Water Master Plan Update

Prepared For:
Mission Springs Water District

2025

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Acknowledgments

We appreciate the combined efforts of the entire project team in the development and preparation of the Master Plan. Our project team includes district staff and consulting staff.

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Special Acknowledgements

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Table of Contents

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

ACRONYMS AND ABBREVIATIONS

°F	degrees Fahrenheit
ACP	Asbestos Cement Pipe
ADD	Average Day Demand
AF	Acre-Feet
AFY	Acre-Feet per Year
ASR	Aquifer Storage and Recovery
AWWA	American Water Works Association
CDPH	California Department of Public Health
Cfs	cubic feet per second
CIP	Capital Improvement Program
CVWD	Coachella Valley Water District
DWA	Desert Water Agency
DBPs	Disinfection/Disinfection Byproducts
DHS	Department of Health Services
DU	Dwelling Unit
EIR	Environmental Impact Report
ENR-CCI	ENR Construction Cost Index
EPA	Environmental Protection Agency
EPS	Extended Period Simulation
fps	Feet per Second
gal	Gallon
GD	Growth Database
GIS	Geographical Information System
gpd	Gallons Per Day
gpd/ac	Gallons Per Day per Acre
gpdc	Gallons Per Day per Capita
gpd/DU	Gallons Per Day per Dwelling Unit
gpd/sf	Gallons Per Day per Square Foot
gpm	Gallons per Minute
HGL	Hydraulic Grade Line
hp	Horsepower
HP	Hydropneumatic
HWL	High Water Level
MCL	Maximum Contaminant Level
MDD	Maximum Day Demand
MF	Multi-Family

mg/L	Milligrams per Liter
MG	Million Gallons
MGD	Million Gallons per Day
Msf	Million square feet
MSL	Mean Sea Level
MWD	Metropolitan Water District of Southern California
NPDES	National Pollutant Discharge Elimination System
PSC	Palm Springs Crest
ppb	Parts per billion
ppm	Parts per million
PHD	Peak Hour Demand
PRS	Pressure Regulating Station
PRV	Pressure Reducing Valves
PS	Pump Station
psi	Pressure per Square Inch
PSV	Pressure Sustaining Valves
PVC	Polyvinyl Chloride
SB	Senate Bill
SBx 7-7	Senate Bill 7 of the 7th Special Legislative Session
SCADA	Supervisory Control and Data Acquisition
SDWA	Safe Drinking Water Act
SF	Single Family
sf	Square Foot
SR	State Route
SWRCB	State Water Resources Control Board
TDH	Total Dynamic Head
TDS	Total Dissolved Solids
UWMP	Urban Water Management Plan
WMP	Water Master Plan
WPS	West Palm Springs
WMP	Water Master Plan

Executive Summary

ES.1 Purpose

The primary objective of this Water System Master Plan (Master Plan) is to update the Mission Springs Water District (District) potable water use characteristics and hydraulic model, evaluate the water system under various demand conditions, identify system improvements needed to accommodate existing and future demands, and recommend a Capital Improvement Program (CIP). This Master Plan is a tool for the District to help make decisions on implementing water system improvements to provide reliable and efficient water service to its existing and future customers. This Master Plan has a 20-year planning horizon through year 2045.

ES.2 Supply and Demand

The District's water is sourced entirely via groundwater wells within the Coachella Groundwater Basin by one of three main potable sub-basins within the Coachella Groundwater Basin: Mission Creek, San Gorgonio Pass, and Indio Subbasins. A total supply capacity of 18.4 MGD can be produced by 16 wells (4 inactive), with plans to expand that capacity to 27.9 MGD.

The District's historical billing data for its approximately 13,600 account from 2018 through 2022 was utilized to determine an average annual demand of 7.36 MGD. Using the land use codes provided in said billing data it was further determined that 73% of the District's water use comes from residential customers.

Future demands were determined through a combination of known development projects and anticipated infill. Projected demands for the 2025-2045 planning years were taken from the several preapproved planning documents that developed per capita was use, population, and density, culminating in a total ultimate demand of 11.1 MGD, or a 51% increase.

ES.3 Hydraulic Model

The District did not have a current hydraulic model, and therefore, a new model was constructed as part of this Master Plan using the InfoWater™ platform. District GIS data for its system facilities and atlas maps were used to develop the physical elements within the model. Topographic information was also obtained to assign elevations. As discussed above, demands were obtained from the District's billing data and imported into the model. System settings and controls were obtained from SCADA and discussions with Operations staff. In addition, tank levels and pump flows obtained from SCADA were used to determine diurnal demand patterns for each pressure zone within the District's system.

Calibration is a key component to developing a hydraulic model. The District's model was subjected to an EPS calibration using SCADA, as well as localized system field tests conducted through an extensive flow testing program. Overall, the model exhibited excellent calibration, meeting the calibration goals presented in Table 6.1.

The hydraulic model development and calibration are discussed in **Chapter 6**.

ES.4 System Evaluation

The system is evaluated under various existing and future (2045) demand conditions using the new hydraulic model. The planning criteria used for evaluating the system is discussed in **Chapter 5**. The hydraulic evaluation includes model analysis of the distribution system, desktop analysis of storage capacity, and desktop analysis of pumping capacity under existing demand and future demand scenarios. The system was evaluated with existing demands and future demands at 5-year increments through 2045. The system was also evaluated with the existing demands and 2040 demands under 72-hour MDD extended period simulations.

Model results of the 24-hour MDD EPS scenario indicate that the system generally maintains adequate service pressures and velocities that meet the criteria outlined in Chapter 5, with the exception of four areas. No projects are recommended at this time to remedy the issues in these areas. Rather, investigation is recommended to validate pipeline diameters.

The desktop storage analysis indicates that the existing system has adequate storage to meet the needs of the system. However, infill and development demands and conditions will require new storage reservoirs at each phased increment. In total, the District will require 9.3 MG of additional storage in order to meet storage criteria limits.

A similar desktop analysis of the booster pump stations shows that the existing system has adequate capacity to meet demands. However, due to the condition and location of the Low Northridge BPS, the District should replace, relocate, and upsize this facility. In the coming phases, 4 new pump stations will be required.

Details of the hydraulic analyses are discussed in **Chapters 6 and 8**.

ES.5 Capital Improvement Program (CIP)

Deficiencies found from the hydraulic analysis, desktop analysis were addressed with recommended CIP projects. These CIP projects include pipe condition assessments, pipe replacement, pipe upsizing, and new storage, supply, and pumping projects. These CIP projects are prioritized into short-term (5-Year, 2025) CIP and long-term CIP with estimated capital costs at 5-yr increments. Estimated capital costs are separated by District-funded and Developer-funded for project/development specific projects. Estimated costs of the 2025 CIP are approximately $55.3 million dollars for District-funded projects as presented in Table ES.1. Details of the CIP are discussed in **Chapter 10**.

ES.1 Summary of District-Funded CIP By Category

CIP Category	2025	2030	2035	2040	2045
Pumping	$ 3,246,375	$ 180,000	$ 2,542,500	$ 5,401,125	$ 180,000
Supply/Wells	$ 7,463,200	$ 240,000	$ 240,000	$ 240,000	$ 240,000
Storage	$ 9,305,594	$ 400,000	$ 10,933,413	$ 2,886,250	$ 9,275,913
Piping	$ 9,477,062	$ 28,096,000	$ 11,852,500	$ 11,852,500	$ 11,852,500
Other	$ 25,775,543	$ 150,000	$ 687,375	$ 150,000	$ 150,000
TOTAL	**$ 55,267,774**	**$ 29,066,000**	**$ 26,255,788**	**$ 20,529,875**	**$ 21,698,413**

Chapter 1 Introduction

1.1 General Description & Background

Desert Hot Springs, California's growth and development led to the establishment of the Old Mutual Water Company which provided groundwater to the community. In 1948, Old Mutual Water Company was incorporated into Desert Hot Springs Water Company, purchased by the Desert Hot Springs County Water District and renamed Mission Springs Water District (MSWD or District) in 1987. The District is located within the northeast portion of Riverside County and the Coachella Valley geographic region; see Figure 1.2.

The District was formed in response to a significant development in the Coachella Valley circa 1940 and an overall need for centralized water and wastewater systems. Since its formation, the District has grown to a service area of approximately 135 square miles. It serves roughly 13,500 water service connections for around 43,500 people across the City of Desert Hot Springs and in unincorporated areas of Riverside County.

The District has experienced some growth since the previous master plan was completed in 2007, with nearly 32 percent population influx. This increased population and expected future growth within the District have created a need for an updated potable water master planning document to guide the District's future planning and development.

1.2 Purpose, Goals, & Expectations

This 2022 Water Master Plan will serve as a high-level planning document to guide the District's future Capital Improvement endeavors. The existing potable water system has been documented and researched to create a baseline inventory of all major water-related assets. These facilities and assets were analyzed with hydraulic modeling software, and the remaining life-risk-based condition assessments provided the District with Capital Improvement Program (CIP) recommendations grouped in five-year increments for future improvements or expansions. These recommendations have been compiled in Section 9 – Capital Improvement Program (CIP).

This Water Master Plan was created to act as a high-level planning document and an easily accessible and transparent guide to inquiries about the District's potable water system. We understand that documents of this nature must provide full transparency to customers while providing District staff with information on existing and future water system improvements.

1.2.1 Population

Table 1.1 shows the historical population growth within the MSWD service area over the past 25 years and the expected population growth through 2045. MSWD's service area encompasses the City of Desert Hot Springs and some unincorporated areas of the County of Riverside. The 2007 WMP was used to determine the historical population. The 2020 Coachella UWMP shows that the MSWD service area serves a population of 43,517 people. Accordingly, the District's service area is expected to rapidly increase over the next 20 years to a population of approximately 72,280 residents. These estimates will be used to determine future demands.

Table 1.1 – Historic and Expected Population Growth

Planning Year	Population
1990	19,500
2000	26,100
2005	32,900
2010	35,738
2015	38,987
2020	43,517
2025	49,081
2030	54,414
2035	59.747
2040	66,064
2045	72,380

1.2.2 Land Use

The service area of MSWD is a developing area consisting predominantly of residential and open space lands. Table 1.2 show the land uses within the District based on the District billing information. The open space component is empty land predominantly of undeveloped desert, mountains, vacant land, and unknown land uses. These areas are controlled by federal agencies, including the Bureau of Indian Affairs, the Bureau of Land Management, and the Forest Service and are not slotted for any new development.

Table 1.2 – Land Use

Land Use Code	% of Total Accounts
Residential	73%
Commercial	5%
Government/Institution	1%
Industrial	1%
Other	19%

1.3 Regulatory & Environmental

All analysis and design criteria have been considered and abided by all regulations set forth by the U.S. Environmental Protection Agency (EPA), California State Water Resources Control Board (SWRCB), and other relevant regulating bodies.

1.4 Study Area

The scope of this WMP and the related CIP recommendations are limited to the District's established service area as of 2022. However, much supporting information, such as population projections and groundwater history, has been sourced from publications concerning the greater Coachella Valley geographic region. The service area includes the City of Desert Hot Springs, parts of Palm Springs Crest, West Palm Springs Village, West Garnet, and several unincorporated areas of Riverside County. The Service Area for MSWD is shown on Figure 1.1.

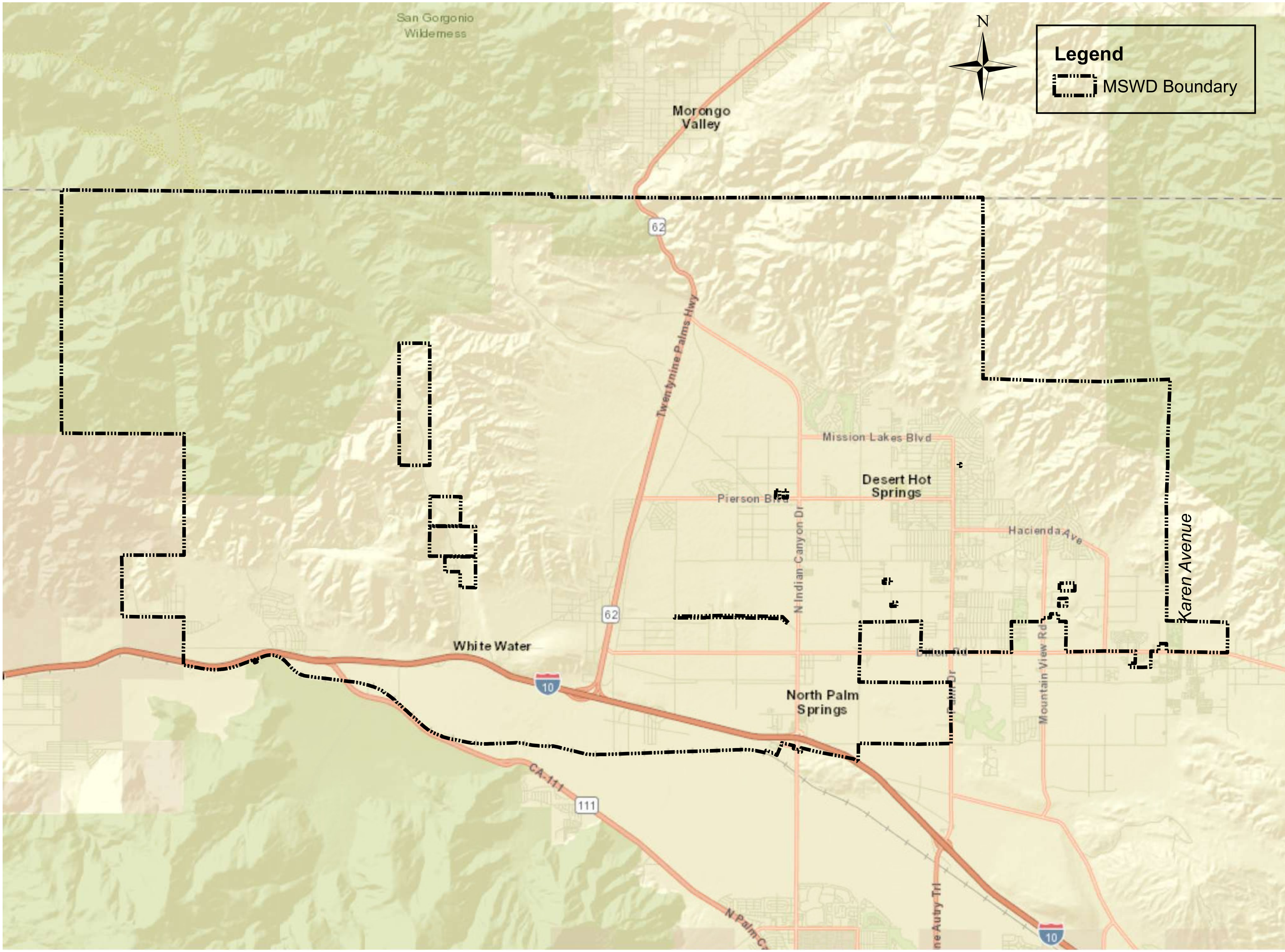


Figure 1.1 MSWD Service Area

Chapter 2 Existing Infrastructure

The District supplies potable water to nearly 13,500 service connections within the City of Desert Hot Springs and additional areas within unincorporated Riverside County. The service area covers four sub-basins within the Upper Coachella Groundwater Desert Hot Springs Basin and additional areas within the unincorporated Riverside County and portion of the City of Palm Springs. These four sub-basins are the Mission Creek Sub-Basin, the San Gorgonio Pass Sub-Basin, the Indio Sub-Basin (previously "Whitewater"), and the hot-water Desert Hot Springs Sub-Basin. The MSWD water system is only supplied by wells within the Mission Creek, Indio, and San Gorgonio Pass Sub-Basins. The "hot water" DHS Sub-basin contains high-temperature, mineral-rich water that does not contribute to the District's potable water supply. The overall system is broken into three distinct sub-systems: the main DHS System, the Palm Springs Crest (PSC) System, and the West Palm Springs Village (WPSV) System. Each system provides potable water service to various land uses, such as single-family and multi-family residential homes, mobile homes, commercial businesses, schools, parks, and District properties within these service areas.

2.1 Facility Inventory

Section 2.2 provides a general description of the major existing system facilities. This will be the basis for analysis of the current system and subsequent CIP Projects. The existing system facilities are shown on Figures 2.1 and 2.2, with a hydraulic schematic of how the system operates on Figure 2.3.

2.1.1 Production Wells

The District currently sources water from 16 groundwater wells within the Upper Coachella Groundwater Basin spread across several sub-basins. Key production well characteristics have been tabulated in Table 2.1.

Well Nos. 28 and 30 have been deemed out of service due to water quality issues, and Well Nos. 22 and 34 are currently offline. Plans for future operations in the coming fiscal year have been approved, and Well Nos. 22 and 34 will be placed back in service. Additionally, the District is in the process of completing Well No. 42, and Well No. 35 is receiving the pumping equipment required to bring this facility online.

Table 2.1 – Wells Facilities

Well No.	Year Built	Capacity (gpm)	HP
22[3]		0	400
24		2,200	600
25	1974	400	125
25A	2004	175	40
26	1928	350	100
26A	2001	170	40
27	1996	1,100	200
28[3]		0	600
29	2010	1,700	350
30[3]	1994	0	NA
31	1996	1,900	350
32	2005	2,000	150
33	2006	800	100
34[3]	2006	0	250
35 [1]		0	NA
37		2,000	350
42 [2]		0	NA
Total		**12,795**	

1) Well No. 35 has been drilled, but equipment was not installed at the time of drilling. Equipment and other appurtenances are to be installed in 2025.

2) Well to be constructed.

3) Well currently offline.

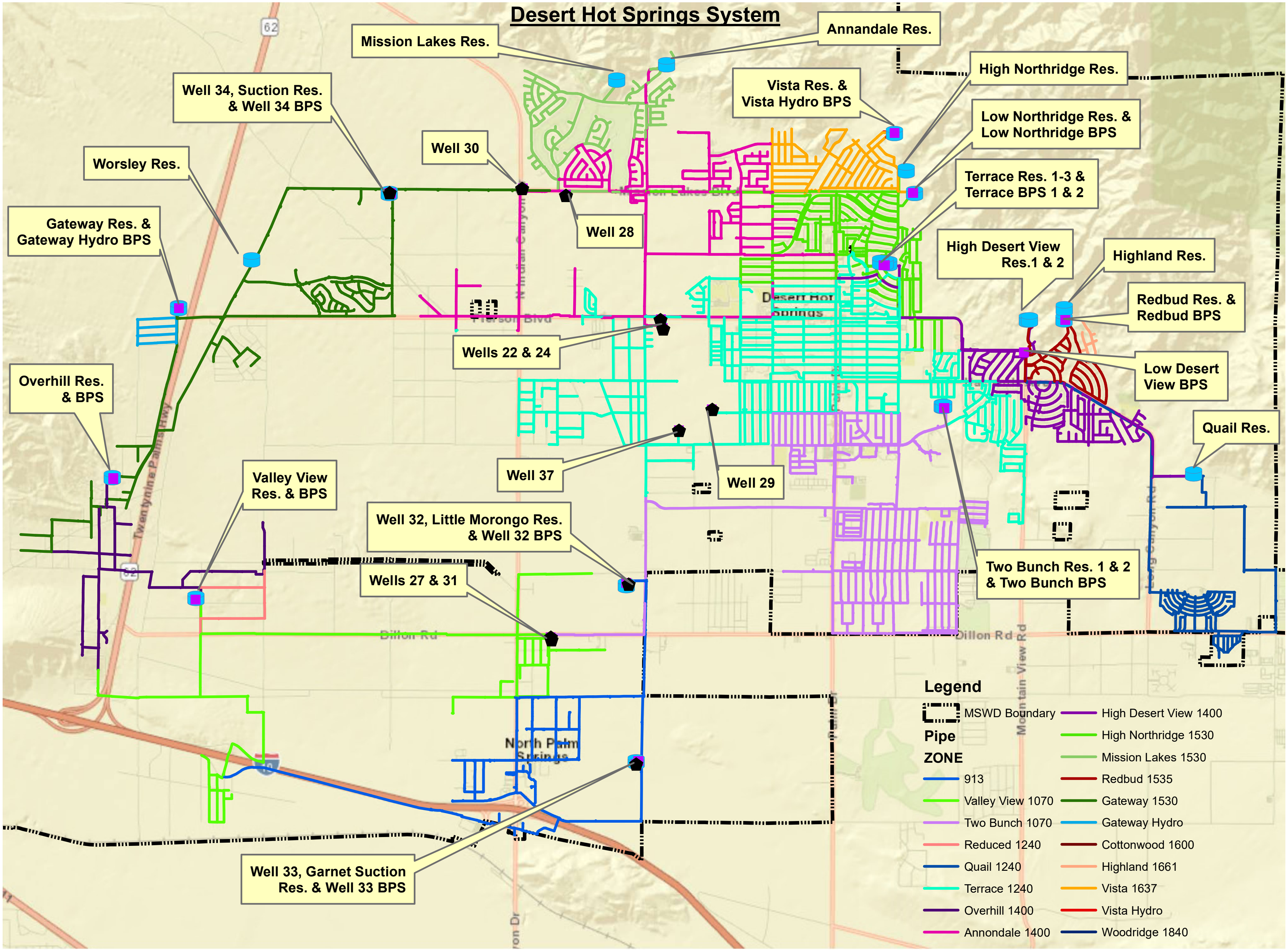


Figure 2.1 - Existing System (Desert Hot Springs System)

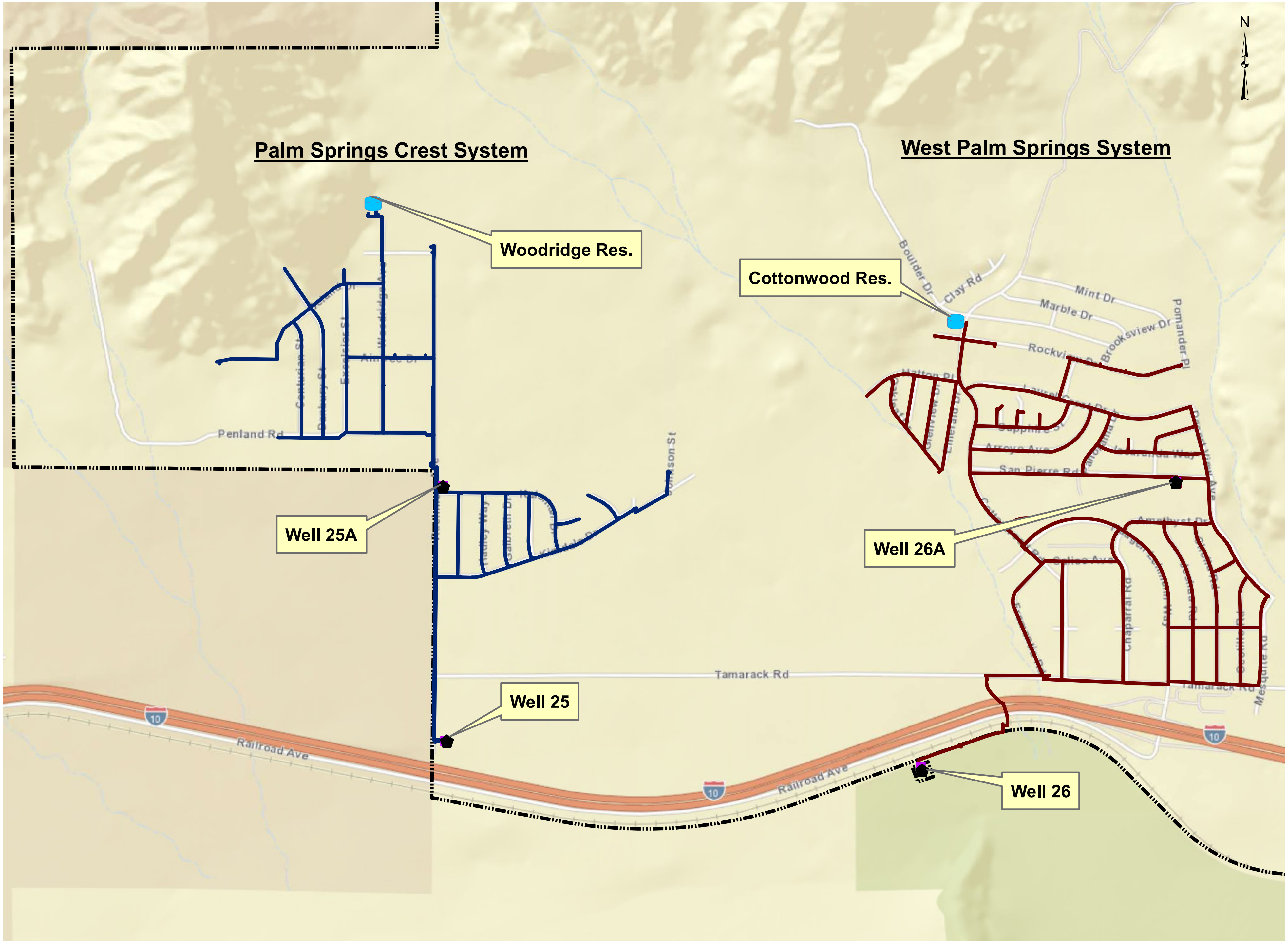


Figure 2.2 - Existing System (Palm Springs Crest & West Palm Springs Systems)

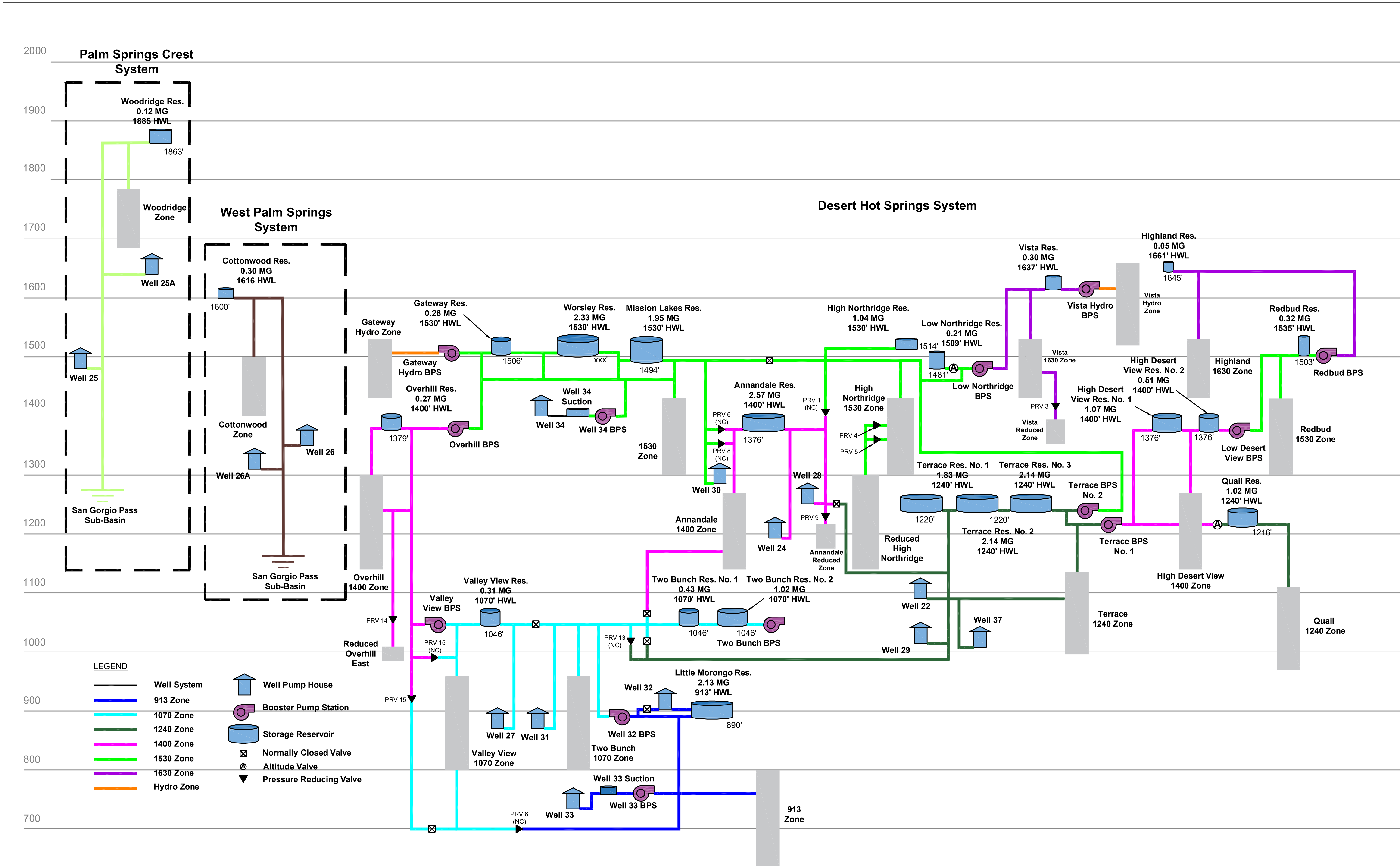


Figure 2.3 Existing System Hydraulic Schematic

2.1.2 Reservoirs

The MSWD system currently contains 24 water storage reservoirs. The storage reservoirs and their associated pressure zones are shown in Table 2.2.

Table 2.2 – Reservoir Facilities

Facility Name	Zone	Year Built	Type	Volume (MG)	Diameter (ft)	System	Seismic Valve/Install
Little Morongo	913	2005	Concrete	2.13	125.5	DHS	Yes/2020
Well 33 Suction	913	2006	Concrete	0.05	26.5	DHS	No
Two Bunch #1	1070	1973	Steel	0.43	55.0	DHS	Yes/2019
Two Bunch #2	1070	1988	Steel	1.02	85.0	DHS	Yes/2017
Valley View	1070	1988	Steel	0.31	47.0	DHS	Yes/2020
Quail	1240	1989	Steel	1.02	85.0	DHS	Yes/2019
Terrace #1	1240	1968	Steel	1.84	125.0	DHS	Yes/2019
Terrace #2	1240	1984	Steel	2.14	135.0	DHS	Yes/2019
Terrace #3	1240	1992	Steel	2.14	135.0	DHS	Yes/2006
Annandale	1400	1989	Steel	2.57	135.0	DHS	Yes/2015
High Desert View #1	1400	1992	Steel	1.07	87.0	DHS	Yes/2018
High Desert View #2	1400	1993	Steel	0.51	60.0	DHS	Yes/2019
Overhill	1400	1988	Steel	0.27	47.0	DHS	Yes/2020
Gateway	1530	1988	Steel	0.26	43.0	DHS	Yes/2020
High Northridge	1530	1981	Steel	1.04	105.0	DHS	Yes/2014
Low Northridge	1530	1957	Steel	0.21	36.0	DHS	Yes/2020
Mission Lakes	1530	1971	Steel	1.95	96.0	DHS	Yes/2013
Well 34 Suction	1530	2007	Concrete	0.08	36.0	DHS	No
Worsley	1530	2007	Concrete	2.33	108.0	DHS	Yes/2006
Redbud	1535	1959	Steel	0.32	41.0	DHS	Yes/2019
Cottonwood	1600	1960	Steel	0.28	55.0	WPSV	Yes/2020
Highland	1600	2008	Steel	0.05	23.8	DHS	No
Vista	1630	1966	Steel	0.30	40.0	DHS	No
Woodridge	1840	2003	Steel	0.12	30.0	PSC	Yes/2020

2.1.3 Booster Pump Stations

The overall MSWD system currently contains 11 booster pump stations: 2 hydropneumatic stations and 9 booster stations, with 2 booster stations coming directly from a well discharge (Well Nos. 32 and 33). The PSC and WPSV systems do not utilize booster stations for water distribution and instead operate on separated gravity-fed distribution systems from the Woodridge and Cottonwood Reservoirs. Pressure zone and booster station interactions are described in detail in Section 2.3. Table 2.3 shows the District's booster stations within their service area.

2.1.4 Pipelines

The MSWD system utilizes more than 279 miles of transmission and distribution pipelines. Pipe characteristics vary from eighty-year-old asbestos concrete pipes to newly installed ductile iron piping. The system also uses approximately 1,900 hydrants, 400 control valves, 80 sampling stations, 13,500 meters, and other related appurtenances. In addition, the District completed a system-wide conversion of traditional water meters to advanced or automated meters infrastructure (AMI) in 2019. This conversion and its effect on demand data are expanded upon in later sections.

Table 2.3 – MSWD Booster Stations

Pump Station	Zone From	Zone To	Unit	Capacity (gpm)	HP	Type
Well 32	--	913	1	1185	75	Turbine
			2	1185	75	Turbine
Well 33	913	1070	1	804	50	Turbine
			2	765	50	Turbine
Redbud	1530	1630	1	373	20	Submersible
			2	385	20	Submersible
Low Northridge	1530	1630	1	385	15	Reciprocating
			2	269	15	Reciprocating
Gateway Hydro	1530	1630	1	75	10	Centrifugal
			2	75	10	Centrifugal
			3	350	10	Centrifugal
Vista Hydro			1	93	5	Centrifugal
			2	93	5	Centrifugal
Low Desert View	1400	1530	1	700	25	Submersible
			2	700	25	Submersible
Overhill	1400	1530	1	564	30	Turbine
			2	588	30	Turbine
Terrace	1240	1400	1	446	50	Turbine
			2	464	50	Turbine
			3	706	75	Turbine
	1240	1530	4	605	75	Turbine
			5	732	60	Turbine
			6	780	60	Turbine
Two Bunch	1070	1240	1	1,068	75	Turbine
			2	1,091	75	Turbine
Valley View	1070	1400	1	583	75	Turbine
			2	602	75	Turbine

2.2 Pressure Zones

The following section describes the District's unique pressure zones. At the time of this report, the District is separated into six distinct pressure zones categorized by existing reservoir high water levels. Additional zone designations are used for different sections of the same HGL. The six also does not include hydropneumatic or reduced pressure zones. Each pressure zone and its related potable water infrastructure have been illustrated in a hydraulic schematic on Figure 2.3.

2.2.1 913 Zone

The 913 Zone is in the southernmost portion of the District. This area is generally north of the I-10, West of Little Morongo Rd, South of 18th Ave and West of Diablo Rd. This zone is also predominantly a commercial land-use area. The 913 Zone is 635 to 850 feet above msl and slopes southwesterly.

The 913 Zone consists of:

Storage Reservoirs:

2.13-MG Little Morongo

0.05-MG Well 33 Suction Tank

Wells:

Well Nos. 32 and 33

Booster Pump Stations:

Little Morongo BPS

Well 33 BPS

Well No. 33 pumps water from the Garnet Hill Subarea of the Indio Subbasin into the Well 33 Suction Tank, which acts as a suction forebay for the Well 33 BPS. The Well 33 BPS then pumps water throughout the 913 Zone and up to the Little Morongo Reservoir. Well No. 32 pumps water from the Mission Creek Subbasin directly to the Little Morongo Reservoir. Well 32 BPS then sends water from the 913 Zone to the 1070 Zone. This site allows either direct feed to the BPS via Little Morongo Reservoir, Well 32, or the suction 913 Zone via Well 33.

The Well No. 33 suction tank is a 0.05 MG reservoir that serves as a dosing point for the water treatment agent liquid sodium hypochlorite. This particular reservoir, as well as Well No. 34 suction reservoir, does not serve as a traditional storage reservoir but rather as suction pressure equalization for the next booster station and as a treatment source.

2.2.2 1070 Zone

1070 Zone includes two service areas: Valley View and Two Bunch. The Valley View Service Area is generally north of 18th Ave, east of the CA-62 Freeway, south of 16th Ave, and east of Little Morongo Rd. The Valley View 1070 Zone also comprises a small residential area east of the I-10 and CA-62 interchange. The Two Bunch 1070 Zone is generally located north of Dillion Rd, west of Little Morongo, south of Ironwood Dr, and east of Yerxa Rd. This Zone ranges between 800 to 970 ft above msl.

This Zone consists of:

- Storage Reservoirs:
  - 0.31-MG Valley View
  - 0.43-MG Two Bunch 1
  - 1.02-MG Two Bunch 2
- Wells:
  - Well Nos. 27 and 31 (both offline as of December 2024)
- Booster Pump Stations:
  - Two Bunch BPS
  - Valley View BPS

Well No. 27 extracts water from the Mission Creek Subbasin and is used to supply the Valley View 1070 Zone and fill the Valley View Reservoir to the west. The Valley View BPS sends water from the Valley View Reservoir to the Overhill 1400 Zone. Well No. 31 extracts water from the Mission Creek Subbasin and pumps water to the Two Bunch 1070 Zone and Two Bunch Reservoirs.

2.2.3 1240 Zone

There are two service areas within the 1240 Zone: Terrace and Quail. The Terrace Service is generally located north of Two Bunch Palms Trail, east of N Indian Canyon Dr, south of 4th St, and west of Mountain View Rd. The Quail Service Area is in the southeastern portion of the District and is generally east of Long Canyon Rd and South of Hacienda Ave. Hydraulically, these two areas are currently connected through normally closed valves.

This Zone consists of:

- Storage Reservoirs:
  - 1.84-MG Terrace No. 1, 2.14-MG Terrace No. 2, and 2.14-MG Terrace No. 3
  - 1.02-MG Quail Reservoir

Wells:

Well Nos. 22 (currently offline), 29, and 37 (offline as of December 2024)

Booster Pump Stations:

Terrace BPS Nos. 1 and 2

The three wells extract water from the Mission Creek Subbasin to service the Terrace 1240 Zone. The Terrace BPS includes two separate sets of pumps: BPS No. 1 sends water from the Terrace Reservoirs to the High Northridge 1530 Zone and BPS No. 2 to the High Desert View 1400 Zone. Several closed valves serve as zone interties between the Terrace and 1400 Zones. The Quail Reservoir is supplied through the High Desert View 1400 Zone through an altitude valve due to matching overflow elevations between the Terrace and Quail reservoirs and prevents overtopping of the Quail Road reservoir.

2.2.4 1400 Zone

The 1400 Zone has three separate Service Areas: High Desert View, Annandale, and Overhill. The Overhill 1400 Zone is generally located north of Dillion Rd, east of Marion Ave, south of Painted Hills Dr, and west of Diablo Rd. The Annandale 1400 Zone is situated north of Pierson Blvd, east of Karen Ave, south of Avenida Jalisco, Mesa Ave, and Warwick Dr, and west of West Dr. The High Desert 1400 Zone is located north of Panorama Dr, east of Miracle Hill Rd, and west of Mountain View Rd and Hacienda Ave. This Zone has an elevation between 1,140 and 1,300 feet above sea level.

The Annandale 1400 Zone consists of:

Storage Reservoirs:

2.57-MG Annandale Reservoir

Wells:

Well No. 24

Well No. 28 (currently offline)

Well No. 42 (currently under construction to be operational in 2024)

Booster Pump Stations:

Well 34 BPS (currently offline)

The Overhill 1400 Zone consists of:

Storage Reservoirs:

0.27-MG Overhill Reservoir

Wells: None

Booster Pump Stations:

Overhill BPS

The Overhill 1400 Zone is supplied through the Valley View BPS and delivers water to the Gateway 1530 Zone. A normally-closed pressure-reducing valve also connects the Valley View 1070 Zone with the Overhill 1400 Zone in Vernon Rd north of Gary Ave.

The High Desert View 1400 Zone consists of:

Storage Reservoirs:

1.07-MG High Desert View No. 1

0.57 MG High Desert View No. 2

Wells: None

Booster Pump Stations:

Low Desert View BPS

Water is supplied to the High Desert View 1400 Zone by the Terrace BPS No. 2. The Low Desert View BPS sends water to the Red Bud 1535 Zone. This Zone also transmits water to the Quail Reservoir in the 1240 Zone via an altitude valve.

2.2.5 1530 Zone

The 1530 Zone has four Service Areas: Gateway, Mission Lakes, High Northridge, and Redbud (1535). The Gateway Zone is generally located along the CA-62 freeway, west of Karen Ave, and along Pearson Blvd, generally north of the Overhill 1400 Zone. The Mission Lakes 1530 Zone is located north of Mission Lakes Blvd between Indian Ave and Little Morongo Rd. The High Northridge Zone is generally located south of Mission Lakes Blvd, east of West Dr, north of Pearson Blvd, and south of Mission Lakes Blvd. Lastly, the Redbud 1535 Zone is located north of Hacienda Ave, east of Mountain View Rd. The zone elevations range between 1,300 and 1,430 feet above msl.

The Gateway 1530 Zone includes:

Storage Reservoirs:

0.26-MG Gateway

2.33-MG Worsley

Wells: None

Booster Pump Stations:

Gateway Hydropneumatic HBPS

The Gateway 1530 Zone is supplied water from the Overhill BPS and 1400 Zone to the south. The Gateway HBPS at the Gateway Reservoir Site also pumps water to an area west of CA-62 and south of Pearson Blvd known as the Gateway Hydro zone. The station pumps into a closed system (no storage provided) and includes a fire pump to supply water to the Gateway Hydro Region in case of a fire.

