ROBERTS CREEK WATER DISTRICT

MASTER PLAN UPDATE

October, 2015

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EXECUTIVE SUMMARY

0.1 GENERAL

The Roberts Creek Water District encompasses approximately 9 square miles or approximately 5,767 acres. The District's existing water supply, transmission and distribution system provides potable water to approximately 3,070 residential, industrial, commercial and institutional services. The existing population within the District boundaries is approximately 8,568. The District currently serves 24 customers outside the District.

0.2 EXISTING SYSTEM

The Roberts Creek Water District is supplied by a single water source, the South Umpqua River. An existing water treatment plant upstream of the Winston Bridge on the east bank of the river treats the raw water and pumps the treated water to the distribution system. Pipe sizes (including transmission and distribution) range from 1-inch to a maximum of 16-inches in diameter. The predominant pipe is polyvinyl chloride (PVC); but also includes steel, asbestos cement (AC), and an increasing amount of cement lined ductile iron (DI).

0.3 WATER DEMAND ESTIMATES

District Population and water demand estimates were developed for the years 2015, 2020, 2025, 2030, and 2035. The actual census population for the year 2010 was used to estimate the other years. The forecasted population and estimated water demands are summarized in **Table 0-1**.

Table 0-1 Population Forecasts and Estimated Water Demand

Year	Estimated District Population	Average Annual Day (mgd)	Maximum Month (mgd)	Maximum Day (mgd)
2013[1]	8508	1.004	1.66	**2.94**
2015	8628	1.104	2.80	**3.31**
2020	8935	1.144	3.08	**3.64**
2025	9252	1.864	3.15	**3.73**
2030	9582	2.096	3.54	**4.19**
2035	9922	2.250	3.80	**4.50**

[1] Actual flow data

The water demand estimates were prepared using the existing zoning and District boundary. Any significant changes in either the zoning or the boundary need to be

carefully assessed for their impact on the water system, especially the water treatment plant and water rights.

0.4 SYSTEM ANALYSIS

This Master Plan Update used the analysis of the District's water system completed in the 2008 Master Plan to evaluate the future improvements required for the District. A separate analysis was done to evaluate the Glengary Loop distribution system and the area that could be served without a booster station. This analysis was also used to evaluate using the existing booster pump to fill the Roberts Creek Tank to its maximum level which is approximately four feet above the overflow elevation of the other storage tanks within the District.

The water system analysis included an evaluation of pressure zones, storage requirements, pumping requirements. Through these analyses, deficiencies were identified and improvement options developed.

Recommended capital improvements were developed through the pressure zone analysis, storage analysis, treatment analysis, computerized network analysis and through the other analysis elements. Estimated project costs were developed for the recommended improvements.

0.5 RECOMMENDATIONS

It is recommended the District continue to follow the recommendations listed below:

1. Formally adopt this update as the Water System Master Plan for the Roberts Creek Water District and submit to State of Oregon Health Department Drinking Water Section.
2. Work closely with Douglas County Planning Department toward the inclusion of this Master Plan as part of the Comprehensive Plans of the Green District Unincorporated Urban Area and Shady Unincorporated Urban Area.
3. Develop and adopt a financing plan to implement the capital improvements recommended in this plan.
4. Continue to handle anticipated requests for annexation into the District on a case-by-case basis. Annexation will be reviewed to determine impact to the District.
5. Work closely with the Douglas County Planning Department to monitor zone change requests that may have an impact on the saturation density used for this plan.
6. Work closely with the Douglas County Industrial Board to determine if additional water rights or a special allocation of Galesville water may be available if the industrial water needs increase within the District.
7. Monitor the actual water use and growth rate to determine how closely it corresponds to the projections used for this master plan.

8. Test the water treatment plant at design flows and develop summer and winter control settings that can be quickly changed to develop more or less water treatment capacity.
9. Review and update this plan within five years to accommodate current conditions that may alter this plan or its recommendations.

Additional recommendations from the 2008 Master Plan Update:

1. Continue monitoring plant production versus billed consumption to identify issues with unaccounted-for water.
2. Continue to work with MAP Engineering on the intake & raw water piping upgrades.
3. Continue to work with MAP Engineering on the Main Tank valving and bypass upgrades.
4. Develop a plan to implement Capital Improvement Plan projects. Of particular note:
    a. Roberts Creek Road piping to allow the Roberts Creek Tank to stay full to maintain adequate pressure in the system.
    b. Develop a plan to meet District storage needs
5. Continue planning to upgrade the existing plant to meet future demands and treatment requirements.

1.0 INTRODUCTION

1.1 AUTHORIZATION

The firm of MAP Engineering, Inc. was authorized by the Roberts Creek Water District to prepare this update to the 2008 Water System Master Plan prepared by MAP Engineering, Inc.

1.2 PURPOSE

The purpose of this master plan is to update the previous comprehensive Master Plan. The necessity of this update was dictated by a number of important factors:

- The Green District had witnessed a growth much higher than that anticipated by Douglas County's during the period covered by the 2008 Master Plan but the trend was reversed during the last 5 years. Population estimates needed to be checked against previous forecasts, and adjusted as necessary.
- The District has significantly upgraded its treatment facilities.

1.3 COMPLIANCE

This plan complies with water system master planning requirements established under OAR Section 333-061-0060(5).

1.4 SCOPE

The scope of work for this plan includes the following:

- Review of the District's current and future service area
- Review and update population estimates and projections
- Review and update water demand and projected water usage
- Review and update District storage requirements based on revised population projections and fire code requirements
- Review and discuss any pertinent amendments to the Safe Drinking Water Act of 1974 as amended in 1986 and 1996.
- Review and discuss state regulatory requirements
- Review and evaluate water conservation strategies and plans
- Inventory District's water rights and describe intake facility
- Inventory and model District's distribution system
- Identify alternatives for correcting deficiencies in the water source, treatment, storage, and distribution systems.
- Identify Capital Improvement Plan projects

2.0 EXISTING WATER SYSTEM

2.1 GENERAL

This section describes the Roberts Creek Water District's existing water system. This section includes a discussion of supply and transmission facilities, storage reservoirs, service levels, distribution system piping, telemetry, and service connections.

The Roberts Creek Water District's existing water supply, transmission and distribution system provides potable water to approximately 2,955 residential, industrial, commercial and institutional services. The existing population within the District boundaries is approximately 8,508 as of 2014.

2.2 BACKGROUND AND STUDY AREA LIMITS

The first treatment plant, distribution system, and storage reservoir were constructed in 1949. In 1973, a new 2.5 million gallon per day (mgd) plant was constructed adjacent to the original treatment plant and the original plant was then abandoned. In 1994, the treatment plant was expanded to theoretically provide 3.42 mgd of treated water for the Roberts Creek Water District. A subsequent analysis, however, showed that the maximum plant output is closer to 2.6 mgd. The treatment plant was upgraded in 2013 to provide 3.4 million gallons per day of treatment that meets the current treatment standards for cryptosporidium and giardia.

