GROVELAND COMMUNITY SERVICES DISTRICT

Water Distribution System Improvements

ENGINEERING DESIGN REPORT

May 2017

Prepared by:

AM Consulting Engineers

5150 N Sixth St, Suite 124

Fresno CA 93710

TABLE OF CONTENTS

List of Tables

List of Figures

ABBREVIATIONS

AWS	Alternative Water Source
AWWA	American Water Works Association
CDP	Census Designated Place
CEQA	California Environmental Quality Act
CFS	Cubic Feet per Second
CSD	Community Services District
CT	Contact Time
DAC	Disadvantaged Community
DBPR	Disinfection Byproducts Rules
District	Groveland Community Services District
GCSD	Groveland Community Services District
GPH	Gallons per Hour
GPM	Gallons per Minute
HP	Horsepower
LF	Linear Feet
MG	Million Gallons
MG/L	Milligram per Liter
MHI	Median Household Income
NEPA	National Environmental Policy Act
PLC	Programmable Logic Controller
PRV	Pressure Reducing Valve
PSI	Pounds per Square Inch
PVC	Polyvinyl Chloride
ROW	Right-of-Way
SCADA	Supervisory Control and Data Acquisition
SDAC	Severely Disadvantaged Community
SWRCB	State Water Resources Control Board
UV	Ultraviolet Light
VFD	Variable Frequency Drive

SECTION 1 - INTRODUCTION

1.1. Purpose of this Preliminary Engineering Report

The purpose of this Engineering Report (Report) is to provide a comprehensive evaluation of the existing condition of the Groveland Community Services District (District) Water Distribution System within the Groveland and Pine Oak Flat areas, and to identify improvements necessary to provide adequate water service.

The preparation of this Engineering Report is being funded by the State Water Resources Control Board (SWRCB) through a Planning Grant. The contents of this report are intended to satisfy the plan of study prepared for that grant.

1.2. Background

The Groveland CSD is located on the western slope of the Sierra Nevada Mountains due east from San Francisco. GCSD is in Tuolumne County, 30 miles south of Sonora and 26 miles from the west entrance to Yosemite National Park. GCSD provides water service to the communities of Groveland, Big Oak Flat and Pine Mountain Lake. In the 2010 Census, the communities of Groveland and Big Oak Flat were combined into a Census Designated Place (CDP) and the community of Pine Mountain Lake was a separate CDP. Table 2-1 provides the 2010 US Census Population and the 2010-2014 Median Household Income by the most recent American community survey.

Table 1-1 Median Household Income

CDP	Population	MHI
Groveland-Big Oak Flat	601	$31,932
Pine Mountain Lake	2,796	$51,604
Total	3,397	$48,124*
*: Weighted Average		

According to the MHI in Table 1-1, Groveland and Big Oak Flat are Severely Disadvantaged Communities (SDACs). The weighted average of the MHI also classifies the entire GCSD area as a DAC. The current monthly residential water rate consists of a fixed service charge dependent on the size of connection, bond/debt charges, and an addition usage charge (see water and sewer rate schedule in Appendix A) The rate schedule details the volume usage charge, which is determined based on metered water use. The minimum monthly rate is $50.64 which is slightly less than 1.5% of the MHI ($56.14), an affordability indicator used by most state and federal funding agencies. There are no additional water costs such as assessments.

The District provides water service to approximately 3,123 connections including residents and businesses. The District's water distribution system consists of laterals and approximately 70 miles of water mains. The water distribution system is divided into 11 pressure zones divided by location and elevation. The water system receives routine maintenance by District Staff. A detailed description of the District's water system is included in the following section.

SECTION 2 - PROJECT PLANNING AREA

2.1. Location

The Groveland Community Service District is a special District formed by the State of California, spanning approximately 15 square miles in southern Tuolumne County, located in the Central Sierra Nevada Mountains. The District is bounded on the north by the Tuolumne River, on the south by Mariposa County, on the east by Stanislaus National Forest, and on the west by Moccasin. The District consists of three areas of concentrated population: Groveland, Big Oak Flat, and Pine Mountain Lakes. This report is limited to planned improvements to the water distribution system within the Groveland and Big Oak Flat areas, with some additional improvements located near White Gulch Rd. to the southeast of Groveland.

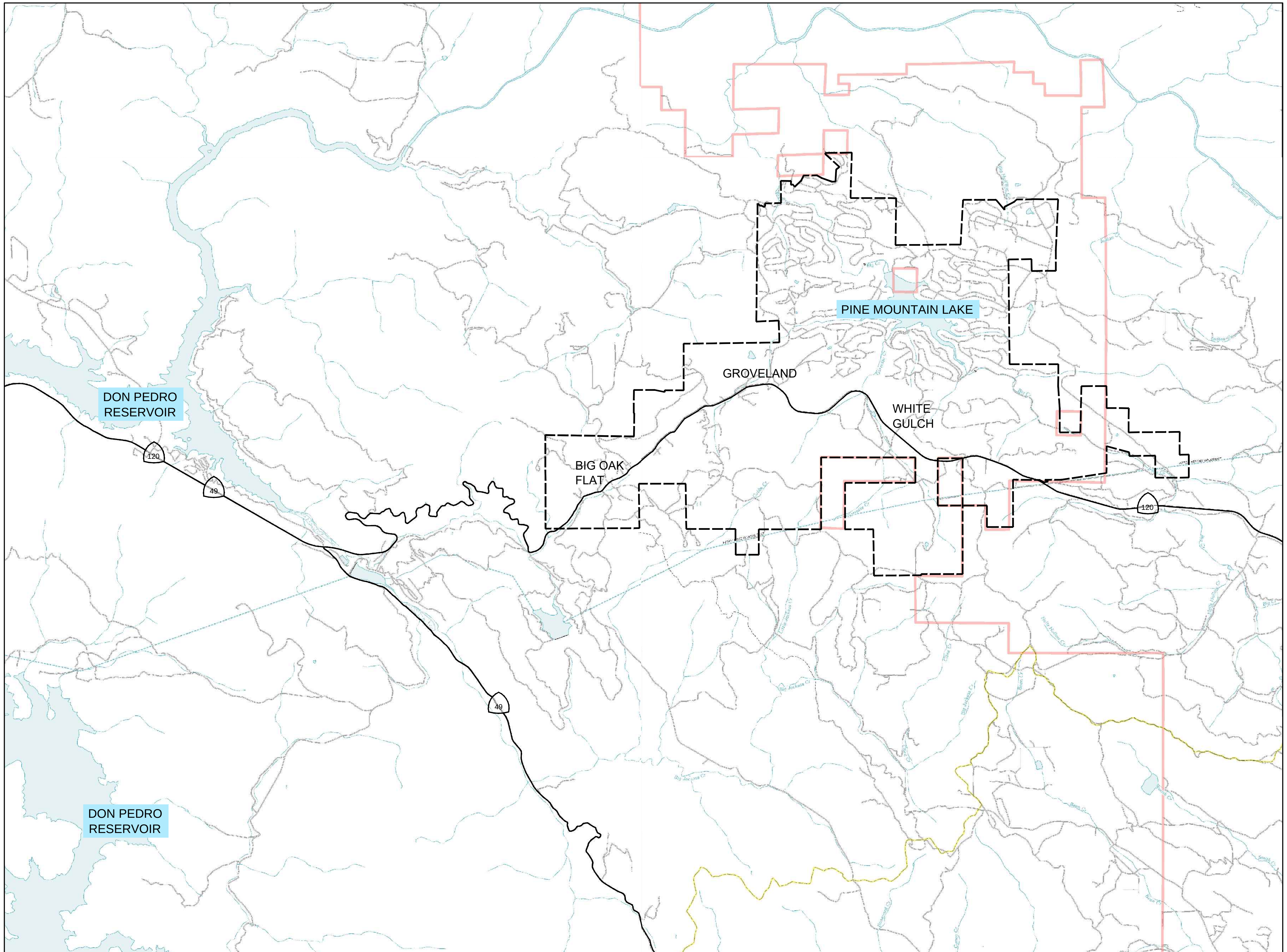
2.2. Environmental Resources

This water system improvements project includes primarily the replacement and rehabilitation of public water mains in existing public rights-of-way (ROW). Biological and cultural resources will be conducted for the project area in accordance with CEQA/NEPA requirements. It is not anticipated that impacts to wetlands, floodplains, farmland, historic resources, or endangered species will be part of the project. Some disturbance to trees and roots may take place. A Notice of Exemption will be prepared and filed for this project.

2.3. Growth Areas and Population

Figure 2-1 shows the current District Service Area. The district covers approximately 15 square miles, some of which is undeveloped and not served by the water distribution system. The distribution system within Groveland and Big Oak Flat covers a much smaller area. The total population of the district is 3,414. The population within the project area is 601. The water system has a total of 3,123 connections. Approximately 2.7% of the connections are classified as commercial/industrial. The remaining connections are classified as single family residential. According to the 2010 Census, there are 277 households within the Groveland and Big Oak Flat area, not including Pine Mountain Lake.

The District boundaries are unlikely to expand in the near future, as most growth is expected to take place within the undeveloped areas of Pine Mountain Lake. Historical data indicates a projected population growth rate of 0.25% Little growth is anticipated for the areas of Groveland and Big Oak Flat. Future growth within the Pine Mountain Lake area is not expected to have a significant effect on the distribution system within Big Oak Flat and Groveland.



GROVELAND COMMUNITY SERVICES DISTRICT

WATER DISTRIBUTION SYSTEM
IMPROVEMENT PROJECT

Groveland Community Services District

GCSD SERVICE AREA BOUNDARY

NORTH

0 6000' 12000'

SCALE: 1" = 6000'

FIGURE 2-1
GROVELAND CSD
SERVICE AREA MAP

AM Consulting Engineers

SECTION 3 - EXISTING FACILITIES AND PROJECT NEED

3.1. Overview

The District owns and operates a water system serving the communities of Groveland, Big Oak Flat, and Pine Mountain Lake. The District‘s current Water Master Plan was adopted in 2001, outlining anticipated improvements to the District‘s water infrastructure to improve fire flows and accommodate expected demand growth. The Plan focuses on infrastructure needs throughout the District’s service area, including the buildout of the Pine Mountain Lake water distribution system.

The District’s water system consists of two supply pumps with treatment facilities and clearwell storage, 5 storage tanks, 11 pressure zones, 17 pressure reducing valves (PRVs), 3 intra-system booster pumps, approximately 425 fire hydrants and approximately 70 miles of water mains. This report only addresses portions of the water system that serve the communities of Groveland and Big Oak Flat, as well as the nearby White Gulch area. Within this area, the distribution system includes approximately 35,000 feet of water mains. Figure 3-1 shows a map of the existing water distribution system infrastructure in Big Oak Flat. Figure 3-2 shows a map of the existing water distribution system infrastructure in Groveland, while Figure 3-3 shows a map of the existing water distribution system in the nearby White Gulch area.

3.2. History

Groveland and Big Oak Flat were established as mining camps in 1852, where they thrived during the California Gold Rush. After the decline in gold production, the communities continued to serve travelers visiting nearby Yosemite National Park. The lakeside community of Pine Mountain Lake was developed during the late 1960s. This community is now included in the GCSD service area. Pine Mountain Lake consists of approximately 3000 housing units, many of which serve as vacation homes during the warmer months.

3.3. Water Supply

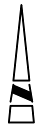
GCSD provides water under Domestic Water Supply Permit No. 03-11-13P-008. GCSD obtains most of its water supply from the Mountain Tunnel which is part of the Hetch Hetchy Aqueduct system. The Hetch Hetchy Aqueduct source is approved for filtration avoidance. The Mountain Tunnel is 19 miles long and has a capacity of 660 cfs. GCSD pumps water from two vertical shafts tapped into the Mountain Tunnel designated as the Big Creek Station and the Second Garrotte Station. Each pumping station lift water from the Mountain Tunnel into a 2 MG clearwell. The pump stations are typically operated for approximately four to six hours in the morning (every day in the summer and every other day in the winter) to meet peak morning demands and to fill the reservoirs for the remainder of the day.

The Big Creek Station supplies approximately 80% of the water used by the District. Water is pumped from the tunnel that is located approximately 570 feet below the pump station. The pump consists of a 400 HP oil lubricated, variable frequency drive (VFD), 9 stage vertical turbine pump. The pump is capable of delivering approximately 1,300 to 1,400 gpm to the distribution system. The pump is located in a locked shed that is within a fenced area. The pump discharge flow is split between two flow meters and then combines again prior to chemical injection. The treatment provided is disinfection and pH adjustment.

Legend

Existing Water Main

0 175 350 FT



PROJECT

GROVELAND COMMUNITY SERVICES DISTRICT
WATER DISTRIBUTION SYSTEM IMPROVEMENTS

BIG OAK FLAT WATER SYSTEM
INFRASTRUCTURE

FIGURE

3-1

Consulting Engineers

Legend

Existing Water Main

0 150 300 FT

Consulting Engineers

PROJECT

GROVELAND COMMUNITY SERVICES DISTRICT
WATER DISTRIBUTION SYSTEM IMPROVEMENTS

GROVELAND WATER SYSTEM
INFRASTRUCTURE

FIGURE

3-2

Legend

Existing Water Main

0 175 350 FT

Consulting Engineers

PROJECT

GROVELAND COMMUNITY SERVICES DISTRICT
WATER DISTRIBUTION SYSTEM IMPROVEMENTS

WHITE GULCH WATER SYSTEM
INFRASTRUCTURE

FIGURE

3-3

The Second Garrotte Station is located approximately three miles downstream of the Big Creek Station and pumps water from the Mountain Tunnel 720 feet below. The pump consists of a 200 HP electric motor and an oil lubricated 16 stage vertical turbine pump. The discharge line includes a 100 HP Aurora centrifugal pump to help boost water to the distribution system and to Tank No. 3. Each pump has an approximate capacity of 700 gpm, and both pumps are located within a fenced area secured by a lock. In similar fashion to the Big Creek Pump Station, the pump discharge is separated into two pipelines each equipped with a flow meter. After the flow meters, the discharge line manifolds back into a single pipe where disinfection and pH adjustment chemicals are then injected.

GCSD's third water supply source is Pine Mountain Lake. This Alternative Water Supply Source (AWS) is only used during periods when the Mountain Tunnel is out of service for maintenance. This AWS is based on an agreement that was reached between the San Francisco Public Utilities Commission, Modesto Irrigation District, Turlock Irrigation District and the District, on July 30, 2007. The agreement allows for withdrawal of up to 200 acre-feet from the lake. Any water that GCSD withdraws from Pine Mountain Lake is deducted from the San Francisco Public Utilities Commission's Don Pedro Reservoir water bank account.

3.4. Water Treatment

GCSD has relied on filtration avoidance to achieve compliance with the SWTR using the disinfection process only. However, since the adoption of the Federal Disinfection Byproducts Rule (DBPR) on January 1, 2004, GCSD modifies the disinfection process to achieve compliance with the DBPR and maintain filtration avoidance.

GCSD provides prechlorination with free chlorine in a 16,900 gallon chlorine contact tank, followed by chloramination in the existing 2.0 MG clearwell, and then UV disinfection at each plant. The purpose of chloramination is to reduce the DBP levels in the distribution system and the UV disinfection is to inactivate Giardia and Cryptosporidium. The free chlorination provides at least 4.0 logs of virus inactivation and the UV disinfection provides at least 3.0 logs of Giardia and Cryptosporidium inactivation.

GCSD uses on-site chlorine generators at both of their plants. The raw water is fed a chlorine solution to provide an initial concentration of 2.85 to 3.0 mg/L of free chlorine into the chlorine contact tank. A chlorine analyzer records the residual going into the tank. When the water leaves the chlorine contact tank, the residual is monitored again and the concentration is approximately 2.75 mg/L. Prior to the chlorinated water entering the 2.0 MG clearwells, it is injected with ammonia to react with the chlorine to form chloramines. Each clearwell contains 5 hypalon curtains to reduce the potential for short circuiting.

Following the 2 MG clearwell and before water is pumped into the distribution system, GCSD provides UV disinfection. UV disinfection equipment consists of a Calgon Carbon Corporation Sentinel UV disinfection system. The Sentinel UV disinfection system installed at the Big Creek and Second Garrotte treatment plants each have two treatment trains, where each reactor (one treatment train) has three banks of two UV lamps.

GCSD uses standard hydrated lime to increase the natural pH of the water to about 9.8. The lime is food grade and certified to meet ANSI/NSF standard 60 requirements for additives. The lime feed system is contained in a separate smaller room, as well as the electrical control panels and some of the SCADA system. All chemical feed pumps used at the treatment plant are Fluid Control ProMinent Sigma series which are able to deliver a maximum capacity of 28.5 gallons per hour (gph) at 145 psi. The chemical feed rates are manually adjusted, but they can also be looped to the ATI chlorine analyzers/controllers and flow pacing equipment that will automatically adjust the pump speed with their respective process controls through the PLC. The lime solution is fed after the booster pump station at each plant.

The District's AWS is treated using a Pall Portable Membrane treatment facility. The Pall Aria portable membrane facility consists of two racks of 20 membrane modules each and each rack is rated to operate at a maximum flow rate of 300 gpm. Flow is upward from the outside of the membrane fibers to the inside. The two racks operate independent of each other, but can be run simultaneously. However, if one rack goes through a clean-in-place (CIP) cycle, the filtering rack can only operate at one-half capacity during the other racks backwashing cycle. Each membrane rack is fed raw water through the Gould 20 HP variable frequency drive (VFD) feed pump rated to deliver up to 530 gpm.

3.5. Water Storage and Distribution

GCSD has five storage reservoirs having a total capacity of approximately 2.5 million gallons. The two clearwells have a total capacity of 4.0 million gallons. The clearwells were installed to meet the CT requirements for filtration avoidance. These two tanks are both welded steel construction and each has a capacity of 2.0 million gallons. Access to the tanks is limited due to fencing and secured access ladders to the top of the clearwells. All vents to the tanks are screened.

Tank No. 1 receives water from the Second Garrotte plant and is a ground level welded steel storage tank with a capacity of 500,000 gallons. Tank No. 1 floats on the water system and is equipped with a common inlet and outlet piping arrangement. This tank serves the greater Groveland, Big Oak and Yosemite Highland pressure zones. Water can flow by gravity from Tank No. 1 to Tank No. 3 if necessary. Both Tanks Nos. 1 and 3 are arranged to have water pumped to the system based on elevation and system configuration.

Water is boosted from the Groveland pressure zone into Tank No. 5 by two 30 HP centrifugal pumps that operate in an alternating mode. Tank No. 5 is a ground level bolted steel tank with a top inlet and bottom outlet arrangement that floats on the Yosemite Highlands subdivision. The tank is 16 feet tall and has a capacity of 140,000 gallons. A two foot drop from full in the tank's water level activates the booster pumps.

