommended at this time to improve fire flow, aside from the previously recommended rehabilitation and replacement plan (Priorities 1 through 3).

8.4.2.3 Future (2040) System Evaluation Results

Figure 8-8 presents available fire flow compared to adjacent land use at each tested hydrant location and along future development pipelines while meeting recommended criteria. Results presented on Figure 8-8 are representative of the system's capacity and do not represent available flow from a specific hydrant. Typically, fire flows exceeding 1,500 gpm are met by multiple hydrants.

As shown on Figure 8-8, results are similar to near-term (2030) and most existing tested locations meet or exceed the recommended fire flow criteria for that location, and a few locations meet at least 75 percent of the criteria. As the COSMUD implements Priority 3 improvements, the number of locations that were found to meet at least 75 percent of the criteria will further improve. All tested locations within future development areas meet the required fire flow.

In South Stockton, the long dead-end pipeline along South Harland Road continues to not meet the recommended fire flow. As development within this area continues, potentially after 2040, the COSMUD should consider looping pipelines in this future development area to improve hydraulic capacity and therefore fire flow. No additional infrastructure is recommended at this time to improve fire flow, aside from the previously recommended rehabilitation and replacement plan (Priorities 1 through 3).

WEST YOST - N:\Clients\129 Stockton\60-20-41 Stockton WMPU\GIS\MXD\Water Master Plan\F8_7_FFResults_NTSys.mxd - wjones - 1/26/2021

North Stockton

Delta Water Treatment Plant
WTP
Well #29
Well #30
Well #18
Northwest
Well #31
Well #19
Well #32
Well #10R
Well #21
Well #03R
14 Mile Slough
Well #27
Stockton East Water District
WTP
ARMSTRONG RD
LIVE OAK RD
WEST LN
EIGHT MILE RD
RINDGE RD
THORNTON RD
LOWER SACRAMENTO RD
ASHLEY LN
HILDRETH LN
HAMMETT
WAIN RD
PETRI
MARCH LN
BROOKSIDE RD
PACIFIC AVE
EL DORADO ST
CHEROKEE RD
WATERLOO RD
ALPINE RD
HOLT RD
SAN JOAQUIN RIVER
CALAVERAS RIVER
MINER AVE
FREMONT ST
99
5
N
0 3,500 7,000
Scale in Feet

South Stockton

WTP
Stockton East Water District
Well SSS10
Well SSS9
Well SSS3
Weston Ranch
FREMONT ST
MINER AVE
SAN JOAQUIN RIVER
NAVY DR
DR MARTIN LUTHER KING JR BLVD
EIGHTH ST
EL DORADO ST
POCKET RD
MARIPOSA RD
AUSTIN RD
NEWCASTLE RD
JACKSTONE RD
HOWARD RD
TARAN RD
ARPORT WAY
99
5
N
0 3,000 6,000
Scale in Feet

Notes:
1. Delta Water Treatment Plant pump station discharge pressure was set to 58 psi and Stockton East Water District pump station discharge pressure was set to 58 psi. Active wells were turned on as needed, based on local pressure.
2. The available flow at each junction is the maximum flow available while maintaining 20 psi residual system pressure.
3. Approximate near-term (2030) development pipelines are in areas where the pipe layout and sizing will be determined by the developer at a later date.

- Available flow is ≥100% of criteria
- Available flow is ≥75% but <100% of criteria
- Available flow is ≥50% but <75% of criteria
- Available flow is <50% of criteria
- Water Treatment Plant
- Reservoir & Pump Station
- Well (Active)
- COSMUD Water Service Boundary

Pipelines

- Existing
- Existing System Improvements
- Near-Term (2030) Improvements
- Future Development Pipelines

Figure 8-7

Near-Term (2030) System Maximum Day Demand Fire Flow Results

City of Stockton
Water Master Plan Update

WEST YOST

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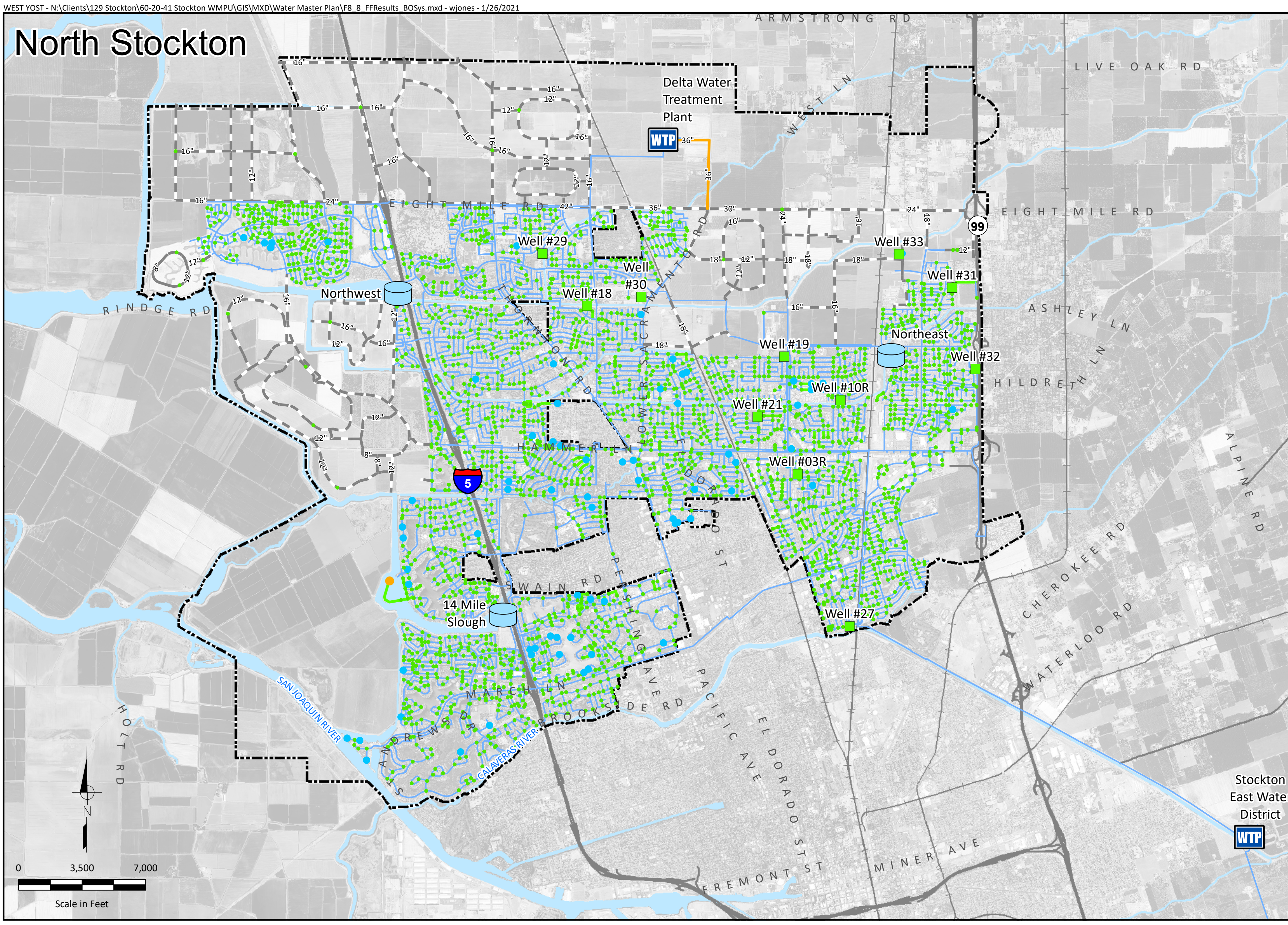

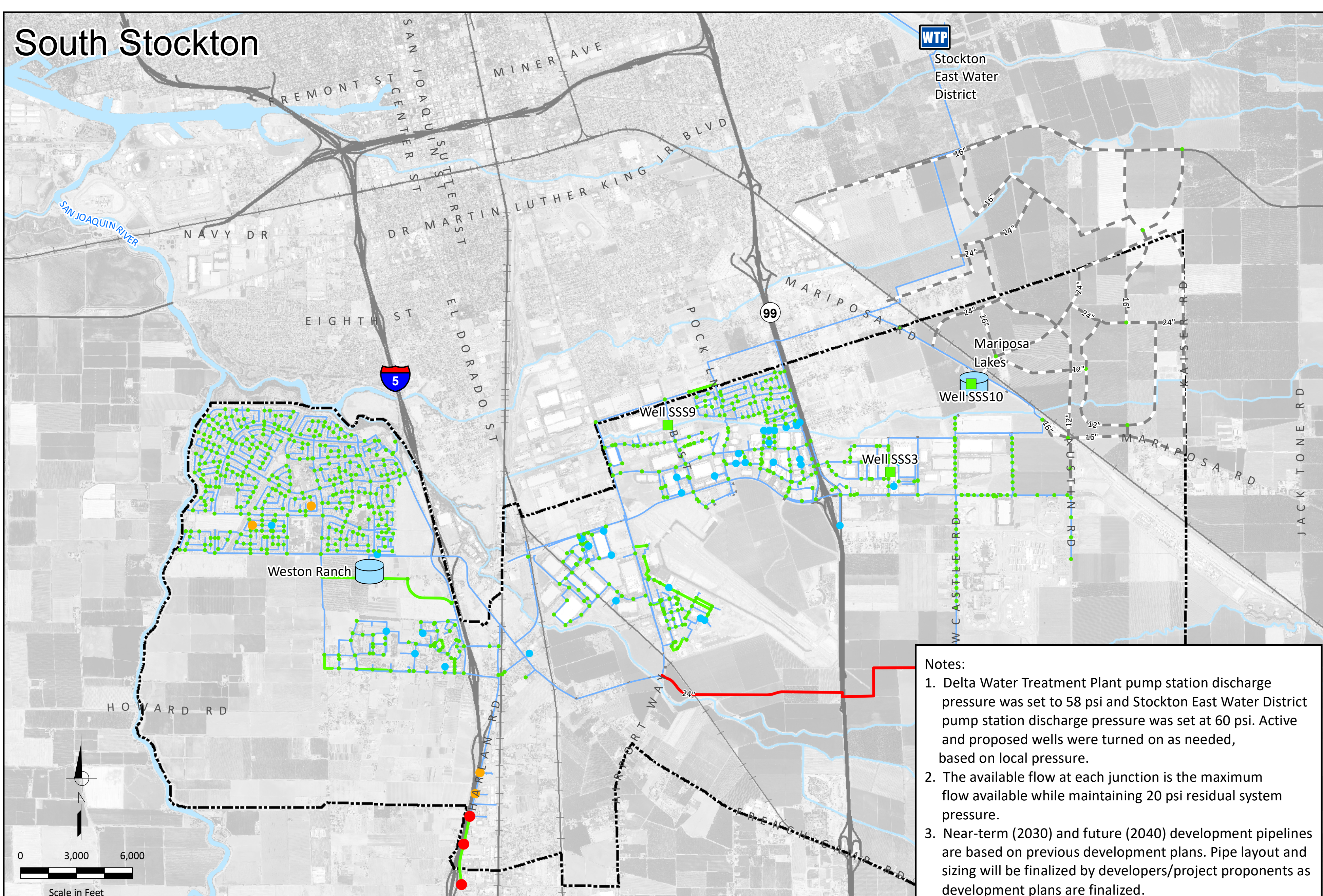

Notes:

1. Delta Water Treatment Plant pump station discharge pressure was set to 58 psi and Stockton East Water District pump station discharge pressure was set at 60 psi. Active and proposed wells were turned on as needed, based on local pressure.
2. The available flow at each junction is the maximum flow available while maintaining 20 psi residual system pressure.
3. Near-term (2030) and future (2040) development pipelines are based on previous development plans. Pipe layout and sizing will be finalized by developers/project proponents as development plans are finalized.

Pipelines

- Existing
- Existing System Improvements
- Near-Term (2030) Improvements
- Future (2040) Improvements
- Future Development Pipelines

- Available flow is ≥100% of criteria
- Available flow is ≥75% but <100% of criteria
- Available flow is ≥50% but <75% of criteria
- Available flow is <50% of criteria
- Water Treatment Plant
- Reservoir & Pump Station

- Well (Active)
- COSMUD Water Service Boundary

Figure 8-8

Buildout (2040) System Maximum Day Demand Fire Flow Results

City of Stockton
Water Master Plan Update

WEST YOST

8.5 SUMMARY OF FINDINGS AND RECOMMENDATIONS FOR THE FUTURE WATER SYSTEM

Table 8-9 provides a summary of findings and recommended improvements identified by evaluating the near-term (2030) and future (2040) water systems and is organized by improvement type and timeframe. These recommendations are used to develop a recommended CIP, which is further described in Chapter 9. Figure 8-9 presents the recommended improvements for the near-term (2030) and future (2040) timeframes.

Table 8-9. Summary of Recommended Near-Term (2030) and Future (2040) System Improvements

Improvement Type	Near-Term (2030)	Future (2040)
North Stockton		
Supply	• Rehabilitate two existing wells in North Stockton, to address aging wells (refer to Groundwater Study in Other Improvements)	• Construct the new Well 33 to mitigate the future storage deficit and improve supply reliability.
Pumping	• No pumping improvements recommended	• 12 mgd Northeast Reservoir pump station (firm) recommended
Storage	• No storage improvements recommended	• New 4 MG Northeast Reservoir
Pipelines	• By the Future (2040) timeframe, new 36-inch diameter pipelines downstream of the DWTP finished water pump station are recommended to maximize distribution capacity • The COSMUD should continue to rehabilitate and replace older and undersized mains, previously discussed in Chapter 7 as Priority 3 pipelines • Refer to Other Improvement section for raw water pipeline improvements	
South Stockton		
Supply	• No supply related improvements recommended (refer to Storage section)	• No supply related improvements recommended (refer to Storage section)
Pumping	• No pumping improvements recommended (refer to Storage Section)	• 12 mgd Mariposa Road Community Reservoir Pump Station (firm) recommended
Storage	• Equip existing Wells SSS3 and SSS9 with backup power • Rehabilitate existing Well SSS2, to bring well to active status, and equip with backup power (refer to Groundwater Study in Other Improvements)	• Rehabilitate existing Well SSS8, to bring well to active status, and equip with backup power (refer to Groundwater Study in Other Improvements) • Construct new well within the Mariposa Road Community area to offset Reservoir Sizing for Mariposa Road Community development • Construct new 3.5 MG reservoir for Mariposa Road Community
Pipelines	• City should continue to rehabilitate and replace older and undersized mains, previously discussed in Chapter 7 as Priority 3 pipelines.	

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North Stockton

Delta Water Treatment Plant
WTP
Well #29
Well #30
Well #18
Well #33
Well #31
Northwest
Northeast
Well #19
Well #32
Well #15
Well #10R
Well #21
Well #03R
Well #28
Well #27
14 Mile Slough
Stockton East Water District
WTP

ARMSTRONG RD
LIVE OAK RD
WEST LN
EIGHT MILE RD
SACRAMENTO RD
THORNTON RD
RINGE RD
ASHLEY LN
HILDRETH LN
HAMMER LN
ELDORADO ST
SWAIN RD
PERSHING AVE
PACIFIC AVE
EL DORADO ST
CHEROKEE RD
WATERLOO RD
ALPINE RD
MARCH LN
ANDREWS DR
BROOKSIDE RD
HOLT RD
SAN JOAQUIN RIVER
CALAVERAS RIVER
FREMONT ST
MINER AVE

0 3,500 7,000
Scale in Feet

South Stockton

WTP
Stockton East Water District
New Well
Mariposa
Well SSS10
Well SSS9
Well SSS8
Well SSS2
Well SSS3
Weston Ranch

SAN JOAQUIN RIVER
NAVY DR
EIGHTH ST
FREMONT ST
MINER AVE
SAN JOAQUIN ST
CENTER ST
SUTTER ST
DR MARTIN LUTHER KING JR BLVD
MARIPOSA RD
POCKET RD
EL DORADO ST
B ST
NEWCASTLE RD
AUSTIN RD
JACKSTONE RD
HOWARD RD
TARLTON RD
ARTWAY

0 3,000 6,000
Scale in Feet

Notes:
1. Near-term (2030) and future (2040) development pipelines are based on previous development plans. Pipe layout and sizing will be finalized by developers/project proponents as development plans are finalized.
2. As discussed in the chapter, a groundwater study is recommended to identify which specific wells should be rehabilitated. For the purposes of this figure, Wells 15 and 28 have been identified, as these are the only standby wells. Other wells (i.e. inactive wells) may be recommended to be rehabilitated.
3. Other improvements not shown include: Improvements to the IPS and pipelines, Priority 3 Pipeline Improvements, DWTP Campus Improvements, Groundwater Recharge Basins, Metering/AMI Improvements.

Pipelines
- Existing
- Existing System Improvements
- Near-Term (2030) Improvements
- Future (2040) Improvements
- Future Development Pipelines

Wells
- New or Rehabilitated Near-Term (2030)
- New or Rehabilitated Future (2040)
- Active Existing
- Backup Power Near-Term (2030)
- Backup Power Future (2040)

- Existing Reservoir & Pump Station
- Future (2040) Reservoir & Pump Station
- Water Treatment Plant
- COSMUD Service Boundary

Figure 8-9

Future System With Improvements

City of Stockton
Water Master Plan Update

WEST YOST

It should be noted that these recommended water system improvements are significantly less extensive than those recommended in the 2008 Water Master Plan due to the following:

- Lower water demand projections associated with the reduced growth rate included in the Envision Stockton 2040 General Plan
- Lower existing demand conditions (and subsequent maximum day and peak hour demands) due to due to recent and continuing water use efficiencies
- The proposed rehabilitation of existing inactive wells instead of the construction of new wells in South Stockton
- The availability of the DWTP to supply treated surface water in North Stockton water service area as the primary water supply, supplemented by groundwater supplies
- The ability to maximize the use of SEWD supplies in both South Stockton and North Stockton with the construction of the North Stockton Pipeline Hypochlorite Facility

8.6 OTHER PLANNED OR RECOMMENDED IMPROVEMENTS

In addition to the improvements identified in the capacity and performance evaluations, other planned or recommended improvements were identified through discussions with COSMUD staff. These projects are included to improve system and/or water supply reliability and are summarized below. These improvements are recommended to be implemented by the near-term (2030) timeframe.

- **Groundwater Study.** A comprehensive groundwater supply study is recommended to investigate existing facility conditions, capacity and water quality/regulatory trends. The outcome of the study would identify recommendations for optimal rehabilitation of existing wells in North Stockton and South Stockton, including identifying appropriate wellhead treatment (at each location or centralized at a reservoir site).
- **Intake Pump Station and Pipeline Upgrade.** Ground settlement at the IPS site has required the interim repair and adjustment of station infrastructure and the 54-inch raw water pipeline that supplies the DWTP. It is recommended that the COSMUD perform additional studies to develop a long-term strategy including appropriate design features and construct improvements to station infrastructure and the raw water pipeline.
- **DWTP Campus Improvements.** COSMUD plans to develop an overall DWTP Campus to centralize treatment and distribution staff. These campus improvements would result in both management and operational efficiencies.
- **Groundwater Storage Bank Study.** A groundwater storage bank/recharge basins study is recommended to address future supply reliability by expanding/augmenting its conjunctive use portfolio, allowing for the flexibility of banking unused supply for use at a later time.
- **Advanced Metering Infrastructure (AMI) Study.** An AMI Study, design, and implementation project is recommended to improve metering technology to allow for enhanced demand tracking, management, and water loss identification.

This chapter presents the recommended capital improvement program (CIP) for the COSMUD existing, near-term (2030) and future (2040) water system, based on the evaluations described in Chapters 7 and 8. This chapter provides a summary of the recommended improvement projects, along with estimates of probable construction costs for each proposed improvement project. It also identifies which costs should be allocated to existing water customers and which costs should be allocated to future development. Discussion of the proposed financial plan to fund the recommended improvement projects is provided in Chapter 10.

It should be noted that the recommended CIP only identifies improvements at a master plan level and does not necessarily include all required on-site infrastructure or provide design of improvements. Subsequent detailed design is required to determine the exact sizes and locations of these proposed improvements.

The following sections of this chapter summarize the cost estimating methodology and present the capital improvement program of recommended upgrades to improve the existing system and support near-term (2030) and future (2040) demands:

- Cost Estimating Assumptions
- Summary of Recommended Capital Improvement Program
- Basis of Recommendations

9.1 COST ESTIMATING ASSUMPTIONS

Cost estimates prepared for this Water Master Plan Update are in accordance with the guidelines of the Association for the Advancement of Cost Engineering (AACE) International for a Class 5 Estimate. AACE International defines a Class 5 Estimate in the following manner:

> Class 5 Estimate: This estimate is prepared based on limited information, where little more than proposed plant type, its location, and the capacity are known. Strategic planning purposes include, but are not limited to, market studies, assessment of viability, evaluation of alternate schemes, project screening, location and evaluation of resource needs and budgeting, and long-range capital planning. Examples of estimating methods used would include cost/capacity curves and factors, scale-up factors, and parametric and modeling techniques. Typically, little time is expended in the development of this estimate. The expected accuracy ranges for this class estimate are -20 to -50 percent on the low side and +30 to +100 percent on the high side.

Construction and Capital Cost estimates are presented in August 2020 dollars based on an Engineering News Record Construction Cost Index (ENR CCI) of 12,921 (San Francisco). Construction costs were developed based on a combination of data supplied from manufacturers, bids on other water facilities design projects build by other public, construction costs previously estimated by West Yost, and from standard cost estimating guides. Total CIP costs include mark-ups equal to 80 percent of base construction costs, and are listed below:

- Design and Construction Contingency: 35 percent
- Project Cost Allowances: 45 percent
  - Engineering: 15 percent
  - Construction Management: 15 percent
  - Implementation: 15 percent

For this Water Master Plan Update, it is assumed that recommended distribution system facilities will be developed in public rights-of-way or on public property; therefore, land acquisition costs have not been included. Construction cost estimates do not include costs for annual O&M.

A complete description of the assumptions used in developing the estimates of probable construction cost is provided in Appendix D.

9.2 SUMMARY OF RECOMMENDED CAPITAL IMPROVEMENT PROGRAM

This section summarizes the overall recommended capital improvement program based on the evaluations described in Chapters 7 and 8. A high-level summary of the overall program is provided below, and subsequent sections describe the program in more detail. Figure 9-1 presents overall recommendations for existing, near-term (2030) and future (2040) for the COSMUD North Stockton and South Stockton water service areas. Pipelines intended to serve future development areas are included for reference only and are not included in the recommended CIP. These pipelines will be funded by project proponents in the future and are expected to change as future development plans are refined.

9.2.1 Summary of Estimated Capital Costs

Table 9-1 summarizes the total capital costs by timeframe, service area, and whether costs are to be allocated to existing water customers or are to be allocated to future development. As shown in Table 9-1 the overall capital improvement costs are estimated to be approximately $199 million (M). Approximately $52M, or approximately 26 percent of the overall program, is recommended to be allocated to future development and paid for through connection fees, as that infrastructure has been identified to be needed to support future demands. Approximately $100M, or 51 percent, of the overall program is attributed to improving aging pipeline infrastructure in both the North Stockton and South Stockton water service areas. These pipeline improvements are further prioritized into three priority levels, as discussed in Chapter 7, and are discussed in more detail in subsequent sections.

Table 9-1. Summary of Improvement Costs by Water Service Area and Time Frame, in millions ($)

Water Service Area	Existing	Near-Term (2030)	Future (2040)	Total
Allocated to Existing Water Customers				
North	87.5	16.5	-	104.0
South	12.4	-	-	12.4
North & South	-	30.8	-	30.8
Subtotal	$99.8	$47.3	-	$147.1
Allocated to Future Development				
North	-	-	25.8	25.8
South	-	3.1	23.0	26.0
North & South	-	-	-	-
Subtotal	-	$3.1	$48.8	$51.8
Total	**$99.8**	**$50.3**	**$48.8**	**$198.9**

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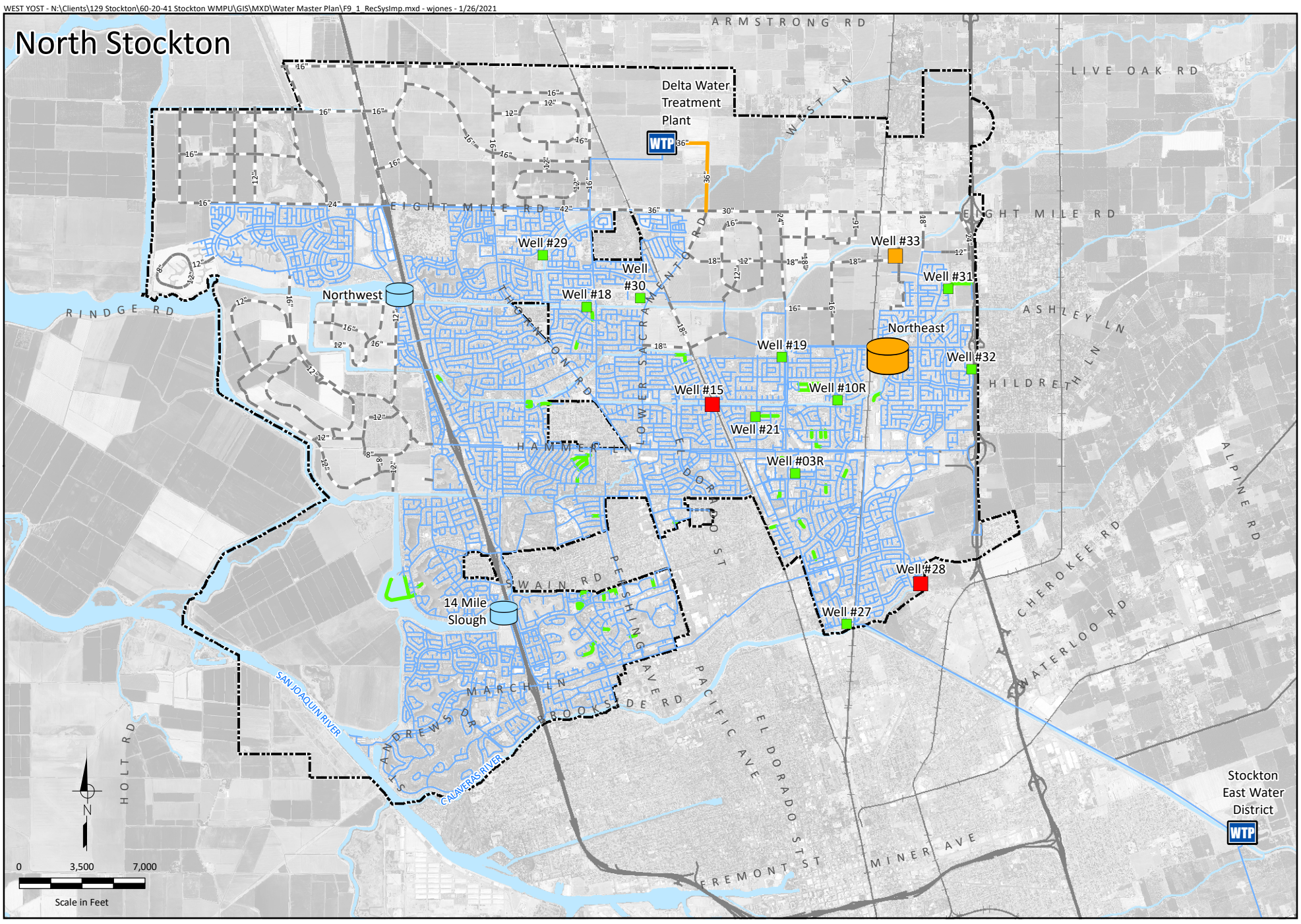
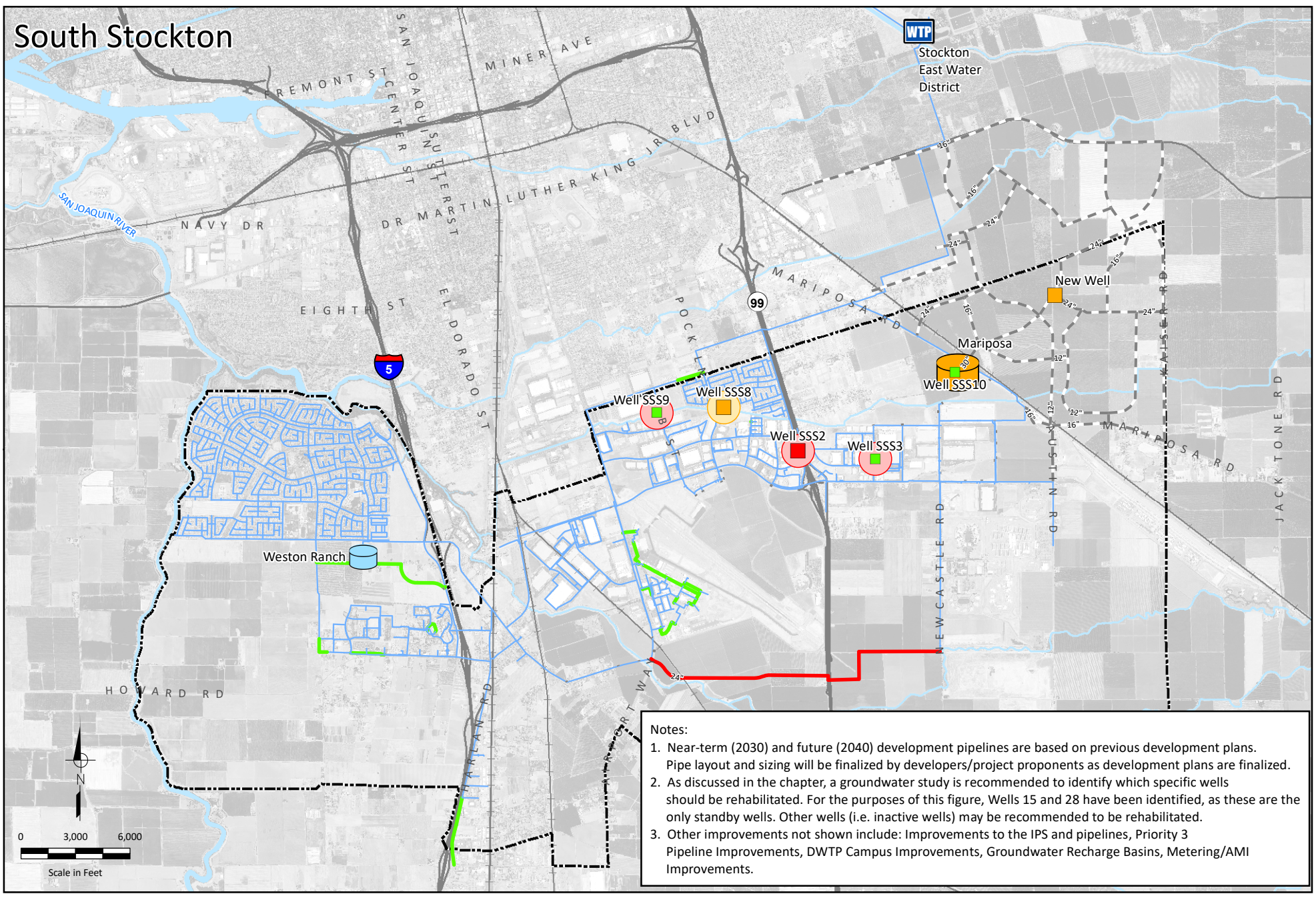
North Stockton



South Stockton



Notes:
1. Near-term (2030) and future (2040) development pipelines are based on previous development plans. Pipe layout and sizing will be finalized by developers/project proponents as development plans are finalized.
2. As discussed in the chapter, a groundwater study is recommended to identify which specific wells should be rehabilitated. For the purposes of this figure, Wells 15 and 28 have been identified, as these are the only standby wells. Other wells (i.e. inactive wells) may be recommended to be rehabilitated.
3. Other improvements not shown include: Improvements to the IPS and pipelines, Priority 3 Pipeline Improvements, DWTP Campus Improvements, Groundwater Recharge Basins, Metering/AMI Improvements.

Pipelines
- Existing
- Existing System Improvements
- Near-Term (2030) Improvements
- Future (2040) Improvements
- Future Development Pipelines

Wells
- New or Rehabilitated Near-Term (2030)
- New or Rehabilitated Future (2040)
- Active Existing
- Backup Power Near-Term (2030)
- Backup Power Future (2040)

- Existing Reservoir & Pump Station
- Future (2040) Reservoir & Pump Station
- Water Treatment Plant
- COSMUD Service Boundary

Figure 9-1

Recommended System Improvements

City of Stockton
Water Master Plan Update

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9.2.2 Recommended Existing System Improvements

Chapter 7 provided a summary of the evaluation of the existing COSMUD water system and its ability to meet recommended water system planning and design criteria described in Chapter 5. In general, the analysis recommended the following:

- **Pipelines.** Development of a Rehabilitation and Replacement (R&R) program is recommended for both the North Stockton and South Stockton water service areas. The intent of this program is to replace older and undersized pipelines on a proactive and programmatic basis before they fail and require more expensive emergency repair and replacement, as well as to improve flows throughout the system. This should also include mains running through private property or through levies, or those that have known tree root damage. Pipelines were generally prioritized into the following areas:
  - Priority 1: Pipelines in this category address areas where existing available fire flow capacity is less than 50 percent of the recommended criteria.
  - Priority 2: Pipelines in this category address areas where existing available fire flow capacity is between 50 and 75 percent of the recommended fire flow criteria.
  - Priority 3: This category contains the remaining smaller diameter (i.e., less than 8-inch diameter) pipelines.[28]

  An asset management plan should be developed so recommended pipeline improvements can be further refined by considering likelihood of failure (e.g., age, condition, leak history, etc.) and consequence of failure (e.g., disruption of water service to critical facilities, potential for damage to adjacent land use and facilities, etc.) to further refine and define program priorities and implementation.
- **Supply (Wells).** It is recommended that the COSMUD design and construct Well SSS10, as well as equip the well with backup power to address the existing storage capacity deficit.

As discussed in Chapter 7, much of the COSMUD water distribution system is older and was designed to earlier fire flow standards in place at the time the pipelines were constructed. Table 2-6 in Chapter 2 provides a summary of the COSMUD distribution system by age. Approximately 28 percent of the COSMUD system was installed in the 1970s or earlier, totaling approximately 164 miles of pipeline in the North Stockton and South Stockton water service areas. Due to the age of the pipelines, it is recommended that the COSMUD begin a comprehensive pipeline R&R program. As presented above, it is recommended that the program be prioritized to address areas where existing available fire flow is less than recommended criteria in place for future development. As mentioned previously, this program can be further refined by reviewing pipeline break and/or leak history.

Table 9-2 summarizes recommended improvements for the existing COSMUD water service areas. Approximately 7.3 miles of older, undersized pipelines are recommended to be replaced under Priority 1 and 2 programs. Since these pipelines address areas where there is a larger gap between recommended fire flow and available fire flow, it is recommended that these improvements be completed by 2030. There are approximately 69.2 miles of pipeline characterized as Priority 3 pipelines. These pipelines are shown on Figure 9-2 and are grouped by age. It is recommended that the COSMUD implement these improvements over 40 years, replacing approximately 2 miles of pipeline per year. The improvements listed above are recommended to increase the reliability of the existing water system, therefore costs are recommended to be allocated to existing water customers.

[28] In addition, as noted in Chapter 7, smaller diameter (less than 8-inch diameter) are allowed per COSMUD standard specifications provided that all capacity requirements are met. For the purposes of this Water Master Plan Update and for budgeting purposes, it is assumed that all small diameter pipelines are replaced with 8-inch diameter pipelines.

Table 9-2. Existing System Capital Improvements[a]

Improvement Area	Improvement Type	Justification	Improvement Description	Quantity and Unit	Construction Cost, dollars [b,c]	Capital Cost, dollars (includes markups)[b,d]
Pipelines (Renewal and Replacement)						
Priority 1						
North	Pipelines	Addresses areas where available fire flow is less than 50 percent of the recommended fire flow.	New 8-inch diameter pipelines	3,585 LF	$654,000	$872,000
North	Pipelines		New 12-inch diameter pipelines	4,364 LF	$1,090,000	$1,454,000
South	Pipelines		New 12-inch diameter pipelines	4,923 LF	$1,230,000	$1,640,000
				Subtotal - Priority 1	$2,974,000	$3,966,000
Priority 2						
North	Pipelines	Addresses areas where available fire flow is between 50 and 75 percent of the recommended fire flow.	New 8-inch diameter pipelines	14,846 LF	$2,706,000	$3,608,000
North	Pipelines		New 12-inch diameter pipelines	4,018 LF	$1,004,000	$1,338,000
South	Pipelines		New 8-inch diameter pipelines	1,249 LF	$228,000	$304,000
South	Pipelines		New 12-inch diameter pipelines	5,445 LF	$1,360,000	$1,814,000
				Subtotal - Priority 2	$5,298,000	$7,064,000
Priority 3 (Renewal and Replacement) [e]						
North	Pipelines	Addresses under sized and older mains (i.e., less than 8-inches in diameter)	New 8-inch diameter pipelines	330,008 LF	$60,144,000	$80,192,000
South	Pipelines		New 8-inch diameter pipelines	35,445 LF	$6,460,000	$8,614,000
				Subtotal - Priority 3 (Renewal and Replacement)(e)	$66,604,000	$88,806,000
Supply Improvements						
South	Supply (Wells)	Addresses supply reliability in South Stockton. Supplies from SEWD could be curtailed depending on the Water Year. SEWD is assumed to supply up to a maximum of 70 percent of the South Stockton demands. Additional wells bolster local supplies in the event of a supply curtailment from SEWD. This well will also satisfy local storage requirements.	One (1) additional well is recommended in the existing time frame. Well SSS10 is already in preliminary design stages and has already been funded; therefore no additional groundwater wells, aside from Well SSS10, are required.	0 wells	$0	$0
				Total North Stockton Improvements	**$65,598,000**	**$87,464,000**
				Total South Stockton Improvements	**$9,278,000**	**$12,372,000**
				Total Existing System Capital Improvements	**$74,876,000**	**$99,836,000**

(a) Costs shown are presented in August 2020 dollars (SF Construction Cost Index 12,921). Unless otherwise noted, improvements are anticipated to be completed by 2030.

(b) Costs rounded to the nearest $1,000.

(c) Estimated construction costs reflect typical conditions and do not account for construction uncertainties or reflect economic bidding climate. Costs include construction contingency of 35 percent from base construction costs.

(d) Costs include Other Project costs equal to 45 percent (Engineering: 15 percent; Construction Management: 15 percent; Program Implementation, CEQA, Legal: 15 percent).

(e) Renewal and Replacement Costs are intended to be completed over a 40-year timeline (i.e. starting 2021 through 2060). Costs presented include development of an asset management program.

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North Stockton

Delta Water Treatment Plant
WTP
Northwest
14 Mile Slough
Well #29
Well #18
Well #30
Well #16
Well #9
Well #7
Well #15
Well #1
Well #4
Well #11
Well #19
Well #24
Well #31
Well #32
Well #10R
Well #20
Well #21
Well #03R
Well #26
Well #25
Well #28
Well #27
Stockton East Water District
WTP
ARMSTRONG RD
LIVE OAK RD
WEST LN
EIGHT MILE RD
RINDGE RD
THORNTON RD
HAMMER LN
SWAIN RD
MARCH LN
ST ANDREWS DR
BROOKSIDE DR
PACIFIC AVE
EL DORADO ST
FREMONT ST
MINER AVE
ASHLEY LN
HILDRETH LN
ALPINE RD
CHEROKEE RD
WATERLOO RD
HOLT RD
SAN JOAQUIN RIVER
CALAVERAS RIVER
N
0 3,500 7,000
Scale in Feet

South Stockton

Stockton East Water District
WTP
Weston Ranch
Well SSS9
Well SSS8
Well SSS2
Well SSS3
Well SSS1
FREMONT ST
MINER AVE
SUTTER ST
SAN JOAQUIN ST
DR MARTIN LUTHER KING JR BLVD
SAN JOAQUIN RIVER
NAVY DR
EIGHTH ST
EL DORADO ST
POCKET RD
MARIPOSA RD
AUSTIN RD
NEWCASTLE RD
JACKSTONE RD
TARLTAN RD
AIRPORT WAY
HOWARD RD
99
5
N
0 3,000 6,000
Scale in Feet

Notes:
1. Priority 1 and 2 pipelines are recommended to be completed by 2030.
2. Priority 3 pipelines are recommended to be completed over a 40 year replacement cycle. These pipelines can be further prioritized based on age (as shown) and/or leak history. Pipelines installed after the 1980s are recommended to be further evaluated by condition to determine if replacement is really needed. For the purposes of developing a CIP, these pipelines have been included in Priority 3 improvements.

- Priority 1 and 2 Pipelines

Priority 3 Pipelines by Decade of Installation

- 1950s or Earlier or Unknown
- 1960s - 1970s
- 1980s or Later
- Existing Pipelines
- COSMUD Service Boundary
- Water Treatment Plant
- Existing Reservoir & Pump Station

Wells

- Active
- Inactive
- Standby

Figure 9-2

Recommended Pipeline Rehabilitation Program

City of Stockton
Water Master Plan Update

WEST YOST

9.2.3 Recommended Near-Term (2030) System Improvements

Chapter 8 provided a summary of the evaluation of the COSMUD water system and its ability to support near-term (2030) demands while meeting recommended water system planning and design criteria described in Chapter 5. In general, the analysis recommended the following:

- **Supply (Wells)**. To address storage needs resulting from projected near-term (2030) demands and to address existing aging groundwater supply facilities, improvements to the following well facilities are recommended:
  - In North Stockton, rehabilitate two existing wells to address older/aging well facilities and maintain groundwater supply reliability.
  - In South Stockton, equip existing Wells SSS3 and SSS9 with backup power to increase the emergency groundwater storage credit and mitigate the projected storage deficit.
  - In South Stockton, rehabilitate existing Well SSS2, and equip with backup power, to increase the emergency groundwater storage credit and mitigate the projected storage deficit.

Improvements and their associated costs are presented in Table 9-3. Locations/extent of the recommended improvements are shown on Figure 9-1. Improvements in North Stockton address older/aging infrastructure and should be allocated to existing water customers. Improvements in South Stockton are triggered by increased demands associated with future development and should be allocated to future development and paid through connection fees.

In addition to the above listed capacity-related improvements, other improvements were identified through discussions with COSMUD staff. These projects are included to improve system and/or water supply reliability and are summarized below. These improvements are also summarized in Table 9-2, along with their associated estimated costs. These improvements are assumed to be funded by existing water customers.

- **Groundwater Study.** A comprehensive groundwater supply study is recommended to investigate existing facility conditions, capacity and water quality/regulatory trends. The outcome of the study would identify recommendations for rehabilitation of wells in North Stockton and South Stockton, including identifying appropriate wellhead treatment (at each location or centralized at a reservoir site).
- **Intake Pump Station and Pipeline Upgrade.** Ground settlement at the IPS site has required the interim repair and adjustment of station infrastructure and the 54-inch raw water pipeline that supplies the DWTP. It is recommended that the COSMUD perform additional studies to develop a long-term strategy including appropriate design features and construct improvements to station infrastructure and the raw water pipeline.
- **DWTP Campus Improvements.** COSMUD plans to develop an overall DWTP Campus to centralize treatment and distribution staff. These campus improvements would result in both management and operational efficiencies.
- **Groundwater Storage Bank Study.** A groundwater storage bank/recharge basins study is recommended to address future supply reliability by expanding/augmenting its conjunctive use portfolio, allowing for the flexibility of banking unused supply for use at a later time.
- **Advanced Metering Infrastructure (AMI) Study.** An AMI Study, design, and implementation project is recommended to improve metering technology to allow for enhanced demand tracking, management, and water loss identification.

