San Jose Water Company

Planning Group

Mountain System Master Plan

March 2016

Final Report

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FINAL REPORT

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Acronyms and Definitions

The following abbreviations and acronyms are used in this report.

ASCE	American Society of Civil Engineers	**hp**	Horsepower
AWWA	American Water Works Association	**MG**	Million Gallons
CIP	Capital Improvement Program	**MWC**	Mutual Water Company
CPUC	California Public Utilities Commission	**NRC**	National Research Council
DBP	Disinfection By-Products	**OES**	Office of Emergency Services
DDW	Division of Drinking Water	**OPE**	Overall Plant Efficiency
DICL	Ductile Iron Cement Lined	**psi**	Pounds per Square Inch
DICLZ	Ductile Iron Cement Lined Zinc Coated	**PVC**	Polyvinylchloride
DOF	Department of Finance	**RMWC**	Redwood Mutual Water Company
DWR	Department of Water Resources	**SCADA**	Supervisory Control and Data Acquisition
EPA	Environmental Protection Agency	**SCCHD**	Santa Clara County Health Department
FEMA	Federal Emergency Management Agency	**SCVWD**	Santa Clara Valley Water District
FF	Fire Flow	**SJWC**	San Jose Water Company
ft	Feet	**UFW**	Unaccounted for Water
gpcd	Gallons per Capita per Day	**USGS**	United State Geological Survey
gpd	Gallons per Day	**WTP**	Water Treatment Plant
gpd/s	Gallons per Day per Service	**WERF**	Water Environment Research Foundation

Key Definitions & Terms

Mountain System	SJWC's distribution system south of the Montevina Water Treatment Plant
Mountain District	SJWC's distribution system acquired under the 2006 RMWC agreement
Montevina Pipeline	Pipelines and pump stations constructed after the 1989 earthquake that convey water from MWTP to customers in the Mountain District
ADD	Average Day Demand; defined as Annual Demands divided by 365 days
MDD	Maximum Day Demand; largest daily water use that occurs over a given year
PHD	Peak Hour Demand; the peak hourly flow that occurs on the maximum day

Executive Summary

ES | Executive Summary

ES-1. Introduction

San Jose Water Company (SJWC) is one of the largest privately owned water systems in the United States, providing high-quality low-cost potable water to over one million customers throughout Santa Clara County. From the company's founding in 1866, its service area has expanded to include much of San Jose, as well as the cities of Campbell, Saratoga, Monte Sereno, Los Gatos, and Cupertino. Comprehensive planning and asset management have been the keys to SJWC success in maintaining high levels of customer service while simultaneously addressing the challenges associated with service area expansion, population changes, aging infrastructure, and new regulatory requirements.

View of Lexington Reservoir

In 2006, SJWC acquired Redwood Mutual Water Company with its service area in and around Redwood Estates. This acquisition greatly expanded SJWC boundary and infrastructure in the Santa Cruz Mountains and is referred to as the *Mountain System* (see Figures ES-1 & ES-2). Following the acquisition, SJWC undertook a thorough evaluation of the entire Mountain System which was compiled into a report known as the Mountain System Master Plan (MSMP). This report was intended to provide both SJWC and its customers a complete understanding of the system's water demands, overall long-term water usage trends, infrastructure deficiencies, and SJWC's 20-year Capital Improvement Plan (CIP) to address identified needs.

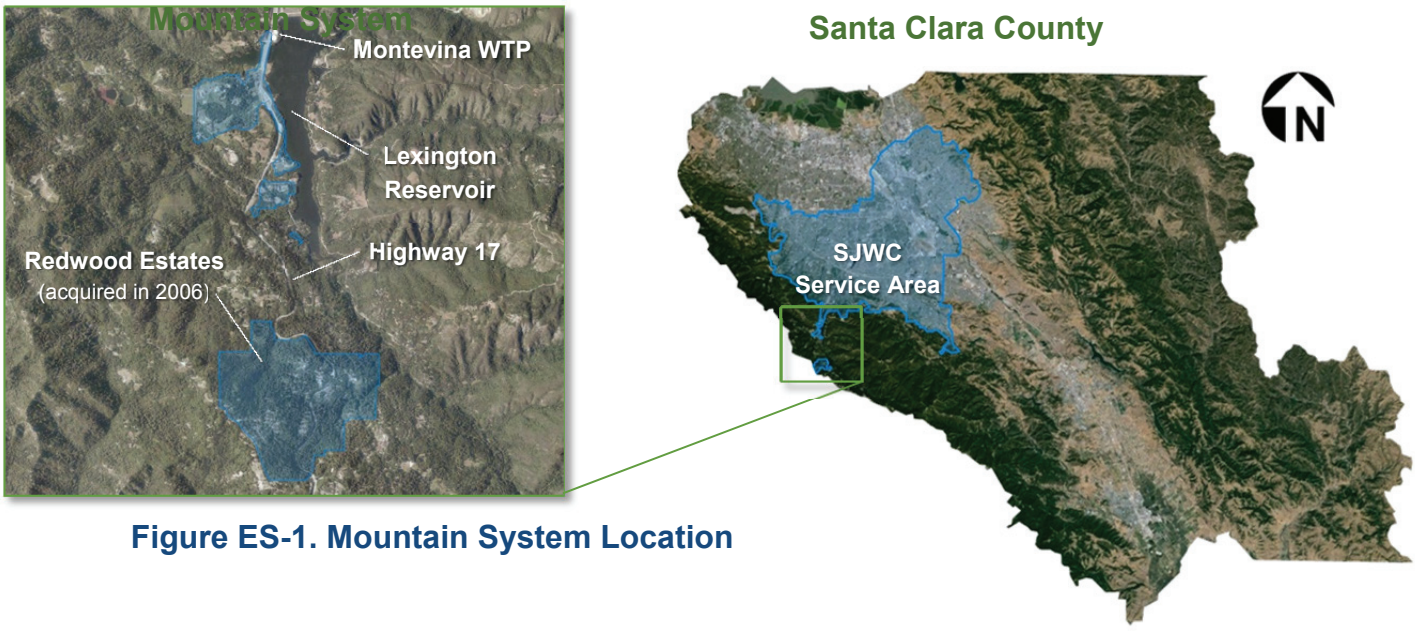

Figure ES-1. Mountain System Location

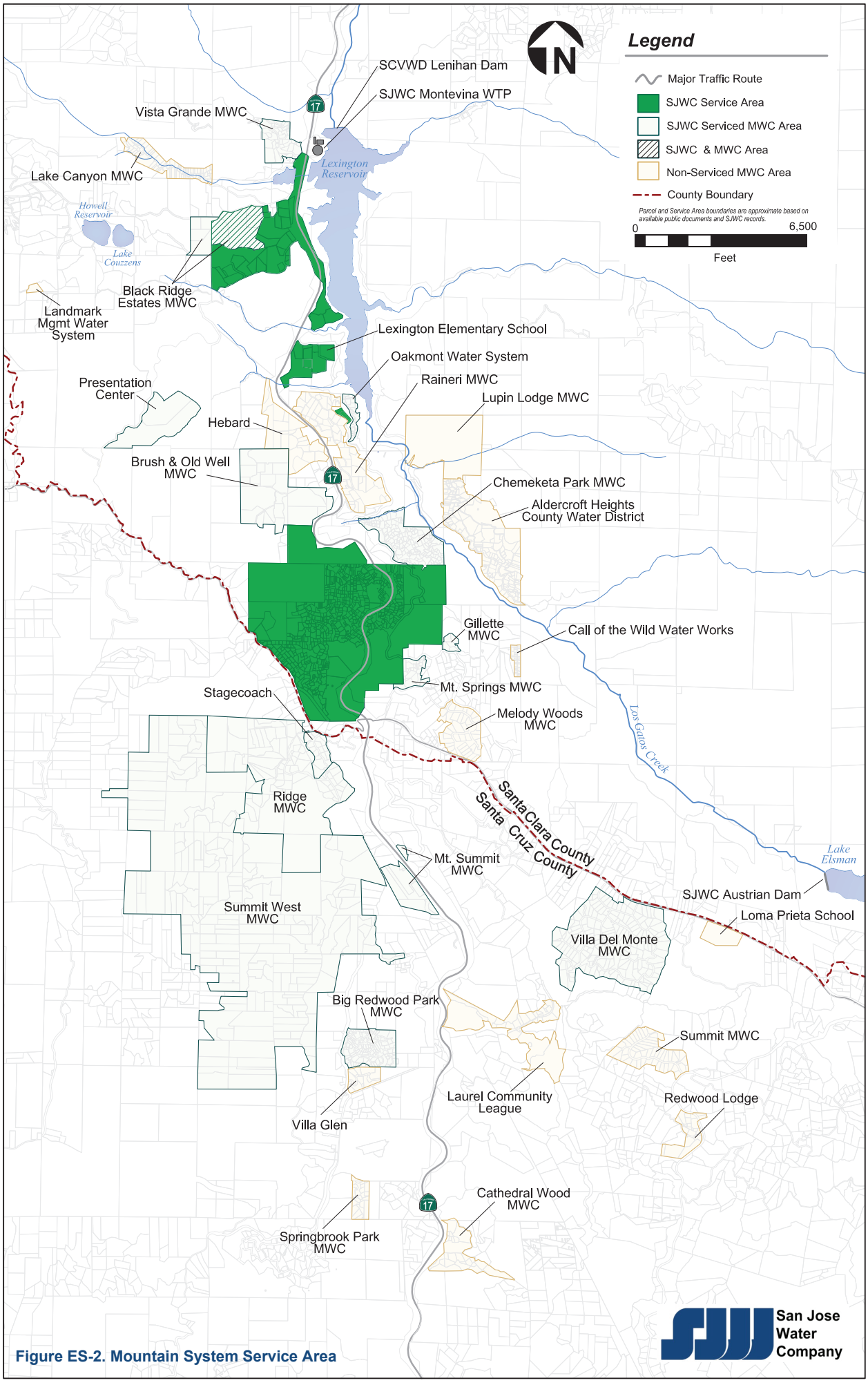

Figure ES-2. Mountain System Service Area

ES-2. Study Approach

The Mountain System Master Plan was developed by following the four step methodology illustrated in Figure ES-3. Projections stopped at 2040 because this was the limit of current Association of Bay Area Governments (ABAG) population projection data.

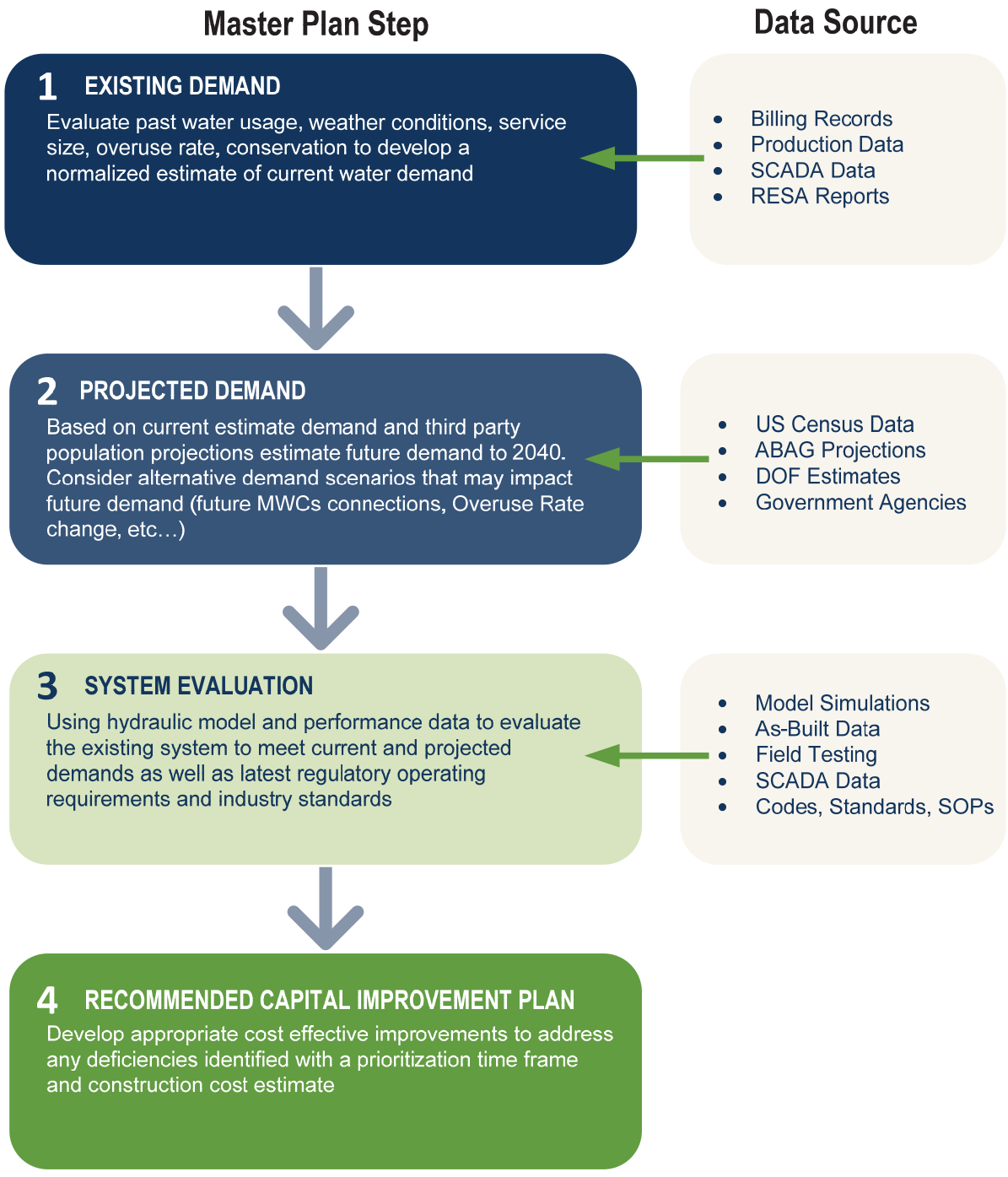

Figure ES-3. MSMP Approach, Sources, and Format

ES-3. Summary of Findings

Existing Water Demand

Average *weather normalized* demand for the Mountain System was determined to be approximately 89.2 million gallons per year with a Maximum Day Demand (MDD) of 579,100 gallons/day. While annual demands for the Mountain System have remained relatively consistent between 2007 to 2014 (see Figure ES-4), there was significant variability within the aggregate annual demands as a results of fluctuations in non-revenue water (i.e. water loss), number of customer accounts, relaxing of the Schedule 1C Mountain District Overuse Rates (Overuse Rate tier), and changes in demands of various Mutual Water Companies (MWCs). Non-revenue water has steadily decreased since the 2006 acquisition in response to SJWC's effort to replace leaking and aging water mains. In 2014 non-revenue water in the Mountain System was 4.1% of total annual water usage, down from a peak of 14.2% in 2007. Almost half of the total annual water usage is from MWCs and other collective users within the Mountain System. Some of these MWCs have alternative sources of water which result in significant changes in their water demand depending available water sources.

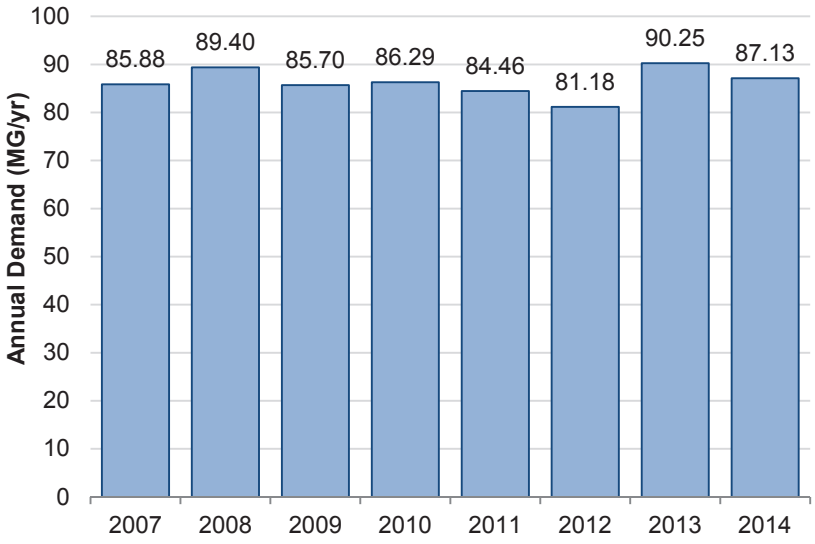

Figure ES-4. Mountain System Annual Demand Summary

Total population in the Mountain System as of December 2014 was approximately 2,600, which results in a daily water usage of 94.0 gallons per capita per day (gpcd). The estimated residential water usage (i.e. actual customer demand excluding system water loss and public/quasi-public services) was determined to be 83.4 gallons per capita per day (R-gpcd). These per capita usages were noted to be lower than SJWC's base average of 114.3 gpcd as shown in SJWC's 2010 *Urban Water Management Plan*. This is attributed to the cooler climate, heavily forested area, minimal residential landscaping, and long-term effects of an Overuse Rate tier within the service area. However, per capita usage in the Mountain System has been gradually increasing, unlike recent trends experienced by SJWC and other water distribution systems across the United States.[1,2] After analyzing past water usage, it was found that daily per capita demand has increased in this area, which was principally attributed to SJWC's relaxing of the Overuse Rate tier.

[1] WRF & USEPA, *North American Residential Water Usage Trends Since 1992* (2010)
[2] CPUC Application No. 12-01-003, *Testimony of the Size Mutual Water Companies* (2012)

The Overuse Rate tier is a usage rate applied to all metered services in an effort to minimize water usage to essential uses only (i.e. bathing, drinking, washing, and sanitation) and is a legacy of Redwood Mutual Water Company's policy since 1991.[3] Since the acquisition, SJWC has relaxed the Overuse Rate tier for these customers from 250 to 500 gallons per day per service (gpd/s) on average as applied at each billing cycle. SJWC has maintained the Overuse Rate tier due to uncertainty in potential customer usage and the insufficient capacity of existing infrastructure to meet additional demands in this service area. Nevertheless, the Overuse Rate tier continues to be a source of contention amongst customers and MWCs subject to it. However, the current 500 gpd/s Overuse Rate tier is greater than the national average daily home at 400 gallons per day[4], and the average daily single family home within the rest of SJWC's distribution at 328 gallons per day.[5] It was determined that relaxing the Overuse Rate tier from 250 gpd/s to 375 gpd/s and again from 375 gpd/s to 500 gpd/s resulted in an 8% and 4% increase in total annual demand respectively for residential customers in the Mountain District (not including MWCs). If the Overuse Rate tier were to be further relaxed the resulting increase in customer usage will taper until customer usage is no longer influenced by the tier. Based on the past increases, it was estimated that a complete abandonment of the Overuse Rate tier would result in roughly a 6% overall increase in annual demand.

Projected Water Demand

Population growth estimates were developed for the Mountain System based on forecasts from ABAG, US Census data, and feedback from local and state government agencies. The Mountain System is projected to experience steady but limited growth over the next 25 years. Table ES-2 and Figure ES-5 summarize the resulting projected water usage, which is expected to increase proportionally to population. Water conservation was not incorporated into the demand forecast as usage has not decreased over time and may increase if the Overuse Rate is removed.

Table ES-2: Population and Demand Projections

Year	2015	2020	2030	2040
Population	2,596	2,608	2,654	2,717
Service Count	934	939	955	978
Annual Demand (MG)	94.3	94.7	96.3	98.5
MDD (gpd)	617,900	620,500	630,800	645,100

Source: *ABAG 2013 Projections, US Census Data*
Demand forecast assuming unrestricted services (no Overuse Rate)
Based on Normalized Water Demand

[3] Boyle Report, *Montevina Pipeline Master Plan* (1991)
[4] EPA-832-F-06-004, *Indoor Water Use in the United States* (2008)
[5] SJWC, *Urban Water Management Plan* (2010)

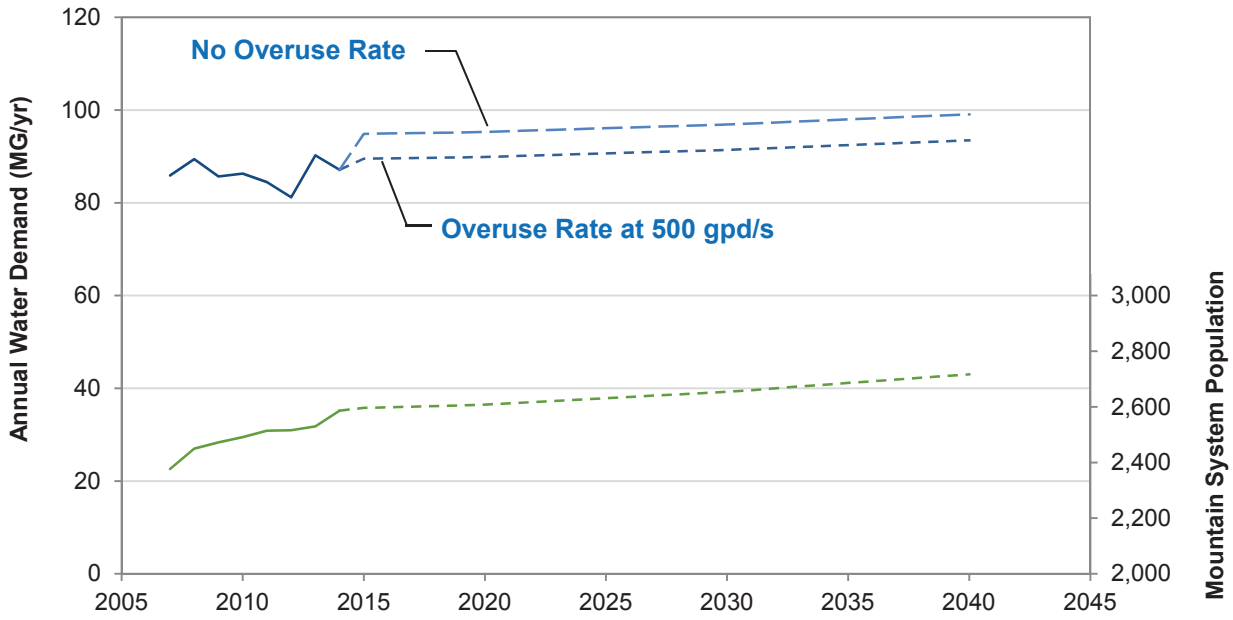

Figure ES-5. Projected Water Demand for the Mountain System

Alternative demand projections were also developed reflecting the potential for additional MWCs or other services in the area to connect to SJWC. Five scenarios were grouped based on the likelihood of the scenario, interest of MWCs, engineering challenges, and comments from County and State health officials. Details for the connection likelihood and potential challenges each MWC may face are presented in Section 5 of the MSMP. Although both Chemeketa and Mountain Springs are currently serviced by SJWC, their services are interruptible and restricted to 10-gpm and therefore they are considered part of specific scenarios to allow them unrestricted services. A summary of the scenarios and resulting demands are presented below:

- Scenario A – no additional connection and Overuse Rate tier remains at 500 gpd/s
- Scenario B – no additional connections, all existing customers (except Chemeketa and Mountain Springs) are provided unrestricted services
- Scenario C – Raineri, Mountain Springs, Aldercroft, Chemeketa, and Hebard systems provided unrestricted water service; all existing customers and mutual water customers provided unrestricted service
- Scenario D – Melody Woods, and Call of the Wild systems provided unrestricted water service in addition to those in Scenario C; all existing customers and mutual water customers provided unrestricted service
- Scenario E – Loma Prieta School provided unrestricted service in addition to those in Scenario D. This scenario also includes an additional 50 services for customers acquired along Summit Road to the school; all existing customers and mutual water services provided unrestricted service

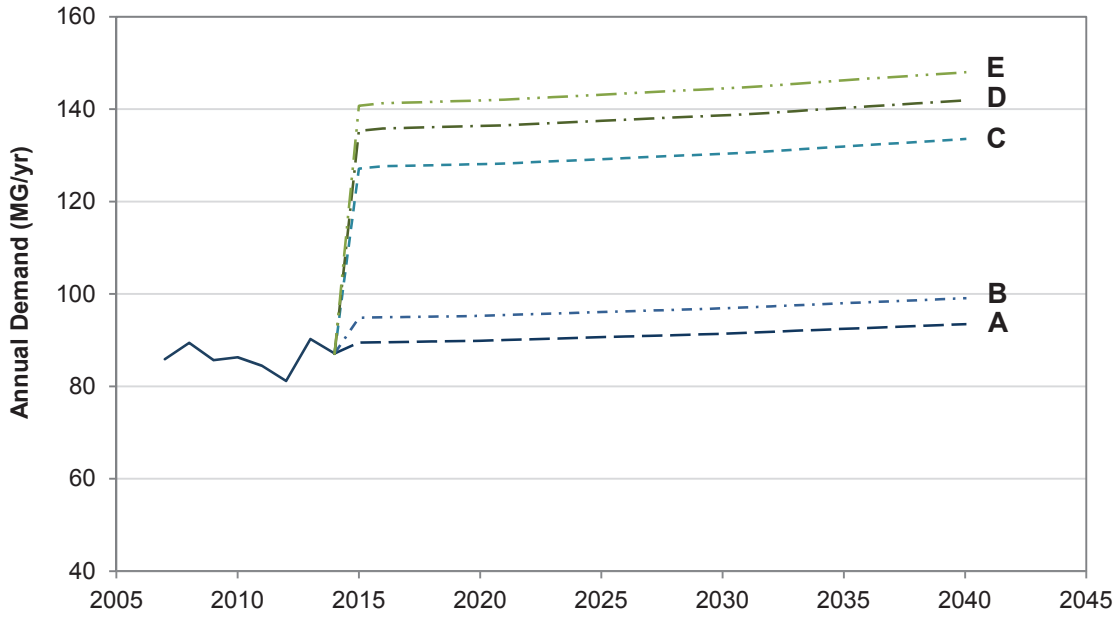

Figure ES-6. Projected Water Demand for the Mountain System

Table ES-3: Projected Annual Demand Scenarios (MG)				
Scenario	**2015**	**2020**	**2030**	**2040**
A	89.0	89.4	90.9	92.9
B	94.3	94.7	96.3	98.5
C	121.4	127.4	129.6	132.8
D	129.1	135.6	137.9	141.1
E	134.3	141.1	143.7	147.1

ES-4. Existing System Evaluation

General Overview

The Mountain System is in need of both significant improvements and an overall redesign in order to bring the service area up to current regulatory requirements and standard industry practices (see Section 6 for details on standards and regulations). Fire flow is generally poor or non-existent throughout the entire distribution system as a result of sub-optimal service pressures, and undersized reservoirs and pumping equipment. The *Montevina Pipeline,* a series of pumps station and pipelines that are the critical lifeline to much of the Mountain System, is operating near maximum capacity and is projected to be unable to meet Maximum Day Demand (MDD) in the next 5 – 10 years. Moreover, past studies found that the pump stations along the Montevina Pipeline were designed essentially as a series of sewer lift stations to meet

instantaneous demand.[6,7] In addition to the different design standards between sewer and water pump stations, an instantaneous demand type pumping system for larger service areas, such as the Mountain System, becomes very costly to maintain and difficult to operate (e.g. higher pumping costs during the day, frequent starts/stops of the pump motors wears equipment significantly faster). It is for these reasons that the American Water Works Associations (AWWA) design manual recommends constructing reservoirs at key points in the system to provide supply to the distribution system during peak demand and allow for pumping during off-peak demand charges (i.e. at night).[8] Based on these deficiencies, and those discussed in more depth below, a schedule of necessary improvements with estimated costs was compiled and is presented in Section ES-5.

Pump Stations: Existing pump stations at Holy City and Oakmont pump stations will be undersized to meet MDD in the next 5 – 10 years. Summit and Montevina pressure systems are currently undersized based on existing demands and Santa Clara County Fire Department (SCCFD) fire flow requirements.

Water Storage Reservoirs: All water storage reservoirs in the Mountain System are undersized to meet MDD and Fire Flow (FF) storage requirements. Some reservoirs are also poorly secured as evident by vandalism observed onsite.

Distribution System: Hydraulic modeling of the system found multiple pockets of low service pressure below the California Public Utilities Commission (CPUC) General Order 103A standard, which requires 24-hr average service pressure to be within a 40 – 125 psi range. Multiple water mains were identified as being undersized for the required MDD plus FF scenario and will be a bottleneck to providing sufficient water to hydrants at the flow rate and pressure specified by SCCFD.

Reliability: The Montevina Pipeline crosses the San Andreas Fault without adequate flexible fittings. This pipeline is a critical lifeline to the entire Mountain System and lessons learned from past earthquakes have found that fault crossings are highly vulnerable points in a distribution system. Installing flexible fittings at this crossing would significantly increase the likelihood of this key pipeline remaining in service following an earthquake or other natural disaster. Permanent generators were also recommended for installation at all stations owing to the potential for road closures following an earthquake.

Water Quality: Bayview reservoir was found to have a very high detention time and poor disinfection residual levels owing to the small number of service connections served and the use of an inlet float valve to control reservoir water level. Holy City, Oakmont, Locust, and Summit Pressure system were also identified as concerns because of the sumps, which needlessly expose the water supply to the outdoor environment potentially allowing foreign matter to enter the water system.

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[6] Boyle Report, *Montevina Pipeline Master Plan* (1991)
[7] Wy'East Engineering, *Montevina Pipeline System Capacity Analysis Report* (2003)
[8] AWWA Manual of Water Supply Practices M42 *Steel Water-Storage Tanks* (2013)

ES-5. Recommended Capital Improvement Program

The following CIP provides a list of improvements needed in the Mountain System to address existing system deficiencies, meet future demand, and transition into a more sustainable, efficient, and reliable water system. A summary of the recommended CIP is illustrated in Figure ES-7, and a list of the projects by year and rate case is presented in Table ES-4 at a grand total of $25,850,000 over the next 20 years.

Oakmont and Holy City Pump Stations Improvements: Oakmont and Holy City pump stations should be relocated and replaced to SJWC owned fee-title property, each with two 700-gpm booster pumps in pressurized barrels and their own 400,000 gallon storage tank. This will greatly reduce complexity of the current VFD pumping systems, increase reliability, and eliminate water quality concerns.

Tank Farm and Locust Stations Consolidation and Improvements: Water storage is to be consolidated at Tank Farm and Locust. This will eliminate the need for Bayview and Beatrice Circle tanks which are undersized and present water quality concerns. Summit will eventually be retired after Tank Farm improvements are completed along with necessary water mains to allow water from Locust to be pumped to Tank Farm. A new larger pressure system will be constructed at Tank Farm to increase pressure and service counts to the current Summit Pressure Zone.

Distribution Main Improvements: A significant number of water main projects are recommended to replace aging infrastructure, improve operating efficiencies, pressures, fire flow, and realign the system to allow for consolidation and other improvements. New regulating stations will be constructed to allow higher pressures into several low pocket areas.

Table ES-4: Capital Improvement Scheduled for the Mountain System (2016 Costs in $ Millions)									
Project No.	Description	Scheduled General Rate Case for Improvement							Total Project Cost
		2015 - 2017	2018 - 2020	2021 - 2023	2024 - 2026	2027 - 2029	2030 - 2032	2033 - 2035	
Reservoir Improvements									
R-1	Tank Farm Expansion	$ 0.40			$ 1.42				**$ 1.82**
R-2	Holy City Tank Installation		$ 3.75						**$ 3.75**
R-3	Oakmont Tank Installation			$ 3.44					**$ 3.44**
R-4	Locust Tank Replacement						$ 3.15		**$ 3.15**
Pump Station Improvements									
PS-1	Holy City Replacement		$ 1.24						**$ 1.24**
PS-2	Oakmont Replacement			$ 1.24					**$ 1.24**
PS-3	Tank Farm Pressure System				$ 1.11				**$ 1.11**
PS-4	Locust PS Replacement						$ 1.21		**$ 1.21**
Reliability Improvements									
S-1	Seismic Fitting on Montevina Pipeline		$ 0.20						**$ 0.20**
Regulating Station Improvements									
RS-1	Locust Regulator Replacement	$ 0.25							**$ 0.25**
RS-2	Madrone Regulator Installation					$0.25			**$ 0.25**
RS-3	Mary Alice Regulator Upgrades						$ 0.25		**$ 0.25**
Distribution Main Improvements									
D-1	Locust Regulated Pipeline	$1.19							**$ 1.19**
D-2	Broadway Drive Pipeline		$0.63						**$ 0.63**
D-3	Oakmont Station Connection			$1.43					**$ 1.43**
D-4	Bayview Main Replacement				$1.75				**$ 1.75**
D-5	Virdell Drive Replacement				$0.78				**$ 0.78**
D-6	Lee Drive Replacement					$0.41			**$ 0.41**
D-7	Summit Road Replacement					$0.45			**$ 0.45**
D-8	Redwood Drive Replacement						$0.70		**$ 0.70**
D-9	Idalyn Drive Replacement							$0.30	**$ 0.30**
D-10	McLuckie Replacement							$0.26	**$ 0.26**
Projected Annual CIP ($ Millions)		**$ 1.84**	**$ 5.82**	**$ 6.12**	**$ 5.07**	**$ 1.11**	**$ 5.32**	**$ 0.56**	**$ 25.85**

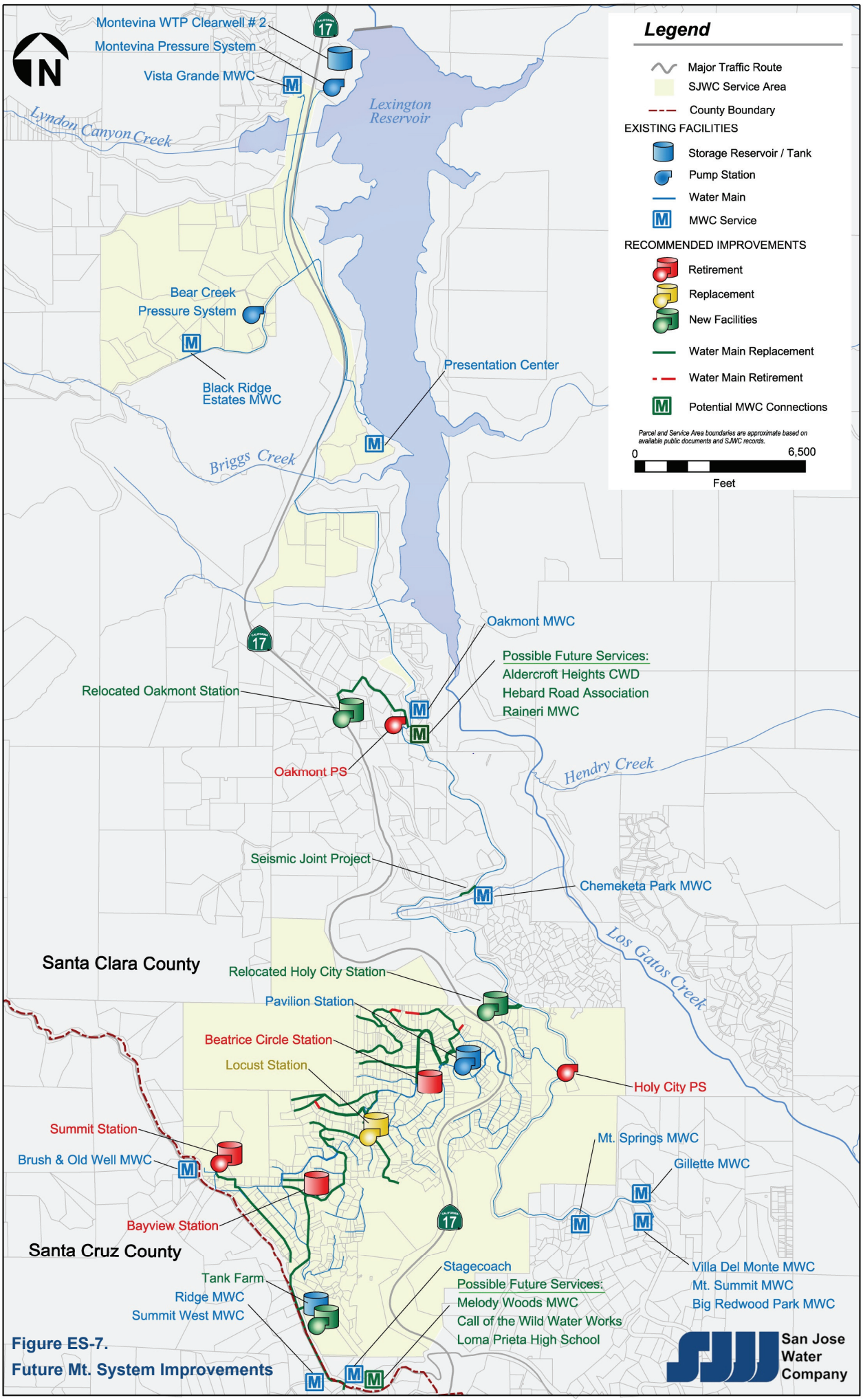


Figure ES-7.
Future Mt. System Improvements

ES-6. Future Recommended Action Items

Montevina Pipeline Replacement Size: The Montevina Pipeline is a critical lifeline to the majority of services in the Mountain. With the projected demand of water to increase in the future, the need to increase flow rate in the pipelines will accelerate pipe wear from the higher velocities and increase pumping costs from increased friction. All future scheduled replacement work on this pipeline shall be upsized to 12-inch diameter piping. The increased pipe diameter will allow significantly more flow at lower friction losses and energy costs.

Removal of the Overuse Rate: The Overuse Rate tier has been a concern for residents and mutual water services in the Mountain System since SJWC acquired RMWC. While the Overuse Rate was initially implemented by RMWC over system capacity limitations, various capital improvements by SJWC have been able to relax this daily allowance limitation significantly from 250 gpd/s to 500 gpd/s. Based on historical demands, the MSMP estimated that abandoning the Overuse Rate tier completely would result in approximately a 6% increase in overall annual water demand. However, the existing Oakmont and Holy City pump stations are already operating at maximum capacity. Therefore, it is recommended to maintain the Overuse Rate tier until the tank and pump station improvements at Oakmont and Holy City are complete, which are currently planned to be operational by the 2021 – 2023 General Rate Case (GRC).

Future MWC Connections: MWCs interested in connecting to SJWC should be contacted during the design of improvements within their vicinity. This would be an opportune time for MWCs to connect on since improvements can be upsized as needed to meet the additional demand without the MWC bearing the entire cost of the improvement project. However, MWCs that opt not to connect will be required to pay the full cost of any upsizing, removal, or additional improvements necessary to connect once the recommended capital improvements are completed in their area.

Summit Road Pipeline Feasibility Study: According to DDW, Loma Prieta School has expressed interest in connecting to a municipal water source to alleviate the challenges of operating an independent water system. For SJWC to service the school directly, this will require a 3.2 mile long pipeline from Tank Farm to the school. This project is estimated to cost upwards of $5 million given the number of fault crossings and other infrastructure that may be required, see Figure ES-8. However, this pipeline would enable a number of residences along Summit Road to connect as well as other mutuals in the area. Alternatively, Loma Prieta School may be served from one of the nearby MWCs if feasible. It is recommended that SJWC conduct a feasibility study to determine the possibility of constructing this pipeline down Summit Road in the future.

Lake Elsman Water Treatment Plant Feasibility Study: Should the pipeline be extended along Summit Road, it is recommended that SJWC conduct a feasibility study to determine the potential for a 0.5 MGD surface water treatment plant to be constructed at Lake Elsman, see Figure ES-8. This would allow for a second source of supply into the Mountain System and would greatly increase system reliability.