Tanks Nos. 2, 3 and 4 receive water from the Big Creek plant and serve the Pine Mountain Lake subdivision area. All three tanks are ground level tanks constructed of reinforced concrete with capacities of 750,000 gallons (Tanks Nos. 2 and 3) and 500,000 gallons (Tank No. 4). Tank No. 2 has a separate bottom inlet and bottom outlet. Tank Nos. 3 and 4 each have common inlet/outlets and float on the distribution system. Hydropneumatic systems are located near Tanks Nos. 2 and 4. The hydropneumatic system at Tank No. 4 serves approximately 200 homes in a closed loop pressure zone near the airport in the Pine Mountain Lake subdivision. The pump station consists of a pressure tank and two 40 HP pumps that operate in an alternating mode. The Tank No. 2 pressure system takes water from the tank feed line and serves two homes with future build out at approximately three to four houses. The pressure system consists of two small hydropneumatic tanks and a 3 HP pump capable of supplying 25 gpm. Water from Tank No. 3 can be pumped through a 50 HP pump to Tank No. 1 if necessary.

The District's distribution system consists primarily of asbestos cement pipe ranging in diameter from 2 to 6 inches and includes some polyvinyl chloride pipe (PVC, AWWA C-900). The AWWA C-900 PVC is used on all new distribution and replacement piping projects. The District has an active leak detection monitoring program that has been quite successful. There are 64 dead ends in the distribution system, but no low pressure water lines. Of the 64 dead ends, 32 of them have some sort of blow off valves. Approximately 80% of the existing connections have pressure reducing valves, and all system services are metered. The District has a water main flushing program and a valve exercising program. In 2011, 32 of the 64 dead ends were flushed and 100 of the 1,072 valves were exercised.

There are some places within the distribution system where the AWWA water-sewer main separation distances are not maintained, but the District is aware of the separation distances and tries to maintain these distances for designs on all new installations. A map of the existing water system facilities is included in Appendix B.

3.6. Project Need

The project is needed to improve the water supply reliability of Groveland and Big Oak Flat and to provide the required infrastructure to meet fire flow requirements. Additional, water mains within the project area are subject to frequent main breaks, which cause disruptions in service and water losses in the system. Providing water distribution system improvements would reduce the water use of the District and lower the cost to operate and maintain the system.

3.6.1. Fire Flow Requirements

GCSD’s Water Master Plan modeled the water distribution system using EPANet®, a modeling software developed by the Environmental Protection Agency. The model exposed several areas of concern caused by either undersized pipelines or high elevations. Among the areas that failed to provide adequate water supply during a fire-flow scenario are downtown Groveland, and Big Oak Flat. Low pressures in the downtown Groveland fire scenario are the result of a looped system with 4-in pipelines. The Big Oak Flat deficiencies are a result of the community being served by a single, 6-in deadend pipeline. A 6-in unlooped pipe cannot support fire flows. The fire flow modeling results are included in Appendix C.

Water Flows for fire suppression are listed in Appendix B of the 2013 California Fire Code. Section B105.1 states that: *“The minimum fire-flow and flow duration requirements for one and two-family dwellings having a fire-flow calculation area that does not exceed 3,600 square feet shall be 1,000 gallons per minute for 1 hour.”* Section B105.2 states that: *“The minimum fire-flow and flow duration for buildings other than one- and two-family dwellings shall be as specified in Table B105.1.”* The minimum fire-flow and duration in Table B105.1 is 1,500 gpm for 2 hours. Appendix B of the 2013 California Fire Code is included in Appendix D of this report for reference. All the fire hydrants in the Big Oak Flat Area and most of the hydrants in Downtown Groveland supply less than 500 gpm.

3.6.2. Reliability

Frequent service interruptions caused by main breaks diminish the quality of service that customers expect of GCSD. Despite the efforts to adequately disinfect and flush the water mains after a repair has been completed, water quality is being compromised at times. This project will improve the existing water distribution system allowing delivery of drinking water that meets drinking water standards and customer expectations.

A major economic driver in Groveland and Big Oak Flat is the highway traffic along Highway 120. Businesses need a reliable water supply without frequent interruptions and require adequate fire flow.

The frequent main breaks in downtown Groveland and Big Oak Flat also cause large amounts of water to be lost. Water is also lost through small unidentified leaks in the distribution system due its deteriorated condition. The construction of new infrastructure will significantly reduce the amount of water losses in the system, increase its overall efficiency and deliver long-term water savings.

SECTION 4 - ALTERNATIVES CONSIDERED

4.1. Description of Alternatives

Three alternatives were considered, including a no project alternative. Alternative I consists of installing improvements along the existing alignment, parallel to the pipes currently in service. Alternative III consist of installing improvements along a new alignment as needed to provide the required flows. In summary, the three Alternative considered are as follows:

- Alternative I – No Project
- Alternative II – Improvements Along Existing Alignment
- Alternative III – Improvements Along Altered Alignment

The project seeks to improve the existing water distribution system. Thus, consolidation or regionalization alternatives were not considered feasible.

4.2. Alternative I - No Project

A no project alternative was considered. The current distribution system cannot provide the required fire flow for most hydrants within Groveland and Big Oak Flat. This alternative was dismissed due to not addressing concerns with the fire flow requirements and reliability.

4.3. Alternative II – Improvements on Existing Alignment

This alternative involves replacing the existing water mains with new mains located along the same alignment as the existing. Both conventional trenching methods and pipe bursting were considered. Conventional construction requires detailed geotechnical investigations and topographical surveys to locate existing utilities that may be impacted by the excavation of the water line. Conventional construction uses heavy equipment to dig the trenches and requires surface restoration of the excavated trench.

Pipe bursting is a method by which the existing pipe is forced outward and opened by a bursting tool. In pipe bursting the existing pipe is used as a guide for inserting the expansion head (part of the bursting tool). The expansion head, typically pulled by a cable rod and winch, increases the area available for the new pipe by pushing the existing pipe radially outward until it cracks. The bursting device pulls the new pipeline behind itself. During the pipe bursting process, the rehabilitated pipe segment must be taken out of service by rerouting flows around it. After the pipe bursting is completed, laterals are re-connected, typically by conventional excavation methods.

Conventional trenching methods are the recommended method. Many of the existing water mains are shallow. Replacing them using pipe bursting methods may disrupt the ground surface which would require significant restoration. This is a particular concern in areas underneath Highway 120 and other streets.

New water mains would be installed parallel to the existing, where needed. Service would be maintained during construction whenever possible. Portions of the existing alignment is located within California Department of Transportation right of way along Highway 120. The alternative requires high cost trenching and repairing within the highway ROW and additional traffic control needs. Caltrans is not willing to grant permits for performing all required work within the right of way, thus Alternative II was dismissed.

4.4. Alternative III – Improvements on Altered Alignment

This alternative consists of constructing new water mains along a different alignment than the existing in Groveland. This new alignment seeks to avoid the right of way issues present in Alternative II and also seeks to minimize trenching within streets. New, larger water mains would be installed in Groveland and Big Oak Flat to supply the required fire flow and provide a more reliable water distribution system. Improvements in Groveland are significantly different than the existing alignment, as much of the existing water mains are in Caltrans right of way. This requires a new alignment in Groveland. The existing water mains in Big Oak Flat are primarily located outside of Caltrans right of way. New mains can be constructed parallel to the existing alignment. The design will also seek to add loops to the water distribution system to aid in fire flows.

The following are the tentative improvements to the downtown Groveland water distribution system:

- Construct 4,995 linear feet (LF) of 6” water main on the lots to the north of Highway 120.
- Construct 160 LF of 6” water main to connect the existing water main to the new water main north of Highway 120.
- Construct 2,610 LF of 6” water main on the lots to the south of Highway 120 and along Back Street.
- Construct 1,310 LF of 6” water main along Foote Street and extending to the east.
- Construct 2 segments of water main, 440 LF and 290 LF respectively, connecting the new water main south of Highway 120 to the new water main along Foote Street.
- Construct 215 LF of 6” water main along Power House Street connecting the new water main on Back Street to the new water main along Foote Street.
- Construct 385 LF of 6” water main connecting the new water mains north of Highway 120 to the new water mains south of Highway 120.
- Construction of new gate valves, pressure reducing valves and fire hydrants along the new water mains, as needed.

The following are the tentative improvements to the Big Oak Flat water distribution system:

- Replace 2,000 LF of 4” water main with 6” water main along Wards Ferry Road, including two (2) gate valves and three (3) fire hydrants.
- Replace 1,015 LF of 4” water main with 6” water main along Scofield Street including one (1) gate valve and three (3) fire hydrants.
- Replace 1,040 LF of 4” water main with 6” water main along Big Oak Road including one (1) gate valve and one (1) fire hydrant.
- Replace 320 LF of 4” water main with 6” water main along Henderson Street including one (1) gate valve and one (1) fire hydrant.
- Replace 295 LF of 4” water main with 6” water main along Black Road including one (1) gate valve and two (2) fire hydrants.
- Replace 745 LF of 4” water main with 6” water main along Harper Street.

- Replace 250 LF of 4" water main with 6" water main along School Street including two (2) gate valves.
- Replace 1,150 LF of 4" water main with 6" water main along Yates Street including one (1) gate valve and one (1) fire hydrant.
- Replace 305 LF of 4" water main with 6" water main along Vassar Street including one (1) fire hydrant and a crossing underneath highway 120.
- Construct 1,200 LF of 6" pipe along Ward Ferry Road and Scofield Street to loop the system including one (1) new PRV, three (3) new fire hydrants, and two (2) new gate valves.

The following are the tentative improvements to the water distribution system in the White Gulch area:

- Replace 5,170 LF of 6" water main along White Gulch Road, near Highway 120.
- Replace 1,200 LF of 4" water main with 6" water main along Old Highway 120.
- Construction of new gate valves, pressure reducing valves and fire hydrants along the new water mains, as needed.

Figures 4-1, 4-2, and 4-3 show the proposed alignments in Big Oak Flat, Groveland, and White Gulch, respectively. Both conventional trenching methods and pipe bursting were considered for water mains to be replaced. Conventional construction requires detailed geotechnical investigations and topographical surveys to locate existing utilities that may be impacted by the excavation of the sewer line. Conventional construction uses heavy equipment to dig the trenches and requires surface restoration of the excavated trench.

Pipe bursting is a method by which the existing pipe is forced outward and opened by a bursting tool. In pipe bursting the existing pipe is used as a guide for inserting the expansion head (part of the bursting tool). The expansion head, typically pulled by a cable rod and winch, increases the area available for the new pipe by pushing the existing pipe radially outward until it cracks. The bursting device pulls the new pipeline behind itself.

During the pipe bursting process, the rehabilitated pipe segment must be taken out of service by rerouting flows around it. After the pipe bursting is completed, laterals are re-connected, typically by conventional excavation methods.

4.4.1. Annual O&M

The proposed Sewer Collection System Improvement project is a capital improvements project. It does not include new mechanical equipment other than valves. The only maintenance required for the proposed improvements will consist of conventional maintenance of a water distribution system. It is noted that conventional and customary maintenance of the water distribution system will decrease from current levels, due to the replacement of aged mains that frequently break and require emergency maintenance. The rehabilitated water distribution system will require less maintenance in comparison.

Legend

- Existing Water Main
- Proposed New Water Main
- Proposed Replacement of Water Main

0 175 350 FT

Consulting Engineers

PROJECT

GROVELAND COMMUNITY SERVICES DISTRICT
WATER DISTRIBUTION SYSTEM IMPROVEMENTS

BIG OAK FLAT WATER SYSTEM IMPROVEMENTS

FIGURE

4-1

aim Consulting Engineers

Legend

- - - - Existing Water Main

—— Proposed New Water Main

0 150 300 FT

PROJECT

GROVELAND COMMUNITY SERVICES DISTRICT
WATER DISTRIBUTION SYSTEM IMPROVEMENTS

GROVELAND WATER SYSTEM
IMPROVEMENTS

FIGURE
4-2

Consulting Engineers

Legend

Existing Water Main

Proposed Replacement of Water Main

0 175 350 FT

PROJECT

GROVELAND COMMUNITY SERVICES DISTRICT
WATER DISTRIBUTION SYSTEM IMPROVEMENTS

WHITE GULCH WATER SYSTEM IMPROVEMENTS

FIGURE

4-3

SECTION 5 - ALTERNATIVE EVALUATION & RECOMENDATION

5.1. Summary of Alternatives

As discussed previously, the purpose of the water system improvement project is to rehabilitate or replace water mains throughout Groveland and Big Oak Flat to meet fire flow requirements and provide reliable service to customers. The anticipated useful life of new water mains is in excess of 50 years. New laterals will need to be constructed in some locations to connect customers to the new water mains. The three alternatives considered are as follows:

- Alternative I – No Project
- Alternative II – Improvements on Existing Alignment
- Alternative III – Improvements on Altered Alignment

Alternative I was discounted as it does not address the long-term fire flow requirements and reliability needs of GCSD. Alternative II was discounted due to Caltrans not granting permits to perform water main replacement within their right of way.

5.2. Design Criteria/Compliance Issues

Alternatives II and III would require the replacement of existing water mains within Big Oak Flat and Groveland. There are no anticipated design issues, as both alternatives implement standard, common construction methods. These alternatives may include excavation and/or ground disturbance near trees or shrubs.

Alternative III seeks to minimize the amount of excavation performed in streets and highways, such as Highway 120. Encroachment permits may be required if work is located on Caltrans right of way. Easements from property owners will be required if water mains pass through private property. A SWPPP will be required, since the project would disturb over 1 acre of land.

5.3. Recommended Alternative

The alternatives were evaluated for feasibility and design criteria/compliance. It is recommended that design move forward with Alternative III. Alternative III is recommended over Alternative II for a variety of reasons. Some of the existing water mains along Highway 120 are shallow and cannot be rehabilitated in place. A new alignment would be required in these areas. The existing water mains are made of asbestos. It is preferable to abandon these lines in place and construct new mains. Other existing water mains are located deep underground and Alternative III would eliminate those spots with deep lines. Alternative III could be designed to improve accessibility of the water lines, as compared to the existing alignment. Alternative III also minimizes the amount of excavation required along transportation right of way.

5.4. Project Schedule

GCSD has previously signed a planning grant agreement with the State Water Resources Control Board to provide design for water distribution system improvements within Groveland and Big Oak Flat. The agreement includes a project schedule, shown in Table 5-1 below:

Table 5-1 Project Schedule

Task	Date
Geotechnical Investigation & Site Surveying	January 31, 2017
Engineering Design	May 15, 2017
CEQA Documentation	June 30, 2017
Draft Plans and Specifications (60%)	September 30, 2017
Final Plans and Specifications with detailed cost breakdown	December 15, 2017
Logos/Disclosures	As necessary
Status Reports	Quarterly
As Needed Reports	As necessary
Final Disbursement Request	November 31, 2018

APPENDIX A

WATER RATE SCHEDULE

Groveland Community Services District

Summary of Water and Sewer Rates

Water

Monthly Fixed Rate Service Charges

Meter Size	Monthly Fixed Rate Charge
5/8" X 3/4"	$36.28
3/4" X 3/4"	$36.28
1"	$58.05
1 1/2"	$94.32
2"	$126.96
3"	$199.52
4"	$282.95

Usage (Variable) Rate

Gallons Used per Month	Usage Charge per gallon	Usage Rate Category
0 to 3,300	$0.00700	Baseline Usage Rate
>3,301	$0.01385	Peak Demand Usage Rate

Sewer

Monthly Fixed Rate Service Charge and Monthly Usage (Variable) Charge

Service Description	Fixed & Usage Charges	
	Residential	Commercial
Monthly Minimum Charge	53.10	53.10
Monthly Volume Usage Charge	0.00698 per gallon of metered water	0.01121 per gallon of metered water

Bonds/Debt Charges

Charge	Water*	Sewer	Water and Sewer Service
Monthly Fixed Rate/Minimum Charge	$36.28	$53.10	$89.38
2013 Water Debt Service	$6.78		$6.78
2014 Water Debt Service	$8.79		$8.79
2014 Wastewater Debt Service		$25.75**	$25.75
Total Fixed Monthly Rate	**$51.85**	**$78.85**	**$130.70**

*Based on 5/8" meter size
**Not applicable to Groveland/Big Oak Flat accounts not tributary to Lift Station 7

Bonds/Debt and Water & Sewer Rate Information

Bonds/Debt

The District has incurred debt (e.g. revenue bonds) to purchase, upgrade or replace capital improvements such as storage tanks, water and sewer lines, and treatment facilities. Debt is generally repaid on a semi-annual basis over a period of 20 to 30 years. The District collects monthly debt service fees to repay these bonds.

- **2013 Water Debt Service**
  In February 2013, the 1998 Installment Sale Agreement executed to finance the acquisition, construction, and improvement of water storage and treatment facilities was refinanced. The loan was issued for $3,117,831. The monthly payment for this bond is $6.78 and it is paid by all GCSD water customers.

- **2014 Water Debt Service (formerly called 2007 Water Debt Service)**
  This $5,031,500 debt was incurred in May 2007 to pay for federal and state mandated upgrades to the two water treatment plants, construction of an emergency water supply system, and upgrade to the radio telemetry and control (SCADA) system. The District had been collecting $5.13 toward this debt service charge. The monthly amount was increased to $8.79 in May 2007. The loan was refinanced in February 2014. This debt service is paid by all GCSD customers. The installment sale agreement matures in 2027.

- **2014 Wastewater Debt Service (formerly called 2007 Wastewater Debt Service)**
  This $4,059,000 debt was incurred in June 2007 to pay for state mandated upgrades to the District's sixteen sewer lift stations. This loan was refinanced in June 2014. The monthly debt service charge is $25.75 and is paid by customers who are on the sewer systems tributary to Lift Station 7. The installment sale agreement matures in 2027.

Water and Sewer Rates

- **Monthly Fixed Rate/Minimum Charge for Water and Sewer**
  This charge provides for the fixed annual costs of operating the buildings, grounds and facilities of the District, irrespective of the quantity of water used or occupancy status.

- **Water and Sewer Consumption (Variable Rate) Charges for Water and Sewer**
  This charge provides for the variable costs of operation and maintenance of the systems, directly proportional to the amount of water used.