The Study Area Limits are essentially the Roberts Creek Water District Boundary although a small number of customers from outside the District Boundary are presently served by the system. A map illustrating the District Boundary is shown in Figure 2-1.

2.3 SUPPLY

The District draws water from the South Umpqua River under their existing water rights and then filters and disinfects the water prior to pumping it into the distribution system. The District currently has water rights for 4.81 cubic feet per second (cfs) or approximately 3.1 million gallons per day (mgd). The water rights are shown in Table 2-1.

Table 2-1 Water Rights Summary

Certificate No.	Priority Year	Quantity	
		CFS	MGD
24522	1948	0.67	0.433
79549	1952	0.144	0.093
64885	1973	4.00	2.585
Totals		**4.814**	**3.111**

In addition to their water rights the District has 750 acre-feet (244 million gallons) reserved through the Lookingglass-Ollala W.C. D. (Berry Creek). The District pays an

annual reservation fee of $2,175 and would pay $64 for each acre-foot used (325,800 gallons).

2.4 TRANSMISSION

The main transmission piping in the Roberts Creek Water District system is from the Water Treatment Plant to the main storage reservoir. This line consists of approximately 1,865 feet of 14-inch AC. A new 16-inch DI line was added to allow the existing 14-inch AC to be maintained. Other pipes in the system over 8-inches in diameter are considered to be transmission mains. **Table 2-2** is a summary of the transmission piping in the existing system.

Table 2-2 Transmission Mains

Size (inches)	AC (lineal feet)	PVC (lineal feet)	DI (lineal feet)	Total (lineal feet)
10	19,670	9,578	1,518	30,766
12	8,888	42,924	9,313	61,125
14	1,238	0	0	1,238
16	0	0	1,531	1,531
Total	29,796	52,502	12,362	94,660

2.5 STORAGE RESERVOIRS

There are three storage reservoirs in the District's distribution system. A summary of the District's storage reservoirs is presented in **Table 2-3**.

Table 2-3 Storage Reservoir Summary

Reservoir Name	Nominal Capacity (million gal)	Floor Elevation (ft)	Overflow Elevation (ft)	Height (ft)	Reservoir Type
Main Tank	2.0	779	811	32	Concrete
Roberts Creek Tank	0.25	783	815	32	Welded Steel
Speedway Tank	1.5	788	811	23	Concrete
Total Storage	3.75				

2.6 PUMPING STATIONS

Water Treatment Plant

The water treated at the Water Treatment Plant is pumped by two 1,100 gpm pumps up to the main reservoir, with one additional pump in reserve.

Glengary Loop Pump Station

The 1999 Roberts Creek Water District Water Master Plan called for a new water storage tank in the Glengary Loop area of the District. The tank needed to be at a higher level than the main District service level. Specifically, a higher service elevation was needed to increase low water pressure in this area and to provide adequate fire flows. A small water booster station would also have been required to raise the water up to the new higher service level.

When the District tried to secure property for the new tank site, they were unable to reach a suitable agreement with the property owners. The high cost of the property made the new tank prohibitively expensive. It was decided to look at a different alternative that would eliminate the need for the additional storage tank while increasing the working pressure in the area and providing adequate fire flows.

Currently, the pump station is not in operation and the booster pumps have been moved to the Highlands pump station. The only pump still at the pump station is the fire booster pump. The District is considering piping changes to allow the existing pump to fill the Roberts Mountain Tank to its full capacity to increase the pressure in the Glengary Loop service area.

Tipton Road Intertie

The Tipton Road pumping station provides an emergency water supply from the City of Roseburg to the Roberts Creek Water District. The pumping station has a design capacity of 840 gpm. A summary of the pump stations is shown in **Table 2-4**.

Highlands Pump Station

A booster station was constructed at The Highlands near Kelly's Corner to serve that development.

A summary of the pump stations is shown in **Table 2-4**.

Table 2-4 Pump Station Summary

Pump Description	Pump Type	Capacity (gpm)	TDH (Total Dynamic Head)	Horsepower
Main Pump Station 1	Vertical Turbine	1,200	320	125
Main Pump Station 2	Vertical Turbine	1,200	320	125
Main Pump Station 3	Vertical Turbine	1,200	320	125
Glengary Pump	Fire Pump	1100	165	75
Highlands Domestic 1	Turbine	17-110	115	5
Highlands Domestic 2	Turbine	17-110	115	5
Highlands Fire Pump	Fire Pump	1200	127	50
Shady Road	Centrifugal	700	381	100
Tipton Road	Centrifugal	140	381	20

2.7 PRESSURE ZONES

The District's primary pressure zone (or service level) at the present time is at an elevation of 686 feet. Some areas in the District are too high to be served by this service elevation and will require either local booster stations or a tank(s) set at a higher level. Most of the areas are too small and isolated to make a higher service level practical and should be served with booster stations, if service is required.

Highlands Pressure Zone

This pump station is designed to increase pressure to the Highlands area by approximately 55 psi. Thus, the Highlands area has an effective service elevation of approximately 810 feet.

2.8 DISTRIBUTION SYSTEM

The distribution system consists of approximately 190,000 lineal feet of water mains. The pipe sizes range from 1-inch to a maximum of 8-inches in diameter. The predominant pipe of choice is PVC for most new installations. The old steel and even some newer AC lines are being replaced each year. The water lines to be replaced are prioritized based on their condition and size. A summary of the pipe in the current distribution system is shown in **Table 2-5**.

