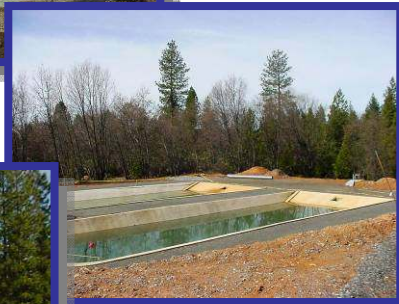


# West Point Water System Master Plan



May 2005

# West Point Water System Master Plan



**Calaveras County Water District**

May, 2005

Prepared under the responsible charge of

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# Executive Summary

## Executive Summary

The Calaveras County Water District (District) is embarking on an effort to develop a District-wide financial plan for all its water and sewer service areas. To accomplish this task, a master plan describing raw water supply and conveyance, water treatment, and treated water storage and distribution improvements is required for the West Point Water System.

The West Point Water System serves the communities of West Point, Bummerville and Wilseyville in the central northern portion of Calaveras County. The system consists of two raw water supplies, two reservoirs, one 1 mgd water treatment plant, three pressure zones, two storage tanks, two pumping stations, and over 17 miles of distribution lines. The West Point Water System currently serves 540 domestic water connections.

Future growth was identified by applying a historical growth average over the existing service area. Based on evaluation from the *Calaveras County General Plan*, Future Land Use Plan, an average growth rate of five new connections per year will be used to identify future growth. The analysis identified 260 new future connections at buildout resulting in a total of 800 connections at buildout.

According to historic water production records, the average annual demand for the West Point Water System per connection is approximately 290 gpd, with a current maximum day water demand of 0.31 MGD.

To comply with the District's Improvement Standards, analysis incorporated the standard unit demand of 500 gpd/connection for all future connections. The analysis of existing connections also assumed the existing average demand per connection was increased every ten years in equal increments until it complied with the standard demand of 500 gpd/connection in 20 years. Buildout maximum day water demands were determined to be 0.8 MGD.

The District's water rights allow 1,830 acre-feet (AF) to be delivered annually through the Bear Creek Diversion, and an additional 100 AF per year through the Mokelumne River Intake and Pump Station. Buildout water use is estimated at approximately 448 acre-feet/year on an average day. The existing water rights should be sufficient to meet the projected annual water demands through buildout. The treated water achieves a sufficient disinfection contact time in the clearwell; the contact time will increase when the clearwell is enlarged as recommended herein. The treated water in the West Point Water System is of high quality and does not have high concentrations of disinfection by-products (DBPs).

The existing capacity of the West Point Water Treatment Plant (West Point WTP) is 1 mgd, and no improvements are recommended because capacity exceeds the projected demands at buildout. However, the raw water collection facilities must be upgraded to meet maximum day demands at buildout.

Hydraulic modeling identified treated water storage and treated water distribution (pump and pipeline) improvements necessary to meet future water demands while complying with District and local fire district standards for fire flow. Fire flow requirements used in the hydraulic

model are from the local fire district (1,000 gpm), which requires twice the fire flow as the District Improvement Standards (500 gpm), which significantly increased the distribution system improvements required.

Recommended projects have been divided into three planning phases to facilitate implementation and to assist District in planning and funding the water system improvements. Table 1 and 2 summarize the recommended schedule of improvements and the total cost per phase. Detailed tables of the costs are included in Appendix B. Recommended improvements will be reviewed in 5 year increments by the district to ensure demands and standards are being met and improvements are scheduled appropriately.

**Table 1. Summary of Capital Improvement Timeline.**

Recommended Improvements	Phase I	Phase II	Phase III
	Yr 1 to 5	Yr 6 to 10	Yr 11 to 15
Wilson Dam	X		
Bummerville Storage Tank and Fire Flow Pump	X		
Downtown West Point Pipelines	X		
Upper Northwest West Point Pipelines	X		
Clearwell Tank and Finished Water Pumps	X		
Bear Creek Diversion SCADA	X		
Mokelumne River Intake and Pump Station		X	
Bummerville Pipelines		X	
Regulating Reservoir			X
Wilseyville Pipelines			X

**Table 2. Summary of Capital Improvement Costs.**

Cost for Improvements	Phase I	Phase II	Phase III
	Yr 1 to 5	Yr 6 to 10	Yr 11 to 15
Recommended Improvement Total Cost	\$3,523,000	\$1,572,000	\$1,224,000
Contingency (approx 21%)	\$642,000	\$290,000	\$220,000
Engineering, Administration, CM, Environmental (approx 18%)	\$769,000	\$363,000	\$247,000
<b>Total Cost</b>	<b>\$4,943,000</b>	<b>\$2,225,000</b>	<b>\$1,691,000</b>
<b>Total Improvement Cost</b>	<b>\$8,850,000</b>		

Existing System



## Existing System

### Introduction

The District is embarking on an effort to develop a District-wide financial plan for all its water and sewer service areas. To accomplish this task, master plans describing water supply, treatment, storage, and distribution system improvements required to meet current and future needs must be developed.

This master plan report presents a summary of the results and findings for the West Point Water System Master Planning Project. The intent of this project is to provide a basis for managed upgrade of the water supply, treatment, storage, and distribution systems and provide financial information for a District-wide financial master plan.

### Background

The West Point Water System Master Plan was last updated in 1996. In 1998, a supplement provided additional analysis for improvements to the West Point, Wilseyville, and Bummerville systems. The most recent study conducted on the West Point Water System was the West Point/Wilseyville and Bummerville Feasibility Study completed by HDR in 2002.

Information from these prior studies has been used in the development of this document.

### Purpose and Specific Objectives

This purpose of this report is to describe the water supply, treatment, storage, and distribution system improvements required to meet the current and future service area needs. In particular, this report provides the following information:

- ◆ Delineation of the service area (West Point, Wilseyville, Bummerville). No expansion of the service area is expected - only infill growth is considered in this report.
- ◆ Characterization of historic water demands, including existing and projected average day, maximum day, and peak hour demands.
- ◆ Description and evaluation of the existing facilities.
- ◆ Identification of the improvements needed to meet growth, improve operations, comply with current and known future regulations, and correct deficiencies.
- ◆ Recommendations for system improvements needed to serve buildout conditions.
- ◆ Timelines and cost information for constructing the recommended improvements.
- ◆ Incorporates public comments received from the public meeting held February 2, 2005 at the West Point Community Hall.

## Existing Service Area

The West Point Water System serves the communities of West Point, Wilseyville and Bummerville located in the northeastern portion of Calaveras County in the sparsely populated higher foothills. The topography ranges from approximately 2,500 feet in Wilseyville to 3,200 feet in Bummerville. Mild summers and cold winters characterize the region, with temperatures ranging from the low 20's to the middle 80's. Snow accounts for a large percentage of the precipitation in the watersheds supplying the study area.

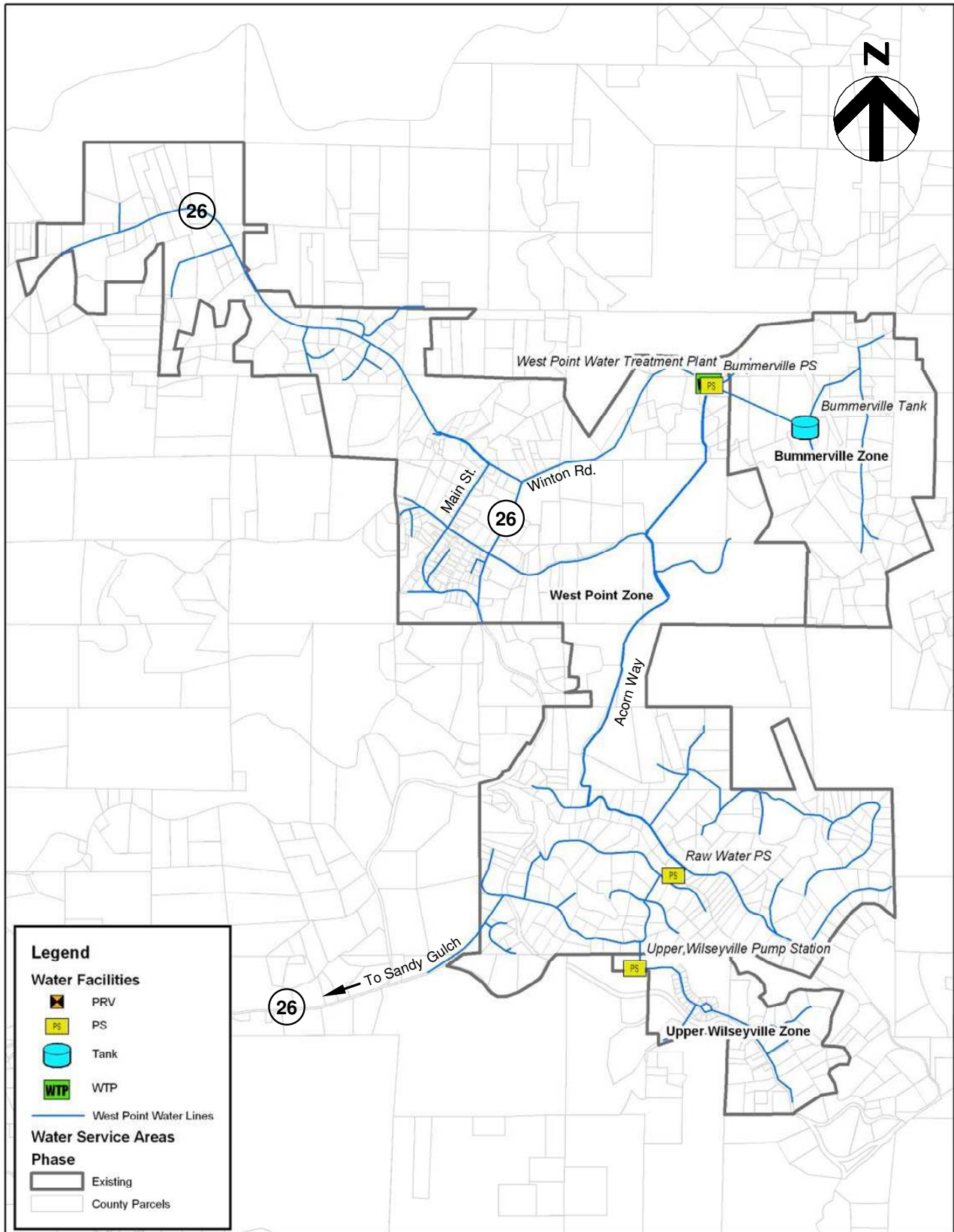
The existing water system serves approximately 540 connections in the communities of West Point, Wilseyville, and Bummerville. The current facilities include two raw water reservoirs (Wilson Lake and the Regulating Reservoir), two raw water diversion facilities (Bear Creek gravity supply and Middle Fork Mokelumne pumped supply), one water treatment plant (West Point), two treated water pump stations (Bummerville and Upper Wilseyville), and the associated distribution and storage system. Figure 1 provides an illustration of the water systems and the interconnection of the water supply and distribution between the three communities.

## Water Supply

The West Point water system has two sources of supply: the Bear Creek Diversion and a pumped source from the Middle Fork of the Mokelumne River. Both sources are generally of good quality and are easily treated to potable standards. The District has rights to divert up to 1,830 acre-feet (AF) annually through the Bear Creek Diversion, and can obtain an additional 100 AF per year from the Calaveras Public Utility District (CPUD) through the Mokelumne Pump Station, located on the Middle Fork of the Mokelumne River.

### Bear Creek Diversion

Water flowing from the Wilson Lake Dam continues down Bear Creek to the Bear Creek diversion. Bear Creek is the primary and preferred source of water for the West Point Water Treatment Plant (West Point WTP). Since 1967, the District has had a permit to divert water at a rate of four cubic feet per second (ft<sup>3</sup>/sec) from Bear Creek to the West Point WTP. This diversion, located east of Bummerville at an elevation of about 3,300 feet, is the primary raw water source for the West Point/Wilseyville domestic water system. The permit allows a maximum annual use from Bear Creek to the West Point WTP of 1,830 acre-feet. The diversion structure is a 5-foot-high concrete structure in the creek channel. The diversion is equipped with a sluice gate that allows water to enter a newly constructed 16-inch 10,000 foot HDPE transmission pipeline from the creek to the regulating reservoir.



Existing West Point Water Distribution System



Figure 1

### Mokelumne River Intake and Pump Station

An additional water supply for the District is the diversion from the Mokelumne River near Wilseyville. This is currently the secondary water supply to the West Point WTP. This diversion consists of a small seasonal dam, which diverts flow to an existing pumping station. The diversion dam is a flashboard structure installed during times when the Bear Creek supply and available regulating reservoir storage cannot provide adequate flow to the West Point WTP. The District is able to divert 100 acre-feet of water from the river according to an agreement with CPUD.

The water in the Mokelumne River used by the District originates from the Schaads Reservoir. Water is released from the Schaads reservoir to the Middle fork of the Mokelumne River under an agreement with the CPUD. Flows in the Mokelumne River are typically well in excess of the 1MGD (or 1.5 cubic feet per second) diversion rate needed when flows are not available from the Bear Creek. This rate is a maximum diversion rate, as opposed to a constant diversion rate, which depends on actual demands.

Raw water from the Mokelumne River to the Regulating Reservoir flows through approximately 10,000 feet of 6-inch polyvinyl chloride (PVC) pipeline constructed in 1991. The approximate capacity of the existing facility is 200 gallons per minute (gpm) or approximately 0.3 MGD.

The existing Middle Fork Mokelumne Pump Station consists of two housed 30-hp vertical turbine pumps with a capacity of 200 gpm each. The pump intakes are located in separate collection sumps that gather water from the river through a gravity system or infiltration gallery. The pumps have 4-inch discharges which connect into a single 8-inch steel discharge pipe. The 8-inch discharge pipe is reduced to a 6-inch PVC pipe that crosses the river and continues up to the West Point WTP approximately two miles to the north. There is a 25-hp booster pump station located along Acorn Way which assists in passing the flow to the West Point WTP.

The infiltration gallery consists of two 12-inch perforated pipes that extend underground approximately 65 feet into the river, and a newer intake system of flashboards and perforated 12-inch PVC pipe above ground. The underground pipes were installed when the pump station was constructed. The underground pipes are placed approximately 2.5 feet below the invert of the channel. Water passing over the gallery is filtered through the gravel bed, collected via the perforations then flows by gravity to the sumps. Per the original design plans, dated July 16, 1974, the pipes were constructed of 12-inch corrugated pipe. The intake pipes are currently buried; therefore, their condition is unknown. The newer system consists of a series of concrete pedestals placed across the river with slots for flashboards and saddles to place a 12-inch perforated pipe that connects into the pre-existing infiltration gallery. The flashboards back up the river allowing head to build over the 12-inch perforated PVC pipe. Water is then passed to a solid PVC pipe connected to the pre-existing 12-inch pipes then carried to the sumps.

The existing pump station is a 23 foot x 10.5 foot metal building housing the pumps and associated controls located in the floodplain of the Middle Fork of the Mokelumne River.

## Raw Water Storage Facilities

The District uses the Wilson Lake Dam and a Regulating Reservoir for raw water attenuation and storage.

### Wilson Lake Dam

The Wilson Lake Dam was constructed in 1937. The embankment is approximately 35 feet tall and 150 feet long. The current capacity of the Lake is 25 AF, however leaks prevents its storage capability. Exploration work performed by Woodward-Clyde-Sherard (WCS) in 1963 indicated that no provisions had been made for underseepage cutoff and that, in fact, no effort had been made to even remove vegetation and residual soil from underneath the embankment. A sinkhole observed in the downstream slope during the exploration is likely due to collapse of all or part of an old wooden box culvert that was incorporated in the original construction.

The existing dam is a homogeneous earthen embankment with a crest width of approximately 15 feet and upstream and downstream slopes of 3:1 and 2:1, respectively. Currently, the outlet works leak, and the District diverts the leakage. An unlined, open channel is located on the left abutment.

The dam is approximately one mile upstream from the District's Bear Creek Diversion. The lakeside face of the dam has slumped, forming a sink hole about 15 feet in diameter and 8 feet deep. The upstream reach of the Lake is silted.

### Regulating Reservoir

Water from Bear Creek and the Mokelumne River is usually stored first in the Regulating Reservoir. The Regulating Reservoir has 50 AF of storage capacity. The existing Regulating Reservoir was constructed under the jurisdiction of the State Division of Safety of Dams (DSOD) in 1964. The dam is approximately 35 feet high, 500 feet long and impounds 50 AF. Permission was obtained from the DSOD in 1987 to install flashboards to capture late spring runoff through the Bear Creek Diversion that increases the storage capacity to a total of 60 AF.

Water is released from an outlet structure consisting of a slanted sluice gate connected to an outlet pipe. The gate can be operated from the top of the reservoir via a hand valve operator. In addition, there is an existing diversion ditch located on the southern side of the reservoir. The purpose of this ditch is to prevent unwanted natural runoff from the surrounding basin from entering the reservoir.

Alternatively, water can be diverted directly to the treatment plant from the Bear Creek Diversion pipeline without entering the reservoir.

## Water Treatment Facilities

The West Point WTP was upgraded in 2002 and has a current capacity of 1.0 MGD. The West Point WTP uses the Microfloc contact filtration process and free chlorine for disinfection. The West Point WTP is required to maintain a 1.6 mg/l free chlorine residual at the point of entry to the distribution system.

## Treated Water Distribution System

The system is operationally divided into three pressure zones. The largest zone is the West Point Zone, which is served by the clearwell at the West Point WTP and includes the lower parts of the Wilseyville area. The upper areas of Wilseyville are served by a hydropneumatic pump station that maintains the hydraulic grade line (HGL) in the Wilseyville Camp area. The Bummerville Zone is located east of the West Point WTP and is served by one redwood tank. The existing pressure zones and available storage are summarized in Table 3.

**Table 3. Existing Pressure Zones and Treated Water Storage.**

Zone	Acres	Portion of Total Area	HGL	Storage
West Point	1,413	77%	2,910	500,000-gallon clearwell at WTP
Bummerville	294	16%	3,180	One redwood tank –useful capacity of approximately 25,000 gallons
Wilseyville	123	7%	3,230	None-hydropneumatic
<b>Total</b>	<b>1,830</b>	<b>100%</b>		

## Treated Water Storage Facilities

Currently, the treated water storage consists of the West Point Treatment Plant clearwell, which serves West Point and Wilseyville, and the redwood tank that serves Bummerville. The clearwell capacity is 500,000 gallons and is located at 2,910 foot elevation. The clearwell is estimated to be over 50 years old and is of questionable condition. The redwood tank was built in 1978, is located at 3,180 foot elevation, and has a useful volume of approximately 25,000 gallons.

## Treated Water Pumping Stations

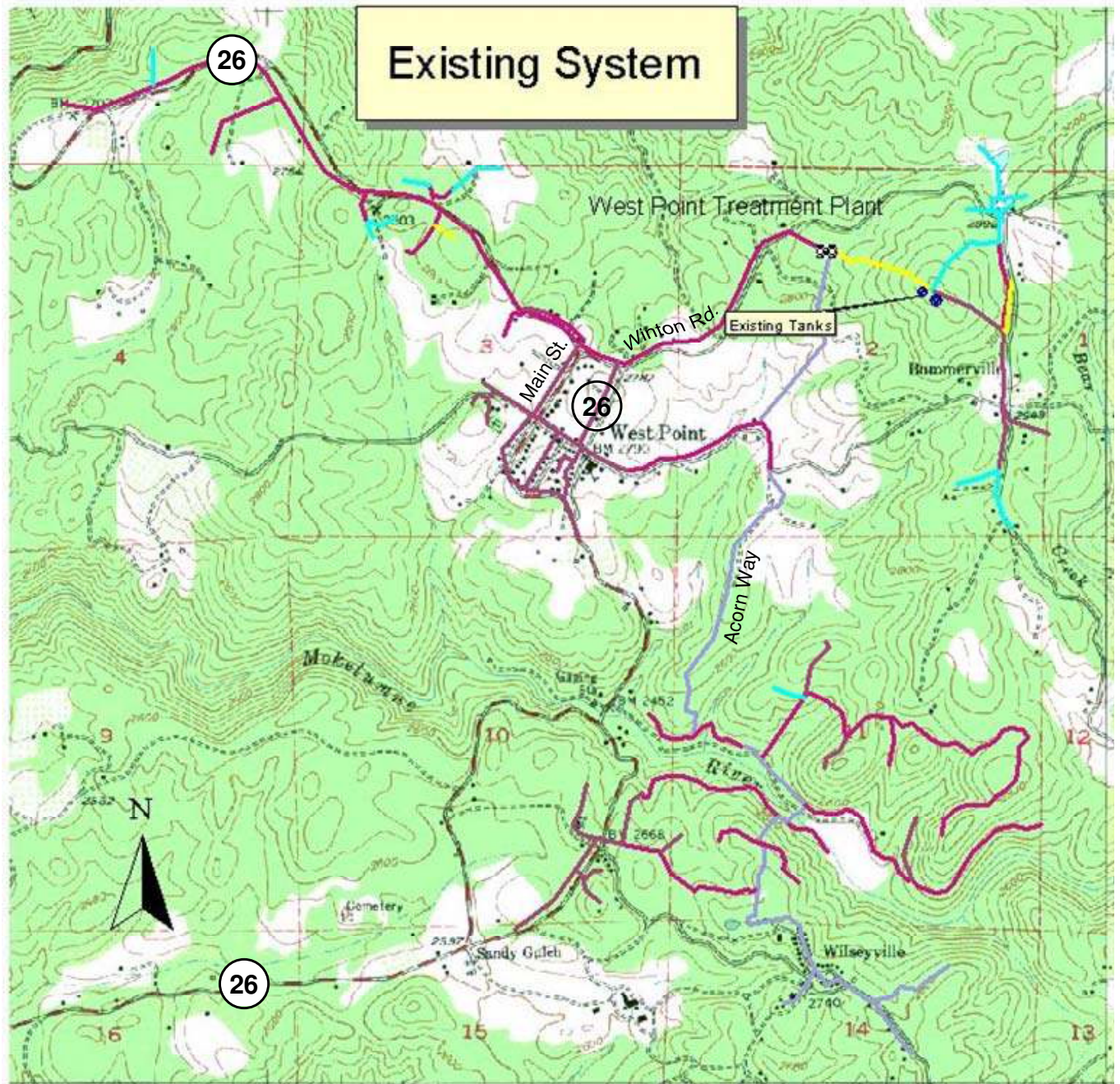
The distribution system includes two treated water pumping stations for moving water between pressure zones. The treated water pumping stations are summarized in Table 4.

**Table 4. Treated Water Pumping Stations.**

	Bummerville Pump Station	Wilseyville Pump Station
<b>Location</b>	West Point WTP	Old Wilseyville WTP
<b>Draws Water From</b>	West Point Clearwell	West Point Pressure Zone
<b>Pumps Water To</b>	Bummerville Zone and Bummerville Tanks	Wilseyville Pressure Zone
<b>Pumps</b>	One 7.5-hp, one 10-hp	Two 15-hp, 40-gpm domestic; one 40-hp, 750-gpm fire

**Treated Water Pipelines**

The distribution system includes approximately 17 miles of distribution pipe ranging from 1 inch to 8 inches in diameter as shown in Figure 2. The West Point system is composed mainly of 6-inch pipe mains with mostly 4-inch pipe to terminal services. The smallest pipe diameter found is 1-inch. Most of Wilseyville's distribution system consists of newer 6-inch and 8-inch lines. The Bummerville distribution grid consists of mainly 4-inch lines with some 2-inch, and only two sections of 6-inch lines.



**Existing System**

-  1-inch existing pipe
-  2-inch existing pipe
-  3-inch existing pipe
-  4-inch existing pipe
-  6-inch existing pipe
-  8-inch existing pipe

**Existing Distribution System with Pipe Diameters.**



**Figure 2**



# Current and Projected Demands

## Current and Projected Demands

### Historic Connections and Demands

The District provided historical data on active connections and water demands served by the West Point WTP. The demands included the average day demand (ADD) and the maximum day demand (MDD), the single highest demand day in a year. The demand data are based on production values recorded at the treatment plant, so they include lost and unaccounted-for water and are summarized in Table 5.

The ratio of MDD to ADD has ranged from 2.2 to 3.3. The MDD per connection has ranged from 750 to 1,118 gpd.

**Table 5. Historic Growth in Connections and Demands.**

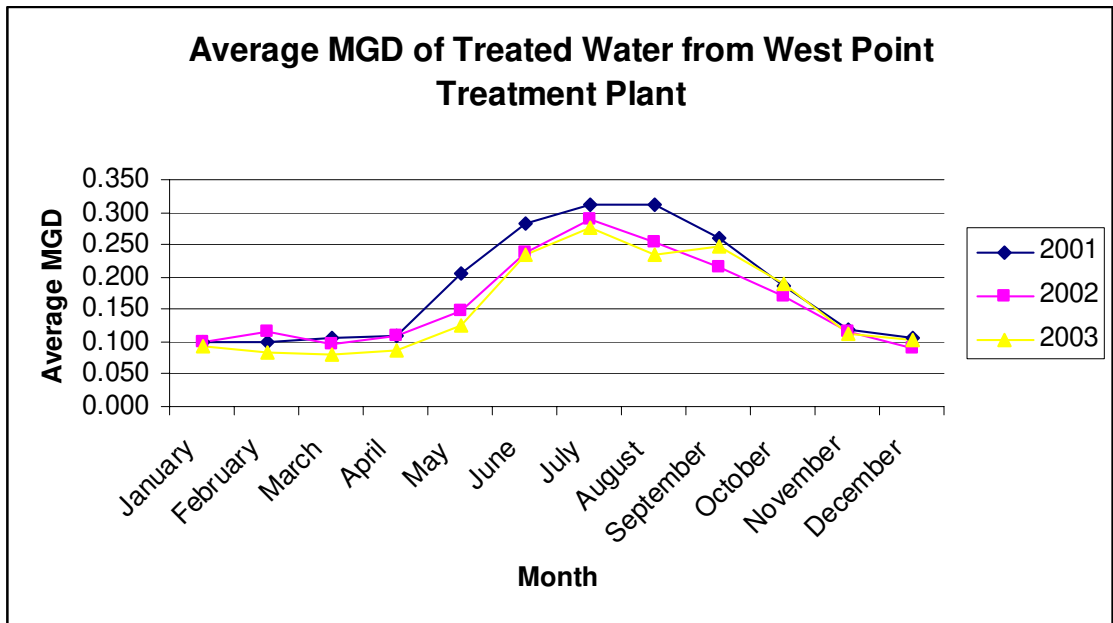
Year	New Connections	Total Connections	Volume Produced (MG)	ADD (MGD)	ADD / Connection (gpd)	MDD (MGD)	MDD:ADD	MDD / Connection (gpd)
1985		315	38.3	0.10	333	0.30	2.9	952
1986	13	328	39.2	0.11	327	0.32	3.0	976
1987	3	331	43.6	0.12	361	0.37	3.1	1,118
1988	8	339	42.8	0.12	346	0.35	3.0	1,032
1989	71	410	50.5	0.14	337	0.38	2.7	927
1990	16	426	55.5	0.15	357	0.41	2.7	962
1991	26	452	50.9	0.14	309	0.42	3.0	929
1992	(1)	451	55.0	0.15	334	0.39	2.6	865
1993	6	457	55.0	0.15	330	0.40	2.7	875
1994	4	461	57.3	0.16	341	0.43	2.7	933
1995	2	463	55.1	0.15	326	0.36	2.4	769
1996	7	470	57.7	0.16	336	0.42	2.6	889
1997	-	470	62.8	0.17	366	0.37	2.2	796
1998	3	473	55.2	0.15	320	0.45	3.0	945
1999	2	475	63.2	0.17	365	0.41	2.4	867
2000	44	519	61.7	0.17	326	0.43	2.5	829
2001	8	527	67.0	0.18	348	0.46	2.5	869
2002	5	532	59.0	0.16	304	0.53	3.3	996
2003	8	540	57.0	0.16	289	0.41	2.6	750

Notes: Connection and demand data provided by the District.

The District also provided monthly demand data for three years to evaluate the seasonal variability in demand. These monthly demands are shown in Table 6 and Figure 3 below.

**Table 6. Monthly Demands.**

Month	Days	2001		2002		2003	
		Millions of Gal. per month	Avg MGD	Millions of Gal. per month	Avg MGD	Millions of Gal. per month	Avg MGD
January	31	3.1	0.100	3.111	0.100	2.839	0.092
February	28	2.829	0.101	3.22	0.115	2.283	0.082
March	31	3.303	0.107	2.945	0.095	2.447	0.079
April	30	3.265	0.109	3.245	0.108	2.622	0.087
May	31	6.326	0.204	4.602	0.148	3.84	0.124
June	30	8.445	0.282	7.086	0.236	7.008	0.234
July	31	9.651	0.311	8.975	0.290	8.586	0.277
August	31	9.633	0.311	7.908	0.255	7.322	0.236
September	30	7.835	0.261	6.493	0.216	7.413	0.247
October	31	5.745	0.185	5.24	0.169	5.855	0.189
November	30	3.538	0.118	3.427	0.114	3.393	0.113
December	31	3.312	0.107	2.799	0.090	3.209	0.104



**Figure 3. Average MGD of Treated Water from West Point WTP.**

### Demand Projections

The District’s Board of Directors has adopted a policy to plan for an ADD of 200 gpd per capita and 2.5 persons per dwelling unit in the West Point area. The corresponding ADD is 500 gpd per connection. District policy has also established a MDD:ADD ratio of 2.0 for future planning purposes, resulting in a MDD of 1,000 gpd per connection. In 2003 the ADD was 290 gpd per connection. For planning purposes, the ADD was assumed to transition from the existing value of 290 to the design value of 500 over a 20-year period. For areas of new development, the assumed ADD is 500 gpd per connection, with an MDD:ADD ratio of 2.0.

