Golden State
Water Company
A Subsidiary of American States Water Company

# *Region* I


# Water Master Plan

September 2009

# Ojai System
# Water Master Plan

**Prepared for Golden State Water Company**
**Region I**

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# Executive Summary

This Ojai Water System Master Plan supports Golden State Water Company's (GSWC's) effort to update existing master plans and hydraulic models for the company's Region I water distribution systems in Northern California and the central coast of California. This executive summary provides a synopsis of this effort under the following topics:

- Purpose
- Master planning process
- Capital improvement program (CIP)

## Purpose

The Master Plan assesses the Ojai System's ability to meet current and future water needs, and identifies system upgrades needed to meet current customer needs. This assessment is developed by using hydraulic design criteria, water quality standards, facility condition standards specified by regulatory agencies, and best management practices to upgrade the existing hydraulic model to represent current conditions within the system.

These updates provide GSWC with a basis to determine the impacts of new development on existing systems and to identify short-, mid-, and long-term system deficiencies and the improvements needed to correct them. These system improvement needs are used as the basis for developing the CIP for the system.

## Master Plan Process

This master plan document is organized to provide information in a sequential manner that considers historical progression (past to present to future) and logical analyses of the system, from existing facilities and requirements through future needs. This was accomplished through the following task progression:

- Collect existing system information
- Establish existing demands and forecast future demands
- Develop and calibrate the system's hydraulic model
- Evaluate supply and storage capacity
- Perform hydraulic analysis and evaluation
- Identify water quality issues
- Assess the condition of the system's facilities
- Develop the CIP

The initial step in the process was to collect data on the existing system. This step included verifying that the existing system model contained all existing and planned facilities. Planned facilities included only those projects committed to be completed by GSWC under the 2007 or 2008 CIPs. Existing and projected future system water demands were compiled from GSWC annual customer billing and water production records and population projections.

The next step in the process was to update and calibrate the system's hydraulic model. This effort involved verifying the physical components represented in the hydraulic model, such as the groundwater well pumps and distribution pipeline network, and then calibrating the model with data collected from field testing. Next, a compilation of hydraulic design criteria and water quality standards was used to evaluate the adequacy of GSWC's water distribution systems. The master planning criteria and standards serve to clearly outline the level of service and safety that GSWC strives to maintain for each of its systems. The criteria contained in this master plan were compiled using applicable regulatory standards, design standards, and design guidelines that are widely recognized in the water industry; sources include the California Public Utility Commission, the United States Environmental Protection Agency (EPA), the California Department of Public Health (CDPH), the American Water Works Association (AWWA), and the Ten States Standards.

The system's supply and storage capacities were evaluated next. This evaluation identified deficiencies by using the design criteria and standards to compare current demands and projected demands to current condition and future condition supply facilities. The supply and storage for the Ojai System must be adequate to meet these evaluation criteria. This analysis examined different demand periods to determine if the system has the ability to reliably meet the system demands under typical demand scenarios using a combination of water supply sources and storage. In this analysis, short-, mid-, and long-term planned facilities were evaluated to see if they could meet average day demands (ADD), maximum day demands (MDD), peak hour demands (PHD), MDD + fire flow, and, if applicable, demands during planned and unplanned connection outages.

The calibrated hydraulic model was then used to identify hydraulic deficiencies based on current and future conditions. Hydraulic model runs simulated ADD, MDD, PHD, and MDD + fire flow demand scenarios to assess if any design criteria could not be met. Potential deficiencies were identified based on the hydraulic design criteria. The fire-flow assessment evaluated a fire demand at a specific location while the system is operating under the MDD scenario. The hydraulic model analyzed each node location in the distribution system model and simulated a fire flow corresponding to the land use category.

Other tasks focused on water quality evaluation and facilities condition assessment. The water quality improvement needs were identified based on current and pending federal and state regulations in conjunction with an assessment of current system operations. The condition assessment was based on a review of current facilities. Appropriate improvements were considered and identified in this master plan based on current condition assessment deficiencies. Any water quality or condition assessment deficiencies identified through these processes were combined with the identified hydraulic deficiencies to establish the CIP for the system.

The CIP is an essential component of this water master plan. The CIP summarizes recommended facilities, identifies the estimated costs of these facilities, and establishes the timing for when the improvements are needed. Improvements were identified where the performance of the water system did not meet the minimum requirements identified in the technical memorandum entitled *Golden State Water Company Master Planning Criteria and Standards* (see Appendices).

# Capital Improvement Program

The system evaluation revealed that GSWC's facilities are well managed and operated, with some potential for improvement consistent with GSWC's water management and operational goals, and with public health and safety goals. To achieve these goals, fire-flow management, water distribution and storage, treatment, system security, and pipeline replacements were included in the CIP planning.

The Ojai System evaluation results served as the basis for developing the CIP. Identified system deficiencies indicated which infrastructure improvements were necessary to comply with the design criteria. The primary aspects of the CIP—short-term, mid-term, and long-term planning horizons; cost estimation; and prioritization and timing of individual projects—are detailed in a comprehensive CIP list. The recommended improvements were prioritized into three time periods: short, mid, or long term. The following descriptions define how projects were prioritized into one of the three categories:

- **Short-term** improvement projects were based on a deficiency identified in the existing system. Deficiencies included supply and storage, hydraulic, condition assessment, and water quality.
- **Mid-term** improvement projects are generally needed within the next 5 to 10 years and include projects needed by 2015. These improvements were identified as correcting a deficiency that exists by 2015 but not in the existing system. Examples include replacing existing supplies due to lost production, increasing supplies where demands are increasing, compliance with future regulations, and replacing aging infrastructure.
- **Long-term** improvement projects are based on deficiencies identified beyond the mid-term planning years through the year 2030. The water system was assumed to be built out by the year 2030. The long-term improvements are typically improvements needed to keep up with future demands and aging infrastructure.

The project selection and prioritization process considered various issues, including existing deficiencies, projected demands, health and safety, regulatory compliance, reliability, contractual obligations, facility conditions, and costs. Each project is assigned a unique identification number that corresponds with an identified deficiency; in some cases, a single project may resolve multiple deficiencies.

Table 1 summarizes the number and cost of all identified CIP projects in this master plan. Costs presented in this table are estimated based on unit costs developed from GSWC's database of historical project construction costs and are in accordance with the guidelines of the Association for the Advancement of Cost Engineering (AACE) International for a Class 5 estimate.

TABLE 1
Summary of Recommended CIP Projects and Costs
*GSWC Region I Water Master Plan—Ojai System*

| Project ID | Recommended Improvement | Deficiency | Priority Category | Estimated Project Cost |
|---|---|---|---|---|
| 1.1.1 | Construct San Antonio Reservoir #1 – 0.5 MG. | Storage | Short term | $1,000,000 |
| 1.2.2 | Fairview Plant – Add Emergency Power to Booster Station | Storage | Short term | $300,000 |
| 1.2.3 | Valley View Plant – Add Emergency Power to Booster Station | Storage | Short term | $300,000 |
| 1.3.1 | Fairview Plant – Add Booster Pump C | Supply and storage | Short term | $250,000 |
| 1.5.1* | Install 12-in PRV to separate High Main Gradient from the Low Main Gradient (Rancho Drive north of Montana-Cuyama intersection). | Pressure | Short term | $226,000 |
| 1.5.2* | Install 12-in PRV to separate High Main Gradient from the Low Main Gradient (Del Norte Rd.–Cuyama Rd. intersection near Sierra-Cuyama CMWD Interconnection). | Pressure | Short term | $226,000 |
| 1.5.3* | Install booster pump station with 850-gpm pump with standby power, and 12-in PRV to separate High Main Gradient from the Low Main Gradient (on Foothill Rd. at Aliso St.–Bristol Rd. intersection). | Pressure | Short term | $2,654,000 |
| 1.6.1 | Replace 4-in pipe with 8-in pipe, 2,400 ft on Country Club Rd. | Pressure | Short term | $1,030,000 |
| 1.6.2 | Replace 4-in pipe with 8-in pipe, 562 ft at El Paseo Rd.–Cuyama Rd. intersection. | Pressure | Short term | $307,000 |
| 1.6.3 | Replace 4-in pipe with 8-in pipe, 490 ft on Cuyama Rd. | Pressure | Short term | $275,000 |
| 1.6.4 | Replace 4-in pipe with 8-in pipe, 1,100 ft at Bald Ave.-Pearl St. intersection. | Pressure | Short term | $528,000 |
| 1.6.5 | Replace 4-in pipe with 8-in pipe, 1,100 ft on Fox St. south of Ojai Ave. | Pressure | Short term | $528,000 |
| 1.7.1 | Install chlorine analyzers at wells and add to SCADA | Water Quality | Short term | $50,000 |
| 1.8.1 | Add Security Lighting and hatch alarms to the Fairview Plant | Conditional Assessment | Short term | $30,000 |
| 1.9.1 | Seismic Improvements to the Fairview Reservoir including air gap on overflow and double-ball seismic joint on inlet and outlet | Conditional Assessment | Short term | $80,000 |
| 1.10.1 | Security Lighting for the Heidelberger Booster Plant | Conditional Assessment | Short term | $10,000 |
| 1.11.1 | SCADA for the Heidelberger Booster Plant | Conditional Assessment | Short term | $25,000 |
| 1.12.1 | Retaining Wall at the Heidelberger Booster Plant | Conditional Assessment | Short term | $15,000 |
| 1.13.1 | Enclosure for Boosters at Heidelberger Booster Plant | Conditional Assessment | Short term | $25,000 |

TABLE 1
Summary of Recommended CIP Projects and Costs
*GSWC Region I Water Master Plan—Ojai System*

| | | | | |
|---|---|---|---|---|
| 1.14.1 | Replace MCC at the Mutual Plant | Conditional Assessment | Short term | $100,000 |
| 1.15.1 | Replace Filter Media at the San Antonio Plant | Conditional Assessment | Short term | $75,000 |
| 1.16.1 | Add SCADA to the Signal Plant | Conditional Assessment | Short term | $25,000 |
| 1.17.1 | Demo non-functional Vault at the Signal Plant | Conditional Assessment | Short term | $10,000 |
| 1.18.1 | Seismic Evaluation for the existing Signal Tank | Conditional Assessment | Short term | $10,000 |
| 1.19.1 | Replace Well – Mutual #5 | Conditional Assessment | Short term | $2,000,000 |
| 1.20.1 | Relocate Valley View Booster Station and increase capacity by adding a 500 gpm booster, add PRV | Conditional Assessment | Short term | $1,000,000 |
| 1.21.1 | Fairview Road 6" steel pipeline replacement with 8" pipeline (600 feet) | Conditional Assessment | Short term | $100,000 |
| 1.22.1 | Foothill Blvd from Valley View Booster Station to Heidelberger Tank - Replace 5 1/2" OD steel pipeline with 8" pipeline (3,300 feet) | Conditional Assessment | Short term | $600,000 |
| 1.23.1 | Replace existing Heidelberger Tank with new 0.1 MG tank | Conditional Assessment | Short term | $250,000 |
| 1.24.1 | Replace 200 feet of 4-inch Transite in private street at the West end of the Heidelberger Zone | Conditional Assessment | Short term | $40,000 |
| 1.25.1 | Replace 450 feet of 3-inch Steel on Bonita Drive | Conditional Assessment | Short term | $90,000 |
| 1.26.1 | Replace 1,800 feet of 8-inch Steel on Sierra Road from El Paseo Road to El Toro Road | Conditional Assessment | Short term | $360,000 |
| 1.27.1 | Replace 1,400 feet of 8-inch Steel on Palomar Road from El Toro Road to El Camino Road | Conditional Assessment | Short term | $280,000 |
| 1.28.1 | Replace 1,000 feet of 8-inch steel on Del Norte Road South of the Fairview Plant | Conditional Assessment | Short term | $200,000 |
| 1.29.1 | Replace 1,300 feet of 8,10 and 12-inch cast iron and steel on Grand Avenue from Drown Avenue | Conditional Assessment | Short term | $350,000 |
| 2.1.1 | Construct San Antonio Reservoir #2 – 0.5 MG | Storage Assessment | Mid-Term | $1,000,000 |
| 2.2.2 | San Antonio Plant – Add Booster Pump C – 1,365 gpm | Supply Assessment | Mid-Term | $300,000 |
| 2.3.1 | Replace 6-in pipeline on Ojai Ave near Del Norte Road Intersection with a 12-in Pipeline (Approx. 310 ft) | Velocity | Mid-Term | $80,000 |
| 2.4.1 | Install VFD's at the Fairview Plant | Conditional Assessment | Mid term | $40,000 |

TABLE 1
Summary of Recommended CIP Projects and Costs
*GSWC Region I Water Master Plan—Ojai System*

| | | | | |
|---|---|---|---|---|
| 2.5.1 | Abandon the Running Ridge Tanks | Conditional Assessment | Mid term | $150,000 |
| 3.1.1 | Install Additional 0.5 MG Tank in the Main Gradient – Signal Plant | Storage Assessment | Long Term | $1,000,000 |
| 3.3.2 | Fairview Plant – Upsize Booster B from 250 gpm to 500 gpm | Supply Assessment | Long Term | $75,000 |
| 3.5.1 | Install a new 6-in pipeline on Douglas St. from Signal St. to Montgomery St., 2,300 ft on Daly Rd. Loop near new Signal Reservoir. | Pressure | Long term | $903,000 |
| 3.6.1 | Replace 8-in pipe with 12-in pipe, 1,150 ft near Sierra-Cuyama intersection on Sierra Rd. (Must be replaced earlier due to condition of pipe see 1.31.1) | Velocity | Long term | $516,000 |

*To establish the new zone, all projects should be done concurrently.

**SECTION 1**

# Introduction

This report outlines Golden State Water Company's (GSWC's) master planning process for updating the existing Ojai System Master Plan. This planning process was used to identify system improvements needed to address current and future deficiencies. This section of the report provides an overview of GSWC, the Ojai System, and the organization of the master plan report.

## 1.1 Overview of Golden State Water Company

GSWC is a subsidiary of American States Water Company, an investor-owned utility dedicated to increasing value through the expert management of utility assets and services. A public utility, GSWC is committed to the purchase, production, distribution, and sale of water to over 240,000 customers.

GSWC is organized into three regions throughout the state of California. Region I is located in northern and the central coast of California; Region II serves communities in Los Angeles County; and Region III serves communities in Los Angeles, San Bernardino, Imperial, and Orange counties.

Region I operates 13 separate water systems serving more than 51,000 service connections and consists of hundreds of miles of distribution pipelines and associated production facilities. Figure 1-1 is a map showing the locations of all Region I systems (all figures in this master plan are provided at the end of their respective sections).

## 1.2 Master Plan Update

The purpose of this master plan is to assess the Ojai System's ability to meet current and future water needs and assess system upgrades needed to meet current customer needs. This assessment is developed by using hydraulic design criteria, water quality standards, facility condition assessments, and best management practices to upgrade the existing hydraulic model to represent current conditions within the system.

Specifically, this master plan supports GSWC's effort to update existing master plans and hydraulic models for the company's Region I water distribution systems in the central coast and northern California. These updates provide GSWC with a baseline for determining the impacts of new development on existing systems as well as identifying short-, mid-, and long-term system needs. These system needs are used as the basis for developing the capital improvement program (CIP) for the system. The primary drivers of this master plan update are the following:

- Assess the distribution system's hydraulic performance.
- Identify infrastructure in poor condition that needs to be replaced.

- Provide documentation for the proposed CIP projects in support of the General Rate Case for the California Public Utilities Commission (CPUC).
- Reduce operations and maintenance (O&M) efforts and costs required to maintain service under current conditions.
- Minimize service failures.

## 1.3 Document Organization

This master plan document is organized to provide information in a sequential manner that considers historical progression (past to present to future) and logical evaluation of the system from existing facilities and requirements through future needs. Each section's title and a brief summary follow.

1. **Introduction:** Provides background information on the company and its systems.
2. **Existing Water System Facilities:** Provides an overview of the system and its facilities. System facilities identified include the system service area boundary, pressure zones, supply sources, storage facilities, pump stations, pressure regulating and water control stations, and transmission and distribution pipelines.
3. **Existing and Future Demands:** Provides definition of demand types and periods, as well as existing and future demands. Explains the demand development approach and determination of peaking factors. Provides the current demands and projected demands developed for a future 2030 condition. Future demands are based on growth rate and water use projections.
4. **Hydraulic Model Development and Calibration:** Provides an overview of the modeling process, including hydraulic model construction and calibration. The discussion of the calibration process includes a description of field testing, selection of pipe-friction coefficients, static and dynamic calibration process, and confidence level of model calibration results.
5. **Supply and Storage Capacity Evaluation:** Documents the evaluation of the system's water supply and storage capacity using the objectives identified in GSWC's *Master Planning Criteria and Standards.* The evaluation results established storage needs for each pressure zone and the entire distribution system. Supply and storage deficiencies in the existing and future systems were also identified. Proposed improvements to mitigate deficiencies are provided.
6. **Hydraulic Analysis and Evaluation:** Outlines the approach for the hydraulic analysis; details how the calibrated hydraulic model was used to determine hydraulic deficiencies under simulated demand scenarios assessed against analysis and design criteria for short-, mid-, and long-term planning periods; and provides recommendations to address identified deficiencies. Scenarios simulated by the hydraulic model include average day, maximum day, peak hour, and fire-flow conditions.
7. **Water Quality Analysis:** Provides GSWC's evaluation of water supply quality based on current and pending federal and state standards and rules.

8. **System Condition Assessment:** Provides GSWC's documentation of system condition assessment efforts including past efforts, recent field inspections, and recommendations for future improvements.

9. **Capital Improvement Program:** Describes the CIP plan resulting from all preceding tasks broken down into short-, mid-, and long-term planning timeframes. This includes prioritization, justification, and costs for the projects included in the CIP.

10. **References**: Lists the primary sources of documentation referred to through throughout the master plan.

All appendices are included on a separate CD and provide supporting information on various specifications and details referred to throughout the master plan. An electronic copy of the entire master plan report is also provided on the CD.


**FIGURE 1-1**
**GSWC REGION I SYSTEMS OVERVIEW MAP**
GSWC REGION I WATER MASTER PLAN

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SECTION 2

# Existing Water System Facilities

This section documents existing water system facilities. Detailed information about the major facilities, such as water supply facilities, storage facilities, pipelines, pumping facilities, and regulating valves, serves as the basis for subsequent system analysis throughout the master plan. This section begins with an overview of the system, and then presents detailed information about these facilities.

## 2.1 Overview

The Ojai System obtains its water supply from the local wells in the Ojai Valley Basin (Ojai Basin) and purchased water from the Casitas Municipal Water District (CMWD). CMWD obtains its water supply from Lake Casitas and conveys this treated surface water to GSWC's Ojai System.

Groundwater is pumped from five active groundwater wells in the local groundwater basin. Water purchased from CMWD is delivered to the Ojai System through three interconnections and one emergency connection with CMWD at the Ojai Valley Inn, which is used only for fire service.

The system has about 32 miles of pipelines that range in diameter from 4 to 16 inches.

## 2.2 Facility Descriptions

The major facilities serving the Ojai System are shown in Figure 2-1. These facilities are discussed in detail in the following subsections:

- Pressure zones
- Supply sources
- Storage facilities
- Pumping stations
- Pressure regulating stations and flow control stations
- Transmission and distribution pipelines

### 2.2.1 Pressure Zones

It is common for water systems to be divided into separate hydraulic regions, known as pressure zones, to maintain adequate pressures throughout the distribution system regardless of topographical variation. In accordance with CPUC standards and GSWC design criteria, pressures should be between 40 pounds per square inch (psi) and 125 psi. A reference pressure, known as the hydraulic grade line (HGL), is typically identified for each pressure zone to indicate the elevation of the maximum pressure expected during low demands. In a pressure zone with a storage tank, the high water level in the tank may be identified as the HGL for the pressure zone. In pressure zones without a storage tank, the

HGL may be specified based on the discharge pressure from a booster pumping station (BPS), groundwater well, pressure regulating station (PRS), or other water supply facility. Water conveyed to a high-pressure zone must be pumped, and water conveyed to a lower-pressure zone must be regulated through a valve, such as a pressure reducing valve (PRV). Therefore, pumps and valves are usually the boundary points that separate pressure zones.

The Ojai System's customer service area (CSA) ranges in elevation from 696 feet above mean sea level (msl) in the southern portion of the water system to 1,340 feet msl in the north. The water system has been divided into six pressure zones as shown in Figure 2-2 to accommodate the range of elevations. Table 2-1 provides details of these pressure zones. Figure 2-3 presents the system's hydraulic profile (schematic of the water system).

TABLE 2-1
Pressure Zone Details
*GSWC Region I Water Master Plan—Ojai System*

| Pressure Zone | HGL (ft msl) | Elevations Served (ft msl) | Supply and Storage Facilities* | | |
|---|---|---|---|---|---|
| | | | **Storage Tanks** | **Wells and Purchased** | **BPS and PRS** |
| Heidelberger Booster Gradient | 1,500 | 1,320–1,333 | None | None | Heidelberger Boosters A and B |
| Heidelberger Tank Gradient | 1,440 | 1,010–1,315 | Heidelberger Tank | None | Valley View Boosters A and B |
| Main Gradient | 1,029 | 802–1,009 | San Antonio Forebay Tank, Fairview Reservoir, Signal Tank | San Antonio Wells 3, 4<br>Mutual Wells 4, 5<br>Gorham Well 1<br>Montana-Cuyama CMWD<br>San Antonio-Grand CMWD<br>Sierra-Cuyama CMWD | San Antonio Boosters A and B, Signal Booster A, One PRV |
| Running Ridge Gradient | 1,150 | 1,010–1,050 | Running Ridge tanks | None | Fairview Boosters A and B |
| Saddle Lane Gradient | 957 | 696–750 | None | None | Two PRVs |
| Signal Booster Gradient | 1,112 | 920–942 | Signal Tank | None | Signal Booster B |

* Does not include hydropneumatic tanks or emergency interconnections.

The majority of water served to the Ojai System is delivered through the Main Gradient, which obtains water from the five groundwater wells and three CMWD interconnections. Water is then fed into the smaller zones (Saddle Lane, Signal, Running Ridge, Heidelberger Tank, and Heidelberger Booster) through PRVs and booster pumps.

## 2.2.2 Supply Sources

Water supplies include local groundwater from GSWC wells and purchased water from CMWD. The wells provide the primary supply, and the CMWD interconnections are used when demand exceeds the production from the wells.

### Groundwater

The system has five active wells and one non-operational well. The well water treated by the San Antonio Plant (which treats water for iron and manganese) meets all applicable state and federal water quality standards for potable water. The level of chlorides in the groundwater is above the allowable amount for NPDES discharge permits; therefore, the water is blended with purchased water from CMWD to achieve an acceptable level when backwashing the filters. A disinfectant (chlorine) is added to the water before it enters the filter.

### Active Wells

Five groundwater wells were identified as active for this master plan; their locations are identified in Figure 2-1. Table 2-2 presents the relevant data for these wells. The elevation shown for each well is the elevation of the wellhead facilities. The pumping water level is the depth measured from the wellhead to the surface of the groundwater while the well pump is running. Pumping water levels were provided by GSWC based on data obtained from historical groundwater levels. The groundwater elevation was calculated by subtracting the pumping water level from the wellhead elevation. Total dynamic head (TDH) represents the amount of energy required by the pump to produce water at the given flow rate. The capacity is the flow rate that the pump was designed to deliver. The discharge location describes where the well pump discharges. None of the wells in the Ojai System have backup power.

TABLE 2-2
Active Wells
*GSWC Region I Water Master Plan—Ojai System*

| Well | Discharge Location | Wellhead Elevation (ft msl) | Pumping Water Level[a] (ft) | Pumping Groundwater Elevation (ft msl) | TDH[b] (ft) | Capacity[b] (gpm) |
|---|---|---|---|---|---|---|
| Gorham Well 1 | San Antonio Forebay | 802 | 271 | 531 | 285 | 800 |
| Mutual Well 4 | San Antonio Forebay | 804 | 170 | 634 | 285 | 450 |
| Mutual Well 5 | San Antonio Forebay | 805 | 186 | 619 | 285 | 500 |
| San Antonio Well 3 | San Antonio Forebay | 804 | 223 | 581 | 264 | 430 |
| San Antonio Well 4 | San Antonio Forebay | 808 | 317 | 491 | 336 | 550 |
| **Total groundwater production capacity** | | | | | | **2,730** |

[a] Based on historical groundwater levels
[b] Based on the design points of the pumps

### Non-operational Wells

The Ojai System has one well that is non-operational, but is currently used for monitoring. Details are provided in Table 2-3.

TABLE 2-3
Non-operational Wells
*GSWC Region I Water Master Plan—Ojai System*

| Well | Discharge Location | Elevation (ft msl) | Previous Capacity (gpm) | Reason | Status |
|---|---|---|---|---|---|
| Mutual Well 3 | Main Gradient | 804 | 285 | N/A | Monitoring well |

## Purchased Water

Many water systems have the ability to supplement local water supplies with purchased water from another water agency. These supplies can come from hundreds of miles away. The cost of purchased water can be significantly higher than the cost of local supplies, such as groundwater. Purchased water is typically used when the production capacity of the local supplies is insufficient to meet demands. For the Ojai System, purchased water is provided by CMWD through three interconnections (Montana-Cuyama, San Antonio-Grand, and Sierra-Cuyama). The purchased water from CMWD originates from Lake Casitas and is treated at a CMWD treatment plant.

### Purchased Water Supply Interconnections

Three CMWD interconnections provide treated surface water to the Ojai System. As shown in Table 2-4, these interconnections can provide a maximum flow rate of 2,700 gpm to the Ojai System.

TABLE 2-4
Purchased Water Supply Interconnections
*GSWC Region I Water Master Plan—Ojai System*

| Name/Location | Connection Elevation (ft msl) | HGL (ft msl) | Control Setting | Maximum Capacity (gpm) |
|---|---|---|---|---|
| Montana-Cuyama | 755 | 1,013 | Controlled by PRV set to match Fairview Reservoir level | 1,000 |
| Sierra-Cuyama | 800 | 1,013 | Manual | 900 |
| San Antonio-Grand Ave. | 805 | N/A | Manual | 800 |
| **Total purchased water supply capacity** | | | | **2,700** |

### Emergency Interconnections

Water distribution systems are often connected to neighboring water systems to allow the sharing of supplies during short-term emergencies or during planned shutdowns of a primary supply source. For most systems, emergency interconnections are not usually used during normal operations. The Ojai System has one available emergency interconnection with CMWD, but this interconnection is only in case of a fire at the Ojai Valley Inn; it cannot provide water to the Ojai System. Table 2-5 provides details on the emergency interconnection.

TABLE 2-5
Emergency Interconnections
*GSWC Region I Water Master Plan—Ojai System*

| Name/Location | Agency | Estimated Capacity (gpm) | Notes |
|---|---|---|---|
| Ojai Valley Inn Interconnection | CMWD | 500 | Metered |

### 2.2.3 Storage Facilities

Water distribution systems rely on stored water to help equalize fluctuations between supply and demand, to supply sufficient water for firefighting, and to meet demands during an emergency or an unplanned outage of a major source of supply. This section describes the existing storage facilities in the system. The locations of storage facilities discussed here are shown in Figure 2-1.

#### Storage Tanks

The Ojai System has five storage tanks. Table 2-6 provides details for these tanks.

TABLE 2-6
Storage Tanks
*GSWC Region I Water Master Plan—Ojai System*

| Tank | Type and Zone | Bottom of Tank (ft msl) | High Water Elevation (ft msl) | Tank Height (ft) | Diameter (ft) | Volume* (MG) |
|---|---|---|---|---|---|---|
| Fairview | Gravity to Main Gradient / Boosted to Running Ridge | 972 | 989.0 | 17.0 | 100.0 | 1.000 |
| Heidelberger | Gravity to Heidelberger Gradient | 1,450 | 1,474.0 | 24.0 | 27.0 | 0.100 |
| Running Ridge 1 | Gravity to Running Ridge Gradient | 1,161 | 1,177.0 | 16.0 | 22.0 | 0.044 |
| Running Ridge 2 | Gravity to Running Ridge Gradient | 1,160 | 1,177.0 | 17.0 | 22.0 | 0.050 |
| San Antonio Forebay | Boosted to Main Gradient | 803 | 822.5 | 19.5 | 21.6 | 0.050 |
| Signal | Boosted to Main Gradient / Boosted to Signal Gradient | 948 | 989.0 | 41.0 | 36.0 | 0.300 |
| **Total systemwide storage capacity** | | | | | | **1.544** |

* Estimated capacity based on reservoir dimensions

#### Hydropneumatic Tanks

A hydropneumatic tank is actually a pressure vessel that provides a small amount of stored water (usually less than 10,000 gallons) under pressures that are adequate for the pressure zone being served. Since the volume of water stored in a hydropneumatic tank is generally considered insignificant to the overall storage of the system, it is usually ignored as a storage facility. The primary benefit is the pressure feature; this allows pumps to cycle off during very low demands, which is more efficient than continuous operation. The Ojai System has one hydropneumatic tank (Table 2-7).

TABLE 2-7
Hydropneumatic Tanks
*GSWC Region I Water Master Plan—Ojai System*

| Facility | Pressure Zone | Elevation (ft msl) | Pressure Range (psi) | HGL Range (ft msl) | Equivalent Diameter (ft) | Length (ft) | Usable Volume* (gal) |
|---|---|---|---|---|---|---|---|
| Heidelberger Hydropneumatic Tank | Heidelberger Booster Gradient | 1,440 | 55–75 | 1,567–1,613 | 4.75 | 17 | 2,000 |

* Estimated and rounded to the nearest 500 gallons

### 2.2.4 Pumping Stations

Pumping stations are required to convey water from ground-level tanks into the distribution system or from lower-pressure zones into higher-pressure zones (usually called booster pumping stations). Pumping stations may consist of one or more individual pumps. Multiple pumps at each station, or multiple pumping stations that serve the same pressure zone, help to increase water system reliability by ensuring that water can still be delivered into that zone if one pump is out of service. Critical pumping stations may be equipped with emergency power supplies in case of failure of the primary power source.

The Ojai System includes five booster pumping stations which contain two pumps each. The Fairview Booster station and the San Antonio Booster station contain one empty can for the provision of a future booster pump. Table 2-8 presents booster pump data relevant to the water system analysis.

TABLE 2-8
Booster Pumps
*GSWC Region I Water Master Plan—Ojai System*

| Facility | Pressure Zone | | Backup Power Available | Elevation (ft msl) | Current TDH* (ft) | Current Capacity* (gpm) |
|---|---|---|---|---|---|---|
| | Suction | Discharge | | | | |
| Fairview Booster A | Fairview Reservoir | Running Ridge Gradient | No | 1,005 | 195 | 250 |
| Fairview Booster B | Fairview Reservoir | Running Ridge Gradient | No | 1,005 | 195 | 250 |
| Heidelberger Booster A | Heidelberger Tank Gradient | Heidelberger Booster Gradient | Yes | 1,320 | 92 | 75 |
| Heidelberger Booster B | Heidelberger Tank Gradient | Heidelberger Booster Gradient | Yes | 1,320 | 92 | 75 |
| San Antonio Booster A | San Antonio Forebay | Main Gradient | No | 797 | 280 | 1,500 |
| San Antonio Booster B | San Antonio Forebay | Main Gradient | No | 797 | 280 | 1,500 |
| Signal Booster A | Signal Tank | Main Gradient | No | 937 | 50 | 600 |
| Signal Booster B | Signal Tank | Signal Gradient | Yes | 937 | 150 | 100 |
| Valley View Booster A | Running Ridge Gradient | Heidelberger Tank Gradient | No | 1,140 | 350 | 250 |
| Valley View Booster B | Running Ridge Gradient | Heidelberger Tank Gradient | No | 1,140 | 350 | 250 |

* Values based on pump design points

### 2.2.5 Pressure Regulating and Flow Control Stations

Pressure regulating and flow control stations allow distribution systems to transfer water from higher pressure zones to lower pressure zones without exceeding the allowable pressures in the lower zones or completely depressurizing the higher zone. The water is transferred through a valve that reduces the pressure or controls the flow rate to a specified setting. Regulating valves can operate based on one or more controlling parameters. The operational controls important to this analysis include pressure reducing, pressure sustaining, pressure relief, and flow rate:

- **Pressure reducing valve:** modulates to maintain a preset downstream pressure setting; if the downstream pressure drops, then the valve will open until the downstream pressure matches the pressure setting.
- **Pressure sustaining valve:** modulates to maintain a preset upstream pressure setting; if the upstream pressure drops, then the valve will close until the upstream pressure matches the pressure setting.
- **Pressure relief valve:** opens when the upstream pressure exceeds a preset maximum pressure setting.

- **Flow control valve:** modulates to maintain a preset flow rate through the valve regardless of pressure.

The Ojai System contains three pressure regulating valves. Table 2-9 lists the relevant data for these valves.

TABLE 2-9
Pressure Regulating and Flow Control Valves
*GSWC Region I Water Master Plan—Ojai System*

| Name/Location | Pressure Zone | | Type | Dia. (in) | Pressure Setting |
|---|---|---|---|---|---|
| | Upstream | Downstream | | | |
| Montana-Cuyama CMWD Interconnection | CMWD Foothill Tank | Main Gradient | Reducing | 8 | 125 psi |
| Saddle Lane | Main Gradient | Saddle Lane Gradient | Reducing | 8 | 90 psi |
| Ventura Street | Main Gradient | Saddle Lane Gradient | Reducing | 8 | 80 psi |

## 2.2.6 Transmission and Distribution Pipelines

The system includes approximately 32 miles of pipelines ranging from 4 to 16 inches in diameter. Pipelines 12 inches in diameter and larger are considered transmission mains (9.5 percent of the system), and the smaller pipes were considered distribution mains (90.5 percent). Table 2-10 lists the estimated footage of pipelines by diameter and material.