Table 9-3. Near Term (2030) System Capital Improvements[a]

Improvement Area	Improvement Type	Justification	Improvement Description	Quantity and Unit	Construction Cost, dollars [b][c]	Capital Cost, dollars (includes markups)[b][d]
Supply Improvements						
North	Supply (Wells)	Addresses need to renew aging wells in North Stockton.	Construction of a new wells, equipped with backup power, or rehabilitation of an existing standby well	2 wells	$8,640,000	$11,520,000
South	Supply (Wells)	Addresses projected near-term storage deficit and improves supply reliability in South Stockton. Wells bolster local supplies in the event of a supply outage from SEWD and also contribute to storage requirements. Rehabilitation of Well SSS2 with treatment required due to the increase in demands from existing to 2030, therefore should be funded by future development. Assumes that TCP contamination at this well can be mitigated with GAC treatment.	Construction of a GAC Treatment system, and backup power	1 well	$1,755,000	$2,340,000
North & South	Supply (Study)	Study the existing condition, capacity and water quality trends of the City's wells in relation to pending and future regulatory requirements, and develop a comprehensive plan to renew and protect groundwater supplies	Study of existing well capacity, and quality to develop a comprehensive plan for the City's wells	1 lump sum	--	$250,000
				Subtotal - Supply Improvements	$10,395,000	$14,110,000
Storage Improvements						
South	Backup Power Improvements	Addresses projected near-term storage capacity deficit in South Stockton by maximizing the emergency groundwater credit. Currently Wells SSS3 and SSS9 do not have backup power, and therefore do not contribute to the emergency groundwater credit in South Stockton. Additional storage is needed due to increased demands, therefore these improvements should be funded by future development.	Installation of backup power generators at Wells SSS3 and SSS9	2 each	$540,000	$720,000
				Subtotal - Storage Improvements	$540,000	$720,000
Other Major Water System Improvements						
North	Intake Pump Station and Pipeline Upgrade	Ground settlement at the Intake Pump Station (IPS) site has required the interim repair and adjustment of station infrastructure and the 54-inch raw water pipeline that supplies the DWTP. It is recommended that the COSMUD perform additional studies to develop a long-term strategy including appropriate design features and construct improvements to station infrastructure and the raw water pipeline.	Perform an assessment, design and construction to the Intake Pump Station pipeline to mitigate settlement[e]	1 lump sum	$3,750,000	$5,000,000
North & South	DWTP Campus Improvements	Upon completion of the DWTP, Water Ops staff has been split up in terms of treatment and distribution. This project would improve/extend the campus at the DWTP so that all of Water Ops staff would be centrally located at the DWTP.	Planning, design and construction of a new Water Distribution Field Staff building and misc. campus improvements at the DWTP[f]	1 lump sum	$13,500,000	$18,000,000
North & South	Groundwater Storage Bank Study	Addresses future supply reliability by expanding/augmenting the City's conjunctive use portfolio and providing for the flexibility of banking unused supply for use at a later time (i.e., drought years).	Planning, design and construction of recharge basins[g]	1 lump sum	$6,000,000	$8,000,000
North & South	Metering/AMI Study	Improve metering technology to allow for enhanced demand tracking, management, and water loss identification	Study of an Advanced Metering Infrastructure (AMI) Program[h]	1 lump sum	--	$500,000
North & South			Feasibility and Pilot AMI Program Planning, Design and Implementation[i]	1 lump sum	$3,000,000	$4,000,000
				Subtotal - Other Major Water System Improvements	$26,250,000	$35,500,000
				Total Near Term System Capital Improvements	**$37,185,000**	**$50,330,000**
				Total City Funded Near Term System Capital Improvements (i.e., excludes Developer Funded projects)	**$34,890,000**	**$47,270,000**

(a) Costs shown are presented in August 2020 dollars (SF Construction Cost Index 12,921). Unless otherwise noted, improvements are anticipated to be complete by 2030.

(b) Costs rounded to the nearest $1,000.

(c) Estimated construction costs reflect typical conditions and do not account for construction uncertainties or reflect economic bidding climate. Costs include construction contingency of 35 percent from base construction costs.

(d) Costs include Other Project costs equal to 45 percent (Engineering: 15 percent; Construction Management: 15 percent; Program Implementation, CEQA, Legal: 15 percent).

(e) Costs associated with the IPS pipelines are anticipated to be incurred starting 2021 and 2022.

(f) Costs associated with the DWTP Ops Building are anticipated to be incurred starting 2022, and spread over 5 years.

(g) Costs associated with the recharge basins are anticipated to be incurred starting 2023, and spread over 5 years.

(h) Costs associated AMI Study are anticipated to be incurred 2022.

(i) Costs associated with the AMI Feasibility and Pilot are anticipated to be incurred 2023 and 2024.

9.2.4 Recommended Future (2040) System Improvements

Chapter 8 provided a summary of the evaluation of the COSMUD water distribution system and its ability to support future (2040) demands while meeting recommended water system planning and design criteria described in Chapter 5. In general, the analysis recommended the following:

- **Storage and Pumping.** To address future storage needs associated with future development, the following is recommended:
  - In North Stockton, a new 4.0 MG Northeast Reservoir and associated 12.0 mgd pump station
  - In South Stockton, a new 3.5 MG Mariposa Road Community Reservoir and associated 12.0 mgd pump station
- **Supply (Wells).** To offset storage reservoir size and/or address the projected storage deficit, via increased emergency groundwater storage credit, and improve water supply reliability, the following are recommended:
  - In North Stockton, construct and equip the planned Well 33 with backup power
  - In South Stockton, construct and equip a new well within the Mariposa Road Community development area, with backup power
  - In South Stockton, rehabilitate existing Well SSS8 and equip with backup power
- **Pipelines.** To address high velocities observed in transmission pipelines downstream of the DWTP, it is recommended that 5,800 linear feet (lf) of 36-inch diameter pipelines be constructed

Improvements and their associated costs are presented in Table 9-4. The location/extent of the recommended improvements is shown on Figure 9-1. Since the above listed recommendations are triggered by future demands, they should be allocated to future development and funded by connection fees.

9.3 BASIS OF RECOMMENDATIONS

The evaluations described in this Water Master Plan Update and the recommended capital improvement plan presented in this chapter are based on several key assumptions which are described throughout this report. These assumptions include the timing, type and extent of future development projects within the COSMUD North Stockton and South Stockton water service areas. The current assumptions for future planned development, used for this Water Master Plan Update, are described in Chapter 3. Should these assumptions change (e.g., development timing is expedited or delayed, future planned land uses are changed, or the extent of development is changed or does not occur at all) the timing, need and sizing for water system improvements may be affected. Before COSMUD proceeds with the design and construction of recommended water system improvements, future development plans and associated water system facility capacity needs should be reviewed and confirmed.

In particular, as described in this Water Master Plan Update, the Mariposa Road Community is a large potential future development area in South Stockton. The development area's previous entitlement has expired, and therefore it is not known if this project area will be developed or if it will be developed as previously planned. For the purposes of this Water Master Plan Update, it was assumed that the Mariposa Road Community will be developed by 2040, based on the most recent land use plan, and be served entirely by COSMUD. This future development area is one of the largest drivers for additional growth within the COSMUD South Stockton water service area. In addition, although this development area is

physically located within both the COSMUD water service area and the Cal Water service area, for the purposes of this Water Master Plan Update, it was conservatively assumed that the COSMUD would serve the entire Mariposa Road Community area. As described in Chapter 8, and as summarized above, future water system improvements have been identified to serve the future Mariposa Road Community area. However, before COSMUD proceeds with the design and construction of water system improvements for the Mariposa Road Community, actual development plans and associated facility capacity needs should be reviewed and confirmed.

Table 9-4. Future (2040) System Capital Improvements[a]

Improvement Area	Improvement Type	Justification	Improvement Description	Quantity and Unit	Construction Cost, dollars [b][c]	Capital Cost, dollars (includes markups)[b][d]
Supply Improvements						
South	Supply (Wells)	Addresses projected future storage deficit and improves supply reliability in South Stockton. Wells bolster local supplies in the event of a supply outage from SEWD and also contribute to storage requirements. Rehabilitation of Well SSS8 with treatment required due to the increase in demands at future (2040) Planning time frame, funding for these should be provided by new development. Assumed that PFOA/PFAS at this well is mitigated with GAC treatment.	Construction of a GAC Treatment system, and backup power	1 well	$1,755,000	$2,340,000
South	Supply (Wells)	Offsets the size of the Mariposa Road Community tank, and improves supply reliability in South Stockton. Since this well is equipped with backup power, it contributes to the EGWC in the Mariposa Road Community Development Area. Need for well is due to future development, and therefore should be funded by project proponents.	Construction of a new well, equipped with backup power	1 well	$4,320,000	$5,760,000
North	Supply (Wells)	Addresses projected future storage deficit and improves supply reliability in North Stockton. Wells bolster local supplies and also contribute/offset storage requirements via the emergency groundwater storage credit. Construction of Well 33 is recommended due to the increase in demands at future (2040) planning time frame, and therefore should be funded by future development.	Construction of new well, equipped with backup power	1 well	$4,320,000	$5,760,000
				Subtotal - Supply Improvements	$10,395,000	$13,860,000
Storage and Pumping Improvements						
South	Reservoir	Addresses projected future storage deficit as a result of future demands. Need for Reservoir and Pump Station is due to future development, and therefore should be funded by future development.	Construction of New Mariposa Road Community Reservoir Facility, 3.5 MG Reservoir and associated 12.0 mgd pump station, equipped with backup power.	3.5 MG	$6,278,000	$8,370,000
South	Reservoir Pump Station			12 mgd	$4,860,000	$6,480,000
North	Reservoir	Addresses projected future storage deficit as a result of future demands. Need for Northeast Reservoir and Pump Station is due to future development, and therefore should be funded by future development.	Construction of new Northeast Reservoir facility, 4.0 MG Reservoir and associated 12.0 mgd pump station, equipped with backup power.	4 MG	$6,885,000	$9,180,000
North	Reservoir Pump Station			12 mgd	$4,860,000	$6,480,000
				Subtotal - Storage and Pumping Improvements	$22,883,000	$30,510,000
Pipeline Improvements						
North	Pipelines	Addresses high velocities observed in existing pipelines downstream of DWTP finished water pump stations. These pipelines allow the COSMUD to maximize use of the DWTP to meet future demands and therefore should be funded by future development.	New 36-inch diameter transmission pipelines downstream of DWTP	5,800 LF	$3,289,000	$4,385,000
				Subtotal - Pipeline Improvements	$3,289,000	$4,385,000
				Total Future (2040) System Capital Improvements	**$36,567,000**	**$48,755,000**
				Total City Funded Future (2040) System Capital Improvements (i.e., excludes Developer Funded projects)	**$0**	**$0**

(a) Costs shown are presented in August 2020 dollars (SF Construction Cost Index 12,921). Unless otherwise noted, improvements are anticipated to be complete by 2040.

(b) Costs rounded to the nearest $1,000.

(c) Estimated construction costs reflect typical conditions and do not account for construction uncertainties or reflect economic bidding climate. Costs include construction contingency of 35 percent from base construction costs.

(d) Costs include Other Project costs equal to 45 percent (Engineering: 15 percent; Construction Management: 15 percent; Program Implementation, CEQA, Legal: 15 percent).

This chapter presents the multi-year financial plan, which provides a summary of the projected water revenues and annual water operating and capital expenses to reflect the recommendations of this COSMUD Water Master Plan Update. The capital costs contained within the financial plan are based on the CIP projects presented in Chapter 9. Currently, the COSMUD is working on a separate comprehensive water rate study update. To align the financial section of the Water Master Plan Update with the comprehensive water rate study, the operating expenses and assumptions for cost escalation as identified in the rate study were used as the basis for the development of this financial chapter. The water rate study will perform a more detailed analysis of the revenues and expenses of the water utility, which may result in minor differences from the information found in this financial chapter. Additionally, the rate transition plans developed in each may differ as assumptions and City Council direction may affect the results.

10.1 INTRODUCTION

The effective implementation of the Water Master Plan Update is dependent on development of a water rate revenue transition plan to support the operating and capital needs to maintain and expand the water system to meet demands, state and local regulatory requirements, and provide the flexibility for the COSMUD to deal with unforeseen changes. In general, the financial plan uses the annual operating expense and identified capital needs of the water utility to determine if the current water rate revenues are sufficient to fund annual operating and capital expenses. If necessary, the financial plan will also develop a rate transition plan to fully fund the utility.

10.2 KEY ASSUMPTIONS

The COSMUD adopted Fiscal Year (FY) 2021 budget was used as the basis for the development of the projection of O&M expenses. Escalation factors were developed which were based on historical inflationary factors for the COSMUD and the local area and are the same factors as those being applied in the comprehensive water rate study. These escalation factors were applied to the budgeted O&M expenses to project future annual O&M expenses over the projected time period.

The financial plan is predicated on the following:

- Projected rate revenue adjustments are implemented,
- The timing and magnitude of the capital improvements are maintained, and
- Customer characteristics remain similar for rate revenue generating purposes.

There is also no assumed additional staffing (i.e., full-time equivalents [FTEs]) needed and no new O&M expenses were added.

10.3 HISTORICAL REVIEW

The first step in reviewing the financial health of the COSMUD water utility is to gain an understanding from prior financial performance. To do this, the analysis starts with the previous 5-year period of FY 2015 to FY 2019. The COSMUD proforma which details historical costs by category as well as budget figures going forward was used as the basis for the analysis. Given this information, one can assess the water utility past financial health and gauge any trends that may be occurring. The information from the historical review helped in the development of the assumptions for the financial plan as well as in gaining

an understanding of the water utility's operations. A summary of the historical operating revenues and expenses is shown in Table 10-1.

Table 10-1. Historical Revenue Requirement, $000s

	Actual FY 2015	Actual FY 2016	Actual FY 2017	Actual FY 2018	Actual FY 2019
Revenues	35,318	33,743	42,377	51,103	50,445
Expenses					
O&M	22,134	21,555	21,301	22,333	24,361
Debt Services	17,660	13,329	12,169	17,437	18,740
Total Expenses	**$39,794**	**$34,884**	**$33,470**	**$39,769**	**$43,101**
Balance/(Deficit) of Funds	($4,476)	($1,141)	$8,908	$11,334	$7,344

As can be seen from the historical review, the COSMUD has - in general - maintained adequate funding for annual operation and maintenance as well as funding capital improvements during this historical time period. Given the balance of funds, it is assumed that the COSMUD uses those funds for funding current and future capital improvement needs. Capital funding could be accomplished through annual funding, often referred to as rate funded capital or pay as you go, or through funding reserves in initial years to fund large projects in the future. In years where the utility is deficient, it is likely indicating a use of reserve funds for capital improvement projects. It is important to note that additional expenses and revenues may not be shown in the available data derived from the COSMUD proforma. However, this table provides a comparison from year to year using available historical data.

10.4 DEVELOPMENT OF THE FINANCIAL PLAN

The financial plan was developed to determine the COSMUD ability to fund its water system capital improvements, as developed in this Water Master Plan Update, as well as the projected O&M needs over the review period. The analysis also took into consideration prudent financial management criteria such as adequate funding of capital through rates, maintaining required debt service coverage (DSC) ratios, and operating and capital fund balances (i.e., reserve levels). The financial plan developed the projected water utility revenues and expenses for FY 2021 through FY 2030. The development of the projection was based on the adopted FY 2021 budget provided by the COSMUD. The budget was then escalated through FY 2030, by applying previously mentioned escalation factors to reflect future cost inflation ranging from 2.0 percent to 6.5 percent, annually, depending on the expense category. The range in inflationary factors is based on historical trends in various costs.

The following sections describe the key components of the financial plan. Worksheets showing the financial analysis are provided in Appendix E.

10.4.1 Revenues

The first component in developing the financial plan is a review of the sources of revenue for the COSMUD water utility. The starting point was the calculated revenue for FY 2021 which was also utilized in the water rate study. The following revenues are received from the COSMUD water customers and operations:

- Rate revenues: annual rate revenues received based on current adopted rate levels
- Other revenues: permit fees, fines and penalties, interest income, rental income, and other miscellaneous sources

The COSMUD water rate revenues are projected to be approximately $51.1 million for FY 2021. Assumed customer growth is conservative at a rate of 0.5 percent per year. It is important to note that the rate revenues projected are prior to any rate adjustments either previously adopted or proposed. With the impact of assumed customer growth, water rate revenues are anticipated to increase to approximately $53.4 million by FY 2031. Other, or miscellaneous, revenues are projected to be approximately $7.0 million in FY 2021. These revenues are anticipated to increase slightly over the review period and total a little over $7.5 million by FY 2030. In total – including both rate and other revenues - the COSMUD is projected to receive $58.1 million in FY 2021, prior to any rate adjustments. Total revenues are projected to increase through FY 2030 to approximately $61.0 million. Provided in Table 10-2 is a summary of the current, and projected, rate and other revenues.

10.4.2 Operations and Maintenance

The next component of the financial plan for the COSMUD water utility was to project the O&M expenses incurred to provide service to its customers. As noted, the projection of future O&M expenses is based on the COSMUD FY 2021 water utility budget. The budgeted figures were then escalated annually through FY 2030 using the assumed inflationary factors described previously.

The O&M expenses in FY 2021 are budgeted at $35.0 million. Based on the increase in O&M over the period and the assumed inflationary factors, O&M expense levels are expected to increase to $54.6 million in FY 2030. This assumes no significant additions or changes made to the O&M practices during the projected period. The forecast of O&M expenses is shown in summary in Table 10-3.

10.4.3 Capital Funding Plan

A major component of the COSMUD planning process, and a focal point of this financial planning analysis, is the funding of the COSMUD CIP. For purposes of financial planning the CIP, as presented in detail in Chapter 9 of this Plan, which is shown in 2020 dollars, is increased annually by 2.7 percent to reflect the future escalation of costs due to inflationary impacts. For the COSMUD to maintain the existing system and level of service to its customers, it is important to reinvest in the system at a level at least equal to depreciation. It is prudent, therefore, to have a level of annual capital projects funded by rates greater than this target level. This is because the replacement cost of the system will continue to increase as a result of inflation and the annual depreciation may actually be the lower threshold of targeted funding. Depreciation expense for FY 2019 was reported at $8.1 million for the water utility. Following prudent financial practices of 1.5 to 2.0 times depreciation, this would result in the need for the COSMUD to invest at least $12.0 million annually to sustain its capital facilities. The financial plan projects that the rate-funded capital will increase over the review period from $9.0 million in FY 2021 and reach $11.0 million by FY 2030 averaging $9.7 million over the review period.

Table 10-2. Projected Water Revenues, $000s

	FY 2021	FY 2022	FY 2023	FY 2024	FY 2025	FY 2026	FY 2027	FY 2028	FY 2029	FY 2030
Revenue										
Rate Revenue[(a)]	$51,146	$51,402	$51,659	$51,917	$52,177	$52,438	$52,700	$52,963	$53,228	$53,494
Misc. Revenue	6,973	7,753	7,664	7,546	7,506	7,459	7,466	7,486	7,506	7,524
Total Revenue	**$58,119**	**$59,155**	**$59,323**	**$59,463**	**$59,683**	**$59,897**	**$60,166**	**$60,449**	**$60,734**	**$61,019**

(a) Rate revenue presented in this table does not include any proposed rate revenue adjustments.

Table 10-3. O&M Expenses, $000s										
	FY 2021	FY 2022	FY 2023	FY 2024	FY 2025	FY 2026	FY 2027	FY 2028	FY 2029	FY 2030
Total Admin. & General	$2,400	$2,473	$2,548	$2,685	$2,782	$2,868	$3,023	$3,133	$3,229	$3,328
Total Op. and Maint.	4,874	5,032	5,192	5,451	5,652	5,835	6,128	6,354	6,561	6,774
Total Utility Billing	1,012	1,042	1,073	1,147	1,193	1,228	1,313	1,365	1,406	1,448
Total Other Support Services	625	644	664	702	729	752	795	826	852	879
Total Water Conservation	164	118	121	127	132	136	142	147	152	157
Total Water Purchase	16,011	17,051	18,160	19,340	20,597	21,936	23,362	24,880	26,497	28,220
Total Hydrant Maintenance	323	333	343	358	371	383	400	414	427	441
Total Delta Water Production	4,801	4,975	5,146	5,372	5,571	5,765	6,019	6,243	6,459	6,684
Total Well Production	1,654	1,713	1,774	1,855	1,927	1,996	2,088	2,169	2,247	2,327
Total DWSP Maint. & Repair	1,168	1,205	1,244	1,305	1,353	1,396	1,465	1,519	1,568	1,618
Total MUD Admin / Finance	730	753	776	818	849	876	924	958	989	1,020
Total Engineering Services	255	264	272	287	297	307	324	336	347	358
Total Lab Services	322	332	343	358	371	382	400	414	427	441
Total Safety	315	325	335	349	360	371	386	399	412	424
Total SCADA	252	260	269	282	292	302	317	329	340	351
Total Outreach & Training	118	121	125	128	132	135	139	143	147	151
Total Revenue	**$35,023**	**$36,641**	**$38,384**	**$40,564**	**$42,608**	**$44,668**	**$47,226**	**$49,630**	**$52,059**	**$54,621**

The CIP from FY 2021 through FY 2030 includes project funding totaling $11.8 million for FY 2021 and fluctuates from year to year to a maximum of $28.0 million in FY 2023. The total capital project funding from FY 2021 through FY 2030 is $133.3 million. The average annual capital funding is approximately $13.3 million over the time period. Funding for the capital projects comes from several sources:

- The first source of funding for capital projects is through the ***rate funded capital*** line item, which is set at $9.0 million in FY 2021 and increases, annually, to a maximum of $11.0 million in FY 2030 for a total funding of $96.7 million over the period or roughly 72.5 percent of the total 10-year CIP funding analysis. This funding source is critical funding component for the annual renewal and replacement of the system, which as mentioned, should be targeted at a level greater than annual depreciation. As mentioned previously, the annual depreciation for FY 2019, which is the target minimum funding, was approximately $8.1 million. During the projected period, the level of rate funded capital reaches approximately 1.2 times depreciation.
- The second source of funding is from available reserves. For purposes of capital funding, the COSMUD financial plan utilized three reserves: operating reserve, connection fee reserve, and Delta Water Supply Project Surface Water Supply Fee (DWSP SWSF) Fund. The COSMUD transfers funds in years of surplus – which can happen for a number of reasons - into the operating fund which can then be used for funding capital projects. Over the review period, it is assumed that the COSMUD will use approximately $24.3 million of operating reserves. The connection fee reserve – as the name implies – is a reserve designated to hold connection fee revenues and be used towards either growth related long-term debt service or growth related capital projects. In total, the CIP is projected to utilize $12.3 million in connection fee reserves. Lastly, the DWSP SWSF fund functions in a similar way as the connection fee reserve but is funded through the DWSP connection fee. There is no assumed use of the DWSP SWSF Fund for capital projects. In total, approximately 27.5 percent of the 10-year CIP funding requirement or $36.6 million comes from reserves over the review period to smooth out rate adjustments and limit long-term debt issuances. It is important to note that the use of reserves from year to year may fluctuate greatly depending on the actual level of capital projects for the COSMUD as well as what type of project is it. The financial model assumes that if there is more capital funding available in a given year then there are planned capital projects, the excess funds will be moved to the operating reserve in order to be saved and available to be used for future capital expenses.
- The final source of funding for capital projects is from long-term debt. This comes in the form of low-interest loans and/or revenue bonds. This source not only allows the COSMUD to secure funding for large one-time projects, but it also serves as a tool to equitably spread the costs of projects to the future beneficiaries, even though they are not connected to the system yet. For this review, it is assumed that the COSMUD will not be issuing any additional long-term debt to fund the capital projects.

Table 10-4 shows a summary of the capital projects by type and the various funding sources.

Table 10-4. Capital Improvement Plan, $000s										
	FY 2021	FY 2022	FY 2023	FY 2024	FY 2025	FY 2026	FY 2027	FY 2028	FY 2029	FY 2030
Total Capital Projects	**$11,803**	**$12,235**	**$27,952**	**$11,484**	**$15,466**	**$12,299**	**$10,000**	**$10,400**	**$10,700**	**$11,000**
Less: Operating Reserves	0	588	15,949	2,114	2,848	2,799	0	0	0	0
Less: Connection Fee Reserves	2,803	2,973	3,053	119	3,367	0	0	0	0	0
Less: Developer Contributions	0	0	0	0	0	0	0	0	0	0
Less: Long-Term Borrowing	0	0	0	0	0	0	0	0	0	0
Less: Rate Funded Capital	9,000	8,675	8,950	9,250	9,250	9,500	10,000	10,400	10,700	11,000

10.4.4 Debt Service

The COSMUD water utility currently has several outstanding debt issuances with an annual debt service payment of approximately $14.3 million for FY 2021. The COSMUD water utility is not assumed to issue additional long-term debt over the next 10 years to fund capital projects.

An important metric used in the analysis of debt is the DSC ratio. The DSC ratio is a comparison of revenues available to fund annual debt service payments after deducting O&M expenses from the total available revenues. Generally, a DSC ratio of 1.5 is considered prudent and adequate for a utility. This number is often looked at by rating agencies and can affect the terms of financing for future long-term debt issuances. For the COSMUD water utility, the DSC ratio is calculated at 1.77 for FY 2021. The number increases slightly - with the help of proposed rate revenue adjustments - to 1.93 by FY 2030.

10.4.5 Reserve Funds

The COSMUD, as mentioned earlier, has an operating reserve which serves a variety of purposes, but the three primary purposes are one or all of the following:

- To supply adequate liquidity and cash flow to cover the operating costs of the utility until revenues are collected for services rendered
- To provide funds for a catastrophic event resulting in a large capital funds need or loss of revenue
- To maintain surplus revenues to disburse in a deficit year, thereby avoiding needed rate increase and decrease and smooth rates over time

The minimum target is set at 180 days of O&M expenses, which reflects general industry standard levels. The beginning balances, based on those provided by the COSMUD for the operating reserve, total $70.4 million in FY 2021. Over the review period, reserves are used for various reasons, such as to fund the CIP and annual debt service payments, thereby minimizing rate adjustments. In FY 2030 it is projected that the ending reserve balance will be approximately $39.5 million. This means that after the COSMUD has met the 180 days of O&M in the operating reserve, it will still have reserve funds available to meet other needs.

10.5 SUMMARY OF THE FINANCIAL PLAN

The individual components discussed above are used to develop the financial plan. The summation of the annual O&M expenses, rate funded capital, debt service payments, and reserve funding is generally known as a revenue requirement. This analysis is used to compare the COSMUD current water rate revenues and operating and capital expenses, to assess the sufficiency of the existing rates. If there is a deficiency, and depending on the magnitude, timing, etc., a rate revenue adjustment may be recommended to maintain adequate funding for the operational and capital needs of the utility. Shown in Table 10-5 is a summary of the water revenue requirement that was prepared for the COSMUD as part of this Water Master Plan Update.

Table 10-5. Revenue Requirement Summary, $000s										
	FY 2021	FY 2022	FY 2023	FY 2024	FY 2025	FY 2026	FY 2027	FY 2028	FY 2029	FY 2030
Revenues										
Rate Revenue	$51,146	$51,402	$51,659	$51,917	$52,177	$52,438	$52,700	$52,963	$53,228	$53,494
Other Revenue	6,973	7,753	7,664	7,546	7,506	7,459	7,466	7,486	7,506	7,524
Add'l Rev from Rate Adj.	0	0	1,808	3,698	5,952	8,319	10,803	13,409	15,811	18,319
Total Revenue	**$58,119**	**$59,155**	**$61,131**	**$63,161**	**$65,635**	**$68,215**	**$70,968**	**$73,858**	**$76,545**	**$79,337**
Expenses										
O&M	$35,023	$36,641	$38,384	$40,564	$42,608	$44,668	$47,226	$49,630	$52,059	$54,621
Net Debt Service	13,785	13,793	13,801	13,522	13,528	13,189	13,207	13,222	13,233	13,234
Rate Funded Capital	9,000	8,675	8,950	9,250	9,250	9,500	10,000	10,400	10,700	11,000
Reserve Funding	310	46	(5)	(175)	249	858	536	606	553	483
Total Expenses	**$58,119**	**$59,155**	**$61,131**	**$63,161**	**$65,635**	**$68,215**	**$70,968**	**$73,858**	**$76,545**	**$79,337**
Balance/(Deficit) of Funds	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0

As noted in Table 10-5, the COSMUD water utility would need to adjust overall water rate revenues over the time period in order to fully fund the operating and capital needs through FY 2030. Key drivers in the financial plan results are the projection of O&M costs and the funding of the proposed CIP from Chapter 9. Any future rate transition plan should aim to provide steady and predictable rate adjustments over time. The proposed rate adjustments should be designed to fund the water utility as identified in this financial plan and in doing this will help to maintain a strong financial position for the COSMUD to fully fund the operational and capital needs of the water utility. As mentioned previously, the COSMUD is currently undertaking a comprehensive water rate study, which will provide a more detailed analysis of the COSMUD water utility and proposed rate revenue adjustments.

10.6 CONNECTION FEES

The COSMUD has a number of funding sources available to offset capital costs of which many were discussed above. Another source which was not described in detail is from connection fees received from new water connections. New water connections are assessed a connection fee as a way to recover part or all of the cost of providing the infrastructure necessary to service the new connection (e.g., customer). The intent is that all new system customers will pay an equitable share of (or 'buy' into) the cost of the water system improvements needed to accommodate growth. The calculation typically includes a value of the existing water system assets and then adds in the anticipated future capital associated with providing capacity for new water customers. This total cost is then reviewed on an incremental approach, that is, a calculation is performed to look at what the costs related to adding an additional single family equivalent unit is. Given this calculation, the schedule of connection fees can be updated. The revenues from these fees can then be utilized to pay directly for capital projects or for long-term debt service related to growth or capacity expansion. Additionally, a portion of the revenue from connection fees may be eligible to offset existing long-term debt payments to the extent they funded growth and expansion related capital infrastructure.

The COSMUD currently has in place two fees that serve this purpose. The first is the water connection fee. This fee reflects the investment in infrastructure (capacity) for the distribution system. The second is the Delta Water Supply Fee which is in place to reflect the water treatment plant infrastructure (capacity) available to new customers. While the water connection fee has not been updated in some time, the Delta Water Supply Fee is updated annually based on the initial study schedule. In order to update the water connection fee, the starting point would be the capital improvements as outlined in this Water Master Plan Update, along with the existing distribution infrastructure. The available capacity in the existing system, plus the growth or expansion related capital projects, would be utilized in the analysis to develop an updated water connection fee. This would provide a fee that reflects the value of the capacity necessary to serve new customers connecting to the COSMUD water system.

10.7 SUMMARY

The financial plan presented in this chapter is based on several assumptions: the level of growth in the system, inflation amounts, and the level of debt financing at certain terms. Should these assumptions change (e.g., growth increases, slows down, or does not occur) the level of balance or deficiency and, therefore, rate adjustments required will be affected. Likewise, if costs escalate faster or slower than indicated in this plan, the projected balance or deficiency would also be affected.

Appendix A

Hydrant Testing and Hydrant Pressure Recorder Placement Plan for Model Calibration

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WEST YOST ASSOCIATES

MEMORANDUM

DATE: June 4, 2020

Project No.: 129-60-20-41
SENT VIA: EMAIL

TO: Gemma Biscocho, PE, City of Stockton

FROM: Roberto Vera, PE, RCE #83500
Megan McWilliams, EIT #164172

REVIEWED BY: Brenda Estrada, PE, RCE #67062

SUBJECT: City of Stockton – Water Master Plan Update
Hydrant Testing and HPR Placement Plan for Model Calibration

This memorandum summarizes West Yost Associates' (West Yost) recommended program for hydrant testing and collection of field system pressures using hydrant pressure recorders (HPR), both of which are required to calibrate the City of Stockton's (City) existing water system hydraulic model. The information provided in this memorandum presents the proposed hydrant test and pressure monitoring locations. The City should share this plan with the appropriate parties (e.g., Water Operations staff, Fire Department, etc.), so they are aware of the equipment being used or temporarily installed at the proposed testing/monitoring locations. Field monitoring with the HPRs is scheduled to occur Thursday, June 18 through Friday, June 26 (monitoring period) and hydrant testing is scheduled for Wednesday, June 24, and if needed, Thursday, June 25, 2020.

HYDRANT TESTING PROGRAM

The purpose of the hydrant testing program is to confirm and "spot-check" the roughness factors (C-factors) that are assigned to pipelines in the City's hydraulic model. West Yost will use data collected though hydrant testing to verify if current pipeline C-factors assigned in the City's hydraulic model are appropriate and representative of actual field conditions. Hydrant test locations were selected based on the combination of pipeline diameter, available material/age estimates, and discussions with City Operations Staff. Results from this testing program will determine C-factor adjustments needed in the hydraulic model to better reflect field conditions.

Details related to the hydrant testing program are presented in the following sections:

- Personnel and System Data Requirements
- Hydrant Testing Schedule
- Testing Requirements and Procedure
- City's Responsibilities

Personnel and System Data Requirements

West Yost requests the following City personnel, system data, and supporting documents to accomplish the recommended hydrant testing program:

- Three (3) to five (5) City staff members (with vehicles) that will be available during regular working hours to assist with, but not limited to, the following:
  - Closing and re-opening valves, as needed before and after hydrant testing
  - Reading and recording hydrant pressure data
  - Flowing the test hydrant
  - Directing and controlling traffic, and hydrant flows, as necessary, to ensure safety during these hydrant flow tests, dechlorination, and direct the discharged water into the nearest drainage system during each test
  - Public outreach and interface, as necessary
- System information during the hydrant testing days (June 24/25th) that includes the following:
  - City SCADA data from all water distribution system facilities, in 1-minute increments during hydrant testing for the following facilities[1]:
    - Reservoir levels (in feet) for all reservoirs, and altitude valve flowrate (gpm), if available
    - Pump Station information (pump operational status, speed settings, discharge pressures [psi], and flow rate [gpm]) for all booster pump stations
    - Groundwater well information (discharge pressure [psi], flow rate [gpm], and speed settings where/if applicable) for all wells
    - Water Treatment Plant information for the Delta Water Supply and Stockton East Water Treatment Plants (discharge pressure [psi], flow rate [gpm])
    - Distribution system pressure monitoring information at key City points, aside from the locations listed above, if available (pressure [psi])
- One copy of the City's Health and Safety Plan for testing hydrants

Hydrant Testing Schedule

West Yost requests that the hydrant testing be scheduled starting at approximately 7:30 AM on June 24, 2020. West Yost will meet with the City staff a half hour before hydrant testing (7:00 AM) to conduct a brief field coordination meeting to review hydrant testing procedures and protocols (i.e., where to go and what to do). West Yost will also use this coordination meeting to distribute pressure gauges (hydrant wrenches to be provided by City staff) necessary to complete the hydrant testing program. In addition, West Yost will also confirm with City staff what order they prefer to

[1] SCADA data from all water distribution system in 15-minute increments will also be requested for the entire HPR monitoring period (i.e., June 17 through June 25, 2020). Data in 15-increments is desired in order to develop a diurnal pattern.

conduct tests (i.e., avoid school traffic or commuter traffic, etc.) and to review hydrant tests that may present minor challenges. If hydrant tests are not completed on June 24, an additional day of hydrant testing for a half-day on June 25 may be required.

Testing Requirements and Procedure

West Yost plans to conduct up to seven (7) hydrant flow tests within the City's water system. Figure 1 shows the proposed hydrant test locations. In addition, one (1) alternative hydrant test has been identified. If any of the seven (7) test locations are unable to be flowed, the alternative location may be used. Table A-1, in Attachment A, lists the proposed test locations. Details regarding each of the proposed tests (e.g., flowing hydrant, observation hydrants, closed valves, etc.) are also provided in Attachment A (Figures A-1 through A-8). As shown in Attachment A, only one test is proposed for South Stockton. This is due to the fact that most of the pipelines in South Stockton are either new (PVC) and are expected to be smooth, or are located in industrial areas where pipeline diameters are large and thus discharges would be large, possibly encumbering nearby operations or traffic.

Each hydrant test will involve maintaining flow from a single hydrant, while monitoring the residual pressure at three (3) to four (4) observation hydrants located near the flowing hydrant. The field observed static and residual pressure readings will then be used to confirm or adjust pipeline C-factors used to calibrate the hydraulic model to more closely reflect observed conditions. Hydrant test locations have been selected to isolate pipelines of a particular material type, diameter, and age. Tests will require City staff to close one (1) or more isolation valves prior to the test and then re-open these isolation valves following the test.

The general testing procedure at each of the hydrant test locations is outlined below and illustrated on Figure 2.

- **Step 1.** Before the test, flush the test (flowing) hydrant and each observation hydrant before attaching the pressure gauge. This allows sediments, which might damage the gauge or cause faulty readings, to be flushed out from the hydrant.
- **Step 2.** Attach the pressure gauge to the hydrant with the gauge's test cock valve **open**. Slowly open the hydrant and bleed off the gauge with the gauge's test cock until the hydrant is fully pressurized.
- **Step 3.** Close the gauge test cock valve, and then measure the static pressures at the designated test hydrant and each observation hydrant.
- **Step 4.** Flow the designated test hydrant and measure the discharge flow and pressure.
- **Step 5.** Measure the residual pressures at the designated test hydrant and at each observation hydrant while the test hydrant is flowing.
- **Step 6.** Continue monitoring pressure until the "all clear" is given by a West Yost employee. Record the static pressure and then detach the pressure gauge.
  IMPORTANT: *Before closing the hydrant, be sure the gauge's test cock valve is open and bleeding while the hydrant is being closed.*

At least one (1) City staff member will be required at the flowing test hydrant and up to three (3) additional City personnel will be required in the field to assist with the opening and closing of valves (refer to Attachment A). West Yost will provide at least five (5) staff members to direct, oversee, and assist in the field data collection work effort. West Yost will staff observation hydrants, so City staff can participate at the flowing hydrant, opening/closing valves, and dechlorination efforts.

It is anticipated that each hydrant test will take no more than one (1) half hour and that each hydrant will be flowing for no more than 10 minutes during a test.

Testing Equipment

West Yost will provide 2.5-inch and 4.5-inch diameter Swivel Piezo Diffusers and pressure gauges during the hydrant testing program. It is our recommendation that the 4.5-inch diameter Swivel Piezo Diffusers be used for all proposed hydrant tests. For any hydrant test where is it not possible to use this type of diffuser due to drainage or traffic control issues, an alternative method will need to be further evaluated and confirmed before the day of field testing. The following equipment is typically used by West Yost during hydrant testing:

- Hydrant wrenches
- Diffusers
- Pressure Gauges
- Plumber's Tape
- Hydrant Pressure Recorder(s) with Data Transfer Unit
- Hydrant Test Memo
- Mobile device (with a data plan) and Survey123 app installed to collect field data
- Vehicles/trucks
- Equipment needed to close valves and for traffic control
- Dechlorination equipment
- Two-way portable communication for each of the testing personnel

City's Responsibilities

The City will be responsible for providing the following hydrant testing equipment:

1. Hydrant wrenches
2. Dechlorination equipment
3. Piece of Plywood

The City is also responsible for notifying other City staff and departments (i.e., Fire Department) about the scheduled hydrant testing, obtaining approvals that may be required, providing proper

drainage of the hydrant flow, and providing equipment for dechlorinating[2] test water and personnel for traffic control, if required.

West Yost requests that the City staff review and inspect each of the proposed hydrant test and HPR placement locations before the testing date to identify any potential problems or hazards with the selected locations. Of particular concern will be the potential for flooding landscaping, building basements, or creating hazardous traffic conditions. West Yost recommends that all drainage inlets/manholes be inspected near the testing site to confirm proper drainage. If possible, the City should also supply a piece of plywood in an effort to protect landscaping adjacent to the flowing hydrant. Additionally, location and status of valves that will be closed during the hydrant testing should be confirmed. Detailed figures, which illustrate the flowing hydrant, observation hydrants, valves to be closed, and adjacent drainage features are provided in Attachment A.

HYDRANT PRESSURE RECORDER PROGRAM

Placement of HPRs at key hydrants within the City's water system is required to collect data necessary to calibrate pressures for extended period calibration of the City's hydraulic model. West Yost has identified a total of sixteen (16) hydrants within the water system to monitor system pressures with the HPRs, with twelve (12) hydrants located in North Stockton and four (4) hydrants located in South Stockton. The selected HPR locations are based on locations in the City's water distribution system that are hydraulically distant from water facilities, thus representing the "boundary" of the water distribution system.

West Yost is proposing to install the sixteen (16) HPRs on June 18, 2020 to collect pressure information for a total of about one (1) week. West Yost plans to attach the HPRs to the 2.5-inch port on specified hydrants and lock them in place with a padlock. After the seven-day monitoring period is complete, West Yost will remove the HPRs from their locations on June 26, 2020, and then download and review the collected data. Figure 3 shows the general location of each HPR. Attachment B includes Table B-1, which provides the approximate location of each hydrant pressure recorder. Attachment B also includes detailed figures that illustrate the specific location of each hydrant selected for HPR placement (see Figures B-1 through B-16).

It is important for City staff to coordinate with local fire departments and any other appropriate parties regarding the locations and duration of monitoring. This will help reduce the chance of inadvertently shutting off a hydrant with an HPR installed and may also reduce the risk of an HPR being removed or tampered with, because the field pressure data required for the hydraulic model calibration cannot be collected once a hydrant is shut off or if the HPR is removed. To further reduce risk, each HPR is equipped with a padlock; a set of keys will be provided to the City staff. However, in case of an emergency, the fire department can break the lock to remove the HPR. In a non-emergency case, if an HPR is required to be removed, or if the associated hydrant needs to be shut off, West Yost requests that the fire department inform the City and the City then coordinate with West Yost staff.

[2] Handling of water released from each hydrant test will need to comply with City Operations procedures and be consistent with the City's NPDES permit for planned releases from hydrant tests.

SUMMARY OF HYDRANT TESTING AND PRESSURE MONITORING PROGRAM

Hydrant testing will be performed as described above beginning at 7:30 AM on June 24, 2020. West Yost proposes to perform the initial HPR installation on June 18, 2020. West Yost will remove the HPRs from their location on June 26, 2020 and download and review the field collected data. During the installation and removal of the HPRs, West Yost requests that City staff accompany West Yost staff. The location descriptions and associated detailed location maps of the designated hydrants are presented in Attachments A and B. After the completion of the hydrant testing (on June 24, 2020, or possibly June 25, 2020) and collection of system pressure via HPRs, West Yost will coordinate with the City to obtain the following SCADA system data:

- 1-minute increments for all facilities listed in the Personnel and System Data Requirements section for June 24, 2020 (and June 25, 2020 if hydrant testing is extended); and,
- 15-minute increments for all facilities listed in the Personnel and System Data Requirements section from June 17, 2020 to June 25, 2020.

Please feel free to contact Bobby Vera at (916) 306-2212 if you have any questions or comments.

