

County Service Area 23
Santa Margarita, California

Water System Master Plan 2003



County of San Luis Obispo
Public Works Department
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Santa Margarita, California

Water System Master Plan
2003

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Executive Summary

The County of San Luis Obispo Public Works Department Staff has prepared this Water System Master Plan for CSA 23 in Santa Margarita, California, in order to more effectively provide water service to our customers. Some improvements are needed to meet the water needs of the community.

The existing system serves 484 residential meters and 22 commercial meters with an average annual water use of 200-215 AFY. Water is supplied from two wells, the combined sustainable yield of which is insufficient to reliably meet the needs of existing customers. A supplemental water source is recommended to provide an additional 100 AFY of sustainable yield to the community. The estimated cost of participation in the Nacimiento water project is \$185,000 per year¹, based on a use of 100 acre-feet per year.

With regard to water storage, two tanks are now in service in Santa Margarita. The 40-year-old undersized welded steel tank should be replaced with a 410,000 gallon tank that provides required storage and is built to current standards. The estimated project cost, in current dollars, for installing a new welded steel tank is \$860,000.

The existing pipeline network is fairly well laid out but pipes are generally undersized to meet required fire flow for the school and business district. The first pipelines that should be increased in size are the ones from the two storage tanks and along Wilhelmina Avenue from I Street to El Camino Real. The existing 8-inch line is too small to provide the required fire flow to the commercial area of Santa Margarita, and should be replaced with 12- and 10-inch pipelines. The estimated total cost for this project is \$560,000. The next critical area for fire-flow is on H Street in front of the school. The 6-inch line should be replaced with a 10-inch line in order to provide the required fire-flow in that area. The estimated total cost for this project is \$500,000. The 8- and 6-inch pipelines on El Camino Real are too small to provide the required fire-flow to commercial buildings in the area and should be replaced with a 10-inch pipeline. The total cost for this project is estimated at \$1,800,000. Three projects in the residential areas of the community are recommended in order to meet required fire-flow. They include looping a 6-inch pipeline from the west end of F Street to the alley on Yerba Buena Avenue, increasing the pipelines at Encina Avenue and K Street to 8-inch pipelines, and upsizing the east end of the waterline on F street. The estimated total costs for these projects are \$260,000, \$450,000 and \$190,000, respectfully, in current dollars.

With these recommended improvements, the build-out system will service approximately 514 residential meters and 41 commercial meters. When the recommended projects are completed, the CSA 23 water system will adequately serve its customers both now and at build-out.

¹ All dollar estimates are in 2003 dollars.

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1.0 Introduction

1.1 Overview

County Service Area 23 (CSA 23) currently services approximately 484 residential meters, 22 commercial meters, and 6 public authority meters in Santa Margarita, California¹. The water service boundary for CSA 23 is shown as the dashed line in Figure 1, which also shows the existing water distribution system.

CSA 23 receives its water supply from two wells, Well #3 and #4. Well #3 is a deep, fractured-rock well and Well #4 is a relatively shallow well that pumps from the alluvial deposits of Santa Margarita Creek. Two other wells, #1 and #2, are near #4, but are not built to current health standards, and can only be used in an emergency. Water is pumped through the distribution system and up to two storage tanks.

The County is facing some critical decisions on behalf of the CSA 23 customers: 1) participation in the proposed Nacimiento Water Project and; 2) whether to renovate or replace the nearly 40 year old welded steel water tank. This master plan addresses both of these issues.

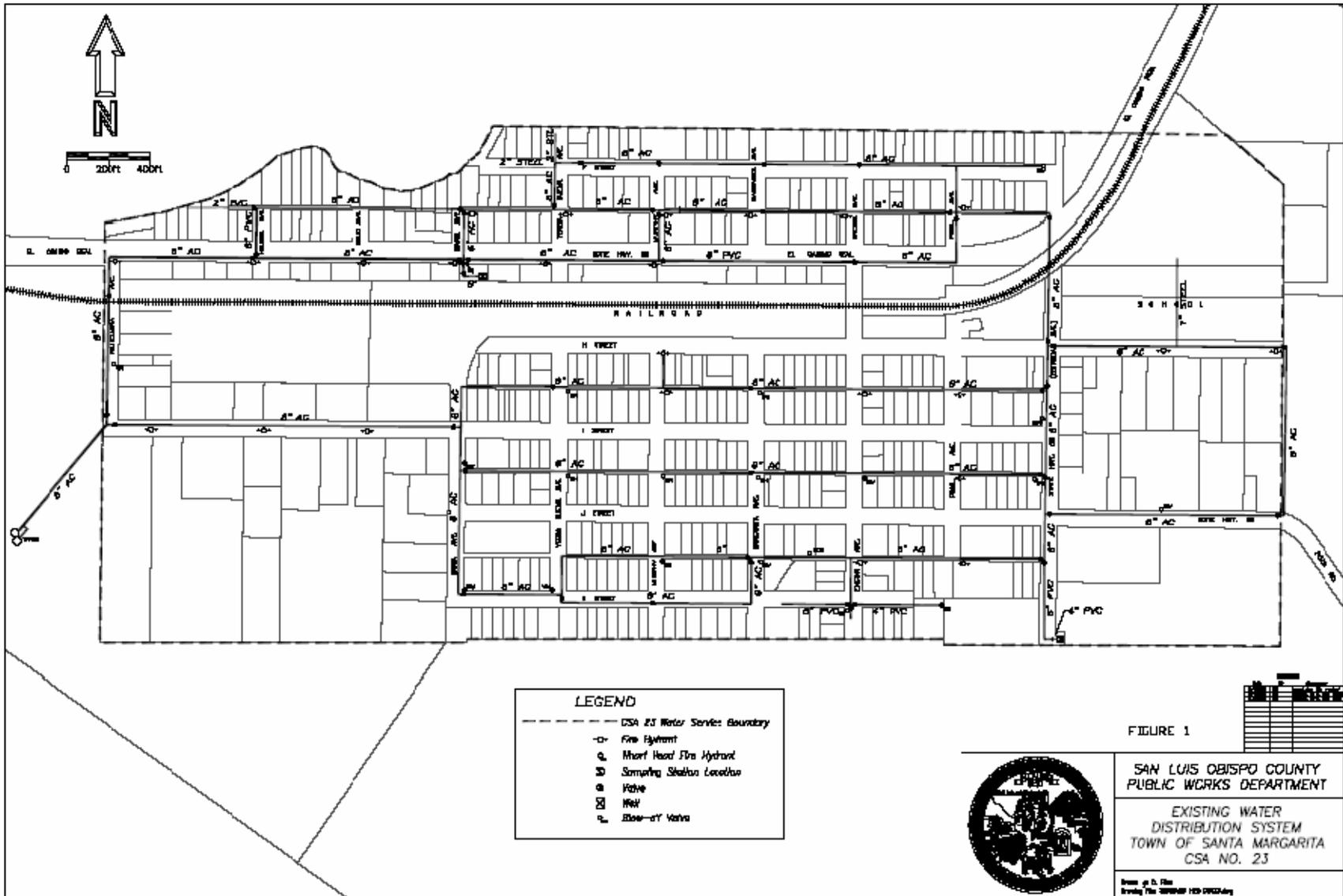
As part of this master plan, a hydraulic computer model of CSA 23's water system was developed to aid in identifying existing and future improvements. The existing system and build-out system models are saved on an attached disk.