TABLE 2-10
Pipes by Size and Material
*GSWC Region I Water Master Plan—Ojai System*

| Diameter (in) | Length of Pipe by Material (ft) | | | | | | Total Length (ft) | Total Length (%) |
|---|---|---|---|---|---|---|---|---|
| | ACP | CI | DIP | PVC | STL | CL STL | | |
| 4 | 995 | 20,384 | 227 | — | 2,869 | — | 24,475 | 14 |
| 6 | 27,078 | 21,951 | 389 | 2,294 | 1,729 | — | 53,441 | 31 |
| 8 | 37,309 | 6,954 | 1,797 | 14,710 | 11,599 | — | 72,370 | 42 |
| 10 | — | 2,870 | — | — | 4,323 | 364 | 7,557 | 4 |
| 12 | — | 12,114 | 1,138 | 1,427 | 949 | — | 15,783* | 9 |
| 16 | — | 24 | 137 | 181 | — | — | 341 | <1 |
| **Totals (ft)** | **65,382** | **64,296** | **3,689** | **18,612** | **21,469** | **364** | **173,967** | |
| **Totals (mi)** | **12.4** | **12.2** | **0.7** | **3.5** | **4.1** | **0.1** | **32.9** | |
| **Percent** | **38** | **37** | **2** | **11** | **12** | **<1** | **100** | **100** |

*Includes 155 ft without material information

ACP: asbestos cement pipe
CI: cast iron
DIP: ductile iron pipe
PVC: polyvinyl chloride
STL: steel pipe
CL STL: cement lined steel pipe

The system dates back to the late 1920s, with pipe installations occurring periodically over the last 85 years. Table 2-11 lists the estimated footage of pipelines by diameter and year constructed. About 14 percent of the pipes are at least 65 years old and over seventy percent of the system was built before 1980.

TABLE 2-11
Pipes by Size and Year Built
*GSWC Region I Water Master Plan—Ojai System*

| Diameter (in) | Length of Pipe by Year Built (ft) | | | | | | | | Total Length (ft) | Total Length (%) |
|---|---|---|---|---|---|---|---|---|---|---|
| | **1920–1939** | **1940–1949** | **1950–1959** | **1960–1969** | **1970–1979** | **1980–1989** | **1990–1999** | **2000–2005** | | |
| 4 | 5,431 | 4,368 | 7,710 | 5,743 | 408 | 815 | 0 | 0 | 24,475 | 14 |
| 6 | 3,869 | 1,986 | 11,704 | 15,998 | 12,862 | 5,747 | 1,275 | 0 | 53,441 | 31 |
| 8 | 2,433 | 1,697 | 7,534 | 19,202 | 6,693 | 25,535 | 7,983 | 0 | 72,370[a] | 42 |
| 10 | 31 | 0 | 6,723 | 603 | 200 | 0 | 0 | 0 | 7,557 | 4 |
| 12 | 12,696 | 0 | 226 | 737 | 0 | 0 | 0 | 1,969 | 15,783[b] | 9 |
| 16 | 0 | 0 | 0 | 160 | 0 | 0 | 181 | 0 | 341 | <1 |
| **Totals (ft)** | **24,459** | **8,051** | **33,898** | **42,444** | **20,163** | **32,097** | **9,440** | **1,969** | **173,967** | |
| **Totals (mi)** | **4.63** | **1.52** | **6.42** | **8.04** | **3.82** | **6.08** | **1.79** | **0.37** | **32.95** | |
| **Percent** | **14** | **5** | **19** | **24** | **12** | **18** | **5** | **1** | **100** | **100** |

[a] Includes 1,292 ft without installation year information
[b] Includes 155 ft without installation year information

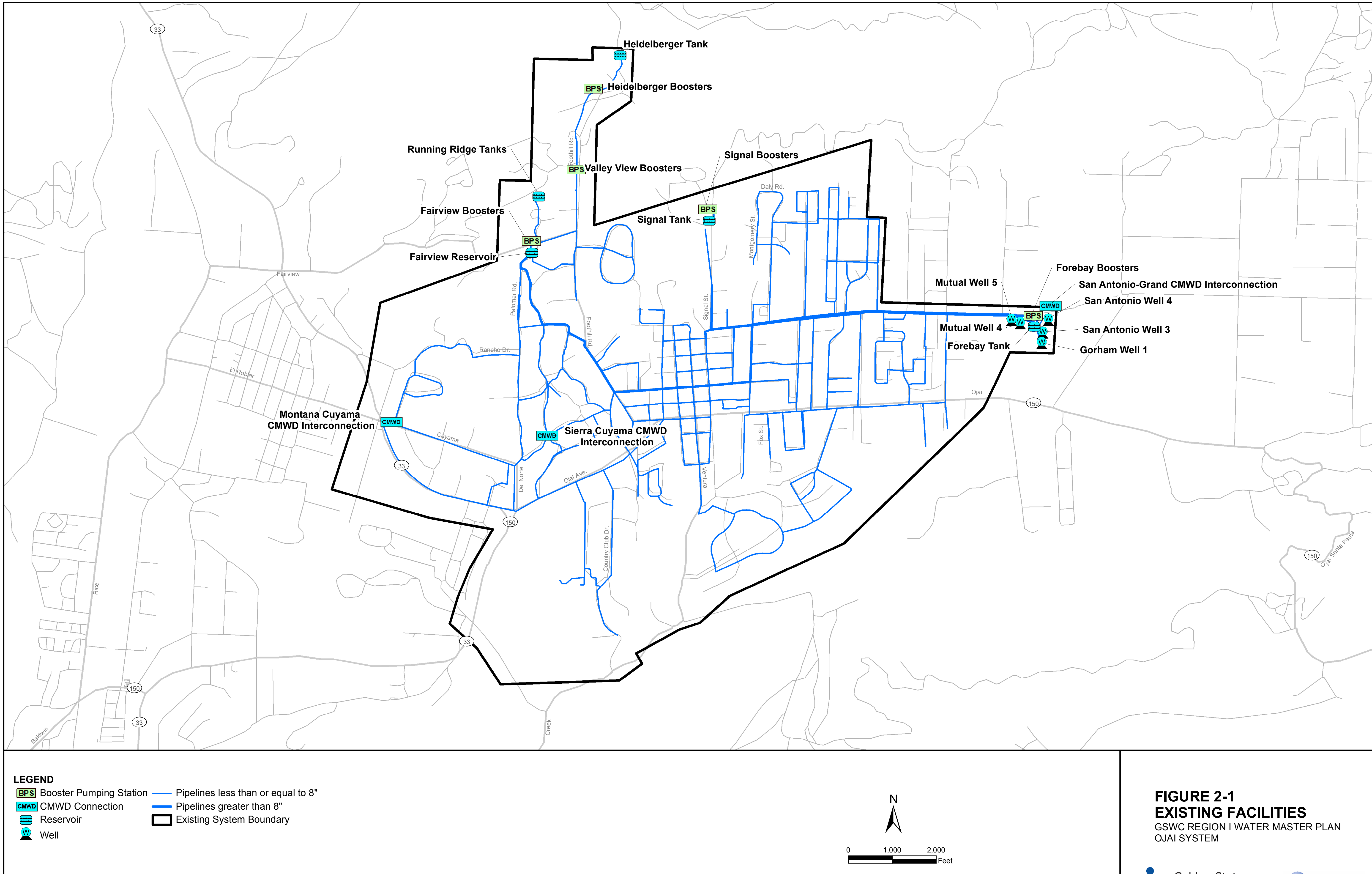



**FIGURE 2-1**
**EXISTING FACILITIES**
GSWC REGION I WATER MASTER PLAN
OJAI SYSTEM

Golden State Water Company
A Subsidiary of American States Water Company
CH2MHILL

\\ZION\SACGIS\PROJ\325343_GOLDEN_STATE\OJAI\MAPFILES\TM2\OJAI_FIG2-1_PIPES.MXD SSCOPES 12/19/2008 07:56:00

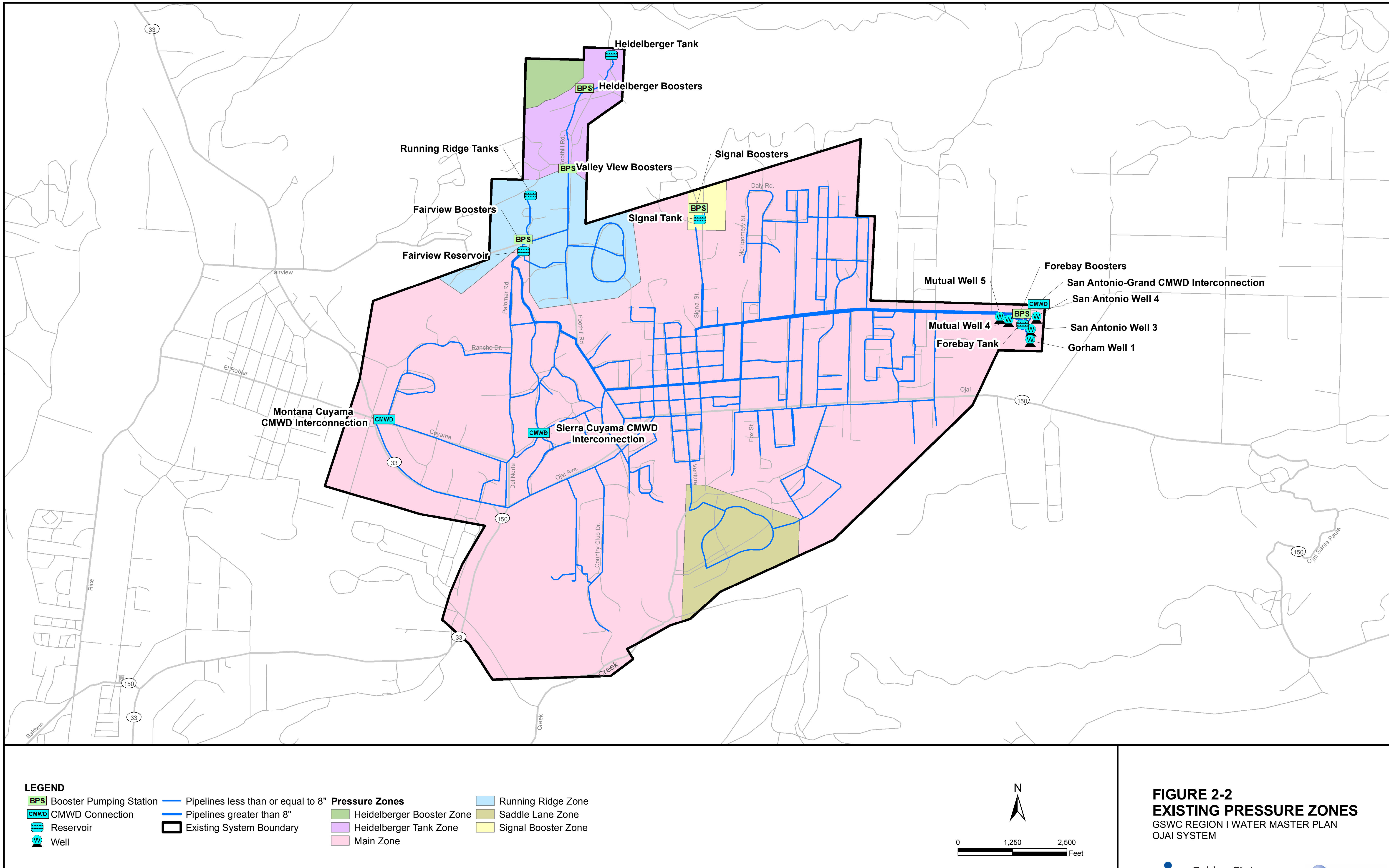
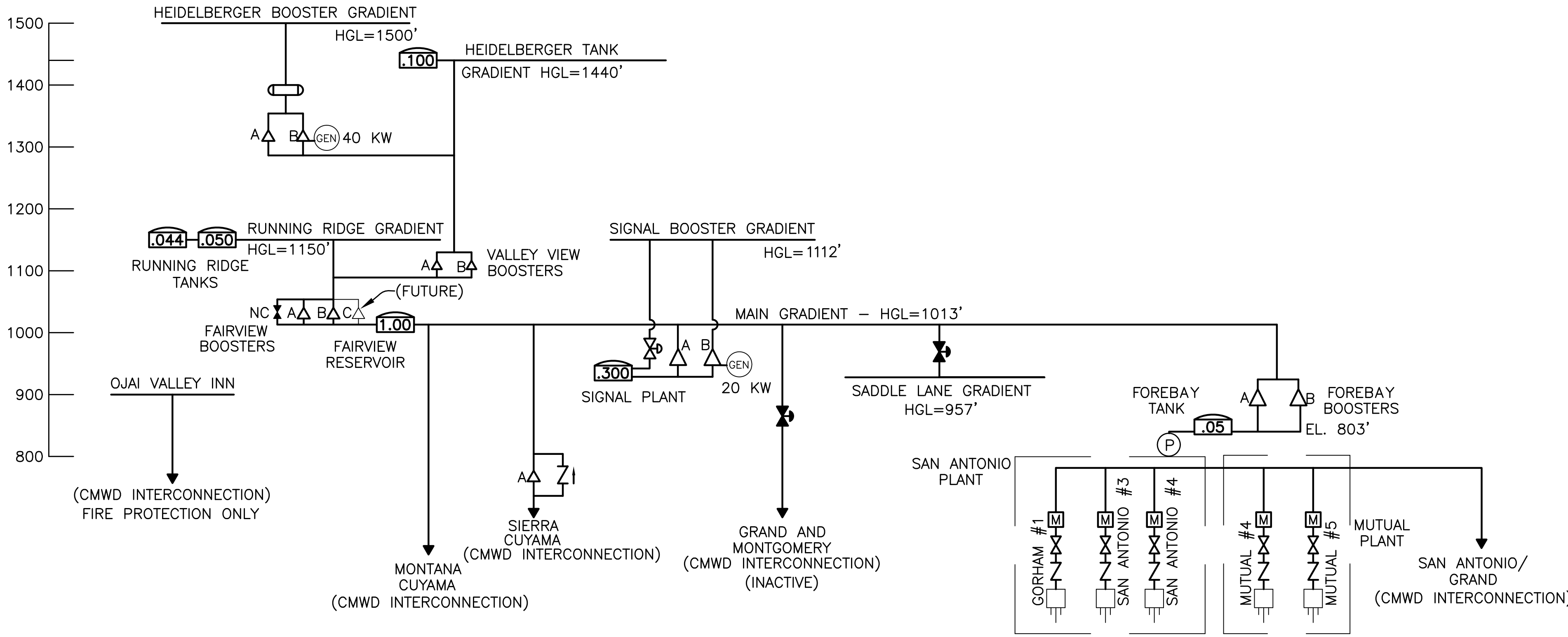



**FIGURE 2-2**
**EXISTING PRESSURE ZONES**
GSWC REGION I WATER MASTER PLAN
OJAI SYSTEM

Golden State Water Company
CH2MHILL

\\ZION\SACGIS\PROJ\325343_GOLDEN_STATE\OJAI\MAPFILES\TM2\OJAI_FIG2-2_PRESSUREZONES.MXD SSCOPES 12/19/2008 07:59:34




## LEGEND

- BOOSTER PUMP
- BOOSTER PUMP (GAS ENGINE)
- CARBON VESSEL (GAC)
- CHECK VALVE
- GENERATOR FOR BACKUP POWER
- HGL: HYDRAULIC GRADE LINE (2/3 FULL ELEV. CONTROLLING RESERVOIR OR PRV SETTING OR CONTROLLING BOOSTER SETTING)
- HYDROPNEUMATIC TANK
- PRESSURE FILTER
- PURCHASED WATER SUPPLY
- RESERVOIR, MG
- SAND TRAP
- VALVE, ALTITUDE
- NC: VALVE, GATE OR BUTTERFLY (NORMALLY CLOSED)
- VALVE, PRESSURE REGULATING
- VALVE, PRESSURE RELIEF
- VFD: VARIABLE SPEED DRIVE
- WELL

**FIGURE 2-3**
**SYSTEM SCHEMATIC**
GSWC REGION I WATER MASTER PLAN
OJAI SYSTEM

Golden State Water Company
A Subsidiary of American States Water Company

CH2MHILL

WB112007002SAC OJ_figure_2-3.ai 12/19/08 tdaus

SECTION 3

# Existing and Future Water Demands

This section documents existing and future water demands for the system and contains the following information:

- Demand definitions and periods
- Existing demands
- Peaking factors
- Future demand projections

## 3.1 Demand Definitions and Periods

Demand is classified in two basic ways:

- Demand: The total quantity of water required for a given period of time to meet the water system's various uses. These uses may include residential, commercial, industrial, and other revenue and non-revenue demands.

- Non-revenue water: The difference between the total amount of water produced from water supply sources and the total amount of water delivered to customers. For systems without meters for all customers, this demand classification may not be quantifiable.

The water industry commonly uses several demand periods for developing water distribution system master plans. These demand periods are designated as average day demand (ADD), maximum day demand (MDD), peak hour demand (PHD), and maximum day demand plus fire flow (MDD+FF). These demands are applied as necessary to evaluate the system. The American Water Works Association (AWWA, 2005) defines these common steady-state demand periods as follows:

- ADD: Total amount of water delivered to the system in 1 year divided by 365 days

- MDD: Maximum amount of water delivered to the system in any single day of the year

- PHD: Amount of water supplied to the system during the hour of MDD with the largest demand

- MDD+FF: Amount of water required to fight a fire during MDD

## 3.2 Existing Demands

The existing demands represent a baseline for evaluating the existing system and to project future demands. The data used to develop the existing demands was based on historical water production data provided by GSWC.

### 3.2.1 Historical Water Use

For this master plan, it was assumed that the historical water production equaled the historical water demand (including non-revenue water). Table 3-1 summarizes the Ojai System's historical annual water production from 1998 through 2006. The average water demand per connection for this period was 0.872 acre-feet per year per connection (AFY/conn.)

TABLE 3-1
Historical Annual Water Production
*GSWC Region I Water Master Plan—Ojai System*

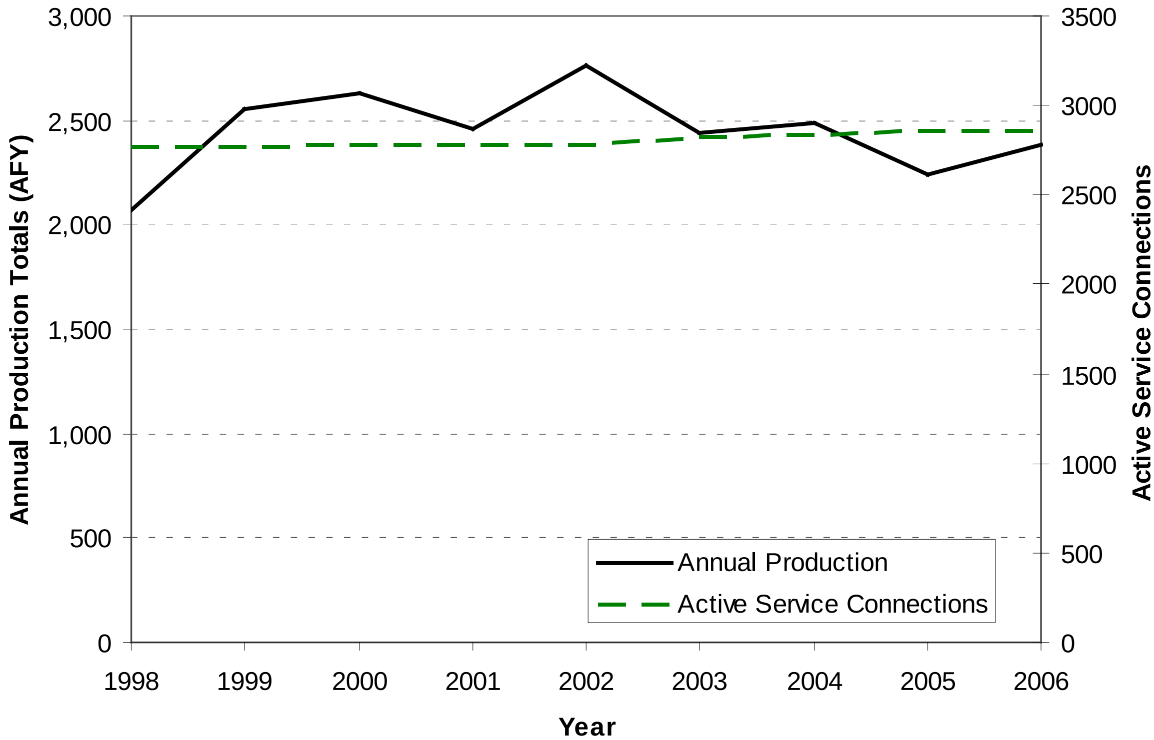
| Year | Active Service Connections | Average Demand (AFY)* | Average Demand per Connection (AFY/conn.) |
|---|---|---|---|
| 1998 | 2,772 | 2,073 | 0.748 |
| 1999 | 2,774 | 2,552 | 0.920 |
| 2000 | 2,779 | 2,631 | 0.947 |
| 2001 | 2,783 | 2,462 | 0.885 |
| 2002 | 2,782 | 2,760 | 0.992 |
| 2003 | 2,820 | 2,442 | 0.866 |
| 2004 | 2,833 | 2,488 | 0.878 |
| 2005 | 2,853 | 2,239 | 0.785 |
| 2006 | 2,859 | 2,379 | 0.832 |
| **9-year average** | | | **0.872** |

* Includes non-revenue water

Figure 3-1 summarizes the historical annual water production and number of active service connections over the nine year period. Figure 3-1 plots the number of active service connections and the amount of water consumed per calendar year over the 9-year period. The average demand per connection over the 9-year period varied between 0.992 and 0.748 AFY/conn.

The existing demand has been calculated by multiplying the 9-year average demand per connection (see Table 3-1) by the number of 2006 active service connections. Based on the number of connections shown in the table, the annual connection growth rate is about 0.35 percent. At this rate, the number of active connections is projected to increase by only 10 between 2006 and 2007. The projected demand (2007) for the Ojai System is 2,493 AFY.

FIGURE 3-1
Historical Annual Production Totals and Active Service Connections for the Last 9 Years
*GSWC Region I Water Master Plan—Ojai System*




## 3.2.2 Non-revenue Water

Non-revenue water equals the amount of water production less the metered water use. This includes water used for fire fighting and flushing and water lost due to system leaks and illegal connections.

For the Ojai System, GSWC provided historical total water demand and existing metered water use. It was found that the 2,859 total active service connections recorded 2,379 AFY of demand in 2006 (Table 3-1). The historical record illustrates that 2,071 AFY was consumed by metered customers. Using this information, the non-revenue water use was estimated to be approximately 308 AFY (Table 3-2), or 13 percent of the total water demand in 2006. It can be concluded that the Ojai System is completely metered.

TABLE 3-2
Existing Water Demands with and without Non-revenue Water in 2006
*GSWC Region I Water Master Plan—Ojai System*

| Demand Description | Demand (AFY) |
|---|---|
| Total water demand | 2,379 |
| Existing metered water use | 2,071 |
| Estimated non-revenue water | 308 |

### 3.2.3 Peaking Factors

To evaluate the system's performance during various demand periods, existing historical demand data were used to develop peaking factors as a function of ADD to facilitate these calculations. This approach allows the calculation of ADD for various planning years, and then allows a direct calculation for other demand periods using the appropriate peaking factor.

Peaking factors are typically calculated as a ratio of the demand period to ADD. For example, to determine the demands for MDD, the MDD peaking factor is multiplied by ADD.

Based on the historical average day and maximum day demands (maximum 3-day demands) provided by GSWC (see Table 3-3), the peaking factors from 1998 to 2006 ranged from 1.59 to 2.51 (see Figure 3-2). When historical data from SCADA was used to verify the supply in 2006, it was found that the MDD:ADD ratio varied from the data obtained through SQUID (a database updated with manual reads). Based on the variations in the two databases, a MDD peaking factor of 2.30 was selected over the 9-year period.

TABLE 3-3
Historical Average and Maximum 3-day Demands
*GSWC Region I Water Master Plan—Ojai System*

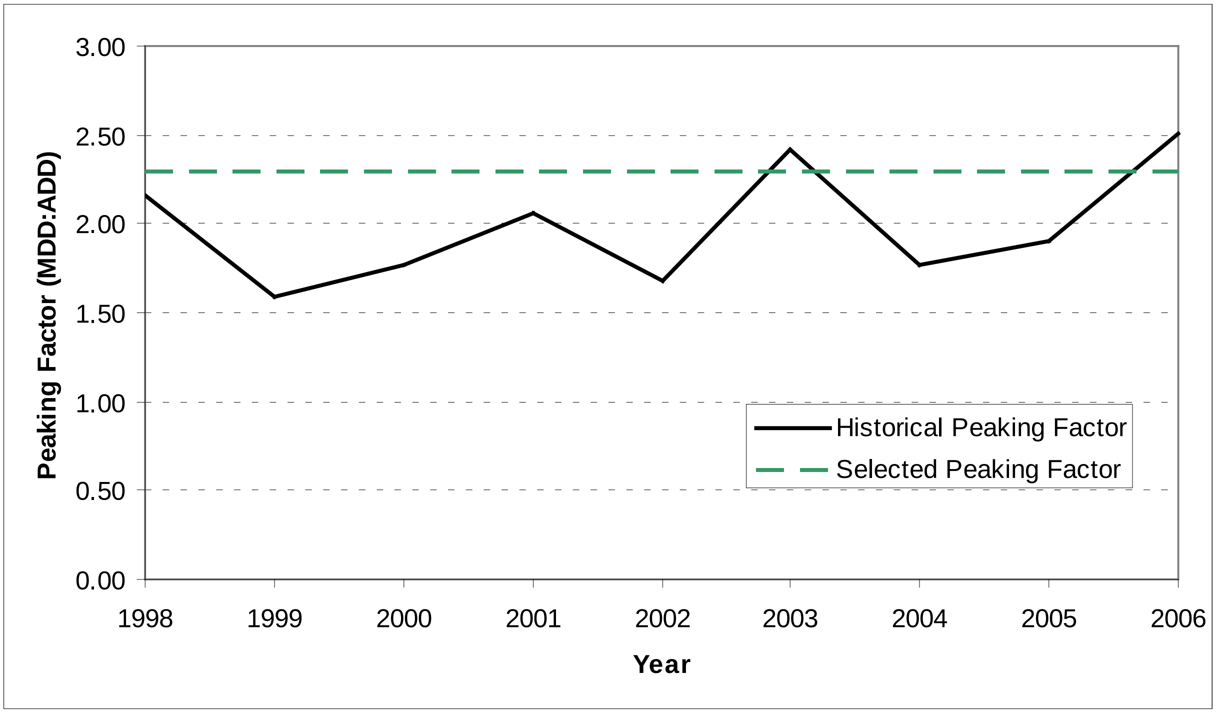
| Year | ADD* | | MDD (gpm) | MDD Peaking Factor (MDD:ADD) |
|---|---|---|---|---|
| | AFY | gpm | | |
| 1998 | 2,073 | 1,285 | 2,770 | 2.16 |
| 1999 | 2,552 | 1,582 | 2,510 | 1.59 |
| 2000 | 2,631 | 1,631 | 2,880 | 1.77 |
| 2001 | 2,461 | 1,526 | 3,138 | 2.06 |
| 2002 | 2,760 | 1,711 | 2,880 | 1.68 |
| 2003 | 2,442 | 1,514 | 3,658 | 2.42 |
| 2004 | 2,489 | 1,543 | 2,721 | 1.76 |
| 2005 | 2,239 | 1,388 | 2,641 | 1.90 |
| 2006 | 2,379 | 1.475 | 3,698 | 2.51 |

* Includes non-revenue water use

Historical MDD peaking factors are presented in Figure 3-2. Figure 3-2 shows that the selected peaking factor determined for this master plan (2.30) fluctuates around the maximum 3-day demand values for the 9-year period.

The single-year maximum peaking factor of 2.51 or 2.70 (based on SCADA) in 2006 was considered to be overly conservative (high compared to all other years) and was therefore not used as the MDD peaking factor.

FIGURE 3-2
Historical MDD Peaking Factors
*GSWC Region I Water Master Plan—Ojai System*




GSWC established the peaking factor for peak hourly demand (PHD) as 1.7 times MDD for the most recent 9-year period. To keep the peaking factors consistent, the peaking factor for PHD was converted to a factor relative to ADD instead of MDD. Table 3-4 summarizes the peaking factors to be used in this master plan.

TABLE 3-4
Summary of Peaking Factors by Demand Period
*GSWC Region I Water Master Plan—Ojai System*

| Demand Period | Peaking Factor |
|---|---|
| MDD | 2.30 × ADD |
| PHD | 3.91 × ADD |

## 3.3 Future Demand Projections

Future demands were projected first to estimate ADD, and then peaking factors were applied to estimate MDD and PHD. The following sources of data and approaches were used:

- Growth rate projections
- Water demand projections

### 3.3.1 Growth Rate Projections

Growth rate projections were obtained from the 2005 Urban Water Master Plan (UWMP) for the Ojai System and were based on estimates of the number of future service connections. The UWMP methodology used year 2000 census data from the Southern California Association of Governments (SCAG) to correlate population growth with the increase in service connections. This correlation was then used to determine future water demand.

Projections in the 2005 UWMP delineated demands into eight water-use categories as defined by the California Department of Water Resources (DWR). SCAG household projections were used to determine the growth rate in single- and multifamily service connections, and SCAG employment growth projections were used to determine the growth rate of commercial, industrial, institutional/governmental, landscape, and agriculture service connections. It was assumed that the number of connections is proportional to the population. Table 3-5 presents the projected number of service connections by water-use category for the planning years used in this master plan.

TABLE 3-5
Projected Service Connections by Water Use Category
*GSWC Region I Water Master Plan—Ojai System*

| Water Use Category | Service Connections by Planning Year | |
|---|---|---|
| | **2015[a]** | **2030** |
| Single family | 2,775 | 3,190 |
| Multifamily | 78 | 89 |
| Commercial | 148 | 161 |
| Industrial | 45 | 49 |
| Institutional/government | 72 | 79 |
| Landscape | 18 | 20 |
| Agriculture | 0 | 0 |
| Other[b] | 2 | 2 |
| **Total** | **3,138** | **3,590** |

Source: 2005 UWMP

[a] Number of service connections based on projected values from UWMP, not historical values
[b] Accounts for any service connections not included in any other category, including idle or inactive connections

### 3.3.2 Water Demand Projections

The future annual average demands are based on projections contained in the 2005 UWMP. These projections are summarized in Table 3-6.

TABLE 3-6
Projected Water Demands by Water Use Category
*GSWC Region I Water Master Plan—Ojai System*

| Water Use Category | Demands by Planning Year (AFY) | |
|---|---|---|
| | **2015**[a] | **2030** |
| Single family | 1,806 | 2,076 |
| Multifamily | 130 | 149 |
| Commercial | 249 | 270 |
| Industrial | 147 | 160 |
| Institutional/government | 158 | 171 |
| Landscape | 14 | 16 |
| Agriculture | 0 | 0 |
| Other[b] | 2 | 2 |
| Non-revenue water | 411 | 467 |
| **Total** | **2,917** | **3,311** |

Source: 2005 UWMP

[a] This number may not match the historical data in Table 3-1 because it was calculated using projected water demands.
[b] This category accounts for any service connections not included in any other category, including idle or inactive connections.

Figure 3-3 presents the historical and projected annual water demands starting from the most recent 10-year period through 2030. Table 3-7 summarizes the projected demands for ADD, MDD, and PHD periods using the peaking factors shown in Table 3-4.

FIGURE 3-3
Historical Water Demand and Future Water Demand Projections
*GSWC Region I Water Master Plan—Ojai System*

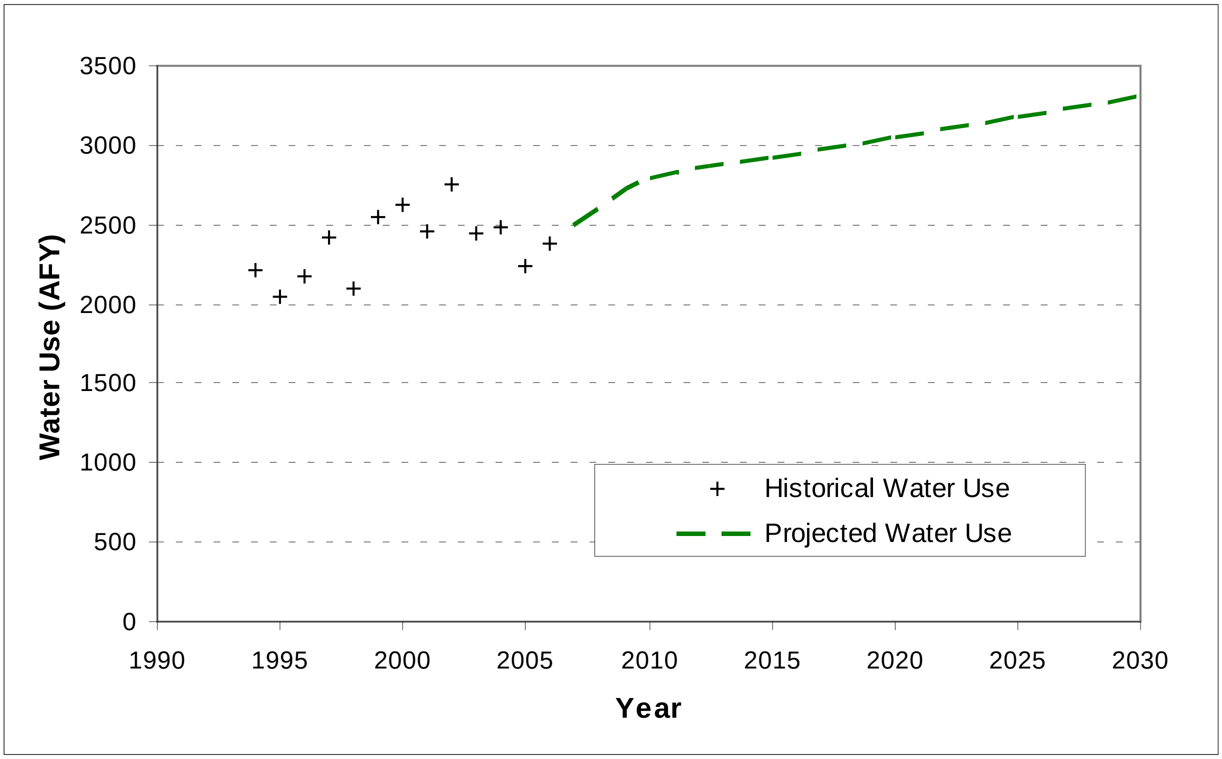



TABLE 3-7
Water System Demands by Demand Period
*GSWC Region I Water Master Plan—Ojai System*

| | Demand Period and Peaking Factor[a] | | | |
|---|---|---|---|---|
| **Planning Year** | **Annual Avg. (AFY)** | **ADD (1.0 × Avg.) (gpm)** | **MDD (2.30 × ADD) (gpm)** | **PHD (3.91 × ADD) (gpm)** |
| 2007[b] | 2,493 | 1,546 | 3,556 | 6,045 |
| 2015 | 2,917 | 1,808 | 4,158 | 7,069 |
| 2030 | 3,311 | 2,053 | 4,722 | 8,027 |

[a] Values are rounded.
[b] The annual average demands represent a baseline for the existing demands to analyze the existing system. This value may not match the historical data for 2007 because it was calculated using the average water demand per customer.