The assumed peak hour demand (PHD) is 3.0 times the ADD, in accordance with the District’s Improvement Standards.

A projection of buildout conditions was made to estimate the ultimate demands in the service area. Growth will come in two ways: infill within the existing service area and expansion of the service area. The Calaveras County General Plan was reviewed for land use designations. West Point is designated as a Community Center with Residential Centers in the vicinity. Land use in the centers are between 7,000 square feet up to five acres in areas with roadways with levels of service A, B, and C. These levels of service evaluate the time delays and travel speeds of motorists on the roadways. The Calaveras Council of Governments has established six levels of service, A being the best down through F, for roadways in the County in the Regional Transportation Plan (RTP). State Route 26 is currently designated with a “C” average daily Level of Service in the West Point Area. The RTP expects the level of service for State Route 26 in the West Point area to decline to “D” through the planning year 2022, and the RTP does not recommend improvement for State Route 26. Therefore, the zoning is not expected to increase in density significantly through the planning period.

The existing service area includes approximately 800 parcels. It is assumed that at buildout, each parcel will represent one connection, with an average density of one connection for two acres. Since there are 540 current connections, the infill potential is the difference of 260 connections. For years between now and buildout, HDR and District staff reviewed the historic growth in connections and established a planned growth rate of five new connections per year, consistent with the historical growth rate, through buildout in 2057.

Previous reports have identified several potential areas of expansion of the West Point Water System. However, based on discussion with District personnel, development of these areas is currently considered unlikely. Therefore this report only considers infill, and expansion of the service area will not be considered for the West Point water system. A summary of the growth projections is shown in Table 7.

**Table 7. Growth Projections.**

Parameter	2005	2015	2025	Buildout	Comments
ADD (gpd/connection)	290	395	500	500	20-year phase-in for existing connections
Connections	540	590	640	800	
ADD (gpd)	156,600	238,300	320,000	400,000	
MDD (gpd)	313,200	476,600	640,000	800,000	
PHD (gpd)	469,800	714,900	960,000	1,200,000	
Annual use (AF)	175	267	358	448	Calculated for supply planning
ADD (gpm)	109	165	222	278	Calculated for hydraulic model
MDD (gpm)	218	331	444	556	Calculated for hydraulic model
PHD (gpm)	326	496	667	833	Calculated for hydraulic model

Notes:

MDD:ADD ratio	2.0
PHD:ADD ratio	3.0
New connections per year	5
Buildout connections in service area	800

The demand data provided by the District are not categorized by pressure zone. As an approximation, the existing demands were allocated among the pressure zones based on acreage in each pressure zone. The allocation of demands by zone is shown in Table 8.

**Table 8. Projected Demands by Zone.**

	West Point	Wilseyville	Bummerville	Total
Acres	1,413	123	294	1,830
2005 ADD (gpd)	120,916	10,526	25,159	156,600
2005 ADD (gpm)	84	7	17	109
2015 ADD (gpd)	183,999	16,017	38,284	238,300
2015 ADD (gpm)	128	11	27	165
2025 ADD (gpd)	247,082	21,508	51,410	320,000
2025 ADD (gpm)	172	15	36	222
Buildout ADD (gpd)	308,852	26,885	64,262	400,000
Buildout ADD (gpm)	214	19	45	278
Buildout MDD (gpd)	617,705	53,770	128,525	800,000
Buildout MDD (gpm)	429	37	89	556
Buildout PHD (gpm)	643	56	134	833

Notes:

Total 2005 ADD (gpd)	156,600
Total 2015 ADD (gpd)	238,300
Total 2025 ADD (gpd)	320,000
Buildout ADD (gpd)	400,000
MDD:ADD ratio	2.0
PHD:ADD ratio	3.0

# Existing and Future Regulations

## Existing and Future Regulations

### Drinking Water Regulations

The quality of the water provided by existing and any future facilities must meet all existing and proposed regulatory requirements. A summary of the existing and proposed drinking water quality regulations covering surface water and groundwater sources is below.

#### Background

The Safe Drinking Water Act (SDWA) of 1974 gave the United States Environmental Protection Agency (EPA) the authority to set standards for contaminants in drinking water supplies. The EPA established primary regulations for the control of contaminants that affect public health and secondary regulations for compounds that affect the taste, odor or aesthetics of drinking water. Under the provisions of the SDWA, the California Department of Health Services (CDHS) has the primary enforcement responsibility. Title 22 of the California Administrative Code establishes CDHS authority, and stipulates State drinking water quality and monitoring standards.

#### Existing and Proposed Federal Regulations

The EPA has recently finalized and is in the process of finalizing several new regulations since the 1986 and 1996 Amendments to the SDWA. These regulations address both surface water and groundwaters. Significant final and proposed regulations are shown in Table 9. The schedule for promulgation of the Safe Water Drinking Act Regulations (Current as of June 22, 2001) is shown in Table 10.

**Table 9. Recently Adopted and Proposed Federal Regulations that Apply to the West Point WTP.**

Regulations	Year Rule Finalized	Targeted Contaminants
National Interim Primary Drinking Water Regulations	1975	Set maximum levels for a wide variety of contaminants
Total Trihalomethanes	1979	Trihalomethanes
Fluoride Rule	1986	Fluoride limits
Surface Water Treatment Rule	1989	Giardia lamblia, viruses, Legionella, and heterotrophic plate count
Total Coliform Rule	1989	Representative sampling of the distribution system for total and fecal coliform
Phase II Rule (organics)	1991	VOCs, SOCs, and IOCs
Lead and Copper Rule	1991	Lead and copper corrosion products
Phase V Rule (organics)	1992	VOCs, SOCs, and IOCs
Source Water Protection	1997	Delineate boundaries and determine origins and susceptibility of water supplies to contamination
Stage 1 Disinfection/Disinfection By-products Rule (D/DBPR)	1998	Disinfection Byproducts (THMs and HAAs); compliance date for systems serving greater than 10,000 was January 2002
Interim Enhanced Surface Water Treatment Rule (IESWTR)	1998	Giardia, Cryptosporidium, Turbidity, DBPR profiling
Arsenic Rule	2001	Arsenic
Filter Backwash Rule	2001	Filter backwash recycle
Long-term 1 Enhanced Surface Water Treatment Rule	2002	Microbiological, Turbidity, and control of DBPs
Public Health Security and Bioterrorism Prevention and Response Act	2002	Vulnerability Assessments
Radon Rule	2004	Radon
Contaminant Candidate List 2	2004	CCL1 required no new regulated contaminants, CCL2 may include perchlorate, metolachor, and MTBE
Stage 2 Disinfectants/Disinfection Byproducts Rule	2004	Introduces locational running annual average compliance for the 80/60 TTHM/HAA5 requirements
Long-term 2 Enhanced Surface Water Treatment Rule	2004	Introduction of microbial toolbox for control of Cryptosporidium
Groundwater Rule	2004	Microbial protection of groundwater supplies



**Table 10. Schedule for Promulgation of Safe Water Drinking Act Regulations (Current as of June 22, 2001).**

Regulation	Proposed	Final	Effective
Fluoride	11/85	4/86	10/87
Trihalomethanes	2/78	11/79	11/83
8 VOCs (Phase I)	11/85	7/87	1/89
Surface Water Treatment Rule (SWTR)	11/87	6/89	6/93
Coliform Rule	11/87	6/89	12/90
Lead and Copper	8/88	6/91	1/92 <sup>a</sup>
Minor Revisions to Lead and Copper	4/98	1/00	1/01
26 Synthetic Contaminants <sup>h</sup> , Seven Inorganic Contaminants (Phase II)	5/89	1/91 <sup>b</sup>	7/92
MCLs for barium, pentachlorophenol (Phase II)	1/91	7/91	1/93
Phase V Organics, Inorganics	7/90	7/92	1/94
Radionuclides (Phase III) Except Radon	4/00	12/00	12/03
Radionuclides (Phase III) Radon	11/99	8/01 <sup>c</sup>	8/04 <sup>d</sup>
Sulfate	12/94	Decision on whether to regulate due 8/01	
MCLs for aldicarb, aldicarb sulfoxide, aldicarb sulfone	Administrative hold; no current schedule available		
Disinfectants/Disinfection Byproducts, Stage 1 DBPR	7/94	12/98 <sup>c</sup>	1/02 <sup>f,g</sup>
Disinfectants/Disinfection Byproducts, Stage 2 DBPR	9/01	5/02	5/05 <sup>h</sup>
Information Collection Rule	2/94	5/96	Completed
Interim ESWTR	7/94	12/98 <sup>c</sup>	1/02 <sup>f</sup>
Interim ESWTR, Stage 1 Long Term Enhanced SWTR	4/00	8/01	1/04 <sup>7</sup>
Interim ESWTR, Stage 2 Long Term Enhanced SWTR	9/01	5/02	5/05
Filter Backwash Recycle Rule	4/00	6/01	12/0 <sup>c</sup>
Consumer Confidence Reports Rule	2/98	8/98	9/98
Ground Water Rule (GWR)	5/00	11/01	6/04
Operator Certification, State Guidance	3/98	2/99	2/01
Unregulated Contaminants, Monitoring Only <sup>i</sup>	2/99	9/99	1/01
Five New Drinking Water Contaminants	8/00	8/01	8/04
Chlorine Gas as Restricted Use	9/00	10/01	10/03
Source Water Protection Program, Guidance <sup>e</sup>	8/97	Completed	Completed
Arsenic	6/00	1/01	Delayed to January 2006

Notes:

- a. Start date for tap monitoring in systems of more than 50,000 consumers.
- b. Maximum Contaminant Level (MCL), MCL + Goal (MCLG) for atrazine to be reconsidered.
- c. Dates mandated by district court
- d. Assumes regulation in effect three years after final promulgation.
- e. Program required as part of 1996 amendment.
- f. For Public Water Systems (PWS) serving more than 10,000 consumers
- g. Effective January 2004 for PWS serving more than 10,000 consumers.
- h. MCL for atrazine to be revisited.
- i. Tiered monitoring approach pending availability of analytical methods.

## State Regulations

The State of California retains primacy for enforcement of drinking water regulations. In this role, the state must adopt regulations equal to or more stringent than federal regulations. For the most part, state regulations are equal to federal regulations with the following exceptions:

- ◆ Cryptosporidium Action Plan - The State set additional more stringent standards for the recycle of filter backwash and other recycle streams.
- ◆ California IESWTR - The State has increased the required level of monitoring for filters and may require additional inspections, monitoring and reporting.
- ◆ Source Water Assessment - The State has structured its SWAP program to allow water utilities to conduct their own assessments to help improve and preserve water quality of the public water supply sources.

## DBP Monitoring Results

Starting in January 1, 2004, TTHM and HAA5 monitoring and compliance is required under the Federal EPA regulations for systems with service populations of 500 to 9999 that use treated surface water supplies. Frequency of monitoring should be 1 sample quarterly, collected at a site representing maximum residence time.

The District has monitored for TTHM and HAA5 at Cemetery Lane and Railroad Flat, and the data submitted to the California Department of Health Services indicates that the system is capable of meeting the maximum contaminant limits of 80 ug/l for TTHM, and 60 ug/l for HAA5.

# System Evaluation

## System Evaluation

The West Point water system was evaluated to identify deficiencies in meeting current District standards. The infrastructure for raw water supply, water treatment, and water distribution was evaluated using District and other criteria.

### Raw Water Supply

The existing facilities and infrastructure used by the District to collect raw water have been evaluated for ability to convey the existing and projected demand discussed previously. Each part of the raw water supply is discussed below.

#### Bear Creek Diversion

During the evaluation of the Bear Creek Diversion, the structure was nearly filled with silt and gravel. In addition, portions of the transmission pipeline were in extreme disrepair, and it was estimated that as much as 75 to 95 percent of the flow in the pipe was lost prior to reaching the Regulating Reservoir because of leaks and pipe breaks. Recently, improvements have been made to the diversion structure and the pipeline has been replaced to fully utilize the water rights.

Estimated low flows in Bear Creek for 10-year and 25-year recurrence intervals are both zero. Therefore Bear Creek remains an unreliable water supply source during the summer months.

#### Mokelumne River Intake and Pump Station

Since the existing pump station is located in the floodplain of the Middle Fork of the Mokelumne River it is susceptible to flooding and instrumentation damage. Currently the instrumentation and pump motors are below the recommended flood level based on the maximum flood of record, which is the 1997 flood. Improvements should be made to correct this deficiency.

The existing pump station, located in the flood plain of the Mokelumne River, has an insufficient pumping capacity to transport projected water demands to the treatment plant. Also, the intake structure does not meet the California Department of Fish and Game (DFG) design criteria. Current capacity of the pump station is approximately 0.3 MGD. Demands through buildout are near 1 MGD. The infiltration gallery to the pump station and the pipeline to the treatment plant must also be replaced to deliver projected demands, when the diversion from Bear Creek cannot deliver water.

#### Wilson Lake Dam

The estimated usable storage in Wilson Lake is minimal, given that the facility has no functional outlet control and no method for drawing from the reservoir in late summer when the supply is needed. However, improvements to the dam may maximize the storage capacity of the reservoir.

## Regulating Reservoir

During the evaluation of the Regulating Reservoir, both the gate and the valve operator are in poor condition and in need of replacement. In addition, the District currently has a problem with fish entering the water treatment facility through the existing outlet structure in the reservoir. In order to stop this problem the District has requested that a fish screen be installed. The District is also interested in the ability to release water from the reservoir at multiple elevations.

## Water Treatment

The West Point WTP was upgraded in 2002 and has a capacity of 1.0 MGD, higher than the projected maximum day demand at buildout, of 0.8 MGD.

The existing finished water effluent pumps are 300 and 700 gpm pumps providing 18 feet of head, using 5 HP motors. The 300 gpm pump would not be able to supply the needed 556 gpm required for buildout MDD. In addition, the power required to pump 556 gpm at 18 feet of head, plus an additional 10 feet due to the re-location of the clearwell, would be approximately 5 HP. This power does not consider the standard 15% additional power added to water pump motors; therefore both effluent pump motors would be insufficient to supply the needed flow from the WTP if the clearwell is relocated.

## Treated Water Distribution

### Evaluation Criteria

The system was evaluated using hydraulic criteria defined by the District and local fire protection districts.

The District standards state storage capacity will be equal to the sum of the following three components:

1. Fire flow storage, a minimum of four hours times the appropriate fire flow demand;
2. System peaking storage, equal to 20 percent of the maximum day flow; and
3. Emergency storage, equal to four hours of the maximum day demand.

The storage tank size was based upon the water demand for build-out. The storage tank capacity equation was based on the District's June 1997 Improvement Standards.

Tank Size (gal) = 20% Max Day + 4Hrs Fire Flow + 4Hrs Max Day

Where:

Max Day = 2 \* Average Day Demand

Ave Day = 200 gallons per day per person \* 2.5 people per service  
 = 500 gallons per day per service (gpd)

The District standard for minimum system pressure is 35 psi, per the 1997 District improvement standards. Minimum system pressure may decrease to 20 psi during fire flow events.

The District and local fire district fire flow requirements are listed in Table 11. Fire Flow demands that will be used in modeling are the more stringent of the District’s improvement standards or the local Fire District minimum standards, and are shown in Table 12.

**Table 11. Fire Flow Requirements by Authority.**

Authority	Building Type	Flow Requirement
<b>District Improvement Standard</b>	Single Family and Duplex Residential Areas	500 gpm
	Townhouse, Multiple Residential	1,000 gpm
	Commercial	1,500 gpm
<b>West Point Fire District</b>	Residential (up to 3,600 sf fire area) <sup>a</sup>	1,000 gpm
	Townhouse, Multiple Residential	1,500 gpm
	Commercial (fire area limit varies) <sup>b</sup>	1,500 gpm

a. Residential fire flow limited to protect dwellings up to 3,600 square feet of fire area (floor area) per California Fire Code, Division III, Fire Protection, Appendix III-A - Fire Flow Requirements for Buildings (attached). It is assumed that residences larger than 3,600 sf of fire area will be required to supply the additional fire flow demands using alternate means.

b. Commercial fire flow is 1,500 gpm minimum, and is limited to protect structures with fire areas from 3,600 sf up to 22,700 fire area, depending on type of commercial construction (see California Fire Code, Division III, Fire protection, Appendix III-A - Fire Flow Requirements for Buildings). It is assumed that commercial buildings larger than the area protected by 1,500 gpm, will be required to supply the additional fire flow demands using alternate means.

**Table 12. Fire Flow Demands for Hydraulic Modeling.**

	West Point System
<b>Residential</b>	1,000 gpm
<b>Townhouse, Multiple Residential</b>	1,500 gpm
<b>Commercial</b>	1,500 gpm

A computer hydraulic model was used to evaluate the distribution system in its existing condition and in buildout condition. The model output was reviewed to identify existing and future deficiencies of the treated water distribution and storage system. The hydraulic evaluation criteria used are summarized in Table 13.

**Table 13. Hydraulic Evaluation Criteria.**

Parameter	Value	Units	Source
Required fire flow - single family	1,000	gpm	West Point Fire District
Required fire flow - multi-family	1,500	gpm	District Improvement Standards
Required fire flow - commercial	1,500	gpm	District Improvement Standards
Minimum pressure excluding fires	35	psi	District Improvement Standards
Minimum pressure during fire	20	psi	District Improvement Standards
Fire flow storage	4	hours	District Improvement Standards
Emergency storage (hours of MDD)	4	hours	District Improvement Standards
Operational storage (% of MDD)	20%		District Improvement Standards

### Treated Water Storage Evaluation

The available storage in each zone was compared to the required storage based on the identified criteria. The storage evaluation is summarized in Table 14.

**Table 14. Evaluation of Available Storage.**

	West Point/Wilseyville <sup>a</sup>	Bummerville
Available storage (gallons)	500,000	30,000
Highest fire flow requirement in zone (gpm)	1,500	1,000
Required fire flow storage (gallons)	360,000	240,000
Buildout MDD (gpd)	672,000	129,000
Required emergency storage (gallons)	112,000	21,500
Required operational storage (gallons)	134,400	25,800
Total required storage (gallons)	606,400	287,300
Storage deficit (gallons)	106,000	257,000 <sup>b</sup>

Notes:

- Required fire flow storage (hours) 4
- Emergency storage (hours of MDD) 4
- Operational storage (% of MDD) 20%

- a. The Wilseyville area distribution system is integral with the West Point Water System; therefore, available storage to the West Point area is also available to Wilseyville.
- b. The Bummerville area distribution system's storage deficit is large enough to create water quality problems if a single storage tank is constructed to satisfy the deficit. Therefore, a smaller tank with an accompanying fire flow pump could be used in lieu of a single larger tank.

### Treated Water Pumping Evaluation

Each booster pumping station should have the ability to pump the peak hour demand of the uphill zone to which it is pumping. In addition, if the uphill zone does not have adequate storage for fire flow, the booster pumping station should have the ability to deliver fire flow to the higher zone.

### Treated Water Pipeline Evaluation

The critical condition is MDD plus fire flow. Therefore this demand scenario is used to analyze the distribution system, and forms the basis of recommendations. The available fire flow was calculated at every node and compared to the required fire flow.

Based on the hydraulic model results, only locations in the immediate vicinity of the treatment plant meet the fire flow requirements under existing MDD. Furthermore, under buildout conditions, the number of locations satisfying the fire flow requirements decreases. All other locations in the distribution system do not meet the fire flow and/or residual pressure requirements under existing MDD. This is a significant change from the Feasibility Study performed in 2002 as the fire flow demand evaluated at that time was 500 gpm under MDD. As the fire flow demand analyzed now is 1,000 gpm, system deficiencies have increased.

## Recommended Improvements

The 2002 Feasibility Study recommended a number of improvement projects. Many of those projects have been reviewed and included or updated for this technical memorandum. In addition, due to the increased fire flow requirement, additional projects are recommended. In order for the study area to achieve a sustainable water supply through the year 2025 and to be assured of adequate fire protection, every recommended project listed must be in place within the next 10 to 15 years.

Preliminary plans have been completed for a portion of the recommended projects during the Feasibility Study and are provided under separate cover. In addition, those projects are described in detail throughout the Feasibility Study. The preliminary designs include site layouts and project alignments, along with some details and profile information where appropriate.

## Raw Water Supply

The existing water rights are expected to provide adequate supply for the West Point area through buildout. Recommendations for improvements to portions of the raw water supply infrastructure are detailed below.

### Bear Creek Diversion

Improvements have recently been completed to improve the diversion structure and to replace the damaged and deteriorated 10-inch raw water pipeline with a 16-inch HDPE pipeline, so no additional improvements are recommended for the conveyance. However, due to the remote location, a remotely-controlled data acquisition monitoring control is recommended.

### Mokelumne River Intake and Pump Station

Upgrades to the pump station are recommended to keep the motors and controls out of the floodplain, and to increase pumping capacity. A new infiltration gallery should be installed to meet DFG requirements for the water intake, and a new transmission pipeline is recommended to deliver the increased flow.

The existing pumps are insufficient to convey the required flow of one MGD to the treatment plant. The existing pumps will be replaced with two 125-hp pumps with a capacity of 1 MGD each. The natural flow in the river and/or the releases from CPUD's Schaads Reservoir should well exceed the proposed diversion rate of one MGD.

The pumps will be designed to convey water to the water treatment plant approximately two miles to the north. Total head required to pump water from the pump station to the treatment plant is approximately 500-feet or 217 psi of pressure. The 217-psi is a relatively high pressure for a pumped system; therefore, care is required to design all pipe connections and restraining systems to control the anticipated system pressures during normal operations and occasions where high-pressure surges may occur.



The pumps will have 8-inch discharge headers that will connect into the existing 8-inch discharge line. Due to the possibility of flooding, the pump motor and controls will be elevated off the ground approximately four feet. The pump discharge and associated valving will be placed at the same elevation as the existing piping to allow for easy connection to the existing 8-inch discharge line. Inline discharge valving would include an 8-inch pump control valve, an 8-inch butterfly valve, and an air release valve. A flow meter will also be included in the 8-inch discharge line leaving the site. A surge anticipation valve will also be included in the system, which will act as a safety feature to relieve high pressures that may occur during power outages or other malfunctions of the system. A surge analysis is required to determine the size of the surge valve necessary to protect the pump station and pipeline.

New modifications to the pump station will include connecting the new controls to the District's SCADA system. Additional improvements including new access platforms and railing should also be made.

The existing infiltration gallery should be removed and replaced with a new system. The new system should include two 10 inch perforated well screens placed approximately five feet under the river channel. The new well screens should be 21 feet long and placed perpendicular to the flow of the river. The well screens utilized shall be 0.06 inch slotted well screens. Each screen should be flanged to a 10-inch high density polyethylene (HDPE) pipe that will run back to the existing opening at the sump. A gravel pack will be placed around well screens, which is specifically designed to hold back fine native material that may clog the well screen. The material above the gravel pack shall become coarser as it moves up to the river bottom. The river bottom above the infiltration gallery shall be cobble material similar to the native material in the area.

To protect the gallery from becoming clogged by finer materials migrating into the filter pack, an air-purge system should be included in the design. A 2-inch perforated PVC pipe should be placed in the infiltration gallery area to blow finer material out of the gravel pack. The perforated pipe should be connected to solid PVC pipe that is routed back to the pump stations where it can be connected to a positive displacement blower. The compressed air flow into each of the air purge lines required to clean the gravel pack is approximately 141 cubic feet per minute (ACFM). Air purging of the system is required on a regular basis to assure that clogging of the system does not take place.

The existing pipeline shall be abandoned and replaced with an 8-inch steel or ductile iron pipeline to run the entire length of the line to the treatment plant. The existing booster station located along Acorn Way will no longer be necessary as the new pumps will be designed to convey water all the way to the treatment plant.

Combination air release/vacuum valves will be required at all the high points along the pipeline route. The valves range from two to four inches based on the steepest localized slope. Blow-off valves will be required at all the low points along the pipeline. The blow-off valves will be

utilized if there is ever a need to drain the pipeline for maintenance or other purposes. The combination valves should be automatic and the blow-off valves should be manually controlled. Neither will be connected to the SCADA system. At the terminus of the pipeline, a butterfly valve will be installed to isolate the pipeline system from the treatment plant.

Due to the anticipated high pressures in the system, the pipeline will be constructed with either steel or ductile iron pipe. Both pipe materials require specific handling and installation procedures that should be specified in design and must be followed during construction.

### **Wilson Lake Dam**

In order to determine the required elevation of the spillway to maximize capacity, a detailed watershed analysis was performed. The analysis included determining the effects of raising the spillway on the reservoir's ability to attenuate a flood event.

After performing the additional study, it was recommended to remove and replace the existing embankment, outlet and spillway. Suitable materials are available in and adjacent to the project site. A new dam would include the embankment, a new concrete lined spillway and an outlet pipe with a gated outlet structure. Approximately 6,700 cubic yards of the existing embankment would be removed, approximately 6,900 cubic yards excavated for the embankment foundation and core trenching, and approximately 13,600 cubic yards of embankment would be used as fill. The toe drain would be 150 feet long and the outlet conduit pipe would be an 18 inch (diameter) concrete encased pipe. The enlarged capacity is expected to become 45 acre-feet. The outlet works would not be fitted with a fish screen as endangered species are not present and mortality rates are expected to be quite low due to infrequent usage and the short length of the outlet pipe.

### **Regulating Reservoir**

It is proposed that the existing outlet structure be replaced with a new hand-operated system. A hand-operated system is ideal for the situation where use is infrequent and the expense of a powered system is not warranted. The reservoir outlet structure is operated only a few times each year. The proposed new gate will lie horizontal replacing the current slanted gate, and the recommended gate for this application is a knife-type gate or a butterfly valve. A second outlet structure is proposed to allow release of water from a second elevation in the reservoir.

Also, to eliminate the problem of fish entering the water treatment facility through the outlet structure, a cylindrical type fish screen is recommended to be placed upstream of the gates. The fish entering the outlet are not endangered or threatened. Due to the location of the fish screen, it will be difficult to clean manually. Therefore, there is a concern of vegetative growth plugging the screen. For this reason it is recommended that the fish screens be self-cleaning; there are several manufacturers who have this type of fish screen available.

An additional diversion ditch on the north side of the reservoir is also recommended to help unwanted natural runoff from the surrounding basin from entering the reservoir.

## Water Treatment

As the existing capacity of the treatment plant exceeds the maximum day demand at buildout conditions, no improvements are recommended.

The existing finished water pumps sending water to the clearwell are insufficiently sized to meet buildout maximum day demands and the head required to pump an additional ten feet to a new location of a clearwell. Both finished water effluent pumps should be replaced with 700 gpm pumps at 28 feet of head.

## Treated Water Storage

Based on the storage system evaluation criteria stated previously, the redwood tank currently in place serving the Bummerville system and the clearwell serving the West Point/Wilseyville system are inadequate in capacity. Additional storage capacity is required to meet the District standards for treated water storage.

### Replace Bummerville Storage Tank

The deficit for the Bummerville treated water storage is calculated at 263,000 gallons; therefore, the recommendation is to replace the existing redwood tank with a new tank. However, a single tank of sufficient size to supply the entire treated water storage required would promote water quality deterioration and increased DBP formation during normal operation. Therefore, a smaller tank and an upgraded fire flow pump are recommended to satisfy the four-hour fire flow demand. The storage tank would be situated at the existing location of the redwood tank and would be a minimum of 50,000 gallons. The tank would be supporting a zone of single-family homes and residential fire demand of 1,000 gpm. The tank would also provide the required emergency and operational storage per District standards.

### Replace Treatment Plant Clearwell

The recommendation is to replace the existing clearwell with a new clearwell. The location would be approximately 300 feet away from the existing clearwell and approximately 10 feet higher in elevation than the existing clearwell. The capacity would be a minimum of 586,600 gallons. For the purpose of cost estimation, the tank size used was 600,000 gallons. The tank would be supporting a zone of single-family homes, commercial demands and a commercial fire demand of 1,500 gpm. The tank would also provide the required emergency and operational storage per District standards for the West Point zone and the Wilseyville zone.

Approximately 300 feet of 8-inch pipe would be installed as a dedicated fill line to tie in the treatment plant to the storage tank. The storage tank would serve to provide the adequate chlorination contact time. Treated water for the Bummerville tank would be pumped from the clearwell through a new 6-inch fill line. In addition, between the clearwell and the Bummerville tank are four local services that would be served from the 6-inch fill line.

**Treated Water Distribution**

Recommended improvements to the distribution system reflect the District Improvement Standards. In general, pipes less than 6 inches in diameter will be upgraded to a minimum of 6 inches in diameter and 8-inch diameter mains will be required for commercial districts. Also a new 10-inch main is recommended for the upper West Point area, and a 12-inch main is recommended for distribution of treated water from the treatment plant south to Wilseyville and Sandy Gulch. Almost all of the pipes would need to be replaced with larger diameter pipelines to meet fire flow demand while maintaining 20 psi residual pressure and 20 psi minimum system pressure.