The Mission Lakes 1530 Zone includes:

Storage Reservoirs:

1.95-MG Mission Lakes

Wells:

Well No. 30 (currently offline)

Well No. 34 (currently offline)

Well No. 35 (currently under construction to be operational in 2025)

Well No. 36 (currently under construction to be operational in 2025)

Booster Pump Stations: None

Supply wells for this zone extract water from the Mission Creek Subbasin. When in operation, Well No. 34 pumps water to Well No. 34 Suction Reservoir for disinfection and from there pumped into the 1530 Zone. Several normally-closed valves allow water from the Mission Lakes 1530 Zone to transfer to the Annandale 1400 Zone and the and High Northridge 1530 Zone.

The High Northridge 1530 Zone includes:

Storage Reservoirs:

1.04-MG High Northridge Reservoir

0.21-MG Low Northridge Reservoir

Wells: None

Booster Pump Stations:

Low Northridge BPS

The High Northridge Zone is typically supplied through the Terrace BPS No. 1. An altitude valve connects the Low Northridge Reservoir, which has a HWL of 1509 ft, to prevent overflowing. The Low Northridge BPS sends water from the Low Northridge Reservoir to the Vista 1630 Zone. The High Northridge Zone can also transfer water to the Annandale 1400 Zone through a normally-closed PRS.

The Redbud 1535 Zone includes:

Storage Reservoirs:

0.32-MG Redbud Reservoir

Wells: None

Booster Pump Stations:

Redbud BPS

The Redbud 1535 Zone is supplied by the 1400 Zone via the Low Desert View Pump Station. The Redbud BPS sends water from the Redbud Reservoir to the Highland Reservoir and 1661 Zone.

2.2.6 1630 and 1661 Zones

The Vista 1630 Zone is located north of Mission Lakes Blvd and east of West Dr and is supplied by the Low Northridge BPS. This Zone includes the 0.30-MG Vista Reservoir (HWL of 1637 ft). No wells currently pump directly into this Zone. The Vista Zone also supplies the Vista Hydro Zone located near the Vista Reservoir. The Vista Hydro BPS serves a small handful of homes at the intersection of Puesta Del Sol and Valencia Dr.

The Highland 1661 Zone is located east of Redbud Rd and north of Deodar Ave and is supplied by the Redbud BPS. This Zone includes the 0.05-MG Highland Reservoir (HWL of 1661 ft). No wells currently pump directly into this Zone.

2.2.7 Reduced and Hydropneumatic Zones

Based on the District's standardized pressure zones there are areas that would likely receive higher or lower than desired service pressures. These areas are therefore served through either pressure regulation or pumped hydropneumatic (hydro) systems. Desired minimum and maximum service pressures are discussed in Chapter 5. Currently, there are only two hydropneumatic zones – Gateway Hydro and Vista Hydro.

2.3 Palm Springs Crest & West Palm Springs Pressure Zones

The PSC and WPSV water systems include the Woodridge 1840 Zone and Cottonwood 1630 Zone. These separated water systems are located west of the DHS System, with topographic elevations ranging from 1,430 to 1,700 feet above msl. These pressure zones are located east of the unincorporated area of Cabazon, north of the I-10, and west of the Whitewater Riverbed.

2.3.1 Palm Springs Crest System

The Woodridge 1840 Zone makes up the PSC System, which is located north of I-10 along Rushmore Ave. This system is in the western-most portion of the District's service area and includes service elevations ranging from 1480 to 1840 ft above msl.

This system includes:

- Storage Reservoirs:
  - 0.12-MG Woodridge Reservoir
- Wells:
  - Well Nos. 25 and 25A
- Booster Pump Stations: None

The wells within the PSC system pull from the San Gorgio Pass Subbasin. Well Nos. 25 and 25A directly supply water to the Woodridge 1840 Zone and Woodridge Reservoir.

2.3.2 West Palm Springs System

Due east of PSC is the West Palm Springs 1600 Zone, location north of I-10 between Cottonview Rd and Desert View Ave. This system includes service elevation ranging from 1350 to 1590 ft above msl.

This system includes:

- Storage Reservoirs:
  - 0.28-MG Cottonwood Reservoir
- Wells:
  - Well Nos. 26 and 26A
- Booster Pump Stations: None

The wells within the WPS 1600 Zone pull from the San Gorgio Pass Subbasin. Well Nos. 26 and 26A directly supply water to the Cottonwood 1600 Zone and Cottonwood Reservoir.

Chapter 3 Water Supply

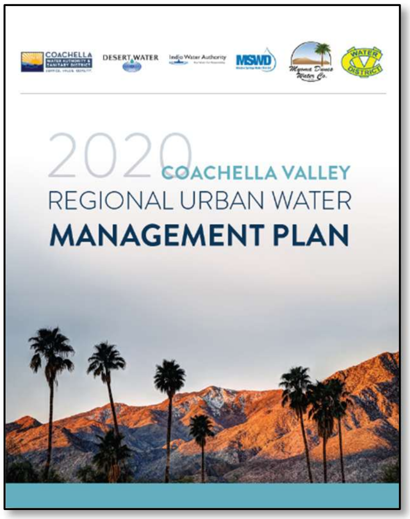
3.1 General Description

MSWD's water is sourced entirely via groundwater wells within the Coachella Groundwater Basin, which is more than 800 square miles extending from the San Bernadino Mountains to the northern shore of the Salton Sea. There is currently a total of 16 groundwater wells spread throughout the system, with plans for additional wells in the near future. The groundwater basins serving MSWD are shown on Figure 3.1.

3.2 Groundwater Basins

The MSWD water system is supplied via groundwater wells by one of three main potable sub-basins within the Coachella Groundwater Basin: Mission Creek, San Gorgonio Pass, and Indio Subbasins. These subbasins were formed by active faults making up the San Andreas Fault system.

The Desert Hot Springs Subbasin, while a part of the overall Coachella Groundwater Basin, is a "hot water" system supplying high-temperature mineralized water used for numerous spas and hotels within the City. This Sub-basin is not considered a potable water source and will not be discussed further in this report.

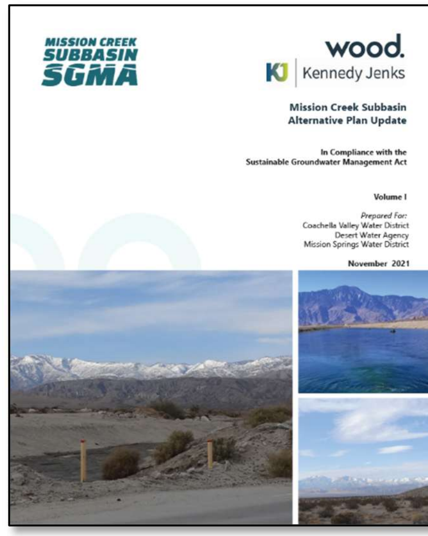


MSWD is one of the six water suppliers that make up the Coachella Valley Regional Water Management Group. The other suppliers include: CVWD, Coachella Water Authority (CWA), DWA, Indio Water Authority (IWA), and Myoma Dunes Mutual Water Company (MDMWC). These agencies collaborate on the most effective use and groundwater management practices for the area, as presented in the 2020 Coachella Valley Regional Urban Water Management Plan (CVRUWMP). Geographically, MSWD is the northernmost water district of these agencies.

3.2.1 Groundwater Subbasins

MISSION CREEK SUBBASIN

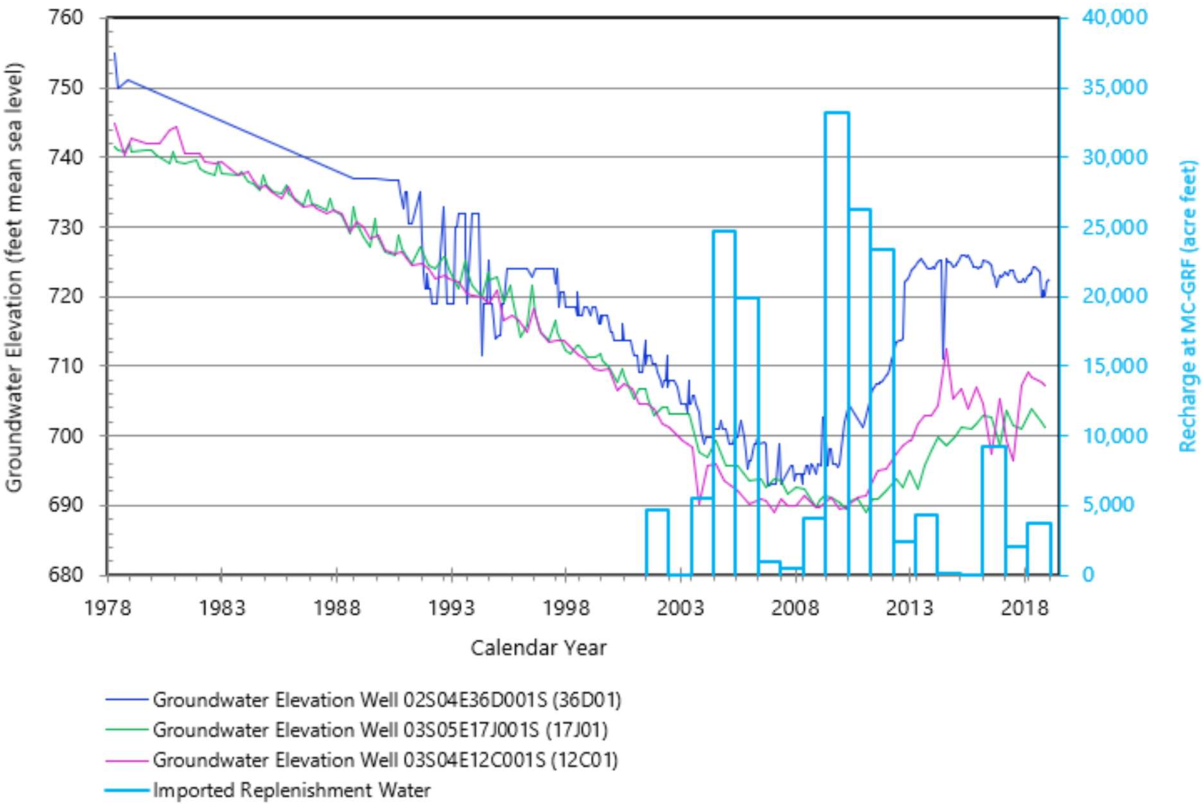
The Mission Creek Subbasin (MCSB) is approximately 77 square miles and supplies water to the entirety of the DHS system. MCSB is bounded by the Banning Fault on the south, Mission Creek Fault to the north and east, and the San Bernadino Mountains to the west. The subbasin is naturally recharged by several area washes and mountain drainage areas, in addition to irrigation drainage and regional wastewater disposal systems.



In the 1990s, CVWD and DWA recognized the need to address declining groundwater levels in the MCSB and implemented a water recharge program in 2002 and constructed the Mission Creek Groundwater Replenishment Facility (MCGRF). Recharge water was contracted by CVWD and DWA with MWD to transfer water rights in the State Water Project (SWP) for Colorado River Aqueduct (CRA) water. Groundwater production in this subbasin has decreased in recent years to less than 14,000 AFY, primarily due to conservation efforts. According to the 2021 Mission Creek Subbasin Alternative Plan (MCSAP), imported water deliveries for recharge to the MCWRF are expected to increase from an average of 7,143 AFY in 2020 to 12,536 AFY in 2045. The average recharge rate produced from this effort is 9,180 AFY but ranges from 0 to 33,210 AFY. Figure 3.2, taken from the MCSAP, shows the direct impact of water recharge efforts since 2002. According to the 2020 CVUWMP, MSWD currently maintains 100,000 AFY of SWP transfer allocations.

Additional information regarding the Mission Creek Subbasin can be found in the MCSAP (Wood/Kennedy Jenks).

Figure 3.2 – Hydrographs of Wells with Groundwater Replenishment at MCWRF



According to the CVRUWMP, the Mission Creek Subbasin has an estimated capacity of 2.6 million AF.

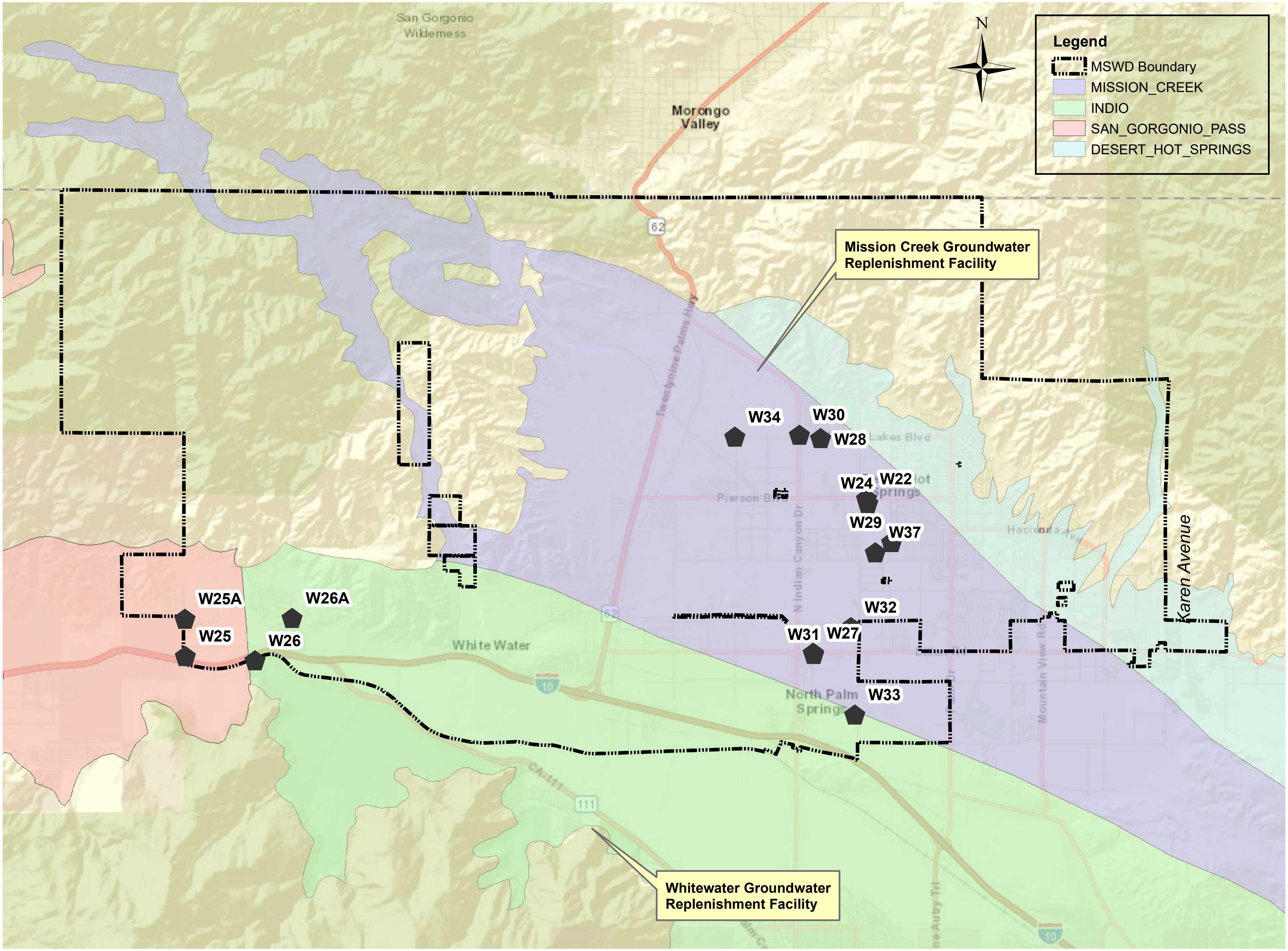
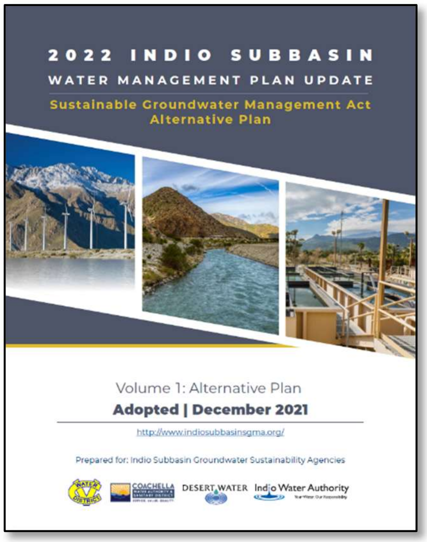


Figure 3.3 Groundwater Subbasins

INDIO SUB-BASIN


2022 INDIO SUBBASIN
WATER MANAGEMENT PLAN UPDATE
Sustainable Groundwater Management Act Alternative Plan
Volume 1: Alternative Plan
Adopted | December 2021
http://www.indiosubbasinsgma.org/
Prepared for: Indio Subbasin Groundwater Sustainability Agencies
COACHELLA DESERT WATER Indio Water Authority

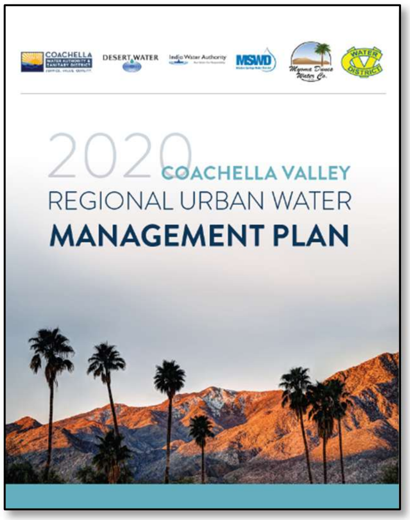
The Indio Subbasin totals approximately 400 square miles, southwest of the Mission Creek Subbasin, stretching from Palm Springs to the Salton Sea, and is bounded by uplifted bedrock. The upper 2,000 ft of the subbasin makes up the majority of the aquifer, providing the primary source of groundwater storage. Groundwater levels in this subbasin reaches their lowest point circa 2009 before increased storage efforts through groundwater management plans stopped this decline. The subbasin is naturally recharged through agricultural and urban return flows, as well as groundwater replenishment at the Whitewater Replenishment Facility, Palm Desert Groundwater Replenishment Facility, and the Thomas E. Levy Groundwater Replenishment Facility.

Replenishment efforts within this subbasin were implemented as early as 1973, similar to those in Mission Creek Subbasin, through the purchase of additional SWP transfers to take water from CRA through MWD, at the Whitewater River Replenishment Facility. Additional information regarding the Indio Subbasin can be found in the 2022 Indio Subbasin Water Management Plan Update (Todd Groundwater/Woodard & Curran).

The Garnet Hill Subbasin, while included as a part of the MCSPA, has been identified as part of the Indio Subbasin by DWR. For compliance with DWR approvals, any mention of Garnet Hills in this Master Plan should be considered as the Indio Subbasin.

The northwest portion of the subbasin is within the MSWD boundary and three of the District's production wells. These wells contribute to both the DHS system and the WPS system. According to the CVRUWMP, the Indio Subbasin has an estimated capacity of 28.8 million AF.

SAN GORGONIO SUBBASIN



The San Gorgonio Pass Subbasin supplies the PSC System. The subbasin is located southwest of the Mission Creek Subbasin, north of the San Jacinto Mountain Range and south of the San Bernardino Mountains. The subbasin is further divided into four storage units: Banning Bench, Banning, Beaumont, and Cabazon Storage Units. The Cabazon Storage Unit is approximately 11 square miles in area is naturally recharged from runoff from the nearby San Jacinto and San Bernadino Mountains. MSWD currently operates two wells within this subbasin.

3.3 Groundwater Treatment

Groundwater quality varies by depth; proximity to fault lines, recharge facilities, and surface runoff contaminants; and other factors. Monitoring efforts within the Coachella Valley has shown that all state and federal drinking water quality standards are met, with the exception of arsenic and chromium-6. Both are naturally occurring substances. Arsenic levels are met through a combination of treatment and blending. Chromium-6, also referred to as Cr-6 occurs due to the erosion of natural deposits. In 2017, a California judge invalidated the Maximum Contaminant Level (MCL) levels for Cr-6 and directed DWR to establish a new one. This decision was made in 2023, which established the MCL for Cr-6 at 10 parts per billion (ppb, or µg/L). In addition, total dissolved solids (TDS) and salinity are of notable concern and are monitored through the Coachella Valley Groundwater Basin Salt and Nutrient Plan.

All MSWD wells are treated with sodium hypochlorite at each wellhead to maintain a minimum residual 0.5 mg/L chlorine level within the supply. The 2005 Water Master Plan established the following treatment procedure, which the District adopted:

Liquid sodium hypochlorite 55-gallon drum storage with secondary containment, 10-gallon drums used for smaller wells (25A and 26A)

Sodium hypochlorite metering pumps (one duty/one standby per wellhead)

Sodium hypochlorite diffuser assembly

A plug flow chlorine contacts basin or pipeline sized for a CT of three (3.0), based upon 4-log virus reduction

Well start-up pump-to-waste valve

3.4 Water Conservation

In response to ongoing drought protection and supplemental to the CVRUWMP, the District prepared their Water Shortage Contingency Plan (WSCP) in 2021. Each of the six governing agencies within Coachella Valley was required to adopt their own WSCP to address water shortages.

As presented in the CVRUWMP, the groundwater basins produce enough water to sustain use during dry periods. However, natural recharge is less than typical basin production, requiring recharge from other sources, in this case, from SWP exchanges with CRA. According to the WSCP, drought conditions have little to no effect on the CRA deliveries due to CVWD's high priority allocation. However, drought conditions do affect SWP deliveries (exchanges), thereby reducing reliability on CRA deliveries via exchange. As this water is used for replenishment, only a prolonged drought directly on SWP deliveries would require water use restrictions.

The California Urban Water Management Planning Act (Act) requires that water suppliers prove that their anticipated water supplies can meet projected water use 5-yr increments for 25 years. Such increments should assess single and multiple dry year periods. The CVRUWMP reviewed the District's ability to meet these requirements, using the worst-case dry year of 2014, where only 5 percent of the SWP exchange deliveries were available for replenishment. This review demonstrated that under all scenarios, the District's water supply source is reliable through the 2045 horizon year.

DWR has defined the six standards for water shortage levels and the appropriate response levels:

Level 1

- <10% Supply shortage
- Normal supplies
- Mandatory restrictions defined by state
- Rebate programs

Level 2

- <20% Supply shortage
- Slightly limited supplies
- Outdoor restrictions, time of day
- Water policing

Level 3

- <30% Supply shortage
- Moderately limited supplies
- Outdoor restrictions, days per week
- Restriction on filling pools

Level 4

- <40% Supply shortage
- Limited supplies
- Limits on new landscaping
- Expanded public info campaign

Level 5

- <50% Supply shortage
- Significantly limited supplies
- Limits on watering parks or school grounds

Level 6

- >50% Supply shortage
- Severe shortage or catastrophic event
- No potable use for outdoor purposes

3.5 Wells

3.5.1 Well Production Capacity

The District relies solely on wells to produce potable water for its service area. Therefore, these wells must meet certain demand conditions to ensure that the District can meet the water needs of its customers.

The District has 16 wells, 4 of which are inactive, with plans to construct two completely new wells (Well Nos. 36 and 42), as well as install mechanical equipment at Well No. 35 to bring it into operation. Table 2.1 shows each existing well and production capacity. As of this Master Plan, the design well production of the District's existing wells is 12,795 gpm (18.4 MGD). With the new wells proposed, this will bring the District's well supply to 19,935 gpm (27.9 MGD).

Chapter 4 Water Demand

This Chapter will review the District's existing and projected potable water demands through year 2045. It will also determine future demands within the system as the District service area further develops.

4.1 Water Demands

This section describes the District's existing and projected potable water demands. The existing water demand section consists of a discussion of the historical water consumption, historical water supply, water loss, and recent peaking factors. The future water demand section consists of a description of the per-capita water use methodology used and demand projections through year 2045, as well as the anticipated phasing of demands in 5-year segments.

4.1.1 Existing and Historical Demand

Water demand consists of water that leaves the distribution system through metered and unmetered connections (such as fire hydrants.) Additional unmetered flows contributing to water consumption include maintenance flushing, reservoir cleaning, and pipeline leaks and/or breaks. The District meters all customer accounts, including temporary construction meters and irrigation meters. Supply wells and pumps stations are also monitored. To more accurately account for water consumption, the District installed automatic meter reading (AMR) through the service area in 2022. As a result, the District and its customers can track water demand and losses.

A description of historical water consumption, water supply, and the estimated amount of water loss or unaccounted for water is presented below.

The District provided historical customer billing records for 2018 through 2022. The customer billing records include 67 different land use codes that have been condensed into 5 main categories: Residential, Commercial, Government/Institutional, Industrial, and Other.

Based on consumption data provided, the District had an average consumption demand of 7.36 MGD. Table 4.1 summarizes consumption per land use. Residential use makes up 73 percent of the District's consumption. This is expected as the service area predominantly comprises residential users.

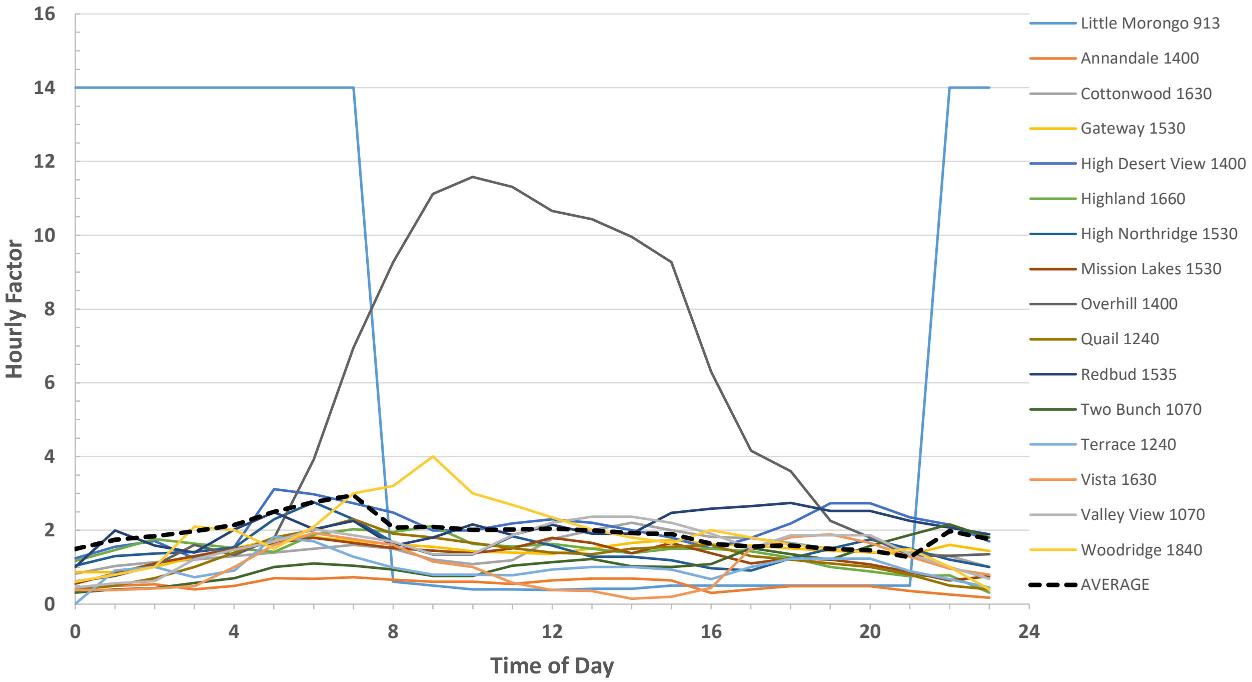
Table 4.1 – Historical Average Water Demand by Land Use

Land Use Type	AAD (gpm)	AAD (MGD)	Percent of Total
Residential	3,713.0	5.35	73%
Commercial	261.0	0.38	5%
Government/Institution	73.7	0.11	1%
Industrial	69.9	0.10	1%
Other	993.6	1.43	19%
TOTAL	***5,111.1***	***7.36***	***100%***

4.2 Diurnal Curve

The diurnal curves in Figure 4.1 are based on hourly volumes during the day for the calibration period provided. This chart shows the District has two peaks during the day at approximately 7:00AM and 8:00PM. It should be noted that the Overhill 1400 and Little Morongo 913 Zones both have abnormal curves. The Overhill 1400 system and demands resemble usage typical for industrial areas, or areas with higher-than-normal irrigation usage, while the Little Morongo 913 system has a large day usage, typical of predominantly commercial areas.

Figure 4.1 – MSWD Diurnal Curves



4.3 Peaking Factors

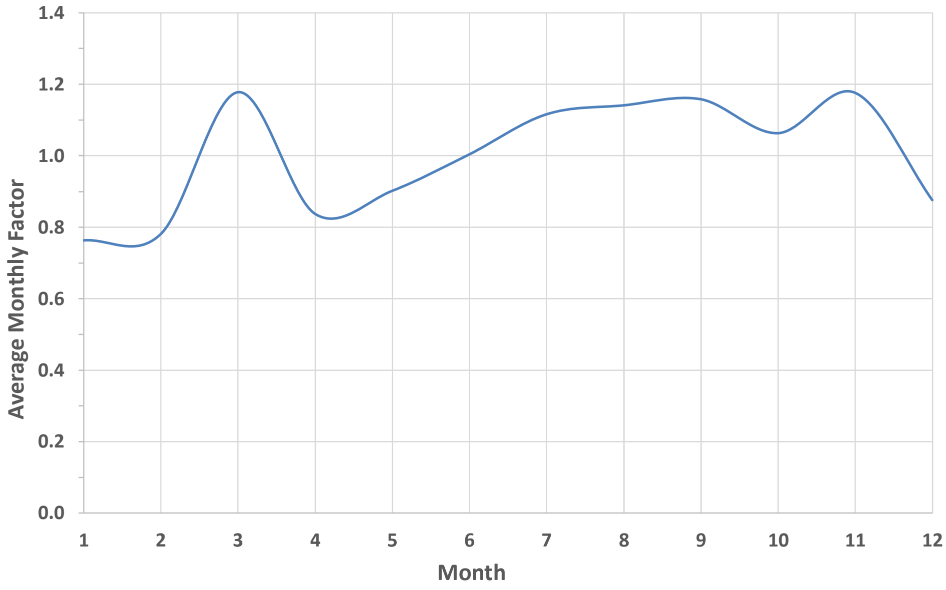
Peaking factors are typically used to determine the water demands under certain conditions other than average day demand (ADD). Peaking factors fluctuate on a seasonal and hourly basis. For example, on a hot summer day, water use is typically higher than on a cold wet winter day due to increased irrigation usage.

The peaking factors determined in this Master Plan include factors for Maximum Day Demand (MDD), Maximum Month (MM), and Peak Hour Demand (PHD). These factors were determined using available SCADA information during the model calibration process. Each factor is then applied to the ADD to determine the appropriate water usage for that time.

4.3.1 Monthly Peaking Factors

Monthly peaking factors represent the seasonal fluctuation in demand. These factors were established from historical billing data. Based on the monthly totals during the billing period provided, the Maximum Month Demand (MMD) is March with a factor of 1.18, and Minimum Month Demand (MinMD) is January, with a factor of 0.76. The monthly averages are shown in Figure 4.2. Typical factors among other water agencies in Southern California are around 1.3 for MMD and 0.5 for MinMD. However, given the nature of the District and weather in the area, it is reasonable to see dampened monthly factors with less variation throughout the year.

Figure 4.2 – Monthly Demand Factors



4.3.2 Maximum Day and Peak Hour Demand Factors

Maximum day peaking factor represents the ratio of the largest daily demand over the course of a single year to the ADD for that same year. The MDD peaking factor can then be used for future planning years to determine certain criteria, such as tank volume, pumping rate, velocity and pressure. Figure 4.1 presents the diurnal curves created by operational SCADA and the corresponding hourly peaking factors for each pressure zone. As discussed above, several zones exhibit abnormalities with respect to a composite (residential and non-residential) curve. For determining the MDD factor for the District as a whole, these zones are set aside. Figure 4.3 below shows the resulting composite diurnal curve for the DHS systems, and Figure 4.4 shows the diurnal curves for both the Palm Springs Crest and West Palm Springs Village systems.

It is recommended that the DHS water system use a MDD factor of 1.5 for planning purposes. In addition, it is recommended that the Palm Springs Crest and West Palm Springs Village use a MDD factor of 2.0 for planning purposes.

Figure 4.3 – Average Composite Diurnal Curve (DHS Only)

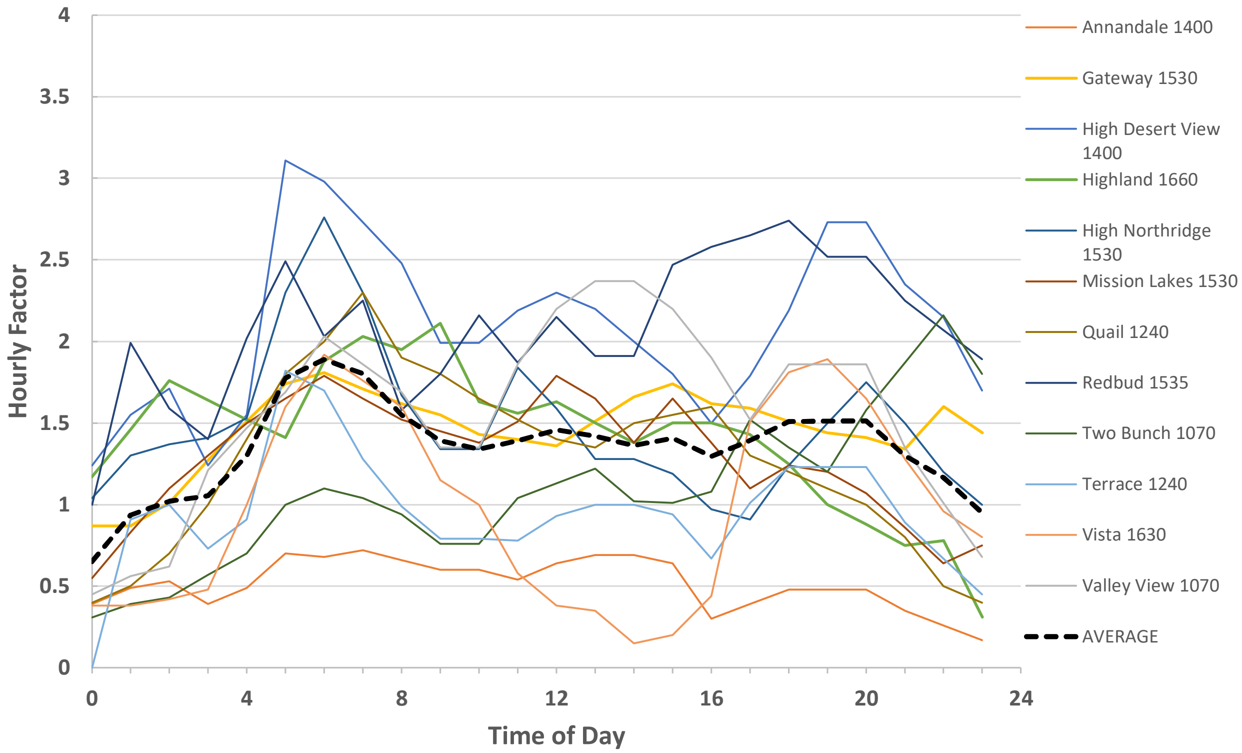
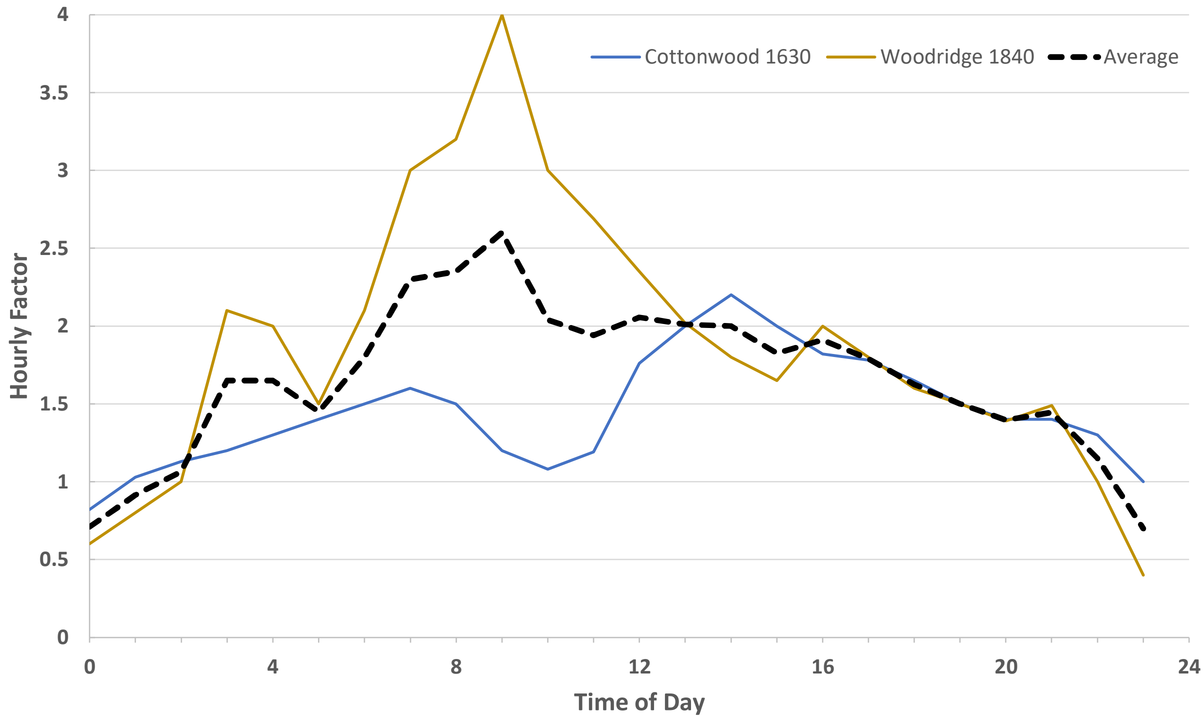


Figure 4.4 – Average Composite Diurnal Curve for WPS & PSC Systems



Based on the diurnal curves, the PHD factor for the DHS water system averages 1.9. It is recommended that the DHS water system use a peak hour demand factor of 2.0 for planning purposes. Individual regions have different peak hour demand factors, depending on the land use within each region. For example, the Palm Springs Crest and West Palm Springs Village systems have higher peak-hour demand factors, closer to 2.0. It is recommended that the Palm Springs Crest and West Palm Springs Village use a PHD factor of 2.5 for planning purposes.

4.4 Fire Flow

The fire flow requirements are designed so that the District can provide adequate water for fire suppression and ensure enough protection is provided during fire emergencies. These fire flow requirements were used in the hydraulic model to analyze the water distribution system in Sections 6 and 7. After discussions with the local fire department, the overall fire flow requirement is set at 1,500 gpm for 2 hours.

4.5 Future Water Use

Projected water uses and demands will create the basis for analyzing the future MSWD water system and related CIP items. Projected demands for the 2025-2045 planning years were taken from the MCSAP and the CVUWMP and will serve as the primary resource for this section.

4.5.1 Methodology

The District is comprised of known developments in multiple stages of completion, from due-diligence planning to multiple phases of construction, as well as unknown infill projects. Several of the known projects have water studies that have been reviewed and approved by the District with projected demands while others have not. These developments are shown on Figure 4.5 and presented in Table 4.2. Additional information regarding demand methodology is provided in Appendix A.

The MCSAP provided a per capita water use for planning purposes of 195 gpdc, 3.11 persons/DU, or 0.085 persons/acre. This water use was then applied to each known development to determine the appropriate population. The 2025-2045 demand projections were developed using assumptions provided by District staff regarding the timing of certain projects.

Table 4.2 – Future Development Population Projections

Development Name	Land Use	Area (ac)	DUs	Projected Demand (MGD) [a]	Increase in Population
Desert Hot Springs 109 Industrial	Industrial	110	--	0.81	4,157
Desert Harvest SPA	Commercial/ Industrial	65	--	0.22	1,143
Desert Land Ventures	Mixed Use	123	--	0.37	1,888
Vista Rosa	SFR	222	1,251	1.24	3,891
Tuscan Hills Community	Hotel	554	--	0.95	4,889
Skyborn	SFR	--	1,796	--	5,586
Green Day Village	SFR & Commercial	--	612	0.47	2,398
Two Bunch Palms [b]	Mixed Use	285	--	--	--
Coachillin' Industrial Park [c]	Commercial/Ag	161	--	0.36	1,832
Rancho Descanso	SFR	--	76	--	236
Miscellaneous Infill	--	--	--	--	2,842
TOTAL					**28,863**

a) Projected Demand per planning studies provided by the District.

b) Per District staff, the Two Bunch Palms Development is not anticipated to be constructed.

c) Per District staff, the Coachillin' Industrial Park is approximately 30% constructed, and the remaining 70% is presented in Table 4.2.