1.2 Goals and Tasks

The goals of this study are to identify whether improvements to the water distribution system are needed to meet existing and projected demands, and to develop a water facilities improvement program to aid the County in conducting long-term planning for CSA 23. Specific tasks that were undertaken to accomplish this include:

a. Data Collection and Review

Data was collected which included water consumption records, water production records, land use and operations plans, and supply, distribution and storage characteristics (see references).



b. Demand Estimates

Existing land use information available on the County's Property Data Management System² was used to determine lot zoning and occupancy status.

Water duty factors for residential and nonresidential land uses were developed using historic water production and consumption data^{3,1}. Peaking factors were determined for maximum day demand and peak hour demand from actual maximum day demand records³ and applicable literature⁴, respectively. Fire flow requirements were established by consulting with Santa Margarita Assistant Fire Chief Bob Murach and using Table A-III-AA-1 of the 1998 California Fire Code.

The existing service area boundary for CSA 23 is the same as the Urban Services Line and is expected to stay the same. In other words, forecasted water needs are based on in-fill of existing lots within the service area.

c. Existing System Operations

Appropriate County employees and operations records⁵ were consulted to acquire an understanding of CSA 23 water system operations.

d. Computer Modeling and Hydrant Testing

A computer model was developed to simulate water system performance under both existing and future demands using EPANET. The model was calibrated using results of fire hydrant flow tests performed by County staff earlier this year.

e. System Deficiencies and Future Needs

A hydraulic analysis was performed to analyze both existing and projected demands. Upgrades were recommended where deficiencies were found. Recommendations for existing and future water supply, storage, back-up power and emergency needs were also made.

f. Recommended Upgrades/Opinion of Probable Cost

The estimated cost and priority of recommended improvements to meet existing and projected water demands were established.

2.0 Existing System

2.1 Overview

The locations of the two wells for CSA 23 are shown in Figure 1. Well water, after treatment at the respective well sites, is delivered to the water distribution system and the two storage tanks, which have an overflow elevation of about 1163 feet.

Santa Margarita is a small inland community, relatively flat, and centered along Highway 58 and the railroad. The regular street pattern makes the water system layout ideal for looping pipelines, which provides good circulation, increased flow capability, increased reliability and even pressures.

2.2 Supply

Water Source:

The community has facilities that pump from two sources of supply. Well #4 pumps from the alluvial aquifer of Santa Margarita Creek.⁶ Older Wells #1 and #2 also tap into the creek alluvium but neither can be used without filtration treatment. Well #3 is a “fractured rock well” that does not pump from the alluvium. Observations about the two active wells are:

Well #4 - 350 gallon per minute (gpm) pump
Subject to Surface Water Treatment Rule
Requires treatment to reduce corrosivity.
Primary source of supply for the community.
Safe yield unknown. Estimated to be 120 acre feet per year (AFY) or less.⁷

Estimated safe yield currently developed is less than 200 AFY.

Well #3 – 100 gpm pump
Taste and odor problems associated with iron, manganese and sulfur
Iron and manganese filter in place
Limited to 12 hour run-times in average hydrologic conditions
Power use per 1,000 gallons high compared to Well #4.
Safe yield unknown. Estimated to be less than 80 AFY.

Prior to 1999, the State Water Resources Control Board recognized Permit No. 7235 for Waterworks District #6 (CSA 23), originally filed in 1947. This stipulated a 1.5 cubic feet per second maximum diversion rate from the Salinas River and up to 200 AF maximum storage. In October 1999, Water Rights Permit No. 7235 was revoked. Public Works Department staff is investigating re-filing for these rights.

It appears that the safe yield (i.e. the amount of water that can be supplied from existing water sources during periods of average to poor rainfall) is marginally adequate to meet current demands. Santa Margarita experienced a water shortage

during the 1987-92 drought. Supplemental water is needed to reliably meet current and projected water demands.

The groundwater wells and their characteristics are shown in Table 2.1. Pictures of the well locations are shown in figures 2 and 3.

Table 2.1 Groundwater Well Characteristics

Well No.	Pumping Capacity (gpm)	Average Production Rate (gpm)	Total Dynamic Head	Motor Information	Notes
#1	650	230	215 feet	15 hp 3250 rpm	Offline; filtration required
#2	300	235	215 feet	15 hp 3250 rpm	Offline; filtration required
#3	100	100	525 feet	20 hp 3250 rpm	Online; Treated to reduce high iron, arsenic and manganese levels
#4	400	350	215 feet	30 hp 3250 rpm	Online; Requires disinfection and treatment for corrosivity

2.3 Distribution and Transmission Pipelines

Water is transmitted to customers from the wells through 8-inch and 6-inch pipelines. The basic gravity was installed in the mid-1960s, and since then, many pipelines have been added to create a well-looped distribution system. Older pipelines are made from asbestos-cement (AC), while newer installations are done with polyvinyl chloride (PVC) piping. However, there are still a 2-inch line off of the north end of Helena, and two 2-inch lines off of the west end of F Street. The 6-inch line on F Street dead-ends at the east end, and 6- and 4-inch lines from Encina to K Street are not looped into the system due to a creek on the west side and a mobile home park to the east. Increasing the size of pipelines and looping them leads to improved circulation, reliability and fire flow capability.

