City of Port Orford
Curry County, Oregon

WATER MASTER PLAN

NOVEMBER 2014

The Dyer Partnership
Engineers & Planners, Inc.

1330 Teakwood Avenue
Coos Bay, Oregon 97420
(541) 269-0732 ◘ Fax (541) 269-2044
www.dyerpart.com

Project No. 183.01

City of Port Orford

Curry County, Oregon

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Section 1

Introduction

1.0 Introduction

This Master Plan outlines infrastructure improvements required to maintain compliance with State and Federal standards as well as provide for anticipated growth. It is also intended to update planning criteria and supersedes the previous "Updated Port Orford Water Master Plan" prepared June 5, 2005 by SHN Consulting Engineers and Geologists, Inc. The capital improvements are presented as projects with estimated costs to allow the City to plan and budget as needed. Supporting technical documentation is included to aid in grant and loan funding applications and meets the requirements of the Oregon Business Development Department Infrastructure Finance Authority (OBD IFA), the Water Resource Department (WRD), Rural Development (RD), as well as the Oregon Health Authority (OHA).

1.1 Background and Need

The city has an existing Water Master Plan that was completed in 1998 and updated in 2005. Since the completion of the updated plan, the City Water Treatment Plant, the North Fork Hubbard Creek raw water source and the distribution system have experienced problems not addressed in the 1998 plan or the 2005 updated plan. This Master Plan Amendment does not address water system needs for expanded growth outside the city limits nor the remaining components of the distribution system for the 20-year planning period.

1.2 Study Objective

The purpose of this Water System Master Plan Amendment is to furnish the City of Port Orford with a comprehensive planning document to provide engineering assessment and planning guidance for the successful management of its water system over the next 20 years. This document satisfies the Oregon Health Division requirement for communities to have a current master plan when 300 or more service connections exist (OAR 333-061-0060). The principal Plan objectives include:

- Evaluation of the existing water system components,
- Prediction of future water demands,
- Evaluation of the capability of the existing system to meet future needs,
- Recommendations for improvements needed to meet future needs and/or address deficiencies (both inside and outside the City's current boundaries),
- Development of a Water Management Plan per OAR 690-086-0010,
- Evaluation of existing raw water source and options for future sources.

1.3 Scope of Study

1.3.1 Planning Period

The planning period for this Water System Master Plan is 20 years, ending in the year 2034. The period must be short enough for current users to benefit from system improvements, yet long enough to provide reserve capacity for future growth and increased demand. Existing residents should not pay an unfair portion for improvements sized for future growth, yet it is not economical to build improvements that will be undersized in a relatively short time. OAR 690-086-0140 suggests that demands be projected over 20 years, which is a typical planning period for water master plans.

1.3.2 Planning Area

The Urban Growth Boundary (UGB) of the city of Port Orford defines the planning area, as well as the additional limits of the system defined by the location of raw water sources and transmission lines, including potential new raw water sources. The Urban Growth Boundary (UGB) includes large areas to the east of the city limits. It is unknown whether additional acreage will be annexed to the City during the 20-year planning period, and this area is not addressed in this plan update.

1.3.3 Work Tasks

In compliance with Oregon Health Authority (OHA) and Water Resource Department (WRD) plan elements and standards, this study provides descriptions, analysis, projections, and recommendations for the City's water system over the next 20 years. The following elements are included:

- Study area characteristics including land use and population trends and projections
- Description of the existing water system including supply, treatment, storage and distribution
- Existing regulatory environment including regulations, rules and plan requirements
- Current water usage quantities and allocations
- Projected water demands within the existing city boundary
- Existing system capacity analysis and treatment evaluation
- Improvement alternatives and recommendations with associated costs
- Recommendations for water management planning and water usage curtailment
- A summary of recommendations in the form of a Capital Improvement Plan
- Funding options
- Maps of the existing system and a map showing recommended improvements

Study Area

Section

2

Section 2

Study Area

2.0 Study Area

The City of Port Orford, shown on the Vicinity Map, Figure 2.0, is a coastal community located in Curry County on Highway 101 between Bandon and Gold Beach. Major landmarks in the vicinity include Elk River and Cape Blanco to the north and Humbug Mountain to the south.

According to the Curry County Comprehensive Plan, Port Orford was settled in 1851 making the City the earliest settlement in the county. Primary landmarks in the community are Garrison Lake, Port Orford Head including an Oregon State Park, the Port of Port Orford on Tichenor Cove, and the Pacific Ocean.

2.1 Physical Environment

The following provides information about the physical environment in and around the city of Port Orford.

Climate

Port Orford is located in a coastal zone that is characterized by wet winters, relatively dry summers, and mild temperatures throughout the year. Like the rest of the region, Port Orford experiences the most precipitation from November through April. Moist air masses moving off the Pacific Ocean onto land, especially during the winter months, produce the significant amount of rainfall (approximately 84.1 inches per year) that Port Orford experiences. Rainfall amounts for November, December and January average approximately 11.5 inches per month. The wettest month is December with a historic average of approximately 12.2 inches of rainfall. The driest month is July with a historic average of approximately 0.63 inch of rainfall. Records show that the maximum 24-hour rainfall was 11.5 inches in 2012.

Moist, ocean winds give Port Orford unusually mild winters and mild summers. Port Orford is generally cooler than the rest of Oregon. Temperatures average 47° F in January and 61° F in August. The yearly mean temperature is approximately 53°F. The average low temperature is 46° F, while the average high temperature is 60° F. Extreme temperatures range from 13 to 93°F. Port Orford experiences onshore breezes from the northwest during the summer and stronger southwesterly winds during the winter.

Location

One of the most vital features in Port Orford is Highway 101, which traverses the City north to south. Commercial development is generally centralized along Highway 101. Residential development is located on both sides of the highway, extending west to Garrison Lake and the ocean beach and extending east into the foothills of the Coast Range. The topography of the City ranges from sea level at the beach to an elevation above 225 feet near the top of Coast Guard Hill where the City's main water storage reservoir is located.

2.2 Economic Conditions

The city of Port Orford has an economy based on a small commercial fishing fleet, and a thriving tourist industry. RV parks support a seasonal population that, combined with the influx of tourists during the summer, increases the peak water demand. Numerous community events are planned each summer, which can cause the City's population to swell. During the winter the community settles to a more gradual pace.

2.3 Population

The Center for Population Research and Census at Portland State University (PSU) prepares annual population estimates for all incorporated cities and each county within the State of Oregon. The Port Orford certified population estimate was 1,133 residents as of January 1, 2010. This population estimate is the most current for the City and will be used as a basis for projecting future population growth as shown in Table 2.3.1.

Safe harbor population projections are based on Curry County growth rates which are based on the "Forecast of Oregon's County Population and Components Change, 2010-2050" prepared by the Office of Economic Analysis. The City's 2010 population is 5.068% of Curry County's population.

Table 2.3.1
Population Projections
For the City of Port Orford

Source	Year	Population
Census	2000	1,153
Census	2010	1,133
PSU Estimate	2012	1,135
Projection	2015	1,130[1]
Projection	2020	1,170[1]
Projection	2025	1,210[1]
Projection	2030	1,240[1]
Projection	2035	1,250[1]
Projection	2040	1,260[1]
(Long Range Projection)	2050	1,309[1]

[1]Based on Curry County safe harbor population projections

2.4 Land Use Characteristics

Residential

Three classifications of residential zoning exist within the city limits. The first type of residential housing, R1, is single-family homes and is low-density development. The second type of residential housing, R2, is for medium density development. The third type of residential housing, R3, consists of trailer parks and manufactured homes spread throughout the community; these multi-family units are located in areas of high density development.

Residential lands outside of the city limits, but inside the urban growth boundary (UGB), are zoned

Residential 2 or R2, as designated by Curry County. The minimum lot size for R2 zoning is one acre with septic and well approval. If water or sewer is available, the minimum lot size is reduced to 12,000 square feet. With both water and sewer available, the lot size can be reduced to minimum of 6,000 square feet.

Commercial

The majority of commercial zoning and establishments are located along the Highway 101 corridor. Commercial development consists of many tourist-oriented shops, restaurants, hotels, and a grocery store. Various other commercial establishments and small businesses are remotely located in other areas of the city. Additional zones for commercial development are located north of the city limits, but inside the UGS.

Industrial

The only industrial area in the city is the Port of Port Orford where fishing and small marine industries are located.

Public

These areas consist of schools, parks, public offices, cemeteries, and public facilities.

Section

3

Existing Water System

Section 3

Existing Water System

3.1 Raw Water Sources and Water Rights

The City of Port Orford has three raw water sources with existing water rights, held by the City, on North Fork Hubbard Creek, on Garrison Lake, and on Gold Run Creek. A discussion of these sources is provided below.

3.1.1 North Fork of Hubbard Creek

Port Orford's primary water source is the North Fork Hubbard Creek. Raw water is drawn from an impoundment that is located approximately one mile east of town, as shown in Figure 3.1. Withdrawal records indicate that the City's water supply has come entirely from this source during the period since 1998.

Timber harvesting and related road construction impacted the North Fork Hubbard Creek watershed during the early 1990s. Siltation due to runoff from harvested areas reduced the storage volume of the impoundment and has had a negative impact on water quality during high flow events. Siltation of the reservoir is currently being addressed by a multi-year dredging project being conducted by City Public Works crews. Dredging activities have provided a temporary solution for storage needs while a longer ranged plan to improve City ownership and restoration of the watershed is implemented. Siltation of the impoundment is becoming less problematic as measures to improve the impoundment watershed have matured.

3.1.2 Garrison Lake

The City of Port Orford also has a raw water intake on Garrison Lake that had not been used since the winter of 1993 when it was improved to supplement the low quantity of water from the Hubbard Creek source. The Garrison Lake intake was, prior to 1980, located in a shallow marshy area near the discharge of an old millpond. In the late 1990s the City constructed a new intake at the end of Pinehurst Dock in an attempt to improve water quality by drawing from a deeper point in the lake. This approach was not successful due to poor water quality (high salinity levels) causing taste and odor problems. The City has proposed moving the existing raw intake to a location west of the Arizona Street bridge. This location receives fresh water from the lake's tributaries. This intake would serve as a secondary backup source since taste and odor issues have proved difficult to treat adequately. For a number of years there has been a persistent public aversion to Garrison Lake water due to taste and odor perception.

Garrison Lake was formed when migrating dunes formed a sand spit, which blocked the outlet to the sea, allowing a fresh water to form. During the winter storms of 1997 and 1998, the dunes breached the sand spit allowing sea water to enter the lake. Garrison Lake continues to be impacted by high salinity levels. The South Coast Watershed Council, Portland State University, and Oregon Lakes Association have studied the water quality of Garrison Lake and according to their reports, the large amount of salt water in the lake induced a very stable stratification in which the lower stratified layer is nearly as saline as the

ocean. The upper layer is only slightly salty and does not mix with the lower layer due to the density difference.

The Garrison Lake Rehabilitation Study prepared by EGR and Associates Inc. (2003) addressed alternatives for dune/shore stabilization. The Oregon State Parks Department developed a solution to lake breaching, which was implemented in 2006. Further outlet repair was done in 2013.

Garrison Lake is accessible to the public for fishing, by boat or on the bank.

3.1.3 Gold Run Creek

Prior to construction of the impoundment on Hubbard Creek, residents of Port Orford obtained their water from a small impoundment on Gold Run Creek. Currently the old impoundment is completely silted in and no longer used as a raw water source. Use of Gold Run Creek as a raw water source will not be considered, due the expense to restore and maintain such a small amount of available water.

3.2 Water Rights

All water in Oregon is publicly owned. Because of this public ownership, a water right from the State of Oregon is generally required for anyone to use water from a source, whether surface or underground.

Oregon's water laws are based on the principal of prior application. That is, if a person obtains a water right on a particular source before someone else, the person would have a "senior" water right that would permit them first use, up to a specified amount, of the water during times of lower flows or droughts. A "junior" water right is one that is, obtained after other senior water rights for a particular source have been assigned. A water right may be both senior to some and junior to others.

During periods of low water availability, a water right holder may use as much water as their water right allows as long as the use is truly beneficial and all senior water rights are satisfied. This method of resource appropriation governs all water used until the water is exhausted.

The water rights currently held by the City are "perfected"; that is, the City holds a certificate for each of the water rights. Typically, a permit allows an entity to remove water for a limited amount of time. When the time limit has expired, an extension must be filed for the water right. If the permit is converted to a certificate, the water right is said to be "perfected" and extensions are no longer required.

The city has water rights for 1.25 cfs (0.81 MGD) from its primary water source on the North Fork of Hubbard Creek and a water right for impoundment of up to 3.2 acre feet (1.04 MG). Additional water rights include those on Garrison Lake (1.0 cfs) and Gold Run Creek (1.0) cfs. The Water Rights Summary is shown in Table 3.2.1.

TABLE 3.2.1
WATER RIGHTS SUMMARY*

Location	Permit #	Cert. #	Magnitude	Priority
N. Fork Hubbard Cr.(R)		69194	3.2 Acre Ft.	01/01/1993
N. Fork Hubbard Cr	S32982	42379	0.50 cfs	03/20/1968
N. Fork Hubbard Cr	S47688	65322	0.75 cfs	07/15/1983
Garrison Lake	S42566	65199	1.00 cfs	04/25/1977
Gold Run Creek	S12266	11810	1.00 cfs	08/20/1936

*Source: Oregon Water Resources Department Water Right Inventory System (WRIS)

3.3 Raw Water Transmission

A schematic of Port Orford's water systems showing raw water intakes, pump stations and transmission lines is provided in Figures 3.6.1, 3.6.2, 3.6.3. Port Orford has two raw water pump stations, intake piping, and raw water transmission piping for appropriating water from either Hubbard Creek or Garrison Lake.

3.3.1 North Fork of Hubbard Creek

The intake at the impoundment on Hubbard Creek consists of a pump station which houses two horizontally mounted centrifugal pumps. The building is an unfinished wood framed shed with a concrete slab floor that has an exterior suction well cast into it. The suction well extends into the water at the impoundment. The pump suction pipes draw water approximately four feet below the normal water surface at the impoundment. The existing pumps each have a capacity of 315 gpm and were installed in 2013.

The raw water transmission line that delivers Hubbard Creek water was constructed in two segments. Prior to construction of the treatment plant, water from Hubbard Creek was simply chlorinated and pumped to the reservoir on Deady Street. (The Deady Street reservoir has since been abandoned.) In 1983 the raw water piping was extended from the reservoir to the treatment plant with 4,880 ft of eight-inch PVC. The section of original raw water line from the impoundment to Deady Street was recently replaced and is also an eight-inch PVC pipeline.

3.3.2 Garrison Lake

Existing intake piping at Garrison Lake is located near the Pinehurst Dock. The original intake consisted of a suction strainer placed within a perforated manhole submerged along the shoreline near the Pinehurst dock. In the fall of 1993 the City was forced to use the Garrison Lake source because of siltation problems in the Hubbard Creek impoundment, and at that time the intake was extended to the end of the dock. The City utilized the lake water through the winter of 1993, but discontinued withdrawal from this source in late spring of 1994 when they began to receive taste and odor complaints due to increased algae growth. As previously discussed, modifications to the intake were implemented to deepen the point of withdrawal; however these modifications failed to improve water quality. The City has not used Garrison Lake as a primary water source since 1994.

Pumping facilities on the shore of Garrison Lake consist of two vertically mounted close coupled centrifugal pumps, with vacuum assisted priming and electrical controls. Pumps are 15 HP and are rated at 560 gpm each at 71 feet of total dynamic head.

3.4 Water Treatment

The City water treatment facility was constructed in 1978 to provide for chemical coagulation, flocculation, sedimentation, filtration, and disinfection of water from either Hubbard Creek or Garrison Lake. The plant was designed with a capacity of 555 gpm (0.8 MGD). However, the plant has only been rated at 450 gpm by the Oregon Health Division based on a filtration rate of 3 gpm/ft^2. A drawing of the plant is shown in Figure 5.1.2.

Sedimentation and filtration occur in "package" aluminum equipment supplied by Keystone Filtration Solutions. A performance evaluation of the plant by the Oregon Health Authority (OHA) was completed in 2011. OHA personnel found during their inspection that the only apparent major deficiency was related to limited chlorine contact time for disinfection.
Upgrades to the treatment plant in 1996 included installation of: filter to waste piping, effluent turbidity meters and chlorine analyzers, larger chemical storage tanks, improved backwash valving and electrical and control modifications.

3.4.1 Chemical Feed System

Chemicals used for the treatment (excluding chlorination) include alum, polymers (1986-N), flocculants, and soda ash. Alum is used as the primary coagulant, while the polymer serves as a supplemental coagulant and filter aid. Soda ash is used for pH control to maintain neutral pH for proper coagulation and suitable final water quality. Kemira Superfloc LMW is used for flocculation.

Chemical storage tanks installed in 1996 include:

- 200-gallon soda ash tank
- 150-gallon polymer tank
- 3,000-gallon alum tank
- 150-pound gaseous chlorine cylinders

Upgrades since 1996 include:

- A Miox system replaced gaseous chlorine in 2009
- Post soda recorder installed for the filters

3.4.2 Pretreatment

The first stage of treatment at the facility is pre-chlorination where chlorine is added to the water ahead of the treatment process to achieve a longer contact time (CT) time and to address seasonal color variations in the raw water. A 20,000-gallon stainless steel tank is used to increase pre-chlorination contact time. Following prechlorination alum, polymer, and soda ash are added to the water utilizing a static flash mixer.

Flocculation is provided in a single hydraulically mixed cylindrical flocculation basin that has a volume of approximately 1,450 ft^3 (10,860 gallons) and provides a theoretical hydraulic detention time (HDT) of 24 minutes at 450 gpm. Actual detention time is approximately 60 minutes at 300 gpm (winter rate) to 54 minutes at 325 gpm (summer rate). Optimum treatment flow rates depend upon the turbidity of the raw water. (The 1998 EPA handbook recommends 25 minutes for single stage flocculation as used at this plant).

3.4.3 Sedimentation

Water leaving the flocculator gravity flows into the two sedimentation cells which are equipped with tube settlers. Each cell is a portion each of the sedimentation/filtration basins. Water enters the bottom of the basin and rises upward. (Additional chlorine and polymer injection points are available just ahead of the basins for additional pre-chlorination and filter-aid polymer additions.) Efficiency of the sedimentation process is enhanced by the use of tube settlers. Each sedimentation basin has a surface area of approximately 144 square feet each, for a total surface area of 288 square feet. Existing sedimentation surface area provides a rise rate of 1.6 gpm/ft^2 at a flow rate of 450 gpm. EPA guidelines recommend rise rates of 1.0-2.0 gpm/ft^2 for turbidity removal with tube settlers.

3.4.4 Filtration

Following sedimentation, water from each sedimentation basin gravity flows into an adjacent filter basin. The two Keystone mixed-media gravity filters provide a filter surface area of approximately 72 square feet. Filter throughput rates are maintained by effluent pumps with on/off (batch) operation controlled by float switches in the sedimentation splitter box. At the plant s maximum flow rate of 450 gpm (as rated by OHA), the filter surface area operates at a filtration rate of 3.12 gpm/ft^2, which is within EPA guidelines. Each filter is equipped with a backwash and surface scour system. After the water is filtered, it is pumped to the chlorine contact chamber by two centrifugal pumps (one pump for each filter). The pumps 290 gpm at 30 feet of total dynamic head. Typically, both of these pumps operate simultaneously to provide a maximum flow of 560 gpm. Based on inspection, these pumps are believed to be capable of continued service, but they should be rebuilt to ensure trouble free operation. Discharge piping from each of these pumps includes a non-slam check valve, a rate of flow control valve, and a knife gate valve.

3.4.5 Chlorination Facilities

Disinfection is accomplished with a Miox system that was installed in 2009.

3.4.6 Chlorine Contact Basin

Disinfection is required to destroy harmful viruses and bacteria in water by inactivation or destruction. Optimum disinfection facilities involve an appropriate disinfecting agent, an adequate dosage rate, and sufficient contact time for virus inactivation and bacteria destruction. Two 18-foot diameter, 11-foot tall stainless steel tanks are provided at the plant for contact basins. Each tank has a usable volume of approximately 20,940 gallons resulting in a theoretical detention time of 60 minutes at 350 gpm, 47 minutes at 450 gpm, and 38 minutes at 550 gpm. Only one tank is baffled and currently being used for contact time. The second tank is not baffled, nor is it being used.

Actual approved tank detention times are usually less than theoretical times because water has a tendency to short circuit within an open tank. For baffled tanks the theoretical contact time should be reduced to 50% - 90% of the full tank volume, with 50% being the recommended value unless testing is performed to prove higher values. For the unbaffled tank, testing tanks similar to Port Orford's tank indicate that an effective volume of 30% of the theoretical volume should be utilized for contact time. Assuming these conservative values, the effective tank volumes are reduced to 10.470 and 8.990 gallons respectively for the baffled and unbaffled tanks. With only the baffled tank in operation, the effective contact times at 350 gpm, 450 gpm, and 550 gpm are 30 minutes, 23 minutes, and 19 minutes respectively. The existing unbaffled tank would add an additional 26 minutes, 20 minutes, and 16 minutes to the total contact time. Based on current requirements, the contact tanks should provide a minimum effective contact time of 45 minutes for post chlorination. At the current flow rate and with only one tank operating, the City currently does not provide the minimum 45-minute contact time. The

second tank should be brought on line to increase contact times. When the plant output is increased to 450 gpm and 550 gpm, additional contact time will also be required. Alternatives to increase the contact time include baffling the existing tank or construction of a new contact basin. When prechlorination is used. some credit for disinfection detention time as the water proceeds through the treatment process is allowed and will reduce required post chlorination contact time; however, reductions in contact time for pre-chlorination must be approved by the Oregon Health Division.

3.4.7 Treated Water Pumping

Water is pumped, from the chlorine contact basin, into the Port Orford distribution system by two 25 HP centrifugal pumps. One pump operates at 290 gpm at 210 feet of dynamic head. The second pump operates at 370 gpm to 415 gpm. Both pumps normally operate independently but can operate in parallel to provide up to 550 gpm to the distribution system. Pump start/stop is controlled by the manual operation of the treatment plant. The two pump discharges are equipped with standard spring-loaded, non-slam check valves, a flow rate control valve, and manual wafer butterfly valves for isolation. A single two-inch combination air/vacuum release valve is located on the combined discharge pipe. Piping from the treated water pumps is provided so that the pumps back to the filter units can be used for filter backwashing in an emergency.

3.5 Treated Water Storage

Port Orford currently has one functional treated-water storage reservoir. This reservoir is a 1.0 million-gallon pre-stressed concrete reservoir constructed in 1976. It is located midway up the Coast Guard Hill Road and has a high water level of 212 feet.

In 1996, the City abandoned the 0.2 million gallon concrete reservoir, located on Deady St., that was built in the early 1950s. Originally the City pumped water from Gold Run Creek directly to this reservoir and provided only chlorination for treatment. This reservoir has an estimated high water level of 217 feet, but is no longer used due to its deteriorated condition. The tank's roofing, fascia, and sheeting exhibit signs of dry rot. The roof needs repair and the walls are in poor condition. The City has no plans at this time to demolish it.

3.5.1 Existing Reservoir Capacity

Basic Data for the Coast Guard Hill Reservoir is as shown below in Table 3.5.1.1.

TABLE 3.5.1.1
EXISTING RESERVOIR CAPACITY

Pressure Supply zone	Material	Year constructed	Nominal Volume, Gallons	Dimensions	Base/Overflow Elevation, Feet
Low	Pre-stressed Concrete	1976	1,000,000	76.5' inside diameter	183, 212

3.5.2 Existing Reservoir Condition

In 1996, level transmitters were installed in both reservoirs. At the same time, the reservoirs were cleaned and inspected and interior crack sealing was applied. The exteriors of the tanks were both painted and/or treated.

The Coast Guard Hill tank's current condition is as follows:

- The gauge was sheared off in a wind storm and needs replacement.
- The tank's access ladder is not functional and needs replacement.
- The tank's interior needs cleaning.
- The tank's exterior is in fair condition but is in need of a new coating.
- The tank does not have any shutoff valves for seismic events.
- The tank has a single line in and out and needs a mixer to improve chlorine contact time and to eliminate or reduce the stale water issue.

Since 1996, the Deady Street reservoir has been abandoned and no further updating has been done.

3.6 Distribution System

The distribution system extends from the reservoirs throughout the City. In general the system is looped, but distribution piping in some areas of the City is undersized.

3.6.1 Pipe Inventory

The City's distribution system is a mixture of pipe materials and diameters, and consists of approximately 73,000 lineal feet of piping, excluding individual services. More than 50% of the system is older asbestos cement (AC) pipe installed in the 1970s. Asbestos cement pipe is more susceptible to cracking and leaking than PVC, potentially contributing to high water losses in the system overall. A pipe size inventory is shown in Table 3.6.1.1.

TABLE 3.6.1.1
PIPE INVENTORY

Pipe Diameter, inch	Materials of Construction			
	Asbestos-Cement	PVC	Total	% of Total
2		1,294	1,294	1.8
4	13,970	2,244	16,214	22.2
6	36,991	4,924	41,915	57.5
8		10,417	10,417	14.3
10	882	2,199	3,081	4.2
12			0	0.0
Total	51,843	21,078	72,921	100
% of Total	71	29		100

3.6.2 Pressure Zones

Pressures at customer connections in a distribution system must never drop below 20 psi, which is equivalent to a 46-foot tall column of water. Customers must be located more than 46 feet below the minimum water level in a storage tank (or effective elevation of a pressure reducing valve) to have sufficient pressure without a booster pump. Storage tanks and pressure reducing valves are generally located to provide a pressure of less than 90 psi at the lowest service elevations in a pressure zone.

Most of the City's service area is in the main lower pressure level, which extends from an elevation of 0 feet (MSL) to an approximate elevation of 146 feet (MSL). Users located above 146-foot elevation need to have their water pumped in order for the pressure to remain at acceptable levels during normal reservoir levels.

3.6.3 Pump Stations

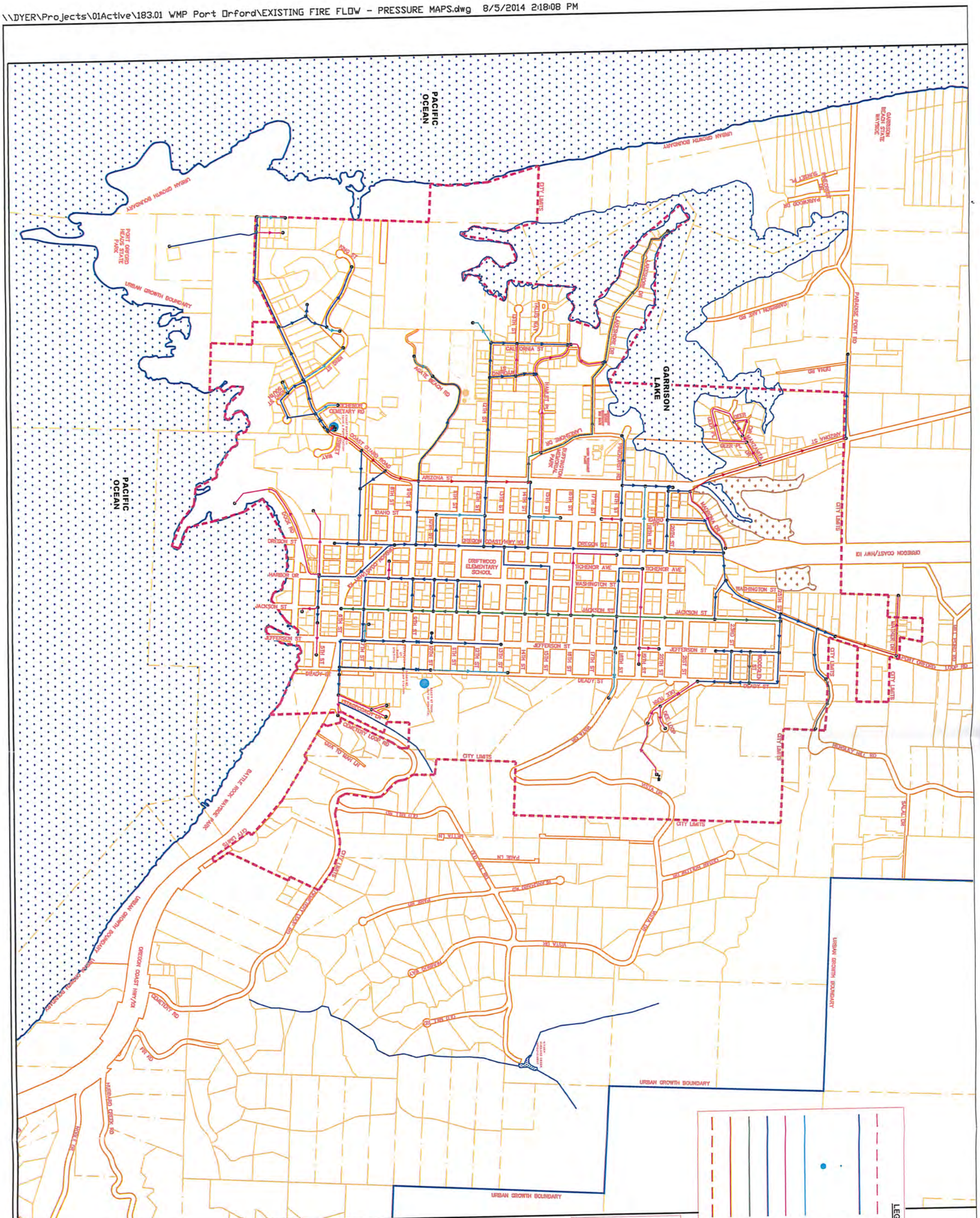
The water distribution system includes four pump stations. The largest of these, Coast Guard Hill, serves approximately 50 residences. This pump station consists of three pumps and electrical controls all contained within a small building. The pumps are part of a constant pressure package booster system provided by PACO Pump Company. Pump controls sense the system pressure and when the pressure drops due to water use, the pumps operate automatically. With all three pumps operating, this station can provide 500 gpm at a total dynamic head of 215 feet. Pump motors consist of one 15 HP jockey pump and two identical 25 HP pumps.

There are currently five other small areas where small pump stations boost the water pressure to serve two to four homes. These areas are as follows: the upper ends of Deady Street, Jefferson Street, (above Battle Rock Park), Vista Drive east of Jefferson Street, and Quah-to-mah.