4.5.2 Projected Potable Water Demands

District-wide ADD is expected to increase from 7.4 MGD currently to 11.1 MGD in 2045. This represents a 51 percent increase. The projected water demands and corresponding population for each planning year are provided in Table 4.3. In addition, Table 4.3 presents the population and demand data provided in the MCSAP and CVUWMP and to be consistent, these are the prevailing targets for this Master Plan. Typically, existing demands are incrementally decreased over the planning periods in anticipation of water conservation efforts and reduced water losses. However, the per capita use of 195 gpdc is rather conservative and as such, will be used throughout the planning years.

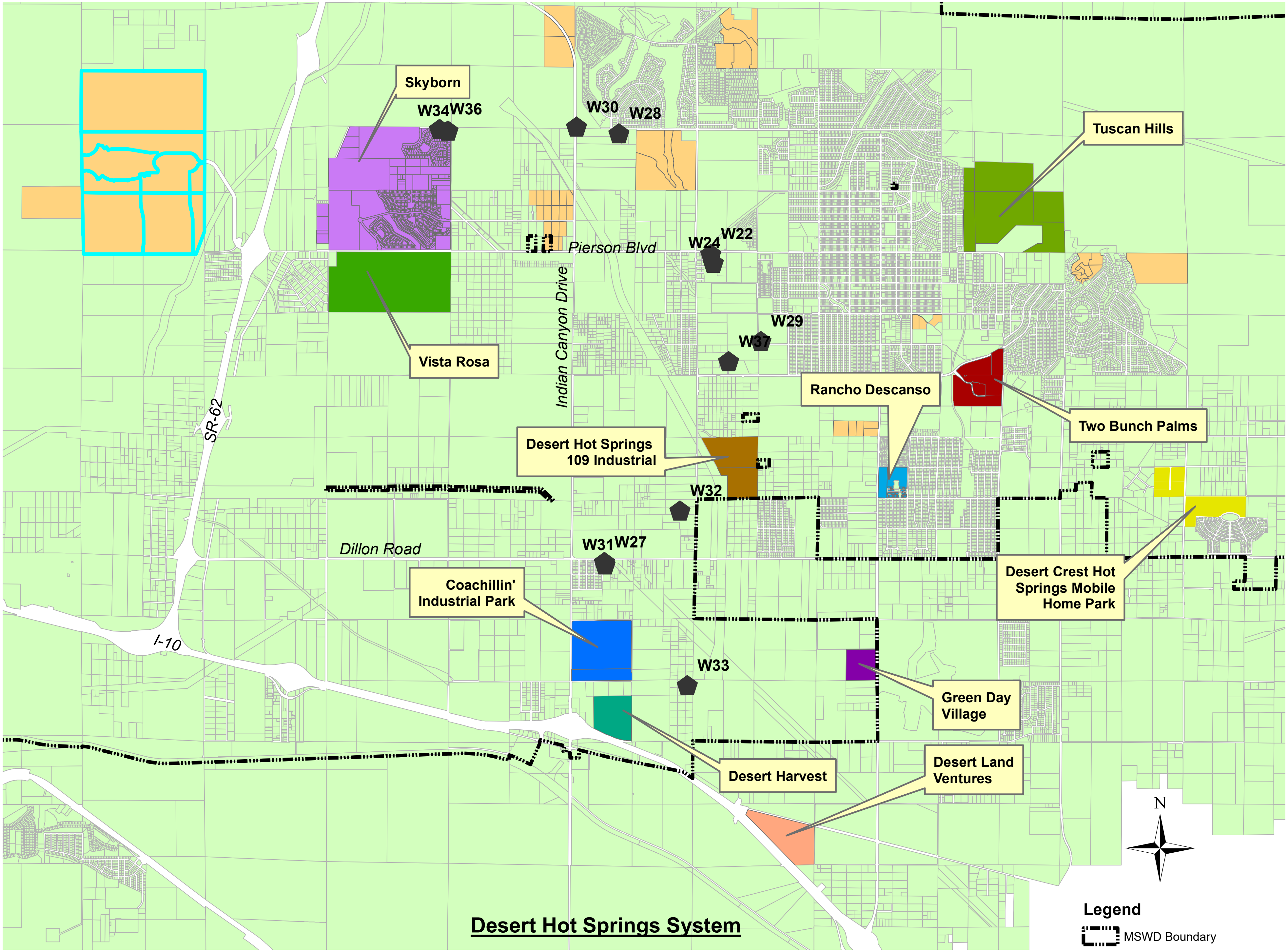


Figure 4.5 - Future Development Areas

Table 4.3 – Projected Water Demand through 2045 (5-year increments)

Parameter	Existing	2025	2030	2035	2040	2045
Population	**43,517**	**49,081**	**54,414**	**59,747**	**66,064**	**72,380**
MCSAP	*43,517*	--	--	*59,444*	--	*72,050*
CVUWMP	*43,517*	*49,081*	*54,414*	*59,747*	*66,064*	*72,380*
ADD	**7.36**	**8.01**	**8.68**	**9.36**	**10.24**	**11.12**
MCSAP	*7.36*	--	--	*9.36*	--	*11.12*
CVUWMP	*7.36*	*8.01*	*8.68*	*9.36*	*10.24*	*11.12*
% Increase	**--**	**9%**	**18%**	**27%**	**39%**	**51%**

Chapter 5 System Design Criteria

The following section documents the recommended design and evaluation criteria used throughout this 2022 Water Master Plan. Design criteria outline the requirements for constructing reliable, safe, and functional infrastructure. For water systems, the requirements will establish the necessary conditions related to, but not limited to storage, demand, pressure, velocity, flow capacity, pipe diameter, head loss, etc. In addition to outlining the requirements for the new design, the established criteria will serve as a benchmark to evaluate existing infrastructure.

Water system design criteria documented in this Section are based on published regional design standards, current MSWD design standards, and data established in previous documents. The water system will be evaluated under a range of normal and emergency operating conditions and demand scenarios. Normal operating conditions include:

- ADD
- PHD
- MDD
- MDD plus Fire Flow

Distribution system evaluation criteria are required to determine the performance of the District's water system under a range of operating conditions discussed above and to identify system deficiencies and improvement projects. Under each condition, system capacities and performance are compared to the evaluation criteria, determining which facilities require attention. Evaluation criteria for potable water systems typically focus on:

- System Pressures
- Pipeline Velocities
- Storage Volume
- Pump Station & Well Capacities

5.1 Production Wells

MSWD does not currently publish comprehensive production criteria related to production wells. However, wells within the MSWD service area must provide adequate supply to the system. According to the California Code of Regulations (Titles 17 & 22) by the State Water Resources Control Board (WRCB) cites that water systems with more than 1,000 customers must be able to supply the system's MDD, at a minimum. Existing and future wells in the MSWD service boundary should be evaluated by their ability to supply the system's MDD with the largest well out of service. Additional parameters, such as safety factors, should be assessed on a case-by-case basis by MSWD.

5.2 Storage

Potable water storage volumes can be separated into one of three categories:

- Operational
- Fire flow
- Emergency

These components are evaluated for each pressure zone, or combination of systems, to ability of the water system to mee the storage needs of that area.

OPERATIONAL STORAGE

Operational storage is defined as the volume of water necessary to meet hourly and daily fluctuations in system demand beyond water that is supplied. Water systems are often designed to supply a set flow rate, and storage is assumed to accommodate the fluctuations from that set point. In the case of MSWD this set point would be MDD supplied by the wells. The operational storage would then be the hourly incremental difference between that zone MDD supplied versus water used. This volume would then be continuously replenished throughout the day to maintain water quality and tank turnover rates. The American Water Works Association (AWWA) recommends an operation supply volume ranging from one quarter to one third of a MDD. However, it is recommended that the District maintain a one half MDD (0.5) operational storage volume in order to increase flexibility in operational scenarios.

FIRE FLOW STORAGE

Fire flow storage is defined as the volume of water required to accommodate the fire flow rate and duration established by the governing fire agency. For MSWD, the City has requested a fire flow of 1,500 gpm for 2 hours for all land uses. Therefore, the required fire flow storage is calculated to be 1,500 gpm for 2 hours, or 180,000 gallons (0.18 MG).

EMERGENCY STORAGE

Emergency storage is defined as the storage required to meet system demands in system failure, power outages, natural disasters, simultaneous fires, earthquakes, etc. The volume of water required is usually based on the amount of time estimated to elapse before disruptions can be corrected. However, the occurrence frequency and magnitude of emergencies are difficult to predict. The required emergency storage will vary based on service area, system type, risk levels, etc. CVWD and EMWD list the required emergency storage as one half of the MDD. Emergency storage design criteria is set at one half the MDD.

5.3 Peaking Factors

System peaking factors for different demand scenarios are discussed in more detail in Chapter 4.

5.4 System Pressures

Minimum system pressures are evaluated under both PHD and MDD plus fire flow conditions, which are set at 40 and 20 psi, respectively. The pressure analysis is limited to demand nodes, as locations with services need to meet these pressure requirements, and nodes near supply and storage sites are typically lower due to elevation.

Maximum service pressures are typical to protect the system pipelines and appurtenances, as well as reducing water loss through leaks. Typical industry standard is that any services that exceed 80 psi would require individual pressure regulators at the connection/meter, and no area should exceed 120 psi without higher class pipe.

5.5 Pipelines

Pipeline velocities are evaluated under a variety of flow conditions for existing and future demands. Setting a maximum pipeline velocity will reduce headloss throughout the system, as well as reduce the wear the pipe itself. That being said, high velocities are not always, by themselves, cause for concern or pipe replacement. Based on the *2012 MSWD Developer/Contractor Handbook*, Section 2.02, maximum pipeline velocity for MDD plus fire flow is set at 7.5 fps, while minimum hour is set at a maximum of 5.0 fps. However, these numbers are highly conservative, and more typical maximum velocities within the industry are in the range of 7.5 fps for PHD and 10 fps for MDD plus fire. Minimum hour velocity is not typically of concern.

Additional information is available in the Handbook, however, an update to reflect the recommendations in this Master Plan is recommended to prevent confusion moving forward.

5.6 Booster Pump Stations

The District's supply picture between zones and service areas is a mixture of BPS and well capacity. For this Master Plan, the capacity and design criteria were modified to reflect system conditions within the District itself, which is not typical of most water systems. Typical systems would account for all zone demands within the pumped zone and all zones higher. However, for MSWD, well supply must also come into the equation, as well as whether or not fire storage is provided in reservoirs. In this case, fire storage is provided and therefore not required at the pump station itself. With respect to the wells, the largest well supplying a service area must also be considered out of service for this analysis, as stated above. Each BPS should have sufficient capacity to meet the required flow of MDD. Redundant pump service and back-up power options should be considered on a case-by-case basis.

The water system design criteria for the 2022 Water Master Plan are summarized and tabulated in Table 5.1.

Table 5.1 – Water System Design Criteria Summary

Item	Criteria
Peaking Factors	
Maximum Day to Average Day	
Desert Hot Springs	1.5
WPSV, PSC	2.0
Peak Hour to Average Day	
Desert Hot Springs	2.0
WPSV, PSC	2.5
Fire Flows	
All conditions	1,500 gpm / 2 hours
Unit Demand Factors	
Per Capita Water Use	175 gpdc
Single Family Residential	550 gpd/DU
Multi-Family Residential	400 gpd/DU
Commercial	1,500 gpd/ac
Industrial	2,000 gpd/ac
Exempt (Public Facilities)	1,500 gpd/ac
Storage	
Operational Storage	0.50 MDD
Fire Storage	0.18 MG
Emergency Reserve	0.50 MDD
Pressure	
MaximumResidual	120 psi
Minimum Residual - Peak Hour	40 psi
Minimum Residual - MDD + Fire	20 psi
Booster Pump Stations	
Pumping Period	24 hours
Firm Pumping Capacity	Total of all pump design capacities
Redundancy	Case-by-case basis
Stand-by Power	Case-by-case basis
Well Supply	
Capacity, for analysis only	Largest well out of service
Pipelines	
Maximum Velocity, MDD + Fire	10 fps
Maximum Velocity, PHD	7.5 fps
Hazen-Williams C-factor	120
Minimum Diameter	8-inch

Chapter 6 Existing System Analysis

6.1 General Description

This chapter includes a discussion of the hydraulic model development for the existing water system and calibration processes, the update and calibration of the hydraulic model, and the existing system and buildout system analyses to meet the future needs of the service area. The analyses and findings of these hydraulic model scenarios are presented later in this chapter, future system analysis in Chapter 7, and Capital Improvement Project (CIP) list is discussed in Chapter 10.

6.2 Methodology

A detailed hydraulic model is a valuable tool used to analyze the complex operation of a water system. The general steps of a model formulation are:

1. Inputting the system's physical data in GIS format
2. Obtaining meter data to set boundary conditions in the model
3. Translating the physical data into a network of nodes and links
4. Inputting accurate water demands
5. Calibrating the model to simulate actual field conditions and system performance
6. Performing model runs based on current and future system conditions to predict performance.

The physical data required for a hydraulic model includes the geographic network of pipes, nodes, tanks, pump stations, valves, and supply sources representing the District's potable water system. The connectivity of the pipes and nodes in GIS allows the system components in the model to be hydraulically linked.

- **Junctions:** Locations where pipe size changes, pipe intersections, or critical hydraulic information (low/high points and demand) occur.
- **Pipes:** Transmission and distribution system piping with information including the pipe diameter, length, material, and associated roughness coefficient. The roughness coefficient function, known as the Hazen-Williams "C" factor (when the Hazen-Williams head loss formula is used), estimates friction losses in the system. The "C" factor is assigned based on the diameter, material, and, when known, pipe age. However, "C" factors are subjective and based on industry best practices and operations input.
- **Storage Tanks:** Distribution system storage reservoirs with information representing base elevation, minimum and maximum water levels, initial water level, and type of storage.

- **Pumps:** Pumps are represented as nodes with information on pumping parameters (flow and head), diameter, and elevation.
- **Reservoirs:** Reservoirs are used to represent where flow enters the system, such as wells or wholesale connections. Input parameters include a flow rate (steady or variable curve), elevation. These locations usually include at least one control valve.
- **Valves:** Specialty system valves, such as pressure-reducing/sustaining, flow-control, and altitude valves are included with diameter and type. Some valves require set points (pressure or tank level) and/or curves. Common system valves, such as gate valves, are not typically included in the model.

Initial hydraulic boundary conditions must be entered into the model database. The initial water level for tanks and the initial open/closed setting for control valves and pumps are of particular importance. District water supply sources, such as pumps from groundwater wells, can be modeled as varied or constant supplies into the water system. Understanding and adequately simulating these boundary conditions is critical to the successful calibration of the model.

Determining accurate water demands is crucial to developing an accurate hydraulic model. Metered demands, water supplies, pumped flows, and changes in tank volumes are reviewed over a given period to determine daily demand patterns. Annual consumption by metered account provides a spatial distribution of demand and average system usage. Typically, nodes along transmission mains and those near critical facilities (tanks, wells, pumps, valves) are excluded from demand allocation.

Node elevations were updated using current topographic layers in GIS. As-built information was used to update the model to match existing conditions where necessary. Storage tanks were annotated with ground elevation, diameter, and height. Operational settings in the model were verified during workshops with District Operations staff and through a detailed review of SCADA operational data. These settings were updated in the hydraulic model. The locations of normally closed valves were also confirmed and identified in the model using a combination of operator input and atlas maps review.

The current operational status and functionality for the District's pressure-reducing stations (PRS) were obtained from staff and updated in the hydraulic model. Settings provided by District staff represent typical conditions and may vary depending on the season, system demands, and storage conditions. For example, operations staff may change the settings to allow more water into a particular part of the system to fill a tank or less water to turn over the tank.

6.3 Existing System Model Development

At the time of this Master Plan, the District did not have a current working hydraulic model for the potable water system. Therefore, a new model was constructed from the available GIS data, which included data for pipes, junctions, valves, pumps, and tanks. All pipes down to 4-inch diameter were included. Laterals and hydrant connections points are typically not included in the model to control the number of pipes and to limit the overall size of the model.

- **Step 1:** District GIS shapefiles for the potable water system were obtained.
- **Step 2:** GIS shapefiles were used to build a new hydraulic model with the software's GIS Gateway, importing as many data fields as necessary while utilizing the power of GIS to construct the facilities. Elevations were extracted from available topography of the region.
- **Step 3:** All major facilities, such as pumps, tanks, and wells, were updated with hydraulic information obtained from operational documentation and pump test data, such as pump and valve set points and tank dimensions.
- **Step 4:** Water demands were imported using the District's billing records. Demands were spatially distributed based on meter location. Each demand was also assigned its associated diurnal pattern based on zone.
- **Step 5:** Modeling parameters need to be established prior to running any analysis or calibration. This includes time steps, pattern time steps, reporting parameter, units, etc. Once these parameters are established, the model can be debugged to ensure no errors or warnings exist prior to analysis.

6.4 Hydraulic Model Calibration

The purpose of a water system hydraulic model is to predict how a water system will respond under a given set of conditions. A properly calibrated model provides the confidence needed to make significant capital planning decisions and provides a planning tool to guide operational decisions. A precise Calibration Plan was developed with District staff to identify calibration goals and determine the extent of field testing and data collection necessary. Both macro and micro level calibration procedures were developed.

"Macro"-level calibration procedures use continuous monitoring to obtain data points to simulate system operations over an extended period. Actual field pressures and flow over time can be obtained using SCADA records or by placing monitoring equipment in the system. For this model, SCADA data for a one-week period including the field-testing days were provided for model calibration.

"Micro" calibration procedures involve stressing the water system through a series of flow tests. A flow test can be described as flowing one (or more) hydrant(s) while measuring the pressure at other nearby fire hydrants. Tests were not performed to determine available fire flow at each hydrant, but rather to compare flows and pressures measured in the field with those simulated by the hydraulic model. Field testing can indicate errors in the data used to develop the model or show a potential unknown condition in the field. Valves are typically assumed fully open unless otherwise noted might present as closed or partially open/closed, or a pipeline that is partially obstructed or an incorrect diameter recorded in the as-builts. Field testing can lead to system verification and erroneous model data. During these tests, additional flow and pressure information was collected throughout the system using SCADA.

The hydraulic model was calibrated for an extended period simulation (EPS). EPS calibration was performed to ensure the model accurately reflected how the overall system operated over time regarding transmission mains, pumps, tanks, and reservoir operations under normal operating conditions. Precise duplication of the data recorded at all locations within the water distribution system during extended period calibration is unrealistic due to many factors influencing the results. Model calibration aims to minimize the error between the SCADA and the model simulations and create a “best fit” at as many locations as possible. Some error between the SCADA and model simulations is expected; however, limits to allowable error must be made to ensure the calibrated model accurately represents the existing water distribution system. Based upon the size and number of facilities in the developed model, the desired accuracies of the extended period calibration for the hydraulic model are:

1. Minimum of 24 hours.
2. Tank levels within 2 feet between field data and model simulations at least 80% of the time.
3. Tank levels within 5 feet between field data and model simulations the entire time.

Extended period simulations were performed on the District’s water system using the diurnal demand curves presented in Figure 4.1. The tanks and SCADA points generally exhibited similar trending patterns in the model compared to the field data collected. Tank and pump station trending graphs resulting from the extended period calibration are included in Appendix B.

Examples of the calibration results are shown in Figure 6.1, Figure 6.2, and Figure 6.3, illustrating some variations between the field data and model simulations. The calibration results for these two tanks and well pump stations are examples of the accuracy between actual field-observed levels and the model predictions.

Figure 6.1 – Calibration Results for the Quail Tank

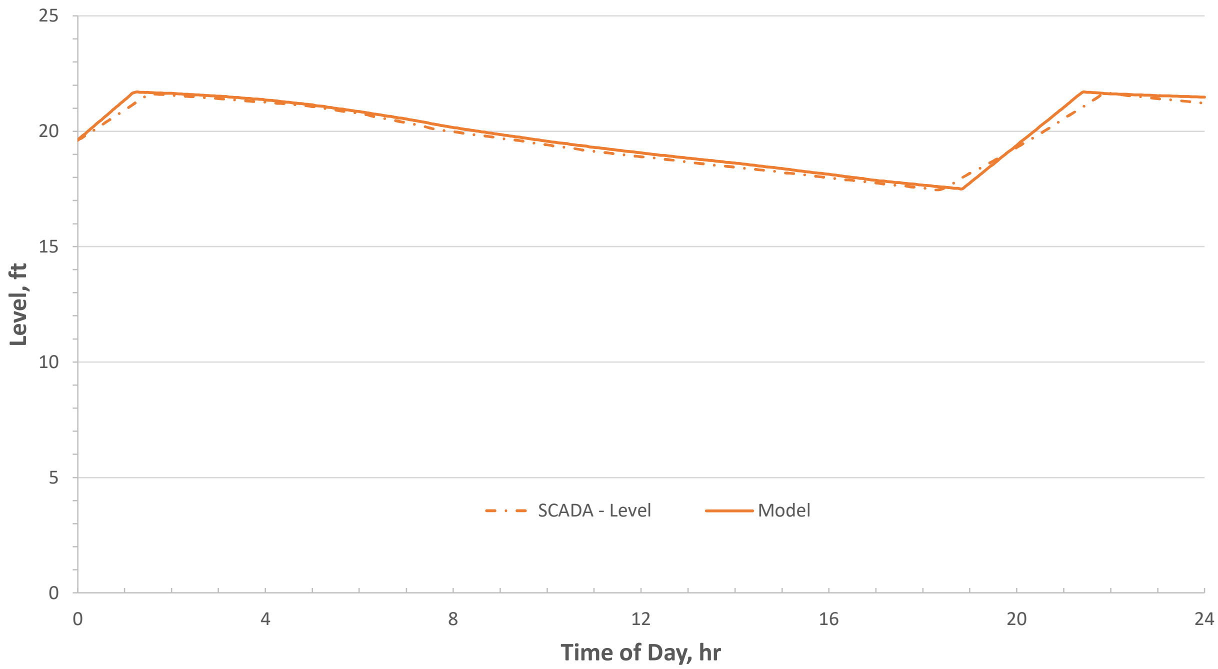


Figure 6.2 – Calibration Results for the Valley View Tank

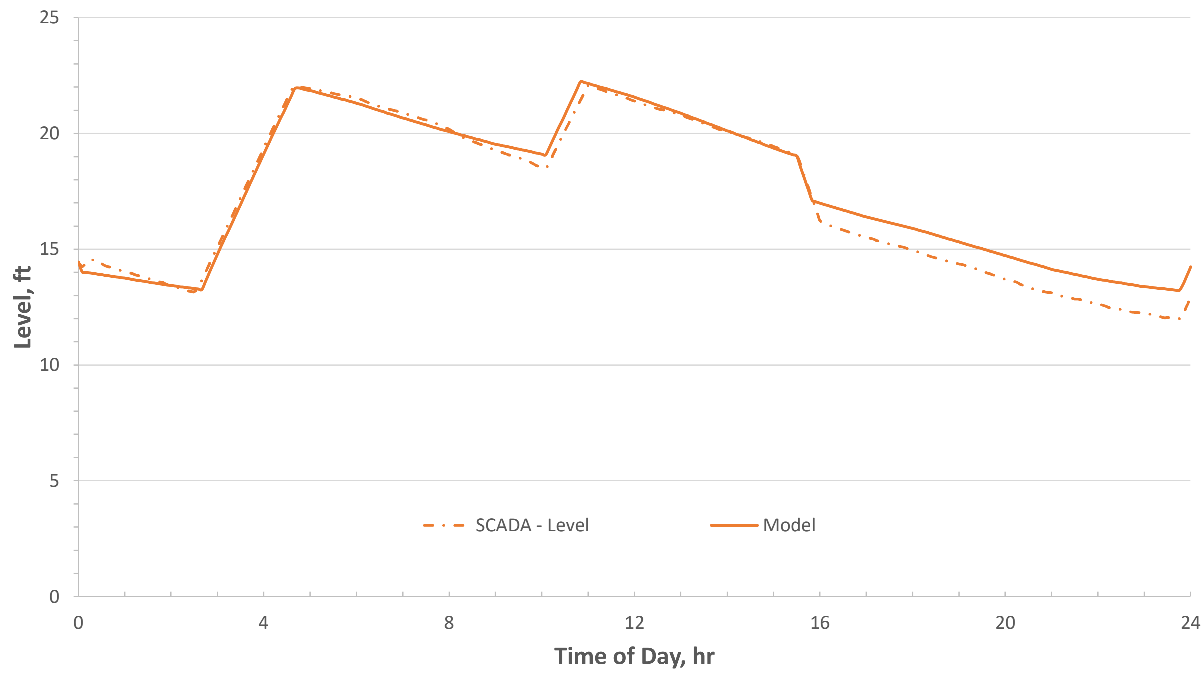
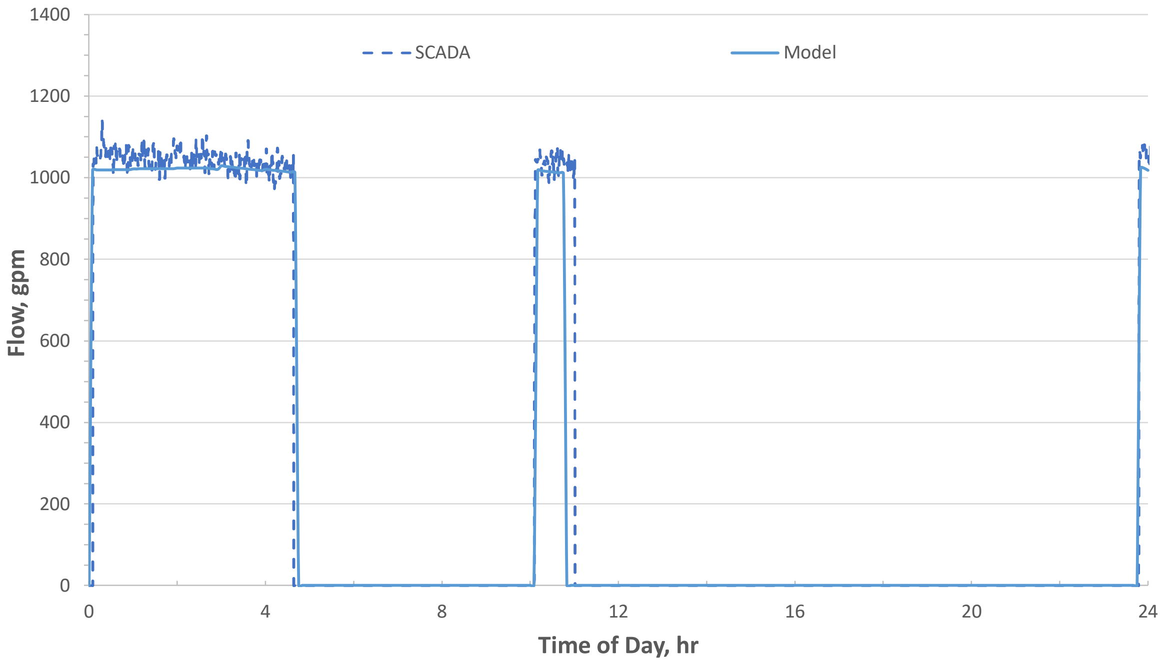


Figure 6.3 – Calibration Results for the Well 27 Pump Station



As shown in the above Figures, the calibrated model accurately simulates actual field conditions recorded by SCADA. Overall, the resulting trends are consistent with the calibration goals as presented in Table 6.1.

Table 6.1 – Model Calibration Accuracy

Parameter	Allowable Deviation	Minimum Acceptance Required	Acceptance Level Achieved
Tank Level Differential between field and model	2 feet	80%	**95%**
Tank Level Differential between field and model	5 feet	100%	**100%**

6.5 Existing Water Distribution Analysis

The calibrated hydraulic model was used to analyze the existing system to determine areas of deficiencies based on District planning criteria as identified in Section 5. System operating conditions were obtained for the maximum day demand(s) and used in the calibrated hydraulic model, as discussed above. Total system pressures and pipelines, storage and pumping capacities, and fire flow capabilities were evaluated based on planning criteria and are presented in the following sections.

6.5.1 System Pressures

The calibrated hydraulic model was reviewed to identify areas of high and low pressure. Areas where pressures exceed 150 psi or under 40 psi (peak hour) during MDD conditions were identified.

Typically, high pressures tend to occur during low demand conditions, particularly if a pump station serving that zone is on and the tank is near full, especially near the pump station. However, high pressures can occur throughout the system and are generally dependent on elevation. For the most part, systems are designed to accommodate a maximum pressure greater than 150 psi but identifying high pressure areas can extend the useful life of the facilities and reduce water loss due to leaks. The calibrated model identified one area of consistent high pressure:

- Highridge 1530 Zone from Cholla Drive to Palm Drive between 5th and 8th Streets: The area is consistently between 150 psi and a max of 210 psi on the western side along Cholla Drive. While high, these pressures do not necessarily exceed anticipated levels served based on pipe material and size. No immediate recommendations are made to change service; however, this area could be served by the lower High Desert View 1400 Zone. There is an existing normally closed valve at the intersection of Palm Drive and 5th Street that could be used to reduce service pressure in the area, thus converting it to the 1400 HGL.

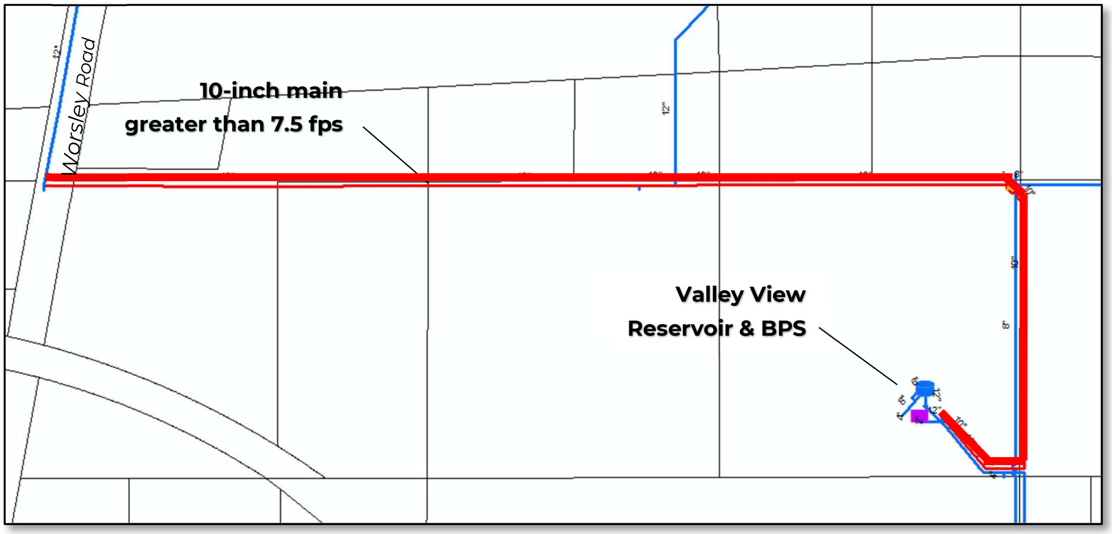
Low pressures tend to occur during high demand periods, tank low water levels, and fire flow events. In addition, low pressures tend to occur near tanks and are ignored if no services (demand) are in the area. The calibrated model identified three areas of consistent low pressure:

- Woodbridge 1840 Zone near the Woodbridge Reservoir: This area, which is very close to the Woodbridge Reservoir, experiences consistent pressures of less than 40 psi. While typical for these situations, the pressures are less than desirable. No improvements are required at this time. If customers so desire, private pumps could be installed to boost pressure past the meter.
- Worsley 1530 Zone along Worsley Road and Mission Lakes Drive: This area, near the recently constructed Worsley Reservoir, experiences consistent low pressure due to elevation. Currently, no services are connected along this stretch of pipe. No improvements are recommended at this time.
- Terrace 1240 Zone at Pierson Blvd and Desert Terrace Way: Northeast of this intersection is a subdivision that experiences consistent pressures less than 40 psi. While this area is currently within the 1240 Zone, an existing 8-inch Annandale 1400 Zone pipeline is within Pierson Blvd that could be utilized to serve the development should the District desire a higher HGL to serve this area.

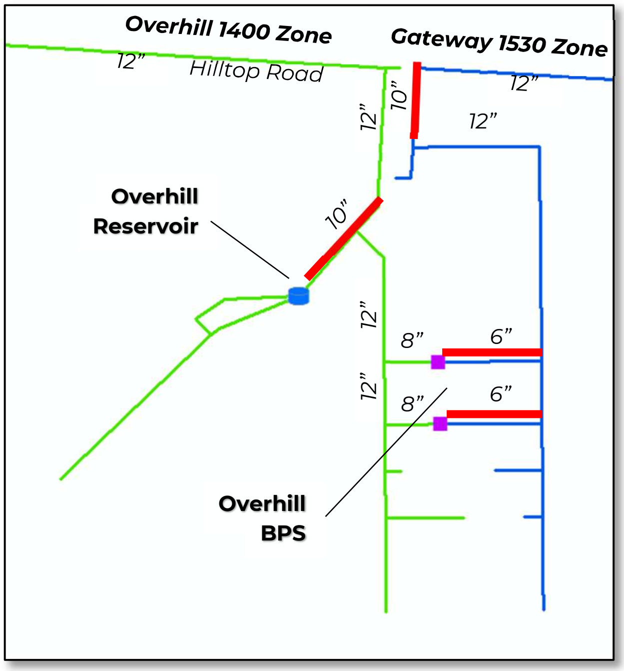
6.5.2 Pipeline Capacity

Pipelines were evaluated during peak hour demand conditions to identify high velocity. As a result, the system as a whole does not exceed the 7.5 fps velocity criteria for peak hour conditions. However, there are several areas that do exceed the 7.5 fps criteria and should be discussed for future improvements or field verification of as-build data. These areas include:

- Well 25A discharge pipeline: GIS data shows that approximately 35 LF of piping from the well 25A header into the distribution system is 3-inch, rather than the 6-inch it connects to. This segment is above 7.5 fps when the well is running and should be investigated to determine is the as-built data in the GIS is wrong, or if the actual location of the well shown in the GIS is erroneously located.
- Overhill 1400 Zone from Valley View BPS to Worsley Road: Approximately 3,050 LF of 10-inch main from the Valley View BPS discharge to the 12-inch main in Worsley Road is above 7.5 fps when the Valley View BPS is running. However, velocities are between 7.5 and 8 fps, making the pipeline marginally above criteria. No improvements are required or recommended at this time. However, should the District make improvements along this stretch, a larger diameter should be considered.



- Overhill BPS and Reservoir yard piping verification: Similar to Well 25A, some pipe diameter verification is recommended around the Overhill Reservoir and BPS site. Particularly, the existing 10-inch main feeding the Overhill Reservoir, the 6-inch discharge pipes at the BPS, and the 10-inch connection to Hilltop Road. Under existing conditions these mains are less than 10 fps when the BPS is on and are therefore considered marginally above criteria. Field verification could alleviate erroneous information in GIS. Should the pipes be confirmed as shown right, they should be considered for upsizing should the District make any improvements.



6.5.3 Storage Analysis

Table 6.2 shows the current storage capacity and requirements based on the design criteria explained in Chapter 5. This includes the Operation, Fire Flow, and Emergency Storage Requirements by zone. The storage capacity would need to store water for fire flow, half the maximum day demand for operational capacity, and half the maximum day demand for emergency storage. The District has maintained operational flexibility to allow systems, while hydraulically isolated through valves, to operate independent of one another while still addressing supply and storage needs. For example, the Quail Reservoir and service are isolated through an altitude valve. The result is a separate 1240 Zone served by the Quail Reservoir. However, the altitude valve would allow water from the Terrace 1240 Zone to serve any deficiencies within the Quail 1240 Zone. Overall, the District has adequate storage for its system. However, several zones show a slight storage deficit.

The 1070 Zone, served by the Two Bunch and Valley View Reservoirs, shows a 0.80-MG deficit. However, this area can also be served through interconnects with the 1240 Zone and the storage surplus there. This would drop the overall surplus in the 1240 Zone to 2.48 MG. Typically, storage deficits should be met through gravity (higher zones) in the event of a power outage. However, the lower 913 Zone and Little Morongo Reservoir also have a surplus that could be met through pumping. Given the options available to meet the 1070 Zone storage deficit, no additional storage is recommended at this time.

The Cottonwood 1600 Zone and Woodridge 1840 Zone show slight deficits with no available options to interconnect to another zone. However, both zones have additional pumping capacity that could be used to make up for these deficits. Due to the low water use in these areas, additional storage is not recommended at this time.

The Vista 1630 and Highland 1661 Zones also have storage deficits. While the deficits can be accommodated by the lower 1530 Zone for the time being, the age and condition (discussed in Chapter 7) of the Vista Reservoir will require replacement at a larger capacity.

Table 6.2 – Existing Storage Analysis

Zone	Tank	Capacity (MG)	ADD		MDD (MGD)	Required Storage (MG)			Total (MG)	Surplus/ Deficit (MG)
			gpm	MGD		Operational (0.5 MDD)	Fire (MG)	Emergency (0.5 MDD)		
913	Little Morongo	2.13	89.8	0.13	0.19	0.10	0.18	0.10	0.37	1.76
1070	Two Bunch #1	0.43	1,101.8	1.59	2.38	1.19	0.18	1.19	2.56	(0.80)
	Two Bunch #2	1.02								
	Valley View	0.31								
1240	Quail	1.02	123.8	0.18	0.27	0.13	0.18	0.13	0.45	0.57
	Terrace #1	1.84	1,704.1	2.45	3.68	1.84	0.18	1.84	3.86	3.28
	Terrace #2	2.14								
	Terrace #3	2.14								
1400	Annandale	2.57	786.1	1.13	1.70	0.85	0.18	0.85	1.88	2.27
	High Desert View #1	1.07								
	High Desert View #2	0.51								
1400	Overhill	0.27	13.9	0.02	0.03	0.02	0.18	0.02	0.21	0.06
1530	Gateway	0.26	925.1	1.33	2.00	1.00	0.18	1.00	2.18	3.61
	Worsley	2.33								
	Mission Lakes	1.95								
	High Northridge	1.04								
	Low Northridge	0.21								
1535	Redbud	0.32	35.6	0.05	0.08	0.04	0.18	0.04	0.26	0.06
1600	Cottonwood	0.28	41.4	0.06	0.12	0.06	0.18	0.06	0.30	(0.02)
1630	Vista	0.30	237.4	0.34	0.51	0.26	0.18	0.26	0.69	(0.39)
1661	Highland	0.05	15.0	0.02	0.03	0.02	0.18	0.02	0.21	(0.16)
1840	Woodridge	0.12	34.4	0.05	0.10	0.05	0.18	0.05	0.28	(0.16)

6.5.4 Well Capacity Analysis

Capacity requirements are based on the planning criteria as discussed in Chapter 5. Typically, the pumping calculations for supplying primary pressure zones are cumulative and include demands for the directly pumped zone and all zones above. However, in the case of the District, some wells are considered primary. Table 6-3 presents the well capacity analysis for the existing system.

The District relies solely on wells to produce potable water for its service area. Therefore, these wells should create the maximum day demand for the District to ensure that it can meet its potable water demands if it depletes its storage supply. The District has also added the requirement that the largest well in a service area be considered out of service when determining adequate supply.

Table 6.3 – Existing Well Production Capacity Analysis

Well No.	Design Capacity (gpm)	Total Capacity (gpm)[1]	Zones Served	ADD (gpm)	MDD (gpm)	Surplus/Deficit (gpm)
25	400	175	Woodridge 1840	34	69	106
25A	175					
26	350	170	Cottonwood 1600	41	83	87
26A	170					
27	1,100	3,800	913, Valley View 1070, Two Bunch 1070, Overhill 1400, Mission Lakes 1530, Gateway 1530, 1875, 2035, 2155	1,689	2,533	1,267
30	--					
31	1,900					
32	2,000					
33	800					
34	--					
36	--					
22	--	3,700	Terrace 1240, High Desert View 1400, Redbud 1535, Highland 1661, Quail 1240, High Northridge 1530, Vista 1630, Annandale 1400	3,344	5,016	(1,316)
24	2,200					
28	--					
29	1,700					
37	2,000					
Total	**12,795**			**5,108**	**7,700**	**145**

1. Largest well out of service.

Table 6.3 shows that the largest deficit occurs in the Terrace 1240 Zone that includes Well Nos. 22, 24, 28, 29, and 37. However, the District plans to rehabilitate Well No. 22 in the current FY, which will add an additional 1,750 gpm to the system. Additionally, Well No. 42 is slated to be completed in 2025 and will add an additional 1,850 gpm, bringing this service area into a surplus state. See Chapter 8 for discussion on future improvements. Furthermore, Well No. 34 is also slated for rehabilitation and is anticipated to add 580 gpm to both the Mission Lakes and Gateway 1530 Zones.