Table 2-5 Distribution Pipe Summary

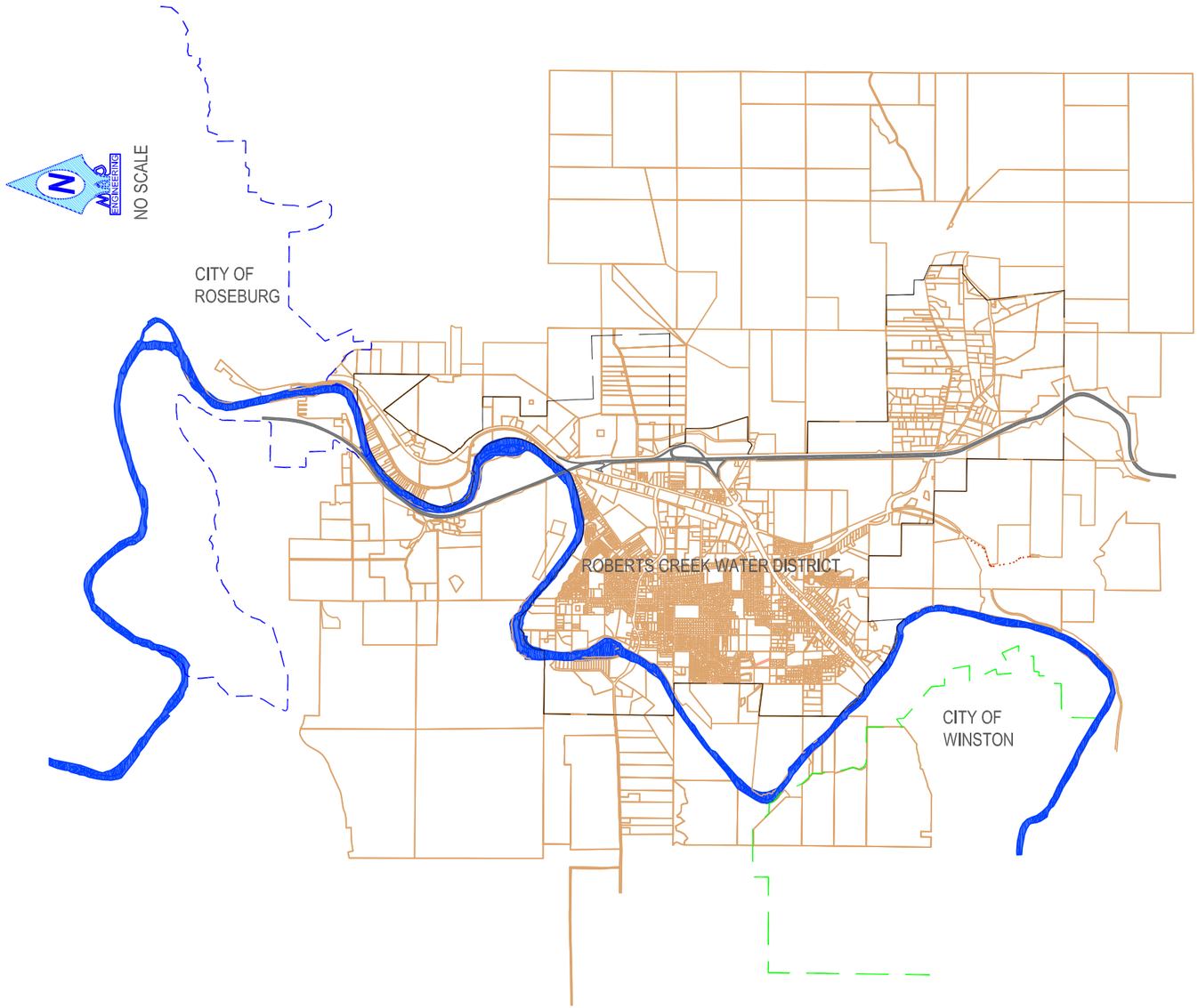
Size (inches)	Steel (lineal feet)	AC (lineal feet)	PVC (lineal feet)	DI (lineal feet)	Total
1	1,251	0	0	0	1,251
2	3,474	0	2,055	0	5,529
3	0	0	999	0	999
4	3,852	3,054	4,489	0	11,395
6	2,900	16,193	47,400	0	66,493
8	152	46,274	57,012	1,299	104,737
TOTALS	**11,629**	**65,521**	**111,955**	**1,299**	**190,404**

2.9 TELEMETRY AND SUPERVISORY CONTROL SYSTEM

The District has a telemetry system that consists of a central control panel at the Water Treatment Plant (WTP) and remote telemetry units located at all storage reservoirs and pump stations. The system can be accessed at a computer workstation in the Water Treatment Plant. Functions include water system monitoring, with manual and automatic control of certain facilities and operations from the WTP. The telemetry system also collects and stores system status and performance data.

2.10 SERVICE CONNECTIONS

The District currently provides service through approximately 3,070 services. Approximately two thousand nine hundred and eighty are standard 5/8 x 3/4 inch service connections to primarily single family residential development. The remaining services consist of twenty-three 1-inch service connections, twenty 1 1/2-inch service connections, twenty-five 2-inch service connections, two 3-inch connections, four 4-inch connections, and one 8-inch connection.



DISTRICT BOUNDARY
FIGURE 2-1

MAP Engineering, Inc.

PROJECT NO. 1471-45

3.0 Estimated Water Requirement and Planning Criteria

3.1 GENERAL

This section presents the planning criteria used in the analysis of the District's water treatment plant, transmission system, distribution system, storage reservoirs and pump stations. These criteria will be used to evaluate system performance and to determine existing deficiencies. Additionally, these criteria will be used to determine any necessary system expansion.

This section also presents revised population and water demand forecasts developed from Douglas County Planning Department data. Water needs for emergency fire suppression are also presented. These needs include service pressure criteria and system storage capacity.

3.2 SERVICE AREA

The Roberts Creek Water District is generally bounded on the north by the City of Roseburg, on the west by the South Umpqua River, on the south by Roberts Mountain and on the east by Roberts Creek. The District encompasses approximately 9 square miles or approximately 5,767 acres. The District also serves approximately 24 customers outside the District.

3.3 LAND USE

Land uses and zoning within the District are established under Douglas County's Green Urban Unincorporated Area. This land use plan is the basis for development of anticipated ultimate (saturation) development population; and, by application of per capita flow estimates, the development of estimated future water requirements. Existing land uses include residential, commercial and industrial designations. The District also includes schools, churches, parks, open spaces and vacant land.

3.4 PLANNING PERIOD

The planning period for this master plan update is 20 years, or to the year 2035. The planning period for transmission and distribution facilities is to saturation or complete development of the District. This assumption allows a determination of the ultimate size of facilities.

It is important to note that saturation does not necessarily represent ultimate population limits. Saturation assumes zoning and the district remain static for the planning period. Changes to county zoning designations and/or a change to the District boundary would change the saturation number utilized in this study.

3.5 POPULATION FORECASTS AND ESTIMATED WATER DEMANDS

Existing Population

The District's 1998 population was approximately 7,693 people based on updated estimates provided by the Douglas County Planning Department for the Green District. Additional population was estimated for the Shady and Glengary Loop areas, which are outside the Green District, but within the existing District boundary.

Population Forecast

The 2015 Roberts Creek Water District Master Plan utilized data provided by the Douglas County Planning Department to estimate population. Subsequent updates have been made to the County's estimates; specifically, updates to the Green Comprehensive Plan have resulted in adjustments to the population estimates of the previous Master Plan.

This Master Plan Update utilizes the Green Comprehensive Plan in conjunction with updated Census data to predict the population served by the District more accurately. A summary of previous population predictions with updated predictions is provided in **Table 3-1**.