2.4 Storage

The original storage tank shown in Figure 4 is welded steel, holds about 150,000 gallons and sits at an elevation of 1140 feet and with an overflow at about 1163 feet. It was erected in 1966 and has had minimal repair work since its installation. It is in need of costly repair based on an inspection report dated January 4, 2001. A 157,500 gallon, bolted-steel tank was installed in 1993 to provide additional storage for the service area. It is built to current standards and the coatings are in good condition. The tanks sit side-by-side on a hill to the west of the service area. There is no all-weather access road to the tanks; in fact, there is barely an access road at all.



Figure 2: Well Number 3



Figure 3: Well Number 4



Figure 4 – Existing CSA 23 Welded Steel Tank

3.0 Existing and Projected Water Demands

3.1 Historic Demand

Historic water production and service meter data from June 1998 to June 2003 for CSA23 was obtained from County meter and well production records^{1,3}. The historic annual water production is shown in Table 3.1. Consumption and meter data was only available for 2002-03. Therefore a percentage of consumption for each type of meter was used to back-estimate the number of meters in previous years. This calculation was reasonable for commercial and public authority meters, and residential meters for 2000/01 and 2001/02. The calculation for residential meters may be inaccurate due to yearly variability of water use.

Table 3.1 Historic Water Use

	1998/99*	1999/00*	2000/01*	2001/02*	2002/03
# of Residential Meters	523	511	482	485	484
# of Commercial Meters	21	21	19	20	22
# of Public Authority Meters	7	7	6	6	6
Total Meters	551	539	508	565	512
Production (AFY)	216	212	200	201	198

* Estimated number of meters for these years; actual production

3.2 Existing Demand used for Planning

According to 2002-03 meter records, residential usage is about 90% of the total consumption, commercial usage is about 3% and public authority usage is about 7%. These percentages were applied to production data to yield a conservative average usage result.

Table 3.2 Water Use by User Class

	98-99	99-00	00-01	01-02	02-03
Production (AFY)	216	212	200	201	198
Residential Consumption (AFY)	194	191	180	181	178
Commercial Consumption (AFY)	6 to 7	6 to 7	6	6	6
Public Authority Consumption (AFY)	15	15	14	14	14

Water Duty Factor Determination:

The water needs for the community are distributed throughout the computer model based on the density of housing and other uses at various points in the system. Duty factors (water consumption per unit or meter) were applied based on historic usage as discussed above. Institutional users (such as the school, fire station, parks, library and the railroad facility) were added into the model at their water service location. Water duty factors are summarized in Table 3.3. Average 2002/03 production and consumption information was used to estimate water duty factors as shown in Appendix A.

Table 3.3 Water Duty Factors

Category	Average Annual Water Duty Factor
Residential	330 gpd/meter
Commercial	250 gpd/meter
Public Authority	Variable

Water usage for the public authority meters is highly variable; therefore the 2002/03 use at each meter was utilized. Since most commercial meters are located in the same area, the average water duty factor was applied to all commercial lots.

3.3 Build-Out Demand

Vacant lot information from County records² was used to forecast build-out demand for CSA 23 by locating empty lots and determining their zoning. The San Luis Obispo County Planning Department also delineates an Urban Services Line that was used to define the build-out area for projecting demand in CSA 23. The Urban Services Line is the same as the service area boundary. Vacant lots were identified and the water duty factors noted above were applied based on their zoning. There are approximately 30 vacant residential lots and 19 vacant commercial lots within the Urban Services Line.

3.4 Fire Flow Requirements

The Uniform Fire Code establishes minimum fire hydrant flow criteria for particular buildings or zones defined in the Uniform Building Code. After surveying the size and type of construction of the buildings in the critical areas of Santa Margarita, the fire flow requirements were determined to be approximately as shown in Table 3.4.

Table 3.4 Fire Flow Required at a 20 psi Residual Pressure

Type of Development	Fire Flow (gpm)	Duration (hrs)
Commercial	2,750	2
School	2,000	2
Residential Areas	1,000	2

3.5 Peaking Factors

In order for the water system to accommodate maximum demands, peaking factors need to be applied to the average daily demands developed in preceding sections. The maximum use was calculated off of the well production logs³ and used to determine the daily peaking factor. The CSA 23 supply sources must be able to supply the maximum day demand plus fire flow requirements at a minimum pressure of 20 psi.

Minimum pressures within the system under normal operating conditions are estimated by using a peak hour demand. Since peak hour demand information was not available, the manual entitled “Distribution Network Analysis for Water Utilities” by the American Water Works Association⁴ was consulted. The manual suggests that typical peak hour demands range from 1.3 to 2.0 times the maximum day demand. Since Santa Margarita is an inland community experiencing hot summer days, a peak hour demand of 2.0 times the maximum day demand was used to estimate peak hour demands.

Calculations of the daily peaking factor and peak hour demand, as well as calculations of the maximum day demand and peak hour demand for CSA 23 build-out, are shown in Appendix B. A 10% planning cushion was added to usage projections, as required by the San Luis Obispo County Board of Supervisors. The results are summarized in Table 3.5.

Table 3.5 Peaking Considerations

	Average Day Demand (gal/day)	Maximum Day Demand (gal/day)	Daily Peaking Factor	Peak Hour Peaking Factor	Peak Hour Demand (gal/hr)
Current	176,750	376,500	2	2	31,400
Build-Out	210,500	421,000	2	2	35,100

4.0 Computer Model

4.1 Model Development

A computer model of the CSA 23 water distribution system was created in order to help analyze the water system's capabilities and needs.