For pipe replacement or installation recommendations, all new pipes received a Hazen-Williams C-factor of 140 in the hydraulic model. Existing pipes use the C-factor currently assigned in the model - frequently the C -factor is 120.

Table 15 lists the length and diameter of pipe recommended using the MDD plus 1,000 gpm fire flow scenario.

**Table 15. Distribution System Improvements Using MDD plus 1000 gpm Fire Flow Scenario.**

Diameter	1000 gpm FF Standard
	Feet of Pipe
6" pipe	17804
8" pipe	5135
10" pipe	6407
12" pipe	13886

**Distribution System**

**West Point/Wilseyville**

Based on modeling results, the existing water distribution system does not meet fire flow standards under MDD. The primary reason the system fails to support the fire demand is inadequate pipe diameters. The existing system is composed mainly of 6-inch diameter pipe mains and 4-inch diameter pipe to terminal service lines. The smallest pipe diameter recorded on the County treated water distribution map is 1-inch diameter with 8-inch diameter as the largest pipeline in the system.

A majority of the pipes in the West Point zone would have to be replaced. The service main between the treatment plant and the rest of the distribution network along Winton Road would need to be upgraded from a 6-inch diameter to a 12-inch diameter pipeline.

The other difficulty in the distribution grid is elevation changes throughout the system. The existing storage elevation is 2,910 feet. The grid has problems with service area that have too little and/or too much pressure. Several locations along Highway 26, near Pinecrest Lane and Dowling Road, are above 2,840 feet in elevation that is 1.5 miles away from the treatment

plant. Based on static conditions alone, these services do not meet the minimum residual pressure of 35 psi. Reasonable increases in pipe diameters produce very little benefit in mitigating these low-pressure concerns. It is recommended that localized booster pumps be installed to bolster fireflow volumes and pressures in these areas. The District is in the process of upgrading the Wilseyville fire flow pump and power generator, which will supply adequate fire flow to the south easternmost area of Wilseyville.

### ***Bummerville***

For the Bummerville system, the primary deficiency is inadequate pipe size. The Bummerville distribution grid also consists of 4-inch diameter and 6-inch diameter pipe. The primary service main runs north/south on Bummerville Road and is connected to the redwood storage tank, by a 4-inch loop. The recommendation is to upsize the existing 4-inch and 6-inch diameter pipes to 6-inches and 8-inches, respectively. Also, any pipe less than four inches in diameter will need to be upsized to 6-inches.

### ***System Sub-division***

For the purposes of prioritization, recommended improvements for the West Point/Wilseyville Distribution system have been divided into 3 sub-systems. System 1 consists of the main distribution pipe from the West Point Water Treatment Plant and the Downtown West Point area. System 2 includes the Upper Northwest West Point system. System 3 consists of improvements to the Wilseyville area. The system sub-division is shown in Figure 4.

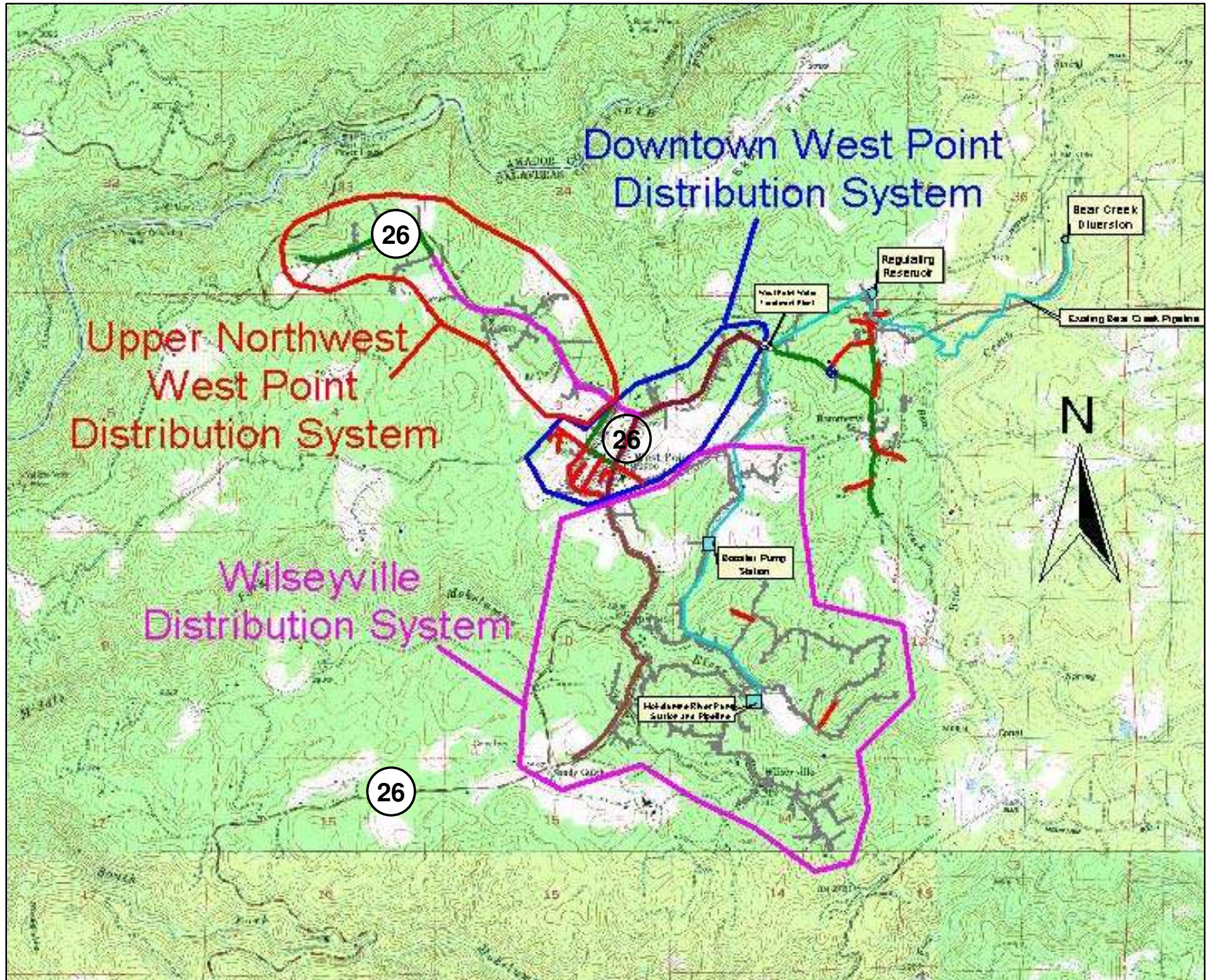
### **Recommendation Priorities**

The improvements are recommended as follows:

1. Downtown West Point Distribution System (Phase 1)
2. Upper Northwest West Point Distribution System (Phase 1)
3. Wilseyville Distribution System (Phase 3)

The highest priority is given to the downtown area to provide increased fire flows to the commercial district and the school. This area has had fire problems in the past and is a high priority for the District. The next priority is given to the Upper Northwest West Point to provide adequate fire flows to this area which lies at a higher elevation and has some of the lowest fire flows. The final priority is given to Wilseyville.

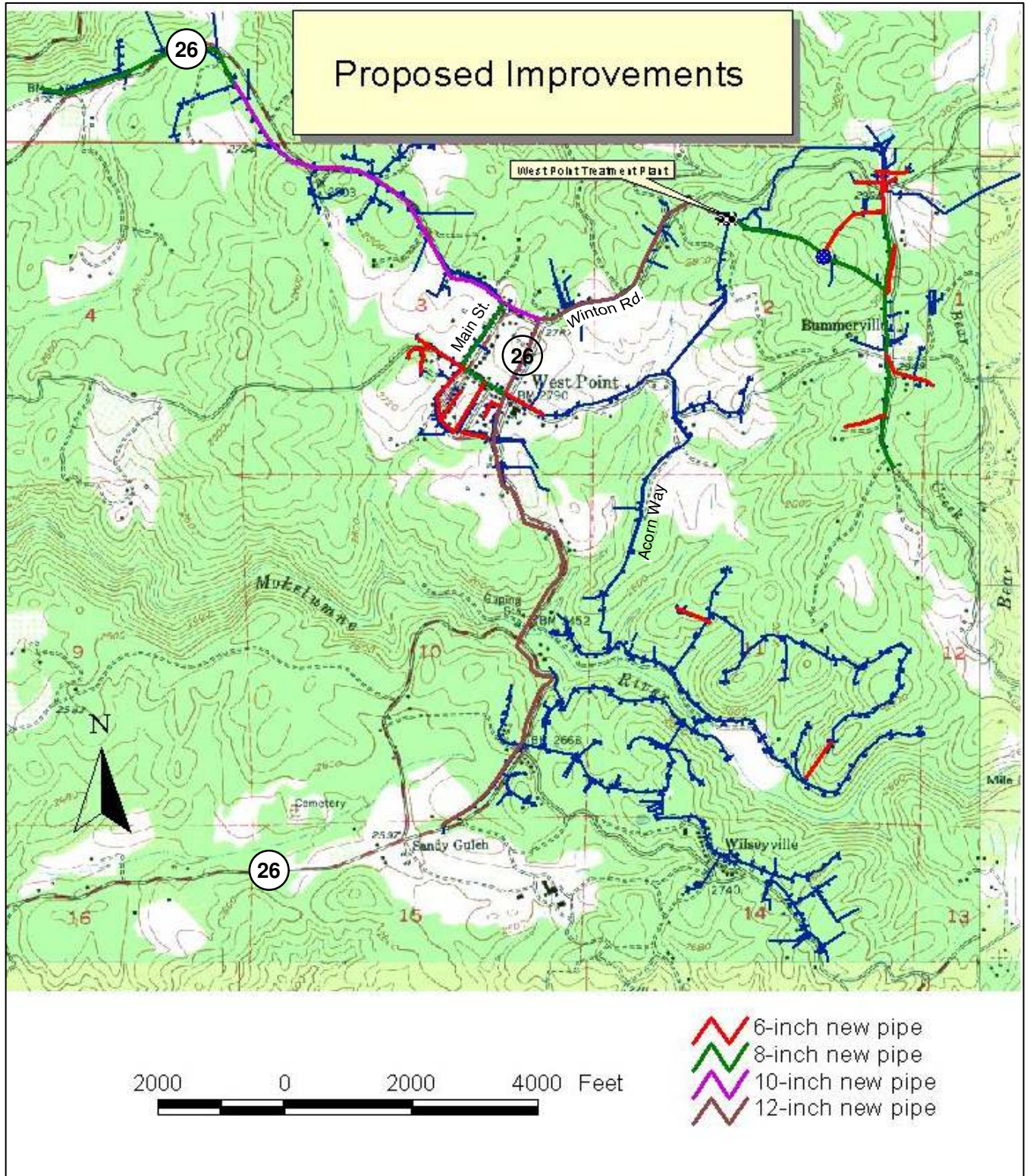
In summary, the recommended improvements to the distribution system are shown on Figure 5 and are described following the figure.



Sub-System Division



Figure 4



**Recommended Loops and Proposed Changes to the Distribution System.**



**Figure 5**

**Downtown West Point Distribution System (Phase 1):**

- |   |                                |
|---|--------------------------------|
| 1. Upsize the existing pipeline from the treatment plant along Winton Road onto State Highway 26 southbound to Main Street to 12 inches in diameter (approximately 5,800 feet). | Phase 1, Year 1<br>(Phase 1-1) |
| 2. Upsize the existing pipeline along State Highway 26 from Winton Road to Main Street to 10 inches in diameter (approximately 600 feet).                                       | Phase 1, Year 2<br>(Phase 1-2) |
| 3. Upsize the existing pipeline along Main Street from State Highway 26 to Pine Street to 8 inches in diameter (approximately 2,000 feet).                                      | Phase 1-2                      |
| 4. Upsize all remaining pipelines to 6 inches in diameter (approximately 7,000 feet).   | Phase 1, Year 3<br>(Phase 1-3) |

**Upper Northwest West Point Distribution System (Phase 1):**

- |   |                                |
|---|--------------------------------|
| 1. Upsize the existing pipeline along State Highway 26 from Main Street to Rhoda Niderost Lane to 10 inches in diameter (approximately 5,807 feet).                         | Phase 1, Year 4<br>(Phase 1-4) |
| 2. Upsize the existing pipeline along State Highway 26 from Rhoda Niderost Lane to the terminus at Centennial Mine Road to 8 inches in diameter (approximately 3,135 feet). | Phase 1, Year 5<br>(Phase 1-5) |
| 3. Upsize the pipeline branches along State Highway 26 to a minimum of 6 inches in diameter (approximately 6,036 feet).   | Phase 1-5                      |

**Wilseyville Distribution System (Phase 3):**

1. Install new 12-inch diameter pipeline connected to the upsized 12-inch diameter line at State Highway 26 and Main Street. Continue southbound onto Railroad Flat Road and Sandy Gulch Road to the terminus immediately prior to the intersection of Sandy Gulch Road and State Highway 26 (approximately 8,086 feet).
2. Upsize other 2-inch and 4-inch diameter pipelines to a minimum of 6-inches in diameter (approximately 293 feet and 4,475 feet respectively).
3. Loop Patricia Way to the southwest to Barney Way using a 6-inch diameter pipeline (approximately 752 feet).



# Capital Improvement Plan

## Capital Improvement Plan

### Cost Estimates

The cost estimates included herein are based on recent similar projects, recent bid prices, and historical trends. They are not based on detailed engineering design and analysis. Therefore, the construction cost estimates are considered to range from +30 percent to -30 percent of the expected bid prices. A 15 percent contingency has been applied to the baseline construction cost to account for unforeseen events and unknown conditions and a cost approximately equal to 18 percent of construction cost (including contingencies) has been applied to account for additional items such as engineering, administration, construction management, and inspection costs. Cost Estimates are provided in Appendix B.

Funding sources for the recommended improvements are addressed within the District’s Financial Plan. Costs will be allocated among user classes: existing, infill, and future. The financial responsibility for the particular improvements will be assigned to each class, or in some cases, a combination of classes. Ultimately, the District’s Board of Directors will consider the adequacy of the operational fees and capacity charges. Additionally, as the District has done in the past, the seeking of grant funds for this community will continue to play an important role in improving the water system. The District is in the process of applying for Proposition 50, Water Use Efficiency Grant funds for some of the recommended improvements included in this report.

**Table 16. Summary of Cost Estimates for All Recommended Improvements.**

Improvements	Estimated Capital Costs
Bummerville Distribution System & Storage Tank	\$1,457,000
Mokelumne Pump Station	\$1,262,000
Regulating Reservoir Improvements, Bear Creek Diversion SCADA	\$202,600
Replacement of Wilson Dam	\$304,000
West Point / Wilseyville Distribution System & Clearwell Replacement	\$5,620,000
Total Improvement Costs	\$8,845,600

**Table 17. Summary of Phase 1 breakdown of Cost Estimates for recommended improvements for the West Point / Wilseyville Distribution System.**

Phase 1 Improvements	Year 1	Year 2	Year 3	Year 4	Year 5
Downtown West Point Distribution System	\$840,000	\$291,000	\$629,000		
Bummerville Storage Tank and Fire Flow Pump	\$492,000				
Replacement of Wilson Dam			\$304,000		
Replacement of Clearwell and Finished Water Pumps			\$650,000		
Upper Northwest West Point Pipelines				\$742,000	\$882,000
Bear Creek Diversion SCADA				\$95,600	
Total Improvement Costs	\$1,332,000	\$291,000	\$1,583,000	\$837,600	\$882,000

Additional detail for the other system improvements is provided in Appendix B.

## References

## References

*Calaveras County Water District, West Point / Wilseyville / Bummerville System Improvements, Final Feasibility Report*, HDR Engineering, Inc., November 2004.

*Calaveras County Water District Improvement Standards*, Calaveras County Water District, June 1997.

*Water Distribution Study of West Point - Wilseyville - Railroad Flat - Mountain Ranch - Valley Springs - Wallace*, Weber Hall Consulting Group, October 1983.

*West Point Water System Technical Memorandum, Basis for Recommended Improvements*, January 24, 2005. Draft.

*West Point Water System Technical Memorandum, Basis for Recommended Improvements*, March 1, 2005. Final.

*West Point / Wilseyville Domestic Water System Master Plan*, Charpier Martin and Associates, September 12, 1996.

*West Point / Wilseyville Domestic Water System Master Plan, Supplement*, Charpier Martin and Associates, January 7, 1998.

*West Point / Bummerville Water Use Efficiency Grant Application, Downtown West Point Water Distribution System Improvements and Bummerville Treated Water Storage Tank Replacement*, HDR / Calaveras County Water District, January 11, 2005.

## Appendix A. Fire Flow Reports

**Scenario: Buildout MDD 2057 + Fire Flow - Min Sys Press + Commercial Fire Areas**

**Fire Flow Analysis**

**Fire Flow Report**

Label	Zone	Satisfies Fire Flow Constraints?	Needed Fire Flow (gpm)	Available Fire Flow (gpm)	Total Flow Needed (gpm)	Total Flow Available (gpm)	Residual Pressure (psi)	Calculated Residual Pressure (psi)	Minimum Zone Pressure (psi)	Calculated Minimum Zone Pressure (psi)	Minimum Zone Junction	Calculated Minimum System Pressure (psi)	Minimum System Junction
J-79	Distribution System Z	false	1,500.00	1,500.00	1,518.93	1,518.93	20.00	21.09	20.00	25.72	J-33	3.46	J-220
J-116	Distribution System Z	true	1,500.00	1,500.00	1,516.56	1,516.56	20.00	55.16	20.00	24.63	J-33	3.46	J-220
J-75	Distribution System Z	false	1,500.00	1,500.00	1,513.60	1,513.60	20.00	73.32	20.00	25.39	J-33	3.46	J-220
J-139	Distribution System Z	true	1,500.00	1,500.00	1,508.87	1,508.87	20.00	52.71	20.00	27.03	J-33	3.46	J-220
J-118	Distribution System Z	true	1,500.00	1,500.00	1,508.87	1,508.87	20.00	71.64	20.00	24.97	J-33	3.46	J-220
J-89	Distribution System Z	true	1,500.00	1,500.00	1,508.87	1,508.87	20.00	39.31	20.00	25.77	J-33	3.46	J-220
J-407	Distribution System Z	true	1,000.00	1,500.00	1,007.69	1,507.69	20.00	45.32	20.00	25.97	J-308	3.46	J-220
J-69	Distribution System Z	false	1,500.00	1,500.00	1,507.69	1,507.69	20.00	21.05	20.00	25.14	J-33	3.46	J-220
J-125	Distribution System Z	false	1,500.00	1,500.00	1,507.69	1,507.69	20.00	95.97	20.00	25.62	J-33	3.46	J-220
J-87	Distribution System Z	false	1,500.00	1,500.00	1,507.69	1,507.69	20.00	27.77	20.00	27.66	J-33	3.46	J-220
J-94	Distribution System Z	false	1,500.00	1,500.00	1,507.69	1,507.69	20.00	62.47	20.00	26.33	J-33	3.46	J-220
J-246	Distribution System Z	true	1,000.00	1,500.00	1,006.51	1,506.51	20.00	52.66	20.00	34.44	J-33	-5.26	J-220
J-228	Distribution System Z	true	1,000.00	1,500.00	1,006.51	1,506.51	20.00	57.41	20.00	34.44	J-33	-5.26	J-220
J-91	Distribution System Z	true	1,500.00	1,500.00	1,506.51	1,506.51	20.00	55.64	20.00	25.78	J-33	3.46	J-220
J-162	Distribution System Z	true	1,500.00	1,500.00	1,506.51	1,506.51	20.00	44.15	20.00	31.34	J-33	3.46	J-220
J-100	Distribution System Z	true	1,000.00	1,486.08	1,006.51	1,492.59	20.00	20.00	20.00	22.54	J-113	3.46	J-220
J-83	Distribution System Z	true	1,500.00	1,500.00	1,506.51	1,506.51	20.00	46.51	20.00	26.24	J-33	3.46	J-220
J-127	Distribution System Z	true	1,500.00	1,500.00	1,505.32	1,505.32	20.00	48.09	20.00	25.79	J-33	3.46	J-220
J-18	Distribution System Z	true	1,500.00	1,500.00	1,505.32	1,505.32	20.00	57.10	20.00	26.13	J-33	3.46	J-220
J-132	Distribution System Z	true	1,500.00	1,500.00	1,505.32	1,505.32	20.00	34.66	20.00	27.21	J-33	3.46	J-220
J-95	Distribution System Z	true	1,500.00	1,500.00	1,505.32	1,505.32	20.00	49.92	20.00	26.30	J-33	3.46	J-220
J-80	Distribution System Z	true	1,500.00	1,500.00	1,505.32	1,505.32	20.00	54.14	20.00	25.76	J-33	3.46	J-220
J-229	Distribution System Z	true	1,000.00	1,500.00	1,005.32	1,505.32	20.00	59.77	20.00	34.44	J-33	-5.26	J-220
J-165	Distribution System Z	true	1,500.00	1,500.00	1,505.32	1,505.32	20.00	40.48	20.00	31.95	J-33	3.46	J-220
J-63	Distribution System Z	true	1,500.00	1,500.00	1,501.51	1,501.51	20.00	40.90	20.00	23.93	J-33	3.46	J-220
J-78	Distribution System Z	true	1,500.00	1,500.00	1,503.55	1,503.55	20.00	62.51	20.00	25.73	J-33	3.46	J-220
J-67	Distribution System Z	true	1,500.00	1,500.00	1,503.55	1,503.55	20.00	71.48	20.00	25.14	J-33	3.46	J-220
J-178	Distribution System Z	true	1,500.00	1,500.00	1,503.55	1,503.55	20.00	36.65	20.00	27.95	J-33	3.46	J-220
J-223	Distribution System Z	true	1,000.00	1,500.00	1,003.55	1,503.55	20.00	56.45	20.00	34.44	J-33	-5.26	J-220
J-425	Distribution System Z	true	1,000.00	1,500.00	1,003.55	1,503.55	20.00	34.96	20.00	25.97	J-308	3.46	J-220
J-81	Distribution System Z	true	1,500.00	1,500.00	1,503.55	1,503.55	20.00	46.19	20.00	26.27	J-33	3.46	J-220
J-161	Distribution System Z	false	1,500.00	1,500.00	1,502.37	1,502.37	20.00	38.57	20.00	30.16	J-33	3.46	J-220
J-405	Distribution System Z	true	1,000.00	1,500.00	1,002.37	1,502.37	20.00	91.79	20.00	25.97	J-308	3.46	J-220
J-419	Distribution System Z	true	1,000.00	1,500.00	1,002.37	1,502.37	20.00	92.87	20.00	25.97	J-308	3.46	J-220
J-140	Distribution System Z	false	1,500.00	1,500.00	1,502.37	1,502.37	20.00	53.11	20.00	27.43	J-33	3.46	J-220
J-90	Distribution System Z	false	1,500.00	1,500.00	1,502.37	1,502.37	20.00	55.50	20.00	25.86	J-33	3.46	J-220
J-137	Distribution System Z	false	1,500.00	1,500.00	1,502.37	1,502.37	20.00	33.95	20.00	26.20	J-33	3.46	J-220
J-245	Distribution System Z	true	1,000.00	1,500.00	1,002.37	1,502.37	20.00	52.10	20.00	34.44	J-33	-5.26	J-220
J-114	Distribution System Z	false	1,500.00	1,500.00	1,502.37	1,502.37	20.00	40.27	20.00	23.96	J-33	3.46	J-220
J-423	Distribution System Z	true	1,000.00	1,500.00	1,002.37	1,502.37	20.00	64.07	20.00	25.97	J-308	3.46	J-220
J-123	Distribution System Z	true	1,500.00	1,500.00	1,501.18	1,501.18	20.00	61.32	20.00	25.57	J-33	3.46	J-220
J-61	Distribution System Z	true	1,000.00	1,377.44	1,001.18	1,378.62	20.00	32.62	20.00	20.00	J-33	3.46	J-220
J-195	Distribution System Z	true	1,000.00	1,500.00	1,001.18	1,501.18	20.00	33.31	20.00	34.44	J-33	-4.07	J-220
J-176	Distribution System Z	true	1,000.00	1,500.00	1,001.18	1,501.18	20.00	63.47	20.00	28.63	J-33	3.46	J-220
J-402	Distribution System Z	true	1,000.00	1,345.09	1,001.18	1,346.28	20.00	74.88	20.00	20.00	J-308	3.46	J-220
J-416	Distribution System Z	true	1,000.00	1,500.00	1,001.18	1,501.18	20.00	104.06	20.00	25.97	J-308	3.46	J-220
J-159	Distribution System Z	true	1,500.00	1,500.00	1,501.18	1,501.18	20.00	54.49	20.00	28.79	J-33	3.46	J-220
J-84	Distribution System Z	true	1,500.00	1,500.00	1,501.18	1,501.18	20.00	45.86	20.00	26.29	J-33	3.46	J-220
J-427	Distribution System Z	true	1,500.00	1,500.00	1,501.18	1,501.18	20.00	96.90	20.00	25.97	J-308	3.46	J-220
J-171	Distribution System Z	true	1,000.00	1,500.00	1,000.00	1,500.00	20.00	73.19	20.00	30.75	J-308	3.46	J-220
J-64	Distribution System Z	true	1,500.00	1,500.00	1,500.00	1,500.00	20.00	40.78	20.00	23.81	J-33	3.46	J-220
J-426	Distribution System Z	true	1,000.00	1,500.00	1,000.00	1,500.00	20.00	33.27	20.00	25.97	J-308	3.46	J-220

