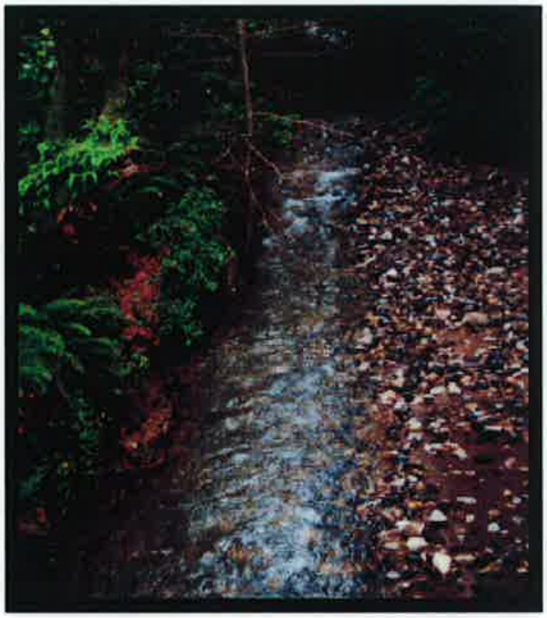
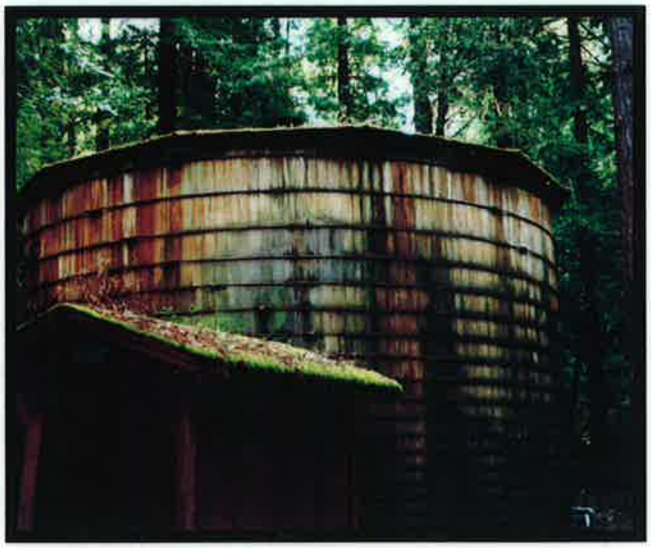
MASTER PLAN

County of San Mateo

April 1998





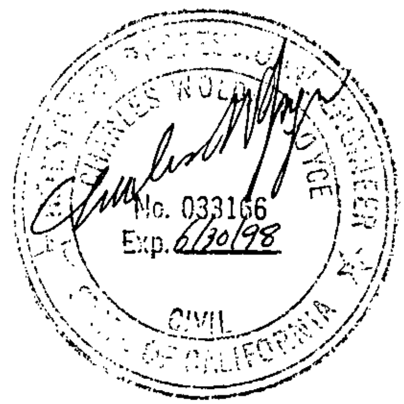
County Service Area No. 7 La Honda Water System Master Plan

BROWN AND CALDWELL

COUNTY OF SAN MATEO

County Service Area No. 7
La Honda

WATER SYSTEM MASTER PLAN



Prepared by:
Brown and Caldwell
April 1998

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BROWN AND CALDWELL

April 20, 1998

Mr. Mark Welsh
County of San Mateo
Department of Public Works
10 Twin Dolpin Drive, Suite C-200
Redwood City, California 94065

011-4692-01/5
011-4692-03/11

Subject: County Service Area No. 7 (CSA No. 7), Water Master Plan

Dear Mr. Welsh:

In completion of your December 17, 1996, authorization, Brown and Caldwell is pleased to submit the subject report.

We wish to express our appreciation to Messrs. Dan Wang, Bill Santos, and Bob Aliamo for their input to our work. Please call Bill Faisst (925/210-2384) or me (925/210-2509) with any questions.

Very truly yours,

BROWN AND CALDWELL

Charles W. Joyce, P.E.
Project Manager

William K. Faisst, Ph.D., P.E.
Vice President

WKF:paa
Enclosure

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1

CHAPTER 1

EXECUTIVE SUMMARY

In December 1996, the County of San Mateo engaged Brown and Caldwell to prepare a comprehensive water system master plan for County Service Area No. 7 (CSA No. 7). This executive summary presents the findings, conclusions, and recommendations regarding this system. It also proposes a capital improvement plan (CIP) and summarizes recommended rates and a revenue plan to finance proposed improvements.

Background

The County of San Mateo (County) operates the CSA No. 7 water system to serve potable water to about 71 residential connections in the La Honda Creek and Alpine Creek drainage on the Pacific coast side of the County. This system also supplies two County facilities—Camp Glenwood and Sam MacDonald Park. Parts of the system such as the water treatment plant (WTP) are of recent construction, while some of the distribution system dates from the 1920s. The water system needs investment in order to provide a reliable, dependable supply.

Findings and Conclusions

Based on master planning for CSA No. 7, Brown and Caldwell has developed the following findings and conclusions regarding water system needs for the service area.

Raw Water Supply

1. The Alpine Creek water source has adequate quantity and is of suitable quality to continue to serve as one water source for CSA No. 7.

2. California Superior Court Decree 355792 requires that residents with riparian water rights in the La Honda Creek drainage be supplied with water from either La Honda Creek or a different source than Alpine Creek. The County could use appropriative rights it controls from Alpine Creek but these rights cannot be exercised in the summer except for a small volume carried over in storage from winter diversions. However, based on current demands, this carry over volume is inadequate to serve residents in the La Honda Creek drainage through the summer.

3. The Alpine Creek diversion works well, but needs a spare pump to improve its reliability.

Water Treatment System

1. The Camp Glenwood WTP is in good working order and produces finished water that is in compliance with current state and federal regulations. To meet future water quality requirements, the County may need to optimize WTP performance, shut the WTP down temporarily when raw water tubidity increases, or modify the WTP.

2. Some minor corrosion is evident in the chemical storage and feed area and should be checked through the application of an appropriate coating.

3. The chemical storage tanks need to be anchored and provided with secondary spill containment.

Water Distribution System

1. Most of the distribution system water pipelines are old, poorly installed, and undersized based on the desired level of service and current water industry standards.

2. The water pipeline serving the Memory Lane area runs through the privately owned "Trailer Park" area where service by County employees is difficult. This pipeline should be replaced with a pipeline paralleling Highway 84.

3. The water pipeline crossing Alpine Creek near Highway 84 is suspended from a cable across the creek and is at risk of failure. It should be reinstalled under the stream bed or rerouted and attached to the adjacent bridge to improve its reliability and durability. An installation under the stream bed might require a temporary stream bed alteration permit from the California Department of Fish and Game depending on the method of installation.

Water Storage

1. The CSA No. 7 system has more than adequate storage in reasonably good physical condition.

2. There is apparently little or no flexibility for the reservoir inlet and outlet pipeline connections. All reservoirs need to have new or additional flexible connections installed on inlet and outlet piping to improve seismic reliability and durability.

3. The roof on the 70,000-gallon redwood treated water storage reservoir (T-2) is deteriorating and needs to be replaced.

4. The redwood boards imbedded on the tops of the concrete grade beam foundations supporting the redwood reservoirs are deteriorating and will eventually need replacement. The redwood reservoirs do not appear to be anchored to supporting

wooden beams and grade beams. The reservoirs should be properly anchored to improve seismic reliability.

5. All reservoirs should be inspected regularly and repaired as needed.

6. There should be a pressure reducing valve on the bypass pipeline for T-2, to control downstream pressures during bypassing.

Recommended Improvements

To respond to system deficiencies identified above, Brown and Caldwell recommends the following improvements and modifications.

Raw Water Supply

1. Purchase a spare raw water pump for the Alpine Creek diversion to have in inventory when the single duty pump needs repair or fails.

2. Establish a new water diversion on La Honda Creek to serve residential connections in the La Honda Creek drainage.

3. Carry out sanitary surveys for the Alpine Creek and La Honda Creek drainages to comply with State of California Department of Health Services requirements for smaller water systems.

Water Distribution System

1. Relocate the water main serving Memory Lane so that it runs from the "Trailer Park" along Highway 84 to Memory Lane.

2. Construct a permanent, dependable crossing for the Alpine Creek water pipeline.

3. Replace older, small-diameter pipelines of diameters less than 4 inches with new, properly-installed, 4-inch-diameter pipe.

4. Read all meters monthly to accurately record water usage as a basis for proper cost allocation and to quantify unaccounted-for water.

5. Rebuild or replace meters on a 10-year cycle to ensure that metering data is accurate.

6. Disconnect unauthorized connections or establish meter accounts whenever they are discovered.

7. Provide looping by installing a 4-inch-diameter water main along Pescadero Road from the Alpine Creek bridge to the La Honda Creek bridge.

Water Storage

1. Provide flexible connections for all reservoir inlet and outlet pipelines.

2. Repair or replace the roof on the 70,000-gallon redwood treated water storage reservoir (T-2). Install a bypass pipeline with pressure reducing valve.

3. Inspect the redwood blocks supporting the redwood reservoirs and replace when their structural integrity fails. Add seismic anchoring.

4. Inspect the welded-steel reservoir regularly and recoat/repaint the interior and exterior as recommended by a competent reservoir painting specialist.

Water Treatment

1. Repair corrosion damage to the electrical system and floor under the chemical storage area. Coat flooring to prevent future damage.

2. Anchor chemical storage tanks and provide secondary containment for stored chemicals.

3. Construct a new WTP using water from La Honda Creek to comply with the Superior Court decree on water rights.

4. Modify WTP operations or the WTP as required by new regulations.

Capital Improvement Plan

Table 1-1 presents the proposed Capital Improvement Plan (CIP) for the CSA No. 7 water system, divided into priorities based upon risk to water users and system needs. Note that for Priority 3 projects, Table 1-1 shows costs for several options depending upon the pipe size chosen by the County.

Table 1-1 CSA No. 7 Capital Improvement Program

Priority	Item	Capital cost, dollars[a]
1	Redwood reservoir structure anchoring	9,600
	Reservoir flexible couplings	3,700
	Water treatment plant repairs	5,000
	Spare raw water pump	3,900
2	Reservoir roof repairs	3,500
	La Honda Creek diversion and raw water transfer pipeline	663,000[b]
3	Replace water pipe, 13,000 feet, 2-inch-diameter PVC, existing location	286,000
	Replace water pipe, 13,000 feet, 4-inch-diameter PVC, existing location	1,016,000
	Replace water pipe, 13,000 feet, 2-inch-diameter PVC, including reroute to Memory Lane	314,000
	Replace, water pipe, 13,000 feet, 4-inch-diameter PVC, including reroute to Memory Lane	1,117,000
	Water pipe crossing Alpine Creek	30,000
4	Install new 4-inch-diameter PVC looping water main along Pescadero Road	555,000[c]

[a]Capital costs include contingency at 30 percent and engineering, legal, and administrative costs at 20 percent.
[b]Option 2, Chapter 7.
[c]This cost will be reduced significantly if installation occurs concurrently with the proposed La Honda Creek raw water transfer line described in Option 1 or Option 2, Chapter 7.

User Fees

Table 1-2 presents the estimated user fee increases needed to finance the proposed CIP. Note that we recommend funding smaller projects on a pay-as-you-go basis. One larger project, the La Honda Creek water diversion, may qualify for a lower interest loan through the State Revolving Fund (SRF). The federal government provided grants to the State of California to fund the SRF as a means of addressing water system needs, especially for smaller, less affluent communities. The County has applied for SRF status for CSA No. 7 and received a ranking of C on a scale where rank A projects have the highest funding priority.

Some projects, such as water main replacement, are amenable to gradual implementation. The County may consider a slower program which would produce a gradual increase in user costs.

Table 1-2 CSA No. 7 Finance Costs for Capital Improvement Program

Priority	Item	Capital cost, dollars	Annual cost of financing, dollars[a]	Annual cost of financing per billing unit, dollars/CCF/year[b]	Annual cost of financing per billing unit, trailer park excluded, dollars/CCF/year
1	a. Redwood reservoir structure anchoring	9,600	n/a	n/a[c]	n/a[c]
	b. Reservoir flexible couplings	3,700	n/a	n/a	n/a
	c. Water treatment plant repairs	5,000	n/a	n/a	n/a
	d. Spare raw water pump	3,900	n/a	n/a	n/a
2	a. Reservoir roof repairs	3,500	n/a	n/a	n/a
	b. La Holda Creek diversion and raw water transfer pipeline	663,000	66,189	5.2	6.821
	(b. La Honda Creek diversion and raw water transfer pipeline-SRF funding)	663,000	42,932[d]	3.373	4.424
3	a. Replace 13,000 feet 2-inch PVC	286,000	28,552	2.243	2.942
	b. Replace 13,000 feet 4-inch PVC	1,016,000	101,429	7.969	10.452
	c. Replace 13,000 feet 2-inch PVC with re-route to Memory Lane	314,000	31,347	2.463	3.230
	d. Replace 13,000 feet 4-inch PVC with re-route to Memory Lane	1,117,000	111,512	8.761	11.491
	e. Pipe crossing Alpine Creek	30,000	2,995	0.235	0.309
4	a. Install new 4-inch looping main along Pescadero Road	555,000	55,407	4.353	5.710

[a]Except for Option 2b., finance cost assumes bundled 20-year COP bonds at 6.5 percent interest with a 10 percent issuance fee. For total amounts of less than 300,000, 5-year bank loans at approximately 6.5 percent would be necessary.
[b]Unit costs assume that no new connections will be made to the existing water system.
[c]All Priority 1 items and Priority 2 item a. would be funded out of the annual operating budget and not financed.
[d]Option 2b., SRF financing, is a 20-year loan at 2.6 percent interest with no issuance fee.

2

CHAPTER 2

INTRODUCTION

This chapter introduces the water master planning process for County Service Area No. 7 (CSA No. 7), including background, authorization, scope of work, and report organization.

Background and Purpose of Work

The CSA No. 7 water system has its origins in the 1920s when private developers diverted water from Alpine Creek to serve a small subdivision consisting primarily of vacation homes. The system was subsequently expanded to serve Camp Glenwood and nearby County parkland. The County of San Mateo (County) took over the system in 1958. The County has repaired and upgraded the system over the years, but such work has been done without benefit of master planning. This report provides an overall framework for water system maintenance and improvements.

Authorization

The County authorized this work through an agreement with Brown and Caldwell dated December 17, 1996.

Scope of Work

The scope of work includes the following activities:

Assessment of Existing Water System. Assemble, review, and summarize all County record information on the CSA No. 7 water system; i.e., design and/or record drawings, schematics, staff and consultant reports, repair/leakage reports, field monitoring data, and any other documentation. Meet with County engineering, operation, and maintenance staffs to obtain oral history of the system focusing on current operating practices and repair requirements. Meet with the local fire marshal to obtain copies of any hydrant testing reports and ISO reports. Meet with Department of Health Services representatives to determine if any system is failing to meet water quality requirements. Obtain water use data and estimate current and future (year 2017) average-day, maximum-day and peak-hour water demands. Determine data gathering requirements and pursue obtaining necessary information on hydrant tests, system elevations and pressure monitoring.

Carry out a detailed inspection of the CSA No. 7 system to assess the structural condition regarding Code compliance, OSHA safety compliance, physical condition, and operability.

Develop proposed design criteria based on California Title 22 and water industry standards to address storage capacity, system pressures, acceptable pipe velocities, and pressure losses. Build a CYBERNET hydraulic model for each distribution system. Run the model to determine its performance during current and buildout minimum, average-day, maximum-day, and peak-hour demands. Use CYBERNET to determine the maximum fire flow achievable at each node coincident with maximum-day demand. Also assess emergency storage and supply systems.

Develop Water System Capital Improvement Plan. Develop priorities for improving deficiencies in the existing system. Review priorities with County staff and develop an annual schedule of required capital improvements for the planning period. Evaluate financing alternatives and develop a financing plan for the district, including recommended rates and connection fees.

Data Management. Enter data generated during the study into the Hansen's Field Module for eventual transferring to Hansen's Water Module.

Master Plan Report. Prepare a water system master plan report for CSA No. 7, supported by the technical memoranda prepared as part of the previous tasks and structured to summarize the improvement projects required.

Report Organization

This report is divided into nine chapters.

- Chapter 1 provides the executive summary.
- Chapter 2 is the introduction.
- Chapter 3 describes the existing water system and the study area, including population and growth projections.
- Chapter 4 summarizes the existing and expected water system demands.
- Chapter 5 discusses existing water quality and current water quality standards.
- Chapter 6 presents the results of computer modeling of the distribution system and recommends future modifications and improvements.

- Chapter 7 reviews the existing Camp Glenwood Water Treatment Plant and recommends necessary improvements.
- Chapter 8 summarizes the costs and prioritizes the system improvements identified in Chapter 6 and Chapter 7.
- Finally, Chapter 9 presents the water rate and revenue plan for the County to finance the Capital Improvement Program described in Chapter 8.
- References, detailed cost estimates, and drinking water standards are provided in the Appendix.

3

CHAPTER 3

EXISTING SYSTEM AND STUDY AREA CHARACTERISTICS

The existing water system facilities and study area characteristics affect planning of system modifications and future system expansion. This chapter describes the factors relevant to water system planning.

EXISTING SYSTEM

County Service Area No. 7 (CSA No. 7) currently supplies water to residences, camps, and parks over a rural area of about 1.0 square mile. The water system includes a raw water diversion, raw water pipeline, and storage; a water treatment plant (WTP) with integral treated water pumping; two treated water storage reservoirs; and distribution mains or pipelines. These components are described below.

Raw Water. The present raw water source is a diversion from Alpine Creek at the Pescadero Creek Road bridge. Water is pumped directly from this diversion through a 3-inch-diameter pipeline to a 70,000-gallon raw water storage reservoir along Pescadero Creek Road. This reservoir is about 27 feet in diameter with a maximum water depth of about 16 feet. The construction year is unknown, but we suspect that it is over 40 years old. Record drawings are unavailable. The reservoir sits on redwood stringers imbedded in parallel concrete foundation walls. There is no evidence that the reservoir is anchored to the foundation. There is apparently no flexibility in piping connections for the inlet and outlet pipeline. The reservoir appears to be in reasonably good condition. However, the roof system is aging. It should be inspected regularly and replaced before it fails.

The raw water reservoir serves several important functions:

- It provides a wide spot in the pipeline, a buffer between the raw water diversion pump and the WTP supply pump.
- It allows pretreatment settling of raw water with a nominal detention time of almost 1 day at the WTP production rate.
- It serves as a raw water reserve when raw water quality deteriorates during local storm events.

There is also a water rights issue regarding the CSA No. 7 water system. As discussed in more detail in Chapter 7, serving La Honda Creek drainage residents with water from Alpine Creek has been ruled to be an illegal diversion.