The EPA-developed computer software, EPANET, was used to model the water system. EPANET uses the Hazen-Williams formula as the basis for calculating head loss. The model consists of two reservoirs (wells 3 and 4), two pumps, two storage tanks, 63 pipes, and 43 nodes. Table 4.1 outlines what required information was input into the model for the system components.

Table 4.1 System Input

Tanks	Name, Elevation, Initial Level, Minimum Level, Maximum Level, Diameter
Reservoirs	Name, Head
Pumps	Name, Pump Curve
Pipes	Name, Length, Diameter, Hazen-Williams C-Factor
Nodes	Name, Elevation, Base Demand

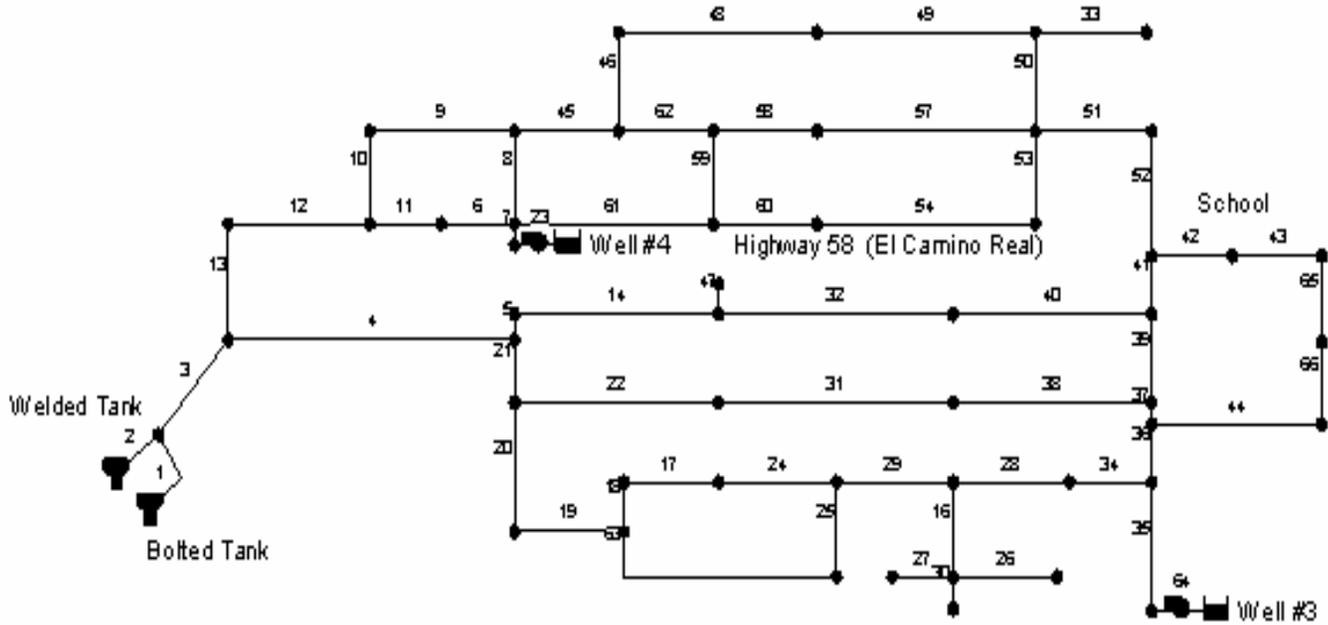
A skeletal diagram of the distribution system was created as the model using available maps and operator input while a consolidated, electronic map of the system was created for this report. Operational characteristics for the tanks and pumps, and pipe diameters were obtained from maps and operators, and pipe lengths were scaled off of available maps. The C-factors were determined from pipe material and installation date, and are 120 for AC pipes and 140 for PVC pipes. Nodal elevations were estimated using available topographic maps and plans. An example calculation for the base demand at a node is in Appendix C. Figure 5 shows the plot of the model from EPANET with pipe identification numbers.

4.2 Model Calibration

Fire-flow tests were performed on three hydrants throughout CSA 23 in August of 2003 in order to use actual field conditions to calibrate the model. First, static pressure, taken at a residual hydrant, and other conditions, such as weather, tank levels and pump status, are noted on a Fire-Flow Test Form. Pressure is taken at a residual hydrant while a flow hydrant is completely opened. Simultaneously, pressure is measured with a pitot-tube at the midpoint of the discharge at the flow hydrant. The pitot-tube pressure and the hydrant's outlet characteristics are used to calculate the observed flow.

The model analysis was run using average base demand conditions. The resulting model-calculated pressures at the residual hydrant-node locations were compared to field-measured static pressures. The pipe and nodal characteristics of the

Figure 5: Santa Margarita Existing System Model



model, such as the Hazen-Williams C-factor, the elevation or the base demand, were adjusted until the model-calculated static pressures matched the field-measured static pressures. Next, the observed flow was set as the base demand at the flow hydrant-node, and the model analysis was run, once for each observed flow condition at each flow hydrant-node. The residual pressure calculated by the model at the residual hydrant-node was compared to the field-measured residual pressure. The model is considered calibrated if the model-calculated static pressure is within 5 psi of the field-measured static pressure, and if the model-calculated residual pressure is within 7 psi of the field-measured residual pressure.

4.3 Calibration Results

The three fire hydrants tested were located at El Camino and Maud, near the school and on Pinal near the Mobile Home Park. Table 4.2 summarizes the field-measured results and the computer model-calculated results.

Table 4.2 Field-Measured and Calculated Results

Location	El Camino	School	Pinal
Static Pressure (psi)	67	59	67
Model Static Pressure (psi)	68	61	68
Residual Pressure (psi)	58	44	51
Model Residual Pressure (psi)	59	43	44
Observed Flow (gpm)	1162	980	1034

4.4 Build-Out Model

After calibrating the model, a build-out model was created for running simulations under future demands. Appropriate base demands were assigned to lots according to their zoning.