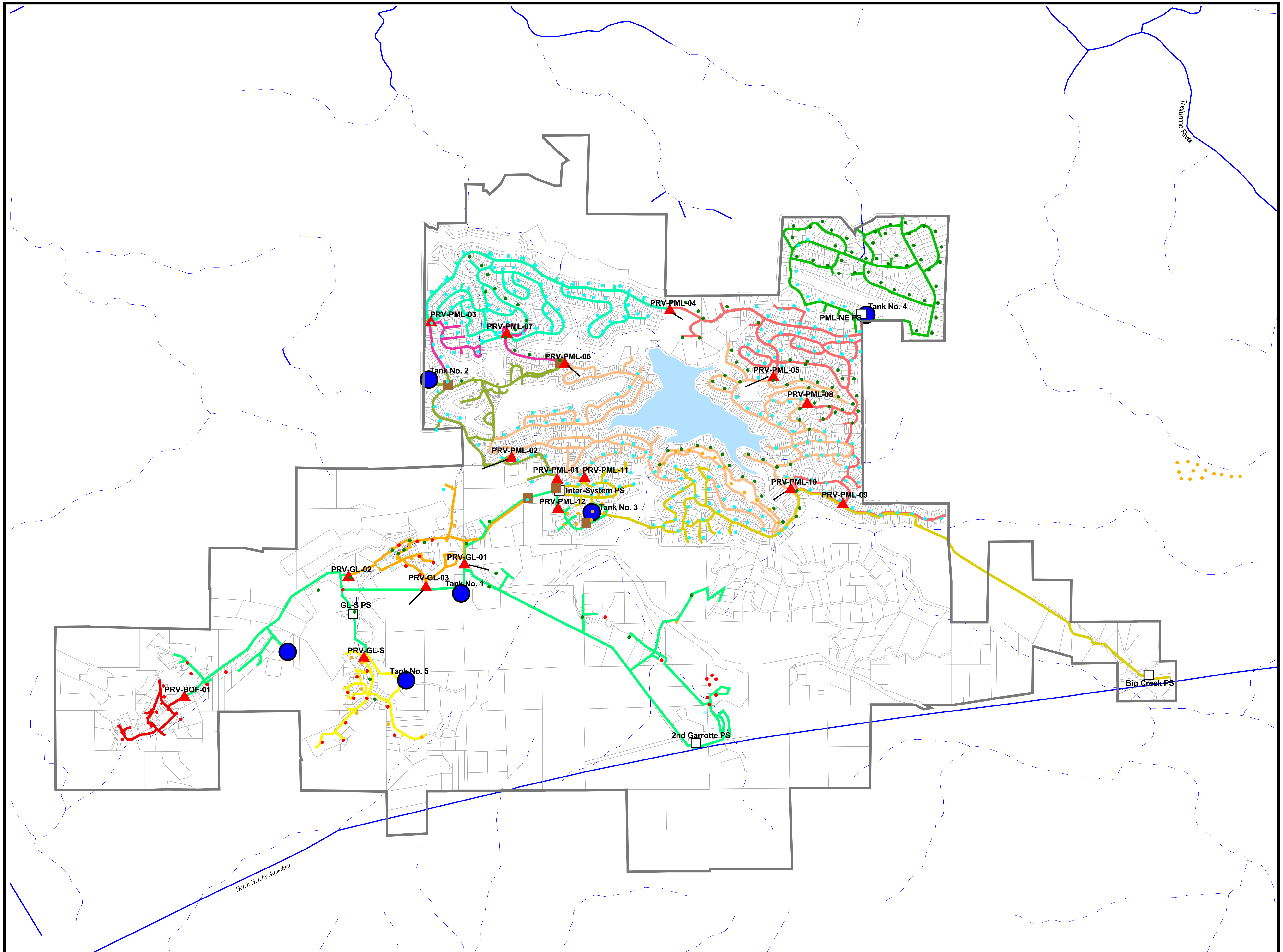
APPENDIX B

EXISTING WATER SYSTEM MAP

Groveland Community Services District

Exhibit 5

Water System Pressure Zone Map



Legend

Water Points
- Booster Pump Station
- Pressure Reducing Station
- Water Tank
- N.C. Gate Valve
- Water Mains
- Stream
- River
- Lakes
- Parcels
- District Boundary

Water Mains by Zone
- BOF
- G-S
- GL-C
- GL-SE
- PML-C
- PML-E
- PML-NE
- PML-NW
- PML-S
- PML-SW
- PML-W

County Hydrant Flow Tests
- 1,500 gpm or greater
- 1,000 - 1,499 gpm
- 500 - 999 gpm
- Less than 500 gpm

N

2000 0 2000 Feet

RBF CONSULTING GIS
14725 ALTON PARKWAY
IRVINE, CALIFORNIA 92618-2027
949.472.3505 ▪ FAX 949.472.8373 ▪ www.RBF.com
PLANNING ▪ DESIGN ▪ CONSTRUCTION

H:Pdata\10101218\GIS\County_water_water2.apr. RYW, JA 10/2/01

APPENDIX C

FIRE FLOW MODELING RESULTS

BALANCED WATER SYSTEM

AREAS OF HIGH PRESSURE

PEAK HOUR

MOD. SYSTEM

Network Table - Nodes

Node ID	Elevation ft	Base Demand GPM	Demand GPM	Pressure psi
Junc 87	2928	0	0.00	-6.07
Resvr 2ndGarrotteRes	2937	#N/A	0.00	0.00
Resvr BigCreekRes	2820	#N/A	-0.00	0.00
Junc 86	2928	0	0.00	0.00
Junc 66	3395	10	20.00	2.53
Tank T3	3004	#N/A	-3034.68	2.60
Tank T4	2912	#N/A	360.17	2.60
Tank T5	3395	#N/A	-80.00	2.60
Tank T1	3136	#N/A	-324.00	2.60
Tank T2	2908	#N/A	596.51	2.60
Junc 27	2912	0	0.00	3.48
Junc 73	2917	0	0.00	8.67
Junc 67	3100	3	6.00	17.49
Junc 91	3100	0	0.00	18.20
Junc 104	3085	0	0.00	22.87
Junc 88	2852	0	0.00	29.95
Junc 5	2852	10	20.00	29.95
Junc 53	2670	15	30.00	31.00
Junc 56	2670	15	30.00	31.00
Junc 76	2900	0	0.00	34.00
Junc 89	2827	25	50.00	37.20

Node ID	Elevation ft	Base Demand GPM	Demand GPM	Pressure psi
Junc 90	2750	25	50.00	42.02
Junc 9	3300	15	30.00	43.52
Junc 21	2820	10	20.00	44.97
Junc 48	2827	15	30.00	46.07
Junc 85	2826	0	0.00	46.50
Junc 69	2630	40	80.00	48.09
Junc 11	2773	0	0.00	49.00
Junc 17	2770	20	40.00	50.00
Junc 96	2760	5	10.00	53.70
Junc 102	2930	0	0.00	54.00
Junc 103	2925	12	24.00	54.80
Junc 77	2850	8	16.00	55.56
Junc 70	3010	0	0.00	56.12
Junc 47	2750	10	20.00	58.00
Junc 38	3000	10	20.00	59.90
Junc 37	2856	10	20.00	61.52
Junc 3	2790	22	44.00	61.92
Junc 129	2850	0	0.00	63.02
Junc 78	2825	8	16.00	66.17
Junc 83	2780	15	30.00	66.45
Junc 100	2900	11	22.00	67.00
Junc 31	2773	10	20.00	67.16

Node ID	Elevation ft	Base Demand GPM	Demand GPM	Pressure psi
Junc 63	2980	0	0.00	68.99
Junc 72	2580	30	60.00	69.82
Junc 33	2580	11	22.00	70.00
Junc 1	2975	0	0.00	71.15
Junc 42	2820	8	16.00	71.49
Junc 41	2820	8	16.00	73.18
Junc 4	2756	20	40.00	74.26
Junc 59	2880	19	38.00	75.59
Junc 82	2710	30	60.00	75.76
Junc 30	2710	0	0.00	76.00
Junc 14	2743	15	30.00	76.60
Junc 79	2800	8	16.00	76.86
Junc 55	2670	13	26.00	77.03
Junc 46	2750	12	24.00	79.30
Junc 16	2800	10	20.00	81.80
Junc 134	2800	5	10.00	82.13
Junc 133	2800	5	10.00	82.14
Junc 20	2730	40	80.00	82.68
Junc 54	2675	20	40.00	82.71
Junc 130	2800	10	20.00	83.21
Junc 131	2800	5	10.00	83.26
Junc 43	2806	20	40.00	83.55

Node ID	Elevation ft	Base Demand GPM	Demand GPM	Pressure psi
Junc 52	2670	20	40.00	84.76
Junc 128	2800	0	0.00	86.40
Junc 132	2795	5	10.00	86.62
Junc 99	2785	0	0.00	86.65
Junc 62	2540	20	40.00	87.21
Junc 60	2850	20	40.00	87.58
Junc 32	2680	0	0.00	89.00
Junc 50	2680	10	20.00	89.00
Junc 101	2930	9	18.00	90.67
Junc 49	2970	0	0.00	91.91
Junc 71	2925	5	10.00	92.73
Junc 127	2785	5	10.00	92.75
Junc 18	2660	25	50.00	97.39
Junc 22	2660	12	24.00	97.64
Junc 40	2910	8	16.00	98.92
Junc 8	2820	17	34.00	101.50
Junc 24	2650	10	20.00	102.03
Junc 75	2900	0	0.00	102.57
Junc 92	2900	5	10.00	103.21
Junc 135	2750	5	10.00	103.82
Junc 98	2900	9	18.00	104.02
Junc 68	2500	30	60.00	104.42

Node ID	Elevation ft	Base Demand GPM	Demand GPM	Pressure psi
Junc 13	2680	15	30.00	104.68
Junc 121	2635	5	10.00	107.82
Junc 125	2745	5	10.00	110.08
Junc 119	2630	5	10.00	110.31
Junc 84	2680	10	20.00	111.65
Junc 51	2920	0	0.00	113.56
Junc 2	2705	0	0.00	113.70
Junc 29	2705	20	40.00	113.70
Junc 28	2620	12	24.00	114.94
Junc 7	2710	0	0.00	115.00
Junc 36	2715	25	50.00	116.81
Junc 6	2912	8	16.00	117.90
Junc 44	2680	15	30.00	118.02
Junc 122	2610	5	10.00	118.66
Junc 94	2610	10	20.00	118.77
Junc 93	2610	10	20.00	118.91
Junc 81	2610	20	40.00	118.94
Junc 118	2610	0	0.00	118.99
Junc 65	3125	15	30.00	119.36
Junc 124	2605	10	20.00	120.86
Junc 80	2600	20	40.00	123.02
Junc 123	2600	10	20.00	123.03

Node ID	Elevation ft	Base Demand GPM	Demand GPM	Pressure psi
Junc 120	2600	10	20.00	123.07
Junc 45	2600	22	44.00	123.59
Junc 95	2590	5	10.00	127.44
Junc 26	2590	20	40.00	127.92
Junc 12	2590	20	40.00	127.94
Junc 64	2980	0	0.00	128.06
Junc 10	2980	0	0.00	128.06
Junc 23	2880	25	50.00	130.84
Junc 15	2880	25	50.00	130.91
Junc 25	2880	15	30.00	130.92
Junc 61	2430	10	20.00	134.82
Junc 58	2820	10	20.00	137.94
Junc 19	2560	15	30.00	140.52
Junc 97	2560	0	0.00	140.81
Junc 57	2411	16	32.00	143.01
Junc 34	2580	0	0.00	145.56
Junc 39	2777	0	0.00	156.55
Junc 74	2917	0	0.00	187.76
Junc 35	2800	0	0.00	259.98

MAX. DAY

FIRE GL-C

Network Table - Nodes

Node ID	Elevation ft	Base Demand GPM	Demand GPM	Pressure psi
Junc 87	2928	0	0.00	-6.07
Junc 104	3085	0	0.00	-4.98
Resvr 2ndGarrotteRes	2937	#N/A	0.00	0.00
Resvr BigCreekRes	2820	#N/A	-0.00	0.00
Junc 86	2928	0	0.00	0.00
Junc 66	3395	10	10.00	2.58
Tank T1	3136	#N/A	-1661.95	2.60
Tank T5	3395	#N/A	-40.00	2.60
Tank T4	2912	#N/A	687.29	2.60
Tank T2	2908	#N/A	969.71	2.60
Tank T3	3004	#N/A	-2696.00	2.60
Junc 67	3100	3	3.00	3.62 ←
Junc 27	2912	0	0.00	4.46
Junc 73	2917	0	0.00	8.67
Junc 91	3100	0	0.00	18.20
Junc 70	3010	0	0.00	27.72
Junc 53	2670	15	15.00	31.00
Junc 56	2670	15	15.00	31.00
Junc 5	2852	10	10.00	31.47
Junc 88	2852	0	0.00	31.47
Junc 103	2925	12	12.00	31.55

Node ID	Elevation ft	Base Demand GPM	Demand GPM	Pressure psi
Junc 76	2900	0	0.00	34.00
Junc 89	2827	25	25.00	37.56
Junc 63	2980	0	0.00	40.69
Junc 1	2975	0	0.00	42.85
Junc 9	3300	15	15.00	43.70
Junc 48	2827	15	15.00	46.67
Junc 38	3000	10	10.00	46.69
Junc 21	2820	10	10.00	47.05
Junc 85	2826	0	0.00	47.10
Junc 69	2630	40	40.00	48.27
Junc 11	2773	0	0.00	49.00
Junc 17	2770	20	20.00	50.00
Junc 101	2930	9	9.00	52.76
Junc 102	2930	0	0.00	52.76
Junc 96	2760	5	5.00	54.16
Junc 77	2850	8	8.00	55.64
Junc 8	2820	1517	1517.00	57.51
Junc 47	2750	10	10.00	58.45
Junc 37	2856	10	10.00	62.67
Junc 90	2750	25	25.00	63.04
Junc 60	2850	20	20.00	64.13
Junc 129	2850	0	0.00	64.38

Node ID	Elevation ft	Base Demand GPM	Demand GPM	Pressure psi
Junc 71	2925	5	5.00	64.49
Junc 3	2790	22	22.00	64.75
Junc 78	2825	8	8.00	66.41
Junc 100	2900	11	11.00	67.00
Junc 83	2780	15	15.00	67.09
Junc 72	2580	30	30.00	69.95
Junc 33	2580	11	11.00	70.00
Junc 31	2773	10	10.00	70.84
Junc 59	2880	19	19.00	73.01
Junc 42	2820	8	8.00	73.05
Junc 41	2820	8	8.00	74.70
Junc 75	2900	0	0.00	75.05
Junc 82	2710	30	30.00	75.93
Junc 30	2710	0	0.00	76.00
Junc 4	2756	20	20.00	76.78
Junc 79	2800	8	8.00	77.20
Junc 14	2743	15	15.00	79.13
Junc 46	2750	12	12.00	80.06
Junc 16	2800	10	10.00	83.56
Junc 134	2800	5	5.00	84.09
Junc 133	2800	5	5.00	84.09
Junc 43	2806	20	20.00	84.41

Node ID	Elevation ft	Base Demand GPM	Demand GPM	Pressure psi
Junc 130	2800	10	10.00	84.87
Junc 131	2800	5	5.00	84.93
Junc 20	2730	40	40.00	85.51
Junc 40	2910	8	8.00	85.69
Junc 62	2540	20	20.00	87.30
Junc 128	2800	0	0.00	87.41
Junc 98	2900	9	9.00	87.74
Junc 132	2795	5	5.00	88.06
Junc 99	2785	0	0.00	88.22
Junc 50	2680	10	10.00	89.00
Junc 32	2680	0	0.00	89.06
Junc 92	2900	5	5.00	90.02
Junc 49	2970	0	0.00	92.72
Junc 127	2785	5	5.00	93.80
Junc 18	2660	25	25.00	97.59
Junc 22	2660	12	12.00	97.73
Junc 54	2675	20	20.00	97.80
Junc 55	2670	13	13.00	97.80
Junc 52	2670	20	20.00	99.94
Junc 24	2650	10	10.00	102.12
Junc 68	2500	30	30.00	104.60
Junc 135	2750	5	5.00	105.76

Node ID	Elevation ft	Base Demand GPM	Demand GPM	Pressure psi
Junc 13	2680	15	15.00	107.71
Junc 121	2635	5	5.00	108.31
Junc 119	2630	5	5.00	110.57
Junc 125	2745	5	5.00	111.13
Junc 64	2980	0	0.00	111.92
Junc 10	2980	0	0.00	111.92
Junc 84	2680	10	10.00	112.56
Junc 51	2920	0	0.00	114.38
Junc 28	2620	12	12.00	115.06
Junc 2	2705	0	0.00	116.56
Junc 29	2705	20	20.00	116.56
Junc 7	2710	0	0.00	117.75
Junc 6	2912	8	8.00	118.08
Junc 36	2715	25	25.00	119.02
Junc 122	2610	5	5.00	119.14
Junc 94	2610	10	10.00	119.17
Junc 93	2610	10	10.00	119.21
Junc 81	2610	20	20.00	119.22
Junc 118	2610	0	0.00	119.23
Junc 65	3125	15	15.00	119.53
Junc 44	2680	15	15.00	119.81
Junc 124	2605	10	10.00	121.32

Node ID	Elevation ft	Base Demand GPM	Demand GPM	Pressure psi
Junc 80	2600	20	20.00	123.46
Junc 123	2600	10	10.00	123.49
Junc 120	2600	10	10.00	123.50
Junc 45	2600	22	22.00	123.68
Junc 58	2820	10	10.00	124.70
Junc 95	2590	5	5.00	127.84
Junc 26	2590	20	20.00	128.04
Junc 12	2590	20	20.00	128.06
Junc 23	2880	25	25.00	131.70
Junc 15	2880	25	25.00	131.71
Junc 25	2880	15	15.00	131.72
Junc 61	2430	10	10.00	134.94
Junc 19	2560	15	15.00	140.85
Junc 97	2560	0	0.00	140.94
Junc 57	2411	16	16.00	143.17
Junc 39	2777	0	0.00	143.32
Junc 34	2580	0	0.00	149.29
Junc 74	2917	0	0.00	187.76
Junc 35	2800	0	0.00	259.98

MAX DAY

FIRE BOF

Network Table - Nodes

Node ID	Elevation ft	Base Demand GPM	Demand GPM	Pressure psi
Junc 79	2800	1516	1516.00	-1590.80
Junc 78	2825	8	8.00	-905.06
Junc 77	2850	8	8.00	-640.52
Junc 76	2900	0	0.00	-596.48
Junc 75	2900	0	0.00	-596.48
Junc 104	3085	0	0.00	-397.41
Junc 87	2928	0	0.00	-0.43
Resvr 2ndGarrotteRes	2937	#N/A	0.00	0.00
Resvr BigCreekRes	2820	#N/A	-0.00	0.00
Junc 86	2928	0	0.00	0.00
Junc 71	2925	5	5.00	0.43
Junc 103	2925	12	12.00	0.43
Junc 63	2980	0	0.00	1.29
Junc 1	2975	0	0.00	3.45
Tank T2	2908	#N/A	1096.67	8.23
Tank T4	2912	#N/A	699.31	8.23
Junc 73	2917	0	0.00	8.67
Tank T3	3004	#N/A	-2834.98	9.10
Junc 66	3395	10	10.00	9.51
Tank T5	3395	#N/A	-40.00	9.53
Junc 27	2912	0	0.00	10.15