Water Treatment. Constructed by the County in 1994, the Camp Glenwood Water Treatment Plant (WTP) treats the raw water from Alpine Creek using full conventional treatment at a rate of 50 gallons per minute (gpm). Table 3-1 summarizes WTP characteristics. Figure 3-1 shows the WTP flow schematic. Alum is the primary coagulant. There is also provision to add polymer to enhance solids removal. Water solids from the tube settler and backwash water are routed to a 6,000-gallon buried tank. After settling, excess water is spray irrigated on adjacent woodlands. A septic tank maintenance firm periodically removes and disposes of settled solids. Treated water is pumped directly to the distribution system after passing through a chlorine contact chamber. We review WTP performance in Chapter 5.

Water Storage. There are two treated water storage reservoirs—one constructed of redwood well over 30 years ago and one constructed of welded steel in 1967. Table 3-2 summarizes the storage reservoir characteristics. Based upon an exterior inspection by a structural engineer, the steel reservoir appears to be in good condition. It is not anchored to a foundation, but sits on a sand base. A concrete ring foundation contains the sand. The tank bottom lip sits about 2 inches below the top of the concrete ring. There is an asphalt seal over the sand around the tank base. The ratio of tank diameter to height indicates there is little chance the tank will overturn in a major earthquake. There are no record drawings available to determine the plate thickness for the reservoir shell.

The inlet/outlet pipeline for the reservoir apparently connects through the base. There is no evidence to suggest that there is flexibility in the connection between the reservoir and connecting piping. Such flexibility is particularly important during seismic events since the reservoir and connecting piping are likely to move independently.

The redwood reservoir appears to be in good condition for water storage, but the roof system apparently needs replacement. The reservoir foundation system is similar to that for the redwood raw water storage reservoir. It appears that there is some deterioration of the redwood blocks at the top of the concrete foundations. The reservoir is not anchored to its foundation. There is no flexibility where the outlet pipe connects to the reservoirs. There is a pressure reducing valve on the reservoir inlet pipeline, installed by County staff to protect the float valve that controls reservoir filling. There is a valved bypass pipeline from the reservoir inlet pipeline to the reservoir outlet pipeline.

Existing Distribution System

The existing distribution system is a simple branched network without looping, that serves residential customers along Alpine Creek and La Honda Creek. Although there is significant elevation difference along each branch, the system as a whole is not divided into pressure zones owing to the small number of connections, rugged terrain, and limited public rights of way and easements in which to construct additional water mains. Figure 3-2 is a schematic diagram of the existing water system. Figure 3-3 shows the areal extent and layout

Table 3-1 Camp Glenwood Water Treatment Plant Characteristics

Flow				
Design flow rate, gallons per minute (gpm)				50
Flocculator (vertical paddle type)				
Minimum detention time at design flow, minutes				24
Tube settler (60-degree inclined type)				
Maximum overflow rate at design flow, gallons per minute per square foot (gpm/sf)				1.25
Filter (dual- or multi-media type)				
Filtration area, square feet				16.7
Maximum filtration rate at design flow, gpm/sf				3.0
Maximum backwash rate, gpm/sf				15.0
Maximum surface wash rate, gpm/sf				3.0
Chlorine contact tank				
Minimum detention time at design flow, minutes				26
Washwater holding/decanting tanks				
Effective volume (minimum) gallons				6,000
Spray area (washwater disposal)				
Required spray area, square feet				7,000
Pumps	Number	Capacity, gallons per minute	Total dynamic head, feet	Motor size, horsepower
Intake (Alpine Creek)	1	50	295	7-1/2
Raw water feed	1	50	50	1-1/2
Treated water	1	50	260	7-1/2
Spray	1	10	150	1/2
Chemicals		Function	Dose range, milligrams per liter	
Alum (12 percent solution)		Coagulant	To 120	
Soda Ash (6 percent solution)		pH adjustment	To 60	
Polymer		Coagulant Aid	5 to 15	
Chlorine		Disinfectant	1 to 5	

Table 3-2 CSA No. 7 System Storage Characteristics

Tank and construction	Volume, gallons	Type of storage	Overflow elevation, feet	Location
RW-1: redwood	70,000	Raw water	670	Camp Glenwood WTP
T-1: welded steel	500,000	Treated water	900	above Camp Glenwood WTP
T-2: redwood	70,000	Treated water	617	Sam MacDonald Park

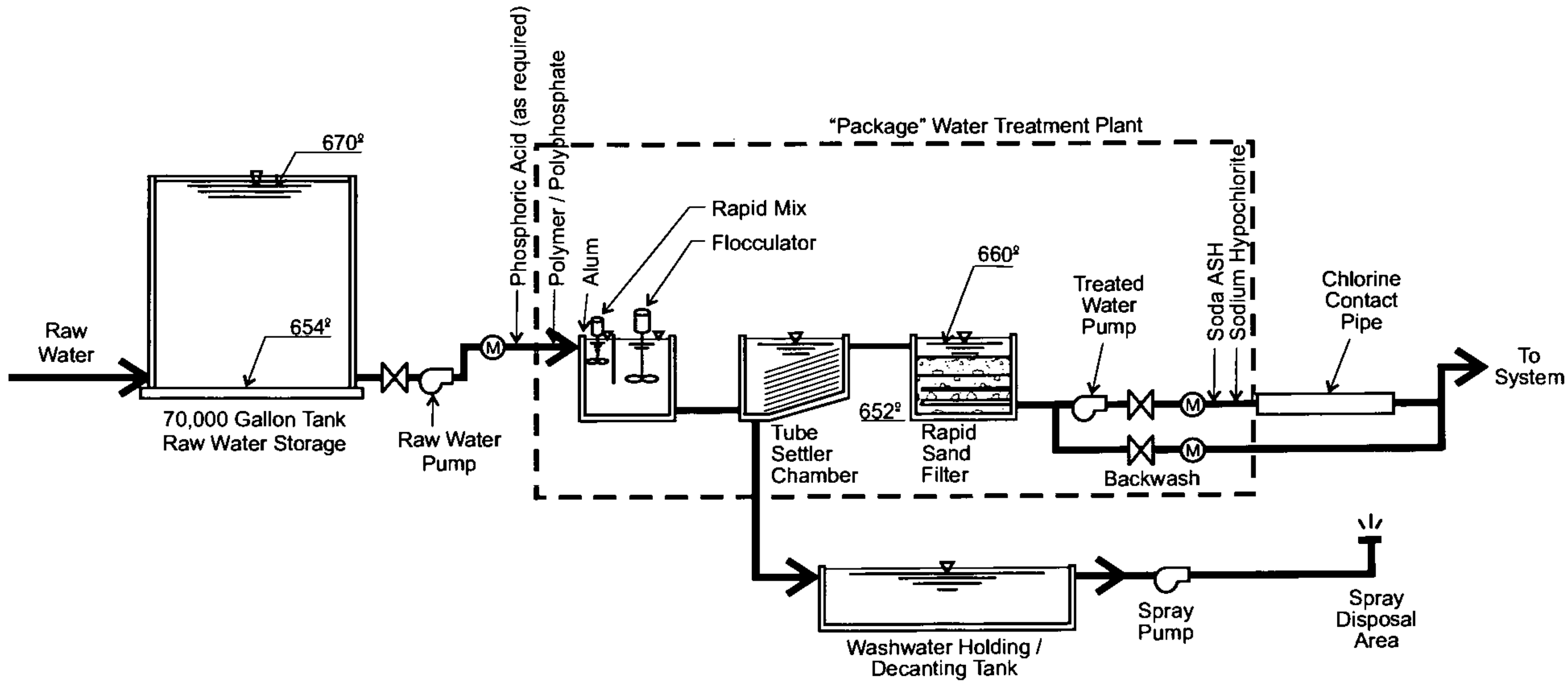


Figure 3-1
Existing Camp Glenwood Water Treatment Plant

4692_12 / LA HONDA Existing Camp Glenwood Water Treatment Plant.cdr

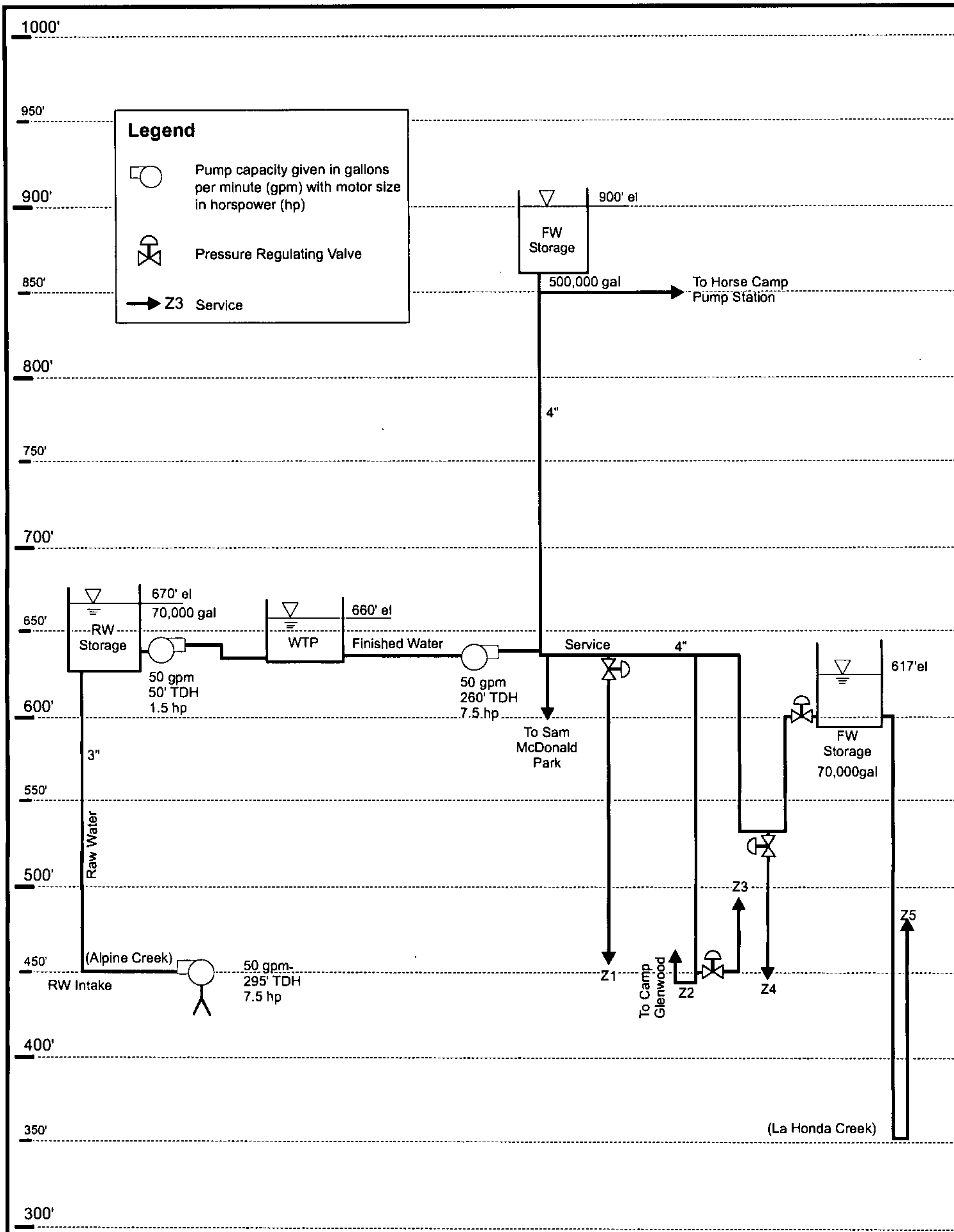
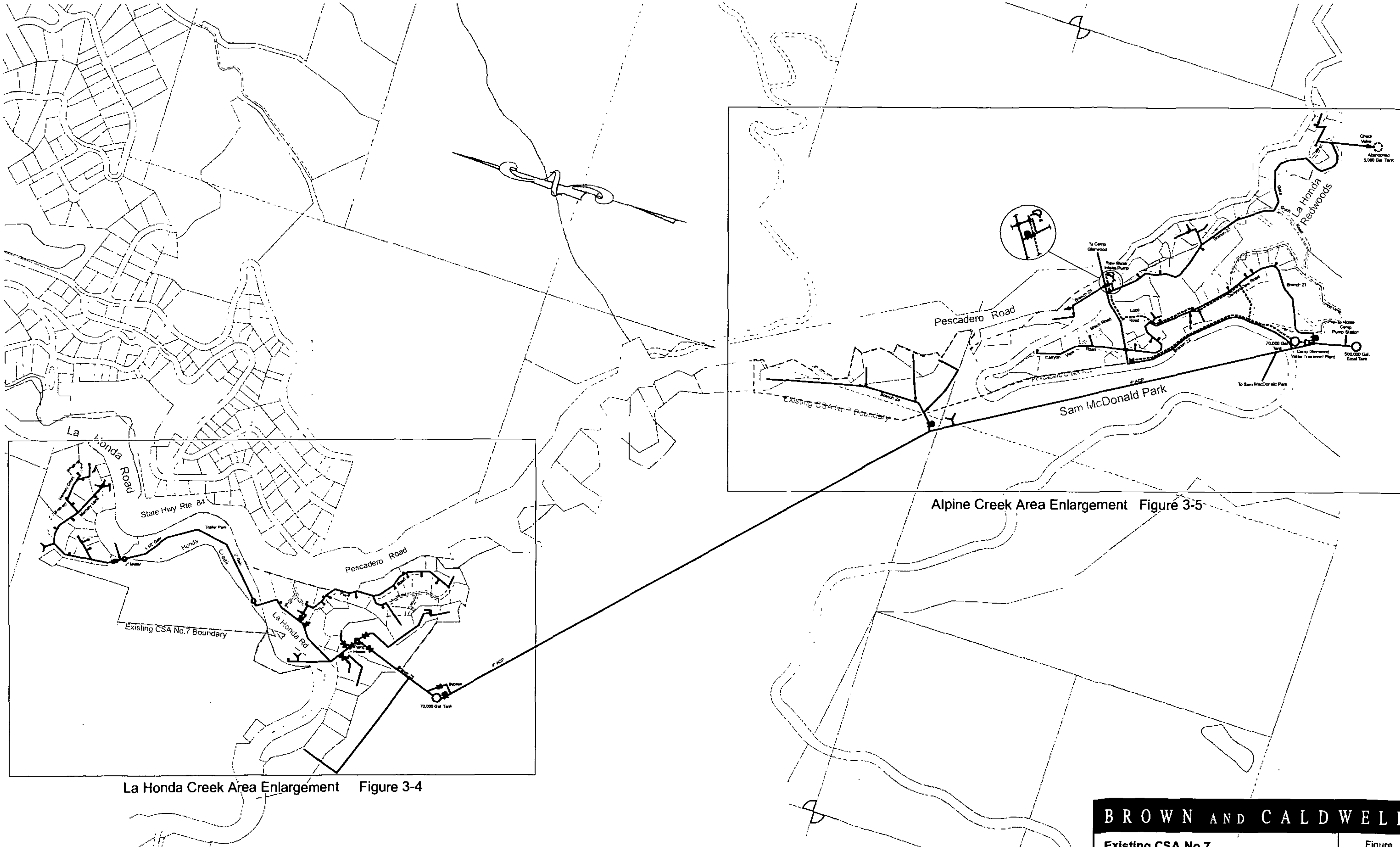


Figure 3-2
Existing CSA No.7 Water System Schematic

4692_12 / LA HONOA Existing CSA 7 Water System Schematic.CDR



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Existing CSA No.7
Water System Plan

Figure
3-3

4692_12 / LA HONDA Existing CSA 7 Water System Plan.cdr of the existing distribution system. All connections to the system are metered. The County has meters on its facilities but historically has not read meters for these facilities.

The portion of the distribution system serving customers at the southeast end of CSA No. 7 along Alpine Creek is shown on Figure 3-4. Branch Z1 serves customers on the upper switchback of Pescadero Creek Road; Branch Z2 crosses the Alpine Creek Bridge and provides service to Camp Glenwood; Branch Z3 serves customers along Alpine Road and the lower switchback of Pescadero Creek Road; and Branch Z4 provides service to four customers along the Pescadero Creek Road downstream of the Alpine Creek bridge. Figure 3-5 shows the portion of the distribution system (Branch Z5) serving customers along Memory Lane in the La Honda Creek drainage as well as customers along Pope Road on the lower reaches of Alpine Creek. As shown on the figures, several of the branch pipelines have pressure regulating valves at their high ends. These valves prevent excessive pressure at the lower ends of the branches. Table 3-3 presents a summary of the estimated demands and characteristics of each branch.

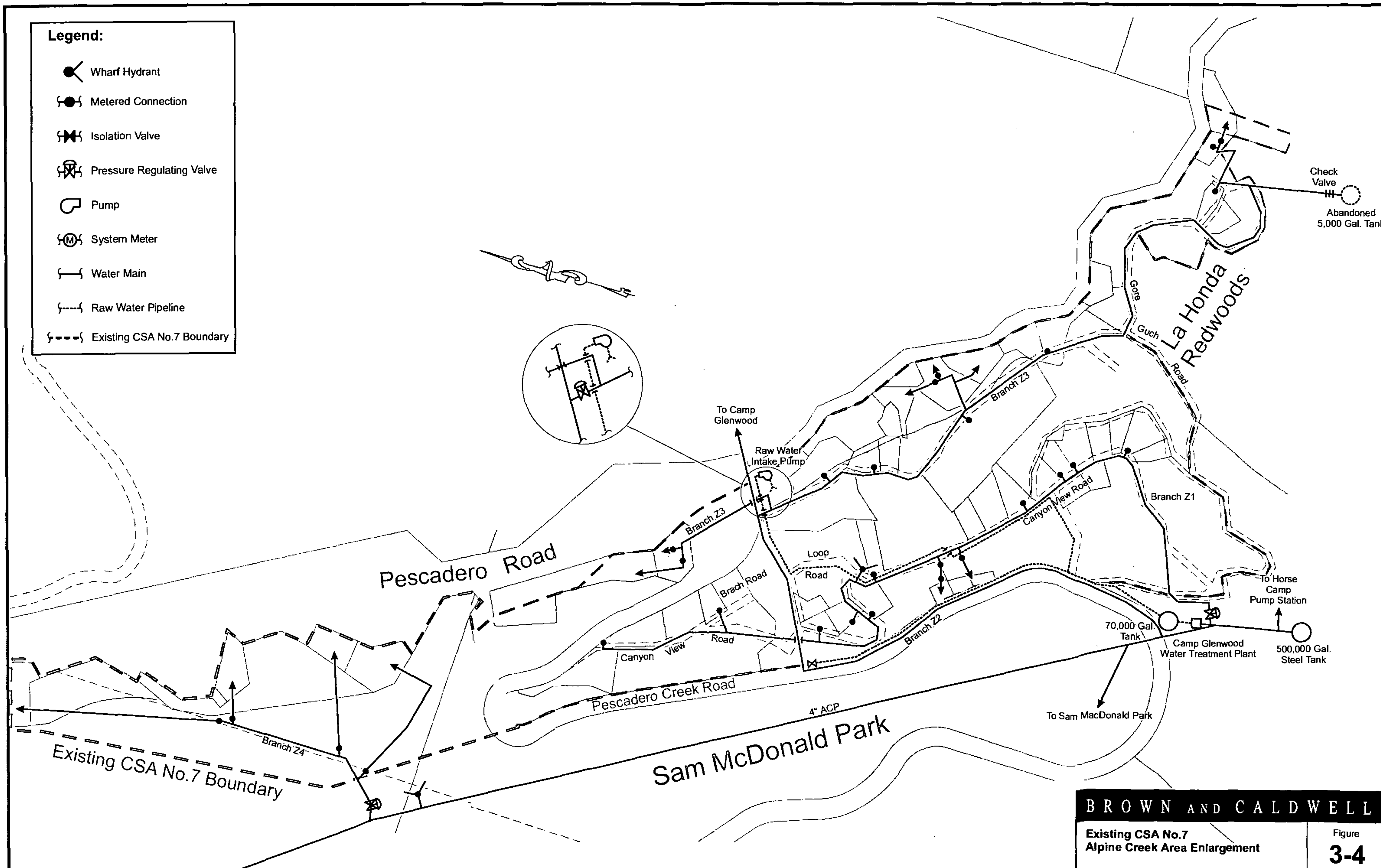
Table 3-3 Summary of Demands and Characteristics

System branch	Household service connections	Approximate average day demand, gpm	Service elevations, ft[a]	Reservoir capacity, gal	Reservoir overflow elevation, ft[a]
Z1	13	1.0	480 - 600	T-1 500,000	900
NA	Sam MacDonald Park	4.3	850	T-1 500,000	900
Z2	Camp Glenwood	4.3	450 - 600	T-1 500,000	900
Z3	12	0.90	450 - 480	T-1 500,000	900
Z4	4	0.30	390 - 400	T-1 500,000	900
Z5	40	3.0	320 - 460	T-1 & T-2 570,000	617
Z5	Trailer Park[b]	4.3	320 - 340	T-1 & T-2 570,000	617

a. Estimated elevations based on United States Geological Survey National Vertical Geodetic Datum of 1929.

b. Includes an estimated 22 household units.