6.5.5 Booster Pump Station Capacity Analysis

Capacity requirements are based on the planning criteria as discussed in Chapter 5. Typically, the pumping capacity should meet MDD of the zone(s) fed through the pump station. The District assumes fire flow fighting needs will come from storage. Findings of the pump station analysis is included in Table 6.4.

Table 6.4 – Existing Booster Pump Station Analysis

BPS Name	From Zone	To Zone	Unit	Capacity (gpm)	Firm Capacity (gpm)	Zones Included	ADD (gpm)	MDD (gpm)	Well Supply (gpm)	Surplus / (Deficit)
--	--	1630	--	--	--	Cottonwood 1630	41	83	170	87
--	--	1840	--	--	--	Woodridge 1840	34	69	175	106
Well 32 BPS	913	1070	1	1185	1155	Two Bunch 1070	1,095	2,189	1,900	866
			2	1155						
Two Bunch	1070	1240	1	1,068	1,068	Terrace 1240	1,704	3,409	3,450	1,109
			2	1,091						
Terrace #1	1240	1400	1	446	910	Quail 1240, High Desert View 1400, Annandale 1400, Redbud 1535, Highland 1600	1,046	2,093	3,600	2,417
			2	464						
			3	706						
Terrace #2	1240	1530	4	605	1337	High Northridge 1530, Vista 1630	679	1,359	1,700	1,678
			5	732						
			6	780						
Low Desert View	1400	1535	1	700	700	Redbud 1535, Highland 1600	52	105	0	595
			2	700						
Low Northridge	1530	1630	1	385	654	Vista 1630, Vista Hydro, Vista Reduced	237	475	0	179
			2	269						
Redbud	1530	1630	1	373	373	Highland 1600	17	34	0	339
			2	385						
Well 33 BPS	--	913	1	1185	1155	Little Morongo 913	168	337	0	818
			2	1155						
--	--	1070	--	--	--	Valley View 1070	75	150	1,100	950
Valley View	1070	1400	1	583	583	Overhill 1400	14	28	0	555
			2	602						
Overhill	1400	1530	1	564	564	Gateway 1530, Worsley 1530, Mission Lakes 1530	639	1,279	2,000	1,285
			2	588						

Based on the analysis presented in Table 6.4, the existing pumping capacity can accommodate the needs of the District without any improvements. Due to zone interconnects throughout the DHS system, well locations, and flexibility built into the system (normally-closed valves, etc.), supply can be diverted if necessary.

Chapter 7 Condition Assessment

7.1 Site Assessment

A site visit of select District facilities was conducted on June 29, 2021 and July 1, 2021. Eight sites were visited and included the following sites: Little Morongo, Well No. 33, Well No. 22, Well No. 37, Vista Reservoir, Worsley Reservoir, Well No. 34, and a future well that a developer will construct (Well No. 35). Five reservoirs, six wells, and eight booster pump stations were inspected during the Site Assessment. Well Nos. 22, 32, 33, Well No. 32 Booster Pumps, and Well No. 34 Booster Pumps were found to need their mechanical and electrical equipment replaced, primarily due to corrosion and other issues. Recommended improvements for this site and others are included in Chapter 10.

7.2 Age Assessment

An age analysis of the District's facilities was conducted to determine the need to rehabilitate a reservoir and replace a pipeline.

7.2.1 Reservoir Age Assessment

The District has a total of 20 steel reservoirs and four concrete reservoirs. Each of these has a different expected service life. For example, the average steel reservoir can be expected to last 50 years and could last longer if it is properly inspected and maintained and no external forces, such as a natural disaster, severely damage the reservoirs. Concrete reservoirs have an average service life of 100 years, if properly inspected and maintained.

Of the District's 20 steel reservoirs, seven have already reached the end of their useful life of 50 years. This alone does not indicate the need to replace or retrofit the reservoir. However, it suggests that the reservoir is aging and degrading and will likely need rehabilitation or replacement relatively soon. The four concrete tanks have all been built in the last 20 years and are well within their useful life. Table 7.1 presents the remaining useful life for these facilities.

Table 7.1 – Pipeline Service Life

Facility Name	Zone	Year Built	Volume (MG)	Type	Useful Life	Remaining Useful Life
Little Morongo	913	2005	2.13	Concrete	100	81
Well 33 Suction	913	2006	0.05	Concrete	100	82
Two Bunch #1	1070	1973	0.43	Steel	50	0
Two Bunch #2	1070	1988	1.02	Steel	50	14
Valley View	1070	1988	0.31	Steel	50	14
Quail	1240	1989	1.02	Steel	50	15
Terrace #1	1240	1968	1.84	Steel	50	0
Terrace #2	1240	1984	2.14	Steel	50	10
Terrace #3	1240	1992	2.14	Steel	50	18
Annandale	1400	1989	2.57	Steel	50	15
High Desert View #1	1400	1992	1.07	Steel	50	18
High Desert View #2	1400	1993	0.51	Steel	50	19
Overhill	1400	1988	0.27	Steel	50	14
Gateway	1530	1988	0.26	Steel	50	14
High Northridge	1530	1981	1.04	Steel	50	7
Low Northridge	1530	1957	0.21	Steel	50	0
Mission Lakes	1530	1971	1.95	Steel	50	0
Well 34 Suction	1530	2007	0.08	Concrete	100	83
Worsley	1530	2007	2.33	Concrete	100	83
Redbud	1535	1959	0.32	Steel	50	0
Cottonwood	1600	1960	0.28	Steel	50	0
Highland	1600	2008	0.05	Steel	50	34
Vista	1630	1966	0.30	Steel	50	0
Woodridge	1840	2003	0.12	Steel	50	29

7.2.2 Pipeline Age Assessment

The District's water distribution pipeline age was also assessed to determine which pipes may need replacement. Useful service life will vary depending on the pipeline's material, typically between 40 and 100 years, depending on the material of the pipeline. Table 7.2 shows the anticipated useful service life for each pipeline material within the District's water distribution system and the total length of the pipeline for each pipeline material.

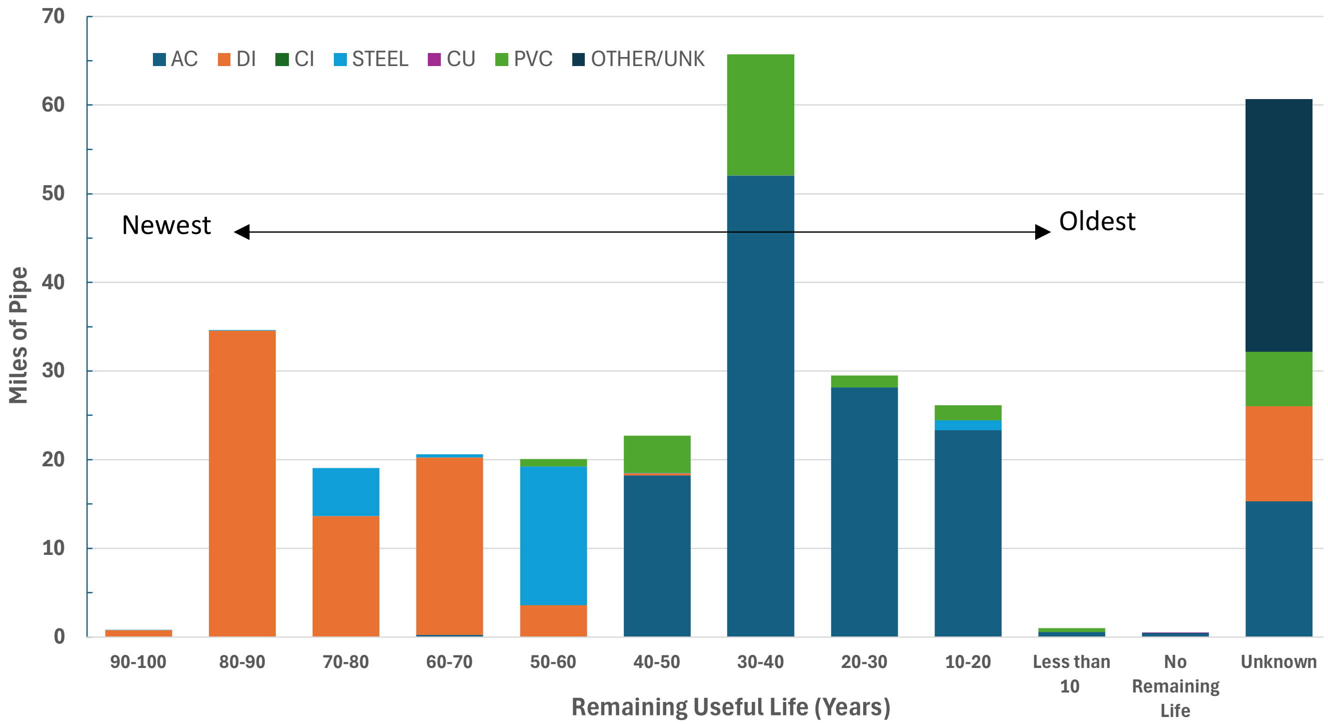
Table 7.2 – Pipeline Service Life

Material	Useful Life (years)	Length	
		Feet (ft)	Miles (mi)
Asbestos Cement Pipe (AC)	70	730,572	138.4
Ductile Iron (DI)	100	441,421	83.6
Cast Iron	100	75	0.0
Steel	100	87,854	16.6
Galvanized Steel	50	31,414	5.9
Copper	50	95	0.0
Polyvinyl Chloride Pipe (PVC)	70	149,226	28.3
Other	--	928	0.2
Unknown	--	244	0.0

Almost half of the District's pipelines are asbestos cement pipes. Asbestos pipes are a risk to the District water distribution system, as broken pipes can release asbestos fibers into the distribution system. The EPA sets the maximum contamination limits for asbestos to seven million fibers per liter. Though a single asbestos pipe breaking will not reach the limit, the number of asbestos pipelines within the District can cause problems if several pipelines degrade and release asbestos into the water distribution system. As a result, it is recommended that these pipelines be replaced as they approach the end of their service life, regardless of the condition.

Figure 7.1 also shows that the District has many pipelines with unknown installation dates and material. It is recommended that a document review and field inspection effort be conducted to determine the age of these facilities. The majority of pipelines that will reach the end of their service life in the next 50 years are asbestos cement pipes.

Figure 7.1 – Remaining Service Life



7.3 Efficiency Assessment

The efficiency of wells and boosters can indicate failures of the mechanical and electrical equipment of the facility. Typically, mechanical and electrical equipment have a service life of 15 to 20 years. The service life can vary depending on the pumps' activity, environmental exposure, regularity of routine maintenance, etc. Low efficiency does indicate the need to replace the electrical and mechanical equipment of the booster pump station. The District's most recent SCE test records were used to evaluate the efficiency of these facilities.

As shown in Table 7.3, seven out of the 15 wells in the District operate above 60% efficiency, allowing the pumps to function correctly. Six wells run between 50% and 60% efficiency. This range is an acceptable efficiency range; however, it suggests the mechanical and electrical equipment could be beginning to degrade, and the pumping capacity could decrease. Two of the District's wells, Well No. 26 has an efficiency below 50% and should be considered for rehabilitation to improve the well's energy consumption and water pumping capacity . Well No. 30, which is currently offline, had no SCE test records.

Table 7.3 – Well SCE Pump Test Results

Well No.	Capacity (gpm)	SCE Test Date	SCE Test Flow	Efficiency
22[1]	0	6/7/2019	1,092	53%
24	2,200	7/24/2020	2,340	70%
25	400	6/7/2019	328	57%
25A	175	6/7/2019	155	55%
26	350	6/7/2019	237	38%
26A	170	6/7/2019	177	60%
27	1,100	7/24/2020	1,035	57%
28[1]	0	6/7/2019	1,328	54%
29	1,700	6/7/2019	1,508	66%
30[1]	0	--	--	--
31	1,900	6/7/2019	1,930	63%
32	2,000	6/7/2019	1,926	69%
33	800	6/7/2019	812	67%
34[1]	0	6/7/2019	528	67%
37	2,000	6/7/2019	1,620	72%

1. Well offline during calibration.

As shown in Table 7.4, only two Booster Pump Stations within the District have no SCE test to check the efficiency of the pumps: Low Northridge (currently out of service), and Redbud. Therefore, 18 individual pump tests were performed to ascertain the system efficiency. Of these 18 individual booster pumps, 12 have an efficiency above 60%, allowing the pump to operate properly. The remaining six booster pumps operate between 50% and 60% efficiency. This range is an acceptable efficiency range; however, it suggests the mechanical and electrical equipment may be beginning to degrade, and the pump's capacity might decrease. Discussions with Operations staff have indicated that the Terrace BPS is in need of rehabilitation. However, continued maintenance, inspection, and testing are recommended for the remaining facilities.

Table 7.4 – SCE Booster Pump Test Results

Booster PS	Unit	Capacity (gpm)	SCE Test Date	Efficiency
Well 32 BPS	1	1185	6/7/2019	63%
	2	1155	6/7/2019	65%
Two Bunch	1	1,068	6/7/2019	69%
	2	1,091	6/7/2019	67%
Terrace #1	1	446	6/7/2019	62%
	2	464	6/7/2019	64%
	3	706	6/7/2019	67%
Terrace #2	4	605	6/7/2019	62.3
	5	732	6/7/2019	55%
	6	780	6/7/2019	60%
Low Desert View	1	700	6/7/2019	53%
	2	700	6/7/2019	54%
Low Northridge	1	385	--	--
	2	269		
Redbud	1	373	--	--
	2	385		
Well 33 BPS	1	1185	6/7/2019	64%
	2	1155	6/7/2019	61%
Valley View	1	583	6/7/2019	66%
	2	602	6/7/2019	68%
Overhill	1	564	6/7/2019	58%
	2	588	6/7/2019	59%

The findings listed above are based on a preliminary condition assessment of these facilities. Staff input regarding issues with equipment has also been taken into account when developing recommendations and CIP Projects as presented in Chapter 10.

Chapter 8 Future System

The intent of the future system analysis is to evaluate the water distribution system under a variety of operating conditions using the criteria presented in Chapter 5 and the future demand projections presented in Chapter 4. The future system analyses were conducted by adding the projected water demands at their anticipated nodes and zones. Planning horizons are broken into 5-year increments and each subsequent increment assumes that all projects identified in the preceding period are constructed and in service.

8.1 Future System Analysis

8.1.1 Water Supply

As previously described in Chapter 3, 100 percent of the District's water supply is supplied through wells. The known well improvements are included in the analysis presented in Table 8.1 for the 2025 planning horizon.

Table 8.1 – 2025 Well Supply Analysis

Well No.	Design Capacity (gpm)	Total Capacity (gpm)[4]	Zones Served	ADD (gpm)	MDD (gpm)	Surplus/Deficit (gpm)
25	400	175	Woodridge 1840	34	69	106
25A	175					
26	350	170	Cottonwood 1630	41	83	87
26A	170					
27	1,100	4,960	913, Valley View 1070, Two Bunch 1070, Overhill 1400, Mission Lakes 1530, Gateway 1530, 1700, 1875, 2035, 2155	2,001	3,001	1,959
30	--					
31	1,900					
32	2,000					
33	800					
34 (2)	**580**					
35 (1)	**580**					
36	--					
22	1,000	6,550	Terrace 1240, High Desert View 1400, Redbud 1535, Highland 1661, Quail 1240, High Northridge 1530, Vista 1630, Annandale 1400	3,430	5,145	1,405
24	2,200					
28	--					
29	1,700					
37	2,000					
42 (3)	**1,850**					
Total	**16,805**			**5,507**	**8,298**	**3,557**

1. Well No. 35 equipment to be installed and operational in 2025.
2. Well No. 34 rehabilitation to be completed in 2025.
3. Construction of new Well No. 42 to be completed and operational in 2025.
4. Largest well capacity out of service.

As shown above the District will have adequate supply capacity as planned for the 2025 planning horizon. Tables 8.2 through 8.5 show the well supply picture subsequent 5-year incremental planning horizons. As shown, the District has adequate capacity to meet their demands through 2045 with the currently-planned well improvements.

Table 8.2 – 2030 Well Supply Analysis

Well No.	Design Capacity	Total Capacity	Zones Served	ADD (gpm)	MDD (gpm)	Surplus/Deficit (gpm)
25	400	175	Woodridge 1840	34	69	106
25A	175					
26	350	170	Cottonwood 1630	41	83	87
26A	170					
27	1,100	4,960	913, Valley View 1070, Two Bunch 1070, Overhill 1400, Mission Lakes 1530, Gateway 1530, 1700, 1875, 2035, 2155	2,314	3,471	1,489
30	--					
31	1,900					
32	2,000					
33	800					
34	580					
35	580					
36	--					
22	1,000	6,550	Terrace 1240, High Desert View 1400, Redbud 1535, Highland 1661, Quail 1240, High Northridge 1530, Vista 1630, Annandale 1400	3,524	5,286	1,264
24	2,200					
28	--					
29	1,700					
37	2,000					
42	1,850					
Total	**16,805**			**5,914**	**8,909**	**2,946**

1. Largest well capacity out of service.

Table 8.3 – 2035 Well Supply Analysis

Well No.	Design Capacity	Total Capacity	Zones Served	ADD (gpm)	MDD (gpm)	Surplus/Deficit (gpm)
25	400	175	Woodridge 1840	34	69	106
25A	175					
26	350	170	Cottonwood 1630	41	83	87
26A	170					
27	1,100	4,960	913, Valley View 1070, Two Bunch 1070, Overhill 1400, Mission Lakes 1530, Gateway 1530, 1700, 1875, 2035, 2155	2,640	3,961	999
30	--					
31	1,900					
32	2,000					
33	800					
34	580					
35	580					
36	--					
22	1,000	6,550	Terrace 1240, High Desert View 1400, Redbud 1535, Highland 1661, Quail 1240, High Northridge 1530, Vista 1630, Annandale 1400	3,618	5,427	1,123
24	2,200					
28	--					
29	1,700					
37	2,000					
42	1,850					
Total	**16,805**			**6,334**	**9,540**	**2,315**

1. Largest well capacity out of service.

Table 8.4 – 2040 Well Supply Analysis

Well No.	Design Capacity	Total Capacity	Zones Served	ADD (gpm)	MDD (gpm)	Surplus/Deficit (gpm)
25	400	175	Woodridge 1840	34	69	106
25A	175					
26	350	170	Cottonwood 1630	41	83	87
26A	170					
27	1,100	4,960	913, Valley View 1070, Two Bunch 1070, Overhill 1400, Mission Lakes 1530, Gateway 1530, 1700, 1875, 2035, 2155	3,055	4,583	377
30	--					
31	1,900					
32	2,000					
33	800					
34	580					
35	580					
36	--					
22	1,000	6,550	Terrace 1240, High Desert View 1400, Redbud 1535, Highland 1661, Quail 1240, High Northridge 1530, Vista 1630, Annandale 1400	3,722	5,583	967
24	2,200					
28	--					
29	1,700					
37	2,000					
42	1,850					
Total	**16,805**			**6,853**	**10,317**	**1,538**

1. Largest well capacity out of service.

Table 8.5 – 2045 Well Supply Analysis

Well No.	Design Capacity	Total Capacity	Zones Served	ADD (gpm)	MDD (gpm)	Surplus/Deficit (gpm)
25	400	175	Woodridge 1840	34	69	106
25A	175					
26	350	170	Cottonwood 1630	41	83	87
26A	170					
27	1,100	4,960	913, Valley View 1070, Two Bunch 1070, Overhill 1400, Mission Lakes 1530, Gateway 1530, 1700, 1875, 2035, 2155	3,470	5,204	(244)
30	--					
31	1,900					
32	2,000					
33	800					
34	580					
35	580					
36	--					
22	1,000	6,550	Terrace 1240, High Desert View 1400, Redbud 1535, Highland 1661, Quail 1240, High Northridge 1530, Vista 1630, Annandale 1400	3,826	5,738	812
24	2,200					
28	--					
29	1,700					
37	2,000					
42	1,850					
Total	**16,805**			**7,371**	**11,094**	**761**

1. Largest well capacity out of service.

8.1.2 Future Storage Analysis

Similar to the well supply analysis, the future storage picture was evaluated using the criteria in Table 5.1. Table Nos. 8.6 through 8.10 show the storage analysis for the 2025 through 2045 planning horizons.

Table 8.6 – 2025 Storage Analysis

Zone	Tank	Capacity (MG)	2025 Demand (MGD)		Required Storage per Design	Surplus/ Deficit (MG)
			ADD	MDD		
913	Little Morongo	2.13	0.24	0.36	0.54	1.59
1070	Two Bunch #1	0.43	1.68	2.53	2.71	(0.95)
	Two Bunch #2	1.02				
	Valley View	0.31				
1240	Quail	1.02	2.64	3.95	4.13	3.01
	Terrace #1	1.84				
	Terrace #2	2.14				
	Terrace #3	2.14				
1400	Annandale	2.57	1.25	1.87	2.05	2.10
	High Desert View #1	1.07				
	High Desert View #2	0.51				
1400	Overhill	0.27	0.02	0.03	0.21	0.06
1530	Gateway	0.26	1.51	2.26	2.44	3.35
	Worsley	2.33				
	Mission Lakes	1.95				
	High Northridge	1.04				
	Low Northridge	0.21				
1535	Redbud	0.32	0.05	0.08	0.26	0.06
1600	Cottonwood	0.28	0.06	0.12	0.30	(0.02)
1630	Vista	0.30	0.34	0.51	0.69	(0.39)
1660	Highland	0.05	0.02	0.04	0.22	(0.17)
1700	**1700-1**	**1.00**	**0.08**	**0.12**	**0.30**	**0.70**
1840	Woodridge	0.12	0.05	0.10	0.28	(0.16)

Table 8.7 – 2030 Storage Analysis

Zone	Tank	Capacity (MG)	2030 Demand (MGD)		Required Storage per Design	Surplus/ Deficit (MG)
			ADD	MDD		
913	Little Morongo	2.13	0.36	0.54	0.72	1.41
1070	Two Bunch #1	0.43	1.79	2.69	2.87	(1.11)
	Two Bunch #2	1.02				
	Valley View	0.31				
1240	Quail	1.02	2.64	3.96	4.14	3.00
	Terrace #1	1.84				
	Terrace #2	2.14				
	Terrace #3	2.14				
1400	Annandale	2.57	1.38	2.07	2.25	1.90
	High Desert View #1	1.07				
	High Desert View #2	0.51				
1400	Overhill	0.27	0.02	0.03	0.21	0.06
1530	Gateway	0.26	1.69	2.53	2.71	3.07
	Worsley	2.33				
	Mission Lakes	1.95				
	High Northridge	1.04				
	Low Northridge	0.21				
1535	Redbud	0.32	0.05	0.08	0.26	0.06
1600	Cottonwood	0.28	0.06	0.12	0.30	(0.02)
1630	Vista	0.30	0.34	0.51	0.69	(0.39)
1660	Highland	0.05	0.03	0.04	0.22	(0.17)
1700	1700-1	1.06	0.16	0.24	0.42	0.64
1840	Woodridge	0.12	0.05	0.10	0.28	(0.16)
1875	**1875-1**	**1.00**	**0.04**	**0.06**	**0.24**	**0.76**

Table 8.8 – 2035 Storage Analysis

Zone	Tank	Capacity (MG)	2035 Demand (MGD)		Required Storage per Design	Surplus/ Deficit (MG)
			ADD	MDD		
913	Little Morongo	2.13	0.48	0.73	0.91	1.22
1070	Two Bunch #1	0.43	1.90	2.85	3.03	1.18
	Two Bunch #2	1.02				
	Valley View #1	0.31				
	Valley View #2	**2.45**				
1240	Quail	1.02	2.64	3.97	4.15	2.99
	Terrace #1	1.84				
	Terrace #2	2.14				
	Terrace #3	2.14				
1400	Annandale	2.57	1.51	2.26	2.44	1.71
	High Desert View #1	1.07				
	High Desert View #2	0.51				
1400	Overhill	0.27	0.02	0.03	0.21	0.06
1530	Gateway	0.26	1.88	2.81	2.99	2.80
	Worsley	2.33				
	Mission Lakes	1.95				
	High Northridge	1.04				
	Low Northridge	0.21				
1535	Redbud	0.32	0.05	0.08	0.26	0.06
1600	Cottonwood	0.28	0.06	0.12	0.30	(0.02)
1630	**Vista #2**	**0.75**	0.34	0.51	0.69	0.06
1660	Highland	0.05	0.03	0.05	0.23	(0.18)
1700	1700-1	1.06	0.24	0.37	0.55	0.51
1840	Woodridge	0.12	0.05	0.10	0.28	(0.16)
1875	1875-1	0.40	0.06	0.09	0.27	0.13
2035	**2035-1**	**1.00**	**0.10**	**0.15**	**0.33**	**0.67**

Table 8.9 – 2040 Storage Analysis

Zone	Tank	Capacity (MG)	2040 Demand (MGD)		Required Storage per Design	Surplus/ Deficit (MG)
			ADD	MDD		
913	Little Morongo	2.13	0.69	1.04	1.22	0.91
1070	Two Bunch #1	0.43	2.01	3.02	3.20	1.01
	Two Bunch #2	1.02				
	Valley View #1	0.31				
	Valley View #2	2.45				
1240	Quail	1.02	2.65	3.97	4.15	2.99
	Terrace #1	1.84				
	Terrace #2	2.14				
	Terrace #3	2.14				
1400	Annandale	2.57	1.65	2.47	2.65	1.50
	High Desert View #1	1.07				
	High Desert View #2	0.51				
1400	Overhill	0.27	0.02	0.03	0.21	0.06
1530	Gateway	0.26	2.09	3.13	3.31	2.27
	Worsley	2.33				
	Mission Lakes	1.95				
	High Northridge	1.04				
	Low Northridge	*0.00*				
1535	**Redbud**	**0.30**	0.05	0.08	0.26	0.04
1600	**Cottonwood**	**0.30**	0.06	0.12	0.30	0.00
1630	Vista #2	0.75	0.34	0.51	0.69	0.06
1660	Highland	0.05	0.03	0.05	0.23	(0.18)
1700	1700-1	1.06	0.34	0.51	0.69	0.37
1840	Woodridge	0.12	0.05	0.10	0.28	(0.16)
1875	1875-1	0.40	0.08	0.13	0.31	0.09
2035	2035-1	1.00	0.14	0.21	0.39	0.61

Table 8.10 – 2045 Storage Analysis

Zone	Tank	Capacity (MG)	2045 Demand (MGD) ADD	2045 Demand (MGD) MDD	Required Storage per Design	Surplus/ Deficit (MG)
913	Little Morongo	2.13	0.90	1.34	1.52	0.61
1070	Two Bunch #1	0.00	2.13	3.20	3.38	1.07
	Two Bunch #2	1.02				
	Two Bunch #3	**0.67**				
	Valley View #1	0.31				
	Valley View #2	2.45				
1240	Quail	1.02	2.65	3.98	4.16	2.98
	Terrace #1	**1.84**				
	Terrace #2	2.14				
	Terrace #3	2.14				
1400	Annandale	2.57	1.79	2.68	2.86	1.29
	High Desert View #1	1.07				
	High Desert View #2	0.51				
1400	Overhill	0.27	0.02	0.03	0.21	0.06
1530	Gateway	0.26	2.30	3.45	3.63	1.95
	Worsley	2.33				
	Mission Lakes	1.95				
	High Northridge	1.04				
	Low Northridge	*0.00*				
1535	Redbud	0.29	0.05	0.08	0.26	0.03
1600	Cottonwood	0.30	0.06	0.12	0.30	0.00
1630	Vista #2	0.75	0.34	0.51	0.69	0.06
1660	Highland	0.05	0.04	0.06	0.24	(0.19)
1700	1700-1	1.06	0.44	0.66	0.84	0.22
1840	Woodridge	0.12	0.05	0.10	0.28	(0.16)
1875	1875-1	0.40	0.11	0.16	0.34	0.06
2035	2035-1	0.60	0.18	0.27	0.45	0.15

Individual tank sizing was determined by the projections at buildout (2045), however, the timing should coincide with when the system can no longer reasonably accommodate the deficit. For example, as shown in Table 8.6 the Two Bunch and Valley View 1070 Zone has a deficit of 0.95 MG. This deficit can be accommodated by the remaining surplus in the Terrace 1240 Zone.

The PSC and WPSV systems show deficits that cannot be supported by other zones. However, due to the size and relatively insignificant deficit in the Cottonwood 1600 Zone, no improvements are recommended at this time. However, this tank is nearly the end of its useful life. Upon time for replacement, a 0.30-MG tank should be constructed. The Woodridge 1840 Zone has a larger deficit and would benefit from additional storage. A second tank of 0.16 MG is recommended for this Zone.

The Vista 1630 Zone has a known deficit, and staff discussions have begun to replace this tank. However, due to site constraints this tank would likely be limited to 0.75 MG. The remaining deficit can be accommodated by excess in the 1530 Zone. At this time, the District is anticipating this project by 2035.

The condition of the Low Northridge Tank should be monitored. This tank is rapidly approaching the end of its useful life, and conditions with the 1530 Zone itself would allow this tank to be decommissioned. The available storage is carried through until 2040.

The Redbud Tank should be considered for replacement by 2040 due to age. To meet ultimate demands for this Zone, a 0.30-MG tank is recommended.

The Highland 1660 Tank was constructed in 2008 and while it carries a deficit, the lower High Desert View 1400 Zone can accommodate the deficit. In the future as the District expands, if another site becomes available for additional storage the District should consider adding to this Zone.

By 2035, the Valley View and Two Bunch 1070 Zone deficit could be addressed by adding a new 2.45 MG tank at the Valley View Site. This would alleviate the need for any deficit here to be covered by the Terrace 1240 Zone. Before buildout, additional storage will be required, not just to cover increased demand, but also due to the age of the Two Bunch #1 Tank.

Ultimately the District will require a storage volume overall of 22.29 MG based on criteria. With the improvements discussed above, the District will carry a storage surplus of 2.81 MG.

8.1.3 Future Pumping Analysis

The District's booster pump stations are similarly evaluated to determine capacity based on ultimate demands and criteria. These criteria define that the booster station firm capacity be able to supply the MDD for the pressure zone(s) it feeds with all wells available, less the largest well. The pumping period is for a full 24-hours with all pumps considered.

Table 8.11 – 2025 Pumping Analysis

Served by BPS	From	Zone To	Unit	Capacity (gpm)	Firm Capacity (gpm)	Zones Included	ADD (gpm)	MDD (gpm)	Well Supply (gpm) [1]	Surplus / (Deficit)	Notes
Well 32 BPS	913	1070	1	1185	1155	Two Bunch 1070	1,095	1,642	1,100	613	Well 31. Also, any surplus from Well 27 serving the 1070 Valley View Zone could be used.
			2	1155							
Two Bunch	1070	1240	1	1,068	1,068	Terrace 1240	1,704	2,557	5,450	3,961	Terrace 1240 served by Wells 22, 29, and 37 with the assumption that the largest well, Well 24, is out of service.
			2	1,091							
Terrace #1	1240	1400	1	446	910	Quail 1240, High Desert View 1400, Annandale 1400, Redbud 1535, Highland 1600	1,046	1,570	1,850	1,190	Once 1400 Zones are connected, then supply from Annandale can be included. For this analysis, Well 42 was included for BPS #1, and Wells 34 and 35 were included for BPS #2, with 36 out of service.
			2	464							
			3	706							
Terrace #2	1240	1530	4	605	1337	High Northridge 1530, Vista 1630	679	1,019	2,000	2,318	
			5	732							
			6	780							
Low Desert View	1400	1535	1	700	700	Redbud 1535, Highland 1600	52	79	0	621	As the higher zones have no well supply, pumps must support MDD for both Redbud and Highland Zones
			2	700							
Low Northridge	**1530**	**1630**	**1**	**250**	500	Vista 1630, Vista Hydro, Vista Reduced	237	356	0	144	Relocate BPS to the High Northridge Tank.
			2	**250**							
			3	**250**							
Redbud	1530	1630	1	373	373	Highland 1600	17	25	0	348	
			2	385							
Well 33 BPS	--	913	1	1185	1155	Little Morongo 913	168	253	800	1,702	Wells 32 and 33, with Well 32 out of service
			2	1155							
Valley View	1070	1400	1	583	583	Overhill 1400, Gateway 1530, Mission Lakes 1530, 1875, 2035, 2155	105	157	1,100	1,526	Well 27. Also, any surplus from Well 31 serving the 1070 Two Bunch Zone could be used.
			2	602							
Overhill	1400	1530	1	564	564	Gateway 1530, Mission Lakes 1530, 1875, 2035, 2155	63	94	3,000	3,470	Wells 34 and 36, with 35 out of service.
			2	588							
1700-1	**1530**	**1700**	**1**	**375**	**375**	**1700, 1875, 2035, 2155**	**91**	**136**	**0**	**239**	
			2	**375**							
			3	**--**							

Table 8.12 – 2030 Pumping Analysis

Served by BPS	From	Zone To	Unit	Capacity (gpm)	Firm Capacity (gpm)	Zones Included	ADD (gpm)	MDD (gpm)	Well Supply (gpm)	Surplus / (Deficit)	Notes
Well 32 BPS	913	1070	1	1185	1155	Two Bunch 1070	1,169	1,753	1,100	502	Well 31. Also, any surplus from Well 27 serving the 1070 Valley View Zone could be used.
			2	1155							
Two Bunch	1070	1240	1	1,068	1,068	Terrace 1240	1,705	2,557	5,450	3,961	Terrace 1240 served by Wells 22, 29, and 37 with the assumption that the largest well, Well 24, is out of service.
			2	1,091							
Terrace #1	1240	1400	1	446	910	Quail 1240, High Desert View 1400, Annandale 1400, Redbud 1535, Highland 1600	1,140	1,710	1,850	1,050	Once 1400 Zones are connected, then supply from Annandale can be included. For this analysis, Well 42 was included for BPS #1, and Wells 34 and 35 were included for BPS #2, with 36 out of service.
			2	464							
			3	706							
Terrace #2	1240	1530	4	605	1337	High Northridge 1530, Vista 1630	679	1,019	2,000	2,318	
			5	732							
			6	780							
Low Desert View	1400	1535	1	700	700	Redbud 1535, Highland 1600	55	82	0	618	As the higher zones have no well supply, pumps must support MDD for both Redbud and Highland Zones.
			2	700							
Low Northridge	1530	1630	1	250	500	Vista 1630, Vista Hydro, Vista Reduced	237	356	0	144	Relocate BPS to the High Northridge Tank.
			2	250							
			3	250							
Redbud	1530	1630	1	373	**373**	Highland 1600	19	28	0	345	
			2	385							
Well 33 BPS	--	913	1	1185	1155	Little Morongo 913	252	378	800	1,577	Wells 32 and 33, with Well 32 out of service
			2	1155							
Valley View	1070	1400	1	583	583	Overhill 1400, Gateway 1530, Mission Lakes 1530, 1875, 2035, 2155	199	298	1,100	1,385	Well 27. Also, any surplus from Well 31 serving the 1070 Two Bunch Zone could be used.
			2	602							
Overhill	1400	1530	1	564	564	Gateway 1530, Mission Lakes 1530, 1875, 2035, 2155	92	138	3,000	3,426	Wells 34 and 36, with 35 out of service.
			2	588							
1875-1	**1700**	**1875**	**1**	**300**	**300**	**1875, 2035, 2155**	**74**	**111**	**0**	**189**	
			2	**300**							
1700-1	1530	1700	1	375	375	1700, 1875, 2035, 2155	185	278	0	97	
			2	375							
			3	--							

Table 8.13 – 2035 Pumping Analysis

Served by BPS	From	Zone To	Unit	Capacity (gpm)	Firm Capacity (gpm)	Zones Included	ADD (gpm)	MDD (gpm)	Well Supply (gpm)	Surplus / (Deficit)	Notes
Well 32 BPS	913	1070	1 2	1185 1155	1155	Two Bunch 1070	1,243	1,864	1,100	391	Well 31. Also, any surplus from Well 27 serving the 1070 Valley View Zone could be used.
Two Bunch	1070	1240	1 2	1,068 1,091	1,068	Terrace 1240	1,705	2,558	5,450	3,960	Terrace 1240 served by Wells 22, 29, and 37 with the assumption that the largest well, Well 24, is out of service.
Terrace #1	1240	1400	1 2 3	446 464 706	910	Quail 1240, High Desert View 1400, Annandale 1400, Redbud 1535, Highland 1600	1,234	1,851	1,850	909	Once 1400 Zones are connected, then supply from Annandale can be included. For this analysis, Well 42 was included for BPS #1, and Wells 34 and 35 were included for BPS #2, with 36 out of service.
Terrace #2	1240	1530	4 5 6	605 732 780	1337	High Northridge 1530, Vista 1630	679	1,019	2,000	2,318	
Low Desert View	1400	1535	1 2	700 700	700	Redbud 1535, Highland 1600	57	85	0	615	As the higher zones have no well supply, pumps must support MDD for both Redbud and Highland Zones
Low Northridge	1530	1630	1 2 3	250 250 250	500	Vista 1630, Vista Hydro, Vista Reduced	237	356	0	144	Relocate BPS to the High Northridge Tank.
Redbud	1530	1630	1 2	373 385	373	Highland 1600	21	32	0	341	
Well 33 BPS	--	913	1 2	1185 1155	1155	Little Morongo 913	336	504	800	1,451	Wells 32 and 33, with Well 32 out of service
Valley View	1070	1400	1 2	583 602	583	Overhill 1400, Gateway 1530, Mission Lakes 1530, 1875, 2035, 2155	499	748	350	185	Well 27. Also, any surplus from Well 31 serving the 1070 Two Bunch Zone could be used.
2035-1	**1875**	**2035**	**1** **2**	**90** **90**	**90**	**1875, 2035, 2155**	**36**	**54**	**0**	**36**	
1875-1	1700	1875	1 2	300 300	300	1875, 2035, 2155	118	178	0	122	
Overhill	1400	1530	1 2	564 588	564	Gateway 1530, Mission Lakes 1530, 1875, 2035, 2155	121	181	3,000	3,383	Wells 34 and 36, with 35 out of service.
1700-1	1530	1700	1 2 3	375 375 **375**	750	1700, 1875, 2035, 2155	281	422	0	328	

Table 8.14 – 2040 Pumping Analysis

Served by BPS	From	Zone To	Unit	Capacity (gpm)	Firm Capacity (gpm)	Zones Included	ADD (gpm)	MDD (gpm)	Well Supply (gpm)	Surplus / (Deficit)	Notes
Well 32 BPS	913	1070	1	1185	1155	Two Bunch 1070	1,324.0	2,648.0	1,900	407	Well 31. Also, any surplus from Well 27 serving the 1070 Valley View Zone could be used.
			2	1155							
Two Bunch	1070	1240	1	1,068	1,068	Terrace 1240	1,705.5	3,410.9	3,450	1,107	Terrace 1240 served by Wells 22, 29, and 37 with the assumption that the largest well, Well 24, is out of service.
			2	1,091							
Terrace #1	1240	1400	1	446	910	Quail 1240, High Desert View 1400, Annandale 1400, Redbud 1535, Highland 1600	1,337.1	2,674.1	3,600	1,836	Once 1400 Zones are connected, then supply from Annandale can be included. For this analysis, Well 42 was included for BPS #1, and Wells 34 and 35 were included for BPS #2, with 36 out of service.
			2	464							
			3	706							
Terrace #2	1240	1530	4	605	1337	High Northridge 1530, Vista 1630	679.5	1,358.9	1,700	1,678	
			5	732							
			6	780							
Low Desert View	1400	1535	1	700	700	Redbud 1535, Highland 1600	59.0	117.9	0	582	As the higher zones have no well supply, pumps must support MDD for both Redbud and Highland Zones
			2	700							
Low Northridge	1530	1630	1	250	500	Vista 1630, Vista Hydro, Vista Reduced	237.4	474.9	0	25	Relocate BPS to the High Northridge Tank.
			2	250							
			3	250							
Redbud	1530	1630	1	373	373	Highland 1600	23.3	46.7	0	326	
			2	385							
Well 33 BPS	--	913	1	1185	1155	Little Morongo 913	479.4	958.8	0	196	Wells 32 and 33, with Well 32 out of service
			2	1155							
Valley View	1070	1400	1	583	583	Overhill 1400, Gateway 1530, Mission Lakes 1530, 1875, 2035, 2155	13.9	27.8	0	555	Well 27. Also, any surplus from Well 31 serving the 1070 Two Bunch Zone could be used.
			2	602							
1875-1	1700	1875	1	300	300	1875, 2035, 2155	150	225	0	75	
			2	300							
2035-1	1875	2035	1	90	90	1875, 2035, 2155	48	72	0	18	
			2	90							
Overhill	1400	1530	1	564	564	Gateway 1530, Mission Lakes 1530, 1875, 2035, 2155	200.5	401.1	3,000	3,163	Wells 34 and 36, with 35 out of service.
			2	588							
1700-1	1530	1700	1	375	750	1700, 1875, 2035, 2155	393	589	0	161	
			2	375							
			3	375							

Table 8.15 – 2045 Pumping Analysis

Served by BPS	From	Zone To	Unit	Capacity (gpm)	Firm Capacity (gpm)	Zones Included	ADD (gpm)	MDD (gpm)	Well Supply (gpm)	Surplus / (Deficit)	Notes
Well 32 BPS	913	1070	1 2	1185 1155	1155	Two Bunch 1070	1,405.4	2,810.9	1,900	244	Well 31. Also, any surplus from Well 27 serving the 1070 Valley View Zone could be used.
Two Bunch	1070	1240	1 2	1,068 1,091	1,068	Terrace 1240	1,705.8	3,411.7	3,450	1,106	Terrace 1240 served by Wells 22, 29, and 37 with the assumption that the largest well, Well 24, is out of service.
Terrace #1	1240	1400	1 2 3	446 464 706	910	Quail 1240, High Desert View 1400, Annandale 1400, Redbud 1535, Highland 1600	1,440.3	2,880.5	3,600	1,629	Once 1400 Zones are connected, then supply from Annandale can be included. For this analysis, Well 42 was included for BPS #1, and Wells 34 and 35 were included for BPS #2, with 36 out of service.
Terrace #2	1240	1530	4 5 6	605 732 780	1337	High Northridge 1530, Vista 1630	679.5	1,358.9	1,700	1,678	
Low Desert View	1400	1535	1 2	700 700	700	Redbud 1535, Highland 1600	61.3	122.5	0	577	As the higher zones have no well supply, pumps must support MDD for both Redbud and Highland Zones
Low Northridge	1530	1630	1 2 3	250 250 250	500	Vista 1630, Vista Hydro, Vista Reduced	237.4	474.9	0	25	Relocate BPS to the High Northridge Tank.
Redbud	1530	1630	1 2	373 385	373	Highland 1600	25.6	51.3	0	322	
Well 33 BPS	--	913	1 2	1185 1155	1155	Little Morongo 913	622.6	1,245.2	0	(90)	Wells 32 and 33, with Well 32 out of service
Valley View	1070	1400	1 2	583 602	583	Overhill 1400, Gateway 1530, Mission Lakes 1530, 1875, 2035, 2155	13.9	27.8	0	555	Well 27. Also, any surplus from Well 31 serving the 1070 Two Bunch Zone could be used.
Overhill	1400	1530	1 2	564 588	1152	Gateway 1530, Mission Lakes 1530, 1875, 2035, 2155	639.2	1,278.4	2,000	1,874	Wells 34 and 36, with 35 out of service.
2035-1	1875	2035	1 2	90 90	90	1875, 2035, 2155	59	89	0	1	
1875-1	1700	1875	1 2	300 300	300	1875, 2035, 2155	198	298	0	2	
1700-1	1530	1700	1 2 3	375 375 375	750	1700, 1875, 2035, 2155	504	756	0	(6)	

Due to the flexibility of the District's supply picture, the booster pump stations are a portion of the zone supply. In addition, several zones are separated by normally-closed valves, which allow these pumped flows to transfer between service areas. Therefore, the only booster station that requires upgrades is the Low Northridge BPS. This station, which serves the Vista 1630, Vista Hydropneumatic, and Vista Reduced, is undersized and should be relocated to the High Northridge Tank. This project, per staff, has a higher priority than the Vista Tank replacement discussed earlier, and should be completed prior to the tank.