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North Stockton

Delta Water Supply Project
WTP
Northwest
14 Mile Slough
Well #29
Well #30
Well #18
Well #16
Well #9
Well #7
Well #15
Well #21
Well #1
Well #11
Well #4
Well #03R
Well #19
Well #20
Well #10R
Well #24
Well #31
Well #32
Well #26
Well #25
Well #28
Well #27
1
2
3
4
5
6
7
8
ARMSTRONG RD
LIVE OAK RD
EIGHT MILE RD
WEST LN
RINDGE RD
DUCK CREEK LEVEE RD
ASHLEY LN
HILDRETH LN
ALPINE RD
CHEROKEE RD
WATERLOO RD
HOLT RD
SAN JOAQUIN RIVER
BROOKSIDE RD
PACIFIC AVE
EL DORADO ST
FREMONT ST
MINER AVE
Stockton East Water District
WTP
0 3,500 7,000
Scale in Feet

South Stockton

Stockton East Water District
WTP
Well SSS9
Well SSS8
Well SSS2
Well SSS3
Well SSS1
Weston Ranch
7
FREMONT ST
MINER AVE
SAN JOAQUIN RIVER
NAVY DR
SUTTER ST
MARTIN LUTHER KING JR BLVD
TURNPIKE RD
EIGHTH ST
EL DORADO ST
POCKET RD
MARIPOSA RD
JACK TONE RD
NEWCASTLE RD
AIRPORT WAY
FRENCH CAMP RD
HOWARD RD
AUSTIN RD
0 3,000 6,000
Scale in Feet

Hydrant Test Location
Storage Tank & Booster Pump Station
Water Treatment Plant
COSMUD Water Service Boundary
Well (Active)
Well (Inactive)
Well (Standby)
Pipeline (Less Than 12-inch)
Pipeline (12-inch or Greater)
Railroad

CITY OF STOCKTON
WEST YOST ASSOCIATES

Figure 1

Hydrant Test Location Map

City of Stockton
Water Master Plan Update

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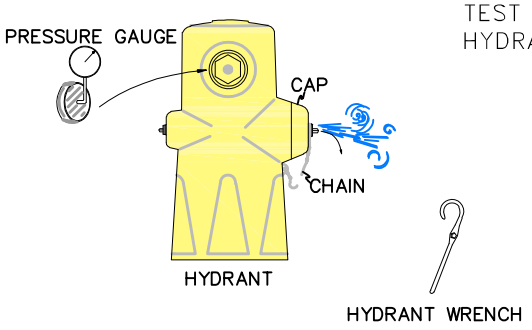
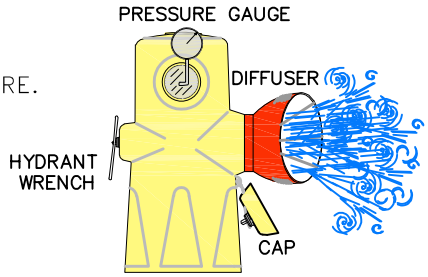
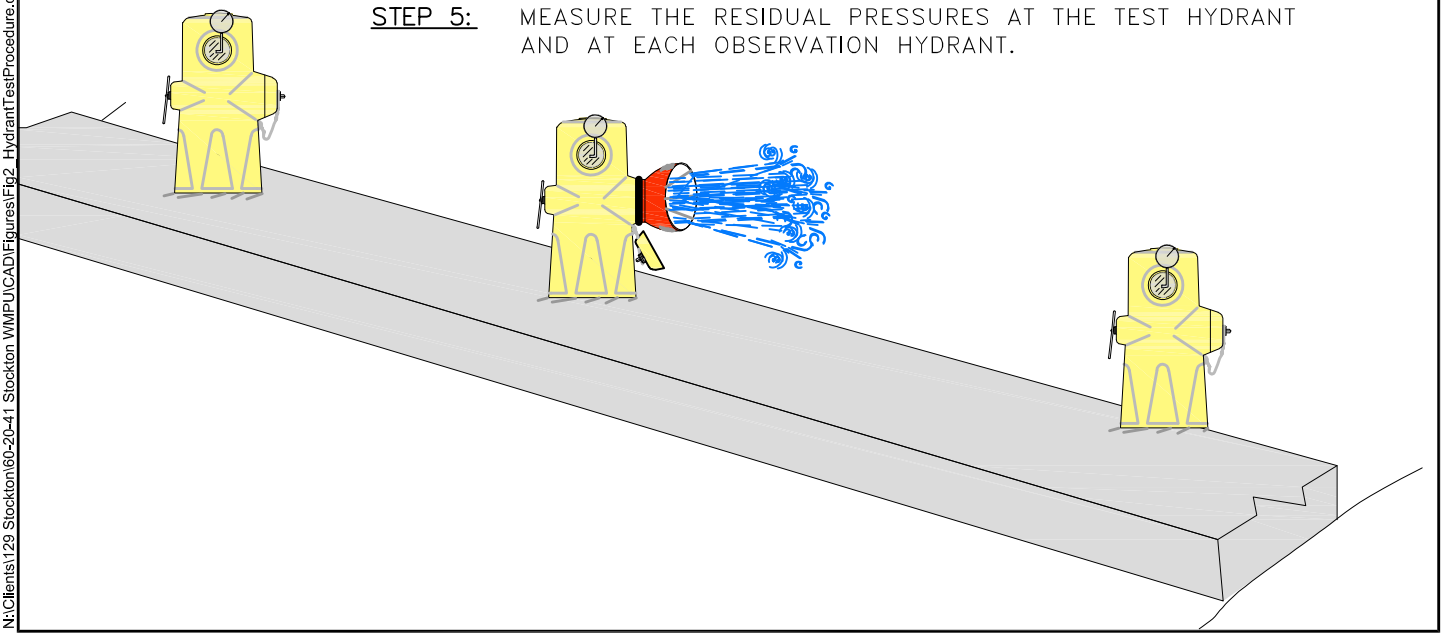
STEPS 1, 2 & 3: REMOVE HYDRANT CAP, FLUSH OUT HYDRANT AND MEASURE THE STATIC PRESSURES AT THE TEST HYDRANT AND AT EACH OBSERVATION HYDRANT.



STEP 4: FLOW THE DESIGNATED TEST HYDRANT AND MEASURE THE DISCHARGE FLOW AND PRESSURE.



STEP 5: MEASURE THE RESIDUAL PRESSURES AT THE TEST HYDRANT AND AT EACH OBSERVATION HYDRANT.



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Note:
1. Figure is not to scale.

CITY OF STOCKTON

WEST YOST ASSOCIATES

Figure 2

Hydrant Test Procedure

City of Stockton
Water Master Plan Update

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North Stockton

ARMSTRONG RD
LIVE OAK RD
EIGHT MILE RD
WEST LN
Delta Water Supply Project
WTP
HPR 01
HPR 12
HPR 07
HPR 11
HPR 02
HPR 08
HPR 06
HPR 09
HPR 03
HPR 05
HPR 10
HPR 04
Northwest
14 Mile Slough
Well #29
Well #30
Well #18
Well #16
Well #9
Well #19
Well #24
Well #31
Well #32
Well #15
Well #20
Well #10R
Well #21
Well #7
Well #1
Well #4
Well #11
Well #26
Well #03R
Well #25
Well #28
Well #27
RINDGE RD
HOLT RD
SAN JOAQUIN RIVER
BOGGS TRACT RD
MARIPOSA RD
BROOKSIDE RD
PACIFIC AVE
EL DORADO ST
PERSHING AVE
FREMONT ST
MINER AVE
WATERLOO RD
CHEROKEE RD
ALPINE RD
ASHLEY LN
HILDRETH LN
99
5
0 3,500 7,000
Scale in Feet

South Stockton

Stockton East Water District
WTP
SAN JOAQUIN RIVER
NAVY DR
EIGHTH ST
MINER AVE
FREMONT ST
SUTTER ST
MARTIN LUTHER KING JR BLVD
TURNPIKE RD
EL DORADO ST
POCK LN
MARIPOSA RD
HPR 15
HPR 16
HPR 13
HPR 14
Well SSS9
Well SSS8
Well SSS2
Well SSS1
Well SSS3
Weston Ranch
FRENCH CAMP RD
HOWARD RD
AIRPORT WAY
NEWCASTLE RD
JACK TONE RD
99
5
0 3,000 6,000
Scale in Feet

Proposed HPR Location
Storage Tank & Booster Pump Station
Water Treatment Plant
COSMUD Water Service Boundary
Well (Active)
Well (Inactive)
Well (Standby)
Pipeline (Less Than 12-inch)
Pipeline (12-inch or Greater)
Railroad

CITY OF STOCKTON
WEST YOST ASSOCIATES

Figure 3

Hydrant Pressure Recorder Map

City of Stockton
Water Master Plan Update

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ATTACHMENT A

Hydrant Test Detail Figures

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Table A-1. Hydrant Test Locations[(a)]

Test No.	Pipeline Material	Approximate Installation Decade	Pipeline Diameter, Inches	Location	No. of Closed Valves	Service Area
1	Asbestos Concrete	1980s	8	Angel Drive, Between Sutton Way and Otto Drive	3	North Stockton
2	Asbestos Concrete	1960s	6	Santa Maria Way and San Lucas Avenue, Between Ponce De Leon Avenue and Don Borgia Way	3	North Stockton
3	Asbestos Concrete	1960s	6	Bonnie Brook Drive and Oak Creek Drive, Between Westland Avenue and Meadow Avenue	5	North Stockton
4	Asbestos Concrete	1970s	10	Knickerbocker Drive, Between New York Drive and Tam O Shanter Drive	2	North Stockton
5	Asbestos Concrete	1980s	8	Shameran Street and Sharkon Lane, Between Montauban Avenue and Hammertown Drive	1	North Stockton
6	Asbestos Concrete	1980s	6	Fort Donelson Drive, Between Five Mile Drive and Palmouth Court	1	North Stockton
7	PVC	1990s	8	Ishi Gotto Street, Between Ken Street and Brick and Tile Circle	5	South Stockton
8	PVC	1980s	8	Boulder Creek Circle	3	North Stockton; Alternate Test Location

(a) 7 test locations and 1 alternate test location if time permits.

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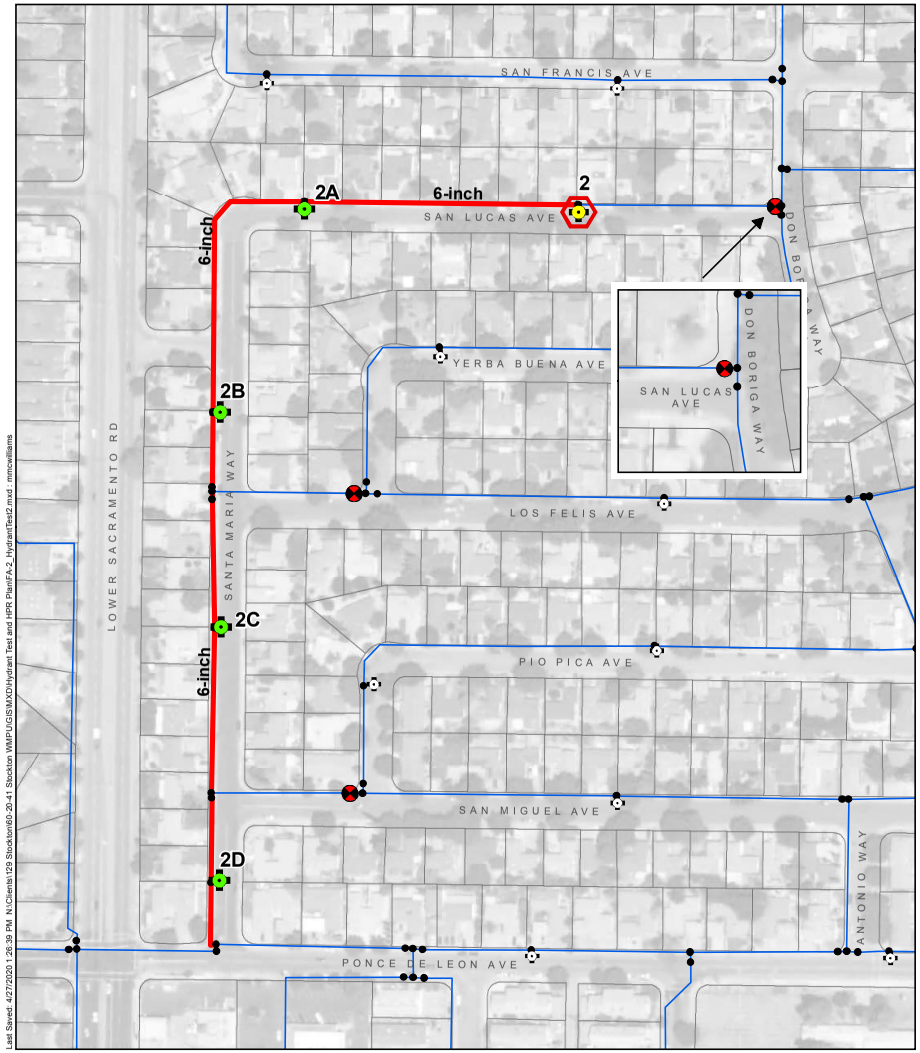


Hydrant Test Location
Observed Hydrant
Hydrant
Closed Valve (3 total)
Valve
Test Pipeline
Pipeline

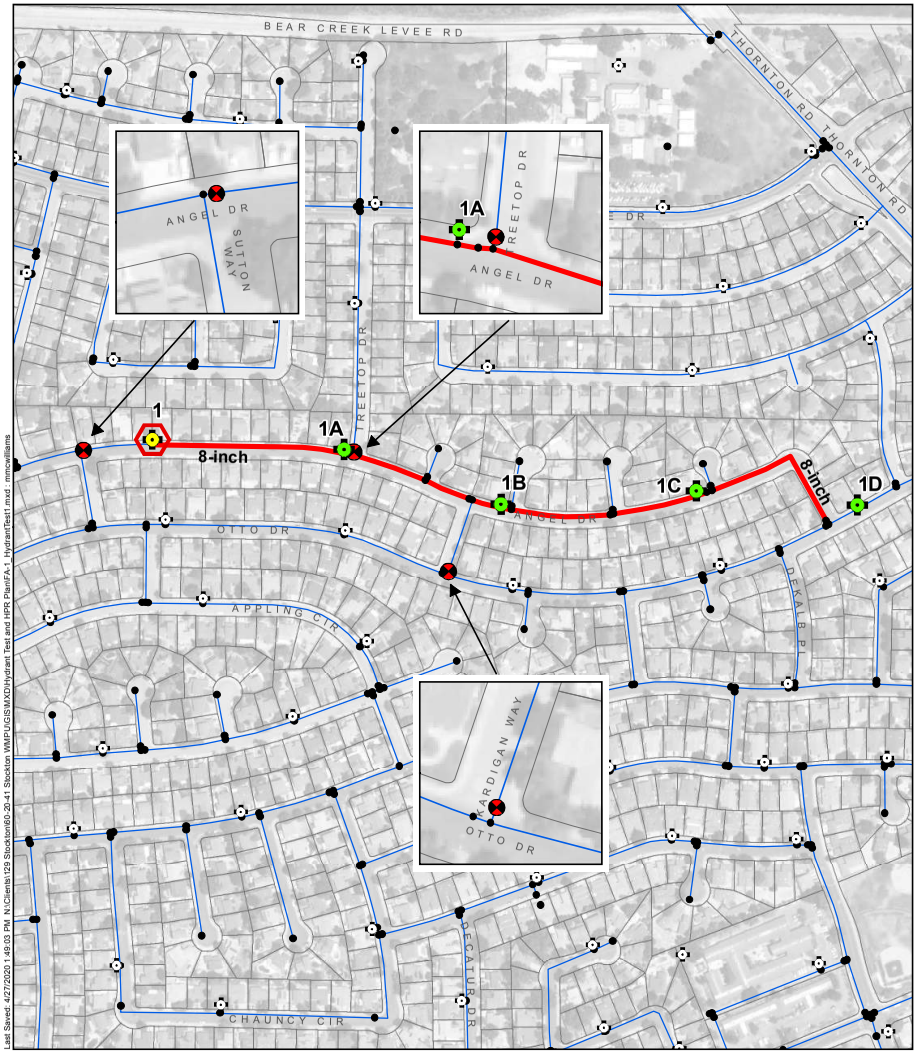
N
0 100 200
Scale in Feet

CITY OF STOCKTON
WEST YOST ASSOCIATES

Figure A-2

Test 2
(6-inch AC - 1960s)

City of Stockton
Water Master Plan Update



Hydrant Test Location
Observed Hydrant
Hydrant
Closed Valve (3 total)
Valve
Test Pipeline
Pipeline

N
0 200 400
Scale in Feet

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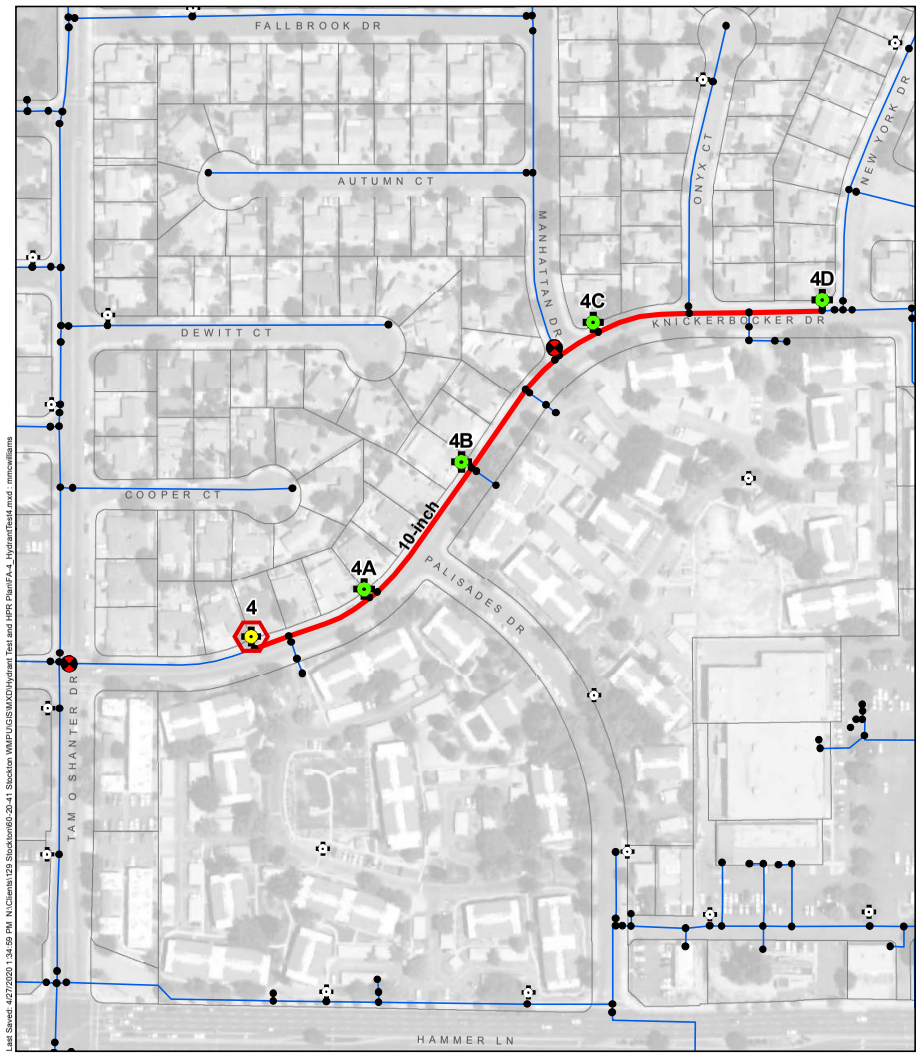
WEST YOST ASSOCIATES

Figure A-1

Test 1
(8-inch AC - 1980s)

City of Stockton
Water Master Plan Update



Hydrant Test Location
Observed Hydrant
Hydrant
Closed Valve (2 total)
Valve
Test Pipeline
Pipeline

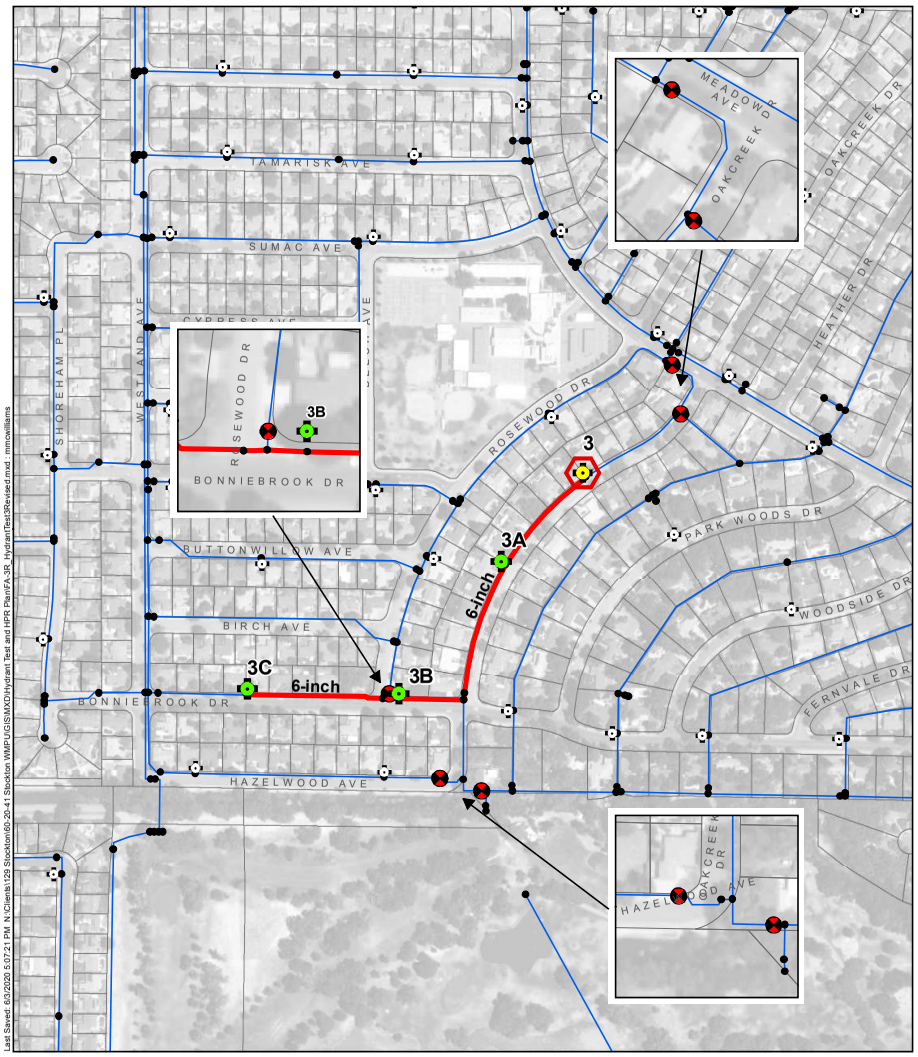
N
0 100 200
Scale in Feet

CITY OF STOCKTON
WEST YOST ASSOCIATES

Figure A-4

Test 4
(10-inch AC - 1970s)

City of Stockton
Water Master Plan Update



Hydrant Test Location
Observed Hydrant
Hydrant
Closed Valve (5 total)
Valve
Test Pipeline
Pipeline

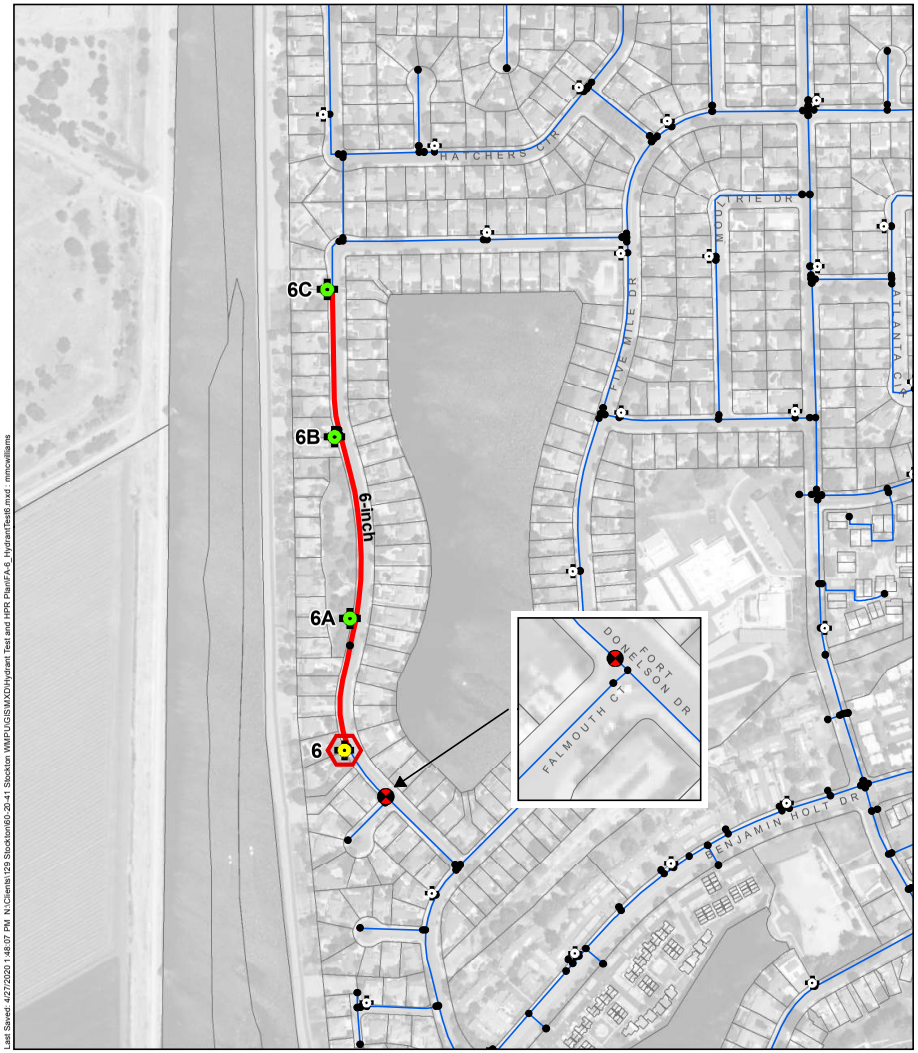
N
0 200 400
Scale in Feet

CITY OF STOCKTON
WEST YOST ASSOCIATES

Figure A-3

Test 3
(6-inch AC - 1960s)

City of Stockton
Water Master Plan Update



Hydrant Test Location
Observed Hydrant
Hydrant
Closed Valve (1 total)
Valve
Test Pipeline
Pipeline

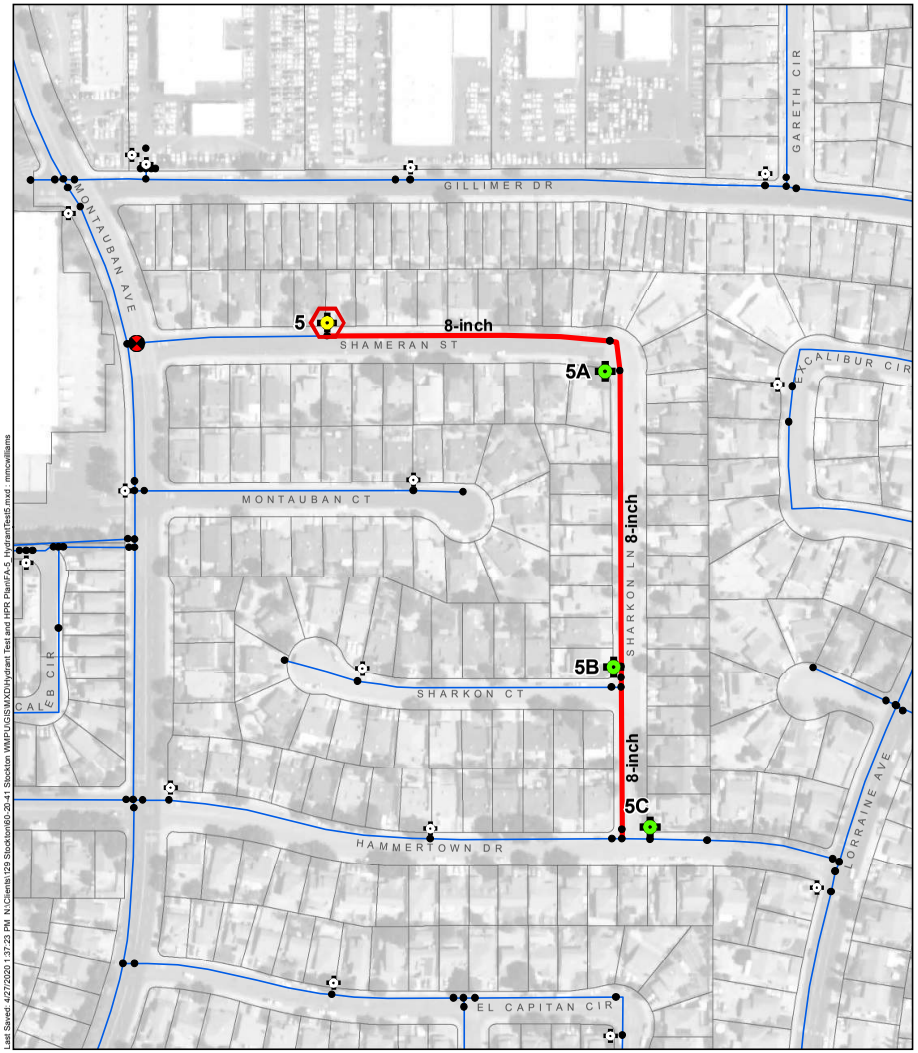
N
0 200 400
Scale in Feet

CITY OF STOCKTON
WEST YOST ASSOCIATES

Figure A-6

Test 6
(6-inch AC - 1980s)

City of Stockton
Water Master Plan Update



Hydrant Test Location
Observed Hydrant
Hydrant
Closed Valve (1 total)
Valve
Test Pipeline
Pipeline

N
0 100 200
Scale in Feet

CITY OF STOCKTON
WEST YOST ASSOCIATES

Figure A-5

Test 5
(8-inch AC - 1980s)

City of Stockton
Water Master Plan Update

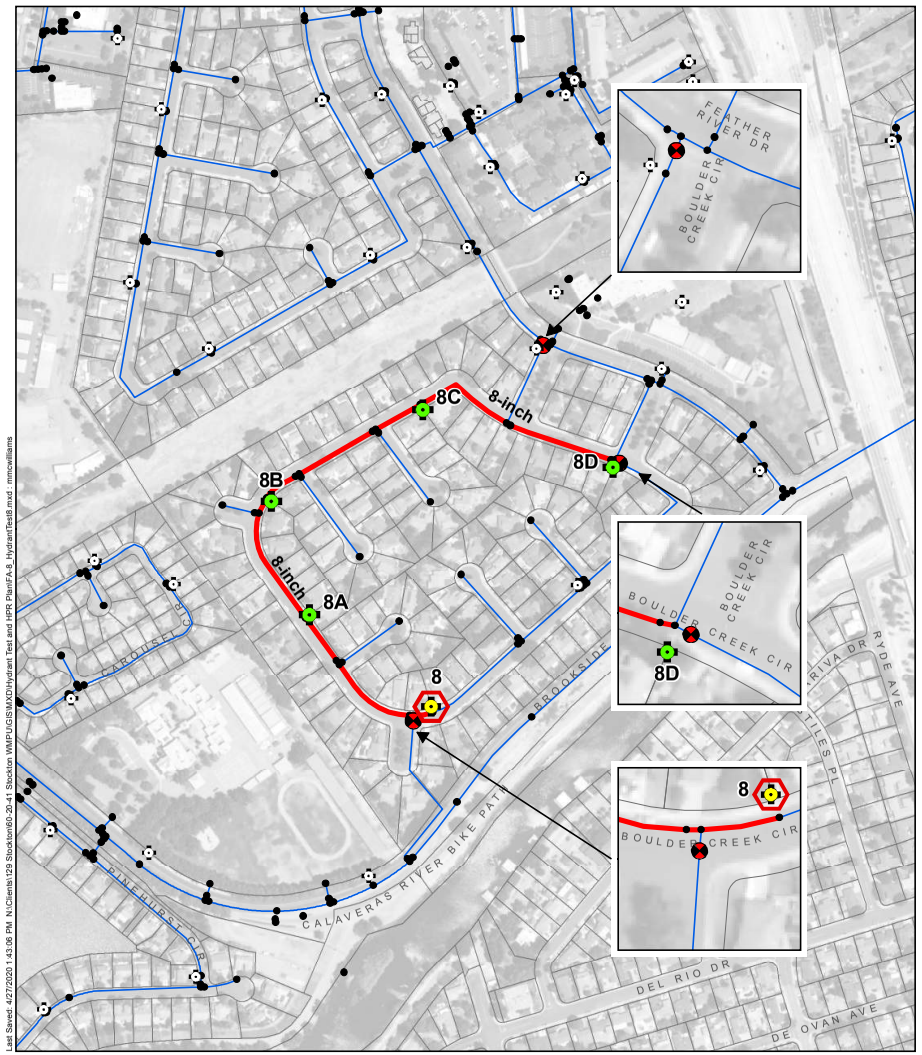


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Figure A-8

Test 8 Alternate (8-inch PVC - 1980s)

City of Stockton
Water Master Plan Update

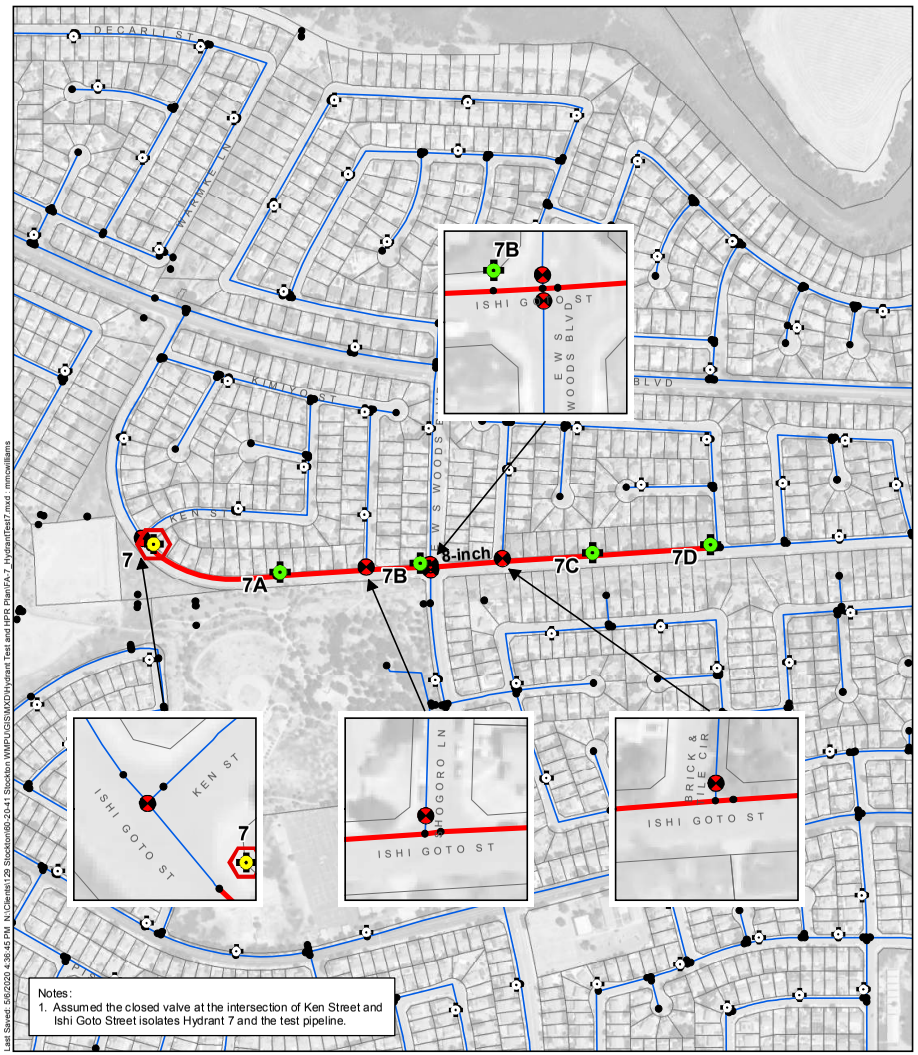

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Figure A-7

Test 7 (8-inch PVC - 1990s)

City of Stockton
Water Master Plan Update

ATTACHMENT B

Hydrant Pressure Recorder Detail Figures

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Table B-1. Hydrant Pressure Recorder Locations	
HPR No.	Location
1	Northeast corner of intersection of Scott Creek Drive and Regatta Lane
2	Intersection of Stanfield Drive and Colington Place
3	Intersection of Benjamin Holt Drive and Cumberland Place
4	Southeast of St. Andrews Drive
5	Intersection of Pershing Avenue and Robinhood Drive
6	Northeast corner of intersection of Etna Street and San Carlos Way
7	Intersection of Villa Point Drive and Marlette Road
8	Intersection of Genova Lane and Perino Drive
9	Hammer Lane, Between Railroad and Girardi Way
10	March Lane, Between West Lane and Weber Ranch Park
11	Northwest corner of intersection of AG Spanos Boulevard and Thornton Boulevard
12	South of intersection of Eight Mile Road and Trinity Park
13	Intersection of William Moss Boulevard and Carolyn Weston Boulevard
14	Intersection of Airport Way and Performance Drive
15	Pock Lane, north of Togninali Lane
16	North of intersection of Raymos Way and New Castle Road

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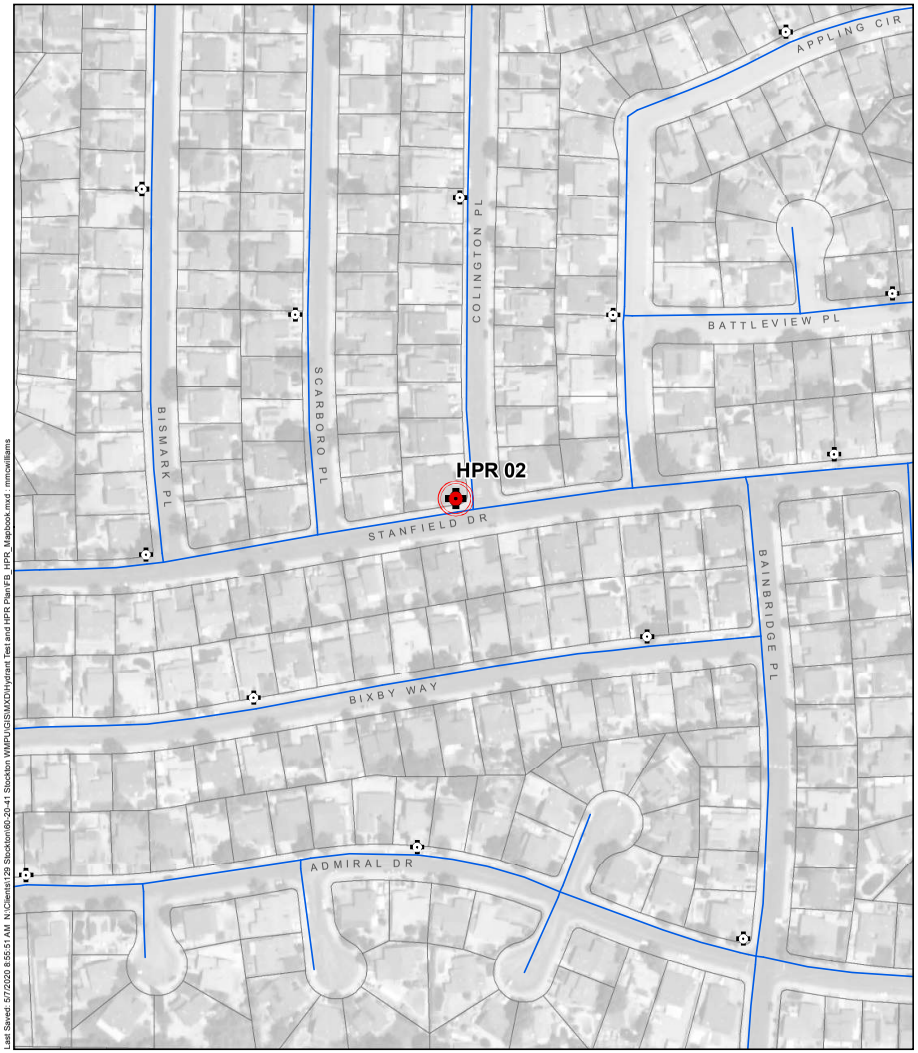