5.0 Distribution System Performance and Design Criteria

The criteria used to evaluate the ability of the CSA 23 water distribution system to meet build-out demands are outlined below, and are referenced from (4).

5.1 Supply System

The source of supply should adequately meet customer needs. The well pumps should be sized to provide maximum-day demand with the largest source of supply out of service. The system should also be able to replenish fire storage over 72 hours during maximum day demand conditions.

5.2 Piping System

Pipe segments are considered deficient, or limiting, if the following conditions exist:

- Velocities greater than 5 feet per second (fps) under average day demand conditions
- Head losses greater than 10 feet per 1000 feet (ft/Kft) under peak hour or maximum day plus fire conditions

Pipelines displaying these conditions usually prevent the system from providing adequate flow and/or pressure, and high velocities can damage infrastructure. Conditions may be improved by appropriate pipe sizing or routing.

Section 64566 of Title 22 of the California Code of Regulations⁸ requires that any changes to the water system should result in an operating pressure of 20 psi under peak hour demand and average day demand plus fire-flow demand conditions. The code also requires that mains be designed for operation at a minimum of 35 psi. For this system, pressure is considered unacceptable if it falls below 35 psi for average day demands, below 30 psi for peak hour demands, and below 20 psi for maximum day demand plus fire flow demand. Negative pressures indicate that the system is unable to provide the needed flow to meet demand at that location.

5.3 Storage System

The most taxing condition for system storage is maximum day demand plus fire flow demand. The tank needs to meet three volume requirements: equalization storage, emergency storage, and fire storage.

Equalization Storage: This storage is required to meet water system demands in excess of what supply can provide during peak demand conditions. The equalization storage volume can be estimated by assuming that daytime demand (150% of maximum day demand) in excess of rate of supply occurs for 14 hours during the day, and therefore equals:

$$(1.5 * \text{Maximum Day Demand} - \text{Rate of Supply}) * 14 \text{ hrs}$$

Emergency Storage: This is a volume of water to be available to sustain basic sanitary needs in the event that an emergency (such as a prolonged power outage) cuts off the normal water supply. The amount of time to restore the normal water supply was estimated at 72 hours, and the basic sanitary demand per capita was estimated to be 50 gallons per day.

Fire Storage: This storage is required to meet the highest fire-flow demand in the CSA23 water system (required flow (gpm) * required hours * 60 min/hr).

6.0 Ability of Existing System to Meet Current and Future Demands

The CSA 23 water system was assessed under average, peak hour, and maximum day demand plus fire flow at critical locations. The results from the model runs were compared with the performance and design criteria for the supply, piping, and storage systems.

6.1 Supply System

Right now, nearly 500 households rely on two wells to supply water and one of those wells is drilled in a fractured rock formation with limited pumping history. Per the “Santa Margarita Water Supply Assessment” prepared by Christine Ferrara, Utilities Division Manager, dated October 17, 2000, an additional 100 AFY of dependable supply is needed to reliably meet the needs of existing and future customers.

6.2 Piping System

Under peak hour demand conditions, the existing system performs well. All pressures are between 50 and 70 psi, well above the 30 psi minimum criteria.

The CSA 23 system could not operate under maximum day demand plus commercial fire-flow conditions for 2 hours with a minimum pressure of 20 psi. The pipelines are too small to deliver this flow rate and the tanks would empty after about an hour.

At El Camino and Helena, the recommended fire flow rate is 2750 gpm; however the existing system can only deliver 2250-2450 gpm.

Fire-flow demands were simulated at four other locations: at Margarita and F Streets, on Murphy Street between J and K Streets, at Encina and K Streets, and on H Street near the school. The residential fire flow requirement was met at Margarita and F Streets, on Murphy Street and at Encina and K Streets, but flow velocities in the small distribution lines were unacceptably high. The system cannot sustain the recommended fire flow to the school which is 2000 gpm for 2 hours. It can only sustain about 1200 gpm for 2 hours with high flow velocities noted.

Appendix D summarizes the locations where the pipeline performance criteria for all fire-flow demand simulations were violated.

6.3 Storage System

Appendix E shows the calculations for the current and future storage requirements for CSA 23. A fire flow of 2750 gpm for 2 hours is the maximum requirement for the community. Table 6.1 below summarizes the results according to storage

design criteria. The current storage capacity is deficient by 244,500 gallons, and capacity for future storage requirements is deficient by 337,350 gallons. Table 6.2 also shows the volume of tank required to replace the old 150,000 gallon tank to meet current and future storage needs.

Table 6.1 Storage System Requirements

	Current Needs	Future Needs
Required Storage	Volume (gallons)	Volume (gallons)
Equalization	27,000	27,000
Emergency	195,000	210,000
Fire	330,000	330,000
Total Required Storage	552,000	567,000
Current Storage	307,500	307,500
Additional Storage Needed	244,500	260,000
Size to Replace Old Tank	394,500	410,000

7.0 Recommended Water System Improvement Projects

This section describes the water system improvement projects, listed in order of priority, which would bring the system into reasonable compliance with design and performance criteria. The projects and their estimated project costs are summarized in Table 7.1, and the calculations are shown in Appendix F. The distribution system with the recommended improvements is shown in Figure 4.

1. Meeting the Storage Requirement

Replacing the old storage tank is a high priority. The old tank is in very poor condition and needs to be completely renovated, including internal and external coatings, safety equipment, new appurtenances and seismic restraints.

Considering the costly repairs needed for the nearly 40 year old tank and the fact that the community needs additional storage to reliably serve customer needs, it is recommended that the existing tank be replaced with a new 410,000 gallon tank with an overflow elevation to match the existing bolted steel tank. Relating to this, the tank site lacks an all-weather access road and construction of such a road is recommended. This is included in the construction cost estimate stated for this project.

The feasibility of restoring the old tank and placing a new storage tank on the east side of the system to meet storage capacity needs was considered. This would offer great hydraulic benefits; however, costs would be much greater than erecting a tank at the existing Westside location particularly due to land acquisition costs. Land may not be available or at the proper grade for tank placement to meet hydraulic requirements. Another consideration was the longer period of time it would take to complete the project.