The projects noted in this Chapter and others are discussed in more detail with preliminary cost estimates in Chapter 10.

Chapter 9 Water Quality

9.1 Methodology

The District uses groundwater wells as its primary source of water supply. The water quality must meet standards set by the U.S. Environmental Protection Agency (EPA) and the California State Water Resources Control Board (SWRCB) to ensure safe drinking water for the public.

9.2 Regulatory Requirements

Groundwater quality in the District requires monitoring specific contaminants to meet regulatory standards. Primary Drinking Water Standards are legally enforceable and focus on protecting public health. These standards address nearly 100 contaminants regulated by the U.S EPA and California Water Board. Contaminants of greatest concern for the District, as highlighted in the District Water Quality Report, include:

- Arsenic
- Fluoride
- Gross Alpha Particles
- Chromium
- Nitrates
- Uranium
- Coliform bacteria
- Chromium VI (Cr(VI))

Secondary Drinking Water Standards are non-mandatory guidelines addressing aesthetic factors such as taste, odor, and appearance. While these contaminants do not pose health risks, maintaining compliance is essential for public trust. Key secondary contaminants include:

- Chloride
- Iron
- Manganese
- Total Dissolved Solids
- Turbidity

9.3 Goals and Preferences

Drinking water standards are categorized into primary and secondary regulations. The U.S. Environmental Protection Agency (EPA) establishes these standards, with the California State Water Resources Control Board (SWRCB) enforcing additional and often stricter requirements.

Primary Standards protect public health by setting legally enforceable Maximum Contaminant Levels (MCLs) for harmful substances. **Table 9.1** highlights common primary contaminants in the Mission Springs Water District (MSWD) region. Although not exhaustive, it includes contaminants of greatest concern.

Secondary Standards focus on aesthetic qualities such as taste, odor, and appearance. While these standards are not enforceable, maintaining compliance is essential for public trust and customer satisfaction. **Table 9.2** lists secondary contaminants of concern and their potential effects when limits are exceeded.

Table 9.1 – Primary Drinking Water Contaminants of Concern

Contaminant	U.S. EPA	California
	MCL	MCL
Fluoride	4 mg/l	2 mg/l
Perchlorate	N/A	6 µg/l
Perfluoro octane sulfonic Acid (PFOS)	N/A	1 µg/l
Perfluorooctanoic Acid (PFOA)	N/A	0.1 µg/l
Trichloro propane (1,2,3-TCP)	N/A	5 ppt
Nitrate	10 mg/l (as N)	45 mg/l (as NO3)
Lead	TT	15 µg/l
Copper	TT	1.3 mg/l
Chromium	0.05	0.05
Arsenic	0.05	0.05
Total Coliforms	5%	N/A
Uranium	30 µg/l	20 pCi/L
Gross Alpha Particle Activity	15 pCi/l	15 pCi/l
Tetrachloroethylene (PCE)	5 µg/l	5 µg/l
Trichloroethylene	5 µg/l	5 µg/l
Turbidity	TT	5

Table 9.2 – Secondary Drinking Water Contaminants of Concern

Contaminant	Secondary MCL		Noticeable Effects above Secondary MCL
	U.S. EPA (mg/L)	California (mg/L)	
Aluminum	0.05 to 0.2	0.2	Colored Water
Chloride	250	500	Salty Taste
Iron	0.3	0.3	Rusty Color, Staining, Metallic Odor
Manganese	0.05	0.05	Black-Brown Color, Staining, Bitter Taste
Sulfate	250	500	Salty Taste
Total Dissolved Solids	500	1000	Hardness, Colored Water, Staining, Salty Taste

9.3.1 Chromium VI Compliance

On October 1, 2024, the SWRCB Division of Drinking Water (DDW) finalized a new MCL of 10 µg/L for hexavalent chromium (Cr(VI)). At least 8 District wells have historically high Cr(VI) levels (>8 µg/L). Due to MSWD having over 10,000 connections, it must comply with the new MCL within 2 years of its implementation (i.e., 10/1/2026).

MSWD prepared a Hexavalent Chromium Treatment Roadmap that identifies strategies for compliance, including system evaluation, treatment alternatives, and operational changes. Wells were categorized into four tiers based on Cr(VI) levels:

- **Tier 1 (Well Nos. 27, 29, 37):** 11.9-16.6 µg/L – require treatment
- **Tier 2 (Well Nos. 24 and 31):** 8.6-9.9 µg/L – potential treatment needed
- **Tier 3 (Well Nos. 22, 32, 33):** 8.8-9.3 µg/L – monitoring recommended
- **Tier 4 (Well Nos. 28 and 34):** < 8.0 µg/L –unlikely to require treatment

An interim plan has been developed to address the MSWD wells implicated by the new MCL, recommending the removal of Tier 1 wells from service and replacing their production with wells in Tiers 2–4. The plan involves turning off Well Nos. 27, 29, and 37 while increasing production from Well Nos. 31, 32 and 33 to compensate for Well No. 27. Additionally, Well Nos. 29 and 37 will be replaced by Well Nos. 22, 24 and 42, requiring the reconfiguration of Well No. 24, which currently serves the 1400 Annandale zone, and the activation of the new Well No. 42 to support the 1240 Terrace zone. If Well No. 24 is rerouted to serve the 1240 Terrace zone, an alternative source must be identified for the 1400 Annandale zone. MSWD is currently in the process of implementing this interim plan and confirming its effectiveness in achieving compliance.

Pending the outcome of the interim plan to meet compliance, MSWD may elect to implement the following treatment alternatives. Alternative 1 involves treating only Tier 1 wells, with a consolidated treatment system for Wells 27 and 31. Although Well No. 31 is a Tier 2 well, it is included due to its shared well site with Well No. 27 and the uncertainty of its Cr(VI) concentration when Well No. 27 is off. Alternative 2 expands treatment to both Tier 1 and Tier 2 wells, while Alternative 3 includes Tier 1, Tier 2, and Tier 3 wells. Each alternative considers both individual wellhead treatment and centralized treatment at a common location. Based on water quality evaluations, Reduction Coagulation Filtration (RCF) is the preferred treatment method, with residuals likely discharged to the sewer.

9.4 Groundwater Quality

9.4.1 General Description

MSWD is located in the northwestern part of the Upper Coachella Valley Groundwater Basin, covering portions of the Mission Creek Subbasin, Garnet Hill Subbasin, Indio Subbasin, San Gorgonia Pass Subbasin, and the Desert Hot Springs Subbasin. These basins are influences by large and active fault systems, including the San Andreas

Fault. Groundwater quality varies by depth, proximity to fault lines, recharge facilities, surface runoff contaminants, and other factors. Most subbasins meet state and federal Maximum Contaminant Level (MCL) standards for potable water, except for the Desert Hot Springs Subbasin, which has elevated mineralization and high temperatures, requiring treatment to make its water potable. The Indio subbasin provides water to the West Palm Springs System and portions of the main DHS system via Well No. 33.

9.4.2 Mission Spring/Garnet Hill Subbasins

The primary water source is the Mission Creek Subbasin, bounded by the Mission Creek Fault to the north and east, the San Bernardino Mountains to the west, the Banning Fault to the south, and Indio Hills to the southeast. The Garnet Subbasin is located to the south of the Mission Creek Subbasin. The banning fault borders it to the north and the Garnet Fault to the South. This information is based on the 2022 Mission Creek Subbasin Alternative Plan Update Total Dissolved Solids (TDS) levels in the Mission Creek Subbasin range from 190 to 660 mg/l, affecting water hardiness and taste. The TDS levels found in wells are affected by their proximity to the Desert Hot Spring Subbasin and its high mineralization levels. Recharge management carefully monitors TDS levels from imported and reclaimed water.

The primary MCL for nitrate concentrations range from 1.1 to 9.4 mg/L due to septic systems in the upper aquifer layers, with some private wells exceeding the MCL of 45 mg/L as NO_3 and 10 mg/L as N., The main contributor of nitrate within the groundwater was the use of septic tanks, as they were found to exist in higher quantities in the upper layers of the aquifer. As a result, nitrate levels were found to vary between 1.1 mg/l to 9.4 mg/l, with some private wells recording concentrations exceeding the maximum contamination limit. MSWD plans to transition all septic systems to a sewer network to reduce nitrate levels. To date, the District has converted approximately 60% of the legacy septic tanks to the wastewater conveyance and treatment system.

Radionuclides, including Uranium and Gross Alpha Radiation, have been detected at levels approaching the MCL. Uranium samples collected in 2008 found levels that range from 4.4 to 23 pCi/L, but none exceeded the four-quarter average MCL limit of 20 pCi/L. Gross Alpha Particle Activity was detected in some wells at 16 pCi/L but was below the four-quarter average MCL limit of 15 pCi/L.

9.4.3 Indio Subbasin

The Indio Subbasin is bounded by the Banning Fault to its north, Indio Hills to the northeast, and the San Jacinto and Santa Rosa Mountains to the south, according to the California Department of Water Resources. The subbasin's TDS level averages 300 mg/l, primarily comprises calcium bicarbonate. A high nitrate plume (45+ mg/l) exist in the southeastern portion of the subbasin. The MSWD service area and wells are located in the northern part of the subbasin but does not affect MSWD wells, which are located in the northern park of the subbasin.

9.4.4 San Gorgonio Pass Subbasin

Based on the California Department of Water Resources report, this subbasin is bounded by the San Bernardino Mountains to the north, the San Jacinto Mountains to the South, and the east by bedrock. Only a tiny portion of the northeastern part of this subbasin is located within the MSWD service area. It is used to supply water to the West Palm Springs Village residential areas in the southwestern portion of the MSWD service area. This subbasin has had no significant issues with its water quality, with reported TDS concentrations ranging from 106 to 205 mg/L.

9.5 Imported Water Quality

To address water level decline, CVWD and DWA, with the support from MSWD, launched the MCSB Groundwater Replenishment Program in 2002, leading to the construction of the Mission Creek Groundwater Replenishment Facility (MC-GRF). This facility recharges the aquifers with imported water to sustain groundwater levels.

CVWD and DWA hold contracts for 194,100 AFY of State Water Project (SWP) water. However, due to the lack of direct delivery infrastructure, they exchange their SWP water with MWD to receive water via the Colorado River Aqueduct (CRA). Additionally, the agencies receive water from the Colorado River that is delivered to the Indio Subbasin primarily via the Coachella Canal. To enhance long-term water reliability, they have pursued additional agreements, such as the Yuba Accord and the Delta Conveyance Facility. Over the past two decades, SWP deliveries have fluctuated between 5% and 100%, with future reliability projected at approximately 45% due to climate change and legal uncertainties.

A key concern is the rising total dissolved solids (TDS) in groundwater, caused by factors such as groundwater use, fertilizer application, wastewater percolation and the recharge of higher TDS imported water. The use of CRA water for recharge has contributed to increased TDS levels in the MCSB. CVWD and DWA explored alternatives such as importing lower TDS SWP water, but this would require costly infrastructure and result in losing 100,000 AFY of CRA water from the MWD exchange. Salt removal via reverse osmosis was also considered but faces technical, financial, and environmental challenges.

TDS management in the Colorado River is addressed through the Colorado River Basin Salinity Control Program, a multi-state effort that has reduced salinity since the 1970s. The program includes salinity control measures, effluent limitations, and improved irrigation practices, successfully preventing over 1.22 million tons of salt from entering the river annually. CRA water quality is monitored at various stations, with Below Parker station being most representative of CRA intake at Lake Havasu. Since recharge began at MC-GRF in 2002, TDS concentration at Below Parker Station have ranged from 560 mg/L to 680 mg/L. Since 2016, concentrations have been declining, reaching approximately 590 mg/L in 2019. TDS levels have remained below regulatory limits since the mid-1980s, following a cyclical pattern of variation every 12 to 14 years.

9.6 Blending

The District does not have any blending facilities in its service area.

9.7 Disinfection

The existing treatment for the well water is the injection of sodium hypochlorite at the wellhead to maintain a chlorine residual of 0.52 µg/L throughout the potable water supply system. The District has standardized an injection point at the well discharge for liquid sodium hypochlorite, followed by a collection tank. In addition, each wellhead should have a hypochlorite drum storage (typically 55 gallons) with secondary containment, sodium hypochlorite metering pumps, sodium hypochlorite diffuser assembly, a plug flow chlorine contact basin or pipeline, and a well start-up pump-to-waste valve.

9.8 Water Age

The goal of any water system is to provide safe, quality drinking water to its customers, and the age of water is one quality measure. The higher the age, typically in days, the lower the disinfection residual; generally, the water will incur a distinct odor and smell. Conversely, the lower the water age, the closer the disinfection residual is to the dosing requirement.

9.8.1 General Information

Based on the U.S. EPA's Effects of Water Age on Distribution Systems Water Quality study that analyzed the water age in over 800 utilities, the average water age is 1.3 days, with a maximum of 24 days. The typical water ages also vary depending on the size of the water distribution system. Several water age estimations published in this study are shown in Table 9.3. According to this information, the District should expect to see water age of up to 24 days.

Table 9.3 – Summary of Water Age Evaluation

Population Served	Miles of water mains	Range of Water Ages within the system (Days)	Method of Determination
800,000	2,750	3 to 7	Hydraulic Model
300,000	1,100	1 to 3	Fluoride tracer
80,000	358	More than 16	Chloramine Conversion
24,000	86	12 to 24	Hydraulic Model

Note: Source is U.S. EPA Effects of Water Age on Distribution System Water Quality, August 15, 2002

The hydraulic model was analyzed to determine the water age throughout the system. This analysis utilized the existing tanks and distribution system to assess the maximum water age over 10 days. This analysis did not, however, include a detailed water quality analysis, which typically requires extensive field sampling and laboratory tests to determine the rate of chlorine decay in the system. The typical standard is to achieve less than 10-day-old water through fresh supply sources, disinfection stations, or tank mixing. Currently, the District does not utilize tank mixing to maintain water quality. Ideally, one would see the water age increase and decrease with the tank cycle for that area, and an age of 2 days would be preferred for most systems.

Figure 9.1 illustrates the water age analysis for the District's distribution system. Water age varies from a few minutes to more than 1 week, with an average of 51 hours. Higher water ages are typically found in the outer regions, low demand areas, and dead ends of the system. The current water age remains below the 10-day standard and falls within the typical range for a utility of this size and population.

9.8.2 Water Age Potential Health Impacts

Various potential health impacts have been associated with the age-related water chemicals and biological issues identified in Table 9.4

Table 9.4 – Summary of Water Quality Problems Associated with Water Age

Chemical Issues	Biological Issues	Physical Issues
Disinfection by-product formation	Disinfection by-product biodegradation	Temperature increase
Disinfection decay	Nitrification	Sediment deposition
Corrosion Control effectiveness	Microbial regrowth/recovery/shielding	Color
Taste and Color	Taste and Odor	--

1. The source is U.S. EPS Effects of Water Age on Distribution System Water Quality, August 15, 2002.
2. The Chemical Health Effects Tables (U.S. Environmental Protection Agency, 2002a) summarizes potential adverse health effects from high/long-term exposures to hazardous chemicals in drinking water.

The Microbial Health Effects Tables (U.S. Environmental Protection Agency, 2002b) summarizes the potential health effects of exposure to waterborne pathogens. The most concerning health effect would be disinfection by-product formation and decay, as the District relies on disinfecting its water at each extraction well. Nitrification could also cause microbial growth and could be an issue if the District does not properly maintain the disinfection system at their wells.

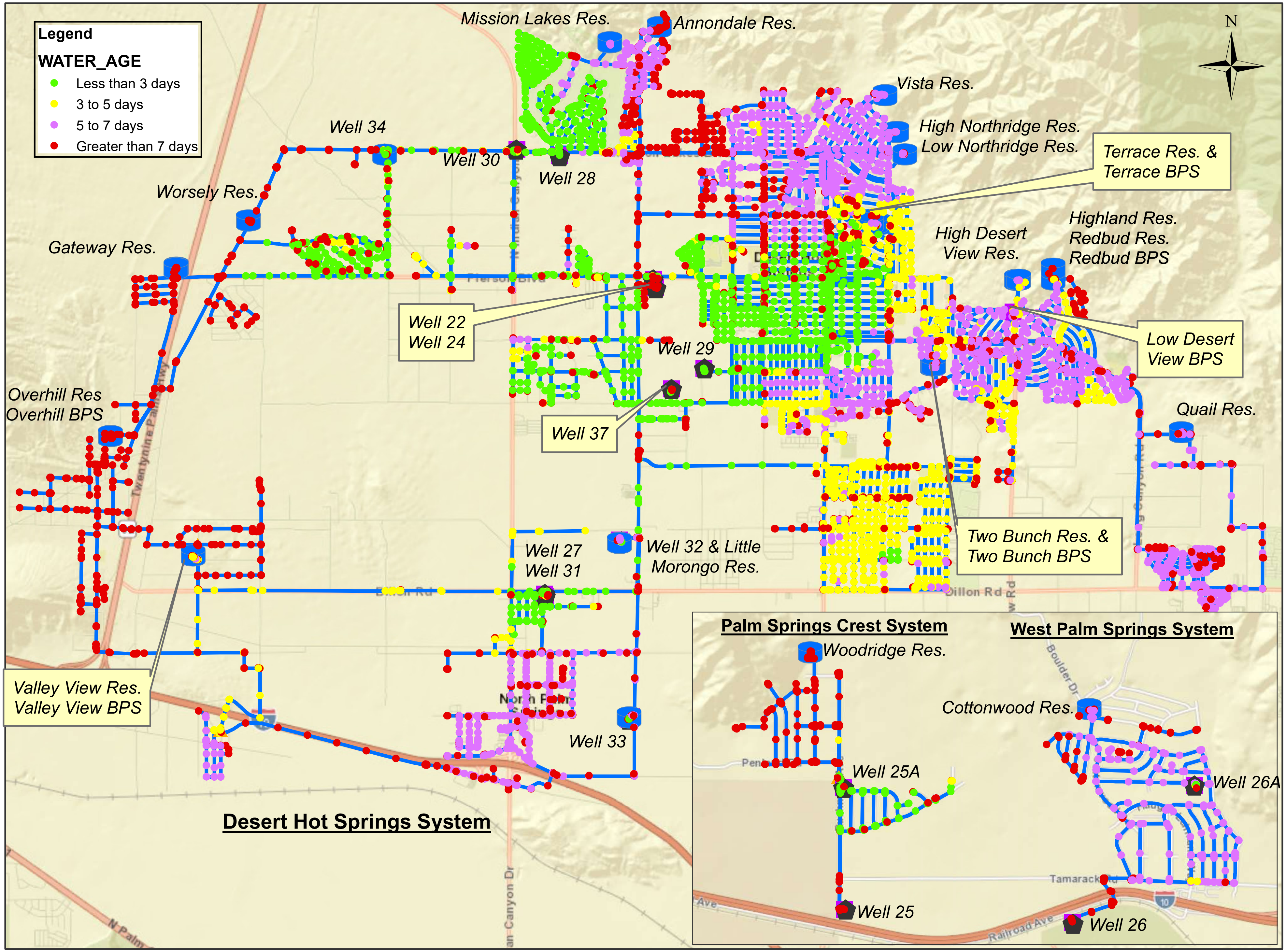


Figure 9.1 Water Age Analysis

Chapter 10 Capital Improvement Program

10.1 General Description

This Chapter presents the recommended Capital Improvement Program (CIP) Projects for the potable water system, along with estimated capital costs. These Projects are based on the water system evaluations described in Chapters 6 and 7.

This Chapter will highlight the proposed capital improvement programs for the 2025 through 2045 planning years and provide recurring annual capital expenditure estimates to repair or replace aging and outdated infrastructure.

10.2 Basis for Capital Improvement Costs

The cost estimates presented in this Chapter are developed using Engineering News Record (ENR) Construction Cost Index 12,704 (ENG Los Angeles, October 2021) and recent bid information for similar projects. Construction costs are to be used for conceptual-level cost estimating only. The cost estimates prepared for this 2024 Water Master Plan are in accordance with the guidelines of the Association for the Advancement of Cost Engineering (AACE) International for a Class 5 Estimate, suitable for long-range capital planning, with an accuracy range of -50 percent to +100 percent. In other words, estimates may be 50 percent less or 100 percent more than actual costs at the time of construction.

The contingencies presented, which include variants to the construction cost, engineering and design, and project management, are typical and align with those seen by MSWD on recent projects. Final constructed costs for a project will depend on actual labor and material cost, competitive market conditions, final scope, implementation schedule, and other variables.

Costs are presented in presented as present-day values.

10.2.1 Pipeline Construction Costs

Pipeline cost estimates are based upon recent bid estimates for similar projects within the District, which include pipelines in existing streets with utilities present. These costs have been trending higher than ENR published unit costs provided in Table 10-1 for reference. For the purposes of this Master Plan, the unit cost used for mains up to 12-inch will be $350/LF before contingencies.

Table 10.1 – Pipeline Unit Cost Reference

Diamter (in.)	Unit Construction Cost[1]
4	$125/LF
6	$185/LF
8	$190/LF
10	$240/LF
12	$250/LF
16	$335/LF
18	$380/LF
20	$415/LF
24	$475/LF

1. Unit Costs based on October 2021 Los Angeles ENR data.

10.2.2 Booster Pump Station Construction Costs

The hydraulic analysis in Chapter 6 and Chapter 7 identified new and rehabilitated booster pump stations required to provide service. Discussions with District staff have led to the need to develop a unit cost for the type of station desired. This construction cost was determined based on similar facilities in size and type of construction.

10.2.3 Reservoir Construction Costs

Unit costs for reservoir construction varies greatly depending on the type of material (steel vs. concrete), size, geotechnical conditions of the site, as well as the complexity of yard piping, to name a few. However, ENR provides a schedule for reservoirs using several of these factors, as shown in Table 10.2.

Table 10.2 – Reservoir Unit Costs

Volume (MG)	Unit Construction Cost[1]
Less than 1	$2.50/gallon
1 to 3	$2.00/gallon
3 to 5	$1.75/gallon
5 to 10	$1.25/gallon

1. Unit Costs based on October 2021 Los Angeles ENR data.

10.2.4 Well Construction Costs

The District is currently constructing several new wells and rehabilitating several others that will complete the water supply picture for the District. At this time, no new wells are anticipated beyond the known facilities. However, the District will require regular maintenance for their wells and associated appurtenances. Rehabilitation costs for minor upgrades is included at an anticipated unit cost of $120,000 per well and anticipating that during each 5-year period the District will perform this service on two wells.

10.3 Contingency and Implementation Costs

Contingency cost and implementation mark-ups must be reviewed on a case-by-case basis because they will vary considerably with each construction project. However, the typical contingencies seen by the District and quoted in ENR show that the construction contingency of a project is approximately 30 percent of the construction cost itself. Obviously, this number can increase with the complexity of a project or as the number of unknowns increases. For the purposes of this 2024 Water Master Plan, 30 percent will be used.

Implementation Contingencies include things such as design, construction management and inspection, permitting and regulatory compliance, administration, and legal fees and has been set at 27.5 percent of the construction cost.

The total contingency and implementation costs are compounded, so the total markup of the base construction cost is as follows:

A.	**Baseline Construction Cost**	**$1,000,000**
B.	Construction Contingency (30%)	$300,000
C.	**Estimated Construction Cost (A + B)**	**$1,300,000**
D.	Implementation Contingencies (27.5% x C)	$357,500
E.	**Total Capital Construction Cost (C + D)**	**$1,657,500**

For the 2024 Water Master Plan, it is assumed that new facilities will be developed in public rights-of-way or on public property. Therefore, land acquisition costs have not been included. The proposed costs do not include costs for annual operation and maintenance.

10.4 CIP Phasing

This Master Plan divided CIP Projects into five-year increments (phases), starting with 2025 and ending in 2045. Each project is classified as:

- Pump Station Improvements
- Well/Supply Improvements
- Storage Improvements
- Pipeline Improvements
- Other Improvements

Rehabilitation and replacement projects are included in each category. Projects are summarized by category and Phase in Table 10.3.

Table 10.3 – Summary Cost Opinion by Category for District-funded Projects

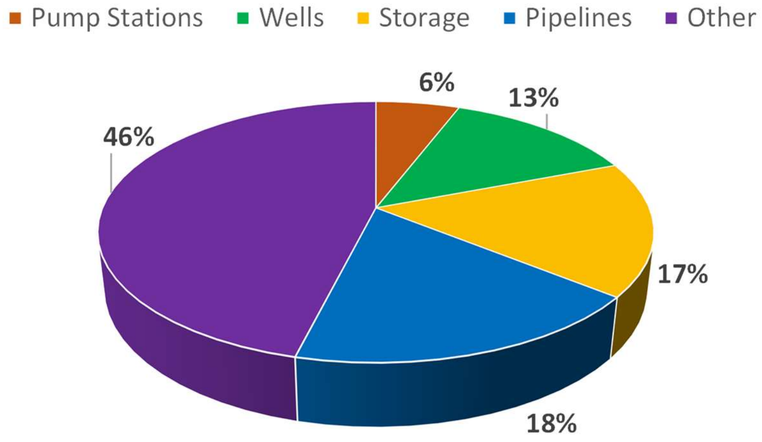
Improvement Category	Planning Horizon				
	2025	2030	2035	2040	2045
Pump Stations	$ 3,246,375	$ 180,000	$ 2,542,500	$ 5,401,125	$ 180,000
Wells	$ 7,463,200	$ 240,000	$ 240,000	$ 240,000	$ 240,000
Storage	$ 9,305,594	$ 400,000	$ 10,933,413	$ 2,886,250	$ 9,275,913
Pipelines	$ 9,738,118	$ 28,096,000	$ 11,852,500	$ 11,852,500	$ 11,852,500
Other	$ 25,775,543	$ 150,000	$ 687,375	$ 150,000	$ 150,000
TOTAL	**$ 55,528,830**	**$ 29,066,000**	**$ 26,255,788**	**$ 20,529,875**	**$ 21,698,413**

The District anticipates development as outlined in Chapter 4. These developments will be responsible for developing infrastructure for those customers. These projects have been identified on a preliminary basis and identified separately and total $10,440,115 in the upcoming 2025 planning period.

10.4.1 Near-Term CIP Projects (2025)

As shown in Tables 10.3, the near-term total for the District is $55.5 million. Of this total, the large majority is dedicated to Other and Pipeline Improvements. Figure 10.1 shows the allocation of funds for this initial phase of the CIP. The Pump Station upgrades include one new station, one station replacement, and general pump station rehabilitation efforts. Well Supply Improvements include two well-specific rehabilitation efforts, one new well installation, and general well maintenance efforts. Storage Improvements include four tank-specific rehabilitation efforts, seismic retrofits, and general tank rehabilitation efforts. The Pipeline Improvements include three specific projects and general condition assessment and pipeline replacement efforts. Finally, the Other Improvements includes chromium treatment efforts and several miscellaneous projects. These projects are described in more detail with costs later in this Chapter and in Table 10.4.

Figure 10.1 – 2025 Potable CIP by Category (District-Funded)



Based on the anticipated growth within the District discussed in Chapter 4, the Developer-funded projects are required in the initial phase (2025) and are an estimate of potential quantities and costs and not intended for bid purposes. These are specific improvements in order to serve these areas include, but are not limited to:

- 1700 Booster Pump Station and 1700 Reservoir
- 2155 Hydropneumatic Pump Station
- Well Nos. 34 and 35 Rehabilitation and Upgrades, as well as the interconnect pipeline
- Miscellaneous transmission piping

10.4.2 Long-Term CIP Projects

Long-term CIP Projects include those beginning in the 2030 planning phase through 2045. Such projects include ongoing annual maintenance of facilities, rehabilitation and replacement program efforts, as well as known specific projects, whether based on age, condition, or capacity as discussed in previous chapters.

10.5 Master Plan CIP Projects

This section contains project descriptions for the District's near-term CIP Projects (District-funded.) These projects as also outlined in Table 10.4.

Booster Pump Rehabilitation Design

Location: District-wide

Budget: $180,000

Overview: The District's booster pumps will need to be inspected and rehabilitated/refurbished to maintain proper operation and efficiency. This Project is a placeholder for periodic review and design for upgrades throughout the District on a rolling 5-year basis.

Low Northridge BPS Replacement

Location: Low Northridge BPS and High Northridge Tank Sites

Budget: $3.1M

Overview: As discussed in previous chapters, this station is in need of replacement. The project would abandon the existing Low Northridge BPS and relocate the facility, preferably next to the High Northridge Tank. The proposed facility would house three 250 gpm pumps to serve this area.

Well No. 42 Installation

Location: Well No. 42

Budget: $5.0M (nearly complete)

Overview: As discussed in previous chapters, this well is necessary to meet the growing demand within the District. At the time of this Master Plan, construction is well underway and should be completed and online within the year.

Well No. 22 Rehabilitation

Location: Well No. 22

Budget: $1.5M

Overview: Well No. 22 has been offline for some time. Plans to bring this well back online after rehabilitation efforts are underway.

Well No. 28 Rehabilitation

Location: Well No. 28

Budget: $790,200

Overview: Well No. 28 has been offline for some time. Plans to bring this well back online after rehabilitation efforts are underway.

Well Rehabilitation Program Design

Location: District-wide

Budget: $240,000

Overview: The District's well facilities will need to be inspected and rehabilitated/refurbished to maintain proper operation and efficiency. This Project is a placeholder for periodic review and design for upgrades throughout the District on a rolling 5-year basis.

Terrace Reservoir Nos. 1, 2, & 3 Rehabilitation (Project ID 11607, 11608, and 11609)

Location: Terrace Reservoir Site

Budget: $7.9M

Overview: The existing Terrace Reservoir Nos. 1, 2 and 3 are in need of rehabilitation to extend the useful life of these critical facilities.

Vista Reservoir Rehabilitation (Project ID 11610)

Location: Vista Reservoir Site

Budget: $975,427

Overview: As discussed in previous chapters, the existing Vista Reservoir is in need of rehabilitation. The District has supplied the approved budget for this item to use in this Master Plan.

Seismic Upgrades Assessment

Location: Throughout District

Budget: $100,000

Overview: The District should conduct seismic assessments at its reservoirs on a rotating schedule. Typically, reporting is done every 5 to 10 years, with requires assessments at critical facilities. This line item is a place-holder for conducting 5 tank assessments during each 5-year period, or 1 tank per year, at $20,000 each.

1400 Zone Interconnect Pipeline

Location: Palm Drive between 8th Street and 5th Street

Budget: $580,125

Overview: Approximately 1,000 LF of 12-inch main is planned to be installed in Palm Drive to connect the Annandale and High Desert View 1400 Zones. This interconnect will allow greater operational flexibility.

Haugen-Lehmann 8-inch Pipeline Replacement

Location: Haugen-Lehmann Drive between Cottonwood Road and Tamarack Road

Budget: $2.0M

Overview: Approximately 3,500 LF of 8-inch main is planned to be installed in Haugen-Lehmann Drive due to consistent breaks and leaks experienced along the length of the pipe.

Water Pipeline Condition Assessment Program

Location: Throughout District

Budget: $250,000

Overview: MSWD has approximately 279 miles of water pipelines, of which several miles have unknown installation dates. The District should allocate funds every year to assess the condition of these facilities and determine the need for replacement. The District anticipates assessing up to 2 miles/year at $25,000 per mile.

Pipeline Replacement Program

Location: Throughout District

Budget: $4.1M

Overview: In conjunction with the Water Pipeline Condition Assessment, the District should conduct regular maintenance and replacement for aging or defective water mains. The near-term goal is to replace up to 7,000LF of piping in the 2025 planning period.

Well 34/35 Intertie

Location: Karen Avenue south of Mission Lakes Blvd.

Budget: $1.1M

Overview: This main will connect Well Nos. 34 and 35 in order to bring additional supply from the recently upgraded Well No. 35 into the distribution system.

New 1700 BPS

Location: TBD

Budget: $2.6M

Funding Source: Development

Overview: As discussed in previous chapters, this station is necessary to serve the northwest area of the DHS System. This project is driven solely by development and to be paid for by the developing entities. This 1700 BPS would take water from the 1535 Zone, likely near the existing Worsley Reservoir, and pump north to a new 1700 Reservoir and 1700 Pressure Zone, yet to be constructed. At this time, no locations have been secured for these facilities.

Well No. 34 Rehabilitation

Location: Well No. 34

Budget: $500,000

Funding Source: Development

Overview: Well No. 34 has been offline for some time and was recently brought back online in December 2024.

Well No. 35 Upgrades

Location: Well No. 35

Budget: $3.0M

Funding Source: Development

Overview: The well component of Well No. 35 was previously drilled, but no mechanical equipment was installed, and no piping was installed to connect the well to the system. This project, as part of new development in the area, would complete these necessary upgrades to bring Well No. 35 into operation, allowing the District to increase its production capability and supply potable water nearby.

Table 10.4 – Summary Cost Opinion for 2025 Planning Period

CIP No.	CIP Item Description	Quantity	Unit	Unit Cost of Construction	Construction Cost	Construction Contingency	Implementation Contingencies	TOTAL DISTRICT FUNDED	TOTAL DEVELOPER FUNDED
Pump Station Improvements									
	Booster Pump Rehabilitation Design	1	EA	$180,000	$ 180,000	$ -	$ -	$ 180,000	$ -
	Replace Low Northridge BPS with 3 - 250 gpm units and relocate to the High Northridge Tank site	1	LS	$1,850,000	$ 1,850,000	$ 555,000	$ 661,375	$ 3,066,375	$ -
	New 1700 BPS	1	LS	$1,550,000	$ 1,550,000	$ 465,000	$ 554,125	$ -	$ 2,569,125
Well/Supply Improvements									
11147	Well 42 Installation[1]	1	LS	$4,973,000	$ 4,973,000	$ -	$ -	$ 4,973,000	$ -
11611	Well 22 Rehabilitation[1]	1	LS	$1,460,000	$ 1,460,000	$ -	$ -	$ 1,460,000	$ -
	Well 28 Rehabilitation	1	LS	$790,200	$ 790,200	$ -	$ -	$ 790,200	$ -
11742	Well 34 Rehabilitation[1]	1	LS	$500,000	$ 500,000	$ -	$ -	$ -	$ 500,000
11741	Well 35 Upgrades[1]	1	LS	$2,955,990	$ 2,955,990	$ -	$ -	$ -	$ 2,955,990
	Well Rehab Program Design	2	EA	$120,000	$ 240,000	$ -	$ -	$ 240,000	$ -
Storage Improvements									
11607	Terrance Reservoir #1 Rehabilitation[1]	1	LS	$2,754,343	$ 2,754,343	$ -	$ -	$ 2,754,343	$ -
11608	Terrance Reservoir #2 Rehabilitation[1]	1	LS	$2,814,461	$ 2,814,461	$ -	$ -	$ 2,814,461	$ -
11609	Terrance Reservoir #3 Rehabilitation[1]	1	LS	$2,361,363	$ 2,361,363	$ -	$ -	$ 2,361,363	$ -
11610	Vista Reservoir Rehabilitation[1]	1	LS	$975,427	$ 975,427	$ -	$ -	$ 975,427	$ -
	Reservoir Rehab Program Design	1	LS	$300,000	$ 300,000	$ -	$ -	$ 300,000	$ -
	Seismic Upgrades Assessments	5	EA	$20,000	$ 100,000	$ -	$ -	$ 100,000	$ -
	New 1700 Reservoir (1.0-MG Steel)	1	LS	$2.0/gal	$ 2,000,000	$ 600,000	$ 715,000	$ -	$ 3,315,000
Piping Improvements									
11622	Install12-inch main in Palm Dr to connect 1400 Zones	1,000	LF	$350/LF	$ 350,000	$ 105,000	$ 125,125	$ 580,125	$ -
118674	GQPP AD-18 Area D3-1 Water Main Replacement	1	LS	$ 2,555,624	$ 2,555,624	$ -	$ -	$ 2,555,624	$ -
	Desert View Ave between Mountain View Drive and Hidalgo Drive	450	LF	$350/LF	$ 157,500	$ 47,250	$ 56,306	$ 261,056	$ -
	Install 8-inch main in Haugen-Lehmann Way	3,500	LF	$350/LF	$ 1,225,000	$ 367,500	$ 437,938	$ 2,030,438	$ -
	Water CIP Pipeline Condition Assessment Program	2	miles/yr	$25,000/mile	$ 250,000	$ -	$ -	$ 250,000	$ -
	Pipeline Replacement Program	7,000	LF	$350/LF	$ 2,450,000	$ 735,000	$ 875,875	$ 4,060,875	$ -
11743	Well 34/35 Intertie	1	LS	$ 1,100,000	$ 1,100,000	$ -	$ -	$ -	$ 1,100,000
Other Improvements									
11460	Well 29 Chromium Treatment Design	1	LS	$ 200,000	$ 200,000	$ -	$ -	$ 200,000	$ -
11621	District Critical Services Facility	1	LS	$ 33,300,000	$ 33,300,000	$ -	$ -	$ 33,300,000	
	Chromium Treatment	5	EA	$ 5,000,000	$ 25,000,000	$ -	$ -	$ 25,000,000	$ -
	Block wall & fencing at Terrace Reservoirs	1	LS	$ 226,288	$ 226,288	$ -	$ -	$ 226,288	$ -
	Well & Reservoir Site Security Cameras	1	LS	$ 225,075	$ 225,075	$ -	$ -	$ 225,075	$ -
	Modular Enclosure - Chlorine Equipment	1	LS	$ 124,180	$ 124,180	$ -	$ -	$ 124,180	$ -
TOTAL								**$ 88,828,830**	**$ 10,440,115**

1. Per MSWD approved budget.

As noted above, the District-funded portion of the Water CIP is $88.8M, while the Development portion is $10.4M over the next five years.