Table 3-1 Population Estimate Correction

Year	County Population	RCWD Pop. (From 2008 Master Plan)	RCWD Pop. Revised Estimate	Notes
2010	107667	8072		
2015	109435	9103	8628	
2020	113327	10244	8935	
2025	117357	11518	9252	Saturation is
2030	121530		9582	approximately
2035	125852		9922	10,244

Population Forecasts

The growth rate estimates show the Green Census Designated Place's growth rate approached 2.5%in the early 2000's. The recent economic downturn has returned the area to a much lower growth rate. For the study period it is assumed that the growth rate remains more or less constant at the lower rate.

The following chart shows the estimated population growth over the study period.

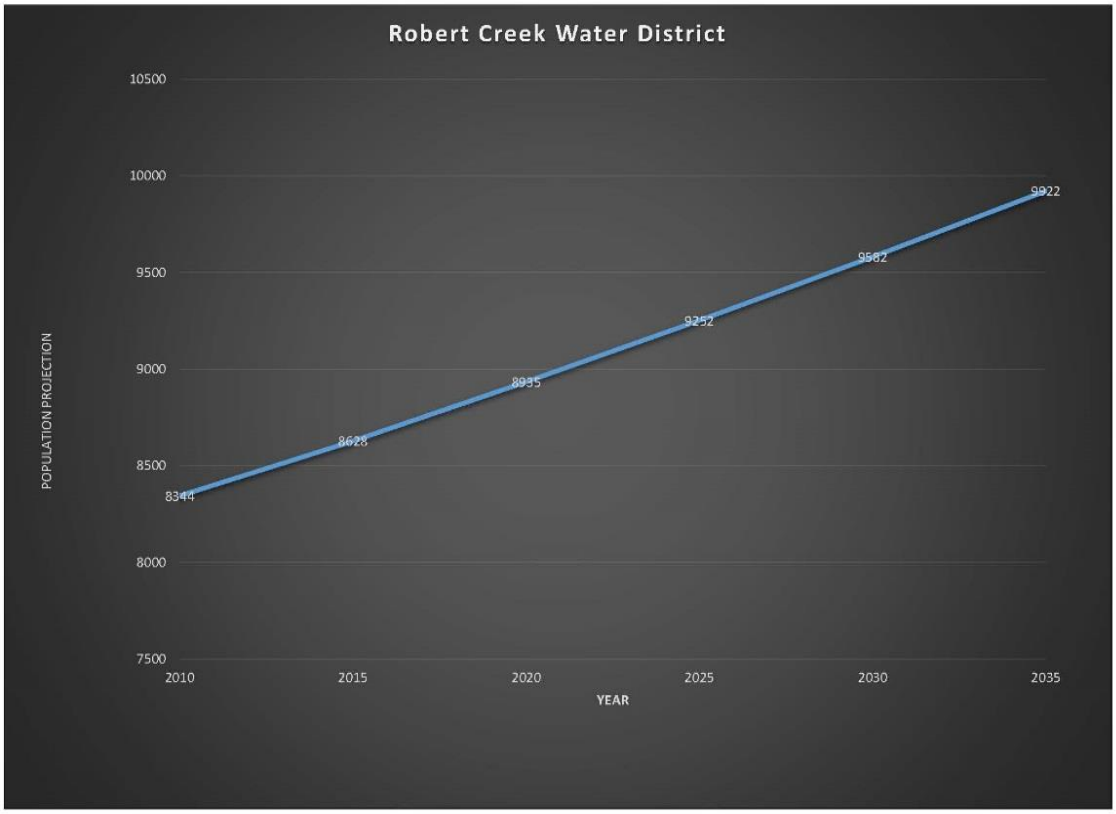


Figure 3-1 Population Estimate Chart

Existing Water Demands

The District collects and maintains water usage data on a monthly basis. The District's budget year (also water year) begins July 1 and runs through June 30 of the following year. Based on this information, the District's existing average demand (as of January 2013) is approximately 1.20 million gallons per day (mgd). **Table 3-2** shows the existing water demand over the past 5 years. The table also shows the ratio of average daily demand to the peak month and peak day demand.

The maximum daily demand witnessed during the five year period is 389 gpcpd. The average annual demand is approximately 130 gpcpd. The average annual demand has gone down over the past few years from a high of 182 gpcpd to the current level.

Table 3-2 Existing Water Demand

Year	Note	District Population	Average Annual Day mgd	Maximum Month mgd	Maximum Day mgd	Ratio to Average Annual Demand Max Month	Ratio to Average Annual Demand Max Day	Per Capita Demand Avg Annual gpcpd	Per Capita Demand Max Monthly gpcpd	Per Capita Demand Max Daily gpcpd
2009		8286	1.17	2.07	**2.84**	1.77	2.43	141	250	343
2010		8344	1.00	1.99	**2.93**	1.99	2.93	120	238	351
2011		8396	0.94	1.59	**2.29**	1.69	2.44	112	189	273
2012		8449	1.09	1.74	**3.29**	1.60	3.02	129	206	389
2013		8508	1.12	1.89	**2.36**	1.70	2.12	131	222	277

Water Demand Estimates

Using the District's existing water consumption data and the population forecasts, water demands were developed to the year 2035 and at saturation development. This estimate is based on the current zoning and the current District boundary. If any major changes are made to the zoning, District boundary, or to the types of water users, then these figures should be revised accordingly.

For the purposes of this master plan, estimated average water and maximum day water usage are assumed to remain constant at 130 gpcpd and 389 gpcpd, respectively. Estimated water demands are summarized in **Table 3-3**.

Table 3-3 Estimated Water Demand

Year	District Population	Average Annual Day mgd	Maximum Month mgd	Maximum Day mgd
2015	8,628	1.122	1.73	**3.36**
2020	8,935	1.162	1.79	**3.48**
2025	9,252	1.203	1.85	**3.60**
2030	9,582	1.246	1.92	**3.73**
2035	9,922	1.290	1.98	**3.86**

3.6 UNACCOUNTED-FOR WATER

Unaccounted-for water is water that leaves the system unmetered or undermetered. This includes uses such as firefighting, main flushing, construction, line breaks and leaks, unmetered usage, improperly registering meters, and possible unauthorized or unrecorded connections to the system.

Table 3-4 shows unaccounted-for water from 2009 through 2013.