**SECTION 4**

# Hydraulic Model Development and Calibration

This section documents the development and calibration of the hydraulic computer model for the Ojai System and contains the following information:

- Construction of the hydraulic model
- Updates to the hydraulic model
- Hydraulic model calibration

## 4.1 Overview

A hydraulic computer model of the water distribution system is an important tool for any hydraulic analysis of the water system and especially for a water master plan. The computer model analyzes the water system facilities, operational characteristics, and water production and consumption data unique to the system. The water distribution system hydraulic model includes pipes, junction nodes (connection points for pipes and demand locations), control valves, pumps, tanks, and reservoirs. Operational characteristics include parameters that control how the water is distributed through the system, such as *on* and *off* settings for pumps, pressure or flow controls for hydraulically actuated valves, or main line valve closures. Data for production and consumption determine where the water supply and demands are applied within the distribution system.

Accurate computer model development begins with entering the correct information into the data file and calibrating the model to match existing conditions in the field. Once this foundation is complete, the resulting model becomes an invaluable tool. It can simulate the existing and future water systems, identify system deficiencies, analyze impacts from increased demands, and determine how effective proposed improvements are for the system.

## 4.2 Construction of the Hydraulic Computer Model

The Ojai System hydraulic computer model was developed from an incomplete older model prepared by GSWC prior to this master plan. The model was checked for accuracy, updated to include newly constructed facilities, and reoriented to real-world coordinates. Valve settings for pressure regulating valves in the Saddle Lane Gradient were entered. The demands were revised based on historical and projected demands.

### 4.2.1 Updating the Previous Hydraulic Computer Model

The previous computer model was prepared using the modeling software EPANET. CH2M HILL converted the model for this master plan into H2OMap. The previous model contained most of the existing distribution system facilities except for a number of distribution pipes in the Main Gradient, Saddle Lane Gradient, and Heidelberger Gradient, and a few booster pumps and tanks. The hydraulic model was reviewed and updated from GSWC's water distribution system map for the Ojai System drawn in AutoCAD and based on as-built drawings received from GSWC. The hydraulic model was updated to reflect the currently operational facilities. Using the previous model allowed GSWC to focus on verifying the accuracy of the data being provided for this master plan. GSWC checked pipe diameters, materials, and years constructed, making corrections as appropriate. Two new pressure regulating valves (PRVs) were identified between the Saddle Lane and Main gradients.

The model was reoriented into real-world coordinates based on the State Plane Coordinate System NAD 83. This update facilitated the use of overlay maps without the need to adjust the coordinates for each overlay. This adjustment made it easier to verify model scale, which is important for obtaining accurate pipe lengths and produces better results from the hydraulic analysis.

Elevations assigned from the previous model were updated by overlaying the geo-referenced model with USGS contour maps.

### 4.2.2 Updating Water Demands in the Model

Water demands allocated in the model were updated based on historical demands (see Section 3, Existing and Future Demands). GSWC provided customer billing records that have customer addresses and respective annual water demand. CH2M HILL used the most current active addresses (2006) and spatially assigned the 2006 demands using GIS. Demands were assigned to the nearest nodes in the model using the Demand Allocator Module in H2OMap. Once 2006 demands were spatially allocated, they were scaled to approximate the 2007 ADD (1,546 gpm). Table 4-1 presents the distribution of demands per pressure zone.

TABLE 4-1
Distribution of Water Demands by Pressure Zone
*GSWC Region I Water Master Plan—Ojai System*

| Pressure Zone | Percent of Total | Demands* (gpm) | Number of Demand Nodes | Demand per Node* (gpm) |
|---|---|---|---|---|
| Heidelberger Tank Gradient | 2.8 | 43 | 12 | 3.6 |
| Heidelberger Booster Gradient | 0.2 | 3 | 1 | 3.0 |
| Main Gradient | 90.3 | 1,395 | 249 | 5.6 |
| Running Ridge Gradient | 2.6 | 40 | 5 | 8.0 |
| Signal Booster Gradient | 1.5 | 23 | 6 | 3.8 |
| Saddle Lane Gradient | 2.6 | 41 | 7 | 5.8 |
| **Total system** | **100.0** | **1,545** | **280** | **5.5 (average)** |

* Allocated and scaled demands totaled to the 2007 ADD. Demands were rounded.

## 4.3 Hydraulic Computer Model Calibration

The purpose of the hydraulic computer model is to estimate or predict how the water system will respond under a given set of conditions. One way to test the accuracy of the computer model is to create a set of known conditions in the water system and then compare the results observed in the field against the results of the computer model simulation using the same conditions. Flow tests conducted in the field can be a profound tool for verifying data used in the hydraulic computer model and for gaining a greater understanding of how the water system operates.

Field testing can identify errors in the data for the computer model, or it may reveal an unknown condition in the field; for example, valves reported as being open might actually be closed (or vice versa), or an obstruction could be discovered in a pipeline. Field testing can also correct erroneous model data such as incorrect pipe diameters or connections between pressure zones. Data obtained from the field tests can be used to determine appropriate roughness coefficients for pipe groups based on specific information about the pipes. The roughness coefficient can vary with age and pipe material, as well as by system. Therefore, these parameters were used in combination with the field testing results to help assign appropriate roughness coefficients.

### 4.3.1 Field Testing

The Ojai System was field tested by conducting real-world flow tests. A comprehensive field testing plan was developed to make efficient use of field personnel and equipment. The plan was reviewed by GSWC staff and then scheduled for a time convenient for GSWC field crews.

#### Field Testing Overview

Field testing for the Ojai System was conducted on November 14, 2007. The detailed approach to field test this system and the data collected during testing is provided in the *Ojai Water Distribution Systems Field Testing Protocol* (Field Testing Protocol) contained in the appendices. The data was compared to the modeling results to determine the level of calibration.

The Field Testing Plan identified multiple test sites, each with the following types of hydrants:

- One flow hydrant - a Pitot tube was utilized to determine the flow from the hydrant.
- One residual hydrant – a hydrant located closest to the flowing hydrant equipped with a pressure data logger to record residual pressure during the flow test.
- One monitoring hydrant or hose bib (hydrant or hose bib located in close proximity to the flowing hydrant equipped with a pressure gauge to monitor pressure during the flow test).

Overall, nine pressure data loggers (electronic devices that automatically record pressure over time) were attached to fire hydrants throughout the system. Two of these were not located near flowing hydrants, but on hydrants near Grand Avenue, west of the San Antonio Plant. These pressure loggers were used to determine whether a bottleneck exists in the distribution pipelines on Grand Avenue, as GSWC operation staff had speculated during field testing development. An investigation on possible blockage in the pipelines was completed, however not included in this Master Plan.

Maps and data collection forms were provided to the field crews prior to testing. Safety precautions were strictly observed during the field work, resulting in zero injuries.

At the beginning of the testing day, pressure loggers were installed on the assigned hydrants. Next, field personnel were dispatched to the first test site. Before any hydrants were opened, personnel recorded the static pressure and verified the boundary conditions established in the Field Testing Plan.

After the static pressure was recorded, the designated flow hydrant was opened. The flow rates from the flowing hydrants were measured using a pitot tube (a device that measures velocity head, which can be converted into a flow rate). When the flowing hydrant was fully opened and the pressure at the monitoring location stabilized, the flow rate was recorded, as was the dynamic pressure from the hand gauge. After all the data was recorded, the flowing hydrants were closed. The data was then checked, and if it appeared reasonable, the field personnel were dispatched to the next site. If the data appeared questionable, the field test was repeated prior to the next test. Pressures from the data loggers were obtained at the end of each day along with the SCADA data.

### Field Testing Locations

The field testing involved eight individual flow tests, including one location where the hydrant was flowed twice with different boundary conditions. The locations of these test sites and the total instantaneous flow rate observed at each is listed in Table 4-2. During Test 6A, both San Antonio booster pumps were turned off; during Test 6B, San Antonio Booster Pump B was turned on, but San Antonio Booster Pump A was turned off. Other boundary conditions remained the same as for other field tests. Pressure data loggers were installed on hydrants adjacent to each flowing hydrant to record pressure at 30-second intervals. Additionally, two pressure data loggers were installed on monitoring hydrants at Los Alamos Drive and Mercer Avenue in the Main Gradient to record the pressure fluctuations near the San Antonio Plant. These monitoring hydrants were at opposite (north and south) sides of Grand Avenue and the Los Alamos Drive data logger was located closer to the San Antonio Plant than the Mercer Avenue data logger. Pressures from nine locations were recorded during the fire flow tests. GSWC's SCADA data supplemented the pressure logger data.

TABLE 4-2
Field Test Locations
*GSWC Region I Water Master Plan—Ojai System*

| Test Number | Location | Pressure Zone | Total Measured Flow Rate (gpm)[a] |
|---|---|---|---|
| 1 | Foothill Rd., F295 | Heidelberger Tank Gradient | 416 |
| 2 | Fairview Rd., F145 | Running Ridge Gradient | 833 |
| 3 | Rancho Dr., F107 | Main Gradient | 721 |
| 4 | Pauline St., F171 | Main Gradient | 589 |
| 5 | Drown Ave., F43 | Main Gradient | 1,343 |
| 6A[b] | Oriole St., F237 | Main Gradient | 833 |
| 6B[c] | Oriole St., F237 | Main Gradient | 1,054 |
| 7 | Buckboard Ln., F273 | Saddle Lane Gradient | 1,381 |

TABLE 4-2
Field Test Locations
*GSWC Region I Water Master Plan—Ojai System*

| Test Number | Location | Pressure Zone | Total Measured Flow Rate (gpm)[a] |
|---|---|---|---|

[a] Flow rate values were calculated from the pitot tube pressure readings at each flow hydrant. A nozzle coefficient of 1.0 (for flow tube) was assumed to calculate flow.
[b] Both San Antonio booster pumps were off.
[c] San Antonio Booster Pump B was on and San Antonio Booster Pump A was off.

## 4.3.2 Calibration

Simulations were created in the hydraulic model to analyze the two field scenarios: static and dynamic. The static run simulated the water system just prior to a test when the hydrants were closed. The dynamic run simulated the system during the test while the hydrants were open. A total of ten simulations were created to calibrate the model: two static simulations (with two boundary conditions) and eight dynamic simulations (with eight fire flow demands and respective boundary conditions). The goal of calibration was to have the model results within 10 psi for dynamic testing and 5 psi for static testing of the field observations for 90 percent of the tests.

The calibration process required that the model simulations duplicate the boundary conditions observed at the time of each test. Boundary conditions include sources of supply, storage facilities, and other locations where water flows into or out of the distribution system. These locations of known flows and pressures were not changed during calibration.

Where significant differences were revealed between the model results and field observations, the model data was rechecked against known data to evaluate the accuracy of the data. This included checking pipe diameters and other similar data. If this data appeared to be correct, additional steps were taken to verify connections between pipes, verify pressure zone boundaries, and perform similar checks. The calibration process attempted to correct any errors found in the model data before calibrating friction coefficients or suggesting that unknown field conditions (such as a closed main line valve) might exist.

The calibration effort began with analyzing the static scenario followed by the dynamic scenarios one at a time. Each time a change was made in the model, it was carried over to the next scenario. Finally, all scenarios were run using the latest adjustments to ensure that the calibration criteria are still met in all tests.

As a general rule, changes were not made unless sufficient justification was shown from the field data to support the change. Once the pumps and valves in the model appeared to be operating correctly, adjustments to the pipe friction coefficients (C-factors for the Hazen-Williams equation) were made to reflect the observed head loss through the pipelines.

### Pipe Friction Coefficients

Preliminary C-factors were assigned based on pipe material and age. These initial C-factors were developed from standard published values for pipes of similar material and age.

Adjustments to the C-factors were made based on pipe groupings, or classes. The classes were determined based on pipes made from similar materials and of similar ages. These pipe classes are presented in Table 4-3.

TABLE 4-3
Pipe Classes by Material and Age
*GSWC Region I Water Master Plan—Ojai System*

| Class No. | Pipe Material | Installation Year | Age (years) | Percent of Total (%) | Typical C-factor Range | Initial C-factor |
|---|---|---|---|---|---|---|
| 1 | ACP | Before 1970 | 35+ | 13.88 | 100–130 | 130 |
| 2 | ACP | After 1970 | 0–35 | 24.84 | 130–150 | 130 |
| 3 | CIP | Before 1955 | 50+ | 20.72 | 70–120 | 130 |
| 4 | CIP | 1955–1970 | 35–50 | 15.13 | 110–140 | 130 |
| 5 | CIP | After 1970 | 0–35 | 0.12 | 130–150 | 130 |
| 6 | DIP | Before 1955 | 50+ | 0.00 | 70–120 | 130 |
| 7 | DIP | 1955–1970 | 35–50 | 0.52 | 110–140 | 130 |
| 8 | DIP | After 1970 | 0–35 | 1.67 | 130–150 | 130 |
| 9 | PVC | All | All | 11.02 | 130–160 | 130 |
| 10 | STL | Before 1955 | 50+ | 5.40 | 80–110 | 130 |
| 11 | STL | 1955–1970 | 35–50 | 6.65 | 110–140 | 130 |
| 12 | STL | After 1970 | 0–35 | 0.05 | 130–150 | 130 |

ACP: asbestos cement pipe
CIP: cast iron pipe
DIP: ductile iron pipe
PVC: polyvinyl chloride
STL: steel pipe

## Data Collection and Accuracy

All nine pressure data loggers recorded data for all the flow tests. Note that the data quality of the pressures recorded during the tests are the most important piece of information in the model calibration process, where the pressure predicted by the model is matched with the pressure logger data at various locations in the distribution system. If the pressure logger data is not accurate in terms of pressure records and the exact time for record, the confidence level in model calibration is affected. The following data inconsistencies were observed between the model and the field observed data:

- Although the intended interval for the pressure data recording was 30 seconds, the pressure logger did not record consistently at the intended interval at all locations. For example, the pressure loggers installed at test sites 5 and 6 recorded data at 1-minute intervals and the pressure logger at test site 4 recorded data at 70 second intervals. This data interval might have missed some of the key pressure fluctuations during the short period (generally lasting for 3 to 5 minutes) of fire flow at a hydrant. The 1-minute interval of record might have influenced the calibration process by averaging flow fluctuations that occurred during 1 minute.

- The pressure logger data suggests two varying levels of very high pressures recorded at the hydrant used for flow during Test 1 throughout much of the field testing period, except when flowing the hydrant. In general, pressure follows a lower plateau and a higher plateau trend. A sudden increase in pressure indicates that a Valley View booster pump turned on to raise the pressure from a lower plateau of pressure of about 125 psi to a higher plateau of pressure at about 150 psi for a couple of hours before returning to its lower plateau pressure. This trend in pressure fluctuations was observed in the data logger data prior to and during the flow tests except during Test 1, when pressure dropped dramatically by about 97 psi from the lower plateau of pressure. This is further discussed in the model calibration section below.
- The demand during the testing period may be slightly lower than ADD since the tests were performed during afternoon and late afternoon hours, when demands in the system are low, particularly in November.

The accuracy of other pressure data and flow readings are described in detail in the following discussions.

### Static Calibration

The overall system demands near the flow tests during static conditions were significantly lower than the demands with the flowing hydrants included. Therefore, the head loss during static demands was also significantly lower. Static demands provided a better condition under which the elevations of junction nodes could be verified. Since the head loss during static demands is low, observed pressures throughout the system would not be sensitive to any changes in C-factors. The best use of the static scenario is to verify system demand distribution, node elevations, tank elevations, and boundary conditions.

The calibration simulations were performed using ADD distributed to various nodes. The demand during the test would have been the most relevant demand data for model calibration. However, demand data was unavailable during the tests, so demand was assumed as ADD for calibration simulations. Reservoir levels were based on data from SCADA and pressure loggers, and were used to verify boundary conditions and the calibration performance.

Where static pressures from the model did not match field-observed pressures, adjustments were made in the model to account for the differences. Elevations, valve settings, and other parameters were checked for accuracy before any changes were implemented. Adjustments made to the model are as follows:

- A Valley View booster pump is on during approximately 2 hours of the field test period.
- Based on the as-built drawings received from GSWC, a few pipe diameters and pipes near the Heidelberger booster pumps and hydro-pneumatic tank were verified and updated in the model.
- Two PRVs (between Main and Saddle Lane gradients) were identified, verified by GSWC, and added to the model. These valves allow flow from Main Gradient to Saddle Lane Gradient.

- The PRV at the CMWD Grand-Montgomery Interconnection is closed for calibration scenarios per GSWC's comments. The valve was non-operational at the time of testing.
- System layout for the Main and Saddle Lane gradients was found to be different from the system schematic. GSWC verified the layout and updated the schematic. Pipes that were located on the Saddle Lane Gradient were added to the model per information from GSWC.
- The altitude valve that lets water into the Signal Tank from the Main Gradient was assumed to be closed. This was later confirmed by GSWC; this valve opens only at night to fill the tank.

After incorporating these changes to the model, there was a close match between observed and modeled flows and pressures. Additional (but minor) adjustments were made in the dynamic scenarios.

### Dynamic Calibration

Dynamic calibration refers to a steady-state calibration when the system is being stressed by a significant and measurable demand in a localized area. To accurately model these localized demands, separate scenarios were developed to represent each field test. Model scenarios were established to define the appropriate boundary conditions and demands.

During the calibration process, adjustments were made to the hydraulic model until simulation results produced similar pressure drops to those observed in the field. Several adjustments were made to the Ojai System hydraulic model to reduce the differences between field measurements and model results. Following are descriptions of the calibration for each test site. All scenarios were run with all the changes incorporated before the final evaluation of the overall system calibration:

- Test 1—Heidelberger Tank Gradient: Except for the test flows conducted at Test 1 and at Test 6A, pressures observed in Heidelberger Tank Zone were slightly higher than the modeled values. As described earlier, it was found that the pressure dropped suddenly during the fire-flow test at this location. It was initially unknown why pressure dropped so dramatically (from 124 psi to 27 psi) for a couple of minutes. Upon investigating this trend with GSWC, it was discovered that pipes (steel pipes installed in 1965) in the higher Heidelberger Tank Gradient are only 5.5 inches in diameter for most of their length and are heavily tuberculated, further reducing the original diameter. This caused tremendous head loss and resulted in a small amount of flow through the pipes (417 gpm from the flow hydrant). The high corrosion likely made most of the inner diameter of the pipes unavailable for flow. The extremely corroded pipes increase the head losses that become significant only during larger flows (such as fire-flow conditions). In order to account for the head loss in the pipes between the Heidelberger Tank and the Valley View boosters, the C-factor needed to be adjusted. By changing the C-factor to 65 (reduced from 130) for these pipes, the model results match within the "high" level of acceptance with the observed pressures collected at the Test 1 monitoring hydrant.
- Test 2—Running Ridge Gradient: This test location was very close to the Fairview Plant and seems to be controlled by the Fairview booster pumps and operation of the Running

Ridge tanks. Both Fairview boosters were turned on during the tests, making it the most stable pressure area, even with the fire-flow test. Pressures estimated by the hydraulic model in the Running Ridge Gradient were either slightly lower or higher than observed values for specific tests. No adjustments were made to the model due to this scenario because results were within the "high" limit of acceptance for static and dynamic conditions.

- Test 3—Main Gradient: This test location was in the western Main Gradient near the Fairview Plant. Pressures estimated by the hydraulic model here were generally lower than observed values (except Tests 6A and 6B). No adjustments were made to the model due to this scenario because results were within the "high" limit of acceptance for static and dynamic conditions.

- Test 4—Main Gradient: This test location was in the Main Gradient near the Signal Booster Plant. The HGL determined from the pressure data at Test 4 was slightly lower than the HGLs at Test 3. Pressures estimated by the hydraulic model in Test 4 were higher than observed values. This was resolved by changing the roughness coefficient of a few older and corroded pipes in this area.

- Test 5—Main Gradient: This test location was influenced by the San Antonio booster pumps. The HGL determined from the pressure data at Test 5 was higher than the HGLs at Tests 3 and 4. Pressures estimated by the hydraulic model at Test 5 were generally higher than observed values. No adjustments were made to the model due to this scenario because results were within the "high" limit of acceptance for static and dynamic conditions.

- Test 6—Main Gradient: This test location was very close to the San Antonio booster pumps and the monitoring hydrants (Locations 8 and 9). Therefore, pressure fluctuations at the San Antonio Plant affected this area. The HGL during Test 6 was higher than at any other test locations within the main gradient. Pressures estimated by the hydraulic model at Test 6 were lower (except Tests 4 and 7) than observed values. The Test 6 location included two tests: Test 6A and Test 6B.

  - Test 6A—Main Gradient: This test was performed when both San Antonio booster pump were turned off. The field pressures were relatively lower than those observed during other flow tests. Pressures estimated by the hydraulic model for Test 6A were slightly higher than observed values. No adjustments were made to the model due to this scenario because results were within the "high" limit of acceptance for static and dynamic conditions.

  - Test 6B—Main Gradient: This test was performed when only one San Antonio booster pump was turned on. Pressures estimated by the hydraulic model for Test 6B were slightly higher than observed values. No adjustments were made to the model due to this scenario because results were within the "high" limit of acceptance for static and dynamic conditions.

- Test 7—Saddle Lane Gradient: This zone has the lowest elevation of the entire system. With the PRV settings provided by GSWC, pressures estimated by the hydraulic model at Test 7 were slightly higher than the observed values. No adjustments were made to the model due to this scenario because results were within the "high" limit of acceptance for static and dynamic conditions.

- Additional pressure data loggers installed at Los Alamos Drive and Mercer Avenue were close to the San Antonio Plant. These two locations were selected to record several issues:
  - The impact of the San Antonio booster pumps on the overall fluctuations of pressures of the Ojai System during and prior to fire-flow tests.
  - Pressure at both sides of the main trunk pipeline on Grand Avenue.
  - Low pressures and possible obstruction of flow in the distribution system compared to the discharge pressure at the San Antonio Plant.

These two pressure loggers provided confidence in model results during all fire-flow tests since they match well with the observed pressure.

## Confidence Level of Calibration Results

Calibration results were analyzed by comparing the differences between field-observed pressures and model results for each test location. These comparisons were made after errors were corrected and adjustments were made in the model. The level of confidence in the calibrated model was directly related to the difference between modeled and observed pressures. Table 4-4 summarizes the level of confidence criteria used for static and dynamic pressures.

TABLE 4-4
Calibration Results Level of Confidence Criteria
*GSWC Region I Water Master Plan—Ojai System*

| Level of Confidence | Difference between Field and Model Pressures | |
|---|---|---|
| | **Static** | **Dynamic** |
| High | Less than 5 psi | Less than 10 psi |
| Medium | 6 psi to 10 psi | 11 psi to 20 psi |
| Low | More than 10 psi | More than 20 psi |

## Summary of Calibration Results

The overall calibration results were based on the percentage of the results having the level of confidence defined in Table 4-4. The overall level of confidence was considered high if at least 90 percent of the calibrated results were in the high level of confidence per Table 4-4. The overall level of confidence was considered medium if 70 to 90 percent of the calibrated results were in high level of confidence per Table 4-4, and low if less than 70 percent of the calibrated results were in high level of confidence per Table 4-4. A summary of the overall calibration results is provided in Table 4-5, which shows that overall confidence level is high for dynamic tests and static tests.

TABLE 4-5
Summary of Calibration Results
*GSWC Region I Water Master Plan—Ojai System*

| System Condition | Number of Test Results by Confidence | | | Percent High Confidence | Overall Confidence |
|---|---|---|---|---|---|
| | High | Medium | Low | | |
| Static | 72 | 0 | 0 | 100% | High |
| Dynamic | 72 | 0 | 0 | 100% | High |

### Final Pipe Friction Coefficients

During hydraulic computer model calibration, C-factors were adjusted based on field-observed pressures. C-factor adjustments were made to match field-measured pressures to model pressures in several areas: older and corroded pipes near the Test 6 location (changed from 130 to 110), for four pipes (changed from 130 to 120) in the Main Gradient, and for six pipes in the Heidelberger Tank Gradient (changed from 130 to 65 from the main branch of the Heidelberger Tank to Valley View boosters). All other C-factors remained the same.

## 4.4 Summary

This hydraulic model update included development and verification of the physical components represented in the hydraulic model, distribution of demands in the model, field testing, and calibration of the updated model. Overall confidence in the hydraulic computer is high. No additional field testing is necessary at this time for the hydraulic computer model.

It is important to note that model calibration for any water system is an ongoing effort. As changes in the system occur from changing demands, new infrastructure development, or changing operational settings, the model must be periodically updated and checked to ensure agreement with field measurements. This calibration effort serves as a baseline for future calibration efforts by GSWC.

SECTION 5

# Supply and Storage Capacity Evaluation

This section documents the evaluation of the water supply and storage capacity for the Ojai System. The evaluation results accomplished the following:

- Established storage needs for the entire distribution system
- Identified supply and storage deficiencies in the existing and future systems
- Proposed facilities that mitigate the deficiencies identified

In each subsection, the supply and storage capacity of the existing and future water systems were measured against the objectives identified in the technical memorandum titled *Master Planning Criteria and Standards* (included in appendices), prepared for GSWC by CH2M HILL. When the analysis indicated that the system did not meet these criteria, a deficiency was identified and facilities were proposed to mitigate the deficiency.

## 5.1 Overview

To provide a reliable water supply, a water system must be able to meet the system demands under a variety of conditions. The water supplied may be provided by a combination of supply sources, stored water, or both. The specific demand period being analyzed may limit the source of water for the scenario. For example, stored water should not be used to meet ADD or MDD, but could be used for PHD or MDD+FF. Therefore, each demand period may require a different ratio of water supplies and storage. This analysis examines various demand periods to determine if the system has the ability to reliably meet the system demands under typical demand scenarios using a combination of water supply sources and storage.

## 5.2 Evaluation Approach

This supply and storage capacity analysis examined the Ojai System under three planning periods:

- **Existing system.** The existing water system analyses assumed 2007 demands and facilities that were operational in 2007.
- **2015 system.** The mid-term planning horizon (2015) water system analysis assumed 2015 demands and included existing facilities, facilities proposed to correct existing deficiencies, and facilities needed to correct deficiencies identified in 2015.
- **2030 system.** The long-term planning horizon (2030) water system analysis assumed 2030 demands (assumed buildout) and facilities included in the mid-term analysis, plus facilities needed to correct deficiencies in 2030.

### 5.2.1 Analysis Criteria

The Ojai System must be capable of providing sufficient water supply and storage capacity to meet the minimum design criteria summarized in Table 5-1. These criteria were developed and provided in the technical memorandum titled *Master Planning Criteria and Standards* (Appendix A). The criteria applies to the system as a whole and to each individual pressure zone.

TABLE 5-1
Supply and Storage Capacity Analysis Criteria
*GSWC Region I Water Master Plan—Ojai System*

| Planning Scenario | Demand and Duration | Evaluation Criterion | Storage Usage | Facilities Assumed to be Out of Service |
|---|---|---|---|---|
| Average day | ADD for 24 hours | Total capacity | No drawdown | None |
| Maximum day | MDD for 24 hours | Firm capacity | No drawdown | San Antonio Booster Pump A or B, or Gorham Well 1[a] |
| Peak hour | PHD for 4 hours[b] | Firm capacity | Operational | San Antonio Booster Pump A or B, or Gorham Well 1[a] |
| MDD + fire flow | MDD plus fire flow, duration varies | Total capacity | Fire | None |
| Planned CMWD outage | ADD for 7 days | Total capacity without CMWD pipeline | Half of operational and all emergency | All three CMWD interconnections |
| Unplanned CMWD outage | MDD for 1 day followed by ADD for 6 days | Total capacity without CMWD pipeline | Half of operational and all emergency | All three CMWD interconnections |

[a] Gorham Well has the largest well capacity, and San Antonio Booster Pump A or B has the largest single booster pump capacity in the system.
[b] Operational storage required to meet peak demands during MDD was defined as the supply needs during 4 hours of PHD.

CMWD provides purchased water to the Ojai System, and all three CMWD interconnections are on the same CMWD pipeline. Therefore, during a planned or unplanned outage, all three interconnections would be unavailable.

For this master plan, the Ojai System was analyzed as two areas based on the system's hydraulic architecture:

- Area 1 includes the Main Gradient, Saddle Lane Gradient, and Signal Booster Gradient.
- Area 2 includes the gradients in the northwest corner of the system: the Heidelberger Booster Gradient, Heidelberger Tank Gradient, and Running Ridge Gradient.

Area 1 is characterized by a relatively higher demand, larger area, and larger distribution piping length. Area 2 is much smaller in size and demand, and does not contain any water supply sources; it relies on supply from Area 1. The analysis for this master plan was performed for each area separately.

It is worth noting that the California Public Utilities Commission (CPUC) and California Department of Public Health (CDPH) currently provide no specific requirements for storage volume. Therefore, recommended standards published by the American Water Works Association (AWWA) were considered in the development of the storage criteria used in this master plan.

### 5.2.2 Storage Needs

In addition to providing adequate water supplies for the water consumers, water distribution systems often rely on stored water within the distribution system to provide the following operational benefits:

- Help equalize fluctuations between supply and demand.
- Supply sufficient water for firefighting.
- Meet demands during an emergency or unplanned outage of a major supply source.

The volume of storage required for any water system can be defined in various ways. AWWA defines three types of storage: operational, fire, and emergency. The amount of storage required for each of these types varies from system to system. Nevertheless, all three types of storage must be considered. In some cases, water stored in the groundwater basin can provide some of this storage. However, when the stored water does not flow by gravity and requires pumping, sufficient pumping redundancy must be provided if the storage source is to be considered reliable.

This analysis evaluates the ability of the Ojai System's storage facilities to meet the system's storage requirements. The resulting volume must be allocated to the pressure zones where the demands exist, or to a higher-pressure zone (if there are pressure-regulating stations available that allow the water to flow into the lower-pressure zone). The water system was also evaluated to determine if the existing booster station at the San Antonio Plant has sufficient capacity to deliver well water from the San Antonio Forebay Tank into the distribution system relative to overall well capacity at the site.

Table 5-2 summarizes the required operational, fire, and emergency storage criteria as defined by GSWC for the Ojai System.

TABLE 5-2
Criteria for Calculating Storage
*GSWC Region I Water Master Plan—Ojai System*

| Storage Category | GSWC Criteria |
|---|---|
| Operational storage | 25 percent of MDD for 24 hours |
| Fire storage | Maximum fire storage required in the specific area of the distribution system |
| Emergency storage | ADD for 12 hours |

#### Operational Storage

The required volume of water for operational storage is determined by the volume needed for regulating the difference between the rate of supply and the daily variations (peaks) in water usage. This difference results in the lowest and highest operating levels in the reservoirs under normal conditions. The resulting volume due to the changes in the reservoir levels must be allocated to either the pressure zones (where the demands exist) or to a higher-pressure zone (for use by the lower-pressure zone).

AWWA Manual of Standard Practices M32 (AWWA, 2005) suggests that a minimum operational storage volume between 10 percent and 30 percent (or more in small systems or in arid areas) of the average maximum daily demand (MDD) is appropriate for potable water distribution systems. In the Southern California area, common practice has been to provide 25 to 33 percent of MDD for operational storage. For this master plan, 25 percent of MDD volume was assumed for operational storage.

### Fire Storage

The volume of water storage required for firefighting is a function of the instantaneous flow rate required to fight the fire, the duration of the fire flow, and the number of fire flows that occur before the volume can be replenished. The fire-flow requirements (per uniform fire code and the 2007 California fire code) listed in Table 5-2 were used to establish the flow rate and duration; these criteria were used to identify the largest volume of water required for firefighting (based on the land use in that zone and the flow rates and durations). The resulting fire-flow volumes are shown in Table 5-3.

TABLE 5-3
Fire Storage Requirements
*GSWC Region I Water Master Plan—Ojai System*

| Land Use Category | Minimum Fire Flow Required (gpm) | Duration (hr) | Required Fire Storage Volume (MG) |
|---|---|---|---|
| Public facilities, commercial, business, schools | 2,000 | 3 | 0.360 |
| Hospital | 2,000 | 3 | 0.360 |
| Parks, recreational facilities | 1,750 | 3 | 0.315 |
| Residential | 1,250 | 2 | 0.150 |

For the Ojai System, it was assumed that fire storage volume requirements would be based on the single largest fire anticipated in the system. However, each pressure zone must be capable of providing the required fire flow using water supplied or stored within that zone and/or from a higher zone, provided that pressure reducing stations are available to move the water from the higher zone into the lower zone when needed. For this master plan analysis, the largest fire volume of 0.36 MG (over a 3-hour duration) and the smaller residential volume of 0.15 MG (over a 2-hour duration) were assumed for Area 1 and Area 2, respectively.