} < 0.00 PSI

Node ID	Elevation ft	Base Demand GPM	Demand GPM	Pressure psi
Tank T1	3136	#N/A	-1669.84	10.40
Junc 67	3100	3	3.00	11.29
Junc 70	3010	0	0.00	25.44
Junc 91	3100	0	0.00	26.00
Junc 56	2670	15	15.00	31.00
Junc 53	2670	15	15.00	31.00
Junc 5	2852	10	10.00	37.19
Junc 88	2852	0	0.00	37.19
Junc 89	2827	25	25.00	43.19
Junc 48	2827	15	15.00	47.27
Junc 85	2826	0	0.00	47.70
Junc 69	2630	40	40.00	48.27
Junc 11	2773	0	0.00	49.00
Junc 17	2770	20	20.00	50.00
Junc 9	3300	15	15.00	50.63
Junc 21	2820	10	10.00	52.82
Junc 102	2930	0	0.00	54.00
Junc 96	2760	5	5.00	54.16
Junc 38	3000	10	10.00	54.36
Junc 47	2750	10	10.00	58.45
Junc 101	2930	9	9.00	59.21
Junc 60	2850	20	20.00	66.51

Node ID	Elevation ft	Base Demand GPM	Demand GPM	Pressure psi
Junc 100	2900	11	11.00	67.00
Junc 83	2780	15	15.00	67.69
Junc 90	2750	25	25.00	68.68
Junc 37	2856	10	10.00	69.09
Junc 72	2580	30	30.00	69.95
Junc 33	2580	11	11.00	70.00
Junc 3	2790	22	22.00	70.63
Junc 129	2850	0	0.00	70.79
Junc 59	2880	19	19.00	75.56
Junc 82	2710	30	30.00	75.93
Junc 30	2710	0	0.00	76.00
Junc 31	2773	10	10.00	76.72
Junc 42	2820	8	8.00	78.01
Junc 41	2820	8	8.00	79.95
Junc 46	2750	12	12.00	80.66
Junc 4	2756	20	20.00	82.59
Junc 14	2743	15	15.00	84.88
Junc 62	2540	20	20.00	87.30
Junc 16	2800	10	10.00	88.90
Junc 50	2680	10	10.00	89.00
Junc 32	2680	0	0.00	89.06
Junc 43	2806	20	20.00	90.27

Node ID	Elevation ft	Base Demand GPM	Demand GPM	Pressure psi
Junc 134	2800	5	5.00	90.46
Junc 133	2800	5	5.00	90.46
Junc 130	2800	10	10.00	91.25
Junc 20	2730	40	40.00	91.27
Junc 131	2800	5	5.00	91.31
Junc 64	2980	0	0.00	91.65
Junc 10	2980	0	0.00	91.65
Junc 99	2785	0	0.00	93.17
Junc 40	2910	8	8.00	93.37
Junc 128	2800	0	0.00	93.84
Junc 132	2795	5	5.00	94.46
Junc 18	2660	25	25.00	97.59
Junc 92	2900	5	5.00	97.69
Junc 22	2660	12	12.00	97.73
Junc 98	2900	9	9.00	97.84
Junc 49	2970	0	0.00	98.35
Junc 127	2785	5	5.00	100.23
Junc 8	2820	17	17.00	100.69
Junc 24	2650	10	10.00	102.12
Junc 54	2675	20	20.00	103.44
Junc 55	2670	13	13.00	103.44
Junc 68	2500	30	30.00	104.60

Node ID	Elevation ft	Base Demand GPM	Demand GPM	Pressure psi
Junc 52	2670	20	20.00	105.57
Junc 121	2635	5	5.00	108.31
Junc 119	2630	5	5.00	110.57
Junc 135	2750	5	5.00	112.13
Junc 13	2680	15	15.00	113.48
Junc 84	2680	10	10.00	113.59
Junc 28	2620	12	12.00	115.06
Junc 125	2745	5	5.00	117.56
Junc 122	2610	5	5.00	119.14
Junc 94	2610	10	10.00	119.17
Junc 93	2610	10	10.00	119.21
Junc 81	2610	20	20.00	119.22
Junc 118	2610	0	0.00	119.23
Junc 51	2920	0	0.00	120.01
Junc 124	2605	10	10.00	121.32
Junc 44	2680	15	15.00	122.26
Junc 29	2705	20	20.00	122.75
Junc 2	2705	0	0.00	122.75
Junc 80	2600	20	20.00	123.46
Junc 123	2600	10	10.00	123.49
Junc 120	2600	10	10.00	123.50
Junc 45	2600	22	22.00	123.68

Node ID	Elevation ft	Base Demand GPM	Demand GPM	Pressure psi
Junc 6	2912	8	8.00	123.72
Junc 7	2710	0	0.00	124.01
Junc 36	2715	25	25.00	125.35
Junc 65	3125	15	15.00	126.46
Junc 95	2590	5	5.00	127.84
Junc 26	2590	20	20.00	128.04
Junc 12	2590	20	20.00	128.06
Junc 58	2820	10	10.00	132.37
Junc 61	2430	10	10.00	134.94
Junc 23	2880	25	25.00	137.33
Junc 15	2880	25	25.00	137.35
Junc 25	2880	15	15.00	137.35
Junc 19	2560	15	15.00	140.85
Junc 97	2560	0	0.00	140.94
Junc 57	2411	16	16.00	143.17
Junc 39	2777	0	0.00	150.99
Junc 34	2580	0	0.00	155.04
Junc 74	2917	0	0.00	187.76
Junc 35	2800	0	0.00	259.98

MAX. DAY
PML-W FIRE

Network Table - Nodes

Node ID	Elevation ft	Base Demand GPM	Demand GPM	Pressure psi
Junc 90	2750	1025	1025.00	-290.06
Junc 55	2670	13	13.00	-161.76
Junc 54	2675	20	20.00	-20.15
Junc 52	2670	20	20.00	-17.99
Junc 87	2928	0	0.00	-6.07
Resvr 2ndGarrotteRes	2937	#N/A	0.00	0.00
Resvr BigCreekRes	2820	#N/A	-0.00	0.00
Junc 86	2928	0	0.00	0.00
Junc 66	3395	10	10.00	2.58
Tank T2	2908	#N/A	96.99	2.60
Tank T1	3136	#N/A	-162.00	2.60
Tank T5	3395	#N/A	-40.00	2.60
Tank T3	3004	#N/A	-2710.02	2.60
Tank T4	2912	#N/A	574.03	2.60
Junc 27	2912	0	0.00	3.98
Junc 73	2917	0	0.00	8.67
Junc 67	3100	3	3.00	18.00
Junc 91	3100	0	0.00	18.20
Junc 104	3085	0	0.00	24.19
Junc 56	2670	15	15.00	29.39
Junc 53	2670	15	15.00	29.41

Node ID	Elevation ft	Base Demand GPM	Demand GPM	Pressure psi
Junc 88	2852	0	0.00	30.73
Junc 5	2852	10	10.00	30.73
Junc 76	2900	0	0.00	34.00
Junc 89	2827	25	25.00	35.21
Junc 9	3300	15	15.00	43.70
Junc 21	2820	10	10.00	46.24
Junc 48	2827	15	15.00	46.67
Junc 69	2630	40	40.00	46.72
Junc 85	2826	0	0.00	47.10
Junc 11	2773	0	0.00	49.00
Junc 17	2770	20	20.00	50.00
Junc 102	2930	0	0.00	54.00
Junc 96	2760	5	5.00	54.16
Junc 77	2850	8	8.00	55.64
Junc 103	2925	12	12.00	55.79
Junc 70	3010	0	0.00	56.90
Junc 47	2750	10	10.00	58.45
Junc 38	3000	10	10.00	61.08
Junc 37	2856	10	10.00	62.58
Junc 3	2790	22	22.00	64.03
Junc 129	2850	0	0.00	64.27
Junc 78	2825	8	8.00	66.41

Node ID	Elevation ft	Base Demand GPM	Demand GPM	Pressure psi
Junc 100	2900	11	11.00	67.00
Junc 83	2780	15	15.00	67.09
Junc 72	2580	30	30.00	68.38
Junc 63	2980	0	0.00	69.86
Junc 33	2580	11	11.00	70.00
Junc 31	2773	10	10.00	70.12
Junc 1	2975	0	0.00	72.03
Junc 42	2820	8	8.00	73.05
Junc 41	2820	8	8.00	74.70
Junc 59	2880	19	19.00	75.65
Junc 82	2710	30	30.00	75.93
Junc 4	2756	20	20.00	75.98
Junc 30	2710	0	0.00	76.00
Junc 79	2800	8	8.00	77.20
Junc 14	2743	15	15.00	77.51
Junc 46	2750	12	12.00	80.06
Junc 16	2800	10	10.00	83.56
Junc 134	2800	5	5.00	83.94
Junc 133	2800	5	5.00	83.94
Junc 20	2730	40	40.00	84.28
Junc 43	2806	20	20.00	84.41
Junc 130	2800	10	10.00	84.73

Node ID	Elevation ft	Base Demand GPM	Demand GPM	Pressure psi
Junc 131	2800	5	5.00	84.80
Junc 62	2540	20	20.00	86.96
Junc 128	2800	0	0.00	87.33
Junc 132	2795	5	5.00	87.95
Junc 99	2785	0	0.00	88.22
Junc 60	2850	20	20.00	88.37
Junc 50	2680	10	10.00	89.00
Junc 32	2680	0	0.00	89.06
Junc 101	2930	9	9.00	91.53
Junc 49	2970	0	0.00	92.72
Junc 71	2925	5	5.00	93.67
Junc 127	2785	5	5.00	93.72
Junc 18	2660	25	25.00	97.59
Junc 22	2660	12	12.00	97.73
Junc 40	2910	8	8.00	100.08
Junc 8	2820	17	17.00	101.62
Junc 24	2650	10	10.00	102.12
Junc 68	2500	30	30.00	103.26
Junc 75	2900	0	0.00	104.23
Junc 92	2900	5	5.00	104.40
Junc 98	2900	9	9.00	104.62
Junc 135	2750	5	5.00	105.61

Node ID	Elevation ft	Base Demand GPM	Demand GPM	Pressure psi
Junc 13	2680	15	15.00	106.58
Junc 121	2635	5	5.00	108.31
Junc 119	2630	5	5.00	110.57
Junc 125	2745	5	5.00	111.05
Junc 84	2680	10	10.00	112.56
Junc 51	2920	0	0.00	114.38
Junc 28	2620	12	12.00	115.06
Junc 2	2705	0	0.00	116.20
Junc 29	2705	20	20.00	116.20
Junc 7	2710	0	0.00	117.47
Junc 6	2912	8	8.00	118.08
Junc 36	2715	25	25.00	118.82
Junc 122	2610	5	5.00	119.14
Junc 94	2610	10	10.00	119.17
Junc 93	2610	10	10.00	119.21
Junc 81	2610	20	20.00	119.22
Junc 118	2610	0	0.00	119.23
Junc 65	3125	15	15.00	119.53
Junc 44	2680	15	15.00	119.81
Junc 124	2605	10	10.00	121.32
Junc 80	2600	20	20.00	123.46
Junc 123	2600	10	10.00	123.49

Node ID	Elevation ft	Base Demand GPM	Demand GPM	Pressure psi
Junc 120	2600	10	10.00	123.50
Junc 45	2600	22	22.00	123.68
Junc 95	2590	5	5.00	127.84
Junc 26	2590	20	20.00	128.04
Junc 12	2590	20	20.00	128.06
Junc 64	2980	0	0.00	128.58
Junc 10	2980	0	0.00	128.58
Junc 23	2880	25	25.00	131.70
Junc 15	2880	25	25.00	131.71
Junc 25	2880	15	15.00	131.72
Junc 61	2430	10	10.00	134.25
Junc 58	2820	10	10.00	139.08
Junc 19	2560	15	15.00	140.85
Junc 97	2560	0	0.00	140.94
Junc 57	2411	16	16.00	141.96
Junc 34	2580	0	0.00	144.28
Junc 39	2777	0	0.00	157.71
Junc 74	2917	0	0.00	187.76
Junc 35	2800	0	0.00	259.98

MAX. DAY

GL-SE FIRE

Network Table - Nodes

Node ID	Elevation ft	Base Demand GPM	Demand GPM	Pressure psi
Junc 92	2900	1005	1005.00	-163.64
Junc 38	3000	10	10.00	-112.92
Junc 40	2910	8	8.00	-58.60
Junc 58	2820	10	10.00	-10.49
Junc 87	2928	0	0.00	-6.07
Junc 86	2928	0	0.00	0.00
Resvr 2ndGarrotteRes	2937	#N/A	0.00	0.00
Resvr BigCreekRes	2820	#N/A	-0.00	0.00
Junc 39	2777	0	0.00	0.00
Junc 66	3395	10	10.00	2.58
Tank T5	3395	#N/A	-40.00	2.60
Tank T1	3136	#N/A	-1161.99	2.60
Tank T4	2912	#N/A	687.29	2.60
Tank T3	3004	#N/A	-2696.00	2.60
Tank T2	2908	#N/A	969.71	2.60
Junc 27	2912	0	0.00	4.46
Junc 73	2917	0	0.00	8.67
Junc 67	3100	3	3.00	10.68
Junc 104	3085	0	0.00	16.87
Junc 91	3100	0	0.00	18.20
Junc 53	2670	15	15.00	31.00

Node ID	Elevation ft	Base Demand GPM	Demand GPM	Pressure psi
Junc 56	2670	15	15.00	31.00
Junc 5	2852	10	10.00	31.47
Junc 88	2852	0	0.00	31.47
Junc 76	2900	0	0.00	34.00
Junc 89	2827	25	25.00	37.56
Junc 9	3300	15	15.00	43.70
Junc 48	2827	15	15.00	46.67
Junc 21	2820	10	10.00	47.05
Junc 85	2826	0	0.00	47.10
Junc 69	2630	40	40.00	48.27
Junc 11	2773	0	0.00	49.00
Junc 70	3010	0	0.00	49.58
Junc 17	2770	20	20.00	50.00
Junc 102	2930	0	0.00	54.00
Junc 96	2760	5	5.00	54.16
Junc 77	2850	8	8.00	55.64
Junc 103	2925	12	12.00	55.79
Junc 47	2750	10	10.00	58.45
Junc 63	2980	0	0.00	62.54
Junc 37	2856	10	10.00	62.67
Junc 90	2750	25	25.00	63.04
Junc 129	2850	0	0.00	64.38

Node ID	Elevation ft	Base Demand GPM	Demand GPM	Pressure psi
Junc 1	2975	0	0.00	64.71
Junc 3	2790	22	22.00	64.75
Junc 78	2825	8	8.00	66.41
Junc 100	2900	11	11.00	67.00
Junc 83	2780	15	15.00	67.09
Junc 72	2580	30	30.00	69.95
Junc 33	2580	11	11.00	70.00
Junc 31	2773	10	10.00	70.84
Junc 42	2820	8	8.00	73.05
Junc 41	2820	8	8.00	74.70
Junc 59	2880	19	19.00	75.65
Junc 82	2710	30	30.00	75.93
Junc 30	2710	0	0.00	76.00
Junc 4	2756	20	20.00	76.78
Junc 79	2800	8	8.00	77.20
Junc 14	2743	15	15.00	79.13
Junc 46	2750	12	12.00	80.06
Junc 16	2800	10	10.00	83.56
Junc 134	2800	5	5.00	84.09
Junc 133	2800	5	5.00	84.09
Junc 101	2930	9	9.00	84.21
Junc 43	2806	20	20.00	84.41

Node ID	Elevation ft	Base Demand GPM	Demand GPM	Pressure psi
Junc 130	2800	10	10.00	84.87
Junc 131	2800	5	5.00	84.93
Junc 20	2730	40	40.00	85.51
Junc 71	2925	5	5.00	86.35
Junc 62	2540	20	20.00	87.30
Junc 128	2800	0	0.00	87.41
Junc 132	2795	5	5.00	88.06
Junc 99	2785	0	0.00	88.22
Junc 60	2850	20	20.00	88.37
Junc 50	2680	10	10.00	89.00
Junc 32	2680	0	0.00	89.06
Junc 49	2970	0	0.00	92.72
Junc 127	2785	5	5.00	93.80
Junc 75	2900	0	0.00	96.91
Junc 98	2900	9	9.00	97.30
Junc 18	2660	25	25.00	97.59
Junc 22	2660	12	12.00	97.73
Junc 54	2675	20	20.00	97.80
Junc 55	2670	13	13.00	97.80
Junc 52	2670	20	20.00	99.94
Junc 8	2820	17	17.00	101.62
Junc 24	2650	10	10.00	102.12

Node ID	Elevation ft	Base Demand GPM	Demand GPM	Pressure psi
Junc 68	2500	30	30.00	104.60
Junc 135	2750	5	5.00	105.76
Junc 13	2680	15	15.00	107.71
Junc 121	2635	5	5.00	108.31
Junc 119	2630	5	5.00	110.57
Junc 125	2745	5	5.00	111.13
Junc 84	2680	10	10.00	112.56
Junc 51	2920	0	0.00	114.38
Junc 28	2620	12	12.00	115.06
Junc 29	2705	20	20.00	116.56
Junc 2	2705	0	0.00	116.56
Junc 10	2980	0	0.00	116.70
Junc 64	2980	0	0.00	116.70
Junc 7	2710	0	0.00	117.75
Junc 6	2912	8	8.00	118.08
Junc 36	2715	25	25.00	119.02
Junc 122	2610	5	5.00	119.14
Junc 94	2610	10	10.00	119.17
Junc 93	2610	10	10.00	119.21
Junc 81	2610	20	20.00	119.22
Junc 118	2610	0	0.00	119.23
Junc 65	3125	15	15.00	119.53

Node ID	Elevation ft	Base Demand GPM	Demand GPM	Pressure psi
Junc 44	2680	15	15.00	119.81
Junc 124	2605	10	10.00	121.32
Junc 80	2600	20	20.00	123.46
Junc 123	2600	10	10.00	123.49
Junc 120	2600	10	10.00	123.50
Junc 45	2600	22	22.00	123.68
Junc 95	2590	5	5.00	127.84
Junc 26	2590	20	20.00	128.04
Junc 12	2590	20	20.00	128.06
Junc 23	2880	25	25.00	131.70
Junc 15	2880	25	25.00	131.71
Junc 25	2880	15	15.00	131.72
Junc 61	2430	10	10.00	134.94
Junc 19	2560	15	15.00	140.85
Junc 97	2560	0	0.00	140.94
Junc 57	2411	16	16.00	143.17
Junc 34	2580	0	0.00	149.29
Junc 74	2917	0	0.00	187.76
Junc 35	2800	0	0.00	259.98