Table 7.1: Priority of Water System Improvement Projects

	Project Description	Project Cost⁽¹⁾	Justification
1	New Storage Tank	\$860,000	Brings storage up to current standards, provides adequate storage for fire flow
2	Supplemental Water ⁽²⁾	Not Available	Provides supplementary water supply
3	Upsize Pipeline from Tanks to Wilhelmina and El Camino	\$560,000	Improves fire flow to the community
4	Upsize Pipeline near the School (H Street)	\$500,000	Improves fire flow to the school
5	Upsize Pipeline Along El Camino Real to Pinal	\$1,800,000	Improves fire flow to the commercial district
5	Upsize Encina and K Street Pipelines	\$450,000	Improves fire flow to the area
5	Upsize Pipeline at the East End of F Street	\$190,000	Improves fire flow to the area
5	Loop and Upsize Pipeline from West End of F Street to Maria Avenue	\$260,000	Improves fire flow and service to customers
	Total	\$4,620,000	

(1) Project costs include construction costs plus preliminary engineering, design, environmental determination, right of way and construction inspection.

(2) Available cost estimate based on an estimated cost of \$1,850 per acre-foot per year, and assuming 100 acre-feet per year will be utilized by Santa Margarita, per the "Draft Engineer's Report for the Nacimiento Project" prepared by Carollo Engineers dated January 2001. This cost is per "Nacimiento Water Supply Project Cost with Delivered Water Cost for Major Reaches" prepared by Carollo Engineers dated June 2001. Santa Margarita's portion of the project costs is not yet available.

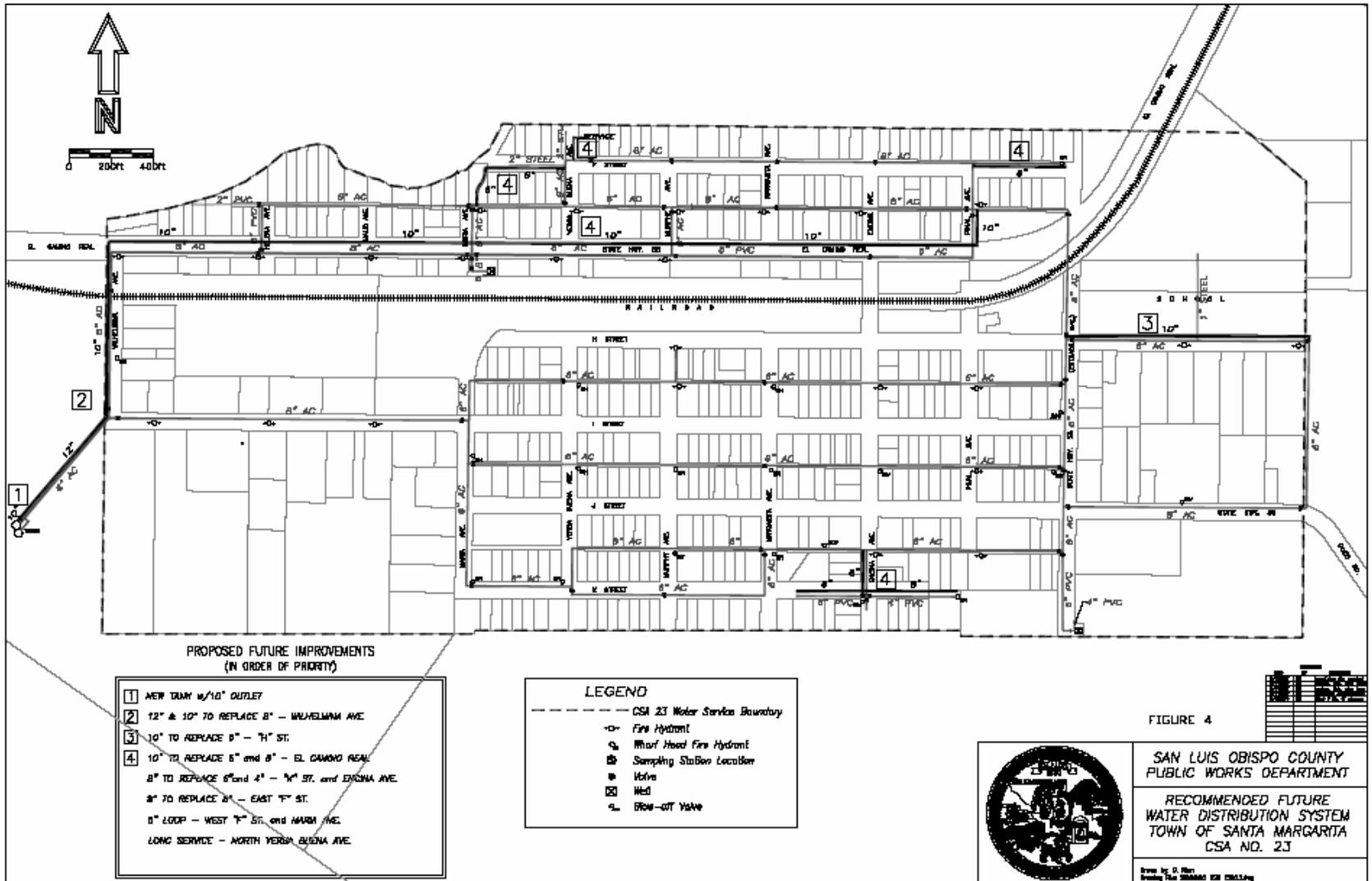




Figure 7: Existing Location of Tanks

2. Supplemental Water

County Public Works staff has worked closely with community advisory groups in recent years to discuss the precarious nature of the existing water supply system. Nearly 500 residences rely on two wells, one of which draws from a fractured rock formation with little operational history, to meet all community water needs and the estimated sustainable yield from those wells falls short of current community water demand. For this reason, CSA 23 should secure an additional 100 AFY reliable supply. One option is participation in the proposed Nacimiento Water Supply Project, as outlined in the document Supplemental Water Supply Options Comparison of Alternatives⁹. In order to meet the supply requirement of maximum day demand with the largest source of water out of service (382,420 gallons), Santa Margarita would need 238,420 gallons of Nacimiento water during a maximum day, an equivalent pumping rate of 166 gpm.