# Scenario: Buildout MDD 2057 + Fire Flow - Min Sys Press + Commercial Fire Areas

## Fire Flow Analysis

### Fire Flow Report

Label	Zone	Satisfies Fire Flow Constraints?	Needed Fire Flow (gpm)	Available Fire Flow (gpm)	Total Flow Needed (gpm)	Total Flow Available (gpm)	Residual Pressure (psi)	Calculated Residual Pressure (psi)	Minimum Zone Pressure (psi)	Calculated Minimum Zone Pressure (psi)	Minimum Zone Junction	Calculated Minimum System Pressure (psi)	Minimum System Junction
J-404	Distribution System Z	true	1,000.00	1,300.54	1,000.00	1,300.54	20.00	66.15	20.00	20.00	J-308	3.46	J-220
J-418	Distribution System Z	true	1,000.00	1,500.00	1,000.00	1,500.00	20.00	103.70	20.00	25.97	J-308	3.46	J-220
J-98	Distribution System Z	true	1,500.00	1,500.00	1,500.00	1,500.00	20.00	54.83	20.00	26.27	J-33	3.46	J-220
J-190	Distribution System Z	true	1,000.00	1,500.00	1,000.00	1,500.00	20.00	73.47	20.00	20.91	J-308	3.46	J-220
J-113	Distribution System Z	true	1,000.00	1,500.00	1,000.00	1,500.00	20.00	22.14	20.00	22.14	J-100	3.46	J-220
J-51	Distribution System Z	true	1,500.00	1,500.00	1,500.00	1,500.00	20.00	29.76	20.00	26.29	J-33	3.46	J-220
J-202	Distribution System Z	true	1,000.00	1,500.00	1,000.00	1,500.00	20.00	51.91	20.00	34.44	J-33	-4.66	J-220
J-42	Distribution System Z	true	1,000.00	1,500.00	1,000.00	1,500.00	20.00	35.83	20.00	29.33	J-210	-4.66	J-220
J-43	Distribution System Z	true	1,000.00	1,500.00	1,000.00	1,500.00	20.00	99.13	20.00	34.44	J-33	0.17	J-220
J-217	Distribution System Z	true	1,000.00	1,500.00	1,000.00	1,500.00	20.00	52.99	20.00	34.44	J-33	-4.82	J-220
J-4	Distribution System Z	true	1,000.00	1,500.00	1,000.00	1,500.00	20.00	32.88	20.00	34.44	J-33	-5.26	J-220
J-135	Distribution System Z	true	1,500.00	1,500.00	1,500.00	1,500.00	20.00	48.67	20.00	26.18	J-33	3.46	J-220
J-62	Distribution System Z	true	1,000.00	1,500.00	1,000.00	1,500.00	20.00	37.20	20.00	22.40	J-33	3.46	J-220
J-424	Distribution System Z	true	1,000.00	1,500.00	1,000.00	1,500.00	20.00	55.67	20.00	25.97	J-308	3.46	J-220
J-68	Distribution System Z	true	1,500.00	1,500.00	1,500.00	1,500.00	20.00	41.91	20.00	25.14	J-33	3.46	J-220
J-247	Distribution System Z	true	1,000.00	1,500.00	1,000.00	1,500.00	20.00	44.77	20.00	34.44	J-33	-5.26	J-220
J-181	Distribution System Z	true	1,000.00	1,500.00	1,000.00	1,500.00	20.00	52.02	20.00	23.98	J-308	3.46	J-220
J-130	Distribution System Z	true	1,500.00	1,500.00	1,500.00	1,500.00	20.00	58.29	20.00	26.32	J-33	3.46	J-220
J-82	Distribution System Z	true	1,500.00	1,500.00	1,500.00	1,500.00	20.00	48.82	20.00	26.18	J-33	3.46	J-220
J-226	Distribution System Z	true	1,000.00	1,500.00	1,000.00	1,500.00	20.00	54.04	20.00	34.44	J-33	-4.96	J-220
J-218	Distribution System Z	true	1,000.00	1,500.00	1,000.00	1,500.00	20.00	48.52	20.00	34.44	J-33	-4.82	J-220
J-231	Distribution System Z	true	1,000.00	1,385.74	1,000.00	1,385.74	20.00	63.98	20.00	20.00	J-308	3.46	J-220
J-138	Distribution System Z	true	1,500.00	1,500.00	1,500.00	1,500.00	20.00	48.99	20.00	26.35	J-33	3.46	J-220
J-403	Distribution System Z	true	1,000.00	1,300.66	1,000.00	1,300.66	20.00	71.80	20.00	20.00	J-308	3.46	J-220
J-175	Distribution System Z	true	1,000.00	1,500.00	1,000.00	1,500.00	20.00	74.69	20.00	27.40	J-308	3.46	J-220
J-70	Distribution System Z	false	1,500.00	1,445.89	1,510.06	1,455.95	20.00	20.00	20.00	25.65	J-33	3.46	J-220
J-8	Distribution System Z	true	1,000.00	1,469.12	1,000.00	1,469.12	20.00	20.00	20.00	30.87	J-210	-4.36	J-220
J-221	Distribution System Z	true	1,000.00	1,278.81	1,001.18	1,279.99	20.00	64.66	20.00	20.00	J-308	3.46	J-220
J-208	Distribution System Z	true	1,000.00	1,442.51	1,003.55	1,446.05	20.00	30.84	20.00	20.00	J-210	-4.10	J-220
J-397	Distribution System Z	true	1,000.00	1,266.11	1,005.32	1,271.44	20.00	87.45	20.00	20.00	J-308	3.46	J-220
J-437	Distribution System Z	true	1,000.00	1,246.70	1,005.32	1,252.03	20.00	56.75	20.00	20.00	J-308	3.46	J-220
J-435	Distribution System Z	true	1,000.00	1,246.70	1,000.00	1,246.70	20.00	51.12	20.00	20.00	J-308	3.46	J-220
J-433	Distribution System Z	true	1,000.00	1,246.70	1,000.00	1,246.70	20.00	58.69	20.00	20.00	J-308	3.46	J-220
J-415	Distribution System Z	true	1,000.00	1,246.58	1,000.00	1,246.58	20.00	54.14	20.00	20.00	J-308	3.46	J-220
J-401	Distribution System Z	true	1,000.00	1,227.05	1,000.00	1,227.05	20.00	100.54	20.00	20.00	J-308	3.46	J-220
J-239	Distribution System Z	true	1,000.00	1,386.29	1,010.06	1,396.35	20.00	20.00	20.00	34.44	J-33	-4.09	J-220
J-60	Distribution System Z	true	1,000.00	1,253.78	1,000.00	1,253.78	20.00	28.27	20.00	20.00	J-33	3.46	J-220
J-443	Distribution System Z	true	1,000.00	1,203.13	1,005.32	1,208.45	20.00	54.20	20.00	20.00	J-308	3.46	J-220
J-444	Distribution System Z	true	1,000.00	1,203.13	1,000.00	1,203.13	20.00	49.37	20.00	20.00	J-308	3.46	J-220
J-445	Distribution System Z	true	1,000.00	1,191.65	1,000.00	1,191.65	20.00	53.27	20.00	20.00	J-308	3.46	J-220
J-442	Distribution System Z	true	1,000.00	1,191.65	1,000.00	1,191.65	20.00	54.00	20.00	20.00	J-308	3.46	J-220
J-389	Distribution System Z	true	1,000.00	1,189.70	1,000.00	1,189.70	20.00	112.57	20.00	20.00	J-308	3.46	J-220
J-509	Distribution System Z	true	1,000.00	1,179.20	1,000.00	1,179.20	20.00	82.95	20.00	20.00	J-308	3.46	J-220
J-387	Distribution System Z	true	1,000.00	1,162.35	1,000.00	1,162.35	20.00	112.83	20.00	20.00	J-308	3.46	J-220
J-57	Distribution System Z	true	1,000.00	1,206.79	1,005.32	1,212.11	20.00	23.93	20.00	20.00	J-33	3.46	J-220
J-224	Distribution System Z	true	1,000.00	1,314.33	1,003.55	1,317.88	20.00	20.00	20.00	34.44	J-33	-3.39	J-220
J-447	Distribution System Z	true	1,000.00	1,141.36	1,005.32	1,146.68	20.00	37.32	20.00	20.00	J-308	3.46	J-220
J-448	Distribution System Z	true	1,000.00	1,141.48	1,000.00	1,141.48	20.00	28.84	20.00	20.00	J-308	3.46	J-220
J-385	Distribution System Z	true	1,000.00	1,136.60	1,000.00	1,136.60	20.00	113.67	20.00	20.00	J-308	3.46	J-220
J-206	Distribution System Z	true	1,000.00	1,265.08	1,000.00	1,265.08	20.00	20.00	20.00	30.83	J-210	-2.49	J-220
J-209	Distribution System Z	true	1,000.00	1,258.61	1,005.32	1,263.93	20.00	39.51	20.00	20.00	J-210	-2.43	J-220
J-252	Distribution System Z	true	1,000.00	1,100.71	1,001.18	1,101.89	20.00	88.31	20.00	20.00	J-308	3.46	J-220

**Scenario: Buildout MDD 2057 + Fire Flow - Min Sys Press + Commercial Fire Areas**  
**Fire Flow Analysis**  
**Fire Flow Report**

Label	Zone	Satisfies Fire Flow Constraints?	Needed Fire Flow (gpm)	Available Fire Flow (gpm)	Total Flow Needed (gpm)	Total Flow Available (gpm)	Residual Pressure (psi)	Calculated Residual Pressure (psi)	Minimum Zone Pressure (psi)	Calculated Minimum Zone Pressure (psi)	Minimum Zone Junction	Calculated Minimum System Pressure (psi)	Minimum System Junction
J-55	Distribution System Z	true	1,000.00	1,120.85	1,003.55	1,124.40	20.00	22.62	20.00	20.00	J-33	3.46	J-220
J-450	Distribution System Z	true	1,000.00	1,078.61	1,001.18	1,079.80	20.00	45.43	20.00	20.00	J-308	3.46	J-220
J-451	Distribution System Z	true	1,000.00	1,078.61	1,000.00	1,078.61	20.00	43.04	20.00	20.00	J-308	3.46	J-220
J-449	Distribution System Z	true	1,000.00	1,073.00	1,002.37	1,075.36	20.00	37.23	20.00	20.00	J-308	3.46	J-220
J-381	Distribution System Z	true	1,000.00	1,069.21	1,005.32	1,074.54	20.00	100.70	20.00	20.00	J-308	3.46	J-220
J-458	Distribution System Z	true	1,000.00	1,065.55	1,001.18	1,066.73	20.00	38.06	20.00	20.00	J-308	3.46	J-220
J-459	Distribution System Z	true	1,000.00	1,065.55	1,000.00	1,065.55	20.00	35.94	20.00	20.00	J-308	3.46	J-220
J-54	Distribution System Z	true	1,000.00	1,082.76	1,000.00	1,082.76	20.00	22.19	20.00	20.00	J-33	3.46	J-220
J-453	Distribution System Z	true	1,000.00	1,073.00	1,000.00	1,073.00	20.00	21.28	20.00	20.00	J-308	3.46	J-220
J-41	Distribution System Z	true	1,000.00	1,073.00	1,000.00	1,073.00	20.00	64.74	20.00	20.00	J-308	3.46	J-220
J-460	Distribution System Z	true	1,000.00	1,073.00	1,000.00	1,073.00	20.00	23.55	20.00	20.00	J-308	3.46	J-220
J-379	Distribution System Z	true	1,000.00	1,031.98	1,002.37	1,034.35	20.00	121.54	20.00	20.00	J-308	3.46	J-220
J-49	Distribution System Z	true	1,000.00	1,058.11	1,001.18	1,059.29	20.00	21.75	20.00	20.00	J-33	3.46	J-220
J-256	Distribution System Z	true	1,000.00	1,022.34	1,000.00	1,022.34	20.00	146.03	20.00	20.00	J-308	3.46	J-220
J-347	Distribution System Z	true	1,000.00	1,015.75	1,003.55	1,019.30	20.00	35.46	20.00	20.00	J-308	3.46	J-220
J-462	Distribution System Z	true	1,000.00	1,073.00	1,000.00	1,073.00	20.00	60.35	20.00	20.00	J-308	3.46	J-220
J-463	Distribution System Z	true	1,000.00	1,073.00	1,000.00	1,073.00	20.00	59.68	20.00	20.00	J-308	3.46	J-220
J-262	Distribution System Z	true	1,000.00	1,012.70	1,003.55	1,016.24	20.00	137.72	20.00	20.00	J-308	3.46	J-220
J-259	Distribution System Z	true	1,000.00	1,012.70	1,001.18	1,013.88	20.00	126.12	20.00	20.00	J-308	3.46	J-220
J-258	Distribution System Z	true	1,000.00	1,012.70	1,000.00	1,012.70	20.00	154.89	20.00	20.00	J-308	3.46	J-220
J-45	Distribution System Z	true	1,000.00	1,036.13	1,001.18	1,037.32	20.00	21.75	20.00	20.00	J-33	3.46	J-220
J-464	Distribution System Z	true	1,000.00	1,059.08	1,007.69	1,066.77	20.00	59.07	20.00	20.00	J-498	3.46	J-220
J-465	Distribution System Z	true	1,000.00	1,059.08	1,000.00	1,059.08	20.00	58.37	20.00	20.00	J-498	3.46	J-220
J-264	Distribution System Z	false	1,000.00	990.48	1,001.18	991.66	20.00	164.05	20.00	20.00	J-308	3.46	J-220
J-40	Distribution System Z	true	1,000.00	1,017.82	1,000.00	1,017.82	20.00	28.25	20.00	20.00	J-33	3.46	J-220
J-343	Distribution System Z	false	1,000.00	973.14	1,000.00	973.14	20.00	136.67	20.00	20.00	J-308	3.46	J-220
J-346	Distribution System Z	false	1,000.00	971.80	1,000.00	971.80	20.00	34.07	20.00	20.00	J-308	3.46	J-220
J-455	Distribution System Z	false	1,000.00	971.80	1,000.00	971.80	20.00	45.29	20.00	20.00	J-308	3.46	J-220
J-342	Distribution System Z	false	1,000.00	971.80	1,000.00	971.80	20.00	54.21	20.00	20.00	J-308	3.46	J-220
J-345	Distribution System Z	false	1,000.00	971.80	1,000.00	971.80	20.00	43.63	20.00	20.00	J-308	3.46	J-220
J-457	Distribution System Z	false	1,000.00	971.80	1,000.00	971.80	20.00	55.22	20.00	20.00	J-308	3.46	J-220
J-469	Distribution System Z	true	1,000.00	1,024.72	1,010.06	1,034.77	20.00	59.05	20.00	20.00	J-498	3.46	J-220
J-266	Distribution System Z	false	1,000.00	962.89	1,006.51	969.40	20.00	164.71	20.00	20.00	J-308	3.46	J-220
J-470	Distribution System Z	true	1,000.00	1,024.72	1,000.00	1,024.72	20.00	58.52	20.00	20.00	J-496	3.46	J-220
J-210	Distribution System Z	true	1,000.00	1,085.78	1,000.00	1,085.78	20.00	20.00	20.00	34.44	J-33	-1.04	J-220
J-341	Distribution System Z	false	1,000.00	954.22	1,003.55	957.77	20.00	130.19	20.00	20.00	J-308	3.46	J-220
J-44	Distribution System Z	false	1,000.00	997.56	1,000.00	997.56	20.00	20.00	20.00	20.00	J-46	3.46	J-220
J-189	Distribution System Z	true	1,000.00	1,053.28	1,005.32	1,058.61	20.00	20.00	20.00	31.55	J-308	3.46	J-220
J-472	Distribution System Z	true	1,000.00	1,000.27	1,005.32	1,005.60	20.00	59.04	20.00	20.00	J-498	3.46	J-220
J-338	Distribution System Z	false	1,000.00	942.02	1,002.37	944.38	20.00	130.52	20.00	20.00	J-308	3.46	J-220
J-339	Distribution System Z	false	1,000.00	942.08	1,002.37	944.44	20.00	125.71	20.00	20.00	J-308	3.46	J-220
J-351	Distribution System Z	false	1,000.00	942.08	1,001.18	943.26	20.00	118.05	20.00	20.00	J-308	3.46	J-220
J-481	Distribution System Z	true	1,000.00	1,000.27	1,002.37	1,002.64	20.00	63.92	20.00	20.00	J-498	3.46	J-220
J-349	Distribution System Z	false	1,000.00	942.08	1,000.00	942.08	20.00	126.49	20.00	20.00	J-308	3.46	J-220
J-483	Distribution System Z	true	1,000.00	1,000.27	1,000.00	1,000.27	20.00	46.10	20.00	20.00	J-498	3.46	J-220
J-268	Distribution System Z	false	1,000.00	938.84	1,000.00	938.84	20.00	169.71	20.00	20.00	J-308	3.46	J-220
J-473	Distribution System Z	false	1,000.00	992.43	1,001.18	993.61	20.00	59.04	20.00	20.00	J-498	3.46	J-220
J-474	Distribution System Z	false	1,000.00	987.88	1,005.32	993.21	20.00	58.16	20.00	20.00	J-496	3.46	J-220
J-322	Distribution System Z	false	1,000.00	940.92	1,001.18	942.10	20.00	154.66	20.00	20.00	J-308	3.46	J-220
J-478	Distribution System Z	false	1,000.00	987.15	1,006.51	993.66	20.00	58.98	20.00	20.00	J-496	3.46	J-220
J-270	Distribution System Z	false	1,000.00	932.86	1,001.18	934.04	20.00	165.54	20.00	20.00	J-308	3.46	J-220
J-323	Distribution System Z	false	1,000.00	940.92	1,000.00	940.92	20.00	140.74	20.00	20.00	J-308	3.46	J-220



**Scenario: Buildout MDD 2057 + Fire Flow - Min Sys Press + Commercial Fire Areas**  
**Fire Flow Analysis**  
**Fire Flow Report**

Label	Zone	Satisfies Fire Flow Constraints?	Needed Fire Flow (gpm)	Available Fire Flow (gpm)	Total Flow Needed (gpm)	Total Flow Available (gpm)	Residual Pressure (psi)	Calculated Residual Pressure (psi)	Minimum Zone Pressure (psi)	Calculated Minimum Zone Pressure (psi)	Minimum Zone Junction	Calculated Minimum System Pressure (psi)	Minimum System Junction
J-479	Distribution System Z	false	1,000.00	987.15	1,000.00	987.15	20.00	58.69	20.00	20.00	J-496	3.46	J-220
J-476	Distribution System Z	false	1,000.00	983.18	1,000.00	983.18	20.00	59.03	20.00	20.00	J-498	3.46	J-220
J-325	Distribution System Z	false	1,000.00	920.90	1,000.00	920.90	20.00	165.84	20.00	20.00	J-308	3.46	J-220
J-9	Distribution System Z	false	1,000.00	941.89	1,000.00	941.89	20.00	20.44	20.00	20.00	J-33	3.46	J-220
J-485	Distribution System Z	false	1,000.00	963.99	1,001.18	965.17	20.00	54.70	20.00	20.00	J-496	3.46	J-220
J-50	Distribution System Z	false	1,000.00	959.47	1,001.18	960.66	20.00	20.00	20.00	20.00	J-58	3.46	J-220
J-486	Distribution System Z	false	1,000.00	949.25	1,001.18	950.43	20.00	59.03	20.00	20.00	J-496	3.46	J-220
J-487	Distribution System Z	false	1,000.00	949.25	1,000.00	949.25	20.00	54.18	20.00	20.00	J-498	3.46	J-220
J-505	Distribution System Z	false	1,000.00	936.13	1,002.37	938.49	20.00	60.99	20.00	20.00	J-498	3.46	J-220
J-488	Distribution System Z	false	1,000.00	936.13	1,002.37	938.49	20.00	59.03	20.00	20.00	J-498	3.46	J-220
J-502	Distribution System Z	false	1,000.00	936.13	1,001.18	937.31	20.00	45.54	20.00	20.00	J-498	3.46	J-220
J-506	Distribution System Z	false	1,000.00	936.13	1,001.18	937.31	20.00	33.99	20.00	20.00	J-498	3.46	J-220
J-507	Distribution System Z	false	1,000.00	936.13	1,000.00	936.13	20.00	33.66	20.00	20.00	J-498	3.46	J-220
J-503	Distribution System Z	false	1,000.00	936.13	1,000.00	936.13	20.00	40.62	20.00	20.00	J-498	3.46	J-220
J-489	Distribution System Z	false	1,000.00	929.60	1,005.32	934.92	20.00	50.35	20.00	20.00	J-498	3.46	J-220
J-25	Distribution System Z	false	1,000.00	885.50	1,008.87	894.37	20.00	50.45	20.00	20.00	J-33	3.46	J-220
J-12	Distribution System Z	false	1,000.00	885.50	1,008.87	894.37	20.00	57.58	20.00	20.00	J-33	3.46	J-220
J-22	Distribution System Z	false	1,000.00	885.50	1,005.32	890.82	20.00	54.54	20.00	20.00	J-33	3.46	J-220
J-10	Distribution System Z	false	1,000.00	885.50	1,005.32	890.82	20.00	57.07	20.00	20.00	J-33	3.46	J-220
J-29	Distribution System Z	false	1,000.00	885.50	1,003.55	889.05	20.00	44.52	20.00	20.00	J-33	3.46	J-220
J-27	Distribution System Z	false	1,000.00	885.50	1,002.37	887.86	20.00	34.27	20.00	20.00	J-33	3.46	J-220
J-20	Distribution System Z	false	1,000.00	885.50	1,000.00	885.50	20.00	59.48	20.00	20.00	J-33	3.46	J-220
J-21	Distribution System Z	false	1,000.00	885.50	1,000.00	885.50	20.00	59.31	20.00	20.00	J-33	3.46	J-220
J-33	Distribution System Z	false	1,000.00	885.50	1,000.00	885.50	20.00	20.00	20.00	21.83	J-9	3.46	J-220
J-11	Distribution System Z	false	1,000.00	885.50	1,000.00	885.50	20.00	56.92	20.00	20.00	J-33	3.46	J-220
J-14	Distribution System Z	false	1,000.00	885.50	1,000.00	885.50	20.00	57.69	20.00	20.00	J-33	3.46	J-220
J-3	Distribution System Z	false	1,000.00	885.50	1,000.00	885.50	20.00	38.34	20.00	20.00	J-33	3.46	J-220
J-26	Distribution System Z	false	1,000.00	885.50	1,000.00	885.50	20.00	47.51	20.00	20.00	J-33	3.46	J-220
J-17	Distribution System Z	false	1,000.00	885.50	1,000.00	885.50	20.00	50.67	20.00	20.00	J-33	3.46	J-220
J-13	Distribution System Z	false	1,000.00	885.50	1,000.00	885.50	20.00	46.64	20.00	20.00	J-33	3.46	J-220
J-15	Distribution System Z	false	1,000.00	885.50	1,000.00	885.50	20.00	59.73	20.00	20.00	J-33	3.46	J-220
J-6	Distribution System Z	false	1,000.00	885.50	1,005.32	890.82	20.00	25.09	20.00	20.00	J-33	3.46	J-220
J-490	Distribution System Z	false	1,000.00	903.38	1,001.18	904.56	20.00	50.35	20.00	20.00	J-498	3.46	J-220
J-491	Distribution System Z	false	1,000.00	903.38	1,000.00	903.38	20.00	49.90	20.00	20.00	J-498	3.46	J-220
J-492	Distribution System Z	false	1,000.00	895.02	1,003.55	898.57	20.00	41.68	20.00	20.00	J-498	3.46	J-220
J-326	Distribution System Z	false	1,000.00	844.36	1,000.00	844.36	20.00	138.65	20.00	20.00	J-308	3.46	J-220
J-58	Distribution System Z	false	1,000.00	884.16	1,001.18	885.34	20.00	20.00	20.00	22.67	J-53	3.46	J-220
J-493	Distribution System Z	false	1,000.00	871.09	1,005.32	876.42	20.00	28.67	20.00	20.00	J-498	3.46	J-220
J-494	Distribution System Z	false	1,000.00	871.09	1,000.00	871.09	20.00	28.31	20.00	20.00	J-496	3.46	J-220
J-495	Distribution System Z	false	1,000.00	866.15	1,002.37	868.52	20.00	28.67	20.00	20.00	J-498	3.46	J-220
J-499	Distribution System Z	false	1,000.00	855.56	1,000.00	855.56	20.00	20.00	20.00	24.92	J-498	3.46	J-220
J-496	Distribution System Z	false	1,000.00	848.05	1,006.51	854.56	20.00	20.00	20.00	20.00	J-498	3.46	J-220
J-498	Distribution System Z	false	1,000.00	846.01	1,000.00	846.01	20.00	20.00	20.00	20.27	J-496	3.46	J-220
J-328	Distribution System Z	false	1,000.00	797.00	1,001.18	798.18	20.00	137.99	20.00	20.00	J-308	3.46	J-220
J-272	Distribution System Z	false	1,000.00	774.54	1,002.37	776.90	20.00	126.74	20.00	20.00	J-308	3.46	J-220
J-274	Distribution System Z	false	1,000.00	774.54	1,000.00	774.54	20.00	81.25	20.00	20.00	J-308	3.46	J-220
J-31	Distribution System Z	false	1,000.00	829.41	1,000.00	829.41	20.00	20.00	20.00	21.47	J-33	3.46	J-220
J-36	Distribution System Z	false	1,000.00	771.24	1,000.00	771.24	20.00	20.01	20.00	20.00	J-38	3.46	J-220
J-280	Distribution System Z	false	1,000.00	731.75	1,000.00	731.75	20.00	98.54	20.00	20.00	J-308	3.46	J-220
J-279	Distribution System Z	false	1,000.00	731.75	1,000.00	731.75	20.00	91.28	20.00	20.00	J-308	3.46	J-220
J-330	Distribution System Z	false	1,000.00	731.57	1,001.18	732.75	20.00	132.95	20.00	20.00	J-308	3.46	J-220
J-282	Distribution System Z	false	1,000.00	722.17	1,002.37	724.53	20.00	40.84	20.00	20.00	J-308	3.46	J-220

# Scenario: Buildout MDD 2057 + Fire Flow - Min Sys Press + Commercial Fire Areas

## Fire Flow Analysis

### Fire Flow Report

Label	Zone	Satisfies Fire Flow Constraints?	Needed Fire Flow (gpm)	Available Fire Flow (gpm)	Total Flow Needed (gpm)	Total Flow Available (gpm)	Residual Pressure (psi)	Calculated Residual Pressure (psi)	Minimum Zone Pressure (psi)	Calculated Minimum Zone Pressure (psi)	Minimum Zone Junction	Calculated Minimum System Pressure (psi)	Minimum System Junction
J-275	Distribution System Z	false	1,000.00	722.17	1,000.00	722.17	20.00	91.15	20.00	20.00	J-308	3.46	J-220
J-283	Distribution System Z	false	1,000.00	722.17	1,000.00	722.17	20.00	43.72	20.00	20.00	J-308	3.46	J-220
J-46	Distribution System Z	false	1,000.00	755.98	1,000.00	755.98	20.00	20.00	20.00	25.75	J-33	3.46	J-220
J-53	Distribution System Z	false	1,000.00	758.30	1,000.00	758.30	20.00	20.00	20.00	25.99	J-33	3.46	J-220
J-52	Distribution System Z	false	1,000.00	748.54	1,003.55	752.08	20.00	20.00	20.00	25.08	J-58	3.46	J-220
J-47	Distribution System Z	false	1,000.00	743.04	1,000.00	743.04	20.00	20.00	20.00	20.47	J-46	3.46	J-220
J-332	Distribution System Z	false	1,000.00	686.89	1,003.55	690.44	20.00	136.99	20.00	20.00	J-308	3.46	J-220
J-335	Distribution System Z	false	1,000.00	663.94	1,002.37	666.31	20.00	136.94	20.00	20.00	J-308	3.46	J-220
J-48	Distribution System Z	false	1,000.00	677.61	1,003.55	681.16	20.00	20.00	20.00	27.13	J-33	3.46	J-220
J-37	Distribution System Z	false	1,000.00	667.85	1,005.32	673.17	20.00	20.00	20.00	20.00	J-38	3.46	J-220
J-277	Distribution System Z	false	1,000.00	637.02	1,001.18	638.21	20.00	21.48	20.00	20.00	J-308	3.46	J-220
J-285	Distribution System Z	false	1,000.00	637.02	1,000.00	637.02	20.00	44.69	20.00	20.00	J-308	3.46	J-220
J-354	Distribution System Z	false	1,000.00	623.78	1,001.18	624.96	20.00	145.72	20.00	20.00	J-308	3.46	J-220
J-286	Distribution System Z	false	1,000.00	608.83	1,001.18	610.01	20.00	56.53	20.00	20.00	J-308	3.46	J-220
J-287	Distribution System Z	false	1,000.00	608.83	1,000.00	608.83	20.00	55.49	20.00	20.00	J-308	3.46	J-220
J-359	Distribution System Z	false	1,000.00	595.15	1,002.37	597.52	20.00	118.47	20.00	20.00	J-308	3.46	J-220
J-358	Distribution System Z	false	1,000.00	595.15	1,001.18	596.34	20.00	132.74	20.00	20.00	J-308	3.46	J-220
J-361	Distribution System Z	false	1,000.00	595.09	1,000.00	595.09	20.00	119.87	20.00	20.00	J-308	3.46	J-220
J-355	Distribution System Z	false	1,000.00	595.15	1,000.00	595.15	20.00	115.64	20.00	20.00	J-308	3.46	J-220
J-288	Distribution System Z	false	1,000.00	589.60	1,001.18	590.78	20.00	65.64	20.00	20.00	J-308	3.46	J-220
J-289	Distribution System Z	false	1,000.00	589.60	1,001.18	590.78	20.00	65.18	20.00	20.00	J-308	3.46	J-220
J-290	Distribution System Z	false	1,000.00	589.60	1,000.00	589.60	20.00	46.85	20.00	20.00	J-308	3.46	J-220
J-291	Distribution System Z	false	1,000.00	589.60	1,000.00	589.60	20.00	72.91	20.00	20.00	J-308	3.46	J-220
J-364	Distribution System Z	false	1,000.00	586.43	1,002.37	588.79	20.00	94.56	20.00	20.00	J-308	3.46	J-220
J-366	Distribution System Z	false	1,000.00	586.43	1,002.37	588.79	20.00	72.16	20.00	20.00	J-308	3.46	J-220
J-374	Distribution System Z	false	1,000.00	586.49	1,002.37	588.85	20.00	62.79	20.00	20.00	J-308	3.46	J-220
J-372	Distribution System Z	false	1,000.00	586.43	1,001.18	587.61	20.00	60.77	20.00	20.00	J-308	3.46	J-220
J-370	Distribution System Z	false	1,000.00	586.43	1,000.00	586.43	20.00	68.71	20.00	20.00	J-308	3.46	J-220
J-373	Distribution System Z	false	1,000.00	586.43	1,000.00	586.43	20.00	51.31	20.00	20.00	J-308	3.46	J-220
J-377	Distribution System Z	false	1,000.00	586.43	1,000.00	586.43	20.00	69.62	20.00	20.00	J-308	3.46	J-220
J-356	Distribution System Z	false	1,000.00	586.43	1,000.00	586.43	20.00	111.44	20.00	20.00	J-308	3.46	J-220
J-365	Distribution System Z	false	1,000.00	586.43	1,000.00	586.43	20.00	100.79	20.00	20.00	J-308	3.46	J-220
J-375	Distribution System Z	false	1,000.00	586.43	1,000.00	586.43	20.00	69.53	20.00	20.00	J-308	3.46	J-220
J-367	Distribution System Z	false	1,000.00	586.49	1,000.00	586.49	20.00	60.22	20.00	20.00	J-308	3.46	J-220
J-327	Distribution System Z	false	1,000.00	586.43	1,000.00	586.43	20.00	51.69	20.00	20.00	J-308	3.46	J-220
J-39	Distribution System Z	false	1,000.00	603.88	1,003.55	607.43	20.00	20.00	20.00	22.40	J-38	3.46	J-220
J-23	Distribution System Z	false	1,000.00	614.69	1,000.00	614.69	20.00	20.00	20.00	24.79	J-46	3.46	J-220
J-292	Distribution System Z	false	1,000.00	573.61	1,001.18	574.79	20.00	57.47	20.00	20.00	J-308	3.46	J-220
J-293	Distribution System Z	false	1,000.00	573.61	1,000.00	573.61	20.00	56.71	20.00	20.00	J-308	3.46	J-220
J-317	Distribution System Z	false	1,000.00	552.00	1,001.18	553.18	20.00	38.53	20.00	20.00	J-308	3.46	J-220
J-296	Distribution System Z	false	1,000.00	550.02	1,000.00	550.02	20.00	75.02	20.00	20.00	J-308	3.46	J-220
J-295	Distribution System Z	false	1,000.00	549.99	1,000.00	549.99	20.00	75.80	20.00	20.00	J-308	3.46	J-220
J-38	Distribution System Z	false	1,000.00	554.08	1,002.37	556.44	20.00	20.00	20.00	24.13	J-37	3.46	J-220
J-297	Distribution System Z	false	1,000.00	531.74	1,002.37	534.10	20.00	59.44	20.00	20.00	J-308	3.46	J-220
J-298	Distribution System Z	false	1,000.00	531.74	1,000.00	531.74	20.00	41.19	20.00	20.00	J-308	3.46	J-220
J-300	Distribution System Z	false	1,000.00	528.75	1,000.00	528.75	20.00	50.95	20.00	20.00	J-308	3.46	J-220
J-301	Distribution System Z	false	1,000.00	512.08	1,000.00	512.08	20.00	34.73	20.00	20.00	J-308	3.46	J-220
J-315	Distribution System Z	false	1,000.00	509.77	1,002.37	512.13	20.00	44.44	20.00	20.00	J-308	3.46	J-220
J-316	Distribution System Z	false	1,000.00	509.77	1,000.00	509.77	20.00	82.79	20.00	20.00	J-308	3.46	J-220
J-313	Distribution System Z	false	1,000.00	503.23	1,000.00	503.23	20.00	36.08	20.00	20.00	J-308	3.46	J-220
J-302	Distribution System Z	false	1,000.00	499.73	1,002.37	502.09	20.00	35.67	20.00	20.00	J-308	3.46	J-220
J-303	Distribution System Z	false	1,000.00	499.76	1,000.00	499.76	20.00	35.19	20.00	20.00	J-308	3.46	J-220