### Emergency Storage

Emergency storage is a dedicated source of water that can be used as a backup supply in the event a major supply source is interrupted. This can be provided by water stored in reservoirs or a purchased water connection deemed reliable during emergencies. The Ojai system is supplied by both purchased water connections and groundwater wells. Groundwater supply is considered reliable during emergency situations if it is equipped with a backup generator and pumps into the system. The wells in the Ojai system are not equipped with backup power nor do they pump to the system, therefore they are not considered reliable during an emergency. During a vulnerability study completed in 2004 for the Ojai system, it was determined that the Montana-Cuyama interconnection can be considered reliable during emergency situations, therefore this is taken into account when determining the need for emergency storage. *Ten State Standards* recommends that emergency storage total between 12 and 24 hours of ADD volume. GSWC assumed 12 hours of ADD volume for the Ojai System.

## 5.3 Existing System Evaluation

Evaluation of the existing system's supply and storage capacity involved analysis of key system facilities to identify supply or storage capacity deficiencies. This approach involved analyzing multiple proposed improvement alternatives to address these deficiencies. These proposed improvements were then evaluated to determine the alternatives, which would then be identified as the recommended improvements and incorporated into the CIP. The following subsections describe the existing system evaluation:

- Water demands for each demand period
- Supply facilities
- Storage facilities
- Capacity analysis
- Proposed improvements to address deficiencies in the existing system

### 5.3.1 Existing System Water Demands for Each Area

Table 5-4 defines the demands by each area for each demand period. The percentage of demands in each area is calculated for future years (2015 and 2030) according to the percentage split of the existing demands in Table 5-4.

TABLE 5-4
Existing System Water Demands
*GSWC Region I Water Master Plan—Ojai System*

| Pressure Zone | ADD (gpm) | MDD (gpm) | PHD (gpm) | Demand by Area (%) |
|---|---|---|---|---|
| **Area 1** | 1,395 | 3,209 | 5,454 | 90 |
| **Area 2** | 151 | 347 | 590 | 10 |
| Total | **1,546** | **3,556** | **6,044** | **100** |

The maximum daily demand is calculated as 2.3 times the average daily demand, and the peak hourly demand is calculated as 3.91 times the average daily demand.

In Area 2, which constitutes only 10 percent of overall Ojai System demand, approximately 80 percent of the Area 2 demand is in the Running Ridge Gradient, and 20 percent demand is in the Heidelberger Tank and Heidelberger Booster gradients.

### 5.3.2 Existing System Supply Facilities

The existing supply facilities in the Ojai System are described in Section 2, Existing Water System Facilities. Table 5-5 summarizes the design production capacity of each supply source as well as the systemwide total capacity and firm capacity. Note that all supply facilities are located in Area 1 as delineated in this analysis. Area 2 relies entirely on supply via the Fairview booster pumps which combined have only 500 gpm total capacity and 250 gpm firm capacity.

TABLE 5-5
Existing System Supply Facilities
*GSWC Region I Water Master Plan—Ojai System*

| Facility Name | Source | Pressure Zone Served | Firm Capacity[a] (gpm) | Total Capacity (gpm) |
|---|---|---|---|---|
| Wells | | | | |
| Gorham Well 1 | Groundwater | San Antonio Forebay Tank | NA[b] | 800 |
| Mutual Well 4 | Groundwater | San Antonio Forebay Tank | NA[b] | 450 |
| Mutual Well 5 | Groundwater | San Antonio Forebay Tank | NA[b] | 500 |
| San Antonio Well 3 | Groundwater | San Antonio Forebay Tank | NA[b] | 430 |
| San Antonio Well 4 | Groundwater | San Antonio Forebay Tank | NA[b] | 550 |
| Interconnections[c] | | | | |
| Montana-Cuyama CMWD Interconnection | CMWD | Main Zone | 1,000 | 1,000 |
| San Antonio-Grand CMWD Interconnection | CMWD | San Antonio Forebay Tank | N/A[b] | 800 |
| Sierra-Cuyama CMWD Interconnection | CMWD | Main Zone | 900 | 900 |
| San Antonio Forebay Booster Pump A | San Antonio Forebay Tank | Main Zone | N/A | 1,500[d] |
| San Antonio Forebay Booster Pump B | San Antonio Forebay Tank | Main Zone | 1,500 | 1,500[d] |
| Fairview Booster Pump A | Fairview Reservoir | Running Ridge | N/A | 250 |
| Fairview Booster Pump B | Fairview Reservoir | Running Ridge | 250 | 250 |
| **Total available production capacity (all located in Area 1)** | | | 3,400[b] | 4,900[d] |

[a] Firm capacity was defined as the total production capacity with the single largest capacity pumping facility (well or booster pump) out of service.
[b] Firm capacity is limited by one of the two forebay booster pumps being out of service. Because the San Antonio-Grand Interconnection and all wells are upstream of the booster pumps, firm capacity is limited to a single booster pump (1,500 gpm) plus the total interconnection capacity of the Montana-Cuyama and Sierra-Cuyama interconnections.
[c] During planned or unplanned CMWD interconnection outages, total supply capacity is 2,730 gpm, which is the total well capacity. This is less than total San Antonio Booster pump capacities.
[d] Total capacity is limited by the forebay booster pumps' output (3,000 gpm total), which is less than the combined capacities of all wells and the San Antonio-Grand Interconnection (3,530 gpm). Therefore, total capacity is the sum of Montana-Cuyama and Sierra-Cuyama interconnections (1,900 gpm) and the forebay boosters (3,000 gpm).

The San Antonio Plant consists of all five wells in the Ojai System (with a total capacity of 2,730 gpm), the San Antonio-Grand CMWD Interconnection (800 gpm), a 50,000-gallon forebay, and two booster pumps (1,500-gpm capacity each). The wells and the interconnection discharge water into the forebay tank, from which the two booster pumps deliver the water to the distribution system. The total supply capacity of the plant is 3,530 gpm. However, it is limited by the discharge capacity of the booster pumps (3,000 gpm). Firm capacity assumes one booster pump is out of service, which further reduces the San Antonio Plant's supply output to 1,500 gpm.

Since all three CMWD interconnections are on the same pipeline, the combined capacity for the purchased water (2,700 gpm) would be unavailable during CMWD planned or unplanned outages. Therefore, the total capacity with all three CMWD interconnections out of service would be provided from only the five wells, with a total capacity of 2,730 gpm.

### 5.3.3 Existing System Storage Facilities

The existing storage facilities in the Ojai System are described in Section 2, Existing Water System Facilities. For this analysis, it was necessary to identify how much storage was allocated into the three categories: operational, fire, and emergency.

Table 5-6.1 lists the allocation of storage by category for Area 1 (Main, Saddle Lane and Signal Booster gradients). Available storage was allocated to meet the required total operational storage volume (25 percent of MDD) for Area 1. The remainder of the available total storage is allocated to fire storage. No capacity remains for emergency storage requirements (12 hours of ADD). The small Forebay Tank (0.05 MG) was not included in the totals; operations staff attempt to maintain a constant level in this tank, so its volume is not available to meet operational and fire needs.

TABLE 5-6.1
Existing Storage Facilities: Area 1
*GSWC Region I Water Master Plan—Ojai System*

| Facility Name | Pressure Zone | Operational (MG) | Fire (MG) | Emergency (MG) | Total Capacity (MG) |
|---|---|---|---|---|---|
| Fairview Reservoir | Area 1 | 0.818 | 0.145 | 0.000 | 0.945 |
| Fairview Reservoir* | Area 2 | 0.037 | 0.018 | 0.000 | 0.055 |
| Signal Tank | Area 1 | 0.300 | 0.000 | 0.000 | 0.300 |
| **Available storage capacity** | | **1.155** | **0.145*** | **0.000** | **1.300** |
| **Required storage capacity** | | **1.155** | **0.360** | **0.280** | **1.795** |
| **Available minus required** | | **0.000** | **-0.215** | **-0.280** | **-0.495** |
| **Storage meets requirements** | | **Yes** | **No** | **No** | **No** |

* Because fire criteria defines only one fire occurring in the entire Ojai System at a given time, fire storage can be provided to either Area 1 or Area 2.

As Table 5-6.1 indicates, the available storage meets the required operational storage capacity, but fire and emergency deficiencies total 0.495 MG in Area 1.

Table 5-6.2 lists the allocation of available storage by category for Area 2. Available storage was allocated to operational and fire storage, but none was available to allocate to emergency conditions. A total of 0.15 MG of storage is required for fire storage (for a 2-hour duration), because this is the required volume for the largest fire (1,250 gpm) in this area.

MDD for Area 2 is 347 gpm, which must be supplied from Area 1. The 500 gpm combined capacity of the two Fairview Reservoir boosters permits fire flow of 153 gpm (0.018 MG over 2 hours). Therefore, 0.018 MG was allocated for fire flow in the Fairview Reservoir.

Note that the Heidelberger Tank operational storage meets the operational storage required by the Heidelberger Booster Gradient and Heidelberger Tank Gradient. The rest of the storage is allocated to fire. The existing distribution system does not allow for Heidelberger Tank storage to be used in the Running Ridge Gradient. To resolve this operational issue, a PRV must be installed at the Valley View Plant to allow water to feed into the lower Running Ridge Gradient in case of a fire or an emergency.

TABLE 5-6.2
Existing System Storage Facilities: Area 2
*GSWC Region I Water Master Plan—Ojai System*

| Facility Name | Pressure Zone | Operational (MG) | Fire (MG) | Emergency (MG) | Total Capacity (MG) |
|---|---|---|---|---|---|
| Fairview Reservoir | Area 2 | 0.037 | 0.018 | N/A | 0.055 |
| Heidelberger Tank | Area 2 | 0.022 | 0.078 | 0.000 | 0.100 |
| Running Ridge Tank 1 | Area 2 | 0.033 | 0.011 | 0.000 | 0.044 |
| Running Ridge Tank 2 | Area 2 | 0.033 | 0.017 | 0.000 | 0.050 |
| **Available storage capacity** | | **0.125** | **0.124** | **0.000** | **0.249** |
| **Required storage capacity** | | **0.125** | **0.150** | **0.109** | **0.384** |
| **Available minus required** | | **0.000** | **-0.026** | **-0.109** | **-0.135** |
| **Storage meets requirements** | | **Yes** | **No** | **No** | **No** |

As Table 5-6.2 indicates, the available storage meets the required operational storage capacity, but fire and emergency storage deficiencies total 0.135 MG in Area 2.

Proposed storage improvements are provided after the capacity analysis.

### 5.3.4 Existing System Capacity Analysis

This analysis of the existing water system evaluated the entire distribution system to verify that adequate supply and storage facilities were available. The analysis reviewed the demand periods (ADD, MDD, PHD, and MDD+FF). The duration for each demand period was needed to equate flow rates and storage volumes. For ADD and MDD, the duration was assumed to be 24 hours. For PHD, duration of 4 hours was used to account for the typical duration of higher-than-average demands during the day. The duration of MDD+FF scenario was established by the fire-flow criteria identified in Table 5-2.

In the following subsections, an analysis is performed for Area 1 and Area 2 of the Ojai System. The demands and production capacities are presented in Tables 5-7.1 (Area 1) and 5-7.2 (Area 2). (This same table format is used to present systemwide capacity analysis information for the existing system, 2015 system, and 2030 system.) These demands are presented as a flow rate and are converted into a demand volume using the duration for the demand period. For example, a demand of 100 gpm for ADD would be equal to a demand volume of 144,000 gallons, given that the duration of ADD is 24 hours.

Available supplies are presented below the demand volume totals. Available supplies include water supply sources, and stored water. Stored water was not used to provide water supplies during ADD or MDD. Stored water that was allocated as operational storage was assumed to be available for PHD, and water stored for fire flows was assumed to be available for MDD+FF. The total supplies were assumed to be available for ADD and MDD+FF. The supplies were reduced to firm capacity for MDD and PHD. Firm capacity was defined as the available capacity with the largest pumping unit out of service. CMWD supply outages (planned or unplanned) were assumed to last for 7 consecutive days. The firm capacity was determined by the loss of the most significant pumping unit. The available production was calculated by converting flow rates into a production volume (using the duration of the demand period) and adding the available storage volume.

The last two lines of the table compare the system's available production capacity to the demands for the same duration. Where production capacity exceeds demands, the row *supply minus demand* will be positive. This indicates an adequate combination of supplies and storage. Where this occurs, the last row of the table, *supply meets demand*, will contain *yes*. However, if demands exceed production, then the row *supply minus demand* will have a negative value, and the row *supply meets demand* will contain *no*. In this latter case, proposed improvements were evaluated to correct the deficiency.

### Area 1 Capacity Analysis

The total existing demands are presented in Table 5-7.1 for their respective demand periods for Ojai System Area 1. The fire flow used for MDD+FF was based on the largest fire flow in the system, a 2,000-gpm fire flow for 3 hours. The source of supply for Area 2 is the Fairview booster station which boosts water out of the Fairview Reservoir from Area 1. This supply to Area 2 is considered as a demand upon Area 1. The results of the supply and storage analysis for Area 1 in the existing system are summarized in Table 5-7.1.

TABLE 5-7.1
Existing System Supply and Storage Capacity Analysis: Area 1
*GSWC Region I Water Master Plan—Ojai System*

| | | Planning Scenario | | | | | |
|---|---|---|---|---|---|---|---|
| **Description** | **Units** | **Avg. Day** | **Max. Day** | **Peak Hour** | **MDD+ FF** | **Planned CMWD Outage** | **Unplanned CMWD Outage** |
| Duration | hrs | 24 | 24 | 4 | 3 | 168 | 168 |
| Area 1 system demands | gpm | 1,395 | 3,209 | 5,454 | 5,209 | 1,395 | 1,654 |
| Demands from Area 2 | gpm | 151 | 250 | 69 | 0[a] | 145 | 173 |
| **Total demand volume** | **MG** | **2.226** | **4.981** | **1.326** | **0.938** | **15.523** | **18.418** |
| Available supply production[b] | gpm | 4,900 | 3,400 | 3,400 | 4,900 | 2,730 | 2,730 |
| Available storage[c] | MG | 0.000 | 0.000 | 1.155 | 0.145 | 0.578 | 0.578 |
| **Total available supply** | **MG** | **7.273** | **5.396** | **1.971** | **1.027** | **28.096** | **28.096** |
| **Supply minus demand** | **MG** | **5.047** | **0.415** | **0.646** | **0.089** | **12.573** | **9.678** |
| **Supply meets demand** | | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** |

[a] This demand is considered zero because only one fire is assumed at any given time in the entire system.
[b] Total supply capacity is available for ADD and MDD+FF. Firm capacity is available for the remaining demand periods.
[c] Available storage for PHD is operational storage, for MDD+FF it is fire storage, and for CMWD outages it is emergency storage plus half of operational storage. It was assumed that no storage would be used to meet demands for ADD and MDD.

The existing system capacity analysis for Area 1 indicates that the existing supply meets the demands for ADD, MDD, PHD and MDD+FF scenarios and for planned or unplanned CMWD outages.

### Area 2 Capacity Analysis

The total existing demands for Area 2 are presented in Table 5-7.2 for their respective demand periods. The fire flow used for MDD+FF was based on a residential fire (a 1,250-gpm fire flow for 2 hours). Flow transferred from Area 1 to meet the demand for Area 2 is included as booster capacity in the supply and storage analysis.

TABLE 5.7.2
Existing System Supply and Storage Capacity Analysis: Area 2
*GSWC Region I Water Master Plan—Ojai System*

| | | Planning Scenario | | | | | |
|---|---|---|---|---|---|---|---|
| **Description** | **Units** | **Avg. Day** | **Max. Day** | **Peak Hour** | **MDD + FF** | **Planned CMWD Outage** | **Unplanned CMWD Outage** |
| Duration | hrs | 24 | 24 | 4 | 2 | 168 | 168 |
| Area 2 system demands | gpm | 151 | 347 | 590 | 1,597 | 151 | 179 |
| **Total demand volume** | **MG** | **0.217** | **0.500** | **0.142** | **0.192** | **1.522** | **1.804** |
| Available supply production[a] | gpm | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Available booster capacity | gpm | 151 | 250 | 69 | 500 | 145 | 173 |
| Available storage[b] | MG | 0.000 | 0.000 | 0.125 | 0.124 | 0.063 | 0.063 |
| **Total available supply** | **MG** | **0.217** | **0.360** | **0.142** | **0.184** | **1.524** | **1.806** |
| **Supply minus demand** | **MG** | **0.000** | **-0.140** | **0.000** | **-0.008** | **0.002** | **0.002** |
| **Supply meets demand** | | **Yes** | **No** | **Yes** | **No** | **Yes** | **Yes** |

[a] Total supply capacity is available for ADD and MDD+FF. Firm capacity is available for the remaining demand periods.
[b] Available storage for PHD is operational storage, for MDD+FF it is fire storage, and for CMWD outages it is emergency storage plus half of operational storage. It was assumed that no storage would be used to meet demands for ADD and MDD.

The results of the existing system capacity analysis reveal that supply does not meet demand for MDD (97 gpm deficiency) nor for MDD+FF (55 gpm deficiency). The recommended improvements are discussed in the following section.

### 5.3.5 Proposed Improvements to Address Deficiencies in the Existing System

The storage analysis indicates 0.495 MG and 0.135 MG deficiencies for Area 1 and Area 2, respectively.

The capacity analysis indicates no supply deficiency for Area 1, but an MDD+FF supply deficiency of 0.008 MG (55 gpm) and an MDD deficiency of 97 gpm for Area 2.

Various alternatives were considered while investigating improvements to correct the deficiencies identified in the supply and storage evaluation and are listed in Tables 5-7.1 and 5-7.2. These proposed improvements were evaluated for their ability to correct the deficiency and be cost effective compared with other alternatives.

The numbering system used in Table 5-8 is a series of three numbers. The first number indicates the planning period: 1 for the existing system, 2 for the 2015 system, and 3 for the 2030 system. The second number indicates the deficiency number, which starts at 1 and increments by 1 for each deficiency identified. The third number identifies the improvement alternative, but zero is reserved for the deficiency. Therefore, the alternative number 1.2.3 would be used to identify the third proposed alternative for the second deficiency in the existing system.

TABLE 5-8
Existing System Proposed Supply and Storage Improvements
*GSWC Region I Water Master Plan—Ojai System*

| Deficiency/ Alternative Number | Deficiency/Alternative Description | Pressure Zone | Supply Capacity (gpm) | Storage Capacity (MG) |
|---|---|---|---|---|
| **1.1.0** | **Inadequate fire and emergency storage** | **Area 1** | **—** | **-0.495** |
| 1.1.1 | Add 0.5 MG Reservoir at the San Antonio Plant | Area 1 | — | 0.500 |
| **1.2.0** | **Inadequate fire and emergency storage** | **Area 2** | **—** | **-0.057** |
| 1.2.1 | Add storage capacity | Area 2 | — | 0.057 |
| 1.2.2 | Add emergency power to the Fairview Booster Station | Area 2 | — | 0.360 |
| 1.2.3 | Add emergency power to the Valley View Booster Station | Area 2 | — | 0.360 |
| **1.3.0** | **Inadequate MDD supply** | **Area 2** | **-97 gpm** | — |
| 1.3.1 | Booster Pump C at the Fairview Pump Station | | 500 gpm | — |
| **1.4.0** | **Inadequate MDD+FF supply** | **Area 2** | **-55 gpm** | — |
| 1.3.1 | Booster Pump C at the Fairview Pump Station | | 500 gpm | — |
| 1.4.2 | Add storage capacity | | — | 0.008 |

By installing a new booster pump C at the Fairview Booster Station, the deficiencies identified during MDD and MDD+FF will be resolved. Because the useful life of the Running Ridge Tanks is running out and access to the site is very limited, a long-term plan to abandon those tanks must be considered. A detailed plan for the abandonment of these tanks is included within the appendices. The installation of a 500 gpm booster pump C at the Fairview booster station coincides with the long term plan for the upper pressure zones of the Ojai system.

Emergency power at both the Valley View booster station and the Fairview booster station are also in line with the long term plan for the upper pressure zones of Ojai. This effectively reduces the amount of emergency storage required within these pressure zones which will help facilitate the abandonment of the Running Ridge tanks.

## 5.4 2015 System Evaluation

Analysis of the water system for the year 2015 was performed to identify mid-term improvements needed beyond those needed for the existing system. This analysis included the following assumptions:

- Existing supply sources would remain active or be replaced in kind.
- Proposed improvements to correct deficiencies in the existing systems were assumed to be in place.

- The demands developed in Section 3, Existing and Future Water Demands, were assumed for the respective demand periods.

### 5.4.1 2015 System Water Demands for Each Area

Table 5-10 defines the 2015 demands by each area for each demand period. The percentage of demands in each area is calculated for future years according to the split of the existing demands in Table 5-4.

TABLE 5-10
2015 System Water Demands
*GSWC Region I Water Master Plan—Ojai System*

| Pressure Zone | ADD (gpm) | MDD (gpm) | PHD (gpm) | Percentage |
|---|---|---|---|---|
| Area 1 | 1,631 | 3,752 | 6,377 | 90 |
| Area 2 | 177 | 406 | 690 | 10 |
| **Total** | **1,808** | **4,158** | **7,067** | **100** |

### 5.4.2 2015 System Supply Facilities

The supply facilities for the 2015 system include all existing supply facilities. The total supply facilities assumed to be available in the 2015 system are shown in Table 5-11.

TABLE 5-11
2015 System Assumed Supply Facilities
*GSWC Region I Water Master Plan—Ojai System*

| Facility Name | Area Served | Source | Firm Capacity (gpm) | Total Capacity (gpm) |
|---|---|---|---|---|
| Existing sources (Table 5-5)* | Systemwide | (see Table 5-5) | 3,400 | 4,900 |
| **Production capacity** | | | **3,400** | **4,900*** |

* During planned or unplanned CMWD interconnection outages, total supply capacity is 2,730 gpm.

### 5.4.3 2015 System Storage Facilities

The storage facilities for the 2015 system are listed in Table 5-12.1 and include all existing storage facilities and any proposed storage improvements from Table 5-8.

With the improvements at the Fairview Plant of an additional 500 gpm booster pump, a portion of water from the Fairview reservoir is transferred to Area 2. To meet operational and fire storage requirements in Area 2, a volume of 0.143 MG is subtracted from the Fairview Reservoir volume reserved for Area 1.

TABLE 5-12.1
2015 System Storage Facilities: Area 1
*GSWC Region I Water Master Plan—Ojai System*

| Facility Name | Pressure Zone | Operational (MG) | Fire (MG) | Emergency (MG) | Total Capacity (MG) |
|---|---|---|---|---|---|
| Fairview Reservoir | Area 1 | 0.493 | 0.071 | 0.277 | 0.841[a] |
| Signal Tank | Area 1 | 0.150 | 0.100 | 0.050 | 0.300 |
| Proposed San Antonio Tank #1 | Area1 | 0.311 | 0.189 | 0.000 | 0.500 |
| **Available storage capacity** | | **0.954** | **0.360** | **0.327** | **1.768** |
| **Required storage capacity** | | **1.351** | **0.360** | **0.454** | **2.165** |
| **Available minus required** | | **-0.397** | **0.000** | **-0.127** | **-0.524** |
| **Storage meets requirements** | | **No** | **Yes** | **No** | **No** |

[a] The remainder of the capacity in the Fairview Reservoir is dedicated to Operational and Emergency Storage for Area 2

The 2015 system capacity analysis results indicate a 0.524 MG storage deficiency (operational, fire, and emergency) in Area 1.

Table 5-12.2 lists the allocation of storage by type for Area 2.

TABLE 5-12.2
2015 System Storage Facilities: Area 2
*GSWC Region I Water Master Plan—Ojai System*

| Facility Name | Pressure Zone | Operational (MG) | Fire (MG) | Emergency (MG) | Total Capacity (MG) |
|---|---|---|---|---|---|
| Fairview Reservoir | Area 2 | 0.031 | 0.071 | 0.127 | 0.230 |
| Heidelberger Tank | Area 2 | 0.049 | 0.051 | 0.000 | 0.100 |
| Running Ridge Tank 1 | Area 2 | 0.033 | 0.011 | 0.000 | 0.044 |
| Running Ridge Tank 2 | Area 2 | 0.033 | 0.017 | 0.000 | 0.050 |
| **Available storage capacity** | | **0.146** | **0.150** | **0.127** | **0.423** |
| **Required storage capacity** | | **0.146** | **0.150** | **0.127** | **0.423** |
| **Available minus required** | | **0.000** | **0.000** | **0.000** | **0.000** |
| **Storage meets requirements** | | **Yes** | **Yes** | **Yes** | **Yes** |

The 2015 system storage capacity analysis results indicate no storage deficiencies for Area 2.

Systemwide, the 2015 system requires 0.524 MG of total additional storage to meet increasing demand.

### 5.4.4 2015 System Capacity Analysis

The supply and storage capacity evaluation for the 2015 system was performed in the same manner as the analysis for the existing system, except that the demands were updated for 2015. The discussion in the following subsections was limited to the differences between the existing and the 2015 system.

#### Area 1 Capacity Analysis

The analysis used the 2015 system Area 1 total demands (Table 5-10) for the respective demand periods. The total and firm production capacities in Table 5-11 and the storage capacities in Table 5-12.1 were used for the appropriate demand periods. The results of the supply and storage capacity analysis for Area 1 are summarized in Table 5-13.1.

TABLE 5-13.1
2015 System Supply and Storage Capacity Analysis: Area 1
*GSWC Region I Water Master Plan—Ojai System*

| | | **Planning Scenario** | | | | | |
|---|---|---|---|---|---|---|---|
| **Description** | **Units** | **Avg. Day** | **Max. Day** | **Peak Hour** | **MDD + FF** | **Planned CMWD Outage** | **Unplanned CMWD Outage** |
| Duration | hrs | 24 | 24 | 4 | 3 | 168 | 168 |
| Area 1 demands | gpm | 1,631 | 3,752 | 6,377 | 5,752 | 1,631 | 1,934 |
| Demands from Area 2 | gpm | 177 | 406 | 81 | 406 | 177 | 210 |
| **Total demand volume** | **MG** | **2.604** | **5.988** | **1.550** | **1.108** | **18.225** | **21.612** |
| Available supply production | gpm | 4,900 | 3,400 | 3,400 | 4,900 | 2,730 | 2,730 |
| Available storage[a] | MG | 0.000 | 0.000 | 0.954 | 0.360 | 0.804 | 0.804 |
| **Total available supply** | **MG** | **7.056** | **4.896** | **1.770** | **1.242** | **28.322** | **28.322** |
| **Supply minus demand** | **MG** | **4.452** | **-1.092** | **0.220** | **0.134** | **10.098** | **6.711** |
| **Supply meets demand** | | **Yes** | **No** | **Yes** | **Yes** | **Yes** | **Yes** |

[a] Available storage for PHD is operational storage, for MDD+FF it is fire storage, and for CMWD outages it is emergency storage plus half of operational storage. It was assumed that no storage would be used to meet demands for ADD and MDD.

The 2015 supply and storage analysis for Area 1 determined that there is a supply deficiency during the MDD scenario of 758 gpm.

#### Area 2 Capacity Analysis

The analysis used the 2015 system Area 2 total demands (Table 5-10) for the respective demand periods. The results of the supply and storage analysis for Area 2 are summarized in Table 5-13.2.

TABLE 5-13.2
2015 System Supply and Storage Capacity Analysis: Area 2
*GSWC Region I Water Master Plan—Ojai System*

| | | Planning Scenario | | | | | |
|---|---|---|---|---|---|---|---|
| **Description** | **Units** | **Avg. Day** | **Max. Day** | **Peak Hour** | **MDD + FF** | **Planned CMWD Outage** | **Unplanned CMWD Outage** |
| Duration | Hrs | 24 | 24 | 4 | 2 | 168 | 168 |
| Area 2 system demands | Gpm | 177 | 406 | 690 | 1,656 | 177 | 210 |
| **Total demand volume** | **MG** | **0.255** | **0.585** | **0.166** | **0.199** | **1.784** | **2.117** |
| Booster Capacity | Gpm | 1,000 | 500 | 500 | 1,000 | 1,000 | 1,000 |
| Available storage[a] | MG | 0.000 | 0.000 | 0.146 | 0.150 | 0.201 | 0.201 |
| **Total available supply** | **MG** | **1.44** | **0.720** | **0.266** | **0.270** | **10.281** | **10.281** |
| **Supply minus demand** | **MG** | **1.185** | **0.135** | **0.101** | **0.071** | **8.496** | **10.281** |
| **Supply meets demand** | | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** |

[a] Available storage for PHD is operational storage, for MDD+FF it is fire storage, and for CMWD outages it is emergency storage plus half of operational storage. It was assumed that no storage would be used to meet demands for ADD and MDD.

The 2015 system capacity analysis Area 2 determined that the supply meets the demands for all the scenarios.

### 5.4.5 Proposed Improvements to Address Deficiencies in the 2015 System

This section addresses the supply and storage proposed improvements to overcome deficiencies identified by the 2015 analysis. Two deficiencies were identified in the 2015 analysis. One deficiency was a lack of storage in Area 1 and the second deficiency was a lack of supply to Area 1. Table 5-14 lists the alternatives for overcoming these deficiencies.

TABLE 5-14
2015 Proposed Supply and Storage Improvements
*GSWC Region I Water Master Plan—Ojai System*

| Deficiency/ Alternative Number | Deficiency/Alternative Description | Pressure Zone | Supply Capacity (gpm) | Storage Capacity (MG) |
|---|---|---|---|---|
| **2.1.0** | **Inadequate operational, fire, and emergency storage volume** | **Area 1** | | |
| 2.1.1 | Additional 0.5 MG San Antonio Tank #2 | | — | 0.500 |
| **2.2.0** | **Inadequate supply for MDD** | **Area 1** | | |
| 2.2.1 | Increase purchased CMWD amount | Area 1 | 758 | — |
| 2.2.2 | Add San Antonio Booster Pump | Area 1 | 758 | — |
| 2.2.3 | Install new groundwater well | Area 1 | 758 | — |

A See conditional assessment chapter for details on GSWC long-term plan for the pressure zones in “Area 2.”

According to storage analysis for the 2015 system, an additional storage volume of 0.524 MG for Area 1 is required. An additional 0.5 MG tank is proposed to fix this deficiency at the San Antonio Plant. This will allow one tank to be taken out of service at a time for maintenance when necessary. Although a 0.5 MG tank does not completely fix the identified deficiency, the remainder will be addressed in the 2030 analysis. Hydraulic evaluations will confirm if additional storage or booster pumping capacity is necessary to meet peak hour demands and fire flows in specific zones.

To address the MDD supply deficiency in Area 1, adding another booster pump at the San Antonio Plant, which is limited by its existing two booster pumps, is the preferred alternative. Redesigning the booster station to have three 1,365-gpm booster pumps (one as a standby) would increase the firm capacity and increase system reliability at the only plant that supplies water to the system. The firm capacity would increase from 1,500 gpm to 2,730 gpm, which is the groundwater supply total capacity. The 1,230-gpm increase in firm capacity would completely resolve the MDD deficiency in 2015 and provide additional capacity in 2030. However, only a 758-gpm increase is necessary to address the 2015 deficiency.

These proposed improvement configurations are further analyzed and presented as recommended improvements in Section 6, Hydraulic Analysis and Evaluation.

## 5.5 2030 System Evaluation

Analysis of the water system for the year 2030 was performed to identify long-term improvements needed for the water system at build-out. This analysis included the following assumptions:

- Existing supply sources would remain active or be replaced in kind.
- Proposed improvements to correct deficiencies in the existing and 2015 systems were assumed to be in place.
- The demands developed in Section 3, Existing and Future Water Demands, were assumed for the respective demand periods.

### 5.5.1 2030 System Water Demands for Each Area

Table 5-15 defines the 2030 demands by each area for each demand period.

TABLE 5-15
2030 System Water Demands
*GSWC Region I Water Master Plan—Ojai System*

| Pressure Zone | ADD (gpm) | MDD (gpm) | PHD (gpm) | Percentage |
|---|---|---|---|---|
| Area 1 | 1,852 | 4,261 | 7,243 | 90 |
| Area 2 | 201 | 461 | 784 | 10 |
| **Total** | **2,053** | **4,722** | **8,027** | **100** |

### 5.5.2 2030 System Supply Facilities

The supply facilities for the 2030 system include all facilities included in the 2015 system and proposed improvements. The total supply facilities assumed to be available in the 2030 system are shown in Table 5-16.

TABLE 5-16
2030 System Assumed Supply Facilities
*GSWC Region I Water Master Plan—Ojai System*

| Facility Name | Area Served | Source | Firm Capacity (gpm) | Total Capacity (gpm) |
|---|---|---|---|---|
| San Antonio Booster Pump C | Area 1 | San Antonio Forebay | 1,230 | 530 |
| Existing sources (Table 5-11)* | Entire System | (see Table 5-11) | 3,400 | 4,900 |
| **Production capacity** | | | **4,630** | **5,430*** |

*During planned or unplanned CMWD interconnection outages, total supply capacity is 2,730 gpm, which is the total well capacity.

### 5.5.3 2030 System Storage Facilities

The storage facilities for the 2030 system include all existing and proposed storage facilities assumed to be operational in 2030 (Table 5-17.1).

TABLE 5-17.1
2030 System Storage Facilities: Area 1
*GSWC Region I Water Master Plan—Ojai System*

| Facility Name | Pressure Zone | Operational (MG) | Fire (MG) | Emergency (MG) | Total Capacity (MG) |
|---|---|---|---|---|---|
| Fairview Reservoir | Area 1 | 0.400 | 0.071 | 0.239 | 0.710* |
| Signal Tank | Area 1 | 0.150 | 0.100 | 0.050 | 0.300 |
| Proposed San Antonio Tank #1 | Area 1 | 0.311 | 0.189 | 0.000 | 0.500 |
| Proposed San Antonio Tank #2 | Area 1 | 0.300 | 0.000 | 0.200 | 0.500 |
| **Available storage capacity** | | **1.161** | **0.360** | **0.489** | **2.010** |
| **Required storage capacity** | | **1.534** | **0.360** | **0.613** | **2.507** |
| **Available minus required** | | **-0.373** | **0.000** | **-0.124** | **-0.497** |
| **Storage meets requirements** | | **No** | **Yes** | **No** | **No** |

* The remainder of the storage in Fairview is designated for operational and emergency storage in Area 2

The 2030 system storage analysis results indicate a 0.497 MG storage deficiency in Area 1.