TABLE 3.6.3.1
PUMP STATIONS

Station	No. of Pumps	RPM	Hp	Flow (gpm)	TDH (feet)	Pressure Range (psi)
Coast Guard Hill	3	3550	25, 25, 15	500	215	85-105
Deady Street	1	3450	5	42	264	90-100
Jefferson Street	1	3450	1 1/2	-		56-68
Vista Drive (east of Jefferson St.)	1	3450	1 1/2	-		50-70
Quah-to-mah	1	3450	1 1/2	-		45-60
Dee Terrace	1	3450	5	42	264	65-150

\\DYER\Projects\01Active\183.01 WMP Port Orford\EXISTING FIRE FLOW - PRESSURE MAPS.dwg 8/5/2014 2:18:08 PM



THE DYER PARTNERSHIP ENGINEERS & PLANNERS	CITY OF PORT ORFORD	FIGURE NO.
DATE: MARCH, 2014	EXISTING WATER DISTRIBUTION SYSTEM MAP	3.6.1
PROJECT NO.: 183.01		

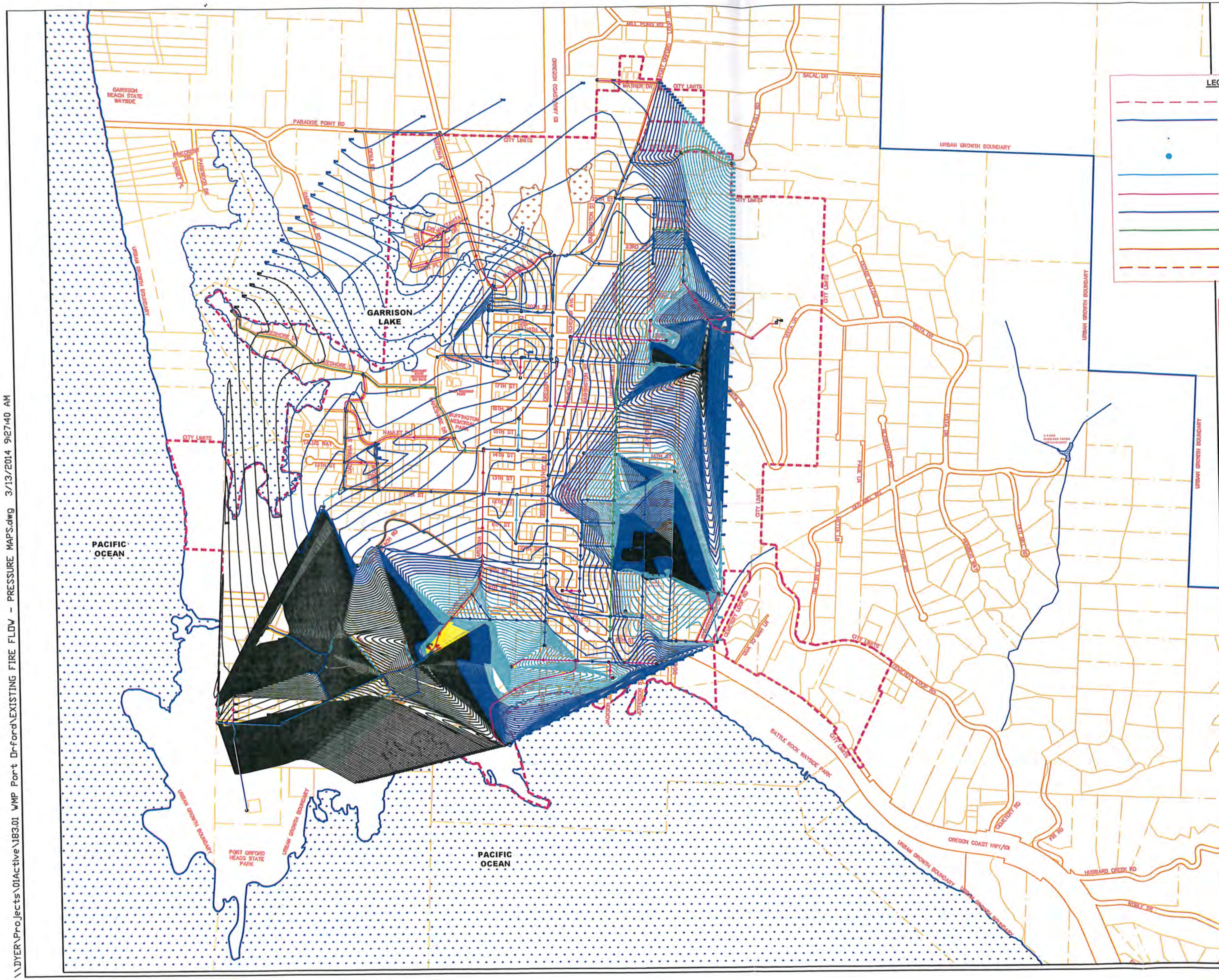


FIGURE NO.
3.6.2

CITY OF PORT ORFORD
EXISTING WATER DISTRIBUTION SYSTEM PRESSURE MAP

THE DYER PARTNERSHIP
ENGINEERS & PLANNERS
DATE: MARCH, 2014
PROJECT NO.: 183.01

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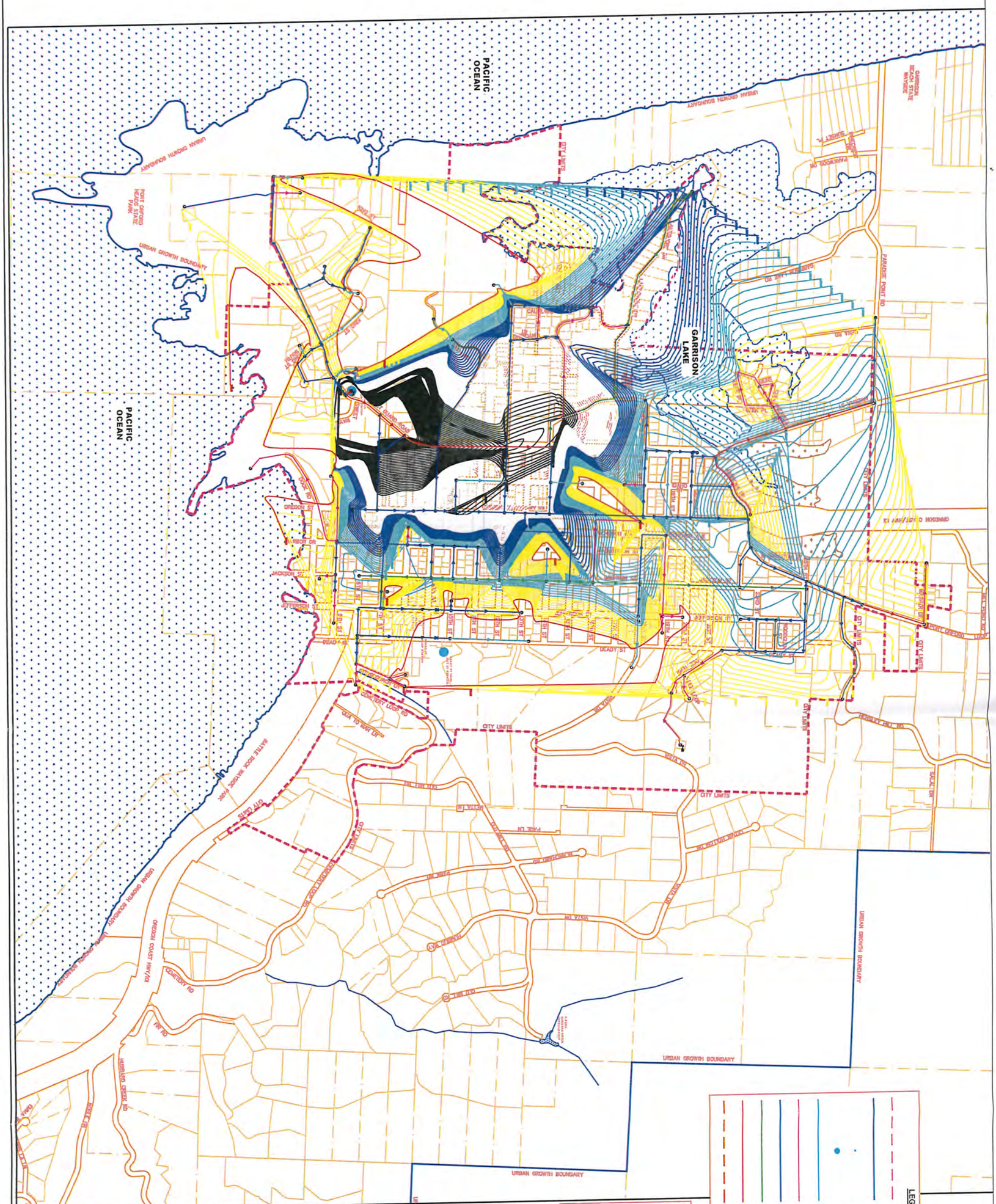

THE DYER PARTNERSHIP ENGINEERS & PLANNERS	CITY OF PORT ORFORD	FIGURE NO.
DATE: MARCH, 2014	EXISTING WATER DISTRIBUTION SYSTEM FIRE FLOW MAP	3.6.3
PROJECT NO.: 183.01		

FIGURE 3.6.3.1
Coast Guard Hill Pump Station Electric Controls

FIGURE 3.6.3.2
Deady Street Pump Station

3.7 Financial Management

The financial management of the City's water system was reviewed by examining the current system water meter records, charges, revenue, and operations and maintenance budget.

3.7.1 System Charges and Revenue

The City collects water system user charges to retire debt and finance the operation and maintenance of the water system. A summary of the current rate charges is given below in Table 3.7.1.

TABLE 3.7.1
MONTHLY WATER RATE CHARGES[1]

Service	Flat Monthly Surcharge	Base Rate for first 2,000 gallons used	Rate for 2,001 to 5,000 gallons used[1]	Rate for 5,001 to 10,000 gallons used[1]	Rate for 10,001 to 20,000 gallons used[1]	Rate for over 20,000 gallons used[1]
Residential - In City	$2.50	$28.79	$7.53	$9.59	$10.63	$11.66
Residential - Out City	$2.50	$43.18	$7.53	$9.59	$10.63	$11.66
Duplex	$2.50	$57.58	$7.53	$9.59	$10.63	$11.66
3-Plex	$2.50	$86.37	$7.53	$9.59	$10.63	$11.66
6-Plex	$2.50	$172.74	$7.53	$9.59	$10.63	$11.66
12-Unit	$2.50	$345.48	$7.53	$9.59	$10.63	$11.66
14-Unit	$2.50	$403.06	$7.53	$9.59	$10.63	$11.66

(1) – per 1000 gallons

The City collects other revenue for the water system operation from user deposit refunds, service fees, new connections, system development charges and other miscellaneous sources. A summary of the revenue budget for the fiscal year 2012-2013 is presented in Table 3.7.2.

TABLE 3.7.2
WATER OPERATIONS REVENUE: FUND 16 (2012-2013 BUDGET)

Item	Amount ($)
Working Capital Carryover	$43,226
Working Capital Carryover Restricted	$0
Water Service Receipts	$357,356
Account Maintenance Fee	$0
Interest on Investments	$323
Miscellaneous Revenues	$1,176
Other Financing Sources	$15,000
Total	$417,081

3.7.2 Operation and Maintenance Budget

Each fiscal year, the City proposes, approves and adopts an operation and maintenance (O&M) budget for the water system. The Public Works Operations Fund is an internal service fund, which acts as a cost center for personnel, equipment and materials to the other internal divisions. A portion of the O&M budget is directed to the Water Reserve Fund, which was created for the distribution of funds required by the Division's Capital Improvement Plan. Additional funds are distributed to the Water Debt Service Fund for the purpose of timely payments of long-term financing of water system improvements. The City has an additional Water Construction Fund created to account for the receipt and distribution of funds for major replacement or additions to the water system infrastructure. A summary of the Water Operation Requirements Fund is presented in Table 3.7.3.

TABLE 3.7.3
WATER OPERATIONS REQUIREMENTS: FUND (2012-2013 BUDGET)

Item	Amount ($)
Personnel Services	$200,418
Materials & Services	$106,880
Debt Service	$61,759
Required Reserve	$0
Transfers To Other Funds	$10,000
Total	$379,057

Section

4

Water Use and Projected Demands

Water Use & Projected Demands

Section 4

4.1 Description and Definitions

Water demand can be defined as the quantity of water delivered to the system over a period of time to meet the needs of consumers, provide filter backwashing water, and to supply the needs of firefighting and system flushing. In addition, virtually all systems have an amount of leakage or loss that cannot be feasibly or economically reduced or eliminated. Total demand, therefore, includes all consumption and lost water. Demand varies seasonally with the lowest usage in winter months and the highest usage during summer months. Variations in demand also occur with respect to time of day (diurnal) with higher usage occurring during the morning and early evening periods and lowest usage during nighttime hours.

The objective of this section is to determine the current water demand characteristics and to project future demand that will allow for system improvement recommendations. Water demand is described in the following terms:

Average Annual Demand (AAD) - The total volume of water delivered to the system in a full year expressed in gallons. When demand fluctuates up and down over several years, an average is used.

Average Daily Demand (ADD) - The total volume of water delivered to the system over a year divided by 365 days. The average use in a single day expressed in gallons per day.

Dry Season Daily Demand (DDD) – The gallons per day average during the months of June through October.

Maximum Monthly Demand (MMD) - The gallons per day average during the month with the highest water demand. The highest monthly usage typically occurs during a summer month.

Peak Weekly Demand (PWD) - The greatest seven day average demand that occurs in a year. Expressed in gallons per day.

Maximum Day Demand (MDD) - The largest volume of water delivered to the system in a single day expressed in gallons per day. The MDD is commonly used to size facilities to provide capacity for periods of high demand. The MDD is usually occurs during the warmest part of the year when agriculture, irrigation, and recreational uses of potable water are at their greatest and are commonly associated with a holiday, such as Fourth of July, or during an event, such as a county fair.

Peak Hourly Demand (PHD) - The maximum volume of water delivered to the system in a single hour expressed in gallons per day. Distribution systems should be designed to adequately handle the peak hourly demand. During this peak usage, storage reservoirs supply the demand in excess of the maximum day demand. Peak hour demand is commonly experienced during the early morning hours when many water users are bathing, cooking, and engaging in other activities that require widespread water use.

Demands described above, expressed in gallons per day (gpd), can be divided by the population served to calculate demand per person or per capita demand which is expressed in gallons per capita per day (gpcd). Per capita demands can be multiplied by future population projections to determine future water demands.

In addition to water demand parameters, various terms are used and values calculated that are related to water conservation. These water conservation terms are described below (EPA 1998).

Loss/Lost Water - Metered source water less revenue producing water and authorized unmetered water uses.

Nonaccount Water – Water that is metered, but not billed, as well as unmetered water. Unmetered water may include authorized and unauthorized uses.

Unaccounted-For Water – the difference between water produced and the total water metered in the system.

For most communities, the known or estimated losses and leaks within a water system are not known. Rather the amount of system lost or leakage is estimated based on an audit of water usage within the system. To the extent possible, we will utilize the above water conservation terms in this report.

4.2 Current Water Demands

Water sales records provide a measurement of unaccounted water (water lost) when compared with plant production records. Water sold is typically less than the amount of water produced at the plant due to system leaks, unmetered use at a water treatment plant (backwash water, turbidity meter water, wash down, etc.), inaccuracies in customer meters, and other unmetered use such as fire flows and system flushing.

Table 4.2.1 summarizes annual water demand for the period from the available data 2011-2012. Raw water is metered at the plant and does not include losses in the transmission line from the raw water source, at the impoundment on North Fork Hubbard Creek. Losses in the treatment plant are unmetered but are assumed to be 10% of the treated water volume.

TABLE 4.2.1
ANNUAL WATER DEMAND

Year	Raw Water Demand[1] MG	Treatment Plant Production[2] MG	Metered Consumption MG	System Losses %
Current	55.02	50.30	28.02	49

1. Metered at the water treatment plant
2. Metered treatment plant influent minus 8.6%

For planning purposes, demand projections and unit design factors for water consumption should be based on the City's yearly water production data rather than historical customer water consumption records (meter readings). This methodology will incorporate all system losses and unmetered usage in the projected water requirements developed later in this Master Plan. Further reference to consumption within

this report implies total water production, including system losses and City and Fire Department usage deductions.

4.2.1 Unaccounted Water

The difference between the quantity of treated water pumped from raw water source to the distribution system and the quantity of water measured at customer meters is referred to as unaccounted water. The difference can be attributed to system leaks, inaccuracies in customer meters, unmetered services, and other unmetered use such as fire flows and system flushing. Since the City does not currently meter raw water at the source, losses in the raw water transmission line are unknown.

Table 4.2.1 illustrates the unaccounted water in the City's water distributions system. With losses of 34%-percent, the City's losses exceed acceptable loss criteria even without taking into account losses in the raw water transmission line. According to the Oregon Water Resources Department and Oregon Administrative Rules 690-086-150, all water systems should work to reduce unaccounted water levels to less than 15 percent, with a ten percent water loss value being the goal for each water system.

4.2.2 Equivalent Dwelling Unit Calculations

Projections for population growth are often utilized to estimate the future demand for public utility services, such as water and sewer. Typically, the future demand is based on an estimated number of single family residential homes, called average dwelling units, projected for the planning horizon. Residential units are only a portion of the future demand however; commercial, industrial, and institutional customers also demand services. Accounting for these customer types requires comparing the demand for services from the respective customer with the demand from the average dwelling unit. The relationship is defined as the equivalent dwelling unit (EDU) methodology. An example of the EDU methodology follows:

If a typical residential dwelling unit requires, on the average, 200 gallons of water per day while a restaurant requires 1000 gallons of water per day, the demand for water from the restaurant is numerically equal to five residential units. In this case, the restaurant is said to be equal to five EDUs.

By totaling all of the commercial, industrial, institutional, and residential usage and dividing that sum by the average single family residential usage rate, the total number of EDUs can be determined. These EDUs can be multiplied by the community's growth rate to to estimate future demands.

Table 4.2.2.1 summarizes the usage totals along with the average water consumption for each user class. This usage includes plant backwash but does not include water loss.

TABLE 4.2.2.1 SUMMARY OF EDU CALCULATIONS 2012		
Description	**Units**	**Value**
Ave. Number of Accounts		643
12 Mo. Water Usage	gals	28,289,937
Water Usage by Customer Class		
No. Res & Small Com EDUs	EDU	848
Res EDU Usage/Yr	gals	18,231,767
Usage per EDU	gpd	92
Small Commercial	gals	2,695,920
Large Commercial	gals	966,210
Multi-Unit	gals	2,695,920
Restaurants	gals	335,640
RV Parks	gals	944,910
Outside	gals	60,750
Institutional / City	gals	1,011,450
Motels	gals	1,347,370
EDUs by Customer Class		
Residential	EDU	546
Small Commercial	EDU	81
Large Commercial	EDU	29
Multi-Unit	EDU	81
Restaurants	EDU	10
RV Parks	EDU	28
Outside	EDU	2
Institutional / City	EDU	30
Motels	EDU	40
Total EDUs	EDU	848

4.2.3 Average Day Demand (ADD)

The average annual demand can be defined as the average daily water demand within the year. ADD is most commonly used to size those portions of facilities based on average use. It is also the basic unit that other demand quantities are based upon.

Water use records are limited, therefore the records for 2012 to compute the ADD rate shown in Table 4.2.3.1 below.

TABLE 4.2.3.1
DAILY WATER PRODUCTION W/BACKWASH

Time Period	ADD, gpd
Current	78,000

Note: Values are based on limited info received from the City

4.2.4 Peaking Factors

The greatest demand for water in the City is in the summer months (June through September), and can be attributable to increases in outside water use for landscaping, outdoor recreation, and usage by an increased tourist population. The peak demand factors are an important sizing parameter for water storage and treatment capacity requirements and distribution system sizing.

Data for the City's maximum month treated and raw water demand are provided in Table 4.2.4.

Peaking factors are commonly used to develop relationships between the ADD and the other planning criteria. A MMD peaking factor of 1.27, shown in Table 4.2.4, is based on Port Orford's most recent production records and is appropriate for the City's demand data. This peaking factor compares well with other water systems, which have MDD peaking factors typically around 150% of the ADD.
In the absence of daily demand data for the City, assumed peaking factors for MDD and PHD were utilized for this Master Plan. Peaking factors were chosen based on experience with similar systems and other water providers within Curry County.

The maximum daily demand (MDD) is the demand that is experienced on the highest demand day of the year. MDD is commonly used to evaluate storage facilities to ensure sufficient capacity for periods of high demand. The MDD may be experienced on a holiday such as the Fourth of July or during a festival. The MDD is usually associated with the warmest part of the year when agriculture, irrigation, and recreational uses of potable water are at their greatest. Peaking factors between 2 and 2.5 are commonly used for MDD.

The peak hour demand (PHD) is used to size piping to insure sufficient capacity to deliver water to customers during the highest demand hour of the day. This usage rate typically occurs on the yearly maximum demand hour of the day. A peak hour demand factor (PDH) is selected as 4.0 and is consistent with the factor observed for the other Curry County communities.

TABLE 4.2.4.1
SUMMARY OF TREATED WATER FLOW PEAKING FACTORS (W/BACKWASH)

Time Period	MMD/ADD	MDD/ADD	PDH
Average	1.25	2.50	4.0

4.2.5 Maximum Day Demand and Peak Hour Demand (MDD & PHD)

A summary of the water usage demands in terms of gpd produced by the selected peaking factors is shown in Table 4.2.5.1.

TABLE 4.2.5.1
CURRENT ANNUAL, MAXIMUM MONTHLY, MAXIMUM DAILY, & PEAK HOURLY WATER CONSUMPTION

ADD, gpd	MMD, gpd	MDD, gpd	PHD, gpd
78,000	97,000	195,000	312,000

4.2.6 Comparative Analysis of Water Demands

Per capita water use for Oregon is documented by the U.S. Department of the Interior in the 2000 U.S. Geological Survey Circular 1268. According to the study, the average per capita water use for Oregon is 207 gallons per capita day (gpcd) including domestic, commercial, industrial, public use and loss. Of the total 207 gpcd, 63% is residential, commercial and public use/loss; 34% is industrial; and 3% is related to thermoelectric power generation. An interagency team from the DEQ, Oregon Business Development Department (OBDD), Oregon Health Division (OHD), the Oregon Department of Water Resources (WRD), the USDA-Rural Utilities Service, Rural Community Assistance Corporation, and the Department of Land Conservation and Development has developed target design numbers based on the USGS study and their experience with Oregon communities. The team has adopted a maximum ADD of 235 gpcd, a MDD of 588 gpcd (2.5 times the ADD), and a PHD of 1,175 gpcd (5 times the ADD).

Based on water production records, showing a current average daily consumption is 54 gpm including losses. The current population is 1,135, therefore the average per capita use in Port Orford is 68 gpcd, which is lower than the interagency team maximum ADD design value of 235 gpcd. Likewise, the calculated MDD and PHD for Port Orford are also lower than the interagency design values. However, as noted in the preceding paragraph, only 63% of the Oregon average per capita water used of 207 gpcd or approximately 130 gpcd is residential, commercial and public use/loss. The remaining 37% of the average Oregon per capita consumption is for industrial and power generation, which is not present to any significant degree in Port Orford. Therefore, Port Orford's per capita average consumption rate of 68 gpd is based on water produced and delivered to the distribution system, is not consistent with Oregon average usage. Conversely, the metered consumption rate of 68 gallons per capita appears to be too low. It is suspected that the old water service meters are reading incorrectly low, as is the typical case with aged and worn meters, rather than attributing all of the difference between metered consumption and production volume to pipe loss. For this study, future water demand for water pumped to the City will be based on the current water parameters (per capita usage, including loss) and projected growth within the City (See Section 3.3). This methodology assumes that water demand characteristics within the City will basically remain the same as the existing produced per capita basis. The future determination of nonaccount water reduction is discussed below in Section 4.3.

4.3 Projected Water Demands

Water demands are projected into the future using the past records of water produced and water sold along with projected population estimates. The goal of projecting future water demand is not to build larger facilities to accommodate excessive water consumption, but rather to evaluate the capability of existing improvements and to size new facilities for reasonable demand rates. While large amounts of leakage and excessive water consumption should not be projected into the future estimates, it is not clear that the difference between produced water and meter water readings are entirely attributed to loss. It is recommended that a program to replace service meters and repair all known leaks be undertaken as soon as possible and that the difference between produced water and metered water be reviewed subsequent to those repairs.

The impact of water conservation measures on a community's future water consumption is also difficult to predict. A number of conservation measures should be recommended, primarily, the location and repair of leaks in the distribution system. Low flow toilets, faucets and showers are simple and inexpensive steps which may be taken to conserve water. It is suspected that accurate metering will also reduce consumption because old "slow" meters cause billing to be less than it should be.

4.3.1 Projections Based on Current Demand

Based on existing demand calculations and the population forecasts presented in Table 2.3.1, the projected water demands were calculated for the City for 10, 20, and 50 years. The demand projections do not include any reductions in usage as a result of water conservation policies because of the unknown impact associated with such policies. A summary of projected water demand is provided in Table 4.3.1.1.

TABLE 4.3.1.1
FUTURE PROJECTIONS

Time Period	ADD, gpd	MMD, gpd	MDD, gpd	PHD, gpd
Current	78,000	97,000	195,000	312,000
2022	110,027	136,828	275,067	440,107
2032	155,204	193,010	388,009	620,814
2062	435,624	541,738	1,089,061	1,742,497
Average	194,624	541,738	1,089,061	1,742,497

Design Criteria and Level of Service

Section

5

Section 5

Design Criteria and Level of Service

5.1 Design Life of Improvements

The design life of a water system component is sometimes referred to as its useful life or service life. The selection of a design life is a matter of judgment based on such factors as the type and intensity of use, type and quality of materials used in construction, and the quality of workmanship during installation. The estimated and actual design life for any particular component may vary depending on the above factors. The establishment of a design life provides a realistic projection of service upon which to base an economic analysis of new capital improvements.

As discussed in Section 1, the planning period for this Water System Master Plan is 20 years ending in the year 2034. The planning period is the time frame during which the recommended water system is expected to provide sufficient capacity to meet the needs of all anticipated users. The required system capacity is based on population, water demand projections, and land use considerations. The planning period for a water system and the design life for its components may not be identical. For example, a properly maintained steel storage tank may have a design life of 60 years, but the projected fire flow and consumptive water demand for a planning period of 20 years is used to determine its size. At the end of the initial 20-year planning period, water demand may be such that an additional storage tank is required; however, the existing tank with a design life of 60 years would still be useful and remain in service for another 40 years. The typical design life for system components is discussed below.

5.1.1 Raw Water Intakes and Transmission

Concrete impoundments should have a design life of 50 to 100 years when properly constructed and maintained. Intake systems should have a design life of 50 years. Raw water pumps should have a 20-year design life although the equipment life can be extended if properly maintained. Water transmission piping is expected to have a design life of 60 years if quality materials and workmanship are incorporated into the construction. Modern PVC and cement mortar lined ductile iron piping can last 100 years or more when properly designed and installed.

5.1.2 Water Treatment Facility

Major structures and buildings should have a design life of approximately 50 years. Pumps and equipment usually have a useful life of about 20 years. The useful life of equipment can be extended when properly maintained if additional treatment capacity is not required. Filter media usually has a design life of 12 to 15 years. Flow meters typically have a design life of 10 to 15 years. Valves usually need to be replaced after 15 to 20 years of use. The Water Treatment Plant was upgraded in 1996 but requires a number of improvements to continue at optimum efficiency and bring it into compliance with current standards.

5.1.3 Treated Water Transmission and Distribution Piping

As noted is Section 5.1.1, water transmission piping is expected to have a design life of 60 years and the use of modern PVC and cement mortar lined ductile iron piping can provide 100 years of service.

5.1.4 Treated Water Storage

Distribution storage tanks should have a design life of 60 years (glass-fused-to-steel construction) to 80 years (concrete and welded steel construction). Steel tanks with a glass-fused coating can have a design life similar to concrete construction. Actual design life will depend on the quality of materials, the workmanship during installation, and the timely administration of maintenance activities. Several practices, such as the use of cathodic protection, regular cleaning and frequent painting can extend or assure the service life of steel or glass-fused-to-steel reservoirs.

5.2 Sizing and Capacity Criteria

Demand projections presented in Section 4.3 are based on population projections presented in Section 2.3. The projections assume a 1.05 percent average annual growth rate until the year 2034 within the City's existing boundaries. For the purposes of longer-term projections required for a 50-year water source analysis, a 1.05 percent growth rate was used, although predictions of growth beyond 20 years should only be considered an assumption. As time progresses, all of the projections should be updated to reflect actual population and demand.

Section 6 of this Master Plan includes an analysis of growth rates, sizing criteria, and capacity issues and provides improvement alternatives for the water system components. Based on these predictions, the final capital improvement project recommendations are provided in Section 8.

5.2.1 Raw Water Source

The water source(s) must be capable of meeting the City's demand for water over a period of many years. Water rights that allow the use of water are becoming critical as the State's population and water demand increases and the number of viable water sources remains constant. Therefore, the water source(s) should be evaluated to ensure enough water to meet the estimated MMD 50 years into the future.

Intake and Pumping Facilities

Intake piping and the finished clear well are not easily expanded and should be sized to meet the anticipated maximum day demand well into the future. A design life of 50 years is common for such facilities.

Pumps and other mechanical equipment can be expected to last no more than 20 years under normal conditions before extensive maintenance or replacement is necessary. Commonly, two pumps are installed in a pumping station, each having capacity equal to the capacity of a water treatment plant or the MDD predicted within a planning period. Duplex pumping systems can be designed to alternate after each cycle to extend the life of the equipment. If future demands increase beyond the ability of a single pump, the second pump can serve as a lag pump in parallel to sustain higher flow rates during peak demand times. Currently installed pumps provide almost double the flow volume required for current needs. The pumps should be furnished with VFD's to allow for a lower flow rate thus yielding energy savings.

MILL POND

TANK OVERFLOW

EXISTING CHAIN LINK FENCE

EXISTING DRIVEWAY

6"ø A.C. PIPE (INFLUENT)

4"ø A.C. PIPE (EFFLUENT)

CONTACT BASIN (NOT USED)

CONTACT BASIN

TREATED WATER TURBIDIMETER & CL2 ANALYZER

8"ø D.I. PIPE

6"ø D.I. PIPE

TREATED WATER PUMPS

EFFLUENT METER

BACKWASH WATER PIPELINES

STORAGE

MIOX

LAB

PUMP ROOM

6"ø D.I. PIPE

10"ø TREATED WATER TO DISTRIBUTION SYSTEM

REST ROOM

LOCKER ROOM

BACKWASH METER

FILTER PUMPS

FILTERED WATER PIPELINES

4" CL2 DRAIN

RAW WATER FLOW CONTROL VALVE

SURFACE WASH PUMP & BACKFLOW PREVENTER

CHEMICAL STATIC MIXER

4"ø D.I. PIPE

WETLAND

RAW WATER TURBIDIMETER

SETTLER NO. 1

FILTER NO. 1

RAW WATER METER

4"ø D.I. PIPE

BACKWASH POND OVERFLOW

14" BACKWASH & OTHER WASTEWATER

14" ø GRAVITY LINE

FLOCCULATOR

SETTLER NO. 2

FILTER NO. 2

FILTER TURBIDIMETERS

RAW WATER BYPASS

BACKWASH POND

8" RAW WATER LINE FROM HUBBARD CREEK

AIR DRYER

AIR COMPRESSOR

SODA ASH

POLYMER

CHEMICAL FEED ROOM

ALUM

6" DECANT

6" RAW WATER FROM GARRISON LAKE

LEGEND

- GATE VALVE
- FLOW METER
- AIR RELEASE VALVE
- BUTTERFLY VALVE

N

NOT TO SCALE

FIGURE NO. 5.1.2

CITY OF PORT ORFORD
WATER MASTER PLAN

WATER TREATMENT PLANT EXISTING SITE PLAN

THE DYER PARTNERSHIP
ENGINEERS & PLANNERS

DATE: FEBRUARY, 2014

PROJECT NO.: 183.01

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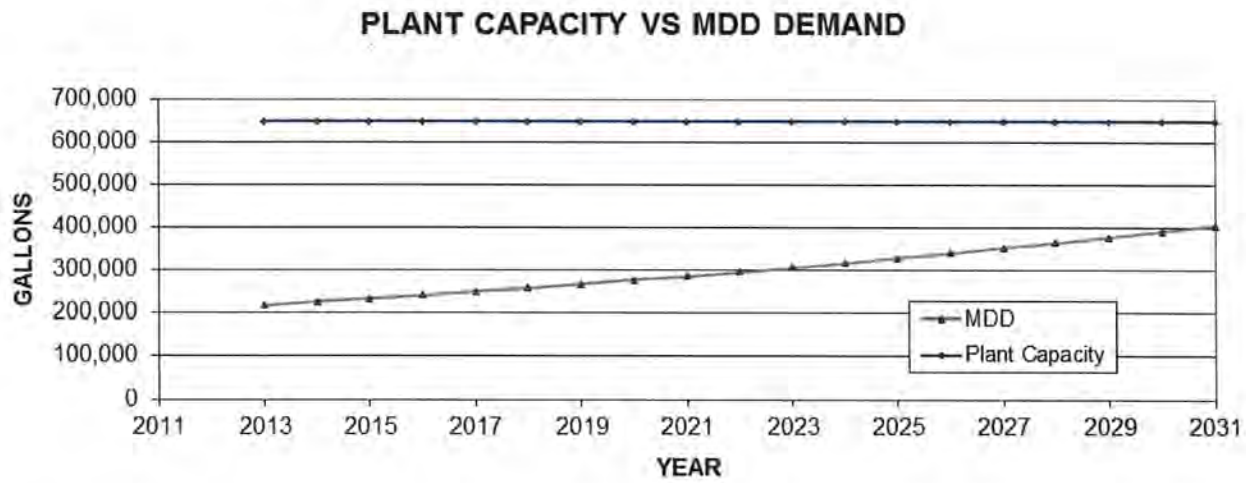
5.2.2 Transmission Piping

The long distances and high replacement costs associated with transmission line construction warrants an analysis for demand beyond the normal 20-year period. The existing transmission lines must have the ability to handle at least the 20-year MMD. The capacity of the raw water and treated water transmission piping will be evaluated against the 20-year MDD and the 50-year MDD in Section 7.