Table 3-4 Unaccounted-for Water

Year	Metered Usage (gal)	Plant Production (gal)	Unaccounted-for Water
2009	343,111,189	426,945,704	20%
2010	317,025,510	366,360,235	13%
2011	321,952,843	344,345,156	7%
2012	336,750,408	396,095,176	15%
2013	391,539,450	435,307,182	10%

It appears that unaccounted-for water has decreased slightly since the levels witnessed in 2009. The rest of the numbers are at or below the 15% threshold. It would be prudent to closely monitor water production versus billed amounts over the next few years to see if the unaccounted-for water is stays below 15%. As old leaking lines continue to be upgraded the water losses should decrease.

3.7 PLANNING AND ANALYSIS CRITERIA

Supply and Distribution System

The water supply and distribution system must be capable of supplying the necessary quantity of water to any given location under several varying conditions. These conditions are:

1. The distribution system must be capable of supplying the peak hourly demand while maintaining minimum service pressures.
2. The distribution system must be capable of providing the required fire flow to a given location while simultaneously supplying the maximum daily demand. The minimum allowable service pressure at any meter in the pressure zone is 20 pounds per square inch (psi). Reservoirs are assumed to be at minimum levels for this condition.
3. The distribution piping must be capable of refilling the reservoirs during periods of low demand. Pipelines between pump stations and storage reservoirs must be adequately sized to limit friction losses and to avoid excessive pressures in the lower elevations of a service level while pumps are operating. Pumping station discharge pressures should not exceed 125 psi unless a separate pipeline is used for water service.

Water mains should normally be at least 8 inches in diameter to supply minimum fire flows. In special cases, 6-inch, 4-inch or even 2-inch diameter mains are acceptable; *e.g.,* if no fire hydrant connection is required, there are limited services on the main, the main is dead-ended, and looping or future extension of the main is not anticipated.

Service Pressure Criteria

Water distribution systems are separated into pressure zones (otherwise known as service levels) to provide service pressures within an acceptable range. Generally, 100 psi is considered the desirable upper pressure limit and 40 psi the lower limit.

Conformance to this pressure range may not always be possible due to topographical conditions, existing or practical system configurations and economic considerations. Ideally, the system should be able to maintain the minimum pressure to all locations under normal operating conditions. Under conditions where firefighting demands are imposed on the system, minimum system pressures to all locations should not be less than 20 psi at the meter, the minimum system pressure required by the Oregon State Health Division.

Storage

Water storage facilities should be provided in each service zone except in special limited cases where direct pumping can be justified. Storage facilities are provided for three purposes: equalization storage, fire storage and emergency storage. The total storage should be the sum of all three of these elements. One standard method used to determine the overall storage requirements for a system is to use three days of average demand plus fire flow. Three days of average demand would be approximately 3.6 million gallons by 2025 (1.20 mg x 3; **Table 3-3**). The maximum fire flow within the District would be a Heavy Industrial fire (**Table 3-6**), which translates to approximately 1.0 million gallons (4500 gpm x 4 hrs). This method would require a total storage volume of approximately 4.6 million gallons by the year 2025.

Pumping

Pumping station capacities should be adequate to supply the maximum daily demand to the service area of the pumping station. Since mechanical equipment is subject to failure, each station should have redundant capacity to allow the largest pump to be out of service and still meet the requirements.

Direct pumping stations (hydropneumatic systems or continuiously operating pumps without storage) are sometimes used to supply small residential areas of 30 to 50 homes. Separate fire pumps can provide fire flow to these areas. These systems should be considered only for small areas where a conventional gravity storage supply system is not practical. These systems are also used as an interim system until a conventional reservoir system can be provided.

Standby power is not normally necessary for pump stations serving a reservoir but is considered essential for stations supplying water by direct pumping.

Water Treatment Plant

The water treatment plant upgrade project was finished in early 2013. The plant can currently produce 3.2 million gallons of treated water per day. The plant is limited by the number of membranes installed. It can produce up to 4 million gallons per day by installing all of the membranes in the first two cells. The rest of the treatment train is sized to produce 4 million gallons per day. The current number of membranes installed closely matches the District's water rights.

The plant has 2 addition cells that can be filled with membranes to add an additional 4 million gallons of future capacity. The piping into and leaving the plant is sized to provide a total treatment capacity of 8 million gallons. Addition UV disinfection units and a larger chlorine contact chamber would also be required to provide disinfection for the increased plant capacity. It is not anticipated that the District will need any addition treatment capacity unless a major industrial user were to build in the District.

The rated capacities of the major treatment plant components are listed in **Table 3-5**.

Table 3-5 Treatment Plant Component Capacities

Component	Design Flow		Maximum Flow	Actual Daily Flow
	gpm/module	gpm		
Membranes	5.2	2,400	3,456,000	3,200,000[1]
Sedimentation Basin		3,600	5,184,000	3,456,000[2]
Influent Pump		1,200	5,184,000	3,456,000[2]
Treated Water Pumps		1,200	5,184,000	3,456,000[2]

1 – With standard backwash and clean cycles
2 - With 2 pumps running and 1 in reserve.

Fire Flow Requirements

In addition to the District's water system providing water for domestic, commercial, and industrial uses, it must also provide for emergency fire flow. The fire flow requirement is the amount of water required on an emergency basis for fire suppression. Fire flow requirements are concentrated in a specific area and are generally much greater in magnitude than the maximum day demand within that area. For planning purposes, the values in **Table 3-6** were used to determine the hydraulic capacity of the pipelines and for calculating storage requirements. Specific fire flow requirements within the District should be determined by Fire District #2 based on building type, use, and whether or not it has a sprinkler system.

If a more precise fire flow calculation is required, the 2014 Oregon Fire Code Appendix B should be referenced. In any case, fire flow requirements should be cross-checked against Appendix B to ensure sufficient reservoir sizing.

Table 3-6

Fire Flow Requirements

Land Use Designation	Fire Flow Requirements (gpm)	Duration (hours)
Agricultural	1,000	2
Community Commercial	3,000	3
General Commercial	3,000	3
Limited Commercial	2,000	2
Tourist Commercial	2,000	2
Farm Grazing	1,000	2
Farm (Cropland)	1,000	2
Farm Forest	1,000	2
Rural Community Industrial	3,000	3
Light Industrial	3,000	3
Medium Industrial	4,500	4
Heavy Industrial	4,500	4
Public Reserve	2,000	2
Single Family Residential	1,000	2
Multifamily Residential	2,000	2
Suburban Residential	1,000	2
Rural Residential	1,000	2
Service Center Commercial	2,000	2

Table 3-7

Fire Flow Requirements from 2014 Oregon Fire Code[a]

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

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

b. Measured at 20 psi.

4.0 WATER SYSTEM ANALYSIS

4.1 GENERAL

This section presents an analysis of the District's water system based on the criteria developed in Section 3. Evaluation of pressure zones, storage requirements, and pumping requirements were included in the analysis based on the population forecasts. The analysis was performed using a computerized hydraulic network analysis of the water distribution system to aid in identifying deficiencies and test improvement options.