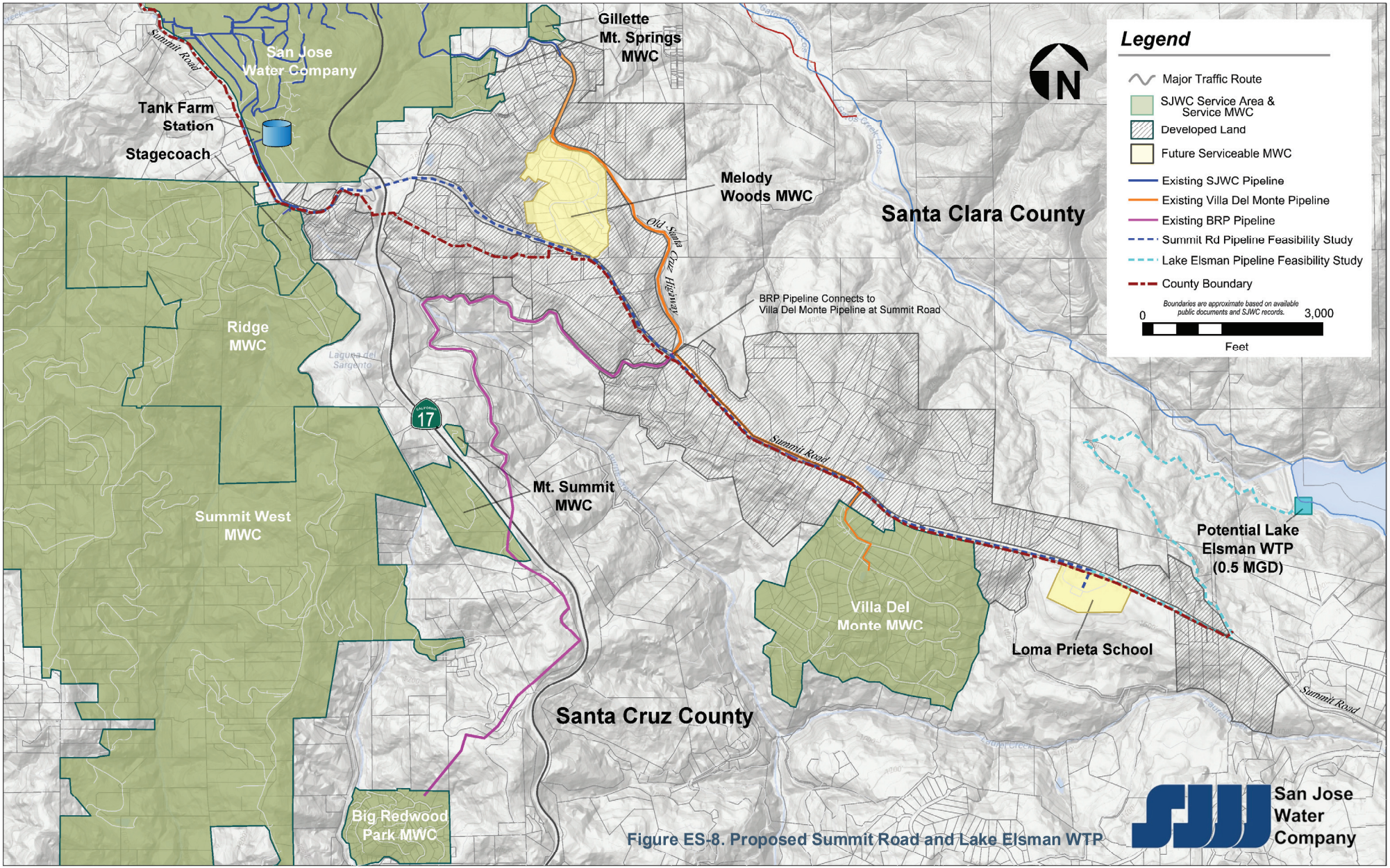
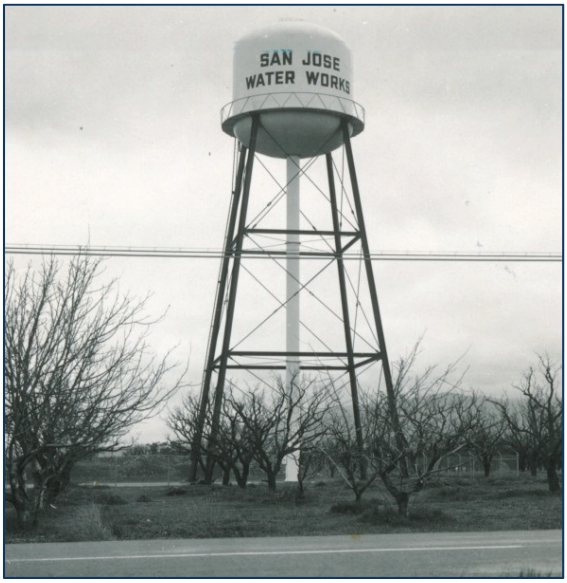


Figure ES-8. Proposed Summit Road and Lake Elsman WTP

Section I
Introduction

Section 1 | Introduction



San Jose Water Company (SJWC) is one of the largest and oldest water distribution systems in California, providing a reliable and high-quality water source to customers for over 150 years. Today SJWC serves one million people throughout the greater San Jose metropolitan area and, to meet the current regulations and continue a legacy of excellence, proper planning and long-term thinking are more critical than ever.

The Mountain System refers to the most southerly extent of SJWC's distribution system located within Santa Cruz Mountains. This service area is unique in SJWC since the majority of the system was acquired, has a separate rate structure, a significant number of mutual water company customers, and geographical isolation from the rest of SJWC's distribution system. In 2015, SJWC's Planning group was tasked with developing a master plan for this area to more clearly understand the existing system and customer needs to reliably provide a high water quality source into the future.

1.0 Study Purpose

The purpose of this *Mountain System Master Plan* (MSMP) is to evaluate the most southerly portion of SJWC's distribution system to: (1) determine current and future customer demands; (2) identify existing system deficiencies; and (3) provide a cost-effective capital improvement program to address the identified deficiencies with construction costs and time frames.

Overall goals of the MSMP are to ensure:

- Mountain System customer demand can be safely and reliably supplied into 2040
- Eliminate the separate rate schedule applied to parts of the Mountain System
- All water quality and service regulatory requirements are met
- Vulnerability to earthquakes and other natural disasters are minimized
- Maintain a cost-effective and fully operational distribution system
- Improve fire flow capability
- Allow more customers and MWCs to connect without impacting existing customers

Section II

Existing System

Section 2 | Existing System

2.0 Service Area

The scope of the MSMP is limited to SJWC's distribution system south of the Montevina Water Treatment Plant (WTP). This service area is generally situated south of the Town of Los Gatos in the Santa Cruz Mountains, sometimes referred to as Lexington Hills. This part of SJWC's system, referred to herein as the Mountain System, encompasses an area of approximately 0.5 square miles and ranges in elevation from 680 feet to 2,165 feet. All of SJWC services in the Mountain System are within Santa Clara County; however several mutual water companies serviced by SJWC provide water to customers within Santa Cruz County.

Total population of the Mountain System, including the 12 mutual water companies serviced, is approximately 2,600 as of December 2014. The Mountain System is divided into 13 separate pressure zones (including MWC master services) based on customer elevation ranges served. Stations and pipelines move water from MWTP, located at an elevation of 680-ft, to Summit Station at an elevation of 2165-ft. The following subsections provide a brief description and summary of each these system type.

2.0.1 Service Group Areas

For purposes of this MSMP the Mountain System service area was separated into four distinct ***Service Group Areas*** based on the key station that two or more pressure zones are drawing water from. Summary statistics, including key service station, customer service elevations, and static service pressures, for each services group area is summarized in Table 2-1. The location of each service group area is presented at the end of this section in Figures 2-1 & 2-2.

2.0.1 Mountain District Area

The term *Mountain District* refers to a uniquely defined service area within the Mountain System comprising customers and MWCs that are billed according to Schedule 1C instead of SJWC's typical Schedule 1 rates. The primary difference in Schedule rates is an *Overuse Rate* tier in Schedule 1C, which is intended to encourage customer to keep water usage at or below 500 gallons per day per service (gpd/s). This billing practice is a legacy of the Redwood Mutual Water Company owing to concerns about the capacity limits of the existing water system (see Section 3.3 and 4.3 for additional details). One of the primary goals of this MSMP is to determine steps to allow for the elimination of the Overuse Rate and better integrate the entire Mountain System with the rest of SJWC's distribution system. Given that goal, the *Mountain District* terminology and service area are not used extensively in this report as it is intended to become obsolete.

Table 2-1: Service Group Areas				
Service Group Area	**Key Service Station**	**Pressure Zone**	**Customer Service Elevation (ft)**	**Static Service Pressure (psi)**
I	Montevina Pressure System	Montevina Pressure	685 – 755	73 – 124
		Bear Creek Pressure	780 - 855	65 – 120
II	Pavilion Tank	Pavilion	1295 – 1455	18 – 97
		Holy City Regulated [(a)]	960	130
III	Locust Reservoir	Idalyn Regulated	1575 – 1610	35 – 55
		Mary Alice Regulated	1530 – 1570	40 – 62
		Locust	1605 – 1785	18 – 100
		Beatrice Circle	1425 – 1570	22 – 100
IV	Summit Reservoir	Summit	1945 – 2130	15 – 95
		Locust Regulated	1735 – 1805	64 – 99
		Summit Pressure	2130 – 2165	61 – 81
		Tank Farm	2015 – 2050	30 – 43
		Bayview	1875 – 2040	21 – 92
(a) Chemeketa MWC to be served in summer 2015 via a newly established Holy City Regulated Zone				

2.1 Existing System Supplies

The Mountain System's primary source of water is the Montevina WTP, which treats surface water from various tributaries of the Los Gatos Creek. The WTP is a 30 million gallons per day (MGD) facility originally constructed in 1950 and is currently undergoing a $62 million retrofit to meet current drinking water standards. This project is scheduled for completion in 2017 and will be using state-of-the-art membrane filtration.

In the event the WTP is unavailable, two backup pumps at SJWC's 7-Mile Station have the ability to move potable water from other treated water sources (Santa Clara Valley Water District turnouts and groundwater wells) to the Montevina WTP, which can then be served into the Mountain System.

2.2 Existing System Facilities

2.2.1 Pipelines

Table 2-2 presents a summary of the materials and pipe diameters in the Mountain System distribution system. Pipe size and construction data are based on as-built engineering drawings and maps obtained from the 2006 acquisition of the Redwood Mutual Water Company (RMWC). Unfortunately, very few post construction record drawings were available from RMWC and therefore there are still many unknowns related to exact pipe alignments, pipe type and pipe age in that section of the Mountain System. Pipe sizes in the distribution range from 1- to 18-inches, with over 50 percent of the system being between 6- and 8-inch diameter piping. The piping system is constructed of various materials with the majority being plastic polyvinylchloride (PVC) pipe and about one-third is ductile iron cement lined (DICL) pipe. The remaining water mains are primarily standard screw steel pipe with some asbestos cement pipes.

Table 2-2: Existing Pipe Lengths by Diameter and Material

Diameter	Asbestos Cement (ft)	Ductile Iron (ft)	Plastic (ft)	Steel (ft)	Total (ft)
< 4"	-	-	5,006	7,575	**12,581**
4"	-	470	22,639	119	**23,228**
6"	2,463	4,205	22,347	9	**29,024**
8"	-	25,372	-	15	**25,387**
10"	-	4,808	-	301	**5,109**
12"	-	321	-	294	**615**
> 12"	-	202	-	-	**202**
Total (ft)	**2,463**	**35,378**	**49,992**	**8,313**	**96,146**

2.2.1 Storage Facilities

The Mountain System reservoirs provide a total of 634,000 gallons of storage. Table 2-3 presents a summary of these facilities and construction details. All storage reservoirs are located in the Redwood Estates area and, with the exception of Pavilion tank, were part of the 2006 acquisition. All customers below Oakmont station are on pressure systems.

Table 2-3: Existing Storage Facilities						
Station Name	**Capacity (gallons)**	**Type**	**Material**	**Year Constructed**	**Base Elevation**	**Overflow Elevation**
Pavilion	99,000	Above Ground	Bolted Steel	2010	1,493	1,514
Beatrice Circle	100,000	Earthen Reservoir	Concrete Lined	Unknown	1,619	1,629
Locust	100,000	Earthen Reservoir	Concrete Lined	Unknown	1,830	1,840
Bayview	100,000	Earthen Reservoir	Concrete Lined	Unknown	2,078	2,087
Summit	125,000	Earthen Reservoir	Concrete Lined	Unknown	2,156	2,166
Tank Farm	100,000	Above Ground	Bolted Steel	1998	2,106	2,130

2.2.1 Station Regulators

Due to natural topography of the Santa Cruz Mountains, a number of regulated stations are required to keep service pressures within an acceptable range per CPUC regulations (average between 40 – 125 psig over a 24 hour period). Station regulators and their set points are presented in Table 2-4. Holy City regulator is the newest regulated facility installed in 2015 and intended to maintain pressure in the Montevina Pipeline between Oakmont and Holy City stations to feed Chemeketa mutual water company.

Table 2-4: Regulator Stations			
Station name	**Elevation (ft)**	**Size (inch)**	**Downstream Pressure Setpoint (psi)**
Holy City	1,245	1	5
Mary Alice	1,535	2	60
		4	50
Idalyn	1,610	2	40
		2	35
Locust	1,825	2	60

2.2.1 Pump Stations

In order to lift water from Montevina WTP to the peak reservoir elevation at Summit station, a series of booster stations are located throughout the Mountain System. In addition, there are also three pressure systems, Montevina, Bear Creek, and Summit, which are small booster pumps with hydro-pneumatic storage tanks that boost pressure for an area of low pressure services. Table 2-5 presents a summary of booster and pressure systems throughout the Mountain System.

Table 2-5: Existing Pumping Facilities

Station Name	Pump No.	HP	Rated Capacity (gpm)	Rated Head (ft)	Nominal RPM	Year Constructed /Rehabilitated	OPE[(a)]
Montevina	B-1	30	475	362	3500	2010	69.5%
	B-2	30	475	362	3500	2010	69.5%
Bear Creek	B-1	5	63	185	3500	2005	57.4%
	B-2	5	63	185	3500	2005	57.4%
	B-3	5	63	185	3500	2005	57.4%
Oakmont	B-1	30	160	530	3560	1990	67.6%
	B-2	30	160	530	3560	1990	65.8%
	B-3	30	160	530	3560	1990	65.8%
Holy City	B-1	20	160	224	3600	2007	63.0%
	B-2	20	160	224	3600	1996	60.2%
	B-3	20	160	224	3600	2011	60.2%
Pavilion	B-1	50	325	368	1800	2010	75.5%
	B-2	50	325	368	1800	2010	75.5%
Locust	B-1	20	125	350	3600	1990	64.3%
	B-2	20	125	350	3600	1990	64.3%
Summit	B-1	3	55	140	3600	2007	53.4%
	B-2	3	55	140	3600	2007	53.4%

(a) Overall Plant Efficiency

2.3 Mutual Water Company Services

As of December 2014, SJWC was providing water to 14 MWCs in the Mountain System who distribute water to an additional 488 privately maintained services. A summary of service counts in each respective MWC is presented in Table 2-6. Water systems with an identification number starting with a "WA" are small water system (<15 services) and regulated by the county health department, whereas a water system identification number starting with "CA" are considered community water systems and are regulated by the State.

Table 2-6: Mutual Water Companies in the Service Area

Mutual Water Company	Pressure Zone Served From	Water System No.	Service Count	Alternative Sources of Water[(b)]
Aldercroft Heights	N/A	CA4300516	116	Raw Water Service Only
Big Redwood Park	Pavilion	CA4400526	64	-
Blackridge Estates	Bear Creek	WA0364164	2	Additional Private Wells
Brush & Old Well	Summit Pressure	CA4300978	27	-
Chemeketa[(a)]	Pavilion Regulated	CA4300517	145	Raw Water Service & Limited Water Service
Gillette	Pavilion	WA0200053	5	-
Lake Canyon	N/A	CA4300522	59	Raw Water Service Only
Mountain Springs	Pavilion	CA4300740	18	Limited Water Service Only Additional Private Wells
Mountain Summit	Pavilion	CA4400570	6	Additional Private Wells
Oakmont	Montevina Pressure	CA4300526	25	-
Presentation	Montevina Pressure	WA0364167	10	-
Ridge	Tank Farm	CA4400618	73	3 Additional Private Wells
Stagecoach	Tank Farm	WA0002398	10	2 Additional Private Wells
Summit West	Tank Farm	CA4400617	139	-
Villa Del Monte	Pavilion	CA4400595	117	Additional Private WTP
Vista Grande	Montevina Pressure	CA4300550	24	-

(a) Chemeketa to be served in fall 2015 via a newly established Pavilion Regulated Zone

(b) Only "Active" sources per DDW or County Health shown

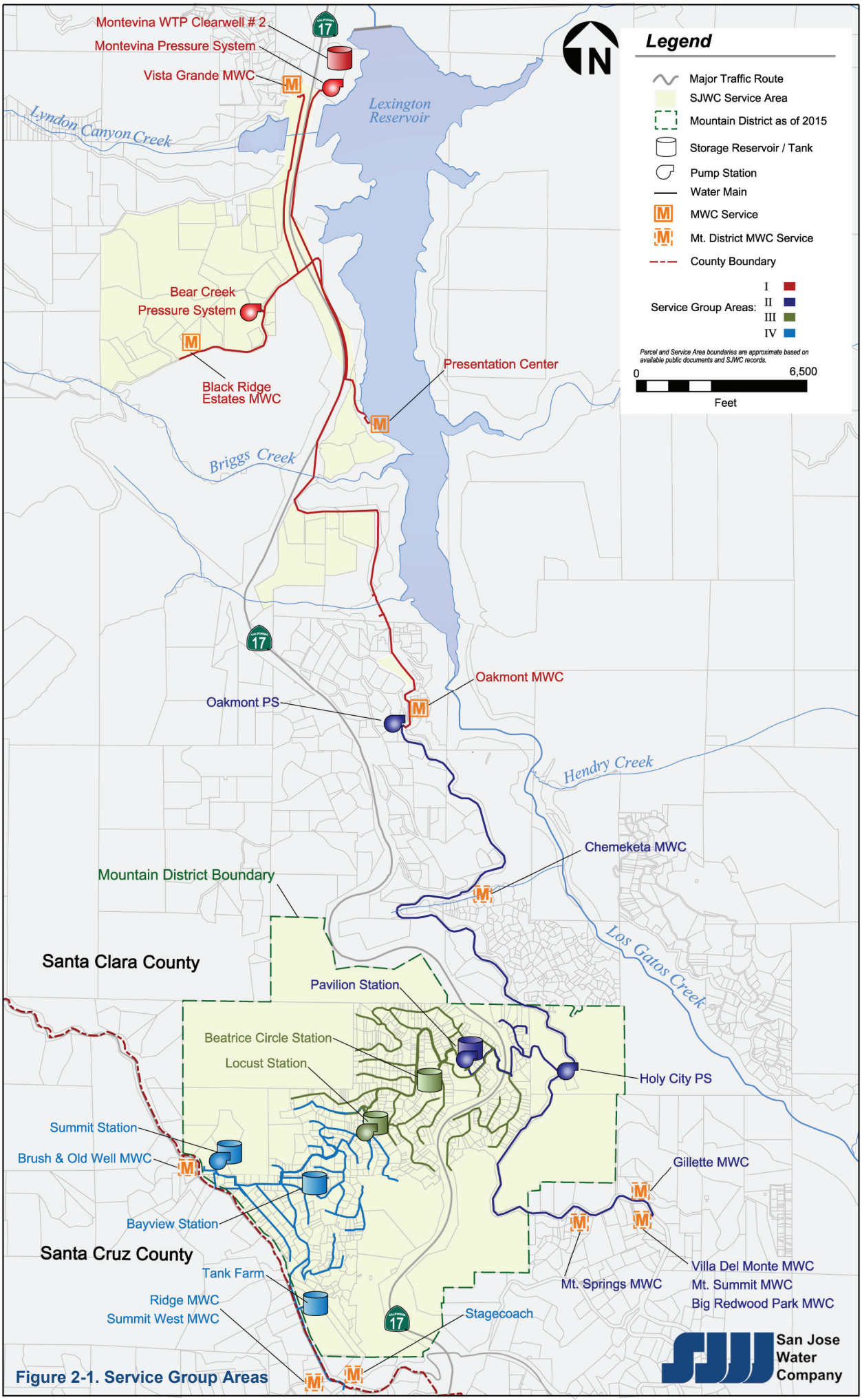


Figure 2-1. Service Group Areas

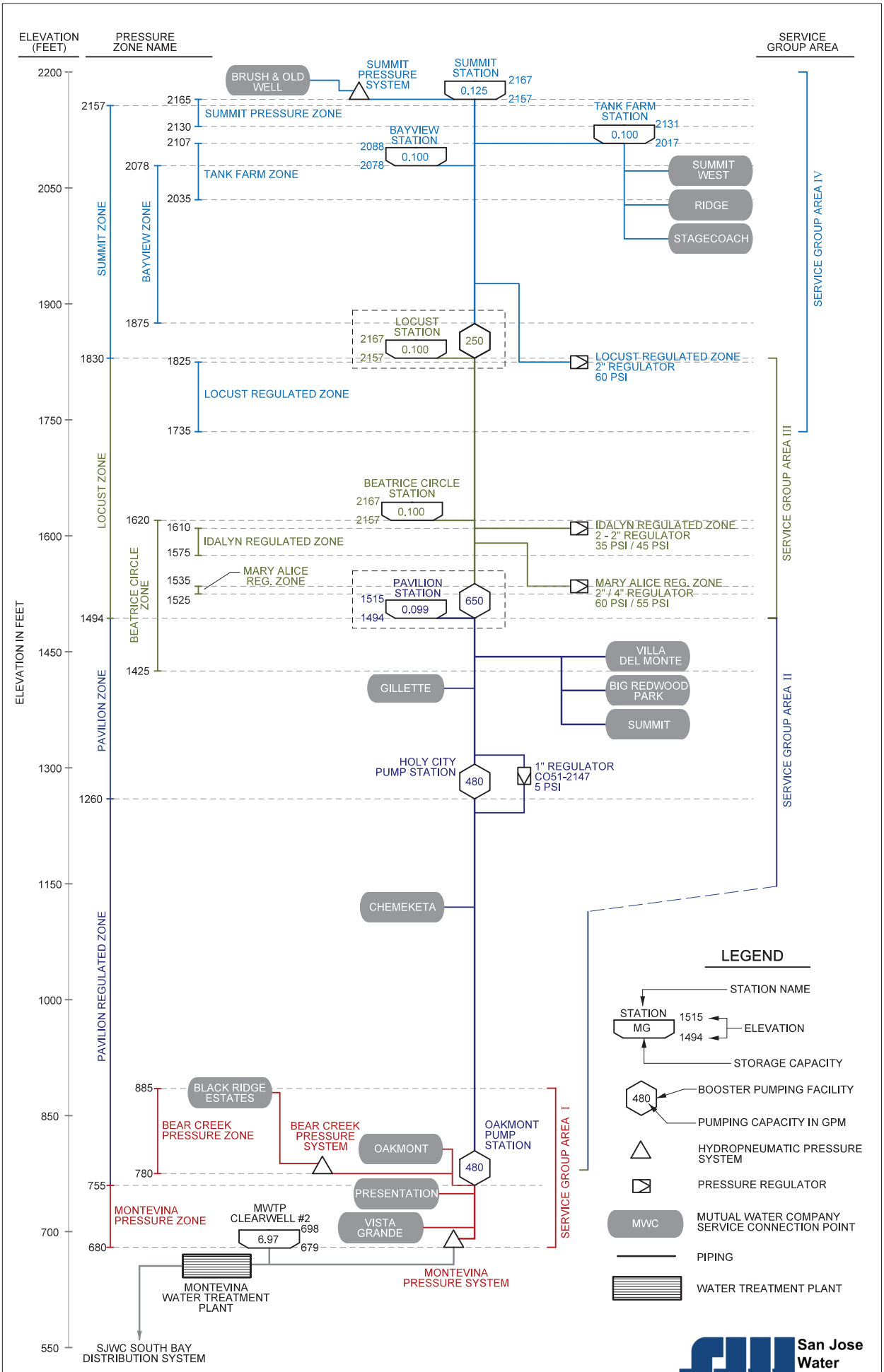


Figure 2-2. Mountain System Schematic Diagram

San Jose Water Company

Section III

General Planning Background

Section 3 | General Planning Background

This section provides a general background of the Mountain System in terms of its history, key system improvements, transition to SJWC, and previous engineering studies. This section is intended to provide an overview of these topics in an effort to better understand customer expectations and the unique environment of the Mountain System.

3.0 Historical Development of the Lexington Hills Area

The Santa Cruz Mountains has a long history of people residing and working throughout the Lexington Hills area, but it was wasn't until the completion of the Glenwood Highway in 1921,[9] a forerunner of Highway 17, that dramatically transformed many of the existing lumber camps and summer cabin retreats into year-around residential communities.[10] These communities continued to grow as road access improved and advertisements for available parcels frequently appeared in local newspapers. During the 1920s, the San Francisco Chronical even included a parcel in Lexington Hills area as a promotional offer for a newspaper subscription.[11]

With the urbanization of Lexington Hills, emerging communities quickly recognized the need to form a combined community water system given the low-yield production of most wells in the area (historical data shows most groundwater wells are limited to 10 to 30 gpm)[12], and allocation of most of the streams and creeks already to meet water demands for power, logging, irrigation, or individual domestic use.[13] By joining together, communities would have more leverage to obtain rights, invest in larger infrastructure, and negotiate agreements. Big Redwood Park, Redwood Estates, and Chemeketa were among the first communities to incorporate as mutual water companies in 1926, 1928, and 1929 respectively. However, many of these mutual water systems grew without any long-term planning, and limited design and financing.[10] MWCs often remained independent of other local communities despite the increasing need for water to serve their communities. The isolation of MWCs with their limited water supply and technical assets would lead to significant challenges in the aftermath of 1989 earthquake.

3.1 Loma Prieta Earthquake

On October 17, 1989, a 6.9 magnitude earthquake occurred centered in Nisene Marks State Park, approximately 8.5 miles southeast of Redwood Estates. Known as the Loma Prieta earthquake, the initial quake and its subsequent aftershocks resulted in 63 deaths, 3,757 injuries and an estimated $6 billion in property damage across the Bay Area.[14]

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[9] Santa Cruz Sentinel, *California's Road of Marvelous Beauty Links Santa Cruz with Her Future Destiny* (1921)
[10] USGS, *The Loma Prieta, California, Earthquake of October 17, 1989 – Lifelines* (1998)
[11] Santa Clara County, *Lexington OWTS Presentation* (2014)
[12] Boyle Engineering, *Montevina Pipeline Master Plan* (1991)
[13] J. Young, *Ghost Towns of the Santa Cruz Mountains* (1984)
[14] USGS, http://earthquake.usgs.gov/earthquakes/states/events/1989_10_18.php (2014)

Damage to water systems' infrastructure in the Lexington Hills & Summit Road areas was immediate and devastating.[18] The estimated infrastructure damage to RMWC alone was over $5 million (approximately $9.9 million in 2016 dollars).[16] The American Society of Civil Engineers (ASCE) survey recorded 92 water-main breaks in the Mountain System area as presented in Table 3-1 & Figure 3-1. Although ASCE was unable to survey all water systems in the area, it was their conclusion that the overall pipeline damage in the area was extensive.[17] Most leaks were noted to have occurred in cast-iron pipe with leaded joints and small diameter galvanized pipe at the threads. Asbestos and ductile-iron pipe with rubber-gasket joints were mostly undamaged.[17] Water storage tanks in the area were similarly affected since many were redwood or bolted-steel, and built without any seismic design consideration. Failures at rigid inflow/outflow piping connections were common, as well as roof structure damage from wave sloshing. Water sloshing drained and collapsed the roofs of all five RMWC reservoirs, and two of the reservoir embankments were heavily cracked.[15] Tanks that did survive the original quake were quickly drained due to the sheer number of leaks in their respective systems.[17] Despite public efforts by neighboring water agencies to assist the Santa Cruz Mountain water systems, limits in MWCs staffing, available records, system maps, and financing, as well as a lack of an established response network to support emergency preparedness, made it extremely difficult to restore these water systems in a timely manner.[18] Most damaging of all was the long-term impact of the earthquake on the local aquifer and springs. According to the former RMWC chief operator, within a few days following the earthquake nearly all existing wells and springs in their water system went dry, similar to the recorded events following the 1906 earthquake.[19]

Table 3-1: Summary of Pipeline Damage

Utility	Report Water Pipeline Repairs
Summit West MWC	16
Ridge MWC	1
RMWC	70
Villa Del Monte MWC	5 (a)
San Lorenzo Valley	54
SJWC	202
East Bay Municipal District	133
City of San Francisco	70
City of Santa Cruz	78

Source: *ASCE/TCLEE Pipeline Database (1992)*

(a) Villa Del Monte also reported four miles of water mains broken and water reservoir severely cracked [15]

[15] USGS, *Preliminary Isoseismal Map for Santa Cruz, California, Earthquake of October 18,1989 UTC* (1990)
[16] SJWC, *Engineering Evaluation and Opinions* (2005)
[17] NRC, *Practical Lessons from Loma Prieta Earthquake* (1994)
[18] USGS, *The Loma Prieta, California, Earthquake of October 17, 1989 - Lifelines* (1998)
[19] *The California Earthquake of April 18, 1906: Report of the State Earthquake Investigation Commission* (1908)

1989 Loma Prieta Earthquake Summit Area Damage

- Extended power outage across Santa Cruz Mountains
- Landslides closed Highway 17 for more than a month
- Some areas inaccessible for 4 days after the event
- Telephone lines saturated and usuable for 15 hours after event
- Water utilities completely devastated by the quake
- Water tanks collapsed or inlet/outlet pipes broke
- Water main leaks depleted water vital for fire fighting
- Repair crew efforts hampered by hazards from landslides, fallen trees, and damaged buildings

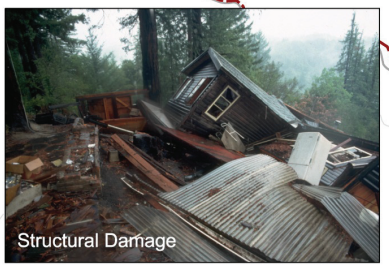


Figure 3-1. Loma Prieta Earthquake Impacts

San Jose Water Company

3.2 Montevina Pipeline Construction

Prior to the earthquake, RMWC was in evaluating the possibility of constructing a 4-inch pipeline from SJWC's Montevina WTP to Redwood Estates. Despite having several wells and a small sand filtration system, RMWC had exhausted much of their readily available local water supply and were in need of a more reliable alternative source of water. With the dramatic loss of their wells and springs as a result of the earthquake, RMWC was forced to expedite the pipeline project with SJWC.

In the aftermath of the earthquake, RMWC petitioned the Federal Emergency Management Agency (FEMA), Office of Emergency Services (OES), and California Department of Water Resource (DWR) to acquire State and Federal earthquake recovery grants to repair their failed infrastructure. The result was a series of pipes and pump stations constructed between Montevina WTP and Redwood Estates that would become known as the *Montevina Pipeline*.[20] Given the needs of other water mutuals in the area following the earthquake, FEMA and the California Department of Public Health (now Division of Drinking Water) directed the pipe size to be upsized to an 8-inch diameter pipe and increased the pumping capacity to allow these other MWCs to benefit from the project as well. Once the pipeline and pump stations were completed in 1991, SJWC began delivering up to 320 gpm of potable water to RMWC.

RMWC was designated as the initial owner of the Montevina Pipeline, however they were obligated by a 1995 settlement agreement with DWR and OES to negotiate transfer of the pipeline to a third-party agency or entity at a later date. The intent of this agreement was to allow RMWC, being the largest MWC benefiting from the project, to be the lead user responsible for operation and maintenance of the new water supply while assuring that over the long term all users of the pipeline would share in benefiting from the pipeline. As a result, the *Mountain Mutual Water Company* was formed as a non-profit Mutual Benefit Corporation comprising 15 mutual water systems along the path of the Montevina Pipeline for the purpose of developing, acquiring, maintaining, and operating a water delivery system for the benefit of its members.[21] However, the transfer of the Montevina Pipeline to the Mountain Mutual was never realized because of lengthy legal and administrative challenges, including a lawsuit against the original engineers and contractors of the Montevina Pipeline. After careful consideration, and even after evaluating the possibility of creating a County Service District (CSD) in the early 2000s, the RMWC Board opted to sell the Montevina Pipeline and distribution system to a third party as a the simplest and most practical alternative.

3.3 Redwood Mutual Water Company Acquisition

SJWC entered into a sales agreement with RMWC for their water distribution system on December 14, 2005 for a purchase price of $569,000 and a commitment to complete a number of

[20] Santa Cruz LAFCO*: Countywide Service Rev*iew (Draft June 2005; Accepted August 2005)
[21] Boyle Engineering, *Montevina Pipeline Master Plan* (1991)

capital improvement projects. The agreement was reviewed and approved by the CPUC effective June 16, 2006.[22] The sales agreement was finalized on September 27, 2006, at which point the existing service agreements between RMWC and eight mutual water companies were transferred to standard SJWC agreements. Upon closure, SJWC began to refer to the RMWC distribution system as the "Mountain District" and integrating this service area into SJWC's system. At the time of closure, SJWC adopted service and quantity rates in the Mountain District equivalent to those that were already in effect for RMWC customers and the eight mutual water companies, including the 250 gallons per day per service (gpd/s) Overuse Rate tier.[23] These general metered service rates for billing in the Mountain District were filed with and accepted by the CPUC as Schedule 1C rates. The decision to maintain the Overuse Rate tier was based on recommendations by RMWC, uncertainty about the available capacity of the existing infrastructure, and historical water usage of existing customers.

Since the 2006 acquisition, SJWC has continued to make improvements throughout the Mountain System to improve the reliability and increase capacity of the system. The following is a partial list of improvements completed by SJWC since the acquisition:

- Replaced over 5,300-ft of buried pipe
- Installed a new 300 horsepower 2,500-gpm backup pump at 7-mile station to supply the system when local surface water supplies are unavailable
- Constructed a 99,000 gallon glass fused bolted steel tank at Pavilion station
- Installed two 375-gpm pumps at Pavilion station
- Updated the Supervisory Control and Data Acquisition system across the system
- Refurbished existing booster pump equipment at all pump stations
- Installed standardized generator receptacles at all critical installation points
- Purchased two 135 kW backup generators for emergency response
- Replaced all residential water meters
- Installed a surge tank at Oakmont Station
- Performed electrical upgrades at Oakmont Station to allow for pumping all three booster pumps simultaneously

3.4 Lexington Elementary School Connection

In 2010, improvements planned at Lexington Elementary School required the installation of a new private fire protection service and upsized domestic service to meet Santa Clara County Fire Department (SCCFD) requirements. The existing domestic service was undersized for the current required fire flow rate and the meter was located more than 1,000-feet from the school. The existing service line also crossed private property through easements and underneath Briggs Creek, making it difficult for the school to access and maintain.

[22] Supplemental Advice Letter 365-A
[23] SJWC Letter to CDHS, *San Jose Water Company's Mountain District Mutuals* (2006)

In order to meet SCCFD requirements, Los Gatos Unified School District (LGUSD) requested SJWC to install new fire and domestic services and to have them located in front of the school on Old Santa Cruz Highway. Since the Montevina Pipeline was not consistently pressurized (being a series pumping station to Redwood Estates) upgrades to the system were required. At LGUSD's request and cost, SJWC designed and constructed a new pressure system, constructed water main tie-ins, upgraded the electrical service at the pump station, and installed other auxiliary improvements to provide a constantly pressurized water main for the school. By pressurizing a portion of the Montevina Pipeline, this pipeline became part of the SJWC's Montevina Pressure zone and no longer exclusively part of the Mountain District. With the construction of the new pressure system, Alma Bridge pump station was no longer required and was retired during the upgrades to the Montevina WTP.

3.5 Past Engineering Studies

Over the years RMWC, Mountain Mutual, and SJWC have conducted several engineering reports regarding the operation of the Montevina Pipeline and Redwood Estates distribution system. These reports were reviewed and applicable findings were incorporated into this MSMP. Key findings from these reports have been complied below as a reference.

3.5.1 Montevina Pipeline Master Plan 1991

In 1991, the Mountain Mutual Water Company contracted Boyle Engineering to develop the *Montevina Pipeline Master Plan*. The Boyle report focused on existing infrastructure, customer demands, and the potential for Mountain Mutual member agencies to connect onto the then recently constructed Montevina Pipeline. This master plan included detailed surveys from each member agency, which documented the number of active connections served in 1991 and the total number of connections they may conceivably provide water to in the foreseeable future (referred to as obligated and ultimate service connections).

Key findings in the 1991 *Montevina Pipeline Master Plan*:

- The Montevina Pipeline was designed only for 80 gallons per capita per day (gpcd), amounting to 200 gallons per home per day (gpd/s)
- It was Mountain Mutual's responsibility to ensure water provided by the Montevina Pipeline was for essential uses only within 200 gpd/s (i.e. bathing, washing, or drinking)
- Recommended the construction a new storage reservoir at Holy City pump station (referred to as pump station 3 in the report) to allow greater flexibility in pumping, increased reliability, and simplified the overly complex operations
- Build-out demand can be met (ultimate service connections) based on the assumption all service usage stays equal or below 200 gpd/s

3.5.2 Montevina Pipeline System Capacity Analysis Report 2003

In 2003, Mountain Mutual contracted Wy'East Engineering to conduct an updated analysis of the Montevina Pipeline. Their purpose was to determine the adequacy of the hydraulic and mechanical components of the system and provide recommendations for increasing capacity. The engineering report acknowledges that the system could meet existing max day demand (based on 250 gpd/s), but it also presented a harsh criticism of the existing pipeline system by identifying it as inefficient, lacking significant storage capacity, and having an overly complex pumping system without practical operational control. This engineering report was entitled *2003 Mountain Mutual Water Company Conveyance Analysis* and was submitted as a draft to the Mountain Mutual Board of Directors but was never formally accepted. Key findings include the following:

- The system has no storage of consequence and is thus actually responding directly to instantaneous customer demand in each served system
- The booster stations are essentially designed as small wastewater lift stations operating in series which significantly increases the complexity of daily operation and poses a significant problem to the operator trying to ensure full delivery to the customer system at any given time
- Wy'East Engineering was "surprised" that the State Department of Health Services (now Division of Drinking Water) even approved the Montevina Pipeline design, much less allowed it to continue in operation given the potential for foreign contaminants to enter the booster sumps and drinking water supply

3.5.3 Preliminary Engineering Study by SJWC 2005

Prior to the purchase of RMWC, engineering and operations staff from SJWC conducted a walk-through to evaluate the system compared with current industry practices and regulatory requirements. While the system appeared to be in "reasonably good condition" overall, staff noted numerous deficiencies. Hydraulic simulations found very low fire flow availability across the entire system and that more than 35% of all residents in RMWC were below the minimum GO 103A water pressure requirements. The system was determined to have insufficient storage capacity, undersized pumps, inadequate booster redundancy, undersized piping, and a lack of fee-title property for many of the existing facilities. Concern was also noted regarding proximity of the system to the San Andreas Fault. In summary, the total estimated cost of necessary improvements to meet current regulatory requirements and minimum industry standards was estimated to be almost $32 million (approximately $40 million in 2016 dollars).[24]

3.5.4 SJWC Engineering Report 2007

This document evaluated SJWC's ability to increase the Overuse Rate tier from 250 gpd/s to 375 gpd/s as required in the original sales agreement with RMWC. The report presented a detailed

[24] Bureau of Labor Statistics, CPI Inflation Calculator, http://www.bls.gov/data/inflation_calculator.htm

analysis by SJWC Engineering and Operations departments using nine months of operational data, including peak summer usage. The report found that while one pump at each of the lower pump stations ran for over 20 hours during a few hot days in August 2007, overall Operations was able to operate the system without any issues. The report also found that Mountain District customer usage was on average 188 gpd/s (including MWCs). Based on the limited water usage data available, the report estimated that increasing the Overuse Rate tier from 250 gpd/s to 375 gpd/s would result in a 25% increase in water consumption but that the system would fully support this increase in daily usage pending the completion of two critical projects: (1) the construction of a new storage tank at Pavilion station (this was completed in 2011); and (2) upgrading the electrical amperage capacity at the pump stations to allow running all three pumps at one time (these were complete in 2008). The report further recommended easing the restrictions to 400 gpd pending the completion of the improvement project. This report made an additional recommendation related to restricting water haulers from pulling from hydrants in the Mountain District during summer months.

3.5.5 SJWC Engineering Report Update 2010

This report updated the aforementioned 2007 report evaluating SJWC's ability to further increase the Overuse Rate tier in the Mountain District from 375 gpd/s to 500 gpd/s. The report concluded that the Montevina Pipeline could supply up to 500 gpd/s to Mountain District customers but stressed that this usage increase be "interruptible". There was sufficient concern that on occasion there may not be enough capacity in the pumps to supply all customers, especially during hot summer months. The report found that there was insufficient data at the time to reliably predict customer demands during extended periods of hot weather. Furthermore, the report stressed the importance that future MWCs or groups of five or more services that wish to connect to SJWC in the Mountain System should not be permitted until sufficient operational data is collected and demonstrates that additional customers can be reliably serviced without reducing usage for existing customers. This report was the last major study completed by SJWC prior to this MSMP and has been the basis of SJWC's position since 2010 in response to several requests for new service connections.

Section IV

Existing Water Demands

Section 4 | Existing Water Demands

This section provides an analysis and summary of historical water demands in the Mountain System in order to better understand existing water usage and provide a basis for demand projections. This section also addresses concerns regarding the Overuse Rate and water conservation.

4.0 Approach

Historical demands were compiled from four key sources: (1) Monthly Production Reports; (2) customer metering data; (3) Redwood Estates Services Association (RESA) annual reports; and (4) Supervisory Control and Data Acquisition (SCADA) records. Based on this data, annual, daily, and per capita demands were calculated for the entire system and each service group area. A normalized average per capita value was then calculated for each service group area which was used to estimate a combined average and maximum existing Mountain System demand. Non-revenue water, long-term water conservation, and Overuse Rate influences were also accounted for and incorporated into the final calculation of existing demand.

Following the acquisition in 2006, SJWC replaced all customer service meters, production master meters, and incorporated SCADA connectivity and data recording into the former RMWC service area. However, these improvements were not completed until late 2006. Therefore, data prior to January 2007 was deemed unreliable and omitted from this master plan. Data presented in this master plan is compiled from the years between 2007 and 2014.

4.1 Combined Mountain System Demand

Figure 4-1 and Figure 4-IV-2 summarize total usage in the Mountain System between 2007 and 2014. Water usage was observed to have been relatively stabled during this period, however, there were significant changes that occurred within the system and therefore a more in-depth analysis was necessary to better understand water customers' usage.