Pipe materials for the CSA No. 7 include galvanized steel, cast iron, ductile iron, asbestos cement, and high-density polyethylene (HDPE). Pipe diameters range from 0.75 inches to 4 inches. According to County staff, some of the older galvanized steel pipe may have been installed in the 1920s. New pipe includes ductile iron pipe installed in 1994 when the WTP was installed and HDPE installed on Upper Memory Lane in 1996. Some pipe is buried in public roads while other pipe is laid exposed running cross-country through park land and easements. There are two distribution locations of particular concern:

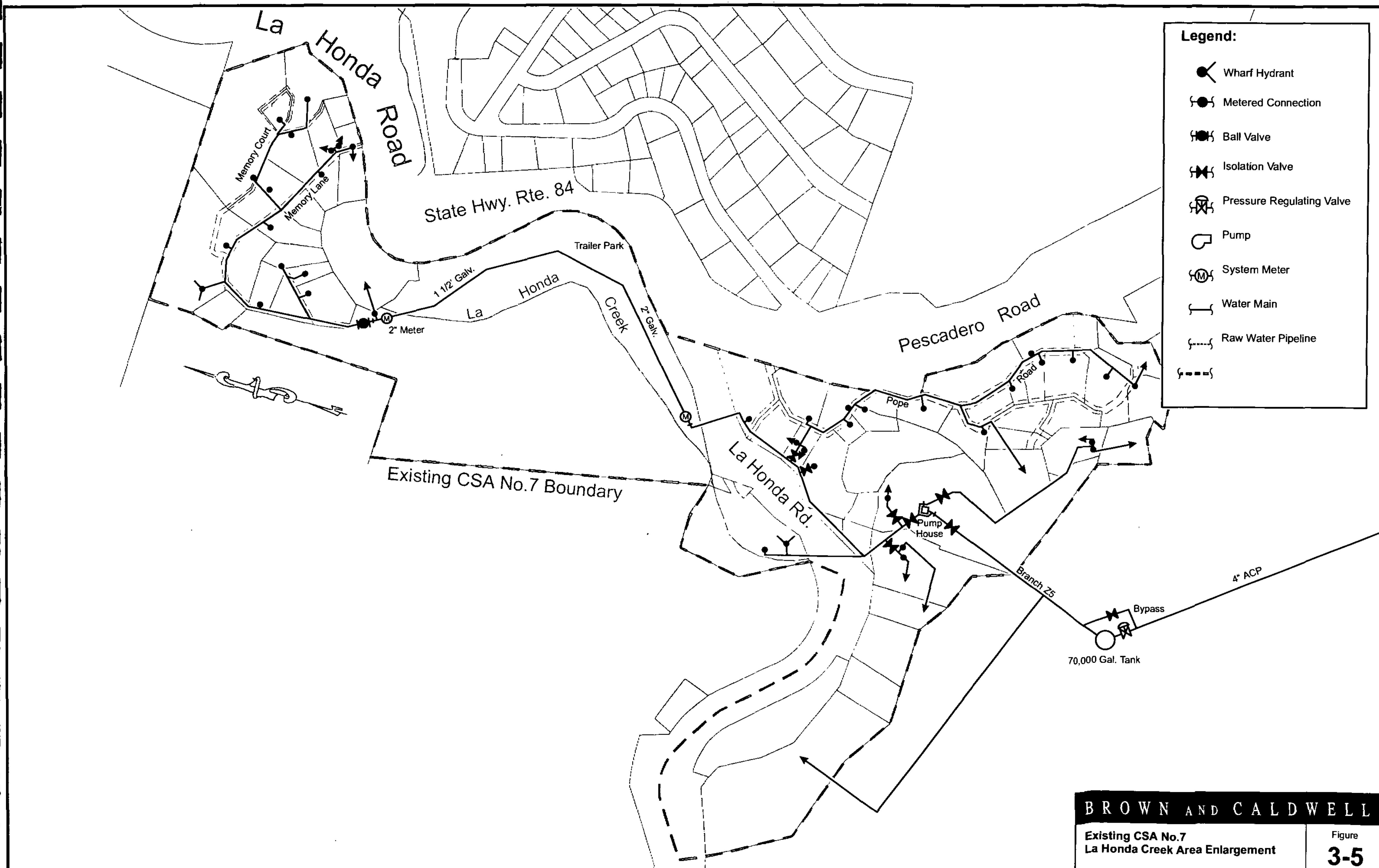


BROWN AND CALDWELL

Existing CSA No.7
Alpine Creek Area Enlargement

Figure
3-4

4692_12 / LA HONDA Existing CSA 7 Alpine Creek Area Enlargement.cdr



BROWN AND CALDWELL

Existing CSA No.7
La Honda Creek Area Enlargement

Figure
3-5

4692_12 / LA HONDA Existing CSA 7 Creek Area Enlargement.cdr

- Pipe crossing of Alpine Creek. At this location off Highway 84, a 2-inch-diameter, galvanized-steel pipe is suspended from a cable stretched between two trees. There is some evidence of erosion on the stream banks on either side. This installation would be far more secure if the pipeline were buried and armored under the stream bottom, directionally drilled under the stream bed or attached to the bridge. Such an installation requires a temporary stream encroachment permit from the California Department of Fish and Game.

- Pipeline through the "Trailer Park" area along La Honda Creek. There are several major difficulties with this situation:

  - The pipeline is on private property and is not readily accessible to County staff for maintenance.

  - There is a crossing of La Honda Creek of similar construction quality and risk to the Alpine Creek crossing.

  - At the Memory Lane end of this pipeline branch, the stream bank is eroding and pipeline integrity is at risk.

  - Metering for the "Trailer Park" is via the difference in readings between upstream and downstream meters, a situation not conducive to accurate metering.

  This situation could be corrected by installing a new water main and water meter along Highway 84, from Alpine Creek to Memory Lane.

The interior and exterior condition of the pipe is generally unknown. County staff report minor exterior corrosion failures. There are several locations where there have been multiple adjacent failures as evidenced by repair clamps on the pipes. There have also been some interior corrosion failures, usually at fittings but no reports of major plugging or loss of transmission capacity.

Overall, we judge that the condition of the distribution system is poor, given the age, pipe materials, and marginal quality of installation. As developed further in Chapter 6, the pipe diameters are small based on current water industry standards and their capacity to deliver necessary flows.

STUDY AREA CHARACTERISTICS

Current land use plans, proposed developments, and population projections are factors that together determine the pattern of future water demand throughout the system and thus the location of future system expansion. We compiled information on land use and projected population from discussions with County staff.

Study Area

For the purpose of analyzing future distribution system expansion, we defined the study area as the area encompassing all land, which may be developed through build-out and for which the County is likely to be relied upon for water service. This area includes the existing service area of about 1 square mile plus an additional 0.3 square miles of already-developed land to the north that could possibly be added to CSA No. 7. This additional area includes the La Honda School and commercial and residential areas near the intersection of Sears Ranch Road and La Honda Road.

Elevations within the study area range from 340 feet to 900 feet; however, all existing and future service connections are expected to be between 340 feet and 640 feet.

Population Forecasts and Future Development

There is currently a moratorium on new water connections in the La Honda area based upon the limited water resources of Alpine Creek and La Honda Creek. We have assumed that this condition will remain in effect throughout the planning period. Future development will be limited to remodeling and replacement of existing structures. We also expect no appreciable population growth in the study area, so future demand will be from existing connections only, and is expected to remain essentially constant.

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CHAPTER 4

WATER REQUIREMENTS

This chapter discusses future water requirements based on historical water use, population projections, and land use projections as presented in Chapter 3. The projected water requirements for average-day, maximum-day, and peak-hour demand are then used as design criteria for planning the future distribution system in Chapter 6.

Historical Water Use

Table 4-1 summarizes historical water use data. We estimated household water use using CSA No. 7 billing records from 1993 through 1997. The average daily residential demand for this period represents a flow of approximately 8.6 gallons per minute (gpm). County staff supplied the estimated average daily demand for Camp Glenwood and Sam MacDonanld Park at 8.6 gpm, with approximately half of that going to Camp Glenwood. There are no data available from which to calculate maximum-day and peak-hour demands. We have estimated factors of 1.5:1 and 3.0:1 based on data for other Peninsula systems.

Table 4-1 Estimated Water Usage for CSA No.7

Customer	Demand, units/month	Demand, gallons per minute
Households (68)	300	5.1
Camp Glenwood	250	4.3
Trailer Park	250	4.3
Sam MacDonald Park	250	4.3
Total average day	1050	17.9
Total maximum day[a]		26.9
Total peak hour[b]		53.7

a. Based on a 1.5: 1 ratio maximum day to average day.
b. Based on a 3:1 ratio peak hour to average day.

Unaccounted-for water is the difference between the actual volume of water treated and the actual metered consumption. Such losses are always present in a water system due to pipe leaks, unauthorized connections or use, meters, unmetered services such as fire protection and training, system flushing, or construction. Since metered data for actual treatment plant output unavailable and there are few data for metered water use at County-owned facilities, we were unable to estimate unaccounted-for water.

Average-Day Residential Water Requirements

We estimated average-day residential water requirements from total billed consumption. Assuming 68 household service connections in CSA No. 7, the average-day single-household demand was approximately 0.075 gpm.

Future Maximum-Day and Peak-Hour Water Requirements

Owing to the limited nature of metering records, there is no available data for estimating maximum-day and peak-hour water demands for CSA No. 7. Extreme demand conditions generally depend on a community's demographics, characteristics, and weather. Peaking is typically greater in a warmer climate such as the Central Valley. It is also greater where there are large lots with extensive water-intensive landscaping. Smaller communities usually have higher peaks than larger communities. The CSA No. 7 service area is, to a large extent, the antithesis of this situation. The climate is typically mild and there is little landscaping. Some of the residences are also still used principally as weekend or vacation retreats. These factors should tend to reduce peaking. We estimated the maximum-day factor of 1.5, which is representative for other cities on the San Francisco Peninsula. Similarly, a ratio of 3.0:1 was assumed to estimate peak-hour demand. Since no appreciable change is expected in water use, future maximum-day and future peak-hour water requirements are expected to be equal to the current peaking factor.

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CHAPTER 5

WATER SUPPLY AND WATER QUALITY

This chapter reviews water sources for the County Service Area No. 7 (CSA No. 7). It also summarizes state and federal water quality standards and reviews raw and treated water quality data for the CSA No. 7 system.

WATER SUPPLY

The CSA No. 7 water system currently draws its entire supply from Alpine Creek. This perennial creek runs over a distance of about 5 miles. La Honda Creek, also a perennial stream, runs about 6 miles. Alpine Creek and La Honda Creek join to form San Gregorio Creek about 0.2 mile below the intersection of Alpine Road and La Honda Road. We were unable to find any data on the annual or monthly discharges from Alpine Creek or La Honda Creek. The nearest United States Geological Survey gauging station is approximately 8 miles downstream on San Gregorio Creek.

According to California Superior Court Decree No. 355792, issued on January 29, 1993, CSA No. 7 must either establish a new point of diversion along La Honda Creek or otherwise provide customers holding riparian water rights from La Honda Creek with water from a source other than Alpine Creek. Options to satisfy this decree are presented in Chapter 7.

WATER QUALITY

Regulations promulgated by the Unites States Environmental Protection Agency and the State of California Department of Health Services define the water quality requirements for potable water delivered by CSA No. 7. These regulations set maximum contaminant levels (MCLs) for a wide variety of physical, chemical, biological, and radiological constituents, to ensure that it is fit to drink. Appendix C provides a complete listing of regulated substances together with the MCLs. The County of San Mateo Environmental Health Services Division oversees monitoring and enforcement of water quality requirements for the CSA No. 7 system. In addition to these requirements, CSA No. 7 must also operate its distribution system to maintain system water quality, principally by adding sufficient chlorine to have a residual of at least 0.2 milligrams per liter as the water enters the distribution system in at least 95 percent of the samples.

Owing to its small size and the cost of monitoring for many parameters, the regulations allow smaller systems such as CSA No. 7 to reduce the frequency of some monitoring when the source water quality is high and the threat of contamination is low. Table 5-1 summarizes the monitoring requirements for CSA No. 7 and notes compliance status.

Another component of maintaining potable water quality is protecting the quality of source water. The DOHS requires that water agencies survey the watersheds from which their raw water is drawn to understand land uses that might affect water quality and determine if risk reduction is prudent. No watershed sanitary survey has taken place for CSA No. 7 although Cuesta La Honda Guild Community Water System has completed such work on part of the Alpine Creek drainage.

Prior to construction of the Camp Glenwood Water Treatment Plant (WTP), CSA No. 7 was repeatedly in violation of the state water quality standards for finished water turbidity and microbiological contaminants.[1] Since the WTP began operation in 1994, the system has been in full compliance with the Surface Water Treatment Rule (SWTR) and no water quality violations have occurred. Monthly averages for raw and finished water turbidity and chlorine residual for September 1995 through January 1996 are presented in Table 5-2.

In summary, CSA No. 7 complies with current water quality requirements although some monitoring should be repeated now. To ensure future water quality and regulatory, CSA No. 7 needs to complete the following activities:

1. Carry out monitoring as required by federal and state regulations.

2. Complete a sanitary survey for the watershed building on the Cuesta La Honda Guild Community Water System work.

3. Continue to track regulatory changes for treatment of surface water sources and update treatment processes as required.

[1] Personal conversation on April 9, 1997, with San Mateo County Department of Health Services, Environmental Health Division.

Table 5-1 Required Water Quality Monitoring for CSA No. 7

Item	Frequency	Comments
General physical	Annual	Needs one more negative sampling set then should only need to sample every 9 years.
General mineral	Annual	Needs one more negative sampling set then should only need to sample every 9 years.
Asbestos	Annual	Need to take a sample at a building at or downstream of asbestos cement (AC) water pipe but as close as possible to the AC water pipe. If okay, then sample every 9 years.
Cyanide	Every 3 years	Need to take a sample. If cyanide is not detected and the system is judged to be not vulnerable to cyanide contamination, then a sampling waiver is possible.
Inorganic chemical	Annual	Need to take at least one more sample. If all constituents are less than MCL, then sample every 9 years.
Lead and copper	Annual	If samples continue to be okay, then reduced sampling schedule is possible.
Nitrate	Annual	Sampling is due.
Nitrite	Every 3 years	Sampling is due.
Total alpha	Quarterly	Needs four consecutive calendar quarters every 4 years. MCL is based on the average results from four consecutive quarters.
Synthetic organic chemical	Every 3 years	If one more sample is okay, then waiver of 3-year requirement is possible.
Volatile organic chemicals	Every 3 years	If one more sample is okay, then sampling every 6 years is possible.

Note: See Appendix C for a list of tested constituents. MCL is maximum contaminant level.

Table 5-2 Raw and Treated Water Turbidity and Treated Water Chlorine Residual for CSA No. 7, September 1995 through January 1997

	Raw water[a]			Treated water			
Month	High Turbidity (NTU)	Low Turbidity (NTU)	Average Turbidity (NTU)	High Turbidity (NTU)	Low Turbidity (NTU)	Chlorine Residual (mg/L)	Number of daily samples
Sept-95	1.85	1.14	1.33	2.00	0.12	1.61	18
Oct-95	2.06	0.84	1.31	0.25	0.15	1.75	23
Nov-95	2.84	0.98	1.75	0.38	0.18	1.50	22
Dec-95	5.00	2.70	4.06	0.25	0.20	2.70	15
Jan-96	7.61	2.86	4.24	0.58	0.11	2.20	15
Feb-96	10.86	8.22	9.14	0.26	0.18	3.60	19
Mar-96	9.99	9.30	9.90	0.23	0.11	2.85	15
Apr-96	11.4	3.01	5.39	0.50	0.05	0.50	21
May-96	7.23	2.20	3.66	0.29	0.04	2.25	16
Jun-96	4.73	1.72	2.47	0.49	0.05	0.42	13
Jul-96	2.49	1.69	1.90	0.27	0.06	0.42	15
Aug-96	22.1[a]	1.74	3.56	0.50	0.07	0.42	21
Sep-96	1.80	1.08	1.50	0.50	0.09	1.28	14
Oct-96	1.39	0.82	1.17	0.40	0.08	1.41	17
Nov-96	9.99	0.45	2.53	0.50	0.45	1.67	11
Dec-96	9.99	1.23	5.63	1.21	0.09	1.76	12
Jan -97	9.99	8.30	9.74	0.50	0.10	1.45	7
Average	7.14	2.84	3383	0.54	0.13	1.62	16
Max	22.1[b]	8.30	9.90	2.00	0.45	3.60	23
Min	1.39	0.45	1.17	0.23	0.04	0.42	7

a. Raw water turbidity only measured when plant was operating. Plant is regularly shut down during high runoff periods when turbidities are high.

b. High value during new pump installation at water intake.

c. Average of all measurements taken.