5.2.3 Water Treatment Facility

Water treatment plants are normally not designed to handle flows above 20-year MMD since these facilities can be expanded and typically have an overall design life of 20 years. The existing treatment plant components will be evaluated against the 20-year MDD.

FIGURE 5.2.3.1
CONSUMPTION MAX. DAILY DEMAND (MDD) VS. PRODUCTION MAX. DAILY DEMAND (MDD)



5.2.4 Treated Water Storage

Total storage capacity must include reserve storage for fire suppression, equalization storage, and emergency storage. In larger communities it is common to provide storage capacity equal to the sum of equalization storage plus the larger of fire storage or emergency storage. In small communities it is recommended that total storage be the sum of fire plus equalization plus emergency storage. This is considered prudent since it is possible for fire danger to increase during water emergencies, such as power failures when alternative sources of heating and cooking might be used.

Total firefighting storage capacity must include reserve storage for equalization storage, and emergency storage and fire reserve.

Equalization storage is the storage of finished water in sufficient quantity to compensate for the difference between a water system's maximum pumping capacity and peak hour demand. Standard industry practice indicates that equalization storage equal to approximately 25 percent of a system's MDD is typically sufficient for analysis and planning purposes.

Emergency storage provides a measure of reliability or safety factor should sources fail or when unusual conditions impose higher than anticipated demands, such as a broken transmission line, electrical outage, treatment plant breakdown, or source contamination. The amount of emergency storage provided can be highly variable depending upon an assessment of risk and the desired degree of system reliability. A reasonable volume for emergency storage for the water service area is approximately two (2) days of average demand. However, emergency storage reserve is usually set at one MDD or three ADD. With one MDD storage criteria, it is assumed that supply disruption will occur on a day of maximum demand and be corrected within 24 hours. The basis for the three ADD criteria is that the supply disruption could occur at anytime and would be repaired within three days.

Fire reserve storage is needed to provide sufficient water for fire suppression in the water system. The amount of fire reserve is based on the maximum flow and duration of flow needed to confine a major fire. Guidelines for determining the required fire flow and duration are generally determined using the "Fire Suppression Rating Schedule" by the Insurance Services Office (ISO) and/or the Uniform Fire Code adopted by the State of Oregon. The minimum fire-flow requirements for one- and two-family dwellings having a fire-flow calculation area which does not exceed 3,600 square feet shall be 1,000 gallons per minute at 20 psi residual water pressure. For one and two-family dwellings not exceeding two stories in height, ISO uses a minimum fire flow of 500 gpm for buildings with more than 100 feet of distance between them and a minimum fire flow of 1,500 gpm for dwellings less than ten feet apart. Total required fire flow may be reduced, but in no case shall the resulting fire flow be less than 1,500 gpm at 20 psi residual water pressure. Commercial, industrial, and institutional buildings typically require higher fire flows with longer durations. Determination of these flows is unique to each building under consideration and will depend upon such factors as the square footage of the floor area, and the type of construction based on the International Building Code (IBC) classifications.

Reserve capacity may have to be balanced by water quality issues. There must be sufficient water changeover in reservoirs to keep water fresh and healthful. In communities where water use and fire risk are seasonal, multiple small reservoir tanks can be employed. During periods of peak use and fire risk, all the tanks can be used for storage. During low use / low danger periods, an appropriate number of tanks can be emptied and left "off-line."

Ideal storage capacity should be the sum of equalizing, emergency and fire reserve storage.

Another important design parameter for reservoirs is elevation. Efforts should be made to locate all reservoirs at the same elevation when possible. As a consistent water surface is maintained in all reservoirs, the need for altitude valves, check valves, PRVs, booster pumps, pumper trucks for extracting fire flows, and other control devices is eliminated. Distribution reservoirs should also be located at an elevation that maintains adequate water pressure throughout the system, sufficient water pressures at high elevations and reasonable pressures at lower elevations. Pressures in the system should be within the range of 20 to 100 psi.

All of the above criteria will be used to evaluate the adequacy of existing storage and the need, if any, for future additional storage in Section 5.

5.2.5 Distribution System

Distribution mains are typically sized for fire flow and 20-year population demand, or fire flow and saturation development demand. The mains should be at least six inches in diameter to provide minimum fire flow capacity. All pipelines should be large enough to sustain a minimum line pressure of approximately 25 psi. The State of Oregon requires a water distribution system be designed and installed to maintain a pressure of at least 20 psi at all service connections at all times. The distribution system

must be sized to handle the peak hourly flows while maintaining minimum pressures, and provide fire flows.

In addition to the design criteria above, the following guidelines are recommended for the design of water distribution systems:

- 6-inch diameter lines: Minimum sized lateral water main for gridiron (looped) system and dead-end mains.
- 8-inch diameter lines: Minimum size for permanently dead-ended mains supplying fire hydrants and for minor trunk mains.
- 10-inch diameter and larger: As required for trunk (feeder) mains. The distribution system lateral mains should be looped whenever possible.

The distribution system secondary mains should be looped whenever possible. A secondary main is defined as a main not exceeding eight inches in diameter which is installed to provide water service and fire protection for a local area including immediately adjacent properties. The normal size of secondary mains for single-family residential areas is six-inch diameter pipe. However, eight-inch diameter or greater secondary mains may be required to meet both the domestic and fire protection needs of an area.

The installation of permanent dead-end mains and dependence of relatively large areas on a single main should be avoided. For the placement of a fire hydrant on a permanently dead-ended main, the minimum size of such secondary mains should be eight inches in diameter. However, six-inch diameter mains may be used for a stub out not exceeding 500 feet in length supplying a single fire hydrant, not on a public street, and for internal fire protection. On new construction, the minimum size secondary main for supplying fire hydrants within public ways should be six inches in diameter, provided six-inch diameter mains are looped.

A computer model of the distribution system was developed as part of this Master Plan. The model utilized actual pipe sizes, system configuration, and materials as well as system pipe junction elevations and storage tank elevations. A computer model of the City's distribution system was checked to determine the maximum flow rate available at various locations within the system. The model was developed using a software program called Bentley WaterCAD® (Version 8 XM) offered by Haestad Methods.

The Driftwood Elementary School building, located within the City, could potentially require high fire flows and the recommended minimum fire flow capability is 3,000 gpm. For a detailed discussion of the distribution system performance and fire flow analysis, see Section 8.6.

According to Appendix B Fire-Flow Requirements for Buildings of the Oregon Office of State Fire Marshal Codes, the minimum fire flow for one and two-family dwellings with an area less than 3,600 SF is 1,000 gpm. A copy of the Code is attached in Appendix D. Commercial, industrial and institutional buildings require higher flows. Determination of these flows is unique to each building under consideration, and depends on construction type, occupancy, and floor area, but the code stipulates that fire flow for any building other than residences shall not be less than 1,500 gpm.

Fire Flow Duration
Flow duration requirements are based on flow rate in thousands of gpm, for a minimum 3 hours. A flow rate of 3,000 gallons per minute, maintained for 3 hours, is required for a commercial building. This will

require a volume of 540,000 gallons available in storage.

Hydrant Spacing
Fire hydrants should be spaced at a maximum distance of 500 feet and spaced at a minimum of 300 feet apart in more developed areas. They are ordinarily located at street corners where use from four directions is possible. Spacing of hydrants can be determined using ISO (Insurance Services Office) standards. Table 5.1.1 shows the fire flow requirements for the developed area.

TABLE 5.2.5.1
FIRE FLOW REQUIREMENTS FOR CITY OF PORT ORFORD

	Flow	Duration	Hydrant Area
	gpm	Hours	SF
Residential	1,000	1	150,000
Commercial	1,500	2	140,000
Driftwood School	3,000	3	110,000

Section

6

Regulatory Environment

Section 6

Regulatory Environment

6.1 Municipal Water Management Plans

The Oregon Water Resources Department has developed rules that govern water management planning (Water Management and Conservation Plans; OAR Chapter 690, Division 86). Included in the rules are groundwater management, hydroelectric power development, in-stream flow protection, interstate cooperation, water resources protection on public riparian lands, conservation and efficient water use, water allocation, and water storage. The Water Resources Commission has adopted a statewide policy on Conservation and Efficient Water Use (Statewide Water Resource Management; OAR 690-410). The policy requires major water users and suppliers to prepare water management plans. Municipal water suppliers are encouraged to prepare water management plans, and are required to do so if a plan is prescribed by a condition of a water use permit. The following elements are to be included in the plan: description of the water system, a water conservation element, a water curtailment element, and a long-range water supply element.

A Water System Master Plan prepared under the requirements of the Oregon Health Division and that substantially meets the requirements of OAR 690-086-0125 to 0150 may be submitted to meet the requirements of this rule. It is the intent of this Plan to meet all of the requirements of this rule.

The elements required in a Water Management and Conservation Plan are briefly described below. A more detailed discussion of the elements required for Water Conservation and Curtailment Plans and a long-range water supply element is presented in Sections 9, 10 and 11 of this Master Plan.

6.1.1 Description of the Water System

The water system description shall include sources of water, storage facilities, transfer and exchange agreements, and intergovernmental cooperation agreements. System capacity, limitations and opportunities for expansion under existing water rights are to be included. Water use shall be discussed, including current average annual water use, peak seasonal demand, average and peak day demands, and quantities of water used from a source. Customer information is required, such as estimated numbers and general water use characteristics of residences, commercial, industrial, and other users. Also required is a schematic of the system which shows the sources of water, storage facilities, treatment facilities, major transmission and distribution lines, pump stations, interconnections with other municipal supply systems, and the service area. All of the applicable information required for a description of the City of Port Orford's water system is included in this Master Plan.

6.1.2 Water Conservation Plan

A water conservation plan is a long-term program intended to reduce average water use and the resulting demand on the water system. Conservation means eliminating waste or otherwise improving the efficiency of water use while satisfying beneficial uses. Conservation can be achieved by modifying the technology or method for diverting, transporting, applying or recovering water, by changing the

management of water use, or by implementing other measures. The plan shall describe the City's existing and proposed water conservation elements, conform to OAR 690-086-150 and include the following.

- An annual water audit that includes a systematic and documented methodology for estimating any unmetered authorized and unauthorized uses.
- A program to install meters on all un-metered water service connections.
- A meter testing and maintenance program.
- A rate structure under which customers' bills are based on the quantity of water metered at the service connections.
- For systems with annual losses greater than 10 percent, a regularly scheduled and systematic program to detect leaks in the transmission and distribution system.
- A public education program to encourage efficient water use and the use of low water use landscaping.

6.1.3 Water Curtailment Plan

A water curtailment plan is defined as a short-term mandatory conservation plan usually brought on by an emergency or extreme water shortage. The goal of a water curtailment plan is to drastically reduce water consumption in order to protect existing resources and system components. Once the water shortage or emergency has passed, the curtailment activities can be discontinued. The water curtailment element shall include at least the following.

- A description of the frequency and magnitude of supply deficiencies within the past ten years and current capacity limitation. The description shall include an assessment of the ability of the water supplier to maintain delivery during long-term drought or other source shortages;
- A list of three or more alert stages for potential shortage or water service difficulties. The stages shall range from a potential or mild alert, increasing through a serious situation to a critical emergency;
- A description of predetermined levels of severity of shortage or water service difficulties which will trigger the curtailment actions under each stage of alert to provide the greatest assurance of maintaining potable supplies for human consumption; and
- A list of specific standby water use curtailment actions for each stage of alert ranging from notice to the public of a potential alert, increasing through limiting nonessential water use, to rationing and/or loss of service at the critical alert stage.

6.1.4 Water Supply Element

Under this task, the adequacy of the existing water sources and need for development or acquisition of new sources is explored in detail. This task will include the following elements primarily based on OAR 690-086-0170.

- A delineation of the current and future service areas consistent with state land use laws that includes available data on population projections and anticipated water-intensive development consistent with relevant acknowledged comprehensive land use plans and urban service agreements or other relevant growth projections.

- A description of how the City intends to exercise all the water rights and water use permits currently held.

- Based on the service area information provided above, an estimate of water demand projections for 10 and 20 years will be compiled.

- A comparison of the projected water needs and the sources of water currently available to the City considering the reliability of existing sources.

- Analysis of alternative water sources that considers availability, quantity (maximum. rate and monthly volume diverted), reliability, feasibility, likely environmental impacts, proposed mitigation measures, if any, and cost effectiveness. Summary of analysis will be compiled as a matrix evaluation table. Alternatives sources includes the following:

    - Analysis of the possibility of wells or well field as an additional source of water.
    - Consideration of conservation measures identified under OAR 690-086-0150.
    - Any other conservation or cooperative regional measures that would provide water at a cost that is equal to or lower than the cost of other identified sources.

6.2 Public Water System Regulations

Drinking water regulations were established in 1974 with the signing of the Safe Drinking Water Act (SDWA). This act and subsequent regulations were the first to apply to all public water systems in the United States. The Environmental Protection Agency (EPA) was authorized to set standards and implement the Act. With the enactment of the Oregon Drinking Water Quality Act in 1981, the State of Oregon accepted primary enforcement responsibility for all drinking water regulations within the State. Requirements are detailed in OAR Chapter 333, Division 61. Since its inception, the SDWA and associated regulations have been amended a number of times, with the most recent amendments in August 1996.

One of the main elements of these drinking water regulations is the establishment of maximum contaminant levels (MCLs) for inorganic, organic, microbiological, and radionuclide contaminants and turbidity. An MCL is the maximum allowable level of a contaminant in water delivered to the users of a public water system. Concentrations above the MCL for a contaminant are considered violations and require the water supplier to perform immediate corrective action and notify the public of such violations.

6.2.1 Surface Water Treatment Rule (SWTR)

The Surface Water Treatment Rule (SWTR) is one amendment to the SDWA. This rule affects all public water systems using surface water sources and established, among other requirements, that water must be treated through filtration and disinfection. This rule is required for all water providers using a surface water source unless certain water quality criteria and site-specific requirements are met. Treatment requirements, performance standards and MCLs are generally summarized as follows (excluding MCLs for inorganic materials, radioactive substances, and secondary contaminants) for a water system:

- For this system, which uses conventional filtration, the turbidity level of representative samples of filtered water must at no time exceed 1 NTU, measured as specified in OAR 333-061-0036(4)(b). That is to say, 0 percent of the turbidity measurements can exceed 1 NTU. Turbidity monitored continuously with results reported every four hours.

- The turbidity level of representative samples of filtered water must be less than or equal to 0.3 NTU in at least 95 percent of the measurements taken each month, measured as specified in OAR 333-061-0036(4)(b). That is to say, the turbidity levels can rise above 0.3 NTU no more than 5 percent of the time.

- Total coliform-positive (coliform present) samples shall not exceed more than one sample collected during a month. A set of at least three repeat samples is required for each positive sample. Repeat sampling continues until the MCL is exceeded or a set of repeat samples with negative results (coliform absent) is obtained. Confirmed presence of fecal coliform or *E. coli* requires immediate notification of the public.

- At least 99.9 percent (3-log) inactivation and/or removal of *Giardia lamblia* cysts at a point downstream at or before the first customer.

- At least 99.99 percent (4-log) inactivation and/or removal of viruses at a point downstream at or before the first customer.

- A free chlorine residual of 0.2 mg/L after 30 minutes of contact time shall be achieved under all flow conditions before the first customer.

- The residual disinfectant concentration in the distribution system, measured as total chlorine, combined chlorine, or chlorine dioxide, as specified in OAR 333-061-0036(4)(b)(C) cannot be undetectable in more than 5 percent of the samples each month, for any two consecutive months.

The adoption of the 1989 Surface Water Treatment Rule (SWTR) has improved the quality of drinking water and greatly reduced the number of infections caused by water borne pathogens. The SWTR set standards to reduce water concentration of *Giardia* and viruses, with a goal to reduce the risk of infection to less than one in 10,000 people per year. However, some water sources have a high concentration of pathogens that, even when treated to the levels required by the rule, do not meet the health goal. Specifically, the rule does not specifically control the protozoan *Cryptosporidium*, which has been linked to at least 50 deaths of *Cryptosporidium*-caused illness outbreaks in Milwaukee, Nevada, Oregon, and Georgia. Although the public health benefits of disinfection are significant and well recognized, it has been found that the disinfection byproducts also pose health risks at certain levels. The Safe Drinking Water Act (SDWA) Amendments, signed by President Clinton in August 1996, mandated the establishment of a series of new drinking water regulations in response to these and other concerns. Since the enactment of the amendments, EPA has been busy developing, proposing, and finalizing regulatory actions. Some of the recent regulatory actions are summarized below.

6.2.2 Long Term 1 Enhanced Surface Water Treatment Rule

One of the first rules developed by EPA under the SDWA amendments was the Interim Enhanced Surface Water Treatment Rule (IESWTR). The IESWTR was promulgated to address health risks from microbial contaminants without significantly increasing the potential risks from chemical contaminants. This rule applies to public water systems that use surface water or ground water under the direct influence of surface water (GWUDI) and serve at least 10,000 people. For water systems with a population of less

than 10,000, the Long Term 1 Enhanced Surface Water Treatment Rule (LT1ESWTR) was adopted. This rule was adopted in January 2002 and includes the following provisions:

- Maximum contaminant level goal (MCLG) is set at zero.
- Filtered systems must physically remove 99% (2-log) of Cryptosporidium.
- Specific combined filter effluent (CFE) turbidity requirements depend on the type of filtration. For conventional and direct filtration, the CFE shall be less than 0.3 NTU 95 percent of the time, and at no time higher than 1 NTU.
- Perform CFE turbidity monitoring at least every four hours; record continuous individual turbidity effluent (IFE) measurements (at least every 15 minutes).
- Disinfection profiling and benchmarking provisions to ensure continued microbial protection.
- Requirements for covers on new finished water reservoirs.

6.2.3 Stage 1 Disinfectants/Disinfection Byproducts Rule (Stage 1 DBPR)

Stage 1 DBPR was published along with the IESWTR to control disinfectants and formation of their harmful byproducts. This rule establishes maximum residual disinfectant level goals (MRDLGs) and maximum residual disinfectant levels (MRDLs) for three disinfectants: chlorine (4.0 mg/l), chloramines (4.0 mg/l), and chlorine dioxide (0.8 mg/l). The rule also establishes maximum contaminant level goals (MCLGs) and maximum contaminant levels (MCLs) for specific disinfection byproducts as given in Table 6.2.3.1.

TABLE 6.2.3.1
MCLGs AND MCLs FOR STAGE 1 DISINFECTANTS

Disinfection By-Product	MCLG (mg/l)	MCL (mg/l)	Time Period
Total trihalomethanes (TTHM)	-	0.080	Annual Average
Bromodichloromethane	0	-	-
Dibromochloromethane	0.06	-	-
Bromoform	0	-	-
Haloacectic acids (HAA5)	-	0.06	Annual Average
Dichloroacetic acid	0	-	-
Trichloroacetic acid	0.3	-	-
Chlorite	0.8	1.0	Monthly Average
Bromate	0	0.010	Annual Average

Water system providers must monitor and control the use of disinfectants and meet the requirements for total trihalomethanes (TTHM) and the sum of five haloacetic acids (HAA5). In addition, water systems that use surface water or GWUDI and use conventional filtration treatment are required to also remove a specified percentage of organic materials, measured as total organic carbon (TOC), which may react with disinfectants to form disinfection byproducts.

Furthermore, Oregon's decision to join the State of Idaho, Washington and EPA Region X in participation with the Area Wide Optimization Program (AWOP) is anticipated to create more stringent treatment standards that the existing Port Orford Water Treatment Plant can now meet under ideal conditions. The AWOP performance goals are listed below in Table 6.2.3.2.

TABLE 6.2.3.2
AWOP PERFORMANCE GOALS

SEDIMENTATION	TURBIDITY	CRITERIA
Settled water	Less than 2 NTU, 95% of the time	Avg. annual raw water turbidity > 10 NTU
Settled water	Less than 1 NTU, 95% of the time	Avg. annual raw water turbidity <= 10 NTU
FILTRATION	**TURBIDITY**	**CRITERIA**
Filtered water	< 0.1 NTU, 95% of the time	Based on 4 hr incremental max valves (15 min. period following backwash excluded)
Filtered water	Max. 0.3 NTU following backwash	Return to < 0.1 NTU < 15 minute of backwash

AWOP is proposed as a program, the objective of which is to achieve "performance goals" without major capital expenditures. While these goals are not currently tied to regulatory compliance requirements, it is anticipated that they will be in time as do other "goals" proscribed under color of law and government regulation. Statements by the State such as "To achieve optimized treatment and provide maximum protection of public health, you must achieve the described AWOP performance goals" certainly creates a civil liability burden to do so.

6.2.4 Stage 2 Disinfection Byproduct Rule (Stage 2 DBPR), Effective March 6, 2006

The EPA is promulgating today's final rule, the Stage 2 DBPR, to provide for increased protection against the potential risks for cancer and reproductive and developmental health effects associated with disinfection byproducts. The final Stage 2 DBPR contains maximum contaminant level goals for chloroform, monochloroacetic acid and trichloroacetic acid; National Primary Drinking Water Regulations, which consist of maximum contaminant levels (MCLs) and monitoring, reporting, and public notification requirements for total trihalomethanes and haloacetic acids; and revisions to the reduced monitoring requirements for bromate. This document also specifies the best available technologies for the final MCLs. EPA is also approving additional analytical methods for the determination of disinfectants and DBPs in drinking water. The Stage 2 DBPR rule is intended to reduce potential cancer and reproductive and developmental health risks from disinfection byproducts (DBPs) in drinking water. The requirements of this rule apply to community water systems and non-transient non-community water systems that add and/or deliver water that is treated with a primary or residual disinfectant other than UV. The Stage 2 rules would be implemented in two phases.

- **Phase 1.** All systems must comply with a 120 mg/l TTHM / 100 mg/l HAA locational running annual average based on Stage 1 monitoring sites and also continue to comply with the Stage 1 annual average requirements. The end of Phase 1 is three years after rule promulgation with an additional two-year extension available systems requiring capital improvements.

- **Phase 2.** For small systems required to do *Cryptosporidium* monitoring, compliance with a 80 mg/l TTHM / 60 mg/l HAA locational running annual average will begin 8.5 years after rule promulgation with an additional two-year extension for systems requiring capital improvements. For all other small systems, compliance with the 80/60 locational running annual averages would begin 7.5 years after rule promulgation with potential two-year capital improvement extension.

An initial distribution system evaluation (IDSE) would be conducted by the water provider and is intended to select new compliance monitoring sites that reflect locations with system high TTHM and HAA5 concentrations. Water providers would recommend new or revised monitoring sites based on their IDSE study. The results from the IDSE study would not be used for compliance purposes. For surface water systems with less than 10,000 people, water providers must monitor either quarterly (population

from 500-9,999) or semi-annually (population <500) for one year at two distribution system sites per plant. These sites must be in addition to the Stage 1 DBPR compliance monitoring sites. Water providers that certify to the State that all samples taken in the last two years were below 40 mg/l TTHM / 30 mg/l HAA5 are not required to conduct the IDSE.

For long-term compliance monitoring, the principles of reduced compliance monitoring strategy (for very low DBP levels) utilized in Stage 1 DBPR would continue in the Stage 2 DBPR. Water providers would collect paired samples (TTHM and HAA5) at the site representing the highest TTHM and the highest HAA5 locations in the distribution system as identified under the IDSE. If the highest levels of TTHM and HAA5 are observed at the same location, then only one sample would be needed. Monitoring would be either quarterly (population from 500 – 9,999) or annually (population <500). The Federal Advisory Committee also recommended that EPA propose that all wholesale and consecutive systems comply with the provisions of the Stage 2 DBPR on the same schedule of the system serving the largest population in the combined distribution system. Additional information on this regulation can be found at: www.epa.gov/safewater/disinfection/stage2/index.html

6.2.5 Long Term 2 Enhanced Surface Water Treatment Rule (LT2ESWTR), Proposed

The Long Term 2 Enhanced Surface Water Treatment Rule (LT2ESWTR) was proposed and reviewed by a Federal Advisory Committee at the same time as the Stage 2 DBPR rules. The requirements of this rule would pertain to all public water systems that use surface waters or GWUDI. The rule will incorporate system specific treatment requirements for one of four categories or "bins" depending upon the results of source water *Cryptosporidium* monitoring. Treatment requirements for each system would depend on the system's existing treatment equipment and removal capabilities. To comply with additional treatment requirements, water providers would choose technologies from a "toolbox" of options. Proposed treatment requirements for average *Cryptosporidium* are presented in Table 6.2.5.1.

TABLE 6.2.5.1
PROPOSED TREATMENT REQUIREMENTS FOR AVERAGE *Cryptosporidium* CONCENTRATIONS

Bin No.	Ave. *Cryptosporidium* Concentration	Additional Treatment Requirements[1]
1	< 0.075/ liter	No action
2	0.075/ liter < x < 1.0/ liter	1-log treatment (any technology or technologies)
3	1.0/ liter < x < 3.0/ liter	2.0 log treatment (must achieve at least 1-log of treatment using specific technology [2]
4	> 3.0/ liter	2.5 log treatment (must achieve at least 1-log treatment using specific technology [2]

[1] - For systems with conventional treatment that are in full compliance with IESWTR.
[2] - Acceptable technologies include ozone, chlorine dioxide, ultraviolet (UV), membranes, bag/cartridge filters, or in-bank filtration.

For small systems monitoring requirements, it is anticipated that source water *E. coli* concentrations would be utilized for *Cryptosporidium* monitoring. Observed *E. coli* concentrations above certain levels would trigger *Cryptosporidium* monitoring. The recommended *E. coli* monitoring for small systems would begin 2.5 years after rule promulgation and would include 24 samples over one year. After six years of the system characterization, a second round of monitoring is proposed.

In summary, the rules are getting tougher with increased treatment standards, lower MCLs, and more regulated substances. Water suppliers must stay informed of upcoming standards and requirements to ensure that their system will stay in compliance. Proper preparation is critical. When upcoming MCLs are established, a supplier should begin to test for these materials to determine if compliance will be a problem. Advanced planning will allow a utility more time to make necessary modifications to treatment

techniques. Additional information on recent and pending regulations can be found at www.epa.gov/safewater/standards.html.

6.2.6 Filter Backwash Recycle Rule

EPA is required to regulate the recycling of filter backwash within the treatment process of a public water system. The provisions of this rule impact all conventional and direct filtration systems, which recycle filter backwash and use of surface water or GWUDI. Under the rule, the following provisions are required.

- Recycle water from filter backwash, supernatant from sludge thickening, and liquids from sludge dewatering must pass through all filtration processes for treatment.

Specific information on the regulations concerning public water systems may be found in the Oregon Administrative Rules (OAR), Chapter 333, Division 61. The rules can be found on the Internet at www.ohd.hr.state.or.us/cehs/dwp/pwsrules.htm.

6.2.7 Arsenic and Clarifications to Compliance and New Source Monitoring Rule

In January 2001, the Arsenic and Clarifications to Compliance and New Source Monitoring Rule was enacted. The major features of this rule included the following.

- Include health effects statements in Consumer Confidence Reports for arsenic levels from 5 to 50 ug/l and when systems are in violation of the arsenic MCL of 10 ug/l.
- All new systems/sources must collect initial monitoring samples for all IOCs, SOCs, and VOCs.
- The arsenic MCL of 10 ug/l became effective on January 23, 2006.
- One sample must be taken and analyzed after effective date of MCL. Surface water systems must take annual samples.
- A system with a sampling point result above the MCL must collect quarterly samples at that sampling point, until the system is reliably and consistently below the MCL.

6.3 Responsibilities as a Water Supplier

Per OAR 333-061-0025, water suppliers are responsible for taking all reasonable precautions to assure that the water delivered to water users does not exceed maximum contaminant levels, to make certain that water system facilities are free of public health hazards, and to verify that water system operation and maintenance are performed as required by these rules. This includes, but is not limited to, the following:

- Routinely collect and submit water samples for laboratory analyses at the frequencies prescribed by OAR 333-061-0036.
- Take immediate corrective action when the results of analyses or measurements indicate that maximum contaminant levels have been exceeded and report the results of these analyses as prescribed by OAR 333-061-0040.

- Continue to report as prescribed by OAR 333-061-0040, the results of analyses or measurements, which indicate that maximum contaminant levels have not been exceeded.

- Notify all customers of the system, as well as the general public in the service area, as prescribed by OAR 333-061-0042, when the maximum contaminant levels have been exceeded.

- Notify all customers served by the system, as prescribed by OAR 333-061-0042, when the reporting requirements are not being met, or when public health hazards are found to exist in the system, or when the operation of the system is subject to a permit or a variance.

- Maintain monitoring and operating records and make these records available for review when the system is inspected.

- Maintain a pressure of at least 20 pounds per square inch (psi) at all service connections at all times.

- Follow-up on complaints relating to water quality from users and maintain records and reports on actions undertaken.

- Conduct an active program for systematically identifying and controlling cross connections.

- Submit plans to the Division, prepared by a professional engineer registered in Oregon, for review and approval before undertaking the construction of new water systems or major modifications to existing water systems, unless exempted from this requirement.

- Assure that the water system is in compliance with OAR 333-061-0032 relating to water treatment.

- Assure that the water system is in compliance with OAR 333-061-0205 relating to certification of water system operators.

- Verify that Non-Community water systems utilizing surface water sources or sources under the influence of surface water are in compliance with OAR 333-061-0065 (2) (c) relating to required special training.

Section

7

Alternatives Analysis

Section 7

Alternatives Analysis

7.0 Alternatives Analysis

The primary goals for the water system master plan are to address the water source limitations, evaluate means to restore Garrison Lake as a viable water source, identify a viable new source(s), develop of a water conservation plan, and develop a capital improvement plan (CIP) for distribution, storage, and treatment system improvements. This section of the Master Plan presents detailed analysis of each water system component and, where appropriate, provides recommended improvement options that address specific component deficiencies. Cost estimates for the recommended projects are developed and prioritized in Section 8 followed by an assessment of impacts to ratepayers in Section 9.

7.1 Raw Water Sources Evaluation

The City's two most prominent water supplies have been impacted by siltation in the Hubbard Creek reservoir and seawater intrusion in Garrison Lake. It is imperative that the City address these problems before their impact becomes so severe that water supply restricts future growth within the community.

In the Hubbard Creek watershed, past logging activities have placed a heavy sediment burden in the reservoir. The City now controls acreage surrounding the reservoir, but may not control sufficient acreage within the watershed to prevent future logging activities from causing further siltation and reducing the supply volume. Siltation of the reservoir is currently being addressed by a dredging project being conducted by the City Public Works crews. Dredging activities must be conducted annually. This causes significant strain on the City's limited resources and manpower, and only provides a temporary solution. A long-term plan is needed that addresses issues by identifying measures to improve the impoundment and maximize the City's use of this facility.