MAX. DAY
PMC-C FIRE

Network Table - Nodes

Node ID	Elevation ft	Base Demand GPM	Demand GPM	Pressure psi
Junc 121	2635	1005	1005.00	-32.74
Junc 87	2928	0	0.00	-6.07
Resvr 2ndGarrotteRes	2937	#N/A	0.00	0.00
Resvr BigCreekRes	2820	#N/A	-0.00	0.00
Junc 86	2928	0	0.00	0.00
Junc 66	3395	10	10.00	2.58
Tank T4	2912	#N/A	589.09	2.60
Tank T5	3395	#N/A	-40.00	2.60
Tank T1	3136	#N/A	-162.00	2.60
Tank T2	2908	#N/A	771.88	2.60
Tank T3	3004	#N/A	-3399.97	2.60
Junc 27	2912	0	0.00	4.04
Junc 73	2917	0	0.00	8.67
Junc 67	3100	3	3.00	18.00
Junc 91	3100	0	0.00	18.20
Junc 104	3085	0	0.00	24.19
Junc 96	2760	5	5.00	24.29
Junc 5	2852	10	10.00	30.82
Junc 88	2852	0	0.00	30.82
Junc 53	2670	15	15.00	31.00
Junc 56	2670	15	15.00	31.00

Node ID	Elevation ft	Base Demand GPM	Demand GPM	Pressure psi
Junc 76	2900	0	0.00	34.00
Junc 89	2827	25	25.00	37.56
Junc 122	2610	5	5.00	38.73
Junc 9	3300	15	15.00	43.70
Junc 48	2827	15	15.00	45.85
Junc 21	2820	10	10.00	46.05
Junc 85	2826	0	0.00	46.28
Junc 69	2630	40	40.00	48.27
Junc 11	2773	0	0.00	49.00
Junc 17	2770	20	20.00	50.00
Junc 102	2930	0	0.00	54.00
Junc 77	2850	8	8.00	55.64
Junc 103	2925	12	12.00	55.79
Junc 70	3010	0	0.00	56.90
Junc 47	2750	10	10.00	58.45
Junc 38	3000	10	10.00	61.08
Junc 37	2856	10	10.00	61.10
Junc 129	2850	0	0.00	62.47
Junc 3	2790	22	22.00	62.85
Junc 90	2750	25	25.00	63.04
Junc 83	2780	15	15.00	66.24
Junc 78	2825	8	8.00	66.41

Node ID	Elevation ft	Base Demand GPM	Demand GPM	Pressure psi
Junc 100	2900	11	11.00	67.00
Junc 42	2820	8	8.00	68.58
Junc 31	2773	10	10.00	68.94
Junc 63	2980	0	0.00	69.86
Junc 72	2580	30	30.00	69.95
Junc 33	2580	11	11.00	70.00
Junc 41	2820	8	8.00	70.10
Junc 1	2975	0	0.00	72.03
Junc 82	2710	30	30.00	74.52
Junc 16	2800	10	10.00	74.88
Junc 4	2756	20	20.00	75.38
Junc 59	2880	19	19.00	75.65
Junc 30	2710	0	0.00	76.00
Junc 79	2800	8	8.00	77.20
Junc 14	2743	15	15.00	78.29
Junc 46	2750	12	12.00	79.21
Junc 134	2800	5	5.00	81.44
Junc 133	2800	5	5.00	81.44
Junc 43	2806	20	20.00	81.77
Junc 130	2800	10	10.00	82.49
Junc 131	2800	5	5.00	82.59
Junc 99	2785	0	0.00	83.74

Node ID	Elevation ft	Base Demand GPM	Demand GPM	Pressure psi
Junc 20	2730	40	40.00	84.54
Junc 128	2800	0	0.00	86.03
Junc 132	2795	5	5.00	86.10
Junc 62	2540	20	20.00	87.30
Junc 60	2850	20	20.00	88.37
Junc 50	2680	10	10.00	89.00
Junc 32	2680	0	0.00	89.06
Junc 124	2605	10	10.00	91.45
Junc 101	2930	9	9.00	91.53
Junc 127	2785	5	5.00	92.39
Junc 49	2970	0	0.00	92.72
Junc 71	2925	5	5.00	93.67
Junc 18	2660	25	25.00	95.93
Junc 22	2660	12	12.00	97.73
Junc 54	2675	20	20.00	97.80
Junc 55	2670	13	13.00	97.80
Junc 123	2600	10	10.00	98.38
Junc 52	2670	20	20.00	99.94
Junc 40	2910	8	8.00	100.08
Junc 119	2630	5	5.00	100.31
Junc 8	2820	17	17.00	101.62
Junc 94	2610	10	10.00	101.67

Node ID	Elevation ft	Base Demand GPM	Demand GPM	Pressure psi
Junc 24	2650	10	10.00	102.12
Junc 120	2600	10	10.00	102.96
Junc 135	2750	5	5.00	103.11
Junc 75	2900	0	0.00	104.23
Junc 92	2900	5	5.00	104.40
Junc 68	2500	30	30.00	104.60
Junc 98	2900	9	9.00	104.62
Junc 13	2680	15	15.00	106.64
Junc 118	2610	0	0.00	108.98
Junc 125	2745	5	5.00	109.72
Junc 95	2590	5	5.00	110.33
Junc 93	2610	10	10.00	110.58
Junc 84	2680	10	10.00	111.13
Junc 2	2705	0	0.00	112.22
Junc 29	2705	20	20.00	112.22
Junc 7	2710	0	0.00	112.87
Junc 81	2610	20	20.00	114.36
Junc 51	2920	0	0.00	114.38
Junc 28	2620	12	12.00	115.06
Junc 36	2715	25	25.00	115.56
Junc 44	2680	15	15.00	116.41
Junc 6	2912	8	8.00	118.08

Node ID	Elevation ft	Base Demand GPM	Demand GPM	Pressure psi
Junc 65	3125	15	15.00	119.53
Junc 80	2600	20	20.00	123.46
Junc 45	2600	22	22.00	123.68
Junc 10	2980	0	0.00	124.45
Junc 64	2980	0	0.00	124.45
Junc 26	2590	20	20.00	128.04
Junc 12	2590	20	20.00	128.06
Junc 23	2880	25	25.00	131.70
Junc 15	2880	25	25.00	131.71
Junc 25	2880	15	15.00	131.72
Junc 61	2430	10	10.00	134.94
Junc 97	2560	0	0.00	135.55
Junc 58	2820	10	10.00	139.08
Junc 19	2560	15	15.00	140.85
Junc 57	2411	16	16.00	143.17
Junc 34	2580	0	0.00	148.46
Junc 39	2777	0	0.00	157.71
Junc 74	2917	0	0.00	187.76
Junc 35	2800	0	0.00	259.98

BALANCED WATER SYSTEM

AREAS OF HIGH VELOCITY

Peak Hour Demand

Network Table - Links

Link ID	Diameter in	Flow GPM	Velocity fps	Unit Headloss ft/Kft	Status
Pipe 113	6	0.00	0.00	0.00	Closed
Pipe 42	16	0.00	0.00	0.00	Closed
Pipe 96	8	0.00	0.00	0.00	Closed
Pipe 104	8	0.00	0.00	0.00	Closed
Pipe 69	6	0.00	0.00	0.00	Closed
Pipe 144	8	0.00	0.00	0.00	Closed
Pump P3	#N/A	0.00	0.00	-580.00	Open
Pump P2	#N/A	0.00	0.00	0.00	Closed
Pipe 14	6	0.00	0.00	0.00	Closed
Valve PRVGL02	4	0.00	0.00	0.00	Closed
Pump P5	#N/A	0.00	0.00	0.00	Closed
Pump P1	#N/A	0.00	0.00	-413.34	Open
Pump P4	#N/A	146.00	0.00	-266.10	Open
Pipe 11	6	0.00	0.00	0.00	Open
Pipe 94	8	0.00	0.00	0.00	Open
Pipe 5	6	0.00	0.00	0.00	Open
Pipe 18	8	0.00	0.00	0.00	Open
Pipe 52	6	1.57	0.02	0.00	Open
Pipe 72	6	1.83	0.02	0.00	Open
Pipe 149	4	1.66	0.04	0.00	Open
Pipe 120	6	-6.29	0.07	0.01	Open

Link ID	Diameter in	Flow GPM	Velocity fps	Unit Headloss ft/Kft	Status
Pipe 54	6	6.76	0.08	0.01	Open
Pipe 63	6	6.76	0.08	0.01	Open
Pipe 10	6	7.33	0.08	0.01	Open
Pipe 59	10	25.72	0.11	0.00	Open
Pipe 64	6	-9.41	0.11	0.02	Open
Pipe 56	6	10.00	0.11	0.02	Open
Pipe 126	6	-10.00	0.11	0.02	Open
Pipe 123	6	10.00	0.11	0.02	Open
Pipe 125	6	10.00	0.11	0.02	Open
Pipe 118	6	-10.00	0.11	0.02	Open
Pipe 131	6	-10.00	0.11	0.02	Open
Pipe 116	6	-10.00	0.11	0.02	Open
Pipe 86	6	-12.11	0.14	0.02	Open
Pipe 45	6	-12.32	0.14	0.03	Open
Pipe 33	6	12.47	0.14	0.03	Open
Valve PRV6	4	5.56	0.14	49.16	Active
Pipe 46	6	13.09	0.15	0.03	Open
Pipe 57	6	13.53	0.15	0.03	Open
Pipe 41	6	14.01	0.16	0.03	Open
Pipe 87	6	-14.44	0.16	0.03	Open
Pipe 102	6	-17.97	0.20	0.05	Open
Pipe 132	6	-20.00	0.23	0.06	Open

Link ID	Diameter in	Flow GPM	Velocity fps	Unit Headloss ft/Kft	Status
Pipe 119	6	-20.00	0.23	0.09	Open
Pipe 105	10	-55.72	0.23	0.03	Open
Pipe 78	8	-36.67	0.23	0.05	Open
Pipe 62	6	22.94	0.26	0.08	Open
Pipe 74	6	-23.44	0.27	0.08	Open
Pipe 32	6	24.15	0.27	0.09	Open
Pipe 79	8	-44.56	0.28	0.07	Open
Pipe 76	8	-46.00	0.29	0.07	Open
Pipe 114	6	26.29	0.30	0.10	Open
Pipe 88	6	26.62	0.30	0.10	Open
Pipe 1	6	-26.62	0.30	0.10	Open
Pipe 47	6	-27.06	0.31	0.11	Open
Pipe 8	4	-12.09	0.31	0.17	Open
Pipe 44	6	-27.56	0.31	0.11	Open
Pipe 89	6	-27.82	0.32	0.11	Open
Pipe 67	6	-28.57	0.32	0.12	Open
Pipe 15	6	29.33	0.33	0.12	Open
Pipe 53	6	-29.34	0.33	0.12	Open
Pipe 106	6	29.56	0.34	0.13	Open
Pipe 55	6	-30.00	0.34	0.13	Open
Pipe 73	6	30.54	0.35	0.13	Open
Pipe 99	4	13.90	0.35	0.23	Open

Link ID	Diameter in	Flow GPM	Velocity fps	Unit Headloss ft/Kft	Status
Pipe 91	6	32.25	0.37	0.15	Open
Pipe 6	8	-58.00	0.37	0.11	Open
Pipe 68	6	35.21	0.40	0.17	Open
Pipe 142	6	35.54	0.40	0.18	Open
Pipe 101	4	16.00	0.41	0.29	Open
Pipe 90	6	-37.33	0.42	0.20	Open
Pipe 100	4	18.10	0.46	0.37	Open
Pipe 37	6	41.54	0.47	0.24	Open
Pipe 95	6	-43.28	0.49	0.26	Open
Pipe 124	6	-43.71	0.50	0.26	Open
Pipe 115	6	46.00	0.52	0.28	Open
Pipe 50	6	46.29	0.53	0.29	Open
Pipe 130	6	46.94	0.53	0.30	Open
Pipe 26	8	84.44	0.54	0.22	Open
Pipe 49	6	48.00	0.54	0.31	Open
Pipe 98	6	48.00	0.54	0.31	Open
Pipe 12	6	48.00	0.54	0.31	Open
Pipe 117	6	-50.00	0.57	0.33	Open
Pipe 145	6	50.09	0.57	0.34	Open
Pipe 9	4	-22.67	0.58	0.56	Open
Pipe 150	4	24.00	0.61	0.62	Open
Pipe 82	8	-96.67	0.62	0.28	Open

Link ID	Diameter in	Flow GPM	Velocity fps	Unit Headloss ft/Kft	Status
Valve PRV5	4	24.30	0.62	36.19	Active
Pipe 75	6	-54.73	0.62	0.40	Open
Pipe 66	6	54.87	0.62	0.40	Open
Pipe 110	6	-55.80	0.63	0.42	Open
Pipe 109	6	55.80	0.63	0.41	Open
Pipe 136	6	-56.29	0.64	0.42	Open
Pipe 135	6	56.29	0.64	0.42	Open
Pipe 4	6	-58.00	0.66	0.44	Open
Pipe 143	6	-58.17	0.66	0.44	Open
Pipe 2	6	63.53	0.72	0.52	Open
Pipe 127	12	-256.13	0.73	0.33	Open
Pipe 23	6	64.29	0.73	0.53	Open
Pipe 39	6	64.65	0.73	0.54	Open
Pipe 7	4	-29.02	0.74	0.88	Open
Pipe 80	6	-66.00	0.75	0.56	Open
Pipe 25	24	1057.84	0.75	0.12	Open
Pipe 16	6	-66.47	0.75	0.57	Open
Pipe 122	6	73.71	0.84	0.69	Open
Pipe 35	6	73.86	0.84	0.69	Open
Pipe 148	4	34.98	0.89	1.25	Open
Pipe 92	6	80.00	0.91	0.80	Open
Pipe 28	6	-83.19	0.94	0.86	Open

Link ID	Diameter in	Flow GPM	Velocity fps	Unit Headloss ft/Kft	Status
Pipe 31	6	-89.68	1.02	0.99	Open
Pipe 83	8	160.25	1.02	0.71	Open
Pipe 146	6	91.75	1.04	1.03	Open
Pipe 27	6	-92.87	1.05	1.05	Open
Pipe 147	6	102.25	1.16	1.26	Open
Valve PRVBOF	4	48.00	1.23	158.25	Active
Pipe 3	4	-50.94	1.30	2.50	Open
Pipe 107	6	-115.28	1.31	1.57	Open
Pipe 40	6	-118.67	1.35	1.66	Open
Pipe 103	6	-121.25	1.38	1.73	Open
Pipe 36	6	-137.49	1.56	2.18	Open
Pipe 134	6	139.19	1.58	2.23	Open
Pipe 70	6	155.41	1.76	2.74	Open
Pipe 34	6	158.46	1.80	2.84	Open
Valve PRVGL01	4	73.75	1.88	85.43	Active
Pipe 112	10	461.33	1.88	1.70	Open
Pipe 133	6	-169.19	1.92	3.20	Open
Pipe 19	10	-506.17	2.07	2.02	Open
Pipe 121	10	506.17	2.07	2.02	Open
Pipe 93	8	-324.00	2.07	2.63	Open
Valve PRVGL03	4	84.25	2.15	84.64	Active
Valve PRV10	4	85.53	2.18	90.01	Active

Link ID	Diameter in	Flow GPM	Velocity fps	Unit Headloss ft/Kft	Status
Pipe 29	10	-581.97	2.38	2.62	Open
Pipe 17	6	210.09	2.38	4.78	Open
Pipe 71	6	-215.92	2.45	5.03	Open
Pipe 129	6	226.13	2.57	5.48	Open
Pipe 128	6	236.13	2.68	5.94	Open
Pipe 30	10	-691.65	2.83	3.61	Open
Pipe 13	12	1032.13	2.93	4.37	Open
Valve PRV3	4	115.41	2.95	124.07	Active
Valve PRV4	4	118.67	3.03	174.39	Active
Pipe 140	12	1081.00	3.07	3.40	Open
Pipe 139	12	1081.00	3.07	3.40	Open
Pipe 138	12	1101.00	3.12	3.51	Open
Pipe 141	12	1107.95	3.14	3.55	Open
Pipe 43	12	1111.60	3.15	3.58	Open
Pipe 48	12	-1197.14	3.40	4.10	Open
Valve PRV8	4	138.46	3.54	41.90	Active
Pipe 21	10	-869.15	3.55	5.51	Open
Valve PRV7	4	139.92	3.57	106.23	Active
Pipe 137	12	1357.14	3.85	5.17	Open
Valve PRV2	4	168.73	4.31	66.98	Active
Pipe 20	10	1057.84	4.32	7.93	Open
Pipe 24	10	-1071.60	4.38	8.12	Open

Link ID	Diameter in	Flow GPM	Velocity fps	Unit Headloss ft/Kft	Status
Pipe 111	6	411.33	4.67	16.60	Open
Pipe 108	10	-1167.40	4.77	9.52	Open
Pipe 60	10	1366.13	5.58	12.73	Open
Valve PRV11	4	219.42	5.60	103.39	Active
Pipe 38	10	1382.13	5.65	13.01	Open
Pipe 65	10	-1427.46	5.83	13.81	Open
Valve PSVT2	8	1057.84	6.75	14.00	Active
Pipe 51	10	1677.55	6.85	18.62	Open
Valve PRV9	6	1111.60	12.61	0.00	Open
Valve PRV1	6	1382.13	15.68	0.00	Open

Max - Day
GL-C Fire

Network Table - Links

Link ID	Diameter in	Flow GPM	Velocity fps	Status
Pipe 69	6	0.00	0.00	Closed
Pipe 113	6	0.00	0.00	Closed
Pipe 42	16	0.00	0.00	Closed
Pipe 104	8	0.00	0.00	Closed
Pipe 14	6	0.00	0.00	Closed
Pipe 96	8	0.00	0.00	Closed
Pipe 144	8	0.00	0.00	Closed
Pump P3	#N/A	0.00	0.00	Open
Valve PRV5	4	0.00	0.00	Closed
Valve PRV6	4	0.00	0.00	Closed
Valve PRVGL02	4	0.00	0.00	Closed
Pump P2	#N/A	0.00	0.00	Closed
Pump P5	#N/A	0.00	0.00	Closed
Pump P1	#N/A	0.00	0.00	Open
Pump P4	#N/A	73.00	0.00	Open
Pipe 32	6	0.00	0.00	Open
Pipe 94	8	0.00	0.00	Open
Pipe 11	6	0.00	0.00	Open
Pipe 5	6	0.00	0.00	Open
Pipe 18	8	0.00	0.00	Open
Pipe 72	6	1.13	0.01	Open