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CHAPTER 6

DISTRIBUTION SYSTEM MODIFICATIONS

In order to determine the needs for improving the County Service Area No. 7 (CSA No. 7) water distribution system, Brown and Caldwell, inspected the water storage facilities and distribution system, and modeled the water distribution system. Computer analyses were conducted to determine improvements to the distribution system to adequately serve the study area under a variety of conditions. These analyses included average-day demand, maximum-day demand, maximum-day demand with fire flow, and peak-hour demand.

DESIGN CRITERIA

Design criteria for analysis of the distribution system include projected water demand, storage, pressure requirements, and pipeline diameters. There are absolute minimum requirements defined in Title 22 of the California Code of Regulations. Table 6-1 presents the Title 22 requirements. The following sections discuss Title 22 and other design criteria.

Table 6-1 California Code of Regulations, Title 22
Distribution System Minimum Design Criteria[a]

Parameter	Criteria
Pressure	
Minimum rated pressure for pipe material	35 psig
Minimum maximum-hour pressure[b]	20 psig
Minimum pressure during fire flow under average-day demands[b]	20 psig
Minimum pressure in water main	5 psig
Maximum service connection pressure[c]	80 psig
Pipe Diameter[d]	
Minimum pipe diameter	4 inches
Minimum pipe diameter (dead-end mains > 1,000 feet in length)	6 inches
Minimum pipe diameter (dead-end mains > 2,000 feet in length)	8 inches

a. California Code of Regulations, Title 22, Chapter 16, Article 5.
b. Section 64566(b) allows for individual service connections to have operating pressures lower than 20 psig provided that, "...the user is fully advised of conditions under which minimum service may be expected and the user's agreement is secured in writing. This waiver shall be applicable only to individual service connections."
c. May require individual service connection pressure reducing valves.
d. These minimum diameters do not apply if the installation is designed under the supervision of a qualified registered engineer to meet the minimum system pressure requirements of Section 64566 (summarized in this table).
Note: psig = pounds per square inch gage.

Water Requirements

The maximum-day and peak-hour water use totals given in Chapter 4 determine design flow rates for the pipe network. The distribution of future water use over the study area is based on the assumption that the existing land use will not change appreciably due to the moratorium on new water connections.

Fire-flow requirements were imposed at "worst-case" locations under maximum-day conditions. Based on recommendations of the Insurance Services Office (ISO) and recommendations of the San Mateo County Fire Marshall, a minimum fire flow rate of 200 gallons per minute (gpm) for a 20-minute duration was used.

Storage Requirements

Treated water storage is usually located within water distribution systems to provide equalization of peak demands (i.e., to provide the difference between the maximum-day supply rate and the peak-hour demands), a reserve for fire flow, and a reserve for emergency conditions such as loss of supply or WTP disruption. There is no overall consensus within the water industry regarding storage needs for water distribution systems. Title 22 of the California Environmental Health Code provides recommendations for minimum water storage based upon the number of connections and the status of metering (metered versus unmetered systems). Figure 6-1 reproduces the figure for metered systems. Based on the water use data from Chapter 4, the system demand is equal to about 160 equivalent single-family connections. Using Figure 6-1, we calculate a storage volume of about 100,000 gallons. Another common approach is to use some multiple of average-day or maximum-day demand, plus fire flow. The multiple of average-day or maximum-day demand includes peak-hour equalization plus emergency storage. Peak-hour equalization is typically 15 to 25 percent of the maximum-day demand. Emergency storage should be sufficient to sustain the system through a reasonable outage based on consideration of raw water supply reliability, equipment reliability, availability of emergency maintenance supplies and support, and similar factors.

We determined fire protection flow requirements from discussions with the San Mateo County Fire Marshall. Though the ISO Level 8 requirement is only 200 gpm for 20 minutes, or 4,000 gallons, the Fire Marshall recommends meeting the Level 6 requirement for storage with 60,000-gallon reserve. The available reserve for CSA No. 7 is more than 9 times this amount, and is sufficient to supply a 200-gpm fire flow plus maximum-day demand for about 3 days. Using one maximum-day demand plus 4,000 gallons for fire storage produces a storage requirement of about 42,000 gallons. One maximum-day demand plus 60,000 gallons for fire storage leads to a storage requirement of about 97,000 gallons. The current storage capacity of 570,000 gallons is more than sufficient to meet these three criteria simultaneously.

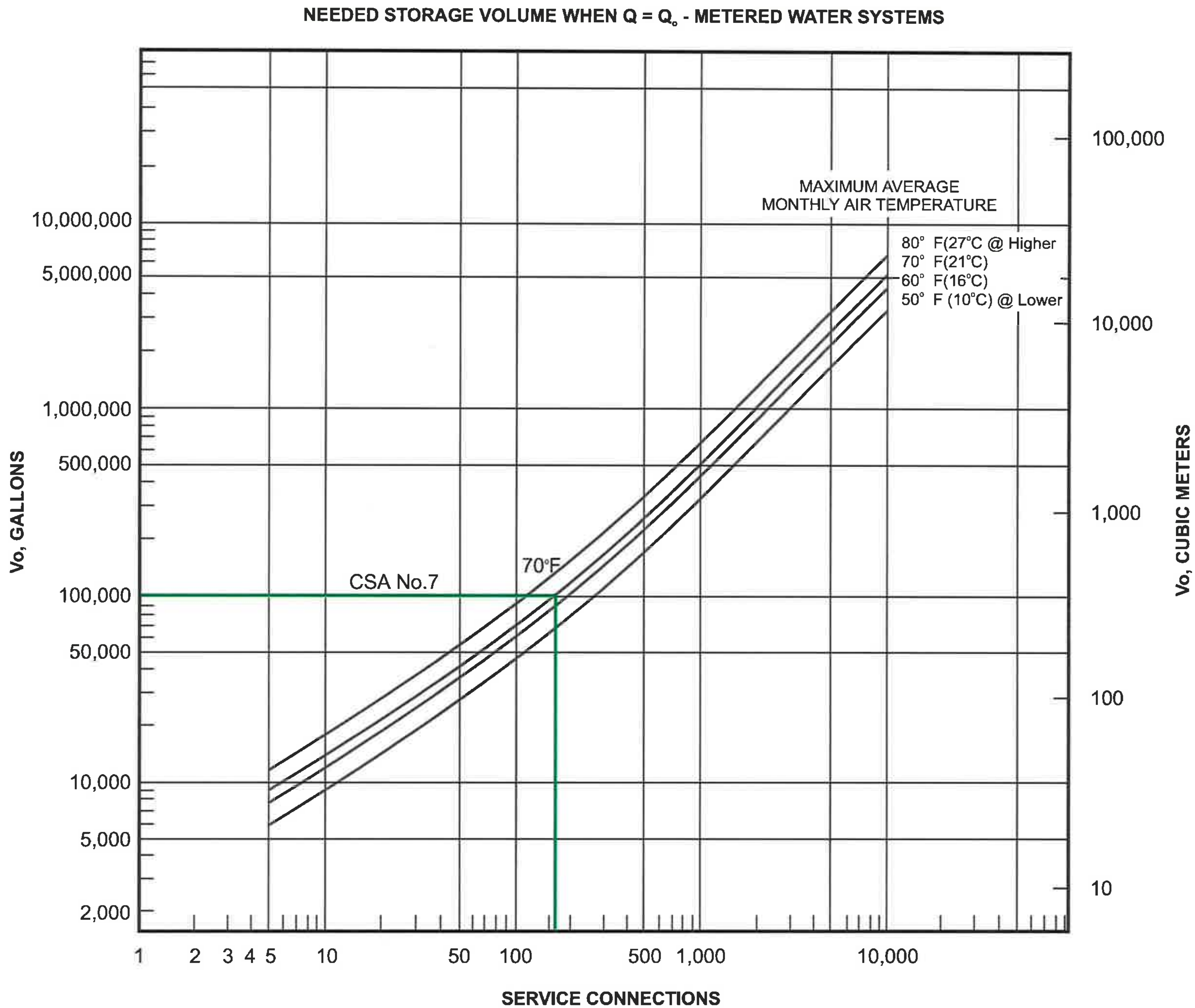

Figure 6-1 Storage Required by Title 22 California Code of Regulations

4692_12 / LA HONDA Storage Required by Title 22 California Code.cdr

Similarly reasoned, the remaining storage reserve for other emergencies such as power outages is more than adequate.

Pressure Requirements and Pipe Sizes

Pressure requirements were determined by the minimum pressure of 20 pounds per square inch gage (psig) under maximum-hour demand, and average-day demand plus fire flow, as allowed for public water systems under Title 22 of the California Environmental Health Code.[1] Many municipalities and special districts set higher minimum pressure requirements for public convenience. For example, many set a peak-hour value of 30 to 40 psig, which is sufficient to deliver good pressure for a second-floor residential shower.

The Uniform Plumbing Code (UPC) prohibits interior pressures greater than 80 psig. Fire departments typically want hydrant pressures less than 125 psig considering the safety of fire fighters. Lower maximum main pressures also reduce leakage and failure potential. Owing to the rural nature of the CSA No. 7 system and its long-established infrastructure, we think that a 20-psig minimum pressure is sufficient. However, wherever it is practically feasible, the County should endeavor to deliver a minimum pressure of 30 psig at peak hour. The system should also conform to UPC maximum interior pressure requirements.

Sizing for distribution piping or mains is driven by the need to deliver adequate flow with the required residual pressure. Typical sizing criteria include maximum headloss per 100 feet of pipeline and peak velocity. The latter criterion is particularly important because the risk for hydraulic surge ("water hammer") increases with pipe velocity. Headlosses also increase in proportion to the square of the pipe velocity.

As mentioned above, Table 6-1 presents minimum design criteria of new or renovated public water systems from Title 22. Note that design criteria for pipe diameter can deviate from Title 22 criteria if a registered professional engineer supervises the water main design.

The American Water Works Association has suggested the distribution main velocities be held to less than 5 feet per second and headlosses less than 10 feet per 1,000 feet under.

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[1] **64566. System Pressure.**

(a) Changes in distribution systems shall be designed to maintain an operating pressure at all service connections of not less than 20 pounds per square inch gage (psig) (140 kiloPascals guage (kPag)) under the following demand conditions:

(1) User maximum hour demand.

(2) User average day demand plus design fire flow.

(b) In a public water system supplying users at widely varying elevations, a water supplier may furnish a service to a user which does not comply with (a) if the user is fully advised of the conditions under which minimum service may be expected and the user's agreement is secured in writing. This waiver shall be applicable only to individual service connections.

Velocities to 10 feet per second are accepted for extreme demands such as fire flow coincident with maximum-day demand.

EXISTING SYSTEM

We used the Haestad Methods Cybernet program to build a computer model of the CSA No. 7 distribution system. The system model includes all existing distribution mains and components as shown on Figures 3-2 through 3-4. We obtained information regarding the existing system from County plans, County Assessor's maps, discussion with County staff, and field inspections. Pipe diameters not specified on the system drawings were assumed to be 2 inches. A Hazen-Williams C factor of 100 was assigned to all pipes to account for frictional losses and minor losses through valves and fittings.

FUTURE SYSTEM

This section presents an evaluation of future system needs including water storage and distribution facilities.

Water Storage

The volume of existing storage is more than adequate for existing and future water demands. All reservoirs should have flexibility; e.g., pairs of Dresser couplings, should be added to each inlet and outlet pipeline to allow more differential movement during earthquakes. Bypass pipelines should be on the pipeline side of the flexible couplings.

Seismic anchoring of the two 70,000-gallon reservoirs should be considered to prevent an entire system failure after a severe earthquake. Additionally, the roof of one tank needs repair.

Distribution System

For pipe sizing, we have considered two options:

1. Replacing all existing galvanized steel pipe with 2-inch-diameter, high density polyethylene (HDPE) or polyvinyl chloride (PVC) pipe, to maintain the current level of service.

2. Replacing all existing smaller-diameter pipe with 4-inch-diameter HDPE or PVC to improve the level of service.

We recommend that the County use a maximum pipe velocity of 10 feet per second. Headloss per 100 feet of pipe is not essential provided that flow requirements are met.

We carried out Cybernet modeling for the water system replacing existing small-diameter water pipelines with either 2-inch- or 4-inch-diameter pipe. With 2-inch-diameter pipes, system performance would be equal to or slightly better than the existing system. The system would not, however, deliver the recommended 200-gpm fire flows. With 4-inch-diameter pipes, the system performance would improve substantially, delivering a 200-gpm fire flow coincident with maximum-day demand while maintaining a 20-psig residual pressure at most locations.

To provide water service to the residents along La Honda Creek in a manner that is more consistent with current industry standards, it is recommended that the water line serving the residents along Memory Lane be rerouted from its current path through the Trailer Park to the public right-of-way along State Highway 84. The approximate location for this rerouted section is shown on Figure 6-2. This would eliminate the pipeline crossing on La Honda Creek and would provide more accurate metering of the Trailer Park consumption through a single service connection. The cost for this option is presented along with other pipeline and replacement improvements in Chapter 8.

In addition to replacement and improvement of approximately 13,000 feet of existing pipelines, it is recommended that a new looping water main, approximately 6,500 feet in length, be installed along Pescadero Road between the Alpine Creek bridge and La Honda Road. Since the existing distribution consists only of unlooped branches, completion of this loop would provide greater capacity to maintain service in remote locations in the unexpected event of pipeline or equipment failure. The approximate location for this pipeline is shown on Figure 6-3 and its capital cost is discussed in Chapter 8.

The most cost-effective suitable pipe material would be Schedule 40 PVC. Alternatively, HDPE pipe (SDR 11) could be used at slightly greater cost, as presented in Chapter 8. Pipe burial should conform to Title 22 requirements, with proper bedding and backfill. Where construction is not in roadways, it would probably be satisfactory to use properly-compacted native material for backfill.

Where there are pressure regulating valves controlling branch pipelines, the County should consider putting two valves in parallel, a smaller valve to convey up to peak-hour flows and a larger valve sized for maximum-day flows plus fire flow. This approach would avoid excessive throttling of a larger valve, causing excessive wear.

As part of installing new pipelines, the County should consult with the County Fire Marshal to select appropriate locations for wharf-hydrant-type fire hydrants.

As discussed above, the pipeline for the Memory Lane area should be rerouted along Highway 84.

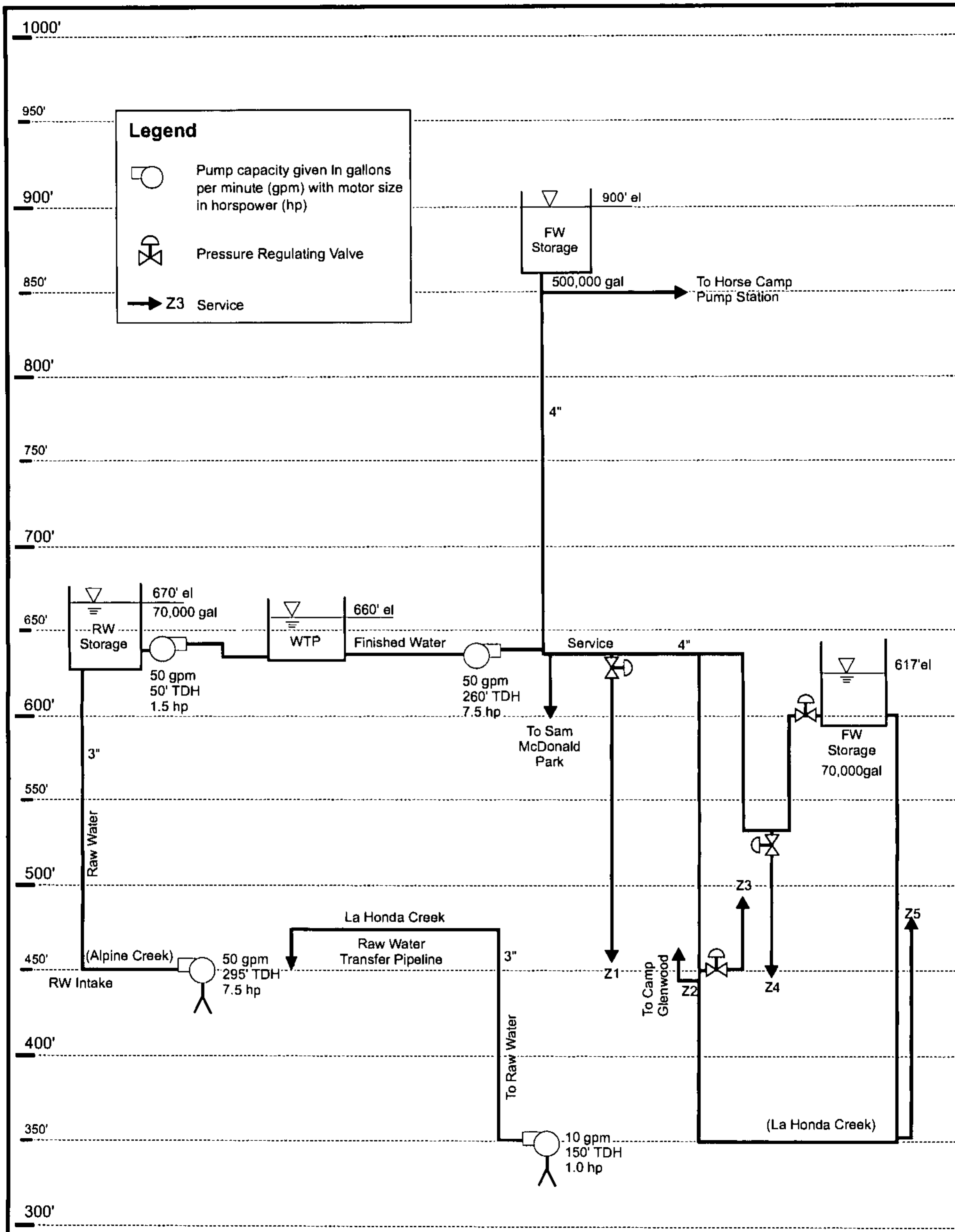
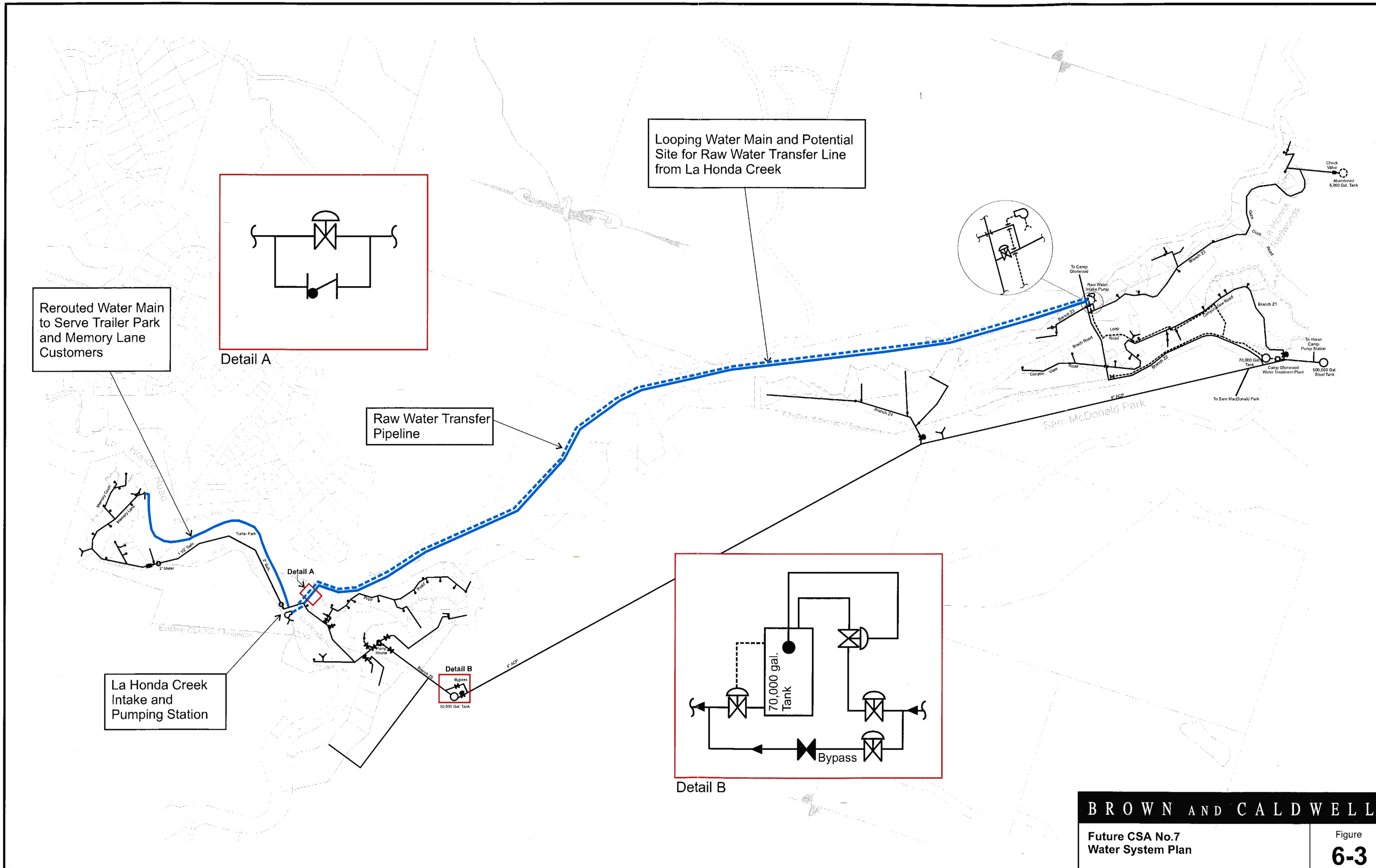