Tables 10.5 through 10.8 present the anticipated CIP Budgets for each of the next 5-year periods.

MCS
Mission Consulting Services
WATER SYSTEMS SPECIALISTS

Dopudja & Wells consulting

Table 10.5 – Summary Cost Opinion for 2030 Planning Period

CIP Item Description	Quantity	Unit	Unit Cost of Construction	Construction Cost	Construction Contingency	Implementation Contingencies	TOTAL DISTRICT FUNDED	TOTAL DEVELOPER FUNDED
Booster Station Upgrades								
Booster Pump Rehabilitation Design	1	EA	$180,000	$ 180,000	$ -	$ -	$ 180,000	$ -
New 1875 BPS	1	LS	$1,550,000	$ 1,550,000	$ 465,000	$ 554,125	$ -	$ 2,569,125
Well Supply								
Well Rehab Program Design	2	EA	$120,000	$ 240,000	$ -	$ -	$ 240,000	$ -
Storage								
Seismic Upgrades Assessments	5	EA	$20,000	$ 100,000	$ -	$ -	$ 100,000	
New 1875 Reservoir (1.0 MG Steel)	1	LS	$2.0/gal	$ 2,000,000	$ 600,000	$ 715,000	$ -	$ 3,315,000
Reservoir Rehab Program Design	1	LS	$300,000	$ 300,000	$ -	$ -	$ 300,000	$ -
Piping								
WPSV and PSC system interconnect	8,000	LF	$400/LF	$ 3,200,000	$ 960,000	$ 1,144,000	$ 5,304,000	$ -
NW transmission system piping	16,500	LF	$400/LF	$ 6,600,000	$ 1,980,000	$ 2,359,500	$ 10,939,500	$ -
Water CIP Pipeline Condition Assessment Program	2	miles/yr	$25,000/mile	$ 250,000	$ -	$ -	$ 250,000	$ -
Pipeline Replacement Program	4,000	LF/yr	$350/LF	$ 7,000,000	$ 2,100,000	$ 2,502,500	$ 11,602,500	$ -
Other								
Meter Replacement (Annual)	1	LS	$ 30,000	$ 150,000	$ -	$ -	$ 150,000	$ -
TOTAL							**$ 29,066,000**	**$ 5,884,125**

MSWD
Mission Springs Water District

Table 10.6 – Summary Cost Opinion for 2035 Planning Period

CIP Item Description	Quantity	Unit	Unit Cost of Construction	Construction Cost	Construction Contingency	Implementation Contingencies	TOTAL DISTRICT FUNDED	TOTAL DEVELOPER FUNDED
Booster Station Upgrades								
Terrace Booster Replacement	1	EA	$1,500,000	$ 1,500,000	$ 450,000	$ 412,500	$ 2,362,500	$ -
New 2035 BPS	1	LS	$850,000	$ 850,000	$ 255,000	$ 303,875	$ -	$ 1,408,875
New 2155 Hydropneumatic PS	1	LS	$850,000	$ 850,000	$ 255,000	$ 303,875	$ -	$ 1,408,875
Booster Pump Rehabilitation Design	1	EA	$180,000	$ 180,000	$ -	$ -	$ 180,000	$ -
Well Supply								
Well Rehab Program Design	2	EA	$120,000	$ 240,000	$ -	$ -	$ 240,000	$ -
Storage								
Seismic Upgrades Assessments	5	EA	$20,000	$ 100,000	$ -	$ -	$ 100,000	$ -
Reservoir Rehab Program Design	1	LS	$300,000	$ 300,000	$ -	$ -	$ 300,000	$ -
New 2035 Reservoir (1.0 MG Steel)	1	LS	$2.0/gal	$ 2,000,000	$ 600,000	$ 715,000	$ -	$ 3,315,000
Vista #2 Reservoir Construction (0.75 MG Steel)	0.75	MG	$2.5/gal	$ 1,875,000	$ 562,500	$ 670,313	$ 3,107,813	$ -
Valley View Reservoir #2 (2.45-MG Concrete)	2.24	MG	$2.0/gal	$ 4,480,000	$ 1,344,000	$ 1,601,600	$ 7,425,600	$ -
Piping								
Water CIP Pipeline Condition Assessment Program	2	miles/yr	$25,000/mile	$ 250,000	$ -	$ -	$ 250,000	$ -
Pipeline Replacement Program	4,000	LF/yr	$350/LF	$ 7,000,000	$ 2,100,000	$ 2,502,500	$ 11,602,500	$ -
Other								
Trailer-mounted Portable Generators	1	LS	$ 537,375	$ 537,375	$ -	$ -	$ 537,375	$ -
Meter Replacement (Annual)	1	LS	$ 30,000	$ 150,000	$ -	$ -	$ 150,000	$ -
TOTAL							**$ 26,255,788**	**$ 6,132,750**

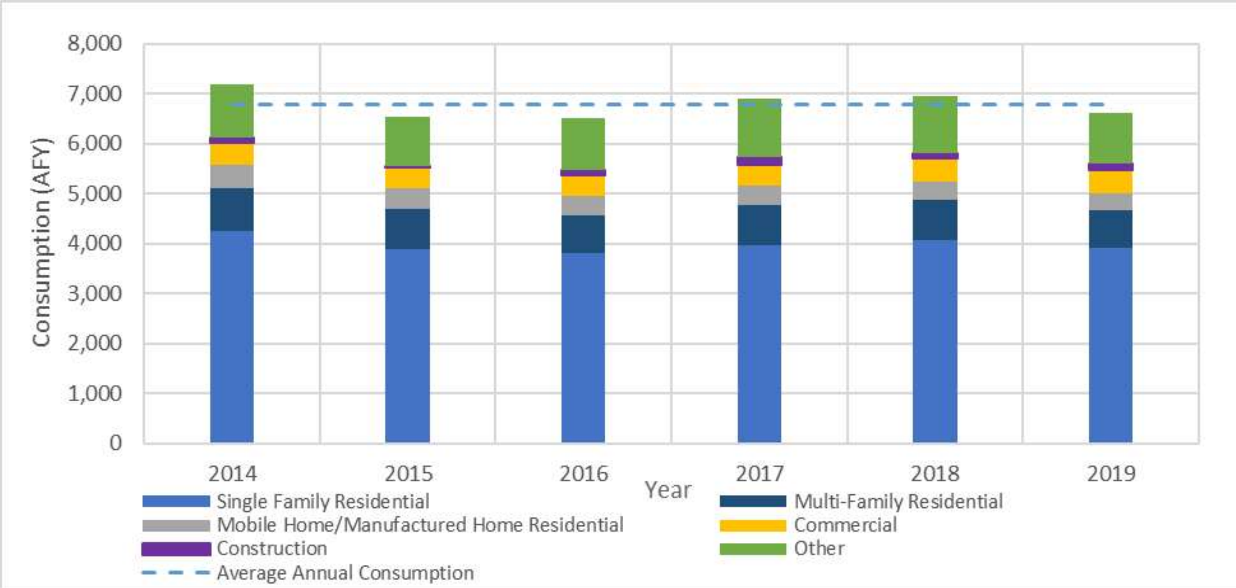
Table 10.7 – Summary Cost Opinion for 2040 Planning Period

CIP Item Description	Quantity	Unit	Unit Cost of Construction	Construction Cost	Construction Contingency	Implementation Contingencies	TOTAL DISTRICT FUNDED	TOTAL DEVELOPER FUNDED
Booster Station Upgrades								
Terrace Booster Replacement	1	LS	$3,150,000	$ 3,150,000	$ 945,000	$ 1,126,125	$ 5,221,125	$ -
Booster Pump Rehabilitation Design	1	LS	$180,000	$ 180,000	$ -	$ -	$ 180,000	$ -
Well Supply								
Well Rehab Program Design	2	EA	$120,000	$ 240,000	$ -	$ -	$ 240,000	$ -
Storage								
Seismic Upgrades Assessments	5	EA	$20,000	$ 100,000	$ -	$ -	$ 100,000	$ -
Reservoir Rehab Program Design	1	LS	$300,000	$ 300,000	$ -	$ -	$ 300,000	$ -
Cottonwood Reservoir Replacement (0.30 MG Steel)	0.30	MG	$2.5/gal	$ 750,000	$ 225,000	$ 268,125	$ 1,243,125	$ -
Redbud Reservoir Replacement (0.30 MG Steel)	0.30	MG	$2.5/gal	$ 750,000	$ 225,000	$ 268,125	$ 1,243,125	$ -
Piping								
Water CIP Pipeline Condition Assessment Program	2	miles/yr	$25,000/mile	$ 250,000	$ -	$ -	$ 250,000	
Pipeline Replacement Program	4,000	LF/yr	$350/LF	$ 7,000,000	$ 2,100,000	$ 2,502,500	$ 11,602,500	$ -
Other								
Meter Replacement (Annual)	1	LS	$ 30,000	$ 150,000		$ -	$ 150,000	$ -
TOTAL							**$ 20,529,875**	**$ -**

Table 10.8 – Summary Cost Opinion for 2045 Planning Period

CIP Item Description	Quantity	Unit	Unit Cost of Construction	Construction Cost	Construction Contingency	Implementation Contingencies	TOTAL DISTRICT FUNDED	TOTAL DEVELOPER FUNDED
Booster Station Upgrades								
Booster Pump Rehabilitation Design	1	LS	$180,000	$ 180,000	$ -	$ -	$ 180,000	$ -
Well Supply								
Well Rehab Program Design	2	EA	$120,000	$ 240,000	$ -	$ -	$ 240,000	$ -
Storage								
Seismic Upgrades Assessments	5	EA	$20,000	$ 100,000	$ -	$ -	$ 100,000	
Reservoir Rehab Program Design	1	LS	$300,000	$ 300,000	$ -	$ -	$ 300,000	$ -
Two Bunch #3 (0.67 MG)	0.67	MG	$2.5/gal	$ 1,675,000	$ 502,500	$ 598,813	$ 2,776,313	$ -
Terrace Reservoir #1 Replacement (1.84 MG)	1.84	MG	$2.0/gal	$ 3,680,000	$ 1,104,000	$ 1,315,600	$ 6,099,600	$ -
Piping								
Water CIP Pipeline Condition Assessment Program	2	miles/yr	$25,000/mile	$ 250,000	$ -	$ -	$ 250,000	
Pipeline Replacement Program	4,000	LF/yr	$350/LF	$ 7,000,000	$ 2,100,000	$ 2,502,500	$ 11,602,500	$ -
Other								
Meter Replacement (Annual)	1	LS	$ 30,000	$ 150,000		$ -	$ 150,000	$ -
TOTAL							**$ 21,698,413**	

Appendix A – Future Demand Development Data



Note: Other is irrigation and other meters that could not be geocoded

Figure C-4: Annual Consumption in the MSWD/DWA Planning Area from 2014 to 2019

Table C-2 tabulates water consumption within the MSWD/DWA Planning Area for the MSWD meters based on Riverside County parcel data land use classifications for the geocoded meters.

Table C-2: MSWD/DWA Planning Area Consumption by Land Use

Land Use	Total Acreage (acres)	Total Annual Average Consumption (AFY)	% Total Consumption
Single Family Residential	2,925	3,980	58.7%
Multi-Family Residential	181	793	11.7%
Mobile Home/Manufactured Home Residential	233	396	5.8%
Commercial	459	443	6.5%
Industrial	60	0	0%
Construction	--[1]	98	1.5%
Other	--[1]	1,073[2]	15.8%
Total	**3,858**	**6,783**	**100%**

[1]These categories were associated with meters that could not be geocoded, so no acreage is associated.
[2]Includes MSWD meter data categorized as irrigation and other that could not be geocoded; these data were accounted for in adjustments to unit consumption.

Total projected demand is estimated to increase from 10,485 AF in 2016 to 16,822 AF in 2045 in the Planning Area. Total demand for 2016 is based on actual demands from existing customers in the CVWD and MSWD municipal service areas. Demands from these existing customers continues into the future and has been adjusted for passive conservation**.** For year 2020 and future years, the demand for future development is forecasted by multiplying projected SCAG population within each TAZ (subdivided by Agency) by unit consumption and adjusting for passive conservation and water loss.

Table C-21: Projected Municipal Production (Demand) by Area

Year	CVWD Planning Area Production			MSWD/DWA Planning Area Production			Total Planning Area Projected Production (AFY)
	Existing (AFY)	Future (AFY)	Total (AFY)	Existing (AFY)	Future (AFY)	Total (AFY)	
2020	2,781	126	2,907	7,519	719	8,238	11,145
2025	2,766	483	3,249	7,435	1,562	8,997	12,245
2030	2,751	841	3,592	7,351	2,404	9,755	13,346
2035	2,735	1,198	3,933	7,266	3,247	10,513	14,447
2040	2,734	1,397	4,131	7,257	4,247	11,504	15,634
2045	2,732	1,596	4,328	7,247	5,247	12,494	16,822

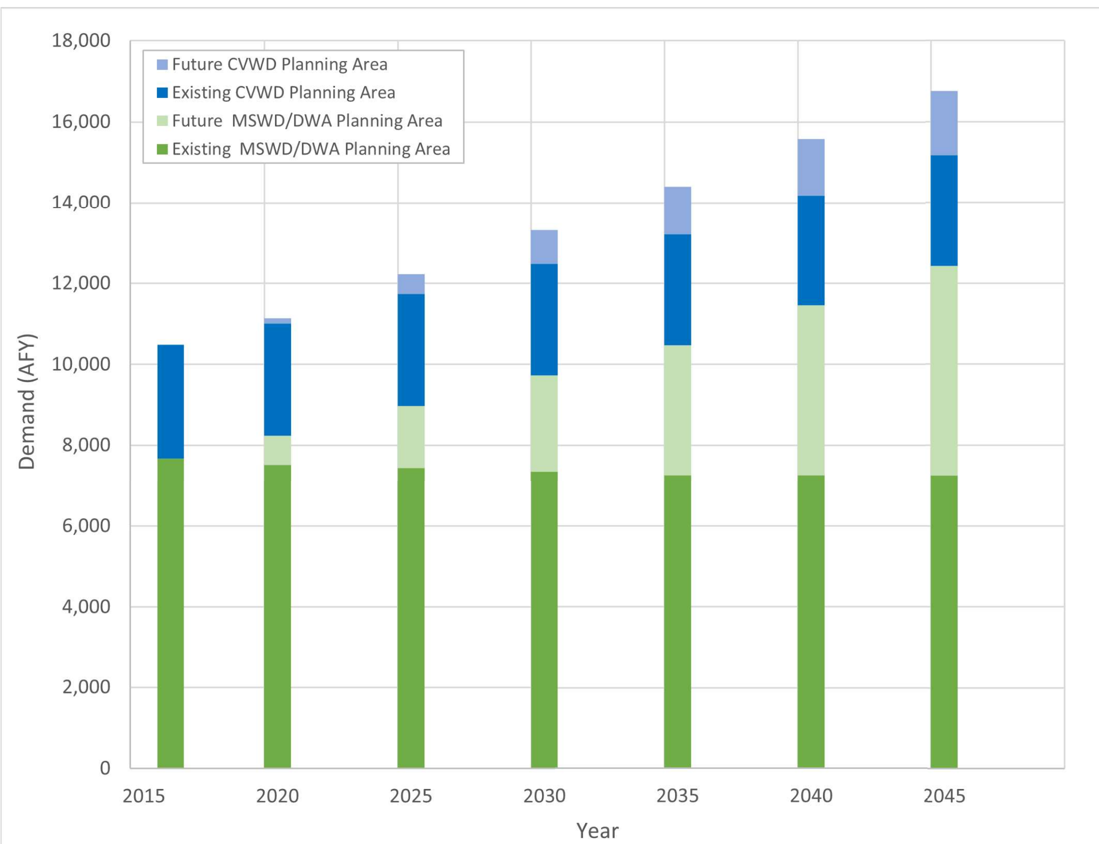


Figure C-9: Projected Municipal Demand by CVWD Planning Area and MSWD/DWA Planning Area

Table C-8: Persons per Parcel by Residential Land Use

Land Use Type	CVWD Planning Area	MSWD/DWA Planning Area
Persons per Household (Single Family Residential)[1]	2.59	3.11
Persons per Household (Mobile Home/Manufactured Home Residential)[2]	1.16	1.16
Units per Multi-Family Residential Parcel[3]	6.50	3.19
Units per Mobile Home/Manufactured Home Residential Acre[4]	11.57	11.57
Persons per Multi-Family Residential Parcel	16.86	9.94
Persons per Mobile Home/Manufactured Home Residential Parcel	92.92	97.46

[1] SCAG 2016 numbers for Households and number of Persons for Single Family Residential.

[2] Value is back-calculated in order for the total calculated population to match the estimated SCAG 2016 population within the ID-8 Service Area. Same value was assumed for MSWD Service Area calculations.

[3] Estimated units per Multi-Family Residential parcel using aerial imagery.

[4] Estimated units per Mobile Home/Manufactured Home Residential acre using aerial imagery. Mobile Home/Manufactured Home Residential parcels vary greatly in size and needed to be calculated on a per acre basis rather than on a per parcel basis due to their highly variable parcel sizes.

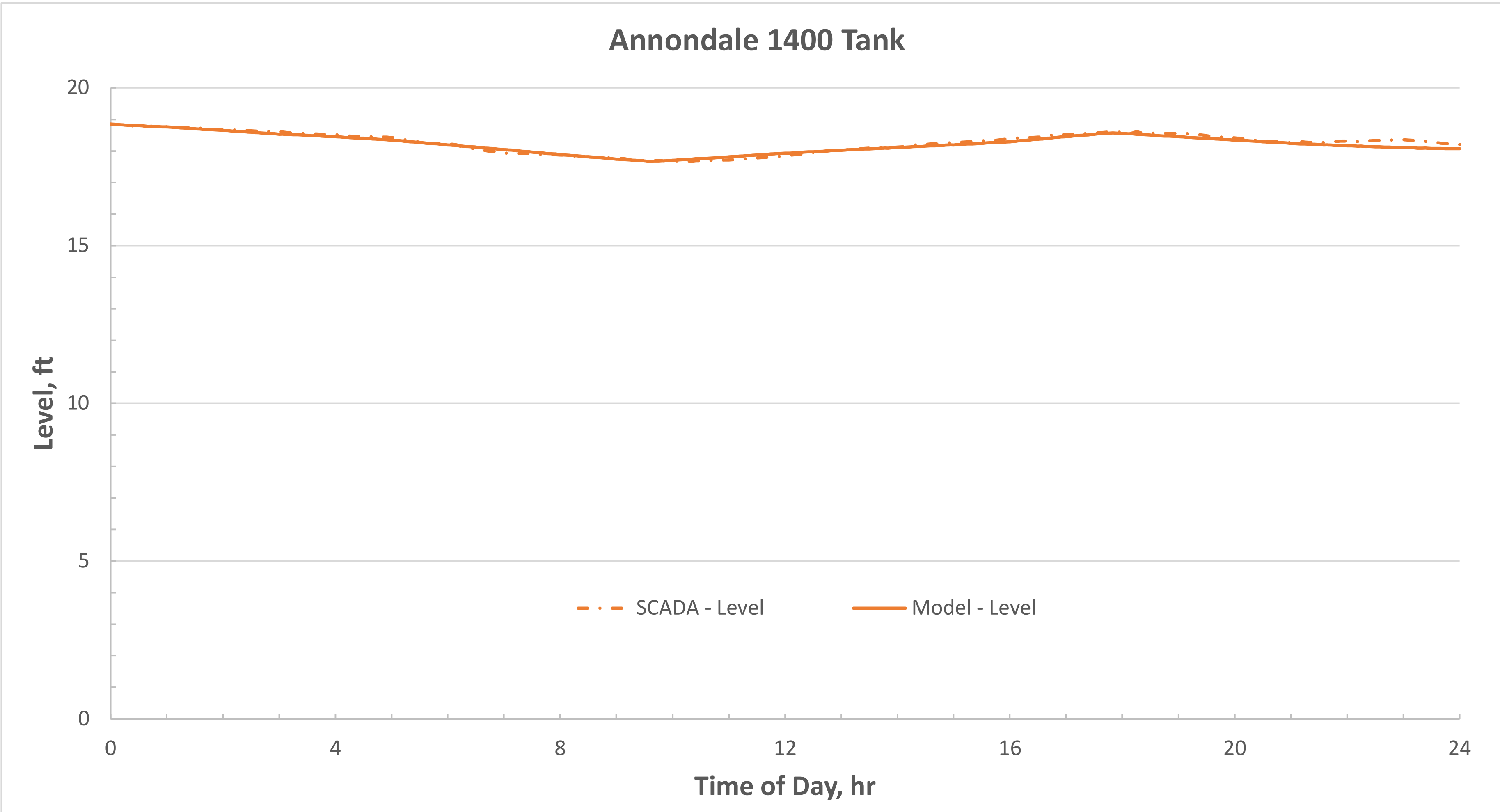
Estimated Weighting of Residential Land Use Types in the Planning Area

Water consumption per person varies by type of housing/land use. However, since the final unit consumption of AFY/person is a singular value, a weighted average of the Single Family Residential, Multi-Family Residential, and Mobile Home/Manufactured Home Residential unit consumptions was used to calculate the final total consumption. The acreages of the remaining residential "available for development" areas in the Planning Area were totaled based on land use to compare what portion of future residential areas may develop as Single Family Residential, Multi-Family Residential, or Mobile Home/Manufactured Home Residential. As **Table C-9** shows, nearly all the remaining acreage was classified as Single Family Residential; therefore, the Single Family Residential calculated values are most heavily weighted in the final aggregate unit consumption.

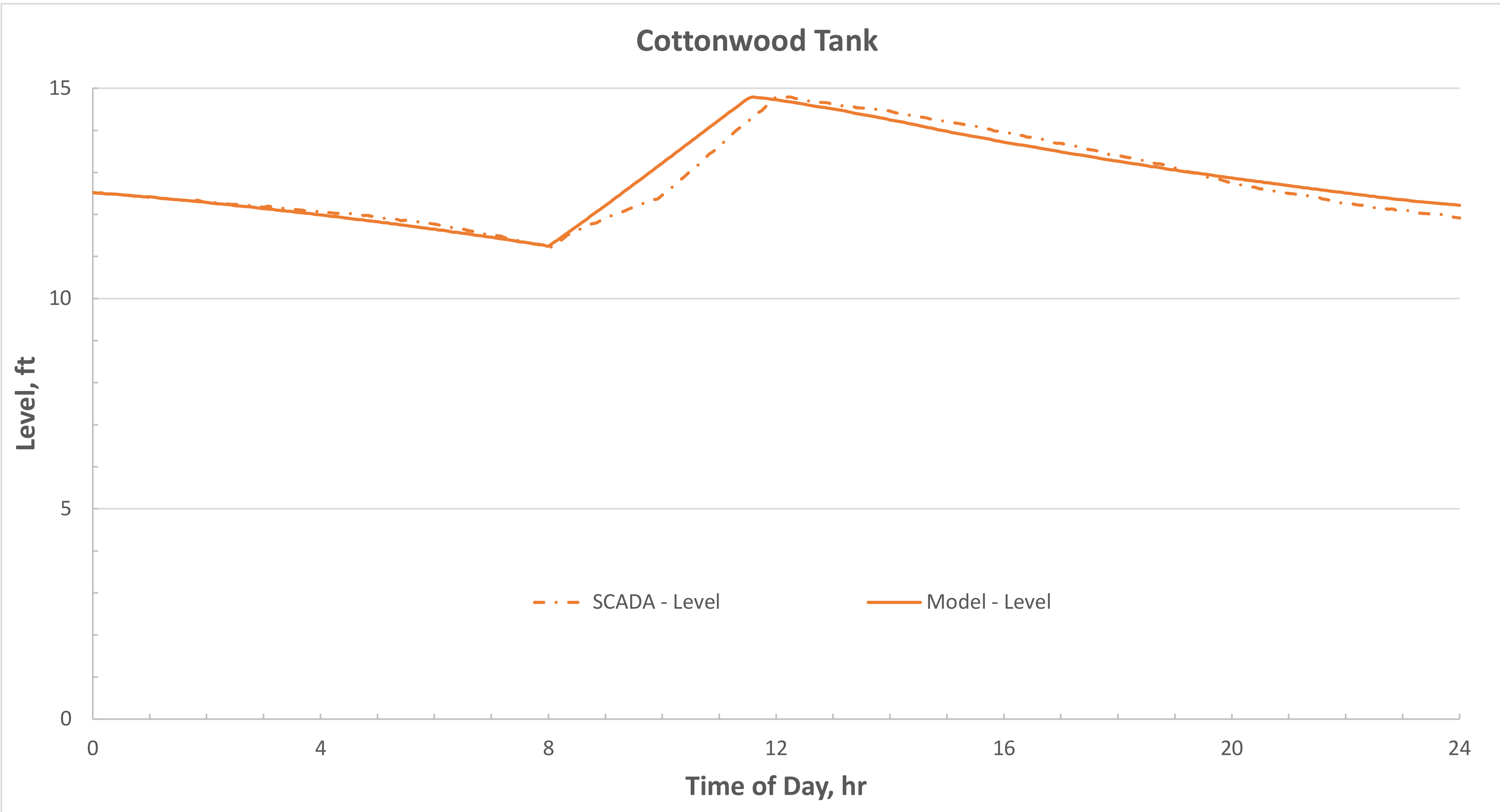
Table C-9: Distribution of Remaining "For Future Development" Residential Parcels

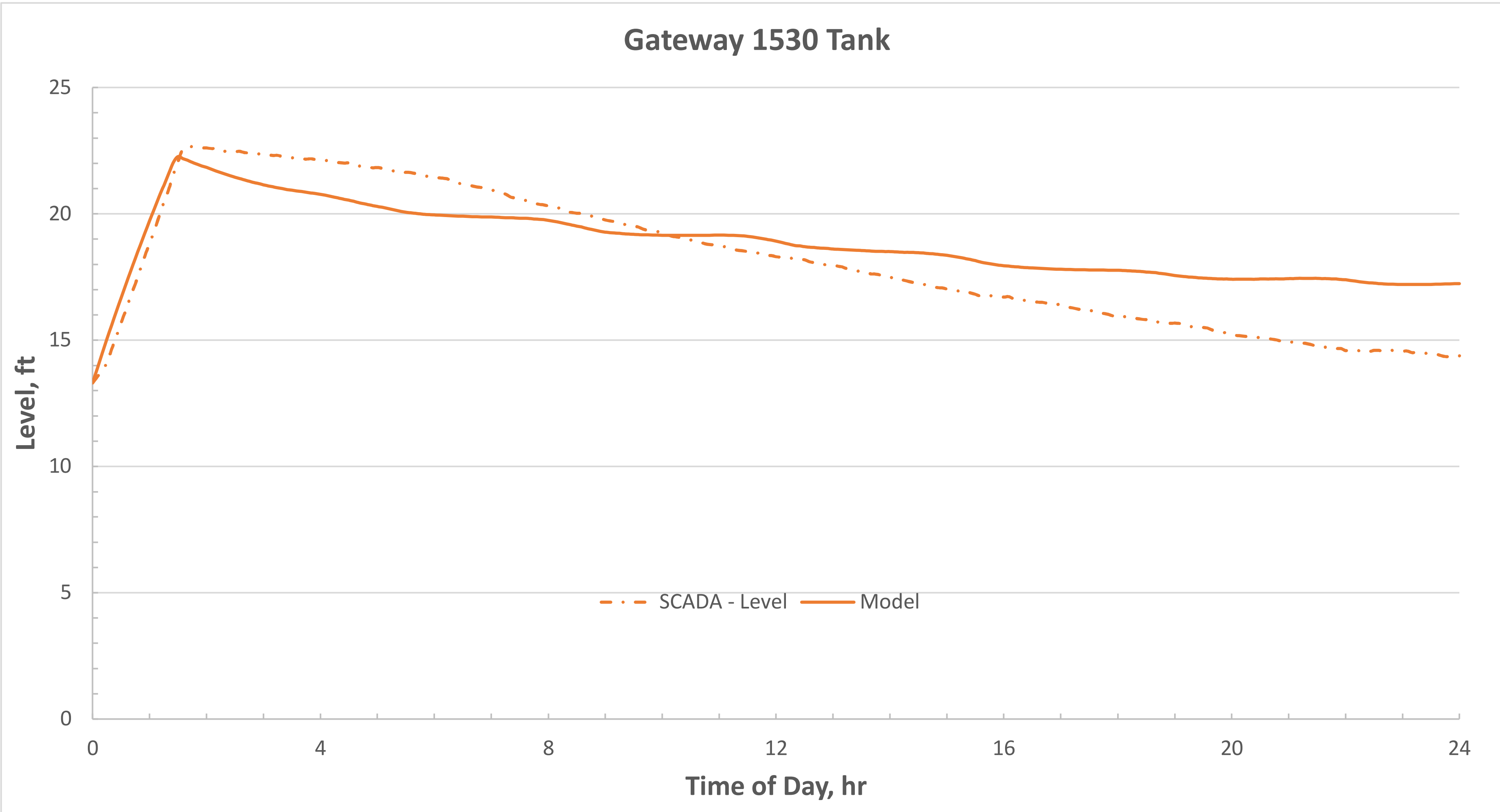
Category	CVWD Planning Area			MSWD/DWA Planning Area		
	Acreage	No. Parcels	% By Area	Acreage	No. Parcels	% By Area
Single Family Residential	7,381	1,436	99.81%	12,018	6,133	99.96%
Multi-Family Residential	14	5	0.19%	4	8	0.03%
Mobile Home/ Manufactured Home Residential	0	0	0.00%	1	2	0.01%
Total	**7,395**	**1,441**	**100.00%**	**12,023**	**6,143**	**100.00%**

Appendix B – Hydraulic Model Calibration Curves

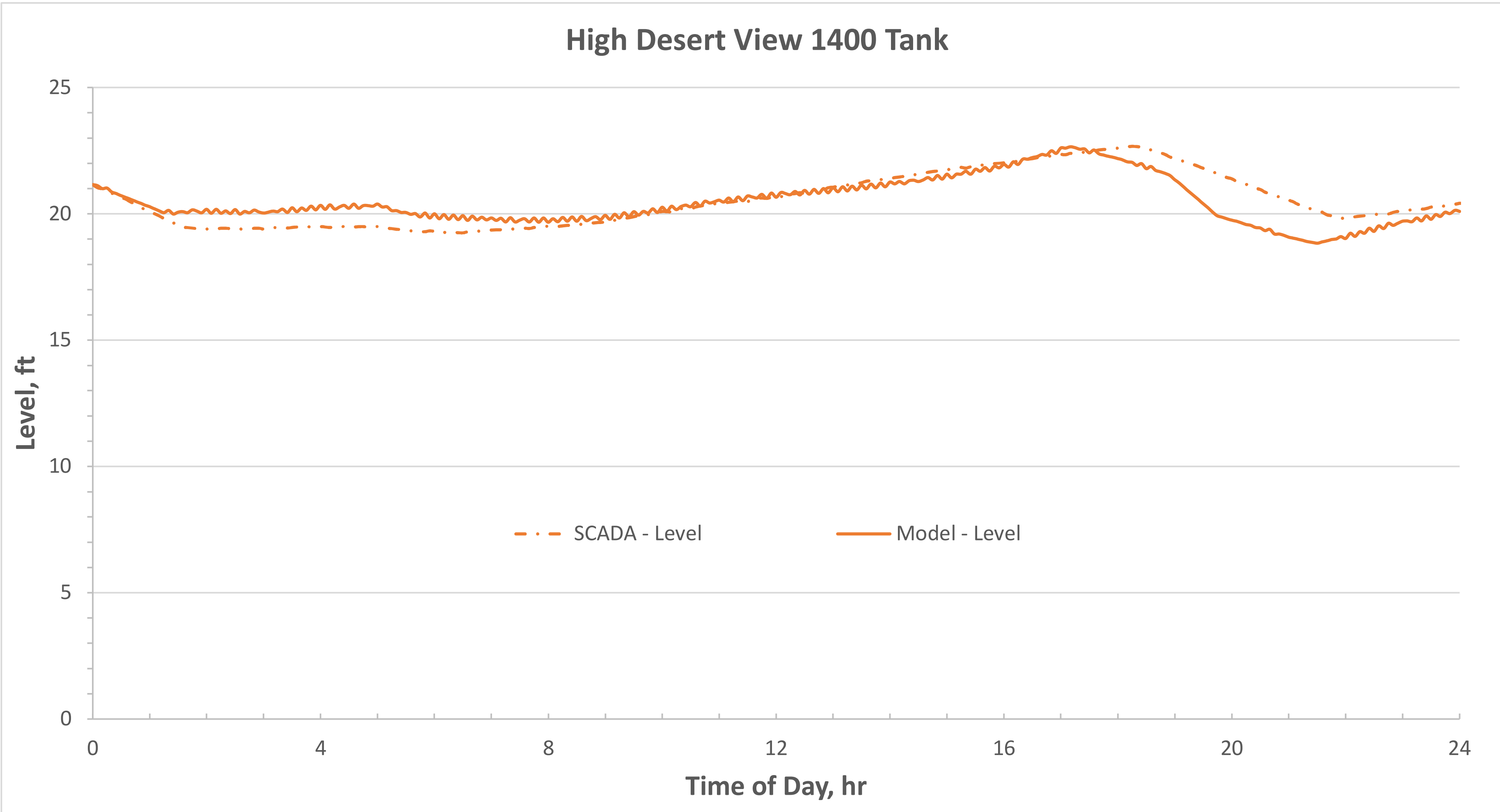


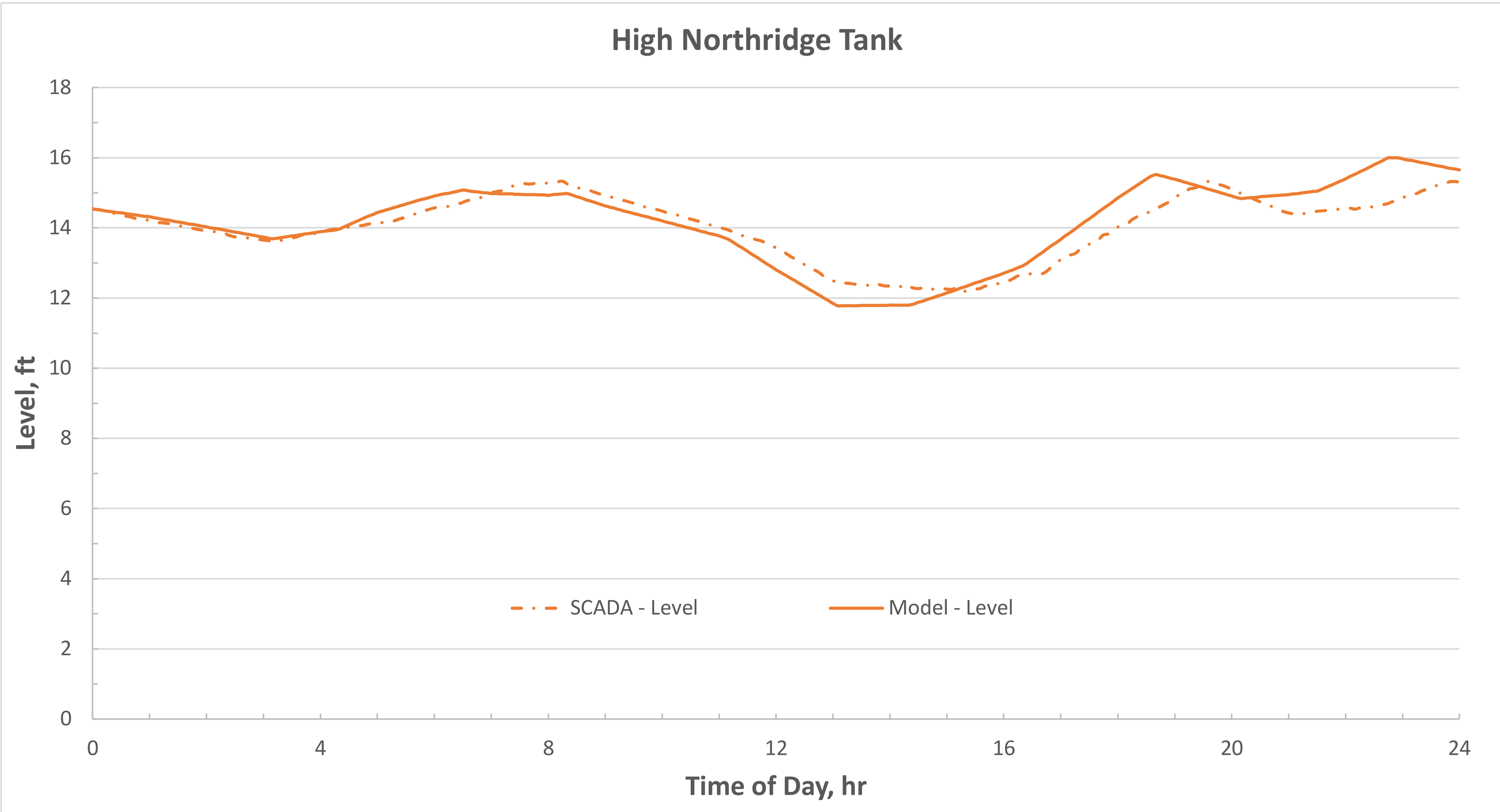
Annondale 1400 Tank
Level, ft
20
15
10
5
0
0
4
8
12
16
20
24
Time of Day, hr
SCADA - Level
Model - Level

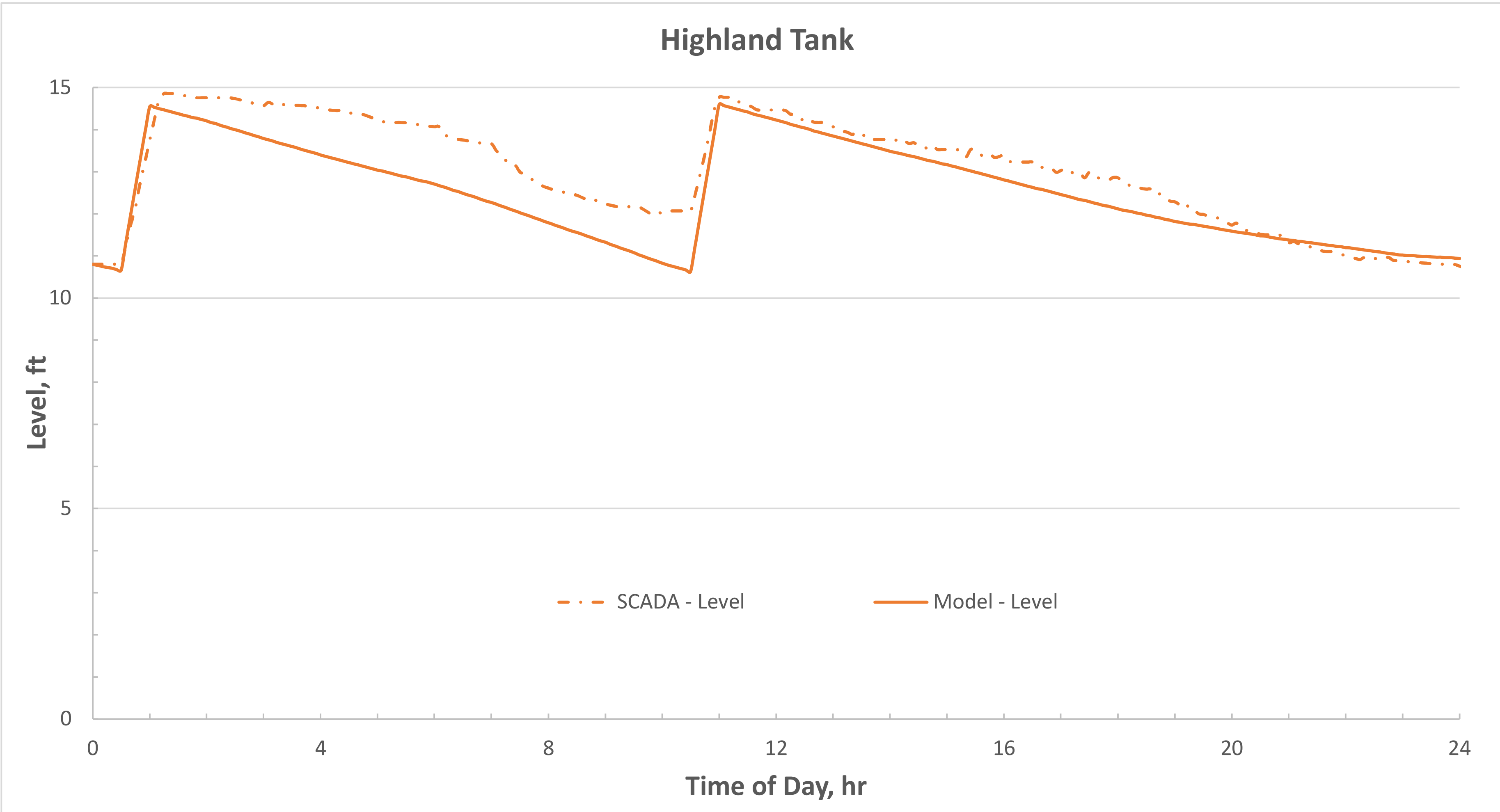

Cottonwood Tank
15
10
5
0
Level, ft
0
4
8
12
16
20
24
Time of Day, hr
SCADA - Level
Model - Level