Proposed HPR Location

Hydrant

Pipeline

N

0 100 200

Scale in Feet

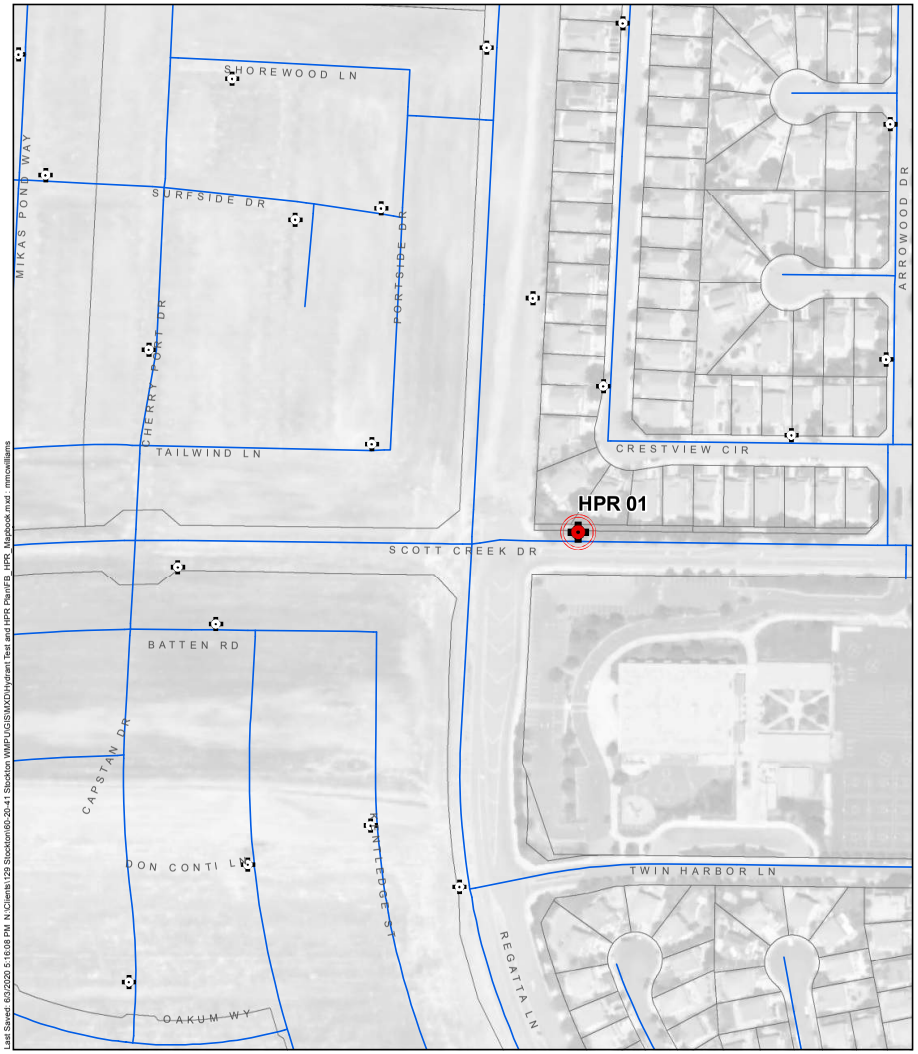
CITY OF STOCKTON

WEST YOST ASSOCIATES

Figure B-2

HPR 2

City of Stockton
Water Master Plan Update



Proposed HPR Location

Hydrant

Pipeline

N

0 100 200

Scale in Feet

CITY OF STOCKTON

WEST YOST ASSOCIATES

Figure B-1

HPR 1

City of Stockton
Water Master Plan Update

Proposed HPR Location

Hydrant

Pipeline

N

0 100 200

Scale in Feet

CITY OF STOCKTON

WEST YOST ASSOCIATES

Figure B-4

HPR 4

City of Stockton
Water Master Plan Update

Proposed HPR Location

Hydrant

Pipeline

N

0 100 200

Scale in Feet

CITY OF STOCKTON

WEST YOST ASSOCIATES

Figure B-3

HPR 3

City of Stockton
Water Master Plan Update

Proposed HPR Location
Hydrant
Pipeline

N
0 100 200
Scale in Feet

CITY OF STOCKTON

WEST YOST ASSOCIATES

Figure B-6

HPR 6

City of Stockton
Water Master Plan Update

Proposed HPR Location
Hydrant
Pipeline

N
0 100 200
Scale in Feet

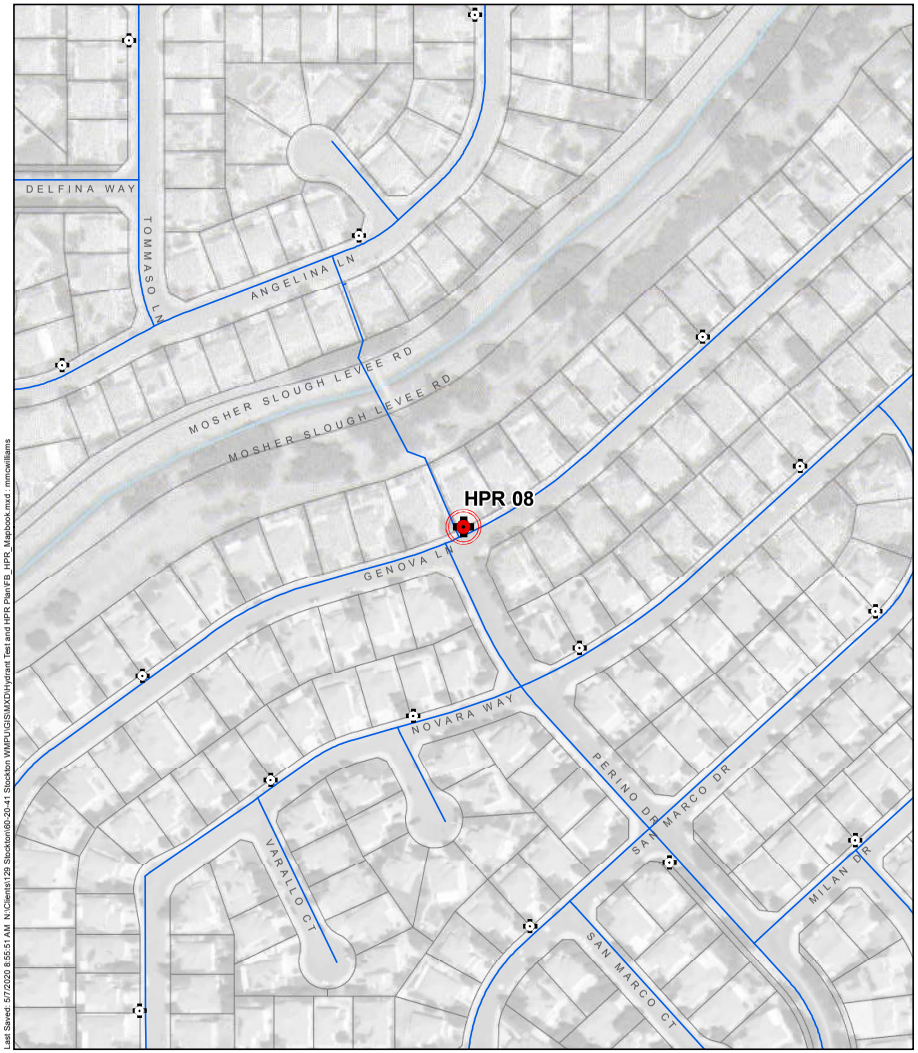
CITY OF STOCKTON

WEST YOST ASSOCIATES

Figure B-5

HPR 5

City of Stockton
Water Master Plan Update



Proposed HPR Location

Hydrant

Pipeline

N

0 100 200

Scale in Feet

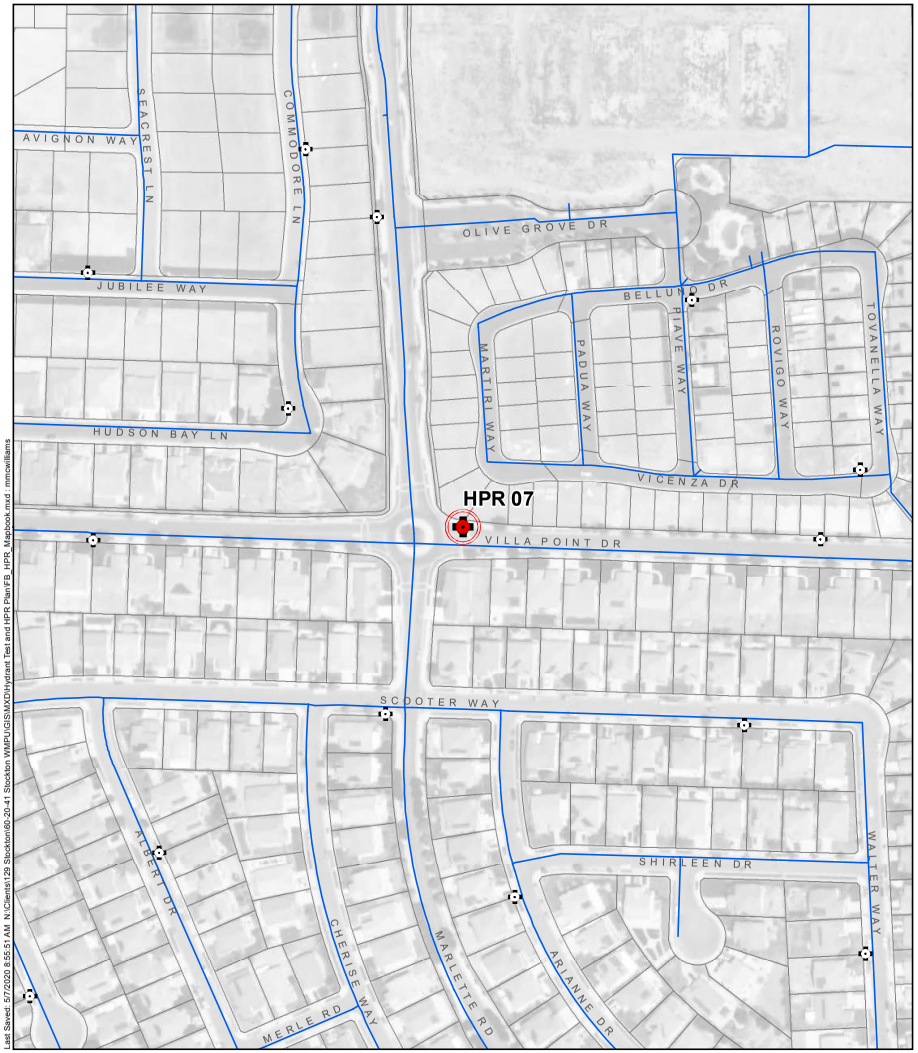
CITY OF STOCKTON

WEST YOST ASSOCIATES

Figure B-8

HPR 8

City of Stockton
Water Master Plan Update



Proposed HPR Location

Hydrant

Pipeline

N

0 100 200

Scale in Feet

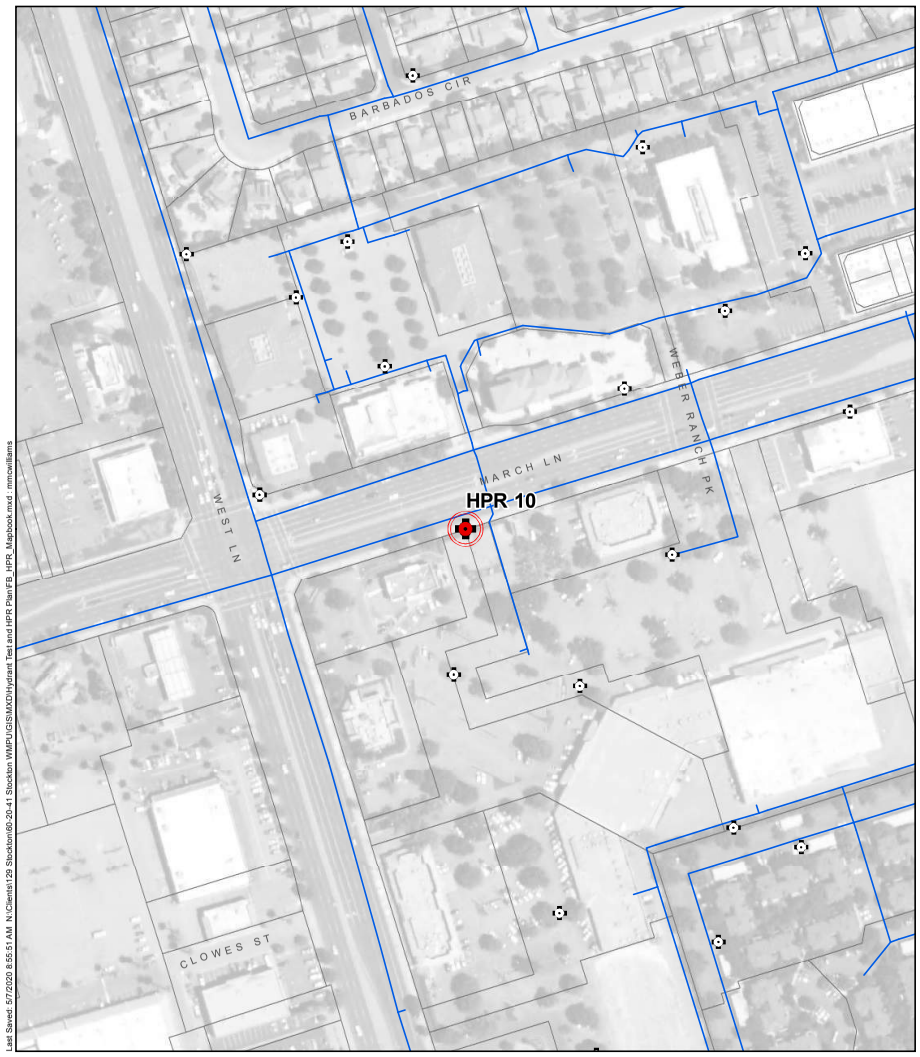
CITY OF STOCKTON

WEST YOST ASSOCIATES

Figure B-7

HPR 7

City of Stockton
Water Master Plan Update



Proposed HPR Location

Hydrant

Pipeline

N

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Scale in Feet

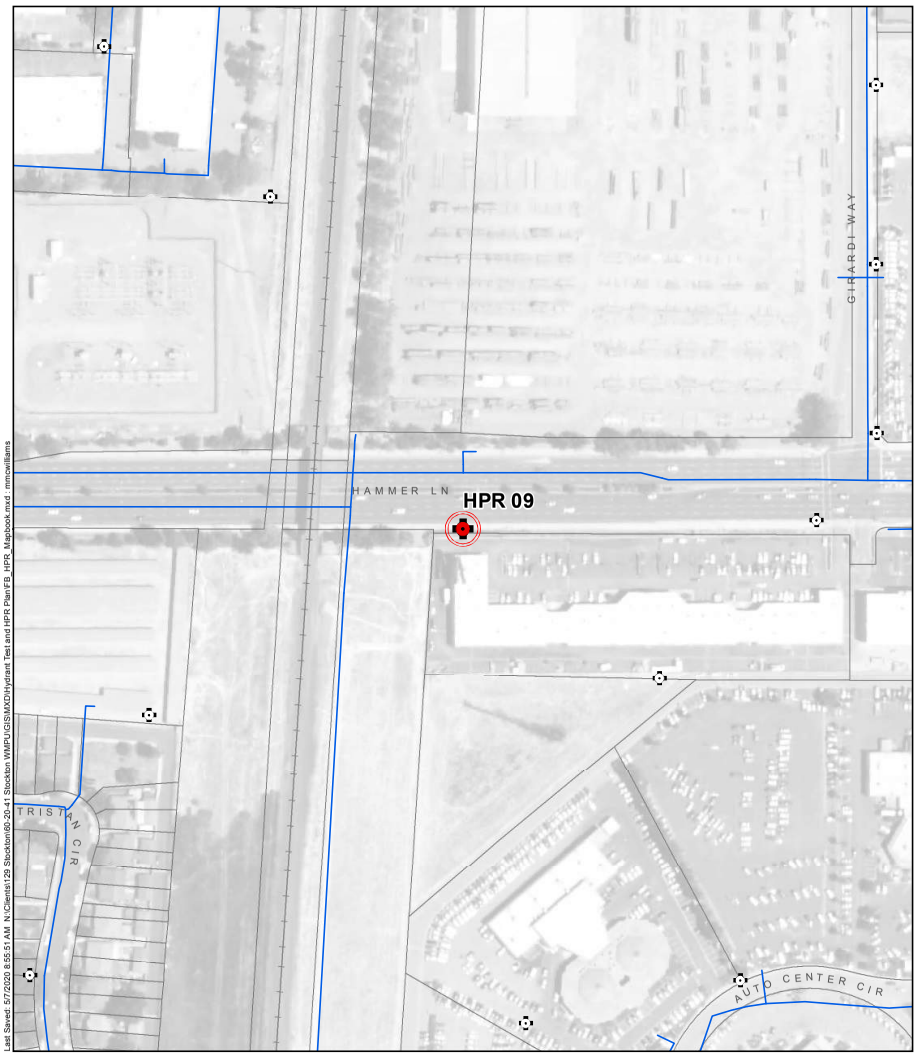
CITY OF STOCKTON

WEST YOST ASSOCIATES

Figure B-10

HPR 10

City of Stockton
Water Master Plan Update



Proposed HPR Location

Hydrant

Pipeline

N

0 100 200

Scale in Feet

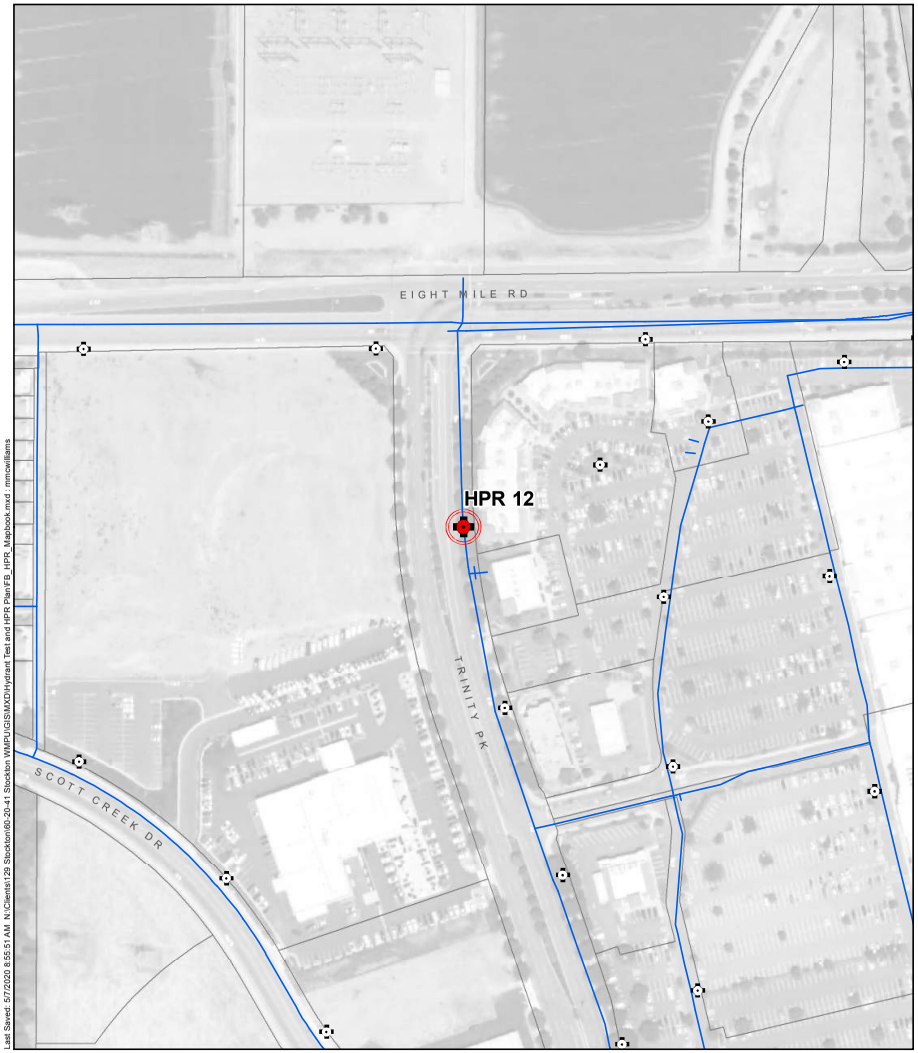
CITY OF STOCKTON

WEST YOST ASSOCIATES

Figure B-9

HPR 9

City of Stockton
Water Master Plan Update



Proposed HPR Location

Hydrant

Pipeline

N

0 100 200

Scale in Feet

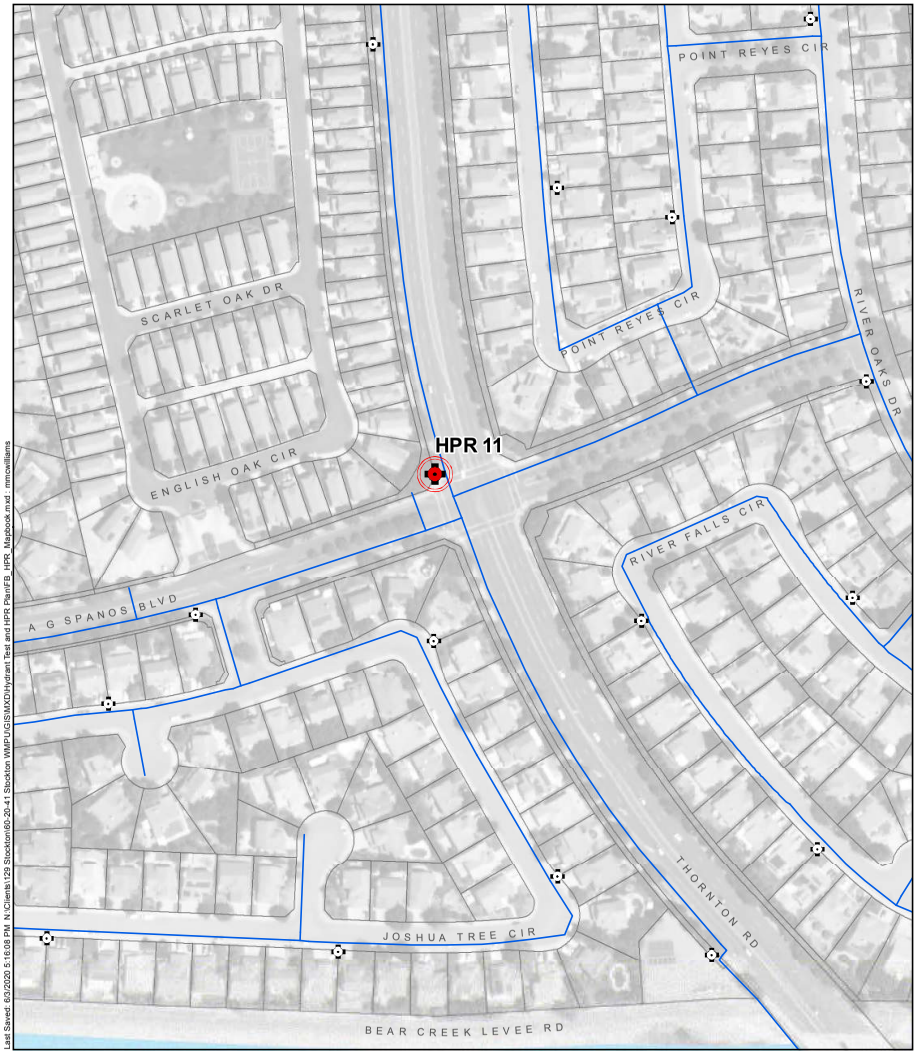
CITY OF STOCKTON

WEST YOST ASSOCIATES

Figure B-12

HPR 12

City of Stockton
Water Master Plan Update



Proposed HPR Location

Hydrant

Pipeline

N

0 100 200

Scale in Feet

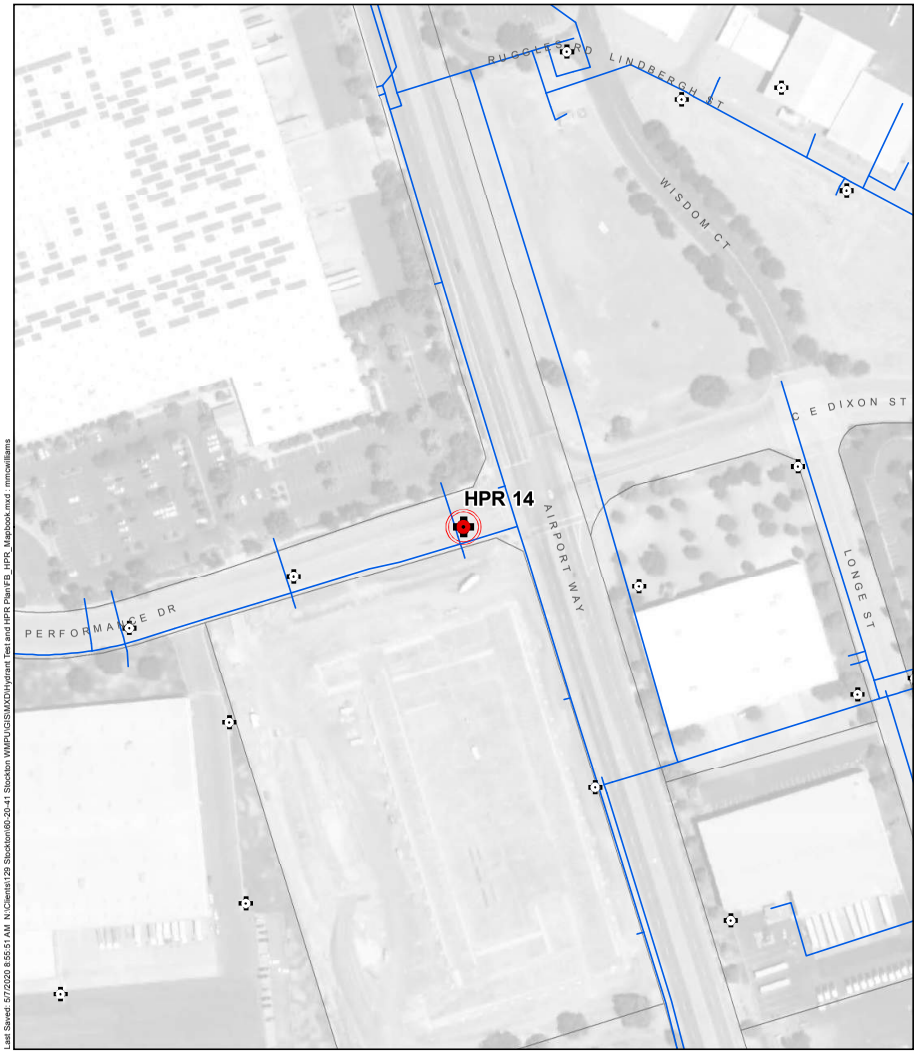
CITY OF STOCKTON

WEST YOST ASSOCIATES

Figure B-11

HPR 11

City of Stockton
Water Master Plan Update



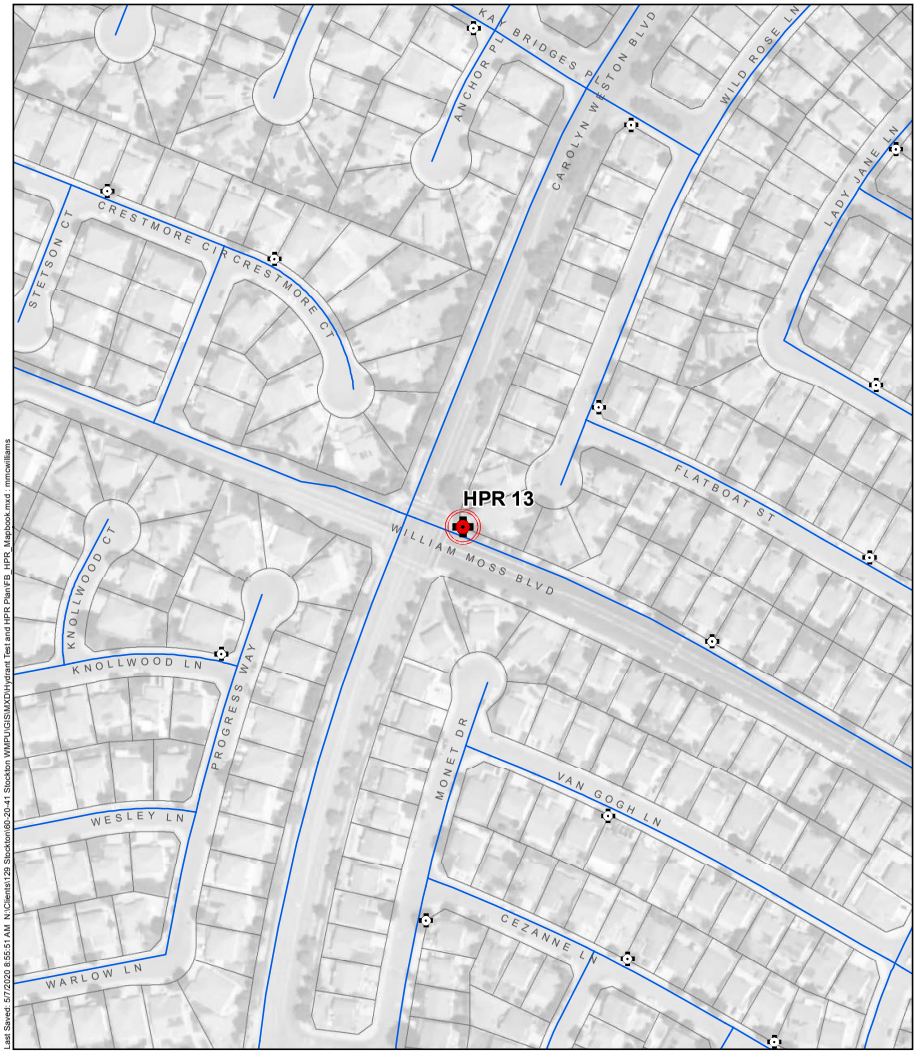
Proposed HPR Location
Hydrant
Pipeline

N
0 100 200
Scale in Feet

Figure B-14

HPR 14

City of Stockton
Water Master Plan Update



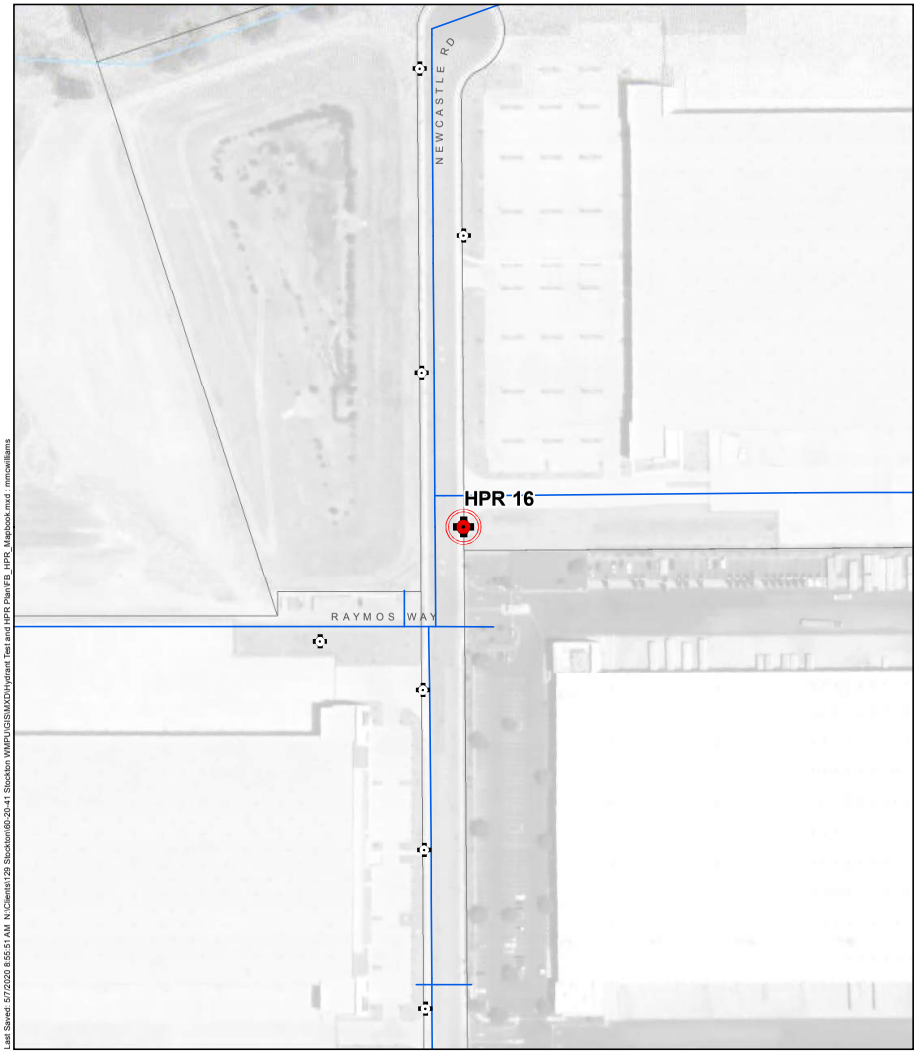
Proposed HPR Location
Hydrant
Pipeline

N
0 100 200
Scale in Feet

Figure B-13

HPR 13

City of Stockton
Water Master Plan Update



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Proposed HPR Location

Hydrant

Pipeline

N

0 100 200

Scale in Feet

CITY OF STOCKTON

WEST YOST ASSOCIATES

Figure B-16

HPR 16

City of Stockton
Water Master Plan Update

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Proposed HPR Location

Hydrant

Pipeline

N

0 100 200

Scale in Feet

CITY OF STOCKTON

WEST YOST ASSOCIATES

Figure B-15

HPR 15

City of Stockton
Water Master Plan Update

Appendix B

Hydraulic Model Calibration Results – North Stockton

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Figure B-1. Delta Water Treatment Plant - Flow and Pressure Comparison
June 23, 2020