Link ID	Diameter in	Flow GPM	Velocity fps	Status
Pipe 118	12	-5.00	0.01	Open
Pipe 33	6	1.26	0.01	Open
Pipe 120	6	-3.19	0.04	Open
Pipe 54	6	3.38	0.04	Open
Pipe 63	6	3.38	0.04	Open
Pipe 10	6	3.66	0.04	Open
Pipe 64	6	-4.71	0.05	Open
Pipe 123	6	5.00	0.06	Open
Pipe 116	6	-5.00	0.06	Open
Pipe 56	6	5.00	0.06	Open
Pipe 131	6	-5.00	0.06	Open
Pipe 126	6	-5.00	0.06	Open
Pipe 125	6	5.00	0.06	Open
Pipe 86	6	-6.14	0.07	Open
Pipe 57	6	6.76	0.08	Open
Pipe 102	6	-8.78	0.10	Open
Pipe 87	6	-10.00	0.11	Open
Pipe 132	6	-10.00	0.11	Open
Pipe 119	6	-10.00	0.11	Open
Pipe 78	8	-18.72	0.12	Open
Pipe 62	6	11.47	0.13	Open
Pipe 74	6	-11.62	0.13	Open

Link ID	Diameter in	Flow GPM	Velocity fps	Status
Pipe 106	6	12.00	0.14	Open
Pipe 79	8	-22.59	0.14	Open
Pipe 76	8	-23.00	0.15	Open
Pipe 114	6	13.19	0.15	Open
Pipe 1	6	-13.25	0.15	Open
Pipe 45	6	-13.26	0.15	Open
Pipe 47	6	-13.53	0.15	Open
Pipe 67	6	-14.25	0.16	Open
Pipe 53	6	14.44	0.16	Open
Pipe 88	6	14.67	0.17	Open
Pipe 55	6	-15.00	0.17	Open
Pipe 73	6	15.16	0.17	Open
Pipe 89	6	-15.33	0.17	Open
Pipe 99	4	6.95	0.18	Open
Pipe 41	6	15.91	0.18	Open
Pipe 91	6	16.20	0.18	Open
Pipe 6	8	-29.00	0.19	Open
Pipe 46	6	16.84	0.19	Open
Pipe 142	6	17.80	0.20	Open
Pipe 68	6	17.88	0.20	Open
Pipe 101	4	8.00	0.20	Open
Pipe 90	6	-18.67	0.21	Open

Link ID	Diameter in	Flow GPM	Velocity fps	Status
Pipe 52	6	19.60	0.22	Open
Pipe 100	4	9.05	0.23	Open
Pipe 95	6	-21.60	0.25	Open
Pipe 124	6	-21.81	0.25	Open
Pipe 115	6	23.00	0.26	Open
Pipe 50	6	23.19	0.26	Open
Pipe 44	6	-23.68	0.27	Open
Pipe 98	6	24.00	0.27	Open
Pipe 49	6	-24.00	0.27	Open
Pipe 12	6	24.00	0.27	Open
Pipe 117	6	-25.00	0.28	Open
Pipe 26	8	45.00	0.29	Open
Pipe 9	4	-11.34	0.29	Open
Pipe 150	4	12.00	0.31	Open
Pipe 75	6	-27.25	0.31	Open
Pipe 66	6	27.37	0.31	Open
Pipe 82	8	-48.72	0.31	Open
Pipe 136	6	-28.19	0.32	Open
Pipe 135	6	28.19	0.32	Open
Pipe 4	6	-29.00	0.33	Open
Pipe 143	6	-29.00	0.33	Open
Pipe 59	10	81.97	0.33	Open

Link ID	Diameter in	Flow GPM	Velocity fps	Status
Valve PRV10	4	13.76	0.35	Active
Pipe 2	6	31.76	0.36	Open
Pipe 23	6	32.42	0.37	Open
Pipe 80	6	-33.00	0.37	Open
Pipe 16	6	-33.24	0.38	Open
Pipe 37	6	34.66	0.39	Open
Pipe 105	10	-96.97	0.40	Open
Pipe 122	6	36.81	0.42	Open
Pipe 92	6	40.00	0.45	Open
Pipe 110	6	47.81	0.54	Open
Pipe 109	6	-47.81	0.54	Open
Pipe 130	6	52.21	0.59	Open
Pipe 39	6	52.52	0.60	Open
Valve PRVBOF	4	24.00	0.61	Active
Pipe 127	12	-217.04	0.62	Open
Pipe 31	6	-56.00	0.64	Open
Pipe 35	6	57.91	0.66	Open
Pipe 40	6	-59.72	0.68	Open
Pipe 103	6	-60.38	0.69	Open
Pipe 15	6	-66.00	0.75	Open
Pipe 25	24	1199.99	0.85	Open
Pipe 70	6	77.53	0.88	Open

Link ID	Diameter in	Flow GPM	Velocity fps	Status
Pipe 112	10	230.28	0.94	Open
Pipe 28	6	-106.53	1.21	Open
Pipe 71	6	-107.75	1.22	Open
Pipe 34	6	120.44	1.37	Open
Pipe 36	6	-121.53	1.38	Open
Pipe 27	6	-122.53	1.39	Open
Pipe 107	6	-123.97	1.41	Open
Valve PRV3	4	57.53	1.47	Active
Pipe 134	6	129.82	1.47	Open
Valve PRV4	4	59.72	1.52	Active
Pipe 133	6	-144.82	1.64	Open
Valve PRV7	4	69.75	1.78	Active
Pipe 149	4	79.60	2.03	Open
Pipe 17	6	185.38	2.10	Open
Valve PRV2	4	87.42	2.23	Active
Pipe 129	6	202.04	2.29	Open
Pipe 111	6	205.28	2.33	Open
Pipe 128	6	207.04	2.35	Open
Pipe 139	12	959.17	2.72	Open
Pipe 140	12	959.17	2.72	Open
Pipe 138	12	969.17	2.75	Open
Valve PRV11	4	109.38	2.79	Active

Link ID	Diameter in	Flow GPM	Velocity fps	Status
Valve PRV8	4	110.44	2.82	Active
Pipe 141	12	1001.38	2.84	Open
Pipe 29	10	-722.48	2.95	Open
Pipe 43	12	1092.44	3.10	Open
Pipe 121	10	760.29	3.11	Open
Pipe 19	10	-760.29	3.11	Open
Pipe 48	12	-1106.20	3.14	Open
Pipe 13	12	1118.03	3.17	Open
Pipe 30	10	-788.48	3.22	Open
Pipe 137	12	1186.20	3.37	Open
Pipe 21	10	-930.01	3.80	Open
Pipe 7	4	151.72	3.87	Open
Pipe 145	6	349.58	3.97	Open
Pipe 24	10	-1072.45	4.38	Open
Pipe 148	4	183.72	4.69	Open
Pipe 20	10	1199.99	4.90	Open
Pipe 146	6	449.13	5.10	Open
Pipe 108	10	-1251.99	5.11	Open
Pipe 65	10	-1304.41	5.33	Open
Pipe 60	10	1354.41	5.53	Open
Pipe 38	10	1362.41	5.57	Open
Pipe 51	10	1509.80	6.17	Open

Link ID	Diameter in	Flow GPM	Velocity fps	Status
Pipe 83	8	1176.82	7.51	Open
Valve PSVT2	8	1199.99	7.66	Active
Pipe 8	4	-330.58	8.44	Open
Pipe 93	8	-1661.95	10.61	Open
Valve PRVGL01	4	440.13	11.24	Active
Valve PRV9	6	1092.45	12.40	Open
Pipe 147	6	1147.82	13.02	Open
Valve PRV1	6	1362.41	15.46	Open
Pipe 3	4	-1034.70	26.42	Open
Valve PRVGL03	4	1138.82	29.08	Open

Max. Day
Fire BOF

Network Table - Links

Link ID	Diameter in	Flow GPM	Velocity fps	Status
Pipe 113	6	0.00	0.00	Closed
Pipe 42	16	0.00	0.00	Closed
Pipe 96	8	0.00	0.00	Closed
Pipe 69	6	0.00	0.00	Closed
Pipe 14	6	0.00	0.00	Closed
Pipe 144	8	0.00	0.00	Closed
Pipe 104	8	0.00	0.00	Closed
Pump P2	#N/A	0.00	0.00	Closed
Valve PRV5	4	0.00	0.00	Closed
Valve PRV6	4	0.00	0.00	Closed
Pump P4	#N/A	73.00	0.00	Open
Pump P3	#N/A	0.00	0.00	Open
Pump P5	#N/A	0.00	0.00	Closed
Pump P1	#N/A	0.00	0.00	Open
Pipe 32	6	0.00	0.00	Open
Pipe 94	8	0.00	0.00	Open
Pipe 18	8	0.00	0.00	Open
Pipe 5	6	0.00	0.00	Open
Pipe 11	6	-0.00	0.00	Open
Pipe 72	6	1.13	0.01	Open
Pipe 33	6	1.26	0.01	Open

Link ID	Diameter in	Flow GPM	Velocity fps	Status
Pipe 120	6	-3.19	0.04	Open
Pipe 54	6	3.38	0.04	Open
Pipe 63	6	3.38	0.04	Open
Pipe 10	6	3.66	0.04	Open
Pipe 149	4	1.75	0.04	Open
Pipe 64	6	-4.71	0.05	Open
Pipe 123	6	5.00	0.06	Open
Pipe 118	6	-5.00	0.06	Open
Pipe 116	6	-5.00	0.06	Open
Pipe 131	6	-5.00	0.06	Open
Pipe 126	6	-5.00	0.06	Open
Pipe 125	6	5.00	0.06	Open
Pipe 56	6	5.00	0.06	Open
Pipe 86	6	-6.14	0.07	Open
Pipe 57	6	6.76	0.08	Open
Pipe 102	6	-8.78	0.10	Open
Pipe 87	6	-10.00	0.11	Open
Pipe 119	6	-10.00	0.11	Open
Pipe 132	6	-10.00	0.11	Open
Pipe 78	8	-18.72	0.12	Open
Pipe 62	6	11.47	0.13	Open
Pipe 74	6	-11.62	0.13	Open

Link ID	Diameter in	Flow GPM	Velocity fps	Status
Pipe 106	6	12.00	0.14	Open
Pipe 79	8	-22.59	0.14	Open
Pipe 76	8	-23.00	0.15	Open
Pipe 114	6	13.19	0.15	Open
Pipe 1	6	-13.25	0.15	Open
Pipe 45	6	-13.26	0.15	Open
Pipe 47	6	-13.53	0.15	Open
Pipe 67	6	-14.25	0.16	Open
Pipe 53	6	14.44	0.16	Open
Pipe 88	6	14.67	0.17	Open
Pipe 55	6	-15.00	0.17	Open
Pipe 73	6	15.16	0.17	Open
Pipe 89	6	-15.33	0.17	Open
Pipe 41	6	15.91	0.18	Open
Pipe 91	6	16.20	0.18	Open
Pipe 46	6	16.84	0.19	Open
Pipe 142	6	17.80	0.20	Open
Pipe 68	6	17.88	0.20	Open
Pipe 90	6	-18.67	0.21	Open
Pipe 52	6	19.60	0.22	Open
Pipe 95	6	-21.60	0.25	Open
Pipe 124	6	-21.81	0.25	Open

Link ID	Diameter in	Flow GPM	Velocity fps	Status
Pipe 115	6	23.00	0.26	Open
Pipe 50	6	23.19	0.26	Open
Pipe 44	6	-23.68	0.27	Open
Pipe 117	6	-25.00	0.28	Open
Pipe 26	8	45.00	0.29	Open
Pipe 9	4	-11.34	0.29	Open
Pipe 75	6	-27.25	0.31	Open
Pipe 66	6	27.37	0.31	Open
Pipe 82	8	-48.72	0.31	Open
Pipe 135	6	28.19	0.32	Open
Pipe 136	6	-28.19	0.32	Open
Pipe 143	6	-29.00	0.33	Open
Valve PRV10	4	13.76	0.35	Active
Pipe 2	6	31.76	0.36	Open
Pipe 23	6	32.42	0.37	Open
Pipe 80	6	-33.00	0.37	Open
Pipe 16	6	-33.24	0.38	Open
Pipe 59	10	94.56	0.39	Open
Pipe 37	6	34.66	0.39	Open
Pipe 122	6	36.81	0.42	Open
Pipe 105	10	-109.56	0.45	Open
Pipe 92	6	40.00	0.45	Open

Link ID	Diameter in	Flow GPM	Velocity fps	Status
Pipe 110	6	49.33	0.56	Open
Pipe 109	6	-49.33	0.56	Open
Pipe 39	6	52.52	0.60	Open
Pipe 130	6	52.89	0.60	Open
Pipe 127	12	-219.14	0.62	Open
Pipe 31	6	-56.18	0.64	Open
Pipe 35	6	57.91	0.66	Open
Pipe 40	6	-59.72	0.68	Open
Pipe 145	6	60.10	0.68	Open
Pipe 103	6	-60.38	0.69	Open
Pipe 70	6	77.53	0.88	Open
Pipe 15	6	-80.51	0.91	Open
Pipe 146	6	82.45	0.94	Open
Pipe 112	10	230.28	0.94	Open
Pipe 25	24	1326.94	0.94	Open
Pipe 8	4	-41.10	1.05	Open
Pipe 71	6	-107.75	1.22	Open
Pipe 28	6	-107.87	1.22	Open
Pipe 34	6	120.44	1.37	Open
Pipe 36	6	-122.87	1.39	Open
Pipe 27	6	-124.05	1.41	Open
Valve PRV3	4	57.53	1.47	Active

Link ID	Diameter in	Flow GPM	Velocity fps	Status
Pipe 134	6	131.25	1.49	Open
Valve PRV4	4	59.72	1.52	Active
Pipe 107	6	-136.56	1.55	Open
Pipe 133	6	-146.25	1.66	Open
Valve PRV7	4	69.75	1.78	Active
Valve PRVGL01	4	73.45	1.88	Active
Valve PRV2	4	87.42	2.23	Active
Pipe 17	6	199.89	2.27	Open
Pipe 129	6	204.14	2.32	Open
Pipe 111	6	205.28	2.33	Open
Pipe 128	6	209.14	2.37	Open
Pipe 140	12	969.08	2.75	Open
Pipe 139	12	969.08	2.75	Open
Pipe 138	12	979.08	2.78	Open
Valve PRV11	4	109.38	2.79	Active
Valve PRV8	4	110.44	2.82	Active
Pipe 141	12	1011.98	2.87	Open
Pipe 29	10	-732.98	2.99	Open
Pipe 43	12	1104.47	3.13	Open
Pipe 19	10	-772.31	3.15	Open
Pipe 121	10	772.31	3.15	Open
Pipe 48	12	-1118.23	3.17	Open

Link ID	Diameter in	Flow GPM	Velocity fps	Status
Pipe 30	10	-799.16	3.26	Open
Pipe 137	12	1198.23	3.40	Open
Pipe 3	4	-134.03	3.42	Open
Pipe 13	12	1232.38	3.50	Open
Pipe 147	6	319.31	3.62	Open
Pipe 21	10	-942.04	3.85	Open
Pipe 7	4	-158.13	4.04	Open
Pipe 24	10	-1084.47	4.43	Open
Pipe 148	4	178.79	4.56	Open
Pipe 20	10	1326.94	5.42	Open
Pipe 108	10	-1378.94	5.63	Open
Pipe 65	10	-1416.86	5.79	Open
Pipe 60	10	1481.37	6.05	Open
Pipe 38	10	1489.37	6.08	Open
Pipe 51	10	1636.75	6.69	Open
Valve PRVGL02	4	304.92	7.78	Open
Pipe 6	8	-1232.08	7.86	Open
Valve PRVGL03	4	310.31	7.92	Active
Pipe 150	4	316.92	8.09	Open
Valve PSVT2	8	1326.94	8.47	Active
Pipe 83	8	1551.39	9.90	Open
Pipe 93	8	-1669.84	10.66	Open

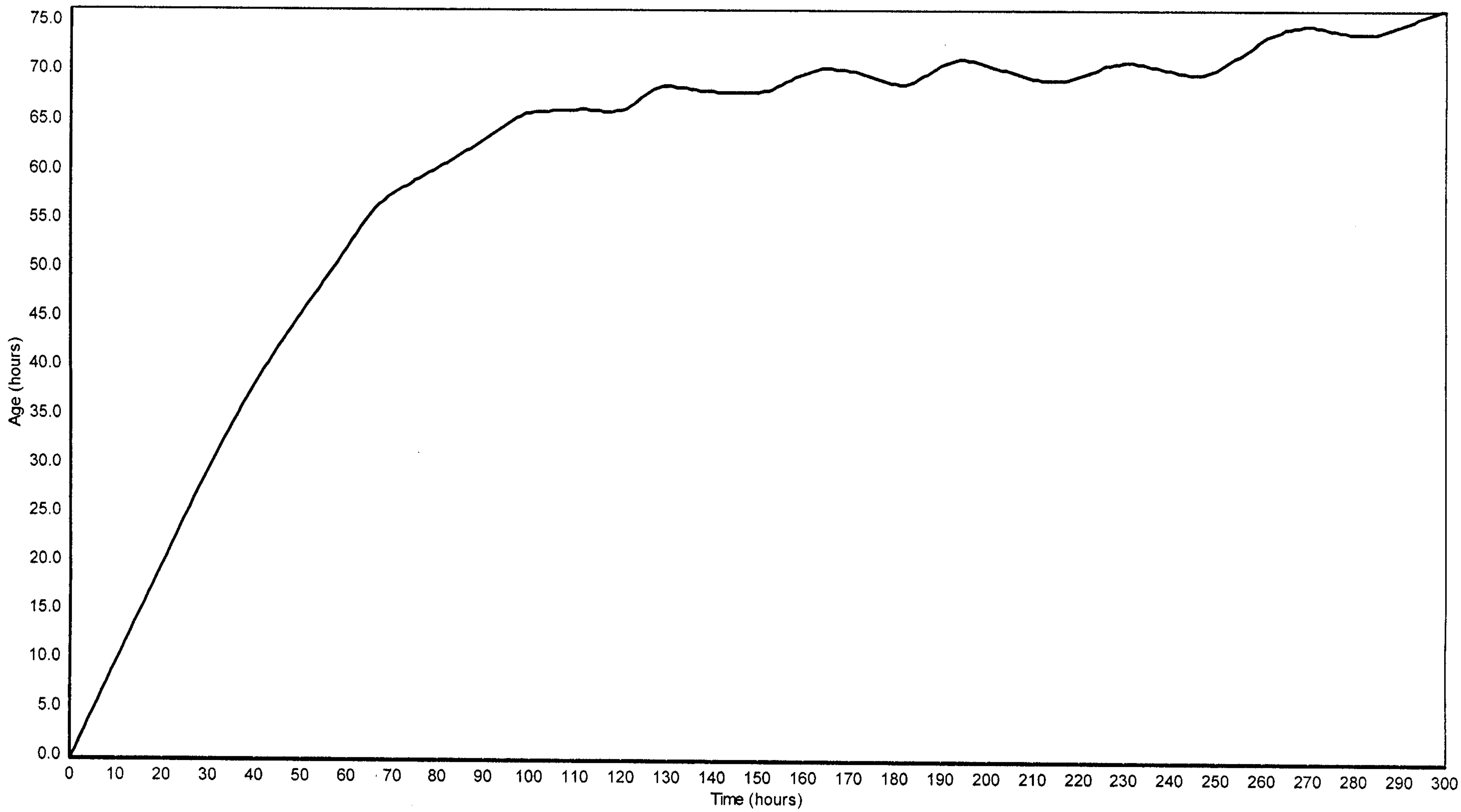
Link ID	Diameter in	Flow GPM	Velocity fps	Status
Valve PRV9	6	1104.47	12.53	Open
Pipe 4	6	-1232.08	13.98	Open
Valve PRV1	6	1489.37	16.90	Open
Pipe 99	4	662.11	16.90	Open
Pipe 49	6	1532.00	17.38	Open
Pipe 98	6	1532.00	17.38	Open
Pipe 12	6	1532.00	17.38	Open
Pipe 100	4	861.89	22.00	Open
Pipe 101	4	1516.00	38.71	Open
Valve PRVBOF	4	1532.00	39.11	Open