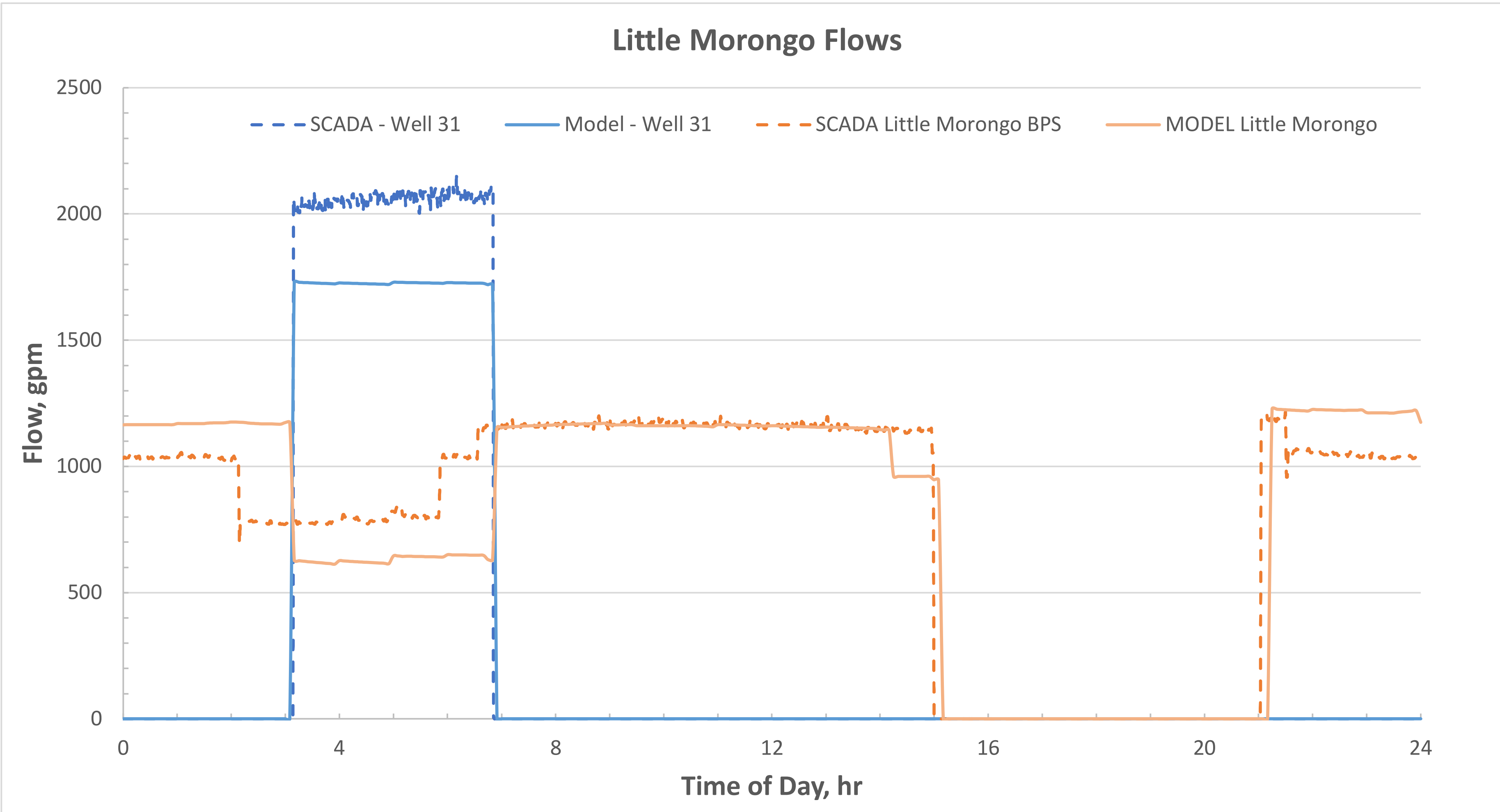
Gateway 1530 Tank
25
20
15
10
5
0
Level, ft
0
4
8
12
16
20
24
Time of Day, hr
SCADA - Level
Model

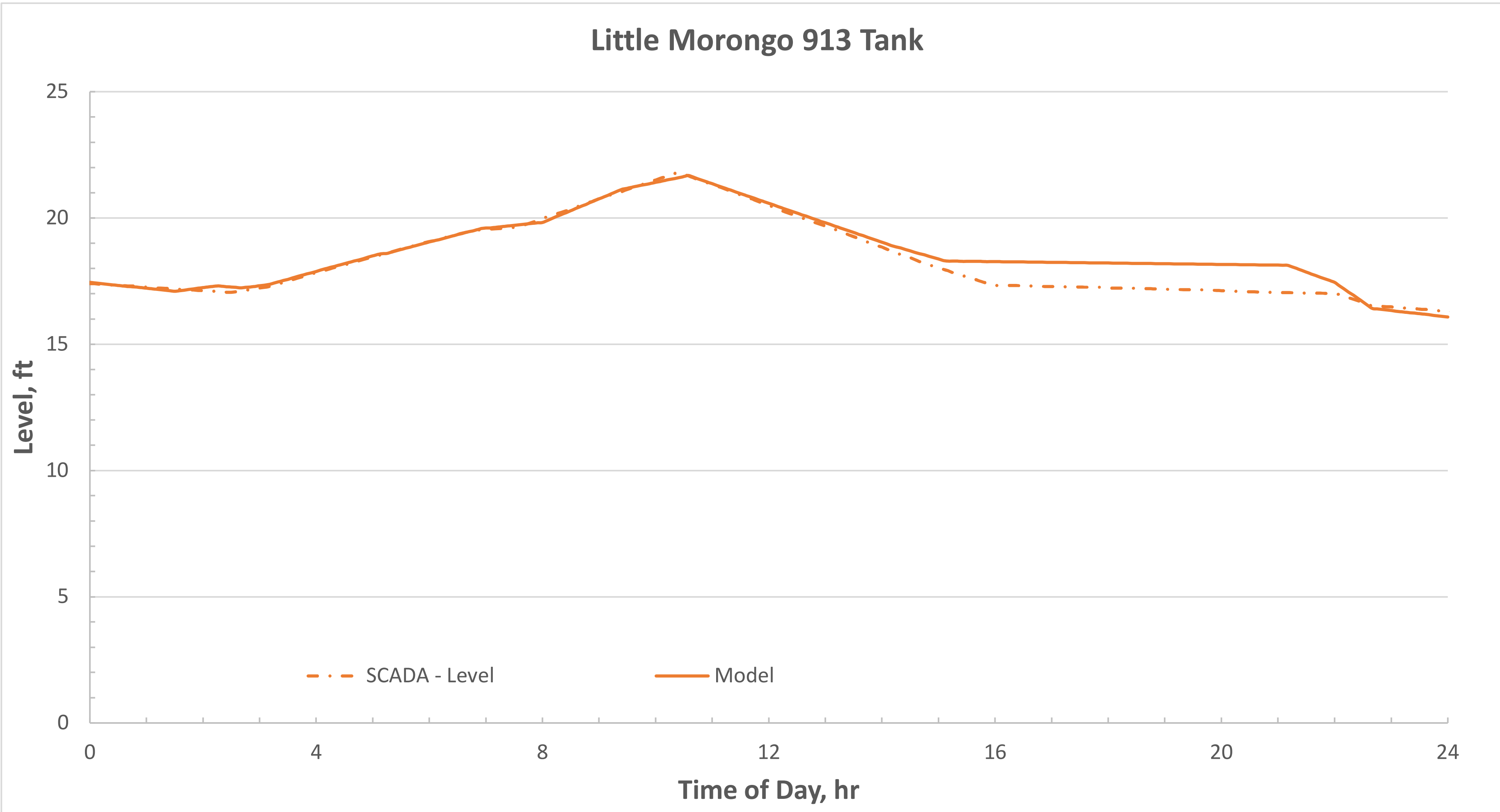

High Desert View 1400 Tank
Level, ft
25
20
15
10
5
0
0
4
8
12
16
20
24
Time of Day, hr
SCADA - Level
Model - Level


High Northridge Tank
Level, ft
Time of Day, hr
SCADA - Level
Model - Level
18
16
14
12
10
8
6
4
2
0
0
4
8
12
16
20
24

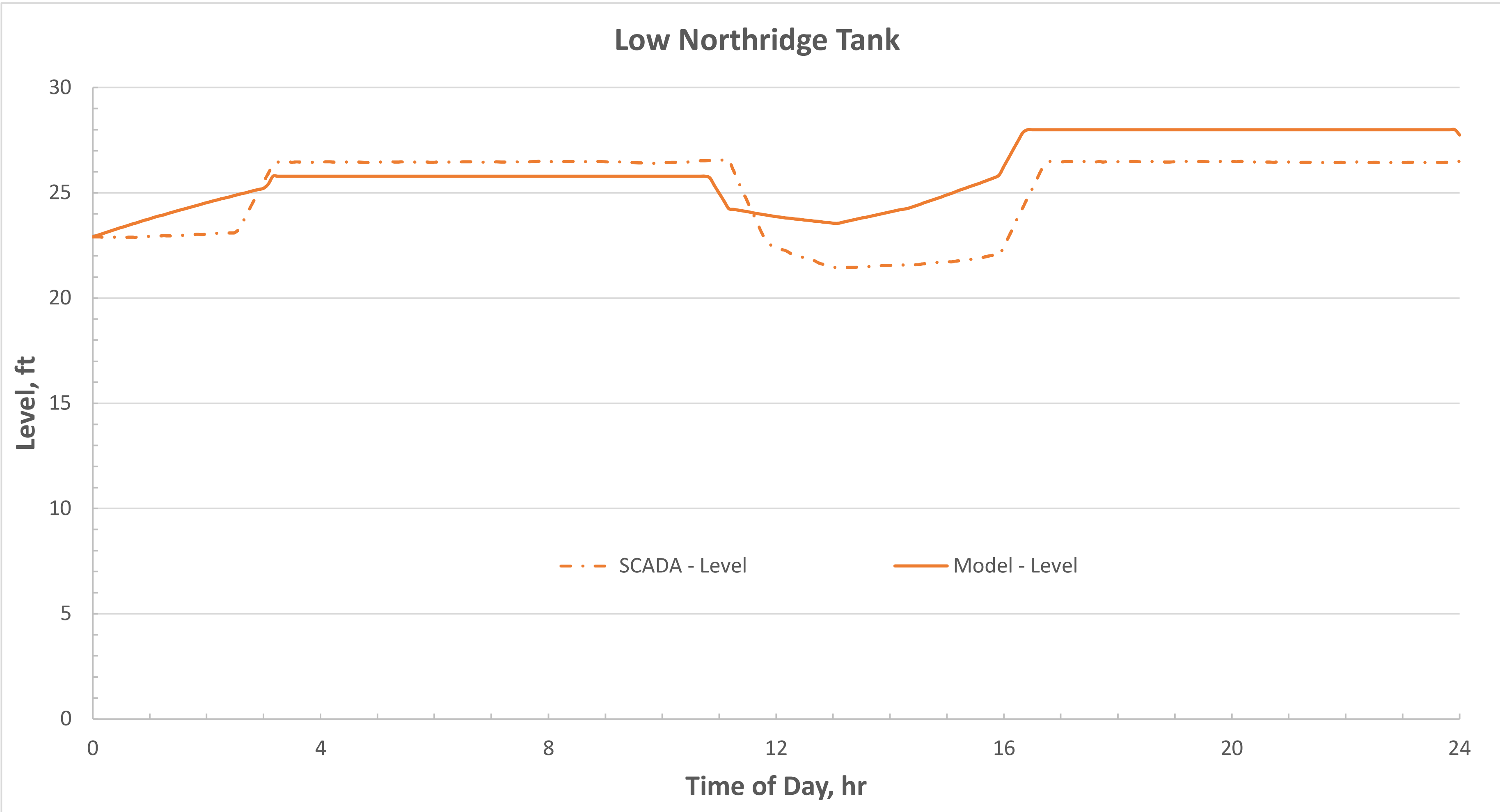


Highland Tank
15
10
5
0
Level, ft
0
4
8
12
16
20
24
Time of Day, hr
SCADA - Level
Model - Level

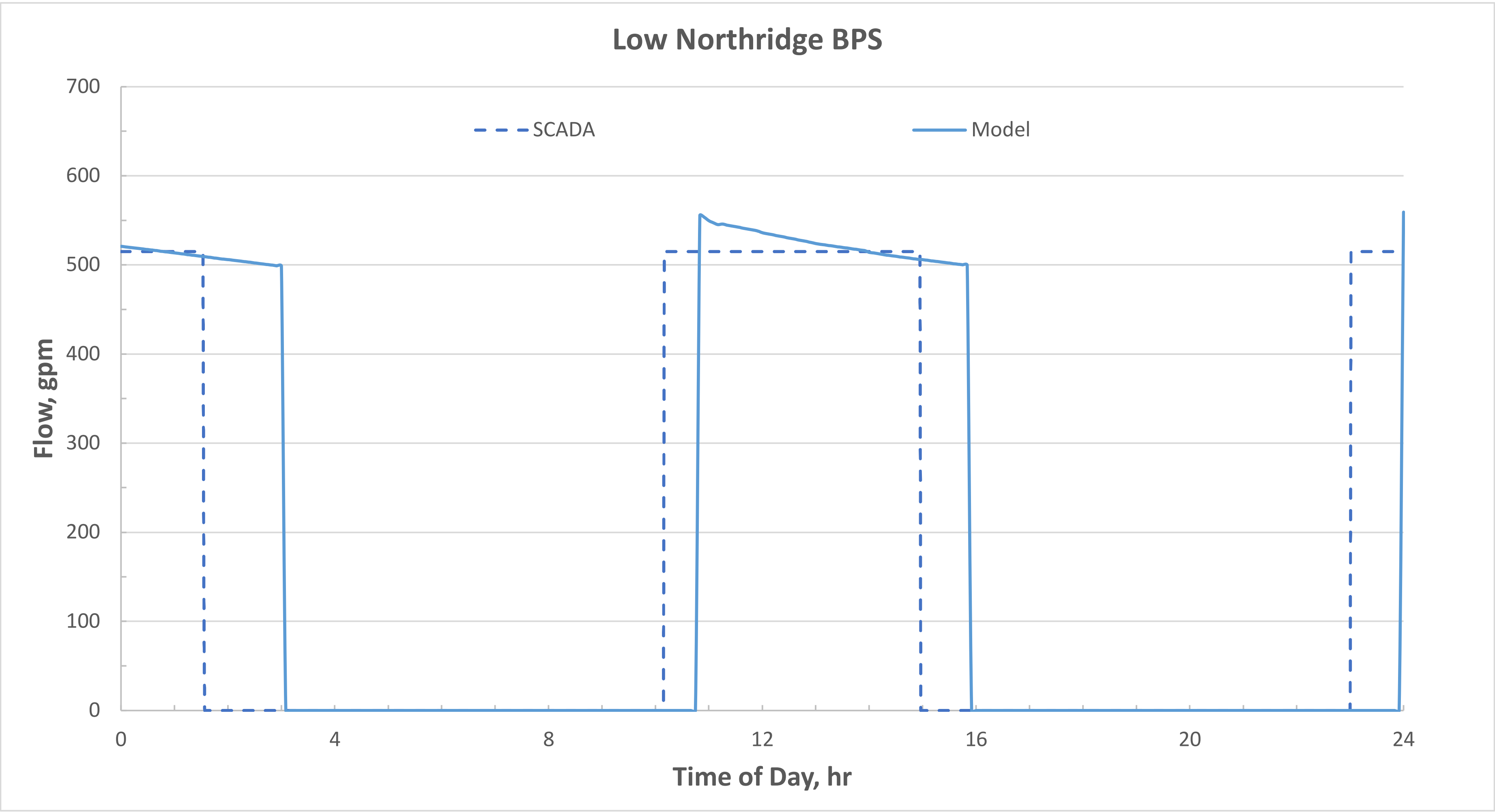

Little Morongo Flows
SCADA - Well 31
Model - Well 31
SCADA Little Morongo BPS
MODEL Little Morongo
Flow, gpm
2500
2000
1500
1000
500
0
0
4
8
12
16
20
24
Time of Day, hr



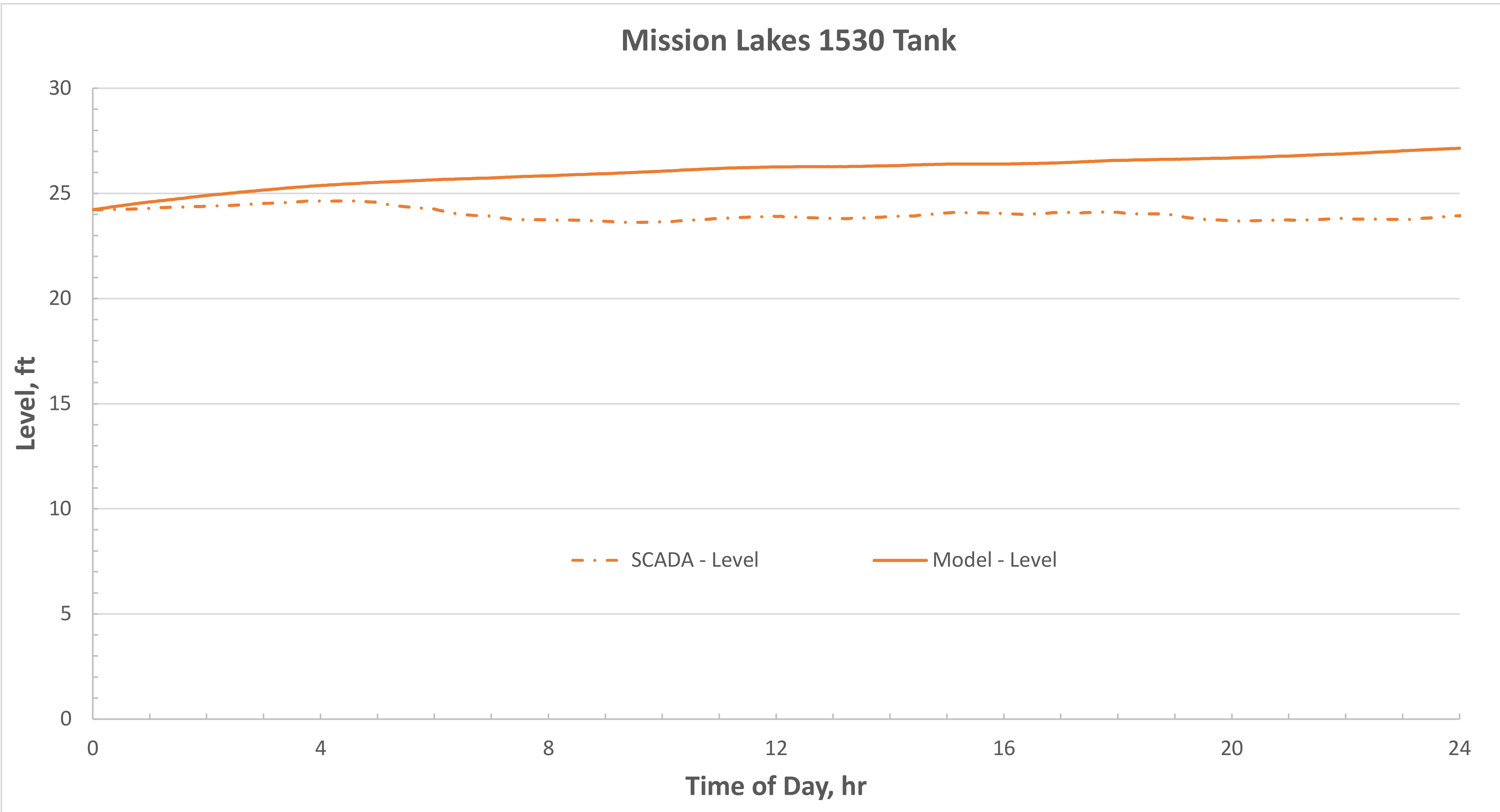
Little Morongo 913 Tank
Level, ft
25
20
15
10
5
0
0
4
8
12
16
20
24
Time of Day, hr
SCADA - Level
Model

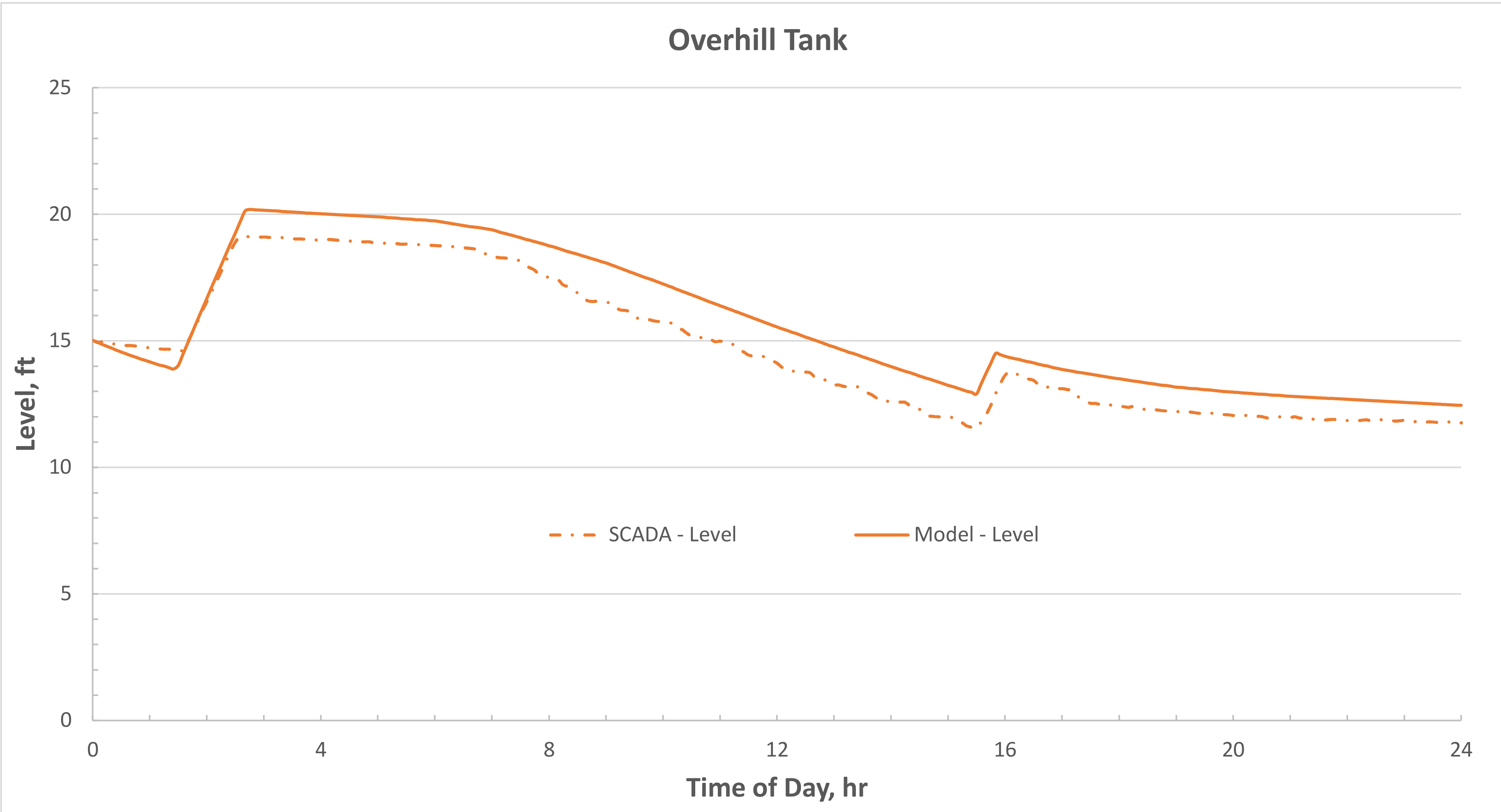


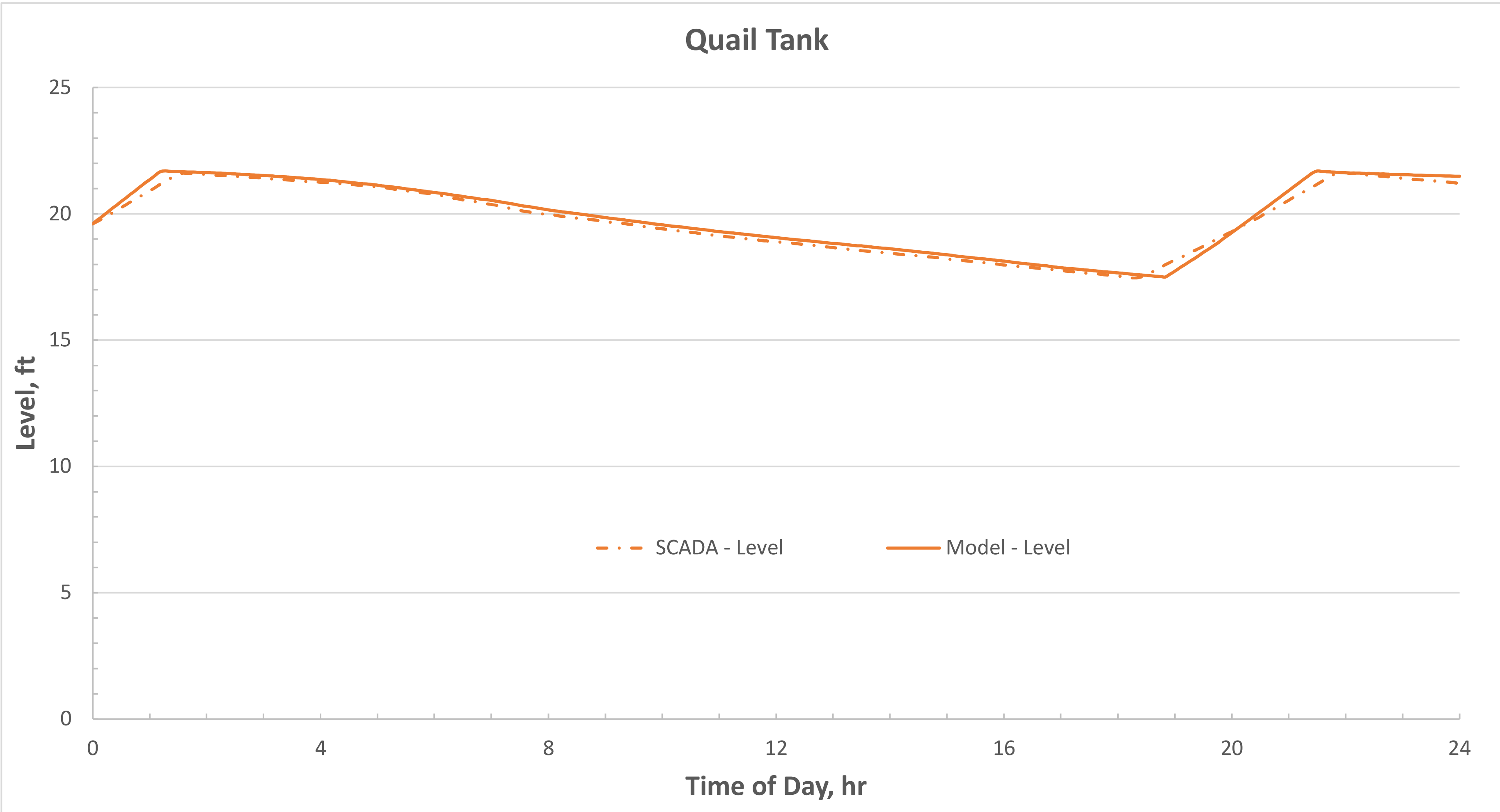
Low Northridge Tank
Level, ft
30
25
20
15
10
5
0
0
4
8
12
16
20
24
Time of Day, hr
SCADA - Level
Model - Level

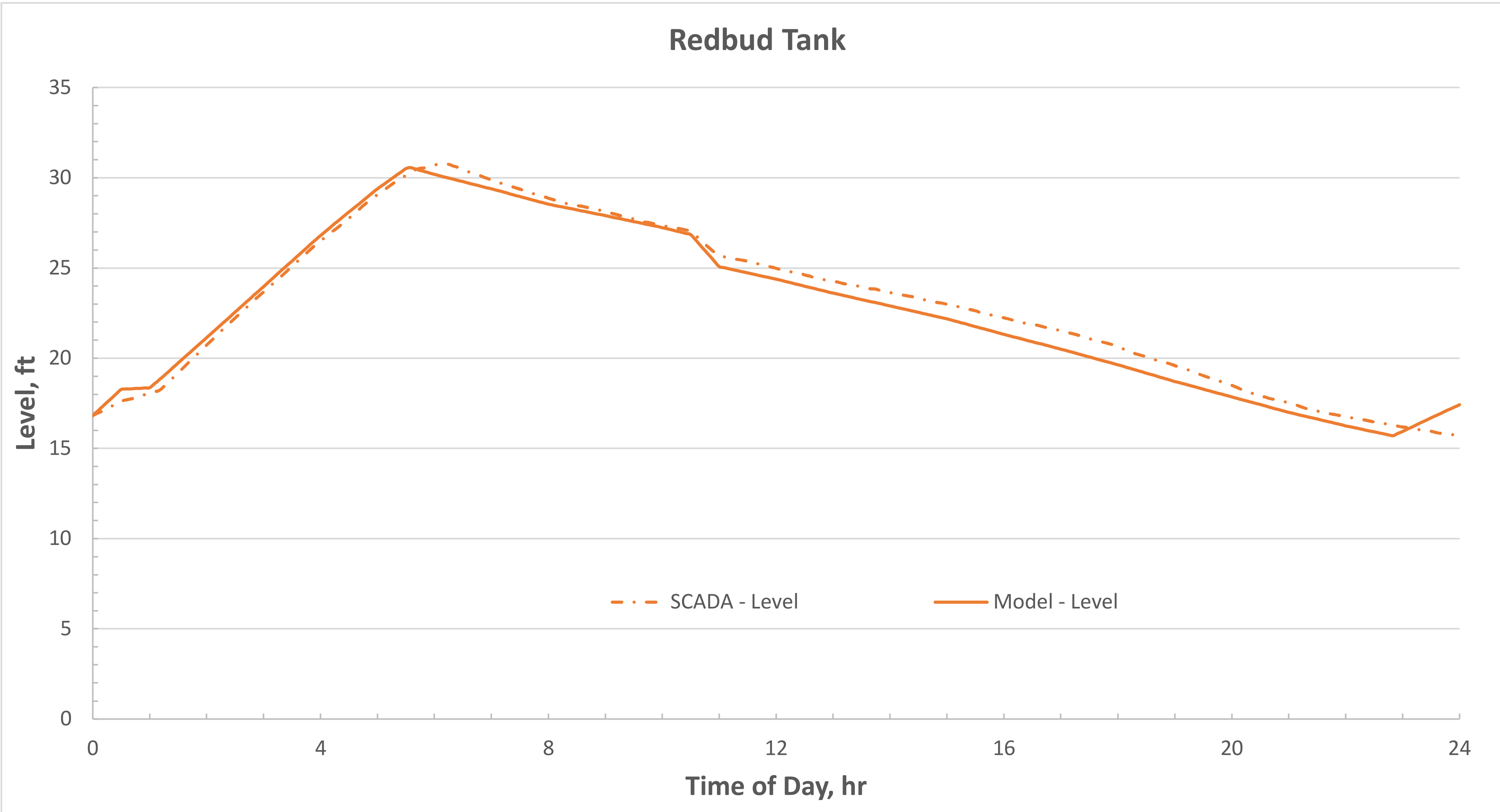


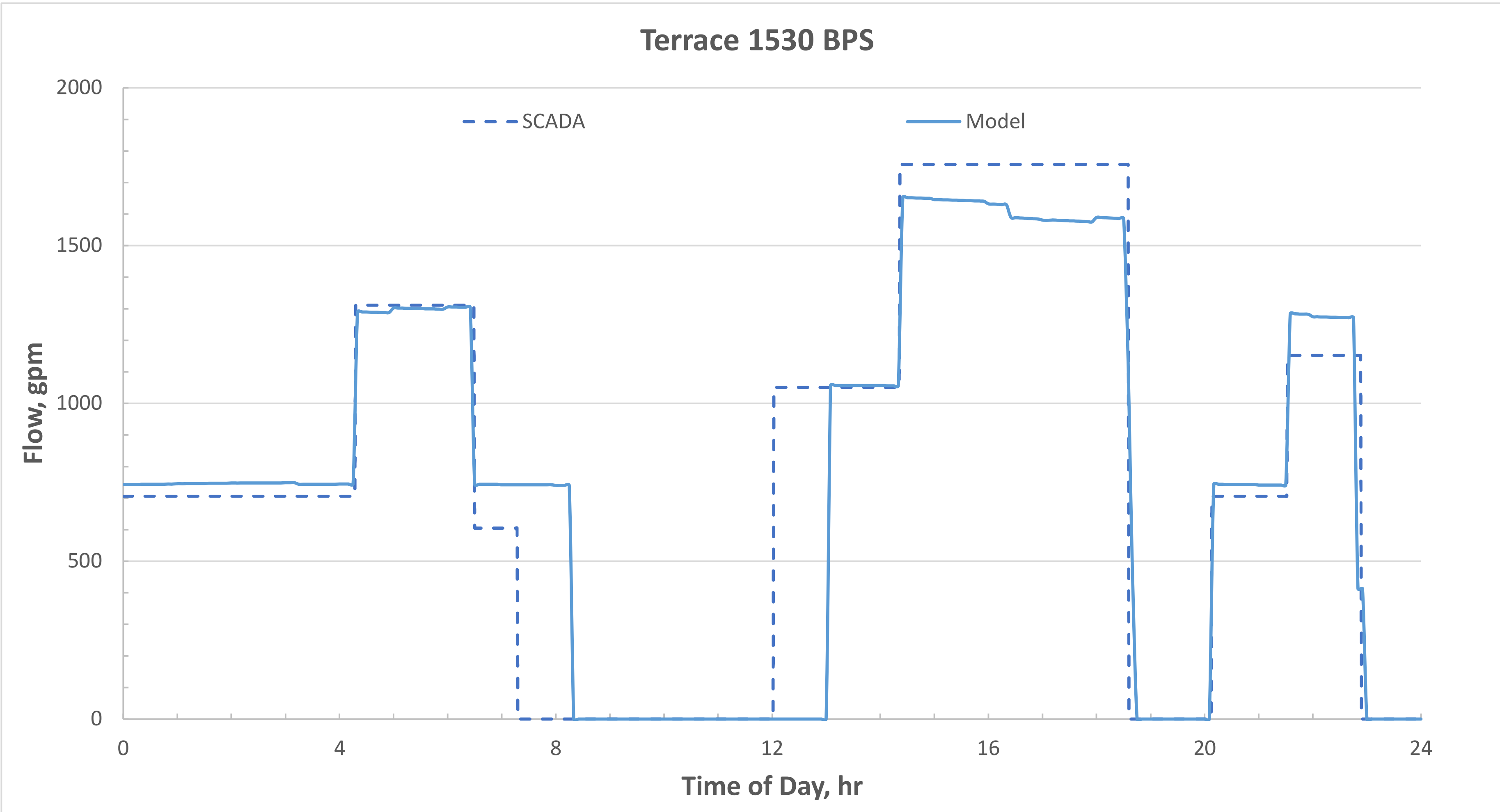
Low Northridge BPS
SCADA
Model
Flow, gpm
700
600
500
400
300
200
100
0
0
4
8
12
16
20
24
Time of Day, hr

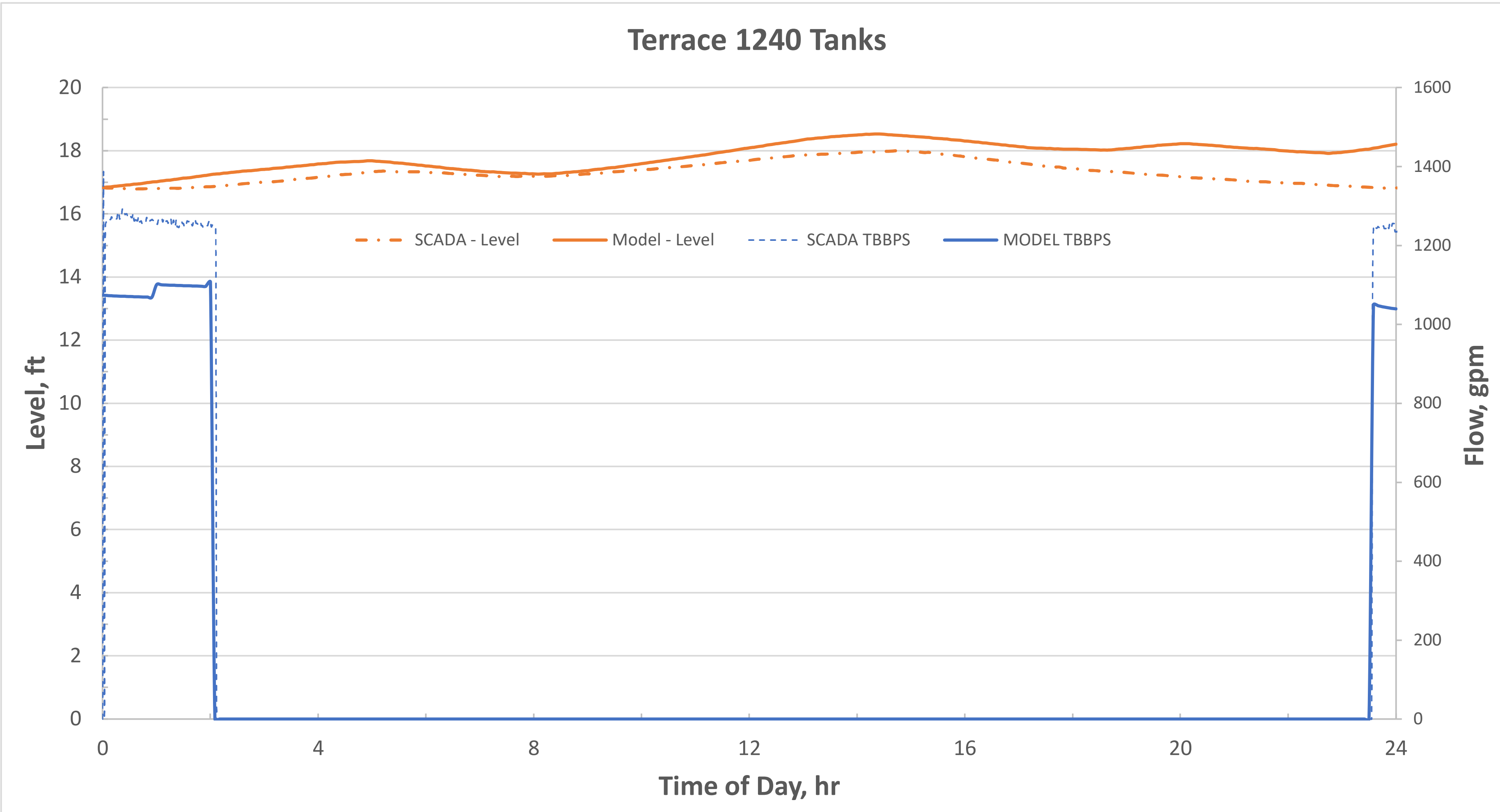

Mission Lakes 1530 Tank
30
25
20
15
10
5
0
Level, ft
0
4
8
12
16
20
24
Time of Day, hr
SCADA - Level
Model - Level