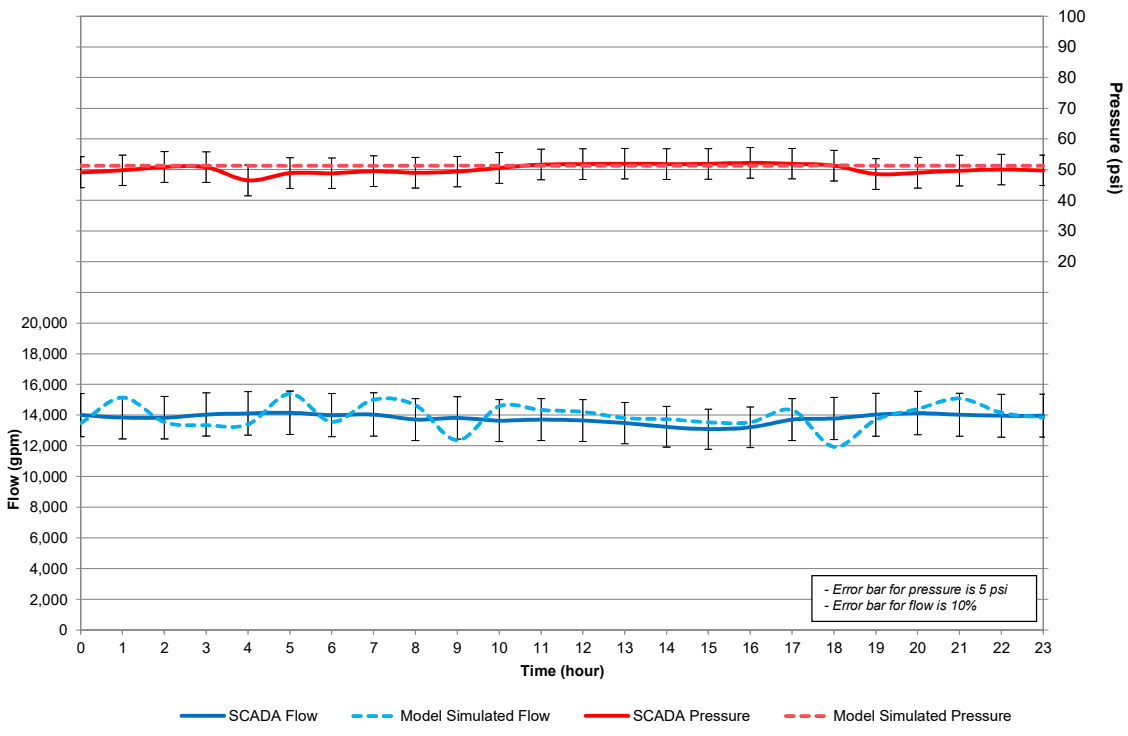


Figure B-2. Northwest Reservoir - Tank Level Comparison
June 23, 2020

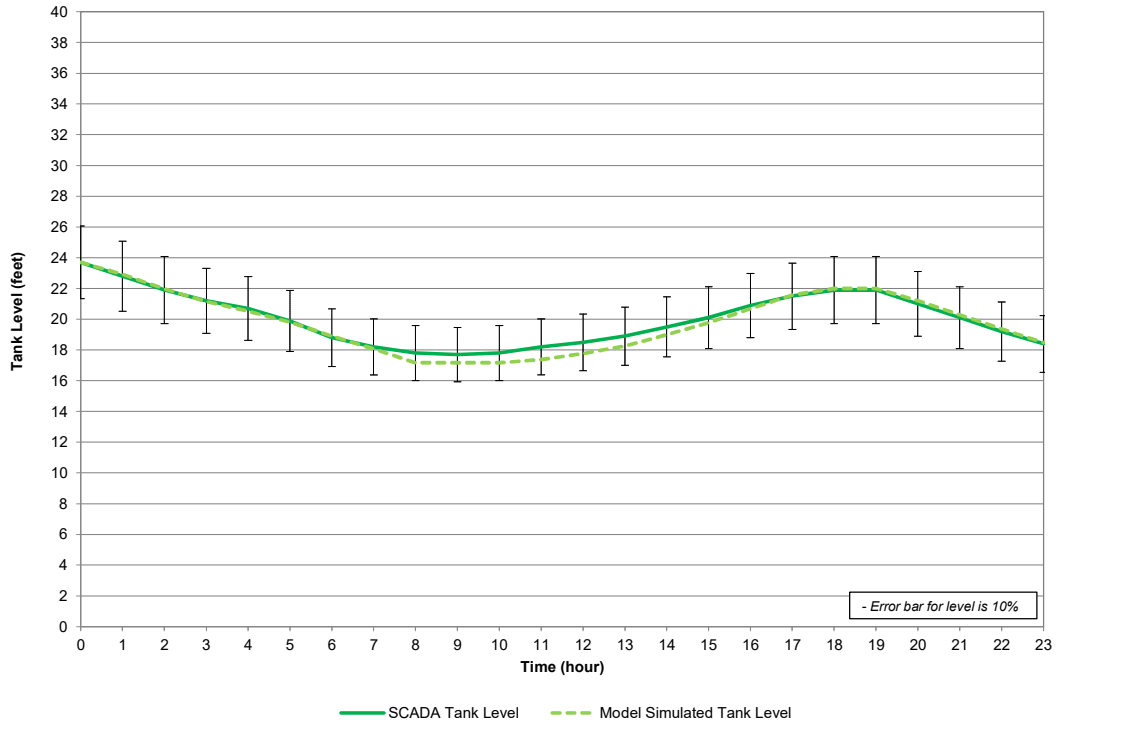


Figure B-3. 14-Mile Slough Reservoir - Tank Level Comparison
June 23, 2020

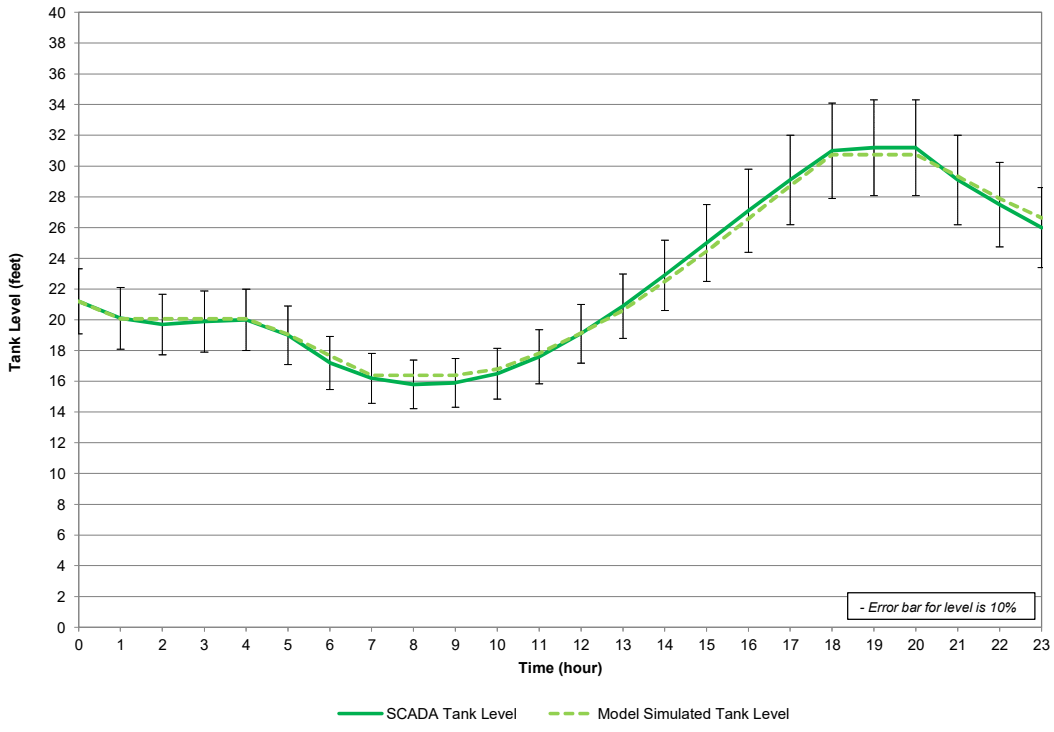


Figure B-4. Well 3R - Flow and Pressure Comparison
June 23, 2020

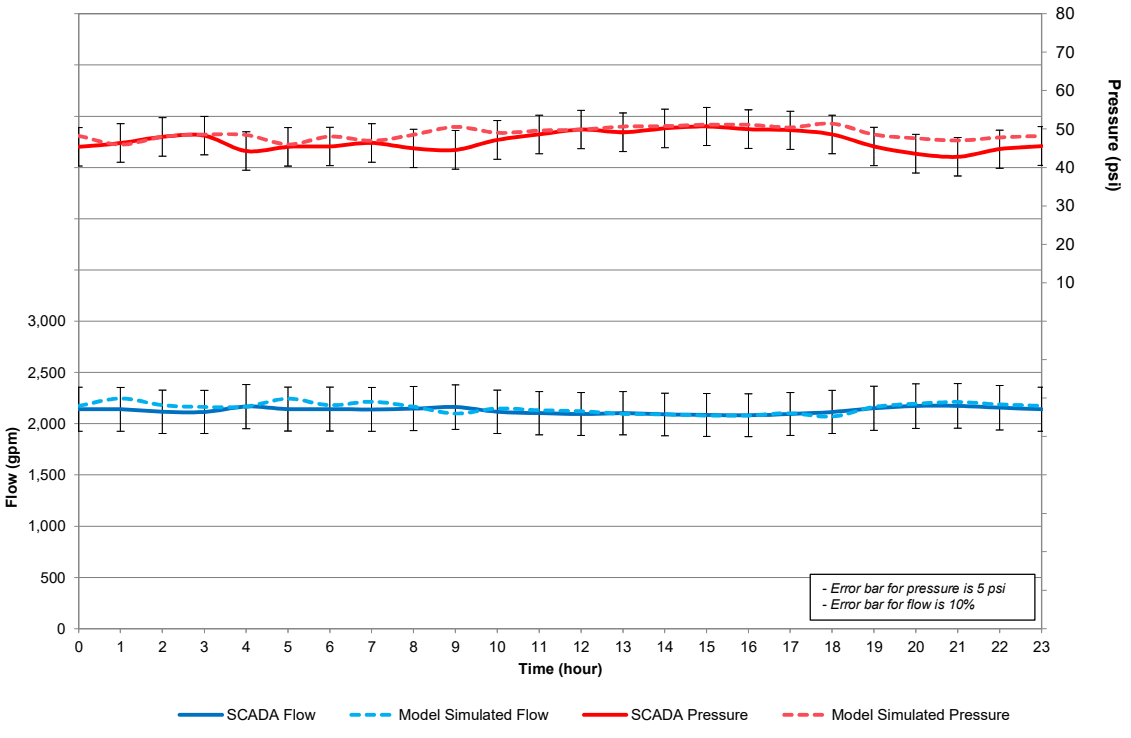


Figure B-5. Well 29 - Flow and Pressure Comparison
June 23, 2020

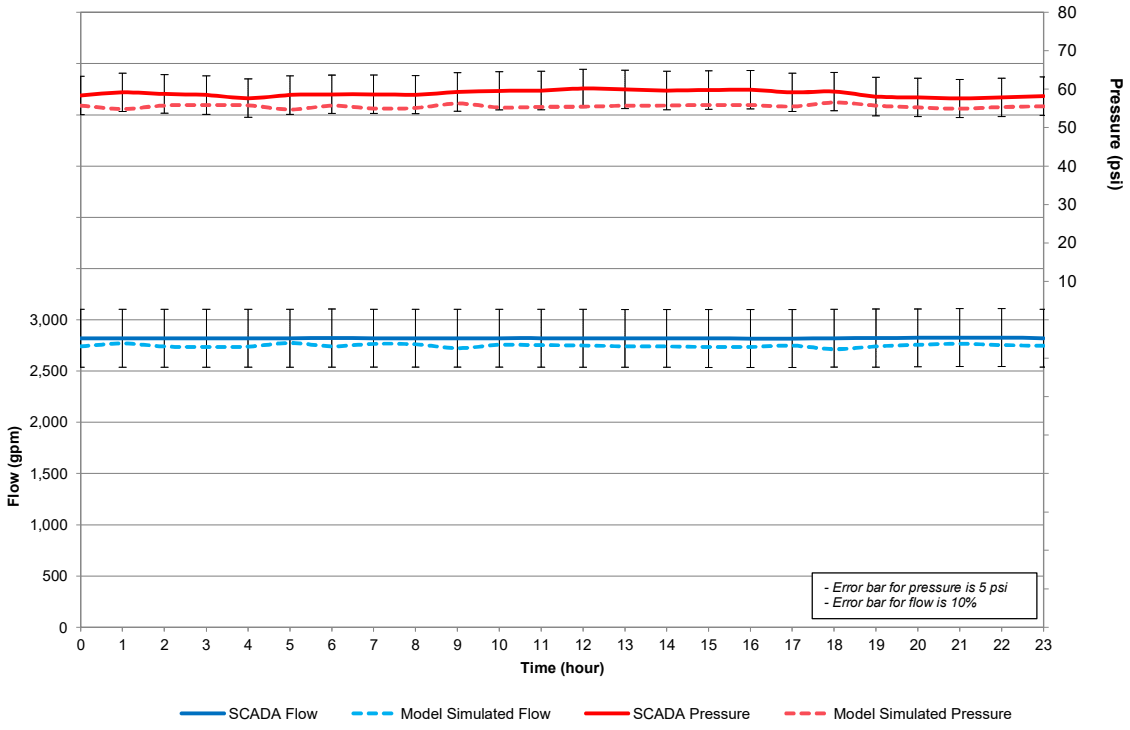


Figure B-6. Well 30 - Flow and Pressure Comparison
June 23, 2020

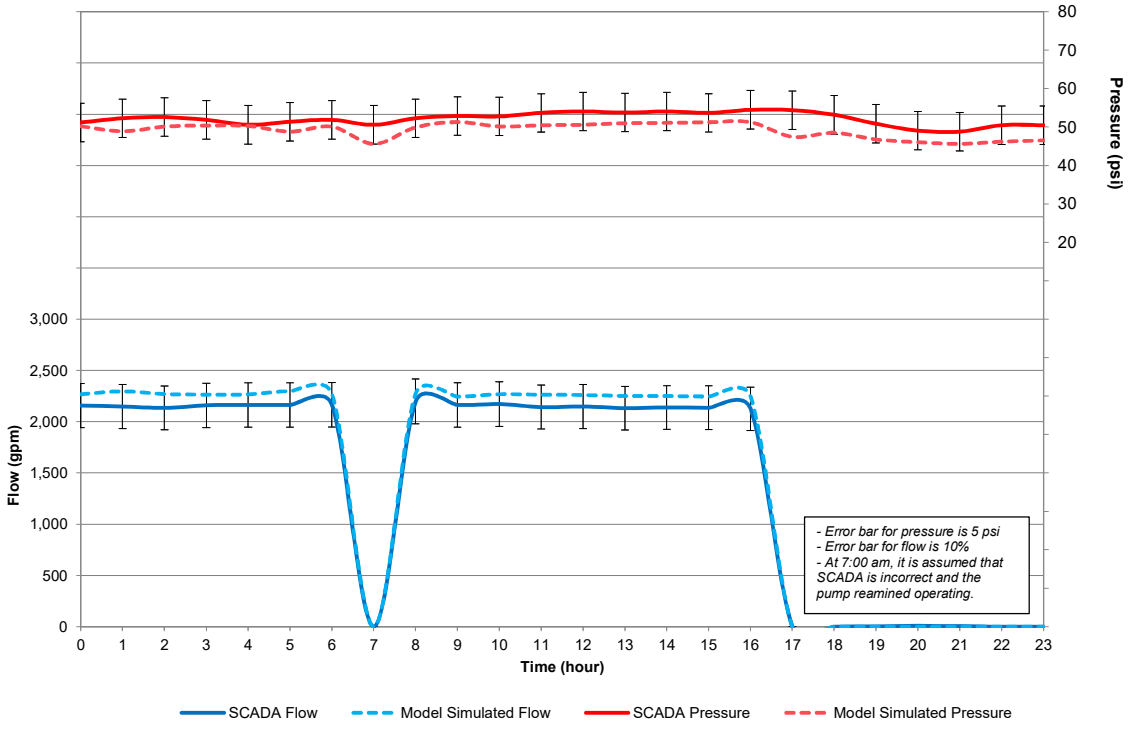


Figure B-7. Well 31 - Flow and Pressure Comparison
June 23, 2020

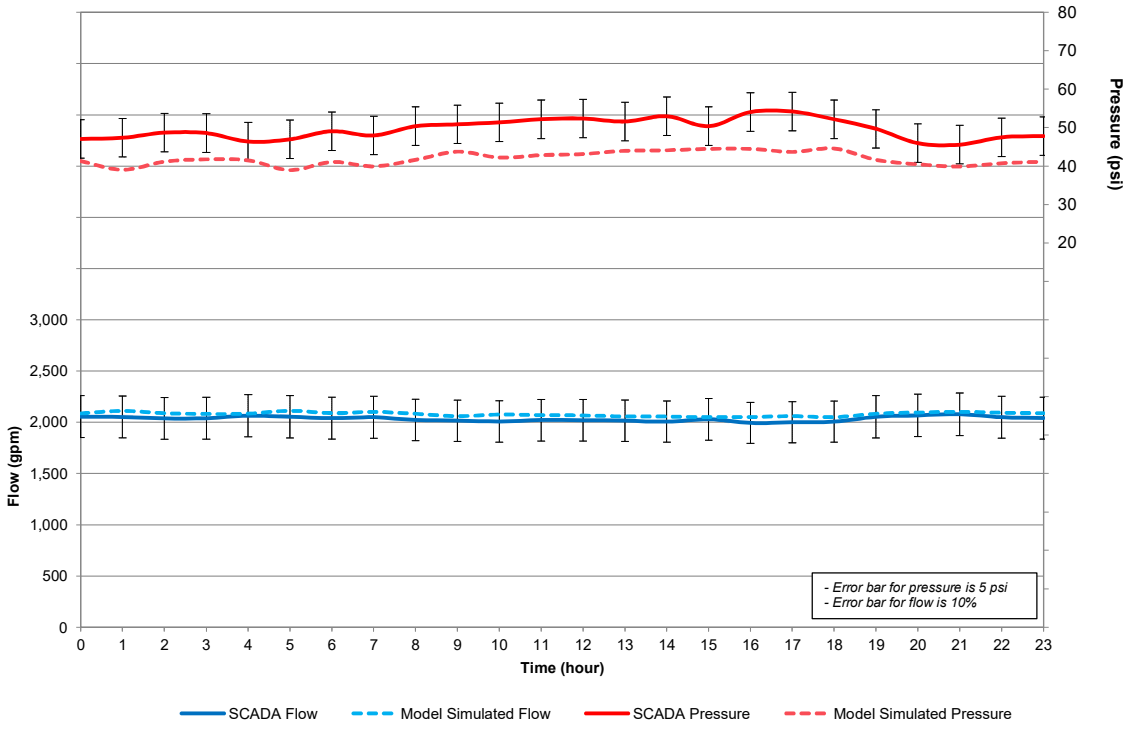


Figure B-8. Well 32 - Flow and Pressure Comparison
June 23, 2020

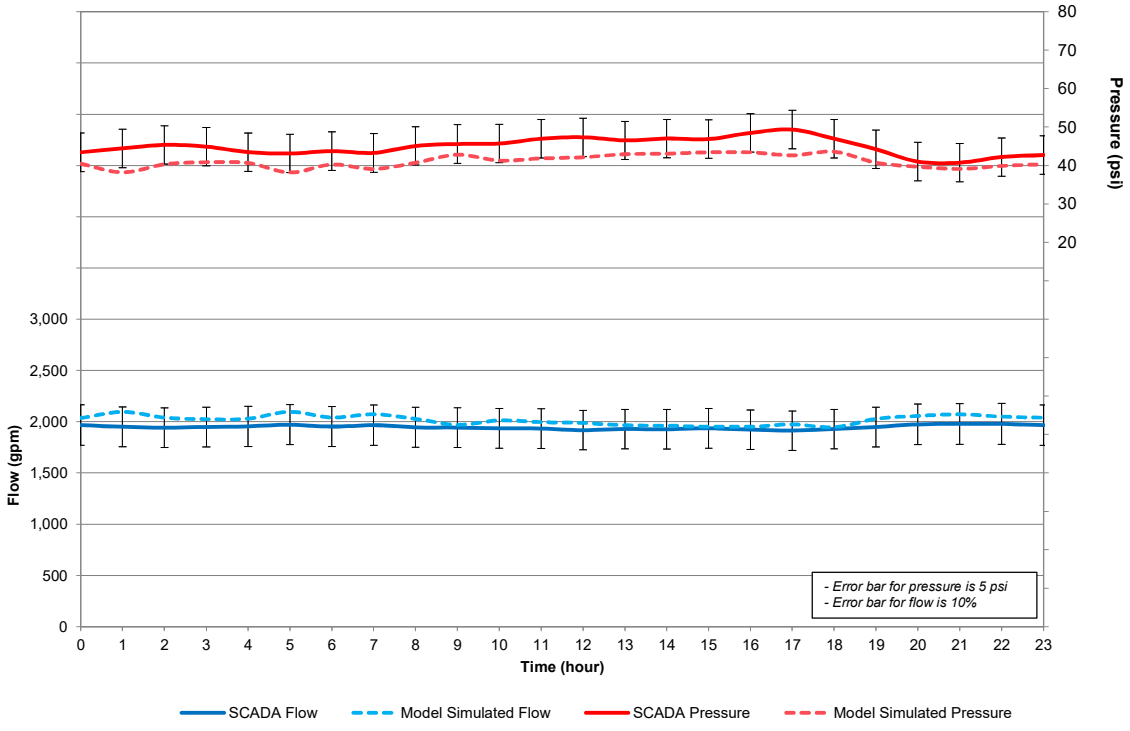


Figure B-9: HPR 1, Northeast corner of intersection of Scott Creek Drive and Regatta Lane
June 23, 2020

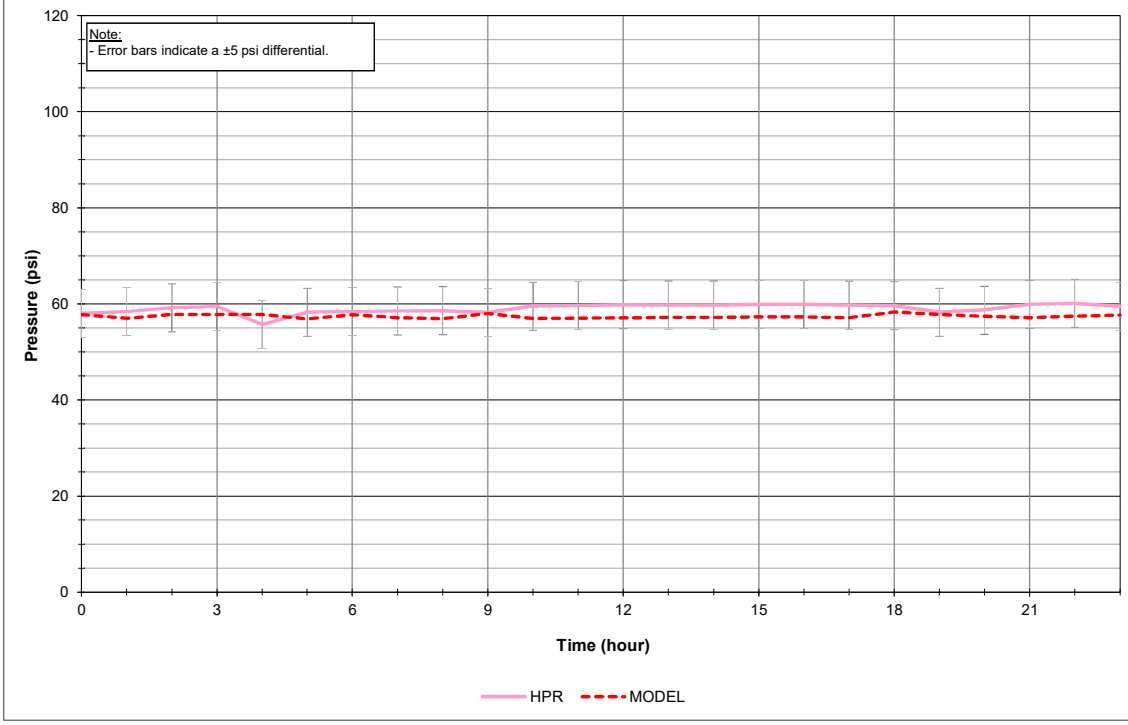


Figure B-10: HPR 2, Intersection of Stanfield Drive and Colington Place
June 23, 2020

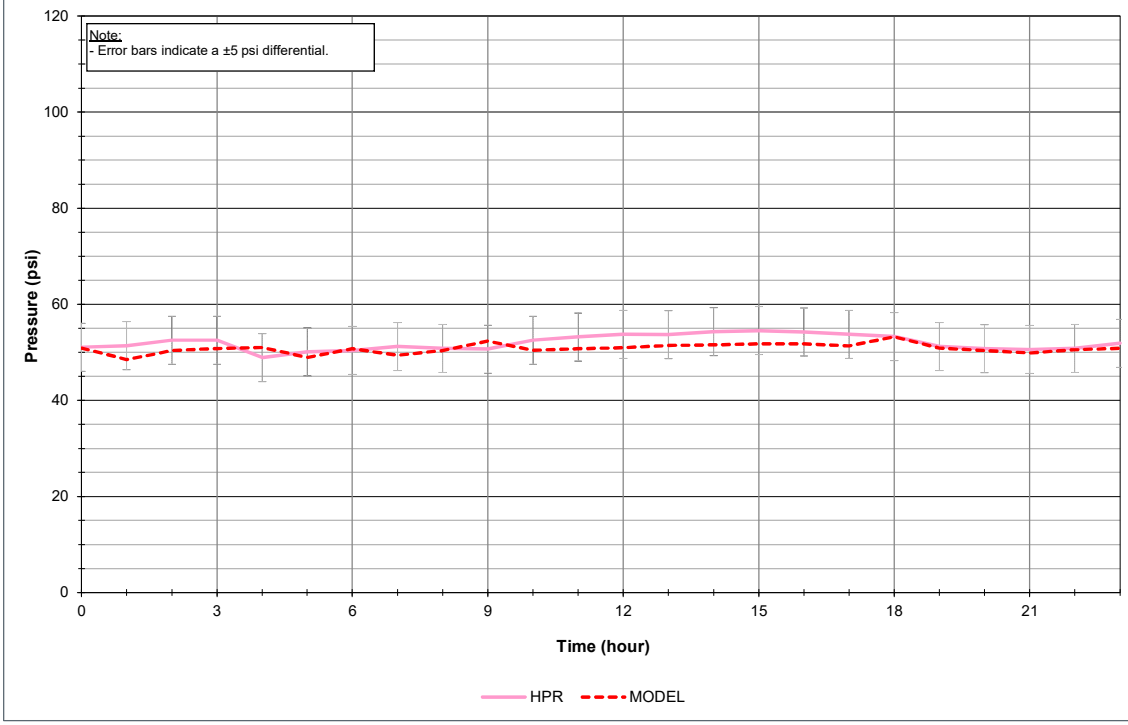


Figure B-11: HPR 3, Intersection of Benjamin Holt Drive and Cumberland Place
June 23, 2020

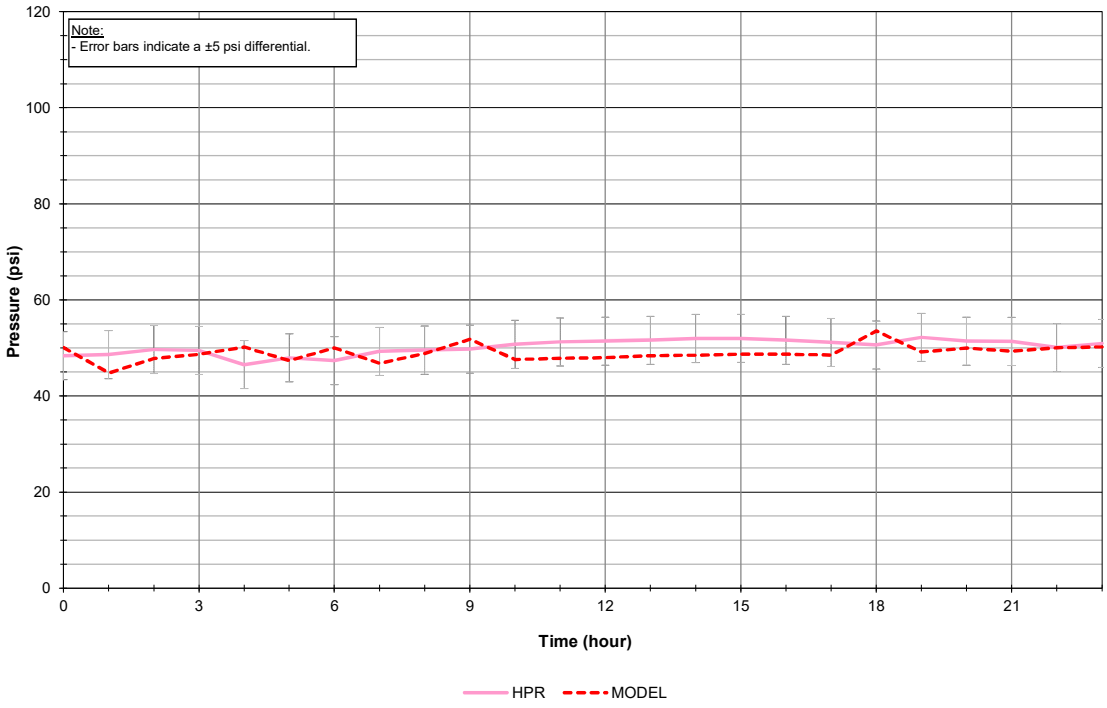


Figure B-12: HPR 4, Southeast of St. Andrews Drive
June 23, 2020

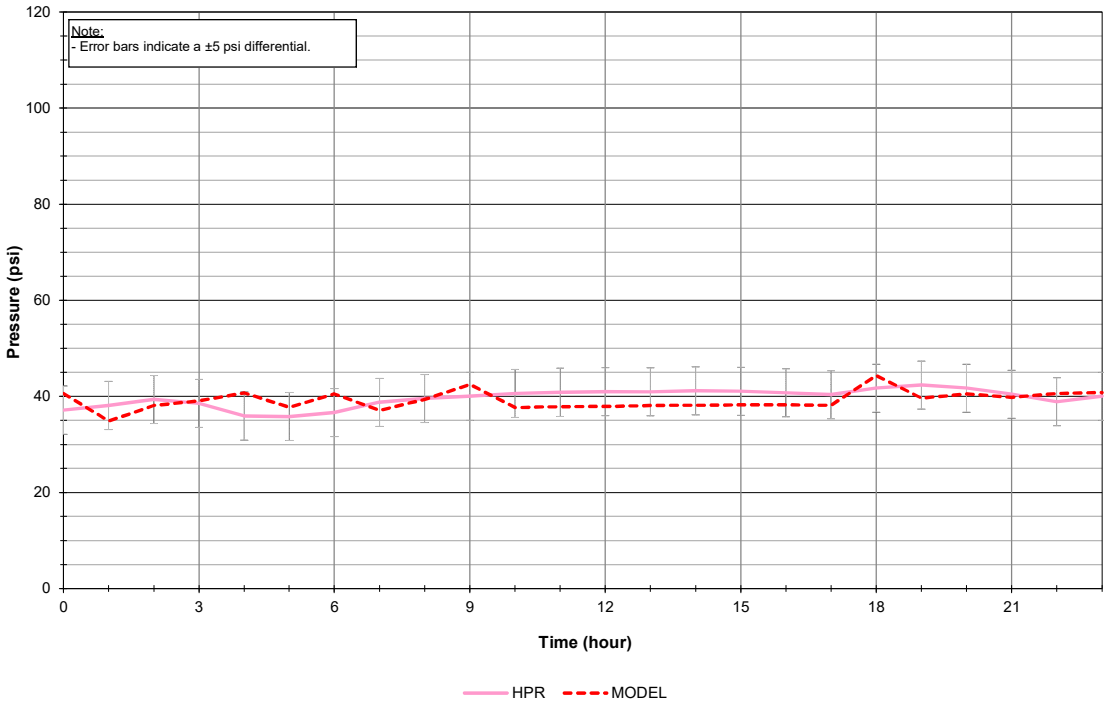


Figure B-13: HPR 5, Intersection of Pershing Avenue and Robinhood Drive
June 23, 2020

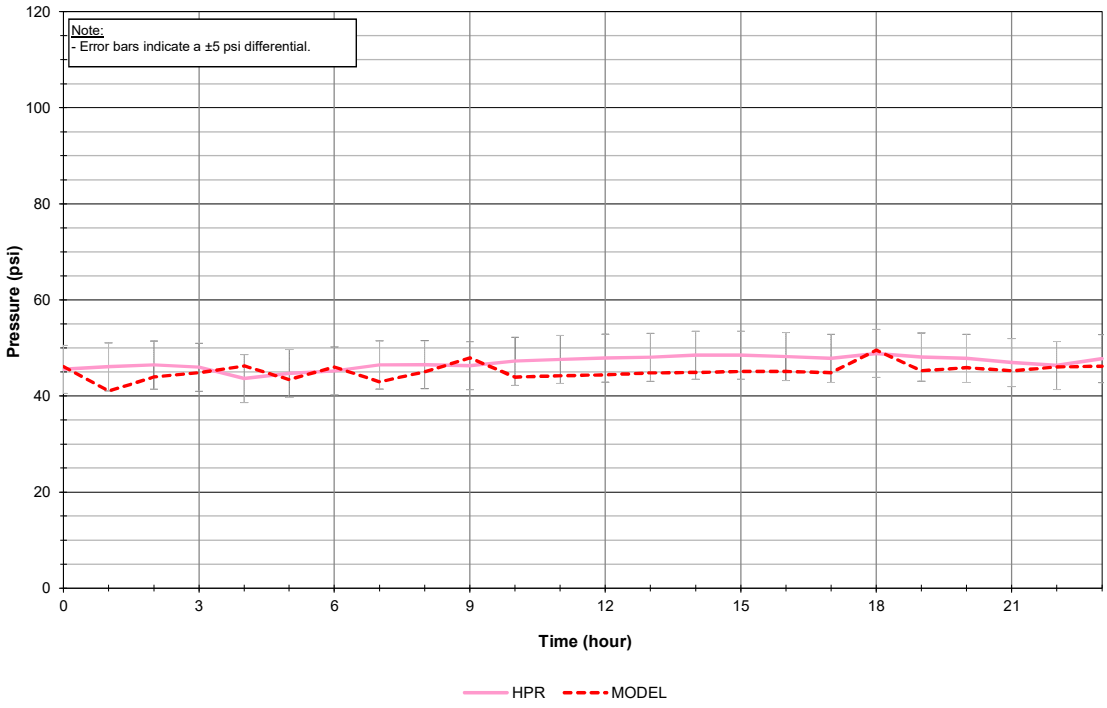


Figure B-14: HPR 6, Northeast corner of intersection of Etna Street and San Carlos Way
June 23, 2020

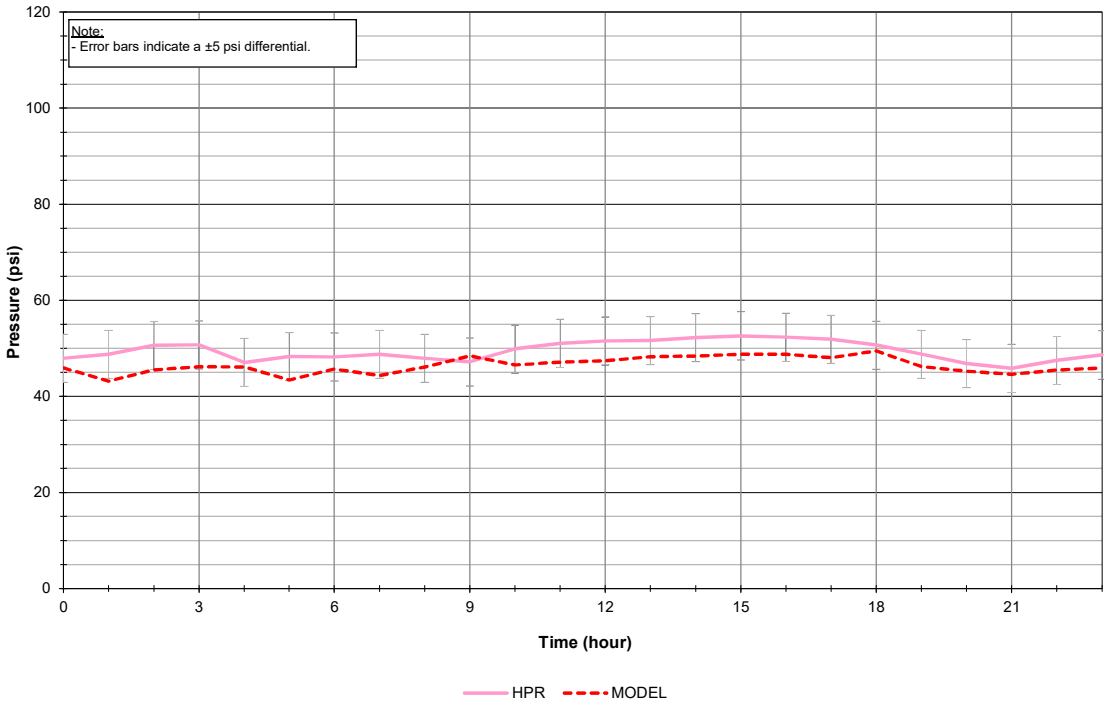


Figure B-15: HPR 7, Intersection of Villa Point Drive and Marlette Road
June 23, 2020

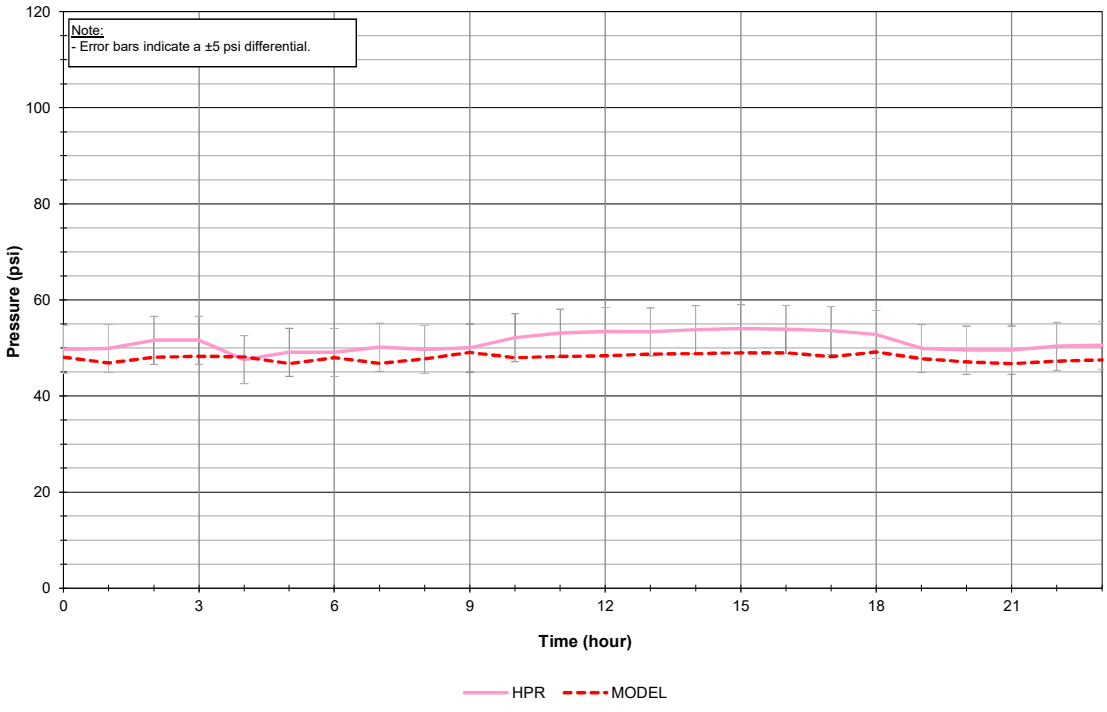


Figure B-16: HPR 8, Intersection of Genova Lane and Perino Drive
June 23, 2020

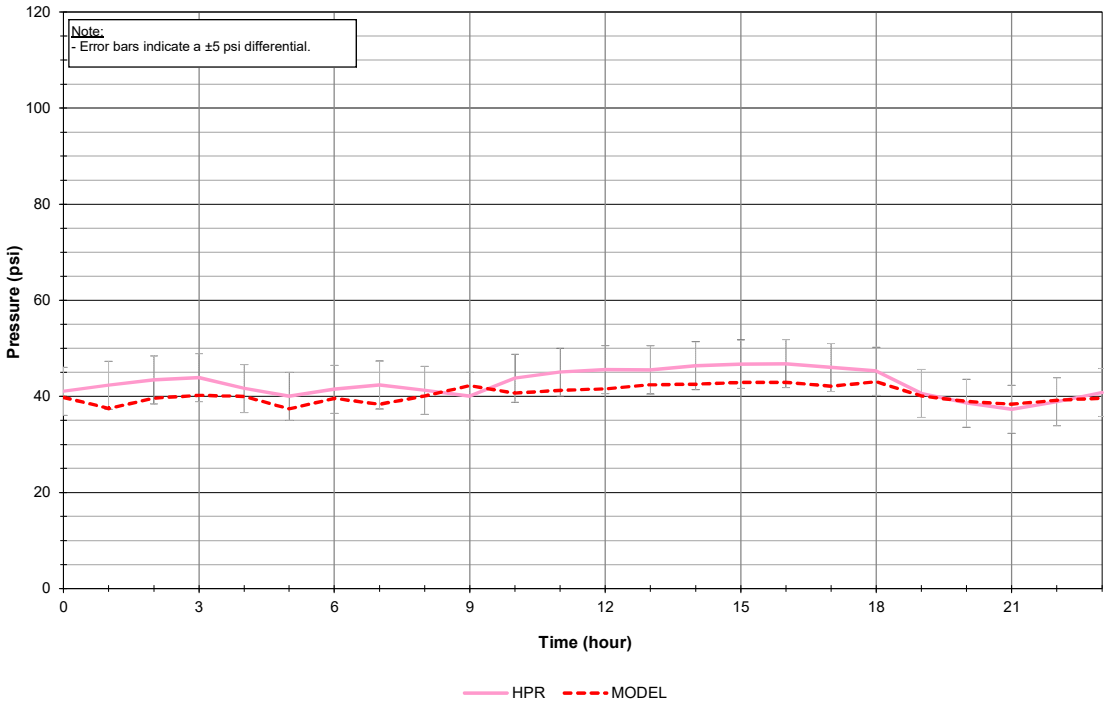


Figure B-17: HPR 9, Hammer Lane, Between Railroad and Girardi Way
June 23, 2020

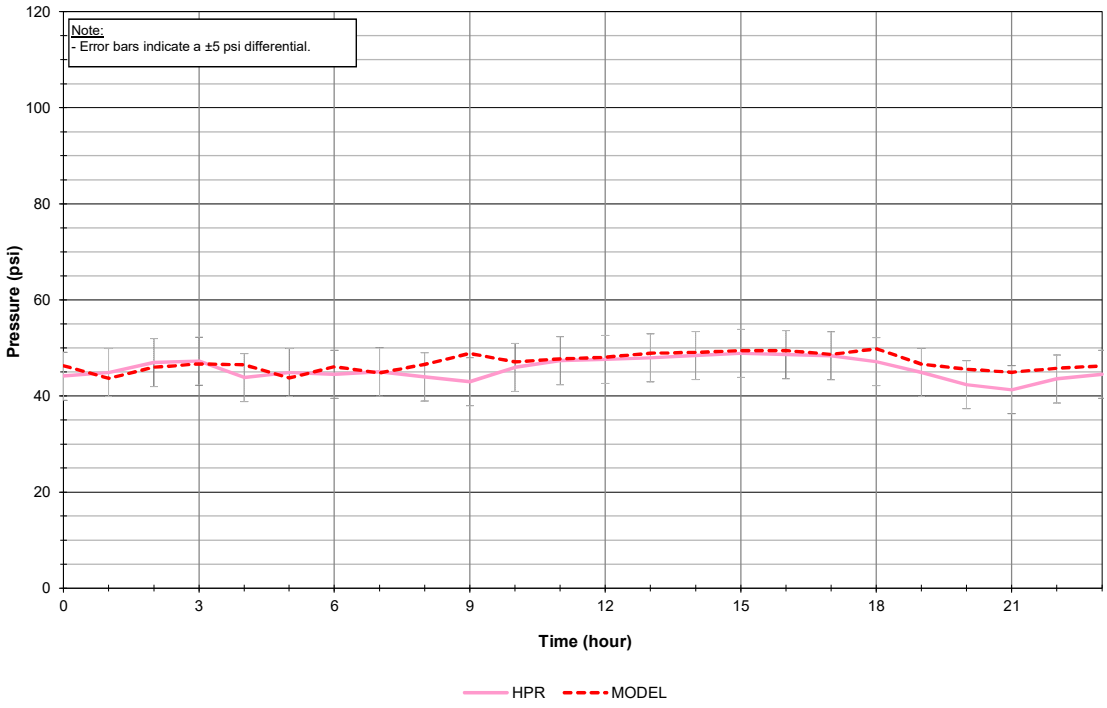


Figure B-18: HPR 10, March Lane, Between West Lane and Weber Ranch Park
June 23, 2020

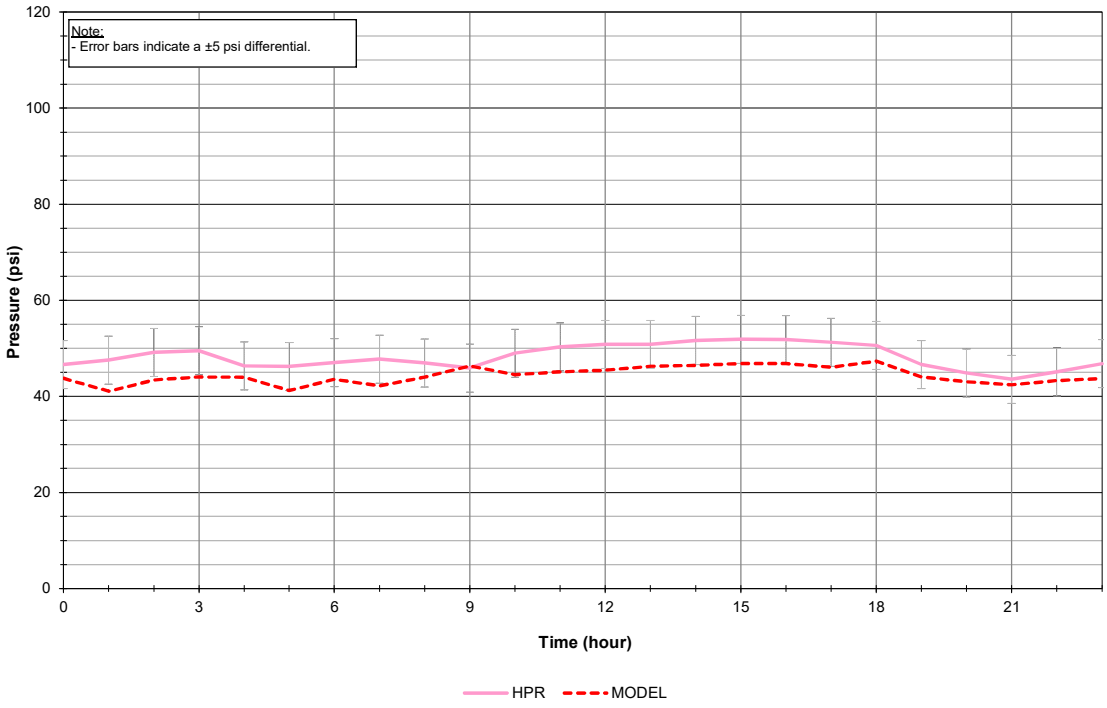


Figure B-19: HPR 11, Northwest corner of intersection of AG Spanos Boulevard and Thornton Boulevard
June 23, 2020

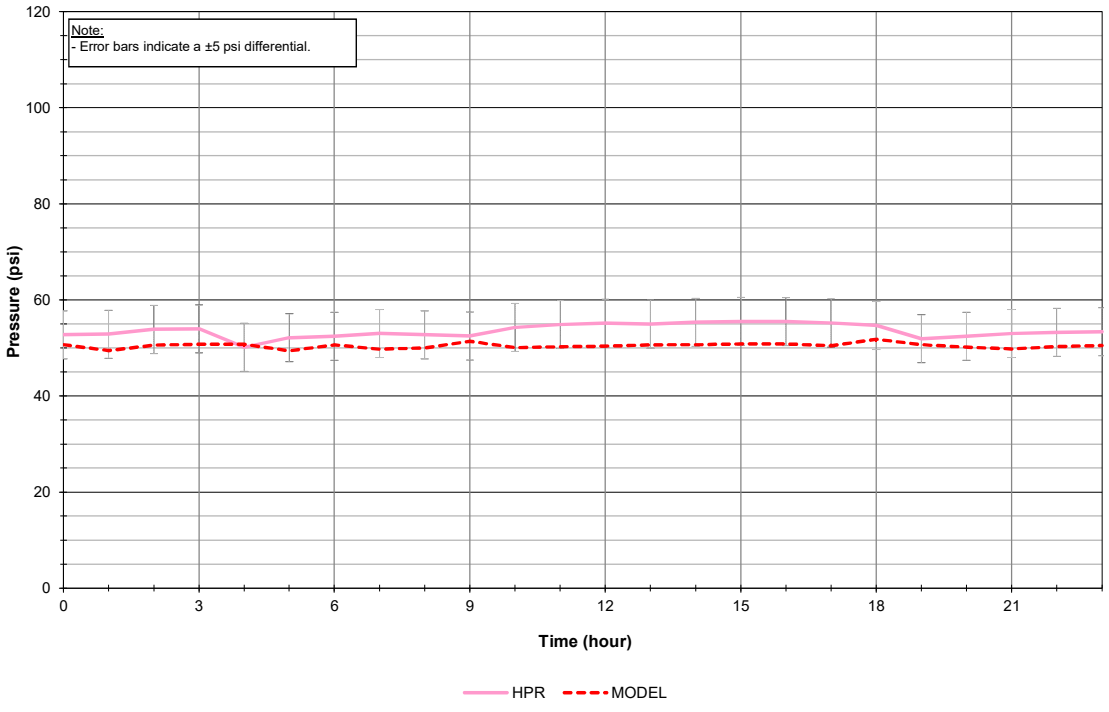
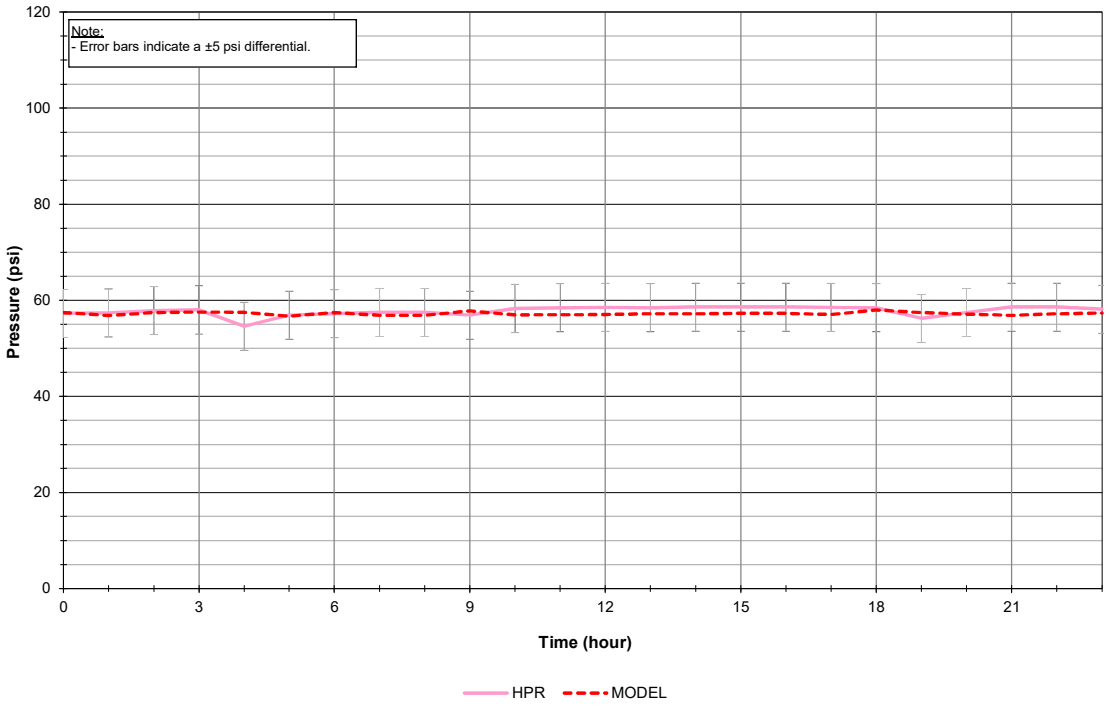


Figure B-20: HPR 12, South of intersection of Eight Mile Road and Trinity Park
June 23, 2020



Appendix C

Hydraulic Model Calibration Results – South Stockton

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Figure C-1. Stockton East Water District - Flow and Pressure Comparison
June 23, 2020