Table 5-17.2 lists storage by type for Area 2. It is assumed that both of the Running Ridge Tanks will need to be taken out of service after the mid-term (2015). All emergency storage will be supplied via the booster stations which need to be equipped with back-up power. Fire flow will be provided via the Heidelberger Tank and through pumps at Fairview and Valley View booster stations. The majority of the operational storage will be provided by the Fairview Reservoir. The booster pumps at the Fairview booster station will be equipped with VFD's to allow for better operation with the removal of the Running Ridge tanks.

TABLE 5-17.2
2030 System Storage Facilities: Area 2
*GSWC Region I Water Master Plan—Ojai System*

| Facility Name | Pressure Zone | Operational (MG) | Fire (MG) | Emergency (MG) | Total Capacity (MG) |
|---|---|---|---|---|---|
| Fairview Reservoir | Area 2 | 0.145 | 0.071 | 0.145 | 0.361 |
| Heidelberger Tank | Area 2 | 0.021 | 0.079 | 0.000 | 0.100 |
| **Available storage capacity** | | **0.166** | **0.150** | **0.145** | **0.461** |
| **Required storage capacity** | | **0.166** | **0.150** | **0.145** | **0.461** |
| **Available minus required** | | **0.000** | **0.000** | **0.000** | **0.000** |
| **Storage meets requirements** | | **Yes** | **Yes** | **Yes** | **Yes** |

The storage capacity analysis results demonstrate that the storage in Area 2 is sufficient.

### 5.5.4 2030 System Capacity Analysis

The supply and storage capacity evaluation for the 2030 system was performed in the same manner as the analysis for the existing and 2015 systems, except that the demands were updated for 2030.

#### Area 1 Capacity Analysis

The total and firm production capacities in Table 5-16 and the storage in Table 5-17.1 were used for the appropriate demand periods. The total 2030 demands are presented in Table 5-18.1 for their respective demand periods. The results of the 2030 system supply and storage capacity analysis for Area 1 are summarized in Table 5-18.1.

TABLE 5-18.1
2030 System Supply and Storage Capacity Analysis: Area 1
*GSWC Region I Water Master Plan—Ojai System*

| | | **Planning Scenario** | | | | | |
|---|---|---|---|---|---|---|---|
| **Description** | **Units** | **Avg. Day** | **Max. Day** | **Peak Hour** | **MDD + FF** | **Planned CMWD Outage** | **Unplanned CMWD Outage** |
| Duration | hrs | 24 | 24 | 4 | 3 | 168 | 168 |
| Area 1 system demands | gpm | 1,852 | 4,261 | 7,243 | 6,261 | 1,852 | 2,196 |
| Flow to Area 2 | gpm | 201 | 461 | 784 | 461 | 201 | 238 |
| **Total demand volume** | **MG** | **2.956** | **6.800** | **1.926** | **1.210** | **20.694** | **24.535** |
| Available supply production[a] | gpm | 5,430 | 4,630 | 4,630 | 5,430 | 2,730 | 2,730 |
| Available storage[b] | MG | 0.000 | 0.000 | 1.161 | 0.360 | 1.070 | 1.070 |
| **Total available supply** | **MG** | **7.8192** | **6.6672** | **2.2722** | **1.3374** | **28.588** | **28.588** |
| **Supply minus demand** | **MG** | **4.863** | **-0.132** | **0.346** | **0.127** | **7.894** | **4.053** |
| **Supply meets demand** | | **Yes** | **No** | **Yes** | **Yes** | **Yes** | **Yes** |

[a] Total supply capacity is available for ADD and MDD+FF. Firm capacity is available for the remaining demand periods.
[b] Available storage for PHD is operational storage, for MDD+FF it is fire storage, and for CMWD outages it is emergency storage plus half of operational storage. It was assumed that no storage would be used to meet demands for ADD and MDD.

The analysis results demonstrate that there is a supply deficiency during the MDD scenario. This deficiency can be fixed by raising the firm capacity of the system 92 gpm.

#### Area 2 Capacity Analysis

The total and firm production capacities in Table 5-16 and the storage in Table 5-17.2 were used for the appropriate demand periods. The total 2030 demands are presented in Table 5-18.2 for their respective demand periods. The results of the supply and storage analysis for Area 2 are summarized in Table 5-18.2.

TABLE 5-18.2
2030 System Supply and Storage Capacity Analysis: Area 2
*GSWC Region I Water Master Plan—Ojai System*

| | | Planning Scenario | | | | | |
|---|---|---|---|---|---|---|---|
| **Description** | **Units** | **Avg. Day** | **Max. Day** | **Peak Hour** | **MDD + FF** | **Planned CMWD Outage** | **Unplanned CMWD Outage** |
| Duration | hrs | 24 | 24 | 4 | 2 | 168 | 168 |
| Area 2 system demands | gpm | 201 | 461 | 784 | 1,711 | 201 | 238 |
| **Total demand volume** | **MG** | **0.289** | **0.664** | **0.188** | **0.205** | **2.026** | **2.399** |
| Available Booster Capacity | gpm | 1,000 | 500 | 500 | 1,000 | 1,000 | 1,000 |
| Available storage[a] | MG | 0.000 | 0.000 | 0.021 | 0.079 | 0.201 | 0.201 |
| **Total available supply** | **MG** | **1.440** | **0.720** | **0.141** | **0.199** | **10.281** | **10.281** |
| **Supply minus demand** | **MG** | **1.151** | **0.056** | **-0.047** | **-0.007** | **8.254** | **7.881** |
| **Supply meets demand** | | **Yes** | **Yes** | **No** | **No** | **Yes** | **Yes** |

[a] Available storage for PHD is operational storage, for MDD+FF it is fire storage, and for CMWD outages it is emergency storage plus half of operational storage. It was assumed that no storage would be used to meet demands for ADD and MDD.

The 2030 system supply and storage capacity analysis for Area 2 demonstrates a deficiency during peak hour demand and under the MDD + FF scenario.

### 5.5.5 Proposed Improvements to Address Deficiencies in the 2030 System

Area 1 needs an additional 0.497 MG of storage. Area 2 needs either more storage or more booster capacity to overcome its deficiency during peak hour demand and under fire flow conditions. Table 5-19 presents proposed supply and storage improvements for the 2030 System.

TABLE 5-19
2030 Proposed Supply and Storage Improvements
*GSWC Region I Water Master Plan—Ojai System*

| Deficiency/ Alternative Number | Deficiency/Alternative Description | Service Area | Supply Capacity (gpm) | Storage Capacity (MG) |
|---|---|---|---|---|
| **3.1.0** | **Inadequate operational, fire, and emergency storage volume** | **Area 1** | | |
| 3.1.1 | Add storage volume | | — | 0.497 |
| **3.2.0** | **Inadequate supply during MDD** | **Area 1** | | |
| 3.2.1 | Add Groundwater Supply | Area 1 | 92 | |
| 3.2.2 | Add new interconnection | Area 1 | 92 | |
| **3.3.0** | **Inadequate capacity for PHD** | **Area 2** | | |
| 3.3.1 | Add storage volume | Area 2 | — | 0.047 |
| 3.3.2 | Add booster capacity | | 250 | |
| **3.4.0** | **Inadequate capacity for MDD + FF** | **Area 2** | | |
| 3.4.1 | Add storage volume | Area 2 | — | .007 |
| 3.3.2 | Add booster capacity | Area 2 | 250 | — |

According to the storage analysis for the 2030 system, an additional storage volume of 0.497 MG is required in Area 1. A 0.5 MG tank can be added in Area 1 to overcome this deficiency. To address the MDD supply issue, two different alternatives have been presented in Table 5-19. In all likelihood, a few of the wells will need to be replaced in Ojai before it is time to correct this identified supply deficiency. The design capacity of the well is based upon testing during drilling to determine what the safe yield is. It is possible that the replacement wells will be slightly larger than those that are existing eliminating the need for an additional well, therefore this analysis should be re-visited in the future.

There is little property available in the upper elevations in Ojai to build a tank on; therefore an alternate plan has been developed to reduce the amount of storage needed in the higher pressure zones – Running Ridge, Heidelberger Tank and Heidelberger Booster Zone. This plan includes upsizing one of the existing pumps at the Fairview booster station (A or B) from a 250 gpm pump to a 500 gpm pump which will fix the deficiencies identified during peak hour demand and fire flows in the Running Ridge Zone. What is also required to make this plan work is to upgrade the capacity of the Valley View booster station to three 500 gpm booster pumps (one redundant). This project will be included in Section 8, the conditional assessment chapter of this Master Plan.

## 5.6 Summary of Proposed Supply and Storage Improvements through 2030

There is a need for more storage and more supply in Ojai now and in the future. To remedy the lack of storage in the system, a total of 1.5 MG is needed through 2030. A 0.5 MG tank is needed for each planning period. The first 0.5 MG tank will be located at the San Antonio Plant and will replace the existing 50,000 gallon forebay. The second tank needed to address the storage deficiency in 2015 will be located at the San Antonio Plant as well and will provide operations with the flexibility to keep one tank in service while performing maintenance on the other. A third 0.5 MG tank needed for the 2030 planning period will be situated in the main zone at a location to be named later. To reduce the amount of emergency storage needed for the higher pressure zones referred to as "Area 2," emergency power must be installed at both the Fairview and Valley View Booster Stations.

More supply is needed for Area 2 which is supplied solely from the Fairview Booster Station. An additional 500 gpm pump is proposed to fix the existing deficiency. The deficiency identified in the 2030 planning period can be fixed by upgrading one of the existing 250 gpm booster pumps to a 500 gpm booster pump.

The main zone exhibits a supply deficiency in 2015 and can be fixed by increasing the firm pumping capacity of the San Antonio Plant. The booster station at the San Antonio Plant is a critical facility for water to get out into the system. With only two 1,500 gpm booster pumps at the plant, the firm capacity is limited to 1,500 gpm. The re-design of the pumps at the booster station to three 1,365 gpm booster pumps will increase the firm capacity to 2,730 gpm which is equal to the groundwater pumping capacity at the plant. An additional deficiency is identified in the 2030 scenario of 92 gpm. At this point in time, no specific fix has been recommended other than the need to add supply which can be done in a number of ways. This deficiency may be corrected by the drilling of replacement wells that may have a slightly larger capacity that their predecessors. If not, and additional source of supply will be needed down the road.

The supply and storage improvements identified in this capacity evaluation are only *proposed*, and are further refined in Section 6, Hydraulic Analysis and Evaluation. The hydraulic analysis helps determine the optimal configuration of improvements to provide maximum operational and cost benefit, and the resulting *recommended* improvements are incorporated into the CIP. A comprehensive list of all recommended storage, supply, and hydraulic improvements is provided at the conclusion of Section 6.

SECTION 6

# Hydraulic Analysis and Evaluation

This section documents the hydraulic analysis and evaluation results for the Ojai System. The hydraulic analysis used the calibrated computer model to evaluate the existing and future water systems. The analysis and evaluation accomplished the following tasks:

- Summarized the criteria established for the hydraulic analysis
- Performed simulations for various demand periods and planning years
- Analyzed the modeling results to identify deficiencies
- Analyzed various proposed improvements to investigate ways to mitigate these deficiencies
- Developed a list of recommended improvements that provide a cost-effective means to correct the deficiencies

In each subsection of the following discussion, the hydraulic analysis results of the existing and future water systems were measured against the objectives identified in the technical memorandum titled *Master Planning Criteria and Standards* (included in appendices) prepared for GSWC by CH2M HILL. When the analysis indicated that the system did not meet these criteria, then a deficiency was identified and facilities and improvements were proposed to mitigate the deficiency.

## 6.1 Overview

Hydraulic analyses of networked water distribution systems were most efficiently performed with the aid of hydraulic computer models and specialized software that performs the numerical analysis. The hydraulic computer model assists with measuring system performance, analyzing operational improvements, and developing a systematic method of determining the size and timing required for new facilities. The model can be used to analyze existing water systems, future water systems, or even specific improvements to the existing water system. By analyzing numerous planning scenarios relatively quickly and easily, the model provides answers to many "what if" questions. The computer program analyzes all of the information in the system data file and generates results in terms of pressures, flow rates, and operating status. The key to successfully using the computer model was correct interpretation of these results and understanding how the water distribution system was affected.

## 6.2 Analysis Approach

This hydraulic analysis was performed after the calibration of the model. The Ojai System was divided into two areas, each comprising of three pressure zones for the hydraulic analysis.

- Area 1 pressure zones: Main Gradient, Saddle Lane Gradient, Signal Gradient
- Area 2 pressure zones: Heidelberger Booster Gradient, Heidelberger Tank Gradient, Running Ridge Gradient

Two of these zones are relatively small. The Heidelberger Booster Gradient is a very small zone with minimal demand, as it only serves a few customers. This zone is served by Heidelberger Booster Pumps A and B and a small-capacity hydropneumatic tank. The Saddle Lane Gradient is connected with the Main Gradient by two PRVs. Other pressure zones are separated by booster pumps and tanks.

The Ojai System was examined for three planning periods during the hydraulic analysis. For each planning period, two models were created: one that represents the system as it would be in a planning year, and a version of the same model with recommended improvements. Following are the assumptions for each model:

- **Existing 2007 system.** The existing water system analyses assumed 2007 demands and facilities that were operational in 2007.
- **Improved 2007 system.** The improved 2007 water system analyses assumed 2007 demands with recommended improvements to overcome existing deficiencies.
- **2015 system.** The short-term planning horizon (2015) water system analyses assumed 2015 demands and included existing facilities and facilities recommended to correct existing deficiencies.
- **Improved 2015 system.** The improved 2015 water system analyses assumed 2015 demands with recommended improvements to overcome 2015 deficiencies.
- **2030 system.** The long-term planning horizon (2030) water system analyses assumed 2030 demands and recommended facilities in the improved 2015 analysis.
- **Improved 2030 system.** The improved 2030 water system analyses assumed 2030 demands with recommended improvements to overcome 2030 deficiencies.

The demands used in the hydraulic analysis are the same as used for the supply and storage capacity analysis in Section 5.

### 6.2.1 System Performance Criteria

Hydraulic analysis of the water system involved the use of a computer model that was developed specifically for the Ojai System and calibrated to conditions observed in the field (see Section 4, Hydraulic Model Development and Calibration). This computer model was used to identify hydraulic deficiencies under existing and future planning scenarios. Hydraulic model simulations were developed to analyze demand periods (ADD, MDD, PHD, and MDD+FF) to determine whether the system could meet the performance objectives identified for this master plan. These criteria are summarized in Table 6-1.

TABLE 6-1
Hydraulic Analysis Criteria
*GSWC Region I Water Master Plan—Ojai System*

| Demand Period | Pipeline Criteria | Pressure Criteria[b] |
|---|---|---|
| ADD | Velocity less than 5 fps and head loss less than 6 ft per 1,000 ft | Greater than 40 psi and less than 125 psi |
| MDD | Velocity less than 5 fps and head loss less than 6 ft per 1,000 ft | Greater than 40 psi and less than 125 psi |
| PHD | Velocity less than 10 fps | Greater than 40 psi and less than 125 psi |
| MDD+FF | Velocity less than 10 fps [a] | Greater than 20 psi |

[a] Pipeline velocity criteria of 10 fps for MDD+FF were considered recommended values for design of new pipe. This master plan does not recommend replacing pipelines due to fire flow velocities more than 10 fps alone.
[b] Pressure criteria apply only at service connections.

### 6.2.2 Fire-flow Requirements

In addition to providing adequate water supply and pressure to serve residential, commercial, and industrial water demands placed on the system, the water system must also deliver an adequate supply for fire fighting. Since fires can occur at any time, the water system must be ready at all times to provide the required flow with an adequate residual pressure. The water system should be capable of providing the fire flow during an MDD period (MDD+FF), which represents the day of the year having the highest water demands.

To determine the system's capacity to provide adequate fire flows, it was necessary to establish minimum fire-flow demand requirements to be applied to various locations throughout the distribution system, as well as a minimum residual pressure (the pressure near the flowing hydrant) and system pressure. In master planning, the fire-flow demands were usually based on the type of land use in the area of the fire flow. Figure 6-1 presents the land use in the Ojai System. The land use categories shown were consolidated from the original categories defined by the Ojai Urban Reserve Line Land Use Categories to simplify the fire-flow allocation process. The land use shown in this figure was used with the required fire flows shown in Table 5-2 (in Section 5, Supply and Storage Capacity) to establish the required fire flow for this system.

## 6.3 Existing System Hydraulic Analysis

Several hydraulic computer model simulations were conducted for the existing distribution system to identify system deficiencies and operational inefficiencies, and to evaluate proposed or recommended system improvements. System improvements for identified hydraulic deficiencies were modeled to verify that the improvements would mitigate the deficiencies for the existing system. In some cases, more than one alternative was possible to mitigate the improvements. Proposed improvement alternatives providing the same level of service were reviewed and evaluated to select a recommended alternative.

### 6.3.1 Operational Assumptions

Table 6-2 presents the operational status of facilities under ADD, MDD, PHD and MDD+FF conditions for the existing system.

TABLE 6-2
Existing System Operating Facility Status
*GSWC Region I Water Master Plan—Ojai System*

| Facility Name | ADD | MDD | MDD+FF | PHD |
|---|---|---|---|---|
| Wells | | | | |
| Gorham Well 1 | Available | Available | Available | Available |
| Mutual Well 4 | Available | Available | Available | Available |
| Mutual Well 5 | Available | Available | Available | Available |
| San Antonio Well 3 | Available | Available | Available | Available |
| San Antonio Well 4 | Available | Available | Available | Available |
| Booster pumps | | | | |
| Fairview Booster A | On | On | On | On |
| Fairview Booster B | Off | Off | Off | Off |
| San Antonio Booster A | On | On | On | On |
| San Antonio Booster B | Off | Off | On | Off |
| Signal Booster A | Off | Off | Off | Off |
| Signal Booster B | On | On | On | On |
| Valley View Booster A | Off | Off | Off | Off |
| Valley View Booster B | Off | Off | Off | Off |
| Storage tanks | | | | |
| Fairview Reservoir | 90% full | 67% full | 67% full | Full* |
| Heidelberger Tank | 90% full | 67% full | 67% full | Full* |
| Running Ridge Tank 2 | 90% full | 67% full | 67% full | Full* |
| Running Ridge Tank 1 | 90% full | 67% full | 67% full | Full* |
| Signal Tank | 90% full | 67% full | 67% full | Full* |
| CMWD interconnections | | | | |
| Montana-Cuyama | Off | On | On | On |
| San Antonio–Grand Ave. | Off | Off | On | Off |
| Sierra-Cuyama | Off | On | On | On |

* Operational storage is allocated 50% of the tank's full capacity.

All the changes made to the computer model during calibration were maintained for the hydraulic analysis too:

- Pressure settings for pressure reducing valves
- Pipeline c-factors

- Two pressure reducing valves (PRVs) between Main Gradient and Saddle Lane Gradient were set per GSWC's recommendation: Saddle Lane PRV at 90 psi and Ventura Street PRV at 80 psi.

Currently, the San Antonio Plant consists of five wells (with a total capacity of 2,730 gpm), the San Antonio–Grand Avenue CMWD Interconnection (800 gpm), a 50,000-gallon forebay, and two booster pumps (1,500 gpm capacity each). The San Antonio–Grand Avenue Interconnection (and the nearby wells) feeds into the forebay upstream of the booster pumps. The total supply capacity of the San Antonio plant is 3,530 gpm. However, supply into the distribution system is limited by the combined discharge capacity of the booster pumps (3,000 gpm). Therefore, the San Antonio Plant's total supply capacity is limited to 3,000 gpm regardless of the greater combined well capacity and the San Antonio–Grand Avenue CMWD Interconnection capacity.

The status of booster pumps and wells were based on the amount of supply needed for each demand period. Either one or two booster pumps at the San Antonio Plant must operate to meet system demands. The specific wells feeding the forebay were not modeled, but since this forebay is relatively small, the supply from the wells must approximately equal flow delivered into the system by the booster pump(s). Three of the five wells must operate when a single booster pump is on. All of the wells plus some capacity from the San Antonio–Grand interconnection are required when two boosters are in use.

For MDD and PHD, only firm capacity is available, therefore only a single San Antonio booster is assumed available under existing conditions. The Montana-Cuyama and Sierra-Cuyama CMWD interconnections are available to provide full capacity to meet demands.

Per criteria, the system storage cannot be tapped during MDD. For Area 2, one of the two Fairview Plant booster pumps was assumed to be operational, which resulted in a deficiency as identified in Section 5.

### 6.3.2 Average Day Scenario Analysis

To analyze the average day scenario for the existing system, simulations were performed using the computer model. The demands were distributed to demand nodes in the model by pressure zone. As shown in this table, the total ADD was 1,546 gpm. The operational status of the facilities was adjusted in the model to agree with the settings in Table 6-2 for ADD. The modeling results were compared to the criteria identified in Table 6-1. Note that the storage should not be drawn down for this planning scenario while total capacity for supply can be used. The results of this analysis are discussed in Subsection 6.3.6, Analysis Results and Proposed Hydraulic Improvements for the Existing System.

### 6.3.3 Maximum Day Scenario Analysis

To analyze the existing system under MDD, simulations were performed using the computer model, demands for MDD, and controls for MDD. The total systemwide maximum day demand of 3,556 gpm was distributed to demand nodes in the model. The demand distribution by pressure zone is shown in Table 5-4. The model controls for the system facilities were adjusted to match the settings shown in Table 6-2 for MDD. The simulation results were compared to the criteria identified in Table 6-1. Note that storage should not be drawn down for this planning scenario, and the supply was limited to firm capacity. The results of this analysis are discussed in Subsection 6.3.6, Analysis Results and Proposed Hydraulic Improvements for the Existing System.

### 6.3.4 Peak Hour Scenario Analysis

The steady-state analysis for PHD in the existing system was run in the hydraulic model using demands for PHD (6,044 gpm) and the operating assumptions shown in Table 6-2. Deficiencies were identified based on the hydraulic design criteria shown in Table 6-1. For this planning scenario, it was considered acceptable to use operational storage, but the supply was still limited to the firm capacity. The results of this analysis were discussed below in Subsection 6.3.6 Analysis Results and Proposed Hydraulic Improvements for the Existing System.

### 6.3.5 Fire-flow Scenario Analysis

The fire-flow analysis evaluated various fire-flow demands at specific locations while the system operates under MDD. The hydraulic model was used to analyze nodes in the hydraulic model and simulate a fire flow corresponding to the type listed in Table 5-2. Fire-flow nodes were selected using Google Earth and confirmed with the land use map (Figure 6-1), which was used to choose the fire-flow nodes that affect the entire system's performance in the event of a fire. Commercial fire flow was assigned to the hospital, Rains Department Store, and a school. This 2,000-gpm fire demand was distributed equally to two nodes in the Main Gradient. The nodes corresponding to the locations of Rains Department Store (218 E. Ojai Avenue) and the Ojai Valley Community Hospital (1306 Maricopa Highway and 204 Pirie Road) were selected in the model to run the fire-flow scenarios. A residential fire flow of 1,250 gpm, also distributed to two nodes equally, was selected for the Main Gradient and the Saddle Lane Gradient. Residential fire flow was used in Drown Avenue–Red Hill Road intersection (J1020; F89) and Red Hill Road–White Oak Circle intersection (J1030; F87) in the Main Gradient. These locations are close to the Daly Street loop node (J1050; F142) that has low pressure in various demand conditions. Residential fire flow was applied at the Buckboard Lane–Longhorn Road intersection (P274_7; F269) and at the Buckboard Lane–Saddle Lane intersection (F273_7; F273) in the Saddle Lane Gradient.

Not all of the nodes in the hydraulic model were assumed to contribute to a fire flow. Therefore, selected nodes were excluded from the fire-flow analysis, such as short dead-end lines (less than 500 feet), nodes on transmission mains that do not have hydrants, and nodes at water system facilities (such as tanks). Analyses and recommendations for such areas are provided in following sections.

### 6.3.6 Analysis Results and Recommended Hydraulic Improvements for the Existing System

Various alternatives were considered while investigating improvements to correct the hydraulic deficiencies identified in the hydraulic analysis. These proposed improvements were evaluated for their ability to correct the deficiency and be cost effective compared to competing alternatives.

The numbering system used in deficiency tables below was a series of three numbers. The first number indicates the planning period: 1 for the existing system, 2 for the 2015 system, and 3 for the 2030 system. The second number indicates the deficiency number, which starts at 1 and increases by 1 for each deficiency identified (note that the first hydraulic deficiency shown may not start at 1, because another deficiency might have been identified in a previous section of the master plan). The third number identifies the improvement alternative, but zero was reserved for the deficiency identification. Proposed improvements to correct the deficiency were numbered starting at 1. Therefore, the alternative number 1.2.3 would be used to identify the third proposed alternative for the second deficiency in the existing system. Note that the deficiencies identified may not start with the number 1.1.0 if deficiencies were identified in Section 5.

### Fire-flow Deficiencies

No fire-flow deficiencies were observed at specific fire nodes, however there are a group of 4-inch cast iron pipelines that are restrictive to allowing flow through that need to be replaced with 8-inch pipelines. 4-inch pipelines near the hydrant cause extremely high head loss that can be greatly reduced by installing a larger-diameter pipeline (at least 8-inch diameter). Many of the old 4-inch cast iron pipes (installed in the 1930s and 1940s) that have been removed throughout the system are extremely corroded. The rust tubercles can significantly reduce the diameter of the pipeline, creating pressure problems, especially during fire flows. Listed under deficiency 1.6.0 are a group of 4-inch pipelines that need to be replaced for fire flow deficiencies.

### Steady-State Deficiencies

Some areas had very high pressures (greater than 125 psi) in the Main Gradient near Country Club Road (ID J1650; F157) and in the Heidelberger Tank Gradient near Foothill Road (ID 36; F178). Pressure as high as 153 psi was observed near Foothill Road. Pressures along Country Club Road were observed in the mid to high 130-psi range and are due to the low elevations compared with the rest of the gradient.

The high pressure nodes (at elevations near 1,092 feet) for the Heidelberger Tank Gradient are on the small-diameter pipeline near the discharge side of the Valley View boosters. These nodes are supplied by the Heidelberger Tank (bottom elevation is 1,430 feet and sets the HGL for this zone), which is located about 340 feet above the node experiencing the highest pressure. Elevation difference is the principal reason for such high pressures. Relocation of the Valley View Booster Station to a higher elevation can help mitigate this deficiency.

One possible solution to overcome the high pressures in the Main Gradient could be to split the zone into two pressure zones to control the HGL: one as a Low Main Gradient at about 950 feet HGL (which is set by the elevation in the Signal Tank) and the other as a High Main Gradient at about 1,017 feet HGL.

The deficiencies identified in the ADD, MDD, and PHD simulations along with the recommended improvements for the existing system are presented in Table 6-3.

TABLE 6-3
Existing System Deficiencies and Recommended Improvements
*GSWC Region I Water Master Plan—Ojai System*

| Deficiency/ Alternative Number | Location | Deficiency | Recommended Improvement | Model ID |
|---|---|---|---|---|
| **1.1.0** | **Area 1** | **Storage** | | |
| 1.1.1 | San Antonio Plant | | Construct new 0.5 MG San Antonio Tank and remove existing forebay. | SAFOREBAY |
| **1.2.0** | **Area 2** | **Storage** | | |
| 1.2.2 | Fairview Plant | | Add emergency power to the Fairview Booster Station | |
| 1.2.3 | Valley View Booster Station | | Add emergency power to the Valley View Booster Station | |
| **1.3.0** | **Area 2** | **MDD supply** | | |
| 1.3.1 | Fairview Reservoir Gradient Booster Pump Station | | Add Booster Pump C - 500 gpm | NA |
| **1.4.0** | **Area 2** | **MDD+FF Supply and storage** | | |
| 1.3.1 | Fairview Reservoir Gradient Booster Pump Station | | Add Booster Pump C - 500 gpm | NA |
| **1.5.0** | **Area 1** | **Pressure >125 psi** | | |
| 1.5.1* | Main Gradient, Rancho Drive north of Montana-Cuyama intersection | | Install a PRV to separate High Main Gradient from the Low Main Gradient. | PRV1 |
| 1.5.2* | Main Gradient, Del Norte Rd.–Cuyama Rd. intersection near Sierra-Cuyama CMWD Interconnection | | Install a PRV to separate High Main Gradient from the Low Main Gradient. | PRV2 |
| 1.5.3* | Main Gradient, on Foothill Rd. at Aliso St.-Bristol Rd. intersection | | Install a booster pump station with 850-gpm pump and a PRV to separate High Main Gradient from the Low Main Gradient. | NEWBOOST, PRV3 |
| **1.6.0** | **Area 1** | | **MDD+FF Pressure** | |
| 1.6.1 | Country Club Road | | Replace 4-in pipe with 8-in pipe, 2,400 ft. | Pipe ID: P307 |
| 1.6.2 | El Paseo Rd.–Cuyama Rd. intersection | | Replace 4-in pipe with 8-in pipe, 562 ft. | Pipe ID: P242 |
| 1.6.3 | Cuyama Rd. | | Replace 4-in pipe with 8-in pipe, 490 ft. | Pipe ID: P286 |
| 1.6.4 | Bald Ave.–Pearl St. intersection | | Replace 4-in pipe with 8-in pipe, 1,100 ft. | Pipe ID: P85 |
| 1.6.5 | Fox St. south of Ojai Ave. | | Replace 4-in pipe with 8-in pipe, 1,100 ft. | Pipe ID: P316, P317, P318, P330 |

* To establish the new zone, all projects must be done concurrently.

Apart from one location (Palomar Road south of the Fairview Reservoir), the pressure deficiencies were identified for high pressures in the existing 2007 system.

Dozens of nodes in the southeastern portion of the distribution system experienced high pressure (between 110 and 125 psi) during ADD, MDD, and PHD scenarios. Several nodes in the Main Gradient in the far southern portion of the system near the Saddle Lane Gradient and on Country Club Road have even higher pressures (>125 psi).

One node near Fairview Reservoir on Palomar Road (ID 176; F121 at 924 feet elevation), the highest node in the Main Gradient, has slightly low pressure (39 psi) during PHD. Since this pipeline has only a few service connections and is influenced by the pressure in the Fairview Reservoir, this low pressure was considered acceptable and no improvements are proposed.

In summary, high pressure (>110 psi) simulated for about one-third of the system seems to be the most critical deficiency and requires system improvements. However, these high pressures could not be improved (decreased) by splitting the main pressure zone. Separating the Main Gradient into two zones would provide these benefits:

- Save expenses for power needed to operate pumps
- Minimize the possibilities of pipeline breakage caused by pressure, consequently increasing pipeline average life

In the 2015 scenarios, a split Main Gradient hydraulic configuration was analyzed in greater detail. Boundaries of the new zones were evaluated, which was followed by reviewing the updated model results, and repeating this process until acceptable results were obtained. The same approach is followed for similar high- and low-pressure points during MDD and PHD scenarios.

For the existing system, some pipelines with velocities above the criteria identified in Table 6-1 were identified. However, these do not appear to contribute to pressure problems or excessive pumping, so no deficiency was identified and no improvements are proposed.

Deficiency 1.1.0: Area 1 needs more storage (0.495 MG) to overcome system deficiencies identified in Table 5-6.1. The existing forebay at the San Antonio Plant is undersized and is in need of replacement. The San Antonio Plant is a critical facility where all of the wells and an interconnection pump into a forebay before being boosted out into the system. Placing the new 0.5 MG tank at the San Antonio Plant will not only correct the identified storage deficiency, but also provide for better operation of the San Antonio Plant. It is recommended that GSWC replace the existing forebay with a 0.5 MG tank at this site.

Deficiency 1.2.0: Storage in Area 2 has a deficiency in the existing system of 0.135 MG. Due to poor access to the existing small Running Ridge tanks and the lack of available property, rather than provide additional storage, stand-by generators should be installed at the Fairview and Valley View Booster Stations to reduce the amount of emergency storage required in the higher pressure zones of Ojai. With the installation of the stand-by generators, the booster stations are considered reliable which allows for the emergency storage to be provided out of the Fairview Tank. The deficiency in fire storage is transferred to the Fairview Reservoir by the installation of booster pump C at the Fairview Plant which allows for greater fire flows out of the Fairview booster station.

Deficiency 1.3.0 and 1.4.0: To address the MDD 97-gpm supply deficiency in Area 2 and the 55 gpm fire-flow deficiency, it is recommended that GSWC proceed with adding a booster C at the Fairview Plant with a capacity of 500 gpm.

Deficiency 1.5.0: These deficiencies relate to high pressures in multiple nodes (about one-third of the system in the southeastern portion of the distribution system). The split zone concept will reduce the HGL in the low Main Gradient such that pressures are 20 to 25 psi lower than the existing scenarios.

To split the Main Gradient in two, three PRVs will isolate the High Main Gradient from the Low Main Gradient. Several valves will need to be closed near the Sierra-Cuyama CMWD Interconnection. Because the CMWD water at this interconnection may not always be available, a booster pump station is required to convey water from the Low Main Gradient to the High Main Gradient. The booster pump station should be located on Foothill Road, north of the intersections with Aliso Street and Bristol Road, to take advantage of the 12-inch distribution pipeline there. Booster pumps with 850-gpm capacity are recommended to meet the MDD demand estimated through 2030 in the High Main Gradient and Area 2. The Signal Tank will set the HGL for the lower main gradient and the Fairview reservoir will set the HGL for the higher main gradient.