In Garrison Lake, the water source has been impacted by increased salinity from ocean wave run-up and overtopping of the Agate Beach berm. Establishing measures such as incresing the Agate Beach berm height that reestablish Garrison Lake as a water source could provide a reliable and cost-effective water supply with acceptable taste and aesthetic properties.

Alternate water sources may be available that could also provide long-term supply solutions including:

- Conservation (reduced water use and water loss equating to increased supply),
- Exploring a new Hubbard Creek impoundment,
- Locating local groundwater reserves such as a well field near the Elk River,
- Moving the Garrison Lake intake from the currently saline lower lake to the upper lake where fresher water exists and installing a membrane filtration system.

Each of these options was considered with City staff for feasibility.

- Conservation may be accomplished by reducing water loss and implementing a meter replacement program.

- Installation of another impoundment upstream of the existing North Fork Hubbard Creek reservoir does not appear to be feasible because of the extremely high construction cost. It does not appear viable due to persistent turbidity and dredging issues which remain.

- Installation of well fields near Elk River does not appear viable. Studies, cited by EGR & Associates, show well water production quantities are not adequate for municipal use and/or are located in areas where contamination by pesticides is a concern. In addition, a well field producing quantities necessary for municipal uses may cause salt water intrusion into nearby private wells.

- Garrison Lake would require relocation of the raw water intake and additional treatment to address taste and odor issues.

7.1.1 Existing Source Capacity to Satisfy Projected Demands

The capacity of individual surface water sources was evaluated based on a search of the Water Resources Department water rights inventory system (WRIS) and water availability report system (WARS). A summary of the findings is provided below.

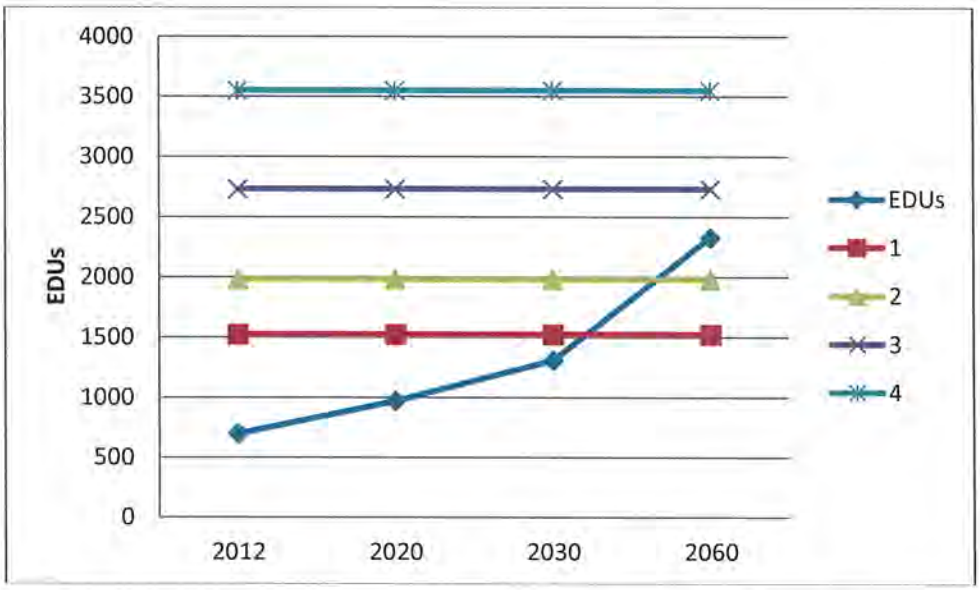
Hubbard Creek currently serves as the only water source for the City of Port Orford, as indicated in Figure 7.1.1.1. The City's water right for diversion of water from Hubbard Creek totals 1.25 cfs (0.81 MGD). This is sufficient for supplying projected maximum day demands through a 30-year planning period, assuming a 1.05 percent growth rate. However, during extreme drought conditions stream flow may fall below 1.25 cfs and the City will need to rely on Garrison Lake for a water source.

The second principle water right of 1.0 cfs certificated in April 1977 for the City is Garrison Lake. Garrison Lake could provide a secondary source of supply. However, in recent years, this source has not been utilized because of salt water intrusion problems. Relocating the intake to the upper end of Garrison Lake above Arizona Street could minimize the impact of salination, but the generally poor quality of the lake water will require improvements to treatment before this source can be used as a viable supply of drinking water.

Estimates of total number of EDUs served by the Hubbard Creek water rights are based on maximum day demand (MDD) values developed in Section 4. The current MDD of 531 gal per EDU per day is based on metered raw water at the treatment plant and includes the approximate 50 percent unaccounted for water as previously discussed in Section4. While losses greater than 15 percent are likely, the age of the service meters is likely a significant contribution.

Reductions in lost water are based on the assumption that the large volume of unaccounted for water is actually lost from the system due to leakage and that the existing consumption metering accurately accounts for demand. This assumption must be verified, since based on the age of the system, many of the meters may be inaccurate.

FIGURE 7.1.1.1
POTENTIAL EDUs SERVED BY EXISTING WATER RIGHTS / GROWTH RATE



1. Hubbard Creek water right of 0.8 MGD will serve 1521 EDUs at current MDD of 531 gal / EDU
2. Hubbard Creek water right of 0.8 MGD will serve 1980 EDUs at reduced MDD of 408 gal / EDU
3. Hubbard Creek Garrison Lake water rights of 1.45 MGD will serve 2730 EDUs at current MDD of 531 gal/EDU
4. Hubbard Creek Garrison Lake water rights of 1.45 MGD will serve 3553 EDUs at MDD of 408 gal / EDU

7.1.2 North Hubbard Creek Impoundment

The City of Port Orford has storage rights for 1.08 MG of water from Hubbard Creek. The existing impoundment will hold this volume of water if it is dredged to the elevations recorded during the as-built survey in 1993. Currently the impoundment volume is less but unknown. The Public Works Department reports that in late summer 2002, the impounded water level continued to drop and no stream flow was discharged through the weir structure. Based on this report, the City needs to find an additional late summer water source or supply.

One option for expanding storage is converting the 200,000-gallon reservoir on Deady Street to raw water storage. Increased storage would increase the reliably of the water supply during the late summer.

Need for Increased Raw Water Storage
The City's rights for water appropriation are senior to all other rights on Hubbard Creek including in-stream rights. The City can, therefore, store any unused water, up to its existing water right, without injury to any other water rights. Water in excess of this amount, would be released to satisfy junior rights.

The existing impoundment allows the City to store the equivalent of two times the maximum daily demand. To date, this quantity of water has satisfied existing demand when the City has utilized 64 percent (0.8 cfs) of its total 1.25 cfs water right. In order for the City to increase its water withdrawal rate to the full water right, the City will need to increase the available storage, either by expanding the existing

impoundment or constructing a new one. The increased storage should be based on increasing the volume in storage to satisfy demands during the maximum monthly demand.

During the drought of year 2002, it was reported by the City that the amount of water flowing into the existing Hubbard Creek impoundment had declined to 0.8 cfs, the same rate that water was being appropriated (Based on City Public Works staff report, the reservoir level remained constant and no water was released downstream.). Given similar drought conditions and projected future demands, the City will need to withdraw all of the water flowing into the impoundment during a drought plus an additional 0.45 cfs from storage during dry drought months.

The Oregon Water Resources Department (OWRD) model of water availability for Hubbard Creek, shown in Table 7.1.2.1, indicates that there is no additional water available for the Hubbard Creek watershed for storage or diversion during the late summer months. In order to provide additional water for storage, the City would need to divert water to storage during the winter months while water is available. Based on OWRD data, the Hubbard Creek watershed has an annual net water availability of 6,160 acre-feet. Approximately 22 percent of the watershed is tributary to the existing Hubbard Creek impoundment, resulting in a net excess of 1,355 acre-feet of water potentially available for storage above the existing Hubbard Creek Impoundment.

Preliminary discussions with the OWRD Water Master indicate that adding a second upper impoundment does not appear to be feasible. It will be also be necessary to apply for a new permit to divert and store water during the months when excess water is available.

TABLE 7.1.2.1
WATER AVAILABILITY AT MOUTH OF HUBBARD CREEK
BASED ON 50% EXCEEDENCE LEVEL[5]

Month	Natural Stream Flow	Water Rights prior to 1/1/1993	Water Rights After 1/1/1993	Expected Stream Flow	Reserved Stream Flow	In stream Water Rights	Net Water Available
	cfs	cfs	cfs	cfs	cfs	cfs	cfs
1	51.1	1.28	0.17	49.7	0	26.00	23.7
2	57	1.28	0.17	55.6	0	26.00	29.6
3	48.8	1.28	0.16	47.4	0	26.00	21.4
4	24.2	1.28	0.03	22.9	0	24.20	-1.31
5	10.1	1.28	0.04	8.79		10.10	-1.31
6	11	1.28	0.08	9.64	0	10.90	-1.26
7	8.01	1.28	0.25	6.48	0	7.97	-1.49
8	5.27	1.28	0.13	3.86	0	5.23	-1.37
9	3.54	1.28	0.04	2.22	0	3.50	4.28
10	4.37	1.28	0.02	3.08	0	4.33	-1.25
11	23.6	1.28	0.03	22.3		23.5	-1.2
12	55.6	1.28	0.17	54.2	0	26.00	28.2
Storage	Acre-ft	Acre-ft	Acre-ft	Acre-ft	Acre-ft	Acre-ft	Acre-ft
	18,200	926	77	17200	0	11,600	6,160
North Fork Hubbard Creek above existing impoundment							1,355[3]
North Fork Hubbard Creek above new impoundment location							8624

1. Availability for storage is based on the stream flow that is expected to be exceeded 50% of the time.
2. Estimate of available storage based on 22% of total watershed acreage above existing Hubbard Creek Impoundment,
3. Estimate of available storage based on 20% of total watershed acreage above potential new Hubbard Creek Impoundment.

Feasibility of Expanding Existing Impoundment
In order for Hubbard Creek to continue to serve as the primary source of water for Port Orford it is recommended that additional storage be provided by constructing a new impoundment. Based on the topography of the canyon, a significant amount of water could be added to storage by construction a new impoundment above the existing facility.

Based on topography of the Hubbard Creek impoundment, there is a potential new reservoir site located approximately 1/4 mile upstream from the existing Hubbard Creek Impoundment. Above this location, the Canyon widens considerably forming a natural basin. To appropriate water at this site would require that the City apply for a new permit to store water and a secondary right to release the water to the lower impoundment where it could be appropriated under the existing water right. It may also be feasible to increase the lower impoundment water right and thereby increase the City's total Hubbard Creek water right. This option does not appear to be feasible at this preliminary stage, because there will be extensive permitting, and geotechnical and environmental issues that must be addressed before the City could actually implement this improvement.

7.1.3 Watershed Protection Measures

The Hubbard Creek Watershed has an area of approximately 6.2 square miles (4224 acres) and the North Fork Hubbard Creek drains approximately 2.0 square miles (1288 Acres) of this area. The watershed area water quality has improved in the last several years due to successful reforestation, road closures and road surface stabilization. The City should continue to restrict access to the watershed. Where fences are not in place, boundaries should be posted. Management practices should include prohibitions on all activities, which would negatively impact the quality of run-off including the following:

- Prohibit / restrict timber harvest.
- Prohibit / restrict further road construction.
- Restrict motorized recreational vehicles access.
- Develop improved storm water management practices for development inside the basin.
- Restrict new development and limit the use of onsite wastewater disposal systems.

7.1.4 Garrison Lake Source

Salinity in Garrison Lake has impacted the existing Garrison Lake source resulting in poor treated water quality and taste concerns. In recent years, conditions in the lake have deteriorated and the existing intake location may not provide water that can be made potable. Relocation of the intake to the upper arm of the lake above Arizona Street is considered the best option for improving the raw water quality in the short term. Relocation, however, may not be sufficient to provide the required raw water quality and treatment options; ultra-filtration or reverse osmosis may be necessary to improve treated water quality.

Relocation of the intake to a new location will involve transfer of water rights; installation of a new raw water transmission line either on land or along the lake bottom; improvements to the raw water pump station or construction of a new raw water pumping facility; and construction of a new multi-level intake.

In the past, algae growth in the lake has posed problems with taste and odor. The ability to withdraw water from various lake depths may eliminate this problem. Water quality sampling should be conducted at the proposed site to determine the effects of algae on water quality. The sampling and analysis should also include determination of whether there are any occurrences of blue-green algae. Access to allow isolating various intake levels will need to be considered. It may be more desirable to install several pipelines from the shore to each intake screen, allowing the City to select an intake level by using valves from shore.

Because of the high levels of organics and salinity in Garrison Lake it may be necessary to use membrane filtration to treat this source. Membrane filtration units provide clarification, softening, disinfection, organic removal, and desalination in compact automated modular units. Membranes are superior to conventional filtration plants because they provide a positive physical barrier between contaminants in the feed water and the purified product water, and are unique in their ability to remove salt.

Since the lake can be classified as brackish due to salt-water intrusion, the removal of salt and other metal ions will require nanofiltration or reverse osmosis membrane systems. Depending on the degree of salinity it may be possible to purify a portion of the raw water source and blend it with water that has been treated using ultra-filtration membranes. Ultra-filtration will remove: viruses, bacteria, particulates, and high molecular weight compounds greater than 0.01 microns, but will not remove divalent ions such as salt.

Two options for construction of the transmission line involve a submerged line running along the lake bottom or an on-land alignment constructed from Arizona Street to the 18th Street boat ramp. Both options would connect to the existing raw water intake line.

Routing of the pipeline across the lake bottom is the preferred option but would require addressing several permitting and engineering issues. Floating and sinking an HDPE pipeline to the lake bottom is anticipated and would require permitting for this type of activity. Another important engineering issue is how to place the line under the bridge, since in-water construction will be difficult and may not be permitted with heavy equipment. It is assumed, therefore, that the work under the bridge will involve hand excavating a trench and encasing the pipe in a concrete backfill for protection from vandalism and scour. If the water line can be installed across the lake, then the existing raw water pumping facility will need to be upgraded to serve the new intake. The upgrade would need to address selection of pumping equipment that would provide the necessary suction lift required for the extended pipeline. If the on-land route is selected, then a new raw water pump station will be required.

A final element for the City to consider is protecting Garrison Lake water quality and reversing eutrification and water quality deterioration. As future development occurs, this issue will become more important since, invariably, lakefront property will be highly desirable. Policy issues addressing storm water discharges and potential prohibition against septic systems along the lakeshore will need to be considered.

7.1.5 Summary of Recommended Source Improvements

The City has sufficient water rights from Hubbard Creek and Garrison Lake to satisfy projected maximum day demands and should concentrate its efforts on improving the capacity and quality of water provided by these two sources.

During drought periods Hubbard Creek may not have sufficient flow to provide the full water right without construction of a second impoundment. This option should be considered during the Master Plan Update Period, for long range planning purposes, since this may be cost-prohibitive. The City may forego this option in favor of improving the Garrison Lake intake.

Water quality problems have limited the use of Garrison Lake as a source of water for the City. It is proposed that the intake be moved to the upper arm of the lake and that measures be taken to prevent salt-water intrusion downstream of this location. Water sampling should be conducted at the proposed site to determine the seasonal impacts of algae on water quality and to determine whether construction of an intake to withdraw water at multiple depths could limit those effects. Moving the intake to above the Arizona Street Bridge or the use of RO membranes for water treatment (salinity removal) should be considered within the next five years. If the intake is relocated, a water rights transfer or a new water right filing should be implemented in the interim.

7.2 Raw Water Transmission

7.2.1 Hubbard Creek

Based on existing water rights, the maximum amount of water the City can withdraw from Hubbard Creek is 1.25 cfs (560 gpm). This volume of water will satisfy projected maximum day demands for raw water in 2060 based on current estimates of growth. Using this rate as the design criteria it can be concluded that the transmission line is adequately sized and since it is of recent construction, it will not need replacement.

Pumps are normally sized for a 20-year design life and the projected maximum day demand for raw water in 2025 is estimated to be 0.55 MG (383 gpm). The two 25-HP raw water pumps are in good condition and can deliver 350 gpm. Both pumps were installed in 2009.

It is recommended that a meter be placed on the raw waterline at the impoundment. Currently the water is metered at the intake to the water treatment plant and there is no measurement of any losses in the 5,000 feet of transmission line. The raw water pumping facility should also include provisions for a backup power supply.

7.2.2 Garrison Lake

Transmission facilities for Garrison Lake have not been utilized in several years and it is likely that the pumping equipment cannot be brought on-line without significant work to the mechanical and electrical systems. Relocation of the new intake will also require evaluating the existing pumps to determine their suitability for the new design condition. If the existing pumps have a low suction lift, or the station is located below the flood elevation, then the station will need to be replaced.

For the purposes of this plan, it is assumed that a new pump station will be required and the wet well will be relocated above the flood level. Sizing of the pumping equipment should be based on a maximum pump rate of 1 cfs (existing water right). The raw water transmission line should be sized with a minimum 10-inches inside diameter or larger. This size line will require that the wet well depth extend 2.5 feet below the low water level of the lake plus the depth required to keep the pump suction flooded during maximum pumping rate. The new wet well should be 8 feet in diameter. Pumping equipment proposed for the facility would be submersible turbine pumps. Preliminary calculations indicate that 5 Hp pumps will be required. Fish screening will be necessary.

7.3 Water Treatment Facility

The City of Port Orford has one potable water treatment plant (WTP). A discussion of the water treatment facilities is presented below.

Water treatment facilities are typically sized to provide the projected maximum day demand (MDD), including allowances for treatment plant losses. Typically a water plant is operated for 5 days a week to allow operators to adjust the process during regular working hours. The existing operational capacity of the City's treatment plant is considerably less than the MDD, and during peak demand periods, staff must operate the facility 7 days a week. Increasing the capacity of the facility is necessary to satisfy both current and future MDD criteria and allow normal weekly operations without extended staff time or weekend duties.

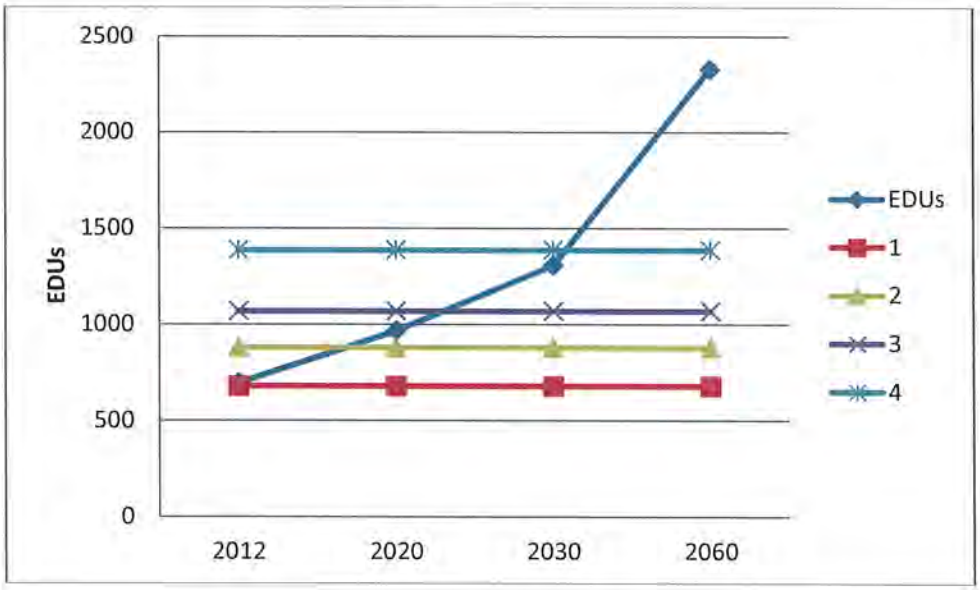
In addition to plant deficiencies the plant has experienced problems with major components, including an inadequately sized contact basin, problematic instrumentation and control components, and the disinfection system. These issues have been discussed with City staff and recommendations to resolve these problems are presented in this section.

7.3.1 Existing Capacity/Demand

The existing operational capacity of the treatment plant is limited to 350 gpm. Although the existing water treatment plant was designed for a capacity of 555 gpm (equivalent to the Hubbard Creek water right), the plant does not produce high quality effluent at this rate. The limiting factor appears to be high turbidity and the clarification process. This limitation is based on operator experience that requires running the plant at a lower rate than the design intent. It is reported that at higher treatment rates, the plant does not function reliably and call-outs and alarms become all too frequent.

Improvements to the existing treatment plant are required to increase the capacity to 555 gpm or 568,000 gpd at 71 percent operational time. This increased capacity will satisfy demands for 1,068 EDUs at the current maximum day demands and 1,387 EDUs if demands are reduced by limiting losses to 15 percent. As shown in Figure 7.3.1.1 the increased capacity will be sufficient to supply projected maximum day demands for more than 20 years at the projected 1.05 percent growth rate.

FIGURE 7.3.1.1
TREATMENT PLANT CAPACITY



1. Current Max Flow 350 gpm Capacity at Current MDD (531 gpd / edu) 677 EDUs
2. Current Max Flow 350 gpm Capacity at Reduced MDD (408 gpd / edu) 880 EDUs
3. Improved Flow **555** gpm Capacity at Current MDD (531 gpd /edu) 1068 EDU
4. Improved Flow **555** gpm Capacity at Current MDD (408 gpd /edu) 1387 EDU

7.3.2 Alternatives for Increasing WTP Capacity

The City's water treatment plant incorporates chemical addition and flocculation, followed by sedimentation and filtration. This type of system is considered a conventional system that various manufacturers have developed into package treatment facilities. The type of sedimentation basins employed at the existing plant utilizes tube settlers a somewhat obsolete technology that is no longer common in modern water treatment facility designs. Current technologies employ the use of adsorption clarifiers, larger up-flow clarifiers with improved tube settler technologies, and/or presedimentation. Conversion to an adsorption clarifier is considered the best means to replace the obsolete tube settler equipment; however, the use of a pre-sedimentation basin could also be considered if the Deady Street reservoir were converted to this duty.

Adsorption Clarifier
An adsorption clarifier combines flocculation and clarification into a single process step and uses less than 60 percent of the area employed in a traditional clarifier. Clarification is accomplished using granular adsorptive media comprised of ionized plastic beads that float and are specifically designed to optimize the removal of coagulated material. Because the plastic media floats, it is necessary to rim the clarifier from the bottom up and hold the media in place using a screen at the top of the tank. Material filtered by the media is removed during a combined air and water-flushing step similar to the backwash cycle in a conventional filter. Using an adsorption clarifier reduces the need to form a settleable floc so longer clarifier hydraulic residence times are not required. This feature allows the clarifier size to be significantly reduced. Typical design loading rates for adsorption clarifiers vary from 10 - 25 gpm/SF.

Conversion of the existing sedimentation basin containing the tube settlers to an adsorption clarifier is considered a feasible and appropriate upgrade for the City's water treatment facility. This changeout has been successfully implemented on several other Keystone package water plants of design similar to the City's facility. In addition to improving the clarification process, the adsorption clarifier will also improve the throughput capacity of the plant by reducing loadings on the filtration system. Following these improvements, the filters should produce high quality treated water at a loading of 4 gpm/SF, or up to 555 gpm.

Pre-sedimentation
The City should use the Deady Street Reservoir to provide pre-treatment for the water treatment plant. Currently this tank is not being used for treated water storage and could be added to the plant process as an interim improvement while the City plans on the conversion to the adsorption clarifier.

Minor piping modifications would be required to convert the reservoir into a large raw water tank that feeds directly into the raw water transmission line rather than being supplied by the treated water distribution system. The 200,000-gallon tank would provide raw water storage, allow sedimentation, and could feed the plant during periods of high turbidity in Hubbard Creek.

The use of this reservoir as a pre-sedimentation tank should be developed more thoroughly in a predesign of the proposed water treatment plant improvements. Pre-sedimentation may be an excellent alternative or addition to the adsorption clarifier and it may prove cost-effective to provide flocculation and sedimentation processes that alleviate the need for the adsorption clarifier.

7.3.3 WTP Component Deficiencies

The water treatment plant suffers from several deficiencies that encompass more than the limited throughput capacity. The most important issues are providing pH control, improving CT time, and replacing the control system. Each of these upgrades is discussed below.

Increased Contact Time
OAR requires that treatment be sufficient to achieve at least 99.9% (3-log) inactivation and/or removal of *Giardia lamblia* cysts and at least 99.99% (4-log) inactivation and/or removal of viruses as determined by OHD. The inactivation ratio is based on "CT" time, which is the residual concentration (C) in mg/L times the contact time (T) in minutes. Required CT values are published in OAR and are dependent on the water temperature, pH, and chlorine residual.

The Port Orford treatment plant is required to provide a 1-log inactivation of *Giardia* cysts with disinfection. Based on a pH of 7.0 and a minimum temperature of 5 degrees Celsius, the CT required to accomplish the required inactivation is 50. At a maximum free chlorine residual of 1.1 mg/L, the City requires a contact tank that provides a minimum effective contact time of 45 minutes.

When the treatment plant capacity is increased to achieve the projected MDD, the contact time will need to be increased and this deficiency will become an even greater priority.

The following alternatives for increasing the contact time were investigated:

- Baffling the existing 20,000 gallon contact tank,
- Construction of a new contact basin, or
- Pre-chlorination of raw water.

Given that the City already has a contact tank, the option to baffle the tank and bring it on line for contact time after treatment is the most efficient and comprehensive means to achieve the regulatory CT requirements. The existing pre-chlorination tank should be valved to allow either prechlorination or post chlorination duty. By combining CT time from both tanks, the contact time prior to distribution in the system will be adequate.

Control Systems
The treatment plant control system does not function as intended. Several automation and emergency call-out features are inoperable or do not function as intended. These limitations require operations staff to run the plant manually and frequently check the plant status on-site. It is generally believed that this lack of automation is the most significant issue that has limited the plant throughput to 60 percent of the design intent. Operators are simply unwilling to push the plant production for fear of failing to produce water or having alarm call-outs around the clock. The lack of an automatic response system also mandates that City staff conduct frequent site visits, even during off hours and in the middle of the night. This limitation represents a higher than normal operating cost and a significant drain on City resources and on the focus of the public works department.

The source of the problem is the RUGAR programmable logic controller (PLC) responsible for operation of the plant. The existing PLC should be replaced with a modem-expandable PLC that is better suited to public infrastructure and can incorporate a Human Interface Machine (i.e. computer with operations and dial-out software).

An additional control system upgrade that should also be considered is a streaming current monitor that adjusts and optimizes chemical feed rates to changes in turbidity. Incorporating the streaming current monitor, allowing for automatic adjustment of coagulant dosages, providing emergency callout features, and adding a human interface machine should greatly improve the plant operations and increase plant throughput to the design intent.

7.4 Treated Water Transmission

The pumps from the treatment plant to the reservoir should have a capacity equal to the maximum day demand MDD. The existing pumps have a capacity of 290 gpm individually and a combined capacity of 500 gpm. There is no back-up pump for supplying peak day flows.

It is recommended that the existing pumps be replaced and that an additional pump be installed to provide redundancy. The capacity of the treated water pumps should be equal to the upgraded capacity of the water treatment plant or 555 gpm. The installation of a flow meter on the treated water discharge and a back-up power generator should be part of these improvements.

7.5 Treated Water Storage

Requirements for treated water storage during the planning period are presented below. Planning for new reservoirs considers peak day requirements for current population projections and the long range population projections excluding the UGB area. Reservoirs also provide enhancement to the hydraulic capabilities of the distribution system and are often located to enhance flow rates during fire flow events.

7.5.1 Reserve Requirements

As was developed in Section 6, there are several methods for determining the treated water storage that are required for a given water system. Two different methods were utilized to determine the treated water

reserve requirements for the City of Port Orford. Each method is briefly summarized below:

State Agency Recommended Method - Method 1
An interagency team made up of personnel from the DEQ, OBDD, OHD, WRD, USDA, DLCD, and others has been working to develop recommended sizing strategies based on state and community consumption averages and their experiences with Oregon communities. Part of these recommendations included sizing parameters for treated water reserve components.

The interagency team suggests that reserves in the system be sized for volumes equal to 2.5 times the ADD plus fire flow reserves. Based on this methodology, the required reserve for the City of Port Orford is 0.733 MG as summarized in Table 7.5.1A. In 20 years, this volume increases to 0.923 MG. If the 200,000-gallon tank at Deady Street is converted to a pre-sedimentation tank, then available storage is reduced to 1.0 MG and there is no excess storage.

TABLE 7.5.1A
STORAGE REQUIREMENTS METHOD 1

	2012	2017	2022	2027	2032
Emergency*	0.193	0.229	0.272	0.323	0.383
Fire Reserve	0.540	0.540	0.540	0.540	0.540
Total	0.733	0.769	0.812	0.863	0.923
Existing Storage	1.000	1.000	1.000	1.000	1.000
Excess	0.267	0.231	0.188	0.137	0.077
Emergency = 2.5 *ADD Assumes 3.5 percent growth					

Standard Methodology - Method 2
The second method used to analyze the reserve requirements for the City of Port Orford is based on methodology commonly used within the industry. The methodology operates under the planning scenario of a major fire occurring during maximum-day conditions. The scenario could be interpreted as the District experiencing a fire on the Fourth of July.

Method 2 suggests having one MDD storage volume to make it through the maximum day demand without further production capabilities for emergency storage. In addition to emergency storage, one-quarter of a MDD should be stored for equalizing flow in order to balance demand and production offsets. Appropriate fire reserves are also included in Method 2.

TABLE 7.5.1B
STORAGE REQUIREMENTS METHOD 2

	2012	2017	2022	2027	2032
	MG	MG	MG	MG	MG
Equalizing	0.0483	0.0573	0.0681	0.0808	0.0710
Emergency	0.193	0.229	0.272	0.323	0.384
Fire Reserve	0.540	0.540	0.540	0.540	0.540
Total	0.781	0.826	0.880	0.944	0.995
Existing	1.000	1.000	1.000	1.000	1.000
Excess	0.219	0.174	0.120	0.056	0.005

A new 100,000 gallon storage tank at the existing Deady Street reservoir will provide additional storage for current and near future use. The storage tank will need to be installed at an elevation of approximately 180 feet.

Based on current per-capita usage, the reservoir would need to have a minimum capacity of 100,000 gallons to meet requirements at the end of the 20-year planning period. Long-range needs are projected to be approximately 500,000 gallons based on the calculated MDD and should be reassessed following water conservation measures.

A number of issues should be considered when sizing new treated water reserve components. The above analyses can be used to develop the requirements for treated water reserve system both now and at the end of the planning period, based on current and predicted system demands. The above methodologies do not, however, take into consideration the remaining life of the existing reserve facilities or the expected life of new components.

Common materials for modern reservoirs are reinforced concrete, welded steel, or bolted glass-fused-to-steel tanks. Reinforced concrete and glass-fused-to-steel bolted tanks typically have a longer useful life than a welded steel tank; however, the initial cost of a concrete tank can be up to 30 percent higher than a steel tank of the same size. The concrete tank can also be totally or partially buried. Bolted steel tanks are typically less costly to construct for volumes up to 750,000 gallons and are generally preferred for small communities. A bolted steel tank cannot be buried within a hillside excavation.

7.6 Distribution System

The existing water system was modeled using hydraulic modeling software called WaterCAD® by Haestead Methods. Figure 7.6.1.1 displays the existing water system infrastructure prior to improvements. The hydraulic performance of the distribution system was modeled under fire flow conditions combined with maximum day demand. The modeling scenario simulates a design condition with the City fighting a fire on the Fourth of July.