**Scenario: Buildout MDD 2057 + Fire Flow - Min Sys Press + Commercial Fire Areas**  
**Fire Flow Analysis**  
**Fire Flow Report**

Label	Zone	Satisfies Fire Flow Constraints?	Needed Fire Flow (gpm)	Available Fire Flow (gpm)	Total Flow Needed (gpm)	Total Flow Available (gpm)	Residual Pressure (psi)	Calculated Residual Pressure (psi)	Minimum Zone Pressure (psi)	Calculated Minimum Zone Pressure (psi)	Minimum Zone Junction	Calculated Minimum System Pressure (psi)	Minimum System Junction
J-304	Distribution System Z	false	1,000.00	493.68	1,001.18	494.87	20.00	36.17	20.00	20.00	J-308	3.46	J-220
J-305	Distribution System Z	false	1,000.00	493.65	1,000.00	493.65	20.00	35.55	20.00	20.00	J-308	3.46	J-220
J-310	Distribution System Z	false	1,000.00	488.04	1,003.55	491.59	20.00	23.88	20.00	20.00	J-308	3.46	J-220
J-308	Distribution System Z	false	1,000.00	480.53	1,001.18	481.71	20.00	20.00	20.00	24.93	J-310	3.46	J-220
J-220	Bummerville Tanks (T	false	1,000.00	0.00	1,005.32	5.32	20.00	3.46	20.00	3.46	J-193	3.46	J-193
J-169	Treatment Plant (PMF	false	1,000.00	0.00	1,003.55	3.55	20.00	25.78	20.00	8.65	J-172	3.46	J-220
J-174	Treatment Plant (PMF	false	1,500.00	0.00	1,502.37	2.37	20.00	8.65	20.00	8.65	J-172	3.46	J-220
J-173	Treatment Plant (PMF	false	1,500.00	0.00	1,501.18	1.18	20.00	25.91	20.00	8.65	J-172	3.46	J-220
J-192	Bummerville Tanks (T	false	1,000.00	0.00	1,000.00	0.00	20.00	3.46	20.00	3.46	J-220	3.46	J-220
J-193	Bummerville Tanks (T	false	1,000.00	0.00	1,000.00	0.00	20.00	3.46	20.00	3.46	J-220	3.46	J-220
J-219	Bummerville Tanks (T	false	1,000.00	0.00	1,000.00	0.00	20.00	20.80	20.00	3.46	J-220	3.46	J-220
J-92	Bummerville Tanks (T	false	1,000.00	0.00	1,000.00	0.00	20.00	3.47	20.00	3.46	J-220	3.46	J-220
J-172	Treatment Plant (PMF	false	1,000.00	0.00	1,000.00	0.00	20.00	8.65	20.00	8.65	J-174	3.46	J-220
J-182	Bummerville Tanks (T	false	1,000.00	0.00	1,000.00	0.00	20.00	16.47	20.00	3.46	J-220	3.46	J-220
J-168	Treatment Plant (PMF	false	1,000.00	0.00	1,000.00	0.00	20.00	43.22	20.00	8.65	J-172	3.46	J-220

# Scenario: Existing MDD 2005 + Fire Flow - Min Sys Press + Commercial Fire Areas

## Fire Flow Analysis

### Fire Flow Report

Label	Zone	Satisfies Fire Flow Constraints?	Needed Fire Flow (gpm)	Available Fire Flow (gpm)	Total Flow Needed (gpm)	Total Flow Available (gpm)	Residual Pressure (psi)	Calculated Residual Pressure (psi)	Minimum Zone Pressure (psi)	Calculated Minimum Zone Pressure (psi)	Minimum Zone Junction	Calculated Minimum System Pressure (psi)	Minimum System Junction
J-43	Distribution System Z	true	1,000.00	1,500.00	1,000.00	1,500.00	20.00	30.21	20.00	29.28	J-33	-12.60	J-220
J-171	Distribution System Z	true	1,000.00	1,031.13	1,000.00	1,031.13	20.00	68.43	20.00	20.00	J-308	2.17	PMP-1
J-175	Distribution System Z	false	1,000.00	851.32	1,000.00	851.32	20.00	72.77	20.00	20.00	J-308	2.17	PMP-1
J-176	Distribution System Z	false	1,000.00	649.41	1,000.46	649.88	20.00	72.81	20.00	20.00	J-33	2.17	PMP-1
J-189	Distribution System Z	false	1,000.00	521.91	1,002.08	524.00	20.00	46.52	20.00	20.00	J-308	2.17	PMP-1
J-181	Distribution System Z	false	1,000.00	521.91	1,000.00	521.91	20.00	55.18	20.00	20.00	J-308	2.17	PMP-1
J-165	Distribution System Z	false	1,500.00	494.48	1,502.08	496.56	20.00	28.41	20.00	20.00	J-33	2.17	PMP-1
J-190	Distribution System Z	false	1,000.00	492.07	1,000.00	492.07	20.00	81.15	20.00	20.00	J-308	2.17	PMP-1
J-231	Distribution System Z	false	1,000.00	457.95	1,000.00	457.95	20.00	72.42	20.00	20.00	J-308	2.17	PMP-1
J-162	Distribution System Z	false	1,500.00	436.71	1,502.55	439.25	20.00	32.74	20.00	20.00	J-33	2.17	PMP-1
J-221	Distribution System Z	false	1,000.00	430.79	1,000.46	431.25	20.00	72.37	20.00	20.00	J-308	2.17	PMP-1
J-509	Distribution System Z	false	1,000.00	402.77	1,000.00	402.77	20.00	89.64	20.00	20.00	J-308	2.17	PMP-1
J-252	Distribution System Z	false	1,000.00	378.85	1,000.46	379.31	20.00	93.91	20.00	20.00	J-308	2.17	PMP-1
J-161	Distribution System Z	false	1,500.00	364.01	1,500.93	364.94	20.00	28.41	20.00	20.00	J-33	2.17	PMP-1
J-202	Distribution System Z	false	1,000.00	364.82	1,000.00	364.82	20.00	23.76	20.00	20.00	J-224	-8.40	J-220
J-217	Distribution System Z	false	1,000.00	363.72	1,000.00	363.72	20.00	25.51	20.00	20.00	J-224	-8.39	J-220
J-226	Distribution System Z	false	1,000.00	362.88	1,000.00	362.88	20.00	26.86	20.00	20.00	J-224	-8.38	J-220
J-223	Distribution System Z	false	1,000.00	361.33	1,001.39	362.72	20.00	29.26	20.00	20.00	J-224	-8.37	J-220
J-178	Distribution System Z	false	1,500.00	356.78	1,501.39	358.17	20.00	46.48	20.00	20.00	J-33	2.17	PMP-1
J-256	Distribution System Z	false	1,000.00	353.52	1,000.00	353.52	20.00	150.19	20.00	20.00	J-308	2.17	PMP-1
J-262	Distribution System Z	false	1,000.00	350.28	1,001.39	351.67	20.00	175.08	20.00	20.00	J-308	2.17	PMP-1
J-259	Distribution System Z	false	1,000.00	350.28	1,000.46	350.74	20.00	147.36	20.00	20.00	J-308	2.17	PMP-1
J-258	Distribution System Z	false	1,000.00	350.28	1,000.00	350.28	20.00	158.85	20.00	20.00	J-308	2.17	PMP-1
J-229	Distribution System Z	false	1,000.00	345.67	1,002.08	347.76	20.00	20.00	20.00	23.28	J-224	-7.47	J-220
J-264	Distribution System Z	false	1,000.00	342.83	1,000.46	343.30	20.00	167.49	20.00	20.00	J-308	2.17	PMP-1
J-266	Distribution System Z	false	1,000.00	333.50	1,002.55	336.04	20.00	167.46	20.00	20.00	J-308	2.17	PMP-1
J-469	Distribution System Z	false	1,000.00	323.24	1,003.94	327.18	20.00	84.47	20.00	20.00	J-308	2.17	PMP-1
J-407	Distribution System Z	false	1,000.00	323.30	1,003.01	326.31	20.00	50.68	20.00	20.00	J-308	2.17	PMP-1
J-464	Distribution System Z	false	1,000.00	323.30	1,003.01	326.31	20.00	84.91	20.00	20.00	J-308	2.17	PMP-1
J-478	Distribution System Z	false	1,000.00	323.24	1,002.55	325.79	20.00	83.88	20.00	20.00	J-308	2.17	PMP-1
J-496	Distribution System Z	false	1,000.00	323.24	1,002.55	325.79	20.00	42.25	20.00	20.00	J-308	2.17	PMP-1
J-443	Distribution System Z	false	1,000.00	323.30	1,002.08	325.39	20.00	65.67	20.00	20.00	J-308	2.17	PMP-1
J-397	Distribution System Z	false	1,000.00	323.30	1,002.08	325.39	20.00	91.52	20.00	20.00	J-308	2.17	PMP-1
J-381	Distribution System Z	false	1,000.00	323.30	1,002.08	325.39	20.00	106.33	20.00	20.00	J-308	2.17	PMP-1
J-447	Distribution System Z	false	1,000.00	323.30	1,002.08	325.39	20.00	48.78	20.00	20.00	J-308	2.17	PMP-1
J-472	Distribution System Z	false	1,000.00	323.28	1,002.08	325.36	20.00	84.13	20.00	20.00	J-308	2.17	PMP-1
J-437	Distribution System Z	false	1,000.00	323.27	1,002.08	325.36	20.00	65.49	20.00	20.00	J-308	2.17	PMP-1
J-489	Distribution System Z	false	1,000.00	323.24	1,002.08	325.33	20.00	74.21	20.00	20.00	J-308	2.17	PMP-1
J-474	Distribution System Z	false	1,000.00	323.24	1,002.08	325.33	20.00	44.13	20.00	20.00	J-308	2.17	PMP-1
J-268	Distribution System Z	false	1,000.00	325.32	1,000.00	325.32	20.00	171.76	20.00	20.00	J-308	2.17	PMP-1
J-493	Distribution System Z	false	1,000.00	323.21	1,002.08	325.30	20.00	51.43	20.00	20.00	J-308	2.17	PMP-1
J-332	Distribution System Z	false	1,000.00	323.30	1,001.39	324.69	20.00	130.55	20.00	20.00	J-308	2.17	PMP-1
J-341	Distribution System Z	false	1,000.00	323.30	1,001.39	324.69	20.00	126.14	20.00	20.00	J-308	2.17	PMP-1
J-347	Distribution System Z	false	1,000.00	323.27	1,001.39	324.66	20.00	37.78	20.00	20.00	J-308	2.17	PMP-1
J-425	Distribution System Z	false	1,000.00	323.24	1,001.39	324.63	20.00	42.79	20.00	20.00	J-308	2.17	PMP-1
J-492	Distribution System Z	false	1,000.00	323.24	1,001.39	324.63	20.00	64.91	20.00	20.00	J-308	2.17	PMP-1
J-449	Distribution System Z	false	1,000.00	323.30	1,000.93	324.23	20.00	45.26	20.00	20.00	J-308	2.17	PMP-1
J-335	Distribution System Z	false	1,000.00	323.30	1,000.93	324.23	20.00	129.62	20.00	20.00	J-308	2.17	PMP-1
J-379	Distribution System Z	false	1,000.00	323.30	1,000.93	324.23	20.00	124.30	20.00	20.00	J-308	2.17	PMP-1
J-338	Distribution System Z	false	1,000.00	323.30	1,000.93	324.23	20.00	126.43	20.00	20.00	J-308	2.17	PMP-1
J-419	Distribution System Z	false	1,000.00	323.30	1,000.93	324.23	20.00	86.71	20.00	20.00	J-308	2.17	PMP-1
J-364	Distribution System Z	false	1,000.00	323.30	1,000.93	324.23	20.00	85.05	20.00	20.00	J-308	2.17	PMP-1

**Scenario: Existing MDD 2005 + Fire Flow - Min Sys Press + Commercial Fire Areas**  
**Fire Flow Analysis**  
**Fire Flow Report**

Label	Zone	Satisfies Fire Flow Constraints?	Needed Fire Flow (gpm)	Available Fire Flow (gpm)	Total Flow Needed (gpm)	Total Flow Available (gpm)	Residual Pressure (psi)	Calculated Residual Pressure (psi)	Minimum Zone Pressure (psi)	Calculated Minimum Zone Pressure (psi)	Minimum Zone Junction	Calculated Minimum System Pressure (psi)	Minimum System Junction
J-374	Distribution System Z	false	1,000.00	323.30	1,000.93	324.23	20.00	71.65	20.00	20.00	J-308	2.17	PMP-1
J-366	Distribution System Z	false	1,000.00	323.30	1,000.93	324.23	20.00	68.95	20.00	20.00	J-308	2.17	PMP-1
J-359	Distribution System Z	false	1,000.00	323.30	1,000.93	324.23	20.00	85.83	20.00	20.00	J-308	2.17	PMP-1
J-405	Distribution System Z	false	1,000.00	323.27	1,000.93	324.20	20.00	76.86	20.00	20.00	J-308	2.17	PMP-1
J-339	Distribution System Z	false	1,000.00	323.27	1,000.93	324.20	20.00	144.45	20.00	20.00	J-308	2.17	PMP-1
J-423	Distribution System Z	false	1,000.00	323.24	1,000.93	324.17	20.00	64.83	20.00	20.00	J-308	2.17	PMP-1
J-505	Distribution System Z	false	1,000.00	323.24	1,000.93	324.17	20.00	87.00	20.00	20.00	J-308	2.17	PMP-1
J-481	Distribution System Z	false	1,000.00	323.24	1,000.93	324.17	20.00	92.33	20.00	20.00	J-308	2.17	PMP-1
J-495	Distribution System Z	false	1,000.00	323.24	1,000.93	324.17	20.00	51.32	20.00	20.00	J-308	2.17	PMP-1
J-488	Distribution System Z	false	1,000.00	323.24	1,000.93	324.17	20.00	82.99	20.00	20.00	J-308	2.17	PMP-1
J-330	Distribution System Z	false	1,000.00	323.30	1,000.46	323.77	20.00	127.73	20.00	20.00	J-308	2.17	PMP-1
J-322	Distribution System Z	false	1,000.00	323.30	1,000.46	323.77	20.00	156.02	20.00	20.00	J-308	2.17	PMP-1
J-402	Distribution System Z	false	1,000.00	323.30	1,000.46	323.77	20.00	69.73	20.00	20.00	J-308	2.17	PMP-1
J-358	Distribution System Z	false	1,000.00	323.30	1,000.46	323.77	20.00	111.80	20.00	20.00	J-308	2.17	PMP-1
J-270	Distribution System Z	false	1,000.00	323.30	1,000.46	323.77	20.00	167.42	20.00	20.00	J-308	2.17	PMP-1
J-450	Distribution System Z	false	1,000.00	323.30	1,000.46	323.77	20.00	53.85	20.00	20.00	J-308	2.17	PMP-1
J-328	Distribution System Z	false	1,000.00	323.30	1,000.46	323.77	20.00	133.71	20.00	20.00	J-308	2.17	PMP-1
J-416	Distribution System Z	false	1,000.00	323.30	1,000.46	323.77	20.00	88.18	20.00	20.00	J-308	2.17	PMP-1
J-372	Distribution System Z	false	1,000.00	323.27	1,000.46	323.74	20.00	65.19	20.00	20.00	J-308	2.17	PMP-1
J-351	Distribution System Z	false	1,000.00	323.27	1,000.46	323.74	20.00	132.18	20.00	20.00	J-308	2.17	PMP-1
J-354	Distribution System Z	false	1,000.00	323.27	1,000.46	323.74	20.00	136.32	20.00	20.00	J-308	2.17	PMP-1
J-427	Distribution System Z	false	1,500.00	323.27	1,500.46	323.74	20.00	77.42	20.00	20.00	J-308	2.17	PMP-1
J-485	Distribution System Z	false	1,000.00	323.24	1,000.46	323.71	20.00	79.11	20.00	20.00	J-308	2.17	PMP-1
J-490	Distribution System Z	false	1,000.00	323.24	1,000.46	323.71	20.00	73.74	20.00	20.00	J-308	2.17	PMP-1
J-458	Distribution System Z	false	1,000.00	323.24	1,000.46	323.71	20.00	45.40	20.00	20.00	J-308	2.17	PMP-1
J-502	Distribution System Z	false	1,000.00	323.24	1,000.46	323.71	20.00	73.65	20.00	20.00	J-308	2.17	PMP-1
J-486	Distribution System Z	false	1,000.00	323.24	1,000.46	323.71	20.00	83.21	20.00	20.00	J-308	2.17	PMP-1
J-473	Distribution System Z	false	1,000.00	323.24	1,000.46	323.71	20.00	84.02	20.00	20.00	J-308	2.17	PMP-1
J-506	Distribution System Z	false	1,000.00	323.21	1,000.46	323.67	20.00	64.58	20.00	20.00	J-308	2.17	PMP-1
J-385	Distribution System Z	false	1,000.00	323.30	1,000.00	323.30	20.00	122.81	20.00	20.00	J-308	2.17	PMP-1
J-415	Distribution System Z	false	1,000.00	323.30	1,000.00	323.30	20.00	66.19	20.00	20.00	J-308	2.17	PMP-1
J-455	Distribution System Z	false	1,000.00	323.30	1,000.00	323.30	20.00	41.84	20.00	20.00	J-308	2.17	PMP-1
J-442	Distribution System Z	false	1,000.00	323.30	1,000.00	323.30	20.00	65.74	20.00	20.00	J-308	2.17	PMP-1
J-387	Distribution System Z	false	1,000.00	323.30	1,000.00	323.30	20.00	122.56	20.00	20.00	J-308	2.17	PMP-1
J-377	Distribution System Z	false	1,000.00	323.30	1,000.00	323.30	20.00	79.71	20.00	20.00	J-308	2.17	PMP-1
J-346	Distribution System Z	false	1,000.00	323.30	1,000.00	323.30	20.00	53.04	20.00	20.00	J-308	2.17	PMP-1
J-375	Distribution System Z	false	1,000.00	323.30	1,000.00	323.30	20.00	79.68	20.00	20.00	J-308	2.17	PMP-1
J-326	Distribution System Z	false	1,000.00	323.30	1,000.00	323.30	20.00	134.59	20.00	20.00	J-308	2.17	PMP-1
J-433	Distribution System Z	false	1,000.00	323.30	1,000.00	323.30	20.00	71.62	20.00	20.00	J-308	2.17	PMP-1
J-345	Distribution System Z	false	1,000.00	323.30	1,000.00	323.30	20.00	54.29	20.00	20.00	J-308	2.17	PMP-1
J-444	Distribution System Z	false	1,000.00	323.30	1,000.00	323.30	20.00	65.25	20.00	20.00	J-308	2.17	PMP-1
J-365	Distribution System Z	false	1,000.00	323.30	1,000.00	323.30	20.00	92.91	20.00	20.00	J-308	2.17	PMP-1
J-401	Distribution System Z	false	1,000.00	323.30	1,000.00	323.30	20.00	109.08	20.00	20.00	J-308	2.17	PMP-1
J-404	Distribution System Z	false	1,000.00	323.30	1,000.00	323.30	20.00	69.30	20.00	20.00	J-308	2.17	PMP-1
J-453	Distribution System Z	false	1,000.00	323.30	1,000.00	323.30	20.00	31.92	20.00	20.00	J-308	2.17	PMP-1
J-445	Distribution System Z	false	1,000.00	323.30	1,000.00	323.30	20.00	69.62	20.00	20.00	J-308	2.17	PMP-1
J-462	Distribution System Z	false	1,000.00	323.30	1,000.00	323.30	20.00	85.22	20.00	20.00	J-308	2.17	PMP-1
J-370	Distribution System Z	false	1,000.00	323.30	1,000.00	323.30	20.00	73.61	20.00	20.00	J-308	2.17	PMP-1
J-361	Distribution System Z	false	1,000.00	323.30	1,000.00	323.30	20.00	90.14	20.00	20.00	J-308	2.17	PMP-1
J-325	Distribution System Z	false	1,000.00	323.30	1,000.00	323.30	20.00	161.64	20.00	20.00	J-308	2.17	PMP-1
J-41	Distribution System Z	false	1,000.00	323.30	1,000.00	323.30	20.00	85.72	20.00	20.00	J-308	2.17	PMP-1
J-448	Distribution System Z	false	1,000.00	323.30	1,000.00	323.30	20.00	44.05	20.00	20.00	J-308	2.17	PMP-1

**Scenario: Existing MDD 2005 + Fire Flow - Min Sys Press + Commercial Fire Areas**  
**Fire Flow Analysis**  
**Fire Flow Report**

Label	Zone	Satisfies Fire Flow Constraints?	Needed Fire Flow (gpm)	Available Fire Flow (gpm)	Total Flow Needed (gpm)	Total Flow Available (gpm)	Residual Pressure (psi)	Calculated Residual Pressure (psi)	Minimum Zone Pressure (psi)	Calculated Minimum Zone Pressure (psi)	Minimum Zone Junction	Calculated Minimum System Pressure (psi)	Minimum System Junction
J-403	Distribution System Z	false	1,000.00	323.30	1,000.00	323.30	20.00	69.73	20.00	20.00	J-308	2.17	PMP-1
J-451	Distribution System Z	false	1,000.00	323.30	1,000.00	323.30	20.00	53.59	20.00	20.00	J-308	2.17	PMP-1
J-435	Distribution System Z	false	1,000.00	323.30	1,000.00	323.30	20.00	65.03	20.00	20.00	J-308	2.17	PMP-1
J-323	Distribution System Z	false	1,000.00	323.30	1,000.00	323.30	20.00	146.62	20.00	20.00	J-308	2.17	PMP-1
J-418	Distribution System Z	false	1,000.00	323.30	1,000.00	323.30	20.00	87.35	20.00	20.00	J-308	2.17	PMP-1
J-463	Distribution System Z	false	1,000.00	323.30	1,000.00	323.30	20.00	85.15	20.00	20.00	J-308	2.17	PMP-1
J-343	Distribution System Z	false	1,000.00	323.30	1,000.00	323.30	20.00	134.26	20.00	20.00	J-308	2.17	PMP-1
J-373	Distribution System Z	false	1,000.00	323.30	1,000.00	323.30	20.00	56.25	20.00	20.00	J-308	2.17	PMP-1
J-457	Distribution System Z	false	1,000.00	323.29	1,000.00	323.29	20.00	47.76	20.00	20.00	J-308	2.17	PMP-1
J-459	Distribution System Z	false	1,000.00	323.27	1,000.00	323.27	20.00	45.17	20.00	20.00	J-308	2.17	PMP-1
J-327	Distribution System Z	false	1,000.00	323.27	1,000.00	323.27	20.00	62.18	20.00	20.00	J-308	2.17	PMP-1
J-389	Distribution System Z	false	1,000.00	323.27	1,000.00	323.27	20.00	122.33	20.00	20.00	J-308	2.17	PMP-1
J-367	Distribution System Z	false	1,000.00	323.27	1,000.00	323.27	20.00	59.20	20.00	20.00	J-308	2.17	PMP-1
J-356	Distribution System Z	false	1,000.00	323.27	1,000.00	323.27	20.00	99.34	20.00	20.00	J-308	2.17	PMP-1
J-349	Distribution System Z	false	1,000.00	323.27	1,000.00	323.27	20.00	125.87	20.00	20.00	J-308	2.17	PMP-1
J-355	Distribution System Z	false	1,000.00	323.27	1,000.00	323.27	20.00	104.26	20.00	20.00	J-308	2.17	PMP-1
J-342	Distribution System Z	false	1,000.00	323.27	1,000.00	323.27	20.00	51.90	20.00	20.00	J-308	2.17	PMP-1
J-487	Distribution System Z	false	1,000.00	323.24	1,000.00	323.24	20.00	78.81	20.00	20.00	J-308	2.17	PMP-1
J-426	Distribution System Z	false	1,000.00	323.24	1,000.00	323.24	20.00	43.77	20.00	20.00	J-308	2.17	PMP-1
J-424	Distribution System Z	false	1,000.00	323.24	1,000.00	323.24	20.00	60.14	20.00	20.00	J-308	2.17	PMP-1
J-470	Distribution System Z	false	1,000.00	323.24	1,000.00	323.24	20.00	84.41	20.00	20.00	J-308	2.17	PMP-1
J-498	Distribution System Z	false	1,000.00	323.24	1,000.00	323.24	20.00	42.21	20.00	20.00	J-308	2.17	PMP-1
J-476	Distribution System Z	false	1,000.00	323.24	1,000.00	323.24	20.00	83.75	20.00	20.00	J-308	2.17	PMP-1
J-465	Distribution System Z	false	1,000.00	323.24	1,000.00	323.24	20.00	84.84	20.00	20.00	J-308	2.17	PMP-1
J-499	Distribution System Z	false	1,000.00	323.24	1,000.00	323.24	20.00	46.04	20.00	20.00	J-308	2.17	PMP-1
J-491	Distribution System Z	false	1,000.00	323.24	1,000.00	323.24	20.00	73.67	20.00	20.00	J-308	2.17	PMP-1
J-479	Distribution System Z	false	1,000.00	323.24	1,000.00	323.24	20.00	83.84	20.00	20.00	J-308	2.17	PMP-1
J-494	Distribution System Z	false	1,000.00	323.24	1,000.00	323.24	20.00	51.36	20.00	20.00	J-308	2.17	PMP-1
J-507	Distribution System Z	false	1,000.00	323.24	1,000.00	323.24	20.00	64.53	20.00	20.00	J-308	2.17	PMP-1
J-460	Distribution System Z	false	1,000.00	323.24	1,000.00	323.24	20.00	36.03	20.00	20.00	J-308	2.17	PMP-1
J-503	Distribution System Z	false	1,000.00	323.21	1,000.00	323.21	20.00	69.24	20.00	20.00	J-308	2.17	PMP-1
J-483	Distribution System Z	false	1,000.00	323.21	1,000.00	323.21	20.00	74.94	20.00	20.00	J-308	2.17	PMP-1
J-87	Distribution System Z	false	1,500.00	313.66	1,503.01	316.67	20.00	35.29	20.00	20.00	J-33	2.17	PMP-1
J-228	Distribution System Z	false	1,000.00	313.03	1,002.55	315.58	20.00	20.22	20.00	20.00	J-239	-5.70	J-220
J-159	Distribution System Z	false	1,500.00	310.00	1,500.46	310.46	20.00	45.75	20.00	20.00	J-33	2.17	PMP-1
J-272	Distribution System Z	false	1,000.00	288.70	1,000.93	289.62	20.00	132.73	20.00	20.00	J-308	2.17	PMP-1
J-274	Distribution System Z	false	1,000.00	288.67	1,000.00	288.67	20.00	89.04	20.00	20.00	J-308	2.17	PMP-1
J-132	Distribution System Z	false	1,500.00	280.52	1,502.08	282.60	20.00	37.33	20.00	20.00	J-33	2.17	PMP-1
J-279	Distribution System Z	false	1,000.00	276.00	1,000.00	276.00	20.00	98.05	20.00	20.00	J-308	2.17	PMP-1
J-280	Distribution System Z	false	1,000.00	275.99	1,000.00	275.99	20.00	106.49	20.00	20.00	J-308	2.17	PMP-1
J-140	Distribution System Z	false	1,500.00	273.19	1,500.93	274.12	20.00	45.76	20.00	20.00	J-33	2.17	PMP-1
J-282	Distribution System Z	false	1,000.00	272.95	1,000.93	273.88	20.00	41.17	20.00	20.00	J-308	2.17	PMP-1
J-275	Distribution System Z	false	1,000.00	272.95	1,000.00	272.95	20.00	98.05	20.00	20.00	J-308	2.17	PMP-1
J-283	Distribution System Z	false	1,000.00	272.95	1,000.00	272.95	20.00	43.21	20.00	20.00	J-308	2.17	PMP-1
J-139	Distribution System Z	false	1,500.00	264.22	1,503.47	267.69	20.00	45.76	20.00	20.00	J-33	2.17	PMP-1
J-81	Distribution System Z	false	1,500.00	251.86	1,501.39	253.25	20.00	39.64	20.00	20.00	J-33	2.17	PMP-1
J-98	Distribution System Z	false	1,500.00	253.23	1,500.00	253.23	20.00	48.26	20.00	20.00	J-33	2.17	PMP-1
J-83	Distribution System Z	false	1,500.00	249.98	1,502.55	252.53	20.00	37.72	20.00	20.00	J-33	2.17	PMP-1
J-95	Distribution System Z	false	1,500.00	249.07	1,502.08	251.15	20.00	40.58	20.00	20.00	J-33	2.17	PMP-1
J-138	Distribution System Z	false	1,500.00	250.95	1,500.00	250.95	20.00	42.73	20.00	20.00	J-33	2.17	PMP-1
J-84	Distribution System Z	false	1,500.00	250.21	1,500.46	250.68	20.00	37.52	20.00	20.00	J-33	2.17	PMP-1
J-137	Distribution System Z	false	1,500.00	249.39	1,500.93	250.32	20.00	25.08	20.00	20.00	J-33	2.17	PMP-1