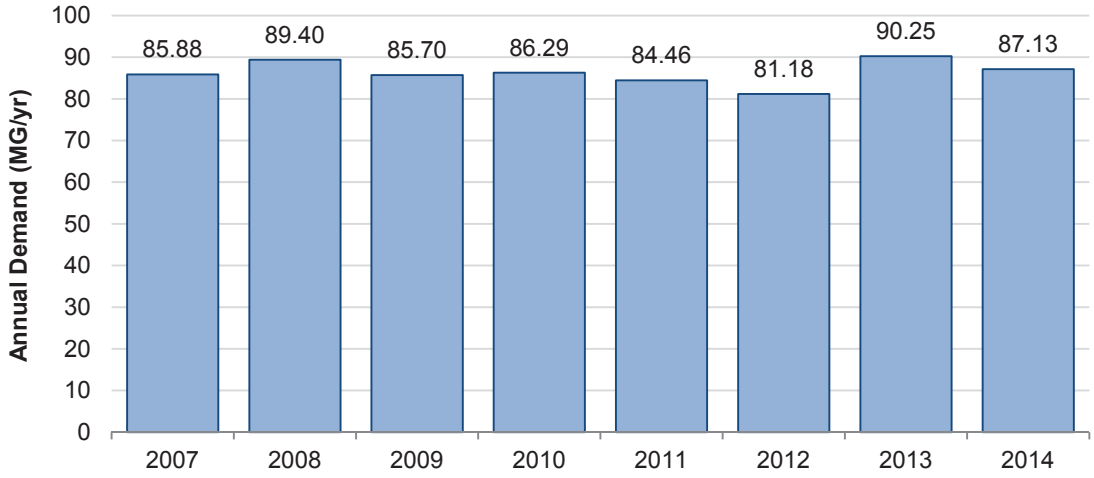


Figure 4-1 Total Annual Historical Usage for the Entire Mountain System

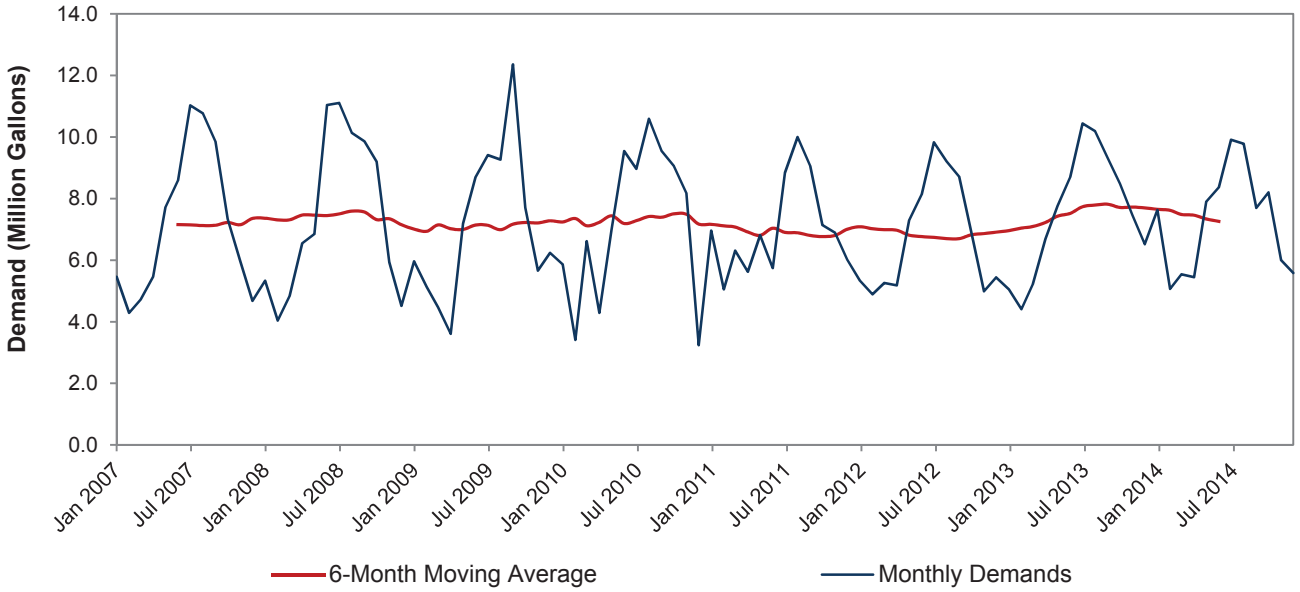


Figure 4-IV-2. Total Monthly Usage and Centered Moving Average Trend for the Entire Mountain System

Average Day Demand (ADD) and Maximum Day Demand (MDD) were compiled for the Mountain System and are presented in Figure 4-3 and Table 4-1. While in general ADD appears to be steady at around 236,400 gallons, MDD fluctuates year to year and peaked at 570,000 gallons in 2014. Peaking factors are consistently higher than the rest of SJWC's service area, but not unexpected for a smaller distribution system based on the principal known as the *Law of Large Numbers* (the concept that a water system's seasonal patterns and peaking factors tend to be more stable and less extreme as the size of the system increases).[25]

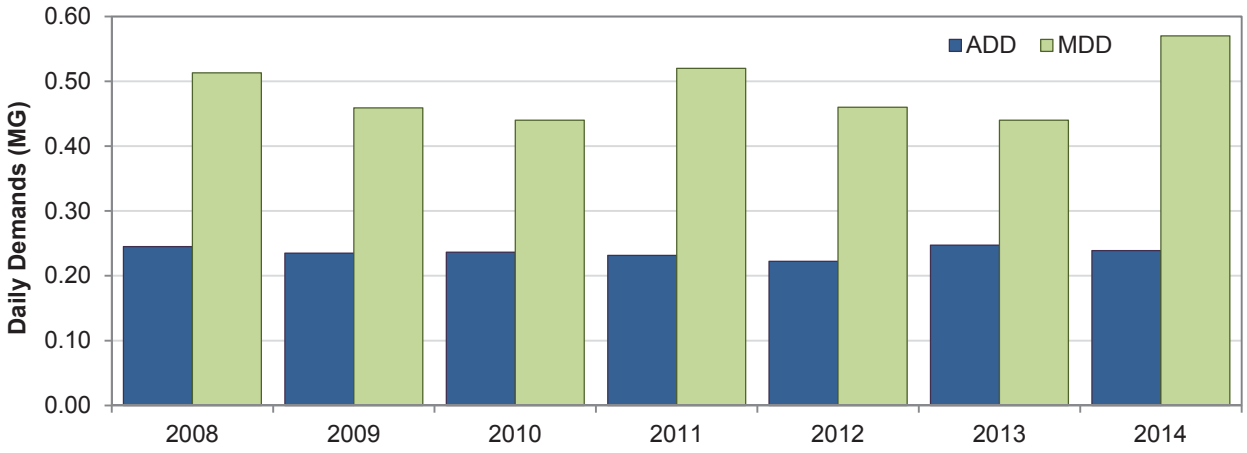


Figure 4-3. Average Historical Daily Demands by Year

[25] AWWA, *Forecasting Urban Water Demands* (2008)

Table 4-1: Historical Average and Maximum Daily Water Usage			
Year	**Average Day Demand (mgd)**	**Maximum Day Demand (mgd)**	**MDD:ADD Peaking Factor**
2007	0.235	0.524	2.23
2008	0.245	0.513	2.09
2009	0.235	0.459	1.96
2010	0.236	0.440	1.86
2011	0.231	0.520	2.25
2012	0.222	0.460	2.07
2013	0.247	0.440	1.78
2014	0.239	0.570	2.39
Average	**0.236**	**0.490**	**2.08**
Maximum	**0.247**	**0.570**	**2.39**

Annual usage by service group area is presented in Figure 4-4 and, again, has been relatively stable since 2007. The following subsections will discuss in more depth water usage, types of customers, and ways water is used in each service area.

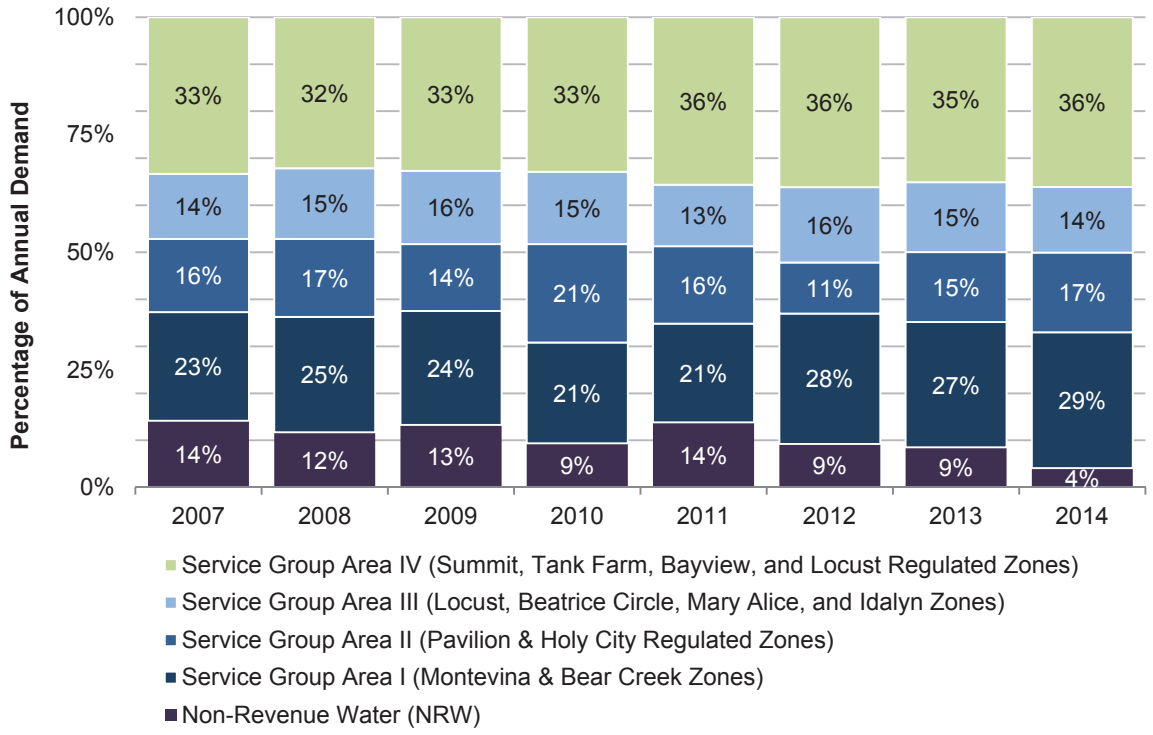


Figure 4-4. Breakdown of Annual Usage by Service Group Area

4.2 Service Group Area I Water Demand

This service group area consists of all potable services north of Oakmont Pump station and Table 4-2 presents all MWCs and pressure zones in this group.

Table 4-2: Average Annual Water Usage and Service Count for Group I

Pressure Zone / Service	Percentage of Average Annual Water Usage	SJWC Service Count	Mutual Service Count
Montevina Pressure Zone	34.2%	24	-
Bear Creek Pressure Zone	21.8%	19	-
Oakmont MWC	14.0%	-	25
Vista Grande MWC	9.4%	-	24
Black Ridge Estates MWC	5.5%	-	2
Presentation Center	12.0%	1	-
Lexington School	3.0%	1	-

With the exception of Oakmont MWC, this service group area was not part of the RMWC acquisition and is not subject to the Overuse Rate. In 2013, Oakmont MWC's service was relocated to Montevina Pressure zone in order to provide a more reliable source of water to these customers. In addition to residential and MWC services, this service group also includes two public water services: (1) Presentation Center; and (2) Lexington Elementary school. Both of these services are treated separate from the rest of the service group because they do not have an applicable daily per capita demand. Presentation Center's service is located near the fire station on Old Santa Cruz Highway and pumps water from the service to their cabins and living areas along Bear Creek Road via a number of privately owned pump stations and tanks, referred to as the Alma Water System. Presentation Center provides a fire service to Midpeninsula Regional Open Space District (Midpen) near Alma College, but the Planning Group has confirmed with the Chief Operator of Presentation Center that there are no plans for expansion or sharing of potable water service with Midpen in the future.

Water usage for the service group is presented in Figure 4-5 and Table 4-2. Overall demand for the service group has trended upwards over the years and this is attributed to the increase in the number of service connections over that same time period. Per capita usage in the Montevina Service Area is higher than anywhere else in the Mountain System, which due to agricultural usage (vineyards and wineries) near Black and Bear Creek roads. In addition, several unauthorized connections on Alma Water System were discovered by the owner which likely accounts for their significant increase in water usage in 2009 and 2010 (over 200% of their historical average). [26]

[26] Midpen, *R-14-160 Waterline Easements Meeting 14-35* (2014)

The absence of SCADA data for the Montevina Pressure System prevented the plotting of an hourly diurnal graph and the determination of maximum day and peak hour demands. MDD and PHD ratios were estimated based on a detailed analysis of the other service group areas and comparing against the overall Mountain System demands. Service Group Area I ratios were estimated to be 2.33 for MDD:ADD and 4.15 for PHD:ADD, where peak hour demands were calculated based on Title 22 Waterworks Standards § 64554(b)(3)(D) which recommends calculating PHD as 1.5 x MDD.

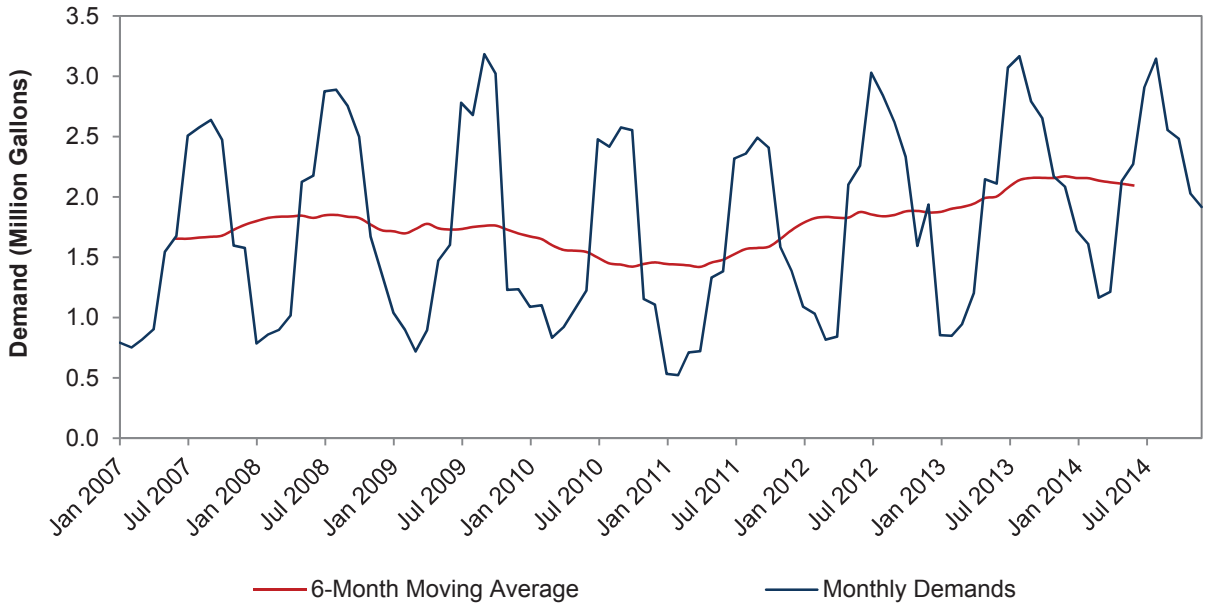


Figure 4-5. Service Group Area I Demands, Growth, and Centered Moving Average

Table 4-3: Historical Demands for Service Area Group I [(a)]

Year	ADD (gpd)	Per Capita Demand (gpcd)	Per Service Demand (gpd/s)
2007	50,100	244	626
2008	53,800	273	681
2009	46,000	255	575
2010	38,800	228	485
2011	41,500	198	472
2012	51,100	252	581
2013	58,200	262	647
2014	58,500	269	636

Public /Quasi-Public Demand not included (Presentation Center & Lexington Elementary School)
(a) SCADA data unavailable for Montevina Pressure System to calculated MDD & PHD

4.3 Service Group Area II Water Demand

This service group area covers all potable services between Oakmont and Pavilion stations and a breakdown of the group is presented in Table 4-4.

Table 4-4: Average Annual Water Usage and Service Count for Group II

Pressure Zone / Service	Percentage of Average Annual Water Usage	SJWC Service Count	Mutual Service Count
Pavilion Pressure Zone	9.7%	21	-
Gillette MWC	6.3%	-	5
Villa Del Monte MWC	56.2%	-	118
Big Redwood Park MWC	25.7%	-	65
Mountain Summit MWC	1.6%	-	6
Mountain Springs MWC[(a)]	0.4%	-	18
Chemeketa MWC[(b)]	-	-	145

(a) Limited data available for Mountain Springs (restricted service connected June 2014).

(b) Restricted service to Chemeketa (completed in Fall 2015 and data was not available when writing this Master Plan).

This group includes several large MWCs including Villa Del Monte, Big Redwood Park, and Mountain Summit, which are supplied through a single 6-inch master service on Old Santa Cruz Highway, just south of Call of the Wild Road. These MWCs then pump this water a considerable distance to their respective service areas, all of which are located in Santa Cruz County. In addition to these MWCs, this service group area also includes two 10-gpm limited interruptible service connections to Chemeketa and Mountain Springs MWCs. These services were intended to provide immediate relief during the current drought; however, until this master plan was completed it was not clear when or if an unrestricted service could be provided. Water usage for the service group, not including Chemeketa MWC, is presented in Figure 4-6 and Table 4-5.

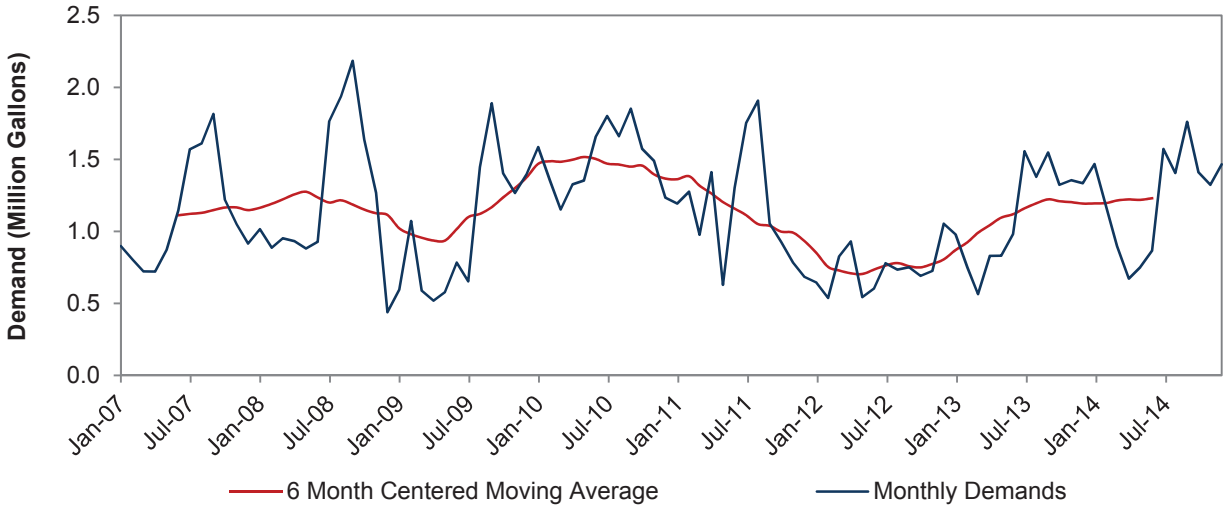


Figure 4-6. Service Group Area II Historical Demand and Service Count

Table 4-5: Historical Demands for Service Area Group II					
Year	ADD (gpd)	MDD (gpd)	PHD (gph)	Per Capita Demand (gpcd)	Per Service Demand (gpd/s)
2007	36,600	-	-	65	182
2008	40,700	-	-	72	199
2009	33,500	-	-	59	163
2010	49,500	-	-	84	233
2011	38,100	65,000	10,600	64	179
2012	24,200	74,200	11,000	41	113
2013	36,800	114,500	18,000	62	171
2014	40,500	117,300	10,600	62	174

The large number of MWCs in this service group area results in dramatic year-to-year demand changes. Fluctuations are attributed to alternative sources of water several MWCs have that supplement their supply from SJWC. However, the low yield of wells in this area and weather dependent surface water supplies make these sources unpredictable. For example, Villa del Monte, the largest MWC in the service area, was granted a $1.15 million State Revolving Fund grant to upgrade their surface water treatment plant.[27] The upgraded treatment system was complete in 2011 and accounts in large part for the drop in their usage between 2011 and 2012. However, as the current drought decreased local surface water supplies, Villa del Monte's demand for SJWC's water has steadily increased since 2013.

Hourly demand is presented in Figure 4-7. This unusual pattern is likely the result of MWCs filling their tanks during the day.

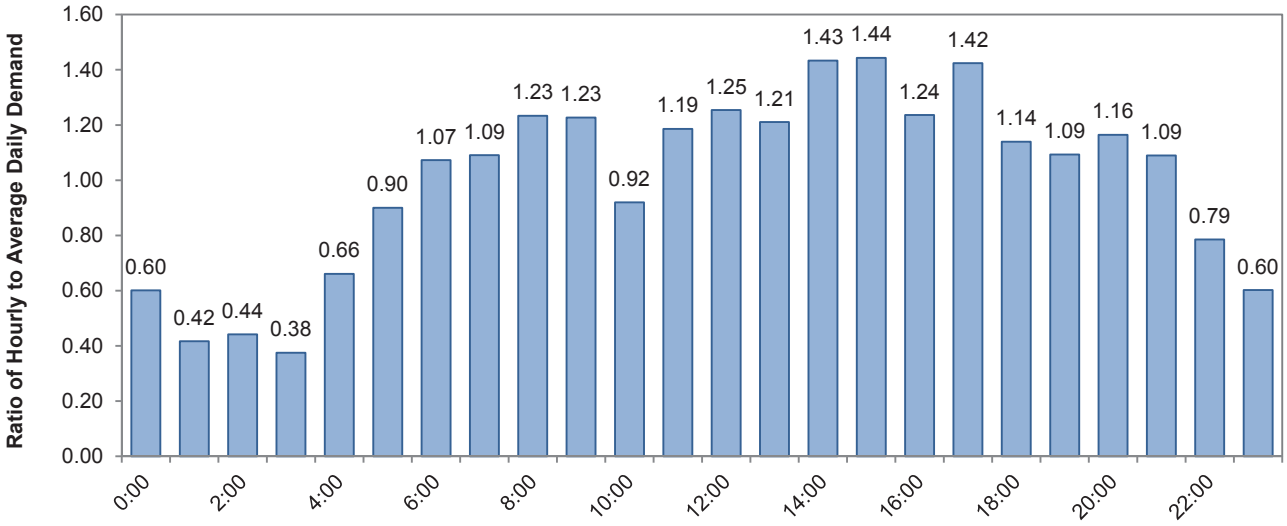


Figure 4-7. Service Group Area II Hourly Peaking Factors

[27] CDPH, *Safe Drinking Water State Revolving Fund and Source Water Projection Projects* (2014)

4.4 Service Group Area III Water Demand

This service group area covers all potable services that draw water from Locust station, and a breakdown of the group is presented in Table 4-6.

Table 4-6: Average Annual Water Usage and Service Count for Group III

Pressure Zone / Service	Percentage of Average Annual Water Usage	SJWC Service Count	Mutual Service Count
Locust Zone	37.8%	83	-
Idalyn Regulated Zone	5.6%	12	-
Mary Alice Regulated Zone	5.4%	13	-
Beatrice Zone	51.3%	110	-

This service group area is unique because it does not provide water to any MWCs. Water usage for this service group is presented in Figure 4-8 and Table 4-7. This service area has not experienced substantial growth and six-month average usage has been relatively flat. Seasonal usage fluctuated significantly in the summers of 2009 and 2010, but has been stable over the last four years. No reason was found for this unusual water usage beyond high usage customers.

Hourly demand is presented in Figure 4-9. Demand is more consistent to typical diurnal curves with a peak hour demand around 6:00 am.

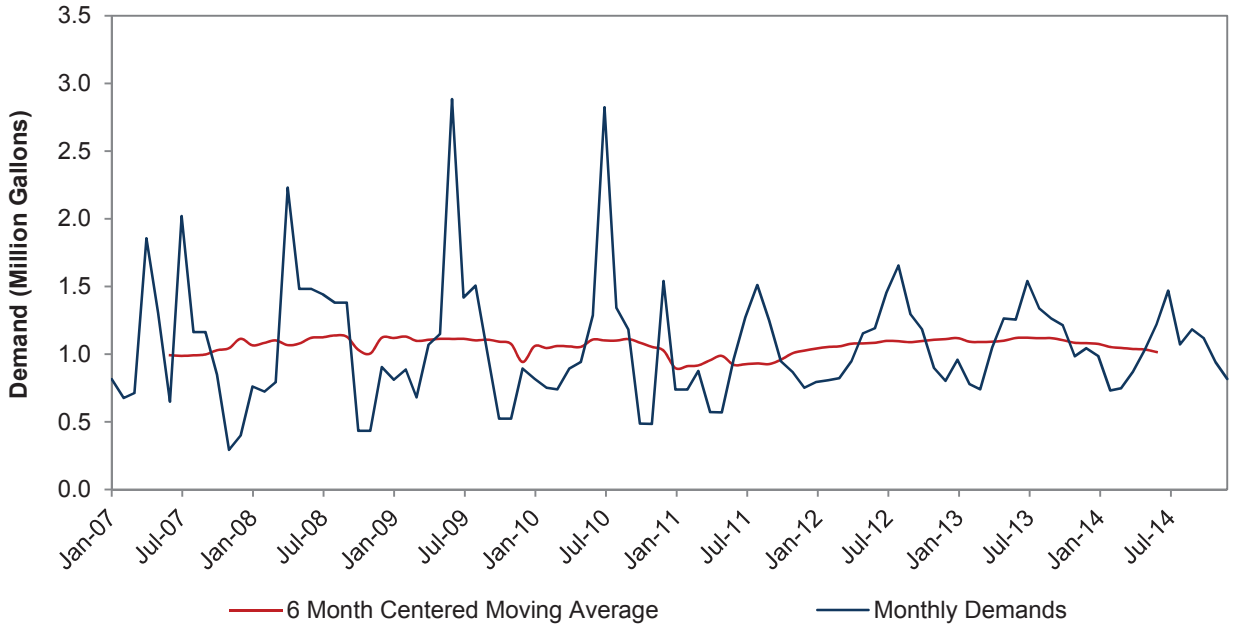


Figure 4-8. Service Group Area III Historical Demand and Service Count

Table 4-7: Historical Demands for Service Area Group III					
Year	ADD (gpd)	MDD (gpd)	PHD (gph)	Per Capita Demand (gpcd)	Per Service Demand (gpd/s)
2007	32,600	-	-	59	163
2008	36,900	-	-	62	172
2009	36,600	-	-	60	167
2010	36,500	-	-	60	167
2011	30,300	88,500	13,600	50	140
2012	35,700	94,200	12,600	59	164
2013	36,800	85,800	14,100	61	169
2014	33,400	71,700	14,800	55	153

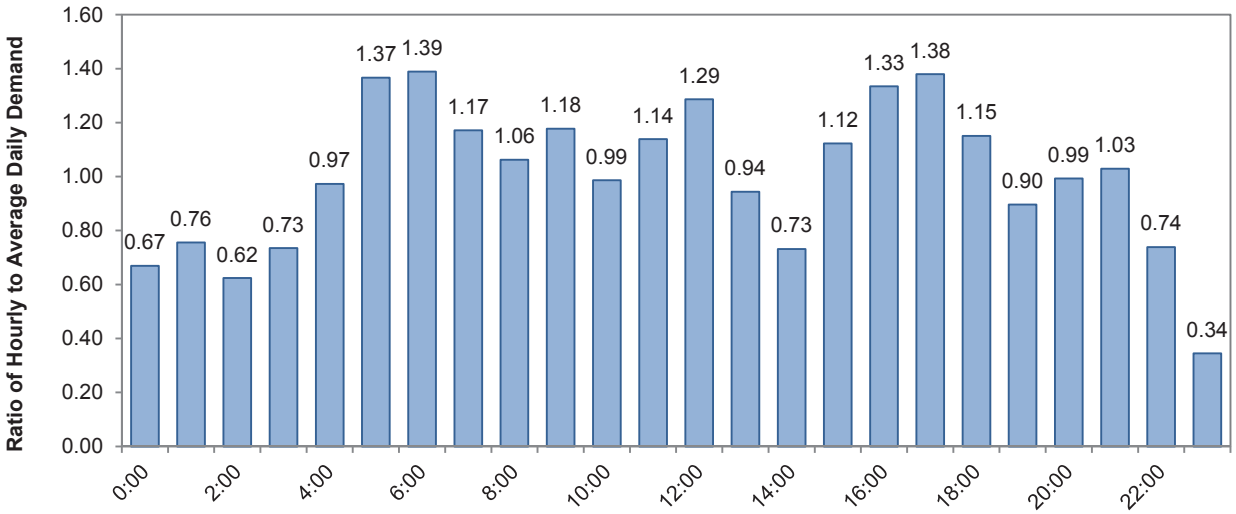


Figure 4-9. Service Group Area III Hourly Peaking Factors

4.5 Service Group Area IV Water Demand

This service group area covers all potable services that draw water from Summit station, and a breakdown of the group is presented in Table 4-8.

Table 4-8: Average Annual Water Usage and Service Count for Group IV

Pressure Zone / Service	Percentage of Average Annual Water Usage	SJWC Service Count	Mutual Service Count
Summit Zone	10.8%	50	-
Summit Pressure Zone	7.3%	32	-
Tank Farm Zone	0.1%	2	-
Bayview Zone	6.7%	36	-
Locust Regulated	2.9%	17	-
Summit West	42.7%	-	139
Ridge	16.4%	-	73
Stagecoach	2.3%	-	10
Brush & Old Well	10.8%	-	28

This service group area is the largest of the four with an estimated 1,054 pople. It also supplies a large number of mutuals, which represent a majority of the usage. Water usage for the service group is presented in Figure 4-10 and Table 4-9. Demand has been relatively constant over the last six years which is attributed to low historical growth, and a limited number of alternative supplies for MWCs. Ridge and Stagecoach are the only MWCs to have active wells available.

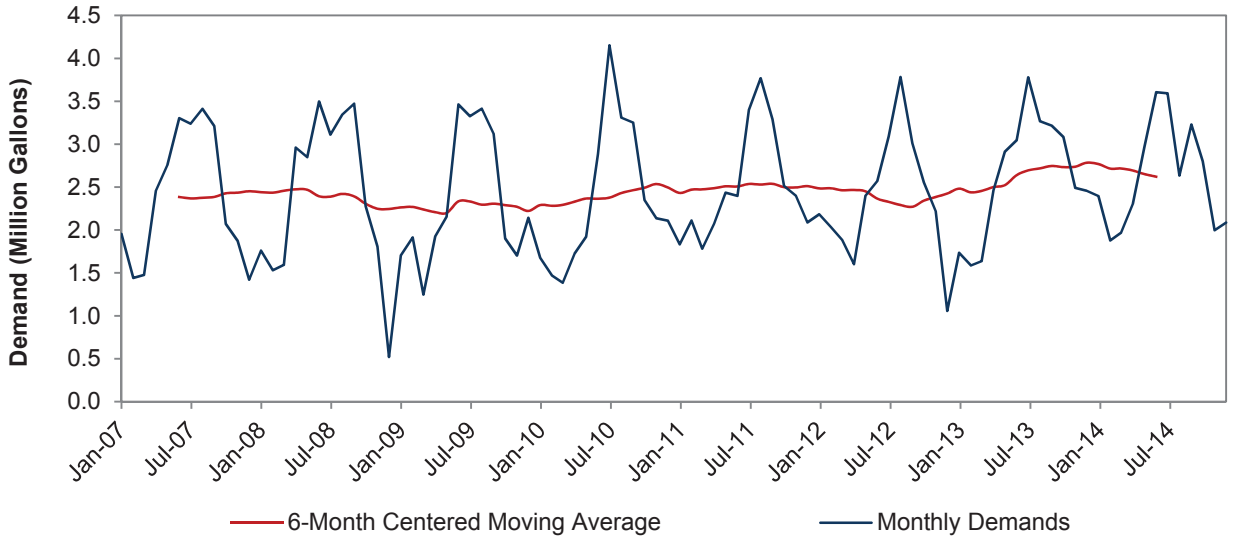


Figure 4-10. Service Group Area IV Historical Water Demands

Table 4-9: Historical Demands for Service Area Group IV					
Year	ADD (gpd)	MDD (gpd)	PHD (gph)	Per Capita Demand (gpcd)	Per Service Demand (gpd/s)
2007	78,400	-	-	74	205
2008	78,700	-	-	74	206
2009	76,800	-	-	72	199
2010	77,800	-	-	72	201
2011	82,500	141,500	9,100	77	214
2012	79,600	143,900	8,700	74	206
2013	86,800	153,100	9,300	81	224
2014	86,200	152,200	9,300	80	223

Hourly demand is presented in Figure 4-11. Demand increase throughout the day and peaks at noon. This is attributed to the MWCs filling their tanks up during the daytime.

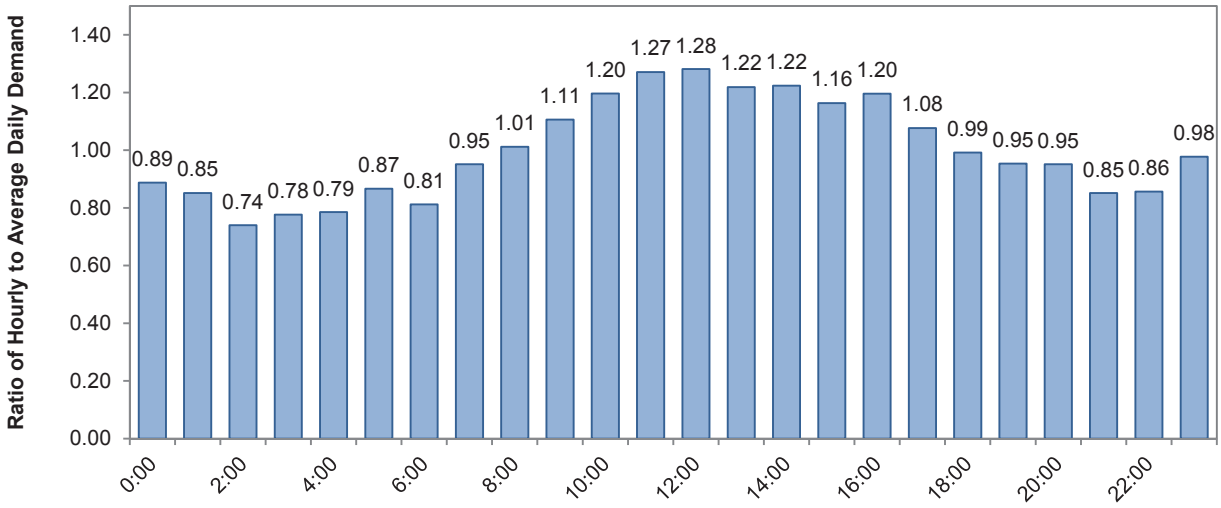


Figure 4-11. Service Group Area IV Hourly Peaking Factors

4.6 Mutual Water Service Water Demand

The percentage of annual water usage for all MWC's is presented in Figure 4-12 and is typically more than 49% of total combined Mountain System usage. Historical water usage by MWC is illustrated in Figure 4-13. Several MWC have alternative sources of supply which can significantly alter usage year-to year (see Section 2.3 for additional details).

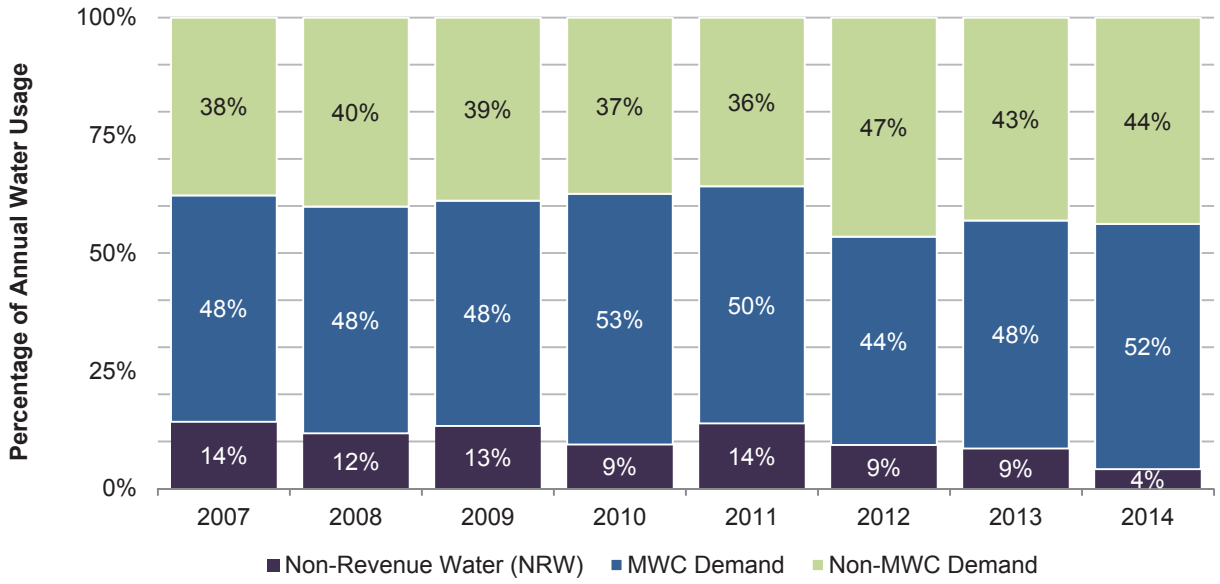


Figure 4-12. Comparison of Water Demands by Customer Type

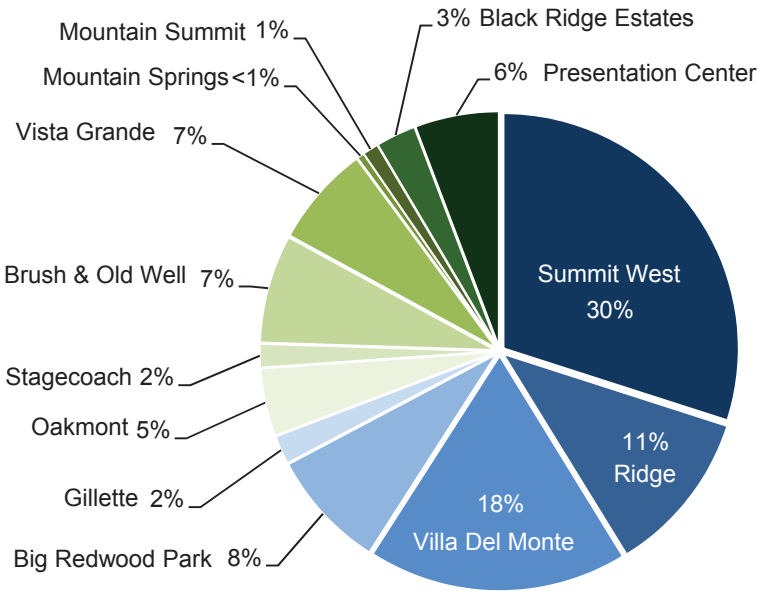


Figure 4-13. Percentage of Mountain System MWC Annual Usage by Mutual 2007 – 2014

Most MWCs have had reasonably consistent usage patterns between 2007 and 2014 and details of this usage are presented in Table 4-10 below. Summit West has consistently been the largest user of water as a MWC, but has had relatively stable demands. Villa del Monte, Ridge, and Presentation Center, are notable exceptions which have experienced significant usage changes. The fluctuations in Presentation Center's usage, as discussed in Section 4.2, is likely due to the several unauthorized connections on its water system which have since been removed. Presentation Center's water demand has stabilized in recent years, and according to their Chief Operator they do not foresee any expansion or change to demands in the future. Villa del Monte and Ridge variations in usage are attributed to their alternative sources of supply, which are further discussed in Section 2.3 & 4.3. Monthly usage trend lines are presented in Figure 4-14 with additional usage figures by MWC included in Appendix E.

Table 4-10: Average Usage for MWC in the Mountain System between 2007 – 2014

MWC	Average Annual Demand (MG)	Daily Demands		
		gpd	gpcd	gpd/s
Big Redwood Park	3.54	9,700	53	149
Brush & Old Well	3.20	9,100	115	321
Chemeketa[(a)]	TBD	-	-	-
Gillette	0.84	2,100	164	461
Mountain Springs[(b)]	0.52	2,500	28	78
Mountain Summit[(c)]	0.22	1,080	-	-
Oakmont	2.00	5,600	78	218
Ridge	4.85	13,500	66	184
Stagecoach	0.69	1,900	66	185
Summit West	12.66	35,100	89	248
Villa Del Monte	7.72	21,500	66	184
Vista Grande	2.96	7,900	124	345
Black Ridge Estates	1.19	3,300	651	1,629
Presentation Center[(d)]	2.48	6,800	-	-

(a) Chemeketa connection was completed in Fall 2015 with a restricted 10-gpm service

(b) Mountain Springs service by SJWC starting June 2014. Insufficient data to calculate ADD variability.