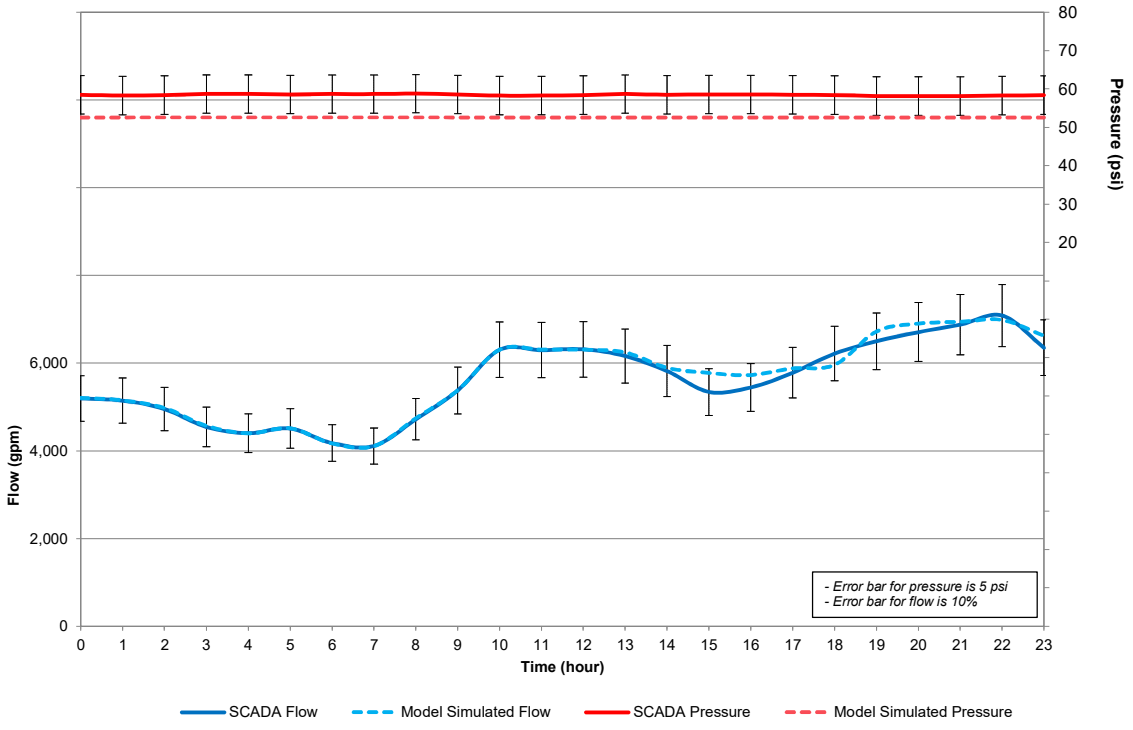


Figure C-2. Weston Ranch Reservoir - Tank Level Comparison
June 23, 2020

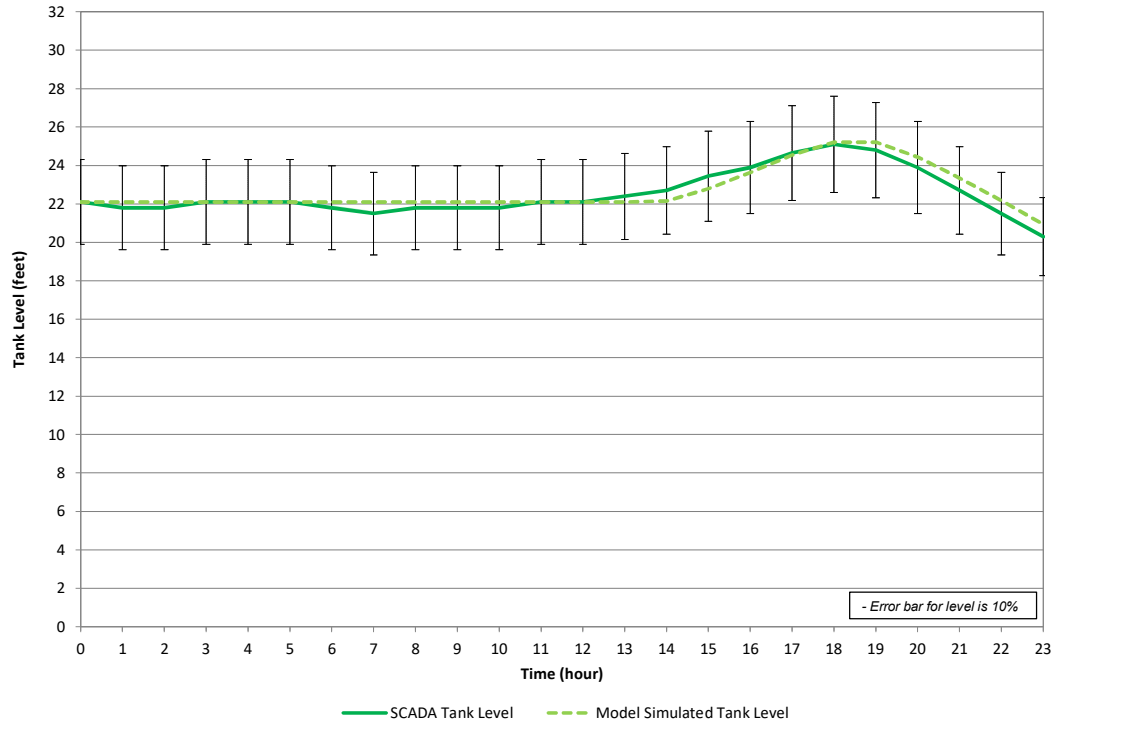


Figure C-3: HPR 13, Intersection of William Moss Boulevard and Carolyn Weston Boulevard
June 23, 2020

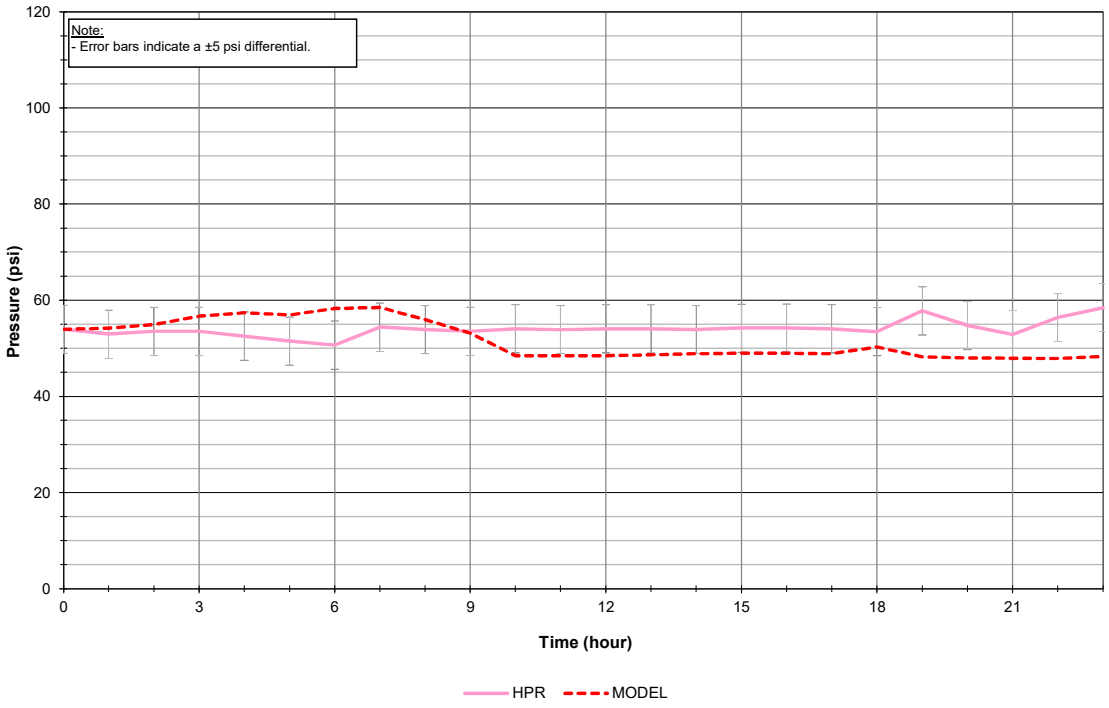


Figure C-4: HPR 14, Intersection of Airport Way and Performance Drive
June 23, 2020

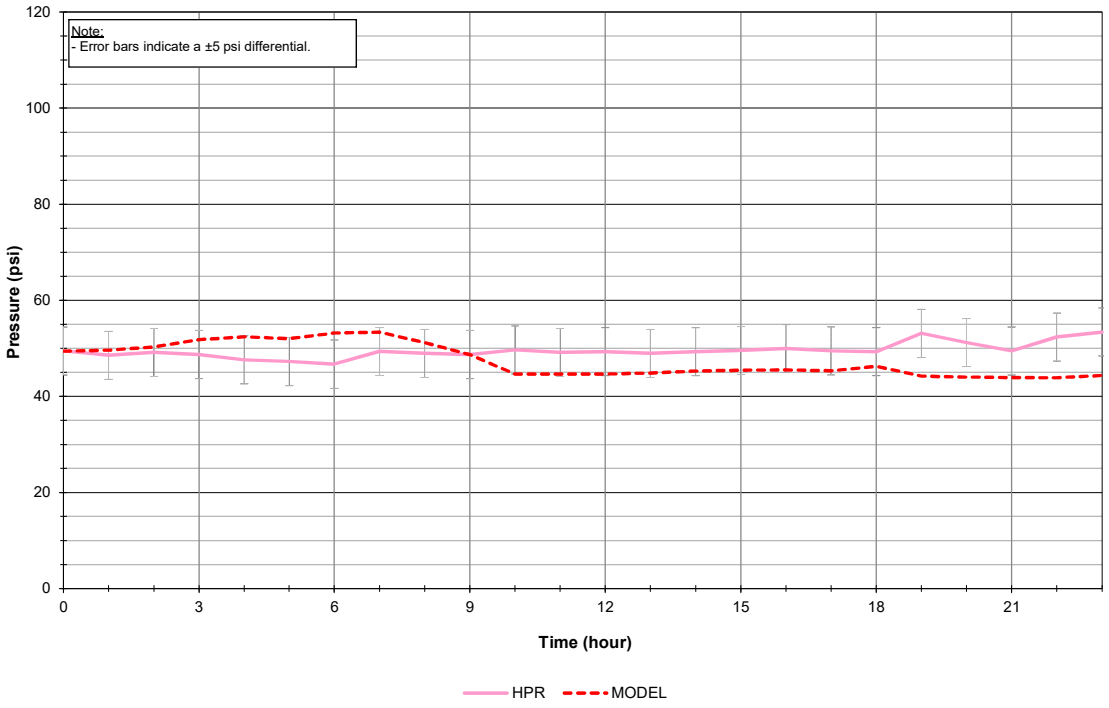


Figure C-5: HPR 15, Pock Lane, north of Togninali Lane
June 23, 2020

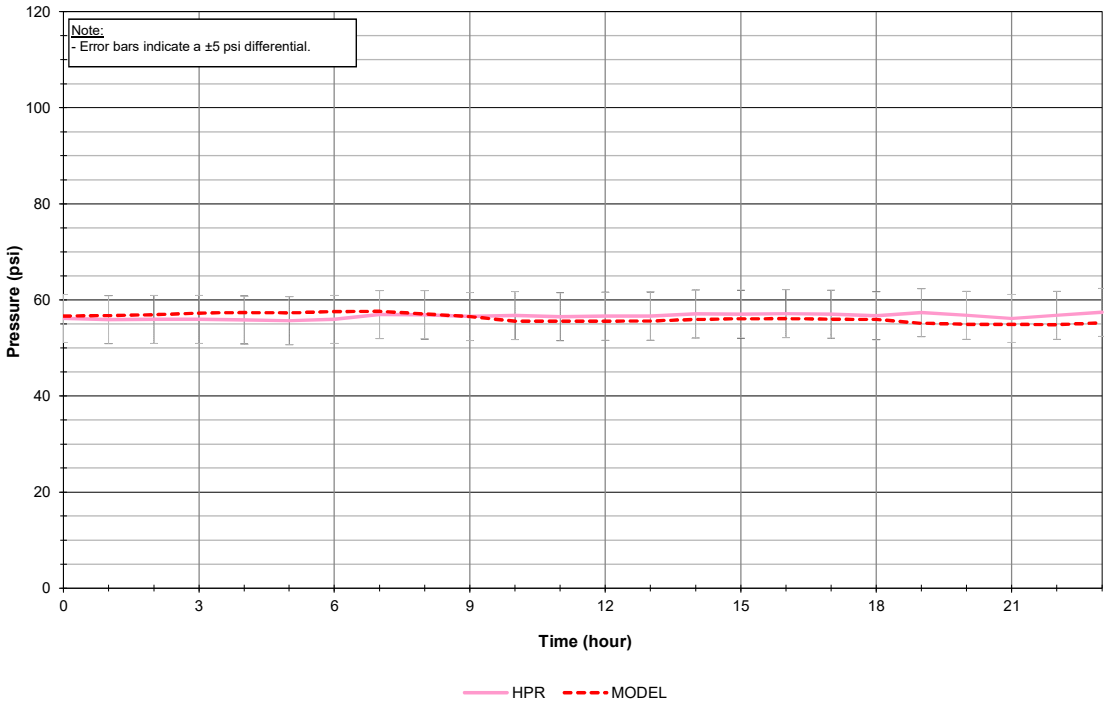
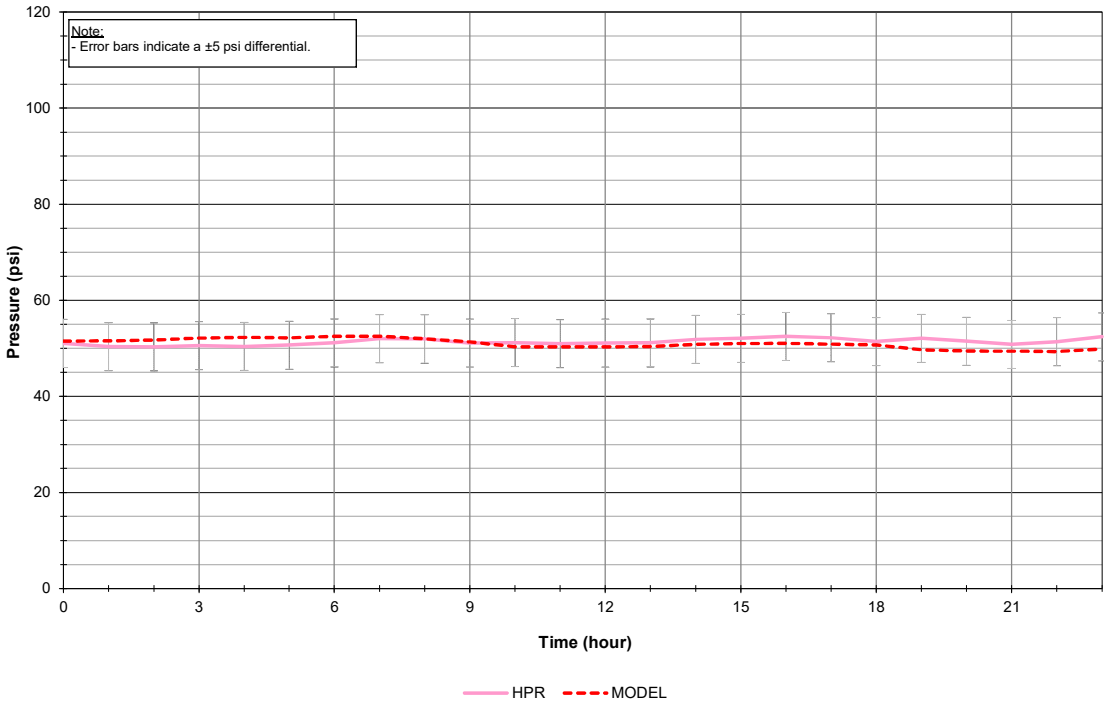


Figure C-6: HPR 16, North of intersection of Raymos Way and New Castle Road
June 23, 2020



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Appendix D

Cost Estimating Assumptions

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This appendix details West Yost's assumptions for estimating probable construction costs for the recommended water system facilities. Construction costs were developed based on a combination of data supplied by manufacturers, published industry standard cost data and curves, construction costs for similar facilities built by COSMUD and/or other public agencies, and construction costs previously estimated by West Yost for similar facilities with similar construction cost indexes.

The costs presented in this appendix are for construction only and do not include estimating or construction uncertainties (e.g., variations in final quantities) or cost estimates for engineering, legal services, environmental review, inspections, and/or contract administration. Some of these items are referred to as contingency costs and are addressed in the last section of this appendix. It should also be noted that the construction costs presented in this appendix represent capital infrastructure costs and do not include costs for purchase of additional surface water supplies, supply reliability, or operation and maintenance.

All estimated construction costs have been adjusted to reflect August 2020 dollars for San Francisco, California. These costs should be used for conceptual cost estimates only and should be updated regularly. Construction costs presented in this appendix are not intended to represent the lowest prices in the industry for each type of construction; rather they are representative of average or typical construction costs. These planning-level construction cost estimates have been prepared for guidance in evaluating various facility improvement options and are intended only for budgetary purposes within the context of this master planning effort.

The following sections of this appendix describe the assumptions used to estimate the probable construction costs for the planning and design of recommended water system facilities for the COSMUD water system:

- Water System Construction Costs
- Contingency Costs

D.1 WATER SYSTEM CONSTRUCTION COSTS

The following sections present the construction cost estimates used to project probable construction costs for recommended water system facilities in the COSMUD water system and are categorized by type of improvement, including the following:

- Treated Water Storage Reservoirs
- Municipal Groundwater Production Wells
- Reservoir Pump Stations
- Potable Water Pipelines
- Backup Power Generators

D.1.1 Treated Water Storage Reservoirs

Table 1 summarizes the estimated construction costs for treated water storage reservoirs between the size range of 1.0 to 6.0 MG. These costs generally include the installation of the storage reservoirs, site piping, earthwork, paving, instrumentation, and related sitework. These costs are representative of construction under normal excavation and foundation conditions and would be significantly higher for special or difficult foundation requirements. Because the existing COSMUD storage reservoirs are all steel aboveground reservoirs, West Yost estimated reservoir costs assuming future reservoirs will also be steel.

Table 1. Construction Costs for Treated Water Storage Reservoirs[a]

Capacity, MG	Estimated Construction Cost, million dollars[b] Aboveground Steel
1.0	2.4
2.0	3.3
3.0	4.2
4.0	5.1
5.0	6.0
6.0	6.9

(a) Based on August 2020 CCI for San Francisco (12,920.6).
(b) Estimated construction costs do not reflect an adjustment to account for the current economic bidding climate.

D.1.2 Municipal Groundwater Production Wells

Well construction consists of pilot hole drilling, water quality/soil sampling, pilot hole reaming, well construction, well development and providing the necessary housing, pump, motor, automatic control equipment, discharge piping, SCADA, and disinfection equipment. Costs also assume a backup power generator will be installed.

Construction costs for new groundwater wells are estimated to be approximately $3,200,000 per well (assuming a well capacity between 1,000 – 2,000 gpm). These estimates are based on recent bids for similarly sized wells and representative of construction under normal drilling conditions. Costs would be significantly higher for special or difficult locations, or if specialized wellhead treatment is required.

D.1.3 Wellhead Treatment

GAC wellhead treatment conceptual costs were developed based on the range of concentrations observed in the COSMUD municipal wells that are temporarily out of service for 1,2,3-TCP and PFOA/PFAS. Costs assume that there is sufficient space and electrical capacity on-site to accommodate the proposed treatment system, three to four 60,000 to 80,000-pound vessels, bitumen coal, for a maximum flow rate of 1,300 gpm. Costs include installation of equipment, onsite electrical (assuming electrical service does not need to be upgraded), and required permitting. Construction costs for the above described systems

are estimated to be approximately $1,300,000 per system, and are based on recent discussions with GAC treatment system vendors.

D.1.4 Reservoir Pump Stations

Pump stations will be required at ground-level and below-grade reservoirs to lift water to the hydraulic grade of the COSMUD water distribution system. Estimated construction costs for reservoir pump stations, as shown in Table 2, are based on enclosed stations with architectural and landscaping treatment suitable for residential areas. Pump station costs can vary considerably, depending on architectural design, pumping head, and pumping capacity. Therefore, these costs presented below are representative of construction under common or normal conditions and would be significantly higher for special or difficult conditions.

Pump station cost estimates include the installation of the pumps, site piping, earthwork, paving, a chemical feed system (hypochlorite), on-site backup/standby power generator, SCADA, and related sitework.

Table 2. Construction Costs for Reservoir Pump Stations[(a)]

Firm Capacity, mgd[(b)]	Estimated Construction Cost, million dollars[(c)]
0.5	1.5
1	1.5
2	1.7
3	1.9
5	2.3
10	3.2
15	4.2

(a) Based on August 2020 CCI for San Francisco (12,920.6).

(b) Equal to the total pumping capacity with the largest pump out of service or on standby.

(c) Estimated construction costs do not reflect an adjustment to account for the current economic bidding climate.

D.1.5 Potable Water Pipelines

Unit construction costs for potable water pipelines 8 through 36 inches in diameter are provided in Table 3. These unit costs are categorized by typical pipeline construction either in developed (e.g., in urban or suburban roads) or undeveloped (e.g., across open fields or in rural roads) areas and are representative of pipeline construction under common or normal conditions. Special or difficult conditions would increase costs significantly.

The unit construction costs presented below generally include pipeline materials, trenching, placing and jointing pipe, valves, fittings, hydrants, service connections, placing imported pipe bedding, native backfill material, and partial asphalt pavement replacement, if required. However, the costs presented in Table 3 do not include jacking and boring pipe or constructing boring and receiving pits. Jack and bore costs are shown in Table 4 and should be added where required.

Table 3. Unit Construction Costs for Pipelines[a]		
Pipeline Diameter, inches	Unit Construction Cost, dollars/linear foot[b]	
	Developed Areas	Undeveloped Areas
8	135	90
10	165	110
12	185	130
14	200	145
16	220	165
18	240	185
20	265	190
24	290	225
30	365	315
36	470	420

(a) Based on August 2020 CCI for San Francisco (12,920.6).
(b) Estimated construction costs do not reflect an adjustment to account for the current economic bidding climate.

Table 4. Unit Construction Costs for Jack and Bore[a]	
Pipeline Size	Unit Construction Cost, dollars/linear foot[b]
12-inch pipe (24-inch casing)	935
16-inch pipe (30-inch casing)	1,170
18-inch pipe (32-inch casing)	1,250
24-inch pipe (36-inch casing)	1,405

(a) Based on August 2020 CCI for San Francisco (12,920.6).
(b) Estimated construction costs do not reflect an adjustment to account for the current economic bidding climate.

D.1.6 Backup Power Generators

On-site backup power generators are recommended so pumps can continue delivering water to the distribution system in the event of a power outage. These generators should be sized to meet the power demands of the pumps. The construction cost for a new on-site backup power generator is estimated to be approximately $200,000. This cost is representative of construction under normal conditions and would be significantly higher for special or difficult conditions.

D.2 CONTINGENCY COSTS

Contingency costs must be reviewed on a case-by-case basis, because they will vary considerably with each construction project. However, to assist COSMUD staff with budgeting for these recommended water system facility improvements, standard contingencies have been added to the planning budget as percentages of the estimated base construction cost, divided into two categories: Construction Contingency Costs and Other Project Costs.

- **Construction Contingency Costs**: 35 percent
  The construction costs presented above are representative of the construction of water system facilities under normal construction conditions and schedules; consequently, it is appropriate to allow for estimating and construction uncertainties unavoidably associated with the conceptual planning of projects. Factors such as unexpected construction conditions, the need for unforeseen mechanical items, and variations in final quantities are only a few of the items that can increase project costs. An allowance of 35 percent of the base construction cost will be included to cover such project related construction contingencies.
- **Other Project Costs:** 45 percent
  Other project fees have been divided into three (3) subcategories, totaling 45 percent (15 percent engineering, 15 percent construction management, and 15 percent program implementation)
  - Engineering costs associated with new facilities include preliminary investigations and reports, right-of-way acquisition, foundation explorations, preparation of drawings and specifications during construction, surveying and staking, sampling of testing material, and start-up services. For this study, engineering costs are assumed to be 15 percent of the base construction cost estimate.
  - Construction management covers such items as contract management and inspection during construction. The cost of these items can also vary, but for the purpose of this study, it is assumed that construction management charges will equal approximately 15 percent of the base construction cost estimate.
  - Program implementation costs cover items such as legal fees, environmental/CEQA compliance requirements, financing expenses, administrative costs, and interest during construction. The cost of these items can also vary, but for the purpose of this study, it is assumed that program implementation costs will equal approximately 15 percent of the base construction cost estimate.

An example application of these standard mark-ups to a project with an assumed base construction cost of $1.0 million is shown in Table 5. As shown, the total cost of all project construction contingencies (construction contingency, engineering, construction management, and program implementation costs) is 80 percent of the base construction cost for each construction project.

Table 5. Example Application of Contingency Costs

Cost Component	Percent	Cost, dollars
Estimated Base Construction Cost before Mark-ups[(a)]	--	1,000,000
Construction Contingency Costs	35	350,000
Other Project Costs		
Engineering	15	150,000
Construction Management	15	150,000
Program Implementation	15	150,000
Estimated Total Project Cost		**$1,800,000**

(a) Assumed cost of an example project.

Appendix E

Financial Plan Worksheets

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City of Stockton MUD
Water Master Plan
Revenue Requirement Summary
Exhibit 1

	Proposed	*Projected*								
	FY 2021	**FY 2022**	**FY 2023**	**FY 2024**	**FY 2025**	**FY 2026**	**FY 2027**	**FY 2028**	**FY 2029**	**FY 2030**
Revenue										
Rate Revenues	$51,146,122	$51,401,852	$51,658,862	$51,917,156	$52,176,742	$52,437,626	$52,699,814	$52,963,313	$53,228,129	$53,494,270
Non-Operating Revenues	6,972,507	7,753,152	7,663,842	7,545,867	7,506,406	7,459,254	7,465,916	7,485,776	7,505,559	7,524,476
Total Revenues	**$58,118,628**	**$59,155,004**	**$59,322,704**	**$59,463,023**	**$59,683,148**	**$59,896,880**	**$60,165,730**	**$60,449,089**	**$60,733,688**	**$61,018,745**
Expenses										
Total Administrative & General	$2,399,761	$2,472,731	$2,547,947	$2,684,563	$2,782,485	$2,867,767	$3,022,764	$3,133,362	$3,229,423	$3,328,458
Total Operations and Maintenance	4,874,311	5,032,055	5,192,345	5,450,930	5,651,904	5,835,383	6,128,017	6,354,495	6,560,792	6,773,906
Total Utility Billing	1,011,829	1,042,171	1,073,423	1,147,115	1,192,616	1,228,380	1,312,787	1,364,881	1,405,812	1,447,970
Total Other Support Services	624,904	644,251	664,213	702,074	728,874	752,056	795,149	825,553	851,800	878,894
Total Water Conservation	164,260	117,768	121,386	127,107	131,591	135,700	142,151	147,182	151,778	156,520
Total Water Purchase	16,010,550	17,051,236	18,159,566	19,339,938	20,597,034	21,935,841	23,361,671	24,880,179	26,497,391	28,219,721
Total Hydrant Maintenance	322,572	332,663	342,833	358,482	371,010	382,615	400,232	414,263	427,225	440,597
Total Delta Water Production	4,800,596	4,975,095	5,146,215	5,372,479	5,571,438	5,764,569	6,019,406	6,242,792	6,459,337	6,683,559
Total Well Production	1,653,512	1,712,618	1,773,644	1,855,171	1,926,632	1,995,956	2,088,065	2,168,588	2,246,609	2,327,489
Total DWSP Maintenance & Repair	1,168,355	1,205,452	1,243,512	1,304,919	1,352,536	1,395,945	1,465,394	1,519,008	1,567,766	1,618,114
Total MUD Admin / Finance	729,513	752,625	776,140	818,168	848,862	875,918	923,649	958,374	988,914	1,020,442
Total Engineering Services	255,477	263,554	271,754	286,662	297,426	306,850	323,789	335,974	346,617	357,603
Total Lab Services	322,363	332,435	342,646	358,371	370,906	382,490	400,199	414,240	427,182	440,534
Total Safety	315,301	325,166	335,056	348,605	360,197	371,282	386,424	399,312	411,606	424,281
Total SCADA	251,712	260,108	268,793	281,774	292,340	302,227	316,908	328,815	339,936	351,441
Total Outreach & Training	117,826	121,140	124,548	128,086	131,702	135,413	139,268	143,205	147,246	151,402
Total O&M Expenses	**$35,022,842**	**$36,641,066**	**$38,384,019**	**$40,564,443**	**$42,607,554**	**$44,668,391**	**$47,225,873**	**$49,630,222**	**$52,059,434**	**$54,620,932**
Net Debt Service	**$13,785,486**	**$13,793,287**	**$13,801,450**	**$13,521,588**	**$13,528,223**	**$13,188,633**	**$13,206,793**	**$13,221,724**	**$13,232,584**	**$13,233,693**
Rate Funded Capital	**$9,000,000**	**$8,675,000**	**$8,950,000**	**$9,250,000**	**$9,250,000**	**$9,500,000**	**$10,000,000**	**$10,400,000**	**$10,700,000**	**$11,000,000**
Reserve Funding	**$310,300**	**$45,651**	**($4,705)**	**($175,210)**	**$249,381**	**$858,402**	**$535,600**	**$606,486**	**$552,718**	**$482,677**
Total Revenue Requirement	**$58,118,628**	**$59,155,004**	**$61,130,764**	**$63,160,822**	**$65,635,157**	**$68,215,425**	**$70,968,266**	**$73,858,432**	**$76,544,737**	**$79,337,302**
Bal. / Def.) of Funds	$0	$0	($1,808,060)	($3,697,799)	($5,952,010)	($8,318,546)	($10,802,536)	($13,409,343)	($15,811,048)	($18,318,557)
Bal. / (Def.) as a % of Rate Rev.	0.0%	0.0%	3.5%	7.1%	11.4%	15.9%	20.5%	25.3%	29.7%	34.2%
Proposed Rate Adjustment	**0.0%**	**0.0%**	**3.5%**	**3.5%**	**4.0%**	**4.0%**	**4.0%**	**4.0%**	**3.5%**	**3.5%**
Add'l Revenue from Adj.	$0	$0	$1,808,060	$3,697,799	$5,952,010	$8,318,546	$10,802,536	$13,409,343	$15,811,048	$18,318,557
Total Bal/(Def.) of Funds	$0	$0	$0	($0)	$0	($0)	$0	$0	$0	($0)
Additional Rate Increase Needed	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**
Avg Res Monthly Bill (5/8" Meter + 15CCF)	**$70.95**	**$70.95**	**$73.43**	**$76.00**	**$79.04**	**$82.21**	**$85.49**	**$88.91**	**$92.03**	**$95.25**
Ending Balance (not including 421 or 425)	**$68,307,112**	**$65,234,166**	**$46,679,585**	**$44,389,884**	**$39,225,611**	**$37,284,789**	**$37,820,390**	**$38,426,876**	**$38,979,594**	**$39,462,270**
Total Target	*$17,271,539*	*$18,069,567*	*$18,929,105*	*$20,004,383*	*$21,011,944*	*$22,028,247*	*$23,289,472*	*$24,475,178*	*$25,673,146*	*$26,936,350*

City of Stockton MUD
Water Master Plan
Exhibit 2
Escalation Factors

	Proposed	*Projected*								
	FY 2021	**FY 2022**	**FY 2023**	**FY 2024**	**FY 2025**	**FY 2026**	**FY 2027**	**FY 2028**	**FY 2029**	**FY 2030**
Revenues										
Customer Growth	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%
SF Cust Growth	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%
SF Consump Growth	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
MF Cust Growth	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%
MF Consump Growth	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
NonRes Cust Growth	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%
NonRes Consump Growth	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Irr Cust Growth	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%
Irr Consump Growth	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Misc Revenues	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%
Expenses										
Labor	Proposed	3.0%	3.0%	7.0%	4.0%	3.0%	7.0%	4.0%	3.0%	3.0%
Benefits - Medical	Proposed	2.0%	2.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%
Benefits - Other	Proposed	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%
Professional / Special Srvcs	Proposed	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%
Materials & Supplies	Proposed	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%
Equipment	Proposed	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%
Radio Equipment	Proposed	50.0%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%
Miscellaneous	Proposed	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%
Utilities	Proposed	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%
Insurance	Proposed	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%
Flat	Proposed	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Purchased Water	Proposed	6.5%	6.5%	6.5%	6.5%	6.5%	6.5%	6.5%	6.5%	6.5%
Interest	0.8%	0.9%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%
New Debt Service:										
Low Interest Loans										
Term in Years	20	20	20	20	20	20	20	20	20	20
Rate	1.8%	2.0%	2.2%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%
Revenue Bond										
Term in Years	20	20	20	20	20	20	20	20	20	20
Rate	3.5%	3.8%	4.0%	4.2%	4.5%	5.0%	5.0%	5.0%	5.0%	5.0%

City of Stockton MUD
Water Master Plan
Exhibit 3
Revenue Requirement

Acct. #		Proposed FY 2021	Projected FY 2022	FY 2023	FY 2024	FY 2025	FY 2026	FY 2027	FY 2028	FY 2029	FY 2030	Notes
	Revenues											
	Rate Revenues											
	Single Family	$34,105,115	$34,275,641	$34,447,019	$34,619,254	$34,792,350	$34,966,312	$35,141,144	$35,316,850	$35,493,434	$35,670,901	As Customer Growth
	Multi-Family	5,081,480	5,106,888	5,132,422	5,158,084	5,183,875	5,209,794	5,235,843	5,262,022	5,288,332	5,314,774	As Customer Growth
	Non-Residential	7,336,179	7,372,860	7,409,724	7,446,773	7,484,007	7,521,427	7,559,034	7,596,829	7,634,813	7,672,987	As Customer Growth
	Irrigation	4,623,347	4,646,464	4,669,696	4,693,045	4,716,510	4,740,092	4,763,793	4,787,612	4,811,550	4,835,608	As Customer Growth
	Total Rate Revenues	**$51,146,122**	**$51,401,852**	**$51,658,862**	**$51,917,156**	**$52,176,742**	**$52,437,626**	**$52,699,814**	**$52,963,313**	**$53,228,129**	**$53,494,270**	
	Non-Operating Revenues											
	Interest	$712,171	$905,879	$805,969	$677,297	$627,032	$568,976	$564,628	$573,371	$581,930	$589,521	Calculated
	Private Fire	175,396	176,281	177,171	178,062	178,961	179,861	180,767	181,679	182,594	183,510	Exhibit 7
	Linc Vill Maint	50,858	51,367	51,880	52,399	52,923	53,452	53,987	54,527	55,072	55,623	As Misc Revenues
	Service Penalties	0	582,202	588,024	593,904	599,843	605,842	611,900	618,019	624,199	630,441	As Misc Revenues
	Reconnection Admin Fees	324,082	327,323	330,596	333,902	337,241	340,613	344,020	347,460	350,934	354,444	As Misc Revenues
	Repayment of In-Lieu Transfers	0	0	0	0	0	0	0	0	0	0	City Provided
	Miscellaneous Other Revenues	10,000	10,100	10,201	10,303	10,406	10,510	10,615	10,721	10,829	10,937	As Misc Revenues
	Allocation Trueup - Cal Water	5,700,000	5,700,000	5,700,000	5,700,000	5,700,000	5,700,000	5,700,000	5,700,000	5,700,000	5,700,000	As Flat
	Total Non-Operating Revenues	**$6,972,507**	**$7,753,152**	**$7,663,842**	**$7,545,867**	**$7,506,406**	**$7,459,254**	**$7,465,916**	**$7,485,776**	**$7,505,559**	**$7,524,476**	
	Total Revenues	**$58,118,628**	**$59,155,004**	**$59,322,704**	**$59,463,023**	**$59,683,148**	**$59,896,880**	**$60,165,730**	**$60,449,089**	**$60,733,688**	**$61,018,745**	
	Administrative & General											
	Employee Services											
10-10	Salaries - Regular	$571,632	$588,781	$606,444	$648,895	$674,851	$695,097	$743,754	$773,504	$796,709	$820,610	As Labor
10-13	Regular Overtime	500	515	530	568	590	608	651	677	697	718	As Labor
10-20	Employee Separation Pay	4,213	4,382	4,557	4,739	4,929	5,126	5,331	5,544	5,766	5,996	As Benefits - Other
10-25	Retirement	167,088	173,772	180,722	187,951	195,469	203,288	211,420	219,876	228,671	237,818	As Benefits - Other
10-27	Medicare	8,158	8,403	8,655	9,261	9,631	9,920	10,614	11,039	11,370	11,711	As Labor
10-29	Health/Dental/Vision	54,036	55,117	56,219	57,906	59,643	61,432	63,275	65,173	67,128	69,142	As Benefits - Medical
10-31	L/T Disability Insurance	3,601	3,709	3,820	3,935	4,053	4,175	4,300	4,429	4,562	4,698	As Insurance
10-32	Life Insurance	454	468	482	496	511	526	542	558	575	592	As Insurance
10-33	Workers Compensation	12,484	12,983	13,503	14,043	14,605	15,189	15,796	16,428	17,085	17,769	As Benefits - Other
10-34	Unemployment Insurance	285	294	302	311	321	330	340	351	361	372	As Insurance
10-45	Cell Phone Allowance	3,030	3,151	3,277	3,408	3,545	3,686	3,834	3,987	4,147	4,313	As Benefits - Other
10-46	Retirement Pension Bond	19,656	20,246	20,853	22,313	23,205	23,901	25,575	26,598	27,395	28,217	As Labor
	Total Employee Services	**$845,137**	**$871,819**	**$899,365**	**$953,826**	**$991,353**	**$1,023,279**	**$1,085,431**	**$1,128,164**	**$1,164,467**	**$1,201,958**	

City of Stockton MUD
Water Master Plan
Exhibit 3
Revenue Requirement

Acct. #		*Proposed* FY 2021	*Projected* FY 2022	FY 2023	FY 2024	FY 2025	FY 2026	FY 2027	FY 2028	FY 2029	FY 2030	*Notes*
	Other Services											
20-15	Telephone	$800	$832	$865	$900	$936	$973	$1,012	$1,053	$1,095	$1,139	As Utilities
20-25	Maint. & Repair Services	15,000	15,450	15,914	16,391	16,883	17,389	17,911	18,448	19,002	19,572	As Materials & Supplies
20-34	Duplication/Copy Costs	1,500	1,545	1,591	1,639	1,688	1,739	1,791	1,845	1,900	1,957	As Materials & Supplies
20-37	Insurance Premiums	37,899	39,036	40,207	41,413	42,656	43,935	45,253	46,611	48,009	49,450	As Insurance
20-41	Automotive Equip Rental	7,692	8,000	8,320	8,652	8,999	9,358	9,733	10,122	10,527	10,948	As Equipment
20-43	Computer/Tech/Oper Supprt	49,336	50,816	52,341	53,911	55,528	57,194	58,910	60,677	62,497	64,372	As Materials & Supplies
20-47	Telephone Rental	6,363	6,618	6,882	7,158	7,444	7,742	8,051	8,373	8,708	9,057	As Equipment
20-52	Publicity & Advertising	5,000	5,125	5,253	5,384	5,519	5,657	5,798	5,943	6,092	6,244	As Miscellaneous
20-53	Printing & Mapping	2,500	2,575	2,652	2,732	2,814	2,898	2,985	3,075	3,167	3,262	As Materials & Supplies
20-54	Postage/Mailing Services	9,500	9,785	10,079	10,381	10,692	11,013	11,343	11,684	12,034	12,395	As Materials & Supplies
20-58	Legal Services	400,000	412,000	424,360	437,091	450,204	463,710	477,621	491,950	506,708	521,909	As Professional / Special Srvcs
20-63	Testing & Analysis Servcs	3,000	3,075	3,152	3,231	3,311	3,394	3,479	3,566	3,655	3,747	As Miscellaneous
20-65	Prof & Special Services	50,000	51,500	53,045	54,636	56,275	57,964	59,703	61,494	63,339	65,239	As Professional / Special Srvcs
20-66	Other Services	85,000	87,550	90,177	92,882	95,668	98,538	101,494	104,539	107,675	110,906	As Professional / Special Srvcs
	Total Other Services	**$673,590**	**$693,906**	**$714,837**	**$736,401**	**$758,617**	**$781,505**	**$805,085**	**$829,380**	**$854,409**	**$880,196**	
	Materials and Supplies											
30-50	Materials & Supplies	$7,700	$7,931	$8,169	$8,414	$8,666	$8,926	$9,194	$9,470	$9,754	$10,047	As Materials & Supplies
30-51	Computer Software	900	927	955	983	1,013	1,043	1,075	1,107	1,140	1,174	As Materials & Supplies
30-53	Fuel - Gas/Oil/Propane	139	143	147	152	156	161	166	171	176	181	As Materials & Supplies
30-55	Library Materials	1,300	1,339	1,379	1,421	1,463	1,507	1,552	1,599	1,647	1,696	As Materials & Supplies
	Total Materials and Supplies	**$10,039**	**$10,340**	**$10,650**	**$10,970**	**$11,299**	**$11,638**	**$11,987**	**$12,347**	**$12,717**	**$13,099**	
	Other Expenses											
40-10	Training	$8,400	$8,610	$8,825	$9,046	$9,272	$9,504	$9,741	$9,985	$10,235	$10,490	As Miscellaneous
40-12	Meetings & Travel	1,000	1,025	1,051	1,077	1,104	1,131	1,160	1,189	1,218	1,249	As Miscellaneous
40-14	Memberships	74,500	76,363	78,272	80,228	82,234	84,290	86,397	88,557	90,771	93,040	As Miscellaneous
40-22	Taxes	8,000	8,200	8,405	8,615	8,831	9,051	9,278	9,509	9,747	9,991	As Miscellaneous
40-25	Indirect Cost Allocation	779,095	802,468	826,542	884,400	919,776	947,369	1,013,685	1,054,232	1,085,859	1,118,435	As Labor
	Total Other Expenses	**$870,995**	**$896,665**	**$923,094**	**$983,366**	**$1,021,216**	**$1,051,345**	**$1,120,261**	**$1,163,473**	**$1,197,831**	**$1,233,206**	
	Total Administrative & General	**$2,399,761**	**$2,472,731**	**$2,547,947**	**$2,684,563**	**$2,782,485**	**$2,867,767**	**$3,022,764**	**$3,133,362**	**$3,229,423**	**$3,328,458**	