# Scenario: Existing MDD 2005 + Fire Flow - Min Sys Press + Commercial Fire Areas

## Fire Flow Analysis

### Fire Flow Report

Label	Zone	Satisfies Fire Flow Constraints?	Needed Fire Flow (gpm)	Available Fire Flow (gpm)	Total Flow Needed (gpm)	Total Flow Available (gpm)	Residual Pressure (psi)	Calculated Residual Pressure (psi)	Minimum Zone Pressure (psi)	Calculated Minimum Zone Pressure (psi)	Minimum Zone Junction	Calculated Minimum System Pressure (psi)	Minimum System Junction
J-51	Distribution System Z	false	1,500.00	250.21	1,500.00	250.21	20.00	37.58	20.00	20.00	J-33	2.17	PMP-1
J-94	Distribution System Z	false	1,500.00	246.92	1,503.01	249.93	20.00	52.72	20.00	20.00	J-33	2.17	PMP-1
J-135	Distribution System Z	false	1,500.00	249.21	1,500.00	249.21	20.00	41.70	20.00	20.00	J-33	2.17	PMP-1
J-79	Distribution System Z	false	1,500.00	240.51	1,507.41	247.92	20.00	49.35	20.00	20.00	J-33	2.17	PMP-1
J-82	Distribution System Z	false	1,500.00	247.83	1,500.00	247.83	20.00	42.73	20.00	20.00	J-33	2.17	PMP-1
J-130	Distribution System Z	false	1,500.00	247.74	1,500.00	247.74	20.00	48.52	20.00	20.00	J-33	2.17	PMP-1
J-18	Distribution System Z	false	1,500.00	245.54	1,502.08	247.63	20.00	52.92	20.00	20.00	J-33	2.17	PMP-1
J-89	Distribution System Z	false	1,500.00	242.20	1,503.47	245.68	20.00	41.10	20.00	20.00	J-33	2.17	PMP-1
J-127	Distribution System Z	false	1,500.00	242.34	1,502.08	244.42	20.00	49.57	20.00	20.00	J-33	2.17	PMP-1
J-80	Distribution System Z	false	1,500.00	242.25	1,502.08	244.33	20.00	52.22	20.00	20.00	J-33	2.17	PMP-1
J-277	Distribution System Z	false	1,000.00	243.41	1,000.46	243.87	20.00	28.68	20.00	20.00	J-308	2.17	PMP-1
J-91	Distribution System Z	false	1,500.00	241.15	1,502.55	243.70	20.00	57.80	20.00	20.00	J-33	2.17	PMP-1
J-90	Distribution System Z	false	1,500.00	242.61	1,500.93	243.54	20.00	54.44	20.00	20.00	J-33	2.17	PMP-1
J-285	Distribution System Z	false	1,000.00	243.41	1,000.00	243.41	20.00	54.22	20.00	20.00	J-308	2.17	PMP-1
J-125	Distribution System Z	false	1,500.00	239.32	1,503.01	242.33	20.00	95.39	20.00	20.00	J-33	2.17	PMP-1
J-75	Distribution System Z	false	1,500.00	236.71	1,505.33	242.04	20.00	76.50	20.00	20.00	J-33	2.17	PMP-1
J-78	Distribution System Z	false	1,500.00	240.51	1,501.39	241.90	20.00	66.07	20.00	20.00	J-33	2.17	PMP-1
J-123	Distribution System Z	false	1,500.00	238.95	1,500.46	239.42	20.00	66.25	20.00	20.00	J-33	2.17	PMP-1
J-70	Distribution System Z	false	1,500.00	233.09	1,503.94	237.03	20.00	53.07	20.00	20.00	J-33	2.17	PMP-1
J-69	Distribution System Z	false	1,500.00	233.05	1,503.01	236.06	20.00	54.83	20.00	20.00	J-33	2.17	PMP-1
J-116	Distribution System Z	false	1,500.00	229.16	1,506.48	235.64	20.00	53.85	20.00	20.00	J-33	2.17	PMP-1
J-118	Distribution System Z	false	1,500.00	231.72	1,503.47	235.19	20.00	70.78	20.00	20.00	J-33	2.17	PMP-1
J-67	Distribution System Z	false	1,500.00	233.05	1,501.39	234.44	20.00	70.59	20.00	20.00	J-33	2.17	PMP-1
J-286	Distribution System Z	false	1,000.00	232.76	1,000.46	233.22	20.00	63.36	20.00	20.00	J-308	2.17	PMP-1
J-68	Distribution System Z	false	1,500.00	233.09	1,500.00	233.09	20.00	61.28	20.00	20.00	J-33	2.17	PMP-1
J-287	Distribution System Z	false	1,000.00	232.79	1,000.00	232.79	20.00	63.18	20.00	20.00	J-308	2.17	PMP-1
J-63	Distribution System Z	false	1,500.00	227.23	1,503.01	230.24	20.00	37.08	20.00	20.00	J-33	2.17	PMP-1
J-100	Distribution System Z	false	1,000.00	227.23	1,002.55	229.78	20.00	29.93	20.00	20.00	J-33	2.17	PMP-1
J-114	Distribution System Z	false	1,500.00	226.32	1,500.93	227.24	20.00	37.01	20.00	20.00	J-33	2.17	PMP-1
J-113	Distribution System Z	false	1,000.00	227.23	1,000.00	227.23	20.00	30.35	20.00	20.00	J-33	2.17	PMP-1
J-64	Distribution System Z	false	1,500.00	225.91	1,500.00	225.91	20.00	37.08	20.00	20.00	J-33	2.17	PMP-1
J-288	Distribution System Z	false	1,000.00	225.40	1,000.46	225.87	20.00	72.03	20.00	20.00	J-308	2.17	PMP-1
J-289	Distribution System Z	false	1,000.00	225.40	1,000.46	225.87	20.00	79.16	20.00	20.00	J-308	2.17	PMP-1
J-290	Distribution System Z	false	1,000.00	225.40	1,000.00	225.40	20.00	61.65	20.00	20.00	J-308	2.17	PMP-1
J-291	Distribution System Z	false	1,000.00	225.40	1,000.00	225.40	20.00	87.68	20.00	20.00	J-308	2.17	PMP-1
J-292	Distribution System Z	false	1,000.00	219.24	1,000.46	219.70	20.00	63.36	20.00	20.00	J-308	2.17	PMP-1
J-293	Distribution System Z	false	1,000.00	219.24	1,000.00	219.24	20.00	63.23	20.00	20.00	J-308	2.17	PMP-1
J-218	Distribution System Z	false	1,000.00	214.20	1,000.00	214.20	20.00	20.00	20.00	29.28	J-33	-1.19	J-220
J-62	Distribution System Z	false	1,000.00	213.99	1,000.00	213.99	20.00	34.90	20.00	20.00	J-33	2.17	PMP-1
J-295	Distribution System Z	false	1,000.00	210.14	1,000.00	210.14	20.00	80.70	20.00	20.00	J-308	2.17	PMP-1
J-296	Distribution System Z	false	1,000.00	210.14	1,000.00	210.14	20.00	80.57	20.00	20.00	J-308	2.17	PMP-1
J-297	Distribution System Z	false	1,000.00	203.19	1,000.93	204.11	20.00	63.36	20.00	20.00	J-308	2.17	PMP-1
J-298	Distribution System Z	false	1,000.00	203.19	1,000.00	203.19	20.00	45.86	20.00	20.00	J-308	2.17	PMP-1
J-300	Distribution System Z	false	1,000.00	202.06	1,000.00	202.06	20.00	54.68	20.00	20.00	J-308	2.17	PMP-1
J-301	Distribution System Z	false	1,000.00	195.86	1,000.00	195.86	20.00	37.35	20.00	20.00	J-308	2.17	PMP-1
J-302	Distribution System Z	false	1,000.00	191.41	1,000.93	192.33	20.00	37.34	20.00	20.00	J-308	2.17	PMP-1
J-303	Distribution System Z	false	1,000.00	191.41	1,000.00	191.41	20.00	37.26	20.00	20.00	J-308	2.17	PMP-1
J-304	Distribution System Z	false	1,000.00	189.27	1,000.46	189.73	20.00	37.34	20.00	20.00	J-308	2.17	PMP-1
J-305	Distribution System Z	false	1,000.00	189.27	1,000.00	189.27	20.00	37.24	20.00	20.00	J-308	2.17	PMP-1
J-310	Distribution System Z	false	1,000.00	184.75	1,001.39	186.14	20.00	24.01	20.00	20.00	J-308	2.17	PMP-1
J-315	Distribution System Z	false	1,000.00	184.75	1,000.93	185.68	20.00	44.81	20.00	20.00	J-308	2.17	PMP-1
J-317	Distribution System Z	false	1,000.00	184.75	1,000.46	185.22	20.00	39.05	20.00	20.00	J-308	2.17	PMP-1

# Scenario: Existing MDD 2005 + Fire Flow - Min Sys Press + Commercial Fire Areas

## Fire Flow Analysis

### Fire Flow Report

Label	Zone	Satisfies Fire Flow Constraints?	Needed Fire Flow (gpm)	Available Fire Flow (gpm)	Total Flow Needed (gpm)	Total Flow Available (gpm)	Residual Pressure (psi)	Calculated Residual Pressure (psi)	Minimum Zone Pressure (psi)	Calculated Minimum Zone Pressure (psi)	Minimum Zone Junction	Calculated Minimum System Pressure (psi)	Minimum System Junction
J-308	Distribution System Z	false	1,000.00	184.75	1,000.46	185.22	20.00	20.00	20.00	24.34	J-310	2.17	PMP-1
J-61	Distribution System Z	false	1,000.00	184.75	1,000.46	185.22	20.00	32.69	20.00	20.00	J-33	2.17	PMP-1
J-316	Distribution System Z	false	1,000.00	184.75	1,000.00	184.75	20.00	83.72	20.00	20.00	J-308	2.17	PMP-1
J-313	Distribution System Z	false	1,000.00	184.75	1,000.00	184.75	20.00	36.39	20.00	20.00	J-308	2.17	PMP-1
J-60	Distribution System Z	false	1,000.00	171.45	1,000.00	171.45	20.00	28.33	20.00	20.00	J-33	2.17	PMP-1
J-57	Distribution System Z	false	1,000.00	166.20	1,002.08	168.28	20.00	23.98	20.00	20.00	J-33	2.17	PMP-1
J-55	Distribution System Z	false	1,000.00	156.31	1,001.39	157.70	20.00	22.66	20.00	20.00	J-33	2.17	PMP-1
J-54	Distribution System Z	false	1,000.00	151.79	1,000.00	151.79	20.00	22.22	20.00	20.00	J-33	2.17	PMP-1
J-52	Distribution System Z	false	1,000.00	148.86	1,001.39	150.25	20.00	29.60	20.00	20.00	J-33	2.17	PMP-1
J-49	Distribution System Z	false	1,000.00	148.86	1,000.46	149.33	20.00	21.78	20.00	20.00	J-33	2.17	PMP-1
J-58	Distribution System Z	false	1,000.00	148.86	1,000.46	149.33	20.00	25.75	20.00	20.00	J-33	2.17	PMP-1
J-50	Distribution System Z	false	1,000.00	148.83	1,000.46	149.30	20.00	25.85	20.00	20.00	J-33	2.17	PMP-1
J-48	Distribution System Z	false	1,000.00	146.24	1,001.39	147.63	20.00	21.66	20.00	20.00	J-33	2.17	PMP-1
J-45	Distribution System Z	false	1,000.00	146.24	1,000.46	146.70	20.00	21.77	20.00	20.00	J-33	2.17	PMP-1
J-46	Distribution System Z	false	1,000.00	146.24	1,000.00	146.24	20.00	21.41	20.00	20.00	J-33	2.17	PMP-1
J-44	Distribution System Z	false	1,000.00	146.24	1,000.00	146.24	20.00	21.70	20.00	20.00	J-33	2.17	PMP-1
J-47	Distribution System Z	false	1,000.00	146.24	1,000.00	146.24	20.00	27.57	20.00	20.00	J-33	2.17	PMP-1
J-23	Distribution System Z	false	1,000.00	146.24	1,000.00	146.24	20.00	29.14	20.00	20.00	J-33	2.17	PMP-1
J-40	Distribution System Z	false	1,000.00	144.04	1,000.00	144.04	20.00	28.27	20.00	20.00	J-33	2.17	PMP-1
J-37	Distribution System Z	false	1,000.00	134.77	1,002.08	136.85	20.00	20.51	20.00	20.00	J-33	2.17	PMP-1
J-195	Distribution System Z	false	1,000.00	136.23	1,000.46	136.69	20.00	20.00	20.00	29.28	J-33	1.03	J-182
J-9	Distribution System Z	false	1,000.00	134.77	1,000.00	134.77	20.00	20.45	20.00	20.00	J-33	2.17	PMP-1
J-36	Distribution System Z	false	1,000.00	134.77	1,000.00	134.77	20.00	20.68	20.00	20.00	J-33	2.17	PMP-1
J-12	Distribution System Z	false	1,000.00	127.84	1,003.47	131.31	20.00	69.26	20.00	20.00	J-33	2.17	PMP-1
J-25	Distribution System Z	false	1,000.00	127.84	1,003.47	131.31	20.00	52.81	20.00	20.00	J-33	2.17	PMP-1
J-22	Distribution System Z	false	1,000.00	127.84	1,002.08	129.92	20.00	58.56	20.00	20.00	J-33	2.17	PMP-1
J-6	Distribution System Z	false	1,000.00	127.84	1,002.08	129.92	20.00	52.27	20.00	20.00	J-33	2.17	PMP-1
J-10	Distribution System Z	false	1,000.00	127.84	1,002.08	129.92	20.00	73.22	20.00	20.00	J-33	2.17	PMP-1
J-29	Distribution System Z	false	1,000.00	127.84	1,001.39	129.23	20.00	45.47	20.00	20.00	J-33	2.17	PMP-1
J-27	Distribution System Z	false	1,000.00	127.84	1,000.93	128.76	20.00	52.53	20.00	20.00	J-33	2.17	PMP-1
J-11	Distribution System Z	false	1,000.00	127.84	1,000.00	127.84	20.00	72.10	20.00	20.00	J-33	2.17	PMP-1
J-20	Distribution System Z	false	1,000.00	127.84	1,000.00	127.84	20.00	68.47	20.00	20.00	J-33	2.17	PMP-1
J-26	Distribution System Z	false	1,000.00	127.84	1,000.00	127.84	20.00	48.70	20.00	20.00	J-33	2.17	PMP-1
J-15	Distribution System Z	false	1,000.00	127.84	1,000.00	127.84	20.00	67.77	20.00	20.00	J-33	2.17	PMP-1
J-33	Distribution System Z	false	1,000.00	127.84	1,000.00	127.84	20.00	20.00	20.00	21.14	J-9	2.17	PMP-1
J-3	Distribution System Z	false	1,000.00	127.84	1,000.00	127.84	20.00	38.92	20.00	20.00	J-33	2.17	PMP-1
J-13	Distribution System Z	false	1,000.00	127.84	1,000.00	127.84	20.00	30.16	20.00	20.00	J-33	2.17	PMP-1
J-31	Distribution System Z	false	1,000.00	127.84	1,000.00	127.84	20.00	56.17	20.00	20.00	J-33	2.17	PMP-1
J-14	Distribution System Z	false	1,000.00	127.84	1,000.00	127.84	20.00	68.91	20.00	20.00	J-33	2.17	PMP-1
J-21	Distribution System Z	false	1,000.00	127.84	1,000.00	127.84	20.00	65.15	20.00	20.00	J-33	2.17	PMP-1
J-17	Distribution System Z	false	1,000.00	127.84	1,000.00	127.84	20.00	70.34	20.00	20.00	J-33	2.17	PMP-1
J-42	Distribution System Z	false	1,000.00	122.12	1,000.00	122.12	20.00	26.57	20.00	20.00	J-210	1.68	J-220
J-245	Distribution System Z	false	1,000.00	118.19	1,000.93	119.11	20.00	20.00	20.00	28.60	J-246	1.75	J-220
J-208	Distribution System Z	false	1,000.00	89.82	1,001.39	91.21	20.00	30.86	20.00	20.00	J-210	2.17	PMP-1
J-8	Distribution System Z	false	1,000.00	89.97	1,000.00	89.97	20.00	20.00	20.00	29.28	J-33	2.17	PMP-1
J-239	Distribution System Z	false	1,000.00	79.34	1,003.94	83.28	20.00	20.00	20.00	29.28	J-33	2.17	PMP-1
J-246	Distribution System Z	false	1,000.00	80.46	1,002.55	83.01	20.00	20.01	20.00	20.01	J-247	2.17	PMP-1
J-209	Distribution System Z	false	1,000.00	71.89	1,002.08	73.97	20.00	39.51	20.00	20.00	J-210	2.17	PMP-1
J-206	Distribution System Z	false	1,000.00	72.32	1,000.00	72.32	20.00	20.00	20.00	29.28	J-33	2.17	PMP-1
J-4	Distribution System Z	false	1,000.00	69.09	1,000.00	69.09	20.00	20.00	20.00	29.28	J-33	2.17	PMP-1
J-247	Distribution System Z	false	1,000.00	64.02	1,000.00	64.02	20.00	20.00	20.00	29.28	J-33	2.17	PMP-1
J-210	Distribution System Z	false	1,000.00	58.67	1,000.00	58.67	20.00	20.00	20.00	29.28	J-33	2.17	PMP-1



**Scenario: Existing MDD 2005 + Fire Flow - Min Sys Press + Commercial Fire Areas**  
**Fire Flow Analysis**  
**Fire Flow Report**

Label	Zone	Satisfies Fire Flow Constraints?	Needed Fire Flow (gpm)	Available Fire Flow (gpm)	Total Flow Needed (gpm)	Total Flow Available (gpm)	Residual Pressure (psi)	Calculated Residual Pressure (psi)	Minimum Zone Pressure (psi)	Calculated Minimum Zone Pressure (psi)	Minimum Zone Junction	Calculated Minimum System Pressure (psi)	Minimum System Junction
J-39	Distribution System Z	false	1,000.00	56.70	1,001.39	58.09	20.00	20.00	20.00	26.49	J-33	2.17	PMP-1
J-53	Distribution System Z	false	1,000.00	51.80	1,000.00	51.80	20.00	20.00	20.00	27.08	J-33	2.17	PMP-1
J-38	Distribution System Z	false	1,000.00	43.63	1,000.93	44.56	20.00	20.00	20.00	27.29	J-33	2.17	PMP-1
J-224	Distribution System Z	false	1,000.00	12.80	1,001.39	14.19	20.00	20.00	20.00	29.28	J-33	2.17	PMP-1
J-220	Bummerville Tanks (T	false	1,000.00	0.00	1,002.08	2.08	20.00	3.46	20.00	3.48	J-193	2.17	PMP-1
J-169	Treatment Plant (PMF	false	1,000.00	0.00	1,001.39	1.39	20.00	21.47	20.00	4.30	J-174	2.17	PMP-1
J-174	Treatment Plant (PMF	false	1,500.00	0.00	1,500.93	0.93	20.00	4.30	20.00	4.32	J-172	2.17	PMP-1
J-173	Treatment Plant (PMF	false	1,500.00	0.00	1,500.46	0.46	20.00	21.45	20.00	4.30	J-174	2.17	PMP-1
J-192	Bummerville Tanks (T	false	1,000.00	0.00	1,000.00	0.00	20.00	3.51	20.00	3.46	J-220	2.17	PMP-1
J-172	Treatment Plant (PMF	false	1,000.00	0.00	1,000.00	0.00	20.00	4.32	20.00	4.30	J-174	2.17	PMP-1
J-219	Bummerville Tanks (T	false	1,000.00	0.00	1,000.00	0.00	20.00	20.76	20.00	3.46	J-220	2.17	PMP-1
J-92	Bummerville Tanks (T	false	1,000.00	0.00	1,000.00	0.00	20.00	3.51	20.00	3.46	J-220	2.17	PMP-1
J-182	Bummerville Tanks (T	false	1,000.00	0.00	1,000.00	0.00	20.00	16.46	20.00	3.46	J-220	2.17	PMP-1
J-193	Bummerville Tanks (T	false	1,000.00	0.00	1,000.00	0.00	20.00	3.48	20.00	3.46	J-220	2.17	PMP-1
J-168	Treatment Plant (PMF	false	1,000.00	0.00	1,000.00	0.00	20.00	38.90	20.00	4.30	J-174	2.17	PMP-1

# Appendix B. Cost Estimates

**Cost Estimate for Replacement of Wilson Dam**

Element Description	Estimated Quantity	Units	Unit Price (installed)	Estimated Amount
<b>Materials/Installation</b>				
Earthwork: Clearing, Grubbing & Stripping	1	LS	\$10,000	\$10,000
Remove Existing Embankment	6,700	CY	\$2.00	\$13,400
Embankment Foundation & Core Trench: Excavation and Clean-up	6,900	CY	\$3.00	\$20,700
Embankment Fill - On-site Source	13,600	CY	\$2.50	\$34,000
Toe Drain	150	LF	\$25	\$3,800
Outlet Conduit: 18" dia. Concrete Encased Pipe	230	LF	\$175	\$40,300
18" Gate, Controls and Trash Rack	1	LS	\$15,000	\$15,000
Diversion of Water	1	LS	\$25,000	\$25,000
Mobilization (Assumed at 3% of Total)	1	LS	\$6,000	<u>\$6,000</u>
			<b>Materials/Installation sub-total =</b>	<b>\$168,000</b>
<b>Structures</b>				
Concrete Lined Spillway	1	LS	\$35,000	<u>\$35,000</u>
			<b>Structures sub-total =</b>	<b>\$35,000</b>
<b>Planning/Design/Engineering</b>	10%	LS		\$20,000
<b>Environmental Mitigation/Enhancement</b>	3%	LS		\$6,000
<b>Construction Administration/Overhead</b>	10%	LS		\$20,000
<b>Other/Environmental Documentation</b>	1	LS	\$15,000	<u>\$15,000</u>
				<u>\$61,000</u>
			<b>SUBTOTAL =</b>	<b>\$264,000</b>
Contingency Costs	15%	LS		<u>\$40,000</u>
			<b>TOTAL ESTIMATED COST =</b>	<b>\$304,000</b>

**Cost Estimate for Bummerville Tank**

Element Description	Estimated Quantity	Units	Unit Price (installed)	Estimated Amount
<b>Materials/Installation</b>				
8-inch Pipe	3,150	LF	\$50	\$157,500
Pump Control Valve, 8-inch valve	1	EA	\$7,500	\$7,500
Butterfly Valve, 8-inch valve	1	EA	\$1,200	<u>\$1,200</u>
			<b>Materials/Installation subtotal =</b>	<b>\$166,200</b>
<b>Structures</b>				
Pump Station	1	LS	\$35,000	\$35,000
Steel Tank for Bummerville	50,000	GAL	\$0.75	\$37,500
Removal of Existing Tanks	1	LS	\$10,000	<u>\$10,000</u>
			<b>Structures subtotal =</b>	<b>\$82,500</b>
<b>Planning/Design/Engineering</b>	8%	LS		\$19,896
<b>Environmental Mitigation/Enhancement</b>	3%	LS		\$7,461
<b>Construction Administration/Overhead</b>	10%	LS		\$24,870
<b>Other/Environmental Documentation</b>	1	LS	\$40,000	<u>\$40,000</u>
				<u>\$92,227</u>
			<b>SUBTOTAL =</b>	<b>\$340,927</b>
Contingency Costs	15%	LS		<u>\$51,139</u>
			<b>TOTAL ESTIMATED COST =</b>	<b>\$393,000</b>

**Cost Estimate for Bummerville Fire Flow Pump**

Element Description	Estimated Quantity	Units	Unit Price (installed)	Estimated Amount
<b>Structures</b>				
Fire Booster Pump Station	1	LS	\$65,000	\$65,000
			<b>Structures subtotal =</b>	<b>\$65,000</b>
<b>Planning/Design/Engineering</b>				
Planning/Design/Engineering	8%	LS		\$5,200
<b>Environmental Mitigation/Enhancement</b>				
Environmental Mitigation/Enhancement	3%	LS		\$1,950
<b>Construction Administration/Overhead</b>				
Construction Administration/Overhead	10%	LS		\$6,500
<b>Other/Environmental Documentation</b>				
Other/Environmental Documentation	1	LS	\$10,000	\$10,000
			<b>SUBTOTAL =</b>	<b>\$23,650</b>
<b>Contingency Costs</b>				
Contingency Costs	15%	LS		\$9,750
			<b>TOTAL ESTIMATED COST =</b>	<b>\$99,000</b>

**Cost Estimate for Clearwell**

Element Description	Estimated Quantity	Units	Unit Price (installed)	Estimated Amount
<b>Materials/Installation</b>				
8-inch Pipe	300	LF	\$50	\$15,000
			<b>Materials/Installation subtotal =</b>	<b>\$15,000</b>
<b>Structures</b>				
Steel Tank for West Point/Wilseyville, incl. new Finish water pumps	600,000	GAL	\$0.70	\$420,000
			<b>Structures subtotal =</b>	<b>\$420,000</b>
<b>Planning/Design/Engineering</b>				
Planning/Design/Engineering	8%	LS		\$35,000
<b>Environmental Mitigation/Enhancement</b>				
Environmental Mitigation/Enhancement	3%	LS		\$13,000
<b>Construction Administration/Overhead</b>				
Construction Administration/Overhead	10%	LS		\$44,000
<b>Other/Environmental Documentation</b>				
Other/Environmental Documentation	1	LS	\$40,000	\$40,000
				\$132,000
			<b>SUBTOTAL =</b>	<b>\$567,000</b>
<b>Contingency Costs</b>				
Contingency Costs	15%	LS		\$85,000
			<b>TOTAL ESTIMATED COST =</b>	<b>\$652,000</b>

**Cost Estimate for Mokelumne River Intake and Pump Station**

Element Description	Estimated Quantity	Units	Unit Price (Installed)	Estimated Amount
<b>Materials/Installation</b>				
Division 1 - General Requirements				
Mobilization, Bonds, Insurance	1	LS	\$15,000	\$15,000
Division 2 - Site Work				
Cross line - Cable service	1	LS	\$15,000	\$15,000
Excavation, River Bed	155	CY	\$8	\$1,240
Pipe Removal and Replacement (8-inch PVC)	4,300	LF	\$65	\$279,500
Filter Pack	75	CY	\$24	\$1,800
AC Removal and Replacement	3,500	LF	\$25	\$87,500
Haul Road - 4" Agg Base, 15 feet wide	4,660	SY	\$6	\$27,960
Haul Road Maintenance	90	DAY	\$300	\$27,000
Remove Existing Infiltration Piping	150	LF	\$20	\$3,000
River Diversion	1	LS	\$24,000	\$24,000
Temporary Erosion Control	7,980	LF	\$0.90	\$7,182
Washed Rock	83	CY	\$20	\$1,660
Demolition	1	LS	\$11,250	\$11,250
Division 5 - Metals				
Aluminum Grating and Railing	1	LS	\$2,890	\$2,890
Division 9 - Finishes				
Painting	1	LS	\$7,500	\$7,500
Division 10 - Specialties				
Testing, 1000' test lengths, hydrostatic, 8" pipe	4,300	LF	\$4.60	\$19,780
Signage and Equipment Tags	1	LS	\$3,000	\$3,000
Division 11 - Equipment				
Booster Pump Station	1	EA	\$180,000	\$180,000
Vertical Turbine Pump, Disch. Piping and Appurtenances	1	EA	\$23,900	\$23,900
Positive Displacement Blower, 380 SCFM	1	EA	\$11,000	\$11,000
Division 13 - Special Construction				
8-Inch Mag. Flow Meter	1	EA	\$10,000	\$10,000
Pressure Gages/ Transmitters	2	EA	\$1,500	\$3,000
Corrosion Metering Stations	3	EA	\$399	\$1,197
Division 15 - Mechanical				
8-inch Steel Pipe, Lined and Coated w/Misc. Fittings	35	LF	\$16	\$560
4" Steel Pipe	150	LF	\$29.50	\$4,425
Pump Station Valves and gases	1	LS	\$26,300	\$26,300
Pipeline valves	1	LS	\$19,260	\$19,260
Infiltration Gallery	1	LS	\$4,070	\$4,070
			<b>Materials/Installation subtotal =</b>	<b>\$818,974</b>
<b>Structures</b>				
Division 3 - Concrete				
Pump Station Structure	1	LS	\$4,700	\$4,700
Division 16 - Electrical and Instrumentation				
Pump Station Electrical	1	LS	\$50,100	\$50,100
			<b>Structures subtotal =</b>	<b>\$54,800</b>
<b>Planning/Design/Engineering</b>	8%	LS		\$70,000
<b>Environmental Mitigation/Enhancement</b>	3%	LS		\$26,200
<b>Construction Administration/Overhead</b>	10%	LS		\$87,000
<b>Other/Environmental Documentation</b>	1	LS	\$40,000	\$40,000
				<u>\$223,200</u>
			<b>SUBTOTAL</b>	<b>\$1,096,974</b>
Contingency Costs	15%	LS		<u>\$164,546</u>
			<b>TOTAL ESTIMATED COST =</b>	<b>\$1,262,000</b>