3. Pipeline Improvements

Pipeline improvements are needed to meet fire flow requirements throughout town. In order of priority, these are:

First Priority Project

The first pipeline replacement should be **replacing the 8-inch supply line from the storage tanks** with a 12-inch diameter pipe. All customers would benefit

from the increased flows from the tanks. Further, the existing 8-inch line along **Wilhelmina Avenue should be replaced with a 10-inch line**, again, to increase fire flow throughout town. This will allow the flow needed to reach the commercial area on El Camino Real, in conjunction with the supply from the wells. Without completing this project first, other pipeline replacements would not be as useful.

Second Priority Project:

The next priority is to **replace the 6-inch section of pipeline on H Street in front of the Santa Margarita Elementary School** with a 10-inch pipeline in order to meet fire flow requirements and pipeline performance criteria.



Figure 8: H Street near the Elementary School

Third Priority Projects:

In order to meet required fire-flow in the commercial area of Santa Margarita along El Camino Real, the pipelines stretching from Wilhelmina and I Streets to El Camino, then along El Camino to Pinal, and then up to the alley should be resized to 10-inches. Required fire flows are impossible to achieve with the existing 6-inch pipelines. Consideration was given to installing a third railroad crossing between El Camino Real and H Street; however, this did not provide enough hydraulic benefit to justify the difficulty of crossing the railroad, especially since the 6-inch pipeline would need to be resized anyway.



Figure 9: Commercial Zone for Santa Margarita; El Camino Real

It is unfeasible to loop the mains on Encina Avenue and K Street into the system due to a creek to the west and a mobile home park to the east. Such main extensions would be costly, requiring a lengthy permitting process, and would be disrupting to the park residents. The main in that area should be replaced with an 8-inch diameter pipe in order to meet fire flow requirements.



Figure 10: Mobile Home Park at the East End of K Street



Figure 11: Creek to the West of Encina Avenue on K Street

An 8-inch pipeline along Estrada Avenue should be installed to connect the waterlines from the alley and F Street in order to provide fire flow to the area. However, as shown in Figure 10, the proximity to the creek and difficulty with construction may necessitate upsizing the existing line to an 8-inch line instead to provide required fire flow. Currently there is only a stretch of 6-inch pipe on F Street that dead-ends at Estrada Avenue, which is too small to provide 1000 gallons per minute during a fire emergency.



Figure 12: F Street and Estrada Avenue Looping Area

The 2-inch steel line at the west end of F Street should be replaced with a 6-inch pipeline that loops into the water line from the alley at Maria Avenue. This will provide the required fire flow and improve service to the customers. The 2-inch steel pipeline that services one customer at the north end of Yerba Buena Avenue

should be converted to a long service by moving the customer meter back to the CSA 23 main.



Figure 13: West End of F Street



Figure 14: Maria Avenue and F Street Looping Area

* * *

In addition to the pipeline projects noted above, older wharfhead fire hydrants throughout the community are gradually being replaced with standard fire hydrants as yearly maintenance funds allow. This program will improve fire protection capabilities in Santa Margarita neighborhoods.

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Appendix A
Calculation of Water Duty Factors

Meters

June 2002 - April 2003

Residential	Commercial	Public Authority	Total
484	22	6	512

Consumption

	Residential	Business	PA	Total
6/4/02-8/1/02	17883	599	1278	19760
8/1/02-10/8/02	19201	651	1778	21630
10/8/02-12/10/02	9078	430	777	10285
12/10/02-2/13/03	6719	269	176	7164
2/13/03-4/9/03	6421	283	285	6989
4/9/03-6/10/03	11349	422	990	12761
Total (100 ft^3)	70651	2654	5284	78589
Gallons	52846948	1985192	3952432	58784572
Percent of Total Use (%)	90	3	7	

Water Duty Factors (based on % of Production)

	Gallons/Year	Gallons/Day/Meter
Total Production 2002-03	64420500	
Residential Use (90%)	57978450	330
Commercial Use (3%)	1932615	250
Public Authority Use (7%)	4509435	2059

(Not Used;
Actual Use Used Instead)

Public Authority Usage

	Gallons per Day
School, Baseball Field	3385
Park	4193
Fire Station	8
Library	293
Railroad	0
Mobile Home Parks	9259

Appendix B
Peaking Factors

Current:

Maximum Day Demand, July 2003 = 376,500 gpd

Daily Peaking Factor = Maximum Day Demand / Average Day Demand

Average Day Demand = 198 AFY (1 Y / 365 d) (1 gallon / 3.07×10^{-6} AF)
= 176,750 gpd

Daily Peaking Factor = 376,500 gpd / 176,750 gpd
= 2

Peak Hour Peaking Factor = 2

Peak Hour Demand = Peak Hour Peaking Factor x Maximum Day Demand
= 2 x 376,750 gpd x (1 d / 24 hr)
= 31,400 gallons/hr

Build-Out:

30 Residential Meters * 330 gpd/meter = 9,900 gpd

19 Commercial Meters * 250 gpd/meter = 4,750 gpd

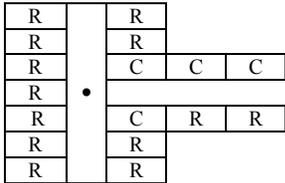
Average Day Demand = 176,750 gpd + 14,650 gpd
= 191,400 gpd

Plus 10% Planning Cushion = 210,500 gpd

Maximum Day Demand = 210,500 gpd * 2
= 421,000 gpd

Peak Hour Demand = 420,000 gpd * 2 * (1 d / 24 hr)
= 35,100 gph

Appendix C
Example of Demand at a Node



13 Residential Meters @ 330 gpd/meter = 4290 gpd
 4 Commercial Meters @ 250 gpd/meter = 1000 gpd

Total Demand at the Node = 5290 gpd

Appendix D
Locations of Pipe Segments Violating Performance Criteria during
Maximum Day Demand plus Fire Flow Demand Hydraulic Model Runs