Figure 6-2
Future CSA No.7 Water System Schematic

4692_12 / LA HONDA Future CSA 7 Water System Schematic.cdr



BROWN AND CALDWELL

Future CSA No.7 Water System Plan

Figure **6-3**

7

CHAPTER 7

WATER TREATMENT MODIFICATIONS

In order to determine the needs for improving the County Service Area No. 7 (CSA No. 7) water treatment system, Brown and Caldwell evaluated the Camp Glenwood Water Treatment Plant (WTP) and also developed and compared four alternatives for serving La Honda Creek drainage residents with water from La Honda Creek.

CAMP GLENWOOD WTP

The Camp Glenwood WTP is generally in good working order. Given the increasingly stringent state and federal water quality regulations, it is highly likely that treatment processes and levels of automation will need to be improved in order to assure future regulatory compliance.

Our field inspection determined that there is minor corrosion deterioration to the electrical wiring gutter behind the chemical storage and pumping area. In addition, the chemical storage tanks need to be suitably anchored and provided with secondary containment.

Additional Water Source on La Honda Creek

In accordance with California Superior Court Decree 355792, San Mateo County Service Area No. 7 must establish either a new point of diversion along La Honda Creek or otherwise provide customers holding riparian water rights from La Honda Creek with water from a source other than Alpine Creek. Since no other suitable sources are available, diversion of La Honda Creek water will be necessary. We have developed and analyzed three options which we think should satisfy the requirement of the court decree. (For the comparison of options, the diversion structure cost is omitted since it will be required regardless of which one is chosen.)

Option 1—La Honda Creek Water to Existing Water Treatment Plant. Construct diversion structure on La Honda Creek at or near La Honda Road bridge. Pump La Honda Creek water to existing Camp Glendale Water Treatment Plant. Lay new 3-inch-diameter pipe along Pescadero Creek Road to Alpine Creek Bridge, and then alongside of the existing raw water line to tie-in with the existing (capped) La Honda Creek raw water pipe on Pescadero Creek Road.

This option requires an intake pump and installation of approximately 7, 000 feet of pipe and control cable.

Estimated capital cost: $705,000

Estimated annual O&M cost: $ 400

Option 2—La Honda Creek Water Diversion Into Alpine Creek. Construct a diversion structure on La Honda Creek at or near La Honda Road (Highway 84) bridge. Pump La Honda Creek water to the existing diversion at Alpine Creek Bridge and discharge directly into Alpine Creek through a new 3-inch-diameter pipe along Pescadero Creek Road to Alpine Creek Bridge as in Option 1.

This option requires an intake pump and installation of approximately 6,500 feet of pipe and control cable.

Estimated capital cost: $663,000

Estimated annual O&M cost: $ 200

Option 3—New La Honda Creek Water Treatment Plant. Construct a diversion structure on La Honda Creek at or near La Honda Road bridge. Acquire approximately 500 square feet of property easement and install a 10-gpm water treatment unit near the point of diversion. Pump treated water to existing 70,000-gallon storage tank in Sam MacDonald Park by connecting to distribution system at or near customer No. 25 (McCarty, APN 83-180-80).

This option requires a small intake pump, a complete 10-gpm treatment unit to meet SWTR requirements for filtration and disinfection, distribution pump, storage shed, and approximately 400 feet of 4-inch-diameter pipe to connect to the distribution system. This option also requires periodic maintenance.

Estimated capital cost: $335,000

Estimated annual O&M Cost: $ 7,000

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CHAPTER 8

CAPITAL IMPROVEMENT PROGRAM

This chapter presents the capital improvement program (CIP) for the County Service Area No. 7 (CSA No. 7). Material includes the basis for cost estimates and the CIP for each component of the system.

BASIS OF ESTIMATES

We developed cost estimates for new piping and other water system improvements using Brown and Caldwell's cost estimating data base supplemented by judgment based on site-specific factors. For all estimates, we have assumed that the County would competitively bid complete engineered designs. We also include an allowance of 30 percent for contingencies and 20 percent for engineering, legal, and administrative costs. All costs are current to the San Francisco Bay Area, spring 1997, and an ENR Construction Cost Index of 6672.

Pipelines

We developed unit costs for pipelines as follows:

	Construction cost in dollars per lineal foot for differing materials	
Diameter, inches	PVC	HDPE
2	$14	$15
4	$50	$56
4 (along Highway 84)	$52.50	$59

A cost of $200 was assumed for each tie-in to the existing system. Where construction would occur along the shoulder of Highway 84, the pipe cost estimate utilizes a lower base cost ($35/lineal foot for PVC) due to improved accessibility. This cost was increased by 50 percent to allow for traffic control and use of select bedding and backfill. For a subaqueous stream crossing of Alpine Creek, add $30,000.

Water Storage and Treatment

For CSA No. 7, modifications and/or repairs to the storage reservoirs and WTP are site-specific and unique. Therefore, we have estimated construction costs based on the special requirements for each item.

For the water storage reservoirs, we have allowed $200 for each flexible coupling. Replacing the roof on the 70,000-gallon redwood treated water storage reservoir would cost about $3,500. We estimated the cost for seismic retrofits of the redwood reservoirs at $4,800 each.

For the WTP, we estimate that minor repairs would cost $5,000. This includes application of corrosion-resistant paint to affected areas, and providing anchoring and secondary containment for the chemical storage tanks.

Cost Estimates and Priority

Table 8-1 presents the capital cost estimates for improvements to the CSA No. 7 water system. We recommend carrying out the seismic improvements to the reservoirs, minor repairs to the WTP, and purchasing a spare raw water pump as the highest priority items. Replacing the roof on the redwood reservoir and developing a La Honda Creek water source should be the second priority. Replacing water mains should be the third priority. Construction of a looping water main along Pescadero Road should be given lowest priority. However, if the County chooses to install a raw water line from La Honda Creek to meet the requirements of current water rights adjudication, the looping potable water main should be run concurrently to realize substantial savings in capital expenditure.

Table 8-1 CSA No. 7 Capital Improvement Program

Priority	Item	Capital cost, dollars[a]
1	Redwood reservoir structure anchoring	9,600
	Reservoir flexible couplings	3,700
	Water treatment plant repairs	5,000
	Spare raw water pump	3,900
2	Reservoir roof repairs	3,500
	La Honda Creek diversion and raw water transfer pipeline	663,000[b]
3	Replace water pipe, 13,000 feet, 2-inch-diameter PVC, existing location	286,000
	Replace water pipe, 13,000 feet, 4-inch-diameter PVC, existing location	1,016,000
	Replace water pipe, 13,000 feet, 2-inch-diameter PVC, including reroute to Memory Lane	314,000
	Replace, water pipe, 13,000 feet, 4-inch-diameter PVC, including reroute to Memory Lane	1,117,000
	Water pipe crossing Alpine Creek	30,000
4	Install new 4-inch-diameter PVC looping water main along Pescadero Road	555,000[c]

[a]Capital costs include contingency at 30 percent and engineering, legal, and administrative costs at 20 percent.

[b]Option 2, Chapter 7.

[c]This cost will be reduced significantly if installation occurs concurrently with the proposed La Honda Creek raw water transfer line described in Option 1 or Option 2, Chapter 7.

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CHAPTER 9

WATER RATES AND REVENUE PLAN

This chapter presents a discussion of financing needs to implement the capital improvement plan (CIP) for County Service Area No. 7 (CSA No. 7) and the associated impact on user fees.

Revenue Requirements and User Fees

Current CSA No. 7 revenues barely cover operating costs. In order to implement capital improvements for CSA No. 7 water system, the County needs to raise money. The ultimate source of such revenue is user fees. The County could raise rates over and above the money needed for yearly system operation, saving the excess until enough funds had accumulated to pay for improvements. Or the County could borrow money now and use money generated by higher user fees to repay the loan. There are several lower cost Priority 1 and Priority 2 projects which CSA No. 7 can most easily fund from annual revenues on a pay-as-you-go basis. The more costly projects will likely require loan financing since they should be implemented in the near future.

Possible sources for loans include certificates of participation (COPs) such as those issued through the Association of Bay Area Governments (ABAG), revenue bonds, and a loan from the State Revolving Fund (SRF). A SRF loan is one made available through the State of California based on a federal grant to the State. A 20-year COP in today's market typically has an interest rate of 6.5 percent and an issuance cost of 10 percent of the loan's value. The rate for revenue bonds is similar. In contrast, a SRF loan has a rate of 2.6 percent, with no issuance fee. The State makes SRF loans available based on need and system deficiencies. The County has applied for a SRF loan for CSA No. 7, and received a C classification for the La Honda Creek raw water intake and raw water transfer pipeline project. An H classification was received for pipeline replacement and other distribution system improvements. It is likely that the State will make funds available for "C" projects, but unlikely for "H" projects, at least in the near future.

Rate Impact

Per $100,000 of debt incurred, we estimate the annual repayment as follows:

Debt source	Annual repayment, dollars
COP	9,983
SRF	6,480

Since there will apparently be few, if any, new water connections in the CSA No. 7 system, user fees must generate all money needed for loan repayment. In a typical year, the CSA No. 7 residential customers receive delivery of about 53 units per household. Table 9-1 presents the estimated rate impact of various proposed capital projects. Note that using a SRF loan would lower the cost of the La Honda Creek diversion and raw water transfer line by about 35 percent. Since the La Honda diversion would be required for, and hence benefit, only users in the La Honda Creek drainage, CSA No. 7 may choose only to charge benefiting residents. Installing minimum improvement (new 2-inch-diameter pipe) would raise the current cost per unit by 50 to 60 percent.

Table 9-1. CSA No. 7 Finance Costs for Capital Improvement Program

Priority	Item	Capital cost, dollars	Annual cost of financing, dollars[a]	Annual cost of financing per billing unit, dollars/CCF/year[b]	Annual cost of financing per billing unit, trailer park excluded, dollars/CCF/year
1	a. Redwood reservoir structure anchoring	9,600	n/a	n/a[c]	n/a[c]
	b. Reservoir flexible couplings	3,700	n/a	n/a	n/a
	c. Water treatment plant repairs	5,000	n/a	n/a	n/a
	d. Spare raw water pump	3,900	n/a	n/a	n/a
2	a. Reservoir roof repairs	3,500	n/a	n/a	n/a
	b. La Holda Creek diversion and raw water transfer pipeline	663,000	66,189	5.2	6.821
	(b. La Honda Creek diversion and raw water transfer pipeline-SRF funding)	663,000	42,932[d]	3.373	4.424
3	a. Replace 13,000 feet 2-inch PVC	286,000	28,552	2.243	2.942
	b. Replace 13,000 feet 4-inch PVC	1,016,000	101,429	7.969	10.452
	c. Replace 13,000 feet 2-inch PVC with re-route to Memory Lane	314,000	31,347	2.463	3.230
	d. Replace 13,000 feet 4-inch PVC with re-route to Memory Lane	1,117,000	111,512	8.761	11.491
	e. Pipe crossing Alpine Creek	30,000	2,995	0.235	0.309
4	a. Install new 4-inch looping main along Pescadero Road	555,000	55,407	4.353	5.710

[a]Except for Option 2b., finance cost assumes bundled 20-year COP bonds at 6.5 percent interest with a 10 percent issuance fee. For total amounts of less than 300,000, 5-year bank loans at approximately 6.5 percent would be necessary.
[b]Unit costs assume that no new connections will be made to the existing water system.
[c]All Priority 1 items and Priority 2 item a. would be funded out of the annual operating budget and not financed.
[d]Option 2b., SRF financing, is a 20-year loan at 2.6 percent interest with no issuance fee.

A

APPENDIX A

REFERENCES

1. California Code of Regulations, Title 22.
2. Personal Communications with Ken Robinson, San Mateo County Department of Health Services, Environmental Health Division.
3. Personal Communications with James Fyfe, State of California Department of Health Services, Berkeley, California, and Rich Haberman, State of California Department of Health Services, Fresno, California.
4. Personal Communications with Rex Buthman, San Mateo County Fire Marshall.
5. San Mateo County Department of Public Works, records and drawings for CSA No. 7 water system.
6. Brian, Kangas and Foulk Consulting Engineers, survey data for reservoir elevations.

B

APPENDIX B

SUMMARY COST ESTIMATES

This appendix presents the cost estimates for alternatives for developing a La Honda Creek water source, presented as Options 1 through 3 in Chapter 7.

Option 1—Lay Pipe to Camp Glenwood WTP

Item	Cost, dollars
7,000 feet of 3-inch-diameter PVC @ $53/foot[a]	371,000
Intake pump, 10 gpm, 350-foot TDH	3,000
Install intake structure and pump	78,100
Subtotal	452,100
Contingency	135,600
Subtotal	587,700
Engineering/legal/administration	117,600
Total estimated capital cost	705,300

[a]Cost assumes $35/foot unit cost with a 50 percent markup to cover select bedding and backfill and traffic control.

Option 2—Lay Pipe to Existing Alpine Creek Intake

Item	Cost, dollars
6,500 feet of 3-inch-diameter PVC @ $53/foot[a]	344,500
Intake pump, 10 gpm, 150-foot TDH	2,500
Install intake structure and pump	78,100
Subtotal	425,100
Contingency	127,500
Subtotal	552,600
Engineering/legal/administration	110,500
Total estimated capital cost	663,100

[a]Cost assumes $35/foot unit cost with a 50 percent markup to cover select bedding and backfill and traffic control.

Option 3—Treatment Unit at La Honda Creek

Item	Capital Cost
Install intake structure and intake pump	78,100
Intake pump	1,000
Additional property acquisition/easement	5,000
Filter unit	79,500
Freight for filter unit	4,000
Clearwells	2,000
Hypochlorite feed system	1,500
Distribution pump	2,000
Pipe to tie-in (400 feet @$50/foot)	20,000
Miscellaneous piping	4,300
Electrical	8,600
Instrumentation	8,600
Subtotal	214,601
Contingency	64,400
Subtotal	279,00
Engineering/legal/administration	56,000
Total estimated capital cost	335,000

Option 3 Annual Operation and Maintenance Costs

Item	Annual cost, dollars
Filter unit @ $0.20/1,000 gallons	630
Hypochlorite	250
Pump power	500
Labor (2 hours/week @ $50/hour)	5,200
Total estimated capital cost	6,850

La Honda Creek Diversion and Pump Installation
(Included in Options 1, 2, and 3 above)

Item	Capital Cost
Property acquisition and easement	10,000
Creek diversion during screen installation	10,000
Excavating equipment	5,000
Screens and bedding material	15,000
Armor rock for streambed and bank (6-10 lb)	10,000
Pad installation and grouting	1,800
Locking pump cabinet	2,000
Control box (assumes 220v current available at site)	5,000
Subtotal	58,800
Contractor indirect expenses (@ 5 percent)	2,900
Subtotal	61,700
Contractor overheat (@ 15 percent)	9,300
Subtotal	71,000
Contractor profit (@ 10 percent)	7,100
Total estimated capital cost	78,100

C

APPENDIX C

DRINKING WATER STANDARDS

This appendix presents the regulated and frequently monitored constituents in drinking water based on current federal and state regulations. We report the maximum contaminant level (MCL) for each constituent where such an MCL is defined.

Table C-1 Regulated and Frequently Monitored Constituents in Treated Water

Parameters	Standard	Maximum contaminant level with concentration units (MCL)
Chemical		
Asbestos	Primary	7 MFL[a]
Total trihalomethane (TTHM)	Primary	0.1 mg/L[b]
Aluminum (Al)	Secondary	0.2 mg/L
Chloride (Cl)	Secondary	250 mg/L
Corrosivity (SI)[b]	Secondary	Noncorrosive
Fluoride (F)	Secondary	1.4 mg/L
Foaming agents (MBAS)	Secondary	0.5 mg/L
Iron (Fe)	Secondary	0.3 mg/L
Manganese (Mn)	Secondary	0.05 mg/L
Silver (Ag)	Secondary	0.1 mg/L
Sulfate (SO4)	Secondary	250 mg/L
Thiobencarb	Secondary	0.001 mg/L
Total dissolved solids (TDS)	Secondary	500 mg/L
Zinc (Zn)	Secondary	5.0 mg/L
Sodium (Na)	None	N/A[c]
Alkalinity (CaCO3)	None	N/A
pH	None	N/A
Total hardness (CaCO3)	None	N/A
EPA lead study (Pb)	Action level	0.015 mg/L at 90th percent
EPA copper study (Cu)	Action level	1.3 mg/l at 90th percent
Physical		
Color	Secondary	15 CU[d]
Odor-threshold	Secondary	3 TON[e]
Turbidity	Primary	1 NTU[f]
Microbiological		
Total coliform	Primary	>5.0 percent positive 2 cfu[g]

Notes:
a. MFL is million fibers per liter.
b. mg/L is milligrams per liter.
c. Not applicable.
d. CU is color units.
e. TON is threshold odor number.
f. NTU is nephelometric turbidity units.
g. Colony forming units.