4.2 WATER DEMAND FORECASTS

The water demand forecast in Section 3 was for the entire District. Separate forecasts are required for individual pressure zones to ensure that these areas have adequate distribution and storage facilities. The 1999 Master Plan identified Glengary Loop as one such area. The Glengary Loop area is being improved to handle current and future population demands. A summary of this area's demand is provided in **Table 4-1**.

Table 4-1 Glengary Loop Water Demand Forecast

Year	Estimated Population	Average Day (gpd)	Maximum Month (gpd)	Maximum Day (gpd)
2015	468	60,840	102,960	182,052
2020	485	63,050	106,700	188,665
2025	502	65,260	110,440	195,278
2030	520	67,600	114,400	202,280
2035	538	69,940	118,360	209282
Saturation	586	76,570	128,920	227,954

4.3 STORAGE VOLUME ANALYSIS

See section 3.7 for storage analysis and recommendations.

4.4 PUMPING REQUIREMENTS AND PUMP STATION IMPROVEMENTS

No pump station improvements have been identified in this Master Plan Update. Although, relocating the intertie with Roseburg is a possible future improvement.

4.5 COMPUTERIZED HYDRAULIC NETWORK ANALYSIS MODEL

General

A hydraulic network analysis computer program was used to evaluate performance of the existing distribution system and to aid in the development of proposed system improvements. The system was modeled using WaterCAD software to simulate operation of the existing water system and to evaluate proposed changes.

The principal objective of a network analysis is to determine the adequacy of the existing water distribution system facilities. Based on the computer model, network analyses can be used to identify the causes of deficiencies in the system and to develop the most cost-effective improvements.

Hydraulic Model

A map of the District's existing water distribution system was drawn onto a tax lot map provided by Douglas County. This information was then transferred into WaterCAD® and used to run the system analyses.

Model Calibration

It is essential that the computer model be calibrated with field conditions in order to provide accurate results under test conditions. Model calibration was performed using existing average day demand dispersed over the existing distribution system. Fire flow data from hydrant tests performed by Fire District #2 were then used to compare the results obtained from the modeled flows.

Model Configuration

The computer analysis was performed with both pressure zones in operation. Required fire flows at point locations were simulated for corresponding land use designations and flow amounts presented in **Table 3-6**.

Fire flow modeling was performed assuming all system reservoirs were operating approximately 11 feet (approximately 1/3) below reservoir overflow elevation. A minimum system pressure of 20 psi had to be maintained at all services during the fire flow modeling in order for the system to satisfy the fire flow requirements.

Findings

Detailed System Map

Figures 4-1 through 4-5 illustrate the existing water system as well as the proposed improvements. The proposed improvements include piping, pump station(s) and storage reservoirs.

Transmission System

As noted in the 2008 Master Plan, the District's existing water supply system has been looped very effectively. For the purpose of this report, any pipe size in excess of 8-inches was considered a part of the transmission system. The District has effectively anticipated growth areas, therefore the transmission system will not require many changes, only additional piping to continue the major loops that have already been started. Those additional pipelines are shown in red on the System Plan.

Fire Flow Modeling

The existing piping system is capable of providing the required fire flows in most areas with the exception of a portion of the Glengary Loop area. The Glengary pump station is sized adequately for providing fire flow to the area but is not presently in use due to old piping in the system. This area should therefore be a priority of the District's Capital Improvement Plan.

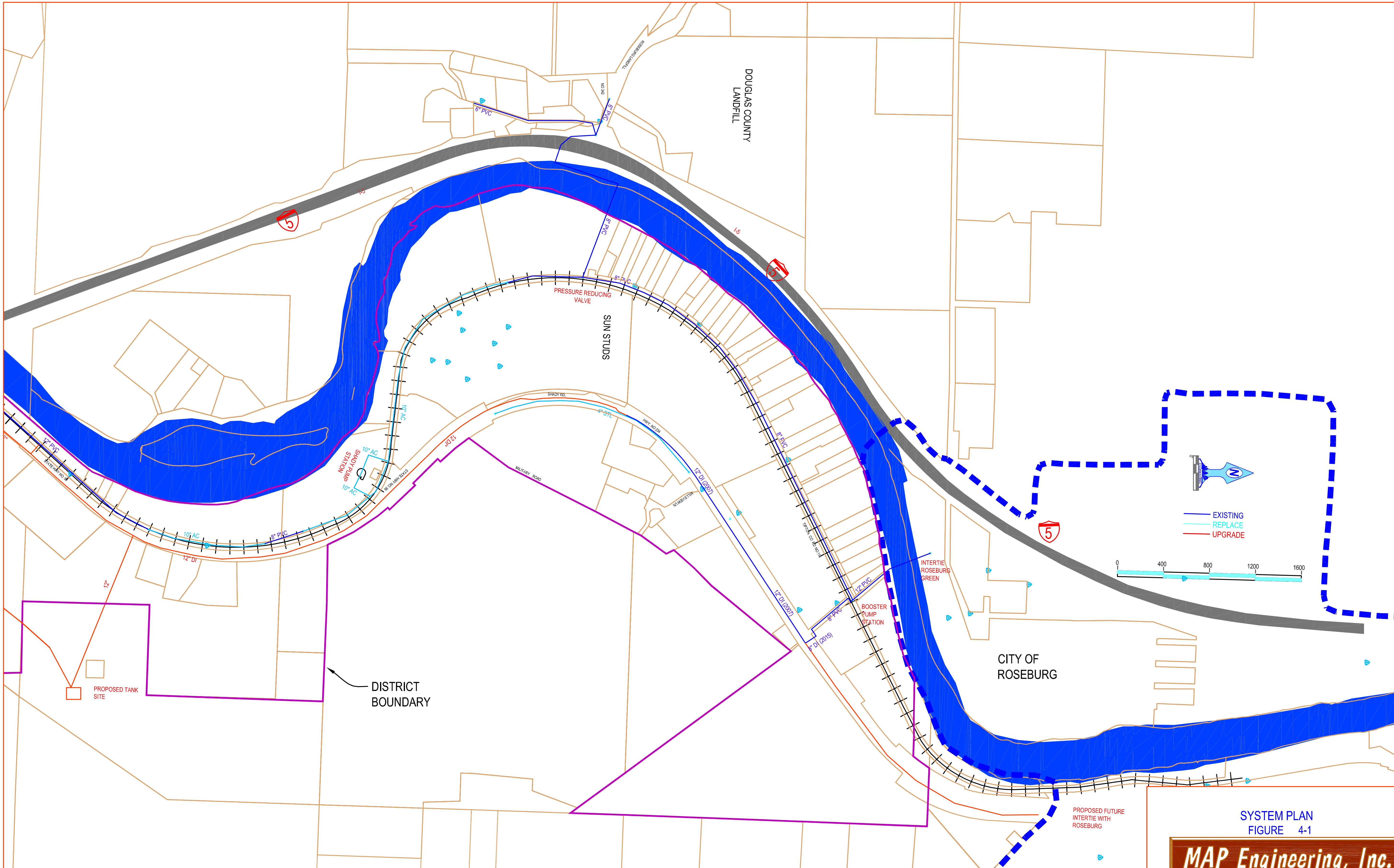
Distribution System

As stated in the 2008 Master Plan, the District's existing water distribution is capable of handling the future system flows. This update continues to identify areas for improvement. The existing steel lines continue to be an area of improvement, as they are generally undersized, prone to leaking and deterioration. These lines have also been identified on the updated System Plan.