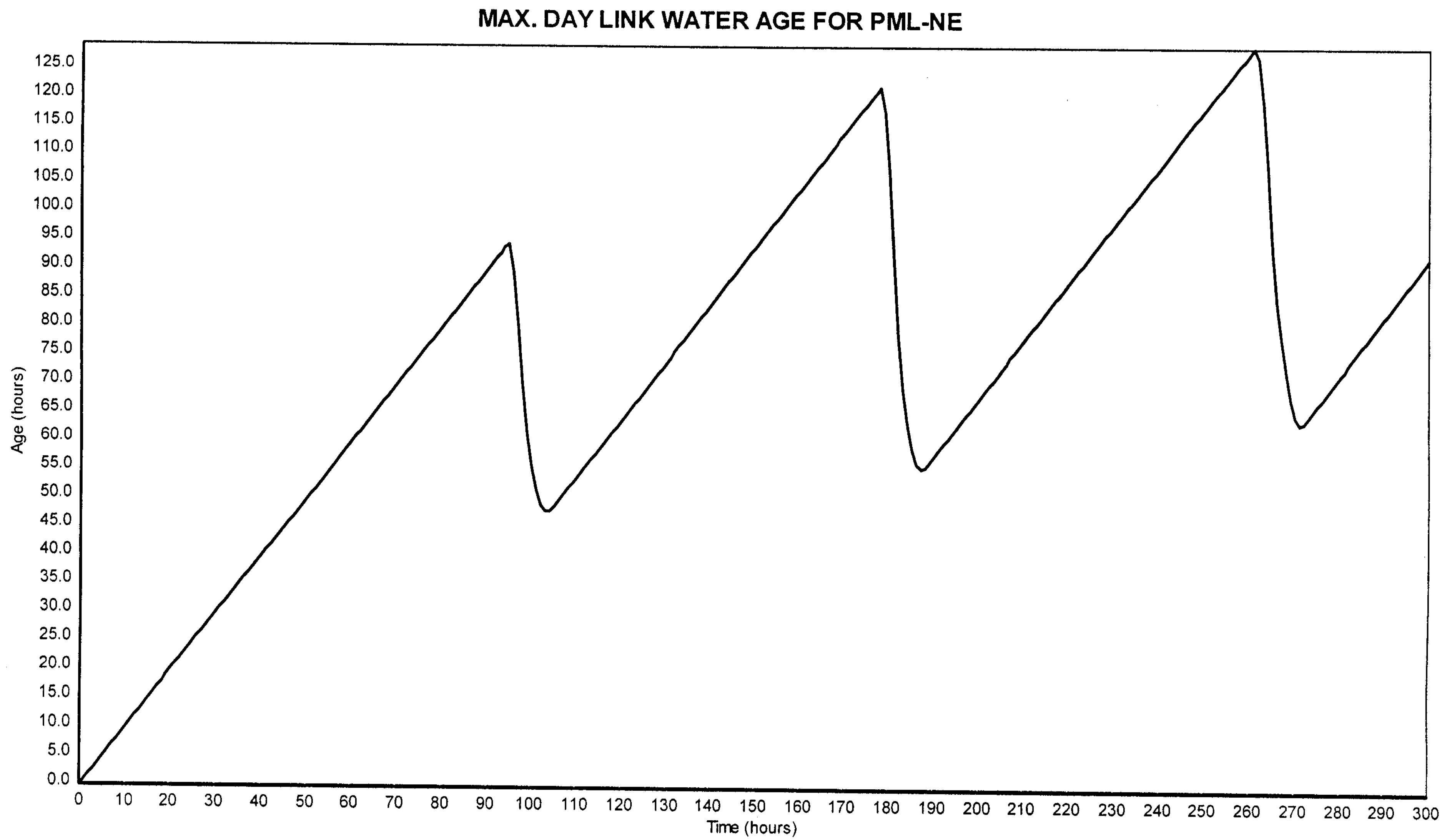
BALANCED WATER SYSTEM

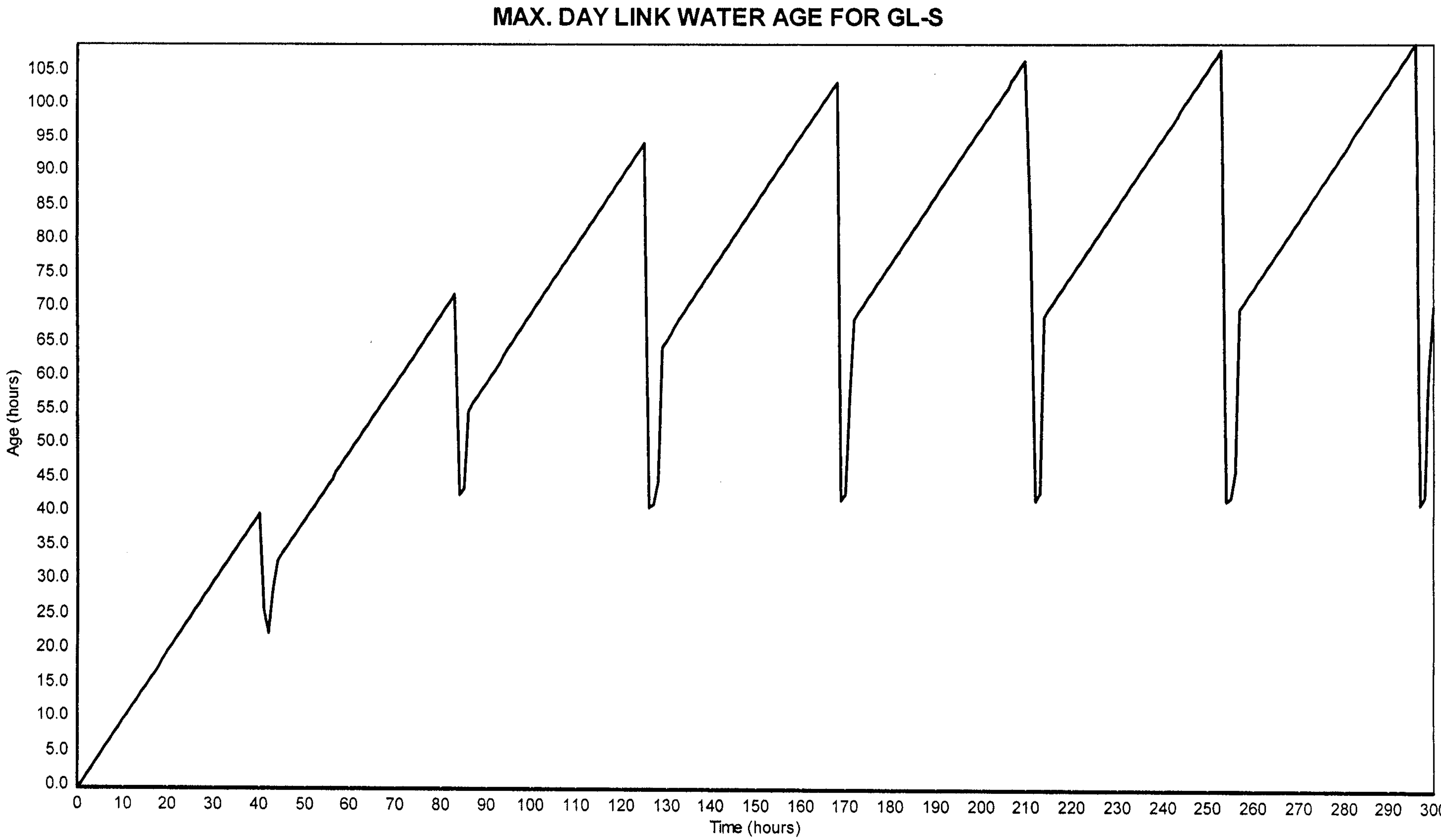
MAXIMUM DAY DEMAND

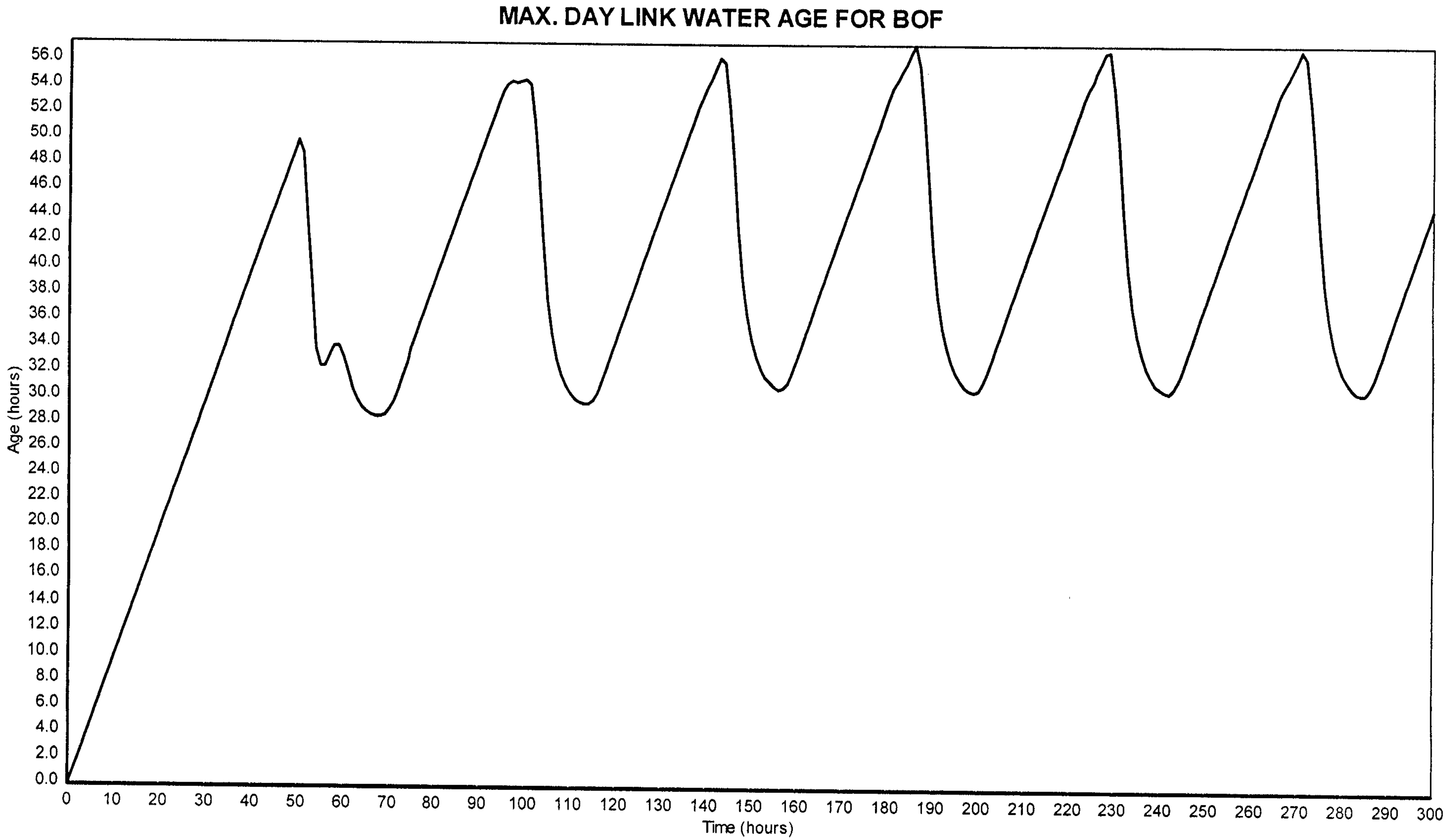
WATER AGE BY PRESS. ZONE

MAX. DAY LINK WATER AGE FOR PML-NW




MAX. DAY LINK WATER AGE FOR PML-NE
Age (hours)
125.0
120.0
115.0
110.0
105.0
100.0
95.0
90.0
85.0
80.0
75.0
70.0
65.0
60.0
55.0
50.0
45.0
40.0
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170
180
190
200
210
220
230
240
250
260
270
280
290
300
Time (hours)


MAX. DAY LINK WATER AGE FOR GL-S
Age (hours)
0.0
5.0
10.0
15.0
20.0
25.0
30.0
35.0
40.0
45.0
50.0
55.0
60.0
65.0
70.0
75.0
80.0
85.0
90.0
95.0
100.0
105.0
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230 240 250 260 270 280 290 300
Time (hours)

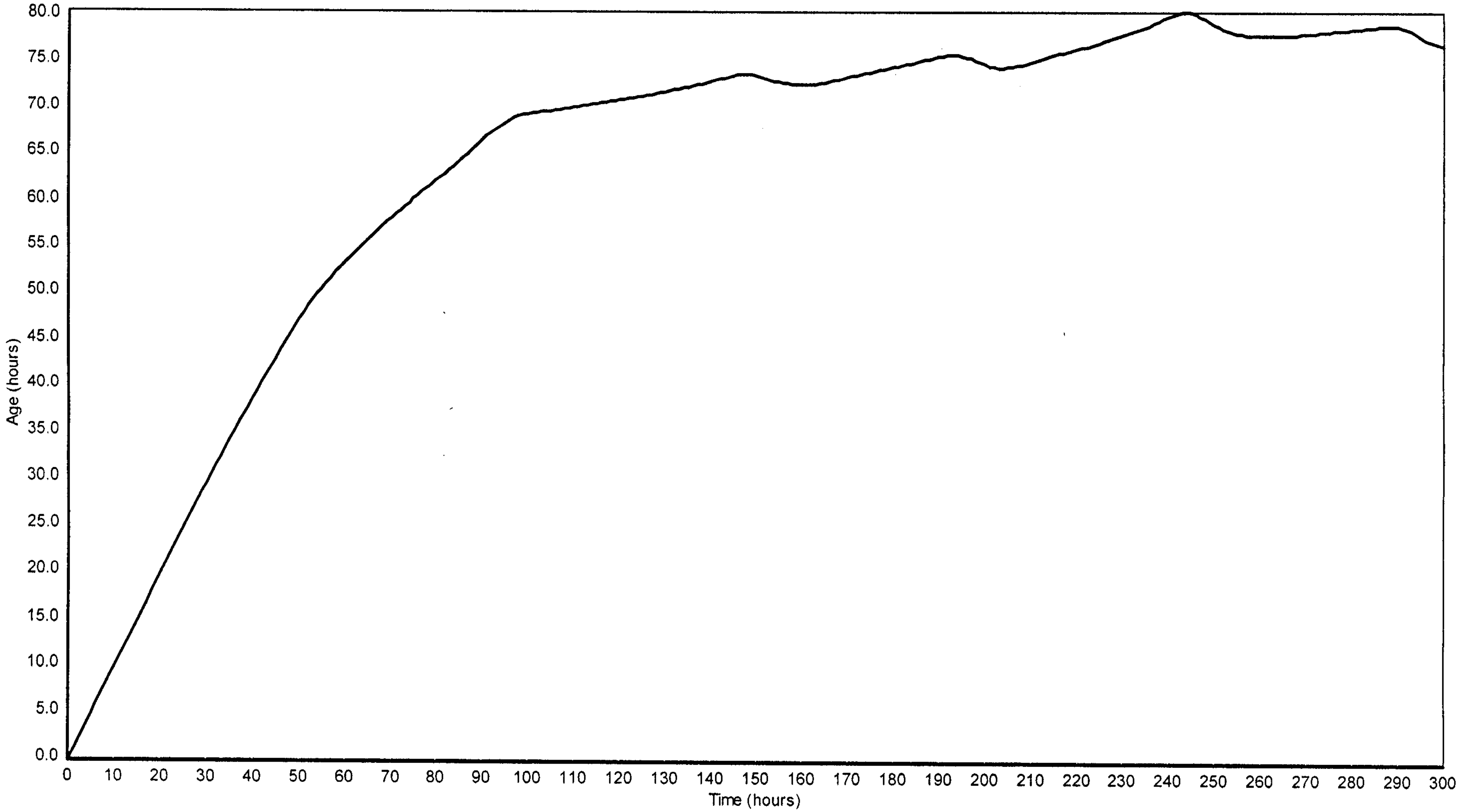

MAX. DAY LINK WATER AGE FOR BOF
Age (hours)
0.0
2.0
4.0
6.0
8.0
10.0
12.0
14.0
16.0
18.0
20.0
22.0
24.0
26.0
28.0
30.0
32.0
34.0
36.0
38.0
40.0
42.0
44.0
46.0
48.0
50.0
52.0
54.0
56.0
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230 240 250 260 270 280 290 300
Time (hours)