Overhill Tank
25
20
15
10
5
0
Level, ft
0
4
8
12
16
20
24
Time of Day, hr
SCADA - Level
Model - Level

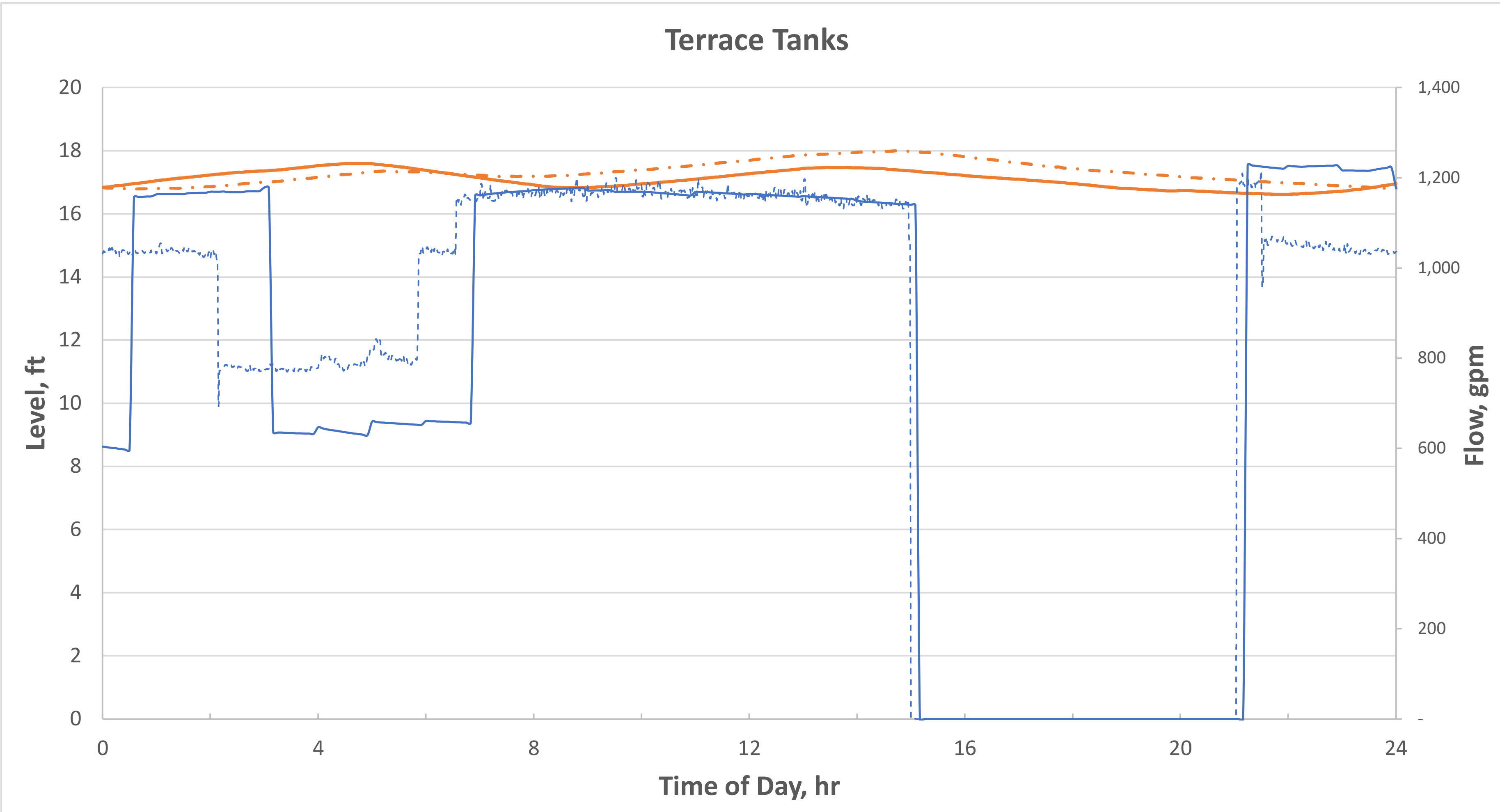

Quail Tank
Level, ft
Time of Day, hr
SCADA - Level
Model - Level
0
5
10
15
20
25
0
4
8
12
16
20
24


Redbud Tank
Level, ft
35
30
25
20
15
10
5
0
0
4
8
12
16
20
24
Time of Day, hr
SCADA - Level
Model - Level

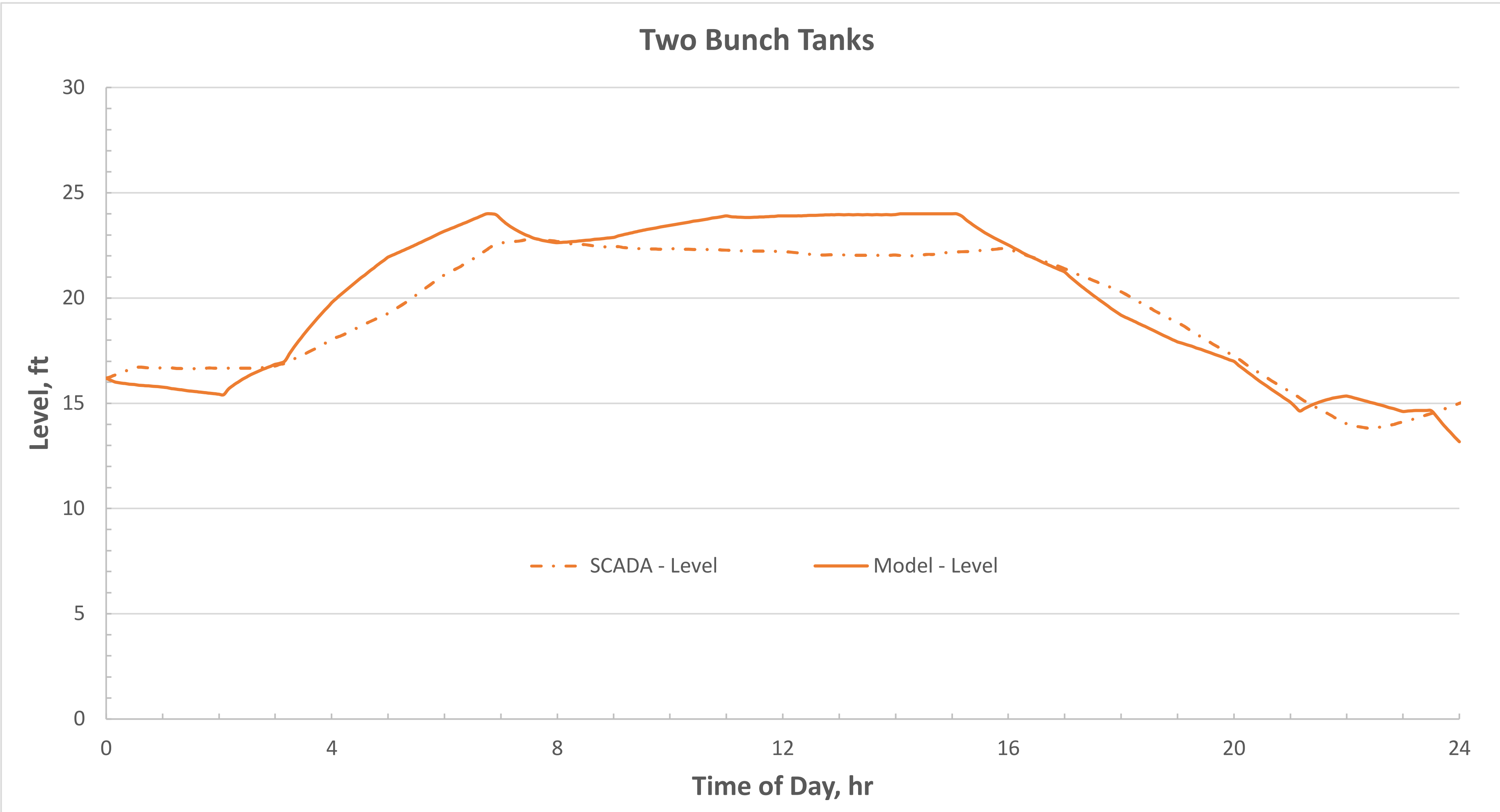

Terrace 1530 BPS
SCADA
Model
2000
1500
1000
500
0
0
4
8
12
16
20
24
Flow, gpm
Time of Day, hr

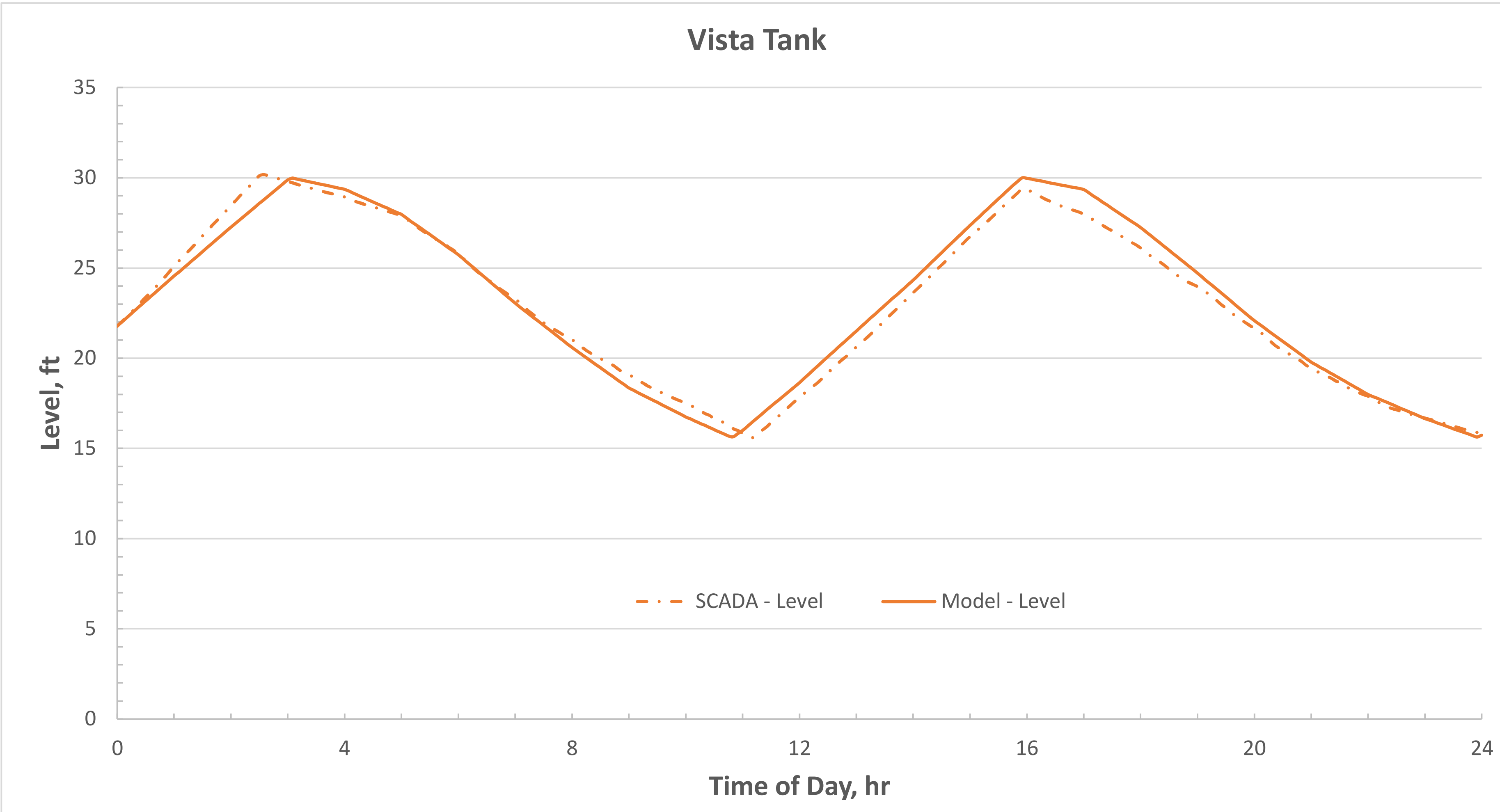


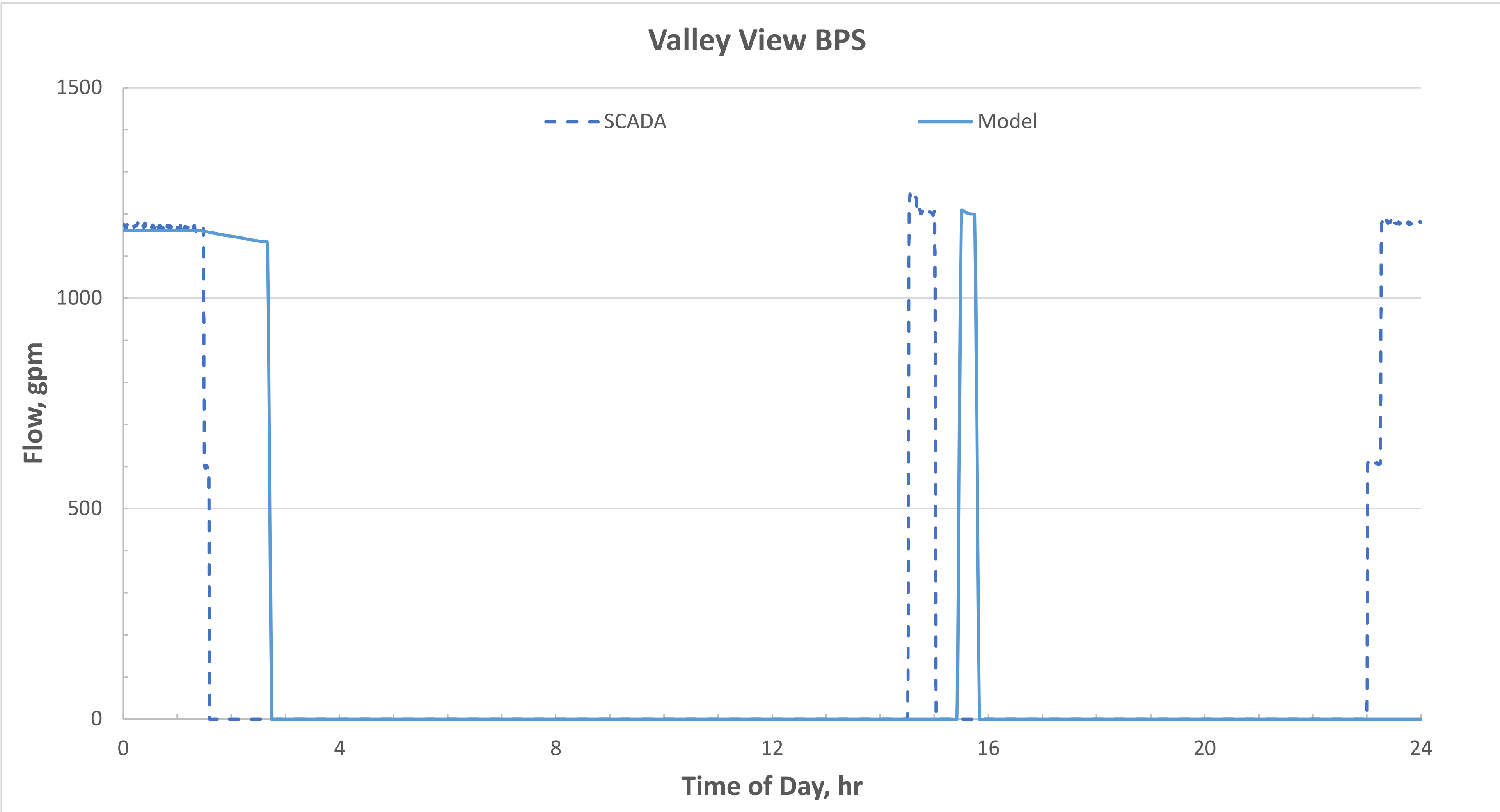
Terrace 1240 Tanks
SCADA - Level
Model - Level
SCADA TBBPS
MODEL TBBPS
Level, ft
Flow, gpm
Time of Day, hr
0
2
4
6
8
10
12
14
16
18
20
200
400
600
800
1000
1200
1400
1600
12
16
24



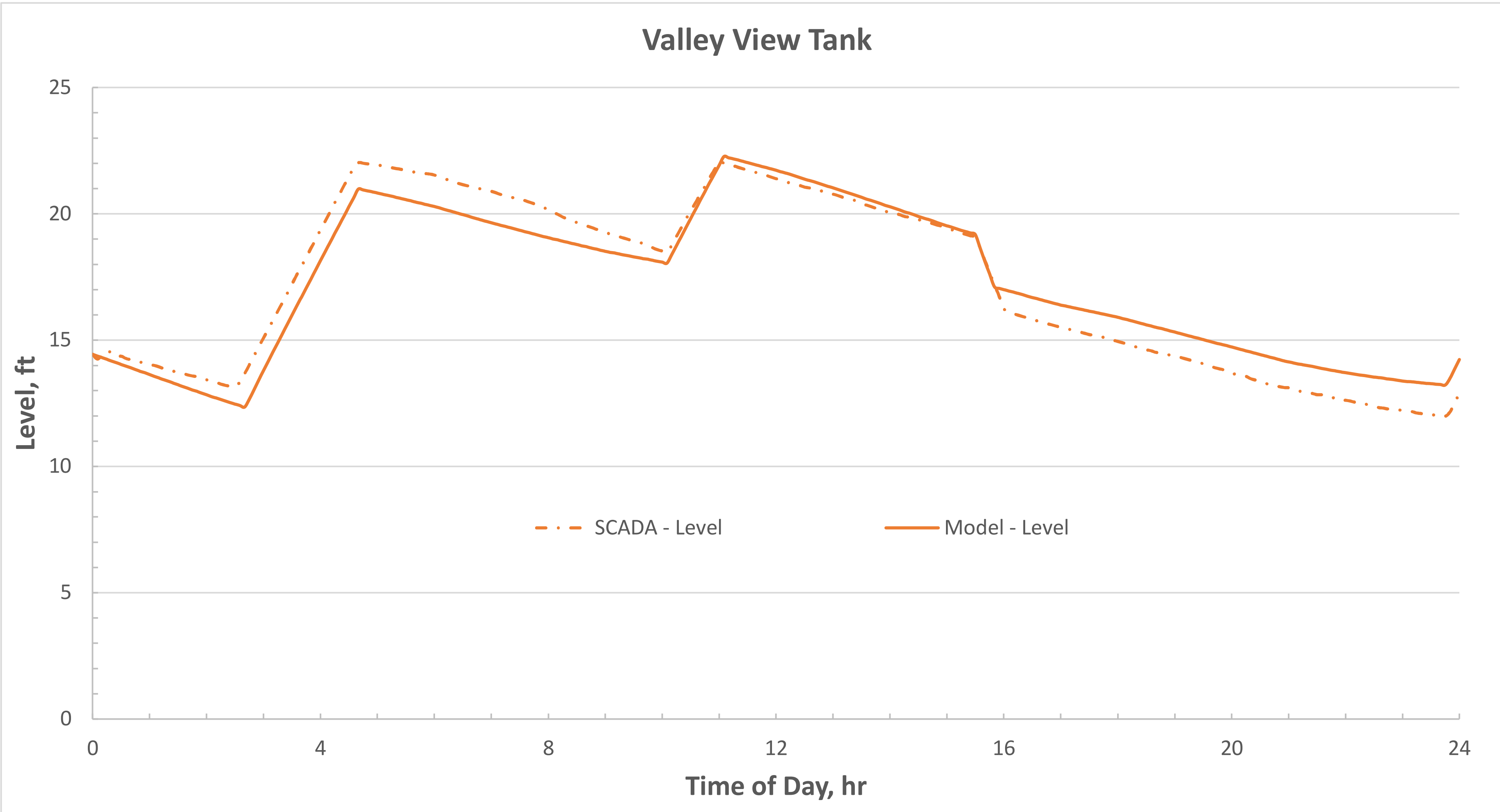
Terrace Tanks
Level, ft
Flow, gpm
Time of Day, hr
20
18
16
14
12
10
8
6
4
2
0
1,400
1,200
1,000
800
600
400
200
-
0
4
8
12
16
20
24

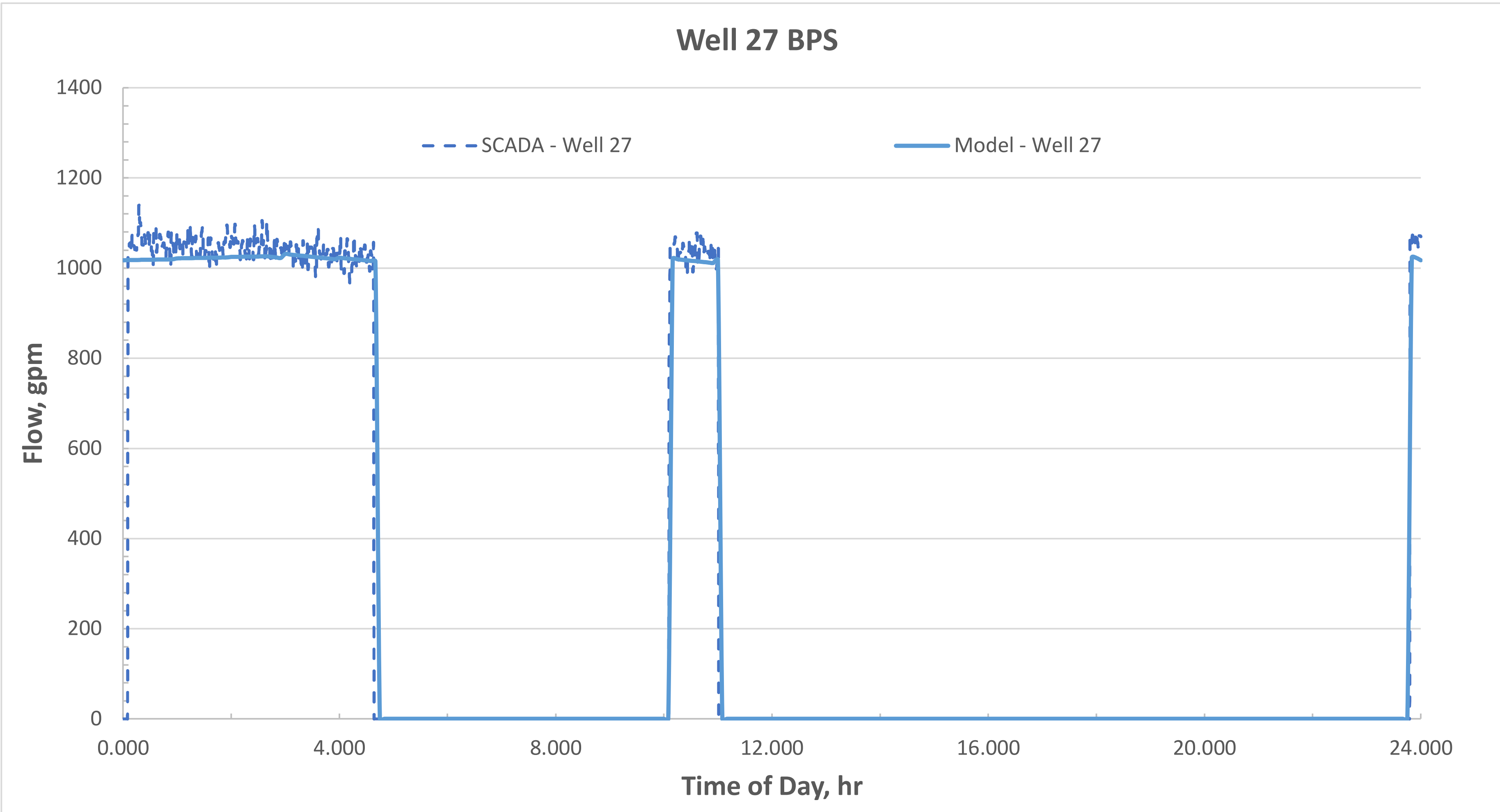

Two Bunch Tanks
Level, ft
30
25
20
15
10
5
0
0
4
8
12
16
20
24
Time of Day, hr
SCADA - Level
Model - Level


Vista Tank
Level, ft
35
30
25
20
15
10
5
0
0
4
8
12
16
20
24
Time of Day, hr
SCADA - Level
Model - Level

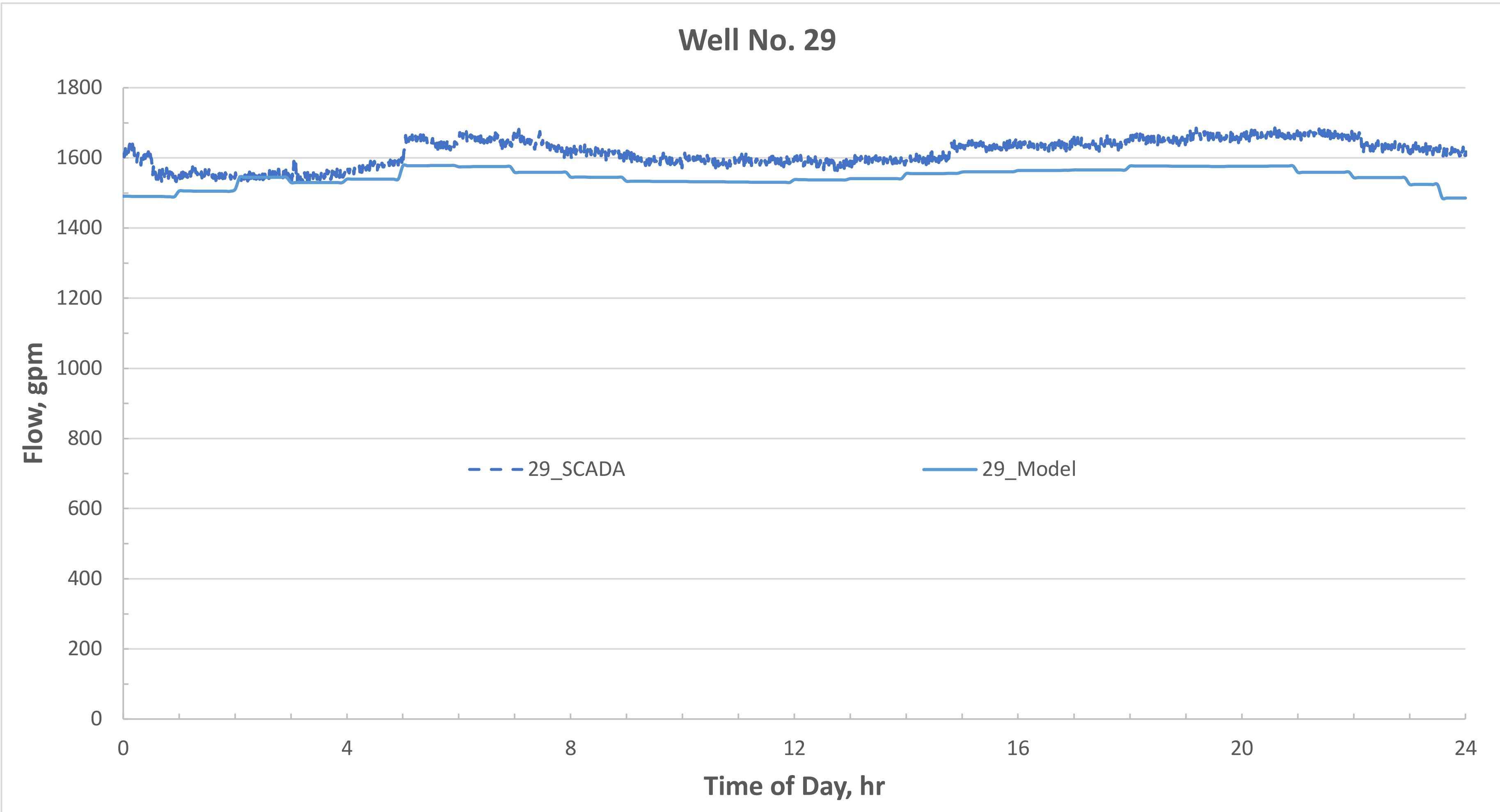


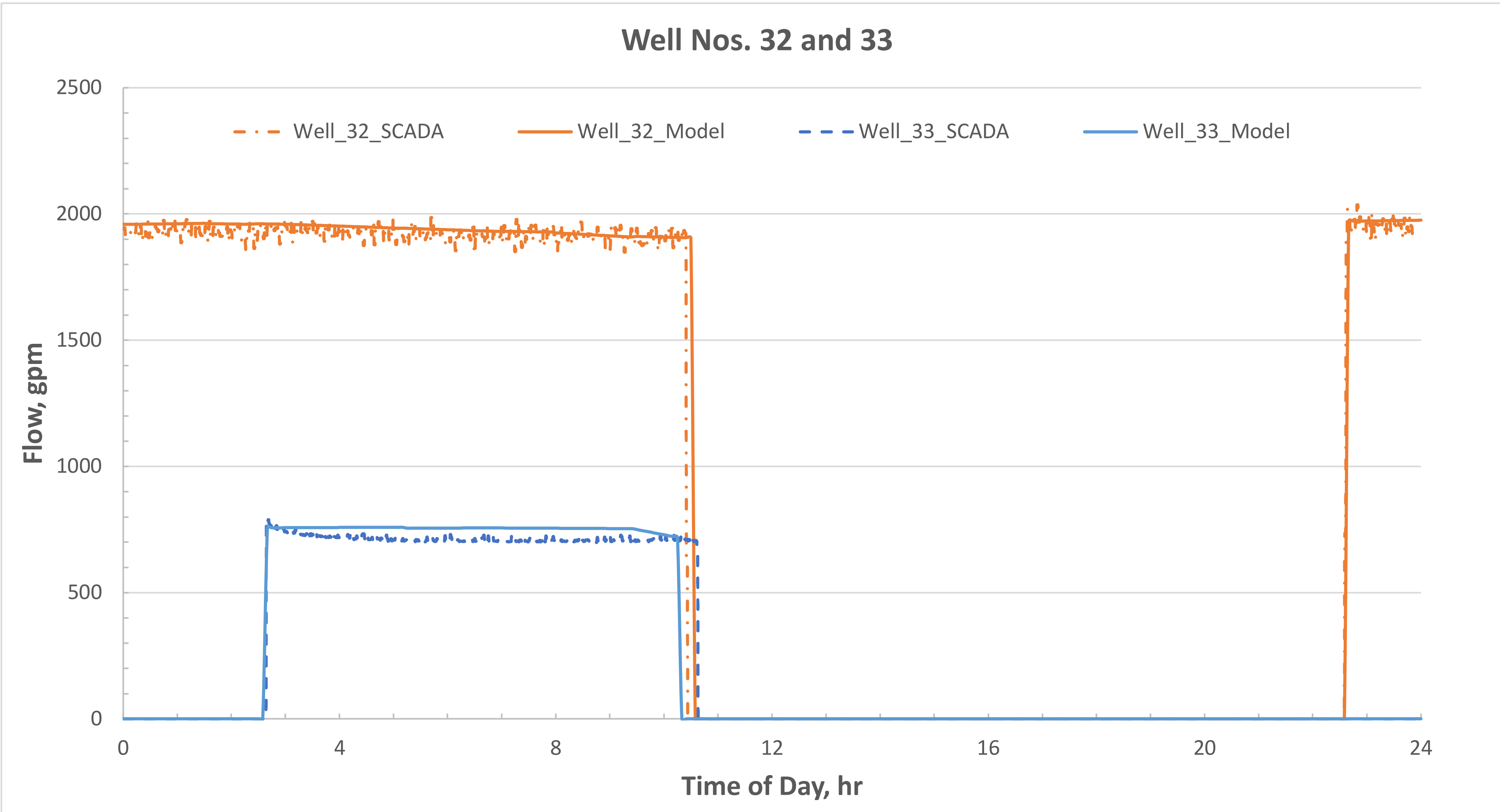
Valley View BPS
SCADA
Model
Flow, gpm
1500
1000
500
0
0
4
8
12
16
20
24
Time of Day, hr

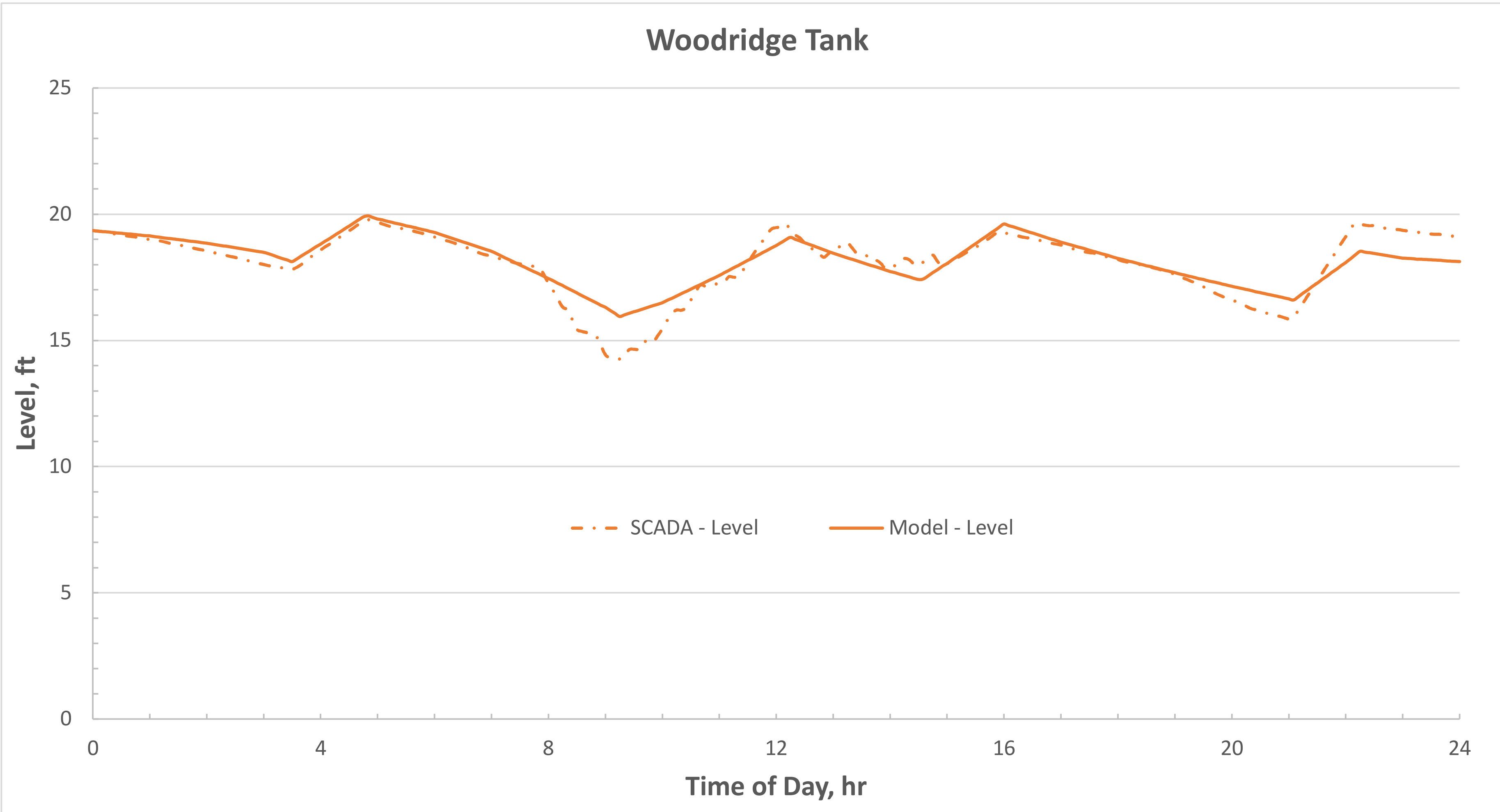

Valley View Tank
25
20
15
10
5
0
Level, ft
0
4
8
12
16
20
24
Time of Day, hr
SCADA - Level
Model - Level

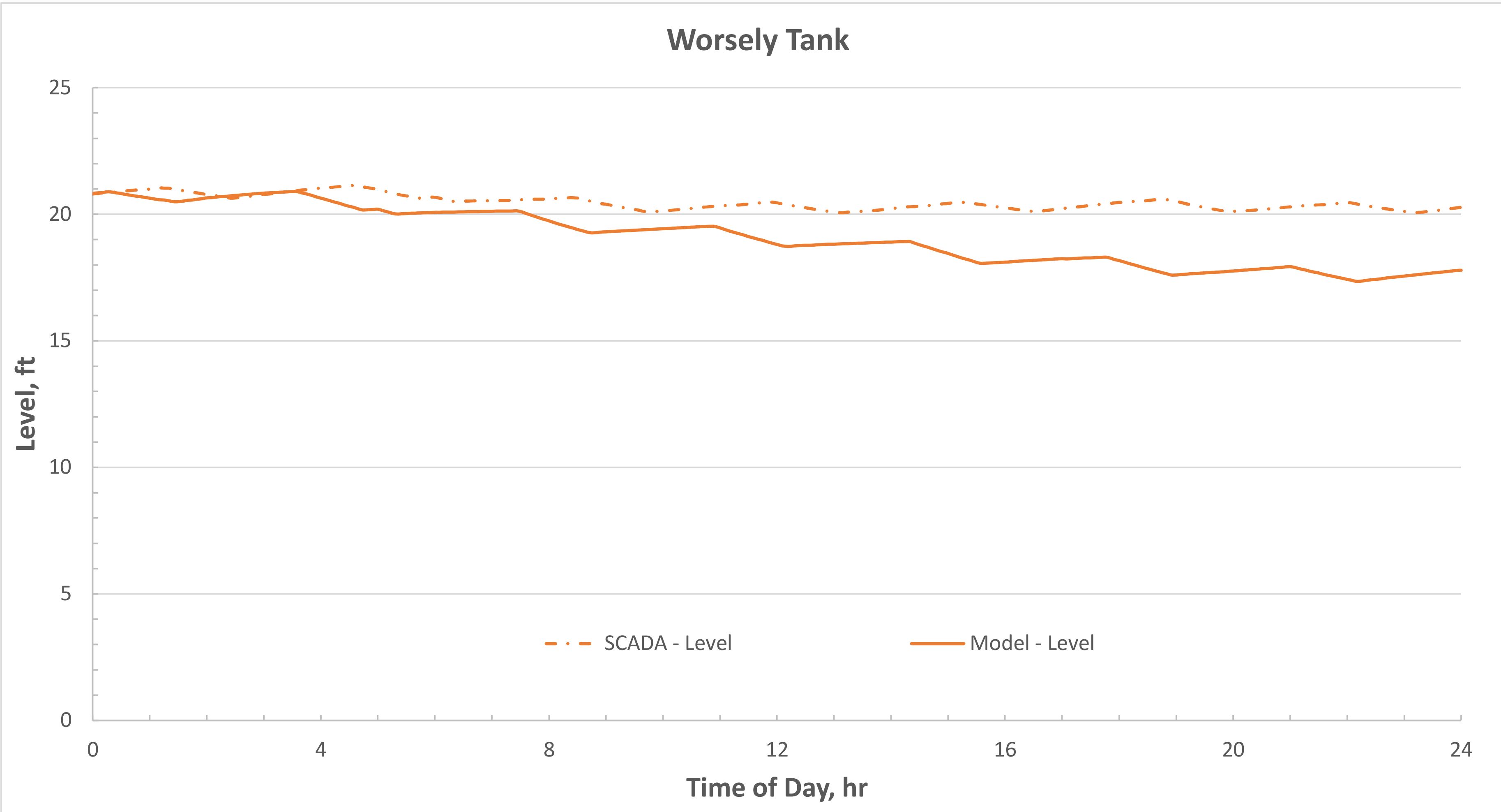


Well 27 BPS
SCADA - Well 27
Model - Well 27
Flow, gpm
1400
1200
1000
800
600
400
200
0
0.000
4.000
8.000
12.000
16.000
20.000
24.000
Time of Day, hr


Well No. 29
Flow, gpm
1800
1600
1400
1200
1000
800
600
400
200
0
0
4
8
12
16
20
24
Time of Day, hr
29_SCADA
29_Model


Well Nos. 32 and 33
Well_32_SCADA
Well_32_Model
Well_33_SCADA
Well_33_Model
Flow, gpm
2500
2000
1500
1000
500
0
0
4
8
12
16
20
24
Time of Day, hr


Woodridge Tank
25
20
15
10
5
0
Level, ft
0
4
8
12
16
20
24
Time of Day, hr
SCADA - Level
Model - Level


Worsely Tank
Level, ft
25
20
15
10
5
0
0
4
8
12
16
20
24
Time of Day, hr
SCADA - Level
Model - Level