(c) Mountain Summit MWC is a Non-Community water system (i.e. restaurants) and has significant variability

(d) Presentation Center is considered public and is not considered to have residential per capita demands

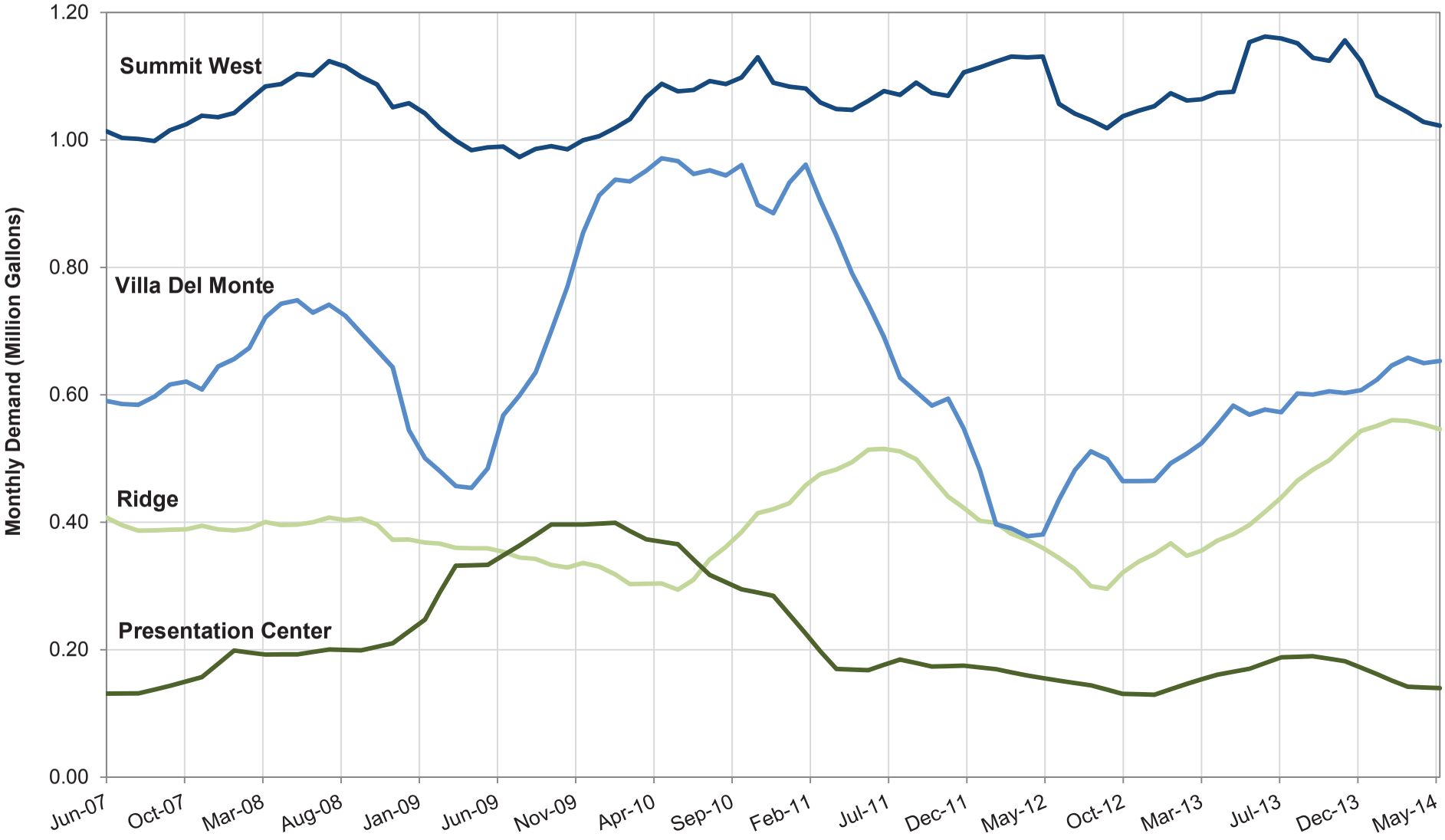


Figure 4-14. Six Month Moving Average Trends for Several MWCs in the Mountain System from 2007 – 2014 (see Appendix E for details)

4.7 Long-Term Change in Residential Demand Trends

Across the country water utilities have noted a decrease in residential water usage despite a continued increase in the number of residents and households.[28] Although there are many theories as to why this is happening (e.g. water-conserving fixtures and appliances, smaller lawns, changing demographics, and price increases) to date there is no definitive report that can validate to what extent these theories contribute to residential water-usage decline.[29] SJWC has experienced this same phenomenon and according to the 2010 *Urban Water Management Plan* SJWC has seen an annual decrease in per capita usage of about -1.05%. However, the Mountain System has not seen this same drop in per capita usage. Rather there has been a 2.38% average annual increase in per capita usage since 2007. A daily per capita usage comparison is presented in Figure 4-15.

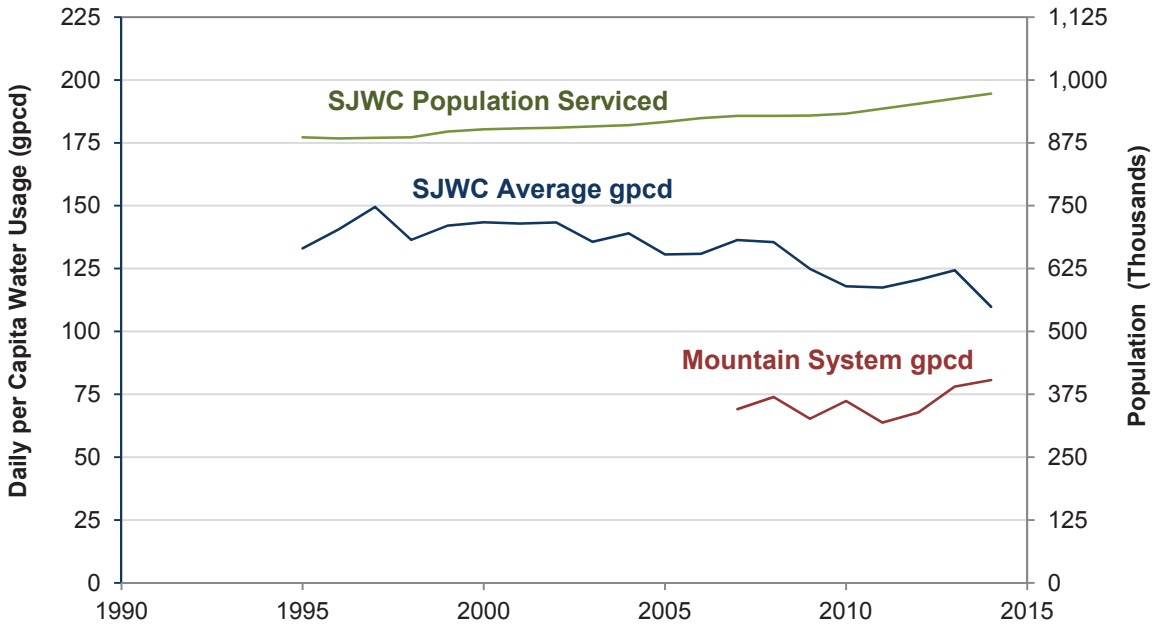


Figure 4-15. SJWC Service Population and Usage

The increase in daily per capita usage in the Mountain System is attributed to the relaxing of the Overuse Rate tier, which allows customers to draw more water without incurring any significant financial penalty (further discussed in Section 4.8). Given the year-to-year fluctuations in per capita demand from alternative sources for some MWCs and swings in demand from the small system size, it is difficult to determine what, if any, long-term usage trend or conservation is going to occur in the Mountain System. Unlike the rest of SJWC's service area, the small number of customers results in significant swings in demand depending on yearly behavior. While it is possible that usage drop may occur in the future, it is not clear by how much or even how likely this is to occur.

[28] USGS, *Estimated Use of Water In the United State in 2010* (November 2014)
[29] WRF/USEPA, *North American Residential Water Usage Trends Since 1992* (2010)

4.8 Overuse Rate Effects on Demand

Much of the Mountain System has a unique rate structure, which is a legacy of operation under the former RMWC. RMWC introduced a price cap, known as an *Overuse Rate*, to encourage water customers to use water for essential uses (e.g. bathing, drinking, washing, and sanitation). The Overuse Rate was set at 250 gpd/s over the course of a billing period, above which the cost for water would increase significantly. This tier level was selected because the original design of the Montevina pipeline was for 200 gpd/s but some modifications enabled an increase to 250 gpd/s.[30] Since the acquisition, SJWC has incrementally increased the available water limit and now maintains an Overuse Rate at 500 gpd/s.

The Overuse Rate only affects those customers in the Mountain District as shown previously in Figure 2-1. Analyzing the SJWC customer usages (excluding MWCs) the percentage of total services exceeding the Overuse Rate for each month since the acquisition was compiled and is presented in Figure 4-16. Surprisingly, at the 250 gpd/s Overuse Rate almost half of all services would exceed this daily limit during the summer. However, customer exceedance of the Overuse Rate has decreased steadily as the Overuse Rate limit has increased. Today, fewer than 10% of all services in the Mountain District exceed the Overuse Rate during the summer months.

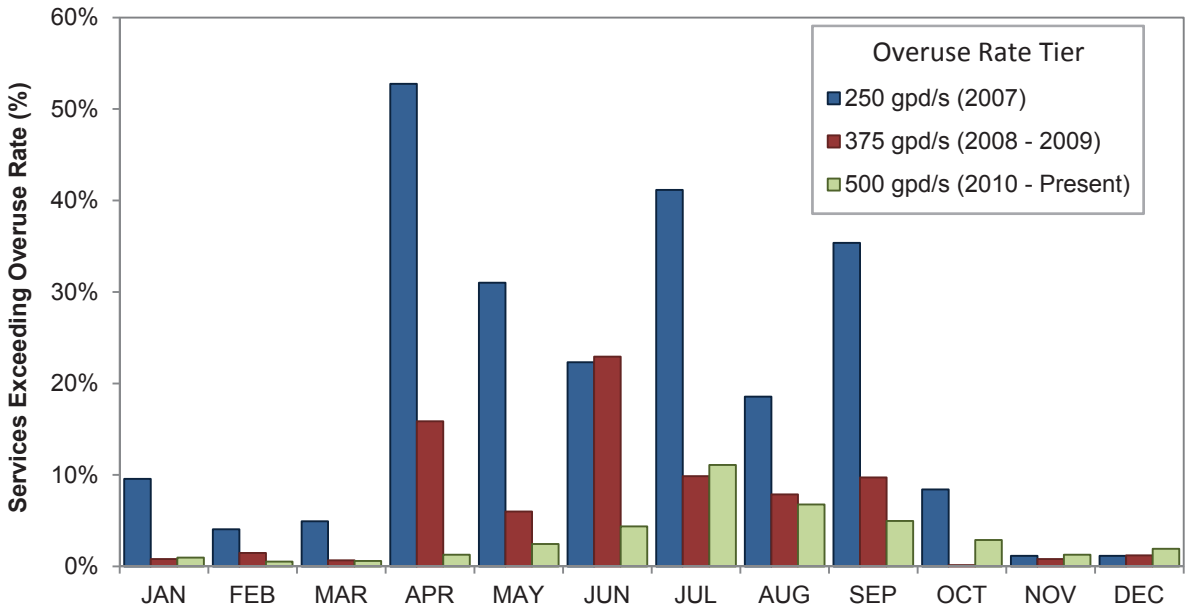


Figure 4-16. Percentage of SJWC Services Exceeding Overuse Rate

Price effects of water are known to encourage water conservation as customers cut back on water purchases to avoid financial penalties.[31] However, Overuse Rates are only effective so long as the overuse tier is within normal customer demand. As the overuse rate moves beyond typical household demands the price effect becomes less effective as suggested in Figure 4-16 where the

[30] Boyle Engineering, *Montevina Pipeline Master Plan* (1991)
[31] AWWA, *Forecasting Urban Water Demands* (2008)

increase in Overuse Rate tier level affects less customers as the tier is increased. Based on this finding, a review of past demand increases with Overuse tier increases was analyzed to determine if a relationship existed that could be used for estimating future demand changes based on Overuse tier changes.

A comparison of maximum day demand in the Mountain District and the cumulative demand increase from 250 gpd/s is presented in Figure 4-17. An exponential function, $f(x) = e^x$, was fitted to extrapolate possible subsequent demand increases associated with relaxing the Overuse Rate tier. Based on this analysis it was estimated that there is an asymptotic relationship between overuse rate and demand; that at some point a change in the overuse rate will not result in any further increase in demand. Therefore, as the Overuse Rate tier is increased there will be a corresponding increase in water demand, although the amount of the increase will diminish with each increase to the Overuse Rate tier.

One of the primary goals of this MSMP is the removal of the Overuse Rate, and to this end an estimate was developed for the total annual increase that can be expected when the Overuse Rate tier is completely removed. Based on the exponential function shown below, the total increase was estimated as an additional 6% in maximum day demand for the Mountain System from the current 500 gpd/s tier. However, based on limited data to model from there remains a high degree of uncertainty in this estimated value as the actual increase could be significantly higher.

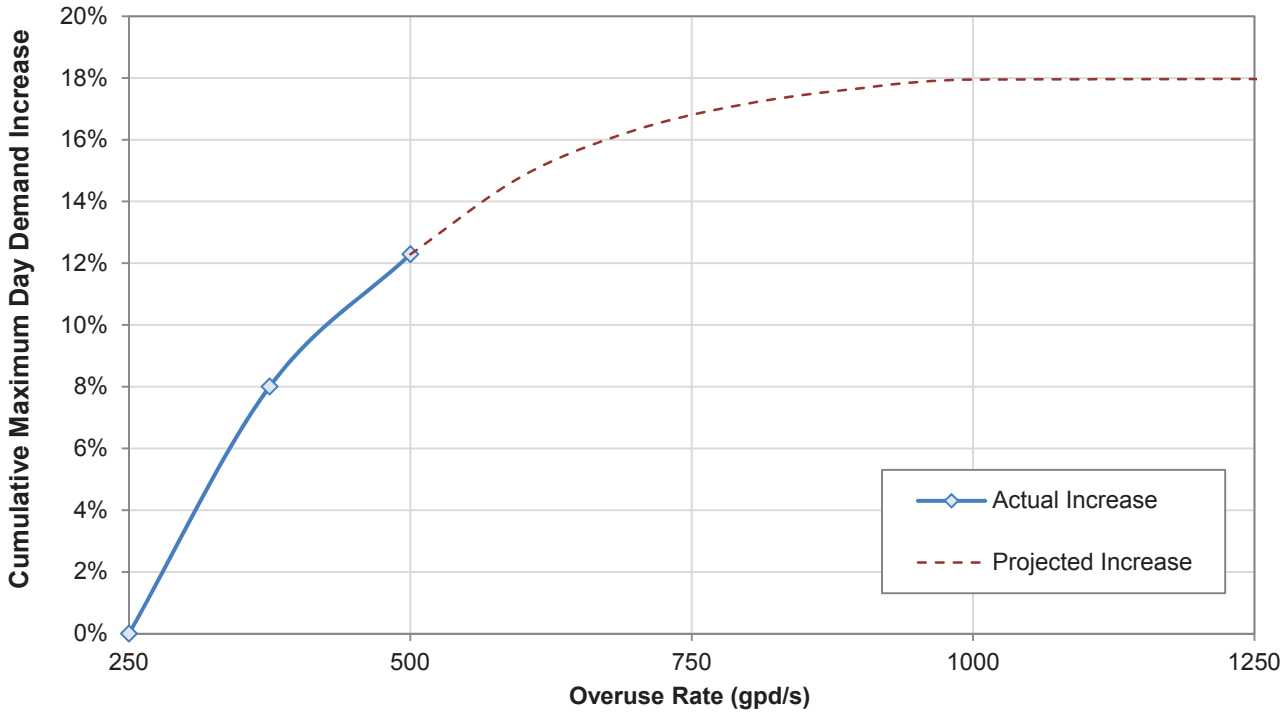


Figure 4-17. Relationship between Overuse Rate and Demand

4.9 Weather Effects on Demand

Weather is often a critical factor in the variability of year-to-year water demand and special consideration was given to determine what a normal weather effect might look like. This data will assist with determining the effects of weather on water demand and develop a weather normalized usage estimate which will reduce the impacts of unusually hot and dry or cool and wet years.

The Mountain System experiences cooler summer months than the rest of SJWC service area, but daily temperature can still fluctuate significantly between 32°F and 102°F throughout the year. Winter months are typically October through March with an average annual rainfall of approximately 36.9 inches.

Water demand in the Mountain System is strongly correlated to monthly temperature ($r = 0.870$, $r^2 = 0.757$) and more loosely to annual rainfall ($r = -0.704$, $r^2 = 0.495$). The relationship between monthly temperature and monthly demand is illustrated in Figure 4-18.

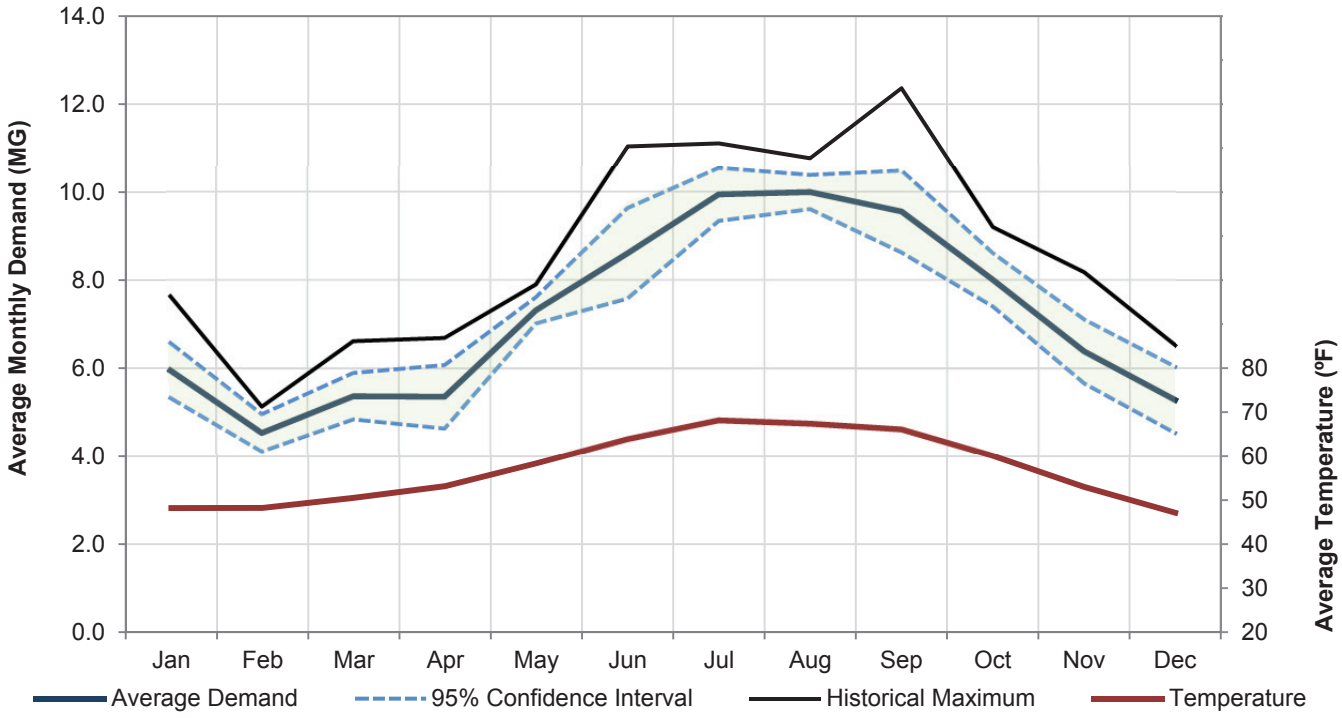


Figure 4-18. Mountain District Average Monthly Water Usage and Temperature

The *Long-Term Weather Index, w*, is intended to help identify years of "normal" weather. The American Water Works Association (AWWA) defines this term as follows:

$$w = t^{*2} + p^{*2}$$

Where: $t^* = (t - \bar{t})/stdev(t)$

$p^* = (p - \bar{p})/stdev(p)$

Standardizing average temperature and total precipitation transforms these values into numbers clustering around zero, i.e. the Long-Term Weather Index. The closer the index is to zero the more representative the weather that year was to an average or "normal" year.

The data and the long-term weather index are summarized in Table 4-11. Based on the data the most "weather-normalized" year was in 2008 when total annual demand was 89.4 million gallons.

Table 4-11: Mountain System Historical Weather Data and Annual Water Usage

Year	Average Annual Temperature (°F)	Total Annual Precipitation (in.)	Annual Water Usage (MG)	Long-Term Weather Index
2005	57.95	40.30	-	**0.552**
2006	56.66	42.53	-	**0.279**
2007	56.35	18.91	85.88	**1.897**
2008	57.35	33.24	89.40	**0.106**
2009	57.04	42.64	85.70	**0.155**
2010	55.57	56.54	86.29	**3.403**
2011	55.63	37.69	84.46	**1.484**
2012	57.07	51.10	81.18	**0.940**
2013	57.67	6.61	90.25	**4.516**
2014	59.70	39.63	87.13	**4.666**
Average	**57.10**	**36.92**		
Standard Deviation	**1.21**	**14.63**		

Source: *The Weather Underground Redwood Estates KCALOSGA8*

4.10 Non-Revenue Water Trends

Water utilities typically find some discrepancy between their customer billing data and the water production data, and this is referred to as Non-Revenue Water (NRW). The discrepancy may be the results of a number of factors including meter inaccuracies, water main leakage or failure, maintenance activities, fire flow, service point leakage, or unauthorized consumption. SJWC has gone to great lengths to minimize NRW in the distribution system and was last reported as about 7% [32], which is significantly below the national average of 13%.[33]

Historical NRW in the Mountain System is presented in Table 4-12. The Mountain System has experienced periods of much higher losses than the rest of SJWC distribution system, but NRW has gradually been decreasing since 2011. This coincides with pipeline replacement work in 2012 on Irma Lyle Drive (H2-006) and Helen Way and La Salle Drive (H1-097). Both these distribution mains were known for having severe leaking and the repair work, in conjunction with other water monitoring activities, have helped to reduce NRW in the Mountain System to 4.3% as of 2014.

Table 4-12: Non-Revenue Water for the Mountain System

Year	Billing Data	Total Annual Demand (MG)	Difference
2007	73.71	85.88	14.2%
2008	78.91	89.40	11.7%
2009	74.30	85.70	13.3%
2010	78.22	86.29	9.4%
2011	72.79	89.74	13.8%
2012	73.34	81.18	9.2%
2013	82.57	90.25	8.5%
2014	83.55	87.13	4.1%
		Average	**10.5%**
		Trimmed Average (Last 3-yrs)	**7.3%**

[32] SJWC, *2010 Urban Water Management Plan* (April 2011)
[33] USEPA 815-R-09-001 2006 *Community Water System Survey: Volume 1: Overview* (February 2009)

4.11 Existing Water Demand Summary

Existing average and maximum demands for the Mountain System were calculated based on weather normalized per capita demands, maximum recorded peaking factors, and average non-revenue water loss. The results are summarized in Table 4-13 & Table 4-14 below.

Table 4-13: Residential Normalized Annual Average Water Demands

Service Group Area	Services / Population	Annual Demand (MG)	Average Residential Day Demand			Max Day Demand (gpd)
			R-gpd	R-gpcd	R-gpd/s	
I	92 / 256	21.1	57,700	225.4	626.1	134,500
II	233 / 648	15.4	42,200	65.1	180.9	131,400
III	218 / 607	13.4	36,800	60.6	168.4	107,500
IV	387 / 1,076	28.8	79,000	73.4	204.1	142,900
Total	**930 / 2,586**	**78.7**	**215,700**	**83.4**	**231.9**	**516,300**

Table 4-14: Mountain System Normalized Annual Average Water Demands

Demands	Average Day Demand (gpd)	Max Day Demand (gpd)	Annual Demand (MG)
Residential Demands	215,700	516,300	**78.7**
Public/Quasi-Public			
• Presentation Center	6,800	15,900	**2.48**
• Lexington School	3,900	9,100	**1.42**
Non-Revenue Water (7.3%)	16,600	39,600	**6.04**
Total Mountain System Demand	**243,000**	**580,900**	**88.7**

Section V

Projected Water Demands

Section 5 | Projected Water Demands

Forecasting water demand is a critical component of a master plan to identify upcoming system changes and necessary improvements. This section documents the methodology applied and resulting population and water demand projections anticipated through 2040 for the Mountain System.

5.0 Approach

Population projections were based on the Association of Bay Area Governments (ABAG) most recent forecast, *Projections 2013 by Census Tract*. To assist planning efforts of local governments and utilities in the Bay Area, ABAG develops projection reports describing anticipated changes to the local population and economy. Population projections were obtained for the applicable census tract the Mountain System is located in and these estimates were converted to water demand forecasts using previously calculated per capita daily demands (gpcd) discussed in Section 4.

Several MWCs served by the Mountain System are located in Santa Cruz County where population projection data from ABAG was not available. However, given their close proximity to the rest of the Mountain System in Santa Clara County and similar climate, vegetation, and topography, their growth was assumed to mimic ABAG projections for the Santa Clara County portion of the Mountain System.

5.1 Population Projections

The Mountain System is located within Census Tract 5118, and more specifically within a Census Designated Place (CDP) known as Lexington Hills. While the majority of Census Tract 5118 is largely rural and unincorporated, covering an area of over 54 square miles, Lexington Hills CDP is the community focal point within the census tract, and consequently is where the majority of the Mountain System is located. Unfortunately, ABAG population projections only provide estimates at the Census Tract Level and historically there has been a difference in the rate of population change between Census Tract 5118 and Lexington Hills CDP as shown in Figure 5-1.

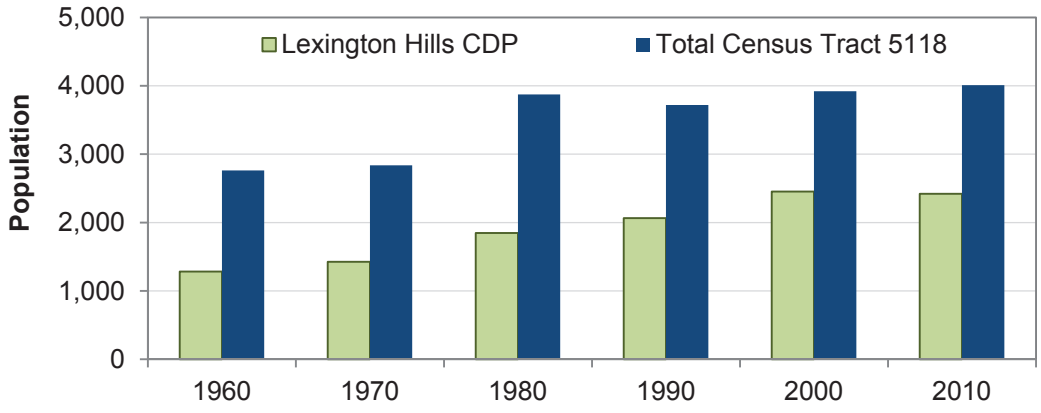


Figure 5-1. Historical Population by US Census Designated Area

To address the difference in population growth, a liner regression model was created relating past census population data between Census Tract 5118 and Lexington Hills CDP ($r = 0.919$; $r^2 = 0.844$). This linear relationship was applied to ABAG projections for Census Tract 5118 to estimate a more specific growth in Lexington Hills CDP. A *Population Envelope* was then developed to reflect the range of possible future growth, presented in Figure 5-2, and an average value between these two estimates was ultimately used for the MSMP.

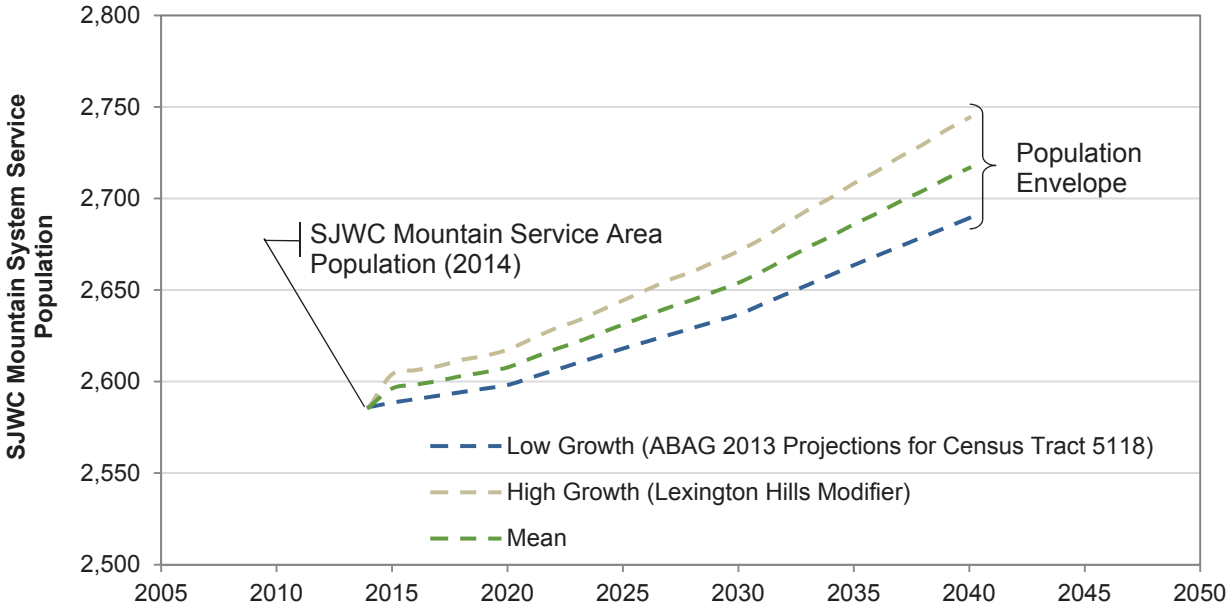


Figure 5-2. Future Population Projections for the Current SJWC Distribution System

Table 5-1 provides anticipated population growth in the Mountain System for the next 25 years. The mean growth rate is estimated to increase at an annual rate of 0.19%. By comparison SJWC's 2010 *Urban Water Management Plan* estimated annual growth for the entire system to be between 1.1% and 1.5%.

Table 5-1: Future Population Growth in the Mountain System Area

	2015	2020	2030	2040
Projected Maximum Population	2,604	2,617	2,671	2,744
Projected Mean Population	2,596	2,608	2,654	2,717
Projected Minimum Population	2,588	2,598	2,637	2,689

The low projected population growth can be partially attributed to limited parcels available for development, County lot size requirements for septic systems and construction, and a Santa Cruz County Environmental Health Services Department building moratorium for certain Mutual Water Companies (see Appendix A for a list of MWCs within the moratorium). In 2013 Santa

Clara County removed the minimum one acre lot size requirement for new development, which, according to the Environmental Impact Report, opened up an additional 83 lots in the Lexington Basin area and represent an approximate 10% increase in developable vacant parcels.[34] However, discussions with Santa Clara County officials stated that there has not been an appreciable increase in the number of building applications in the area since the policy change. Santa Cruz County still has a one acre minimum lot size requirement for new development and the moratorium.

5.2 Water Demand Projections

Demand projections were based on a widely accepted approach by water utilities to estimate total water demand as the product of total population at any given time and average water use per capita.[35] For this MSMP demand was calculated as follows:

$$Q_t = R\,(N_t\, q_{t\,+} w_{avg} - C_t)$$

Where:

Q_t = total system water use in time period t
N_t = population in water-system service area in time period t
q_t = per capita water use in time period
w_{avg} = historical average non-revenue water
C_t = water conservation in effect at time period t
R = Overuse Rate factor

Daily residential per capita demand was set at 83.4 gpcd, average non-revenue water at 7.9%, and public/quasi-public demand was anticipated to remain constant at 3.91 MG/yr as calculated previously in Section 4. Conservation was assumed to be negligible for future water projections based on the analysis in Section 4.7. The Overuse Rate factor was included to account for any additional water that may be required if the Overuse Rate tier was to change. At the current 500 gpd/s the overuse rate factor is 1.0, but if the Overuse Rate is abandoned this factor would increase to 1.06, representing a 6% increase in total demand (see Section 4.8 for additional details).

Table 5-2 and Figure 5-3 present the calculated Mountain System water demand projections through year 2040 based on the population estimates for this area.

Table 5-2: Projected Mountain System Service Area Annual Demand (MG)

Year	2015	2020	2030	2040
Overuse Rate at 500 gpd/s	89.0	89.4	90.9	92.9
No Overuse Rate	94.3	94.7	96.3	98.5

[34] Santa Clara County, *Final EIR for the SCC Onsite Wastewater Treatment System Ordinance* (2013)
[35] AWWA, *Forecasting Urban Water Demand*, 2007

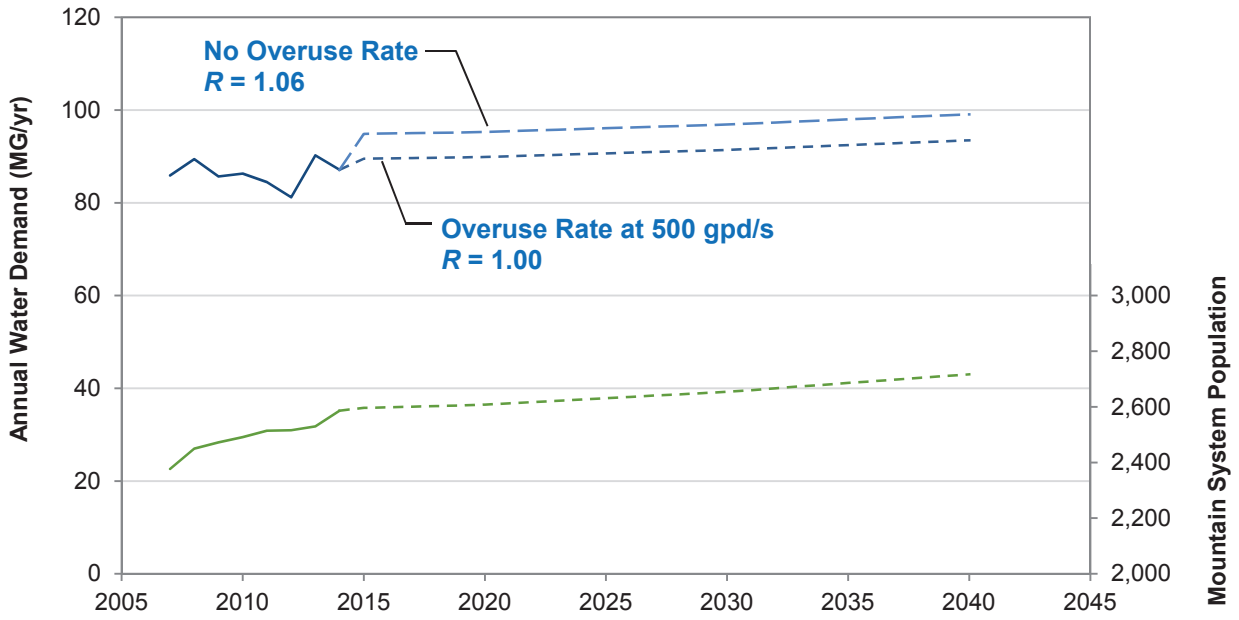


Figure 5-3. Population and Water Demand Projections Based only on Internal Growth

Table 5-3 presents average and maximum daily demand projections for both overuse rate scenarios. Maximum day demands were estimated as 2.39 times average day demand (see Section 4.1).

Table 5-3: Projected Mountain System Service Area Daily Demands (gpd)

Year		2015	2020	2030	2040
Overuse Rate at 500 gpd/s	ADD	243,800	244,900	249,000	254,600
	MDD	582,700	585,400	595,200	608,500
No Overuse Rate	ADD	258,500	259,600	263,900	269,900
	MDD	617,900	620,500	630,800	645,100

5.3 "Build-Out" Potential

Since the acquisition of RMWC, there has been a concern over (1) what potential "build-out" capacity is in the Mountain System; (2) what that impact might have on existing infrastructure; and (3) when hydraulic capacity will be reached.[36] The basis for these concerns comes from the Montevina System Schematic and Boyle Report survey prepared for the Mountain Mutual Water Company, which both detail future "obligated" and "ultimate" services for each MWC (see Appendix B). These numbers do not address the likelihood of reaching these service counts and as a result has led to uncertainty related to future demand and required system capacities.

[36] SJWC, *Engineering Perspectives of Redwood Mutual Water Company*, 2006

Obligated services were those that MWC's had committed to serving as of December 30, 1990. Ultimate services were those that MWC's had reserved capacity for as of December 30, 1990. The terms "obligated" and "ultimate" services came from a survey completed by the Boyle Report in 1991, and later updated by Roy Nelson, to define possible future service connections that each MWC expected to supply water via the Montevina Pipeline. A summary of these service counts are presented in Table 5-4.

Table 5-4: Comparison of 1991 Surveyed "Build-Out" and Current Actual Services

Location	1991 Estimated "Build-Out"		Actual (2014)	
	Ultimate Services	Population	Services	Population
RMWC (now SJWC)	429	1,193	376	1,047
Summit West MWC	218	607	139	387
Ridge MWC	102	284	73	203
Stagecoach MWC	13	37	10	28
Brush & Old Well MWC	31	87	28	78
Villa del Monte MWC	295	821	118	329
Gillette MWC	5	14	5	14
Big Redwood Park MWC	79	220	65	181
Mountain Springs MWC	18	51	18	51
Mountain Summit MWC	45	126	6	17
Oakmont MWC	25	70	25	70
Montevina Pressure Zone	-	-	22	62
Bear Creek Pressure	-	-	19	53
Vista Grande MWC	-	-	24	67
Black Ridge Estates MWC	-	-	2	6
Presentation Center MWC	12	-	1	-
Lexington School	1	-	1	-
TOTAL	**1,273**	**3,510**	**932**	**2,405**

Sources: *Roy Nelson Montevina System Schematic (2002); Boyle Report (1991); DDW Drinking Water Watch (2014)*

While the past population survey estimate do provide valuable insight into each MWC at the time, and it is likely that the Mountain System will continue to develop over time (especially as the pressure from the housing market forces Bay Area residents to look to new areas), these numbers do not reflect today's reality nor the current regulatory climate. Past population trends, the building moratorium for most MWCs in Santa Cruz County, and the septic system land requirements are significant hurdles that will need to be overcome to reach this projected "build-out" in the foreseeable future. The likelihood that any of the above MWCs will reach their estimated "build-out" size within the next 50+ years is extremely unlikely.

5.4 Future MWC Connections

Since acquiring RMWC, SJWC has been cautious to incorporate more MWCs into the distribution system out of concern for limited available pumping along the Montevina Pipeline. This was in keeping with the views and opinions of RMWC.[37] MWCs that formally expressed interest in receiving service from SJWC were given preliminary costs necessary to upgrade SJWC facilities in order to reliably provide them water service without negatively impacting existing customers. Often these costs were beyond the budgets of the MWC's, which has led to erroneous speculation that SJWC is extorting money from the mutuals.[38] In actuality, these costs were necessary to improve the system owing to significant existing deficiencies as discussed in subsequent sections.

Table 5-5 presents the current understanding of MWCs interest in connecting to the Mountain System. This summary assumes that "connecting" means an unrestricted metered service, unlike the current services provided to Mountain Springs and Chemeketa. This table was assembled based on past expressed interest of MWCs to connect to SJWC and discussions with County and State health officials overseeing water systems in this area.

Table 5-5: Summary of Future Potential Mutual Water Connections

MWC	Water System No.	Service Count	Connection Likelihood
Aldercroft Heights	CA4300516	116	Likely
Chemeketa	CA4300517	145	Likely
Hebard [(a)]	-	14	Likely
Mountain Springs	CA4300740	18	Likely
Raineri	CA4300520	44	Likely
Call of the Wild	WA0200059	8	Possibly
Loma Prieta School	CA4300721	6	Possibly
Lupin Lodge	CA4300716	22	Possibly
Melody Woods	CA4300525	54	Possibly
Lake Canyon	CA4300522	59	May Never Connect
Land Management	WA2000045	8	May Never Connect
Laurel Community	CA4400528	26	May Never Connect
Redwood Lodge	WA0002111	8	May Never Connect
Springbrook	WA0002115	17	May Never Connect
Summit	CA4400559	55	May Never Connect

(a) Hebard, Kent, & Iron Springs (HKI) Road Association

[37] SJWC, *Engineering Evaluation and Opinions* (2006)
[38] Application No. 12-01-003, *Testimony of the Six Mutual Water Companies* (Filed: January 3, 2012)

5.4.1 Likely MWCs to Connect

Aldercroft Heights County Water District (AHCWD)

AHCWD was not previously involved in the Montevina Pipeline likely due to their multiple wells and raw water treatment system. AHCWD system currently purchases raw water from SJWC for their treatment system and it was reported by the Santa Clara County Health Department reported that they had recently drilled a well in 2014. However, looking for a long-term solution to their water problems, on December 9, 2015 a representative from AHCWD, Victoria Pearce, made an informal request that SJWC evaluate serving their system through an unrestricted potable water service connection to supplement to their other water.

It may also be possible to feed AHCWD through Chemeketa but how this might be achieved would be determined by those two mutuals. Additionally, according to RMWC records, there is a 6-inch DICL raw water pipeline that travels from the Montevina Pipeline to Los Gatos creek near the AHCWD service as area shown in Figure 5-4. This pipeline was installed following the Loma Prieta earthquake to provide an emergency raw water supply to RMWC. As a result, limited documents and drawings are available for this pipeline and SJWC is currently investigating the exact whereabouts of this pipeline. Following completion of capital improvements at Holy City station, if this water main can be located, SJWC will conduct an inspection and evaluation to determine the feasibility of using this pipeline to serve AHCWD potable water. It is also possible that Lupin Lodge may be interested in a connection through a shared service with AHCWD given their need for water as well.