Table C-2 Constituents Included in Raw Water Monitoring

	Maximum contaminant level with concentration units (MCL)
Inorganic Chemical	µg/L[a]
Antimony	6 µg/L[a]
Arsenic (As)	50 µg/L
Asbestos	7 MFL[b]
Barium (Ba)	2,000 µg/L
Beryllium	1 µg/L[a]
Cadmium (Cd)	5 µg/L
Chromium (Cr)	100 µg/L
Cyanide	200 µg/L
Mercury (Hg)	2 µg/L
Nickel (Ni)	100 µg/L
Nitrate	45 mg/L
Nitrite	1,000 µg/L
Nitrate + nitrate (sum as N)	10 mg/L
Selenium (Se)	50 µg/L
Sulfate (EPA proposed MCL)	500 mg/L
Thallium	2 µg/L
Regulated Organic Chemicals	(All concentrations shown as µg/L)
1,1,1-Trichloroethane (1,1,1,-TCA)	200
1,1,2,2-Tetrachloroethane	1
1,1,2-Trichloro-1,2,2-trifluoroethane	1,200
1,1,2-Trichloroethane (1,1,2-TCA)	32
1,1-Dichloroethane (1,1,-DCA)	5
1,1-Dichloroethylene (1,1-DCE)	6
1,2,4-Trichlorobenzene	70
1,2-Dibromo-3-chloropropane (DBCP)[a]	0.2
o-DCB	

Notes:
a. µg/L is micrograms per liter.
b. MFL is million fibers per liter.
c. mg/L is milligrams per liter.
d. pCi/L is pico Curies per liter.

Table C-2 Constituents Included in Raw Water Monitoring (continued)

Regulated Organic Chemicals	(All concentrations shown as μg/L)
1,2-Dichloroethane (1,2-DCA)	0.5
1,2-Dichloropropane (1,2-DCA)	5
1,3-Dichloropropene	0.5
1,4-Dichlorobenzene (p-DCB)	5
2,3,7,8-TCDD (Dioxin)	5.00E-08
2,4,5-TP Silvex	10
2,4-D	100
Alachlor (Alanex)	0.2
Aldicarb (Temix)	3
Aldicarb sulfone	4
Aldicarb sulfoxide	4
Arochlor (PCB)	0.5
Atrazine	3
Bentazon	18
Benzene	1
Carbofuran	18
Carbon tetrachloride	0.5
Chlordane	0.1
cis-1,2-Dichoroethylene	6
Dalapon	200
Di(2-ethylhexyl)adipate	500
Dieldrin	0.05
Diethylhexylphthalate (DEHP)	4
Dinoseb	7
Diquat	20
Endothall	100
Endrin	0.2
Ethylbenzene	680
Ethylene dibromide (EDB)	0.02
Glyphosate	700
Heptachlor	0.01
Heptachlor epoxide	0.01
Hexachlorobenzene	1
Hexachlorocyclopentadiene	50

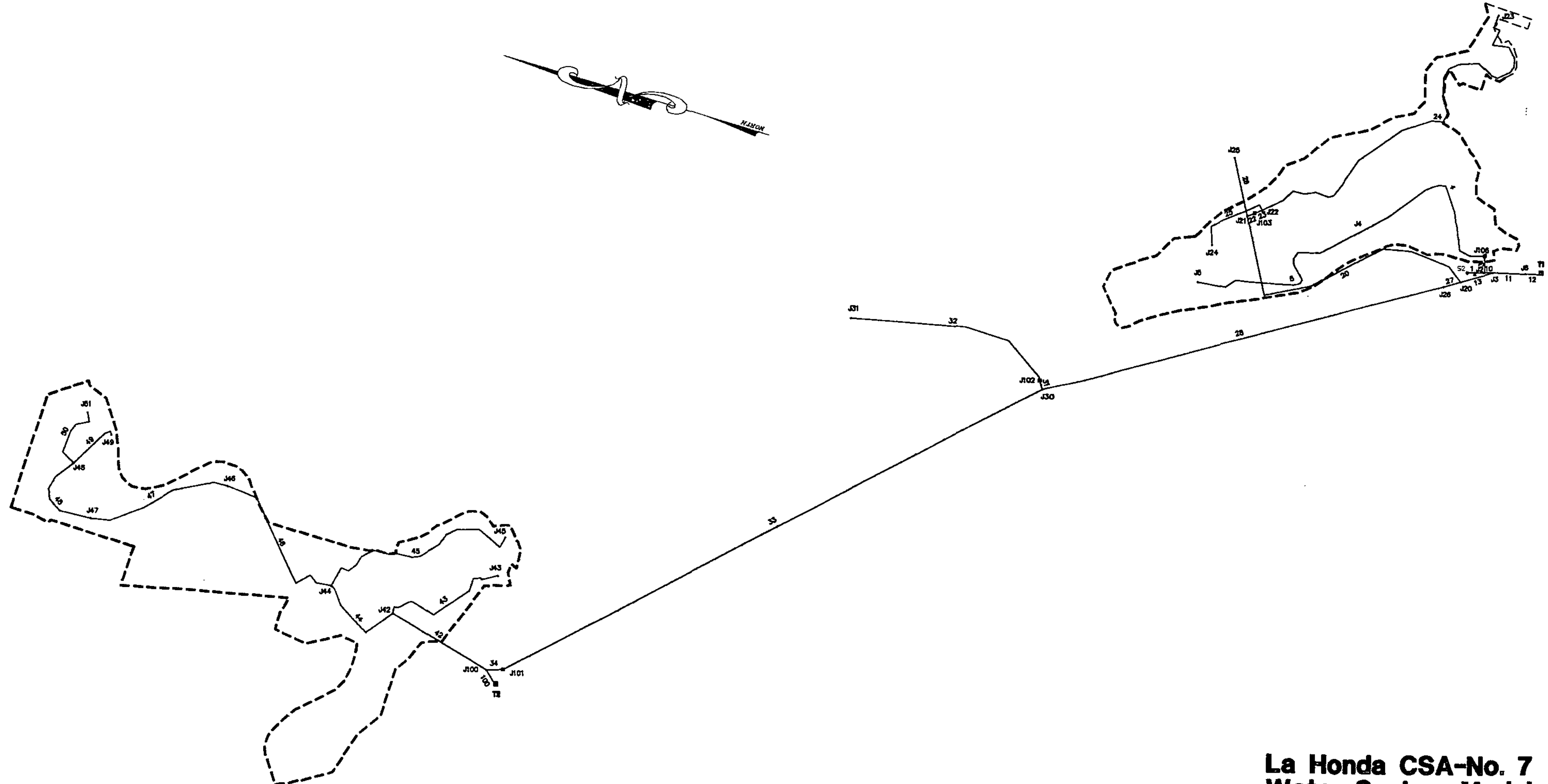
Table C-2 Constituents Included in Raw Water Monitoring (continued)

Regulated Organic Chemicals	(All concentrations shown as μg/L)
Lindane	4
Methoxychlor	100
Methylene chloride	5
Molinate	20
Monochlorobenzene	30
Oxamyl (Vydate)	200
PAHs (Benzoapyrene)	0.2
Pentachlorophenol (PCP)	1
Picloram	500
Simazine	10
Styrene	100
Tetrachloroethylene (PCE)	5.0
Thiobencarb	70
Toluene	1,000
Total xylenes (m, p, o)	1,750
Toxaphene	5
trans-1,2-Dichloroethylene	10
Trichloroethylene (TCE) (Freon™11)	5.0
Trichlorofluoromethane	150
Vinyl chloride (VC)	0.5
Radiochemistry	All concentrations shown as pCi/L[d]
Total alpha	15
Total beta	50
Strontium 90 (Sr-90)	8
Tritium (H3)	20,000
Uranium (U)	20
Combined Ra 226 & Ra 228	5
Radon 222 (+=EPA proposed)	300+

D

APPENDIX D

CYBERNET WATER MODEL



La Honda CSA-No. 7 Water System Model

EXISTING SYSTEM MODEL

Input Data File

****

S U M M A R Y O F O R I G I N A L D A T A

****

Run Description: Basic Network
Drawing: LAHONDAE

R E G U L A T I N G V A L V E D A T A

VALVE TYPE	POSITION JUNCTION	CONTROLLED PIPE	VALVE SETTING (ft or gpm)
PRV-1	101	34	615.00
PRV-1	102	32	545.00
PRV-1	103	23	630.00
PRV-1	106	4	760.00

P I P E L I N E D A T A

STATUS CODE: XX -CLOSED PIPE BN -BOUNDARY NODE PU -PUMP LINE
CV -CHECK VALVE RV -REGULATING VALVE

PIPE NUMBER	NODE NOS. #1	#2	LENGTH (ft)	DIAMETER (in)	ROUGHNESS COEFF.	MINOR LOSS COEFF.	BND-HGL (ft)
1-BNPU	0	2	12.0	4.0	130.00	0.00	660.00
3	2	106	4.0	4.0	100.00	0.00	
4-RV	106	4	1192.0	2.0	100.00	0.00	
5	4	5	1333.0	2.0	100.00	0.00	
10	3	2	56.0	4.0	130.00	0.00	
11	3	6	201.0	4.0	130.00	0.00	
12-BN	6	0	29.0	4.0	130.00	0.00	899.00
13	20	3	165.0	4.0	140.00	0.00	
20	20	21	1694.0	4.0	130.00	0.00	
22	21	103	2.0	4.0	150.00	0.00	
23-RV	103	22	4.0	4.0	100.00	0.00	
24	22	23	2270.0	2.0	100.00	0.00	
25	22	24	554.0	2.0	100.00	0.00	
26	21	25	50.0	2.0	100.00	0.00	
27	26	20	21.0	4.0	140.00	0.00	
28	30	26	2430.0	4.0	140.00	0.00	
31	30	102	10.0	4.0	150.00	0.00	
32-RV	102	31	1319.0	2.0	100.00	0.00	
33	30	101	3408.0	4.0	140.00	0.00	
34-RV	101	100	4.0	4.0	140.00	0.00	
42	42	100	675.0	2.0	100.00	0.00	
43	42	43	746.0	2.0	100.00	0.00	
44	44	42	501.0	2.0	100.00	0.00	
45	44	45	1229.0	2.0	100.00	0.00	
46	46	44	1015.0	2.0	100.00	0.00	
47	47	46	746.0	2.0	150.00	0.00	
48	48	47	522.0	2.0	100.00	0.00	
49	49	48	298.0	2.0	100.00	0.00	

50	51	48	375.0	2.0	150.00	0.00	
100-BN	100	0	10.0	2.0	100.00	0.00	615.00

P U M P   D A T A

THERE IS A PUMP IN LINE 1 DESCRIBED BY THE FOLLOWING DATA:

HEAD (ft)	FLOWRATE (gpm)
270.00	0.00
260.00	50.00
240.00	60.00

J U N C T I O N   N O D E   D A T A

JUNCTION NUMBER	JUNCTION TITLE	EXTERNAL DEMAND (gpm)	JUNCTION ELEVATION (ft)	CONNECTING PIPES		
2-1		0.33	655.00	1	3	10
3-1		0.00	655.00	10	11	13
4-1		0.66	600.00	4	5	
5-1		0.44	480.00	5		
6-1	Horse Camp	2.15	850.00	11	12	
20-1		0.00	630.00	13	20	27
21-1		0.00	450.00	20	22	26
22-1		0.44	450.00	23	24	25
23-1		0.55	460.00	24		
24-1		0.22	480.00	25		
25-1	Camp Glenwoo	4.30	450.00	26		
26-1	Sam McDonald	2.15	630.00	27	28	
30-1		0.11	540.00	28	31	33
31-1		0.33	380.00	32		
42-1		0.44	330.00	42	43	44
43-1		0.33	380.00	43		
44-1		0.44	320.00	44	45	46
45-1		0.88	360.00	45		
46-1	Trailer park	1.65	340.00	46	47	
47-1		0.44	380.00	47	48	
48-1		0.44	410.00	48	49	50
49-1		0.44	385.00	49		
51-1		0.33	460.00	50		
100-1		0.44	600.00	34	42	100
101-1	prv 4	0.00	601.00	33	34	
102-1	prv 3	0.11	540.00	31	32	
103-1	prv 2	0.00	450.00	22	23	
106-1	prv 1	0.00	655.00	3	4	

EXISTING SYSTEM MODEL

Output File:
Average Day

MAXIMUM DIMENSIONS

Number of pipes	2000
Number of pumps	500
Number junction nodes	2000
Flow meters	500
Boundary nodes	200
Variable storage tanks	500
Pressure switches	500
Regulating Valves	500
Items for limited output	2000
limit for non-consecutive numbering	20510

Cybernet version 2.18. SN: 1132182930-2000

Extended Description:

U N I T S   S P E C I F I E D

FLOWRATE .... = gallons/minute
HEAD (HGL) .... = feet
PRESSURE .... = psig

O U T P U T   O P T I O N   D A T A

OUTPUT SELECTION: ALL RESULTS ARE INCLUDED IN THE TABULATED OUTPUT

S Y S T E M   C O N F I G U R A T I O N

NUMBER OF PIPES ....(p) =	30
NUMBER OF JUNCTION NODES ....(j) =	28
NUMBER OF PRIMARY LOOPS ....(l) =	0
NUMBER OF BOUNDARY NODES ....(f) =	3
NUMBER OF SUPPLY ZONES ....(z) =	1

****
S I M U L A T I O N   R E S U L T S
****

The results are obtained after 7 trials with an accuracy = 0.00167
The regulating valves required 1 adjustments.

S I M U L A T I O N   D E S C R I P T I O N

CyberNet Version 2.18. Copyright 1991,92 Haestad Methods Inc.
Run Description: Basic Network
Drawing: LAHONDAE

PIPELINE RESULTS

STATUS CODE: XX -CLOSED PIPE BN -BOUNDARY NODE PU -PUMP LINE
CV -CHECK VALVE RV -REGULATING VALVE TK -STORAGE TANK

PIPE NUMBER	NODE NOS. #1	#2	FLOWRATE (gpm)	HEAD LOSS (ft)	PUMP HEAD (ft)	MINOR LOSS (ft)	LINE VELO. (ft/s)	HL/ 1000 (ft/ft)
THE PUMP IN LINE 1 IS OPERATING OUT OF RANGE								
1-BNPU	0	2	60.14	0.04	239.58	0.00	1.54	2.93
3	2	106	1.10	0.00	0.00	0.00	0.03	0.00
4-RV	106	4	1.10	0.10	0.00	0.00	0.11	0.08
5	4	5	0.44	0.02	0.00	0.00	0.04	0.02
10	3	2	-58.71	0.16	0.00	0.00	1.50	2.80
11	3	6	45.03	0.34	0.00	0.00	1.15	1.71
12-BN	6	0	42.88	0.05	0.00	0.00	1.09	1.57
13	20	3	-13.68	0.03	0.00	0.00	0.35	0.16
20	20	21	5.51	0.06	0.00	0.00	0.14	0.04
22	21	103	1.21	0.00	0.00	0.00	0.03	0.00
23-RV	103	22	1.21	0.00	0.00	0.00	0.03	0.00
24	22	23	0.55	0.05	0.00	0.00	0.06	0.02
25	22	24	0.22	0.00	0.00	0.00	0.02	0.00
26	21	25	4.30	0.05	0.00	0.00	0.44	1.05
27	26	20	-8.17	0.00	0.00	0.00	0.21	0.06
28	30	26	-6.02	0.09	0.00	0.00	0.15	0.04
31	30	102	0.44	0.00	0.00	0.00	0.01	0.00
32-RV	102	31	0.33	0.01	0.00	0.00	0.03	0.01
33	30	101	5.47	0.10	0.00	0.00	0.14	0.03
34-RV	101	100	5.47	0.00	0.00	0.00	0.14	0.03
42	42	100	-5.39	1.08	0.00	0.00	0.55	1.60
43	42	43	0.33	0.01	0.00	0.00	0.03	0.01
44	44	42	-4.62	0.60	0.00	0.00	0.47	1.20
45	44	45	0.88	0.07	0.00	0.00	0.09	0.06
46	46	44	-3.30	0.65	0.00	0.00	0.34	0.64
47	47	46	-1.65	0.06	0.00	0.00	0.17	0.08
48	48	47	-1.21	0.05	0.00	0.00	0.12	0.10
49	49	48	-0.44	0.00	0.00	0.00	0.04	0.02
50	51	48	-0.33	0.00	0.00	0.00	0.03	0.00
100-BN	100	0	-0.36	0.00	0.00	0.00	0.04	0.01

JUNCTION NODE RESULTS

JUNCTION NUMBER	JUNCTION TITLE	EXTERNAL DEMAND (gpm)	HYDRAULIC GRADE (ft)	JUNCTION ELEVATION (ft)	PRESSURE HEAD (ft)	JUNCTION PRESSURE (psi)
2-1		0.33	899.55	655.00	244.55	105.97
3-1		0.00	899.39	655.00	244.39	105.90
4-1		0.66	759.90	600.00	159.90	69.29
5-1		0.44	759.88	480.00	279.88	121.28
6-1	Horse Camp	2.15	899.05	850.00	49.05	21.25
20-1		0.00	899.36	630.00	269.36	116.72
21-1		0.00	899.30	450.00	449.30	194.70
22-1		0.44	630.00	450.00	180.00	78.00

23-1		0.55	629.95	460.00	169.95	73.64
24-1		0.22	630.00	480.00	150.00	65.00
25-1	Camp Glenwoo	4.30	899.25	450.00	449.25	194.68
26-1	Sam McDonald	2.15	899.36	630.00	269.36	116.72
30-1		0.11	899.27	540.00	359.27	155.69
31-1		0.33	544.99	380.00	164.99	71.49
42-1		0.44	613.92	330.00	283.92	123.03
43-1		0.33	613.91	380.00	233.91	101.36
44-1		0.44	613.32	320.00	293.32	127.10
45-1		0.88	613.25	360.00	253.25	109.74
46-1	Trailer park	1.65	612.67	340.00	272.67	118.15
47-1		0.44	612.60	380.00	232.60	100.79
48-1		0.44	612.55	410.00	202.55	87.77
49-1		0.44	612.55	385.00	227.55	98.60
51-1		0.33	612.55	460.00	152.55	66.10
100-1		0.44	615.00	600.00	15.00	6.50
101-1	prv 4	0.00	899.17	601.00	298.17	129.21
102-1	prv 3	0.11	899.27	540.00	359.27	155.69
103-1	prv 2	0.00	899.30	450.00	449.30	194.70
106-1	prv 1	0.00	899.55	655.00	244.55	105.97

R E G U L A T I N G   V A L V E   R E P O R T

VALVE TYPE	POSITION NODE	CONTROLLED PIPE	VALVE SETTING (ft or gpm)	VALVE STATUS	UPSTREAM GRADE (ft)	DOWNSTREAM GRADE (ft)	THROUGH FLOW (gpm)
PRV-1	101	34	615.00	THROTTLED	899.17	615.00	5.47
PRV-1	102	32	545.00	THROTTLED	899.27	544.99	0.33
PRV-1	103	23	630.00	THROTTLED	899.30	630.00	1.21
PRV-1	106	4	760.00	THROTTLED	899.55	759.90	1.10

S U M M A R Y   O F   I N F L O W S   A N D   O U T F L O W S

(+) INFLOWS INTO THE SYSTEM FROM BOUNDARY NODES
(-) OUTFLOWS FROM THE SYSTEM INTO BOUNDARY NODES

PIPE NUMBER	FLOWRATE (gpm)
1	60.14
12	-42.88
100	0.36

NET SYSTEM INFLOW = 60.50
NET SYSTEM OUTFLOW = -42.88
NET SYSTEM DEMAND = 17.62

**** CYBERNET SIMULATION COMPLETED ****

DATE: 4/09/1998
TIME: 11:02:57

EXISTING SYSTEM MODEL

Output File:
Peak Hour

```
+------------------------------------------------------+
|                 MAXIMUM DIMENSIONS                    |
|                                                       |
|  Number of pipes ...................... 2000          |
|  Number of pumps ......................  500          |
|  Number junction nodes................. 2000          |
|  Flow meters ..........................  500          |
|  Boundary nodes .......................  200          |
|  Variable storage tanks ...............  500          |
|  Pressure switches ....................  500          |
|  Regulating Valves.....................  500          |
|  Items for limited output ............. 2000          |
|  limit for non-consecutive numbering ..20510          |
+------------------------------------------------------+
```

Cybernet version 2.18. SN: 1132182930-2000

Extended Description:

U N I T S   S P E C I F I E D

```
FLOWRATE ............ = gallons/minute
HEAD (HGL) .......... = feet
PRESSURE ............ = psig
```

O U T P U T   O P T I O N   D A T A

OUTPUT SELECTION: ALL RESULTS ARE INCLUDED IN THE TABULATED OUTPUT

S Y S T E M   C O N F I G U R A T I O N

```
NUMBER OF PIPES ..................(p)  =   30
NUMBER OF JUNCTION NODES .........(j)  =   28
NUMBER OF PRIMARY LOOPS ..........(l)  =    0
NUMBER OF BOUNDARY NODES .........(f)  =    3
NUMBER OF SUPPLY ZONES ...........(z)  =    1
```

****
S I M U L A T I O N   R E S U L T S
****

The results are obtained after 6 trials with an accuracy = 0.00382
The regulating valves required 1 adjustments.