**Cost Estimate for Regulating Reservoir Improvements**

Element Description	Estimated Quantity	Units	Unit Price (installed)	Estimated Amount
<b>Materials/Installation</b>				
Cylindrical Fish Screen	2	EA	\$15,000	\$30,000
Hydraulic Hand Pump with valving (Waterman FHP-12 Hand Pump Type Actuator)	2	EA	\$4,290	\$8,580
Hydraulic Cylinder and adapter plate	2	EA	\$2,475	\$4,950
18 inch diameter knife gate or butterfly valve	2	EA	\$4,950	\$9,900
HDPE Piping and hydraulic hose (HDPE piping to protect hydraulic hose)	60	LF	\$50	<u>\$3,000</u>
			<b>Materials/Installation sub-total =</b>	<b>\$56,430</b>
<b>Structures</b>				
Concrete for box	13	CY	\$990	<u>\$12,870</u>
			<b>Structures sub-total =</b>	<b>\$12,870</b>
<b>Planning/Design/Engineering</b>	10%	LS		\$7,000
<b>Construction Administration/Overhead</b>	10%	LS		\$7,000
<b>Other/Environmental Documentation</b>	1	LS	\$10,000	<u>\$10,000</u>
				<u>\$24,000</u>
			<b>SUBTOTAL</b>	<b>\$93,300</b>
Contingency Costs	15%	LS		<u>\$14,000</u>
			<b>TOTAL ESTIMATED COST =</b>	<b>\$107,000</b>

**Overall Cost Estimate for Downtown West Point Distribution System Improvements**

Element Description	Estimated Quantity	Units	Unit Price (installed)	Estimated Amount
<b>Materials/Installation</b>				
<b>Pipeline</b>				
6-inch Pipe	7,000	LF	\$45	\$315,000
8-inch Pipe	2,000	LF	\$55	\$110,000
10-inch Pipe	600	LF	\$70	\$42,000
12-inch Pipe	5,800	LF	\$80	\$464,000
<b>Valves, Installed</b>				
Along the 6-inch Pipe	23	EA	\$850	\$19,550
Along the 8-inch Pipe	7	EA	\$1,000	\$7,000
Along the 10-inch Pipe	2	EA	\$1,200	\$2,400
Along the 12-inch Pipe	19	EA	\$1,500	\$28,500
<b>Pavement Replacement</b>				
Along the 6-inch Pipe	7,000	LF	\$8	\$56,000
Along the 8-inch Pipe	2,000	LF	\$10	\$20,000
Along the 10-inch Pipe	600	LF	\$10	\$6,000
Along the 12-inch Pipe	5,800	LF	\$12.50	\$72,500
Service Connections	173	EA	\$950.00	<u>\$163,875</u>
			<b>Materials/Installation subtotal =</b>	<b>\$1,306,825</b>
<b>Planning/Design/Engineering</b>	12%	LS		\$156,819
<b>Environmental Mitigation/Enhancement</b>	3%	LS		\$39,205
<b>Other/Environmental Documentation</b>	1	LS	\$50,000	<u>\$50,000</u>
				<u>\$246,024</u>
			<b>SUBTOTAL =</b>	<b>\$1,552,849</b>
Contingency Costs	15%	LS		<u>\$232,927</u>
			<b>TOTAL ESTIMATED COST =</b>	<b>\$1,786,000</b>

**Phase 1, Year 1 (Phase 1-1) Cost Estimate for Downtown West Point Distribution System Improvements**

Element Description	Estimated Quantity	Units	Unit Price (installed)	Estimated Amount
<b>Materials/Installation</b>				
<b>Pipeline</b>				
12-inch Pipe	5,800	LF	\$80	\$464,000
<b>Valves, Installed</b>				
Along the 12-inch Pipe	19	EA	\$1,500	\$28,500
<b>Pavement Replacement</b>				
Along the 12-inch Pipe	5,800	LF	\$12.50	\$72,500
Service Connections	65	EA	\$950.00	<u>\$61,750</u>
	<b>Materials/Installation subtotal =</b>			\$626,750
<b>Planning/Design/Engineering</b>	12%	LS		\$75,210
<b>Environmental Mitigation/Enhancement</b>	3%	LS		\$18,803
<b>Other/Environmental Documentation</b>	1	LS	\$25,000	<u>\$9,416</u>
				<u>\$103,428</u>
			<b>SUBTOTAL =</b>	\$730,178
Contingency Costs	15%	LS		<u>\$109,527</u>
	<b>TOTAL ESTIMATED COST =</b>			<b>\$840,000</b>

**Phase 1, Year 2 (Phase 1-2) Cost Estimate for Downtown West Point Distribution System Improvements**

Element Description	Estimated Quantity	Units	Unit Price (installed)	Estimated Amount
<b>Materials/Installation</b>				
<b>Pipeline</b>				
6-inch Pipe	0	LF	\$45	\$0
8-inch Pipe	2,000	LF	\$55	\$110,000
10-inch Pipe	600	LF	\$70	\$42,000
12-inch Pipe	0	LF	\$80	\$0
<b>Valves, Installed</b>				
Along the 6-inch Pipe	0	EA	\$850	\$0
Along the 8-inch Pipe	7	EA	\$1,000	\$7,000
Along the 10-inch Pipe	2	EA	\$1,200	\$2,400
Along the 12-inch Pipe	0	EA	\$1,500	\$0
<b>Pavement Replacement</b>				
Along the 6-inch Pipe	0	LF	\$8	\$0
Along the 8-inch Pipe	2,000	LF	\$10	\$20,000
Along the 10-inch Pipe	600	LF	\$10	\$6,000
Along the 12-inch Pipe	0	LF	\$12.50	\$0
Service Connections	30	EA	\$950.00	<u>\$28,500</u>
	<b>Materials/Installation subtotal =</b>			\$215,900
<b>Planning/Design/Engineering</b>	12%	LS		\$25,908
<b>Environmental Mitigation/Enhancement</b>	3%	LS		\$6,477
<b>Other/Environmental Documentation</b>	1	LS	\$25,000	<u>\$4,221</u>
				<u>\$36,606</u>
			<b>SUBTOTAL =</b>	\$252,506
Contingency Costs	15%	LS		<u>\$37,876</u>
	<b>TOTAL ESTIMATED COST =</b>			<b>\$291,000</b>

**Phase 1, Year 3 (Phase 1-3) Cost Estimate for Downtown West Point Distribution System Improvements**

<b>Element Description</b>	<b>Estimated Quantity</b>	<b>Units</b>	<b>Unit Price (installed)</b>	<b>Estimated Amount</b>
<b>Materials/Installation</b>				
<b>Pipeline</b>				
6-inch Pipe	7,000	LF	\$45	\$315,000
8-inch Pipe	0	LF	\$55	\$0
10-inch Pipe	0	LF	\$70	\$0
12-inch Pipe	0	LF	\$80	\$0
<b>Valves, Installed</b>				
Along the 6-inch Pipe	23	EA	\$850	\$19,550
Along the 8-inch Pipe	0	EA	\$1,000	\$0
Along the 10-inch Pipe	0	EA	\$1,200	\$0
Along the 12-inch Pipe	0	EA	\$1,500	\$0
<b>Pavement Replacement</b>				
Along the 6-inch Pipe	7,000	LF	\$8	\$56,000
Along the 8-inch Pipe	0	LF	\$10	\$0
Along the 10-inch Pipe	0	LF	\$10	\$0
Along the 12-inch Pipe	0	LF	\$12.50	\$0
Service Connections	79	EA	\$950.00	<u>\$75,050</u>
	<b>Materials/Installation subtotal =</b>			\$465,600
<b>Planning/Design/Engineering</b>	12%	LS		\$55,872
<b>Environmental Mitigation/Enhancement</b>	3%	LS		\$13,968
<b>Other/Environmental Documentation</b>	1	LS	\$25,000	<u>\$11,364</u>
				<u>\$81,204</u>
			<b>SUBTOTAL =</b>	\$546,804
Contingency Costs	15%	LS		<u>\$82,021</u>
<b>TOTAL ESTIMATED COST =</b>				<b>\$629,000</b>



**Overall Cost Estimate for Upper Northwest West Point Distribution System Improvements**

Element Description	Estimated Quantity	Units	Unit Price (installed)	Estimated Amount
<b>Materials/Installation</b>				
<b>Pipeline</b>				
6-inch Pipe	6,036	LF	\$45	\$271,620
8-inch Pipe	3,135	LF	\$55	\$172,425
10-inch Pipe	5,807	LF	\$70	\$406,490
<b>Valves, Installed</b>				
Along the 6-inch Pipe	21	EA	\$850	\$17,850
Along the 8-inch Pipe	11	EA	\$1,000	\$11,000
Along the 10-inch Pipe	20	EA	\$1,200	\$24,000
<b>Pavement Replacement</b>				
Along the 6-inch Pipe	6,036	LF	\$8	\$48,288
Along the 8-inch Pipe	3,135	LF	\$10	\$31,350
Along the 10-inch Pipe	5,807	LF	\$10	\$58,070
Service Connections	173	EA	\$950.00	<u>\$163,875</u>
	<b>Materials/Installation subtotal =</b>			\$1,204,968
<b>Planning/Design/Engineering</b>				
	12%	LS		\$144,596
<b>Environmental Mitigation/Enhancement</b>				
	3%	LS		\$36,149
<b>Other/Environmental Documentation</b>				
	1	LS	\$25,000	<u>\$25,000</u>
				<u>\$205,745</u>
			<b>SUBTOTAL =</b>	\$1,410,713
<b>Contingency Costs</b>				
	15%	LS		<u>\$211,607</u>
	<b>TOTAL ESTIMATED COST =</b>			<b>\$1,623,000</b>

**Phase 1, Year 4 (Phase 1-4) Cost Estimate for Upper Northwest West Point Distribution System Improvements**

Element Description	Estimated Quantity	Units	Unit Price (installed)	Estimated Amount
<b>Materials/Installation</b>				
<b>Pipeline</b>				
10-inch Pipe	5,807	LF	\$70	\$406,490
<b>Valves, Installed</b>				
Along the 10-inch Pipe	20	EA	\$1,200	\$24,000
<b>Pavement Replacement</b>				
Along the 10-inch Pipe	5,807	LF	\$10	\$58,070
Service Connections	67	EA	\$950.00	<u>\$63,650</u>
	<b>Materials/Installation subtotal =</b>			\$552,210
<b>Planning/Design/Engineering</b>				
	12%	LS		\$66,265
<b>Environmental Mitigation/Enhancement</b>				
	3%	LS		\$16,566
<b>Other/Environmental Documentation</b>				
	1	LS	\$25,000	<u>\$9,693</u>
				<u>\$92,525</u>
			<b>SUBTOTAL =</b>	\$644,735
<b>Contingency Costs</b>				
	15%	LS		<u>\$96,710</u>
	<b>TOTAL ESTIMATED COST =</b>			<b>\$742,000</b>

**Phase 1, Year 5 (Phase 1-5) Cost Estimate for Upper Northwest West Point Distribution System Improvements**

Element Description	Estimated Quantity	Units	Unit Price (installed)	Estimated Amount
<b>Materials/Installation</b>				
<b>Pipeline</b>				
6-inch Pipe	6,036	LF	\$45	\$271,620
8-inch Pipe	3,135	LF	\$55	\$172,425
<b>Valves, Installed</b>				
Along the 6-inch Pipe	21	EA	\$850	\$17,850
Along the 8-inch Pipe	11	EA	\$1,000	\$11,000
<b>Pavement Replacement</b>				
Along the 6-inch Pipe	6,036	LF	\$8	\$48,288
Along the 8-inch Pipe	3,135	LF	\$10	\$31,350
Service Connections	106	EA	\$950.00	\$100,700
	<b>Materials/Installation subtotal =</b>			<b>\$653,233</b>
<b>Planning/Design/Engineering</b>	12%	LS		\$78,388
<b>Environmental Mitigation/Enhancement</b>	3%	LS		\$19,597
<b>Other/Environmental Documentation</b>	1	LS	\$25,000	\$15,308
				<u>\$113,293</u>
			<b>SUBTOTAL =</b>	<b>\$766,526</b>
Contingency Costs	15%	LS		<u>\$114,979</u>
	<b>TOTAL ESTIMATED COST =</b>			<b>\$882,000</b>

**Cost Estimate for Wilseyville Distribution System Improvements**

Element Description	Estimated Quantity	Units	Unit Price (installed)	Estimated Amount
<b>Materials/Installation</b>				
<b>Pipeline</b>				
6-inch Pipe	4,768	LF	\$45	\$214,560
12-inch Pipe	8,086	LF	\$80	\$646,880
<b>Valves, Installed</b>				
Along the 6-inch Pipe	0	EA	\$850	\$0
Along the 12-inch Pipe	27	EA	\$1,500	\$40,500
<b>Pavement Replacement</b>				
Along the 6-inch Pipe	4,768	LF	\$8	\$38,144
Along the 12-inch Pipe	8,086	LF	\$12.5	\$101,075
Service Connections	120	EA	\$950.00	\$114,000
	<b>Materials/Installation subtotal =</b>			<b>\$1,155,159</b>
<b>Planning/Design/Engineering</b>	12%	LS		\$138,619
<b>Environmental Mitigation/Enhancement</b>	3%	LS		\$34,655
<b>Other/Environmental Documentation</b>	1	LS	\$50,000	\$50,000
				<u>\$223,274</u>
			<b>SUBTOTAL =</b>	<b>\$1,378,433</b>
Contingency Costs	15%	LS		<u>\$206,765</u>
	<b>TOTAL ESTIMATED COST =</b>			<b>\$1,585,000</b>

**Cost Estimate for Bummerville Distribution System Improvements**

Element Description	Estimated Quantity	Units	Unit Price (installed)	Estimated Amount
<b>Materials/Installation</b>				
<b>Pipeline</b>				
6-inch Pipe	5,500	LF	\$45	\$247,500
8-inch Pipe	5,750	LF	\$55	\$316,250
Valves, Installed				
Along the 6-inch Pipe	18	EA	\$850	\$15,300
Along the 8-inch Pipe	19	EA	\$1,000	\$19,000
Pavement Replacement	6,000	LF	\$10	\$60,000
Service Connections	43	EA	\$950.00	\$40,850
			<b>Materials/Installation subtotal =</b>	<b>\$698,900</b>
<b>Planning/Design/Engineering</b>	12%	LS		\$83,868
<b>Environmental Mitigation/Enhancement</b>	3%	LS		\$20,967
<b>Other/Environmental Documentation</b>	1	LS	\$35,000	\$35,000
				\$139,835
			<b>SUBTOTAL =</b>	<b>\$838,735</b>
Contingency Costs	15%	LS		\$125,810
			<b>TOTAL ESTIMATED COST =</b>	<b>\$965,000</b>

**Cost Estimate for Bear Creek Diversion SCADA**

Element Description	Estimated Quantity	Units	Unit Price (installed)	Estimated Amount
<b>Materials/Installation</b>				
2 - Control panel and Metering Pedestal	2	LS	\$6,000	\$12,000
2 - 2" PVC Conduit	1,300	LF	\$10	\$13,000
2 - Testing/startup	2	EA	\$3,500	\$7,000
2 - Telemetry Panel	2	EA	\$5,000	\$10,000
Pull Boxes	4	EA	\$600	\$2,400
2 - Transformer	2	EA	\$3,000	\$6,000
2 - Ultrasonic Level	2	EA	\$5,000	\$10,000
			<b>Materials/Installation subtotal =</b>	<b>\$60,400</b>
<b>Planning/Design/Engineering</b>	8%	LS		\$4,832
<b>Environmental Mitigation/Enhancement</b>	3%	LS		\$1,812
<b>Construction Administration/Overhead</b>	10%	LS		\$6,040
<b>Other/Environmental Documentation</b>	1	LS	\$10,000	\$10,000
				\$22,684
			<b>SUBTOTAL =</b>	<b>\$83,084</b>
Contingency Costs	15%	LS		\$12,463
			<b>TOTAL ESTIMATED COST =</b>	<b>\$95,600</b>

**Cost Estimate for Distribution System Improvements Phase 1, Year 1 (Phase 1-1) (1,000 gpm Fire Flow)**

Element Description	Estimated Quantity	Units	(Installed)	Amount
<b>Materials/Installation</b>				
<b>Pipeline</b>				
4-inch Pipe	0	LF	\$70	\$0
6-inch Pipe	665	LF	\$45	\$29,926
8-inch Pipe	5760	LF	\$55	\$316,775
10-inch Pipe	2283	LF	\$70	\$159,835
12-inch Pipe	4091	LF	\$80	\$327,252
14-inch Pipe	0	LF	\$90	\$0
<b>Valves, Installed</b>				
Along the 4-inch Pipe	0	EA	\$650	\$0
Along the 6-inch Pipe	0	EA	\$850	\$226
Along the 8-inch Pipe	2	EA	\$1,000	\$2,304
Along the 10-inch Pipe	1	EA	\$1,200	\$1,096
Along the 12-inch Pipe	2	EA	\$1,500	\$2,454
Along the 14-inch Pipe	0	EA	\$2,000	\$0
<b>Pavement Replacement</b>				
Along the 4-inch Pipe	0	LF	\$8	\$0
Along the 6-inch Pipe	665	LF	\$8	\$5,320
Along the 8-inch Pipe	5,760	LF	\$10	\$57,596
Along the 10-inch Pipe	2,283	LF	\$10	\$22,834
Along the 12-inch Pipe	4,091	LF	\$12.50	\$51,133
Along the 14-inch Pipe	0	LF	\$15	\$0
Service Connections	265	EA	\$1,500	\$397,986
PRV Replacement	6	EA	\$2,500	\$15,000
	<b>Materials/Installation subtotal =</b>			\$1,389,737
Contingency Costs	25%	LS		\$347,434
			<b>SUBTOTAL =</b>	\$1,737,171
<b>Planning/Design/Engineer</b>	12%	LS		\$208,461
<b>Environmental Mitigation/</b>	4%	LS		\$69,487
<b>Other/Environmental Docu</b>	4%	LS		\$69,487
				\$347,434
<b>TOTAL ESTIMATED COST =</b>				\$2,085,000

**Cost Estimate for Distribution System Improvements Phase 1-2 (1,000 gpm Fire Flow)**

Element Description	Estimated Quantity	Units	Unit Price (installed)	Estimated Amount
<b>Materials/Installation</b>				
<b>Pipeline</b>				
4-inch Pipe	0	LF	\$70	\$0
6-inch Pipe	0	LF	\$45	\$0
8-inch Pipe	0	LF	\$55	\$0
10-inch Pipe	0	LF	\$70	\$0
12-inch Pipe	5,068	LF	\$80	\$405,407
14-inch Pipe	0	LF	\$90	\$0
<b>Valves, Installed</b>				
Along the 4-inch Pipe	0	EA	\$650	\$0
Along the 6-inch Pipe	0	EA	\$850	\$0
Along the 8-inch Pipe	0	EA	\$1,000	\$0
Along the 10-inch Pipe	0	EA	\$1,200	\$0
Along the 12-inch Pipe	2	EA	\$1,500	\$3,041
Along the 14-inch Pipe	0	EA	\$2,000	\$0
<b>Pavement Replacement</b>				
Along the 4-inch Pipe	0	LF	\$8	\$0
Along the 6-inch Pipe	0	LF	\$8	\$0
Along the 8-inch Pipe	0	LF	\$10	\$0
Along the 10-inch Pipe	0	LF	\$10	\$0
Along the 12-inch Pipe	5,068	LF	\$12.50	\$63,345
Along the 14-inch Pipe	0	LF	\$15	\$0
Service Connections	214	EA	\$1,500	\$320,676
PRV Replacement	6	EA	\$2,500	\$15,000
	<b>Materials/Installation subtotal =</b>			<b>\$807,469</b>
Contingency Costs	25%	LS		<u>\$201,867</u>
			SUBTOTAL =	<b>\$1,009,336</b>
<b>Planning/Design/Engineer</b>	12%	LS		\$121,120
<b>Environmental Mitigation/</b>	4%	LS		\$40,373
<b>Other/Environmental Docu</b>	4%	LS		\$40,373
				<u>\$201,867</u>
<b>TOTAL ESTIMATED COST =</b>				<b>\$1,212,000</b>

**Cost Estimate for Distribution System Improvements Phase 1-3 (1,000 gpm Fire Flow)**

Element Description	Estimated Quantity	Units	Unit Price (installed)	Estimated Amount
<b>Materials/Installation</b>				
<b>Pipeline</b>				
4-inch Pipe	0	LF	\$70	\$0
6-inch Pipe	0	LF	\$45	\$0
8-inch Pipe	0	LF	\$55	\$0
10-inch Pipe	0	LF	\$70	\$0
12-inch Pipe	8,126	LF	\$80	\$650,096
14-inch Pipe	0	LF	\$90	\$0
<b>Valves, Installed</b>				
Along the 4-inch Pipe	0	EA	\$650	\$0
Along the 6-inch Pipe	0	EA	\$850	\$0
Along the 8-inch Pipe	0	EA	\$1,000	\$0
Along the 10-inch Pipe	0	EA	\$1,200	\$0
Along the 12-inch Pipe	3	EA	\$1,500	\$4,876
Along the 14-inch Pipe	0	EA	\$2,000	\$0
<b>Pavement Replacement</b>				
Along the 4-inch Pipe	0	LF	\$8	\$0
Along the 6-inch Pipe	0	LF	\$8	\$0
Along the 8-inch Pipe	0	LF	\$10	\$0
Along the 10-inch Pipe	0	LF	\$10	\$0
Along the 12-inch Pipe	8,126	LF	\$12.50	\$101,578
Along the 14-inch Pipe	0	LF	\$15	\$0
Service Connections	234	EA	\$1,500	\$351,262
PRV Replacement	6	EA	\$2,500	\$15,000
	<b>Materials/Installation subtotal =</b>			<b>\$1,122,811</b>
Contingency Costs	25%	LS		<u>\$280,703</u>
			SUBTOTAL =	<b>\$1,403,514</b>
<b>Planning/Design/Engineer</b>	12%	LS		\$168,422
<b>Environmental Mitigation/</b>	4%	LS		\$56,141
<b>Other/Environmental Docu</b>	4%	LS		\$56,141
				<u>\$280,703</u>
<b>TOTAL ESTIMATED COST =</b>				<b>\$1,685,000</b>

**Cost Estimate for Distribution System Improvements Phase 1-4 (1,000 gpm Fire Flow)**



Element Description	Estimated Quantity	Units	Unit Price (installed)	Estimated Amount
<b>Materials/Installation</b>				
<b>Pipeline</b>				
4-inch Pipe	0	LF	\$70	\$0
6-inch Pipe	0	LF	\$45	\$0
8-inch Pipe	0	LF	\$55	\$0
10-inch Pipe	0	LF	\$70	\$0
12-inch Pipe	13,265	LF	\$80	\$1,061,211
14-inch Pipe	0	LF	\$90	\$0
<b>Valves, Installed</b>				
Along the 4-inch Pipe	0	EA	\$650	\$0
Along the 6-inch Pipe	0	EA	\$850	\$0
Along the 8-inch Pipe	0	EA	\$1,000	\$0
Along the 10-inch Pipe	0	EA	\$1,200	\$0
Along the 12-inch Pipe	5	EA	\$1,500	\$7,959
Along the 14-inch Pipe	0	EA	\$2,000	\$0
<b>Pavement Replacement</b>				
Along the 4-inch Pipe	0	LF	\$8	\$0
Along the 6-inch Pipe	0	LF	\$8	\$0
Along the 8-inch Pipe	0	LF	\$10	\$0
Along the 10-inch Pipe	0	LF	\$10	\$0
Along the 12-inch Pipe	13,265	LF	\$12.50	\$165,814
Along the 14-inch Pipe	0	LF	\$15	\$0
Service Connections	268	EA	\$1,500	\$402,651
PRV Replacement	6	EA	\$2,500	\$15,000
	<b>Materials/Installation subtotal =</b>			\$1,652,636
Contingency Costs	25%	LS		\$413,159
			SUBTOTAL =	\$2,065,795
<b>Planning/Design/Engineer</b>	12%	LS		\$247,895
<b>Environmental Mitigation/</b>	4%	LS		\$82,632
<b>Other/Environmental Docu</b>	4%	LS		\$82,632
				\$413,159
<b>TOTAL ESTIMATED COST =</b>				\$2,479,000

**Cost Estimate for Distribution System Improvements Phase 1-5 (1,000 gpm Fire Flow)**

Element Description	Estimated Quantity	Units	Unit Price (installed)	Estimated Amount
<b>Materials/Installation</b>				
<b>Pipeline</b>				
4-inch Pipe	0	LF	\$70	\$0
6-inch Pipe	0	LF	\$45	\$0
8-inch Pipe	3580.31	LF	\$55	\$196,917
10-inch Pipe	1,740	LF	\$70	\$121,782
12-inch Pipe	10,207	LF	\$80	\$816,530
14-inch Pipe	0	LF	\$90	\$0
<b>Valves, Installed</b>				
Along the 4-inch Pipe	0	EA	\$650	\$0
Along the 6-inch Pipe	0	EA	\$850	\$0
Along the 8-inch Pipe	1	EA	\$1,000	\$1,432
Along the 10-inch Pipe	1	EA	\$1,200	\$835
Along the 12-inch Pipe	4	EA	\$1,500	\$6,124
Along the 14-inch Pipe	0	EA	\$2,000	\$0
<b>Pavement Replacement</b>				
Along the 4-inch Pipe	0	LF	\$8	\$0
Along the 6-inch Pipe	0	LF	\$8	\$0
Along the 8-inch Pipe	3,580	LF	\$10	\$35,803
Along the 10-inch Pipe	1,740	LF	\$10	\$17,397
Along the 12-inch Pipe	10,207	LF	\$12.50	\$127,583
Along the 14-inch Pipe	0	LF	\$15	\$0
Service Connections	284	EA	\$1,500	\$425,267
PRV Replacement	6	EA	\$2,500	\$15,000
	<b>Materials/Installation subtotal =</b>			<b>\$1,764,670</b>
Contingency Costs	25%	LS		<u>\$441,167</u>
			SUBTOTAL =	<b>\$2,205,837</b>
<b>Planning/Design/Engineer</b>	12%	LS		\$264,700
<b>Environmental Mitigation/</b>	4%	LS		\$88,233
<b>Other/Environmental Docu</b>	4%	LS		\$88,233
				<u>\$441,167</u>
<b>TOTAL ESTIMATED COST =</b>				<b>\$2,648,000</b>