4.6 RECOMMENDED SYSTEM PLAN

A recommended system plan was developed through system evaluation, hydraulic analysis, and the network analysis of the water system. System improvements discussed in this section are illustrated on the System Plan, Figures 4-1 through 4-5. The System Plan illustrates recommended improvements to serve the study area through the year 2035 or saturation development as noted.

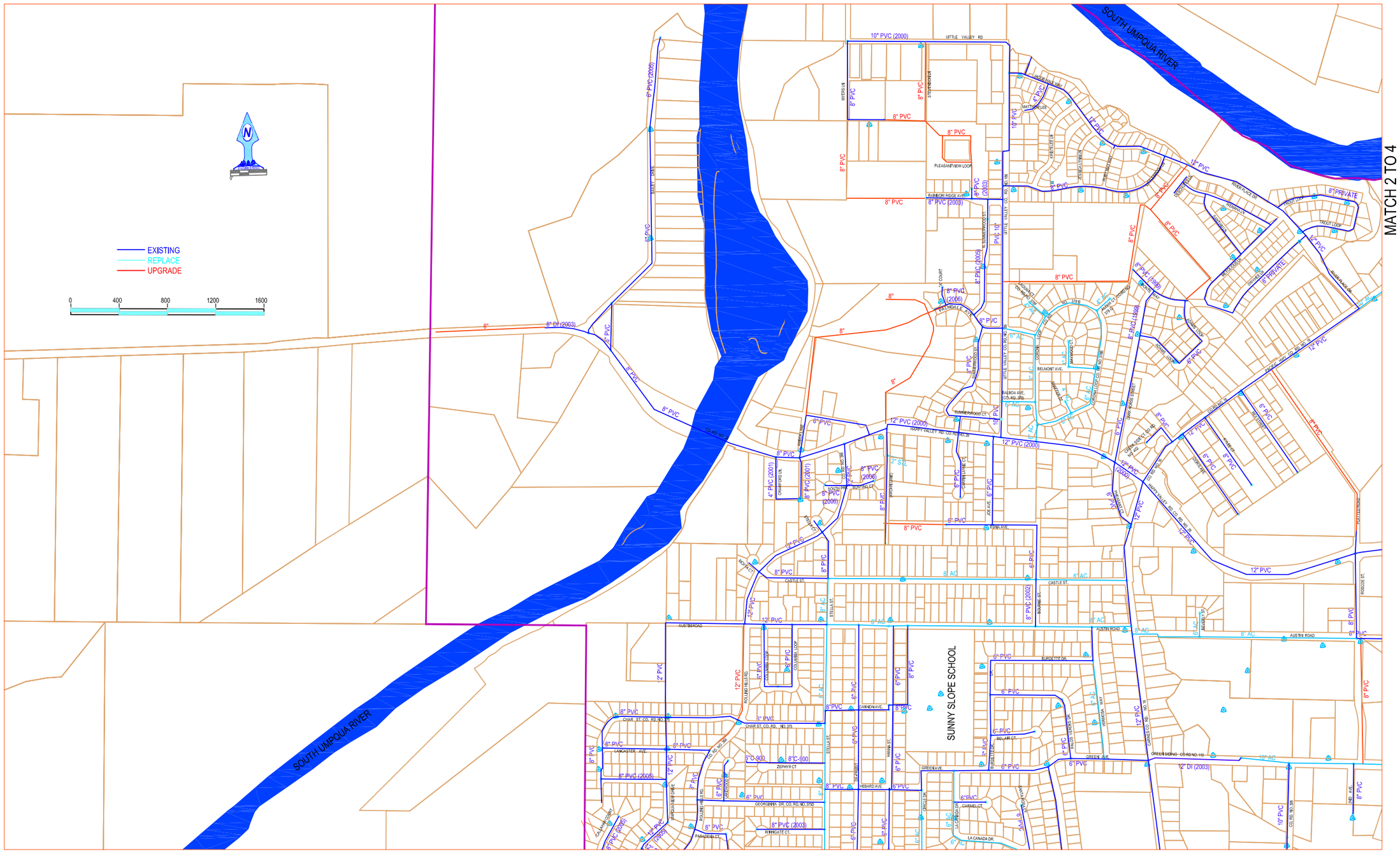
A preliminary map review of the proposed water main alignments illustrated on the System Plan was completed with assistance from the District as part of this study. Proposed water mains shown in undeveloped areas may require refinement to meet the needs of the development and topography.



SYSTEM PLAN
FIGURE 4-1

MAP Engineering, Inc.

PROJECT NO. 1471-45



SYSTEM PLAN
FIGURE 4-2

MAP Engineering, Inc.

PROJECT NO. 1471-45

MATCH 3 TO 2

MATCH 3 TO 4

MATCH 3 TO 5

CITY OF WINSTON

SOUTH UMPQUA RIVER

WASTEWATER TREATMENT FACILITY

PROPOSED 1.5 MG TANK SITE

PROPOSED 0.5 MG TANK SITE

EXISTING 2MG RESERVOIR

HIGHLANDS PUMP STATION

GREEN SCHOOL

WTP

EXISTING
REPLACE
UPGRADE

0 400 800 1200 1600

SYSTEM PLAN
FIGURE 4-3

MAP Engineering, Inc.

PROJECT NO. 1471-45

MATCH 4 TO 3

MATCH 4 TO 2

MATCH 4 TO 1

EXISTING
REPLACE
UPGRADE

0 400 800 1200 1600

SYSTEM PLAN
FIGURE 4-4

MAP Engineering, Inc.

PROJECT NO. 1471-45

MATCH 5 TO 4

MATCH 5 TO 3

EXISTING
REPLACE
UPGRADE

0 400 800 1200 1600

GLENGARY LOOP PUMP STATION (NOT IN USE)

.25 MG

SYSTEM PLAN
FIGURE 4-5

MAP Engineering, Inc.