Build-out Model:**Commercial Model – El Camino Real and Helena Avenue**

Pipe Description	Pipe ID(s)	Velocity (ft/sec)	Headloss (ft/Kft)
8-inch from both tanks	3	13	79
8-inch on Wilhelmina Ave.	13	9	42
8-inch on El Camino Real	12	9	31
8-inch from 150K gallon tank	2	8	31

Residential – Margarita Avenue and F Street

Pipe Description	Pipe ID(s)	Velocity (ft/sec)	Headloss (ft/Kft)
6-inch on Pinal Ave.	50	6	25
6-inch on Yerba Buena Ave.	46	6	25
6-inch on F St.	48, 49	6	24

Residential – Murphy Street between J and K Streets

Pipe Description	Pipe ID(s)	Velocity (ft/sec)	Headloss (ft/Kft)
6-inch on Maria Ave	20	6.50	30.50
6-inch on K St.	19	6.50	30
6-inch on Maria Ave.	21	6	29
6-inch in alley between J St. and K St.	24	6	28
6-inch in alley between J St. and K St.	34	5.5	23

Residential – Encina Avenue and K Street

Pipe Description	Pipe ID(s)	Velocity (ft/sec)	Headloss (ft/Kft)
6-inch on Encina Avenue	16	11	87
6-inch in alley between J St. and K St.	34	7	33
6-inch in alley between J St. and K St.	28	7	32
6-inch on Maria Ave.	21	6	27
6-inch on Estrada Avenue	3	6	23

School Model – H Street near the School

Pipe Description	Pipe ID(s)	Velocity (ft/sec)	Headloss (ft/Kft)
6-inch on H St.	42	12	92
8-inch from both tanks	3	8	32
6-inch on Maria Ave.	21	6	24

Appendix E
Calculation of Storage Requirements

Calculations of Required Storage Volumes for Current System

Equalization Storage:

Assume that demand in excess of the rate of supply occurs for 14 hours during the day.

$$\begin{aligned}\text{Equalization Storage} &= (1.5 \text{ Maximum Day Demand} - \text{Rate of Supply}) * 14 \text{ hrs} \\ &= (23,531 \text{ gph} - 27,000 \text{ gph}) * 14 \text{ hrs}\end{aligned}$$

Since the rate of supply exceeds maximum daytime demand (150% of the maximum day demand), the volume of storage should be an amount that will limit the pumps to 1-hour cycles.

$$450 \text{ gpm} * 60 \text{ min} = 27,000 \text{ gallons}$$

Emergency Storage:

Minimum sanitary supply = 50 gallons per capita for 3 days

Estimated Population = 1,300

$$1,300 \text{ capita} * 50 \text{ gallons/capita} * 3 \text{ days} = 195,000 \text{ gallons}$$

Fire Storage:

Highest fire-flow demand: 2,750 gpm for 2 hours

$$2,750 \text{ gpm} * 60 \text{ min/hr} * 2 \text{ hr} = 330,000 \text{ gallons}$$

Total Required Storage = 27,000 + 195,000 + 330,000 = 552,000 gallons

Existing = 307,500 gallons Need = 244,500 gallon tank

Replacement for 150,000 gallon tank = 394,500 gallons

Calculations of Required Storage Volumes at Build-Out

Equalization Storage:

Assume that demand in excess of the rate of supply occurs for 14 hours during the day.

$$\begin{aligned}\text{Equalization Storage} &= (1.5 \text{ Maximum Day Demand} - \text{Rate of Supply}) * 14 \text{ hrs} \\ &= (26,250 \text{ gph} - 27,000 \text{ gph}) * 14 \text{ hrs}\end{aligned}$$

Since the rate of supply exceeds maximum daytime demand (150% of the maximum day demand), the volume of storage should be an amount that will limit the pumps to 1-hour cycles.

$$450 \text{ gpm} * 60 \text{ min} = 27,000 \text{ gallons}$$

Emergency Storage:

Minimum sanitary supply = 50 gallons per capita for 3 days

Current population = 1,300; 1,300 people / 484 meters \approx 3 people per meter
30 vacant residential lots * 3 people per meter = 1,400 people at build-out

$$1,400 \text{ capita} * 50 \text{ gallons/capita} * 3 \text{ days} = 210,000 \text{ gallons}$$

Fire Storage:

Highest fire-flow demand: 2,750 gpm for 2 hours

$$2,750 \text{ gpm} * 60 \text{ min/hr} * 2 \text{ hr} = 330,000 \text{ gallons}$$

Total Required Storage = 27,000 + 210,000 + 330,000 = 567,000 gallons

Existing = 307,500 gallons Need = 260,000 gallon tank

Replacement for 150,000 gallon tank = 410,000 gallons

Appendix F
Construction Cost Estimates of Recommended
Water System Improvement Projects

Tank Construction

All-Weather Access Road	\$25,000	130yd ³ of base @ \$40/yd ³ +\$20,000 for grading
30 ft of Waterline	\$4,800	\$160/LF
Foundation Work	\$68,310	1/3 of the tank cost
Tank	\$207,000	Superior Tank Quote, welded steel tank
Total	\$305,110	
Construction Contingency 50%	\$457,665	

Pipeline Projects

Per Christine Ferrara on 9/25/02:

For pipe projects in pavement	\$200/LF	6-inch
	\$240/LF	8- to 10-inch
For pipe projects not in pavement	\$120/LF	6-inch
	\$160/LF	8- to 10-inch
	add	
For bore and jack, metal casing	\$100/LF	

Project Name	\$/LF	Linear Feet	Cost
Pipeline from Tanks to Wilhelmina and El Camino	\$160, \$240	630, 800	\$292,800
School (H Street)	\$240	1140	\$273,600
El Camino Real to Pinal	\$240	4360	\$1,050,000
West F Street Loop	\$240	600	\$144,000
Upsize East F Street	\$240	440	\$105,600
Encina and K Street	\$240	1040	\$249,600