Deficiency 1.6.0: These deficiencies were due to fire-flow requirements in areas connected by smaller diameter (4-inch) pipes only. Hydrants are supplied with only 4-inch pipes at these five locations:

- Pipe ID P307 (F228) on Country Club Road
- Pipe ID P242 (F113) on El Paseo Road–Cuyama Road intersection
- Pipe ID P286 on Cuyama Road east of Cuyama Road–Sierra Road intersection
- Pipe ID P85 (F44) on Bald Avenue–Pearl Street intersection
- Pipe IDs P316, P317, P318 and P330 (F23, F327, F21, F191) on Fox Street south of Ojai Avenue

These 4-inch pipes are all 50-80 years old and are made of unlined cast iron, so corrosion further constricts flow and greatly increases head loss. These pipes also tend to leak frequently. Overall poor pipe condition warrants replacement.

### 6.3.7 Operating Facility Status with Existing System Recommended Improvements

Table 6-4 presents the operating facility status for the existing system with all recommended improvements implemented.

TABLE 6-4
Existing System with Improvements Operating Facility Status
*GSWC Region I Water Master Plan—Ojai System*

| Facility Name | ADD | MDD | MDD+FF | PHD |
|---|---|---|---|---|
| | | Wells | | |
| Gorham Well 1 | Available | Available | Available | Available |
| Mutual Well 4 | Available | Available | Available | Available |
| Mutual Well 5 | Available | Available | Available | Available |
| San Antonio Well 3 | Available | Available | Available | Available |
| San Antonio Well 4 | Available | Available | Available | Available |

TABLE 6-4
Existing System with Improvements Operating Facility Status
*GSWC Region I Water Master Plan—Ojai System*

| Facility Name | ADD | MDD | MDD+FF | PHD |
|---|---|---|---|---|
| Booster pumps | | | | |
| Fairview Booster A | On | On | On | On |
| Fairview Booster B | Off | On | On | On |
| Fairview Booster C | Off | Off | On | Off |
| San Antonio Booster A | On | On | On | On |
| San Antonio Booster B | Off | Off | On | Off |
| Signal Booster A | Off | Off | Off | Off |
| Signal Booster B | On | On | On | On |
| Valley View Booster A | On | On | On | Off |
| Valley View Booster B | Off | Off | On | Off |
| Storage tanks | | | | |
| Fairview Reservoir | 90% full | 67% full | 67% full | Full |
| Heidelberger Tank | 90% full | 67% full | 67% full | Full |
| Running Ridge Reservoirs | 90% full | 67% full | 67% full | Full |
| San Antonio Reservoir (new) | 90% full | 67% full | 67% full | Full |
| Signal Tank | 90% full | 67% full | 67% full | Full |
| CMWD interconnections | | | | |
| Montana-Cuyama | Off | On | On | On |
| San Antonio–Grand Ave | Off | On | On | Off |
| Sierra-Cuyama | On | On | On | On |

### 6.3.8 Existing System Pressures *without* Improvements

The existing distribution system was analyzed to identify areas of the system that experienced pressures below 40 psi or above 125 psi for ADD, MDD, and PHD criteria (these criteria were identified in Table 6-1). As pressures are very high in the entire southeastern portion of the system, pressures above 110 psi were also identified. The various steady-state planning scenarios were used to analyze system pressures under different demand conditions to verify adequate system pressure. This analysis was performed *without any proposed improvements* to identify the excessive pressures throughout large areas of the Main Gradient. The pressure analysis *with recommended improvements*, including the split Main Gradient to address excessive pressures, is presented in the 2015 system analysis.

Hydraulic modeling analyses results were discussed earlier for the various demand conditions. The recommended improvements developed from the analysis (see Table 6-3) include a major re-configuration of the Ojai system; the large Main Gradient is to be split into two (one high and one low) zones to address the high pressures. Commercial fire flow was applied at the nodes near the Hospital in the Main Gradient and residential fire flows were applied within the Main Gradient and Saddle Lane Gradient. The results are presented in Table 6-5. This table lists the lowest pressure and the highest pressure observed in each pressure zone for the demand conditions analyzed.

TABLE 6-5
Existing System Pressure Range Results
*GSWC Region I Water Master Plan—Ojai System*

| | ADD (psi) | | MDD (psi) | | Commercial MDD+FF[a] (psi) | | Residential MDD+FF[b] (psi) | | PHD (psi) | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Pressure Gradient** | **Low** | **High** | **Low** | **High** | **Low** | **High** | **Low** | **High** | **Low** | **High** |
| Main Gradient[c] | 40 | 136 | 40 | 136 | 40 | 127 | 40 | 136 | 39 | 128 |
| Saddle Lane Gradient | 74 | 97 | 74 | 97 | 74 | 97 | 71 | 95 | 74 | 97 |
| Signal Gradient | 82 | 84 | 81 | 84 | 81 | 84 | 81 | 84 | 79 | 81 |
| Heidelberger Tank Gradient | 57 | 153 | 57 | 153 | 57 | 153 | 57 | 153 | 57 | 153 |
| Running Ridge Gradient | 47 | 109 | 45 | 107 | 45 | 107 | 45 | 107 | 43 | 105 |

[a] Commercial fire-flow locations are near a hospital and simulated pressures: 92 psi at Ojai Ave.–El Paseo intersection (ID J1590; F207), and 100 psi at Maricopa Rd. Hwy-Ojai Ave. intersection (ID560, F220).
[b] Residential fire-flow location and simulated pressures: Main Gradient—56 psi at Drown–Red Hill Rd. intersection (ID J1020; F89) and 59 psi at White Oak Circle (ID J1030; F87). Saddle Lane Gradient— 71 psi at Buckboard Ln.–Longhorn Rd. intersection (ID P274_7; F269) and 76 psi at Buckboard Ln.–Saddle Ln. intersection (ID F273_7; F273).
[c] Assumes the single Main Gradient before the recommended split.

The results indicate pressure deficiencies in the Main Gradient for high and low pressure criteria and in the Heidelberger Gradient for high pressure criteria. Pressures during fire-flow conditions were higher than 20 psi. Table 6-4 presents the highest pressures in each zone, but there are many nodes with high pressures in the Main Gradient.

Splitting the existing Main Gradient to create a High Main Gradient and a Low Main Gradient will decrease excessive pressures throughout the southeastern portion of the system.

### 6.3.9 System Velocities

High velocities in water pipelines can be an indication of an operational inefficiency, can lead to scouring of the pipe lining material, and increase the chances of a valve failure. Increased velocities contribute to increased head loss, usually resulting in a less efficient water distribution system. Higher velocities may be acceptable for short-term operation, such as when needed in fighting fires, but otherwise should be avoided where practical.

The planning scenarios used to analyze the Ojai System for pressure deficiencies were also used to evaluate the velocities under the same demand periods (ADD, MDD, and PHD). The velocity criteria used to evaluate the distribution system for each demand period are defined in Table 6-1.

The results of the velocity analysis are presented in Table 6-6. This table lists the lowest velocity and the highest velocity observed in each pressure zone for the demand conditions analyzed. The results indicate that there are some high velocities that require improvements.

TABLE 6-6
Existing System Velocity Range Results
*GSWC Region I Water Master Plan—Ojai System*

| | ADD (fps) | | MDD (fps) | | Commercial MDD+FF[a] (fps) | | Residential MDD+FF[b] (fps) | | PHD (fps) | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Pressure Gradient** | **Low** | **High** | **Low** | **High** | **Low** | **High** | **Low** | **High** | **Low** | **High** |
| Main Gradient[c] | 0.0 | 5.43[2] | 0.0 | 5.41[2] | 0.0 | 10.35[2] | 0.0 | 10.51[2] | 0.0 | 6.39 |
| Saddle Lane Gradient | 0.01 | 0.26 | 0.03 | 0.60 | 0.03 | 0.60 | 1.24 | 5.96 | 0.05 | 1.02 |
| Signal Gradient | 0.04 | 6.62[2] | 0.09 | 7.25[2] | 0.09 | 6.69 | 0.09 | 6.46 | 0.15 | 2.59 |
| Heidelberger Tank Gradient | 0.0 | 0.29 | 0.0 | 0.67 | 0.0 | 0.67 | 0.0 | 0.67 | 0.0 | 1.14 |
| Running Ridge Gradient | 0.01 | 3.97 | 0.01 | 4.46 | 0.01 | 4.45 | 0.01 | 4.46 | 0.03 | 4.82 |

[a] Pipes need improvements (see Table 6-3).
[b] The most critical velocities simulated with two residential fire-flow conditions in each zone have been reported.
[c] Assumes the single Main Gradient before the recommended split.

The high velocities observed near the new Signal Tank can be solved by providing a 12-in pipeline parallel to the existing 8-in and 10-in pipe between Grand Avenue and the Signal Tank on Signal Street. High velocities observed on Grand Avenue in Main Gradient are for pipes of small lengths (about 17 feet) near the San Antonio Plant connecting the three distribution pipes (12- 10–, and 8-inch) there. Because these are just pipes that interconnect the parallel pipes, there is no recommendation to increase their size.

## 6.4 2015 System Hydraulic Analysis

Analysis of the 2015 system was performed to identify short-term improvements needed beyond those incorporated for the existing system. The analysis was performed in a manner similar to the existing system analysis and used the following assumptions:

- Existing supply sources would remain active or be replaced in kind.
- Recommended improvements to correct deficiencies in the existing system were assumed to be in place.
- The demands developed in Section 3, Existing and Future Water Demands, were assumed for the respective demand periods.

The demands used for the 2015 system were based on water demands shown in Table 5-10.

### 6.4.1 Operational Assumptions

The operating status of the relevant facilities in the Ojai System operated under ADD, MDD, PHD, and MDD+FF for 2015 are presented in Table 6-7.

TABLE 6-7
2015 System Operating Facility Status
*GSWC Region I Water Master Plan—Ojai System*

| Facility Name | ADD | MDD | MDD+FF | PHD |
|---|---|---|---|---|
| Wells | | | | |
| Gorham Well 1 | Available | Available | Available | Available |
| Mutual Well 4 | Available | Available | Available | Available |
| Mutual Well 5 | Available | Available | Available | Available |
| San Antonio Well 3 | Available | Available | Available | Available |
| San Antonio Well 4 | Available | Available | Available | Available |
| Booster pumps | | | | |
| Fairview Booster A | On | On | On | On |
| Fairview Booster B | Off | On | On | On |
| Fairview Booster C (new) | Off | Off | On | Off |
| San Antonio Booster A | On | On | On | On |
| San Antonio Booster B | Off | Off | Off | Off |
| Signal Booster A | Off | Off | Off | Off |
| Signal Booster B | On | On | On | On |
| Valley View Booster A | Off | Off | Off | Off |
| Valley View Booster B | Off | Off | Off | Off |
| Storage tanks | | | | |
| Fairview Reservoir | 90% full | 67% full | 67% full | Full* |
| Heidelberger Tank | 90% full | 67% full | 67% full | Full* |
| Running Ridge Reservoirs | 90% full | 67% full | 67% full | Full* |
| San Antonio Reservoir (new) | 90% full | 67% full | 67% full | Full* |
| Signal Tank | 90% full | 67% full | 67% full | Full* |
| CMWD interconnections | | | | |
| Montana-Cuyama | Off | On | On | On |
| San Antonio–Grand Ave. | Off | On | On | Off |
| Sierra-Cuyama | On | On | On | On |

* Operational storage is allocated 50% of the tank's full capacity.

### 6.4.2 Average Day Scenario Analysis

To analyze the average day scenario for the 2015 system, simulations were performed using the computer model with ADD. The demands used in the computer model for ADD in 2015 were 1,808 gpm. The operational status of the facilities was modified to agree with Table 6-7, and the recommended improvements identified for the existing system were included in the 2015 system analysis. For this scenario, total capacity can be used for supply, but no storage drawdown is allowed. The modeling results were compared to the criteria identified in Table 6-1. Where these criteria were not met, a deficiency was identified. The 2015 ADD analysis results are discussed in Subsection 6.4.6 Analysis Results and Proposed Hydraulic Improvements for the 2015 System.

### 6.4.3 Maximum Day Scenario Analysis

The hydraulic analysis included simulating MDD in the 2015 system. The 2015 demands used in the computer model for MDD were 4,158 gpm. The model controls were based on the operational settings listed in Table 6-7. Note that for the maximum day scenario, there should be no storage drawdown in the system and the supply was limited to firm capacity. The 2015 MDD analysis results are discussed in Subsection 6.4.6, Analysis Results and Proposed Hydraulic Improvements for the 2015 System.

### 6.4.4 Peak Hour Scenario Analysis

The steady-state analysis for the 2015 system peak hour scenario was created using the operational settings identified in Table 6-7. Under PHD, storage drawdown was considered acceptable provided that sufficient operational storage was available but the supply was still limited to firm capacity. The demands used in the computer model for PHD were 7,067 gpm. The 2015 PHD analysis results are discussed in Subsection 6.4.6, Analysis Results and Proposed Hydraulic Improvements for the 2015 System.

### 6.4.5 Fire-flow Scenario Analysis

The fire-flow analysis for the 2015 system was performed in a manner similar to the existing system fire-flow analysis. The differences in the future system include higher base demands (MDD).and the recommended improvements for the existing system.

The results were tabulated and included in the appendices.

### 6.4.6 Analysis Results and Recommended Hydraulic Improvements for the 2015 System

Improvements to correct the hydraulic deficiencies identified in the hydraulic analysis for the 2015 system are presented in this section. These recommended improvements were evaluated for their ability to correct the deficiency and be cost effective.

#### Fire-flow Deficiencies

The results of fire-flow analysis indicate that there are no fire-flow deficiencies.

#### Steady-state Deficiencies

The deficiencies identified in the ADD, MDD, and PHD simulations for the 2015 system are presented in Table 6-8.

TABLE 6-8
2015 System Deficiencies and Recommended Improvements
*GSWC Region I Water Master Plan—Ojai System*

| Deficiency/ Alternative Number | Location | Deficiency | Proposed Improvement | Model ID |
|---|---|---|---|---|
| **2.1.0** | **Area 1** | **Inadequate Storage** | | |
| 2.1.1 | | | Additional 0.5 MG Tank at San Antonio Plant | |
| **2.2.0** | **Area 1** | **MDD Supply** | | |
| 2.2.2 | | | San Antonio Booster Pump C | |
| **2.3.0** | **Area 1** | **ADD and MDD Velocity >5 fps** | | |
| 2.3.1 | Pipeline near hospital on Ojai Ave.–Del Norte Rd. intersection | | Replace existing 6-in pipe with 12-in pipe, 310 ft | Pipe ID: P301 |

Deficiency 2.1.0: The system is short on storage and another reservoir is required in the main gradient. A second reservoir can be placed at the San Antonio Plant where a first 0.5 MG tank was proposed for the existing system. The second reservoir will allow GSWC operations the flexibility to take one out of service for maintenance while keeping the other in service.

Deficiency 2.2.0: To make full use of the 2,730 gpm groundwater supply available at the San Antonio Plant, a new booster pump at the San Antonio Plant is required. This pump will meet the system demands to resolve the supply deficiency identified in Section 5 (deficiency 2.2.0). With three booster pumps, supply reliability will be greatly improved, because two of the three booster pumps (one may be out of operation, which is the definition of firm capacity) will be available during all scenarios.

Deficiency 2.3.0: The 6-inch waterline on Ojai Avenue is undersized and is surrounded by larger pipelines. The velocity of water in this pipeline is normally above 5 ft/s indicating an operational inefficiency. This pipeline should be replaced with a larger diameter pipeline.

### 6.4.7 Operating Facility Status with 2015 System Recommended Improvements

The facility status includes only two changes from what is shown in Table 6-7 - the additional booster pump and additional reservoir at the San Antonio Plant.

### 6.4.8 System Pressures with Recommended Improvements

The 2015 system was analyzed in the same manner as the existing system, except that the 2015 demands were used, and recommended improvements were also included with the existing system facilities. Various steady-state planning scenarios were developed to analyze the system under different demand conditions to verify adequate system pressure.

Results of the hydraulic modeling analyses were discussed earlier for the various demand conditions. The recommended improvement was included in this summary to document the performance of the existing system with the recommended improvements. The results are presented in Table 6-9. This table lists the lowest pressure and the highest pressure observed in each pressure zone for the demand conditions analyzed. Note that pressures in the Low Main Gradient and High Main Gradient are much lower than pressures simulated for the single Main Gradient in the existing system, although demand increased in the 2015 system. Commercial fire flow was applied at the nodes near the hospital, and residential fire flow was applied at Low Main Gradient, High Main Gradient, and Saddle Lane Gradient. The results indicate that there were no other pressure deficiencies in the 2015 system provided that the recommended improvement was incorporated. All pressure zones met the minimum and maximum pressure criteria for ADD, MDD, and PHD simulations including fire-flow conditions.

TABLE 6-9
2015 System with Recommended Improvements Pressure Range Results
*GSWC Region I Water Master Plan—Ojai System*

| | ADD (psi) | | MDD (psi) | | Commercial MDD+FF[a] (psi) | | Residential MDD+FF[b] (psi) | | PHD (psi) | |
|---|---|---|---|---|---|---|---|---|---|---|
| Pressure Gradient | Low | High | Low | High | Low | High | Low | High | Low | High |
| Low Main Gradient | 47 | 115 | 46 | 119 | 44 | 97 | 34 | 117 | 40 | 111 |
| High Main Gradient | 40 | 84 | 40 | 85 | 40 | 85 | 33 | 84 | 40 | 85 |
| Saddle Lane Gradient | 74 | 97 | 74 | 97 | 74 | 97 | 71 | 95 | 74 | 97 |
| Signal Gradient | 76 | 78 | 75 | 77 | 75 | 77 | 75 | 77 | 72 | 74 |
| Heidelberger Tank Gradient | 57 | 153 | 57 | 153 | 57 | 153 | 57 | 153 | 57 | 153 |
| Running Ridge Gradient | 46 | 109 | 45 | 107 | 44 | 107 | 44 | 107 | 43 | 105 |

[a] Commercial Fire-flow locations are near the hospital and simulated pressures: at Ojai Ave-El Paseo intersection (ID J1590; F207) – 60 psi and Maricopa Rd. Hwy-Ojai Ave. intersection (ID560, F220) – 68 psi

[b] Residential Fire-flow location and simulated pressures are: For Low Main Gradient: at Drown – Red Hill Rd. intersection (ID J1020; F89) – 34 psi and White Oak Circle (ID J1030; F87) – 38 psi; For High Main Gradient: at Rancho Dr. (ID F107_3; F116) - 33 psi and Rancho dr. – El Norte Rd. intersection (ID P104_3; F114) – 51 psi; For Saddle Lane Gradient: at Buckboard Ln. - Longhorn Rd. intersection (ID P274_7; F269) – 71 psi and Buckboard Ln.-Saddle Ln. intersection (ID F273_7; F273) – 76 psi

### 6.4.9 System Velocities with Recommended Improvements

The approach used to analyze the 2015 system for pressure deficiencies was the same used for the existing system, except that the demands for 2015 were used and the recommended improvements for the existing system were included.

The results of the velocity analysis are presented in Table 6-10. This table lists the lowest velocity and the highest velocity observed in each pressure zone for the demand periods analyzed. The results indicate that there were no velocity deficiencies in the existing system provided that the recommended improvements (presented in Table 6-8) are incorporated. All pressure zones met the maximum velocity criteria for ADD, MDD, and PHD simulations. Also, all pressure zones met the maximum velocity criteria for commercial and residential fire-flow simulations. Note that the maximum velocities observed for any of the three residential fire-flow conditions in each zone were less than the maximum velocity criteria.

TABLE 6-10
2015 System with Recommended Improvements Velocity Range Results
*GSWC Region I Water Master Plan—Ojai System*

| Pressure Gradient | ADD Velocity (fps) | | MDD Velocity (fps) | | MDD+FF (commercial) Velocity (fps) | | MDD+FF[a] (residential) Velocity (fps) | | PHD Velocity (fps) | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Low | High | Low | High | Low | High | Low | High | Low | High |
| Low Main Gradient | 0.0 | 6.04[b] | 0.0 | 8.82[b] | 0.0 | 9.53 | 0.0 | 8.93 | 0.0 | 8.86 |
| High Main Gradient | 0.01 | 1.80 | 0.01 | 5.47 | 0.01 | 5.47 | 0.01 | 6.53 | 0.02 | 5.28 |
| Saddle Lane Gradient | 0.01 | 0.30 | 0.03 | 0.70 | 0.03 | 0.70 | 1.19 | 5.96 | 0.05 | 1.19 |
| Signal Gradient | 0.04 | 1.0 | 0.10 | 0.36 | 0.10 | 2.65 | 0.10 | 2.34 | 0.18 | 3.92 |
| Heidelberger Tank Gradient | 0.0 | 0.34 | 0.0 | 0.78 | 0.0 | 0.78 | 0.0 | 0.78 | 0.0 | 1.32 |
| Running Ridge Gradient | 0.01 | 4.04 | 0.02 | 4.58 | 0.02 | 4.58 | 0.02 | 4.58 | 0.03 | 4.92 |

[a] The most critical velocities simulated with three residential fire-flow conditions in each zone have been reported.
[b] Pipes need improvements (see Table 6-8).

# 6.5 2030 System Hydraulic Analysis

Analysis of the 2030 system was performed to identify long-term improvements needed beyond those needed for the existing and 2015 systems. The analysis was performed in a manner similar to the existing system analysis and used the following assumptions:

- Existing supply sources would remain active or be replaced in kind.
- Recommended improvements to correct deficiencies in the earlier planning years were assumed to be in place.
- The demands developed in Section 3, Existing and Future Water Demands, were assumed for the respective demand periods.

The demands used for the 2030 system were based on water demands shown in Table 5-14.

## 6.5.1 Operational Assumptions

The operating status of the relevant facilities to be operated under ADD, MDD, and PHD periods for 2030 is presented in Table 6-11.

TABLE 6-11
2030 System Operating Facility Status
*GSWC Region I Water Master Plan—Ojai System*

| **Facility Name** | **ADD** | **MDD** | **MDD+FF** | **PHD** |
|---|---|---|---|---|
| Wells | | | | |
| Gorham Well 1 | Available | Available | Available | Available |
| Mutual Well 4 | Available | Available | Available | Available |
| Mutual Well 5 | Available | Available | Available | Available |
| San Antonio Well 3 | Available | Available | Available | Available |
| San Antonio Well 4 | Available | Available | Available | Available |
| Booster pumps | | | | |
| Fairview Booster A | On | On | On | On |
| Fairview Booster B | On | On | On | On |
| Fairview Booster C (new) | Off | Off | On | Off |
| San Antonio Booster A | On | On | On | On |
| San Antonio Booster B | Off | Off | Off | Off |
| San Antonio Booster C (new) | Off | On | On | On |
| Signal Booster A | Off | Off | Off | Off |
| Signal Booster B | On | On | On | On |
| Valley View Booster A | On | On | On | On |
| Valley View Booster B | Off | Off | On | Off |
| Storage tanks | | | | |
| Fairview Reservoir | 90% full | 67% full | 67% full | Full* |
| Heidelberger Tank | 90% full | 67% full | 67% full | Full* |
| San Antonio Reservoir #1 (new) | 90% full | 67% full | 67% full | Full* |
| San Antonio Reservoir #2 (new) | 90% full | 67% full | 67% full | Full* |
| Signal Tank | 90% full | 67% full | 67% full | Full* |
| CMWD interconnections | | | | |
| Montana-Cuyama | Off | On | On | On |
| San Antonio–Grand Ave. | Off | On | On | Off |
| Sierra-Cuyama | On | On | On | On |

* Operational storage is allocated 50% of the tank's full capacity.

### 6.5.2 Average Day Scenario Analysis

To analyze the average day scenario for the 2030 system, simulations were performed using the computer model with ADD. The demands used in the computer model for ADD in 2030 were 2,053 gpm. The operational status of the facilities was modified to coincide with Table 6-11, and the recommended improvements identified for earlier planning years were included in the 2030 system analysis. The modeling results were compared to the criteria identified in Table 6-1. The analysis results are discussed in Subsection 6.5.6, Analysis Results and Proposed Hydraulic Improvements for the 2030 System.

### 6.5.3 Maximum Day Scenario Analysis

The hydraulic analysis included simulating MDD in the 2030 system. The demands used for 2030 MDD in the computer model were 4,722 gpm. The model controls were based on the operational settings listed in Table 6-11.

The 2030 MDD analysis results are discussed in Subsection 6.5.6 Analysis Results and Proposed Hydraulic Improvements for the 2030 System.

### 6.5.4 Peak Hour Scenario Analysis

The steady-state analysis for the 2030 system peak hour scenario was created using the operational settings identified in Table 6-11. Under PHD conditions, storage drawdown was considered acceptable provided that sufficient operational storage was available. The demands used for 2030 PHD in the computer model were 8,027 gpm. The 2030 PHD analysis results were discussed in Subsection 6.5.6, Analysis Results and Proposed Hydraulic Improvements for the 2030 System.

### 6.5.5 Fire-flow Scenario Analysis

The fire-flow analysis for the 2030 system was performed in a manner similar to the existing system fire-flow analysis. The differences in the future system included higher base demands (MDD). In addition, the analysis included the recommended improvements for earlier planning years. The results were tabulated and included in the appendices.

### 6.5.6 Analysis Results and Recommended Improvements for the 2030 System

Various alternatives were considered while investigating improvements to correct the deficiencies identified in the hydraulic analysis. These proposed improvements were evaluated for their ability to correct the deficiency and be cost effective.

#### Fire-flow Deficiencies

The results of fire-flow analysis indicated that there were no low pressures during a commercial fire in the Low Main Gradient near the hospital area and during a residential fire in the Low Main Gradient, High Main Gradient, and Saddle Lane Gradient.

#### Steady-state Deficiencies

The deficiencies identified in the ADD, MDD, and PHD simulations for the 2030 system are presented in Table 6-12.

One node on the Daly Road loop (ID 1050; F142; Elev.: 861 ft) in the Main Gradient, which is the highest node in the Main Gradient, has slightly low pressure (35 psi) during PHD scenarios. Another node at the Libby Avenue and Raymond intersection (ID 1480; F 265; Elev.: 861 ft) has slightly low pressure (39 psi). The low-pressure points in the Main Gradient were observed at the ends of the loops. Since these pipelines were used only to supply water to a higher elevation in the Main Gradient, these low pressures were also considered acceptable, and no improvements were proposed.

Some pipelines in the 2030 system experience high velocities according to the criteria for ADD and MDD scenarios presented in Table 6-12.

TABLE 6-12
2030 System Deficiencies and Recommended Improvements
*GSWC Region I Water Master Plan—Ojai System*

| Deficiency/ Alternative Number | Location | Deficiency | Proposed Improvement | Model ID |
|---|---|---|---|---|
| **3.1.0** | **Area 1** | **Inadequate storage volume** | | |
| 3.1.1 | Signal Plant | | Add 0.5 MG Reservoir | |
| **3.2.0** | **Area 1** | **MDD Supply (92 gpm)** | | |
| N/A | | | | |
| **3.3.0** | **Area 2** | **PHD Capacity** | | |
| 3.3.2 | Fairview Plant | | Upsize booster B from 250 gpm to 500 gpm | |
| **3.4.0** | **Area 2** | **MDD+FF** | | |
| 3.3.2 | Fairview Plant | | Upsize booster B from 250 gpm to 500 gpm | |
| **3.5.0** | **Area 1** | **Pressures <40 psi** | | |
| 3.5.1 | Daly Road Loop near new Signal Reservoir | | Install a new 6–in pipeline on Douglas Street from Signal Street to Montgomery Street, 2,300 ft. | 1089 |
| **3.6.0** | **Area 1** | **Velocity >5 fps** | | |
| 3.6.1 | Pipeline near Sierra-Cuyama intersection on Sierra Road | | Replace 8-in pipe with 12-in pipe, 1,150 ft. | Pipe ID: P283 |

**Deficiency 3.1.0.** Additional storage is required in the main zone as a result of the storage analysis in Section 5. A location other than the San Antonio Plant would be preferred for this storage. The Signal Plant is a potential location for this additional 0.5 MG reservoir.

**Deficiency 3.2.0.** Additional supply of 92 gpm is required during MDD to supply the main zone. By this planning period, there will be multiple wells that will need to be replaced. It is possible that these wells can have slightly larger capacities than their predecessors which could make up for this deficiency. This will be re-evaluated in the future and if a deficiency is still expected, a solution will be proposed.

**Deficiency 3.3.0. and 3.4.0.** The upper pressure zones of Ojai need additional capacity during peak hour demand and fire flow conditions. Because land is limited in this area of Ojai, a general plan to improve pumping capabilities to these areas has been planned. To resolve these deficiencies, one of the 250 gpm booster pumps at Fairview (Fairview Booster A or Booster B) should be changed out to a 500 gpm booster pump.

**Deficiency 3.5.0.** One node on Daly Road has low pressure (35 psi) during PHD. A new 6-inch-diameter pipeline connecting the New Signal Reservoir site area with the Daly Road loop could improve the pressure by at least 5 psi, to greater than 40 psi. The new pipeline could align with Douglas Street from Signal Street to Montgomery Street to connect with the Daly Road loop. The length of this pipeline would be about 2,300 feet.

**Deficiency 3.6.0.** A pipe near the Sierra-Cuyama intersection on Sierra Road has velocity slightly more than 5 fps (simulated as 5.20 fps). To overcome this deficiency, the smaller-diameter pipes need to be replaced with a new, larger-diameter pipe. Some other pipelines with slightly high velocities are directly connected to valves or pumps and were not recommended for improvements.

### 6.5.7 Operating Facility Status with 2030 System Recommended Improvements

The facility status remains the same as the 2030 system before improvements (Table 6-11).

### 6.5.8 2030 System Pressures with Recommended Improvements

The 2030 system was analyzed in the same manner as the existing and 2015 systems, except that the 2030 demands were used and recommended improvements were also included with the existing system facilities. Various steady-state planning scenarios were developed to analyze the system under different demand conditions to verify adequate system pressure.

Results of the hydraulic modeling analyses were described earlier for the various demand conditions. The recommended improvements developed from the 2030 system analysis were included in this summary to document the performance of the existing system with the recommended improvements. The results are presented in Table 6-13. This table lists the lowest pressure and the highest pressure observed in each pressure zone for the demand conditions analyzed.

TABLE 6-13
2030 System with Recommended Improvements Pressure Range Results
*GSWC Region I Water Master Plan—Ojai System*

| Pressure Gradient | ADD (psi) | | MDD (psi) | | Commercial MDD+FF[a] (psi) | | Residential MDD+FF[b] (psi) | | PHD (psi) | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Low | High | Low | High | Low | High | Low | High | Low | High |
| Low Main Gradient | 47 | 114 | 45 | 117 | 42 | 102 | 33 | 116 | 35[c] | 106 |
| High Main Gradient | 40 | 84 | 40 | 85 | 40 | 85 | 33 | 84 | 40 | 85 |
| Saddle Lane Gradient | 74 | 97 | 74 | 97 | 74 | 97 | 71 | 97 | 73 | 97 |
| Signal Gradient | 76 | 78 | 75 | 77 | 74 | 77 | 75 | 77 | 71 | 73 |
| Heidelberger Tank Gradient | 57 | 153 | 57 | 153 | 57 | 153 | 57 | 153 | 56 | 153 |
| Running Ridge Gradient | 46 | 108 | 44 | 106 | 44 | 106 | 44 | 106 | 42 | 104 |

[a] Commercial Fire-flow locations are near Hospital and simulated pressures: at Ojai Ave.–El Paseo intersection (ID J1590; F207) – 59 psi and Maricopa Rd. Hwy-Ojai Ave. intersection (ID560, F220) – 67 psi

[b] Residential Fire-flow location and simulated pressures are: For Low Main Gradient: at Drown–Red Hill Rd. intersection (ID J1020; F89) – 33 psi and White Oak Circle (ID J1030; F87) – 37 psi; For High Main Gradient: at Rancho Dr. (ID F107_3; F116) - 33 psi and Rancho Dr.–El Norte Rd. intersection (ID P104_3; F114) – 51 psi; For Saddle Lane Gradient: at Buckboard Ln.–Longhorn Rd. intersection (ID P274_7; F269) – 70 psi and Buckboard Ln.–Saddle Ln. intersection (ID F273_7; F273) – 75 psi

[c] Daly Road loop (ID 1050; F142 at 861 ft elevation) in Low Main Gradient, which is the highest node in the Low Main Gradient, has slightly low pressure (35 psi) during PHD scenarios. Another node on Libby Ave.–Raymond intersection (ID 1480; F 265 at 861 ft elevation) in the Low Main Gradient has also slightly low pressure (39 psi).

The results show that there could be some low pressures in the highest elevation in the Low Main Gradient during PHD scenarios. The low pressure at Libby Avenue (39.3 psi) in the Low Main Gradient could be dismissed because it is within the error tolerance of the model to the low-pressure criterion (40 psi).

All other pressure zones met the minimum and maximum pressure criteria for ADD, MDD, and PHD simulations.

### 6.5.9 2030 System Velocities with Recommended Improvements

The approach used to analyze the 2030 system for pressure deficiencies was the same used for earlier planning years, except that the 2030 demands were used and the recommended improvements for the existing and 2015 systems were included.

Results of the hydraulic modeling analyses were discussed earlier for the various demand periods. The recommended improvements that were developed from the 2030 system analysis were included in this summary to document the performance of the existing system with the recommended improvements. The results of the velocity analysis were presented in Table 6-14. This table lists the lowest velocity and the highest velocity observed in each pressure zone for the demand period analyzed. The results indicate that there were no velocity deficiencies in the 2030 system provided that the recommended improvements were incorporated. All pressure zones met the maximum velocity criteria for ADD, MDD, and PHD simulations.