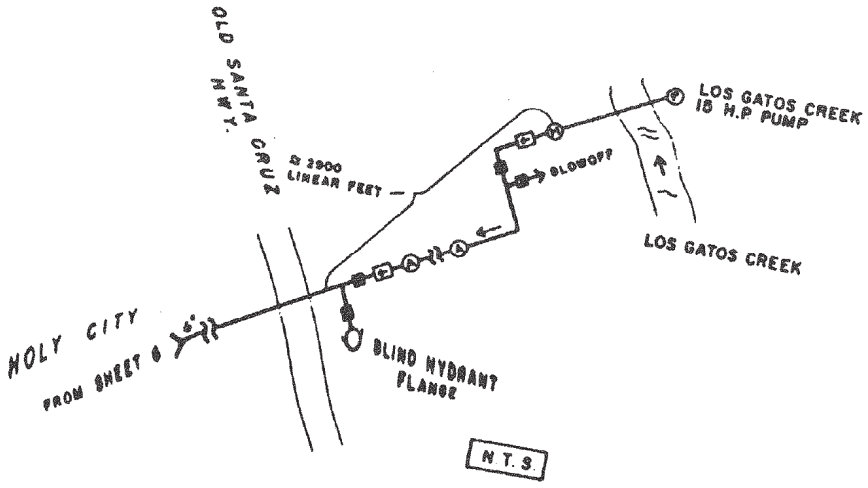


Figure 5-4. Existing 6-inch DICL pipe from Holy City to Los Gatos Creek installed by RMWC

Chemeketa / Mountain Springs

Chemeketa and Mountain Springs are currently provided service through interruptible service connections restricted to 10 gpm. Both systems have alternative sources of water, but are highly weather dependent and/or aging. It is likely that if offered, both customers would opt for an

unrestricted service connection either as supplemental as-needed water or as the sole water source. While it would be a simple transition for Mountain Springs to upgrade their service, there is currently no additional capacity in Pavilion zone to support this connection. Similarly, Chemeketa is served by a Pavilion zone pressure regulator when Oakmont boosters are not operating. Some significant capital improvements would be necessary at Holy City and Oakmont stations before Chemeketa could be provided an unrestricted metered service.

Hebard, Kent, Iron Springs (HKI) Road Association

There is some debate as to the existence and location of this small water system. According to Santa Clara County, Hebard system does not officially exist; however, the Boyle Report details a Hebard, Kent, and Iron Springs (HKI) Road Association with 14 homes listed within its service area. The State DDW department is aware of such a water system, but it was their understanding that the system was under the County's jurisdiction and had no further knowledge of the system. The County had no records of a water system within this area.

It is highly likely that homes within this area and adjacent to Oakmont station would have an interest in receiving an unrestricted metered service. Capital improvements at Holy City station and an additional 2,200 feet of pipe are needed to move water to these residents.

Raineri

Raineri (formally Idylwild) has expressed interest in connecting onto the Montevina Pipeline since it was first constructed, as documented in the Boyle survey. [39] More recently, Raineri has approached SJWC for quotes and a scope of work to connect. However, due to the necessary improvements to support this connection, preliminary estimates from SJWC had been cost prohibitive until the recent upgrades by Lexington School.[40] Significant improvements would still be needed to provide an unrestricted service connection and, given Raineri's recent completion of a slow sand treatment system, while they would likely be interested in a future supplemental connection they might not be as open to the idea as before.

5.4.2 Possible MWCs to Connect

Call of the Wild Water Works

This system is a collection of six homes east of Gillette MWC. Although there is the possibility of further expansion to another 30+ lots and homes around this system, Call of the Wild has not undergone any major expansion since it was first constructed in the early 1960s. There may also be a hindrance to expand since that will require additional oversight by the State if they were to expand beyond 15 connections. While it is likely that they would be willing to connect to SJWC if offered, it is not likely that they will actively seek this given their past preference to remain independent. The system would also require a 2,700 foot main extension to connect their system.

[39] Roy Nelson, P.E., *Report to the Board of Directors of the Mountain Mutual Water Company* (May 2003)
[40] SJWC, *Service Options for Raineri Mutual (Formally Idywild)* (2014)

However, this pipeline would more than likely result in additional services along Call of the Wild Road that would express an interest in connecting to SJWC.

Loma Prieta School

Located along Summit Road, Loma Prieta School has wanted to connect to the Montevina Pipeline for many years. In December of 2015 DDW inquired on their behalf on the possibility of connecting to SJWC. Previously, they tried to acquire the pipeline towards Villa del Monte to extend this main and service the school, but this plan was rejected by Mountain Mutual Water Company. Consequently the school has remained independent and is primarily served by onsite wells. However, well water supply along Summit Road is believed to be low and it is likely that the school wants to connect to SJWC.

Significant capital improvements are needed to facilitate this connection. Although it is likely that this project could be partially funded by the school, this is probably the least likely of the "Possibly" category. This would require 2.8 – 3.0 miles of new pipe crossing numerous active fault lines on Summit Road, which require additional design considerations. However, it is possible that residences in the area would be interested in connecting as well, which could offset some of the cost. Other improvements would also be needed to service this pipeline including additional pumping capacity at Oakmont and Holy City, and additional storage at Tank Farm. Although Loma Prieta School is now in Santa Cruz County, it falls under DDW Santa Clara County office jurisdiction because the original school was located in Santa Clara County.

Melody Woods

According to the 2002 Roy Nelson report for Mountain Mutual, Melody Woods was listed as "Likely" to connect on to the Montevina Pipeline. However, there has been no further indication of Melody Wood's desire to connect. After discussing this system with DDW, SJWC was informed that Melody Woods has recently completed improvements to their treatment plant and have two active wells. While it is likely that they may still be interested in obtaining an unrestricted metered service from SJWC to diversify their water supply sources, there is probably not an urgent need given the upfront costs. Significant improvements would be needed to connect this service to include storage improvements at Oakmont, Holy City, and Tank Farm stations as well as about one mile of new pipeline to reach Melody Wood's service area.

5.5 Alternative Water Demand Projections

Based on population projections and the likelihood of MWCs connecting to the Mountain System, five future scenarios were compiled that represent the possible future water demand envelope:

- Scenario A – no additional connections and Overuse Rate remains at 500 gpd/s
- Scenario B – no additional connections, all existing customers (except Chemeketa and Mountain Springs) are provided unrestricted service

- Scenario C – Raineri, Mountain Springs, Aldercroft, Chemeketa, and Hebard systems provided unrestricted water service; all existing customers and mutual water customers provided unrestricted service
- Scenario D – Melody Woods, and Call of the Wild systems provided unrestricted water service in additional to those in Scenario C; all existing customers and mutual water customers provided unrestricted service
- Scenario E – Loma Prieta High School provided unrestricted service in addition to those in Scenario D. This scenario also includes an additional 50 services for customers acquired along Summit Road to the school; all existing customers and mutual water services provided unrestricted service

Table 5-6 and Figure 5-5 present a summary of possible future water demand scenarios for the Mountain System through year 2040.

Table 5-6: Annual Demand Scenarios (MG)

YEAR	2015	2020	2030	2040
Scenario A	89.0	89.4	90.9	92.9
Scenario B	94.3	94.7	96.3	98.5
Scenario C	121.4	127.4	129.6	132.8
Scenario D	129.1	135.6	137.9	141.1
Scenario E	134.3	141.1	143.7	147.1

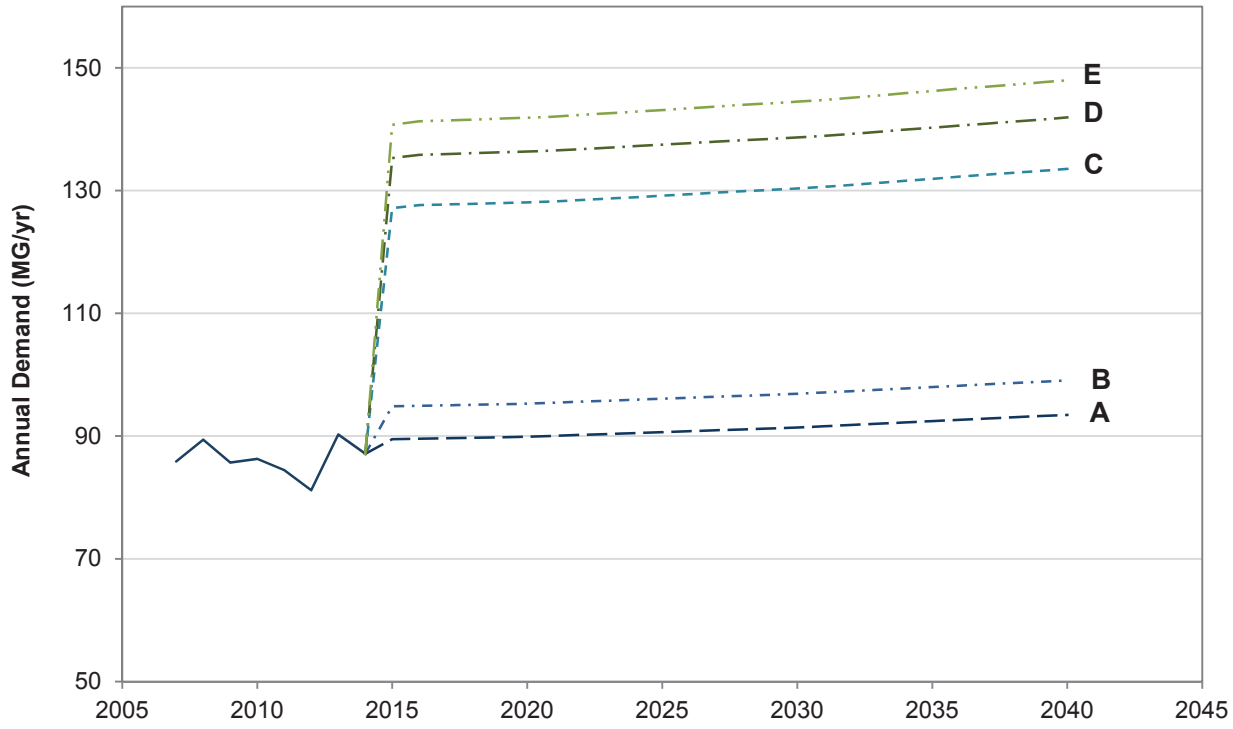


Figure 5-5. Annual Demand Scenarios for Mountain System to 2040

Section VI

System Performance Criteria

Section 6 | Existing System Evaluation

This Section provides a detailed description of the evaluation criteria used to analyze the system, identify deficiencies and to determine the size of new and replacement facilities. System performance criteria were established based on a combination of reviewing ten water master plans in California and from discussions amongst key parties involved with this Master Plan at SJWC. Table 6-1 summarizes the criteria for pump stations, storage reservoirs, and distribution pipeline facilities.

6.0 Demands

Demands used in the analysis will be based on unrestricted projected demands with the exception of Chemeketa and Mountain Springs MWCs, which will be limited to 10 gpm per service. Unrestricted demands were selected for the analysis because it was one of primary goals of the MSMP to ultimate remove this tier and using the unrestricted demand will help to identify deficiencies required to achieve this and fully incorporate the Mountain System into the rest of SJWC's distribution system.

6.1 Pump Station Criteria

Firm capacity of a pump station is defined as the capacity with the largest pumping unit out of service. Pump stations must have a firm capacity equal to or greater than maximum day demand. For hydropneumatic pressure systems, firm capacity is defined as the ability to meet peak hour demand plus fire flow conditions with the single largest pumping unit out of service. Hydropneumatic tanks are intended to provide water for domestic demand and to minimize pump starts and stops. Therefore, any storage in these hydropneumatic tanks is not considered usable storage to offset fire flow requirements.

6.2 Storage Reservoir Criteria

Water storage tanks provide multiple benefits for distribution systems including supplying water during peak demands, regulating system pressures, and supplying additional water for fire flow and emergency events, such as power outages or pump failures. The storage sizing requirements used in this Master Plan are documented in SJWC's *2014 Tank Design Handbook* and are based on necessary operational, emergency, and fire reserve storage volumes.

6.3 Distribution System Criteria

6.3.1 Service Pressure

Adequate system pressure is a basic indicator of acceptable distribution system performance. In SJWC's service area, General Order (GO) 103-A governs operating pressure at each service connection. Per GO 103-A pressure should be greater than 40 psi and less than 125 psi, except during periods of peak hourly demand pressure must be greater than 30 psi and during periods of

minimum hourly demand pressure must be less than 150 psi. SJWC has been granted a pressure variance in the Mountain District by the California Public Utilities Commission, which allows normal operating pressure at certain service locations to be below 40 psi. However, in all normal operating and during maximum day plus fire flow conditions each service connection must maintain a minimum pressure of 20 psi based on the Division of Drinking Water Waterworks standards.

6.3.2 Fire Flows

According to the Lexington Hills Community Wildfire Protection Plan published by the Santa Clara County Fire Safe Council, much of SJWC's service area in the Mountain System is considered a very high hazard risk for a wildfire.[41] Fire flow requirements for this region are under the jurisdiction of the Santa Clara County Fire Department (SCCFD). It is SJWC's policy to upgrade the existing system in response to new developments, when replacing under-sized mains that are in poor condition, or when installing main improvements for other purposes. A Letter of Understanding was signed between SCCFD and SJWC confirming that all future infrastructure and improvements in the Mountain System will be designed with a fire flow goal of 1,000 gpm for 2 hours (see Appendix C for details). It was assumed that only one fire flow event would occur at any given time. Therefore, multiple fires across the Mountain System were not evaluated as part of this master plan.

6.3.3 Pipeline Performance

SJWC uses pipeline performance criteria (maximum velocities and pressure loss) for sizing all new pipelines. The criteria included a maximum pressure headloss of 10 feet per 1,000 feet of pipeline under non-fire conditions; maximum velocities of 5 feet per second under non-fire conditions; and maximum velocities of 15 feet per second under maximum day plus fire flow conditions. Existing pipelines that exceed velocity or headloss criteria would not necessarily be deemed deficient, unless they also result in low pressure. Master plan improvements were sized using these velocities and headloss criteria.

6.4 System Reliability Criteria

SJWC adopted the *Emergency Power Program for Disaster Recover* (2011) which summarizes system reliability criteria based on GO 103-A. These criteria were designed to help SJWC establish goals for the continued operation of critical facilities and to maintain public health and safety following a significant seismic event. Planning for a seismic event in this area is particularly important, as the San Andreas Fault passes directly through the Mountain System and this area was significantly impacted by the Loma Prieta earthquake.

[41] Santa Clara County Fire Safe Council, *Lexington Hills Community Wildfire Protection Plan* (2010)

6.5 Water Quality Goals

This master plan includes water quality goals based on regulation requirements and SJWC's experiences and standard operating practices. Water quality problems are dependent on a number of factors, such as system infrastructure, water chemistry, water age and temperature. In order to meet SJWC's commitment to providing reliable drinking water, it is necessary to ensure that water in the system meets the current regulatory requirements. SJWC tests water supplies for over 200 possible contaminants and conducts over 17,000 tests on an annual basis. Additional information is available in the yearly SJWC *Consumer Confidence Report*; however, for the purposes of this master plan the water quality analysis was limited to water age, disinfectant levels and sight inspections.

Water age plays a significant role and provides a general indicator of the potential for water quality problems. According to the latest research, water tanks should be turned every five days as excessive water age in storage facilities has been found to be one of the most important factors related to water quality deterioration.[42,43] Additional free chlorine can increase the potential formation of DBPs, which could have long-term health implications for consumers. Theoretical detention time of storage facilities for storage facilities is calculated as follows (assuming complete mixing):

$$Detention\ Time = \frac{Water\ Storage\ Volume,\ \ gallons}{Daily\ Flow\ Rate,\ \ gal/day}$$

Disinfectant levels were also analyzed for residual chlorine levels throughout the entire system were within regulatory required limits. Site inspections were also conducted at each station to determine if there were any critical deficiencies that could expose the system to water quality risks.

[42] Water Research Foundation, *Maintaining Water Quality in Finished Water Storage Facilities* (1999)
[43] EPA, *Finish Water Storage Facilities* (2002)

Table 6-1: Summary of Evaluation Criteria		
Facility / Description	**Criterion**	**Reference**
Pump Stations		
Firm capacity for zones with storage	Maximum Day Demand	SJWC Design Guidelines Hydraulic Institute Standards
Firm capacity for pressure systems	Peak Hour Demand plus Fire Flow	
Storage Reservoirs		
Operational volume	16-hours Max Day Demand	SJWC Design Guidelines AWWA M42
Emergency volume	2.5-hours Max Day Demand	
Fire Reservoir volume	SJWC Fire Flow Storage Method[(a)]	
Distribution System Pressures and Pipelines		
Minimum pressure for non-fire conditions	40 psig[(b)]	AWWA M31, M41, M44, M23 CPUC GO 103-A Waterworks Title 22 SCCFD & SJWC Letter of Understanding
Minimum pressure for MDD plus fire flow	20 psig[(c)]	
Maximum pressure	125 psig[(d)]	
Fire flow	1,000 gpm for 2 hours[(e)]	
Maximum headloss, non-fire conditions	10 feet / 1000 feet	
Maximum velocity during peak	5 feet / second	
Max velocity during max day plus fire	15 feet / second	
System Reliability		
Reliability criteria that outline system reliability goals for fighting fires and restoring service to customers after a major seismic event	Diesel back-up generators at booster stations	SJWC Generator Reliability Standard Seismic Guidelines for Water Pipelines (FEMA 2005)
	Seismic fittings at fault crossings	
Water Quality		
Disinfectant residual	0.1 mg/L – 4.0 mg/L	Water Works Title 22 USEPA Publications
Target maximum reservoir water age under average day demand conditions[(f)]	5 days	

(a) SJWC Storage Tank Evaluation and Asset Management Study 2013, Fire Flow Storage = $V_{FF} - V_{IN} + V_{OUT} + VMDD$

(b) In accordance with GO 103-A Average 24-hour period

(c) California Waterworks Standards §64602

(d) In accordance with GO 103-A Section VII 6(A)

(e) Per SCCFD & SJWC Letter of Understanding (see Appendix C)

(f) This is a not a SJWC officially adopted criteria or goal, but is used as an evaluation metric for water storage tanks based on USEPA Distribution System Issues Papers and recommendations

Section VII

System Evaluation

Section 7 | System Evaluation

This section describes the analysis and identified system deficiencies for existing and future demand conditions. This section serves as the basis for the recommended capital improvements described in Section 8.

7.0 Pump Station Analysis

As described in Section 6, firm capacity is defined as the capacity with the largest pumping unit out of service and pump stations must have a firm capacity equal to or greater than maximum day demand. For pressure systems, pumps must have a firm capacity equal to peak hour demand and also be able to meet maximum day demand plus fire flow.

Table 7-1 and Table 7-2 compare existing firm pumping capacity with required firm capacity for existing and future demand conditions (2020, 2030, and 2040). Therefore, demands are 6% higher than projected demands with the Overuse Rate still in effect. Table 7-2 shows all pump stations currently have the ability to meet current MDD. However, based on the 25-year population and water demand projections, Oakmont and Holy City pump stations will quickly be undersized and unable to satisfy future demands. Currently these pumps operate more than 20 hours per day during peak summer demand periods, which validates that these pumps do not have additional capacity to meet future demand. Additional capacity will be needed and these pumps are recommended for replacement as part of the capital improvement plan.

Pumps at Locust and Pavilion stations are adequately sized to meet current and future demands although the pumps can operate upwards of 12 hours per day during peak demand. However, it is suspected that higher run times are due to the limited storage volume in Summit, Locust and Pavilion stations.

All pressure systems were found to be appropriately sized for domestic demands; however, Table 7-2 shows they do not meet peak hour demand plus fire flow requirements. In fact, Bear Creek pressure system does not have any public hydrants and Summit pressure system piping and boosters are too small to accommodate any meaningful fire flows. In both cases these pressure systems are not designed to support the Santa Clara County Fire Department fire flow target of 1,000 gpm for 2 hours. Booster pumps in Montevina pressure system were sized to meet MDD and 510 gpm of fire flow at Lexington School, which was their development specific required fire flow. Additional piping and facility improvements are needed to meet the fire flow target in all three pressure systems.

Table 7-1: Comparison of Existing and Required Pump Station Capacity										
Station	Existing Capacity[(a)] (gpd) [1]		Required Firm Pumping (gpd) [2]				Firm Capacity Deficiencies (gpd) [2] – [1] = [3]			
	Total	Firm	Existing	2020	2030	2040	Existing	2020	2030	2040
Oakmont	604,800	453,600	381,700	466,500	474,200	484,800	-	5,700	13,400	24,000
Holy City	576,000	432,000	381,700	466,500	474,200	484,800	-	11,460	19,160	29,760
Pavilion	828,000	504,000	258,200	287,100	292,200	299,100	-	-	-	-
Locust	360,000	180,000	162,600	163,800	166,700	170,700	-	-	-	-
(a) Capacity based on Hydraulic Model and Field Pump Tests (SJWC Booster and Pressure System 2013)										

Table 7-2: Comparison of Existing and Required Pressure System Capacity										
Station	Existing Capacity[(a)] (gpm) [1]		Required Firm Pumping (gpm) [2]				Firm Capacity Deficiencies (gpm) [2] – [1] = [3]			
	Total	Firm	Existing	2020	2030	2040	Existing	2020	2030	2040
Montevina Pressure	950	475	1,346	1,363	1,366	1,370	871	888	891	895
Bear Creek Pressure [(a)]	189	126	40	40	41	42	-	-	-	-
Summit Pressure	110	55	1,036	1,037	1,037	1,038	981	982	982	983
(a) Fire flow requirement not included for Bear Creek since there are no hydrants in this zone										

7.1 Storage Analysis

Reservoir storage volume is based on operational, emergency, and fire storage needs. The current SJWC criterion is to provide storage equal to 16 hours of maximum day demand for operational usage and 2.5 hours of maximum day demand for emergency usage. Fire flow storage is calculated based on SJWC's fire flow methodology described in SJWC *Storage Tank Evaluation and Asset Management Study* (2013).

As shown in Table 7-3 and Table 7-4 all Mountain System water storage reservoirs were determined to be undersized, primarily due to the fire flow volume needed to meet the Santa Clara County Fire Department requirements. Replacement storage facilities for Locust and Summit pressure zones to address the deficits will be included in the list of capital improvements. Tank Farm zone currently has no hydrants and the distribution system piping is undersized to provide the required fire flow. A main replacement project will be recommended in this zone as part of the capital improvement plan to establish fire flow capacity in this part of the service area.

There is no additional space available at Pavilion station to increase the size of the tank and the existing Pavilion tank was constructed in 2011 as part of the RMWC Agreement. Therefore, even though there is a deficit, this tank will not be part of any capital improvement recommendation. Instead improvements recommended for Holy City will include sizing of the pumps to provide additional input to reduce the fire flow storage required at Pavilion station.

7.2 Distribution Evaluation

Hydraulic evaluations were performed to assess operational performance and to identify necessary system improvements. The analysis included the following hydraulic modeling scenarios:

- Maximum Flow Condition: Fire flow scenario for existing system during a maximum demand day to verify a minimum of 1,000 gpm is available at hydrants at 20 psi minimum and to ensure pipe velocities are below 15 fps when flowing individual hydrants. A summary of the resulting hydraulic situations of fire hydrants are presented in Table 7-5 & Table 7-6
- Normal Operation Condition: Average day demand scenario to determine where service pressures are outside of the General Order 103-A required 40 – 125 psi

Fire flow is generally poor or non-existent throughout the Mountain System; however, SCCFD has recognized hydrants in this area have substandard fire flow capacity and do not meet the County's fire flow requirements.[44]

[44] SJWC, *Preliminary Engineering Study* (2005)

Table 7-3: Required Storage Capacity									
Station	Operational Storage (gal) [1]			Emergency Storage (gal) [2]			Fire Flow Storage (gal) [3]		
	Existing	2025	2040	Existing	2025	2040	Existing	2025	2040
Pavilion	87,600	101,300	104,600	13,700	15,900	16,336	54,400	56,100	56,600
Locust	31,200	31,800	32,900	4,900	5,000	5,200	69,900	70,000	70,200
Beatrice Circle	50,700	51,600	53,200	8,000	8,100	8,400	126,400	126,500	126,700
Summit	35,800	36,400	37,600	9,100	5,700	5,900	102,900	103,000	103,100
Bayview	10,200	10,400	10,700	1,600	1,700	1,700	121,300	121,300	121,400
Tank Farm	63,100	64,200	66,200	9,900	10,100	10,400	127,900	128,100	128,300

Table 7-4: Comparison of Existing and Required Storage Capacity							
Station	Existing Volume[(a)] (gallons) [5]	Required Storage (gal) [1] + [2] + [3] = [4]			Deficiency (gallons) [5] – [4] = [6]		
		Existing	2025	2040	Existing	2025	2040
Pavilion	99,000	155,700	173,300	177,600	56,700	74,300	78,600
Locust	100,000	106,000	106,800	108,300	6,000	6,800	8,300
Beatrice Circle	100,000	185,100	186,200	188,300	85,100	86,200	88,300
Summit	125,000	147,800	145,100	146,600	22,800	20,100	21,600
Bayview	100,000	133,100	133,400	133,800	33,100	33,400	33,800
Tank Farm	96,000	200,900	202,400	204,900	104,900	106,400	108,900

(a) Design Volume is defined as the volume of water in a tank from the overflow weir to the reservoir base[45]

[45] SJWC *Storage Tank Evaluation and Asset Management* (2013)

Table 7-5: Hydrant Results		
Flow (gpm)	Percentage of Hydrants	Compliant with SCCFD
1,000 or more	26%	Yes
1000 – 500	26%	No
499 – 100	31%	
99 – 1	9%	
0	8%	

Table 7-6: No Flow Hydrants	
Hydrant Number	Static Pressure (psi)
P-00081	16.8
P-00080	17.2
P-00057	14.2
P-00052	15.6
P-00034	14.7
P-00009	15.2

7.2.1 Normal Operations

Hydraulic model simulations were performed to evaluate distribution system services during an average day event to determine service pressure at each customer meter. A number of low pressure pockets were found and are presented in Figure 7-1 with the parcel outlined in red. Several key areas were determined:

Bayview Station: A number of customer services supplied by Bayview reservoir are too close in elevation to the reservoir such that their pressure is below 40 psi at the meter for the majority of the day.

Irma Lyle Drive: While this stretch of pipeline was recently replaced in 2012 due to leaks, the majority of these services are too close in elevation to Summit Reservoir. These services should be considered for incorporation into an expanded Summit Pressure system to increase static pressure.

Locust Station: A number of services along Locust Drive should be transferred to Locust Regulated zone to provide the additional pressure needed.

Lee & Madrone Drive: Because of the elevation changes along Lee and Madrone Drive there are a number of low pressure pockets along the water main in this area. This water main should be connected to a higher pressure zone to allow for an increase in pressure.

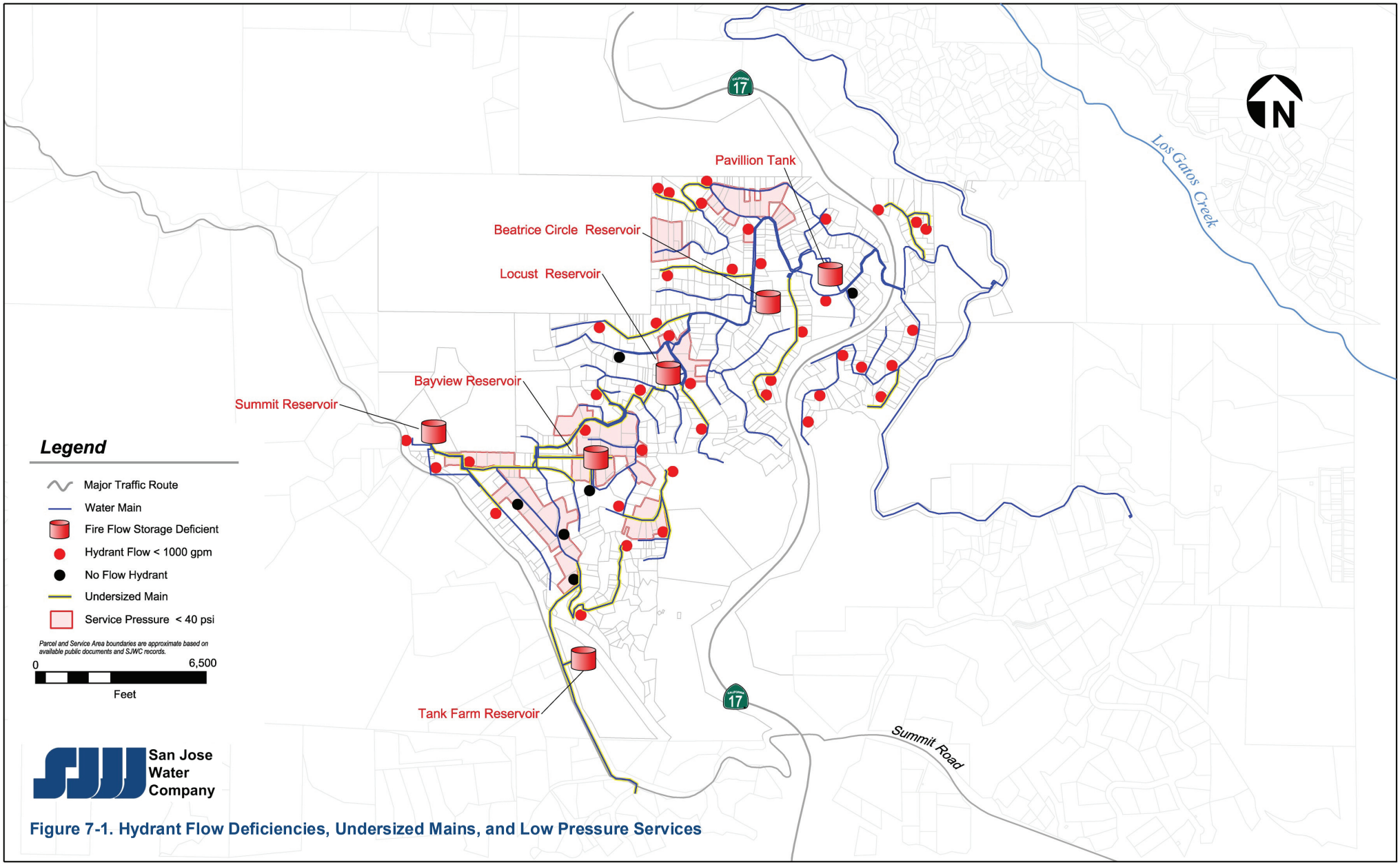


Figure 7-1. Hydrant Flow Deficiencies, Undersized Mains, and Low Pressure Services

7.3 Reliability Analysis

7.3.1 Emergency Backup Power Existing Plan

In 2011 SJWC completed the *Emergency Power Report* outlining SJWC's strategy and capacity to respond to natural disasters and maintain the established level of service goal. The service goal was defined as "*to continue serving customers, immediately after a major earthquake, or other natural disaster, by self-generating sufficient emergency power for pumping equipment to produce enough water to satisfy the baseline customer water usage*." Average winter day demand was used to represent baseline customer usage, without irrigation, which was determined as necessary to preserve health and safety of customers. The report concluded with a six-year $11 million capital improvement program recommendation to significantly upgrade SJWC's standby power network.

The report analysis found that four portable generators could be delivered to the Mountain System in the event of an emergency, which would provide sufficient pumping to meet the baseline demand. The report estimated trailers could be installed and operational within 48 hours of natural disasters. These portable generators are currently stored at Will Wool Station. All generator receptacles in the Mountain System were updated in 2007 and 2008 and are now compatible with the portable generators SJWC owns and operates.[46] A summary of the Mountain System generator needs is presented in Table 7-7.

Table 7-7: Generator Plan for Mountain System

Facility	Size (kW)	Fuel Consumption at full load (gal/hr)	On-Board Fuel Tank (gal)	Run Time on Fuel tank (hr)
Oakmont	135	10	250	25.0
Holy City	135	10	250	25.0
Pavilion	275	22	250	11.4
Locust	275	22	250	11.4
Montevina	100	8.9	225	25.3
Summit	10	3.9	100	25.6

Source: *SJWC Emergency Generator Study 2011*

7.3.2 Emergency Backup Power Analysis

According to USGS, the Loma Prieta earthquake inflicted substantial damage to mountain roads in the Summit area, including a number of bridge failures, which "…*effectively isolated a number of towns [in the area] for up to 4 days*." [47] The lack of easy travel hindered emergency

[46] SJWC, *RESA Report* (2007)
[47] USGS, *The Loma Prieta, California, Earthquake of October 17, 1989 – Lifelines* (1998)

responders and care givers from being able to access these areas. Highway 17 was closed for 32 days to all but minimal local traffic, which were escorted during specific hours only.[48]

SJWC's 2011 *Emergency Power Report* assumed portable generators will be installed and fully operational within 48 hours. Given the last experience following the Loma Prieta earthquake, roads may not be easily accessible. Although SJWC would still be able to pass through, it is likely that access will be extremely limited. Therefore, onsite mobile or permanent generators are recommended in the capital improvement plan at all pump stations during station upgrades. This will eliminate the delay in moving generators onsite, increase reliability of the system, and allow Operations greater flexibility to address other issues following a major natural disaster. Fixed emergency generators were also a recommendation of past engineering reports to increase system reliability.[49]

7.3.3 Seismic Assessment

The entire Mountain System is located in a proven high vulnerability earthquake zone. The last earthquake cost over $5,000,000 in 1989 dollars to repair.[50] The main supply line feeding the Mountain System crosses the San Andreas Fault and based on original Montevina Supply Pipeline construction drawings by GHH Engineering, they did not take the fault into account in their design of this section of pipe. Given that this pipeline is the only source of supply for the entire Mountain System, it is critical that it remains in service following an earthquake and subsequent aftershocks. Flexible connections with sufficient expansion and contraction should be incorporated at the fault crossing of this pipeline in accordance with standard seismic practices for water mains and are included in the capital improvement plan.[51] This was also one of the key recommendations from USGS during their study of the Loma Prieta earthquake aftermath. [52]

Flexible connections at reservoirs are also required since this will be a point of high stress on the reservoir during an earthquake and may cause the reservoir to fail. Pavilion is currently the only reservoir of the six Mountain System reservoirs to have a flexible inlet/outlet connection.

7.4 Water Quality Analysis

7.4.1 Water Storage Reservoirs

After reviewing available historical data on chlorine disinfectant levels in the Mountain System, only Bayview Station was identified as a reservoir of concern. SJWC's Water Quality Department has reported Operators will add additional free chlorine to Bayview reservoir in order to ensure distribution system disinfectant levels stay within the acceptable range described in Section 6. The reason for this water quality challenge is low demand in the pressure zone and

[48] USGS, *The Loma Prieta, California, Earthquake of October 17, 1989 – Lifelines* (1998)
[49] Boyle Engineering, *Montevina Pipeline Master Plan* (1991)
[50] SJWC *Mountain District Analysis* (2010)
[51] ALA, *Design Guideline for Seismic Resistant Water Pipeline Installations* (2005)
[52] USGS, *The Loma Prieta, California, Earthquake of October 17, 1989 – Lifelines* (1998)

poor design of Bayview reservoir. With only 36 customers on this 100,000 gallon reservoir and the float valve used to fill the tank, the storage reservoir remains constantly filled and does not properly cycle. Based on demand in Bayview pressure zone, the theoretical water age is approximately 11.9 days. This is substantially higher than the rest of the Mountain System, as presented in Table 7-8, and is above the five day limit.

Table 7-8: Detention Times for Storage Reservoirs

Station	Design Volume (gallons)	Average Daily Flows (gpd)	Detention Times (days)
Pavilion	99,000	166,900	0.59
Locust	100,000	124,700	0.80
Beatrice Circle	100,000	26,000	3.84
Summit	125,000	89,900	1.39
Bayview	100,000	8,400	11.90
Tank Farm	96,000	52,300	1.84

7.4.2 Pump Station Overflow

The Oakmont, Holy City, and Locust station sumps are not actually sealed from the outside environment. The sumps are an air gap and include a screened overflow vent, only one foot from the ground in some areas (see image to the right). This design provides easy access for debris, dirt, or foreign matter to enter the sump and the water distribution system. Wy'East Engineering in their 2003 study were "surprised" at the approval of this design and that it continued to be in operation to that day.[53] At minimum these vents should be sealed and a proper screened vent installed at the top of the sump.

7.4.3 Summit Pressure Location

The Summit Pressure System components are poorly situated in the middle of Summit reservoir.

The pumps are only accessible by a wooden bridge with no safety rails and suspended from the roof (see following image). Not only is this a safety hazard for Operators, but it also allows an opportunity for foreign matter to enter the reservoir and water distribution system whenever the pumps are maintained. This pressure system needs to be completely redesigned to remove it from the reservoir

[53] Wy'East, Montevina Pipeline System Capacity Analysis Report (2003)

interior and plumbed in a location more easily accessible by Operators and staff.

7.5 System Evaluation Summary

7.5.1 General Findings

The Mountain System is in need of significant improvements as demonstrated in this deficiencies analysis as well as past studies and reports that have identified major design flaws and short comings. The pump station setup is overly complex, inefficient, and susceptible to foreign debris. The original Mountain System storage reservoirs are not optimally located, undersized, lack seismic fittings, and do not meet SJWC standards site security requirements.

7.5.2 System Deficiencies Summary

Based on the system evaluation the following is a list of existing system deficiencies:

Overall System Operation: The system needs to move from a reactive type to a more industry standard water storage type municipal water system. This has been identified in previous studies as well.

Pumping Supplies: The pumps at Holy City and Oakmont will be undersized to meet expected demand in 3 – 5 years, depending on whether the Overuse Rate remains in effect. It will be critical that these stations are upsized to continue to provide a reliable source of water to customers during summer months.

Pressure Systems: The existing Montevina and Summit Pressure systems do not meet SCCFD fire flow requirements and need to incorporate an additional pumping capacity to address this. The location of Summit Pressure System also poses safety and water quality concerns.

Water Storage: The reservoir storage in the Mountain System is generally insufficient to meet fire flow capacity requirements set by SCCFD. The reservoirs are also improperly located in relation to the elevation of customers being served and are not all situated on secured and controlled sites.

Water Mains: Multiple pipelines were identified that are undersized for meeting MDD and fire flow conditions. These water mains should be upsized to provide the water necessary.

Service Pressure: Pockets of low pressure services have been identified, which do not meet GO 103-A requirements. Additional regulators or transferring services on to higher pressure zones is necessary to bring these customers up to regulatory requirements.

Section VIII

Recommended Improvements, Costs, and Sequencing

Section 8 | Recommended Improvements, Costs, and Sequencing

Capital improvement projects were developed to correct deficiencies identified in the system analysis presented in Section 7. While it is likely that other MWC's will connect with SJWC in the future as discussed in Section 5, the capital improvements presented in this Section are to address deficiencies that affect existing customers only. Tanks, pumps and pipelines improvements will be sized for future capacity needs were appropriate to avoid any premature replacement due to additional MWC connections or increased demands from existing customers.

8.0 Basis for Estimating Costs

Construction costs were based on the following assumptions:

- All new construction will meet current applicable standards and codes
- New reservoirs will be above ground welded steel type, unless otherwise noted
- Pipeline costs to connect new reservoirs to the distribution system were included in the estimated costs for the reservoir facilities, including the required seismic fittings and isolation valves
- New pumps are assumed to be submersible barrel type
- Pipe replacement is to be ductile iron cement lined and zinc coated (DICLZ) with V-Bio™ enhanced polyethylene encasement in accordance with SJWC's latest material specifications
- Costs to retire existing infrastructure are included with the improvement costs
- All costs are Present Value (PV) for 2016 in the Bay Area

Project costs cover all necessary expenditures for planning, environmental, design, construction management, legal, and other miscellaneous costs. Costs for land acquisitions were also included for new facility sites and were added to the project capital cost. Project cost estimates developed for this master plan are considered to be preliminary level. The accuracy of planning cost estimates, based on the assumptions and the methodology presented, should range from +50 to -30 percent, which is consistent with American Association of Cost Engineers (AACE) International guidelines for master planning studies or Class 5 estimates.[54] Cost estimate details are located in Appendix D.

8.1 Recommended Capital Improvements

Improvements were identified to mitigate existing system deficiencies and to meet future demand through 2040. Figures 8-1 and 8-2 depict the improvements and final system configuration, and Table 8-1 summarizes the capital improvement project costs. Total cost of all recommended improvements for the Mountain System is approximately $ 25.85 million.