PROJECT NO. 1471-45

5.0 RECOMMENDED CAPITAL IMPROVEMENT PLAN

5.1 GENERAL

This section provides a recommended capital improvement plan for the District. This plan provides for correction of existing deficiencies and expansion of the system to meet future needs. The capital improvement plan includes expansion of the transmission system, reservoirs, and pumping stations. This section also develops cost estimates for the recommended improvements and recommends priorities for the improvements based on need.

5.2 COST ESTIMATES

The capital improvement plan recommends project priorities and estimates costs associated with the projects. Cost estimates are based on current public works construction costs (as of 2015). The majority of listed projects will be subject to the prevailing rate of wage; consequently, actual project costs will be dependent on a number of factors including legislative requirements, market conditions, regulatory conditions and material and labor costs.

Cost estimates included in this plan consist of allowances for current construction costs plus 35% to cover engineering, administration, and contingencies for other project related costs. Construction costs are volatile and future costs are not easily predictable. Future project costs were estimated utilizing the Engineering News-Record Construction Cost Index (CCI). This index is a nationally recognized index utilized for projecting construction costs. The current index is 10,037 during July 2015, reflecting the 20-city average. The index is a historical record and not necessarily an accurate tool for projections, however it is the most reliable information available for projection purposes.

5.3 RECOMMENDED ACTION

We recommend that the District adopt this Master Plan Update and implement the associated capital plan through a series of actions outlined as follows:

1. Adopt the Roberts Creek Water District System Plan Update through formal Board Action. This adoption will include a prioritized Capital improvement Plan (CIP). The CIP is a dynamic series of projects that should be reviewed periodically to ensure that project priorities continue to meet District needs.

2. Develop and adopt a financial plan to fund and implement the capital improvements included in this document. The financial plan should include a balance of apportionment of ongoing utility rates as well as implementation of updated System Development Charges (SDC). A review of current and historical rates is included as Exhibit 1. Current and historical information relating to SDCs is included as Exhibit 2. Information relating to existing fees and charges and their relationship to the District's ability to carry out the Master Plan recommendations will be presented in separate documents.

3. Adopt system operations, maintenance and improvement standards as outlined in the plan. This will provide direction to the Board and District personnel to ensure that a balance is achieved between ongoing maintenance and necessary capital improvement projects.

5.4 CAPITAL IMPROVEMENT PLAN PRIORITIES

The capital project priorities are based on information available at the time this plan was completed. It is essential to understand that as circumstances and District needs change, these priorities should be revisited to ensure that the most efficient service continues to be provided to District customers.

Major capital projects are outlined in the following narrative. A listing of recommended distribution and storage projects is included in tabular format in Section 5.4.1 and in Tables 5-1 through 5-2.

1. Storage

a. Chandler Drive Storage Tank

An additional storage tank of 1.5 million gallons is recommended for this general area.

Estimated Budget Level Cost: $1,350,000

b. Town Tank

The Town Tank site is existing but the tank was demolished several years ago due to structural problems. A new coated steel tank on this site would be useful to allow an alternative in the event that the old steel line under the railroad should need replacement. Total storage added by this item should be approximately 0.5 million gallons.

Estimated Budget Level Cost: $650,000

c. Tank Mixers

Mixers should be added to the Main Tank, Speedway Tank the Roberts Mountain Tank to help turn over water stored in the tanks and help improve water quality. The units would be solar powered due to a lack of power at the tank sites.

Estimated Budget Level Cost: $150,000

2. Transmission Piping Improvements

The proposed transmission piping improvements are shown in Table 5-1.

Table 5-1 Transmission Piping Improvements

LOCATION	DESCRIPTION	UNIT	QUAN	UNIT PRICE	EST. TOTAL
Town Tank Intertie	8" Ductile Iron	LF	3200	$84.00	$268,800
Shady (Old Hwy 99)	12" Ductile Iron	LF	8800	$96.00	$704,000
I-5 Intertie (east side)	12" Ductile Iron	LF	7400	$84.00	$621,600
I-5 Intertie (west side)	12" Ductile Iron	LF	5900	$84.00	$413,000

3. Distribution Piping Improvements

The proposed distribution piping improvements are shown in Table 5-2.

Table 5-2 Distribution Piping Improvements

LOCATION	DESCRIPTION	UNIT	QUAN	UNIT PRICE	EST. TOTAL
Town Tank Piping	Replace 8-inch steel with 12-inch DI	LF	1450	$84.00	$121,800
Knife River (Beaver State Road)	Replace 2-inch steel with 6-inch PVC	LF	375	$60.00	$22,500
Holgate Street	Replace 2-inch steel with 6-inch PVC	LF	436	$60.00	$26,160
Holgate Street (south)	Replace 4-inch steel with 6-inch PVC	LF	710	$60.00	$42,600
Holgate (middle)	Replace 2-inch steel with 8-inch PVC	LF	507	$66.00	$33,462
Holgate (north)	Replace 1-inch steel with 8-inch PVC	LF	1250	$66.00	$82,500
Delmar Drive	Replace 6-inch steel with 6-inch PVC	LF	1150	$66.00	$75,900
				TOTAL	**$404,922**

5.5 OPERATION AND MAINTENANCE RECOMMENDATIONS

The primary obligation of the District is to provide domestic water to its customers. In conjunction with the local Fire District and Douglas County, the District is also attempting to meet current fire flow requirements for increased commercial and industrial uses within the District.

It is essential that future land use and development decisions consider the District's ability to meet fire flow demands. Participation from private and public partners will be required to meet these needs. The recommendations of the 2008 Master Plan are included below for reference:

We recommend that for all new development, a minimum 8 inch diameter pipe size be required, unless it can be shown that a smaller size should be used for water quality and fire flow is not an issue. This will ensure that future District cost to provide fire flow will be minimized. Under certain circumstances, this requirement may be modified if the District finds that fire flow requirements are met through another means or that the existing system will not accommodate an 8-inch diameter pipe. In the event that a deviation from standard is allowed, we recommend that an agreement to participate in future infrastructure be required of the developer or property owner.

It is also recommended that the District continues its policy of replacing and upgrading existing substandard mains within the system. Prioritization should consider current maintenance requirements, cost of improvements, and available replacement funding. As substandard lines are prioritized, coordination with fire service providers will be essential to allow for allocation of necessary resources. Wherever possible, improvements should be planned to include looping within the existing system to ensure water quality and maintenance efficiency.

As necessary, provide customers with voluntary conservation information relating to water consumption. Also, develop a mandatory water conservation program to comply with source restrictions including minimum stream flow and potential hazard infiltration. For planned restrictions, written guidelines should be developed for distribution to customers