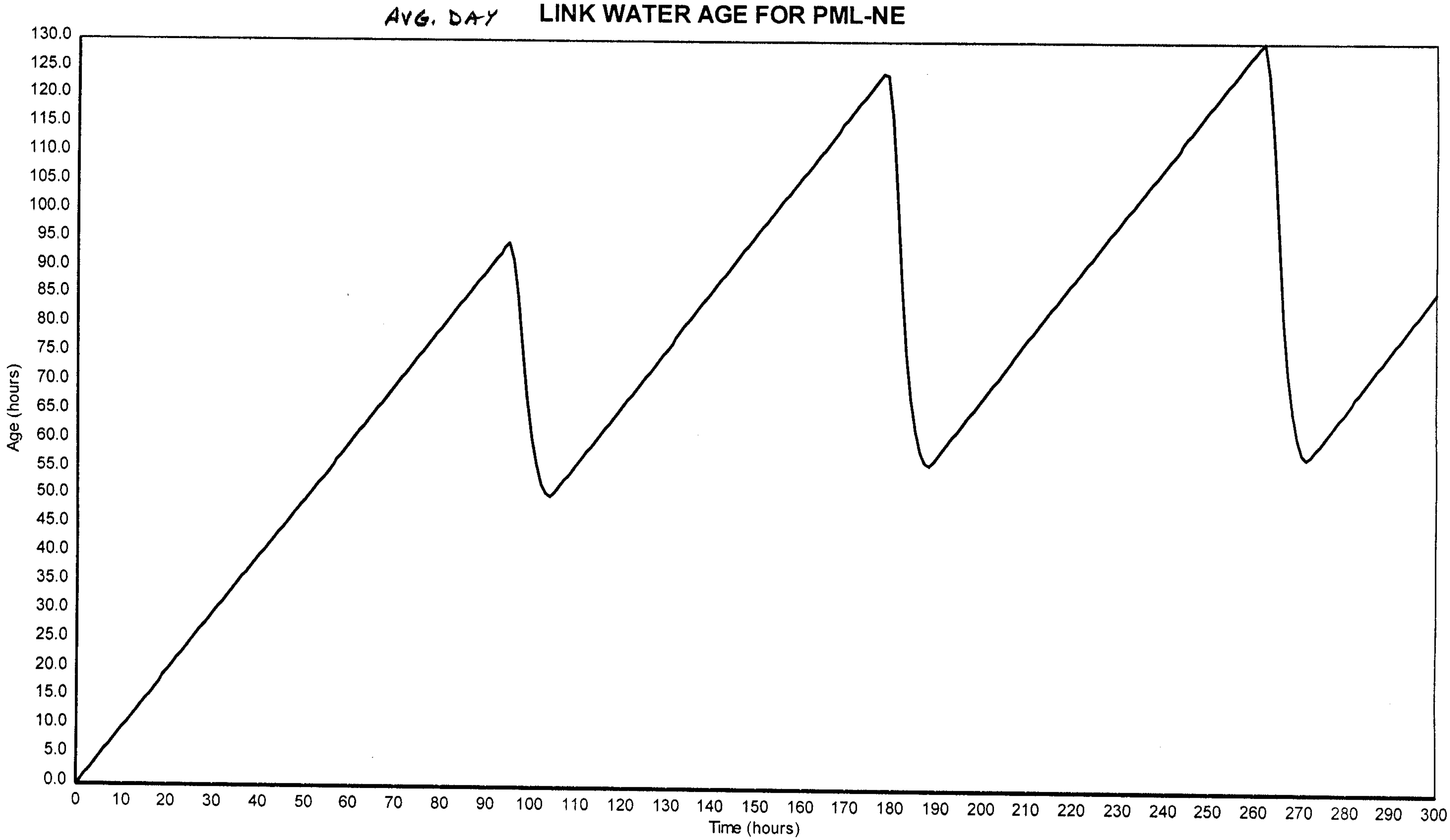
BALANCED WATER SYSTEM

AVERAGE DAY DEMAND

WATER AGE BY PRESS. ZONE

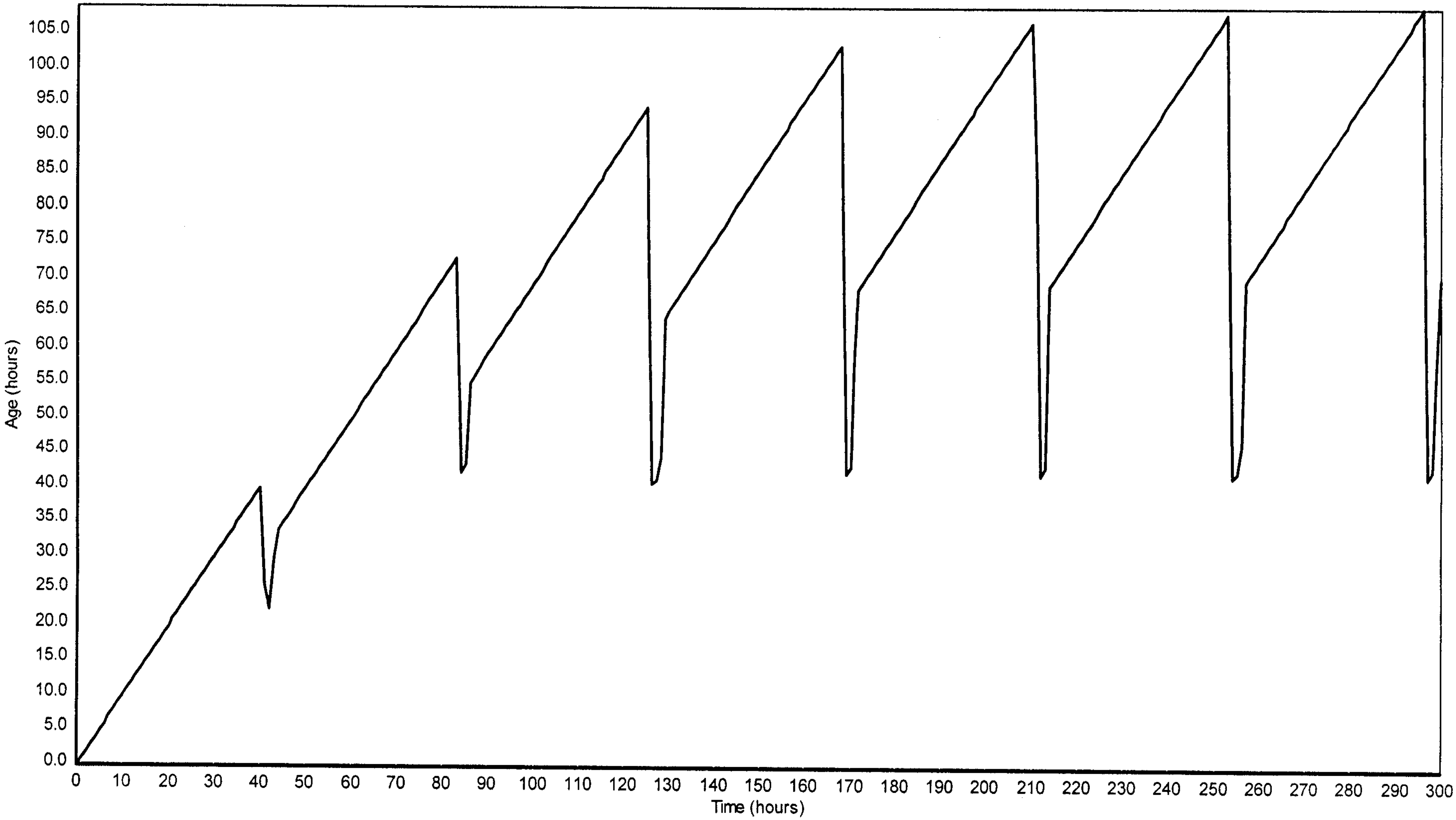
AVG. DAY **LINK WATER AGE FOR PML-NW**



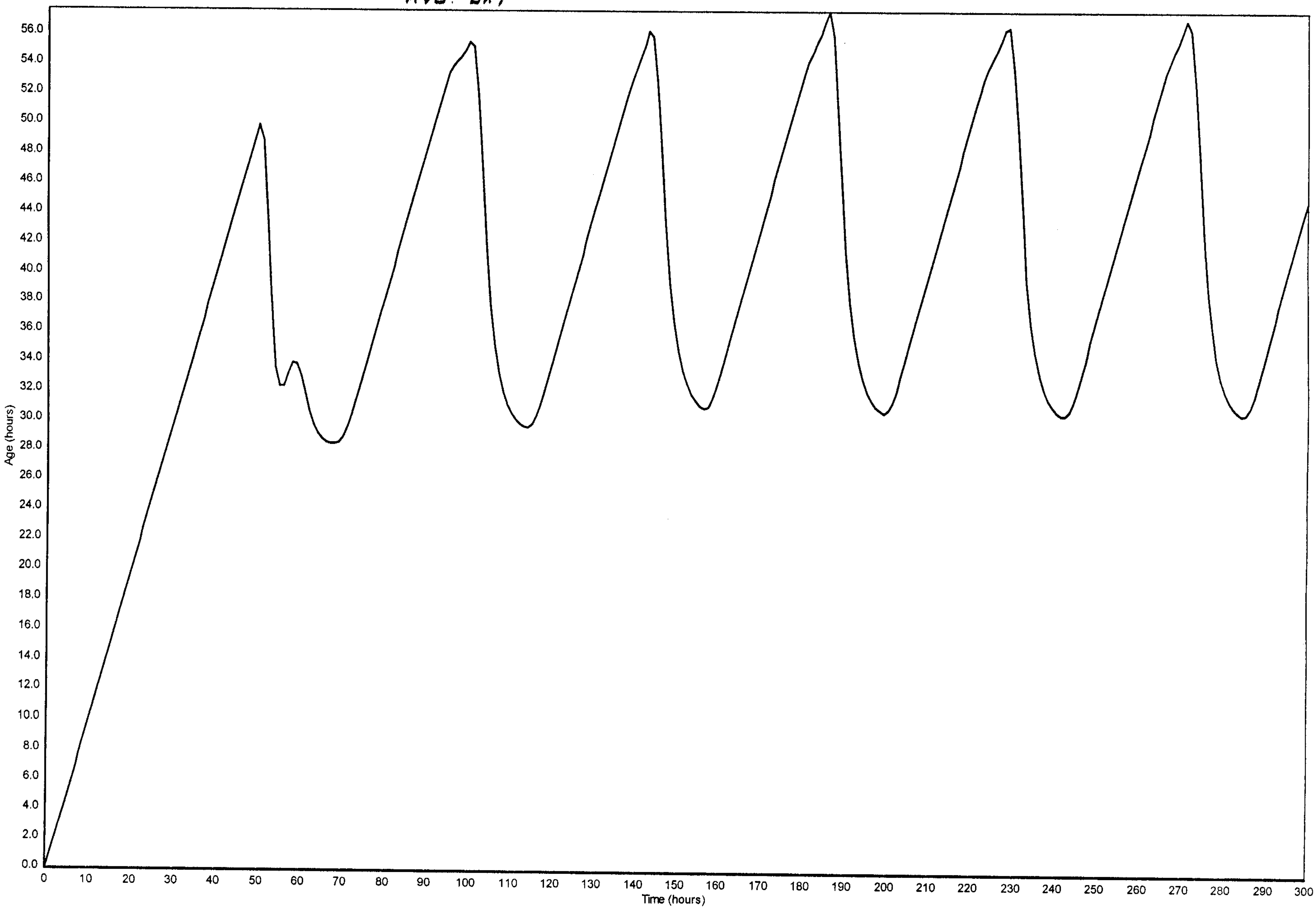

AVG. DAY
LINK WATER AGE FOR PML-NE
Age (hours)
130.0
125.0
120.0
115.0
110.0
105.0
100.0
95.0
90.0
85.0
80.0
75.0
70.0
65.0
60.0
55.0
50.0
45.0
40.0
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230 240 250 260 270 280 290 300
Time (hours)

AVG. DAY

LINK WATER AGE FOR GL-S



AVG. DAY LINK WATER AGE FOR BOF



EPANET 2

APPENDIX D

2013 CALIFORNIA FIRE CODE

CALIFORNIA FIRE CODE – MATRIX ADOPTION TABLE
APPENDIX B – FIRE-FLOW REQUIREMENTS FOR BUILDINGS

(Matrix Adoption Tables are non-regulatory, intended only as an aid to the user. See Chapter 1 for state agency authority and building applications.)

Adopting Agency	BSC	SFM		HCD			DSA		OSHPD				BSCC	DHS	AGR	DWR	CEC	CA	SL	SLC
		T-24	T-19*	1	2	1/AC	AC	SS	1	2	3	4								
Adopt Entire Chapter																				
Adopt Entire Chapter as amended (amended sections listed below)		X																		
Adopt only those sections that are listed below																				
[California Code of Regulations, Title 19, Division 1]																				
Chapter / Section																				
B105.2		X																		

* The *California Code of Regulations* (CCR), Title 19, Division 1 provisions that are found in the *California Fire Code* are a reprint from the current CCR, Title 19, Division 1 text for the code user's convenience only. The scope, applicability and appeals procedures of CCR, Title 19, Division 1 remain the same.

APPENDIX B

FIRE-FLOW REQUIREMENTS FOR BUILDINGS

SECTION B101 GENERAL

B101.1 Scope. The procedure for determining fire-flow requirements for buildings or portions of buildings hereafter constructed shall be in accordance with this appendix. This appendix does not apply to structures other than buildings.

SECTION B102 DEFINITIONS

B102.1 Definitions. For the purpose of this appendix, certain terms are defined as follows:

FIRE-FLOW. The flow rate of a water supply, measured at 20 pounds per square inch (psi) (138 kPa) residual pressure, that is available for fire fighting.

FIRE-FLOW CALCULATION AREA. The floor area, in square feet (m^2), used to determine the required fire flow.

SECTION B103 MODIFICATIONS

B103.1 Decreases. The fire chief is authorized to reduce the fire-flow requirements for isolated buildings or a group of buildings in rural areas or small communities where the development of full fire-flow requirements is impractical.

B103.2 Increases. The fire chief is authorized to increase the fire-flow requirements where conditions indicate an unusual susceptibility to group fires or conflagrations. An increase shall not be more than twice that required for the building under consideration.

B103.3 Areas without water supply systems. For information regarding water supplies for fire-fighting purposes in rural and suburban areas in which adequate and reliable water supply systems do not exist, the fire code official is authorized to utilize NFPA 1142 or the *California Wildland-Urban Interface Code.*

SECTION B104 FIRE-FLOW CALCULATION AREA

B104.1 General. The fire-flow calculation area shall be the total floor area of all floor levels within the exterior walls, and under the horizontal projections of the roof of a building, except as modified in Section B104.3.

B104.2 Area separation. Portions of buildings which are separated by fire walls without openings, constructed in accordance with the *California Building Code*, are allowed to be considered as separate fire-flow calculation areas.

B104.3 Type IA and Type IB construction. The fire-flow calculation area of buildings constructed of Type IA and Type IB construction shall be the area of the three largest successive floors.

> **Exception:** Fire-flow calculation area for open parking garages shall be determined by the area of the largest floor.

SECTION B105 FIRE-FLOW REQUIREMENTS FOR BUILDINGS

B105.1 One- and two-family dwellings. The minimum fire-flow and flow duration requirements for one- and two-family dwellings having a fire-flow calculation area that does not exceed 3,600 square feet (344.5 m^2) shall be 1,000 gallons per minute (3785.4 L/min) for 1 hour. Fire-flow and flow duration for dwellings having a fire-flow calculation area in excess of 3,600 square feet (344.5m^2) shall not be less than that specified in Table B105.1.

Exception: A reduction in required fire-flow of 50 percent, as approved, is allowed when the building is equipped with an approved automatic sprinkler system.

B105.2 Buildings other than one- and two-family dwellings. The minimum fire-flow and flow duration for buildings other than one- and two-family dwellings shall be as specified in Table B105.1.

Exceptions:

1. A reduction in required fire-flow of up to 75 percent, as approved, is allowed when the building is provided with an approved automatic sprinkler system installed in accordance with Section 903.3.1.1 or 903.3.1.2. The resulting fire-flow shall not be less than 1,500 gallons per minute (5678 L/min) for the prescribed duration as specified in Table B105.1.

2. [SFM] Group B, S-2 and U occupancies having a floor area not exceeding 1,000 square feet, primarily constructed of noncombustible exterior walls with wood or steel roof framing, having a Class A roof assembly, with uses limited to the following or similar uses:

2.1. California State Parks buildings of an accessory nature (restrooms).

2.2. Safety roadside rest areas, (SRRA), public restrooms.

2.3. Truck inspection facilities, (TIF), CHP office space and vehicle inspection bays.

2.4. Sand/salt storage buildings, storage of sand and salt.

TABLE B105.1
MINIMUM REQUIRED FIRE-FLOW AND FLOW DURATION FOR BUILDINGS

FIRE-FLOW CALCULATION AREA (square feet)					FIRE-FLOW (gallons per minute)[b]	FLOW DURATION (hours)
Type IA and IB[a]	Type IIA and IIIA[a]	Type IV and V-A[a]	Type IIB and IIIB[a]	Type V-B[a]		
0-22,700	0-12,700	0-8,200	0-5,900	0-3,600	1,500	
22,701-30,200	12,701-17,000	8,201-10,900	5,901-7,900	3,601-4,800	1,750	
30,201-38,700	17,001-21,800	10,901-12,900	7,901-9,800	4,801-6,200	2,000	2
38,701-48,300	21,801-24,200	12,901-17,400	9,801-12,600	6,201-7,700	2,250	
48,301-59,000	24,201-33,200	17,401-21,300	12,601-15,400	7,701-9,400	2,500	
59,001-70,900	33,201-39,700	21,301-25,500	15,401-18,400	9,401-11,300	2,750	
70,901-83,700	39,701-47,100	25,501-30,100	18,401-21,800	11,301-13,400	3,000	
83,701-97,700	47,101-54,900	30,101-35,200	21,801-25,900	13,401-15,600	3,250	3
97,701-112,700	54,901-63,400	35,201-40,600	25,901-29,300	15,601-18,000	3,500	
112,701-128,700	63,401-72,400	40,601-46,400	29,301-33,500	18,001-20,600	3,750	
128,701-145,900	72,401-82,100	46,401-52,500	33,501-37,900	20,601-23,300	4,000	
145,901-164,200	82,101-92,400	52,501-59,100	37,901-42,700	23,301-26,300	4,250	
164,201-183,400	92,401-103,100	59,101-66,000	42,701-47,700	26,301-29,300	4,500	
183,401-203,700	103,101-114,600	66,001-73,300	47,701-53,000	29,301-32,600	4,750	
203,701-225,200	114,601-126,700	73,301-81,100	53,001-58,600	32,601-36,000	5,000	
225,201-247,700	126,701-139,400	81,101-89,200	58,601-65,400	36,001-39,600	5,250	
247,701-271,200	139,401-152,600	89,201-97,700	65,401-70,600	39,601-43,400	5,500	
271,201-295,900	152,601-166,500	97,701-106,500	70,601-77,000	43,401-47,400	5,750	
295,901-Greater	166,501-Greater	106,501-115,800	77,001-83,700	47,401-51,500	6,000	4
—	—	115,801-125,500	83,701-90,600	51,501-55,700	6,250	
—	—	125,501-135,500	90,601-97,900	55,701-60,200	6,500	
—	—	135,501-145,800	97,901-106,800	60,201-64,800	6,750	
—	—	145,801-156,700	106,801-113,200	64,801-69,600	7,000	
—	—	156,701-167,900	113,201-121,300	69,601-74,600	7,250	
—	—	167,901-179,400	121,301-129,600	74,601-79,800	7,500	
—	—	179,401-191,400	129,601-138,300	79,801-85,100	7,750	
—	—	191,401-Greater	138,301-Greater	85,101-Greater	8,000	

For SI: 1 square foot = 0.0929 m^2, 1 gallon per minute = 3.785 L/m, 1 pound per square inch = 6.895 kPa.

a. Types of construction are based on the *California Building Code*.

b. Measured at 20 psi residual pressure.

SECTION B106
REFERENCED STANDARDS

ICC	IWUIC—12	California Wildland-Urban Interface Code	B103.3
NFPA	1142—12	Standard on Water Supplies for Suburban and Rural Fire Fighting	B103.3