S I M U L A T I O N   D E S C R I P T I O N

CyberNet Version 2.18. Copyright 1991,92 Haestad Methods Inc.
Run Description: Peak Hour
Drawing: LAHONDAE

PIPELINE RESULTS

STATUS CODE: XX -CLOSED PIPE BN -BOUNDARY NODE PU -PUMP LINE
CV -CHECK VALVE RV -REGULATING VALVE TK -STORAGE TANK

PIPE NUMBER	NODE NOS. #1	#2	FLOWRATE (gpm)	HEAD LOSS (ft)	PUMP HEAD (ft)	MINOR LOSS (ft)	LINE VELO. (ft/s)	HL/ 1000 (ft/ft)
THE PUMP IN LINE 1 IS OPERATING OUT OF RANGE								
1-BNPU	0	2	60.27	0.04	239.19	0.00	1.54	2.94
3	2	106	3.85	0.00	0.00	0.00	0.10	0.03
4-RV	106	4	3.85	1.02	0.00	0.00	0.39	0.86
5	4	5	1.54	0.21	0.00	0.00	0.16	0.16
10	3	2	-55.26	0.14	0.00	0.00	1.41	2.50
11	3	6	7.45	0.01	0.00	0.00	0.19	0.06
12-BN	6	0	-0.08	0.00	0.00	0.00	0.00	0.00
13	20	3	-47.82	0.28	0.00	0.00	1.22	1.67
20	20	21	19.28	0.60	0.00	0.00	0.49	0.36
22	21	103	4.23	0.00	0.00	0.00	0.11	0.02
23-RV	103	22	4.23	0.00	0.00	0.00	0.11	0.03
24	22	23	1.92	0.54	0.00	0.00	0.20	0.24
25	22	24	0.77	0.02	0.00	0.00	0.08	0.04
26	21	25	15.05	0.54	0.00	0.00	1.54	10.70
27	26	20	-28.54	0.01	0.00	0.00	0.73	0.64
28	30	26	-21.01	0.88	0.00	0.00	0.54	0.36
31	30	102	1.54	0.00	0.00	0.00	0.04	0.00
32-RV	102	31	1.15	0.12	0.00	0.00	0.12	0.09
33	30	101	19.09	1.04	0.00	0.00	0.49	0.30
34-RV	101	100	19.09	0.00	0.00	0.00	0.49	0.30
42	42	100	-18.86	10.98	0.00	0.00	1.93	16.27
43	42	43	1.15	0.07	0.00	0.00	0.12	0.09
44	44	42	-16.17	6.13	0.00	0.00	1.65	12.23
45	44	45	3.08	0.70	0.00	0.00	0.31	0.57
46	46	44	-11.55	6.65	0.00	0.00	1.18	6.56
47	47	46	-5.77	0.64	0.00	0.00	0.59	0.86
48	48	47	-4.23	0.53	0.00	0.00	0.43	1.02
49	49	48	-1.54	0.05	0.00	0.00	0.16	0.16
50	51	48	-1.15	0.02	0.00	0.00	0.12	0.04
100-BN	100	0	-1.32	0.00	0.00	0.00	0.13	0.12

JUNCTION NODE RESULTS

JUNCTION NUMBER	JUNCTION TITLE	EXTERNAL DEMAND (gpm)	HYDRAULIC GRADE (ft)	JUNCTION ELEVATION (ft)	PRESSURE HEAD (ft)	JUNCTION PRESSURE (psi)
2-1		1.15	899.15	655.00	244.15	105.80
3-1		0.00	899.01	655.00	244.01	105.74
4-1		2.31	758.98	600.00	158.98	68.89
5-1		1.54	758.77	480.00	278.77	120.80
6-1	Horse Camp	7.52	899.00	850.00	49.00	21.23
20-1		0.00	898.74	630.00	268.74	116.45
21-1		0.00	898.13	450.00	448.13	194.19
22-1		1.54	630.00	450.00	180.00	78.00

23-1		1.92	629.46	460.00	169.46	73.43
24-1		0.77	629.98	480.00	149.98	64.99
25-1	Camp Glenwoo	15.05	897.60	450.00	447.60	193.96
26-1	Sam McDonald	7.52	898.72	630.00	268.72	116.45
30-1		0.38	897.84	540.00	357.84	155.06
31-1		1.15	544.88	380.00	164.88	71.45
42-1		1.54	604.02	330.00	274.02	118.74
43-1		1.15	603.95	380.00	223.95	97.05
44-1		1.54	597.89	320.00	277.89	120.42
45-1		3.08	597.20	360.00	237.20	102.79
46-1	Trailer park	5.78	591.24	340.00	251.24	108.87
47-1		1.54	590.60	380.00	210.60	91.26
48-1		1.54	590.07	410.00	180.07	78.03
49-1		1.54	590.02	385.00	205.02	88.84
51-1		1.15	590.05	460.00	130.05	56.36
100-1		1.54	615.00	600.00	15.00	6.50
101-1	prv 4	0.00	896.80	601.00	295.80	128.18
102-1	prv 3	0.38	897.84	540.00	357.84	155.06
103-1	prv 2	0.00	898.13	450.00	448.13	194.19
106-1	prv 1	0.00	899.15	655.00	244.15	105.80

REGULATING VALVE REPORT

VALVE TYPE	POSITION NODE	CONTROLLED PIPE	VALVE SETTING (ft or gpm)	VALVE STATUS	UPSTREAM GRADE (ft)	DOWNSTREAM GRADE (ft)	THROUGH FLOW (gpm)
PRV-1	101	34	615.00	THROTTLED	896.80	615.00	19.09
PRV-1	102	32	545.00	THROTTLED	897.84	544.88	1.15
PRV-1	103	23	630.00	THROTTLED	898.13	630.00	4.23
PRV-1	106	4	760.00	THROTTLED	899.15	758.98	3.85

SUMMARY OF INFLOWS AND OUTFLOWS

(+) INFLOWS INTO THE SYSTEM FROM BOUNDARY NODES
(-) OUTFLOWS FROM THE SYSTEM INTO BOUNDARY NODES

PIPE NUMBER	FLOWRATE (gpm)
1	60.27
12	0.08
100	1.32

NET SYSTEM INFLOW = 61.67
NET SYSTEM OUTFLOW = 0.00
NET SYSTEM DEMAND = 61.67

**** CYBERNET SIMULATION COMPLETED ****

DATE: 4/09/1998
TIME: 11:06:28

EXISTING SYSTEM MODEL

Output File:
Average Day Plus Fireflow

Cybernet Version: 2.18 SN: 1132182930 10-04-1998
Description: ave day fire flow
Drawing: E:\4692\LAHONDA\LAHONDAE

Fire Flow Summary.

JCT No.	Avg. Day Demand (gpm)	Avg. Day Pressure (psi)	Zone No.	Needed Fire Flow (gpm)	Available Fire Flow (gpm)	@Residual Pressure (psi)	Min. Zone Pressure (psi)	@JCT No.
2	0.3	102.6	1	200.3	500.0	77.6	13.9	101
3	0.0	102.5	1	200.0	500.0	80.1	13.9	101
4	0.7	69.3	1	200.7	48.0*	19.9	15.6	101
5	0.4	121.3	1	200.4	47.5*	20.0	15.6	101
6	2.2	20.8	1	202.2	181.5*	20.0	15.6	101
20	0.0	110.2	1	200.0	500.0	73.7	12.6	101
21	0.0	188.1	1	200.0	500.0	40.8	12.6	101
22	0.4	78.0	1	200.4	500.0	40.3	12.6	101
23	0.6	73.6	1	200.6	35.7*	20.0	15.6	101
24	0.2	65.0	1	200.2	70.4*	20.0	15.4	101
25	4.3	188.1	1	204.3	358.5	20.0	13.7	101
26	2.2	109.8	1	202.2	500.0	71.6	12.5	101
30	0.1	104.3	1	200.1	205.4	62.4	10.0	101
31	0.3	71.5	1	200.3	47.2*	20.0	14.4	101
42	0.4	132.6	1	200.4	70.3*	66.9	9.9	51
43	0.3	110.9	1	200.3	58.3*	20.0	12.4	101
44	0.4	136.7	1	200.4	51.6*	70.9	9.9	51
45	0.9	119.3	1	200.9	45.6*	19.8	13.1	101
46	1.7	127.7	1	201.7	36.6*	62.0	9.9	51
47	0.4	110.4	1	200.4	33.8*	44.7	10.0	51
48	0.4	97.3	1	200.4	30.7*	31.7	10.0	51
49	0.4	108.2	1	200.4	30.7*	37.2	10.0	51
51	0.3	75.7	1	200.3	27.1*	20.0	14.1	101
100	0.4	16.1	1	200.4	0.0*	16.1	15.7	101
101	0.0	15.7	1	200.0	0.0*	15.7	16.1	100
102	0.1	104.3	1	200.1	205.4	62.3	10.0	101
103	0.0	188.1	1	200.0	500.0	40.7	12.6	101
106	0.0	102.6	1	200.0	500.0	77.2	13.9	101

FUTURE SYSTEM MODEL

Input Data File:

This version of the future system was modeled by upgrading the existing system model to have all 4 inch diameter pipe with a Hazen Williams C factor of 130. The input parameters are otherwise identical to those in the existing system model.

****
S U M M A R Y   O F   O R I G I N A L   D A T A
****

CyberNet Version 2.18. Copyright 1991,92 Haestad Methods Inc.
Run Description: Basic Network
Drawing: LAHONDAE

R E G U L A T I N G   V A L V E   D A T A

VALVE TYPE	POSITION JUNCTION	CONTROLLED PIPE	VALVE SETTING (ft or gpm)
PRV-1	101	34	617.00
PRV-1	102	32	545.00
PRV-1	103	23	630.00
PRV-1	106	4	760.00

P I P E L I N E   D A T A

STATUS CODE: XX -CLOSED PIPE BN -BOUNDARY NODE PU -PUMP LINE
CV -CHECK VALVE RV -REGULATING VALVE

PIPE NUMBER	NODE NOS. #1	#2	LENGTH (ft)	DIAMETER (in)	ROUGHNESS COEFF.	MINOR LOSS COEFF.	BND-HGL (ft)
1-BNPU	0	2	12.0	4.0	130.00	0.00	660.00
3	2	106	4.0	4.0	100.00	0.00	
4-RV	106	4	1192.0	4.0	130.00	0.00	
5	4	5	1333.0	4.0	130.00	0.00	
10	3	2	56.0	4.0	130.00	0.00	
11	3	6	201.0	4.0	130.00	0.00	
12-BN	6	0	29.0	4.0	130.00	0.00	899.00
13	20	3	165.0	4.0	140.00	0.00	
20	20	21	1694.0	4.0	130.00	0.00	
22	21	103	2.0	4.0	150.00	0.00	
23-RV	103	22	4.0	4.0	100.00	0.00	
24	22	23	2270.0	4.0	130.00	0.00	
25	22	24	554.0	4.0	130.00	0.00	
26	21	25	50.0	4.0	130.00	0.00	
27	26	20	21.0	4.0	140.00	0.00	
28	30	26	2430.0	4.0	140.00	0.00	
31	30	102	10.0	4.0	150.00	0.00	
32-RV	102	31	1319.0	4.0	130.00	0.00	
33	30	101	3408.0	4.0	140.00	0.00	
34-RV	101	100	4.0	4.0	140.00	0.00	
42	42	100	675.0	4.0	130.00	0.00	
43	42	43	746.0	4.0	130.00	0.00	
44	44	42	501.0	4.0	130.00	0.00	
45	44	45	1229.0	4.0	130.00	0.00	
46	46	44	1015.0	4.0	130.00	0.00	
47	47	46	746.0	4.0	130.00	0.00	
48	48	47	522.0	4.0	130.00	0.00	
49	49	48	298.0	4.0	130.00	0.00	

50	51	48	375.0	4.0	130.00	0.00	
100-BN	100	0	10.0	4.0	130.00	0.00	615.00

PUMP DATA

THERE IS A PUMP IN LINE 1 DESCRIBED BY THE FOLLOWING DATA:

HEAD (ft)	FLOWRATE (gpm)
270.00	0.00
260.00	50.00
240.00	60.00

JUNCTION NODE DATA

JUNCTION NUMBER	JUNCTION TITLE	EXTERNAL DEMAND (gpm)	JUNCTION ELEVATION (ft)	CONNECTING PIPES		
2-1		0.33	655.00	1	3	10
3-1		0.00	655.00	10	11	13
4-1		0.66	600.00	4	5	
5-1		0.44	480.00	5		
6-1	Horse Camp	2.15	850.00	11	12	
20-1		0.00	630.00	13	20	27
21-1		0.00	450.00	20	22	26
22-1		0.44	450.00	23	24	25
23-1		0.55	460.00	24		
24-1		0.22	480.00	25		
25-1	Camp Glenwoo	4.30	450.00	26		
26-1	Sam McDonald	2.15	630.00	27	28	
30-1		0.11	540.00	28	31	33
31-1		0.33	380.00	32		
42-1		0.44	330.00	42	43	44
43-1		0.33	380.00	43		
44-1		0.44	320.00	44	45	46
45-1		0.88	360.00	45		
46-1	Trailer park	1.65	340.00	46	47	
47-1		0.44	380.00	47	48	
48-1		0.44	410.00	48	49	50
49-1		0.44	385.00	49		
51-1		0.33	460.00	50		
100-1		0.44	0.00	34	42	100
101-1	prv 4	0.00	601.00	33	34	
102-1	prv 3	0.11	540.00	31	32	
103-1	prv 2	0.00	450.00	22	23	
106-1	prv 1	0.00	655.00	3	4	

FUTURE SYSTEM MODEL

Output File:
Average Day

```
+----------------------------------------------------+
|              MAXIMUM DIMENSIONS                    |
|                                                    |
|   Number of pipes ..................... 2000       |
|   Number of pumps .....................  500       |
|   Number junction nodes................ 2000       |
|   Flow meters .........................  500       |
|   Boundary nodes ......................  200       |
|   Variable storage tanks ..............  500       |
|   Pressure switches ...................  500       |
|   Regulating Valves....................  500       |
|   Items for limited output ............ 2000       |
|   limit for non-consecutive numbering ..20510      |
+----------------------------------------------------+
```

Cybernet version 2.18.   SN: 1132182930-2000

Extended Description:

U N I T S   S P E C I F I E D

```
FLOWRATE ............ = gallons/minute
HEAD (HGL) .......... = feet
PRESSURE ............ = psig
```

O U T P U T   O P T I O N   D A T A

OUTPUT SELECTION: ALL RESULTS ARE INCLUDED IN THE TABULATED OUTPUT

S Y S T E M   C O N F I G U R A T I O N

```
NUMBER OF PIPES ...................(p)  =   30
NUMBER OF JUNCTION NODES ..........(j)  =   28
NUMBER OF PRIMARY LOOPS ...........(l)  =    0
NUMBER OF BOUNDARY NODES ..........(f)  =    3
NUMBER OF SUPPLY ZONES ............(z)  =    1
```

```
************************************
 S I M U L A T I O N   R E S U L T S
************************************
```

The results are obtained after 5 trials with an accuracy = 0.00000
The regulating valves required   1 adjustments.