Pipe sections were identified as deficient based upon the modeled capacity to provide the required fire flows. Improved scenarios were modeled based on replacing the undersized pipes. All of the recommended improvements to the distribution system are included in Section 8 where a summary of each distribution project is provided with a cost estimate. Section 9 provides recommendations for project prioritization.

7.6.1 Calibration of Hydraulic Model

The model of the existing system was calibrated with help from Port Orford staff. Modeled static pressures and simulated fire flows are compared to those obtained by City staff in Table 7.6.1.1. There is good agreement between the static pressures predicted by the simulation and those measured at individual hydrants. The differences are within the range that would be expected given daily variations in reservoir levels of 10 to 30 feet.

There is also variation in simulated fire flows with those measured by City staff. This variation is a function of differences in the residual pressures. The model calculates fire flows by assuming that the pressure does not fall below 20 psi either at the hydrant or anywhere else within the system. Flows measured by City staff are limited by the physical constraints of the hydrant. At the Driftwood School hydrant (13th and Tichenor Avenue) a flow of 1100 gpm is measured when the 2-inch port on the hydrant is wide open, but there is a residual pressure of 40 psi in the system. The model simulation predicts a higher flow because the residual pressure is allowed to drop to 20 psi. The simulated flow would accurately predict what a fire truck could deliver from the hydrant without dropping system pressures below 20 psi.

TABLE 7.6.1.1
MODEL CALIBRATION

	Pressure		Available Fire Flow		Residual Pressure	
	Simulated psi	Measured psi	Simulated gpm	Measured gpm	Simulated psi	Measured psi
Hensley Hill	72	68	980	920	30	24
Vista & Jackson	67	64	1370	1110	25	38
Harbor (end)	81	80	420	410		
Geer Circle	72	70	750	340		
6th St. (end)	59	58	667	750	10	14
13th & Tichenor	72	70	1340	1110	29	42
16th & Jackson	68	64	1400	1190	22	

7.6.2 Hydraulic Performance

To determine overall system performance the projected maximum day demands were applied at distribution system nodes. The simulation indicated that system pressures in the main pressure zone are adequate (40-80 psi) under all reservoir levels at MDD conditions.

Fire flows provide the limiting condition for determining system deficiencies. The range of simulated fire flows is shown in Figure 6.4. Out of 140 nodes, 50 nodes had fire flows less than 1,000 gpm, the minimum for residential flows. Commercial zoned areas north of 18th Street along Highway 101 and Port Orford Loop Road have fire flows which are less than 1,500 gpm, the minimum required for commercial zoning.

There are currently two hydrants which can be used to serve the Driftwood Grade School; they are located at the intersections of 13th and Tichenor Avenue and 12th and Washington. The Tichenor hydrant is directly in front of the school and the Washington Street hydrant is behind the school at a distance of approximately 200 feet. Fire flows at the school were modeled at each of the hydrants and also by applying fire flow demand at each hydrant individually. The maximum flow that could be obtained with either methodology was 2,000 gpm. As discussed in Section 5.2.5 these fire flows are less than what the Fire Marshal would recommend, based upon the Uniform Fire Code.

7.6.3 Recommended Improvements

Where fire flows were deficient, line sizes were upsized to create an improved model scenario. The improvements, and resulting pressures and fire flows are shown in Figures 8.3.1, 8.3.2, and 8.3.3.

In addition to replacing lines where fire flow is deficient it is recommended that the City implement a program of replacing all the older 6-inch asbestos concrete lines. These lines crack easily, are subject to deterioration, and may be contributing to the high rate of leakage in the system. As these older lines are replaced with eight-inch lines, fire flows will increase. At the school these improvements increase fire flows to a range of 3,500 gpm to 4,000 gpm.

7.6.4 Pump Stations Within Existing System

Of the six pump stations in the distribution system only the Coast Guard Hill (C.G.H.) pump station serves over ten residences and is designed to deliver fire flow. Inadequate surge control, varying line pressures that cause short runtimes and frequent cycling, corroded galvanized piping, and deficient fire flow capacities require, however, that the C.G.H. pump station be replaced.

The Deady Hill and Jefferson Street Pump Stations are also reported to be problematic and do not have a pump or pipeline capable of delivering residential fire flows. This station should also be considered for replacement.

TABLE 7.6.4.1
EXISTING PUMP STATIONS

Station	No. of Pumps	RPM	Hp	Flow (gpm)	TDH (feet)	Pressure Range
Coast Guard Hill	3	3550	25, 25, 15	500	215	85-105
Deady Street	1	3450	5	42	264	90/100
Jefferson Street	1	3450	1 1/2	-		56-68
Vista Drive (east of Jefferson St.)	1	3450	1 1/2	-		50-70
Quah-to-mah	1	3450	1 1/2	-		45-60
Dee Terrace	1	3450	5	42	264	65-150

Section

8

Capital Improvement Plan

Section 8

Capital Improvement Plan

8.1 Background

A Capital Improvement Plan (CIP) is a long-term program for replacement of existing or installation of new infrastructure required to improve a system's function or maintenance. The Capital Improvement Plan for water and wastewater systems provides the City Council, staff and residents with a systematic approach to dealing with its short-term and long-term infrastructure needs and demands.

Under ORS 223.309(1), a capital plan, public facilities plan, master plan or comparable plan must be prepared before the adoption of system development charges (SDCs). This plan must list the capital improvements that may be funded with improvement fee revenues and include the estimated cost and timing of each improvement. Oregon Revised Statutes discuss which improvements may be funded by SDC revenues (ORS 223.307) and what type of projects qualifies for credit purposes. The Capital Improvement Plan may be modified at any time pursuant to ORS 223.309 (2).

Water system improvements recommended for the City of Port Orford are provided in this Plan along with associated costs. The recommended improvements for the City's Capital Improvement Plan were derived from the analysis presented in Sections 4, 5, 6, 7, 9, and 10.

8.2 Project Phasing

To assist the City in its planning efforts, the proposed Capital Improvements have been assigned to one of two phases with Phase I being the most critical projects and Phase 2 being lower priority projects. A brief description of each Phase and the types of projects within that phase is provided below.

Phase I projects are considered the most critical and should be undertaken as soon as funding is available. These projects include improvements that are considered to maintain the quality of the system, increase fire flow, reduce unaccounted water losses, and meter the system.

Phase II projects are important projects that should be taken as funding becomes available. These improvements include water treatment plant improvements, extension of the life of the existing tanks, installation of needed telemetry for the entire system and addressing future water source needs. While these projects are not included in the "critical" list, they should be considered as important and necessary for continued optimal system performance.

The phase of each improvement will be presented and discussed with City staff and council. The cost estimates presented in this Plan reflect the basis previously described in Section 8. The estimates presented herein are preliminary and are based on the level and detail of planning presented in this Plan. As projects proceed and as site-specific information becomes available, the estimates may require updating.

Compilation of an environmental report is typically a requirement of government organizations funding infrastructure improvements. The purpose of this environmental report is to consider any adverse effects that the project may have on the surrounding environment and propose mitigation measures to minimize these impacts. The estimated cost for compiling an environmental report for each Phase was included in this CIP.

A brief description of each phase of improvements including recommended improvements, associated costs, and estimated percentage and cost eligibility for improvement system development charges (See Section 8.), is discussed below. Detailed cost estimates for the CIP project are in Appendix F.

8.2.1 Phase I Improvements

Phase I improvements called for in this CIP represent the highest priority projects that require addressing in order to ensure the effective treatment and delivery of water for the City's residents and customers.

Project Descriptions

1. Meters (Total Cost: $200,000)

Comparison of the raw water usage records and metered water use indicate a high percentage of unaccounted-for water within the distribution system. A meter replacement program is proposed to eliminate meter inaccuracies that contribute to the high loss rate. According to City staff many of the meters are over forty years old and had use prior to installation. The meter replacement project includes approximately 500 residential meters, 140 larger commercial meters, and a backflow prevention device for the grade school.

To identify areas with badly deteriorated and leaking pipelines, it is proposed that metering vaults be placed on mains within the distribution system. As shown as part of the proposed improvements in Figure 5.5 four metering vaults locations are proposed.

Total construction cost for service meter replacement and installation of distribution system metering is $161,000. The total project budget, including contingency and engineering for the mainline metering vaults is estimated at $200,000.

2. Leakage and Detection Program (Total Cost: $50,000)

The City may wish to perform a preliminary survey of the water treatment plant by an engineer before embarking on this improvement. This preliminary study is estimated to cost from $10,000 to $20,000 for development of a program to detect and repair leaks to reduce the quantity of unaccounted water.

3. Replace Filters and Install Air Scour System for Water Treatment Plant (Total Cost: $719,000)

The water treatment plant is in need of the following: repair floor slab, replace filter media, and install air scour system for the filtration system.

4. Priority 1 Waterline Replacement Improvements (Total Cost: $2,822,605)

Based on input from the City's staff regarding excessive leakage and other high maintenance issues the following waterlines were determined to be of the highest priority for replacement:

A. **Lakeshore Drive (a):** The existing unknown-size water main needs to be replaced due to excessive leakage and other high maintenance issues. The new 6-inch diameter line will begin at the intersection of Lakeshore Drive and Hamlet Place. The line will continue west along Lakeshore Drive, in the same location as the existing waterline, to the end of Lakeshore Drive. The total improvement length is approximately 1,550 feet.

B. **Hamlet Place:** The existing 4-inch water main needs to be replaced due to excessive leakage and other high maintenance issues. The new 6-inch diameter line will begin at the intersection of Lakeshore Drive and Hamlet Place. The line will continue west along Hamlet Place in the same location as the existing waterline, to the end of Lakeshore Drive.
The total improvement length is approximately 2,500 feet.

C. **Lakeshore Drive:** The existing 4-inch water main needs to be replaced due to excessive leakage and other high maintenance issues. The new 6-inch diameter line will begin at the intersection of Lakeshore Drive and Pinehurst Drive. The line will continue east along Lakeshore Drive, then along Park Drive in the same location as the existing waterline, to Arizona Street.
The total improvement length is approximately 1,260 feet.

D. **Wyoming Street:** The existing 6-inch water main needs to be replaced due to excessive leakage and other high maintenance issues. The new 6-inch diameter line will begin at the intersection of Hamlet Place and Wyoming St. The line will continue south along Wyoming St. in the same location as the existing waterline, continuing east along 12th Street to Arizona Street, continuing north along Arizona Street to 12th Street, then east along 13th Street to Oregon Street. The section along 13th Street is a new installation that was requested by the City for serviceability issues.
The total improvement length is approximately 2,680 feet.

E. **Jackson Street:** The existing 6-inch water main needs to be replaced due to excessive leakage and other high maintenance issues. The new 6-inch diameter line will begin at the intersection of 25th Street and Jackson Street. The line will continue south along Jackson Street, in the same location as the existing waterline, to 18th Street.
The total improvement length is approximately 1,960 feet.

F. **Ninth Street:** The existing 6-inch water main needs to be replaced due to excessive leakage and other high maintenance issues. The new 6-inch diameter line will begin at the intersection of Arizona Street and 9th Street. The line will continue east along 9th Street, in the same location as the existing waterline, to Jackson Street.
The total improvement length is approximately 1,670 feet.

G. **Seventh Street:** The existing 6-inch water main needs to be replaced due to excessive leakage and other high maintenance issues. The new 6-inch diameter line will begin at the intersection of Coast Guard Road and 7th Street. The line will continue east along 7th Street, in the same location as the existing waterline, crossing a wooded draw to Oregon Street.
The total improvement length is approximately 1,020 feet.

H. **Pinehurst Drive:** The existing 6-inch water main needs to be replaced due to excessive leakage and other high maintenance issues. The new 6-inch diameter line will begin at the intersection of Arizona Street and Pinehurst Drive. The line will continue east along Pinehurst Drive, in the same location as the existing waterline, to Oregon Street/Highway 101.
The total improvement length is approximately 820 feet.

5. Priority 1 Treated Water Storage Improvements (Total Cost: $1,947,300)

Based on computer modeling of the City's water distribution system, fire flows available to certain areas are below those required:

Deady Street Reservoir: The abandoned existing treated water reservoir needs to be removed and replaced with a new 0.1MG treated water reservoir.

6. Priority 2 Waterline Replacement Improvements (Total Cost: $3,029,225)

Based on computer modeling of the City's water distribution system, fire flows available to certain areas are below those required:

A. **Coast Guard Hill Road:** The existing 6-inch water main needs to be replaced due to inadequate fire flow availability. The new 8-inch diameter line will begin at the intersection of Coast Guard Hill Road and Sweet Way. The line will continue west along Coast Guard Hill Road, in the same location as the existing waterline, to the end of Coast Guard Hill Road. A new pump station and PRV will be installed along Coast Guard Hill Road between Sweet Way and Tichenor Avenue. The total improvement length is approximately 3,900 feet.

B. **Deady Street South:** The existing 6-inch water main needs to be replaced due to inadequate fire flow availability. The new 10-inch diameter line will begin at 9th St. and Deady St. The line will continue south along Deady Street, in the same location as the existing waterline, to the end of Deady Street at 6th Street.
The total improvement length is approximately 700 feet.

C. **Deady Street North:** The existing 2-inch water main needs to be replaced due to inadequate fire flow availability. The new 8-inch diameter line will begin at 9th Street and Deady Street. The line will continue north along Deady Street, in the same location as the existing waterline, to the end of Deady Street. Also a new pump station and PRV station will be installed near Deady Street and 10th Street.
The total improvement length is approximately 1,000 feet.

D. **Sixth Street/Jefferson/Seventh Street:** The existing 6-inch water main needs to be replaced due to inadequate fire flow availability. The new 8-inch diameter line will begin at 6th Street and Deady Street. The line will continue west along 6th Street, in the same location as the existing waterline, run north along Jefferson Street to 7th Street, then to the intersection of Jackson Street and 7th Street.
The total improvement length is approximately 1,400 feet.

E. **Jefferson Street Pump Station:** The existing pump station needs to be replaced due to inadequate fire flow availability. The new pump station and PRV station will be constructed near 9th Street and Deady Street.

F. **Dock Road:** The existing 4-inch water main needs to be replaced due to inadequate fire flow availability. The new 8-inch diameter line will begin at 5th Street and Dock Road. The line will continue south along Dock Road, in the same location as the existing waterline, to the end of Dock Road. A new PRV station will be installed approximately 300 feet along Dock Road from 5th Street.
The total improvement length is approximately 1,800 feet.

G. **King Street:** The existing 2-inch waterline needs to be replaced due to inadequate fire flow availability. The new 6-inch diameter line will begin at King Street and Coast Guard Hill Road. The line will continue west along King Street, in the same location as the existing waterline, and a new section of 6-inch line will connect the gap and replace the existing 2-inch line approximately halfway along King Street. Individual PRVs will need to installed to each residence along the King Street after the improvement site.
The total improvement length is approximately 1,060 feet.

H. **Idaho Street, 14th Street to 18th Street:** The existing 2-inch and 4-inch waterlines along Idaho Street (Idaho Street and 14th Street, and Idaho Street and 18th, respectively), needs to be replaced due inadequate fire flow availability. The new 4-inch diameter line will begin at Idaho Street and 14th St. The line will continue north along Idaho Street, in the same location as the existing waterline, to Idaho Street and 18th Street.
The total improvement length is approximately 1,150 feet.

I. **20th Street/Jefferson Street/19th Street:** The existing 4-inch waterline needs to be replaced due to inadequate fire flow availability. The new 6-inch diameter line will begin at 20th Street and Jackson Street. The line will continue east along 20th Street, in the same location as the existing waterline, to Jefferson Street, south to 19th Street, and then continue west along 19th Street to Tichenor Avenue.
The total improvement length is approximately 1,600 feet.

J. **Beacon Hill Lane and Flake Street:** The existing 2-inch and 4-inch waterlines need to be replaced due to inadequate fire flow availability. The new 4-inch diameter line will begin at Beacon Hill Lane and Coast Guard Hill Road. The line will continue north along Beacon Hill Lane in the same location as the existing waterline, and then run east to the end of Flake Street. A new 6-inch waterline will begin at Coast Guard Hill Road. and Flake Street, then run along Flake Street to its end where the above-mentioned new 4-inch waterline will connect.
The total improvement length is approximately 875 feet.

7. Priority 2 Coast Guard Hill Reservoir Improvements (Total Cost: $567,350)

The Coast Guard Hill Reservoir is in need of maintenance and improvements. A mixer needs to be installed to resolve the ongoing problem with stagnant water that contributes to taste and odor issues. The gauge on the side of the tank suffered storm damage some years ago and needs replacement. The exterior of the concrete tank is in need of general maintenance to extend it lifetime. In addition, the installation of a seismic shutoff valve assembly is recommended for safety reasons and to retain water in the tank in case of a seismic event.

A summary of the Phase I, Priority 2 improvements is presented in Table 8.2.1.1.

TABLE 8.2.1.1
SUMMARY OF PHASE 1, PRIORITY 1 WATER SYSTEM IMPROVEMENTS

No. as per Fig. A	Project Description	Project Cost, $
N/A	Metering	$200,000
N/A	Leakage and Detection Program	$50,000
		$250,000

TABLE 8.2.1.2
SUMMARY OF PHASE 1, PRIORITY 1 WATER TREATMENT PLANT PROJECTS

No. as per Fig. A	Project Description	Project Cost, $
N/A	Filter Replacement/Install Air Scour System	$719,000
	Total	$719,000

TABLE 8.2.1.3
SUMMARY OF PHASE 1, PRIORITY 1 WATERLINE REPLACEMENT PROJECTS

No. as per Fig. A	Project Description	Project Cost, $
A	Lakeshore Drive (a)	$343,650
B	Hamlet Place	$512,600
C	Lakeshore Drive (b)	$242,275
D	Wyoming Street	$515,550
E	Jackson Street	$347,700
F	9th Street	$411,880
G	7th Street	$257,175
H	Pinehurst Street	$191,775
	Total	$2,822,605

TABLE 8.2.1.4
SUMMARY OF PHASE 1, PRIORITY 1 TREATED WATER STORAGE IMPROVEMENTS

No. as per Fig. A	Project Description	Project Cost, $
A	Deady St. Reservoir Replacement	$1,947,300

TABLE 8.2.1.5
SUMMARY OF PHASE 1, PRIORITY 2 TREATED WATER STORAGE IMPROVEMENTS

No. as per Fig. A	Project Description	Project Cost, $
A	Coast Guard Hill Reservoir Improvements	$567,350

TABLE 8.2.1.6
SUMMARY OF PHASE 1, PRIORITY 2 WATERLINE REPLACEMENT PROJECTS

No. as per Fig. A	Project Description	Project Cost, $
A	Coast Guard Hill	$821,820
B	Deady S	$179,500
C	Deady N	$350,750
D	6th/Jeff/7th	$318,275
E	Jefferson PS	$149,500
F	Dock	$296,955
G	King	$235,000
H	Idaho	$200,650
I	20th	$296,325
J	Beacon	$180,450
	Total	$3,029,225

Total Phase I Improvements is $9,335,480.

8.2.2 Phase II Improvements

Phase II improvements of this CIP represent important projects that require addressing once Phase I Improvements have been addressed and financing is available. These projects include water treatment improvements projects and water source improvements. These improvements are discussed in detail below.

Project Descriptions

1. Priority 3 Waterline Replacement Improvements (Total Cost: $2,919,965)

Based on computer modeling of the City's water distribution system, fire flows available to certain areas are below those required:

A. **Agate Beach Road/California Street:** The existing dead end 2-inch waterlines along Agate Beach Road need to be replaced due to inadequate fire flow availability. The new 6-inch diameter line will begin at the intersection of California Street and 12th Street. The line will continue southwest along California Street, then south to Agate Beach Road, then east to a point. The total improvement length is approximately 2,000 feet.

B. **18th Street and Oregon Street:** The existing dead end 4-inch water main at the intersection of 18th Street and Oregon Street needs to be connected to the three way waterline intersection at the same street intersection to increase fire flow. The new 6-inch diameter line will connect these two locations.
The total improvement length is approximately 100 feet.

C. **Vista Drive and Pump Station:** The existing 4-inch waterline needs to be replaced due to inadequate fire flow availability. The new 6-inch diameter line will begin at the intersection of Vista Drive and Jefferson Street. The line will continue east along Vista Drive, in the same

location as the existing waterline, to the end of the existing waterline. A new pump station will be installed along Vista Drive approximately 125 feet from the intersection of Vista Drive and Jefferson Street.
The total improvement length is approximately 700 feet.

D. **Fifth Street (Harbor Drive to Idaho Street):** The existing 4-inch waterline needs to be replaced due to inadequate fire flow availability. The new 6-inch diameter line will begin at the intersection of Harbor Drive and 5th Street. The line will continue west along 5th Street, in the same location as the existing waterline, to the end of 5th Street. A new 6-inch waterline will also connect to the deadended existing 6-inch waterline at 6th Street and Oregon Street.
The total improvement length is approximately 1,000 feet.

E. **Highway 101:** The new 8-inch diameter line will begin at 6th Street and Deady Street. The line will continue south along Highway 101 to Qua-To-Mah Lane.
The total improvement length is approximately 875 feet.

F. **Qua-To-Mah Lane:** The new 6-inch diameter line will begin at Highway 101 and Qua-To-Mah Lane. The line will continue north along Qua-To-Mah Lane to its end. A new pump station will be installed near the base of Qua-To-Mah Lane to ensure adequate fire flow.
The total improvement length is approximately 750 feet.

G. **Hensley Hill Road:** The existing 6-inch water main needs to be replaced due to inadequate fire flow availability. The new 8-inch diameter line will begin at the intersection of Port Orford Loop Road and Hensley Hill Road. The line will continue east along Hensley Hill Road, in the same location as the existing waterline, to the existing 8-inch waterline along Hensley Hill Road.
The total improvement length is approximately 675 feet.

H. **Fifth Street at Jefferson Street:** The existing 4-inch waterline that deadends along 5th Street toward Deady Street will need to be replaced due to inadequate fire flow availability. The new 6-inch diameter line will begin halfway along 5th Street, between Jackson Street and Jefferson Street, and run east along 5th Street.
The total improvement length is approximately 400 feet.

I. **Sweet Way:** The new 6-inch diameter line will begin at the intersection of Sweet Way and Coast Guard Hill Road. The line will continue east to the end of Sweet Way for approximately 400 feet.
The total improvement length is approximately 400 feet.

J. **Jackson Street:** The line on Jackson Street that dead ends at 6th Street will need to be installed due to inadequate fire flow availability. The new 6-inch diameter line will begin at this location and run south along Jackson Street to the existing 6-inch waterline on 5th Street.
The total improvement length is approximately 300 feet.

K. **Pinehurst Road:** The existing 6-inch waterline that deadends at the most western portion of Pinehurst Road needs to be looped to improve fire flow. The new 6-inch diameter line will begin at this location and run south to connect to Lakeshore Drive.
The total improvement length is approximately 400 feet.

L. **Manzanita Drive:** The existing 4-inch waterline will need to be replaced due to inadequate fire flow availability. The new 6-inch diameter line will begin at the intersection of Arizona Street

and Manzanita Drive. The line will continue west along Manzanita Drive, in the same location as the existing waterline, to the existing 4-inch waterline at Manzanita Drive and Geer Place. The total improvement length is approximately 325 feet.

M. **Madrona Drive:** The existing 4-inch waterline will need to be looped due to inadequate fire flow availability. The new 6-inch diameter line will begin at the intersection of Madrona Drive and Highway 101, which will connect to the existing 6-inch three-way waterline intersection. The line will continue west to the existing 4-inch waterline at Madrona Drive. The total improvement length is approximately 100 feet.

N. **Idaho Street (10th Street to 12th Street):** The existing 2-inch waterline will need to be replaced due to inadequate fire flow availability. The new 4-inch diameter line will begin at the intersection of Idaho Street and 10th Street. The line will continue north along Idaho Street, in the same location as the existing waterline, to the existing 6-inch waterline on 12th Street. The total improvement length is approximately 600 feet.

O. **19th Street (Arizona Street to Oregon Street/Highway 101):** The existing 2-inch waterline will need to be replaced due to inadequate fire flow availability. The new 4-inch diameter line will begin at the intersection of Arizona Street and 19th Street. The line will continue east along 19th Street, in the same location as the existing waterline, to the existing 6-inch waterline on Oregon Street/Highway 101. The total improvement length is approximately 800 feet.

P. **Dee Terrace:** The existing 4-inch waterline will need to be replaced due to inadequate fire flow availability. The new 6-inch diameter line will begin at the base of Dee Terrace. The line will continue south along Dee Terrace, in the same location as the existing waterline, to the existing tank at the top of Dee Terrace. The new 6-inch waterline will also replace the existing 4-inch waterline on Dee Loop. The total improvement length is approximately 1850 feet.

Q. **14th Street (Jackson Street to Washington Street):** The existing 2-inch waterline will need to be replaced due to inadequate fire flow availability. The new 4-inch diameter line will begin at the intersection of Jackson Street and 14th Street. The line will continue west along 14th Street, in the same location as the existing waterline, for approximately 400 feet. The total improvement length is approximately 400 feet.

R. **Tichenor Cemetery Road:** The existing 2-inch waterline will need to be replaced due inadequate fire flow availability. The new 6-inch diameter line will begin at the intersection of Coast Guard Hill Road and Tichenor Cemetery Road. The line will continue north along Tichenor Cemetery Road, in the same location as the existing waterline, approximately 325 feet. The total improvement length is approximately 325 feet.

S. **Stagecoach Lane:** The existing 4-inch waterline will need to be replaced due to inadequate fire flow availability. The new 6-inch diameter line will begin at the intersection of Stagecoach Lane and Cemetery Loop. The line will continue north in the same location as the existing waterline. The total improvement length is approximately 325 feet.

T. **Seventh Street and Jefferson Street:** The existing 2-inch waterline will need to be replaced due to inadequate fire flow availability. The new 4-inch diameter line will begin at the intersection of 7th Street and Jefferson Street. The line will continue west along 7th Street, in the same location as the existing waterline, approximately 250 feet.
The total improvement length is approximately 250 feet.

U. **Sea Cliff:** The existing 2-inch waterline will need to be replaced due to inadequate fire flow availability. The new 4-inch diameter line will begin at the intersection of King Street South and Sea Cliff. The line will continue west along Sea Cliff, in the same location as the existing waterline, approximately 150 feet.
The total improvement length is approximately 150 feet.

2. Repair, Maintenance, and Improvement for Water Treatment Plant (Total Cost: $1,264,270)

The water treatment plant is in need of the following: replace roof, retrofit to meet seismic protection, replace valves, actuators, solenoids, install variable frequency drives for pumps, replace flow meters and turbidity meters, install transducer for level control, update electrical system, install computer system, provide backup pumps and generator.

3. Raw Water Source Improvements

Existing water rights on Hubbard Creek may be sufficient to supply the estimated 848 EDUs within the City in Year 2060 if per-capita usage is reduced. However the existing impoundment is not large enough to store the 3.2 acre-feet as allowed by the water right. Enlarging the impoundment to meet this amount would mean raising the impoundment an estimated 23 feet. Structural issues and permitting requirements for the existing structure make this alternative impractical for supplying long range demands.
Another alternative explored in the previous Water Master Plan recommended the City pursue a long-range plan to construct a new water reservoir in the upper portion of Hubbard Creek. This option requires additional planning studies, geotechnical investigations, and permitting and may prove unproductive.

Another option to be considered is a well field. This option may not be viable because, according to a hydro geologist consulted, well records show productivity too low to meet municipal needs, the possibility of saltwater-intrusion and the possibility of fouling nearby wells.

Garrison Lake is currently not used as a primary source because of taste and odor issues. Further investigation into these issues and possible treatment options should be conducted. Relocating the Garrison Lake intake to a new location, above Arizona Street in the upper arm of the lake, should be considered. However, treatment of this water may not be a-cost effective option.

Relocation of the intake will include installation of an intake screen, anchor piles, concrete anchors, HDPE transmission piping, and a bridge under-crossing. Estimated costs for relocation are based on the assumption that new transmission facilities, including a pump station and wet well, will be required in addition to the new intake structure. Total construction cost is estimated to be $220,000. Including auxiliary costs for engineering, contingency, administration, and geotechnical, the total cost is estimated to be $306,000.

Although moving the intake will improve the raw water quality, the brackish water and the possibility of high concentrations of organics still makes treatment for taste difficult. Treatment utilizing a membrane filtration treatment system is an expensive alternative. The project cost for construction of an ultra-filtration treatment system to remove bacteria, viruses, organics and any material larger than 0.02 microns at a flow rate of 1 cfs (448.8 gpm) is approximately $2,400,000. This facility would be located adjacent to

the existing water treatment facility and incorporate power system upgrades, a building extension, and auxiliary equipment including vacuum and backwash pumps. Including relocation of the intake system, the Garrison Lake source improvements will cost approximately $3,000,000.

If the existing intake is not relocated, then a nano-filtration or reverse osmosis system must be employed to remove salinity from the existing raw water source. The total project cost for the treatment system including engineering and contingency would increase to $5,000,000. This cost includes the same construction features as the ultra-filtration system, except RO modules would be required. If an RO system is utilized, the new raw water pumping equipment would not require relocation from the existing intake site.

It may be necessary for the City to implement a small scale RO treatment system for emergency use of Garrison Lake water. This project would involve construction of a 100 gpm ultrafiltration/ RO treatment system for the purpose of supplying water in the late summer when Hubbard Creek supplies are at their lowest. The improvements proposed would include installation of a packaged treatment system, electrical systems improvement, and pump and piping modifications. Construction costs for a 100 gpm system including equipment, plant modifications, engineering, contingency, and administration are estimated at $1,300,000. Costs for a 50 gpm system would be approximately $1,250,000.

4. Raw Water Storage Improvements (Total Cost: $2,513,075)

Another possible option is to construct a raw water reservoir. A raw water reservoir could serve as storage during periods of high turbidity and drought. Locating a site within a practical distance of the Water Treatment Plant should be explored.

5. SCADA System

A new SCADA System will be constructed and incorporated into the Water Treatment Plant. This system will allow radio remote control of each water reservoir within the City for varying needs related to water level and pump control.

TABLE 8.2.2.1
SUMMARY OF PHASE 2, PRIORITY 3 WATERLINE REPLACEMENT PROJECTS

No. as per Fig. A	Project Description	Project Cost, $
A	Agate/California	$350,825
B	18th/Oregon	$65,500
C	Vista & PS	$240,650
D	5th	$192,700
E	Hwy 101	$296,350
F	Qua-To-Mah	$192,425
G	Hensley Hill	$164,575
H	5th at Jefferson	$101,600
I	Sweet Way	$90,100
J	Jackson	$89,500
K	Pinehurst	$83,800
L	Manzanita	$76,600
M	Madrona	$48,700
N	Idaho	$111,750
O	19th	$130,540
P	Dee Terrace	$281,850
Q	14th	$78,875
R	Tichenor	$99,100
S	Stagecoach	$101,575
T	7th	$61,475
U	Sea Cliff	$61,475
	Total	$2,919,965

TABLE 8.2.2.2.
SUMMARY OF PHASE II WATER SYSTEM PROJECTS

No. as per Fig. 7.3.1	Project Description	Project Cost, $
1	Water Treatment Plant	$1,264,270
2	Waterline Improvements	2,919,965
3	Raw Water Storage Improvements	2,513,075
4	SCADA System	$10,000
	Total	**$6,707,310**

Total Phase II Improvements is $6,707,310.