TABLE 6-14
2030 System with Recommended Improvements Velocity Range Results
*GSWC Region I Water Master Plan—Ojai System*

| | ADD (fps) | | MDD (fps) | | Commercial MDD+FF (fps) | | Residential MDD+FF[a] (fps) | | PHD (fps) | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Pressure Gradient** | **Low** | **High** | **Low** | **High** | **Low** | **High** | **Low** | **High** | **Low** | **High** |
| Low Main Gradient | 0.0 | 6.04[b] | 0.0 | 8.83[b] | 0.0 | 8.97 | 0.0 | 8.96 | 0.0 | 8.95 |
| High Main Gradient | 0.01 | 1.79 | 0.02 | 5.19[b] | 0.02 | 4.68 | 0.02 | 6.58 | 0.03 | 5.22 |
| Saddle Lane Gradient | 0.02 | 0.34 | 0.04 | 0.79 | 0.04 | 0.79 | 1.23 | 6.06 | 0.06 | 1.35 |
| Signal Gradient | 0.05 | 2.18 | 0.12 | 0.51 | 0.12 | 2.65 | 0.12 | 1.48 | 0.20 | 3.56 |
| Heidelberger Tank Gradient | 0.0 | 0.38 | 0.0 | 0.88 | 0.0 | 0.88 | 0.0 | 0.88 | 0.0 | 1.50 |
| Running Ridge Gradient | 0.01 | 4.10 | 0.02 | 4.68 | 0.02 | 5.44 | 0.02 | 4.68 | 0.03 | 5.07 |

[a] The most critical velocities simulated with three residential fire-flow conditions in each zone have been reported.
[b] Pipes need improvements (see Table 6-12).

## 6.6 Summary of Recommended Supply, Storage, and Hydraulic Improvements

The hydraulic analysis identified various supply, storage, and hydraulic deficiencies according to GSWC criteria. The system was analyzed as two areas, and recommended projects are phased in a manner that cost-effectively addresses resolving deficiencies in Area 1 and Area 2 simultaneously with a single project wherever feasible.

Storage deficiencies in the main zone referred to as Area 1 total 1.5 MG, 0.5 MG in each planning period. To correct the existing storage deficiency, the forebay at the San Antonio Plant will be replaced with a 0.5 MG tank. The deficiency identified for the 2015 planning year will be corrected with an additional 0.5 MG tank at the San Antonio Plant which will allow for more flexibility in the operation of that plant. The deficiency identified for the 2030 planning scenario will be corrected by an additional 0.5 MG reservoir in the main zone. This reservoir can be located at the Signal Plant, but can also be located elsewhere in the system. The exact location for this reservoir will be determined in the future.

In the existing system, a storage deficiency was also identified for Area 2 which includes the following gradients; Running Ridge, Heidelberger Booster and Heidelberger Tank. A lack of available property has led to GSWC pursuing booster station upgrades to increase capacity and reliability in lieu of additional storage. To fix the existing deficiency, backup power is proposed at both the Valley View booster station and the Fairview booster station. The Fairview booster station will require expansion to three booster pumps

The upper pressure zones of Ojai (Area 2) are deficient in supply. The only source of supply to the higher zones is the Fairview booster station which is equipped with two 250 gpm booster pumps. The installation of a third booster pump with a 500 gpm capacity will fix the existing MDD deficiency. There are additional deficiencies created when the Running

Ridge tanks are to be abandoned during PHD and fire flow. This will require the upsizing of one of the 250 gpm booster pumps to a 500 gpm booster pump.

A supply deficiency was identified for the main zone in the 2015 planning period. This deficiency can be corrected with the installation of a third booster pump at the San Antonio Plant.

Hydraulic deficiencies are significant throughout the southeast portion of the Main Gradient, where excessive pressures warrant splitting the Main Gradient in to a High Main Gradient and Low Main Gradient separated by three PRVs and a booster pump station. Other pipeline improvements in various locations address velocity and pressure deficiencies. The results of the analysis are summarized in Table 6-15 and presented in Figure 6-2.

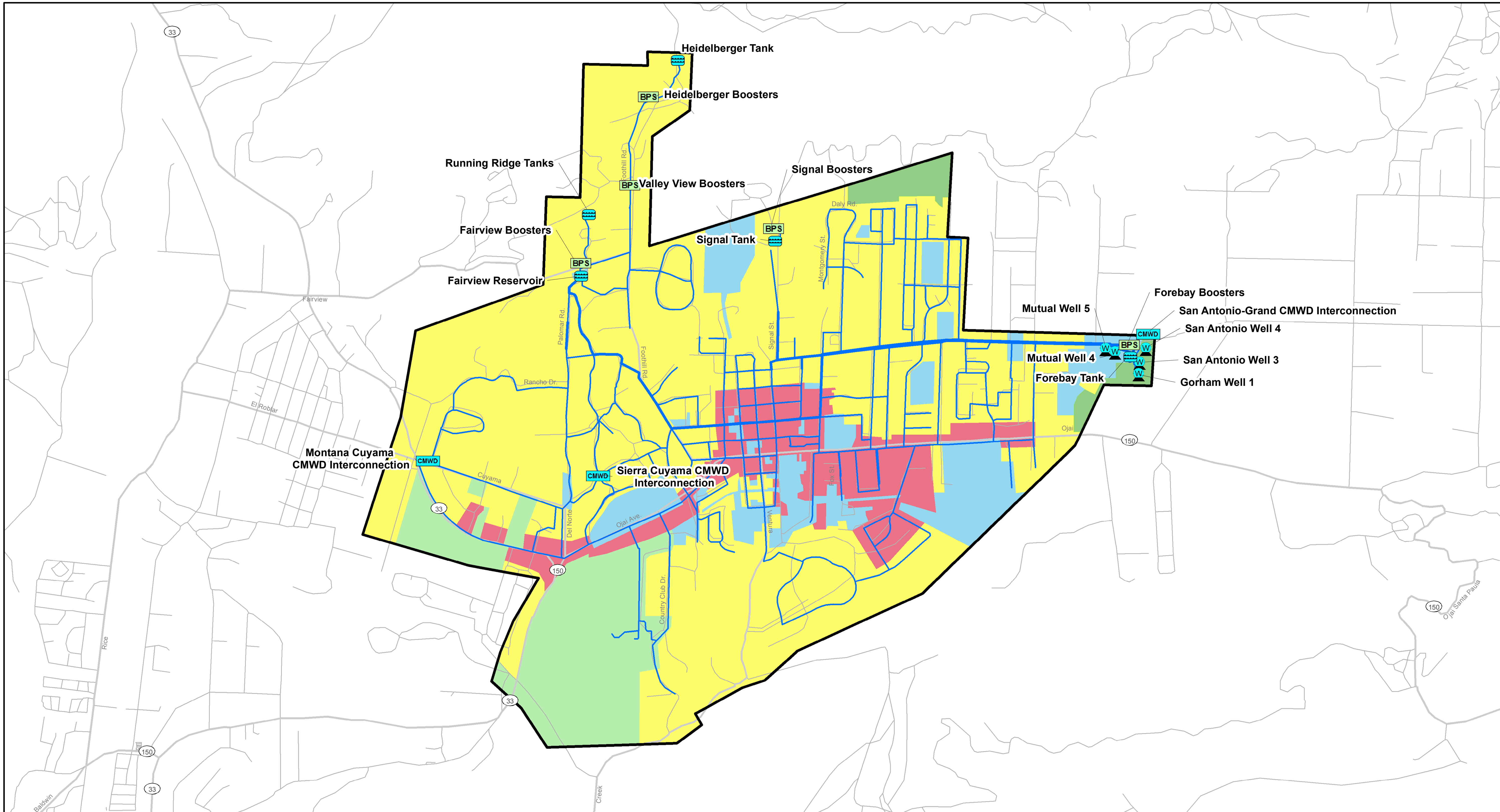
TABLE 6-15
Summary of Recommended Supply, Storage, and Hydraulic Improvements
*GSWC Region I Water Master Plan—Ojai System*

| Project ID | Location | Deficiency | Recommended Improvement | Model ID |
|---|---|---|---|---|
| 1.1.1 | San Antonio Plant | Storage | Construct San Antonio Tank #1 - 0.5 MG | SAFOREBAY |
| 1.2.2 | Fairview Plant | Storage | Add Emergency Power to Booster Station | |
| 1.2.3 | Valley View Plant | Storage | Add Emergency Power to Booster Station | |
| 1.3.1 | Fairview Plant | Supply | Add Booster Pump C – 500 gpm | |
| 1.5.1* | Main Gradient, Rancho Dr. north of Montana-Cuyama intersection | Pressure | Install a PRV to separate High Main Gradient from the Low Main Gradient. | PRV1 |
| 1.5.2* | Main Gradient, Del Norte Rd.–Cuyama Rd. intersection near Sierra-Cuyama CMWD Interconnection | Pressure | Install a PRV to separate High Main Gradient from the Low Main Gradient. | PRV2 |
| 1.5.3* | Main Gradient, on Foothill Rd. at Aliso St.–Bristol Rd. intersection | Pressure | Install a booster pump station with 850-gpm pump and a PRV to separate High Main Gradient from the Low Main Gradient. | NEWBOOST, PRV3 |
| 1.6.1 | Country Club Road | Pressure | Replace 4-in pipe with 8-in pipe, 2,400 ft. | Pipe ID P307 |
| 1.6.2 | El Paseo Rd.–Cuyama Rd. intersection | Pressure | Replace 4-in pipe with 8-in pipe, 562 ft. | Pipe ID P242 |
| 1.6.3 | Cuyama Rd. | Pressure | Replace 4-in pipe with 8-in pipe, 490 ft. | Pipe ID P286 |
| 1.6.4 | Bald Ave.–Pearl St. intersection | Pressure | Replace 4-in pipe with 8-in pipe, 1,100 ft. | Pipe ID P85 |
| 1.6.5 | Fox St. south of Ojai Ave. | Pressure | Replace 4-in pipe with 8-in pipe, 1,100 ft. | Pipe IDs P316, P317, P318, P330 |
| 2.1.1 | San Antonio Plant | Storage | Construct San Antonio Tank #2 – 0.5 MG | |
| 2.2.2 | San Antonio Plant | Supply | Add Booster Pump C – 1,365 gpm | |
| 2.3.1 | Pipeline near hospital on Ojai Ave.–Del Norte Rd. intersection | Velocity | Replace 6-in pipe with 12-in pipe, 310 ft. | Pipe ID P301 |

TABLE 6-15
Summary of Recommended Supply, Storage, and Hydraulic Improvements
*GSWC Region I Water Master Plan—Ojai System*

| Project ID | Location | Deficiency | Recommended Improvement | Model ID |
|---|---|---|---|---|
| 3.1.1 | Signal Plant | Storage | Add 0.5 MG Tank | |
| 3.3.2 | Fairview Plant | Supply | Upsize Booster B from 250 gpm to 500 gpm | |
| 3.5.1 | Daly Road Loop near new Signal Reservoir | Pressure | Install a new 6-in pipeline on Douglas St. from Signal St. to Montgomery St., 2,300 ft. | 1089 |
| 3.6.1 | Pipeline near Sierra-Cuyama Intersection on Sierra Road | Velocity | Replace 8-in pipe with 12-in pipe, 1,150 ft. | Pipe ID: P283 |

*To establish the new zone, all projects should be done concurrently.




**LEGEND**

- BPS Booster Pumping Station
- CMWD CMWD Connection
- Reservoir
- W Well
- Pipelines less than or equal to 8"
- Pipelines greater than 8"
- Existing System Boundary

**General Zoning**

- Agriculture/Open Space
- Commercial
- Public
- Recreation
- Residential

N

0 1,000 2,000 Feet

**FIGURE 6-1**
**LAND USE FOR FIRE-FLOW REQUIREMENTS**

GSWC REGION I WATER MASTER PLAN
OJAI SYSTEM

Golden State Water Company

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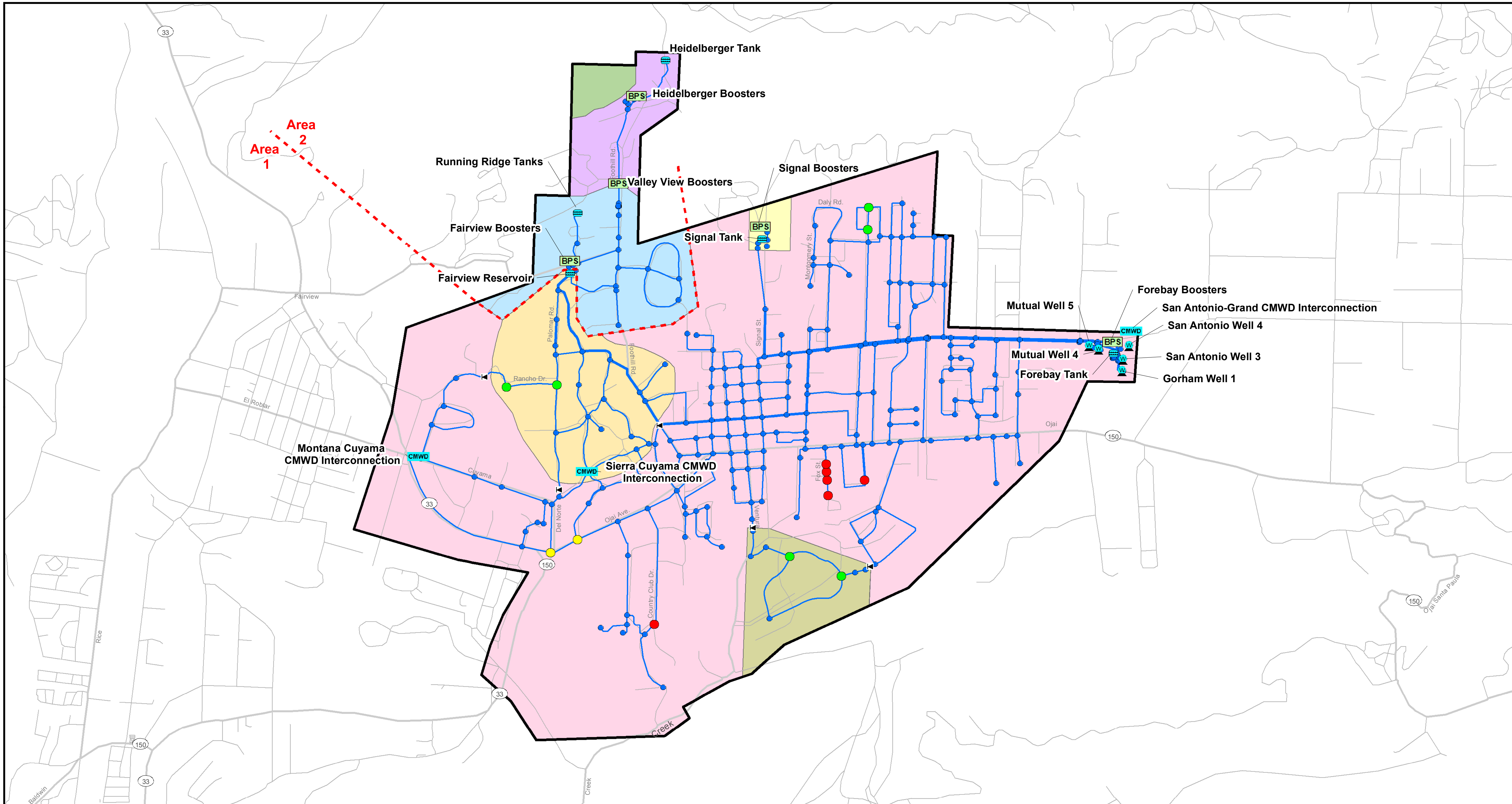


**LEGEND**

| | | | |
|---|---|---|---|
| BPS Booster Pumping Station | Fire Flow Deficiency | **Pressure Zones** | Low Main Zone |
| CMWD CMWD Connection | Fire Flow Nodes (1250 gpm) | Heidelberger Booster Zone | Running Ridge Zone |
| Pressure Reducing Valves (PRV) | Fire Flow Nodes (2000 gpm) | Heidelberger Tank Zone | Saddle Lane Zone |
| Reservoir | Nodes | High Main Zone | Signal Booster Zone |
| Well | Existing System Boundary | | |
| Pipelines less than or equal to 8" | | | |
| Pipelines greater than 8" | | | |

N

0 1,250 2,500 Feet

**FIGURE 6-2**
**FIRE-FLOW NODES AND DEFICIENCIES**
GSWC REGION I WATER MASTER PLAN
OJAI SYSTEM

Golden State Water Company
A Subsidiary of American States Water Company

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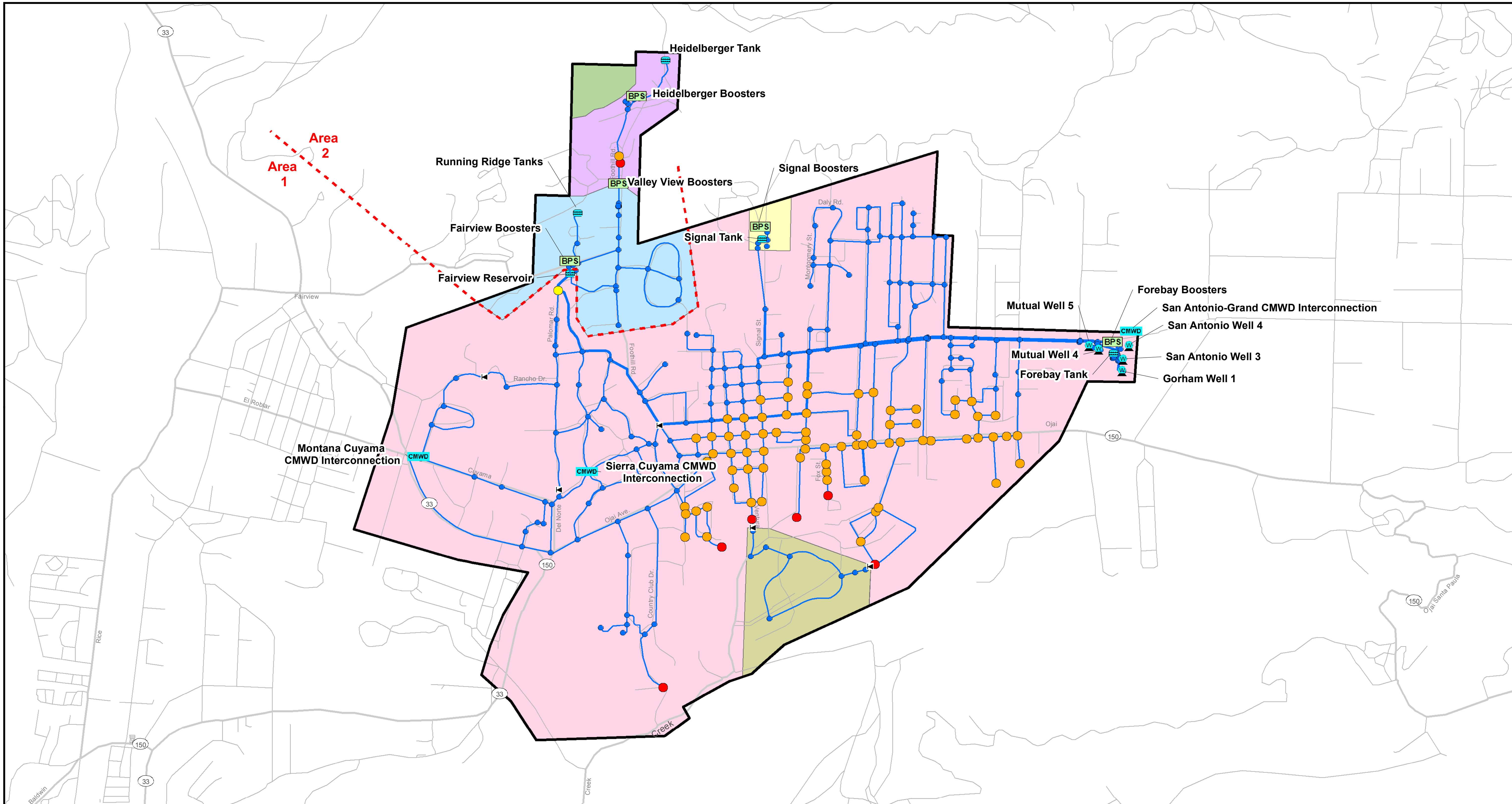


**LEGEND**

BPS Booster Pumping Station
CMWD CMWD Connection
Pressure Reducing Valves (PRV)
Reservoir
Well
Pipelines less than or equal to 8"
Pipelines greater than 8"

**Pressure Deficiencies**

> 125 psi
110 psi - 125 psi
35 psi - 39 psi
Nodes
Existing System Boundary

**Pressure Zones**

Heidelberger Booster Zone
Heidelberger Tank Zone
Main Zone
Running Ridge Zone
Saddle Lane Zone
Signal Booster Zone

N

0 1,250 2,500 Feet

# FIGURE 6-3
# PRESSURE DEFICIENCIES

GSWC REGION I WATER MASTER PLAN
OJAI SYSTEM

Golden State Water Company
A Subsidiary of American States Water Company

CH2MHILL

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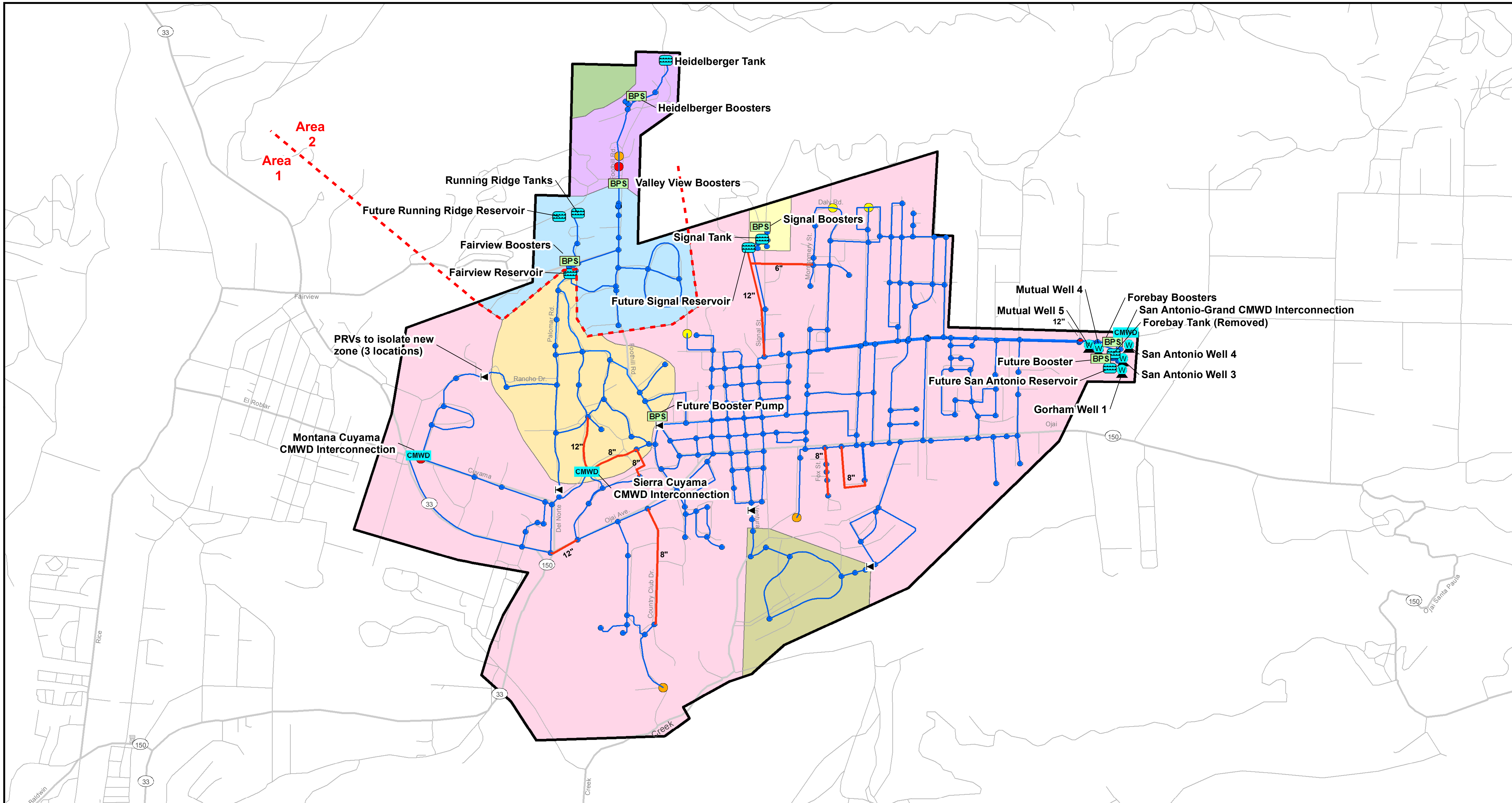


LEGEND

BPS Booster Pumping Station
CMWD CMWD Connection
Pressure Reducing Valves (PRV)
Reservoir
Well
Existing Pipelines
Recommended Improvements

**Pressure Deficiencies**
> 125 psi
110 psi - 125 psi
35 psi - 39 psi
Nodes
Existing System Boundary

**Pressure Zones**
Heidelberger Booster Zone
Heidelberger Tank Zone
High Main Zone
Low Main Zone
Running Ridge Zone
Saddle Lane Zone
Signal Booster Zone

N
0 1,250 2,500 Feet

**FIGURE 6-4**
**PRESSURE DEFICIENCIES FOR 2015 AND 2030**
GSWC REGION I WATER MASTER PLAN
OJAI SYSTEM

Golden State Water Company
CH2MHILL

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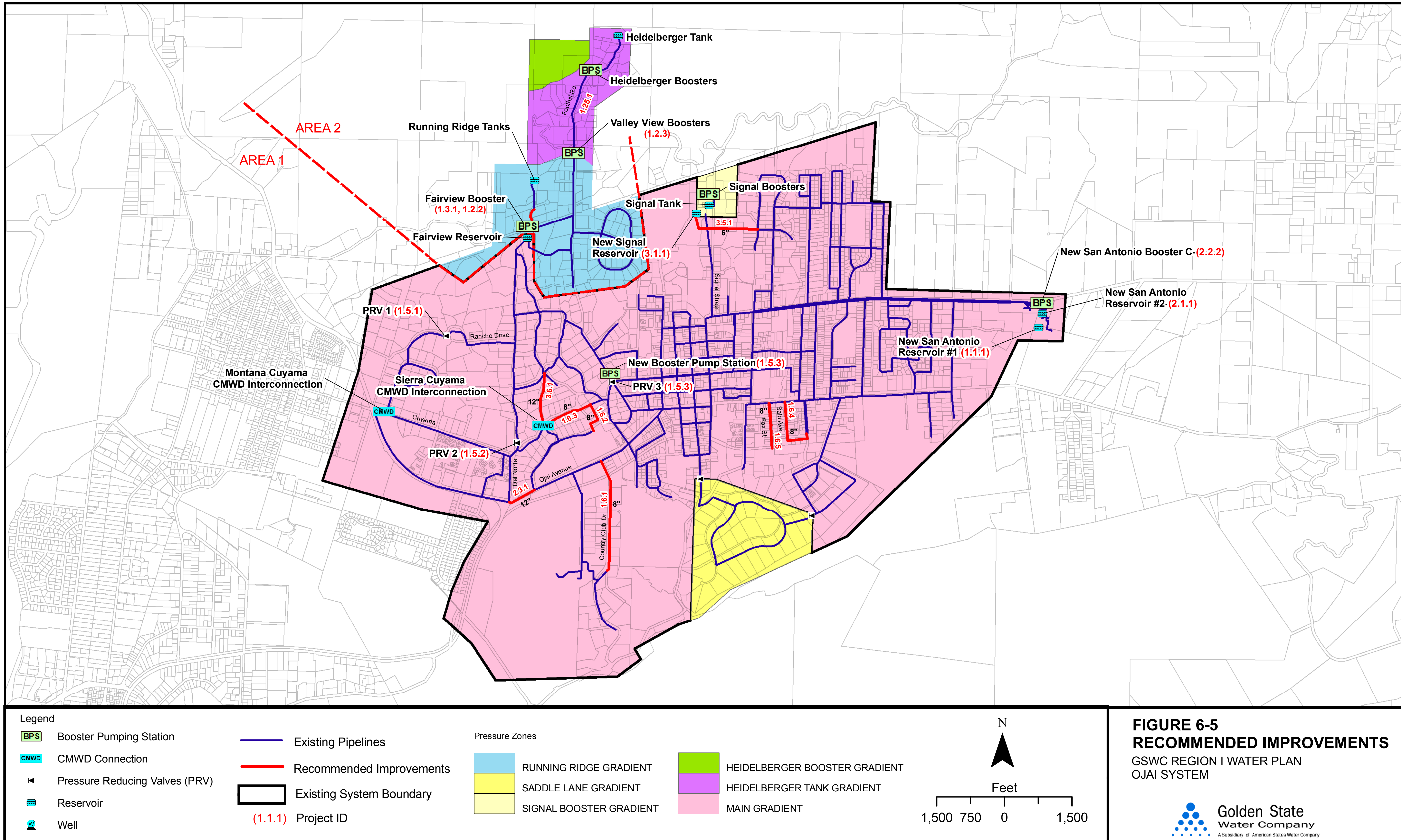



**FIGURE 6-5**
**RECOMMENDED IMPROVEMENTS**
GSWC REGION I WATER PLAN
OJAI SYSTEM

SECTION 7

# Water Quality Evaluation

The purpose of this section is to provide documentation of GSWC's water quality assessment effort for the Ojai System. Water quality of local groundwater and imported water were evaluated based on current federal and state standards and rules. The total potential estimated cost for various treatments of source water to meet the health and regulatory requirements is provided in this section.

## 7.1 Current Status of Drinking Water Quality

The Ojai System is supplied by five active wells, all located at the San Antonio Plant. Some of these wells are high in iron and/or manganese. Since the output from these wells is combined prior to any treatment, all of the output from each of the wells is directed through a single high pressure iron and manganese filter to reduce these compounds to an acceptable level. At each well, 12.5 percent liquid sodium hypochlorite is injected to provide a disinfectant residual in the water entering the distribution system. The Ojai System has four interconnections to the Casitas Mutual Water District (CMWD) system. Water is purchased from the CMWD on an as needed basis to supplement the Ojai System during periods of high demand.

The drinking water quality of the Ojai System must comply with the Safe Drinking Water Act (SDWA), which is composed of primary and secondary drinking water standards. Compliance with primary drinking water standards is regulated by the U.S. Environmental Protection Agency (EPA). Compliance with both primary and secondary standards is required by the California Department of Public Health (CDPH).

Water quality sampling is performed at the source and within the distribution system to ensure compliance with regulatory standards. Sources are sampled as prescribed in Title 22 of the California Code of Regulations. Monitored constituents include general mineral, general physical, inorganic, volatile organic, synthetic organic, and radiological chemicals. The frequency of monitoring is dependent upon the parameter tested and the concentration of the constituent in the source water. Monitoring frequencies range from weekly to once every 9 years. The parameters monitored include specific constituents of concern (that is, if treatment is provided then the constituent being treated for would be tested), coliform bacteria, heterotrophic plate counts (HPCs), and chlorine residual. The distribution system is tested regularly for coliform bacteria, chlorine residual, general physical parameters, and disinfection by-products (trihalomethanes [TTHM] and haloacetic acids [HAA5]). The distribution system is tested weekly for the presence of coliform bacteria at representative locations throughout the system and general physical samples. Collection of disinfection by-product samples is performed on a quarterly basis.

## 7.2 Imported Water Quality

The Ojai System has four interconnections to the Casitas Mutual Water District (CMWD) system. Water is purchased from the CMWD on an as needed basis to supplement the Ojai System during periods of high demand. Since the CMWD utilizes chloramines as a residual disinfectant, and this source at times can make up more than 50% of the water entering the Ojai System, the CMWD water undergoes breakpoint chlorination in order to avoid the problems associated with mixing chloraminated water with chlorinated water in the distribution system.

## 7.3 Groundwater Quality

The Ojai Systems active groundwater sources currently comply with all primary and secondary MCLs, except for iron and manganese where previously noted. Water from these wells is treated through a single high pressure iron and manganese filter to reduce these compounds to an acceptable level.

## 7.4 Water Quality Evaluation

The following discussion provides information on the relevant water quality evaluation items for the Ojai System, including:

- Groundwater Rule
- Stage 2 Disinfectants and Disinfectant By-products Rule
- Radon

### 7.4.1 Groundwater Rule

The recently promulgated Groundwater Rule may require treatment of one or more of the Ojai System's groundwater wells. The CDPH will make a final determination of whether this is required based on the results of a sanitary survey and hydrogeologic assessment at each well. If the CDPH determines that the Groundwater Rule requires compliance at a specific site, it will be necessary to equip the plant sites with online chlorine analyzers and chlorine contact chambers. The potential cost of future improvements to comply with the Groundwater Rule, if necessary, is provided in Section 7.5.

Installation of chlorine analyzers at groundwater production sites is recommended even if this action is not required under the Groundwater Rule because chlorine analyzers would continuously monitor the chlorine residual leaving the sites and would alert the operator via a SCADA system if the wells are producing water with abnormally low or high chlorine residual. This system would provide a means to continuously verify the quality of the water supply and protect GSWC customers.

### 7.4.2 Stage 2 Disinfectants and Disinfection By-products Rule

On January 4, 2006, the EPA published the Stage 2 Disinfectants and Disinfection By-products Rule (Stage 2 DBP Rule) in the Federal Register (71 FR 388). The intent of the Stage 2 DBP Rule is to give customers more equitable public health protection from potentially carcinogenic DBPs and to find DBP hot spots within distribution systems. The Stage 2 DBP Rule will change how DBP compliance is calculated. Under the Stage 1 Rule, results from DBP sampling were averaged across the entire distribution system. Under the Stage 2 DBP Rule, this would be changed and the results of sampling will be averaged quarterly at each sampling site and a running annual average of the results computed. The running average at each location would have to be below 80 micrograms per liter (µg/L) for TTHM and 60 µg/L for HAA5.

The Stage 2 DBP Rule also will require utilities to conduct an Initial Distribution System Evaluation (IDSE) to identify areas in a distribution system with representative high DBP concentrations. In general, high DBPs occur in areas of higher residence time and well-maintained residual disinfectant.