[54] AACE International No.18R-97 *Cost Estimate Classification System* (2011)

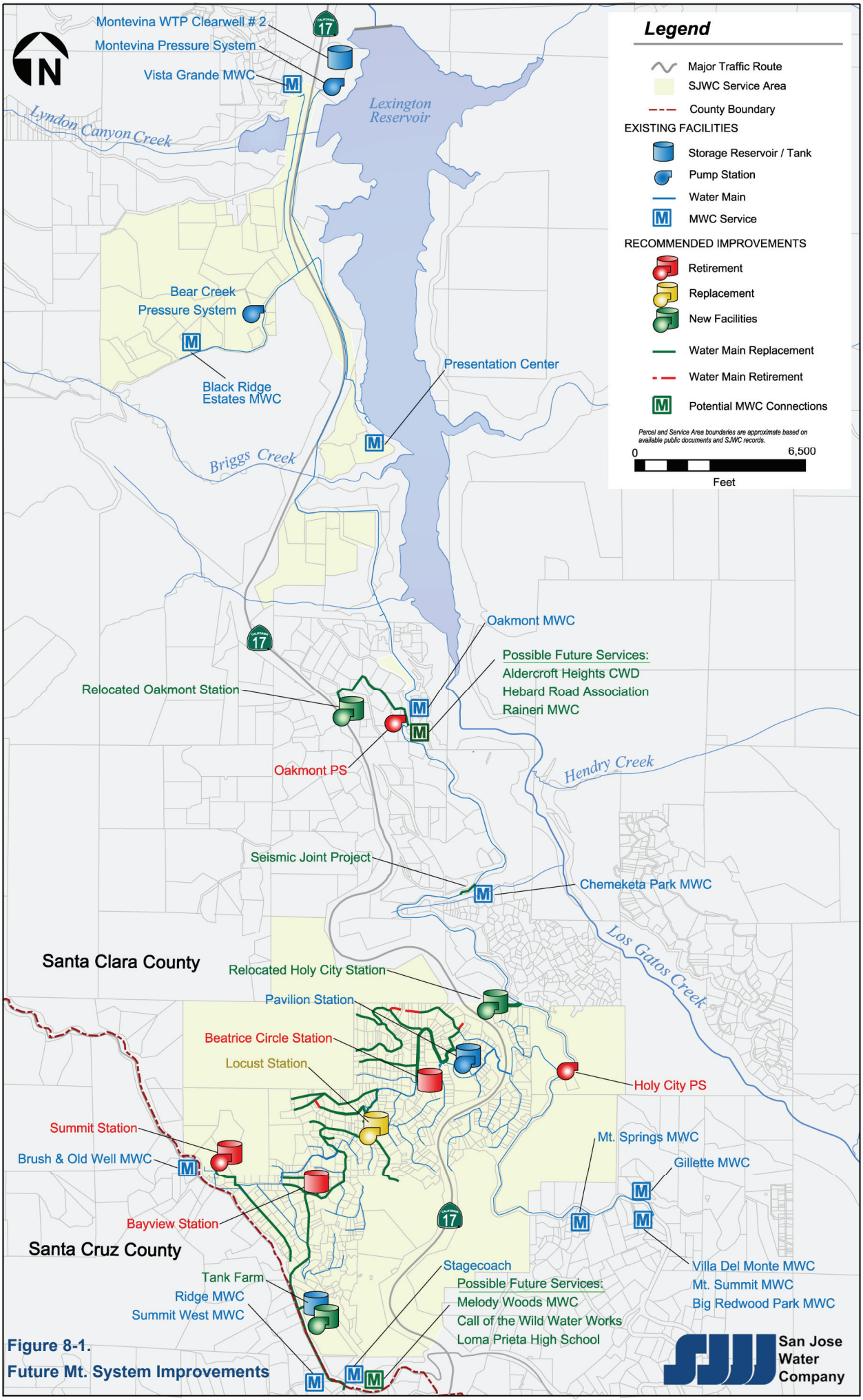


Figure 8-1.
Future Mt. System Improvements

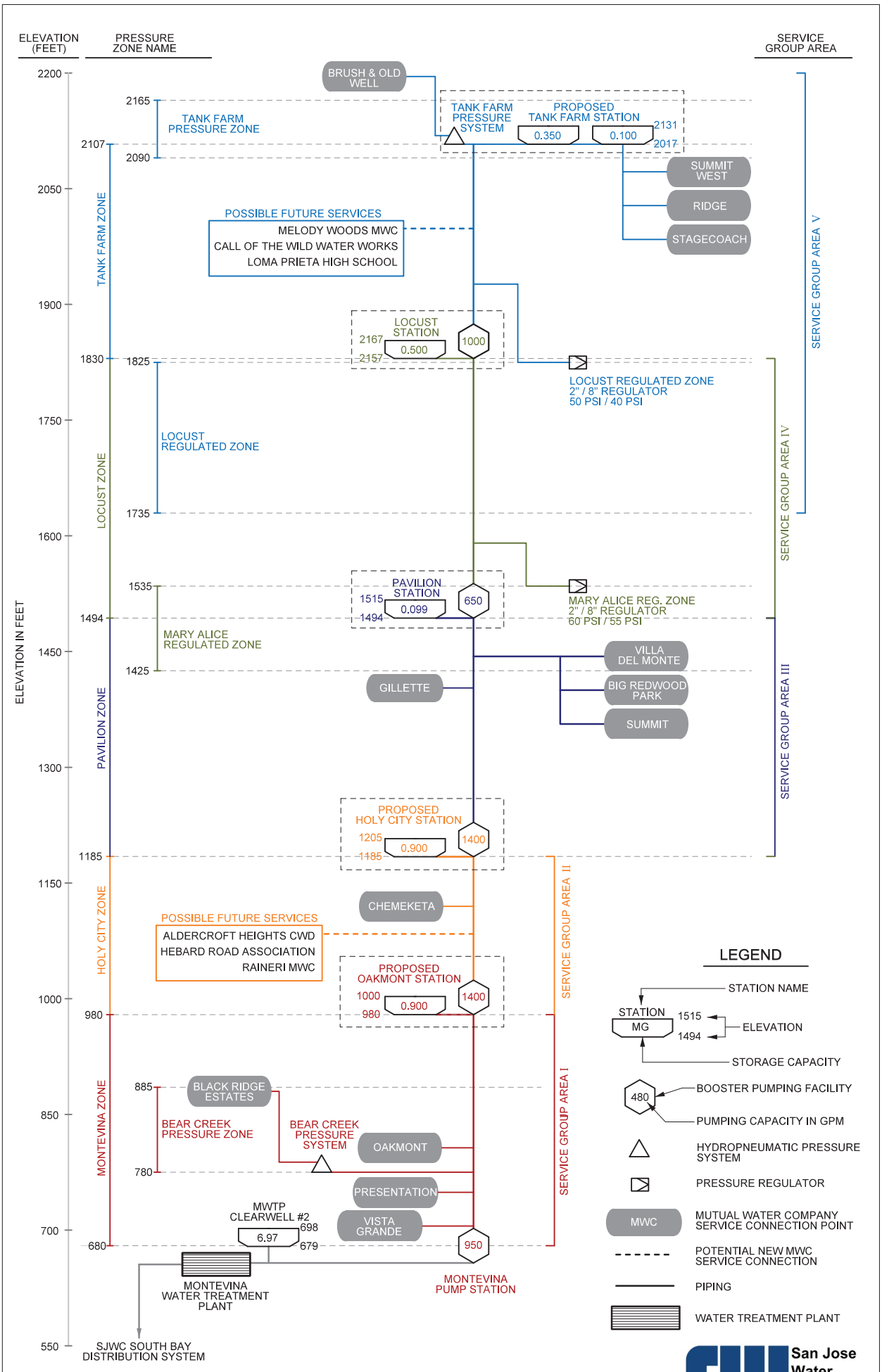


Figure 8-2. Future Mountain System Schematic Diagram

Table 8-1: Summary of Recommended Capital Improvements and Costs		
Component	**Improvement**	**Capital Cost ($ Million)**
Storage	• 3 New Reservoirs • 1 Reservoir Replacement	$ 12.17
Pumping	• 3 Pump Stations Replacements • 1 New Pressure System	$ 4.81
Pipelines	• 27,600 feet of Pipe Replacement	$ 8.87
Regulators	• 2 Regulators Stations Replacements • 1 New Regulating Station	$ 0.76
Reliability	• Seismic Fault Crossing Improvement	$ 0.20
	TOTAL	**$ 25.85**

8.1.1 Water Storage Reservoirs Improvements

New 400,000 gallon water storage reservoirs should be constructed near Oakmont and Holy City pump stations, to increase system reliability and significantly reduce complexity of the current VFD in-series pumping system. These tanks projects will relocate these critical pumping stations to new locations that can be more secure and protected. Both Oakmont and Holy City pump stations are exposed along a heavily trafficked but winding road, and if a car were to run into either of these pump station it would completely shut down the entire Mountain System for an extended period of time. The new reservoir at Oakmont station would also allow Montevina pressure zone to become gravity fed and thereby decrease electrical costs and maintenance needs while simultaneously improving fire flow ability in the zone. The new reservoir at Holy City would allow for mutual water connections between Oakmont and Holy City to have similar service to the rest of the Mountain District until the Overuse Rate is completely retired. Land acquisitions will be required for both of these tanks because existing stations are located within the public right-of-way and cannot accommodate storage facilities. Costs to purchase new land could vary significantly from what is budgeted depending on the market and negotiations, which will impact the estimated total cost of each project.

Remaining storage tanks need to be consolidated and upsized to meet current demands and fire flow requirements. To achieve this, storage will be expanded and consolidated at Tank Farm and Locust stations, which will allow for the retirement of Summit, Bayview and Beatrice Circle reservoirs. By consolidating storage this will also simplify system operations and increase overall system reliability. This will also alleviate water quality concerns, especially at Bayview, and allow for better tank turnover. The existing tank at Tank Farm will remain in service and a second tank will be constructed at 350,000 gallons. The replacement tank at Locust is assumed to be a partially buried pre-stressed concrete tank given the site restrictions and sized for 300,000 gallons.

No action will be taken at Pavilion Station since this tank is new (constructed in 2011) and there is insufficient space to expand onsite. Table 8-2 summarizes recommended reservoir capacity improvements and costs.

Table 8-2: Recommended Reservoir Capacity Improvements

Item	Project Description	Capacity (gallons)	Total Project Cost ($ Million)
R-1	Additional Tank at Tank Farm	350,000	$ 1.82
R-2	Install New Storage Tank at/near Holy City PS	400,000	$ 3.75
R-3	Install New Storage Tank at/near Oakmont PS	400,000	$ 3.44
R-4	Replace Locust Storage Tank	300,000	$ 3.15
		TOTAL	**$ 12.17**

8.1.2 Regulator Station Improvements

Additional regulators will be added to allow customers currently served low pressure water (<40 psi) to receive water more compliant with GO 103-A.

Table 8-3: Recommended Pump Station Improvements

Item	Description	Total Project Cost ($ Million)
RS-1	Locust Regulator Replacement and Upsizing	$ 0.25
RS-2	New Madrone Regulator Station Installation	$ 0.25
RS-3	Mary Alice Regulator Replacement and Upsizing	$ 0.25
	TOTAL	**$ 0.76**

8.1.3 Pump Station Improvements

In addition to the new tanks at the relocation sites for Oakmont and Holy City stations, new booster pumps will be incorporated into the design as well. The existing pumps will remain in service at their existing location during construction, simplifying design and transition to the new station location. The new Oakmont and Holy City stations will each have two pumps for reliability and each will be sized at 700-gpm. This will ensure that velocity in the existing Montevina Pipeline does not exceed 5 fps as recommended by AWWA, and the pumps will be capable of meeting MDD plus FF into 2040.

Locust PS supplies water to Summit station and these boosters will be replaced as part of the pre-stressed concrete tank installation project. However, unlike Oakmont and Holy City, the new boosters at Locust are to be constructed on the same site and in close proximity to the existing boosters, which result in design challenges and higher costs. Summit Pressure system will be

relocated to Tank Farm as part of the overall improvements at that site. This will allow easy access for Operations staff to access the station, unlike the current setup at Summit station. The pressure system will be resized for additional customers to be incorporated with this system and to provide fire flow when necessary.

Pump station improvements are summarized in Table 8-4. Costs for land acquisitions were included with the tank projects in the previous table and are not included in these estimates.

Table 8-4: Recommended Pump Station Improvements

Item	Project Description[(a)]	Total Project Cost ($ Million)
PS-1	Holy City Pump Station Relocation	$ 1.24
PS-2	Oakmont Pump Station Relocation	$ 1.24
PS-3	Install New Tank Farm Pressure System	$ 1.11
PS-4	Replace Locust Pump Station	$ 1.21
	TOTAL	**$ 4.81**

8.1.4 Distribution Improvements

Table 8-5 summarizes recommended pipeline improvements to the distribution system and projected costs. Total pipeline improvement costs are estimated at $7.90 million to address undersized piping, leaks, and necessary reconfigurations to achieve a more reliable and compliant water distribution system.

Key projects are highlighted below:

- Locust Regulated Zone pipeline replacement will simplify the existing parallel piping, rezone customers that have low pressures (below 40 psig), and upsize the piping to meet fire flow requirements.
- Broadway Road pipeline from Pavilion station to Beatrice Circle station will increase fire flow, improve static pressures for customers along the proposed alignment currently being served from Beatrice pressure zone, and allow for more efficient pumping operations.
- Madrone Drive regulated zone pipe replacement project will involve the installation of a new regulated zone.
- Bayview main replacement project will allow for low pressure customers in Bayview zone along the proposed alignment to be transferred to Summit pressure zone and later to Tank Farm pressure zone when tank and pressure system improvements at that station are complete.

- Virdelle and Woolaroc Dr. pipeline projects will allow for the expansion of Tank Farm pressure system. Once connected to the Tank Farm pressure system, this will allow for the retirement of Bayview and Summit stations.
- Oakmont pipeline extension to the possible location of the new tank and pump station.
- Summit Rd. pipeline replacement project will replace the undersized pipe in Tank Farm zone and include the installation of fire hydrants, which will improve firefighting capabilities.

Costs for inlet/outlet piping for the new reservoirs are addressed previously in the reservoir projects and are not included in the estimated costs below.

Table 8-5: Recommended Pipeline Improvements

Item	Description	Size and Length	Total Project Cost ($ Million)
D-1	Locust Regulated Pipeline Replacement	5,350-ft of 8-inch	$ 1.19
D-2	Broadway Drive Pipeline Replacement	1,970-ft of 12-inch	$ 0.63
D-3	Oakmont Station Connection	2,860-ft of 8-inch	$ 1.43
D-4	Bayview Main Replacement	5,350-ft of 12-in	$1.75
D-5	Virdelle Dr. and Woolaroc Dr. Pipeline Replacement	3,330-ft of 8-in	$ 0.78
D-6	Lee Drive Pipeline Replacement	4,400-ft of 12-in	$ 0.41
D-7	Summit Road Pipeline replacement	1,400-ft of 12-in	$ 0.45
D-8	Redwood Drive Pipeline Replacement	1,415-ft of 8-in	$ 0.70
D-9	Idalyn Drive Replacement	870-ft of 8-in	$ 0.30
D-10	McLuckie Pipeline Replacement	650-ft of 8-in	$ 0.26
		TOTAL	**$ 7.90**

8.1.5 Reliability Improvements

It is recommended to conduct a geotechnical study of the 8-inch main crossing the San Andreas Fault on Old Santa Cruz Highway. This project involves working with a geotechnical consultant to locate and map the exact fault crossing and then install the necessary flexible piping to ensure resiliency in the pipeline during the next earthquake event.

Table 8-6: Recommended Pump Station Improvements

Item	Description	Total Project Cost ($ Million)
S-1	12-inch Seismic Connection Design and Install	$ 0.20
	TOTAL	**$ 0.20**

8.2 Capital Improvement Schedule

Recommended improvement projects described in this Section were scheduled for inclusion in SJWC's overall capital improvement program plan. Project priority was based on the criticality of the system deficiency and benefit to the system reliability or ability to meet fire flow requirements. Other projects were included based on the severity of the deficiency and overall cost effectiveness. The allocation of improvement projects over the next 20 years is present in Table 8-8.

8.3 Future Recommended Action Items

8.3.1 Montevina Pipeline Replacement Size

The Montevina Pipeline is the critical lifeline to the Mountain System since it is the only source of drinking water servicing the pressure zones throughout the service area. As the system expands, this pipeline will only become more critical and will require that more flow will be pushed through it as shown in Table 8-7. It is therefore recommended that all future improvements of this pipeline be upsized to 12-inch diameter piping going forward. The increased pipe diameter will allow significantly more flow through it at lower friction losses and energy costs.

Table 8-7: Pipeline Nominal Capacity

Pipeline Size (inches)	Flow (gpm)
4	200
6	455
8	824
10	1,280
12	1,840

Based on 5 fps velocity per AWWA M41

8.3.2 Overuse Rate Abandonment

The Overuse Rate has been an issue of concern for residents and mutual water services in the Mountain System since SJWC acquired RMWC. Based on previous increases in the Overuse Rate, this Overuse Rate provides diminishing conservation returns as the Overuse Rate increases and at some point will no longer provide any water conservation benefit at all. Given that Oakmont and Holy City pump stations are operating near maximum capacity and will likely be undersized in the next 5 – 10 years, it is recommended to maintain the Overuse Rate until improvements at Oakmont and Holy City are complete. Based on the current sequencing plan, this will require the Overuse Rate to remain in effect until the end of 2023. While this may be

unpopular, the existing Overuse Rate of 500 gpd/s is already greater than the average national household average and SJWC average household demand as previously discussed.

8.3.3 Future MWC Connections

MWCs interested in connecting to SJWC should be contacted during the design of improvements within their vicinity. This would be an opportune time for MWCs to connect since improvements can be upsized as needed to meet the additional demand without the MWC bearing the entire cost of the improvement project. MWCs that opt not to connect will be required to pay the full cost of any upsizing, removal, or additional improvements necessary to connect once the recommended capital improvements are completed in their area.

8.3.4 Summit Road Expansion Feasibility Study

According to DDW, Loma Prieta school has expressed interest in connecting to a municipal water source to alleviate the challenges of operating an independent water system. For SJWC to service the school it will require a 3.2 mile long pipeline be installed from Tank Farm to the school. This project is estimated to cost upwards of $5 million project given the number of fault crossings and other infrastructure that may be required to be constructed to complete this, see Figure 8-3. However, this pipeline would enable a number of residences along Summit Road to connect as well as other mutuals in the area. It is recommended that SJWC coordinate with Loma Prieta School and the local community in the vicinity to determine the feasibility of such a project as the recommended CIP design is completed.

8.3.5 Elsman Water Treatment Feasibility Study

Based on the findings and of the Summit Road Expansion, it is further recommended to conduct a feasibility study to determine the potential for a surface water treatment plant to be constructed at Lake Elsman, see Figure 8-3. This would allow there to be more than one input available into the Mountain System and would greatly increase the system reliability and reduce pumping costs.

Table 8-8: Capital Improvement Scheduled for the Mountain System (2016 Costs in $ Millions)									
Project No.	Description	Scheduled General Rate Case for Improvement							Total Project Cost
		2015 - 2017	2018 - 2020	2021 - 2023	2024 - 2026	2027 - 2029	2030 - 2032	2033 - 2035	
Reservoir Improvements									
R-1	Tank Farm Expansion	$ 0.40			$ 1.42				**$ 1.82**
R-2	Holy City Tank Installation		$ 3.75						**$ 3.75**
R-3	Oakmont Tank Installation			$ 3.44					**$ 3.44**
R-4	Locust Tank Replacement						$ 3.15		**$ 3.15**
Pump Station Improvements									
PS-1	Holy City Replacement		$ 1.24						**$ 1.24**
PS-2	Oakmont Replacement			$ 1.24					**$ 1.24**
PS-3	Tank Farm Pressure System				$ 1.11				**$ 1.11**
PS-4	Locust PS Replacement						$ 1.21		**$ 1.21**
Reliability Improvements									
S-1	Seismic Fitting on Montevina Pipeline		$ 0.20						**$ 0.20**
Regulating Station Improvements									
RS-1	Locust Regulator Replacement	$ 0.25							**$ 0.25**
RS-2	Madrone Regulator Installation					$0.25			**$ 0.25**
RS-3	Mary Alice Regulator Upgrades						$ 0.25		**$ 0.25**
Distribution Main Improvements									
D-1	Locust Regulated Pipeline	$1.19							**$ 1.19**
D-2	Broadway Drive Pipeline		$0.63						**$ 0.63**
D-3	Oakmont Station Connection			$1.43					**$ 1.43**
D-4	Bayview Main Replacement				$1.75				**$ 1.75**
D-5	Virdell Drive Replacement				$0.78				**$ 0.78**
D-6	Lee Drive Replacement					$0.41			**$ 0.41**
D-7	Summit Road Replacement					$0.45			**$ 0.45**
D-8	Redwood Drive Replacement						$0.70		**$ 0.70**
D-9	Idalyn Drive Replacement							$0.30	**$ 0.30**
D-10	McLuckie Replacement							$0.26	**$ 0.26**
Projected Annual CIP ($ Millions)		**$ 1.84**	**$ 5.82**	**$ 6.12**	**$ 5.07**	**$ 1.11**	**$ 5.32**	**$ 0.56**	**$ 25.85**

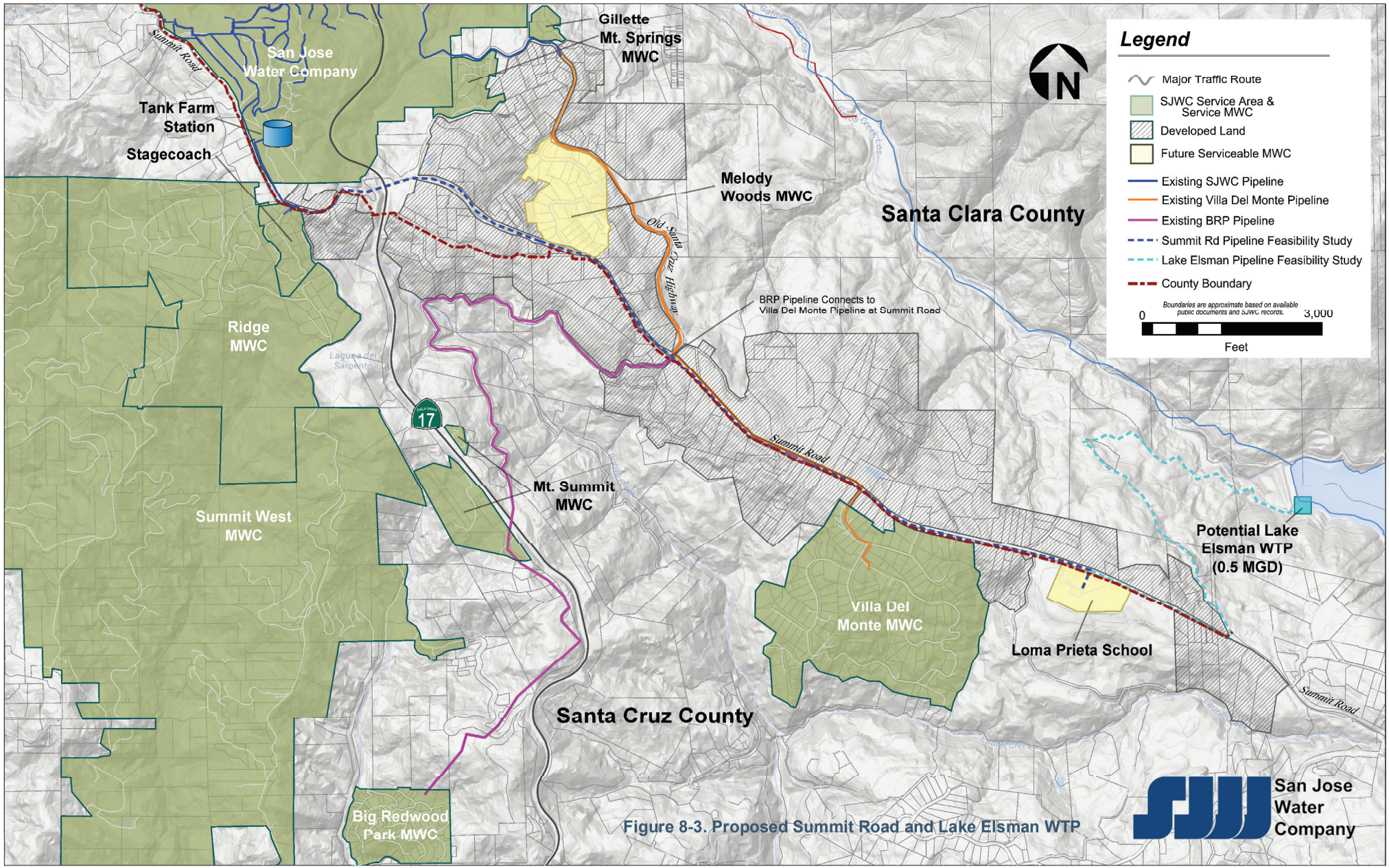


Figure 8-3. Proposed Summit Road and Lake Elsman WTP

San Jose Water Company

Section IX

References

9.0 References

Association of Bay Area Governments (ABAG), *Projections 2013*

ABAG, *Plan Bay Area – A Strategy for A Sustainable Region*, 2013

American Water Works Association (AWWA), *Forecasting Urban Water Demand* 2nd Ed., 2008

Boyle Engineering, *Montevina Pipeline Master Plan*, 1991

Santa Clara Valley Water District (SCVWD), *Urban Water Management Plan*, 2010

SJWC *Booster Pump and Pressure System Evaluation Study*, 2013

SJWC *Engineering Report Update*, 2010

SJWC *Engineering Report*, 2007

SJWC *Preliminary Engineering Study*, 2005

SJWC *Urban Water Management Plan*, 2010

SJWC *Water Storage Tank Evaluation and Asset Management*, 2013

Wy'East Engineering, *Montevina Pipeline System Capacity Analysis Report*, 2003

APPENDIX A

Santa Cruz County MWC Building Moratorium

WATER SYSTEMS WITH CONNECTION MORATORIA OR LIMITS
NO ADDITIONAL CONNECTIONS

Bonnymede Mutual Water Company
4175 Smith Grade, Santa Cruz

Calabasas Road Mutual
Calabasas Road near White Road

Fernbrook Woods Mutual Water Company
612 Nelson Road, Scotts Valley

Forest Springs Mtual Water Company
Acorn Drive, Boulder Creek

Laurel Community League Water Company
14750 Laurel Road, Los Gatos

Mountain Charlie Water Works
Mountain Charlie Road, Los Gatos

Olympia Mutual Water Company
8006 Pine Drive, Felton

Quail Hollow Circle
400 Quail Hollow, Felton

Redwood Lodge Water Company
5121 Old San Jose Road, Los Gatos

River Grove Water Company
Glengarry Road, Felton

Springbrook Park Mutual Water Company
370 Woodland Drive, Scotts Valley

Sun and Shadows Mutual Water Company
310 Beel Drive, Santa Cruz

Villa Glen Mutual Water Company
17010 Villa Glen, Los Gatos

Zayante Acres Water Association
Mc Enery Road, Felton

Big Redwood Park Water & Improvement Assn.
Upper Glenwood Hwy., Santa Cruz

Brackenbrae Country Club
Big Basin Way, Boulder Creek

Cathedral Woods
Highway 17 & Sugarloaf

Fern Grove Club
1826 Lockhart Gulch Road, Santa Cruz

Greenbelt Water Company
Redwood Drive, Aptos

Hughes Road Mutual Water Company
51 Hughes Road, Watsonville

Lompico County Water District
Lompico/Zayante

Mountain Top Mutual Water Company
3010 Smith Grade, Santa Cruz

Pinecrest Improvement Assn.
Pinecrest Drive, Boulder Creek

Ridgeview Estates Mutual Water Company
785 Quigg Way, Boulder Creek

Sky Ranch Mutual Water Company
Empire Grade Road, Santa Cruz

Sunset Beach Mutual Water Company
31 Sunset Way, Watsonville

Villa Del Monte Mutual Water Company
23550 Skyview Terrace, Los Gatos

White-Calabasas
White & Calabasas Road, Aptos

PURCHASED WATER SYSTEM
NEED CLEARANCE FROM SAN LORENZO VALLEY WATER DISTRICT

Wildwood Mutual Water Company
Highway 9, Boulder Creek

Wildwood Woodlands Mutual Water Company
Woodland Way, Boulder Creek

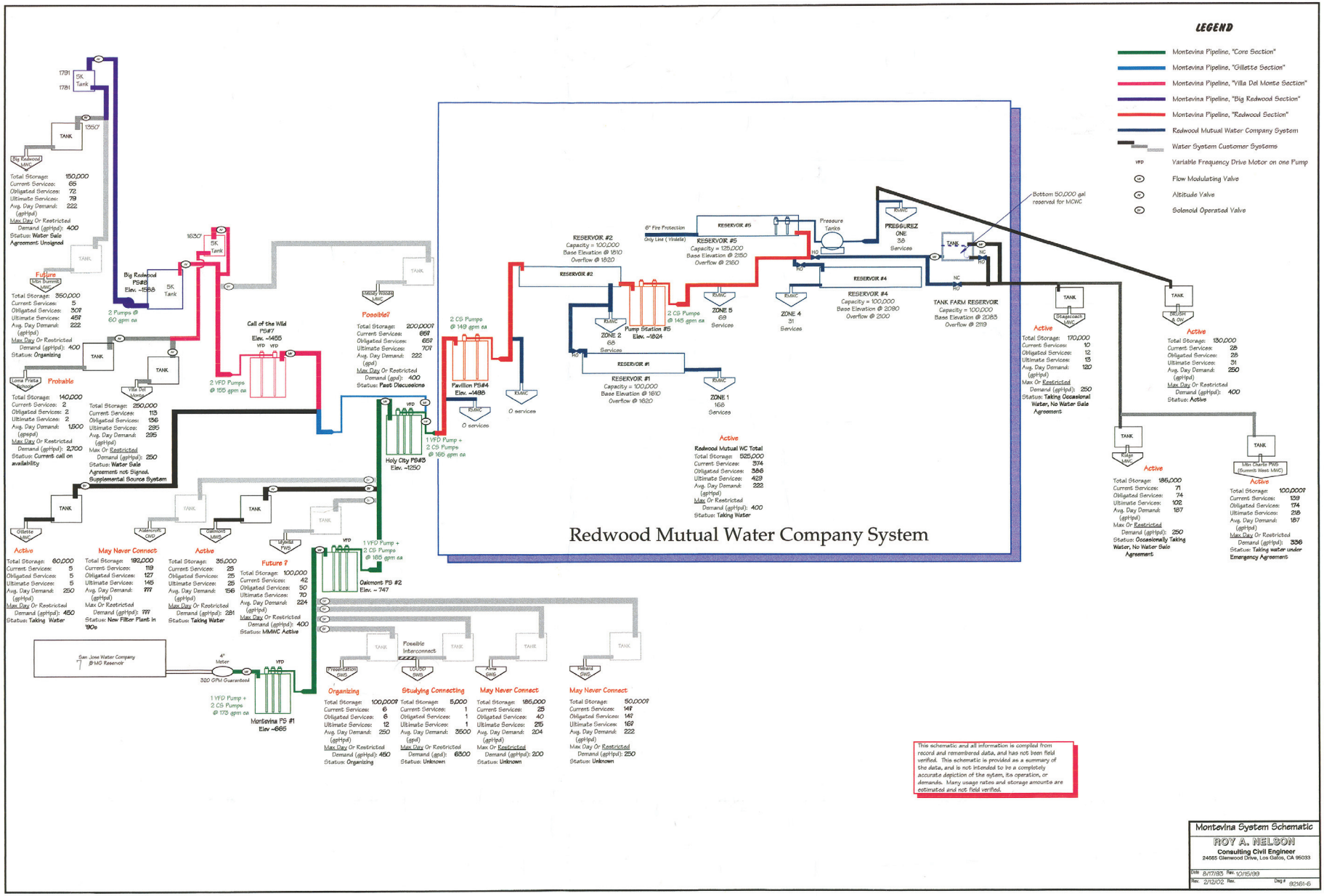
PURCHASED WATER SYSTEM
NEED CLEARANCE FROM CITIZENS UTILITIES

El Sol Mutual Water Company
1125 El Solyo Heights, Felton

Felton Heights Mutual Water Company
Lost Acre Drive, Felton

APPENDIX B

RMWC Montevina System Schematic


LEGEND
Montevina Pipeline, "Core Section"
Montevina Pipeline, "Gillette Section"
Montevina Pipeline, "Villa Del Monte Section"
Montevina Pipeline, "Big Redwood Section"
Montevina Pipeline, "Redwood Section"
Redwood Mutual Water Company System
Water System Customer Systems
VFD Variable Frequency Drive Motor on one Pump
FV Flow Modulating Valve
AV Altitude Valve
SV Solenoid Operated Valve
Redwood Mutual Water Company System
Bottom 50,000 gal reserved for MCWC
Total Storage: 150,000
Current Services: 65
Obligated Services: 72
Ultimate Services: 79
Avg. Day Demand: 222 (gpHpd)
Max Day Or Restricted Demand (gpHpd): 400
Status: Water Sale Agreement Unsigned
Future
Total Storage: 350,000
Current Services: 5
Obligated Services: 307
Ultimate Services: 457
Avg. Day Demand: 222 (gpHpd)
Max Day Or Restricted Demand (gpHpd): 400
Status: Organizing
Probable
Total Storage: 140,000
Current Services: 2
Obligated Services: 2
Ultimate Services: 2
Avg. Day Demand: 1,500 (gpspd)
Max Day Or Restricted Demand (gpHpd): 2,700
Status: Current call on availability
Total Storage: 250,000
Current Services: 113
Obligated Services: 156
Ultimate Services: 295
Avg. Day Demand: 295 (gpHpd)
Max Or Restricted Demand (gpHpd): 250
Status: Water Sale Agreement not Signed. Supplemental Source System
Possible?
Total Storage: 200,000?
Current Services: 669
Obligated Services: 669
Ultimate Services: 709
Avg. Day Demand: 222 (gpd)
Max Day Or Restricted Demand (gpd): 400
Status: Past Discussions
Active
Redwood Mutual WC Total
Total Storage: 525,000
Current Services: 574
Obligated Services: 586
Ultimate Services: 629
Avg. Day Demand: 222 (gpHpd)
Max Or Restricted Demand (gpHpd): 400
Status: Taking Water
Active
Total Storage: 170,000
Current Services: 10
Obligated Services: 12
Ultimate Services: 15
Avg. Day Demand: 120 (gpHpd)
Max Or Restricted Demand (gpHpd): 250
Status: Taking Occasional Water, No Water Sale Agreement
Active
Total Storage: 130,000
Current Services: 28
Obligated Services: 28
Ultimate Services: 31
Avg. Day Demand: 250 (gpHpd)
Max Day Or Restricted Demand (gpHpd): 400
Status: Active
Active
Total Storage: 185,000
Current Services: 71
Obligated Services: 74
Ultimate Services: 102
Avg. Day Demand: 187 (gpHpd)
Max Or Restricted Demand (gpHpd): 250
Status: Occasionally Taking Water, No Water Sale Agreement
Active
Total Storage: 100,000?
Current Services: 139
Obligated Services: 174
Ultimate Services: 218
Avg. Day Demand: 187 (gpHpd)
Max Day Or Restricted Demand (gpHpd): 336
Status: Taking water under Emergency Agreement
Active
Total Storage: 60,000
Current Services: 5
Obligated Services: 5
Ultimate Services: 5
Avg. Day Demand: 250 (gpHpd)
Max Day Or Restricted Demand (gpHpd): 450
Status: Taking Water
May Never Connect
Total Storage: 192,000
Current Services: 119
Obligated Services: 127
Ultimate Services: 145
Avg. Day Demand: 177 (gpHpd)
Max Or Restricted Demand (gpHpd): 177
Status: New Filter Plant in 90s
Active
Total Storage: 35,000
Current Services: 25
Obligated Services: 25
Ultimate Services: 25
Avg. Day Demand: 156 (gpHpd)
Max Day Or Restricted Demand (gpHpd): 281
Status: Taking Water
Future ?
Total Storage: 100,000
Current Services: 42
Obligated Services: 50
Ultimate Services: 70
Avg. Day Demand: 224 (gpHpd)
Max Day Or Restricted Demand (gpHpd): 400
Status: MMWC Active
Organizing
Total Storage: 100,000?
Current Services: 6
Obligated Services: 6
Ultimate Services: 12
Avg. Day Demand: 250 (gpHpd)
Max Day Or Restricted Demand (gpHpd): 450
Status: Organizing
Studying Connecting
Total Storage: 5,000
Current Services: 1
Obligated Services: 1
Ultimate Services: 1
Avg. Day Demand: 3500 (gpd)
Max Day Or Restricted Demand (gpd): 6500
Status: Unknown
May Never Connect
Total Storage: 185,000
Current Services: 25
Obligated Services: 40
Ultimate Services: 215
Avg. Day Demand: 204 (gpHpd)
Max Or Restricted Demand (gpHpd): 200
Status: Unknown
May Never Connect
Total Storage: 50,000?
Current Services: 147
Obligated Services: 147
Ultimate Services: 169
Avg. Day Demand: 222 (gpHpd)
Max Day Or Restricted Demand (gpHpd): 250
Status: Unknown
RESERVOIR #2
Capacity = 100,000
Base Elevation @ 1510
Overflow @ 1820
RESERVOIR #5
Capacity = 125,000
Base Elevation @ 2150
Overflow @ 2160
RESERVOIR #4
Capacity = 100,000
Base Elevation @ 2080
Overflow @ 2100
RESERVOIR #1
Capacity = 100,000
Base Elevation @ 1610
Overflow @ 1820
TANK FARM RESERVOIR
Capacity = 100,000
Base Elevation @ 2085
Overflow @ 2119
PRESSUREZ ONE
38 Services
ZONE 1
168 Services
ZONE 2
68 Services
ZONE 4
31 Services
ZONE 5
69 Services
Pressure Tanks
6" Fire Protection Only Line (Visible)
Pump Station #5
Elev. ~1824
2 CS Pumps @ 145 gpm ea
Pavilion PS#4
Elev. ~1498
2 CS Pumps @ 149 gpm ea
0 services
Holy City PS#3
Elev. ~1250
1 VFD Pump + 2 CS Pumps @ 165 gpm ea
Call of the Wild PS#7
Elev. ~1455
2 VFD Pumps @ 155 gpm ea
Big Redwood PS#2
Elev. ~1598
2 Pumps @ 60 gpm ea
Oakmont PS #2
Elev. ~ 747
1 VFD Pump + 2 CS Pumps @ 165 gpm ea
Montevina PS #1
Elev ~665
1 VFD Pump + 2 CS Pumps @ 175 gpm ea
San Jose Water Company @ MG Reservoir
4" Meter
320 GPM Guaranteed
Possible Interconnect
Big Redwood MWC
Future Mtn Summit MWC
Lorna Prieta Acres
Villa Del Monte
Gillette MWC
Aldercroft CWD
Oakmont MWS
MMWD PWS
Kirkley Woods MWC
Presentation PWS
LOUSD SWS
Alma SWS
Holland SWS
Stagecoach MWC
Ridge MWC
Mtn Charlie PWS (Summit West MWC)
This schematic and all information is compiled from record and remembered data, and has not been field verified. This schematic is provided as a summary of the data, and is not intended to be a completely accurate depiction of the system, its operation, or demands. Many usage rates and storage amounts are estimated and not field verified.
Montevina System Schematic
ROY A. NELSON
Consulting Civil Engineer
24665 Glenwood Drive, Los Gatos, CA 95033
Date 8/17/93 Rev. 10/15/99
Rev. 2/12/02 Rev.
Dwg # 92161-6

APPENDIX C

Fire Flow Requirement Letter of Understanding

San Jose Water Company

LETTER OF UNDERSTANDING BY AND BETWEEN SANTA CLARA COUNTY FIRE DEPARTMENT AND SAN JOSE WATER COMPANY

Purpose:

This letter of understanding, between Santa Clara County Fire Department (SCCFD) and San Jose Water Company (SJWC), is intended to clarify fire flow criterion for design of future water distribution facilities within SJWC's service area in the Santa Cruz Mountains of Santa Clara County as outlined in the enclosed map.

Background:

In 2006, SJWC acquired Redwood Mutual Water Company (RWMC) which significantly expanded SJWC's service area in the Santa Cruz Mountains. RMWC's existing fire hydrants did not meet SCCFD's fire flow standards and the exception from this requirement was transferred to SJWC as part of the acquisition. Then in 2011, SCCFD provided SJWC with an email correspondence identifying 1,500-gpm as the minimum acceptable fire flow for single-family residential areas throughout the system. However, the former RMWC was not designed to accommodate a 1,500-gpm flow as many of the tanks, piping and boosting systems are too small and there is not currently adequate space to install the necessary water storage facilities. In fact, some hydrants are currently simulated to provide less than 100-gpm fire flow.