S I M U L A T I O N   D E S C R I P T I O N

CyberNet Version 2.18. Copyright 1991,92 Haestad Methods Inc.
Run Description: Basic Network
Drawing: LAHONDAE

PIPELINE RESULTS

STATUS CODE: XX -CLOSED PIPE BN -BOUNDARY NODE PU -PUMP LINE
CV -CHECK VALVE RV -REGULATING VALVE TK -STORAGE TANK

PIPE NUMBER	NODE NOS. #1	#2	FLOWRATE (gpm)	HEAD LOSS (ft)	PUMP HEAD (ft)	MINOR LOSS (ft)	LINE VELO. (ft/s)	HL/1000 (ft/ft)
THE PUMP IN LINE 1 IS OPERATING OUT OF RANGE								
1-BNPU	0	2	62.98	0.04	231.01	0.00	1.61	3.19
3	2	106	1.10	0.00	0.00	0.00	0.03	0.00
4-RV	106	4	1.10	0.00	0.00	0.00	0.03	0.00
5	4	5	0.44	0.00	0.00	0.00	0.01	0.00
10	3	2	-61.55	0.17	0.00	0.00	1.57	3.06
11	3	6	-231.61	7.15	0.00	0.00	5.91	35.58
12-BN	6	0	-233.76	1.05	0.00	0.00	5.97	36.20
13	20	3	-293.16	7.92	0.00	0.00	7.48	47.99
20	20	21	5.51	0.06	0.00	0.00	0.14	0.04
22	21	103	1.21	0.00	0.00	0.00	0.03	0.00
23-RV	103	22	1.21	0.00	0.00	0.00	0.03	0.00
24	22	23	0.55	0.00	0.00	0.00	0.01	0.00
25	22	24	0.22	0.00	0.00	0.00	0.01	0.00
26	21	25	4.30	0.00	0.00	0.00	0.11	0.02
27	26	20	-287.65	0.97	0.00	0.00	7.34	46.34
28	30	26	-285.50	111.04	0.00	0.00	7.29	45.70
31	30	102	0.44	0.00	0.00	0.00	0.01	0.00
32-RV	102	31	0.33	0.00	0.00	0.00	0.01	0.00
33	30	101	284.95	155.18	0.00	0.00	7.27	45.53
34-RV	101	100	284.95	0.18	0.00	0.00	7.27	45.53
42	42	100	-5.39	0.02	0.00	0.00	0.14	0.03
43	42	43	0.33	0.00	0.00	0.00	0.01	0.00
44	44	42	-4.62	0.01	0.00	0.00	0.12	0.03
45	44	45	0.88	0.00	0.00	0.00	0.02	0.00
46	46	44	-3.30	0.01	0.00	0.00	0.08	0.01
47	47	46	-1.65	0.00	0.00	0.00	0.04	0.00
48	48	47	-1.21	0.00	0.00	0.00	0.03	0.00
49	49	48	-0.44	0.00	0.00	0.00	0.01	0.00
50	51	48	-0.33	0.00	0.00	0.00	0.01	0.00
100-BN	100	0	279.12	0.50	0.00	0.00	7.13	50.27

JUNCTION NODE RESULTS

JUNCTION NUMBER	JUNCTION TITLE	EXTERNAL DEMAND (gpm)	HYDRAULIC GRADE (ft)	JUNCTION ELEVATION (ft)	PRESSURE HEAD (ft)	JUNCTION PRESSURE (psi)
2-1		0.33	890.97	655.00	235.97	102.25
3-1		0.00	890.80	655.00	235.80	102.18
4-1		0.66	760.00	600.00	160.00	69.33
5-1		0.44	760.00	480.00	280.00	121.33
6-1	Horse Camp	2.15	897.95	850.00	47.95	20.78
20-1		0.00	882.88	630.00	252.88	109.58
21-1		0.00	882.82	450.00	432.82	187.56
22-1		0.44	630.00	450.00	180.00	78.00

23-1		0.55	630.00	460.00	170.00	73.67
24-1		0.22	630.00	480.00	150.00	65.00
25-1	Camp Glenwoo	4.30	882.82	450.00	432.82	187.55
26-1	Sam McDonald	2.15	881.91	630.00	251.91	109.16
30-1		0.11	770.86	540.00	230.86	100.04
31-1		0.33	545.00	380.00	165.00	71.50
42-1		0.44	615.48	330.00	285.48	123.71
43-1		0.33	615.48	380.00	235.48	102.04
44-1		0.44	615.47	320.00	295.47	128.04
45-1		0.88	615.47	360.00	255.47	110.70
46-1	Trailer park	1.65	615.45	340.00	275.45	119.36
47-1		0.44	615.45	380.00	235.45	102.03
48-1		0.44	615.45	410.00	205.45	89.03
49-1		0.44	615.45	385.00	230.45	99.86
51-1		0.33	615.45	460.00	155.45	67.36
100-1		0.44	615.50			
101-1	prv 4	0.00	615.68	601.00	14.68	6.36
102-1	prv 3	0.11	770.86	540.00	230.86	100.04
103-1	prv 2	0.00	882.82	450.00	432.82	187.56
106-1	prv 1	0.00	890.97	655.00	235.97	102.25

R E G U L A T I N G   V A L V E   R E P O R T

VALVE TYPE	POSITION NODE	CONTROLLED PIPE	VALVE SETTING (ft or gpm)	VALVE STATUS	UPSTREAM GRADE (ft)	DOWNSTREAM GRADE (ft)	THROUGH FLOW (gpm)
PRV-1	101	34	617.00	WIDE OPEN	615.68	615.50	284.95
PRV-1	102	32	545.00	THROTTLED	770.86	545.00	0.33
PRV-1	103	23	630.00	THROTTLED	882.82	630.00	1.21
PRV-1	106	4	760.00	THROTTLED	890.97	760.00	1.10

S U M M A R Y   O F   I N F L O W S   A N D   O U T F L O W S

(+) INFLOWS INTO THE SYSTEM FROM BOUNDARY NODES
(-) OUTFLOWS FROM THE SYSTEM INTO BOUNDARY NODES

PIPE NUMBER	FLOWRATE (gpm)
1	62.98
12	233.76
100	-279.12

NET SYSTEM INFLOW = 296.74
NET SYSTEM OUTFLOW = -279.12
NET SYSTEM DEMAND = 17.62

**** CYBERNET SIMULATION COMPLETED ****

DATE: 4/09/1998
TIME: 15:30:23

FUTURE SYSTEM MODEL

Output File:
Peak Hour

```
+----------------------------------------------------+
|                MAXIMUM DIMENSIONS                  |
|                                                    |
|   Number of pipes ...................... 2000      |
|   Number of pumps ......................  500      |
|   Number junction nodes................. 2000      |
|   Flow meters ..........................  500      |
|   Boundary nodes .......................  200      |
|   Variable storage tanks ...............  500      |
|   Pressure switches ....................  500      |
|   Regulating Valves.....................  500      |
|   Items for limited output ............ 2000      |
|   limit for non-consecutive numbering ..20510      |
+----------------------------------------------------+
```

Cybernet version 2.18. SN: 1132182930-2000

Extended Description:

UNITS SPECIFIED

```
FLOWRATE ............ = gallons/minute
HEAD (HGL) .......... = feet
PRESSURE ............ = psig
```

OUTPUT OPTION DATA

OUTPUT SELECTION: ALL RESULTS ARE INCLUDED IN THE TABULATED OUTPUT

SYSTEM CONFIGURATION

```
NUMBER OF PIPES ....................(p) =   30
NUMBER OF JUNCTION NODES ..........(j) =   28
NUMBER OF PRIMARY LOOPS ...........(l) =    0
NUMBER OF BOUNDARY NODES ..........(f) =    3
NUMBER OF SUPPLY ZONES ............(z) =    1
```

```
*************************************
SIMULATION  RESULTS
*************************************
```

The results are obtained after 5 trials with an accuracy = 0.00000
The regulating valves required   1 adjustments.

SIMULATION DESCRIPTION

CyberNet Version 2.18. Copyright 1991,92 Haestad Methods Inc.
Run Description: Peak Hour
Drawing: LAHONDAE

PIPELINE RESULTS

STATUS CODE: XX -CLOSED PIPE BN -BOUNDARY NODE PU -PUMP LINE
CV -CHECK VALVE RV -REGULATING VALVE TK -STORAGE TANK

PIPE NUMBER	NODE NOS. #1	#2	FLOWRATE (gpm)	HEAD LOSS (ft)	PUMP HEAD (ft)	MINOR LOSS (ft)	LINE VELO. (ft/s)	HL/ 1000 (ft/ft)
THE PUMP IN LINE 1 IS OPERATING OUT OF RANGE								
1-BNPU	0	2	63.49	0.04	229.47	0.00	1.62	3.24
3	2	106	3.85	0.00	0.00	0.00	0.10	0.03
4-RV	106	4	3.85	0.02	0.00	0.00	0.10	0.02
5	4	5	1.54	0.00	0.00	0.00	0.04	0.00
10	3	2	-58.49	0.16	0.00	0.00	1.49	2.78
11	3	6	-253.20	8.44	0.00	0.00	6.46	41.97
12-BN	6	0	-260.73	1.28	0.00	0.00	6.66	44.31
13	20	3	-311.69	8.87	0.00	0.00	7.96	53.76
20	20	21	19.28	0.60	0.00	0.00	0.49	0.36
22	21	103	4.23	0.00	0.00	0.00	0.11	0.02
23-RV	103	22	4.23	0.00	0.00	0.00	0.11	0.03
24	22	23	1.92	0.01	0.00	0.00	0.05	0.00
25	22	24	0.77	0.00	0.00	0.00	0.02	0.00
26	21	25	15.05	0.01	0.00	0.00	0.38	0.23
27	26	20	-292.41	1.00	0.00	0.00	7.47	47.77
28	30	26	-284.88	110.60	0.00	0.00	7.27	45.51
31	30	102	1.54	0.00	0.00	0.00	0.04	0.00
32-RV	102	31	1.15	0.00	0.00	0.00	0.03	0.00
33	30	101	282.96	153.18	0.00	0.00	7.22	44.95
34-RV	101	100	282.96	0.18	0.00	0.00	7.22	44.95
42	42	100	-18.86	0.23	0.00	0.00	0.48	0.34
43	42	43	1.15	0.00	0.00	0.00	0.03	0.00
44	44	42	-16.17	0.13	0.00	0.00	0.41	0.26
45	44	45	3.08	0.01	0.00	0.00	0.08	0.01
46	46	44	-11.55	0.14	0.00	0.00	0.29	0.14
47	47	46	-5.77	0.03	0.00	0.00	0.15	0.04
48	48	47	-4.23	0.01	0.00	0.00	0.11	0.02
49	49	48	-1.54	0.00	0.00	0.00	0.04	0.00
50	51	48	-1.15	0.00	0.00	0.00	0.03	0.00
100-BN	100	0	262.55	0.45	0.00	0.00	6.70	44.88

JUNCTION NODE RESULTS

JUNCTION NUMBER	JUNCTION TITLE	EXTERNAL DEMAND (gpm)	HYDRAULIC GRADE (ft)	JUNCTION ELEVATION (ft)	PRESSURE HEAD (ft)	JUNCTION PRESSURE (psi)
2-1		1.15	889.43	655.00	234.43	101.59
3-1		0.00	889.28	655.00	234.28	101.52
4-1		2.31	759.98	600.00	159.98	69.32
5-1		1.54	759.97	480.00	279.97	121.32
6-1	Horse Camp	7.52	897.72	850.00	47.72	20.68
20-1		0.00	880.41	630.00	250.41	108.51
21-1		0.00	879.80	450.00	429.80	186.25
22-1		1.54	630.00	450.00	180.00	78.00

23-1		1.92	629.99	460.00	169.99	73.66
24-1		0.77	630.00	480.00	150.00	65.00
25-1	Camp Glenwoo	15.05	879.79	450.00	429.79	186.24
26-1	Sam McDonald	7.52	879.41	630.00	249.41	108.08
30-1		0.38	768.81	540.00	228.81	99.15
31-1		1.15	545.00	380.00	165.00	71.50
42-1		1.54	615.22	330.00	285.22	123.59
43-1		1.15	615.22	380.00	235.22	101.93
44-1		1.54	615.09	320.00	295.09	127.87
45-1		3.08	615.07	360.00	255.07	110.53
46-1	Trailer park	5.78	614.95	340.00	274.95	119.14
47-1		1.54	614.92	380.00	234.92	101.80
48-1		1.54	614.91	410.00	204.91	88.79
49-1		1.54	614.91	385.00	229.91	99.63
51-1		1.15	614.91	460.00	154.91	67.13
100-1		1.54	615.45			
101-1	prv 4	0.00	615.63	601.00	14.63	6.34
102-1	prv 3	0.38	768.81	540.00	228.81	99.15
103-1	prv 2	0.00	879.80	450.00	429.80	186.25
106-1	prv 1	0.00	889.43	655.00	234.43	101.59

REGULATING VALVE REPORT

VALVE TYPE	POSITION NODE	CONTROLLED PIPE	VALVE SETTING (ft or gpm)	VALVE STATUS	UPSTREAM GRADE (ft)	DOWNSTREAM GRADE (ft)	THROUGH FLOW (gpm)
PRV-1	101	34	617.00	WIDE OPEN	615.63	615.45	282.96
PRV-1	102	32	545.00	THROTTLED	768.81	545.00	1.15
PRV-1	103	23	630.00	THROTTLED	879.80	630.00	4.23
PRV-1	106	4	760.00	THROTTLED	889.43	759.98	3.85

SUMMARY OF INFLOWS AND OUTFLOWS

(+) INFLOWS INTO THE SYSTEM FROM BOUNDARY NODES
(-) OUTFLOWS FROM THE SYSTEM INTO BOUNDARY NODES

PIPE NUMBER	FLOWRATE (gpm)
1	63.49
12	260.73
100	-262.55

NET SYSTEM INFLOW = 324.22
NET SYSTEM OUTFLOW = -262.55
NET SYSTEM DEMAND = 61.67

**** CYBERNET SIMULATION COMPLETED ****

DATE: 4/09/1998
TIME: 15:30:25

FUTURE SYSTEM MODEL

Output File:
Average Day Plus Fireflow

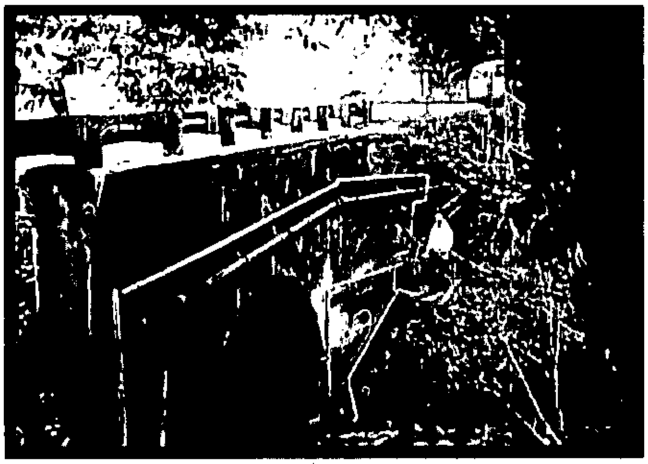
Cybernet Version: 2.18 SN: 1132182930 10-04-1998
Description: ave day fire flow
Drawing: E:\4692\LAHONDA\LAHONDAF

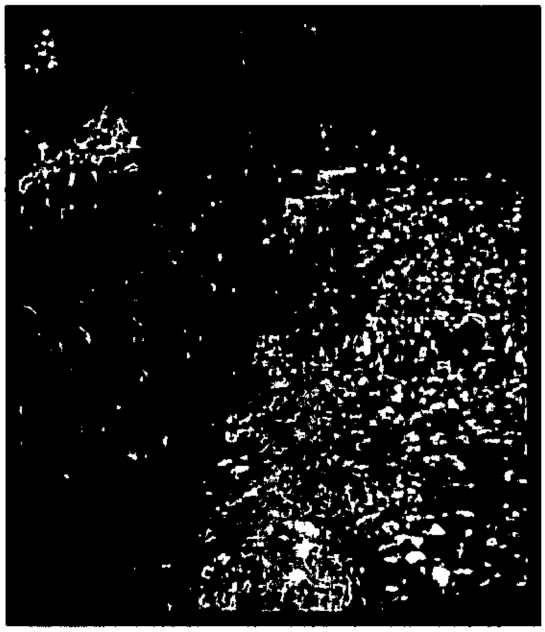
Fire Flow Summary.

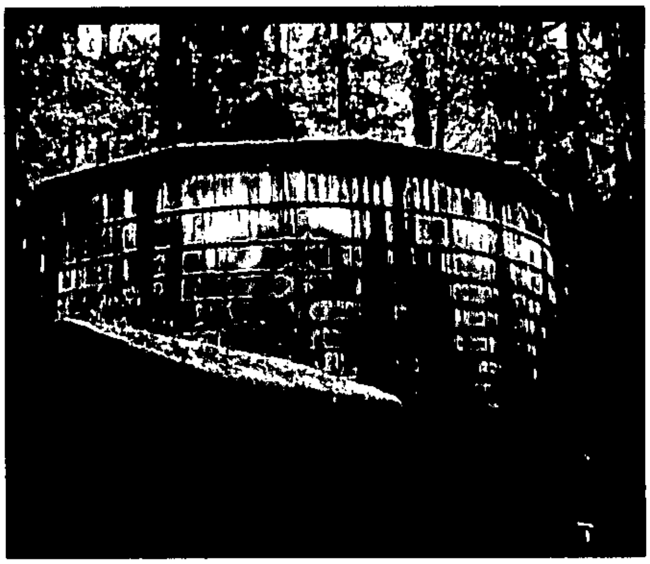
JCT No.	Avg. Day Demand (gpm)	Avg. Day Pressure (psi)	Zone No.	Needed Fire Flow (gpm)	Available Fire Flow (gpm)	@Residual Pressure (psi)	Min. Zone Pressure (psi)	@JCT No.
2	0.3	102.3	1	200.3	500.0	76.9	17.9	6
3	0.0	102.2	1	200.0	500.0	79.4	17.9	6
4	0.7	69.3	1	200.7	393.7	20.0	18.7	6
5	0.4	121.3	1	200.4	387.5	20.0	18.7	6
6	2.2	20.8	1	202.2	169.9*	20.0	65.0	24
20	0.0	109.6	1	200.0	500.0	72.7	18.1	6
21	0.0	187.6	1	200.0	500.0	39.8	18.1	6
22	0.4	78.0	1	200.4	500.0	39.3	18.1	6
23	0.6	73.7	1	200.6	290.8	20.0	19.4	6
24	0.2	65.0	1	200.2	452.3	20.0	18.4	6
25	4.3	187.6	1	204.3	500.0	36.6	18.1	6
26	2.2	109.2	1	202.2	500.0	70.6	18.1	6
30	0.1	100.0	1	200.1	500.0	29.1	20.1	6
31	0.3	71.5	1	200.3	382.2	20.0	20.1	6
42	0.4	123.7	1	200.4	500.0	79.2	20.8	6
43	0.3	102.0	1	200.3	468.8	20.0	20.8	6
44	0.4	128.0	1	200.4	425.2	70.7	10.0	51
45	0.9	110.7	1	200.9	372.0	20.0	20.8	6
46	1.7	119.4	1	201.7	303.4	62.0	10.0	51
47	0.4	102.0	1	200.4	259.1	44.7	10.0	51
48	0.4	89.0	1	200.4	237.2	31.7	10.0	51
49	0.4	99.9	1	200.4	237.3	37.7	10.0	51
51	0.3	67.4	1	200.3	202.1	20.0	20.8	6
100	0.4	6.7	2	200.4	0.0*	0.0	0.0	0
101	0.0	6.4	2	200.0	0.0*	0.0	0.0	0
102	0.1	100.0	1	200.1	500.0	28.6	20.1	6
103	0.0	187.6	1	200.0	500.0	39.7	18.1	6
106	0.0	102.3	1	200.0	500.0	76.5	17.9	6

County of San Mateo

April 1998







County Service Area No. 7
La Honda Water System
Master Plan

BROWN AND CALDWELL