TABLE 8.2.2.3.
SUMMARY OF PHASES/PRIORITIES WATER SYSTEM PROJECTS

PHASE	PRIORITY	Project Description	Project Cost, $
1	1	Metering/Leakage and Detection Program	$250,000
1	1	Water Treatment Plant	$719,000
1	1	Waterline Improvements	$2,822,605
1	1	Treated Water Storage Improvements	$1,947,300
1	2	Waterline Improvements	$3,029,225
1	2	Coast Guard Hill Storage Improvements	$567,350
2	1	Water Treatment Plant	$1,264,270
2	3	Waterline Improvements	$2,919,270
2	1	Raw Water Storage Improvements	$2,513,075
2	1	SCADA System	$10,000
		Total	**$13,122,825**

8.3 Capital Improvement Plan (CIP)

The improvements, which have been discussed in the previous sections are summarized in Tables 8.2.1.1.-8.2.1.6, and 8.2.2.1-8.2.2.3. The tables include the total estimated cost for each project, its priority, and an estimate of the projected increase in capacity.

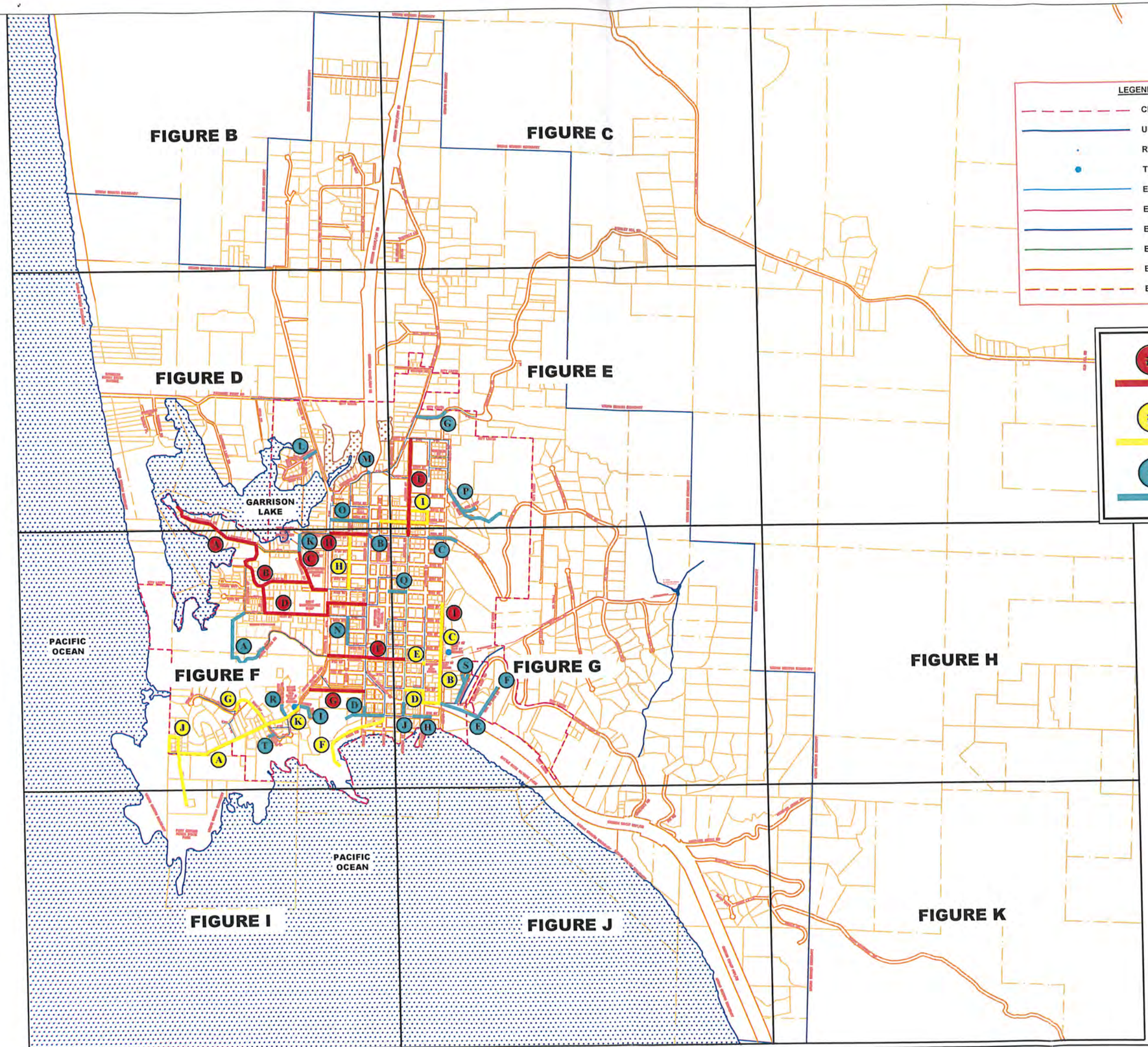


FIGURE NO. 8.3.1-A

CITY OF PORT ORFORD

IMPROVEMENTS - WATER DISTRIBUTION SYSTEM MAP

THE DYER PARTNERSHIP
ENGINEERS & PLANNERS

DATE: MARCH, 2014

PROJECT NO.: 183.01

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THE DYER PARTNERSHIP ENGINEERS & PLANNERS	CITY OF PORT ORFORD	FIGURE NO.
DATE: MARCH, 2014	IMPROVEMENTS - WATER DISTRIBUTION SYSTEM MAP	8.3.1-B
PROJECT NO.: 183.01		

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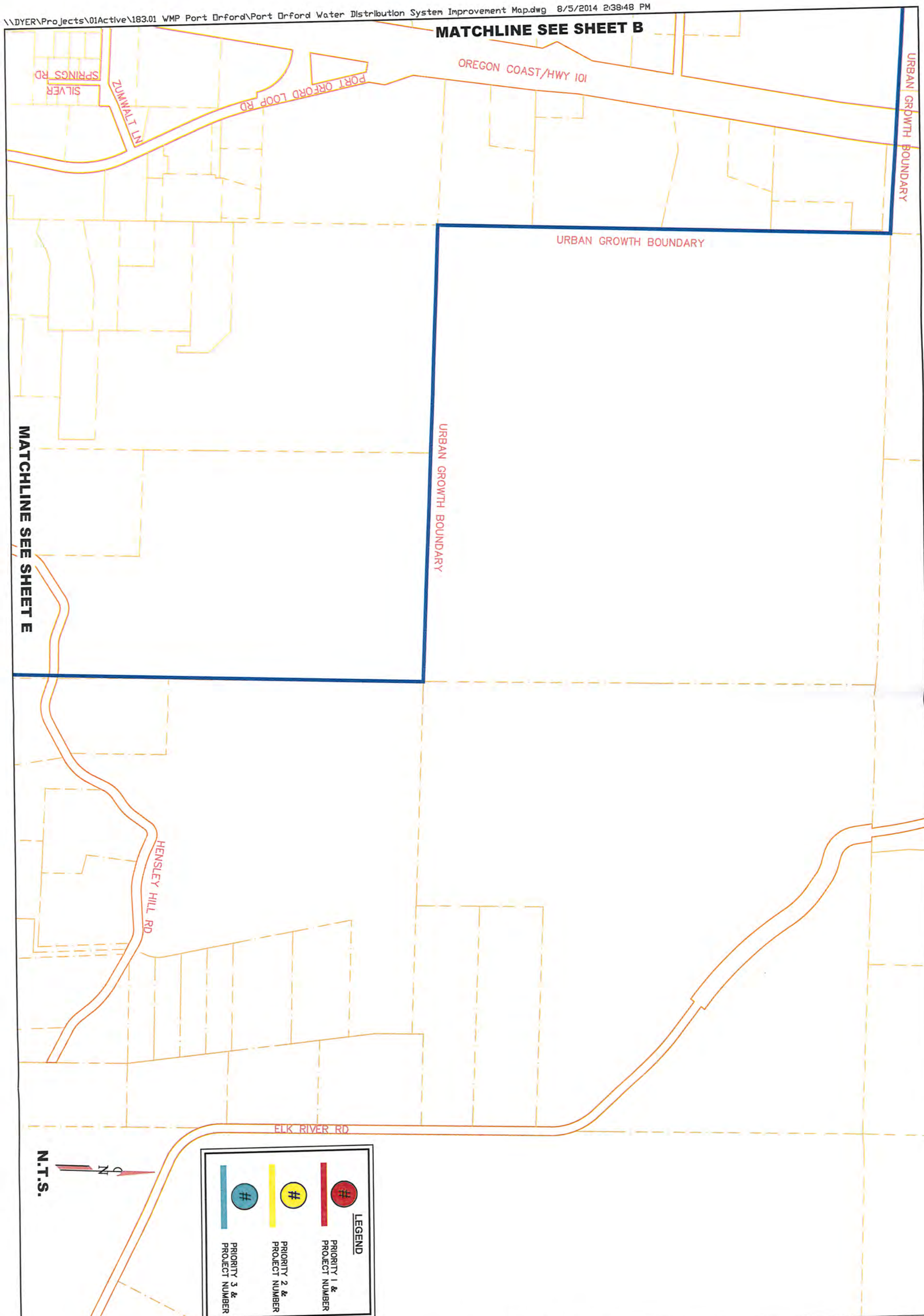

THE DYER PARTNERSHIP ENGINEERS & PLANNERS	CITY OF PORT ORFORD	FIGURE NO.
DATE: MARCH, 2014	IMPROVEMENTS - WATER DISTRIBUTION SYSTEM MAP	8.3.1-C
PROJECT NO.: 183.01		

MATCHLINE SEE SHEET B

MATCHLINE SEE SHEET E

MATCHLINE SEE SHEET F

URBAN GROWTH BOUNDARY

URBAN GROWTH BOUNDARY

PACIFIC OCEAN

GARRISON BEACH STATE WAYSIDE

PARADISE POINT RD

PINECREST DR

SUNSET PL

PARKWOOD DR

GARRISON LAKE RD

DENA RD

GARRISON LAKE

LAKESHORE DR

ARIZONA ST

CITY LIMITS

ORREGON COAST/HWY 101

SECONDARY

GEER CIR

MANZANITA DR

GEER PL DR

GEER PL

MADRONA DR

20TH ST

19TH ST

CITY HALL

TICHENOR AVE

IDAHO ST

A

L

M

O

I

N

N.T.S.

LEGEND

PRIORITY 1 & PROJECT NUMBER

PRIORITY 2 & PROJECT NUMBER

PRIORITY 3 & PROJECT NUMBER

FIGURE NO. 8.3.1-D

CITY OF PORT ORFORD

IMPROVEMENTS - WATER DISTRIBUTION SYSTEM MAP

THE DYER PARTNERSHIP
ENGINEERS & PLANNERS

DATE: MARCH, 2014

PROJECT NO.: 183.01

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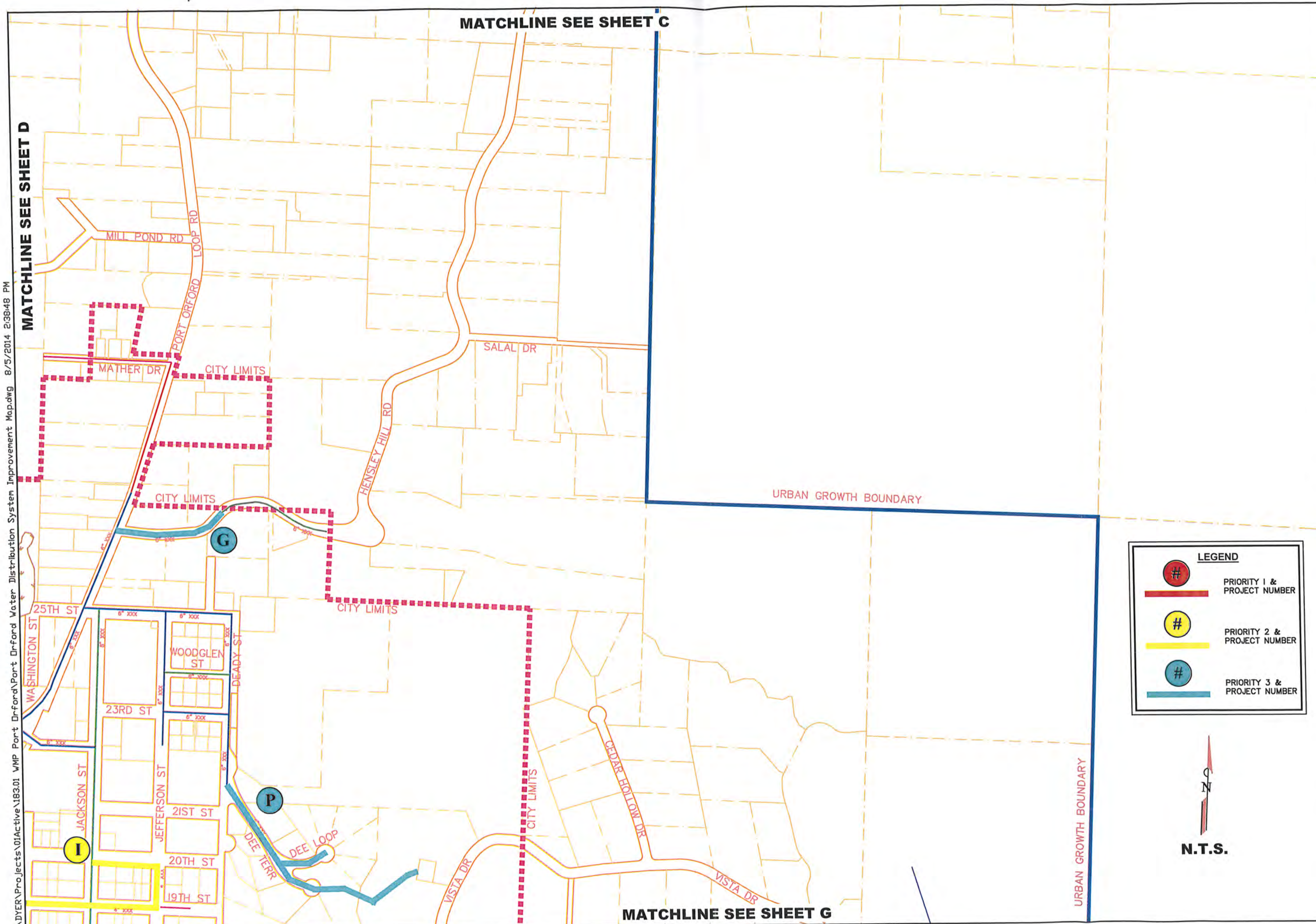

CITY OF PORT ORFORD

IMPROVEMENTS - WATER DISTRIBUTION SYSTEM MAP

FIGURE NO. 8.3.1-E

THE DYER PARTNERSHIP ENGINEERS & PLANNERS

DATE: MARCH, 2014

PROJECT NO.: 183.01

MATCHLINE SEE SHEET D

GARRISON LAKE

CITY LIMITS

PACIFIC OCEAN

LAKESHORE DR

INTAKE (EMERGENCY USE ONLY)

PINEHURST RD

18TH ST

17TH ST

16TH ST

15TH ST

14TH ST

13TH ST

12TH ST

11TH ST

10TH ST

9TH ST

8TH ST

WATER TREATMENT PLANT

BUFFINGTON MEMORIAL PARK

HAMLET PL

TALUS WAY

CALIFORNIA ST

WYOMING ST

ODOT MAINTENANCE SHOP

WASTEWATER TREATMENT PLANT

AGATE BEACH RD

ARIZONA ST

OREGON ST

TICHENOR AVE

WASHINGTON ST

OREGON COAST HWY 101

DRIFTWOOD ELEMENTARY SCHOOL

KING ST

KING SOUTH ST

TICHENOR CEMETERY RD

COAST GUARD HILL TANK & PUMP STATION

COAST GUARD ROAD

SWEET WAY

IDAHO ST

DOCK RD

HARBOR DR

MATCHLINE SEE SHEET G

MATCHLINE SEE SHEET I

LEGEND

PRIORITY 1 & PROJECT NUMBER

PRIORITY 2 & PROJECT NUMBER

PRIORITY 3 & PROJECT NUMBER

N

N.T.S.

FIGURE NO. 8.3.1-F

CITY OF PORT ORFORD

IMPROVEMENTS - WATER DISTRIBUTION SYSTEM MAP

THE DYER PARTNERSHIP ENGINEERS & PLANNERS

DATE: MARCH, 2014

PROJECT NO.: 183.01

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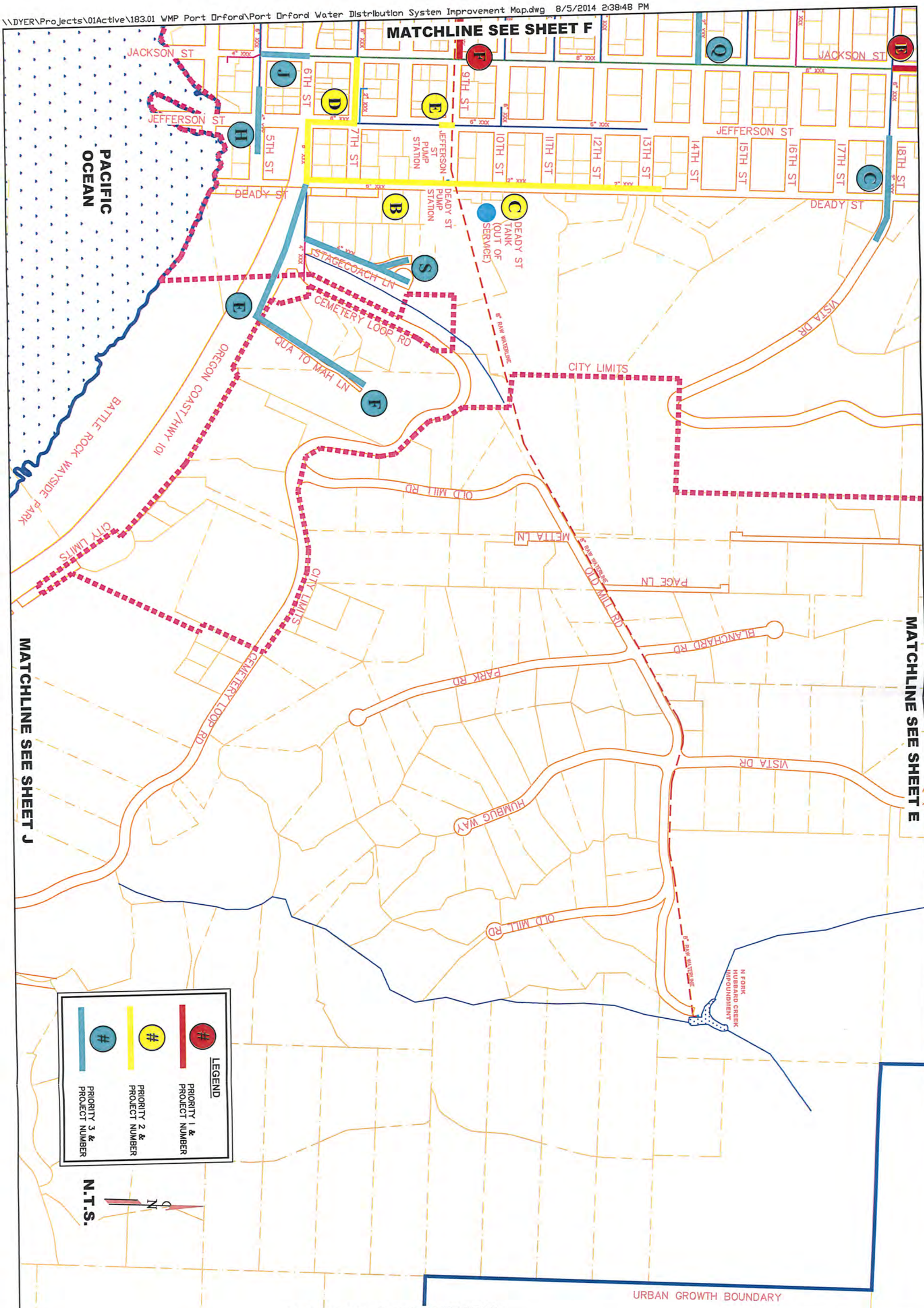

THE DYER PARTNERSHIP ENGINEERS & PLANNERS	CITY OF PORT ORFORD	FIGURE NO.
DATE: MARCH, 2014	IMPROVEMENTS - WATER DISTRIBUTION SYSTEM MAP	8.3.1-G
PROJECT NO.: 183.01		

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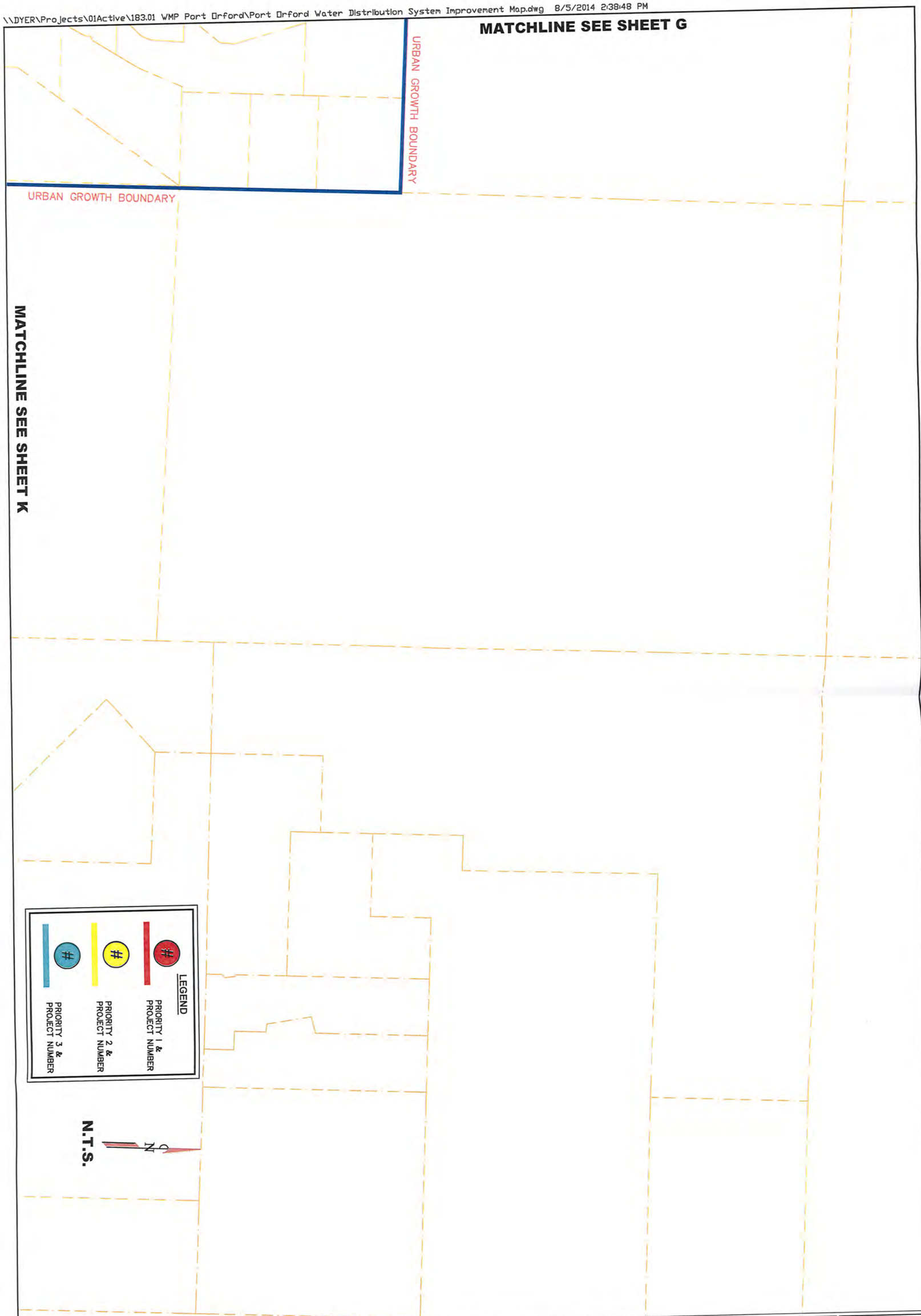

THE DYER PARTNERSHIP ENGINEERS & PLANNERS	CITY OF PORT ORFORD	FIGURE NO.
DATE: MARCH, 2014	IMPROVEMENTS - WATER DISTRIBUTION SYSTEM MAP	8.3.1-H
PROJECT NO.: 183.01		

MATCHLINE SEE SHEET F

URBAN GROWTH BOUNDARY

A

PORT ORFORD HEADS STATE PARK

URBAN GROWTH BOUNDARY

PACIFIC OCEAN

MATCHLINE SEE SHEET J

LEGEND

PRIORITY 1 & PROJECT NUMBER

PRIORITY 2 & PROJECT NUMBER

PRIORITY 3 & PROJECT NUMBER

N

N.T.S.

CITY OF PORT ORFORD

IMPROVEMENTS - WATER DISTRIBUTION SYSTEM MAP

FIGURE NO. 8.3.1-I

THE DYER PARTNERSHIP ENGINEERS & PLANNERS

DATE: MARCH, 2014

PROJECT NO.: 183.01

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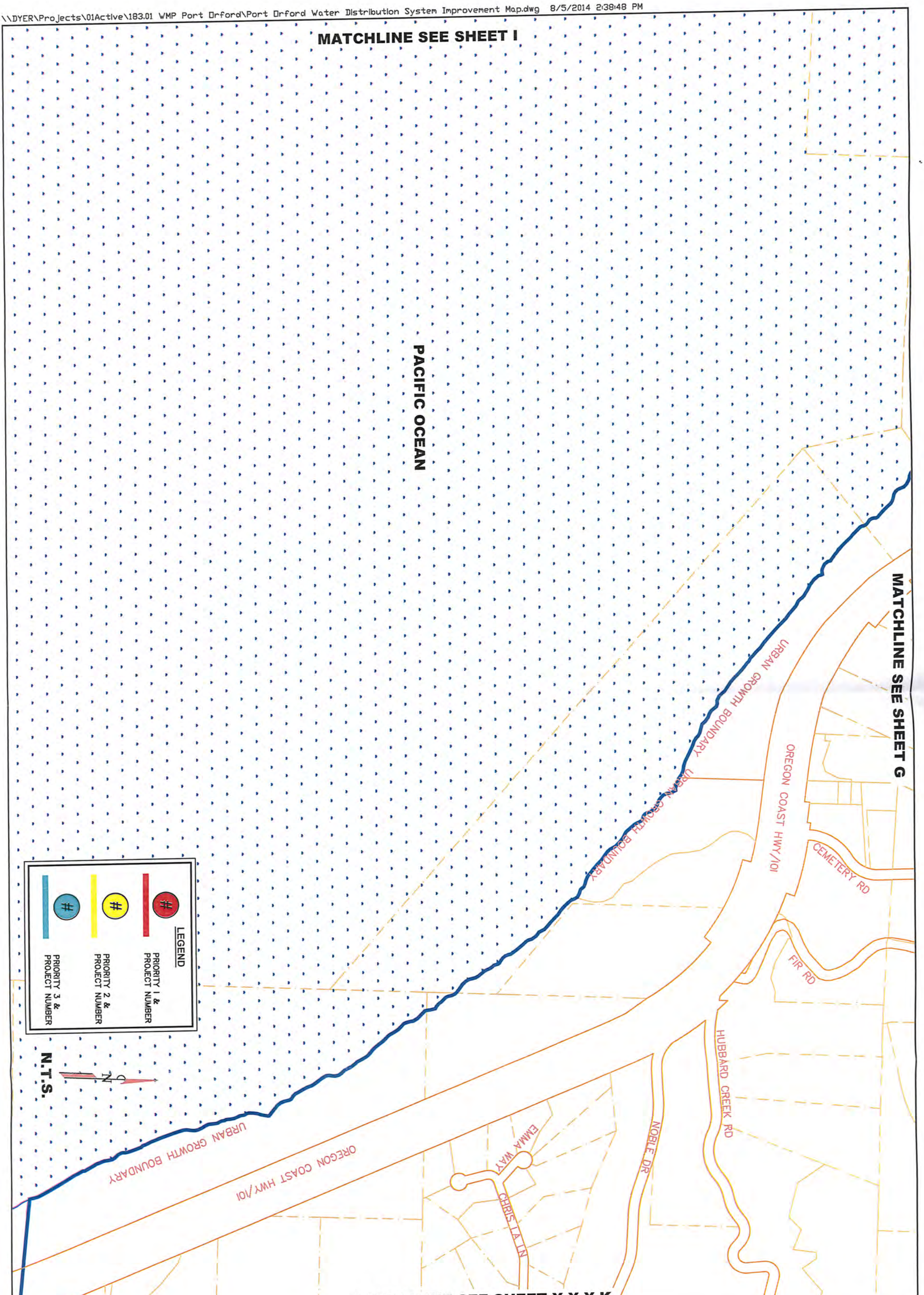
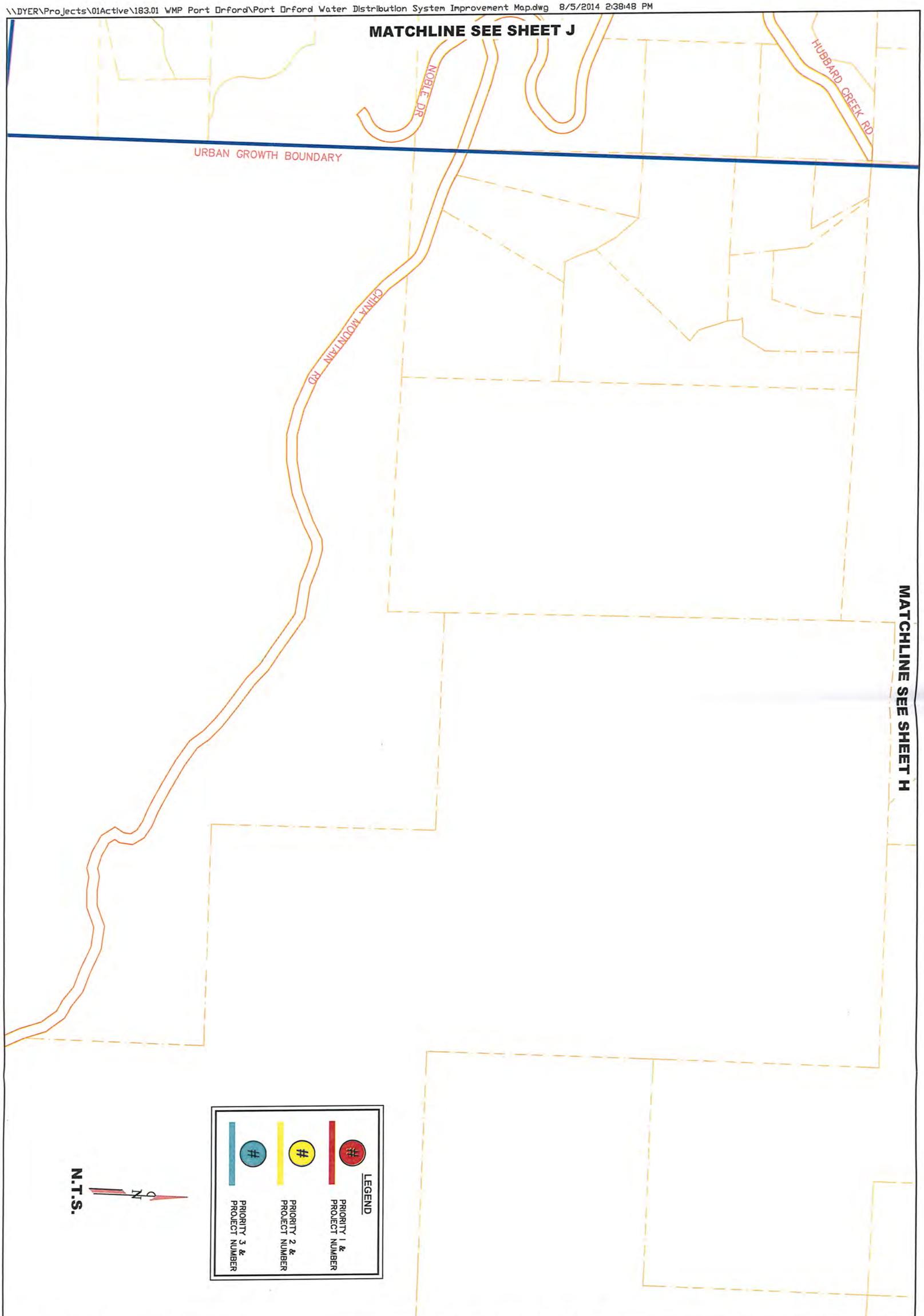
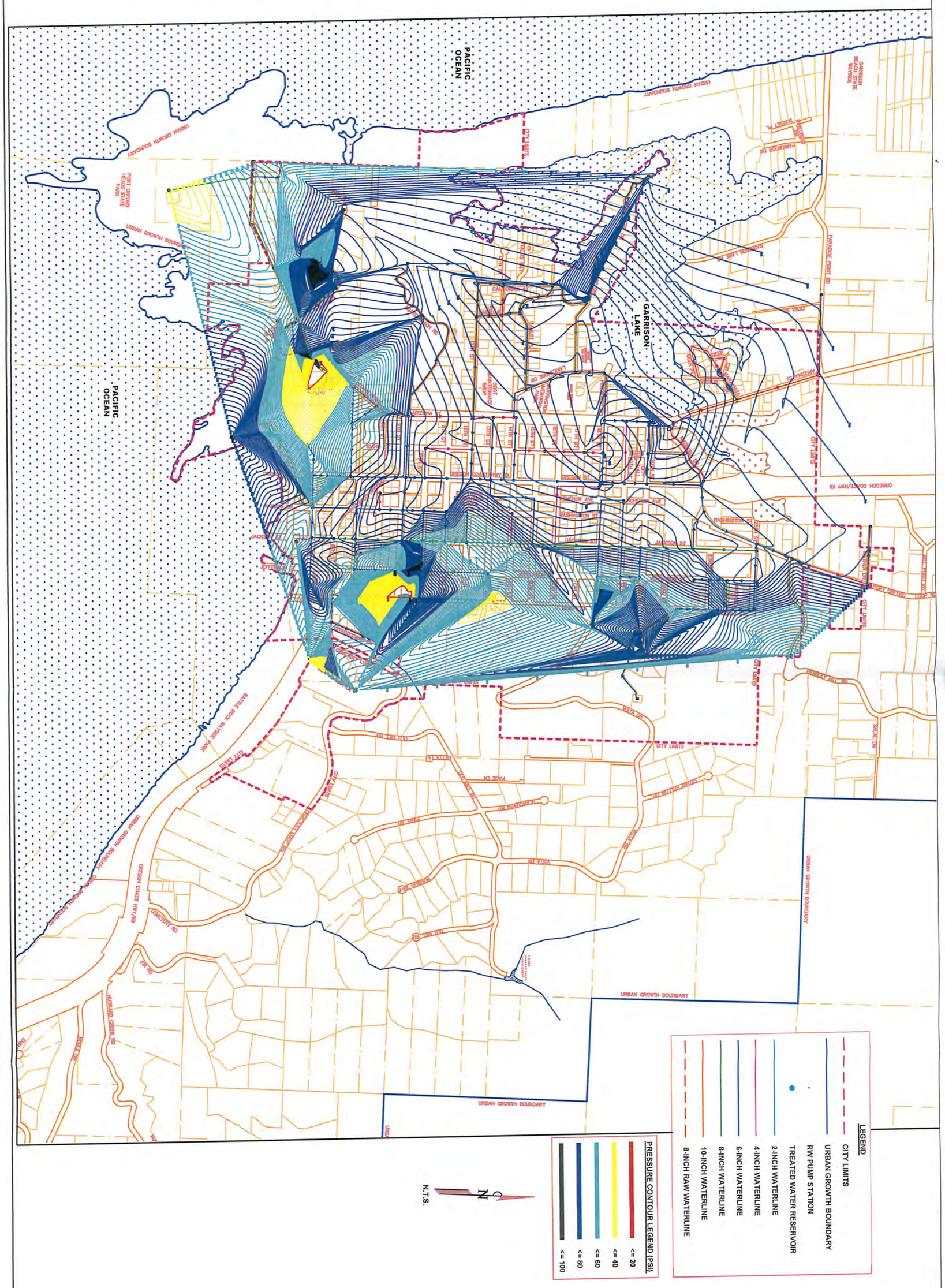