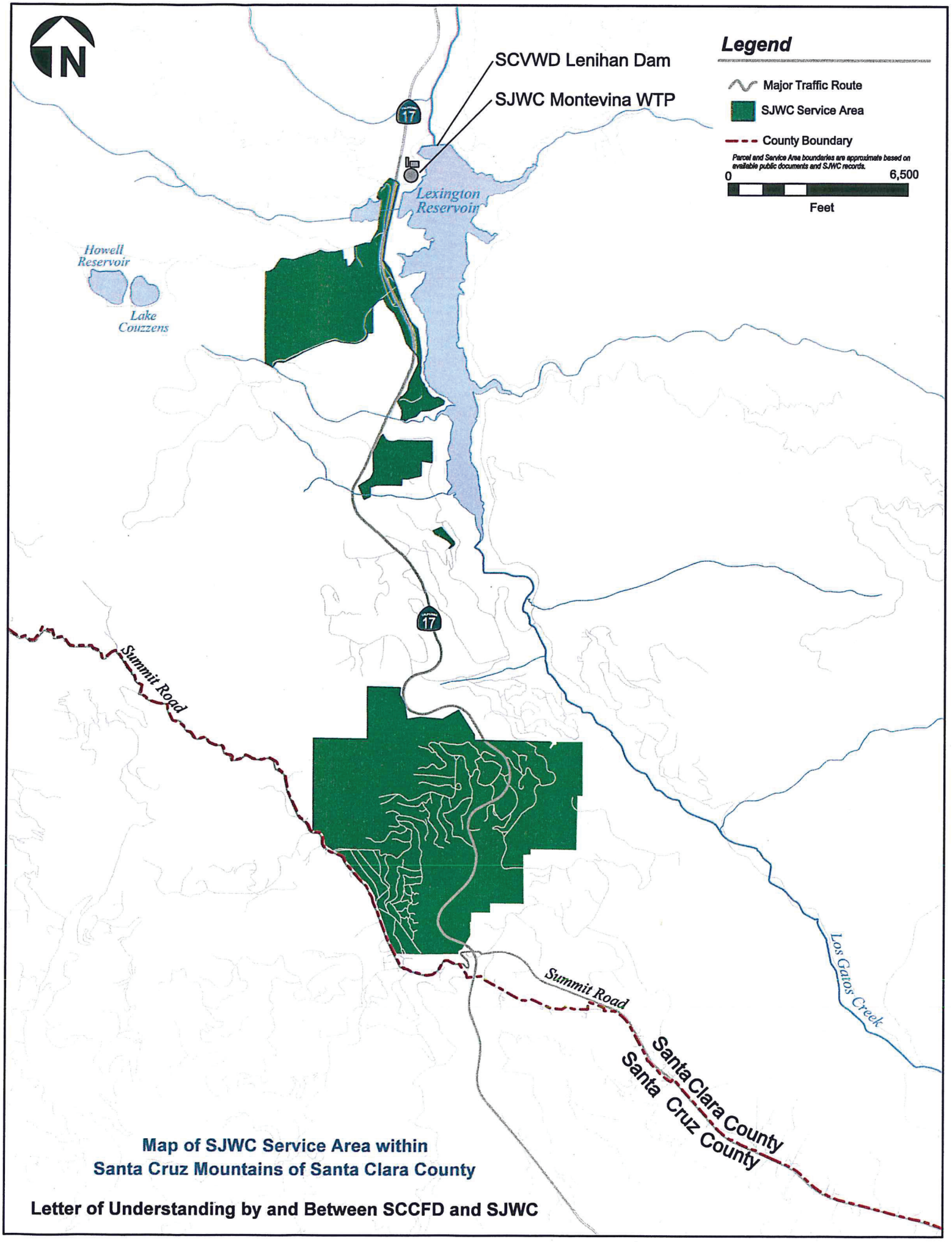
For master planning purposes, a standardized fire flow rate goal is necessary and will allow SJWC to move forward with confidence that replacement tanks, pumps and pipelines are sized appropriately. For the aforementioned service area, SJWC feels that a fire flow target of 1,000-gpm for 2-hours is appropriate.

Understanding:

Wherever reasonable, SJWC will design water system infrastructure improvements within the enclosed service area that can accommodate a rate of **1,000-gpm for 2-hours**.

Name	Date	Signature
Doug Harding, DFM SCCFD	2/4/16	Doug Harding
Jake Walsh, P.E. Engineering Unit Manager SJWC	2/4/16	Jacob Walsh

Enclosed: 1- Map of SJWC Service area within Santa Cruz Mountains of Santa Clara County



Map of SJWC Service Area within Santa Cruz Mountains of Santa Clara County

Letter of Understanding by and Between SCCFD and SJWC

APPENDIX D

Cost Estimate Details

Project Conceptual Cost Estimate

San Jose Water Company

GRC	2015 - 2017; 2024 - 2026	*Computed: GKD*	*QC: JW*
Project	R - 1	*Date: 2/9/16*	*Date: 2/12/16*
Task	Additional Tank at Tank Farm		

Item	Description	Estimated Quantity	Unit	Unit Price (includes material & labor)	Estimated Amount
Bidding Requirements					
	Mobilization (3%)	1	LS	3% of all Work	$28,128
	Insurance and Bonds (2%)	1	LS	2% of all Work	$18,752
	Subtotal				**$46,880**
Site Work					
	Demolition of Summit Earthen Reservoir	1	LS	$50,000	$50,000
	Demolition of Bayview Earthen Reservoir	1	LS	$50,000	$50,000
	Clear and Grub	1	LS	$30,000	$30,000
	3" AC Paving over 9" AB	3,000	SF	$35	$105,000
	8' Chain Link Fence w/gate	750	LS	$70	$52,500
	SWPPP Best Management Practices	1	LS	$50,000	$50,000
	Site Restoration	1	LS	$35,000	$35,000
	Subtotal				**$287,500**
Major Equipment					
	Welded Steel Tank (Weld, Paint, Foundation)	300,000	gal	$1.48	$444,000
	Shark Tank Mixing System	1	LS	$50,000	$50,000
	Anti-Climb Fence w/ 3-ft Gate	1	LS	$8,850	$8,850
	Passive CP System	1	LS	$8,000	$8,000
	Subtotal				**$510,850**
Major Piping and Valves					
	Flextend with Appurtenances for both tanks	1	LS	$75,000	$75,000
	Sample Lines and Appurtenances	1	LS	$4,000	$4,000
	Subtotal				**$79,000**
Major Structural					
	Subtotal				**$0**
Major Electrical					
	Tank Instrumentation and Electrical	1	LS	$50,000	$50,000
	Water Level Transmitter w/Box & Sensing Line	1	LS	$10,250	$10,250
	Subtotal				**$60,250**
PROJECT COST SUMMARY					
	Subtotal, Bidding Requirements				$46,880
	Subtotal, Site Work				$287,500
	Subtotal, Major Equipment				$510,850
	Subtotal, Major Piping & Valves				$79,000
	Subtotal, Major Structural				$0
	Subtotal, Major Electrical				$60,250
	Estimated Construction Cost				**$985,000**
	SJWC Design Cost (Drafting & Design)				$39,400
	Project Contingencies			15% of Construction	$148,000
	Consultants (Survey, Hazardous Disposal, etc..)			3% of Construction	$30,000
	Permits and Fees			2% of Construction	$20,000
	SJWC Labor Charge and Burden			2% of Construction	$20,000
	Construction Management			5% of Construction	$50,000
	Estimated Design and Management Cost				**$307,400**
	SUBTOTAL				**$1,293,000**
	SJWC Overhead			10% of Subtotal	$130,000
	LAND PURCHASE				$400,000
TOTAL ESTIMATED PROJECT COST					**$1,823,000**

Project Conceptual Cost Estimate

San Jose Water Company

GRC 2018 - 2020 | Computed: GKD | QC: JW

Project R - 2 | Date: 2/9/16 | Date: 2/12/16

Task Holy City Tank Improvement

Item	Description	Estimated Quantity	Unit	Unit Price (includes material & labor)	Estimated Amount
Bidding Requirements					
	Mobilization (3%)	1	LS	3% of all Work	$42,543
	Insurance and Bonds (2%)	1	LS	2% of all Work	$28,362
	Subtotal				**$70,905**
Site Work					
	Demolition of Existing Structure	1	LS	$45,000	$45,000
	Clear and Grub	1	LS	$35,000	$35,000
	3" AC Paving over 9" AB	9,000	SF	$35	$315,000
	8' Chain Link Fence w/gate	1,200	LS	$70	$84,000
	SWPPP Best Management Practices	1	LS	$150,000	$150,000
	Site Restoration	1	LS	$35,000	$35,000
	Subtotal				**$395,000**
Major Equipment					
	Welded Steel Tank (Weld, Paint, Foundation)	400,000	gal	$1.33	$532,000
	Shark Tank Mixing System	1	LS	$50,000	$50,000
	Anti-Climb Fence w/ 3-ft Gate	1	LS	$8,850	$8,850
	Passive CP System (V&A Quote)	1	LS	$8,000	$8,000
	Subtotal				**$598,850**
Major Piping and Valves					
	Flextend with Appurtenances	1	LS	$50,000	$50,000
	Sample Lines and Appurtenances	1	LS	$4,000	$4,000
	12" DICL Watermain Piping	700	LF	$300	$210,000
	Subtotal				**$264,000**
Major Structural					
	Retaining Wall	2,000	SF	$50	$100,000
	Subtotal				**$100,000**
Major Electrical					
	Tank Instrumentation and Electrical	1	LS	$50,000	$50,000
	Water Level Transmitter w/Box & Sensing Line	1	LS	$10,250	$10,250
	Subtotal				**$60,250**
PROJECT COST SUMMARY					
	Subtotal, Bidding Requirements				$70,905
	Subtotal, Site Work				$395,000
	Subtotal, Major Equipment				$598,850
	Subtotal, Major Piping & Valves				$264,000
	Subtotal, Major Structural				$100,000
	Subtotal, Major Electrical				$60,250
	Estimated Construction Cost				**$1,490,000**
	SJWC Design Cost (Drafting & Design)				$150,000
	Project Contingencies			15% of Construction	$224,000
	Consultants (Survey, Hazardous Disposal, etc..)			3% of Construction	$45,000
	Permits and Fees			2% of Construction	$30,000
	SJWC Labor Charge and Burden			2% of Construction	$30,000
	Construction Management			5% of Construction	$75,000
	Estimated Design and Management Cost				**$554,000**
	SUBTOTAL				**$2,044,000**
	SJWC Overhead			10% of Subtotal	$205,000
	LAND PURCHASE			LS	$1,500,000
	TOTAL ESTIMATED PROJECT COST				**$3,749,000**

Project Conceptual Cost Estimate

San Jose Water Company

GRC 2021 - 2023 | Computed: GKD | QC: JW

Project R - 3 | Date: 2/9/16 | Date: 2/12/16

Task Oakmont Tank Improvement

Item	Description	Estimated Quantity	Unit	Unit Price (includes material & labor)	Estimated Amount
Bidding Requirements					
	Mobilization (3%)	1	LS	3% of all Work	$31,218
	Insurance and Bonds (2%)	1	LS	2% of all Work	$20,812
	Subtotal				**$52,030**
Site Work					
	Demolition of Existing Structure	1	LS	$35,000	$35,000
	Clear and Grub	1	LS	$30,000	$30,000
	3" AC Paving over 9" AB	7,500	SF	$35	$262,500
	8' Chain Link Fence w/gate	900	LS	$70	$63,000
	SWPPP Best Management Practices	1	LS	$150,000	$150,000
	Site Restoration	1	LS	$35,000	$35,000
	Subtotal				**$327,500**
Major Equipment					
	Welded Steel Tank (Weld, Paint, Foundation)	400,000	gal	$1.33	$532,000
	Shark Tank Mixing System	1	LS	$50,000	$50,000
	Anti-Climb Fence w/ 3-ft Gate	1	LS	$8,850	$8,850
	Passive CP System (V&A Quote)	1	LS	$8,000	$8,000
	Subtotal				**$598,850**
Major Piping and Valves					
	Flextend with Appurtenances	1	LS	$50,000	$50,000
	Sample Lines and Appurtenances	1	LS	$4,000	$4,000
	Subtotal				**$54,000**
Major Structural					
	Subtotal				**$0**
Major Electrical					
	Tank Instrumentation and Electrical	1	LS	$50,000	$50,000
	Water Level Transmitter w/Box & Sensing Line	1	LS	$10,250	$10,250
	Subtotal				**$60,250**
PROJECT COST SUMMARY					
	Subtotal, Bidding Requirements				$52,030
	Subtotal, Site Work				$327,500
	Subtotal, Major Equipment				$598,850
	Subtotal, Major Piping & Valves				$54,000
	Subtotal, Major Structural				$0
	Subtotal, Major Electrical				$60,250
	Estimated Construction Cost				**$1,093,000**
	SJWC Design Cost (Drafting & Design)				$150,000
	Project Contingencies			15% of Construction	$164,000
	Consultants (Survey, Hazardous Disposal, etc..)			3% of Construction	$33,000
	Permits and Fees			2% of Construction	$22,000
	SJWC Labor Charge and Burden			2% of Construction	$22,000
	Construction Management			5% of Construction	$55,000
	Estimated Design and Management Cost				**$446,000**
	SUBTOTAL				**$1,539,000**
	SJWC Overhead			10% of Subtotal	$154,000
	LAND PURCHASE			LS	$1,750,000
	TOTAL ESTIMATED PROJECT COST				**$3,443,000**

Project Conceptual Cost Estimate

San Jose Water Company

GRC	2030 - 2032	Computed: GKD	QC: JW
Project	R - 4	Date: 2/9/16	Date: 2/12/16
Task	Locust Station Improvements		

Item	Description	Estimated Quantity	Unit	Unit Price (includes material & labor)	Estimated Amount
Bidding Requirements					
	Mobilization (3%)	1	LS	3% of all Work	$57,648
	Insurance and Bonds (2%)	1	LS	2% of all Work	$38,432
	Subtotal				**$96,080**
Site Work					
	Demolition of Existing Earthen Reservoir	1	LS	$50,000	$50,000
	Demolition of Beatrice Circle Earthen Reservoir	1	LS	$50,000	$50,000
	Temporary Tanks and Piping	1	LS	$200,000	$200,000
	3" AC Paving over 9" AB	2,500	SF	$35	$87,500
	8' Chain Link Fence w/gate	500	LS	$70	$35,000
	SWPPP Best Management Practices	1	LS	$200,000	$200,000
	Site Restoration	1	LS	$35,000	$35,000
	Subtotal				**$422,500**
Major Equipment					
	Concrete Tank	300,000	gal	$4.31	$1,293,000
	Shark Tank Mixing System	1	LS	$50,000	$50,000
	Anti-Climb Fence w/ 3-ft Gate	1	LS	$8,850	$8,850
	Passive CP System (V&A Quote)	1	LS	$8,000	$8,000
	Subtotal				**$1,359,850**
Major Piping and Valves					
	Flextend with Appurtenances	1	LS	$75,000	$75,000
	Sample Lines and Appurtenances	1	LS	$4,000	$4,000
	Subtotal				**$79,000**
Major Structural					
	Subtotal				**$0**
Major Electrical					
	Tank Instrumentation and Electrical	1	LS	$50,000	$50,000
	Water Level Transmitter w/Box & Sensing Line	1	LS	$10,250	$10,250
	Subtotal				**$60,250**
PROJECT COST SUMMARY					
	Subtotal, Bidding Requirements				$96,080
	Subtotal, Site Work				$422,500
	Subtotal, Major Equipment				$1,359,850
	Subtotal, Major Piping & Valves				$79,000
	Subtotal, Major Structural				$0
	Subtotal, Major Electrical				$60,250
	Estimated Construction Cost				**$2,018,000**
	SJWC Design Cost (Drafting & Design)				$300,000
	Project Contingencies			15% of Construction	$303,000
	Consultants (Survey, Hazardous Disposal, etc..)			3% of Construction	$61,000
	Permits and Fees			2% of Construction	$41,000
	SJWC Labor Charge and Burden			2% of Construction	$41,000
	Construction Management			5% of Construction	$101,000
	Estimated Design and Management Cost				**$847,000**
	SUBTOTAL				**$2,865,000**
	SJWC Overhead			10% of Subtotal	$287,000
	LAND PURCHASE				$0
TOTAL ESTIMATED PROJECT COST					**$3,152,000**

Project Conceptual Cost Estimate

San Jose Water Company

GRC	2018 - 2020	Computed: GKD	QC: JW
Project	PS-1	Date: 2/9/16	Date: 2/12/16
Task	Holy City Pump Station Relocation		

Item	Description	Estimated Quantity	Unit	Unit Price (includes material & labor)	Estimated Amount
Bidding Requirements					
	Mobilization (3%)	1	LS	3% of all Work	$23,610
	Insurance and Bonds (2%)	1	LS	2% of all Work	$15,740
	Subtotal				**$39,350**
Site Work					
	Retirement of Old Pump Station	1	LS	$35,000.00	$35,000
	Subtotal				**$35,000**
Major Equipment					
	2 Submersible Pump Bowls and Barrels	2	EA	$50,000	$100,000
	2 Submersible Motors	2	EA	$30,000	$60,000
	Subtotal				**$160,000**
Major Piping and Valves					
	6" Discharge Piping w/ Pumper Connection	1	LS	$20,000	$20,000
	8" Suction Piping w/ Pumper Connection	1	LS	$35,000	$35,000
	Subtotal				**$55,000**
Major Structural					
	Pump Barrels and Concrete Pump Pad	2	EA	$40,000	$80,000
	MCC Concrete Pad	1	LS	$10,000	$10,000
	Subtotal				**$90,000**
Major Electrical					
	6012 2" probe holders and 1500 series relay	2	EA	$3,500	$7,000
	High Pressure Sensors w/ 3/4" copper	2	EA	$2,500	$5,000
	Flow Meters	2	EA	$15,000	$30,000
	Furnish and Install New MCC w/ATS	1	LS	$275,000	$275,000
	Conduits and Cables (Miscellaneous)	1	LS	$30,000	$30,000
	Generator Purchase and Install	1	LS	$100,000	$100,000
	Subtotal				**$447,000**
PROJECT COST SUMMARY					
	Subtotal, Bidding Requirements				$39,350
	Subtotal, Site Work				$35,000
	Subtotal, Major Equipment				$160,000
	Subtotal, Major Piping & Valves				$55,000
	Subtotal, Major Structural				$90,000
	Subtotal, Major Electrical				$447,000
	Estimated Construction Cost				**$827,000**
	SJWC Design Cost (Drafting & Design)				$75,000
	Project Contingencies			15% of Construction	$125,000
	Consultants (Survey, Hazardous Disposal, etc..)			3% of Construction	$25,000
	Permits and Fees			2% of Construction	$17,000
	SJWC Labor Charge and Burden			2% of Construction	$17,000
	Construction Management			5% of Construction	$42,000
	Estimated Design and Management Cost				**$301,000**
	SUBTOTAL				**$1,128,000**
	SJWC Overhead			10% of Subtotal	$113,000
	LAND PURCHASE			INCLUDED WITH TANK	$0
TOTAL ESTIMATED PROJECT COST					**$1,241,000**

Project Conceptual Cost Estimate

San Jose Water Company

GRc	2021 - 2023	Computed: GKD	QC: JW
Project	PS-2	Date: 2/9/16	Date: 2/12/16
Task	Oakmont Pump Station Relocation		

Item	Description	Estimated Quantity	Unit	Unit Price (includes material & labor)	Estimated Amount
Bidding Requirements					
	Mobilization (3%)	1	LS	3% of all Work	$23,610
	Insurance and Bonds (2%)	1	LS	2% of all Work	$15,740
	Subtotal				**$39,350**
Site Work					
	Retirement of Old Pump Station	1	LS	$35,000.00	$35,000
	Subtotal				**$35,000**
Major Equipment					
	2 Submersible Pump Bowls and Barrels	2	EA	$50,000	$100,000
	2 Submersible Motors	2	EA	$30,000	$60,000
	Subtotal				**$160,000**
Major Piping and Valves					
	6" Discharge Piping w/ Pumper Connection	1	LS	$20,000	$20,000
	8" Suction Piping w/ Pumper Connection	1	LS	$35,000	$35,000
	Subtotal				**$55,000**
Major Structural					
	Pump Barrels and Concrete Pump Pad	2	EA	$40,000	$80,000
	MCC Concrete Pad	1	LS	$10,000	$10,000
	Subtotal				**$90,000**
Major Electrical					
	6012 2" probe holders and 1500 series relay	2	EA	$3,500	$7,000
	High Pressure Sensors w/ 3/4" copper	2	EA	$2,500	$5,000
	Flow Meters	2	EA	$15,000	$30,000
	Furnish and Install New MCC w/ATS	1	LS	$275,000	$275,000
	Conduits and Cables (Miscellaneous)	1	LS	$30,000	$30,000
	Generator Purchase and Install	1	LS	$100,000	$100,000
	Subtotal				**$447,000**
PROJECT COST SUMMARY					
	Subtotal, Bidding Requirements				$39,350
	Subtotal, Site Work				$35,000
	Subtotal, Major Equipment				$160,000
	Subtotal, Major Piping & Valves				$55,000
	Subtotal, Major Structural				$90,000
	Subtotal, Major Electrical				$447,000
	Estimated Construction Cost				**$827,000**
	SJWC Design Cost (Drafting & Design)				$75,000
	Project Contingencies			15% of Construction	$125,000
	Consultants (Survey, Hazardous Disposal, etc..)			3% of Construction	$25,000
	Permits and Fees			2% of Construction	$17,000
	SJWC Labor Charge and Burden			2% of Construction	$17,000
	Construction Management			5% of Construction	$42,000
	Estimated Design and Management Cost				**$301,000**
	SUBTOTAL				**$1,128,000**
	SJWC Overhead			10% of Subtotal	$113,000
	LAND PURCHASE			INCLUDED WITH TANK	$0
TOTAL ESTIMATED PROJECT COST					**$1,241,000**

Project Conceptual Cost Estimate

San Jose Water Company

GRC 2030 - 2032 | Computed: GKD | QC: JW

Project PS - 4 | Date: 2/9/16 | Date: 2/12/16

Task Locust Pump Station Improvements

Item	Description	Estimated Quantity	Unit	Unit Price (includes material & labor)	Estimated Amount
Bidding Requirements					
	Mobilization (3%)	1	LS	3% of all Work	$23,010
	Insurance and Bonds (2%)	1	LS	2% of all Work	$15,340
	Subtotal				**$38,350**
Site Work					
	Retirement of Old Pump Station	1	LS	$15,000.00	$15,000
	Subtotal				**$15,000**
Major Equipment					
	2 Submersible Pump Bowls and Barrels	2	EA	$50,000	$100,000
	2 Submersible Motors	2	EA	$30,000	$60,000
	Subtotal				**$160,000**
Major Piping and Valves					
	6" Discharge Piping w/ Pumper Connection	1	LS	$20,000	$20,000
	8" Suction Piping w/ Pumper Connection	1	LS	$35,000	$35,000
	Subtotal				**$55,000**
Major Structural					
	Pump Barrels and Concrete Pump Pad	2	EA	$40,000	$80,000
	MCC Concrete Pad	1	LS	$10,000	$10,000
	Subtotal				**$90,000**
Major Electrical					
	6012 2" probe holders and 1500 series relay	2	EA	$3,500	$7,000
	High Pressure Sensors w/ 3/4" copper	2	EA	$2,500	$5,000
	Flow Meters	2	EA	$15,000	$30,000
	Furnish and Install New MCC w/ATS	1	LS	$275,000	$275,000
	Conduits and Cables (Miscellaneous)	1	LS	$30,000	$30,000
	Generator Purchase and Install	1	LS	$100,000	$100,000
	Subtotal				**$447,000**
PROJECT COST SUMMARY					
	Subtotal, Bidding Requirements				$38,350
	Subtotal, Site Work				$15,000
	Subtotal, Major Equipment				$160,000
	Subtotal, Major Piping & Valves				$55,000
	Subtotal, Major Structural				$90,000
	Subtotal, Major Electrical				$447,000
	Estimated Construction Cost				**$806,000**
	SJWC Design Cost (Drafting & Design)				$75,000
	Project Contingencies			15% of Construction	$121,000
	Consultants (Survey, Hazardous Disposal, etc..)			3% of Construction	$25,000
	Permits and Fees			2% of Construction	$17,000
	SJWC Labor Charge and Burden			2% of Construction	$17,000
	Construction Management			5% of Construction	$41,000
	Estimated Design and Management Cost				**$296,000**
	SUBTOTAL				**$1,102,000**
	SJWC Overhead			10% of Subtotal	$111,000
	LAND PURCHASE			Included with R-4	$0
TOTAL ESTIMATED PROJECT COST					**$1,213,000**

Project Conceptual Cost Estimate

San Jose Water Company

GRC 2024 - 2026 | Computed: GKD | QC: JW

Project PS - 4 | Date: 2/9/16 | Date: 2/12/16

Task Tank Farm Pressure System Improvement

Item	Description	Estimated Quantity	Unit	Unit Price (includes material & labor)	Estimated Amount
Bidding Requirements					
	Mobilization (3%)	1	LS	3% of all Work	$20,805
	Insurance and Bonds (2%)	1	LS	2% of all Work	$13,870
	Subtotal				**$34,675**
Site Work					
	Subtotal				**$0**
Major Equipment					
	Fiberglass pump house	1	LS	$85,000	$85,000
	Storage Bladder Tanks	1	LS	$50,000	$50,000
	Package Pump System w/Fire Pump	1	LS	$65,000	$65,000
	Subtotal				**$200,000**
Major Piping and Valves					
	4" Discharge Piping w/ Pumper Connection	1	LS	$25,000	$25,000
	4" Suction Piping w/ Pumper Connection	1	LS	$25,000	$25,000
	Subtotal				**$50,000**
Major Structural					
	Pump House Concrete Pad	1	LS	$15,000	$15,000
	New MCC Concrete Pad	1	LS	$10,000	$10,000
	Subtotal				**$25,000**
Major Electrical					
	Pressure Sensor Lines	1	LS	$3,500	$3,500
	Furnish and Install New MCC w/ATS	1	LS	$275,000	$275,000
	Conduits and Cables (Miscellaneous)	1	LS	$40,000	$40,000
	Generator Purchase and Install	1	LS	$100,000	$100,000
	Subtotal				**$418,500**
PROJECT COST SUMMARY					
	Subtotal, Bidding Requirements				$34,675
	Subtotal, Site Work				$0
	Subtotal, Major Equipment				$200,000
	Subtotal, Major Piping & Valves				$50,000
	Subtotal, Major Structural				$25,000
	Subtotal, Major Electrical				$418,500
	Estimated Construction Cost				**$729,000**
	SJWC Design Cost (Drafting & Design)				$75,000
	Project Contingencies			15% of Construction	$110,000
	Consultants (Survey, Hazardous Disposal, etc..)			3% of Construction	$22,000
	Permits and Fees			2% of Construction	$15,000
	SJWC Labor Charge and Burden			2% of Construction	$15,000
	Construction Management			5% of Construction	$37,000
	Estimated Design and Management Cost				**$274,000**
	SUBTOTAL				**$1,003,000**
	SJWC Overhead			10% of Subtotal	$111,000
	LAND PURCHASE			INCLUDED WITH R-3	$0
TOTAL ESTIMATED PROJECT COST					**$1,114,000**

Project Conceptual Cost Estimate

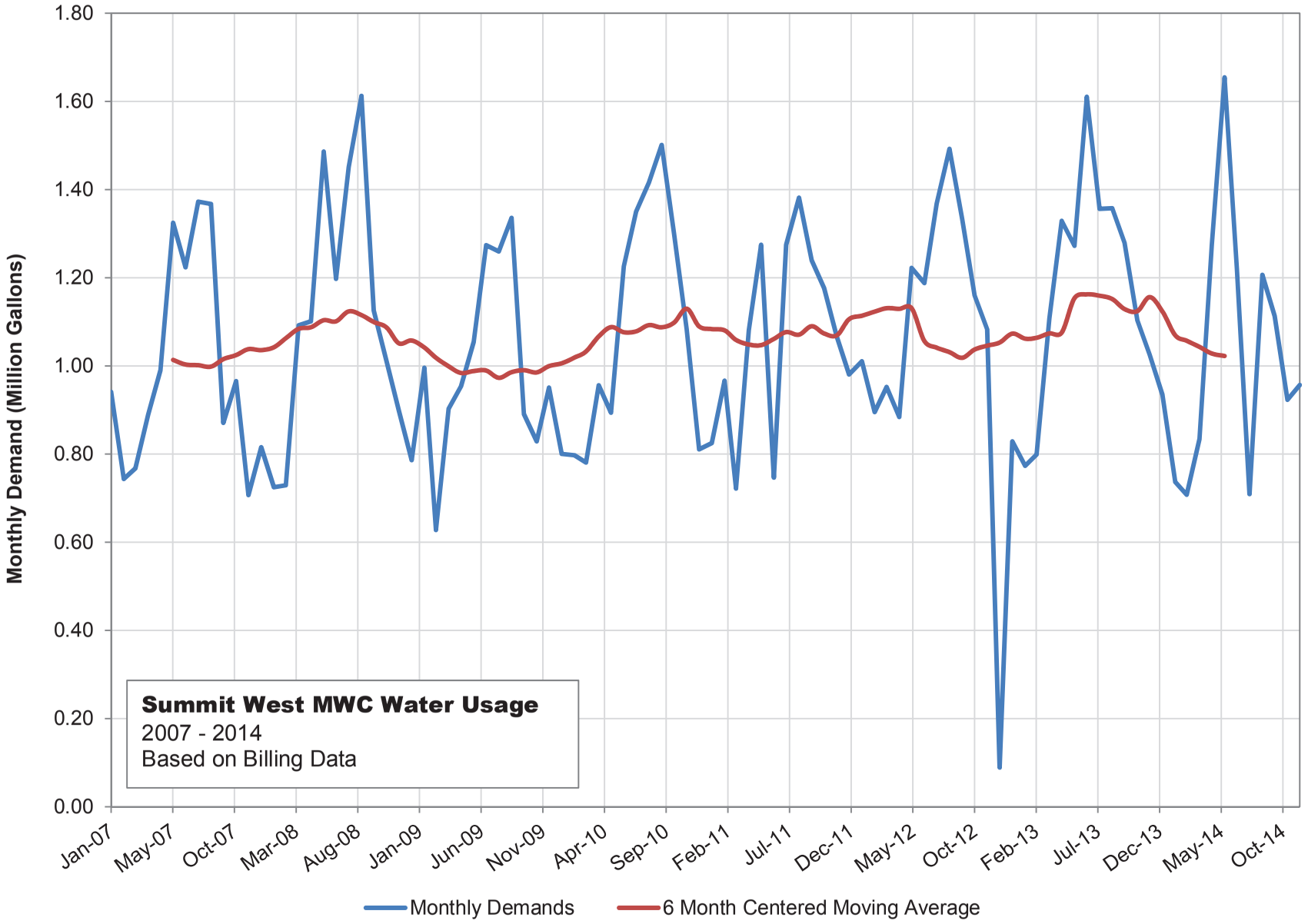
San Jose Water Company

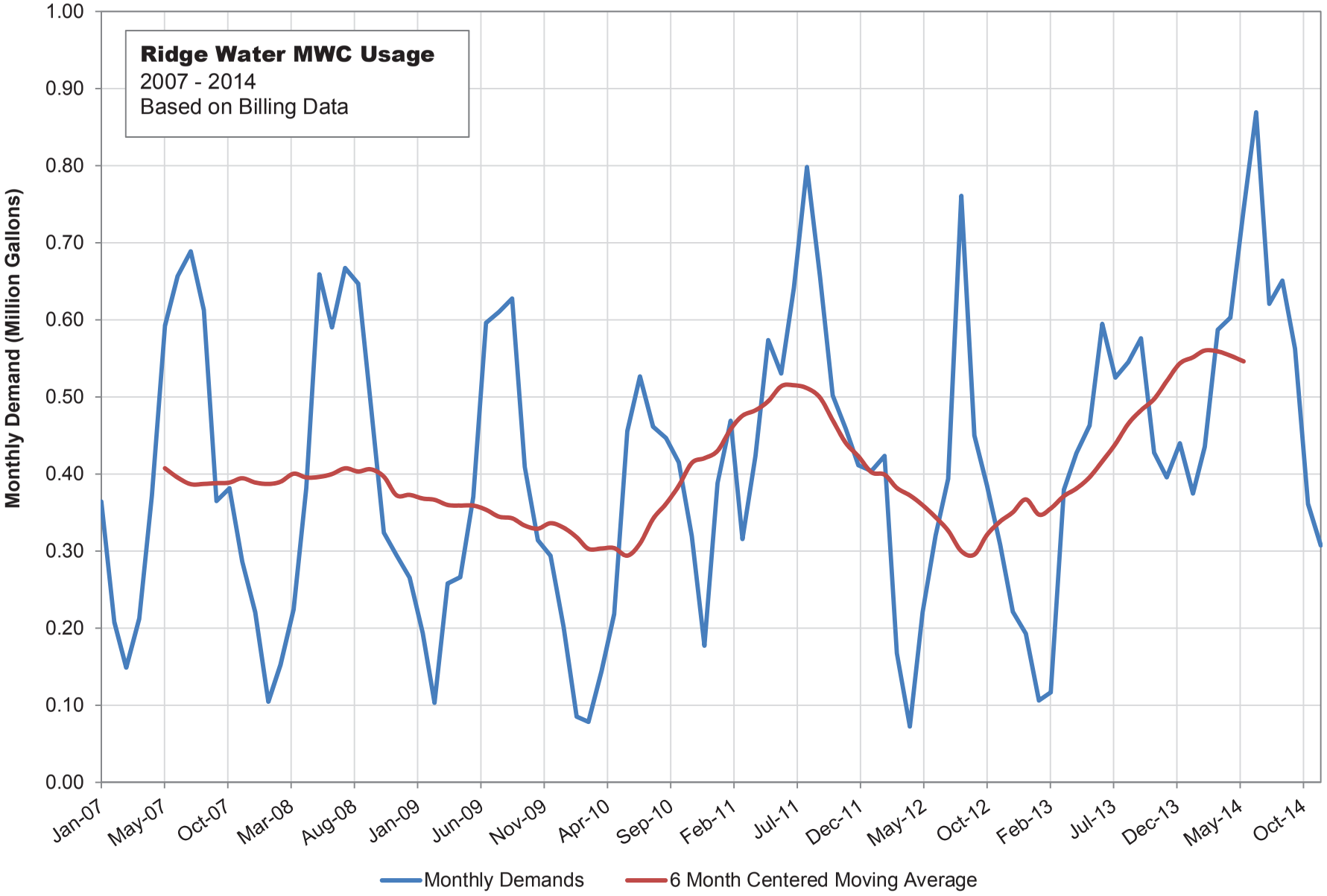
GRC	See Summary Improvements for Specific Project	Computed: GKD	QC: JW
Project	RS -1 thru RS -3	Date: 2/9/16	Date: 2/12/16
Task	Various Regulator Improvements		

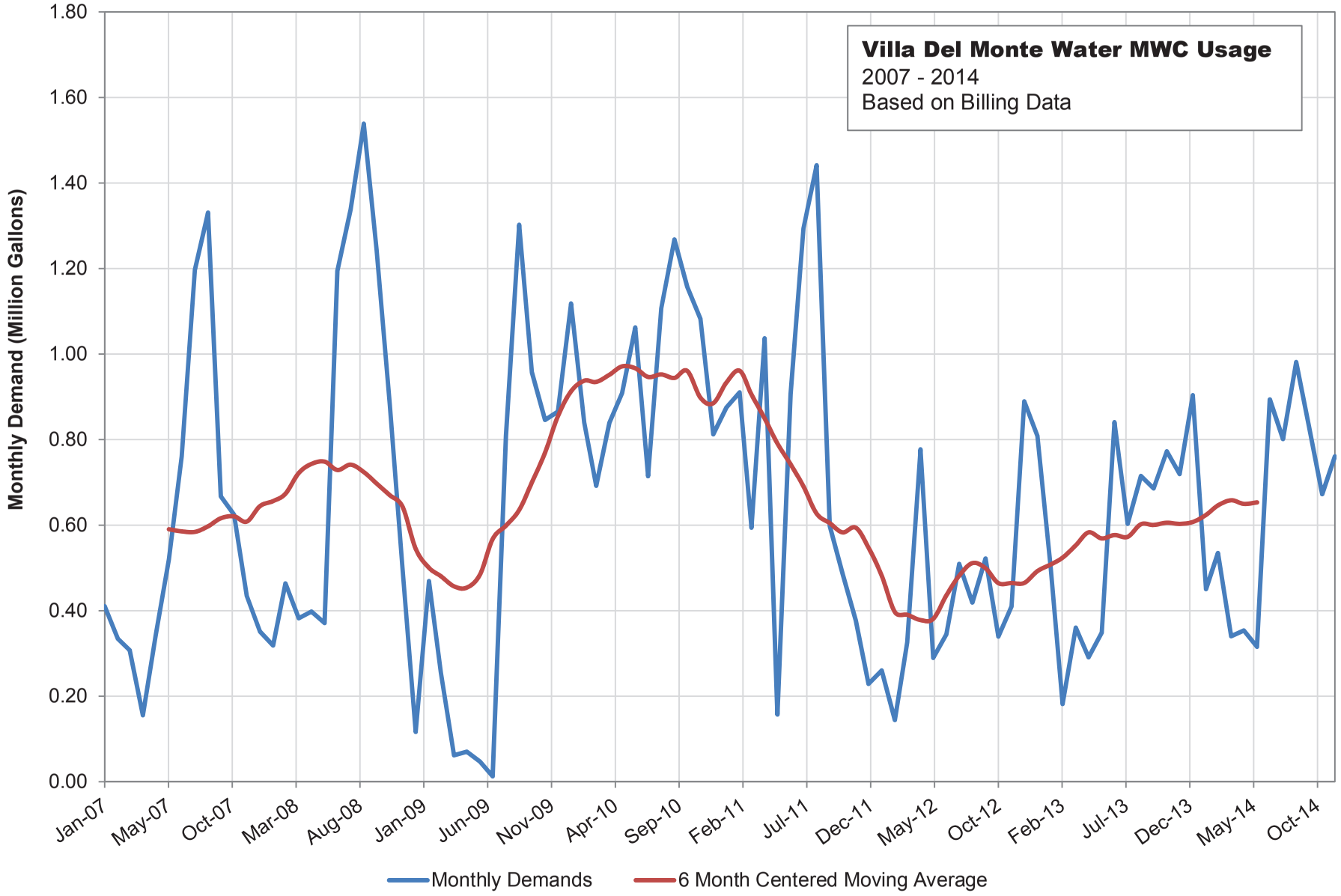
Item	Description	Estimated Quantity	Unit	Unit Price (includes material & labor)	Estimated Amount
Bidding Requirements					
	Mobilization (3%)	3	LS	3% of all Work	$36,450
	Insurance and Bonds (2%)	3	LS	2% of all Work	$24,300
	Subtotal				**$60,750**
Site Work					
	Hydroseeding & Site Restoration	3	LS	$10,000	$30,000
	Subtotal				**$30,000**
Major Equipment					
	8" Pressure Regulator w/2" Bypass & Appurtenaces	3	LS	$15,000	$45,000
	Subtotal				**$45,000**
Major Piping and Valves					
	Miscellaneous Pipes, Valves, and connections	3	LS	$45,000	$135,000
	Subtotal				**$135,000**
Major Structural					
	Valve Vault H20 Rated with Sump	3	LS	$65,000	$195,000
	Subtotal				**$195,000**
Major Electrical					
	Subtotal				**$0**
PROJECT COST SUMMARY					
	Subtotal, Bidding Requirements				$60,750
	Subtotal, Site Work				$30,000
	Subtotal, Major Equipment				$45,000
	Subtotal, Major Piping & Valves				$135,000
	Subtotal, Major Structural				$195,000
	Subtotal, Major Electrical				$0
	Estimated Construction Cost				**$466,000**
	SJWC Design Cost (Drafting & Design)				$45,000
	Project Contingencies			15% of Construction	$70,000
	Consultants (Survey, Hazardous Disposal, etc..)			3% of Construction	$14,000
	Permits and Fees			2% of Construction	$10,000
	SJWC Labor Charge and Burden			2% of Construction	$10,000
	Construction Management			5% of Construction	$24,000
	Estimated Design and Management Cost				**$173,000**
	SUBTOTAL				**$639,000**
	SJWC Overhead			10% of Subtotal	$64,000
TOTAL ESTIMATED PROJECT COST					**$703,000**