Appendix C. Public Presentations and Response  
to Public Comments



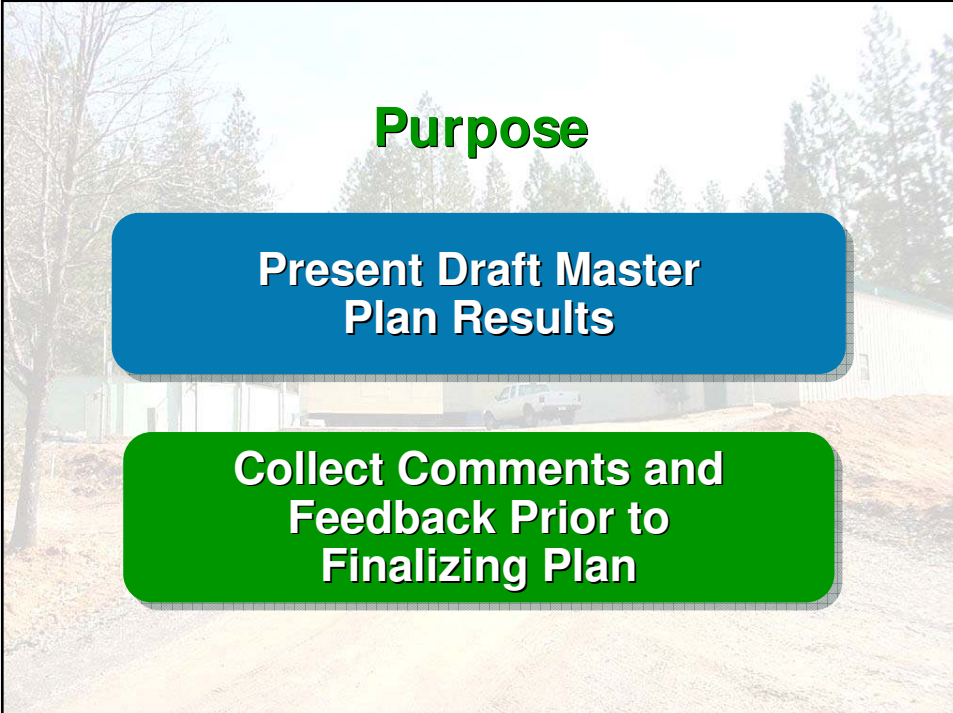
**West Point  
Water Master  
Plan**

Calaveras County  
Water District

**PUBLIC  
PRESENTATION**

*February 2, 2005*

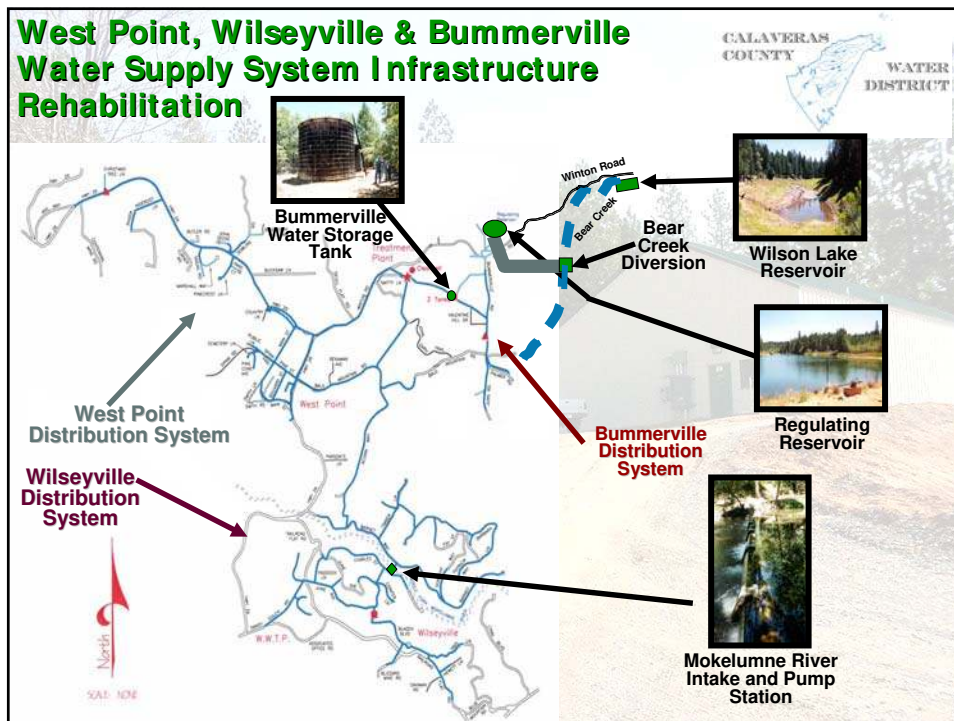
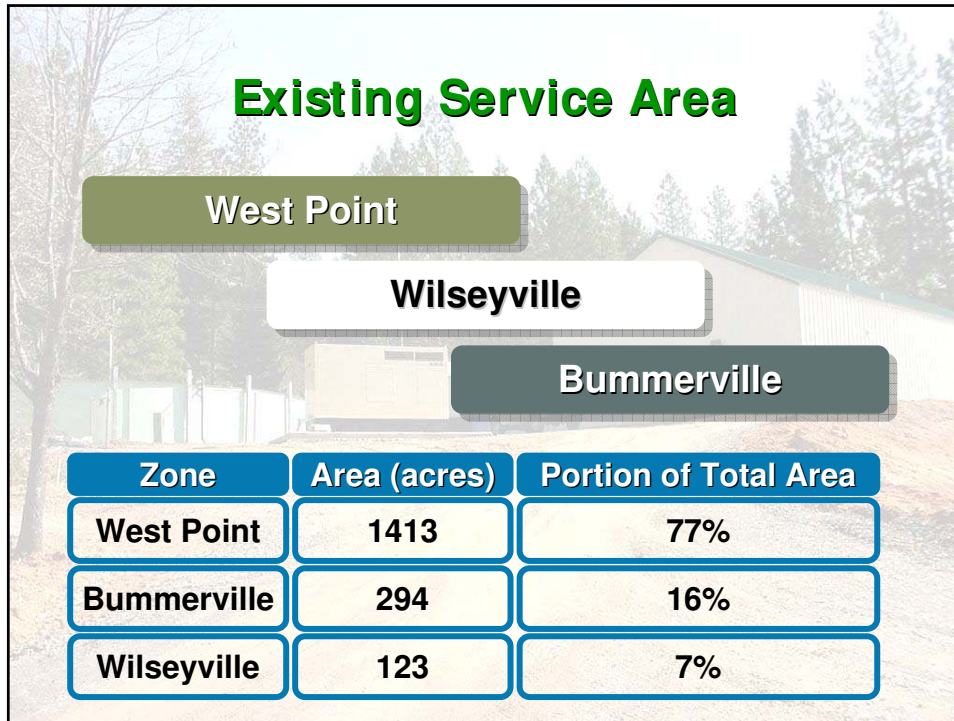
**HDR**



**Purpose**

**Present Draft Master  
Plan Results**

**Collect Comments and  
Feedback Prior to  
Finalizing Plan**



## Existing Demand

540 Connections

Average Day (MGD) = 0.16

Maximum Day (MGD) = 0.31

Peak Hour (MGD) = 0.47

## Demand Characterization

Average Day Demand gpd/conn

Historical

290

CCWD Design  
Standard

500

## Phased Demand Approach

Increase historical demand to meet  
CCWD design standard

→ Ten year increments over 20 years

<i>Phase</i>	<i>Unit Demand gpd/conn</i>	<i>Number of Connections</i>	<i>Average Day MGD</i>	<i>Maximum Day MGD</i>	<i>Peak Hour MGD</i>
<i>Phase I (10 – Year)</i>	395	540	0.21	0.43	0.64
<i>Phase II (20 – Year)</i>	500	540	0.27	0.54	0.81

## Future Demand - Growth

Based on historical growth rate of five (5)  
new connections per year

<i>Phase</i>	<i>Cumulative Number of New Connections</i>	<i>Average Day MGD</i>	<i>Maximum Day MGD</i>	<i>Peak Hour MGD</i>
<i>Phase I (10 -Year)</i>	50	0.03	0.05	0.08
<i>Phase II (20 -Year)</i>	100	0.05	0.1	0.15

## System Evaluation

<b>Treatment</b>	1 MGD Water Treatment Plant
<b>Water Supply</b>	2 Reservoirs, creek diversion, pump station
<b>Treated Water Storage</b>	2 Water Storage Tanks

## Distribution System

Approximately 17 miles of distribution piping

Utilized hydraulic model to assess ability to meet

- Peak Hour Flows
- Fire Flow Demands**
  - 1000 gpm residential
  - 1500 gpm commercial

## Improvements

Water Treatment

Water Supply

Treated Water Storage

Distribution System

## Wilson Dam



## Wilson Dam

Why does the dam need to be replaced?

- Sinkhole was created when old wooden box culvert collapsed
- Recommended to replace the existing embankment, concrete lined spillway and outlet structure

## Bear Creek Diversion

What is recommended?

- Due to remote location of structure
- Recommended to add remote monitoring and control



## Regulating Reservoir



## Regulating Reservoir

What is recommended?

- **Replace outlet pipe structure**
- **Provide the ability to take water from different levels within the reservoir**

## Middle Fork Mokelumne River Intake and Pump Station

### What is wrong with the current system?

- Pump Station is located in the floodplain
- Capacity is lower than the new West Point Water Treatment Plant (WTP)

## Middle Fork Mokelumne River Intake and Pump Station

### What is recommended?

- Raise pump motor out of floodplain
- Increase capacity to 1 MGD (1.5 cfs) to meet West Point WTP capacity
- Add a SCADA system to connect the pump station to controls at the WTP



### Bummerville Storage Tank

**Why does the tank need to be replaced?**

- Old leaking redwood tank
- More cost effective than only single tank as clearwell

**What criteria was used for sizing?**

- CCWD 1997 Improvement Standards
- Sized to meet system peaking storage, part of fire flow storage and emergency storage. New Fire Flow Pump to provide remaining fire flow.

## West Point WTP Clearwell



## West Point WTP Clearwell

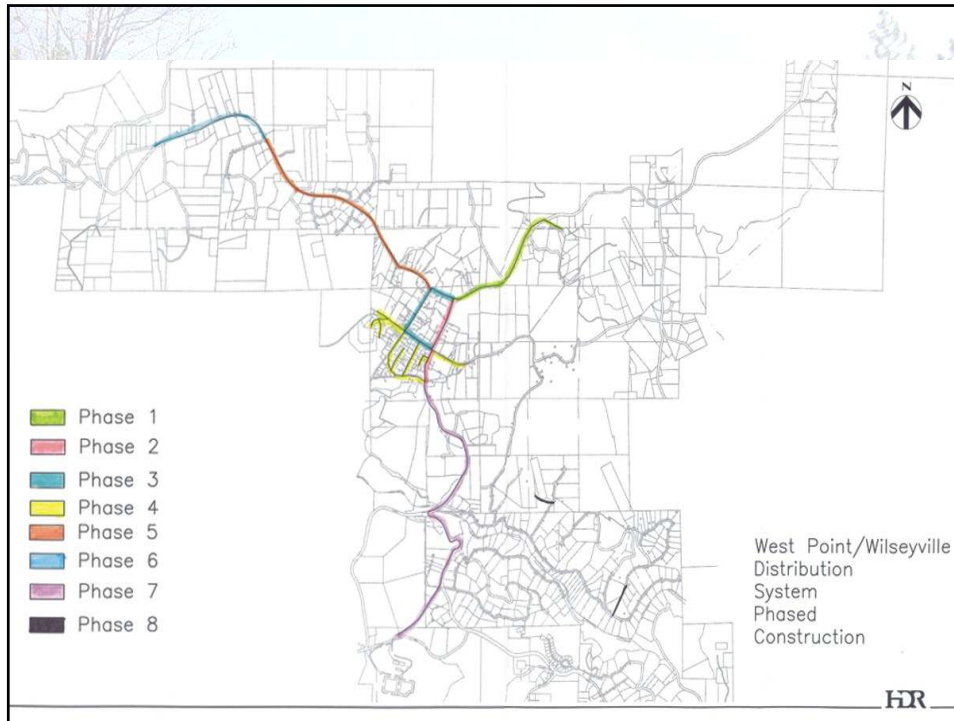
Why does the tank need to be replaced?

- Floating covers are no longer advised by Department of Health Services (DOHS)
- Inadequate capacity to meet fire flow storage requirements

What criteria was used for sizing?

- Department of Health Services (DOHS)
- CCWD 1997 Improvement Standards
- Sized to meet system peaking storage, fire flow storage and emergency storage

Calaveras County Water District  
 West Point Water Master Plan Presentation (February 2, 2005)



<i>Alternative</i>	<i>Description</i>	<i>Estimated Capital Costs</i>
<b>Bummerville Distribution System &amp; Storage Tank</b>	5500 ft - 6-inch pipe 5750 ft - 8-inch 1- 150,000 gallon tank 1-1000 gpm -Fire Flow Pump	<b>\$1,550,000</b>
<b>Mokelumne Pump Station</b>	Infiltration gallery and pump station upgrades and 10,350 feet of 8-inch pipeline	<b>\$1,262,000</b>
<b>Regulating Reservoir Improvements</b>	New intake, dual water level intakes & north perimeter diversion ditch	<b>\$107,000</b>
<b>Replacement of Wilson Dam</b>	Complete replacement of embankment and outlet pipe	<b>\$304,000</b>
<b>West Point/Wilseyville Distribution System &amp; Treated Water Storage Tanks</b>	8,600 ft - 6-inch pipe 5,200 ft - 8-inch pipe 6,500 ft - 10-inch pipe 13,800 ft - 12-inch pipe 1 -600,000 gallon tank at West Point 1-1000 gpm Fire Flow Pump	<b>\$4,800,000</b>
	<b>TOTAL PROGRAM CAPITOL COSTS</b>	<b>\$8.23 Million</b>




**West Point Water Master Plan**

Calaveras County Water District

Questions

February 2, 2005

**HDR**

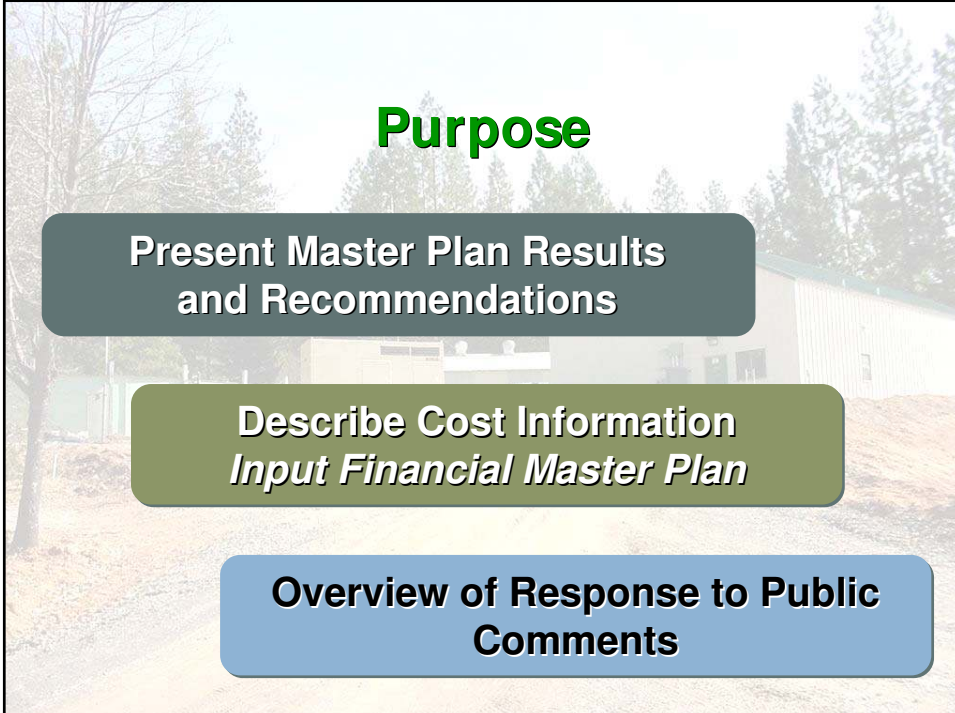



**West Point  
Water Master  
Plan**

Calaveras County  
Water District

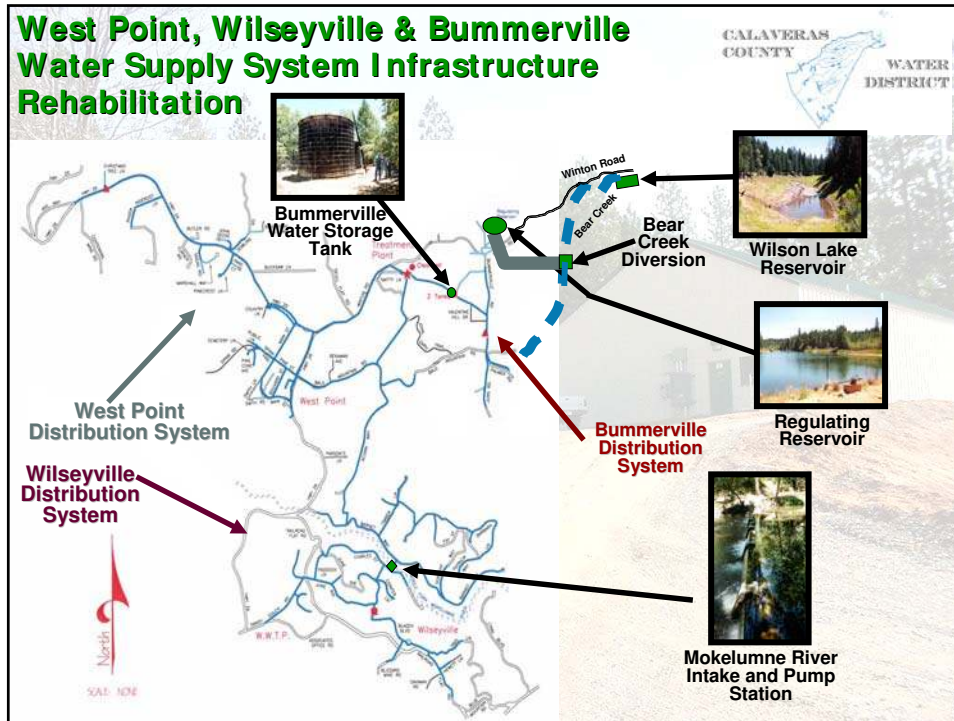
**PUBLIC  
PRESENTATION**

*April 26, 2005*



**Purpose**

- Present Master Plan Results  
and Recommendations**
- Describe Cost Information  
*Input Financial Master Plan***
- Overview of Response to Public  
Comments**



## Existing System

West Point, Wilseyville, Bummerville

540 Connections

Average Day Demand (MGD)	0.16
Maximum Day Demand (MGD)	0.31
Peak Hour Demand (MGD)	0.47

Historical ADD Demand  
290 gpd/conn.

Design Standard  
500 gpd/conn.



## Overall Demand

Increase existing demand to meet CCWD design standard in 10 year increments

Future demand based on historical growth rate of five new connections per year

Hydraulic modeling assessed ability of distribution system to meet:  
Peak Hour Flows  
Fire Flow Demands ←

## Improvements

Water Treatment ✘

Water Supply ✔

Treated Water Storage ✔

Distribution System ✔

## Wilson Dam

- Sinkhole was created when old wooden box culvert collapsed
- CCWD plans to restore the existing embankment, concrete lined spillway and outlet structure



## Bear Creek Diversion

What is recommended?

- Due to remote location of structure
- Recommended to add remote monitoring and control

## Regulating Reservoir

- Replace outlet pipe structure
- Provide the ability to take water from different levels within the reservoir



## Middle Fork Mokelumne River Intake and Pump Station

What is wrong with the current system?

- Pump Station located in the floodplain
- Capacity is lower than the new West Point Water Treatment Plant (WTP)

What is recommended?

- Raise pump motor out of floodplain
- Increase capacity to 1 MGD (1.5 cfs) to meet West Point WTP capacity
- Add SCADA System



### Bummerville Storage Tank

**Why does the tank need to be replaced?**

- Old leaking tank
- Redwood material may promote disinfection by products

**What criteria was used for sizing?**

- CCWD 1997 Improvement Standards
- Sized to meet system peaking storage and emergency storage. New Fire Flow Pump to provide fire flow.

## West Point WTP Clearwell



## West Point WTP Clearwell

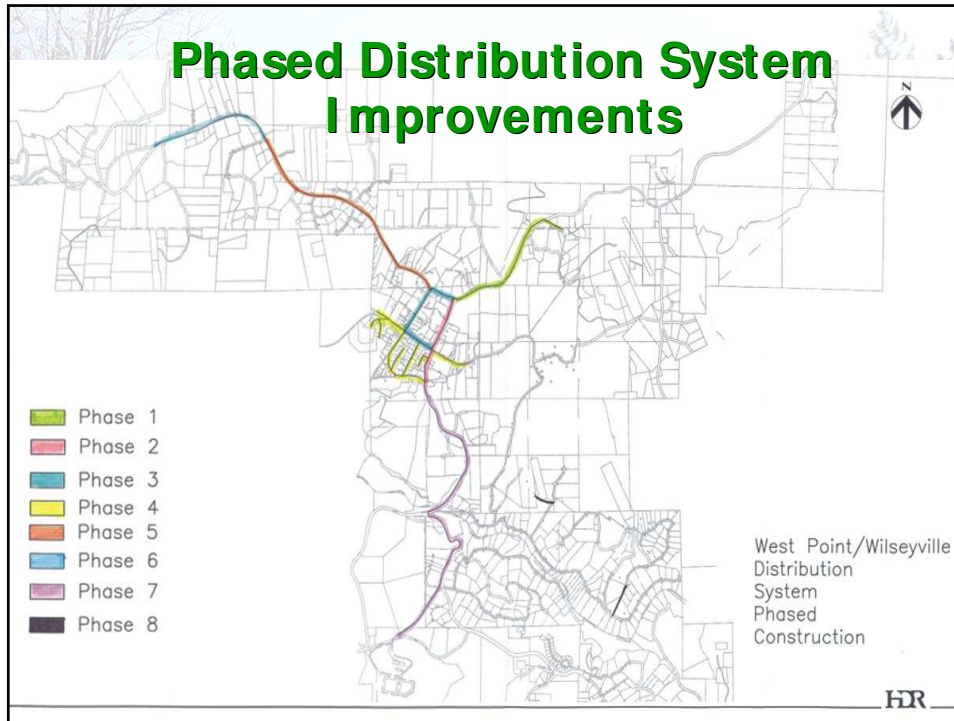
### Why does the tank need to be replaced?

- Floating covers are no longer advised by Department of Health Services (DOHS)
- Inadequate capacity to meet fire flow storage requirements

### What criteria was used for sizing?

- Department of Health Services (DOHS)
- CCWD 1997 Improvement Standards
- Sized to meet system peaking storage, fire flow storage and emergency storage

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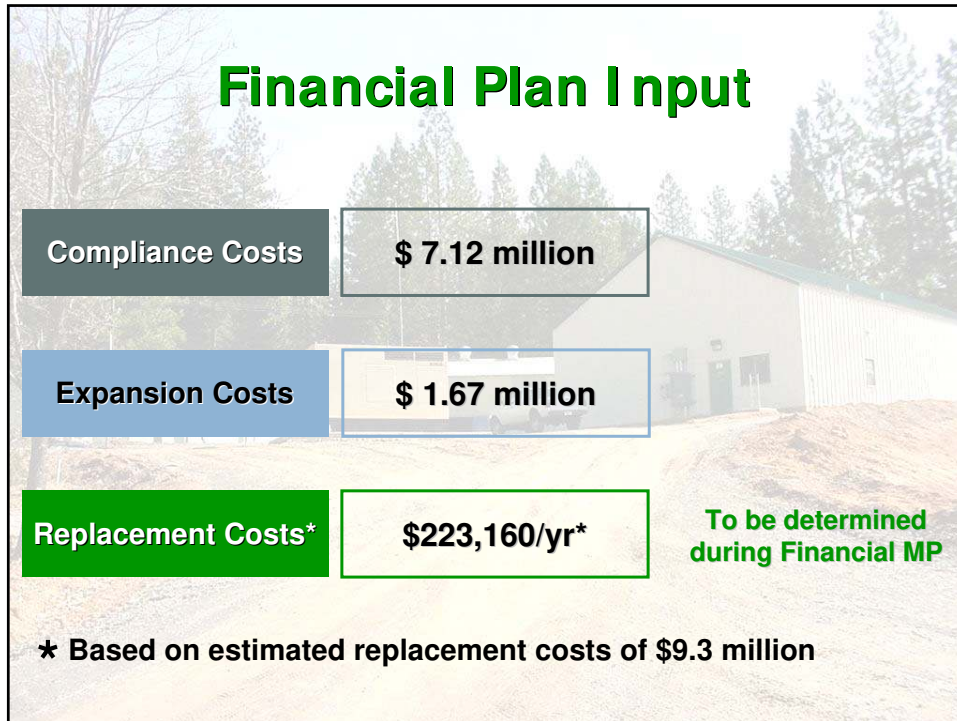
	<b>Improvements</b>	<b>Estimated Capital Costs</b>	
	<b>Bummerville Distribution System &amp; Storage Tank</b>	<b>\$1,457,000</b>	
	<b>Mokelumne Pump Station</b>	<b>\$1,262,000</b>	
	<b>Regulating Reservoir Improvements</b>	<b>\$107,000</b>	
	<b>Replacement of Wilson Dam</b>	<b>\$304,000</b>	
	<b>West Point/Wilseyville Distribution System &amp; Treated Water Storage Tanks</b>	<b>\$5,638,000</b>	
	<b>Total Improvement Costs</b>	<b>\$8.77 Million</b>	

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 West Point Water Master Plan Presentation (April 26, 2005)

<b>Phase I Improvements</b>	<b>Year 1</b>	<b>Year 2</b>	<b>Year 3</b>	<b>Year 4</b>	<b>Year 5</b>
Downtown West Point Distribution System	\$878,000	\$980,000			
Bummerville Storage Tank and Fire Flow Pump	\$492,000				
Replacement of Wilson Dam			\$304,000		
Replacement of Clearwell			\$650,000		
Upper Northwest West Point Pipelines				\$717,000	\$842,000
Bear Creek Diversion SCADA				\$95,600	
<b>Total Improvement Costs</b>	<b>\$1.37 Million</b>	<b>\$0.98 Million</b>	<b>\$0.95 Million</b>	<b>\$0.81 Million</b>	<b>\$0.84 Million</b>

**Replacement Costs**  
*Infrastructure Valuation*

	<b>Replacement Cost</b>	<b>Useful Life</b>
<b>Building</b>	<b>\$1,033,600</b>	<b>50</b>
<b>Improvements other than Buildings</b>	<b>\$7,848,800</b>	<b>50</b>
<b>Machinery &amp; Equipment</b>	<b>\$455,100</b>	<b>10</b>
<b>TOTAL</b>	<b>\$9,337,500</b>	





# Questions



## West Point Water Master Plan

Calaveras County  
Water District

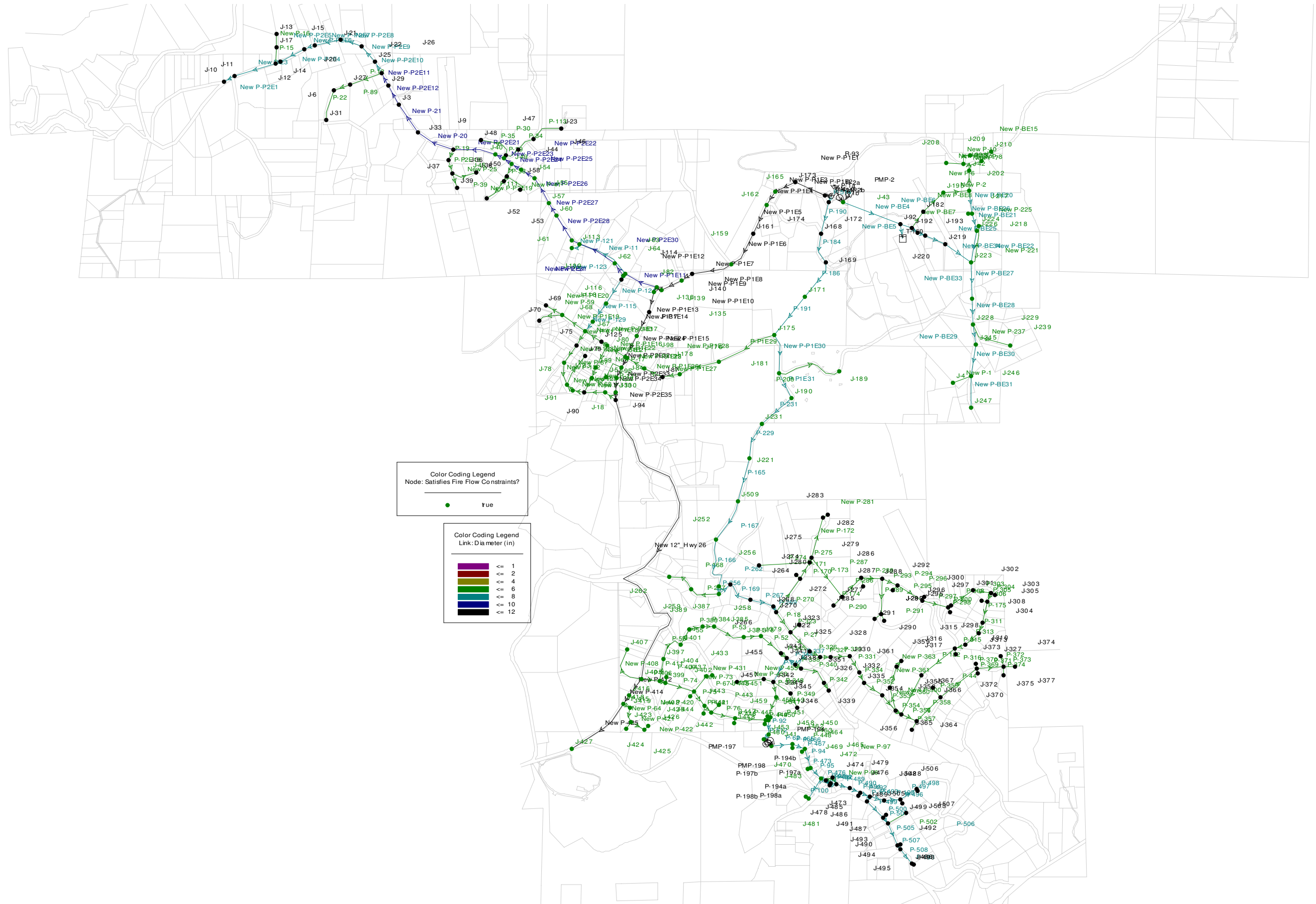
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*April 26, 2005*

**HDR**

## Appendix D. System Pipe and Node Map

# Scenario: Buildout MDD 2057 + Fire Flow - Min Sys Press + Commercial Fire Areas



Color Coding Legend  
Node: Satisfies Fire Flow Constraints?  
● true

Color Coding Legend  
Link: Diameter (in)  

Red	<= 1
Orange	<= 2
Yellow	<= 4
Green	<= 6
Blue	<= 8
Black	<= 10
Black	<= 12

### Scenario: Existing MDD 2005 + Fire Flow - Min Sys Press + Commercial Fire Areas