THE DYER PARTNERSHIP ENGINEERS & PLANNERS	CITY OF PORT ORFORD	FIGURE NO.
DATE: MARCH, 2014	IMPROVEMENTS - WATER DISTRIBUTION SYSTEM MAP	8.3.1-J
PROJECT NO.: 183.01		

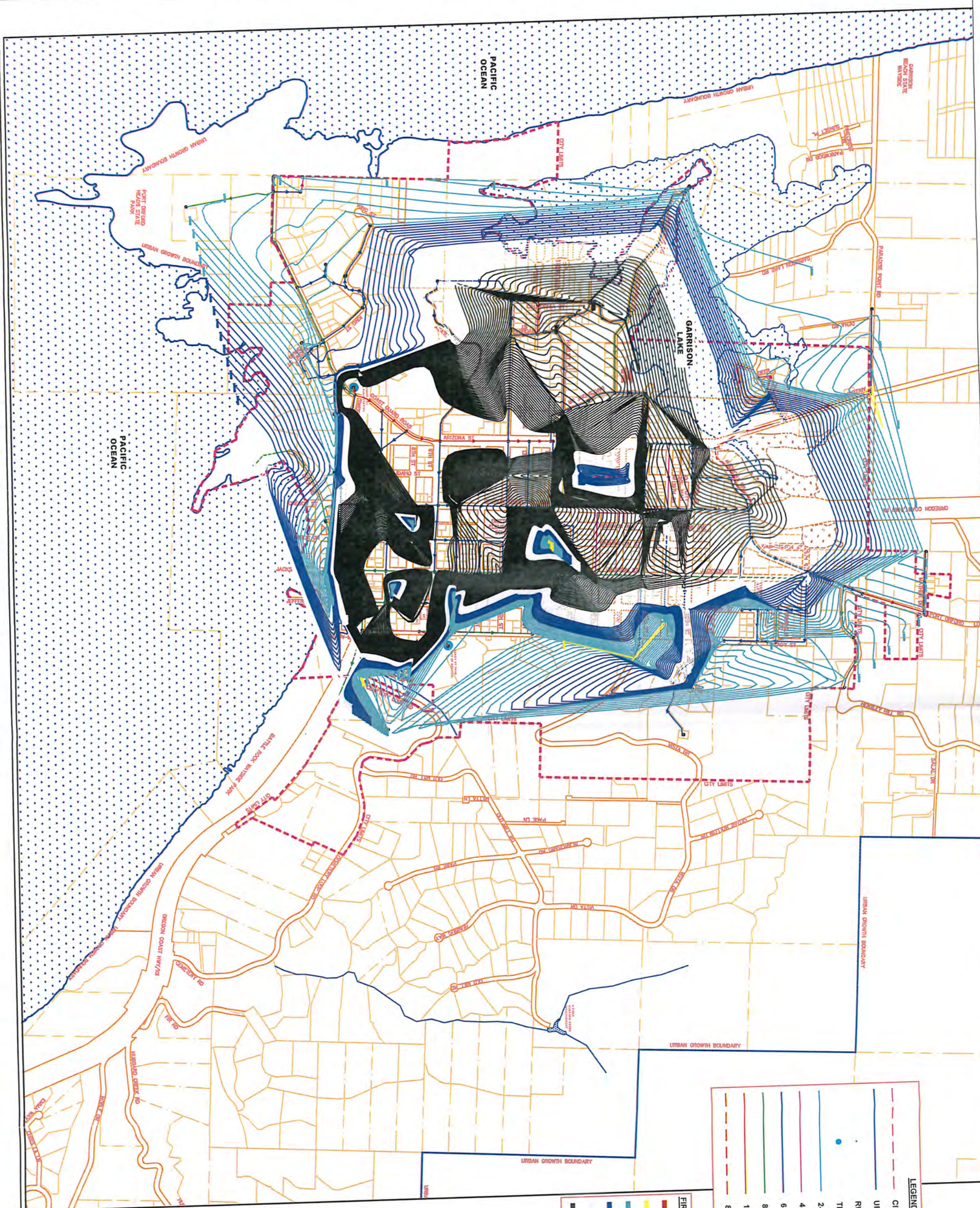
\\DYER\Projects\01Active\183.01 WMP Port Orford\Port Orford Water Distribution System Improvement Map.dwg 8/5/2014 2:38:48 PM



THE DYER PARTNERSHIP ENGINEERS & PLANNERS	CITY OF PORT ORFORD	FIGURE NO.
DATE: MARCH, 2014	IMPROVEMENTS - WATER DISTRIBUTION SYSTEM MAP	8.3.1-K
PROJECT NO.: 183.01		



THE DYER PARTNERSHIP ENGINEERS & PLANNERS	CITY OF PORT ORFORD	FIGURE NO.
DATE: MARCH, 2014	IMPROVEMENT - WATER DISTRIBUTION SYSTEM PRESSURE MAP	8.3.2
PROJECT NO.: 183.01		



THE DYER PARTNERSHIP ENGINEERS & PLANNERS	CITY OF PORT ORFORD	FIGURE NO.
DATE: MARCH, 2014	IMPROVEMENT - WATER DISTRIBUTION SYSTEM FIRE FLOW MAP	8.3.3
PROJECT NO.: 183.01		

Financing

Section

9

Section 9

Financing

9.0 Financing

Most communities are unable to finance major infrastructure improvements without some form of governmental funding assistance such as low-interest loans or grants. In this Section, a number of major Federal and State funding programs and local funding mechanisms that are appropriate for the recommended improvements are discussed. A recommended financing strategy for the proposed infrastructure system improvements is also presented, along with a discussion of the potential impact to rate payers.

9.1 Grant and Loan Programs

Some level of outside funding assistance in the form of grants or low interest loans may be necessary to make the proposed improvement projects affordable for the City of Port Orford and its citizens. The amount and types of outside funding will dictate the amount of local funding that the City must secure. In evaluating grant and local programs, the major objective is to select a program, or a combination of programs, which are most applicable and available for the intended project.

A brief description of the major Federal and State funding programs that are typically utilized to assist qualifying communities in the financing of infrastructure improvement programs is given below. Each of the government assistance programs has particular prerequisites and requirements. These assistance programs promote such goals as aiding economic development, benefiting areas of low to moderate-income families, and providing for specific community improvement projects. With each program having its specific requirements, not all communities or projects may qualify for each of these programs.

9.1.1 Economic Development Administration (EDA) Public Works Grant Program

The EDA Public Works Grant Program, administered by the U.S. Department of Commerce, is aimed at projects which directly create permanent jobs or remove impediments to job creation in the project area. Thus, to be eligible for this grant, a community must be able to demonstrate the potential to create jobs from the project. Potential job creation is assessed with a survey of businesses to demonstrate the prospective number of jobs that might be created if the proposed project were completed.

Proposed projects must be located within an EDA-designated Economic Development District. Priority consideration is given to projects that improve opportunities for the establishment or expansion of industry and that create or retain private sector jobs in both the near-term and the long-term. Communities that can demonstrate that the existing system is at capacity (i.e. moratorium on new connections) have a greater chance of being awarded this type of grant. EDA grants are usually in the range of 50 to 80 percent of the project cost; therefore some type of local funding is also required. Grants typically do not exceed one million dollars.

9.1.2 Water and Waste Disposal Loans and Grants (Rural Development)

The Rural Development Administration (Rural Development) manages the loans and grants for wastewater programs that used to be overseen by the Farmers Home Administration. While these programs are administered by a new agency, the program requirements are essentially the same. The Rural Utilities Service (RUS) is one of three entities that comprise the USDA's Rural Development mission area. The RUS supports various programs that provide financial and technical assistance for development and operation of safe and affordable water supply systems and sewer and other forms of waste disposal facilities.

Rural Development has the authority to make loans to public bodies and non-profit corporations to construct or improve essential community facilities. Grants are also available to applicants who meet the median household income (MHI) requirements. Eligible applicants must have a population of less than 10,000. Priority is given to public entities in areas smaller than 5,500 people to restore a deteriorating water supply, or to improve, enlarge, or modify a water facility and/or inadequate waste facility. Preference is given to requests that involve the merging of small facilities and those serving low-income communities.

In addition, borrowers must meet the following stipulations:

- Be unable to obtain needed funds from other sources at reasonable rates and terms,
- Legal capacity to borrow and repay loans, to pledge security for loans, and to operate and maintain the facilities or services,
- Financially sound and able to manage the facility effectively,
- Financially sound facility based on taxes, assessments, revenues, fees, or other satisfactory sources of income to pay all facility costs including operation and maintenance, and to retire the indebtedness and maintain a reserve,
- Water and waste disposal systems must be consistent with any development plans of state, multi-jurisdictional area, county, or municipality in which the proposed project is located. All facilities must comply with federal, state, and local laws including those concerned with zoning regulations, health and sanitation standards, and the control of water pollution.

Loan and grant funds may be used for the following types of improvements:

- Construct, repair, improve, expand, or otherwise modify waste collection, pumping, treatment, or other disposal facilities. Facilities to be financed may include such items as sewer lines, treatment plants (including stabilization ponds), storm sewer facilities, sanitary landfills, incinerators, and necessary equipment.
- Legal and engineering costs connected with the development of facilities,
- Other costs related to the development of the facility, including the acquisition of rights-of-way and easements, and the relocation of roads and utilities,
- Finance facilities in conjunction with funds from other agencies or those provided by the applicant.

Interim commercial financing will normally be used during construction and Rural Development funds will be available when the project is completed. If interim financing is not available or if the project cost is less than $50,000, multiple advances of Rural Development funds may be made as construction progresses.

The maximum term on all loans is 40 years. However, no repayment period will exceed any statutory limitation on the organization's borrowing authority, nor the useful life of the improvement of the facility to be financed. Interest rates are set quarterly and are based on current market yields for municipal obligations. Current interest rates may be obtained from any Rural Development office.

The following rates currently apply for the Rural Development program:

Market rate. Those applicants pay the market rate whose median household income (MHI) of the service area is more than the $41,230 (Oregon non-metropolitan MHI). The market rate is currently 3.375%.

Intermediate rate. The intermediate rate is paid by those applicants whose MHI of the service area is less than $41,230 but greater than $32,984. The intermediate rate is currently 2.75%.

Poverty line rate. Those applicants whose MHI of the service area is below $32,984 (80% of the non-metropolitan MHI) pay the lowest rate. Improvements must also be to correct a regulatory violation or health risk issue to qualify for this lowest rate. The current poverty line rate is 2.0%.

Maximum grant amounts, based on MHI, are provided in Table 9.1.2.1. The grants are calculated on the basis of eligible costs that do not include the costs attributable to reserve capacity or interim financing. In addition, grant funds cannot be used to reduce total user costs below that of comparable communities funded by RUS.

TABLE 9.1.2.1
MAXIMUM RURAL DEVELOPMENT GRANT FUNDS
BASED ON MEDIAN HOUSEHOLD INCOME

Median Household Income (MHI)	Maximum Grant [a]	Interest Rate [b]
<$32,684	75%	2.0%
$32,984 - $41,230	45%	2.75%
>$41,230	0%	3.375%

[a] MHI<32,984 may be considered for a grant up to 75% of eligible project cost if the project is needed to alleviate a health or sanitary problem.
[b] Rates are current as of this quarter.

Eligibility for the RD grants and loans are currently based on 2010 Census data and Port Orford qualifies for this assistance. The MHI for households in Port Orford, based on 2010 Census data, is $38,438. At this MHI, the City is eligible for a maximum grant of up to 75 percent and a loan at the poverty rate, if they are in violation.

Other restrictions and requirements may be associated with these loans and grants. If the City becomes eligible for grant assistance, the grant will apply only to eligible project costs and is only available after a City has incurred long-term debt resulting in an annual debt service obligation equal to one-half of one percent of the MHI. To receive a Rural Utilities Service loan, the City must secure bonding authority,

usually in the form of general obligation or revenue bonds.

Rural Utilities Service funds for use in Oregon are limited by an annual funding allocation. Because of the success of the Rural Utilities Service Grant and Loans, and tightening of the Federal budget, it is becoming increasingly difficult to obtain sole funding from Rural Development for a large project. Rural Development staff believes the maximum amount of grant funding would consist of a 45 percent split between grant and loan funds.

9.1.3 Technical Assistance and Training Grants (TAT)

Available through the USDA Rural Utilities Service (RUS) as part of the Water and Waste Disposal programs, technical assistance grants are intended to provide technical assistance to associations on a wide range of issues relating to the delivery of water and waste disposal services.

Rural communities with populations of less than 10,000 persons are eligible along with private, nonprofit organizations that have been granted tax-exempt status by the IRS. TAT funds may be used for the following activities:

- Identify and evaluate solutions to water and/or waste-related problems for associations in rural areas.
- Assist entities with preparation of applications for Water and Waste Disposal loans and grants.
- Preparation of environmental reports.
- Pay expenses related to providing technical assistance.

Grants may be made for up to $15,000. Applications are filed with any USDA Rural Development office. For additional information on Rural Development loans and grant programs, call 1-541-673-0136 or visit the RUS website at http://www.usda.gov/rus/water/.

9.1.4 Oregon Community Development Block Grant (OCDBG) Program

The Oregon Business Development Department (OBDD) is an excellent source of funding to help finance public improvements, and contributed in part to the development of this master plan through a Technical Assistance grant and loan. OBDD has three separate programs offering funding assistance, including Community Development Block Grants (OCDBG), the Special Public Works Fund, and the Water/ Wastewater Financing Program.

Another excellent source of public infrastructure funding is from federal funds available through the U.S. Department of Agriculture, through its Rural Utility Services section part of Rural Development (RD). The Rural Utilities Service administers the water and wastewater loan and grant program.

Coos Curry Business Development Department (CCD) will assist the City with completing and submitting funding applications free of charge. They will also provide fund management during the design and construction phase of the project. Tracy Loomis may be contacted at: 1-800-452-6010 x 302; or 1-541-672-3728 x 302; and at: t.loomis@ccdbusiness.com

Oregon Business Development District (OBDD-IFA) finances or helps finance, publicly owned, public works projects using Community Development Block Grants (CDBG) and other sources of funds. Funds come from the U.S. Department of Housing and Urban Development (HUD) and, under the Public Works category, are targeted to water and wastewater systems. Grants and technical assistance are available to develop livable urban communities for persons of low and moderate incomes by expanding economic opportunities and providing housing and suitable living environments.

Non-metropolitan cities and counties in rural Oregon can apply for and receive grants. Oregon tribes, urban cities (Ashland, Bend, Corvallis, Eugene, Gresham, Hillsboro, Medford, Portland, Salem and Springfield) and counties (Clackamas, Multnomah, Washington) receive funds directly from HUD.

All projects must meet one of three national objectives:

1. The proposed activities must benefit low- and moderate-income individuals.
2. The activities must aid in the prevention or elimination of slums or blight.
3. There must be an urgent need that poses a serious and immediate threat to the health or welfare of the community.

Funding amounts are based on:

- The applicant's need;
- the availability of funds; and
- other restrictions defined in the program's guidelines.

The following are the maximum grants possible for any individual project, by category:

- Economic Development: $750,000
- Microenterprise: $100,000
- Public Works
  - Water and Wastewater Improvements: $2,000,000 except preliminary/engineering planning grants: $150,000
  - Downtown Revitalization: $400,000
  - Off-site Infrastructure: $225,000
- Community/Public Facilities: $1,500,000
- Community Capacity/Technical Assistance: no specific per-award-limit but limited overall funds
- Emergency Grants: $500,000
- Regional Housing Rehabilitation: $400,000
- Emergency Projects: $500,000

For additional information on the CDBG programs, call 1-866-467-3466 or visit the IFA website at http://www.orinfrastructure.org/Learn-About-Infrastructure-Programs/Interested-in-a-Community-Development-Project/Community-Development-Block-Grant/.

9.1.5 Special Public Works Fund

The Special Public Works Fund (SPWF) provides funds for publically-owned facilities that support economic and community development in Oregon. Special Public Works Funds provide funding for construction and/or improvement of infrastructure needed to support industrial, manufacturing and certain types of commercial development. Funds are available to public entities for:

- Planning;

- designing;
- purchasing;
- improving and constructing publically owned facilities;
- replacing publically owned essential community facilities; and
- emergency projects as a result of a disaster.

Public agencies that are eligible to apply for funding are:

- Cities;
- counties;
- county service districts (organized under ORS Chapter 451);
- tribal councils;
- ports;
- districts as defined in ORS 198.010; and
- airport districts (ORS 838).

Facilities and infrastructure projects that are eligible for funding are:

- Airport facilities;
- buildings and associated equipment;
- restoration of environmental conditions on publically owned industrial lands;
- port facilities, wharves and docks;
- the purchase of land, rights-of-way and easements necessary for a public facility;
- telecommunications facilities;
- railroads;
- roadways and bridges;
- solid waste disposal sites;
- storm drainage systems;
- wastewater systems; and
- water systems.

Loans
Loans for development (construction) projects range from less than $100,000 to $10 million. The Infrastructure Finance Authority offers very attractive interest rates that reflect tax-exempt market rates for highly qualified borrowers. Initial loan terms can be up to 25 years or the useful life of the project, whichever is less.

Grants
Grants are available for construction projects that create or retain traded-sector jobs. They are limited to $500,000 or 85 percent of the project cost, whichever is less, and are based on up to $5,000 per eligible job created or retained.

Limited grants are available to plan industrial site development for publically owned sites and for feasibility studies.

For additional information on IFA programs, call 1- 503-986-0123 or visit the IFA website at http://www.orinfrastructure.org/Learn-About-Infrastructure-Programs/Interested-in-a-Community-Development-Project/Special-Public-Works-Fund/.

9.1.6 Water/Wastewater Financing Program

Water/Wastewater Financing is available for construction and/or improvement of water and wastewater systems to meet state and federal standards. This loan program funds the design and construction of public infrastructure needed to ensure compliance with the Safe Drinking Water Act or the Clean Water Act.

The public entities that are eligible to apply for the program are:

- Cities;
- counties;
- county service districts (organized under ORS Chapter 451);
- tribal councils;
- ports; and
- special districts as defined in ORS 198.010.

The proposed project must be owned and operated by a public entity as listed above. Allowable funded project activities may include:

- Reasonable costs for construction improvement or expansion of drinking water system, wastewater system or storm water system;
- water source, treatment, storage and distribution;
- wastewater collection, treatment and disposal facilities;
- storm water system;
- purchase of rights-of-way and easements necessary for construction;
- design and construction engineering; or
- planning/technical assistance for small communities.

To be eligible for funding:

- A system must have received, or is likely to soon receive, a Notice of Non-Compliance by the appropriate regulatory agency or is for a facility plan or study required by a regulatory agency; and

- a registered Professional Engineer will be responsible for the design and construction of the project.

Funding and Uses
Loan and grant amounts are determined by a financial analysis of the applicant's ability to afford a loan (debt capacity, repayment sources and other factors).

Loans
Program guidelines, project administration, loan terms and interest rates are similar to the Special Public Works Fund program. The maximum loan term is 25 years or the useful life of the infrastructure financed, whichever is less. The maximum loan amount is $10 million per project through a combination of direct and/or bond-funded loans. Recently IFA, was offering lower, reduced interest rates for municipalities whose household income is less than the statewide median income. The current terms of this loan are for 25 years at 1.94 percent interest.

Loans are generally repaid with utility revenues or voter-approved bond issues. A limited tax general obligation pledge also may be required. "Creditworthy" borrowers may be funded through the sale of state revenue bonds.

Grants
Grant awards up to $750,000 may be awarded based on a financial review.

An applicant is not eligible for grant funds if the applicant's annual median household income is equal to or greater than 100 percent of the state average median household income for the same year.

Funding for Technical Assistance
The Infrastructure Finance Authority offers technical assistance with financing for municipalities with populations of less than 15,000. The funds may be used to finance preliminary planning, engineering studies and economic investigations.

Technical assistance projects must be in preparation for a construction project that is eligible and meets the established criteria.

- Grants up to $20,000 may be awarded per project.
- Loans up to $50,000 may be awarded per project.

Interested applicants should contact the Oregon Business Development Department (OBDD) prior to submitting an application. Applications are accepted year-round. For additional information on this IFA program, call 1-503-986-0123 or visit the IFA website at http://www.orinfrastructure.org/Learn-About-Infrastructure-Programs/Interested-in-a-Water-or-Wastewater-Improvement-Project/water-wastewater-financing/.

9.1.7 Department of Environmental Quality, Clean Water State Revolving Fund (CWSRF)

The CWSRF Program is administered by DEQ and was developed to replace the EPA Construction Grants Program. CWSRF is a loan program that provides low-interest-rate loans instead of grants for the planning, design, and construction of water pollution control facilities.

Interest rates on design and/or construction loans are two-thirds of the current municipal bond rate during the quarter that the loan agreement is signed. Estimated loan rates are currently 2.45 percent for a 20-year loan. In addition, a servicing fee (0.5 percent of the outstanding balance) is also assessed to cover program administration by DEQ. Loans can be in the form of general obligation bonds or other rated debt obligations, revenue secured loan, or a discretionary loan. Loans are for up to a 20-year period, with the repayment date set based on substantial completion of construction.

All eligible proposed projects are ranked based on their application information. Points are assigned based on specific ranking criteria, which include: 1) the anticipated benefit for water quality or public health; 2) potential water quality or public health consequences of not funding the project; and 3) other considerations such as education and outreach. The DEQ website lists detailed ranking criteria.

The first step to obtain CWSRF funding is to submit an application. There are additional requirements depending on the nature of the project. An applicant needs to contact a DEQ Project Officer to discuss the project and further requirements. For additional information on this and other DEQ programs, call 1-800-452-4011 or visit the DEQ website at http://www.deq.state.or.us/programs.htm.

9.1.8 Oregon Department of Energy, Small Scale Energy Loan Program (SELP)

The SELP program offers loans to projects whose purpose is to promote energy conservation and renewable energy resource development. Eligible applicants include cities, counties, special districts, individuals, and non-profit groups. Loans will cover up to 100% of construction costs, including engineering, fees, and studies. The finished project must at least break even in power costs.

The program offers low-interest loans for projects that:

- Conserve natural gas, electricity, oil, or other source of energy,
- produce energy from renewable resources such as water, wind, geothermal, solar, biomass, waste materials or waste heat,
- use recycled materials to create products.

Interested parties should contact the Oregon Office of Energy for details. For additional information on the Office of Energy programs, call 1-503-378-4040 or visit the Office of Energy website at http://oregon.gov/ENERGY/

9.1.9 Oregon Department of Energy, Business Energy Tax Credit

The Business Energy Tax Credit was revamped in 2001 to allow public entities to participate. The State of Oregon Department of Energy offers a tax credit of 35% of project costs, taken over a five-year period, for qualifying capital improvements that reduce energy use. Requirements for projects are similar to that of the SELP program. Public entities do not pay taxes and so are not eligible for a direct tax credit, but may sell their credit to private businesses at a discounted rate, usually about 28%. Lighting retrofits, Variable Frequency Drives (VFD), efficient motors, and controls are typical projects that qualify for funding.

9.2 Local Funding Sources

The amount and type of local funding obligations for infrastructure improvements will depend, in part, on the amount of grant funding anticipated and the requirements of potential loan funding. Local revenue sources for capital expenditures include *ad valorem* taxes, various types of bonds, wastewater service charges, connection fees, and system development charges. Local revenue sources for operating costs include *ad valorem* taxes and wastewater service charges. The following sections identify those local funding sources and financing mechanisms that are most common and appropriate for the improvements identified in this study.

9.2.1 General Obligation Bonds

A general obligation (G.O.) bond is backed by the full faith and credit of the issuer. For payment of the principal and interest on the bond, the issuer may levy *ad valorem* general property taxes. Such taxes are not needed if revenue from assessments, user charges or other sources are sufficient to cover debt service.

Oregon Revised Statutes limit the maximum term to 40 years for cities. Except in the event that Rural Development Administration will purchase the bonds, the realistic term for which general obligation bonds should be issued is 15 to 20 years. Under the present economic climate, the lower interest rates will be associated with the shorter terms.

Financing of wastewater system improvements by general obligation bonds is usually accomplished by the following procedure:

- Determination of the capital costs required for the improvement,
- An election authorizing the sale of general obligation bonds,
- Following voter approval, the bonds are offered for sale,
- The revenue from the bond sale is used to pay the capital costs associated with the projects.

From a fundraising viewpoint, general obligation bonds are preferable to revenue bonds in matters of simplicity and cost of issuance. Since the bonds are secured by the power to tax, these bonds usually command a lower interest rate than other types of bonds. General obligation bonds lend themselves readily to competitive public sale at a reasonable interest rate because of their high degree of security, their tax-exempt status, and their general acceptance.

These bonds can be revenue-supported, wherein a portion of the user fee is pledged toward payment of the debt service. Using this method, the need to collect additional property taxes to retire the obligated bonds is eliminated. Such revenue-supported general obligation bonds have most of the advantages of revenue bonds, but also maintain the lower interest rate and ready marketability of general obligation bonds. Because the users of the water system pay their share of the debt load based on their water usage rates, the share of that debt is distributed in a fare and equitable manner.

Advantages of general obligation bonds over other types of bonds include:

- The laws authorizing general obligation bonds are less restrictive than those governing other types of bonds.
- By the levying of taxes, the debt is repaid by all property benefited and not just the system users.
- Taxes paid in the retirement of these bonds are IRS-deductible.
- General obligation bonds offer flexibility to retire the bonds by tax levy and/or user charge revenue.

The disadvantage of general obligation bond debt is that it is often added to the debt ratios of the underlying municipality, thereby restricting the flexibility of the municipality to issue debt for other purposes. Furthermore, general obligation bonds are normally associated with the financing of facilities that benefit an entire community and must be approved by a majority vote and often necessitate extensive public information programs. A majority vote often requires waiting for a general election in order to obtain an adequate voter turnout. Waiting for a general election may take years, and too often a project needs to be undertaken in a much shorter amount of time.

9.2.2 Revenue Bonds

Revenue bonds offer some advantages over general obligation bonds and are becoming a more frequently used option. Revenue bonds are payable solely from charges made for the services provided. These bonds cannot be paid from tax levies or special assessments; their only security is the borrower's promise

to operate the system in a way that will provide sufficient net revenue to meet the debt service and other obligations of the bond issue.

Many communities prefer revenue bonding, as opposed to general obligation bonding, because it insures that no tax will be levied. In addition, debt obligation will be limited to system users since repayment is derived from user fees. Another advantage of revenue bonds is that they do not count against a municipality's direct debt, but instead are considered "overlapping debt." This feature can be a crucial advantage for a municipality near its debt limit or for the rating agencies, which consider very closely the amount of direct debt when assigning credit ratings. Revenue bonds also may be used in financing projects extending beyond normal municipal boundaries. These bonds may be supported by a pledge of revenues received in any legitimate and ongoing area of operation, within or outside the geographical boundaries of the issuer.

Successful issuance of revenue bonds depends on the bond market evaluation of the revenue pledged. Revenue bonds are most commonly retired with revenue from user fees. Recent legislation has eliminated the requirement that the revenues pledged to bond payment have a direct relationship to the services financed by revenue bonds. Revenue bonds may be paid with all or any portion of revenues derived by a public body or any other legally available monies. In addition, if additional security to finance revenue bonds is needed, a public body may mortgage grant security and interests in facilities, projects, utilities or systems owned or operated by a public body.
Normally, there are no legal limitations on the amount of revenue bonds to be issued, but excessive issue amounts are generally unattractive to bond buyers because they represent high investment risks. In rating revenue bonds, buyers consider the economic justification for the project, reputation of the borrower, methods and effectiveness for billing and collecting, rate structures, provision for rate increases as needed to meet debt service requirements, track record in obtaining rate increases historically, adequacy of reserve funds provided in the bond documents, supporting covenants to protect projected revenues, and the degree to which forecasts of net revenues are considered sound and economical.