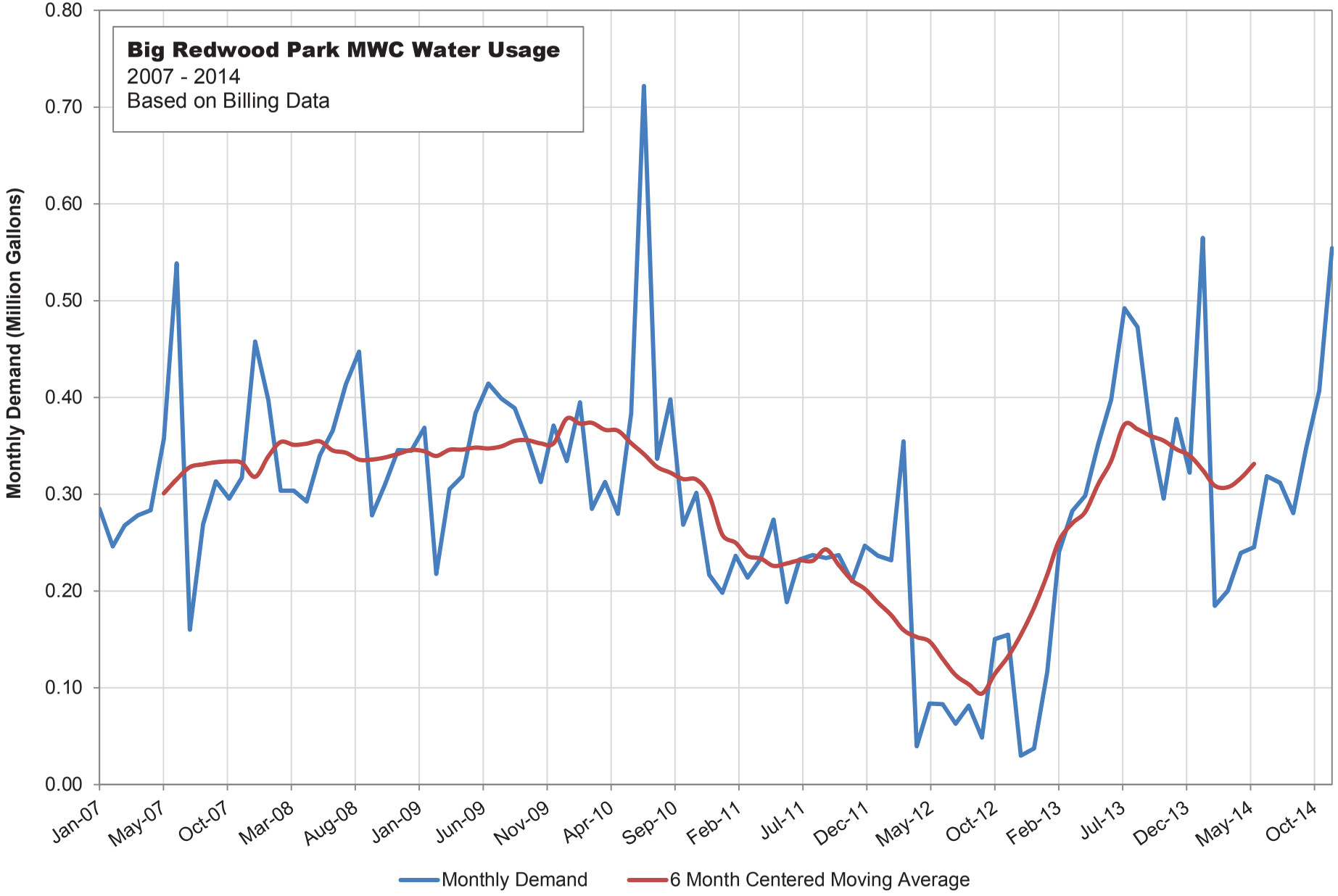
APPENDIX E

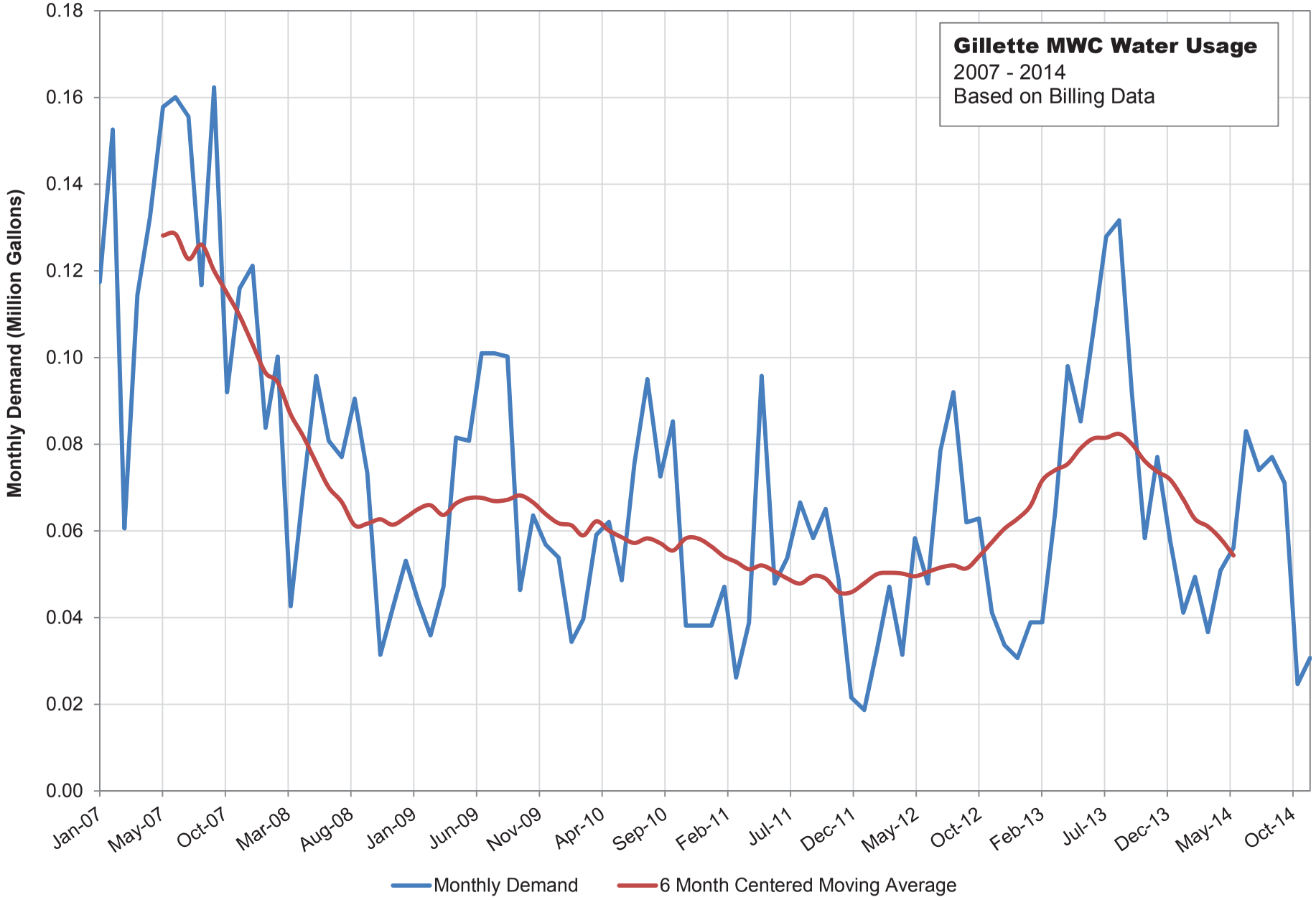
Monthly Water Demand Figures by MWC

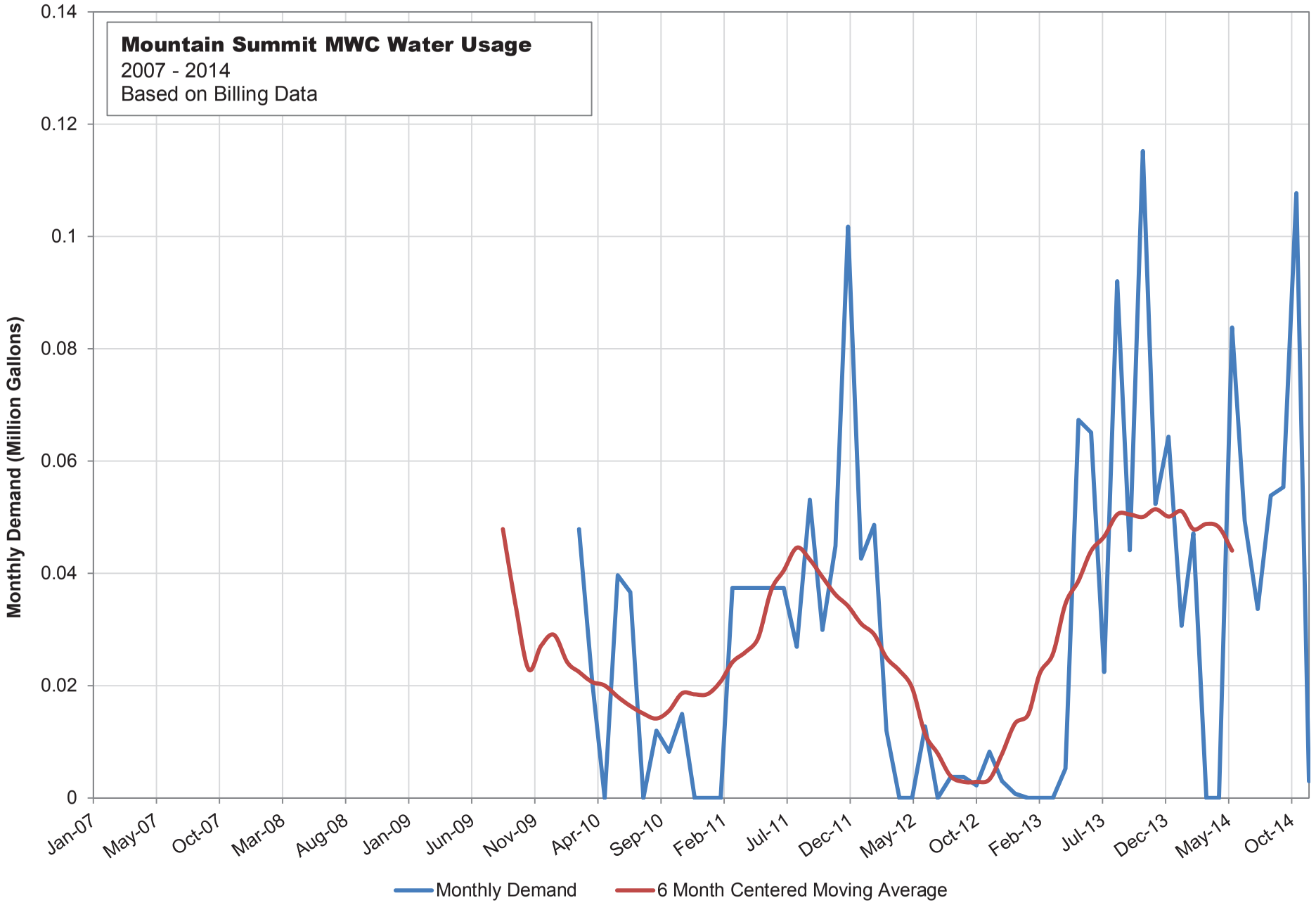

Monthly Demand (Million Gallons)
1.80
1.60
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
Jan-07
May-07
Oct-07
Mar-08
Aug-08
Jan-09
Jun-09
Nov-09
Apr-10
Sep-10
Feb-11
Jul-11
Dec-11
May-12
Oct-12
Feb-13
Jul-13
Dec-13
May-14
Oct-14
Summit West MWC Water Usage
2007 - 2014
Based on Billing Data
Monthly Demands
6 Month Centered Moving Average

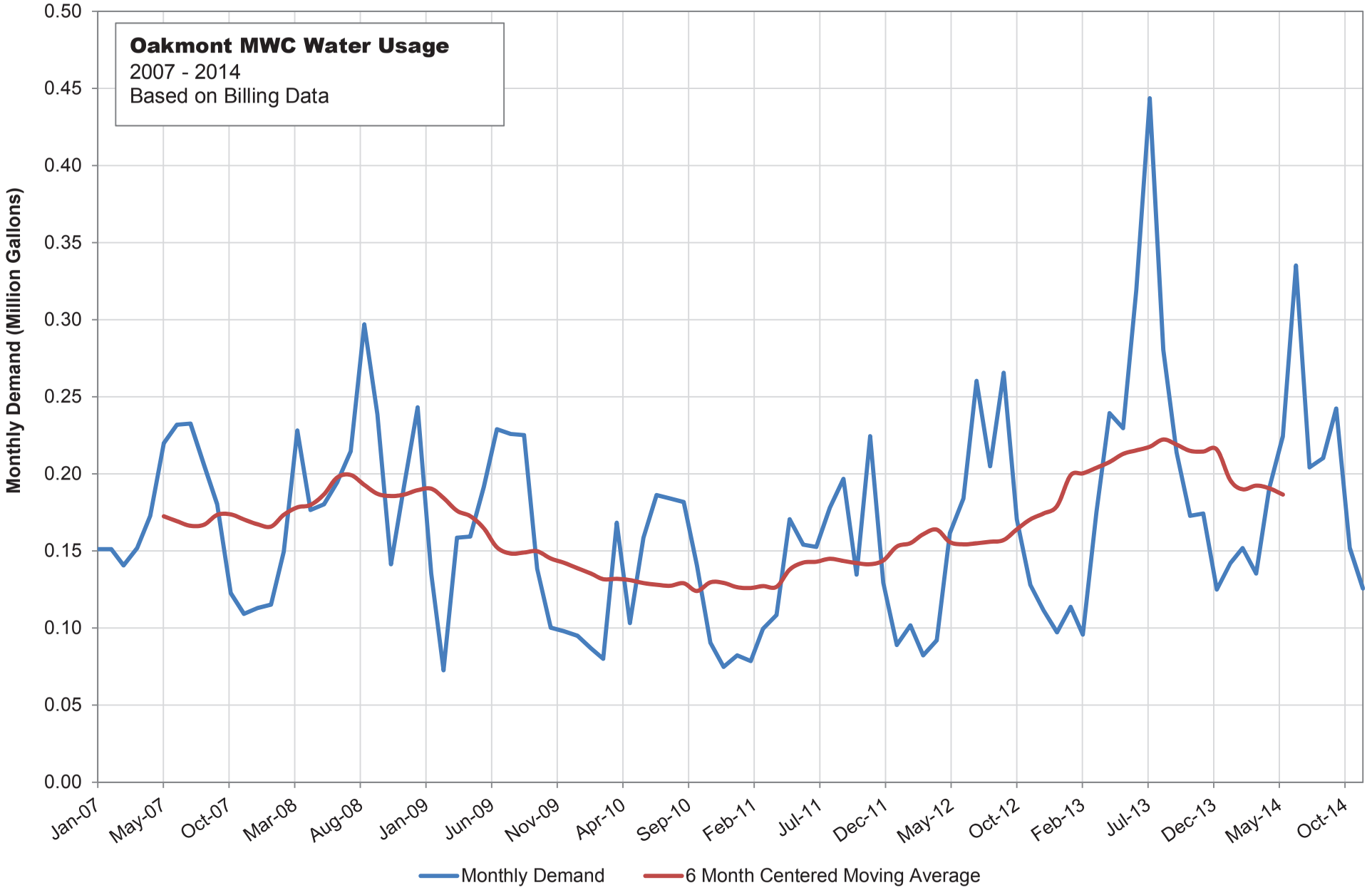

Ridge Water MWC Usage
2007 - 2014
Based on Billing Data
Monthly Demand (Million Gallons)
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
Jan-07
May-07
Oct-07
Mar-08
Aug-08
Jan-09
Jun-09
Nov-09
Apr-10
Sep-10
Feb-11
Jul-11
Dec-11
May-12
Oct-12
Feb-13
Jul-13
Dec-13
May-14
Oct-14
Monthly Demands
6 Month Centered Moving Average

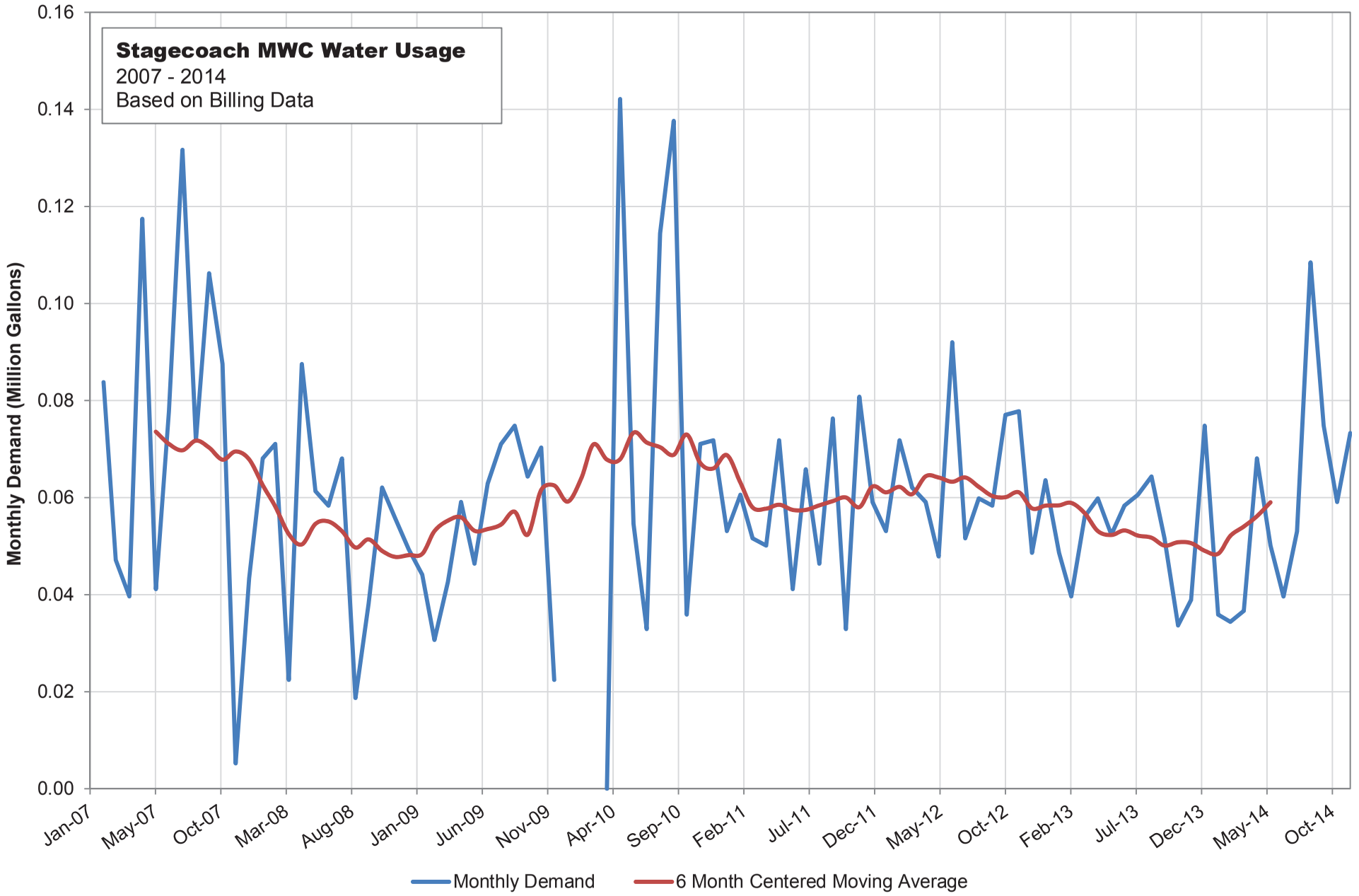

Villa Del Monte Water MWC Usage
2007 - 2014
Based on Billing Data
Monthly Demand (Million Gallons)
1.80
1.60
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
Jan-07
May-07
Oct-07
Mar-08
Aug-08
Jan-09
Jun-09
Nov-09
Apr-10
Sep-10
Feb-11
Jul-11
Dec-11
May-12
Oct-12
Feb-13
Jul-13
Dec-13
May-14
Oct-14
Monthly Demands
6 Month Centered Moving Average

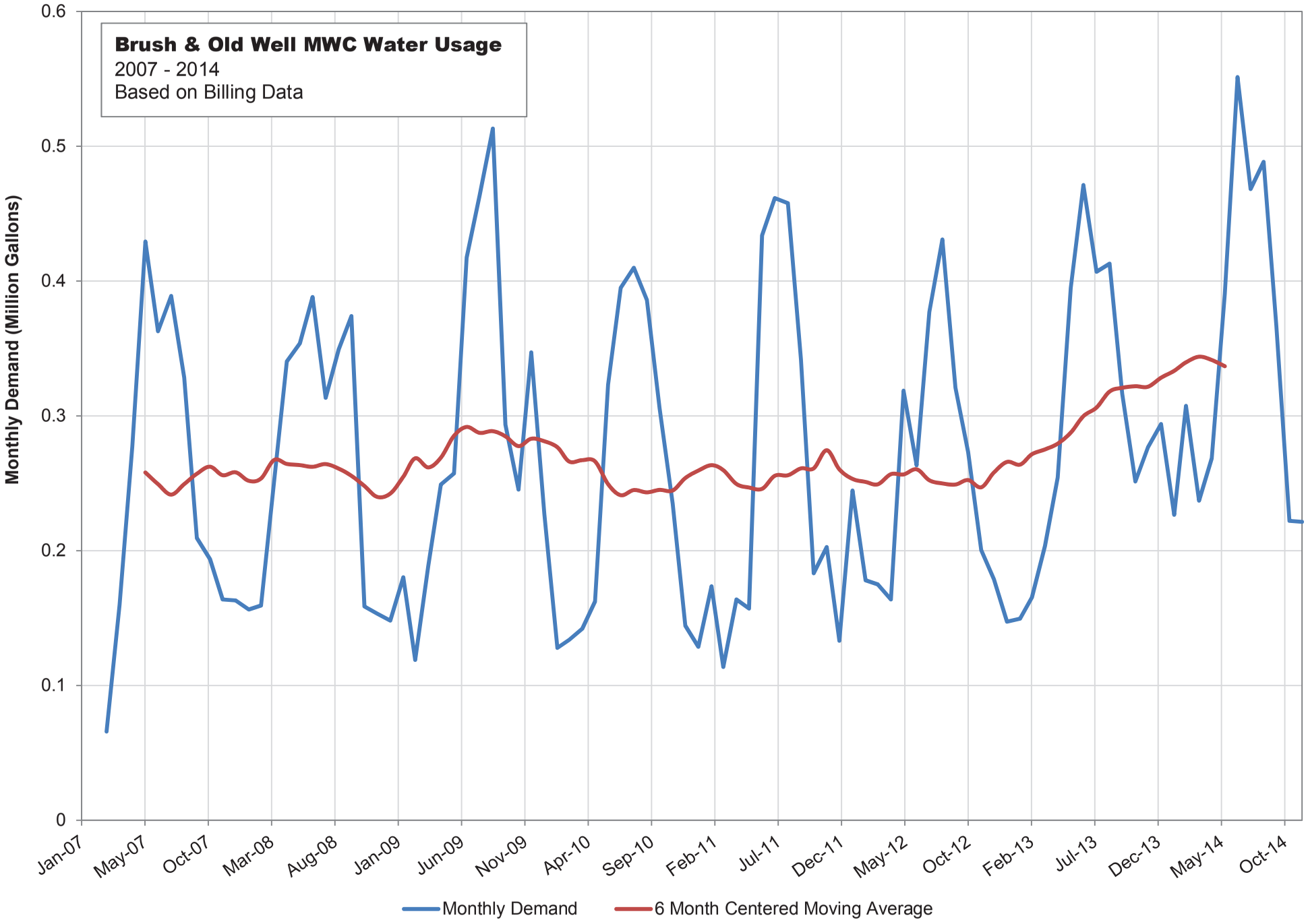

Big Redwood Park MWC Water Usage
2007 - 2014
Based on Billing Data
Monthly Demand (Million Gallons)
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
Jan-07
May-07
Oct-07
Mar-08
Aug-08
Jan-09
Jun-09
Nov-09
Apr-10
Sep-10
Feb-11
Jul-11
Dec-11
May-12
Oct-12
Feb-13
Jul-13
Dec-13
May-14
Oct-14
Monthly Demand
6 Month Centered Moving Average

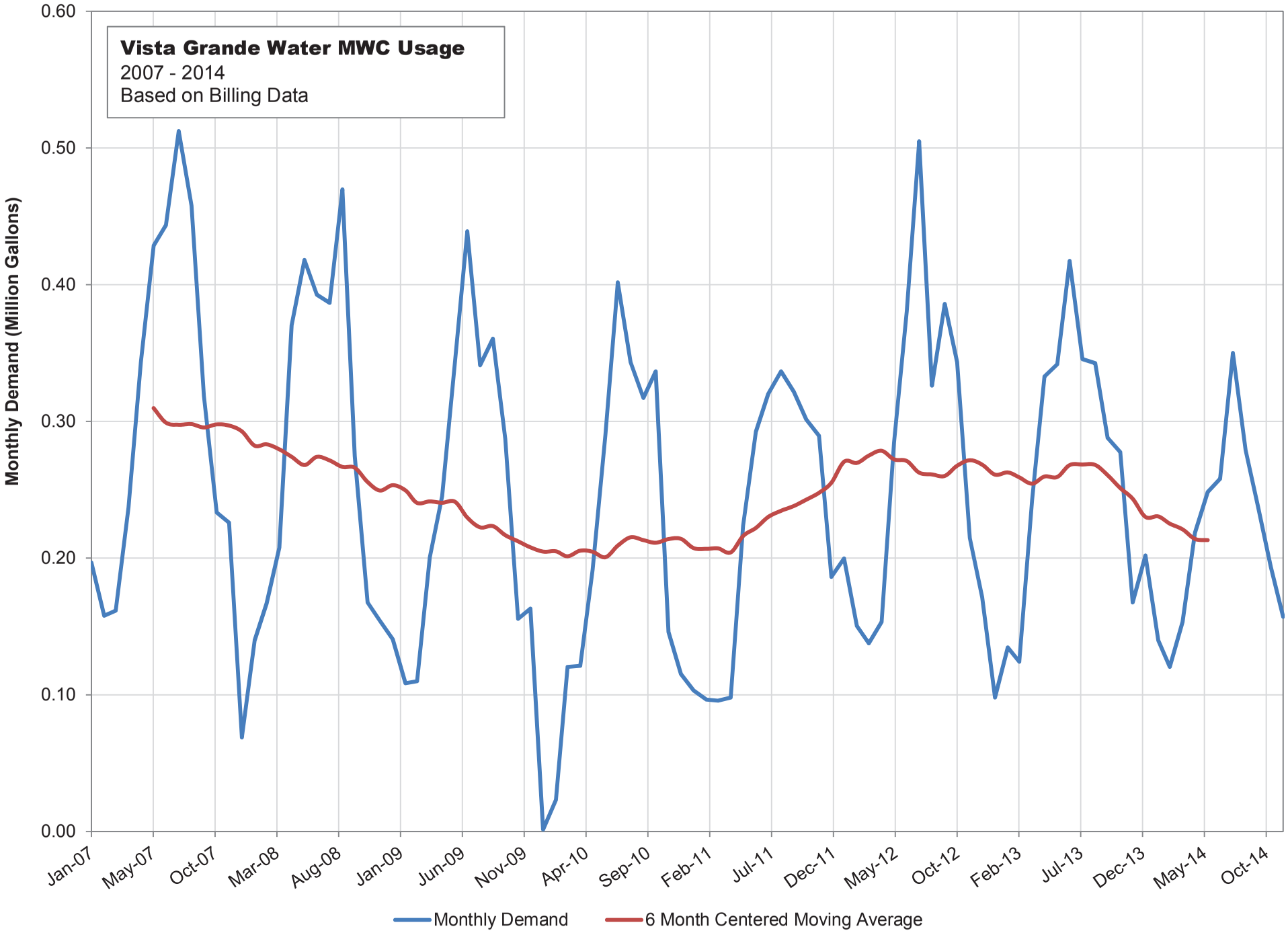

Gillette MWC Water Usage
2007 - 2014
Based on Billing Data
Monthly Demand (Million Gallons)
0.18
0.16
0.14
0.12
0.10
0.08
0.06
0.04
0.02
0.00
Jan-07
May-07
Oct-07
Mar-08
Aug-08
Jan-09
Jun-09
Nov-09
Apr-10
Sep-10
Feb-11
Jul-11
Dec-11
May-12
Oct-12
Feb-13
Jul-13
Dec-13
May-14
Oct-14
Monthly Demand
6 Month Centered Moving Average

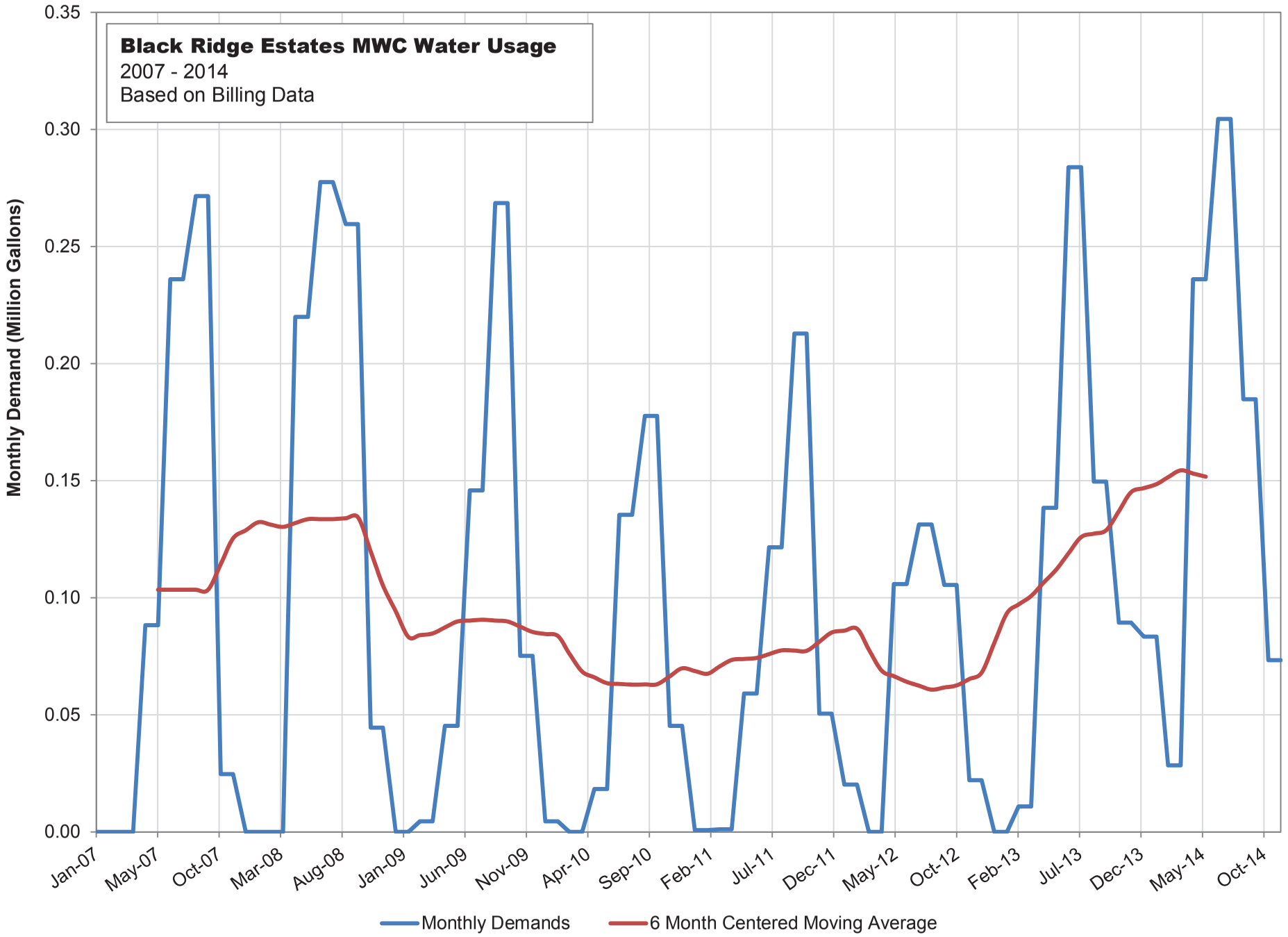

Mountain Summit MWC Water Usage
2007 - 2014
Based on Billing Data
Monthly Demand (Million Gallons)
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
Jan-07
May-07
Oct-07
Mar-08
Aug-08
Jan-09
Jun-09
Nov-09
Apr-10
Sep-10
Feb-11
Jul-11
Dec-11
May-12
Oct-12
Feb-13
Jul-13
Dec-13
May-14
Oct-14
Monthly Demand
6 Month Centered Moving Average

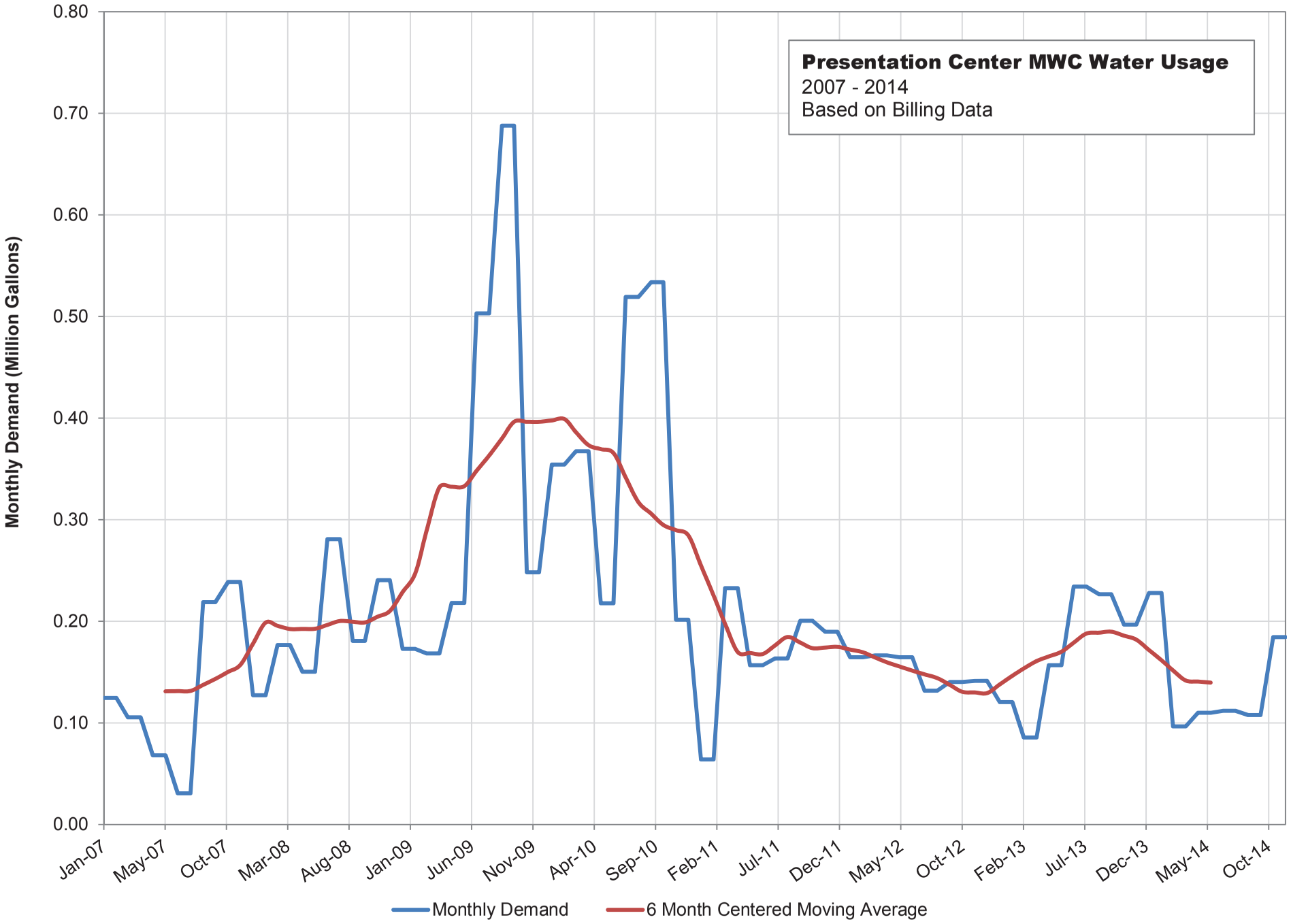

Oakmont MWC Water Usage
2007 - 2014
Based on Billing Data
Monthly Demand (Million Gallons)
0.50
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
Jan-07
May-07
Oct-07
Mar-08
Aug-08
Jan-09
Jun-09
Nov-09
Apr-10
Sep-10
Feb-11
Jul-11
Dec-11
May-12
Oct-12
Feb-13
Jul-13
Dec-13
May-14
Oct-14
Monthly Demand
6 Month Centered Moving Average

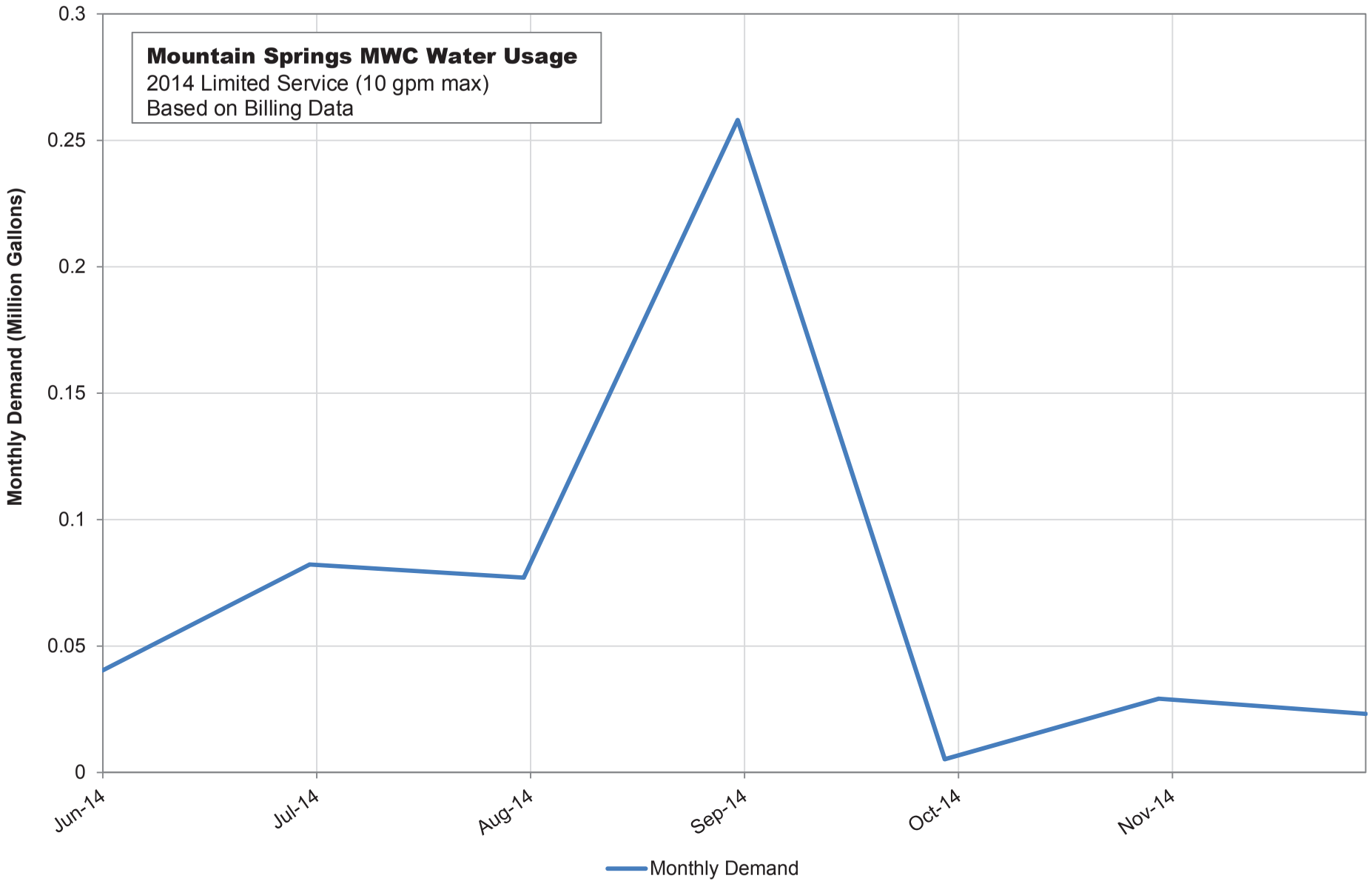

Stagecoach MWC Water Usage
2007 - 2014
Based on Billing Data
Monthly Demand (Million Gallons)
0.16
0.14
0.12
0.10
0.08
0.06
0.04
0.02
0.00
Jan-07
May-07
Oct-07
Mar-08
Aug-08
Jan-09
Jun-09
Nov-09
Apr-10
Sep-10
Feb-11
Jul-11
Dec-11
May-12
Oct-12
Feb-13
Jul-13
Dec-13
May-14
Oct-14
Monthly Demand
6 Month Centered Moving Average


Brush & Old Well MWC Water Usage
2007 - 2014
Based on Billing Data
Monthly Demand (Million Gallons)
0.6
0.5
0.4
0.3
0.2
0.1
0
Jan-07
May-07
Oct-07
Mar-08
Aug-08
Jan-09
Jun-09
Nov-09
Apr-10
Sep-10
Feb-11
Jul-11
Dec-11
May-12
Oct-12
Feb-13
Jul-13
Dec-13
May-14
Oct-14
Monthly Demand
6 Month Centered Moving Average


Vista Grande Water MWC Usage
2007 - 2014
Based on Billing Data
Monthly Demand (Million Gallons)
0.60
0.50
0.40
0.30
0.20
0.10
0.00
Jan-07
May-07
Oct-07
Mar-08
Aug-08
Jan-09
Jun-09
Nov-09
Apr-10
Sep-10
Feb-11
Jul-11
Dec-11
May-12
Oct-12
Feb-13
Jul-13
Dec-13
May-14
Oct-14
Monthly Demand
6 Month Centered Moving Average


Black Ridge Estates MWC Water Usage
2007 - 2014
Based on Billing Data
Monthly Demand (Million Gallons)
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
Jan-07
May-07
Oct-07
Mar-08
Aug-08
Jan-09
Jun-09
Nov-09
Apr-10
Sep-10
Feb-11
Jul-11
Dec-11
May-12
Oct-12
Feb-13
Jul-13
Dec-13
May-14
Oct-14
Monthly Demands
6 Month Centered Moving Average


Presentation Center MWC Water Usage
2007 - 2014
Based on Billing Data
Monthly Demand (Million Gallons)
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
Jan-07
May-07
Oct-07
Mar-08
Aug-08
Jan-09
Jun-09
Nov-09
Apr-10
Sep-10
Feb-11
Jul-11
Dec-11
May-12
Oct-12
Feb-13
Jul-13
Dec-13
May-14
Oct-14
Monthly Demand
6 Month Centered Moving Average


Mountain Springs MWC Water Usage
2014 Limited Service (10 gpm max)
Based on Billing Data
Monthly Demand (Million Gallons)
0.3
0.25
0.2
0.15
0.1
0.05
0
Jun-14
Jul-14
Aug-14
Sep-14
Oct-14
Nov-14
Monthly Demand