City of Stockton MUD
Water Master Plan
Exhibit 3
Revenue Requirement

Acct. #		*Proposed* FY 2021	*Projected* FY 2022	FY 2023	FY 2024	FY 2025	FY 2026	FY 2027	FY 2028	FY 2029	FY 2030	*Notes*
	Operations and Maintenance											
	Employee Services											
10-10	Salaries - Regular	$1,771,933	$1,825,091	$1,879,844	$2,011,433	$2,091,890	$2,154,647	$2,305,472	$2,397,691	$2,469,622	$2,543,710	As Labor
10-11	Salaries Part Time - Temp	25,000	25,750	26,523	28,379	29,514	30,400	32,528	33,829	34,844	35,889	As Labor
10-13	Regular Overtime	50,000	51,500	53,045	56,758	59,028	60,799	65,055	67,657	69,687	71,778	As Labor
10-17	Stand By Time (Call Back)	20,822	21,447	22,090	23,636	24,582	25,319	27,092	28,175	29,021	29,891	As Labor
10-18	Holiday Pay	2,800	2,884	2,971	3,178	3,306	3,405	3,643	3,789	3,902	4,020	As Labor
10-20	Separation Pay	13,830	14,383	14,959	15,557	16,179	16,826	17,499	18,199	18,927	19,684	As Benefits - Other
10-21	Additional Pay	64,001	65,921	67,899	72,652	75,558	77,824	83,272	86,603	89,201	91,877	As Labor
10-25	Retirement	533,021	554,342	576,516	599,576	623,559	648,502	674,442	701,419	729,476	758,655	As Benefits - Other
10-26	Deferred Compensation	95,455	98,319	101,268	108,357	112,691	116,072	124,197	129,165	133,040	137,031	As Labor
10-27	Medicare	27,724	28,556	29,412	31,471	32,730	33,712	36,072	37,515	38,640	39,799	As Labor
10-29	Health/Dental/Vision	298,620	304,592	310,684	320,005	329,605	339,493	349,678	360,168	370,973	382,102	As Benefits - Medical
10-31	L-T Disability Insurance	11,158	11,493	11,838	12,193	12,558	12,935	13,323	13,723	14,135	14,559	As Insurance
10-32	Life Insurance	2,591	2,669	2,749	2,831	2,916	3,004	3,094	3,187	3,282	3,381	As Insurance
10-33	Workers' Compensation	177,733	184,842	192,236	199,925	207,922	216,239	224,889	233,885	243,240	252,969	As Benefits - Other
10-34	Unemployment Insurance	1,575	1,622	1,671	1,721	1,773	1,826	1,881	1,937	1,995	2,055	As Insurance
10-45	Cell Phone Allowance	600	624	649	675	702	730	759	790	821	854	As Benefits - Other
10-46	Retirement Pension Bond	61,808	63,662	65,572	70,162	72,969	75,158	80,419	83,635	86,145	88,729	As Labor
	Total Employee Services	**$3,158,671**	**$3,257,697**	**$3,359,924**	**$3,558,510**	**$3,697,483**	**$3,816,891**	**$4,043,314**	**$4,201,367**	**$4,336,951**	**$4,476,984**	
	Other Services & Charges											
20-11	Electricity	$14,500	$15,080	$15,683	$16,311	$16,963	$17,641	$18,347	$19,081	$19,844	$20,638	As Utilities
20-12	Gas	1,500	1,560	1,622	1,687	1,755	1,825	1,898	1,974	2,053	2,135	As Utilities
20-15	Telephone	23,100	24,024	24,985	25,984	27,024	28,105	29,229	30,398	31,614	32,879	As Utilities
20-25	Maint. & Repair Services	287,796	296,430	305,323	314,482	323,917	333,634	343,643	353,953	364,571	375,509	As Materials & Supplies
20-27	Uniform/Laundry Services	8,500	8,755	9,018	9,288	9,567	9,854	10,149	10,454	10,768	11,091	As Professional / Special Srvcs
20-34	Duplication/Copy Costs	1,200	1,236	1,273	1,311	1,351	1,391	1,433	1,476	1,520	1,566	As Materials & Supplies
20-37	Insurance Premiums	127,779	131,612	135,561	139,628	143,816	148,131	152,575	157,152	161,867	166,723	As Insurance
20-41	Automotive Equip Rental	143,443	149,181	155,148	161,354	167,808	174,520	181,501	188,761	196,312	204,164	As Equipment
20-43	Computer/Tech/Oper Supprt	90,752	94,382	98,157	102,084	106,167	110,414	114,830	119,423	124,200	129,168	As Equipment
20-44	Radio Equipment Rental	5,625	8,438	8,733	9,038	9,355	9,682	10,021	10,372	10,735	11,111	As Radio Equipment
20-45	Other Rentals	5,000	5,200	5,408	5,624	5,849	6,083	6,327	6,580	6,843	7,117	As Equipment
20-47	Telephone Rental	3,636	3,781	3,933	4,090	4,254	4,424	4,601	4,785	4,976	5,175	As Equipment
20-54	Postage/Mailing Services	1,800	1,854	1,910	1,967	2,026	2,087	2,149	2,214	2,280	2,349	As Professional / Special Srvcs
20-57	Processing Fees	65,000	66,950	68,959	71,027	73,158	75,353	77,613	79,942	82,340	84,810	As Professional / Special Srvcs
20-63	Testing & Analysis Servcs	1,300	1,333	1,366	1,400	1,435	1,471	1,508	1,545	1,584	1,624	As Miscellaneous
20-65	Prof & Special Services	52,900	54,487	56,122	57,805	59,539	61,326	63,165	65,060	67,012	69,023	As Professional / Special Srvcs
20-66	Other Services	96,241	99,128	102,102	105,165	108,320	111,570	114,917	118,364	121,915	125,573	As Professional / Special Srvcs
	Total Other Services & Charges	**$930,072**	**$963,431**	**$995,301**	**$1,028,246**	**$1,062,303**	**$1,097,510**	**$1,133,907**	**$1,171,534**	**$1,210,434**	**$1,250,651**	

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Acct. #		*Proposed* FY 2021	*Projected* FY 2022	FY 2023	FY 2024	FY 2025	FY 2026	FY 2027	FY 2028	FY 2029	FY 2030	*Notes*
	Materials and Supplies											
30-50	Materials & Supplies	$505,000	$520,150	$535,755	$551,827	$568,382	$585,433	$602,996	$621,086	$639,719	$658,910	As Materials & Supplies
30-51	Computer Software	500	515	530	546	563	580	597	615	633	652	As Materials & Supplies
30-53	Fuel - Gas/Oil/Propane	82,839	85,324	87,884	90,520	93,236	96,033	98,914	101,882	104,938	108,086	As Materials & Supplies
30-55	Library Materials	1,500	1,545	1,591	1,639	1,688	1,739	1,791	1,845	1,900	1,957	As Materials & Supplies
	Total Materials and Supplies	**$589,839**	**$607,534**	**$625,760**	**$644,533**	**$663,869**	**$683,785**	**$704,299**	**$725,428**	**$747,190**	**$769,606**	
	Other Expenses											
40-10	Training	$8,000	$8,200	$8,405	$8,615	$8,831	$9,051	$9,278	$9,509	$9,747	$9,991	As Miscellaneous
40-12	Meetings & Travel	500	513	525	538	552	566	580	594	609	624	As Miscellaneous
40-22	Taxes	2,500	2,563	2,627	2,692	2,760	2,829	2,899	2,972	3,046	3,122	As Miscellaneous
40-68	Retirement Expense	184,729	192,118	199,803	207,795	216,107	224,751	233,741	243,091	252,814	262,927	As Benefits - Other
	Total Other Expenses	**$195,729**	**$203,393**	**$211,360**	**$219,641**	**$228,249**	**$237,197**	**$246,498**	**$256,166**	**$266,217**	**$276,664**	
	Total Operations and Maintenance	**$4,874,311**	**$5,032,055**	**$5,192,345**	**$5,450,930**	**$5,651,904**	**$5,835,383**	**$6,128,017**	**$6,354,495**	**$6,560,792**	**$6,773,906**	
	Utility Billing											
10-97	Employee Services Summary	$519,433	$535,016	$551,066	$589,641	$613,227	$631,624	$675,837	$702,871	$723,957	$745,676	As Labor
20-97	Other Services Summary	458,587	472,345	486,515	520,571	541,394	557,636	596,670	620,537	639,153	658,328	As Labor
30-97	Materials & Supplies Summary	31,199	32,135	33,099	34,092	35,115	36,168	37,253	38,371	39,522	40,708	As Materials & Supplies
40-97	Other Expenses Summary	2,610	2,675	2,742	2,811	2,881	2,953	3,027	3,102	3,180	3,260	As Miscellaneous
	Total Utility Billing	**$1,011,829**	**$1,042,171**	**$1,073,423**	**$1,147,115**	**$1,192,616**	**$1,228,380**	**$1,312,787**	**$1,364,881**	**$1,405,812**	**$1,447,970**	
	Total Utility Billing	**$1,011,829**	**$1,042,171**	**$1,073,423**	**$1,147,115**	**$1,192,616**	**$1,228,380**	**$1,312,787**	**$1,364,881**	**$1,405,812**	**$1,447,970**	
	Other Support Services											
	Employee Services											
10-10	Salaries - Regular	$366,128	$377,112	$388,425	$415,615	$432,240	$445,207	$476,371	$495,426	$510,289	$525,598	As Labor
10-13	Regular Overtime	2,000	2,060	2,122	2,270	2,361	2,432	2,602	2,706	2,787	2,871	As Labor
10-20	Employee Separation Pay	3,146	3,272	3,403	3,539	3,680	3,828	3,981	4,140	4,306	4,478	As Benefits - Other
10-21	Additional Pay	393	405	417	446	464	478	511	532	548	564	As Labor
10-25	Retirement	107,153	111,439	115,897	120,533	125,354	130,368	135,583	141,006	146,646	152,512	As Benefits - Other
10-26	Deferred Compensation	4,020	4,141	4,265	4,563	4,746	4,888	5,230	5,440	5,603	5,771	As Labor
10-27	Medicare	5,225	5,382	5,543	5,931	6,168	6,354	6,798	7,070	7,282	7,501	As Labor
10-29	Health/Dental/Vision	42,888	43,746	44,621	45,959	47,338	48,758	50,221	51,728	53,279	54,878	As Benefits - Medical
10-31	L/T Disability Insurance	2,307	2,376	2,447	2,521	2,597	2,674	2,755	2,837	2,922	3,010	As Insurance
10-32	Life Insurance	353	364	374	386	397	409	422	434	447	461	As Insurance
10-33	Workers Compensation	9,649	9,842	10,039	10,340	10,650	10,970	11,299	11,638	11,987	12,346	As Benefits - Medical
10-34	Unemployment Insurance	226	233	240	247	254	262	270	278	286	295	As Insurance
10-45	Cell Phone Allowance	2,208	2,296	2,388	2,484	2,583	2,686	2,794	2,906	3,022	3,143	As Benefits - Other
10-46	Retirement Pension Bond	16,197	16,683	17,183	18,386	19,122	19,695	21,074	21,917	22,574	23,252	As Labor
	Total Employee Services	**$561,893**	**$579,349**	**$597,364**	**$633,220**	**$657,954**	**$679,009**	**$719,911**	**$748,057**	**$771,980**	**$796,679**	

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Acct. #		*Proposed* FY 2021	*Projected* FY 2022	FY 2023	FY 2024	FY 2025	FY 2026	FY 2027	FY 2028	FY 2029	FY 2030	*Notes*
	Other Services											
20-22	Contractual Employees	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	As Labor
20-37	Insurance Premiums	24,320	25,050	25,801	26,575	27,372	28,194	29,039	29,911	30,808	31,732	As Insurance
20-65	Prof & Special Services	38,691	39,852	41,047	42,279	43,547	44,853	46,199	47,585	49,013	50,483	As Professional / Special Srvcs
	Total Other Services	**$63,011**	**$64,901**	**$66,848**	**$68,854**	**$70,919**	**$73,047**	**$75,238**	**$77,496**	**$79,820**	**$82,215**	
	Materials and Supplies											
30-50	Materials and Supplies	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	As Materials & Supplies
	Total Materials and Supplies	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	
	Other Expenses											
40-10	Training	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	As Labor
40-12	Meetings & Travel	0	0	0	0	0	0	0	0	0	0	As Materials & Supplies
40-14	Memberships	0	0	0	0	0	0	0	0	0	0	As Materials & Supplies
	Total Other Expenses	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	
	Total Other Support Services	**$624,904**	**$644,251**	**$664,213**	**$702,074**	**$728,874**	**$752,056**	**$795,149**	**$825,553**	**$851,800**	**$878,894**	
	Water Conservation											
	Employee Services											
10-10	Salaries - Regular	$44,544	$45,880	$47,257	$50,565	$52,587	$54,165	$57,956	$60,275	$62,083	$63,945	As Labor
10-20	Employee Separation Pay	73	76	79	82	85	89	92	96	100	104	As Benefits - Other
10-25	Retirement	13,020	13,541	14,082	14,646	15,232	15,841	16,474	17,133	17,819	18,532	As Benefits - Other
10-27	Medicare	643	662	682	730	759	782	837	870	896	923	As Labor
10-29	Health/Dental/Vision	5,688	5,802	5,918	6,095	6,278	6,467	6,661	6,860	7,066	7,278	As Benefits - Medical
10-31	L/T Disability Insurance	281	289	298	307	316	326	336	346	356	367	As Insurance
10-32	Life Insurance	49	50	52	54	55	57	59	60	62	64	As Insurance
10-33	Workers Compensation	896	932	969	1,008	1,048	1,090	1,134	1,179	1,226	1,275	As Benefits - Other
10-34	Unemployment Insurance	30	31	32	33	34	35	36	37	38	39	As Insurance
10-45	Cell Phone Allowance	270	281	292	304	316	328	342	355	370	384	As Benefits - Other
10-46	Retirement Pension Bond	320	330	339	363	378	389	416	433	446	459	As Labor
	Total Employee Services	**$65,814**	**$67,874**	**$70,001**	**$74,186**	**$77,089**	**$79,568**	**$84,342**	**$87,645**	**$90,462**	**$93,371**	
	Other Services											
20-15	Telephone	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	As Utilities
20-37	Insurance Premiums	2,940	3,028	3,119	3,213	3,309	3,408	3,511	3,616	3,724	3,836	As Insurance
20-51	Community/Program	41,000	42,230	43,497	44,802	46,146	47,530	48,956	50,425	51,938	53,496	As Materials & Supplies
20-65	Prof & Special Services	50,000	0	0	0	0	0	0	0	0	0	As Professional / Special Srvcs
	Total Other Services	**$93,940**	**$45,258**	**$46,616**	**$48,014**	**$49,455**	**$50,939**	**$52,467**	**$54,041**	**$55,662**	**$57,332**	

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Acct. #		*Proposed* FY 2021	*Projected* FY 2022	FY 2023	FY 2024	FY 2025	FY 2026	FY 2027	FY 2028	FY 2029	FY 2030	*Notes*
	Materials and Supplies											
30-50	Materials & Supplies	$1,800	$1,854	$1,910	$1,967	$2,026	$2,087	$2,149	$2,214	$2,280	$2,349	As Materials & Supplies
	Total Materials and Supplies	**$1,800**	**$1,854**	**$1,910**	**$1,967**	**$2,026**	**$2,087**	**$2,149**	**$2,214**	**$2,280**	**$2,349**	
	Other Expenses											
40-10	Training	$1,100	$1,128	$1,156	$1,185	$1,214	$1,245	$1,276	$1,308	$1,340	$1,374	As Miscellaneous
40-68	Retirement Expense	1,606	1,654	1,704	1,755	1,808	1,862	1,918	1,975	2,034	2,095	As Materials & Supplies
	Total Other Expenses	**$2,706**	**$2,782**	**$2,859**	**$2,939**	**$3,022**	**$3,106**	**$3,193**	**$3,283**	**$3,375**	**$3,469**	
	Total Water Conservation	**$164,260**	**$117,768**	**$121,386**	**$127,107**	**$131,591**	**$135,700**	**$142,151**	**$147,182**	**$151,778**	**$156,520**	
	Water Purchase											
	Materials and Supplies											
30-56	Merchandise For Resale	$14,210,550	$15,134,236	$16,117,961	$17,165,629	$18,281,394	$19,469,685	$20,735,215	$22,083,004	$23,518,399	$25,047,095	As Purchased Water
	Total Materials and Supplies	**$14,210,550**	**$15,134,236**	**$16,117,961**	**$17,165,629**	**$18,281,394**	**$19,469,685**	**$20,735,215**	**$22,083,004**	**$23,518,399**	**$25,047,095**	
	Other Expenses											
40-22	Groundwater Pumping Tax	$1,800,000	$1,917,000	$2,041,605	$2,174,309	$2,315,639	$2,466,156	$2,626,456	$2,797,176	$2,978,992	$3,172,627	As Purchased Water
	Total Other Expenses	**$1,800,000**	**$1,917,000**	**$2,041,605**	**$2,174,309**	**$2,315,639**	**$2,466,156**	**$2,626,456**	**$2,797,176**	**$2,978,992**	**$3,172,627**	
	Total Water Purchase	**$16,010,550**	**$17,051,236**	**$18,159,566**	**$19,339,938**	**$20,597,034**	**$21,935,841**	**$23,361,671**	**$24,880,179**	**$26,497,391**	**$28,219,721**	
	Hydrant Maintenance											
	Employee Services											
10-10	Salaries - Regular	$100,339	$103,349	$106,450	$113,901	$118,457	$122,011	$130,552	$135,774	$139,847	$144,042	As Labor
10-13	Regular Overtime	5,000	5,150	5,305	5,676	5,903	6,080	6,506	6,766	6,969	7,178	As Labor
10-20	Separation Pay	856	890	926	963	1,001	1,041	1,083	1,126	1,171	1,218	As Benefits - Other
10-25	Retirement	29,455	30,633	31,859	33,133	34,458	35,837	37,270	38,761	40,311	41,924	As Benefits - Other
10-26	Deferred Compensation	5,519	5,685	5,855	6,265	6,516	6,711	7,181	7,468	7,692	7,923	As Labor
10-27	Medicare	1,407	1,449	1,493	1,597	1,661	1,711	1,831	1,904	1,961	2,020	As Labor
10-29	Health/Dental/Vision	22,752	23,207	23,671	24,381	25,113	25,866	26,642	27,441	28,265	29,113	As Benefits - Medical
10-31	L-T Disability Insurance	632	651	670	691	711	733	755	777	801	825	As Insurance
10-32	Life Insurance	198	204	210	216	223	230	236	244	251	258	As Insurance
10-33	Workers' Compensation	9,733	10,122	10,527	10,948	11,386	11,842	12,315	12,808	13,320	13,853	As Benefits - Other
10-34	Unemployment Insurance	120	124	127	131	135	139	143	148	152	157	As Insurance
10-46	Retirement Pension Bond	3,777	3,890	4,007	4,288	4,459	4,593	4,914	5,111	5,264	5,422	As Labor
	Total Employee Services	**$179,788**	**$185,355**	**$191,100**	**$202,190**	**$210,023**	**$216,793**	**$229,428**	**$238,327**	**$246,004**	**$253,932**	

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Revenue Requirement

Acct. #		*Proposed* FY 2021	*Projected* FY 2022	FY 2023	FY 2024	FY 2025	FY 2026	FY 2027	FY 2028	FY 2029	FY 2030	*Notes*
	Other Services											
20-11	Electricity	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	As Utilities
20-15	Telephone	200	208	216	225	234	243	253	263	274	285	As Utilities
20-25	Maint. & Repair Services	80,000	82,400	84,872	87,418	90,041	92,742	95,524	98,390	101,342	104,382	As Materials & Supplies
20-27	Uniform/Laundry Services	500	515	530	546	563	580	597	615	633	652	As Professional / Special Srvcs
20-37	Insurance Premiums	6,622	6,821	7,025	7,236	7,453	7,677	7,907	8,144	8,389	8,640	As Insurance
20-44	Radio Equipment Rental	508	762	789	816	845	874	905	937	969	1,003	As Radio Equipment
20-57	Processing Fees	2,000	2,060	2,122	2,185	2,251	2,319	2,388	2,460	2,534	2,610	As Professional / Special Srvcs
20-66	Other Services	1,500	1,545	1,591	1,639	1,688	1,739	1,791	1,845	1,900	1,957	As Professional / Special Srvcs
	Total Other Services	**$91,330**	**$94,311**	**$97,146**	**$100,066**	**$103,075**	**$106,173**	**$109,365**	**$112,654**	**$116,040**	**$119,529**	
	Materials and Supplies											
30-50	Materials & Supplies	$50,000	$51,500	$53,045	$54,636	$56,275	$57,964	$59,703	$61,494	$63,339	$65,239	As Materials & Supplies
30-53	Fuels - Gas/Oil/Propane	1,454	1,498	1,543	1,589	1,636	1,686	1,736	1,788	1,842	1,897	As Materials & Supplies
	Total Materials and Supplies	**$51,454**	**$52,998**	**$54,588**	**$56,225**	**$57,912**	**$59,649**	**$61,439**	**$63,282**	**$65,180**	**$67,136**	
	Other Expenses											
40-12	Meetings/Travel	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	As Miscellaneous
40-14	Memberships	0	0	0	0	0	0	0	0	0	0	As Miscellaneous
40-60	Miscellaneous Refunds	0	0	0	0	0	0	0	0	0	0	As Miscellaneous
	Total Other Expenses	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	
	Total Hydrant Maintenance	**$322,572**	**$332,663**	**$342,833**	**$358,482**	**$371,010**	**$382,615**	**$400,232**	**$414,263**	**$427,225**	**$440,597**	
	Delta Water Production											
	Employee Services											
10-10	Salaries - Regular	$904,253	$931,381	$959,322	$1,026,475	$1,067,534	$1,099,560	$1,176,529	$1,223,590	$1,260,298	$1,298,106	As Labor
10-13	Regular Overtime	120,000	123,600	127,308	136,220	141,668	145,918	156,133	162,378	167,249	172,267	As Labor
10-17	Stand By Time (Call Back)	12,000	12,360	12,731	13,622	14,167	14,592	15,613	16,238	16,725	17,227	As Labor
10-18	Holiday Pay	25,000	26,000	27,040	28,122	29,246	30,416	31,633	32,898	34,214	35,583	As Benefits - Other
10-20	Separation Pay	7,625	7,930	8,247	8,577	8,920	9,277	9,648	10,034	10,435	10,853	As Benefits - Other
10-21	Additional Pay	1,218	1,255	1,292	1,383	1,438	1,481	1,585	1,648	1,698	1,749	As Labor
10-25	Retirement	271,957	282,835	294,149	305,915	318,151	330,877	344,112	357,877	372,192	387,080	As Benefits - Other
10-26	Deferred Compensation	41,233	42,470	43,744	46,806	48,678	50,139	53,648	55,794	57,468	59,192	As Labor
10-27	Medicare	14,889	15,336	15,796	16,901	17,577	18,105	19,372	20,147	20,751	21,374	As Labor
10-29	Health/Dental/Vision	118,879	121,257	123,682	127,392	131,214	135,150	139,205	143,381	147,682	152,113	As Benefits - Medical
10-31	L-T Disability Insurance	5,696	5,867	6,043	6,224	6,411	6,603	6,801	7,005	7,216	7,432	As Insurance
10-32	Life Insurance	1,029	1,060	1,092	1,124	1,158	1,193	1,229	1,266	1,304	1,343	As Insurance
10-33	Workers' Compensation	91,997	95,677	99,504	103,484	107,623	111,928	116,406	121,062	125,904	130,940	As Benefits - Other
10-34	Unemployment Insurance	627	646	665	685	706	727	749	771	794	818	As Insurance
10-45	Cell Phone Allowance	1,200	1,248	1,298	1,350	1,404	1,460	1,518	1,579	1,642	1,708	As Benefits - Other
10-46	Retirement Pension Bond	34,381	35,412	36,475	39,028	40,589	41,807	44,733	46,523	47,918	49,356	As Labor
	Total Employee Services	**$1,651,984**	**$1,704,333**	**$1,758,387**	**$1,863,308**	**$1,936,486**	**$1,999,234**	**$2,118,914**	**$2,202,191**	**$2,273,491**	**$2,347,140**	

City of Stockton MUD
Water Master Plan
Exhibit 3
Revenue Requirement

Acct. #		Proposed FY 2021	Projected FY 2022	FY 2023	FY 2024	FY 2025	FY 2026	FY 2027	FY 2028	FY 2029	FY 2030	Notes
	Other Services											
20-11	Electricity	$1,750,000	$1,820,000	$1,892,800	$1,968,512	$2,047,252	$2,129,143	$2,214,308	$2,302,881	$2,394,996	$2,490,796	As Utilities
20-15	Telephone	19,000	19,760	20,550	21,372	22,227	23,116	24,041	25,003	26,003	27,043	As Utilities
20-25	Maint. & Repair Services	3,800	3,914	4,031	4,152	4,277	4,405	4,537	4,674	4,814	4,958	As Materials & Supplies
20-27	Uniform/Laundry Services	9,100	9,373	9,654	9,944	10,242	10,549	10,866	11,192	11,528	11,873	As Professional / Special Srvcs
20-37	Insurance Premiums	70,180	72,285	74,454	76,688	78,988	81,358	83,799	86,313	88,902	91,569	As Materials & Supplies
20-41	Automotive Equip Rental	49,097	51,061	53,103	55,227	57,437	59,734	62,123	64,608	67,193	69,880	As Equipment
20-43	Computer/Tech/Oper Supprt	32,382	33,677	35,024	36,425	37,882	39,398	40,974	42,613	44,317	46,090	As Equipment
20-44	Radio Equipment Rental	20,498	30,747	31,823	32,937	34,090	35,283	36,518	37,796	39,119	40,488	As Radio Equipment
20-45	Other Rentals	10,000	10,400	10,816	11,249	11,699	12,167	12,653	13,159	13,686	14,233	As Equipment
20-47	Telephone Rental	4,545	4,727	4,916	5,113	5,317	5,530	5,751	5,981	6,220	6,469	As Equipment
20-57	Processing Fees	100,000	103,000	106,090	109,273	112,551	115,927	119,405	122,987	126,677	130,477	As Professional / Special Srvcs
20-63	Testing & Analysis Servcs	2,000	2,050	2,101	2,154	2,208	2,263	2,319	2,377	2,437	2,498	As Miscellaneous
20-64	Training Services	7,500	7,725	7,957	8,195	8,441	8,695	8,955	9,224	9,501	9,786	As Professional / Special Srvcs
20-65	Prof & Special Services	40,000	41,200	42,436	43,709	45,020	46,371	47,762	49,195	50,671	52,191	As Professional / Special Srvcs
20-66	Other Services	222,230	228,897	235,764	242,837	250,122	257,625	265,354	273,315	281,514	289,960	As Professional / Special Srvcs
	Total Other Services	**$2,340,332**	**$2,438,816**	**$2,531,520**	**$2,627,787**	**$2,727,753**	**$2,831,563**	**$2,939,366**	**$3,051,317**	**$3,167,576**	**$3,288,311**	
	Materials and Supplies											
30-50	Materials And Supplies	$105,000	$108,150	$111,395	$114,736	$118,178	$121,724	$125,375	$129,137	$133,011	$137,001	As Materials & Supplies
30-53	Fuels-Gas/Oil/Propane	21,480	22,124	22,788	23,472	24,176	24,901	25,648	26,418	27,210	28,027	As Materials & Supplies
30-54	Chemicals	565,300	582,259	599,727	617,719	636,250	655,338	674,998	695,248	716,105	737,588	As Materials & Supplies
	Total Materials and Supplies	**$691,780**	**$712,533**	**$733,909**	**$755,927**	**$778,604**	**$801,963**	**$826,021**	**$850,802**	**$876,326**	**$902,616**	
	Other Expenses											
40-10	Training	$5,000	$5,125	$5,253	$5,384	$5,519	$5,657	$5,798	$5,943	$6,092	$6,244	As Miscellaneous
40-12	Meetings & Travel	1,500	1,538	1,576	1,615	1,656	1,697	1,740	1,783	1,828	1,873	As Miscellaneous
40-22	Taxes	110,000	112,750	115,569	118,458	121,419	124,455	127,566	130,755	134,024	137,375	As Miscellaneous
	Total Other Expenses	**$116,500**	**$119,413**	**$122,398**	**$125,458**	**$128,594**	**$131,809**	**$135,104**	**$138,482**	**$141,944**	**$145,493**	
	Total Delta Water Production	**$4,800,596**	**$4,975,095**	**$5,146,215**	**$5,372,479**	**$5,571,438**	**$5,764,569**	**$6,019,406**	**$6,242,792**	**$6,459,337**	**$6,683,559**	
	Well Production											
	Employee Services											
10-10	Salaries - Regular	$338,600	$348,758	$359,221	$384,366	$399,741	$411,733	$440,554	$458,177	$471,922	$486,080	As Labor
10-13	Regular Overtime	5,300	5,459	5,623	6,016	6,257	6,445	6,896	7,172	7,387	7,608	As Labor
10-17	Stand By Time (Call Back)	21,000	21,630	22,279	23,838	24,792	25,536	27,323	28,416	29,269	30,147	As Labor
10-18	Holiday Pay	3,200	3,296	3,395	3,633	3,778	3,891	4,164	4,330	4,460	4,594	As Labor
10-20	Separation Pay	2,161	2,226	2,293	2,453	2,551	2,628	2,812	2,924	3,012	3,102	As Labor
10-21	Additional Pay	10,302	10,611	10,929	11,694	12,162	12,527	13,404	13,940	14,358	14,789	As Labor
10-25	Retirement	101,702	105,770	110,001	114,401	118,977	123,736	128,685	133,833	139,186	144,754	As Benefits - Other
10-26	Deferred Compensation	18,623	19,182	19,757	21,140	21,986	22,645	24,230	25,200	25,956	26,734	As Labor
10-27	Medicare	5,408	5,570	5,737	6,139	6,385	6,576	7,036	7,318	7,537	7,763	As Labor
10-29	Health/Dental/Vision	56,425	57,554	58,705	60,466	62,280	64,148	66,073	68,055	70,096	72,199	As Benefits - Medical
10-31	L-T Disability Insurance	2,133	2,176	2,219	2,286	2,354	2,425	2,498	2,573	2,650	2,729	As Benefits - Medical
10-32	Life Insurance	492	507	522	538	554	570	587	605	623	642	As Insurance
10-33	Workers' Compensation	36,762	38,232	39,762	41,352	43,006	44,727	46,516	48,376	50,311	52,324	As Benefits - Other
10-34	Unemployment Insurance	298	307	316	326	335	345	356	367	377	389	As Insurance
10-45	Cell Phone Allowance	576	599	623	648	674	701	729	758	788	820	As Benefits - Other
10-46	Retirement Pension Bond	11,630	11,979	12,338	13,202	13,730	14,142	15,132	15,737	16,209	16,696	As Labor
	Total Employee Services	**$614,612**	**$633,855**	**$653,720**	**$692,498**	**$719,562**	**$742,775**	**$786,995**	**$817,780**	**$844,143**	**$871,370**	

City of Stockton MUD
Water Master Plan
Exhibit 3
Revenue Requirement

Acct. #		*Proposed* FY 2021	*Projected* FY 2022	FY 2023	FY 2024	FY 2025	FY 2026	FY 2027	FY 2028	FY 2029	FY 2030	*Notes*
	Other Services											
20-11	Electricity	$800,000	$832,000	$865,280	$899,891	$935,887	$973,322	$1,012,255	$1,052,745	$1,094,855	$1,138,649	As Utilities
20-15	Telephone	5,500	5,720	5,949	6,187	6,434	6,692	6,959	7,238	7,527	7,828	As Utilities
20-17	Storm Water	3,000	3,120	3,245	3,375	3,510	3,650	3,796	3,948	4,106	4,270	As Utilities
20-25	Maint. & Repair Services	4,500	4,635	4,774	4,917	5,065	5,217	5,373	5,534	5,700	5,871	As Materials & Supplies
20-37	Insurance Premiums	24,994	25,744	26,516	27,312	28,131	28,975	29,844	30,739	31,662	32,612	As Insurance
20-41	Automotive Equip Rental	14,458	15,036	15,638	16,263	16,914	17,590	18,294	19,026	19,787	20,578	As Equipment
20-43	Computer/Tech/Oper Supprt	22,324	23,217	24,146	25,111	26,116	27,161	28,247	29,377	30,552	31,774	As Equipment
20-44	Radio Equipment Rental	508	762	789	816	845	874	905	937	969	1,003	As Radio Equipment
20-47	Telephone Rental	908	944	982	1,021	1,062	1,105	1,149	1,195	1,243	1,292	As Equipment
20-57	Processing Fees	500	515	530	546	563	580	597	615	633	652	As Professional / Special Srvcs
20-65	Prof & Special Services	15,000	15,450	15,914	16,391	16,883	17,389	17,911	18,448	19,002	19,572	As Professional / Special Srvcs
20-66	Other Services	27,000	27,810	28,644	29,504	30,389	31,300	32,239	33,207	34,203	35,229	As Professional / Special Srvcs
	Total Other Services	**$918,692**	**$954,953**	**$992,406**	**$1,031,335**	**$1,071,797**	**$1,113,855**	**$1,157,570**	**$1,203,009**	**$1,250,239**	**$1,299,331**	
	Materials and Supplies											
30-50	Materials And Supplies	$50,000	$51,500	$53,045	$54,636	$56,275	$57,964	$59,703	$61,494	$63,339	$65,239	As Materials & Supplies
30-53	Fuels-Gas/Oil/Propane	9,208	9,484	9,769	10,062	10,364	10,675	10,995	11,325	11,664	12,014	As Materials & Supplies
30-54	Chemicals	60,000	61,800	63,654	65,564	67,531	69,556	71,643	73,792	76,006	78,286	As Materials & Supplies
	Total Materials and Supplies	**$119,208**	**$122,784**	**$126,468**	**$130,262**	**$134,170**	**$138,195**	**$142,341**	**$146,611**	**$151,009**	**$155,539**	
	Other Expenses											
40-10	Training	$1,000	$1,025	$1,051	$1,077	$1,104	$1,131	$1,160	$1,189	$1,218	$1,249	As Miscellaneous
	Total Other Expenses	**$1,000**	**$1,025**	**$1,051**	**$1,077**	**$1,104**	**$1,131**	**$1,160**	**$1,189**	**$1,218**	**$1,249**	
	Total Well Production	**$1,653,512**	**$1,712,618**	**$1,773,644**	**$1,855,171**	**$1,926,632**	**$1,995,956**	**$2,088,065**	**$2,168,588**	**$2,246,609**	**$2,327,489**	
	DWSP Maintenance & Repair											
	Employee Services											
10-10	Salaries - Regular	$425,489	$438,254	$451,401	$482,999	$502,319	$517,389	$553,606	$575,750	$593,023	$610,814	As Labor
10-13	Regular Overtime	10,000	10,300	10,609	11,352	11,806	12,160	13,011	13,531	13,937	14,356	As Labor
10-17	Stand By Time (Call Back)	17,500	18,025	18,566	19,865	20,660	21,280	22,769	23,680	24,391	25,122	As Labor
10-18	Holiday Pay	500	515	530	568	590	608	651	677	697	718	As Labor
10-20	Separation Pay	3,803	3,917	4,035	4,317	4,490	4,624	4,948	5,146	5,300	5,459	As Labor
10-21	Additional Pay	4,626	4,765	4,908	5,251	5,461	5,625	6,019	6,260	6,447	6,641	As Labor
10-25	Retirement	125,160	130,166	135,373	140,788	146,419	152,276	158,367	164,702	171,290	178,142	As Benefits - Other
10-26	Deferred Compensation	23,066	23,758	24,471	26,184	27,231	28,048	30,011	31,212	32,148	33,113	As Labor
10-27	Medicare	6,494	6,689	6,889	7,372	7,667	7,897	8,449	8,787	9,051	9,323	As Labor
10-29	Health/Dental/Vision	60,748	61,963	63,202	65,098	67,051	69,063	71,135	73,269	75,467	77,731	As Benefits - Medical
10-31	L-T Disability Insurance	2,680	2,787	2,899	3,015	3,135	3,261	3,391	3,527	3,668	3,814	As Benefits - Other
10-32	Life Insurance	528	544	560	577	594	612	630	649	669	689	As Insurance
10-33	Workers' Compensation	44,273	46,044	47,886	49,801	51,793	53,865	56,019	58,260	60,591	63,014	As Benefits - Other
10-34	Unemployment Insurance	320	330	339	350	360	371	382	394	405	418	As Insurance
10-45	Cell Phone Allowance	3,144	3,270	3,401	3,537	3,678	3,825	3,978	4,137	4,303	4,475	As Benefits - Other
10-46	Retirement Pension Bond	14,805	15,249	15,707	16,806	17,478	18,003	19,263	20,033	20,634	21,253	As Labor
	Total Employee Services	**$743,136**	**$766,575**	**$790,775**	**$837,879**	**$870,734**	**$898,906**	**$952,631**	**$990,015**	**$1,022,021**	**$1,055,081**	

City of Stockton MUD
Water Master Plan
Exhibit 3
Revenue Requirement

Acct. #		*Proposed* FY 2021	*Projected* FY 2022	FY 2023	FY 2024	FY 2025	FY 2026	FY 2027	FY 2028	FY 2029	FY 2030	*Notes*
	Other Services											
20-15	Telephone	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	As Utilities
20-25	Maint. & Repair Services	100,000	103,000	106,090	109,273	112,551	115,927	119,405	122,987	126,677	130,477	As Materials & Supplies
20-27	Uniform/Laundry Services	2,400	2,472	2,546	2,623	2,701	2,782	2,866	2,952	3,040	3,131	As Professional / Special Srvcs
20-37	Insurance Premiums	30,206	31,112	32,046	33,007	33,997	35,017	36,068	37,150	38,264	39,412	As Insurance
20-41	Automotive Equip Rental	36,761	38,231	39,761	41,351	43,005	44,725	46,514	48,375	50,310	52,322	As Equipment
20-43	Computer/Tech/Oper Supprt	31,974	33,253	34,583	35,966	37,405	38,901	40,457	42,076	43,759	45,509	As Equipment
20-44	Radio Equipment Rental	508	762	789	816	845	874	905	937	969	1,003	As Radio Equipment
20-47	Telephone Rental	1,363	1,418	1,474	1,533	1,595	1,658	1,725	1,794	1,865	1,940	As Equipment
20-52	Publicity & Advertising	1,200	1,230	1,261	1,292	1,325	1,358	1,392	1,426	1,462	1,499	As Miscellaneous
20-61	Engineering Services	5,000	5,150	5,305	5,464	5,628	5,796	5,970	6,149	6,334	6,524	As Professional / Special Srvcs
20-63	Testing & Analysis Servcs	500	513	525	538	552	566	580	594	609	624	As Miscellaneous
20-65	Prof & Special Services	5,000	5,150	5,305	5,464	5,628	5,796	5,970	6,149	6,334	6,524	As Professional / Special Srvcs
20-66	Other Services	0	0	0	0	0	0	0	0	0	0	As Professional / Special Srvcs
	Total Other Services	**$214,912**	**$222,291**	**$229,683**	**$237,327**	**$245,230**	**$253,402**	**$261,852**	**$270,589**	**$279,624**	**$288,966**	
	Materials and Supplies											
30-50	Materials And Supplies	$201,000	$207,030	$213,241	$219,638	$226,227	$233,014	$240,005	$247,205	$254,621	$262,259	As Materials & Supplies
30-53	Fuels-Gas/Oil/Propane	3,307	3,406	3,508	3,614	3,722	3,834	3,949	4,067	4,189	4,315	As Materials & Supplies
	Total Materials and Supplies	**$204,307**	**$210,436**	**$216,749**	**$223,252**	**$229,949**	**$236,848**	**$243,953**	**$251,272**	**$258,810**	**$266,574**	
	Other Expenses											
40-10	Training	$6,000	$6,150	$6,304	$6,461	$6,623	$6,788	$6,958	$7,132	$7,310	$7,493	As Miscellaneous
	Total Other Expenses	**$6,000**	**$6,150**	**$6,304**	**$6,461**	**$6,623**	**$6,788**	**$6,958**	**$7,132**	**$7,310**	**$7,493**	
	Total DWSP Maintenance & Repair	**$1,168,355**	**$1,205,452**	**$1,243,512**	**$1,304,919**	**$1,352,536**	**$1,395,945**	**$1,465,394**	**$1,519,008**	**$1,567,766**	**$1,618,114**	
	MUD Admin / Finance											
	Employee Services											
10-10	Salaries - Regular	$381,672	$393,122	$404,916	$433,260	$450,590	$464,108	$496,596	$516,459	$531,953	$547,912	As Labor
10-13	Regular Overtime	2,100	2,163	2,228	2,384	2,479	2,554	2,732	2,842	2,927	3,015	As Labor
10-20	Separation Pay	3,231	3,328	3,428	3,668	3,814	3,929	4,204	4,372	4,503	4,638	As Labor
10-21	Additional Pay	644	663	683	731	760	783	838	871	898	924	As Labor
10-25	Retirement	111,751	116,221	120,870	125,705	130,733	135,962	141,401	147,057	152,939	159,057	As Benefits - Other
10-27	Medicare	5,090	5,243	5,400	5,778	6,009	6,189	6,623	6,888	7,094	7,307	As Labor
10-29	Health/Dental/Vision	46,642	47,575	48,526	49,982	51,482	53,026	54,617	56,255	57,943	59,681	As Benefits - Medical
10-31	L-T Disability Insurance	2,405	2,501	2,601	2,705	2,814	2,926	3,043	3,165	3,291	3,423	As Benefits - Other
10-32	Life Insurance	381	392	404	416	429	442	455	469	483	497	As Insurance
10-33	Workers' Compensation	7,719	8,028	8,349	8,683	9,030	9,391	9,767	10,158	10,564	10,987	As Benefits - Other
10-34	Unemployment Insurance	246	253	261	269	277	285	294	303	312	321	As Insurance
10-45	Cell Phone Allowance	1,560	1,622	1,687	1,755	1,825	1,898	1,974	2,053	2,135	2,220	As Benefits - Other
10-46	Retirement Pension Bond	14,344	14,774	15,218	16,283	16,934	17,442	18,663	19,410	19,992	20,592	As Labor
	Total Employee Services	**$577,785**	**$595,886**	**$614,571**	**$651,618**	**$677,176**	**$698,935**	**$741,206**	**$770,300**	**$795,033**	**$820,574**	

Acct. #		Proposed FY 2021	Projected FY 2022	FY 2023	FY 2024	FY 2025	FY 2026	FY 2027	FY 2028	FY 2029	FY 2030	Notes
	Other Services											
20-14	Water	$158	$164	$171	$178	$185	$192	$200	$208	$216	$225	As Utilities
20-15	Telephone	0	0	0	0	0	0	0	0	0	0	As Utilities
20-17	Stormwater	480	499	519	540	562	584	607	632	657	683	As Utilities
20-25	Maint. & Repair Services	3,300	3,399	3,501	3,606	3,714	3,826	3,940	4,059	4,180	4,306	As Materials & Supplies
20-27	Uniform/Laundry Services	780	803	828	852	878	904	931	959	988	1,018	As Professional / Special Srvcs
20-34	Duplication/Copy Costs	900	927	955	983	1,013	1,043	1,075	1,107	1,140	1,174	As Materials & Supplies
20-37	Insurance Premiums	25,431	26,194	26,980	27,789	28,623	29,481	30,366	31,277	32,215	33,182	As Materials & Supplies
20-41	Automotive Equip Rental	9,718	10,107	10,511	10,931	11,369	11,823	12,296	12,788	13,300	13,832	As Equipment
20-44	Radio Equipment Rental	724	1,086	1,124	1,163	1,204	1,246	1,290	1,335	1,382	1,430	As Radio Equipment
20-47	Telephone Rental	3,136	3,261	3,392	3,528	3,669	3,815	3,968	4,127	4,292	4,464	As Equipment
20-52	Publicity & Advertising	450	461	473	485	497	509	522	535	548	562	As Miscellaneous
20-54	Postage/Mailing Services	330	340	350	361	371	383	394	406	418	431	As Professional / Special Srvcs
20-57	Processing Fees	150	155	159	164	169	174	179	184	190	196	As Professional / Special Srvcs
20-58	Legal Services	3,000	3,090	3,183	3,278	3,377	3,478	3,582	3,690	3,800	3,914	As Professional / Special Srvcs
20-63	Testing & Analysis Servcs	60	62	63	65	66	68	70	71	73	75	As Miscellaneous
20-64	Training Services	3,000	3,090	3,183	3,278	3,377	3,478	3,582	3,690	3,800	3,914	As Professional / Special Srvcs
20-65	Prof & Special Services	15,000	15,450	15,914	16,391	16,883	17,389	17,911	18,448	19,002	19,572	As Professional / Special Srvcs
20-66	Other Services	26,400	27,192	28,008	28,848	29,713	30,605	31,523	32,469	33,443	34,446	As Professional / Special Srvcs
	Total Other Services	**$93,017**	**$96,280**	**$99,312**	**$102,440**	**$105,668**	**$108,999**	**$112,437**	**$115,984**	**$119,645**	**$123,422**	
	Materials and Supplies											
30-50	Materials And Supplies	$54,900	$56,547	$58,243	$59,991	$61,790	$63,644	$65,553	$67,520	$69,546	$71,632	As Materials & Supplies
30-51	Computer Software	150	156	162	169	175	182	190	197	205	213	As Equipment
30-53	Fuels-Gas/Oil/Propane	353	364	374	386	397	409	422	434	447	461	As Materials & Supplies
	Total Materials and Supplies	**$55,403**	**$57,067**	**$58,780**	**$60,545**	**$62,363**	**$64,236**	**$66,165**	**$68,152**	**$70,198**	**$72,306**	
	Other Expenses											
40-10	Training	$3,000	$3,075	$3,152	$3,231	$3,311	$3,394	$3,479	$3,566	$3,655	$3,747	As Miscellaneous
40-12	Meetings & Travel	150	154	158	162	166	170	174	178	183	187	As Miscellaneous
40-14	Memberships	158	163	168	173	178	183	189	194	200	206	As Materials & Supplies
	Total Other Expenses	**$3,308**	**$3,391**	**$3,477**	**$3,565**	**$3,655**	**$3,747**	**$3,842**	**$3,939**	**$4,038**	**$4,140**	
	Total MUD Admin / Finance	**$729,513**	**$752,625**	**$776,140**	**$818,168**	**$848,862**	**$875,918**	**$923,649**	**$958,374**	**$988,914**	**$1,020,442**	
	Engineering Services											
	Employee Services											
10-10	Salaries - Regular	$123,841	$127,556	$131,383	$140,580	$146,203	$150,589	$161,130	$167,575	$172,603	$177,781	As Labor
10-13	Regular Overtime	300	309	318	341	354	365	390	406	418	431	As Labor
10-20	Separation Pay	3,987	4,107	4,230	4,526	4,707	4,848	5,188	5,395	5,557	5,724	As Labor
10-21	Additional Pay	947	975	1,005	1,075	1,118	1,152	1,232	1,281	1,320	1,359	As Labor
10-25	Retirement	36,475	37,934	39,451	41,029	42,671	44,377	46,153	47,999	49,919	51,915	As Benefits - Other
10-27	Medicare	1,776	1,829	1,884	2,016	2,097	2,160	2,311	2,403	2,475	2,550	As Labor
10-29	Health/Dental/Vision	13,992	14,272	14,557	14,994	15,444	15,907	16,384	16,876	17,382	17,904	As Benefits - Medical
10-31	L-T Disability Insurance	780	796	812	836	861	887	913	941	969	998	As Benefits - Medical
10-32	Life Insurance	113	116	120	123	127	131	135	139	143	147	As Insurance
10-33	Workers' Compensation	3,182	3,309	3,442	3,579	3,722	3,871	4,026	4,187	4,355	4,529	As Benefits - Other
10-34	Unemployment Insurance	74	76	79	81	83	86	88	91	94	97	As Insurance
10-45	Cell Phone Allowance	194	202	210	218	227	236	245	255	266	276	As Benefits - Other
10-46	Retirement Pension Bond	17,419	17,942	18,480	19,773	20,564	21,181	22,664	23,571	24,278	25,006	As Labor
	Total Employee Services	**$203,080**	**$209,423**	**$215,970**	**$229,172**	**$238,178**	**$245,790**	**$260,860**	**$271,119**	**$279,777**	**$288,716**	