The Stage 1 DBP sampling has shown that the Ojai System may have some difficulty in meeting the new Stage 2 DBP Rule requirements, which must be implemented in early 2012. Since October 2005, the highest TTHM sample was 87 µg/L. During the same time period, the highest sample result for HAA5 was 25 µg/L.

### 7.4.3 Radon

The proposed Radon Rule applies to all community water systems that use groundwater or mixed groundwater and surface water supply sources. The Radon Rule includes a two-pronged approach that allows states and water suppliers to reduce radon risks in indoor air while protecting public health from the highest levels of radon in drinking water. The proposed rule includes the following provisions:

- MCL Goal: zero
- MCL: 300 picocuries per liter (pCi/L)
- Alternative MCL (AMCL): 4,000 pCi/L

The AMCL provision of the rule applies to water systems that adopt and comply with a multimedia mitigation (MMM) program aimed at reducing household indoor/air health risks from soil and tap water. The AMCL of 4,000 pCi/L is based on the National Research Council recommended estimate of 10,000 to 1 as the transfer factor from water to air, and the national average outdoor radon concentration of 0.4 pCi/L in air. Thus, an estimate of 0.4 pCi/L in air would be equivalent to 4,000 pCi/L in water.

If a future MCL at this low level is implemented, all of the Ojai wells could potentially require treatment. These wells have levels of radon ranging upward to 1434 pCi/L.

## 7.5 Cost for Improvements

The water quality concerns that were discussed in the previous sections are summarized in Table 7-1. A cost estimate is included for each capital option.

TABLE 7-1
Capital Cost of Improvements to Address Water Quality Concerns
*GSWC Region I Water Master Plan—Ojai System*

| Alternative Number | Alternative Description | Estimated Cost |
|---|---|---|
| **1.7.0** | **Monitor Chlorine Residual at Wells** | |
| 1.7.1 | Install chlorine residual monitors at all wells that do not currently have them and tie into the SCADA system. | $50,000 |

SECTION 8

# System Condition Assessment

The purpose of this section is to provide documentation of GSWC's system condition assessment effort for the Ojai System. This section is organized as follows:

- Previous system condition assessment efforts
- Updated condition assessments

## 8.1 Previous System Condition Assessment Efforts

More than 10 years ago, GSWC conducted several facility condition assessment efforts. GSWC worked with several engineering consulting companies to develop a complete condition assessment for each of the Region I systems. Facilities in the Ojai System were addressed in this effort. Four tanks were addressed in this report including the Running Ridge tanks, the Signal tank and the San Antonio Forebay. The report recommended a seismic analysis for the Signal tank which has been included in Table 8-1.

## 8.2 Updated Condition Assessments

GSWC assembled a team familiar with the maintenance of each type of asset to the Ojai system in order to evaluate the plant sites to identify projects required in order to maintain GSWC's desired level of service. The team for the Ojai conditional assessments included an electrician, the senior water supply operator, two engineers and the superintendent of the system. A key aspect of the conditional assessments is talking to the operators who maintain and run the system to find out what required maintenance can be fixed with a capital project. For example, if dirt continually sloughs over a retaining wall and requires a back-hoe to clean up the access area, the retaining wall height should be raised or some sort of slope stabilization method should be considered. The following sections describe the methods utilized during the conditional assessments.

Pipeline conditional assessments are conducted through the tracking of pipeline leaks and breaks and more importantly input from operations staff. A pipeline that is very hard to access (i.e. a main running through a backyard) may only have 2 leaks in the past 5 years, but, be a higher priority than a 6" main in a cul-de-sac that has had 5 leaks in the past 5 years.

### 8.2.1 Facility Condition Review

In 2008, GSWC reviewed the condition of all plants in the Ojai System. The purpose of this review was to identify plant improvement projects based on the following:

- Operational needs and requests
- Common items that are not installed at all plant sites
- Recommendations from the previous condition assessments that were not installed

GSWC reviewed each of the following elements to identify potential recommended improvements at each facility:

- Electrical
- Mechanical
- Structural
- Other site improvements

A standard form was created in order to rank various aspects of the plant sites on a scale of 1-4. A score of 1 corresponded to an asset working as intended with no need for maintenance. A score of 4 corresponded to an asset in need of replacement due to various reasons including hazardous conditions, not operating as intended, severe corrosion. A copy of this conditional assessment form can be found in the appendices.

Due to the poor condition of the Heidelberger Tank, a project has been fast-tracked to replace the 0.1 MG bolted steel tank. This master plan for the Ojai system was not available at the time of the project scope preparation and further analysis was required to determine the required tank size. The analysis considered the Running Ridge Zone, the Heidelberger Tank Zone and the Heidelberger booster zone. A copy of this analysis can be found in the appendices. The resulting projects from the analysis are included in Table 8-1.

Table 8-1 summarizes the recommendations that GSWC developed as a result of the 2008 Ojai System condition assessment review and the analysis.

TABLE 8-1
2008 Condition Assessment Projects Identified by GSWC
GSWC REGION I WATER MASTER PLAN— OJAI SYSTEM

| Alternative Number | Facility | Project Description | Reason | Priority Category | Estimated Cost |
|---|---|---|---|---|---|
| 1.8.1 | Fairview Reservoir | Site security | Site currently does not have lighting and need intrusion alarms (3) for hatches | Short-Term | $30,000 |
| 1.9.1 | Fairview Reservoir | Seismic improvements | Bring reservoir up to current seismic standards | Short-Term | $50,000 |
| 1.10.1 | Heidelberger Boosters | Site lighting | Site currently does not have lighting | Short-Term | $10,000 |
| 1.11.1 | Heidelberger Boosters | SCADA | Plant currently not on SCADA | Short-Term | $25,000 |
| 1.12.1 | Heidelberger Boosters | Retaining wall | Drainage conditions are poor | Short-Term | $10,000 |
| 1.13.1 | Heidelberger Boosters | Pump enclosure | Needs enclosure to extend life of boosters | Short-Term | $25,000 |

| | | | | | |
|---|---|---|---|---|---|
| 1.14.1 | Mutual Plant | New MCC | Existing MCC is at the end of its useful life | Short-Term | $100,000 |
| 1.15.1 | San Antonio Plant | Filter media | Filter media needs replacement | Short-Term | $75,000 |
| 1.16.1 | Signal Plant | SCADA | Plant not currently on SCADA | Short-Term | $25,00 |
| 1.17.1 | Signal Plant | Demo vault | Vault is non-operational | Short-Term | $10,000 |
| 1.18.1 | Signal Plant | Seismic evaluation | Tank needs seismic evaluation | Short-Term | $10,000 |
| 1.19.1 | Mutual # 5 | Replacement Well | Existing Well has a hole in the casing and the liner | Short-Term | $2,000,000 |
| 1.20.1 | Valley View Plant | Relocate Booster Station, add PRV, add booster C | Increase Capacity and Reliability | Short-Term | $1,000,000 |
| 1.21.1 | Pipeline on Fairview Rd. 600' of 6" Steel Pipeline | Replace with 8" Pipeline | Poor Condition and Undersized | Short-Term | $100,000 |
| 1.22.1 | Pipeline on Foothill Blvd - 3,300' of 5 1/2" OD Steel Pipeline | Replace with 8" Pipeline on Foothill Blvd from Valley View Booster Station to Heidelberger Tank | Poor Condition and Undersized | Short-Term | $600,000 |
| 1.23.1 | Heidelberger Tank | Replace Tank with 0.1 MG | Poor Condition | Short-Term | $200,000 |
| 2.4.1 | Fairview Plant | Install VFD's | Allow for abandonment of Running Ridge Tanks | Mid-Term | $30,000 |
| 2.5.1 | Running Ridge Plant | Abandon tank | Poor Condition, limited site access | Mid-Term | $150,000 |

### 8.2.2 Pipeline Condition Review

In addition to facility condition, GSWC monitors distribution system condition through water loss and the tracking of pipeline breaks and leaks. GSWC tracks the status of breaks/leaks in the Ojai System on a monthly basis. Figure 8-1 is a map of the leaks in the

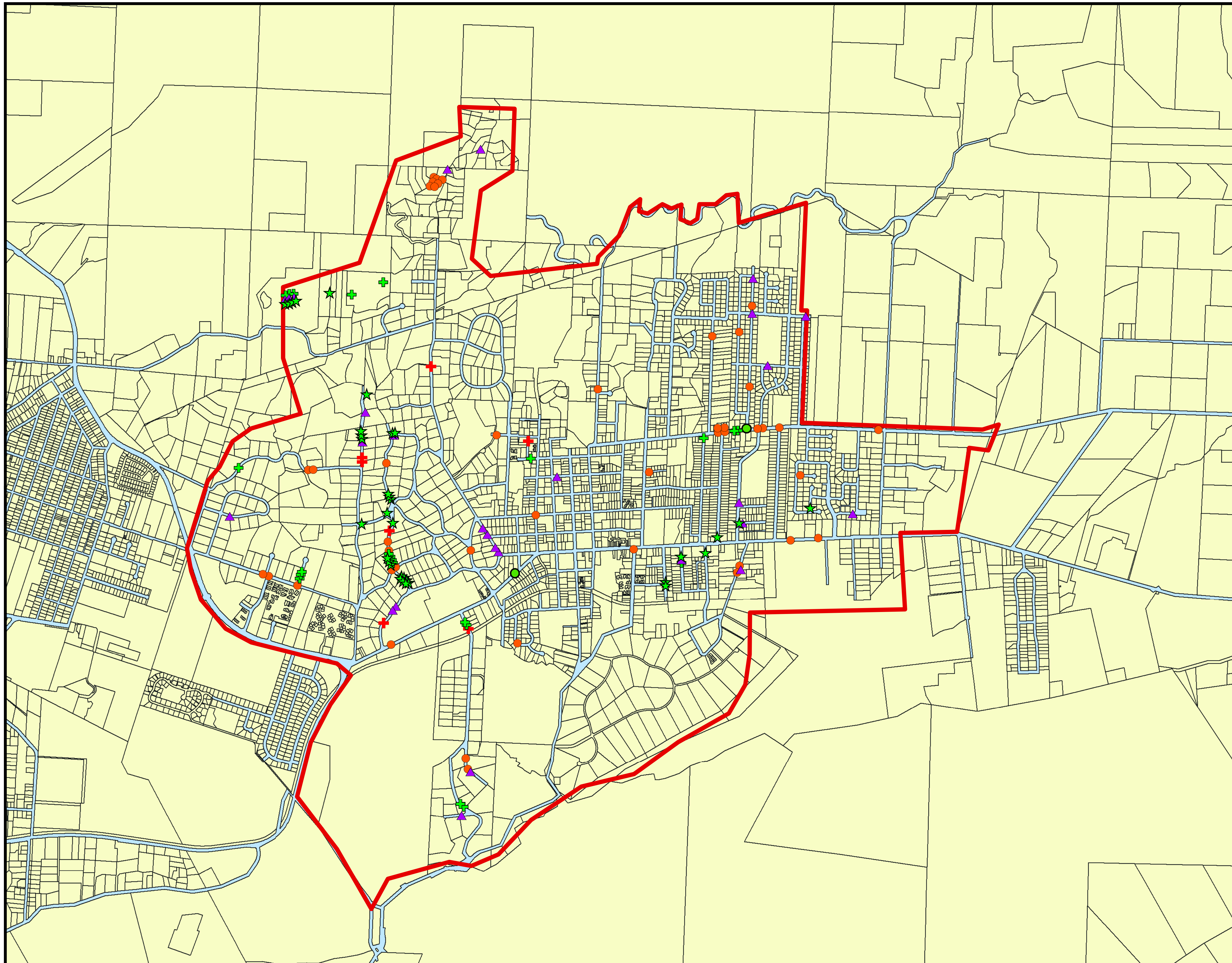
Ojai System from 2004 to 2008. This information is used to identify pipeline segments that may need rehabilitation or replacement. Also, leak data is used along with additional risk assessment analysis to make recommendations regarding potential CIP projects as well as prioritization of CIP projects. This analysis is described in GSWC's *Pipeline Replacement Program Report* and *Risk Based Asset Management Program Report*. Table 8-2 lists the pipelines that need replacement as a result of excessive leaks.

TABLE 8-2
Projects Identified Through Leak Analysis
GSWC REGION I WATER MASTER PLAN – OJAI SYSTEM

| Alternative Number | Facility | Project Description | Priority Category | Estimated Cost |
|---|---|---|---|---|
| 1.24.1 | 200' - 4" Transite Installed in 1966 | Heidelberger Booster Zone on pipe in private street (or easement) at the very west end of the pressure zone | Short-Term | $40,000 |
| 1.25.1 | 450' – 3" Steel Installed in 1952 | Bonita Drive Water Main Replacement | Short-Term | $90,000 |
| 1.26.1 | 1,800' – 8" Steel Installed in 1939 | Sierra Road from El Paseo Road to El Toro Road Watermain Replacement | Short-Term | $360,000 |
| 1.27.1 | 1,400' – 8" Steel Installed in 1939 | Palomar Road from El Toro Road to El Camino Road Watermain Replacement | Short-Term | $280,000 |
| 1.28.1 | 1,000' – 8" Steel Installed in 1920 | Del Norte Road South of Fairview Plant Watermain Replacement | Short-Term | $200,000 |
| 1.29.1 | 1,300' – 8", 10" and 12" Pipeline (Cast Iron and Steel) | Grand Avenue from Drown Avenue to Sandy Lane Watermain Replacement | Short-Term | $350,000 |

In addition to the leaking pipes in Ojai, there is a large quantity of aging 4-inch pipelines made out of various materials that exhibit heavy tuberculation effectively decreasing the diameter of the pipeline which can be a source of pressure problems and will restrict fire flow capabilities. In this master plan a portion of these pipelines were identified as needing replacement in Section 6. The ensuing master plan will identify additional small diameter steel and cast iron pipelines for replacement.

# COASTAL DISTRICT
# OJAI SYSTEM
# LEAK MAP 2009



*Legend*

- YEAR 2003 - 2 EACH
- YEAR 2004 - 45 EACH
- YEAR 2005 - 7 EACH
- YEAR 2006 - 23 EACH
- YEAR 2007 - 28 EACH
- YEAR 2008 - 35 EACH

N
W E
S

Feet
0 1,000 2,000 4,000

Golden State
Water Company
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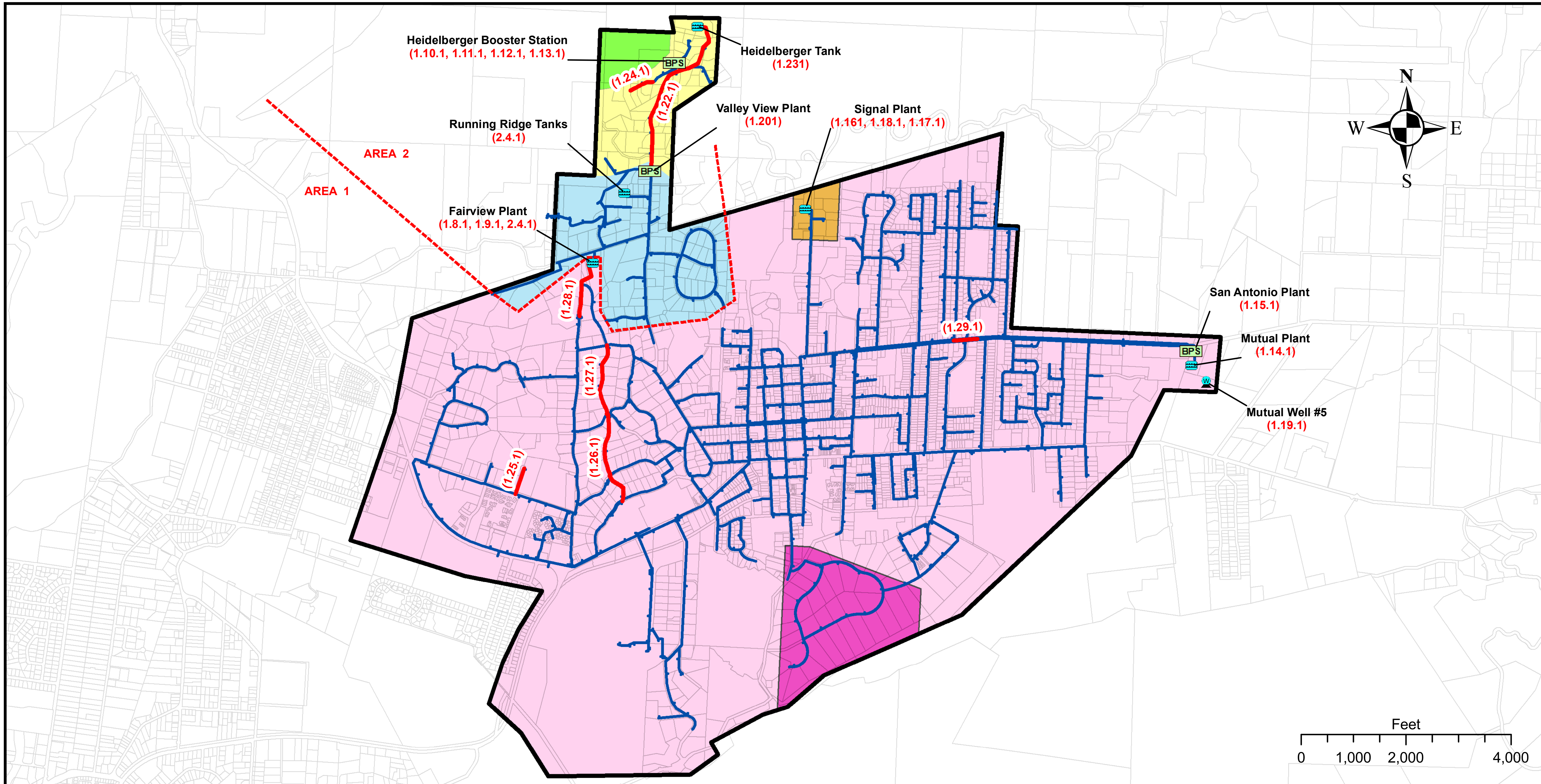


**Legend**

- BPS BOOSTER PUMPS
- CMWD CMWD CONN
- PRESSURE REDUCING VALVES (PRV)
- RESERVOIR
- WELL
- Existing Pipelines
- Recommended Improvements
- Ojai Service Area
- (1.5.1) Project ID

**Preesure Zones:**

- RUNNING RIDGE GRADIENT
- SADDLE LANE GRADIENT
- SIGNAL BOOSTER GRADIENT
- HEIDELBERGER BOOSTER GRADIENT
- HEIDELBERGER TANK GRADIENT
- MAIN GRADIENT

## FIGURE 8-2
## RECOMMENDED IMPROVEMENTS

**GSWC REGION I WATER PLAN**
**OJAI SYSTEM**

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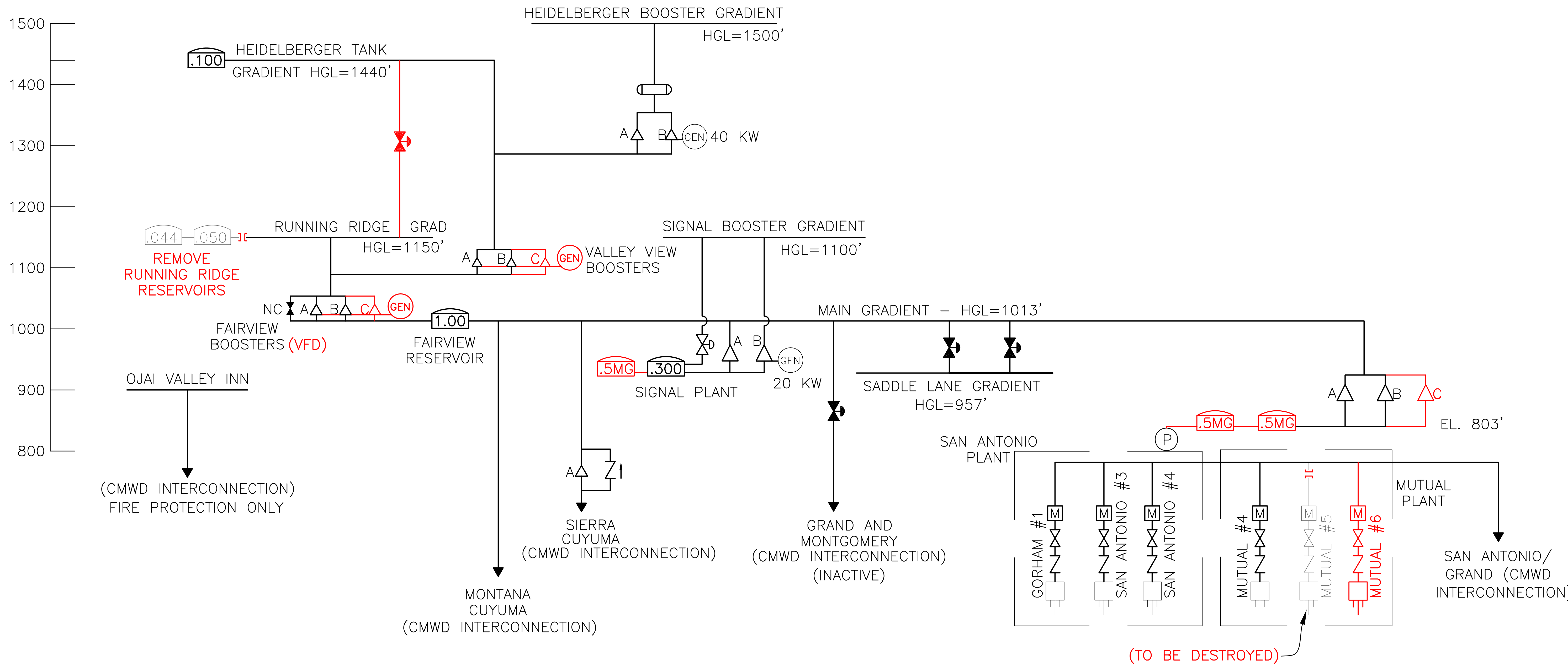


## LEGEND

| | |
|---|---|
| BOOSTER PUMP | HYDROPNEUMATIC TANK |
| BOOSTER PUMP (GAS ENGINE) | PRESSURE FILTER |
| CARBON VESSEL (GAC) | PURCHASED WATER SUPPLY |
| CHECK VALVE | RESERVOIR, MG (1.00) |
| GENERATOR FOR BACKUP POWER | SAND TRAP |
| HGL: HYDRAULIC GRADE LINE (2/3 FULL ELEV. CONTROLLING RESERVOIR OR PRV SETTING OR CONTROLLING BOOSTER SETTING) | VALVE, ALTITUDE |

VALVE, GATE OR BUTTERFLY (NORMALLY CLOSED) (NC)
VALVE, PRESSURE REGULATING
VALVE, PRESSURE RELIEF
VFD: VARIABLE SPEED DRIVE
WELL

| | |
|---|---|
| DRAWN BY: HRG | Date: 08/26/09 |
| DESIGNED BY: A. COMBES | Date: 08/26/09 |
| JURISDICTION: CITY/COUNTY: OJAI | |
| ENGINEERING APPROVAL: | Date |
| ENTERED ON HYDRAULIC MODEL BY: | Date |
| REGION: 1 | DISTRICT: COASTAL |

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A Subsidiary of American States Water Company

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# OJAI (EXHIBIT–A) SYSTEM SCHEMATIC FIGURE 8–3

| CUSTOMER SERVICE AREA | TAX CODE | JOB NO. | |
|---|---|---|---|
| OJAI | | | |
| SYSTEM | | SHEET NUMBER | DRAWING NO. |
| OJAI | | 1 OF 1 | C–1 |

SECTION 9

# Capital Improvement Program

The capital improvement program (CIP) is an essential component of this water master plan. The CIP summarizes recommended facilities, identifies the estimated costs of these facilities, and establishes the priority and timing of necessary improvements. The recommended improvements were analyzed and evaluated in the previous sections of this report. Improvements were identified where water system performance did not meet the minimum requirements identified in the technical memorandum titled *Golden State Water Company Master Planning Criteria and Standards* (Appendix A). The costs presented in this section were estimated based on unit costs developed from GSWC's database of historical project construction costs from 2003 through 2007. The recommended improvements were prioritized into three categories—short term (existing system), mid-term (2015 system), or long term (2030 system)—to identify when these improvements are required. The project selection and prioritization process considered various issues, including existing deficiencies, projected demands, water quality, regulatory compliance, reliability, facility condition, and costs.

## 9.1 Cost Estimation

The cost estimates prepared for this master plan are based on GSWC's database of historical project construction costs for the past 5 years. These estimates are intended to provide guidance for project evaluation and budgeting and are based on the information available at the time of estimation. The final costs of a project, and the project's resulting feasibility, will depend on actual labor and material costs, inflation, competitive market conditions, actual site conditions, final project scope, implementation schedule, continuity of personnel and engineering, and other variable factors. Therefore, the final project costs will vary from the estimate presented in this master plan. Because of these factors, project feasibility, benefit-cost ratios, risks, and funding needs must be carefully reviewed prior to making specific financial decisions or establishing project budgets to help ensure proper project evaluation and adequate funding. Prior to design and construction of any recommended projects in this master plan, a detailed project cost estimate should be performed to account for specific issues not considered or impossible to predict in this master plan.

## 9.2 Project Prioritization

The recommended improvements identified in this master plan were categorized into one of three groups:

- Short-term improvement (existing conditions)
- Mid-term improvement (2015)
- Long-term improvement (2030)

The following descriptions define how projects were prioritized into one of the three categories:

- **Short-term improvement** projects were based on deficiencies identified in the existing system. Deficiencies included supply and storage, hydraulic, condition assessment, and water quality. Operational improvements were included as a short-term improvement only when a significant short-term benefit was identified.
- **Mid-term improvement** projects are generally needed within the next 5 to 10 years and include projects needed by 2015. These improvements were identified as correcting a deficiency that exists by 2015 but does not exist in the existing system. Examples include replacing existing supplies due to lost production, increasing supplies where demands are increasing, compliance with future regulations, and replacing aging infrastructure.
- **Long-term improvement** projects are based on deficiencies identified beyond the mid-term planning years through the year 2030. The water system was assumed to be built out by the year 2030. The long-term improvements are typically projects necessary to meet future demands and replace or rehabilitate aging infrastructure.

## 9.3 Project Cost Estimates

Table 9-1 summarizes the recommended improvements for the Ojai System and provides an estimated cost and priority for each. Each project is assigned a unique identification number and a priority: short term, mid-term, or long term. As shown in Table 9-1, most of the recommended projects are targeted to meet the short-term demand. Once they are functional, these improvements will help to meet demands during the mid-term and long-term conditions. Many of the projects listed should be combined into larger projects encompassing upgrades for an entire plant during budgeting. Any GSWC-planned projects already in progress are not included in the cost estimates.

TABLE 9-1
Summary of Recommended CIP Projects and Costs
*GSWC Region I Water Master Plan—Ojai System*

| Project ID | Recommended Improvement | Deficiency | Priority Category | Estimated Project Cost |
|---|---|---|---|---|
| 1.1.1 | Construct San Antonio Reservoir #1 – 0.5 MG. | Storage | Short term | $1,000,000 |
| 1.2.2 | Fairview Plant – Add Emergency Power to Booster Station | Storage | Short term | $300,000 |
| 1.2.3 | Valley View Plant – Add Emergency Power to Booster Station | Storage | Short term | $300,000 |
| 1.3.1 | Fairview Plant – Add Booster Pump C | Supply and storage | Short term | $250,000 |
| 1.5.1* | Install 12-in PRV to separate High Main Gradient from the Low Main Gradient (Rancho Drive north of Montana-Cuyama intersection). | Pressure | Short term | $226,000 |
| 1.5.2* | Install 12-in PRV to separate High Main Gradient from the Low Main Gradient (Del Norte Rd.–Cuyama Rd. intersection near Sierra-Cuyama CMWD Interconnection). | Pressure | Short term | $226,000 |
| 1.5.3* | Install booster pump station with 850-gpm pump with standby power, and 12-in PRV to separate High Main Gradient from the Low Main Gradient (on Foothill Rd. at Aliso St.–Bristol Rd. intersection). | Pressure | Short term | $2,654,000 |
| 1.6.1 | Replace 4-in pipe with 8-in pipe, 2,400 ft on Country Club Rd. | Pressure | Short term | $1,030,000 |
| 1.6.2 | Replace 4-in pipe with 8-in pipe, 562 ft at El Paseo Rd.–Cuyama Rd. intersection. | Pressure | Short term | $307,000 |
| 1.6.3 | Replace 4-in pipe with 8-in pipe, 490 ft on Cuyama Rd. | Pressure | Short term | $275,000 |
| 1.6.4 | Replace 4-in pipe with 8-in pipe, 1,100 ft at Bald Ave.-Pearl St. intersection. | Pressure | Short term | $528,000 |
| 1.6.5 | Replace 4-in pipe with 8-in pipe, 1,100 ft on Fox St. south of Ojai Ave. | Pressure | Short term | $528,000 |
| 1.7.1 | Install chlorine analyzers at wells and add to SCADA | Water Quality | Short term | $50,000 |
| 1.8.1 | Add Security Lighting and hatch alarms to the Fairview Plant | Conditional Assessment | Short term | $30,000 |
| 1.9.1 | Seismic Improvements to the Fairview Reservoir including air gap on overflow and double-ball seismic joint on inlet and outlet | Conditional Assessment | Short term | $80,000 |
| 1.10.1 | Security Lighting for the Heidelberger Booster Plant | Conditional Assessment | Short term | $10,000 |
| 1.11.1 | SCADA for the Heidelberger Booster Plant | Conditional Assessment | Short term | $25,000 |
| 1.12.1 | Retaining Wall at the Heidelberger Booster Plant | Conditional Assessment | Short term | $15,000 |

TABLE 9-1
Summary of Recommended CIP Projects and Costs
*GSWC Region I Water Master Plan—Ojai System*

| | | | | |
|---|---|---|---|---|
| 1.13.1 | Enclosure for Boosters at Heidelberger Booster Plant | Conditional Assessment | Short term | $25,000 |
| 1.14.1 | Replace MCC at the Mutual Plant | Conditional Assessment | Short term | $100,000 |
| 1.15.1 | Replace Filter Media at the San Antonio Plant | Conditional Assessment | Short term | $75,000 |
| 1.16.1 | Add SCADA to the Signal Plant | Conditional Assessment | Short term | $25,000 |
| 1.17.1 | Demo non-functional Vault at the Signal Plant | Conditional Assessment | Short term | $10,000 |
| 1.18.1 | Seismic Evaluation for the existing Signal Tank | Conditional Assessment | Short term | $10,000 |
| 1.19.1 | Replace Well – Mutual #5 | Conditional Assessment | Short term | $2,000,000 |
| 1.20.1 | Relocate Valley View Booster Station and increase capacity by adding a 500 gpm booster, add PRV | Conditional Assessment | Short term | $1,000,000 |
| 1.21.1 | Fairview Road 6" steel pipeline replacement with 8" pipeline (600 feet) | Conditional Assessment | Short term | $100,000 |
| 1.22.1 | Foothill Blvd from Valley View Booster Station to Heidelberger Tank - Replace 5 1/2" OD steel pipeline with 8" pipeline (3,300 feet) | Conditional Assessment | Short term | $600,000 |
| 1.23.1 | Replace existing Heidelberger Tank with new 0.1 MG tank | Conditional Assessment | Short term | $250,000 |
| 1.24.1 | Replace 200 feet of 4-inch Transite in private street at the West end of the Heidelberger Zone | Conditional Assessment | Short term | $40,000 |
| 1.25.1 | Replace 450 feet of 3-inch Steel on Bonita Drive | Conditional Assessment | Short term | $90,000 |
| 1.26.1 | Replace 1,800 feet of 8-inch Steel on Sierra Road from El Paseo Road to El Toro Road | Conditional Assessment | Short term | $360,000 |
| 1.27.1 | Replace 1,400 feet of 8-inch Steel on Palomar Road from El Toro Road to El Camino Road | Conditional Assessment | Short term | $280,000 |
| 1.28.1 | Replace 1,000 feet of 8-inch steel on Del Norte Road South of the Fairview Plant | Conditional Assessment | Short term | $200,000 |
| 1.29.1 | Replace 1,300 feet of 8,10 and 12-inch cast iron and steel on Grand Avenue from Drown Avenue | Conditional Assessment | Short term | $350,000 |
| 2.1.1 | Construct San Antonio Reservoir #2 – 0.5 MG | Storage Assessment | Mid-Term | $1,000,000 |
| 2.2.2 | San Antonio Plant – Add Booster Pump C – 1,365 gpm | Supply Assessment | Mid-Term | $300,000 |
| 2.3.1 | Replace 6-in pipeline on Ojai Ave near Del Norte Road Intersection with a 12-in Pipeline (Approx. 310 ft) | Velocity | Mid-Term | $80,000 |

TABLE 9-1
Summary of Recommended CIP Projects and Costs
*GSWC Region I Water Master Plan—Ojai System*

| | | | | |
|---|---|---|---|---|
| 2.4.1 | Install VFD's at the Fairview Plant | Conditional Assessment | Mid term | $40,000 |
| 2.5.1 | Abandon the Running Ridge Tanks | Conditional Assessment | Mid term | $150,000 |
| 3.1.1 | Install Additional 0.5 MG Tank in the Main Gradient – Signal Plant | Storage Assessment | Long Term | $1,000,000 |
| 3.3.2 | Fairview Plant – Upsize Booster B from 250 gpm to 500 gpm | Supply Assessment | Long Term | $75,000 |
| 3.5.1 | Install a new 6-in pipeline on Douglas St. from Signal St. to Montgomery St., 2,300 ft on Daly Rd. Loop near new Signal Reservoir. | Pressure | Long term | $903,000 |
| 3.6.1 | Replace 8-in pipe with 12-in pipe, 1,150 ft near Sierra-Cuyama intersection on Sierra Rd. (Must be replaced earlier due to condition of pipe see 1.31.1) | Velocity | Long term | $516,000 |

*To establish the new zone, all projects should be done concurrently.

SECTION 10

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