Acct. #		Proposed FY 2021	Projected FY 2022	FY 2023	FY 2024	FY 2025	FY 2026	FY 2027	FY 2028	FY 2029	FY 2030	Notes
	Other Services											
20-15	Telephone	210	218	227	236	246	255	266	276	287	299	As Utilities
20-25	Maint. & Repair Services	900	927	955	983	1,013	1,043	1,075	1,107	1,140	1,174	As Materials & Supplies
20-27	Uniform/Laundry Services	83	85	88	91	93	96	99	102	105	108	As Professional / Special Srvcs
20-34	Duplication/Copy Costs	300	309	318	328	338	348	358	369	380	391	As Materials & Supplies
20-37	Insurance Premiums	8,260	8,508	8,763	9,026	9,297	9,576	9,863	10,159	10,464	10,777	As Insurance
20-41	Automotive Equip Rental	430	447	465	484	503	523	544	566	588	612	As Equipment
20-44	Radio Equipment Rental	286	429	444	460	476	492	510	527	546	565	As Radio Equipment
20-47	Telephone Rental	1,159	1,205	1,254	1,304	1,356	1,410	1,467	1,525	1,586	1,650	As Equipment
20-52	Publicity & Advertising	750	769	788	808	828	849	870	892	914	937	As Miscellaneous
20-53	Printing & Mapping	75	77	80	82	84	87	90	92	95	98	As Materials & Supplies
20-54	Postage/Mailing Services	75	77	80	82	84	87	90	92	95	98	As Professional / Special Srvcs
20-57	Processing Fees	138	142	146	151	155	160	165	170	175	180	As Professional / Special Srvcs
20-63	Testing & Analysis Servcs	75	77	79	81	83	85	87	89	91	94	As Miscellaneous
20-65	Prof & Special Services	11,250	11,588	11,935	12,293	12,662	13,042	13,433	13,836	14,251	14,679	As Professional / Special Srvcs
20-66	Other Services	90	93	95	98	101	104	107	111	114	117	As Professional / Special Srvcs
	Total Other Services	**$24,081**	**$24,952**	**$25,717**	**$26,506**	**$27,319**	**$28,157**	**$29,022**	**$29,913**	**$30,832**	**$31,779**	
	Materials and Supplies											
30-50	Materials And Supplies	$23,750	$24,463	$25,196	$25,952	$26,731	$27,533	$28,359	$29,210	$30,086	$30,988	As Materials & Supplies
30-51	Computer Software	2,250	2,340	2,434	2,531	2,632	2,737	2,847	2,961	3,079	3,202	As Equipment
30-52	Subscription-Periodical	8	8	8	9	9	9	10	10	10	10	As Materials & Supplies
30-53	Fuels-Gas/Oil/Propane	140	144	149	153	158	162	167	172	177	183	As Materials & Supplies
	Total Materials and Supplies	**$26,148**	**$26,955**	**$27,787**	**$28,645**	**$29,530**	**$30,442**	**$31,382**	**$32,352**	**$33,353**	**$34,384**	
	Other Expenses											
40-10	Training	$1,800	$1,845	$1,891	$1,938	$1,987	$2,037	$2,087	$2,140	$2,193	$2,248	As Miscellaneous
40-12	Meetings & Travel	75	77	79	81	83	85	87	89	91	94	As Miscellaneous
40-14	Memberships	270	278	286	295	304	313	322	332	342	352	As Materials & Supplies
40-15	Car Mileage Reimbursement	23	24	24	25	26	27	27	28	29	30	As Materials & Supplies
	Total Other Expenses	**$2,168**	**$2,224**	**$2,281**	**$2,339**	**$2,399**	**$2,461**	**$2,524**	**$2,589**	**$2,656**	**$2,724**	
	Total Engineering Services	**$255,477**	**$263,554**	**$271,754**	**$286,662**	**$297,426**	**$306,850**	**$323,789**	**$335,974**	**$346,617**	**$357,603**	
	Lab Services											
	Employee Services											
10-10	Salaries - Regular	$101,859	$104,915	$108,062	$115,627	$120,252	$123,859	$132,529	$137,830	$141,965	$146,224	As Labor
10-11	Salaries Part Time - Temp	8,000	8,240	8,487	9,081	9,445	9,728	10,409	10,825	11,150	11,484	As Labor
10-13	Regular Overtime	860	886	912	976	1,015	1,046	1,119	1,164	1,199	1,235	As Labor
10-18	Holiday Pay	560	577	594	636	661	681	729	758	780	804	As Labor
10-21	Additional Pay	209	215	222	237	247	254	272	283	291	300	As Labor
10-25	Retirement	30,030	31,231	32,480	33,780	35,131	36,536	37,998	39,517	41,098	42,742	As Benefits - Other
10-26	Deferred Compensation	5,304	5,463	5,627	6,021	6,262	6,450	6,901	7,177	7,392	7,614	As Labor
10-27	Medicare	1,582	1,629	1,678	1,796	1,868	1,924	2,058	2,141	2,205	2,271	As Labor
10-29	Health/Dental/Vision	16,495	16,825	17,161	17,676	18,207	18,753	19,315	19,895	20,492	21,106	As Benefits - Medical
10-31	L-T Disability Insurance	642	668	694	722	751	781	812	845	879	914	As Benefits - Other
10-32	Life Insurance	144	148	153	157	162	167	172	177	182	188	As Insurance
10-33	Workers' Compensation	2,823	2,936	3,053	3,175	3,303	3,435	3,572	3,715	3,863	4,018	As Benefits - Other
10-34	Unemployment Insurance	87	90	92	95	98	101	104	107	110	114	As Insurance
10-45	Cell Phone Allowance	210	218	227	236	246	255	266	276	287	299	As Benefits - Other
10-46	Retirement Pension Bond	21	22	22	24	25	26	27	28	29	30	As Labor
	Total Employee Services	**$168,826**	**$174,063**	**$179,467**	**$190,240**	**$197,670**	**$203,995**	**$216,283**	**$224,739**	**$231,924**	**$239,343**	

City of Stockton MUD
Water Master Plan
Exhibit 3
Revenue Requirement

Acct. #		*Proposed* FY 2021	*Projected* FY 2022	FY 2023	FY 2024	FY 2025	FY 2026	FY 2027	FY 2028	FY 2029	FY 2030	*Notes*
	Other Services											
20-15	Telephone	$540	$562	$584	$607	$632	$657	$683	$711	$739	$769	As Utilities
20-25	Maint. & Repair Services	18,100	18,643	19,202	19,778	20,372	20,983	21,612	22,261	22,929	23,616	As Materials & Supplies
20-27	Uniform/Laundry Services	480	494	509	525	540	556	573	590	608	626	As Professional / Special Srvcs
20-34	Duplication/Copy Costs	100	103	106	109	113	116	119	123	127	130	As Materials & Supplies
20-37	Insurance Premiums	7,368	7,589	7,817	8,051	8,293	8,542	8,798	9,062	9,334	9,614	As Materials & Supplies
20-41	Automotive Equip Rental	3,698	3,846	4,000	4,160	4,326	4,499	4,679	4,866	5,061	5,263	As Equipment
20-44	Radio Equipment Rental	381	572	592	612	634	656	679	703	727	753	As Radio Equipment
20-47	Telephone Rental	636	661	688	715	744	774	805	837	870	905	As Equipment
20-52	Publicity & Advertising	200	205	210	215	221	226	232	238	244	250	As Miscellaneous
20-54	Postage/Mailing Services	50	52	53	55	56	58	60	61	63	65	As Professional / Special Srvcs
20-57	Processing Fees	5,840	6,015	6,196	6,382	6,573	6,770	6,973	7,182	7,398	7,620	As Professional / Special Srvcs
20-63	Testing & Analysis Servcs	120	123	126	129	132	136	139	143	146	150	As Miscellaneous
20-64	Training Service	150	155	159	164	169	174	179	184	190	196	As Professional / Special Srvcs
20-65	Prof & Special Services	12,000	12,360	12,731	13,113	13,506	13,911	14,329	14,758	15,201	15,657	As Professional / Special Srvcs
20-66	Other Services	30	31	32	33	34	35	36	37	38	39	As Professional / Special Srvcs
20-68	Laboratory Service	54,280	55,908	57,586	59,313	61,093	62,925	64,813	66,758	68,760	70,823	As Professional / Special Srvcs
	Total Other Services	**$103,973**	**$107,318**	**$110,590**	**$113,962**	**$117,437**	**$121,018**	**$124,709**	**$128,514**	**$132,435**	**$136,476**	
	Materials and Supplies											
30-50	Materials And Supplies	$31,750	$32,703	$33,684	$34,694	$35,735	$36,807	$37,911	$39,048	$40,220	$41,427	As Materials & Supplies
30-51	Computer Software	1,700	1,768	1,839	1,912	1,989	2,068	2,151	2,237	2,327	2,420	As Equipment
30-53	Fuels-Gas/Oil/Propane	602	620	639	658	678	698	719	740	763	785	As Materials & Supplies
30-54	Chemicals	12,200	12,566	12,943	13,331	13,731	14,143	14,567	15,004	15,455	15,918	As Materials & Supplies
30-55	Library Materials	120	124	127	131	135	139	143	148	152	157	As Materials & Supplies
	Total Materials and Supplies	**$46,372**	**$47,780**	**$49,231**	**$50,727**	**$52,267**	**$53,855**	**$55,492**	**$57,178**	**$58,916**	**$60,706**	
	Other Expenses											
40-10	Training	$2,400	$2,460	$2,522	$2,585	$2,649	$2,715	$2,783	$2,853	$2,924	$2,997	As Miscellaneous
40-12	Meetings & Travel	416	426	437	448	459	471	482	494	507	520	As Miscellaneous
40-14	Memberships	376	387	399	411	423	436	449	462	476	491	As Materials & Supplies
	Total Other Expenses	**$3,192**	**$3,274**	**$3,357**	**$3,443**	**$3,532**	**$3,622**	**$3,715**	**$3,810**	**$3,907**	**$4,007**	
	Total Lab Services	**$322,363**	**$332,435**	**$342,646**	**$358,371**	**$370,906**	**$382,490**	**$400,199**	**$414,240**	**$427,182**	**$440,534**	
	Safety											
	Employee Services											
10-10	Salaries - Regular	$73,191	$75,387	$77,648	$83,084	$86,407	$88,999	$95,229	$99,038	$102,010	$105,070	As Labor
10-13	Regular Overtime	750	773	796	851	885	912	976	1,015	1,045	1,077	As Labor
10-25	Retirement	21,414	22,271	23,161	24,088	25,051	26,053	27,096	28,179	29,307	30,479	As Benefits - Other
10-26	Deferred Compensation	1,404	1,446	1,490	1,594	1,658	1,707	1,827	1,900	1,957	2,016	As Labor
10-27	Medicare	1,009	1,039	1,070	1,145	1,191	1,227	1,313	1,365	1,406	1,448	As Labor
10-29	Health/Dental/Vision	10,921	11,139	11,362	11,703	12,054	12,416	12,788	13,172	13,567	13,974	As Benefits - Medical
10-31	L-T Disability Insurance	461	479	499	519	539	561	583	607	631	656	As Benefits - Other
10-32	Life Insurance	91	94	97	99	102	105	109	112	115	119	As Insurance
10-33	Workers' Compensation	1,486	1,545	1,607	1,672	1,738	1,808	1,880	1,955	2,034	2,115	As Benefits - Other
10-34	Unemployment Insurance	58	60	62	63	65	67	69	71	73	76	As Insurance
10-45	Cell Phone Allowance	384	399	415	432	449	467	486	505	526	547	As Benefits - Other
	Total Employee Services	**$111,169**	**$114,632**	**$118,207**	**$125,250**	**$130,141**	**$134,323**	**$142,356**	**$147,920**	**$152,670**	**$157,576**	

Acct. #		Proposed FY 2021	Projected FY 2022	FY 2023	FY 2024	FY 2025	FY 2026	FY 2027	FY 2028	FY 2029	FY 2030	Notes
	Other Services											
20-25	Maint. & Repair Services	$600	$618	$637	$656	$675	$696	$716	$738	$760	$783	As Materials & Supplies
20-27	Uniform/Laundry Services	250	258	265	273	281	290	299	307	317	326	As Professional / Special Srvcs
20-34	Duplication/Copy Costs	1,250	1,288	1,326	1,366	1,407	1,449	1,493	1,537	1,583	1,631	As Materials & Supplies
20-37	Insurance Premiums	4,881	5,027	5,178	5,334	5,494	5,658	5,828	6,003	6,183	6,369	As Insurance
20-44	Radio Equipment Rental	603	905	936	969	1,003	1,038	1,074	1,112	1,151	1,191	As Radio Equipment
20-47	Telephone Rental	227	236	246	255	266	276	287	299	311	323	As Equipment
20-54	Postage/Mailing Services	63	65	67	69	71	73	75	77	80	82	As Professional / Special Srvcs
20-64	Training Service	50,000	51,500	53,045	54,636	56,275	57,964	59,703	61,494	63,339	65,239	As Professional / Special Srvcs
20-65	Prof & Special Services	25,000	25,750	26,523	27,318	28,138	28,982	29,851	30,747	31,669	32,619	As Professional / Special Srvcs
20-66	Other Services	87,652	90,282	92,990	95,780	98,653	101,613	104,661	107,801	111,035	114,366	As Professional / Special Srvcs
	Total Other Services	**$170,526**	**$175,927**	**$181,212**	**$186,656**	**$192,263**	**$198,038**	**$203,987**	**$210,115**	**$216,427**	**$222,929**	
	Materials and Supplies											
30-50	Materials And Supplies	$24,788	$25,532	$26,298	$27,087	$27,899	$28,736	$29,598	$30,486	$31,401	$32,343	As Materials & Supplies
30-51	Computer Software	1,875	1,950	2,028	2,109	2,193	2,281	2,372	2,467	2,566	2,669	As Equipment
30-52	Subscription-Periodicals	750	773	796	820	844	869	896	922	950	979	As Materials & Supplies
30-55	Library Materials	625	644	663	683	703	725	746	769	792	815	As Materials & Supplies
	Total Materials and Supplies	**$28,038**	**$28,898**	**$29,784**	**$30,698**	**$31,640**	**$32,611**	**$33,612**	**$34,645**	**$35,709**	**$36,805**	
	Other Expenses											
40-10	Training	$5,250	$5,381	$5,516	$5,654	$5,795	$5,940	$6,088	$6,241	$6,397	$6,557	As Miscellaneous
40-14	Memberships	318	328	337	347	358	369	380	391	403	415	As Materials & Supplies
	Total Other Expenses	**$5,568**	**$5,709**	**$5,853**	**$6,001**	**$6,153**	**$6,309**	**$6,468**	**$6,632**	**$6,799**	**$6,971**	
	Total Safety	**$315,301**	**$325,166**	**$335,056**	**$348,605**	**$360,197**	**$371,282**	**$386,424**	**$399,312**	**$411,606**	**$424,281**	
	SCADA											
	Employee Services											
10-10	Salaries - Regular	$89,616	$92,304	$95,074	$101,729	$105,798	$108,972	$116,600	$121,264	$124,902	$128,649	As Labor
10-13	Regular Overtime	640	659	679	727	756	778	833	866	892	919	As Labor
10-25	Retirement	26,195	27,243	28,333	29,466	30,644	31,870	33,145	34,471	35,850	37,284	As Benefits - Other
10-27	Medicare	1,287	1,326	1,365	1,461	1,519	1,565	1,675	1,742	1,794	1,848	As Labor
10-29	Health/Dental/Vision	10,921	11,139	11,362	11,703	12,054	12,416	12,788	13,172	13,567	13,974	As Benefits - Medical
10-31	L-T Disability Insurance	565	582	599	617	636	655	675	695	716	737	As Insurance
10-32	Life Insurance	86	89	91	94	97	100	103	106	109	112	As Insurance
10-33	Workers' Compensation	1,813	1,886	1,961	2,039	2,121	2,206	2,294	2,386	2,481	2,580	As Benefits - Other
10-34	Unemployment Insurance	58	60	62	63	65	67	69	71	73	76	As Insurance
10-45	Cell Phone Allowance	384	399	415	432	449	467	486	505	526	547	As Benefits - Other
	Total Employee Services	**$131,565**	**$135,687**	**$139,941**	**$148,331**	**$154,140**	**$159,096**	**$168,667**	**$175,277**	**$180,909**	**$186,725**	

City of Stockton MUD
Water Master Plan
Exhibit 3
Revenue Requirement

Acct. #		*Proposed* FY 2021	*Projected* FY 2022	FY 2023	FY 2024	FY 2025	FY 2026	FY 2027	FY 2028	FY 2029	FY 2030	*Notes*
	Other Services											
20-15	Telephone	$11,200	$11,648	$12,114	$12,598	$13,102	$13,627	$14,172	$14,738	$15,328	$15,941	As Utilities
20-37	Insurance Premiums	5,957	6,136	6,320	6,509	6,705	6,906	7,113	7,326	7,546	7,773	As Materials & Supplies
20-47	Telephone Rental	582	605	629	655	681	708	736	766	797	828	As Equipment
20-65	Prof & Special Services	27,200	28,016	28,856	29,722	30,614	31,532	32,478	33,453	34,456	35,490	As Professional / Special Srvcs
	Total Other Services	**$44,939**	**$46,405**	**$47,920**	**$49,485**	**$51,102**	**$52,773**	**$54,499**	**$56,283**	**$58,127**	**$60,032**	
	Materials and Supplies											
30-50	Materials And Supplies	$17,000	$17,510	$18,035	$18,576	$19,134	$19,708	$20,299	$20,908	$21,535	$22,181	As Materials & Supplies
30-51	Computer Software	56,128	58,373	60,708	63,136	65,662	68,288	71,020	73,861	76,815	79,888	As Equipment
	Total Materials and Supplies	**$73,128**	**$75,883**	**$78,743**	**$81,713**	**$84,795**	**$87,996**	**$91,319**	**$94,768**	**$98,350**	**$102,069**	
	Other Expenses											
40-10	Training	$480	$492	$504	$517	$530	$543	$557	$571	$585	$599	As Miscellaneous
40-12	Meeting & Travel	1,280	1,312	1,345	1,378	1,413	1,448	1,484	1,522	1,560	1,599	As Miscellaneous
40-15	Car Mileage Reimbursement	320	330	339	350	360	371	382	394	405	418	As Materials & Supplies
	Total Other Expenses	**$2,080**	**$2,134**	**$2,189**	**$2,245**	**$2,303**	**$2,362**	**$2,423**	**$2,486**	**$2,550**	**$2,616**	
	Total SCADA	**$251,712**	**$260,108**	**$268,793**	**$281,774**	**$292,340**	**$302,227**	**$316,908**	**$328,815**	**$339,936**	**$351,441**	
	Outreach & Training											
	Employee Services											
10-13	Regular Overtime	$750	$773	$796	$851	$885	$912	$976	$1,015	$1,045	$1,077	As Labor
10-27	Medicare	11	11	12	12	13	13	14	15	15	16	As Labor
10-33	Workers Compensation	15	15	16	17	18	18	20	20	21	22	As Labor
10-97	Summary Account	0	0	0	0	0	0	0	0	0	0	As Labor
	Total Employee Services	**$776**	**$799**	**$823**	**$881**	**$916**	**$944**	**$1,010**	**$1,050**	**$1,082**	**$1,114**	
	Other Services											
20-34	Duplication/Copy Costs	$5,000	$5,200	$5,408	$5,624	$5,849	$6,083	$6,327	$6,580	$6,843	$7,117	As Utilities
20-37	Insurance Premiums	50	52	53	55	56	58	60	61	63	65	As Insurance
20-52	Publicity & Advertising	55,000	56,375	57,784	59,229	60,710	62,227	63,783	65,378	67,012	68,687	As Miscellaneous
20-53	Printing & Mapping	250	260	270	281	292	304	316	329	342	356	As Equipment
20-54	Postage/Mailing Services	20,000	20,600	21,218	21,855	22,510	23,185	23,881	24,597	25,335	26,095	As Professional / Special Srvcs
20-64	Training Services	1,500	1,545	1,591	1,639	1,688	1,739	1,791	1,845	1,900	1,957	As Professional / Special Srvcs
20-65	Prof & Special Services	18,000	18,540	19,096	19,669	20,259	20,867	21,493	22,138	22,802	23,486	As Professional / Special Srvcs
20-97	Summary Account	0	0	0	0	0	0	0	0	0	0	
	Total Other Services	**$99,800**	**$102,572**	**$105,421**	**$108,352**	**$111,365**	**$114,464**	**$117,651**	**$120,928**	**$124,298**	**$127,764**	
	Materials and Supplies											
30-50	Materials & Supplies	$15,500	$15,965	$16,444	$16,937	$17,445	$17,969	$18,508	$19,063	$19,635	$20,224	As Materials & Supplies
30-51	Computer Software	500	520	541	562	585	608	633	658	684	712	As Equipment
30-52	Subscription-Periodical	250	258	265	273	281	290	299	307	317	326	As Materials & Supplies
30-97	Summary Account (2)	0	0	0	0	0	0	0	0	0	0	As Materials & Supplies
	Total Materials and Supplies	**$16,250**	**$16,743**	**$17,250**	**$17,773**	**$18,312**	**$18,867**	**$19,439**	**$20,028**	**$20,636**	**$21,262**	

City of Stockton MUD
Water Master Plan
Exhibit 3
Revenue Requirement

Acct. #		Proposed FY 2021	Projected FY 2022	FY 2023	FY 2024	FY 2025	FY 2026	FY 2027	FY 2028	FY 2029	FY 2030	Notes
	Other Expenses											
40-10	Training	$500	$513	$525	$538	$552	$566	$580	$594	$609	$624	As Miscellaneous
40-12	Meetings & Travel	250	256	263	269	276	283	290	297	305	312	As Miscellaneous
40-14	Memberships	250	258	265	273	281	290	299	307	317	326	As Materials & Supplies
40-97	Summary Account (3)	0	0	0	0	0	0	0	0	0	0	As Materials & Supplies
	Total Other Expenses	**$1,000**	**$1,026**	**$1,053**	**$1,081**	**$1,109**	**$1,138**	**$1,168**	**$1,199**	**$1,230**	**$1,263**	
	Total Outreach & Training	**$117,826**	**$121,140**	**$124,548**	**$128,086**	**$131,702**	**$135,413**	**$139,268**	**$143,205**	**$147,246**	**$151,402**	
	Total Operations & Maintenance	**$35,022,842**	**$36,641,066**	**$38,384,019**	**$40,564,443**	**$42,607,554**	**$44,668,391**	**$47,225,873**	**$49,630,222**	**$52,059,434**	**$54,620,932**	
	Debt Service											
	2002 A Revenue Bond	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	Ref - 2018 A
	2005 A Revenue Bond	0	0	0	0	0	0	0	0	0	0	Ref - 2018 A
	2009 A Revenue Bond	0	0	0	0	0	0	0	0	0	0	Ref - 2018 A
	2009 B Revenue Bond	0	0	0	0	0	0	0	0	0	0	Ref - 2018 A
	Less BAB Interest Rebate	0	0	0	0	0	0	0	0	0	0	
	2010 A Revenue Bond	0	0	0	0	0	0	0	0	0	0	Ref - 2019 A
	2017 A Revenue Bond	0	0	0	0	0	0	0	0	0	0	Ref - 2018 A
	Drought Relief Loan	0	0	0	0	0	0	0	0	0	0	Exhibit 5
	2018 A Revenue Bond	11,860,050	11,873,675	11,878,425	11,601,050	11,611,050	11,620,675	11,634,050	11,650,175	11,663,175	11,662,550	Exhibit 5
	2019 A Revenue Bond	2,425,436	2,419,612	2,423,025	2,420,538	2,417,173	2,417,958	2,422,743	2,421,549	2,419,409	2,421,143	Exhibit 6
	New SRF Loans	0	0	0	0	0	0	0	0	0	0	Calc @ 2.4% for 20 Yrs
	New Revenue Bonds	0	0	0	0	0	0	0	0	0	0	Calc @ 4.6% for 20 Yrs
	Balance to Debt Paid	0	0	0	0	0	0	0	0	0	0	
	Total Debt Service	**$14,285,486**	**$14,293,287**	**$14,301,450**	**$14,021,588**	**$14,028,223**	**$14,038,633**	**$14,056,793**	**$14,071,724**	**$14,082,584**	**$14,083,693**	
	Less Connection Fees	$0	$0	$0	$0	$0	$350,000	$350,000	$350,000	$350,000	$350,000	
	Less DWSP Fees	500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000	
	Net Debt Service	**$13,785,486**	**$13,793,287**	**$13,801,450**	**$13,521,588**	**$13,528,223**	**$13,188,633**	**$13,206,793**	**$13,221,724**	**$13,232,584**	**$13,233,693**	
	Rate Funded Capital	**$9,000,000**	**$8,675,000**	**$8,950,000**	**$9,250,000**	**$9,250,000**	**$9,500,000**	**$10,000,000**	**$10,400,000**	**$10,700,000**	**$11,000,000**	$8,071,035 FY 2019 Dep. Exp.
	Reserve Funding											
	To/(From) Operating Cash	$310,300	$45,651	($4,705)	($175,210)	$249,381	$858,402	$535,600	$606,486	$552,718	$482,677	
	To/(From) Capital Reserve	0	0	0	0	0	0	0	0	0	0	
	To/(From) Rate Stabilization	0	0	0	0	0	0	0	0	0	0	
	Total Reserve Funding	**$310,300**	**$45,651**	**($4,705)**	**($175,210)**	**$249,381**	**$858,402**	**$535,600**	**$606,486**	**$552,718**	**$482,677**	
	Total Revenue Requirement	**$58,118,628**	**$59,155,004**	**$61,130,764**	**$63,160,822**	**$65,635,157**	**$68,215,425**	**$70,968,266**	**$73,858,432**	**$76,544,737**	**$79,337,302**	
	Bal/(Def.) of Funds	$0	$0	($1,808,060)	($3,697,799)	($5,952,010)	($8,318,546)	($10,802,536)	($13,409,343)	($15,811,048)	($18,318,557)	
	Rate Adj. as a % of Rate Rev.	0.0%	0.0%	3.5%	7.1%	11.4%	15.9%	20.5%	25.3%	29.7%	34.2%	
	Proposed Rate Adjustment	**0.0%**	**0.0%**	**3.5%**	**3.5%**	**4.0%**	**4.0%**	**4.0%**	**4.0%**	**3.5%**	**3.5%**	
	Effective Months	*12*	*12*	*12*	*12*	*12*	*12*	*12*	*12*	*12*	*12*	
	Add'l Revenue from Adj.	$0	$0	$1,808,060	$3,697,799	$5,952,010	$8,318,546	$10,802,536	$13,409,343	$15,811,048	$18,318,557	
	Total Bal/(Def.) of Funds	$0	$0	$0	($0)	$0	($0)	$0	$0	$0	($0)	
	Additional Rate Increase Needed	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	

City of Stockton MUD
Water Master Plan
Exhibit 3
Revenue Requirement

Acct. #		*Proposed* FY 2021	*Projected* FY 2022	FY 2023	FY 2024	FY 2025	FY 2026	FY 2027	FY 2028	FY 2029	FY 2030	*Notes*
	Avg Res Monthly Bill (5/8" Meter + 15CCF)											
	After Proposed Rate Adjustment	$70.95	$70.95	$73.43	$76.00	$79.04	$82.21	$85.49	$88.91	$92.03	$95.25	
	Annual $ Change	0.00	0.00	2.48	2.57	3.04	3.16	3.29	3.42	3.11	3.22	
	Cumulative Change	0.00	0.00	2.48	5.05	8.09	11.26	14.54	17.96	21.08	24.30	
	Reserve Funds											
	Beginning Balance *(not including 421 or 425)*	**$70,368,596**	**$68,307,112**	**$65,234,166**	**$46,679,585**	**$44,389,884**	**$39,225,611**	**$37,284,789**	**$37,820,390**	**$38,426,876**	**$38,979,594**	
421	***Operating Cash***											
	Beginning Balance	**$70,368,596**	**$68,307,112**	**$65,234,166**	**$46,679,585**	**$44,389,884**	**$39,225,611**	**$37,284,789**	**$37,820,390**	**$38,426,876**	**$38,979,594**	
	Plus: To Operating Reserves	310,300	45,651	0	0	249,381	858,402	535,600	606,486	552,718	482,677	
	From: Rate Stabilization Fund	0	0	0	0	0	0	0	0	0	0	
	Less: Transfer to 425	(2,371,784)	(2,530,939)	(2,600,529)	0	(2,565,202)	0	0	0	0	0	
	Less: Defeasance	0	0	0	0	0	0	0	0	0	0	
	Less: Uses of Funds	0	(587,658)	(15,954,051)	(2,289,702)	(2,848,452)	(2,799,223)	0	0	0	0	
	Ending Balance	**$68,307,112**	**$65,234,166**	**$46,679,585**	**$44,389,884**	**$39,225,611**	**$37,284,789**	**$37,820,390**	**$38,426,876**	**$38,979,594**	**$39,462,270**	
	Target: 180 days of O&M	*$17,271,539*	*$18,069,567*	*$18,929,105*	*$20,004,383*	*$21,011,944*	*$22,028,247*	*$23,289,472*	*$24,475,178*	*$25,673,146*	*$26,936,350*	
	days of O&M	*712*	*650*	*444*	*399*	*336*	*305*	*292*	*283*	*273*	*264*	
424	***Connection Fee Reserve***											
	Beginning Balance	**($0)**	**$0**	**$0**	**$0**	**$327,305**	**$0**	**$115,625**	**$241,684**	**$378,466**	**$526,268**	
	Plus: Connection Fees	418,055	426,416	434,945	443,644	452,517	461,567	470,798	480,214	489,819	499,615	
	Plus: Transfer from 421	2,371,784	2,530,939	2,600,529	0	2,565,202	0	0	0	0	0	
	Plus: Interest	12,883	15,296	17,439	2,814	22,373	4,058	5,260	6,568	7,984	9,511	
	Less: Uses of Funds	(2,802,722)	(2,972,652)	(3,052,913)	(119,153)	(3,367,396)	(350,000)	(350,000)	(350,000)	(350,000)	(350,000)	
	Ending Balance	**$0**	**$0**	**$0**	**$327,305**	**$0**	**$115,625**	**$241,684**	**$378,466**	**$526,268**	**$685,394**	
425	***DWSP SWSF Fund***											
	Beginning Balance	**$3,295,762**	**$3,546,595**	**$3,817,630**	**$4,109,875**	**$4,420,175**	**$4,749,011**	**$5,096,879**	**$5,464,282**	**$5,851,739**	**$6,259,776**	
	Plus: Connection Fees	723,573	738,044	752,805	767,861	783,219	798,883	814,861	831,158	847,781	864,737	
	Plus: Interest	27,260	32,991	39,440	42,438	45,618	48,985	52,543	56,299	60,256	64,421	
	Less: Uses of Funds	(500,000)	(500,000)	(500,000)	(500,000)	(500,000)	(500,000)	(500,000)	(500,000)	(500,000)	(500,000)	
	Ending Balance	**$3,546,595**	**$3,817,630**	**$4,109,875**	**$4,420,175**	**$4,749,011**	**$5,096,879**	**$5,464,282**	**$5,851,739**	**$6,259,776**	**$6,688,934**	
	Ending Balance *(not including 421 or 425)*	**$68,307,112**	**$65,234,166**	**$46,679,585**	**$44,389,884**	**$39,225,611**	**$37,284,789**	**$37,820,390**	**$38,426,876**	**$38,979,594**	**$39,462,270**	
	Total Target	*$17,271,539*	*$18,069,567*	*$18,929,105*	*$20,004,383*	*$21,011,944*	*$22,028,247*	*$23,289,472*	*$24,475,178*	*$25,673,146*	*$26,936,350*	

City of Stockton MUD
Water Master Plan
Exhibit 4
Capital Improvement Plan

Inflation	**2.7%**

Fund		FY 2020	FY 2021	FY 2022	FY 2023	FY 2024	FY 2025	FY 2026	FY 2027	FY 2028	FY 2029	FY 2030	*Total*
	Water Connection Fee												
424	Henry Long Loop Reimbursement	$0	$0	$0	$0	$0	$149,069	$0	$0	$0	$0	$0	$149,069
424	Holman Rd / Hendrix Dr to Eight Mile Oversizing	0	0	0	0	0	240,290	0	0	0	0	0	240,290
424	Lower Sac Rd Water Main (Marlette and 8 Mile Rd)	0	0	0	0	0	229,165	0	0	0	0	0	229,165
424	Northest Reservoir No. 1 and Pump Station	0	0	0	0	0	0	0	0	0	0	0	0
424	Origone Ranch Oversizing Reimbursment	0	0	0	0	0	291,463	0	0	0	0	0	291,463
424	Preserve / Atlas Tract Oversizing	0	0	0	0	0	537,315	0	0	0	0	0	537,315
424	Sactury / Shima Tract Oversizing Reimbursement	0	0	0	0	0	1,920,094	0	0	0	0	0	1,920,094
424	Tam O'Shanter Dr and Knickerbocker Dr Roundabout	0	0	0	0	0	0	0	0	0	0	0	0
424	Veteran Affairs Medical Center Off-Site Improv.	0	0	0	0	0	0	0	0	0	0	0	0
424	Waterline Extension for VA Medical Facility	0	1,757,722	0	0	0	0	0	0	0	0	0	1,757,722
424	West, East, and South Bear Creek Oversizing Reimb.	0	1,045,000	2,972,652	3,052,913	0	0	0	0	0	0	0	7,070,565
424	Westlake Village Oversizing Reimb.	0	0	0	0	119,153	0	0	0	0	0	0	119,153
	Total Water Connection Fee	**$0**	**$2,802,722**	**$2,972,652**	**$3,052,913**	**$119,153**	**$3,367,396**	**$0**	**$0**	**$0**	**$0**	**$0**	**$12,314,835**
	Water												
423/427	16" Water Line Along I-5 North of East Roth Rd	$0	$0	$0	$0	$94,759	$708,099	$0	$0	$0	$0	$0	$802,858
423/427	Cathodic Protection (Bear Creek & Trinity Pkwy)	0	121,000	0	0	0	0	0	0	0	0	0	121,000
423/427	Left Turn Lane Additions at Various Locations	0	0	0	0	0	0	0	0	0	0	0	0
423/427	Lincoln St and 8th St Roundabout	0	0	0	0	0	0	0	0	0	0	0	0
423/427	Groundwater Recharge Basin	0	329,000	0	0	0	0	0	0	0	0	0	329,000
423/427	Water Main Relocation - Bonniebrook Dr	0	281,000	0	0	0	0	0	0	0	0	0	281,000
423/427	Water Service Line Replacement	0	195,400	513,500	527,365	541,603	556,227	571,245	586,668	0	0	0	3,492,008
423/427	Water System Street Improvements	0	77,000	77,025	79,105	81,241	83,434	85,687	88,000	0	0	0	571,491
423/427	Water System Street Improvements (PW)	0	140,000	154,050	158,209	162,481	166,868	171,373	176,001	0	0	0	1,128,982
423/427	Water Well South Stockton System #10	0	1,750,000	0	0	0	0	0	0	0	0	0	1,750,000
423/427	Abandonment of Wells 1, 9, 11, & 16	0	0	0	0	0	0	0	0	0	0	0	0
423/427	Master Plan Update	0	0	0	0	0	0	0	0	0	0	0	0
423/427	West Lane Pedestrian Access, Improv	0	0	0	0	0	0	0	0	0	0	0	0
423/427	Well/Reservoir Site Improv Ph 2	0	0	77,025	79,105	81,241	83,434	0	0	0	0	0	320,804
423/427	Zephyr Rd Water Main Connection	0	548,000	0	0	0	0	0	0	0	0	0	548,000
423/427	Condition Assessment (Pipelines)	0	0	256,750	263,682	0	0	0	0	0	0	0	520,432
423/427	North & South Well Capacity Study	0	0	256,750	0	0	0	0	0	0	0	0	256,750
423/427	Water Supply - Well #33	0	0	459,069	0	0	0	0	0	0	0	0	459,069
	Total Water	**$0**	**$3,441,400**	**$1,794,169**	**$1,107,465**	**$961,324**	**$1,598,061**	**$828,305**	**$850,669**	**$0**	**$0**	**$0**	**$10,581,394**

City of Stockton MUD
Water Master Plan
Exhibit 4
Capital Improvement Plan

Inflation **2.7%**

Fund		FY 2020	FY 2021	FY 2022	FY 2023	FY 2024	FY 2025	FY 2026	FY 2027	FY 2028	FY 2029	FY 2030	*Total*
	Water Master Plan												
423/427	Pipeline Improvements Priority 1	$0	$0	$934,022	$959,241	$985,140	$688,386	$706,973	$0	$0	$0	$0	$4,273,762
423/427	Pipeline Improvements Priority 2	0	0	156,104	160,319	0	0	687,017	1,445,238	0	0	0	2,448,678
423/427	Replace Undersized and/or Old Mains	0	0	0	2,114,521	2,404,881	2,469,813	2,536,498	0	0	0	0	9,525,713
423/427	South Wells - SEWD Reliability (0 Wells)	0	0	0	0	0	0	0	0	0	0	0	0
423/427	North Well - Aging Infras. Replac. (2 Well)	0	0	0	0	0	0	0	6,758,419	6,940,897	0	0	13,699,316
424	South Wells - SEWD Reliability (1 Well)	0	0	0	0	0	0	0	0	2,819,739	0	0	2,819,739
423/427	DWTP - Raw Water Pipeline Improvements	0	150,000	2,567,500	2,636,823	0	0	0	0	0	0	0	5,354,323
423/427	DWTP - Campus Improvements	0	0	924,300	12,014,495	5,280,015	0	0	0	0	0	0	18,218,810
423/427	Groundwater Supply Management	0	0	1,643,200	1,687,566	1,733,131	1,779,925	1,827,983	0	0	0	0	8,671,806
423/427	Advanced Metering Infrastructure (Pilot)	0	0	503,923	4,218,916	0	5,562,266	5,712,448	0	0	0	0	15,997,553
423/427	Backup Power Improvements	0	0	739,440	0	0	0	0	0	0	0	0	739,440
	Total Water Master Plan	**$0**	**$150,000**	**$7,468,489**	**$23,791,880**	**$10,403,168**	**$10,500,391**	**$11,470,918**	**$8,203,657**	**$9,760,636**	**$0**	**$0**	**$81,749,140**
Summary by Fund													
423/427	Total Capital Projects	$4,790,000	$3,591,400	$9,262,658	$24,899,346	$11,364,492	$12,098,452	$12,299,223	$9,054,327	$6,940,897	$0	$0	$94,300,795
424	Total Capital Projects	0	2,802,722	2,972,652	3,052,913	119,153	3,367,396	0	0	2,819,739	0	0	15,134,575
	Total	**$4,790,000**	**$6,394,122**	**$12,235,310**	**$27,952,259**	**$11,483,645**	**$15,465,848**	**$12,299,223**	**$9,054,327**	**$9,760,636**	**$0**	**$0**	**$109,435,369**
	Future Unidentified Projects	$0	$5,408,600	$0	$0	$0	$0	$0	$945,673	$639,364	$10,700,000	$11,000,000	$37,693,637
	To Capital Reserves	$4,210,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$4,210,000
Total Capital Improvement Projects		**$9,000,000**	**$11,802,722**	**$12,235,310**	**$27,952,259**	**$11,483,645**	**$15,465,848**	**$12,299,223**	**$10,000,000**	**$10,400,000**	**$10,700,000**	**$11,000,000**	**$151,339,006**
Less: Outside Funding Sources													
	Operating Cash	$0	$0	$587,658	$15,949,346	$2,114,492	$2,848,452	$2,799,223	$0	$0	$0	$0	$24,299,171
	DWSP SWSF Fund	0	0	0	0	0	0	0	0	0	0	0	0
	Connection Fee Reserve	0	2,802,722	2,972,652	3,052,913	119,153	3,367,396	0	0	0	0	0	12,314,835
	Developer Funded	0	0	0	0	0	0	0	0	0	0	0	0
	New SRF Loans	0	0	0	0	0	0	0	0	0	0	0	0
	New Revenue Bonds	0	0	0	0	0	0	0	0	0	0	0	0
	Total Outside Funding Sources	**$0**	**$2,802,722**	**$3,560,310**	**$19,002,259**	**$2,233,645**	**$6,215,848**	**$2,799,223**	**$0**	**$0**	**$0**	**$0**	**$36,614,006**
Rate Funded Capital		**$9,000,000**	**$9,000,000**	**$8,675,000**	**$8,950,000**	**$9,250,000**	**$9,250,000**	**$9,500,000**	**$10,000,000**	**$10,400,000**	**$10,700,000**	**$11,000,000**	**$114,725,000**

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WE SUPPORT OUR COMMUNITIES

WE ARE WATER FOCUSED

WE TAKE PRIDE IN WHAT WE DO

WE STRIVE TO BECOME OUR BEST

WE DO WHAT'S RIGHT

WE BELIEVE IN QUALITY

WE LISTEN

WE SOLVE CHALLENGING PROBLEMS

WE SEE THE BIGGER PICTURE

WE TAKE OWNERSHIP

WE COLLABORATE

WE HAVE FUN

WE ARE WEST YOST

WEST YOST

Water. Engineered.