Municipalities may elect to issue revenue bonds for revenue-producing facilities without a vote of the electorate (ORS 288.805-288.945). In this case, certain notice and posting requirements must be met and a 60-day waiting period is mandatory. A petition signed by 5% of the municipality's registered voters may cause the issue to be referred to an election.

9.2.3 Improvement Bonds

Improvement (Bancroft) bonds can be issued under an Oregon law called the Bancroft Act. The bonds are an intermediate form of financing that is less than full-fledged G.O. or revenue bonds, but is quite useful especially for smaller issuers or for limited purposes.

An improvement bond is payable only from the receipts of special benefit assessments, not from general tax revenues. Such bonds are issued only where certain properties are recipients of special benefits not occurring to other properties. For a specific improvement, all property within the improvement area is assessed on an equal basis, regardless of whether it is developed or undeveloped. The assessment is designed to apportion the cost of improvements, approximately in proportion to the afforded direct or indirect benefits, among the benefited property owners. This assessment becomes a direct lien against the property, and owners have the option of either paying the assessment in cash or applying for improvement bonds. If the improvement bond option is taken, the city sells Bancroft improvement bonds to finance the construction, and the assessment is paid over 20 years in 40 semi-annual installments with interest. Cities and special districts are limited to improvement bonds not exceeding three percent of true cash value.

With improvement bond financing, an improvement district is formed, the boundaries are established, and the benefited properties and property owners are determined. The engineer usually determines an approximate assessment, either on a square foot or a front-foot basis. Property owners are then given an opportunity to object to the project assessments. The assessments against the properties are usually not levied until the actual cost of the project is determined. Since this determination is normally not possible until the project is completed, funds are not available from assessments for the purpose of making monthly payments to the contractor. Therefore, some method of interim financing must be arranged, or a pre-assessment program, based on the estimated total costs, must be adopted. Commonly, warrants are issued to cover debts, with the warrants to be paid when the project is complete.

The primary disadvantage to this source of revenue is that the property to be assessed must have a true cash value at least equal to 50 percent of the total assessments to be levied. As a result, owners of undeveloped property usually require a substantial cash payment. In addition, the development of an assessment district is very cumbersome and expensive when facilities for an entire community are contemplated. In comparison, G.O. bonds can be issued in lieu of improvement bonds, and are usually more favorable.

9.2.4 Capital Construction (Sinking) Fund

Sinking funds are often established by budget for a particular construction purpose. Budgeted amounts from each annual budget are carried in a sinking fund until sufficient revenues are available for the needed project. Such funds can also be developed with revenue derived from system development charges or serial levies.

A City may wish to develop sinking funds for each sector of the public services. This fund can be used to rehabilitate or maintain existing infrastructure, construct new infrastructure elements, or to obtain grant and loan funding for larger projects.

The disadvantage of a sinking fund is that it is usually too small to undertake any significant projects. Also, setting aside money generated from user fees without a designated and specified need is not generally accepted in municipal or public utility budgeting processes.

9.2.5 Connection Fees

Most cities charge connection fees to cover the cost of connecting new development to water systems. Based on recent legislation, connection fees can no longer be programmed to cover a portion of capital improvement costs.

9.2.6 System Development Charges

A system development charge (SDC) is essentially a fee collected as each piece of property is developed, and which is used to finance the necessary capital improvements and municipal services required by the development. Such a fee can only be used to recover the capital costs of infrastructure. Operating, maintenance, and replacement costs cannot be financed through system development charges.
Two types of charges are permitted under the Oregon Systems Development Charges Act, improvement fees and reimbursement fees. SDCs charged before construction are considered improvement fees and are used to finance capital improvements to be constructed. After construction, SDCs are considered reimbursement fees and are collected to recapture the costs associated with capital improvements already constructed or under construction. A reimbursement fee represents a charge for utilizing excess capacity in an existing facility paid for by others. The revenue generated by this fee is typically used to pay back existing loans for improvements.

Under the Oregon SDC Act, methodologies for deriving improvement and reimbursement fees must be documented and available for review by the public. A capital improvement plan must also be prepared which lists the capital improvements that may be funded with improvement fee revenues, and the estimated cost and timing of each improvement. Thus, revenue from the collection of SDCs can only be used to finance specific items listed in a capital improvement plan. In addition, SDCs cannot be assessed on portions of the project paid for with grant funding.

9.2.7 Local Improvement District (LID)

Improvement bonds issued for local improvement districts (LIDs) are used to administer special assessments for financing local improvements in cities, counties, and some special districts. Common improvements financed through an LID include storm and sanitary sewers, street paving, curbs, sidewalls, water mains, recreational facilities, street lighting, and off-street parking. The basic principle of special assessment is that it is a charge imposed upon property owners who receive special benefits from an improvement beyond the general benefits received by all citizens in the community. A public agency should consider three "principles of benefit" when deciding to use special assessment: 1) direct service, 2) obligation to others, and 3) equal sharing/basis. Cities are limited to improvement bonds not exceeding three percent of true cash value.

The Oregon Legislature has provided cities with a procedure for special assessment financing (ORS 223.387-399), which applies when city charter or ordinance provisions do not specify otherwise. To establish an LID, an improvement district is formed, the boundaries are established, and the benefited properties and property owners are determined. An approximate assessment to each property is determined based on the above three principles of benefit, and is documented in a written report. Property owners are then given an opportunity to object to the project assessments. The assessments against the properties are usually not levied until the actual cost of the project is determined. Since this determination is normally not possible until the project is completed, funds are not available from assessments for the purpose of making monthly payments to the contractor. Therefore, some method of interim financing must be arranged based on the estimated total costs.

The primary disadvantage to this source of revenue is that the property to be assessed must have a true cash value at least equal to 50 percent of the total assessments to be levied. As a result, owners of undeveloped property usually require a substantial cash payment. In addition, the development of an assessment district is very cumbersome and expensive.

9.2.8 Ad Valorem Taxes

Ad valorem property taxes are often used as a revenue source for utility improvements. Property taxes may be levied on real estate, personal property or both. Historically, ad valorem taxes were the traditional means of obtaining revenue to support all local governmental functions.

A marked advantage of these taxes is the simplicity of the system; it requires no monitoring program for developing charges, additional accounting and billing work is minimal, and default on payments is rare. In addition, ad valorem taxation provides a means of financing that reaches all property owners that benefit from a system, whether a property is developed or not. The construction costs for the project are shared proportionally among all property owners based on the assessed value of each property.

Ad valorem taxation, however, is less likely to result in individual users paying their proportionate share of the costs as compared to their benefits.

9.2.9 User Fees

User fees can be used to retire general obligation bonds and are commonly the sole source of revenue to retire revenue bonds and to finance operation and maintenance costs. User fees represent monthly charges to all residences, businesses, and other users that are connected to the wastewater system. These fees are established by resolution and can be modified, as needed, to account for increased or decreased operating and maintenance costs. The monthly charges are usually based on the class of user (e.g. single family dwelling, multiple family dwelling, schools, etc.) and the quantity of water through a user's connection.

9.2.10 Assessments

Under special circumstances, the beneficiary of a public works improvement may be assessed for the cost of a project. For example, the city may provide some improvements or services that directly benefit a particular development. The city may choose to assess the industrial or commercial developer to provide up-front capital to pay for the administered improvements.

9.3 Financing Strategy

A financing strategy or plan must provide a mechanism to generate capital funds in sufficient amounts to pay for the proposed improvements over the relatively short duration in design and construction, generally two years. The financing strategy must also identify the manner in which annual revenue will be generated to cover the expense for long-term debt repayment and the on-going operation and maintenance of the system. The objectives of a financial strategy include the following:

- Identify the capital improvement cost for the project and the estimated expense for operation and maintenance.
- Evaluate the potential funding sources and select the most viable program.
- Determine the availability of outside funding sources and identify the local cost share.
- Determine the cost to system users to finance the local share and the annual cost for operation and maintenance.

With any of the proposed funding sources within the financial strategy, the City is advised to confirm specific funding amounts with the appropriate funding agencies prior to making local financing arrangements.

Proposed Financing Plan

A financial strategy to address financing of the Phase I Improvements within the Capital Improvement Plan is discussed below.

Low Interest Loans

Four types or programs of project funding were identified as viable for funding the City's proposed Phase I improvements: 1) Rural Development Rural Water and Waste Disposal Grants and Loans; 2) Infrastructure Finance Authority Water/Wastewater Financing Program; 3) Drinking Water State Revolving Fund; and 4) Private Financing. Based on these funding programs, four alternative funding packages were compiled and evaluated. A summary of the funding alternatives for these improvements is given in Table 9.3.1.

TABLE 9.3.1
FUNDING ALTERNATIVES FOR PHASE I IMPROVEMENTS

Funding Source	Grant Amount, $ [1]	Loan Amount, $ [1]	Loan Term, years	Interest Rate, %	Rate Increase, $/EDU/month
Rural Development (RD)/IFA Water/Wastewater Grants & Loans					
RD 15/85 (Grant/Loan)	2,400,000	5,741,700	40	3.5	$26.42
IFA Water/Wastewater Grants & Loans					
IFA Grant/Loan	1,000,000	7,141,700	25	1.6	$34.28
Drinking Water SRF Loan					
Drinking Water SRF		8,141,700	30	2.1	$36.22
Private Loan					
Private Funding		8,141,700	25	4.75	$55.35

[1] – Amount based on current dollars.

The City is working on correcting regulatory compliance issues with the Hubbard Creek impoundment, and might qualify for some state or federal agency grants. The projected rate increases anticipated from the funding options range from $26.42 to $55.35 per EDU per month. These rate increases are very similar in magnitude and should be investigated further at a "One-Stop" meeting with the funding agencies and in discussions with private funding sources. For the purposes of this financing plan, further evaluation will be made with the most conservative value, which is $55.35 per EDU per month.

Local Financing Requirements

The financing plan for the Phase I improvements is based on the City securing authorization to issue bonds of approximately $8,141,700. A breakdown of approximate monthly water user costs for the improvements, based on present worth costs and including current water Operations and Management (O&M) budget and debt reserve, is given in Table 9.3.2. For this table, it was assumed that the City's debt service for the Phase I Improvements would be $8,141,700 with IFA financing.

TABLE 9.3.2
APPROXIMATE MONTHLY USER COSTS

Item	Annual Cost	Monthly User Cost/EDU
Total EDUs = 848		
Debt Service on $8,141,700	$268,868	$26.42
Debt Service @ 10%	$26,887	$2.69
O&M Cost & Exist. Debt – Year 2012 Budget	$386,242	$40.92
Total	$681,997	$70.03

The estimated total monthly average cost to each EDU is anticipated to be approximately $70.03. A loan for improvements is conditional upon the determination of Rural Development and IFA of the City's eligibility for funding. The loan funds will not be offered by Rural Development if the City does not acquire authorization to issue bonds in the minimum amount required by the agency.

The City has the option of two different types of bonding, as discussed in detail above general obligation (G.O.) bonds or revenue bonds. The G.O. bond option will require the City to hold an election and receive a favorable majority vote. This option would enable the City to levy a tax and/or user fees to make bond payments. The revenue bond option offers the City the ability to issue bonds without a vote

of the electorate, if certain notice and posting requirements are met. Revenue bonds ensure no tax will be levied and require payment from user fee revenue.

The interest rate for this funding is quite low, resulting in the lowest annual payments and cost per EDU. Actual financing may be dictated by availability or changes in programs from the date of this plan.

System Development Charges

In addition to the proposed financing strategy consisting of grants and low interest loans, the City should revise its system development charges (SDC) to assist in financing necessary capital improvements to the water system required by growth and development.

As mentioned in Section 8, SDCs may be developed and assessed as reimbursement and/or improvement fees. The reimbursement fee approach is based on the premise that new customers are entitled to water service at the same cost as existing customers. Consequently, the reimbursement SDC is calculated as the average water system investment per customer. Calculation of a reimbursement SDC is beyond the scope of this study as research and documentation is needed to determine the total investment made to the City's water system, contributed capital, and debt service payments.

An SDC improvement fee is based on the projected improvements needed to increase system capacity. Approximately 60 percent of the proposed improvement costs were attributed to future growth demands. With an SDC improvement fee, new users of the City's water system would be assessed approximately 60 percent of the projected cost to design and construct these improvements. The present cost for the future improvements presented in Section 8 is estimated to be $13,450,200. The number of projected EDUs is calculated as follows.

Estimated SDCs Based on Improvement Fee

Year 2012	
Total Number of Billable EDUs	= 848 EDUs
Amount of Billable Water/EDU	= 33,361 gallons/EDU/year
Total Billable Amount of Water	= 28,289,937 gallons/year
Population in Year 2012	= 1,135 people
Billable Amount of Water/Population	= 2,077 gallons/year/person
Present Worth Cost for Proposed Improvements	= $13,440,200
% SDC Eligible	= 2.47% Phase I and 1.24% Phase II Improvements
Present Worth SDC Eligible Costs	= $498,631
Calculated SDC Improvement Fee	= $498,631 4 848 EDUs = $588/EDU

Based on an estimated growth of 848 EDUs in the next 20 years, the calculated SDC improvement fee is $588/EDU. Estimated growth of EDUs based upon population growth is a factor of 1.05%.

Affordability

One major consideration in deciding on any proposed capital improvements is the users' ability to support the full cost of utility service, including debt repayment. Several measures of household affordability or ability to pay have been proposed or are currently being utilized. The majority of affordability indicators are largely a function of income and employment. A summary of affordability measures and thresholds from selected studies is provided in Table 9.3.3. The Environmental Protection Agency (EPA no date) compiled this information for assessing affordability issues with the Safe Drinking Water Act.

One of the most common affordability indicators is the ratio of annual user charges to the median household income. The threshold of affordability for this ratio varies from 1.5 to 2.5 percent of median household income. OBDD utilizes 1.39 percent of the median household income as a threshold for qualifying for grant monies.

TABLE 9.3.3
SUMMARY OF AFFORDABILITY MEASURES AND THRESHOLDS

Source	Indicator(s)	Threshold
Future Investment in Drinking Water & Wastewater Infrastructure (2002)	Ratio of annual user charge & median household income	2.5% of MHI
Rural Utilities Service Water & Waste Disposal Loans & Grants	Debt service portion of annual user charge & median household income (MHI)	>0.5% & MHI below poverty line or >1.0% & MHI between 80 & 100% of statewide non-metropolitan MHI
Department of Housing & Urban Development	Ratio of water & sewer bills, & household income	1.3 to 1.4%
National Consumer Law Center "The Poor and the Elderly – Drowning in the High Cost of Water", circa 1991	Ratio of sum of water & sewer bills & household income	>2.00 %
EPA Economic Guidance for Water Quality Standards Workbook	Ratio of annual user charge & median household income	<0.8% - no hardship expected 0.8 – 1.5% - mid-range >1.5% may be unreasonable burden
Affordability Criteria For Small Drinking Water Systems: An EPA Science Advisory Board Report (2002)	Discussion of affordability threshold, expenditure baselines, and differences in cost, income, and benefits	1. >1.0% must provide additional security. 2. >25% - system probably cannot issue debt
National Drinking Water Advisory Council Affordability Recommendations (2003)	EPA national affordability threshold given size category	grounds for consideration of measures other than median income
State of Idaho Assessment Tools for SRF Loans	Ratio of annual user charge & median household income	1.5% MHI

Abbreviations: AUC – annual user charge
MHI – median household income

One limitation of using the ratio of annual user charges to the median household income is determination of a representative median household income for a community. Currently, most funding agencies still utilize the 2000 Census data for making this determination. We have chosen to use the Consumer Price Index (CPI) for all urban consumers (CPI-U) to approximate current MHI. The underlying assumption is that wages in the area have increased in a similar manner to that of the CPI. Data for the CPI-U were taken for the years 2000 through 2007 for the month of September. A linear curve was fit to the data in order to project the CPI for September 2007. Data is not yet available for September 2011. As a check, the latest CPI referred to was July 2002. The CPI for July 2007 is higher than the projected CPI for September 2000. In order to be conservative, the higher July 2007 CPI was utilized. A summary of these calculations is given in Table 9.3.4.

TABLE 9.3.4
AFFORDABILITY OF PROJECTED WATER USER COSTS FOR THE CITY OF PORT ORFORD

Description	2012
Median Household Income (MHI), $	$29,931
Current Rates	
Est. Annual User Charge, $/EDU[1]	$27.75
Annual User Charge/MHI, %	1.2%
Projected Rates	
Est. Annual User Charge, $/EDU	$70.03
Annual User Charge/MHI, %	1.43%

[1]Estimated. $35,106 according to 2010 census ($36,574 according to 2009 census)

Based on affordability measured by the ratio of annual user charge and the median household income, the current user rates are considered affordable (0.9 – 1.0%). The proposed rate structures for financing the future water system operation and improvements pushes the projected water rates to the marginally affordable (1.1 – 1.2%) level.

9.4 Recommendations

The following recommendations are made to the City Council to implement the elements of this Water Master Plan Update.

- Submit Plan to the Oregon Health Division and Department of Water Resources for review and approval.
- Submit system information to private funding sources for consideration of private financing.
- Submit necessary applications to the funding agencies requesting loans and grants to finance the Phase I Improvements.
- Following favorable review by the selected financing agencies, secure the authority to issue revenue or general obligation bonds in the amount needed to finance the Phase I Improvements.
- Authorize detailed design of recommended improvements and preparation of plans and specifications for the Phase I improvements. Secure the necessary special use permits for construction.
- Receive construction bids and award contracts for Phase I Improvements.
- Initiate study of user rates for water system and implement proposed changes.
- Revise system development charges (SDCs) for the water system based on the CPI given in this study.
- Commence with new water management and conservation measures and programs per the recommended benchmarks.
- Submit necessary applications to the funding agencies requesting loans and grants to finance the Phase II Improvements.
- Following favorable review by the selected financing agencies, secure the authority to issue revenue or general obligation bonds in the amount needed to finance the Phase II Improvements.
- Authorize detailed design of recommended improvements and preparation of plans and specifications for the Phase II improvements. Secure the necessary special use permits for construction.
- Receive construction bids and award contracts for Phase II Improvements.

9.5 Project Implementation

A tentative schedule, identifying the key activities and approximate implementation date for the Water Master Plan Update over the next three years, is presented in Table 8.4.1.

TABLE 9.5.1
PROJECT IMPLEMENTATION SUMMARY

Item No.	Key Activity	Implementation Date
1	Adopt Water Master Plan Update	September 2014
2	Submit Plan to Health Division & Department of Water Resources	September 2014
3	Approval of Plan by Health Division & Department of Water Resources	November 2014
4	Initiate Water Conservation Plan Tasks Per Benchmarks	January 2015
5	Start Rate Study and SDC Revisions	March 2015
6	Complete Rate Study & SDC Revisions	November 2015
7	Start Environmental Evaluation/Notice	June 2015
8	Submit Application for Financing for Phase I and Associated Environmental Evaluation/Notice for Project	January 2015
9	Obtain Financing for Phase I Improvements	May 2015
10	Start Preparation of Plans, Specifications for Phase I	June 2015
11	Complete Design & Preparation of Plans, Specifications, & Contract	March 2016
12	Health Division Approval of Plans & Specifications	May 2016
13	Advertise for Phase I Construction Bids	May 2016
14	Receive Construction Bids for Phase I	June 2016
15	Start Construction of Phase I	July 2016
16	Complete Construction of Phase I Improvements	April 2017

Water Management and Conservation Plan

Section

10

Water Management and Conservation Plan

Section 10

10.1 Conservation Planning Strategy

Water conservation consists of any beneficial reduction in water losses, waste, or consumption. As water providers face growing demands of them and their limited resources, conservation planning is playing an increasingly important role in their management practices. Water that is conserved, in effect, becomes a new and relatively inexpensive source of water for the utility.

Conservation can have the effect of helping water providers avoid, downsize, or postpone water and wastewater expansion projects. Capital, maintenance, and financing costs, and many other expenses may be reduced by effectively practicing conservation within the water system. Additional benefits for the environment include restoring stream flows to support aquatic life, providing recreational opportunities, and maintaining water quality. Investments in conservation planning yield savings that can be measured in terms of reclaimed water, resources and related operating dollars.

A water conservation plan is a long-term program intended to reduce average per capita water consumption, thus diminishing the overall demand placed on a water system and its resources. The Oregon Department of Water Resources reviews municipal water management and conservation plans based on the requirements found in the Oregon Administrative Rules (OAR) Division 86 (OAR 690-086-100 to 170). Much of what is required in a conservation plan is provided in a standard water master plan. However, the conservation and curtailment elements of a conservation plan are typically not part of a water system master plan. Sections 9 and 10 of this Master Plan have been specifically prepared to satisfy the requirements outlined in OAR 690-086-100 to 170. The entire Master Plan will be submitted to the Oregon Department of Water Resources as well as to the Oregon Health Division for review and acceptance.

As outlined in OAR 690-086-125, a water management and conservation plan shall include the following:

- Water supplier description,
- Water conservation element,
- Water curtailment element,
- Water supply element,
- A list of affected local governments to whom the draft plan was made available pursuant to OAR 690-086-120(6), and a copy of any comments on the plan provided by the local governments,
- A proposed date for submittal of an updated plan with no more than 10 years based on proposed schedule for implementation of conservation measures, any relevant schedules for other community planning activities, and the rate of growth or other changes expected by the water supplier or an explanation of why submittal of an updated plan is unnecessary and will not be required, and

- If the municipal water supplier is requesting additional time to implement metering as required under OAR 690-086-0150(4)(b) or a benchmark established in a previously approved plan, documentation showing additional time is necessary to avoid unreasonable and excessive costs.

Much of this Master Plan is summarized in this section, including information on the existing system, service population, system demand, and long-range supply. The municipal water supplier description and conservation elements of the City's Water Management and Conservation Plan are addressed in this section. The water curtailment element is discussed in Section 10 and the water supply element is presented in Section 11.

10.2 Municipal Water Supplier Description (OAR 690-86-140)

The City of Port Orford is located next to Highway 101 in the northern portion of Curry County, approximately 26 miles south of Bandon and 24 miles north of Gold Beach. (Figure 3.1.1). Port Orford is located along the Pacific Ocean, surrounded by forested hills and farm and pasture land. The City provides potable water service to its residents, commercial/industrial users, schools, and public/non-profit customers.

A comprehensive description of the City's water supply and usage is given below in accordance with OAR 690-086-140.

Supply Sources and Supply/Delivery Contracts (OAR 690-86-140 (1))

The primary water source for the City of Port Orford is the North Fork of Hubbard Creek. The City's withdrawal from North Fork of Hubbard Creek Reservoir is based on the City's water right of 1.25 cfs from North Fork of Hubbard Creek and the City's water right for stored water in the reservoir (3.2 ac-ft for municipal diversion). The City has water right permits for the diversion of water from Garrison Lake and Gold Run Creek, but is not currently diverting water from these two sources.

The City does not have any other interconnections with other municipal or community water systems.

Current Service Area and Population (OAR 690-086-140(2))

The City's water service area includes users within the City limits and outside the City limits as well. The City's service area is shown in Figure 10.2.1.

The current population (Year 2012) within the City of Port Orford is 1,135 based on Portland State University (PSU) Population Research Center's estimate. Based on United States Census data, the City of Port Orford's population decreased from 1,153 to 1,135 between 2000 and 2010. This decrease equates to an average annual growth rate of -0.2%. During this same period, the average growth rate in Curry County was 0.6%. Table 10.2.1 summarizes the population projections over the next 20 years, using the Year 2013 PSU estimate of the City population (1,133) as the base figure.

Growth is expected to continue at a rate lower than that experienced in the community during the last decade. The coordinated population projection of 0.45% per year has been selected by Curry County in its Comprehensive Plan (2009) for the next 25 years (to the Year 2040).

TABLE 10.2.1
CURRENT POPULATION ESTIMATE AND POPULATION PROJECTIONS

Year	2000	2010	2013	2018	2023	2030	2040
Residential Population	1153	1133	1132	1146	1185	1232	1260

For Calendar Year 2012, there were 546 residential potable water connections within the City. The number of equivalent dwelling units (EDUs) for these connections is 546 (See Section 6.2 for more details.). With a current city population of 1,133, the number of per capita equivalent dwelling units is 2.08 (1,133 capita/546 EDUs, rounded).

In addition to the City's residents, there are a total of 2 residential water connections outside the City limits. The number of equivalent dwelling units (EDUs) for these connections is 2 EDUs outside the City (See Section 6.2 for more details.). Based on representative Year 2010 Census data, the average number of persons per household ranges from approximately 2.35 to 2.47. Assuming 2.47 persons per EDU and 2 EDUs with water service outside the City, the estimated population of potable water users outside the City limits is 4.94. City staff considers future growth of potable water users in these currently served areas to be equal to or exceeding City growth.

The current and future total number of potable water users on the City's system is summarized in Table 10.2.2.

TABLE 10.2.2
CURRENT AND FUTURE POTABLE WATER USE POPULATION

	Population		
Year	Exist. & Future City Users	Exist Outside Users	Total
2013	1,132	891	2,023
2015	1,131	926	2,057
2020	1,162	936	2,098
2025	1,200	950	2,150
2030	1,232	962	2,194
2035	1,250	975	2,225
2040	1,260	987	2,247

Assessment on the Adequacy and Reliability of Existing Water Supplies (OAR 690-086-140(3))

The City currently diverts water from the North Fork Hubbard Creek Reservoir. To date, this supply has been adequate to satisfy the City's potable water demand. The main limitation has been the City's ability to provide adequate storage in the reservoir due to siltation and dredging issues.

This source has been historically unreliable due to the issues associated with dredging the reservoir. The City has not been able to maintain the size of impoundment while sustaining flow downstream in the creek during the dry summer months. This source is capable of supplying an adequate amount of water during the wet winter months; however turbidity limits use at times.

Quantification of Water Delivered by Supplier (OAR 690-086-140(4))

The amount of water produced at the water treatment plant and sent to the City for consumption is based on daily records supplied by the City staff. The amount of treated water produced at a WTP is typically

equal to the sum of the amount of water sent to the City for consumption plus the amount of water used for backwash, and miscellaneous water usage at the WTP (e.g. for pump seals, sanitary usage, etc.). As the City does not currently record miscellaneous water usage at the WTP, this miscellaneous usage at the WTP is not known. Consequently, for this study, water treatment plant production will be based on the sum of water pumped to the City for consumption and the amount of water used for backwash.

Water production rates were derived from the plant data for average annual demand (AAD), average daily demand (ADD), maximum monthly demand (MMD), peak weekly demand (PWD), and maximum daily demand (MDD). A definition of each of these water demand parameters was previously given in Section 6.1. A summary of the compiled water demand parameters for the current year is presented in Table 10.2.3.

TABLE 10.2.3
CURRENT ANNUAL, MONTHLY, WEEKLY & DAILY WATER PRODUCTION W/BACKWASH

ADD, gpd	MMD, gpd	MDD, gpd	PHD, gpd
78,000	97,000	195,000	312,000

Tabular List of Water Rights (OAR 690-086-140(5))

A tabular list summarizing information on the City's water rights and sources is presented in Table 10.2.4.

TABLE 10.2.4
WATER RIGHTS AND SOURCES

Location	Application	Permit	Certification	Magnitude	Priority Date
N. Fork Hubbard Creek/Reservoir	R 74399	-	69194	3.2af	1/1/1993
N. Fork Hubbard Creek	S 43146	S32982	42379	0.50 cfs	3/20/1968
N. Fork Hubbard Creek	S 65306	S47688	65322	0.75 cfs	7/15/1983
Garrison Lake	S 55747	S42566	65199	1.00 cfs	4/25/1977
Gold Run Creek	R 74403	S12266	11810	1.00 cfs	8/20/1936

Existing Service Population (OAR 690-086-140(6))

The City of Port Orford services users inside and outside the City limits. A summary of the City's water user accounts for the Year 2011 is provided in Table 9.2.5.

TABLE 10.2.5 SUMMARY OF EDU CALCULATIONS 2012		
Description	**Units**	**Value**
Ave. Number of Accounts		643
12 Mo. Water Usage	gals	28,289,937
Water Usage by Customer Class		
No. Res & Small Com EDUs	EDU	848
Res EDU Usage/Yr	gals	18,231,767
Usage per EDU	gpd	92
Small Commercial	gals	2,695,920
Large Commercial	gals	966,210
Multi-Unit	gals	2,695,920
Restaurants	gals	335,640
RV Parks	gals	944,910
Outside	gals	60,750
Institutional / City	gals	1,011,450
Motels	gals	1,347,370
EDUs by Customer Class		
Residential	EDU	546
Small Commercial	EDU	81
Large Commercial	EDU	29
Multi-Unit	EDU	81
Restaurants	EDU	10
RV Parks	EDU	28
Outside	EDU	2
Institutional / City	EDU	30
Motels	EDU	40
Total EDUs	EDU	848

It will be reiterated that Table 10.2.5 shows the average consumption levels within the system. All losses, nonaccount water, and other water uses are not accounted for within the consumption data. Residential sources account for approximately 86 percent of all water consumed within the City. The remaining system users (i.e. commercial/industrial, schools, public/non-profit) utilize 14 percent of the city-metered water.

Connections with Other Systems (OAR 690-86-140(7))

The City has no connections with and nor does it supply potable water to any other systems.

System Schematic (OAR 690-86-140(8))

A schematic of the City of Port Orford's existing water system is displayed in Figure 10.2.2. This schematic shows the raw water diversions, the WTP, treated water mains from the WTP, and treated water reservoir tanks. The actual location of these facilities is shown in Figures 3.1.2 and 5.5.1.

Quantification & Description of System Losses (OAR 690-086-140(9))

Water sold is typically less than the amount of water produced at the plant due to system leaks, unmetered use at the WTP (backwash water, turbidimeter water, washdown, etc.), unmetered use within the distribution system, inaccuracies in customer meters, and other unmetered use such as fire flows and system flushing. A comparison of the amount of water treated (sum of water pumped to the City and backwash), and the amount of water consumed is given in Table 10.2.6.

TABLE 10.2.6.
COMPARISON OF WATER PRODUCED, BACKWASH, PUMPED & CONSUMED

Time Period	Water Produced	Backwash	Water Pumped	Water Consumed
2011	54,670,000	1,850,000	50,491,000	29,846,340
2012	55,023,000	1,481,000	50,299,000	28,289,937
Average	54,846,500	1,665,500	50,395,000	29,068,139

Over the last five years, the average amount of nonaccount water pumped to the City is approximately 47 percent. Previously, the percent of nonaccount water within the City has been reported as 30 percent in 1999-2001, and 42 percent in 2001 (SHN 2005). Potential sources of lost treated water include the following:

- Leakage within the City's water distribution system.
- Inaccurate water meters.
- Unauthorized use or connections without meters.
- Unmetered water for firefighting and operations such as street cleaning, water main flushing and testing.
- Losses due to main line breaks or leaking lines.
- Other approved, but non-metered, water uses.

10.3 Water Conservation Element (OAR 690-086-150)

Municipal water providers are in the service of providing potable drinking water to their patrons. The sale of that water allows the utility to pay expenses, retire debts for system development loans, and plan for future water production facilities. Some providers may view conservation as an activity that may jeopardize the financial survival of their water system. However, practically every water system is capable of making changes in their operation that will result in reducing "lost water" and lowering production costs. Conservation often results in an increase of operating revenues and a decrease in unnecessary and wasteful expenses. Responsible water management also includes educating the public about wasteful water usage practices. This section addresses current and proposed water conservation measures for the City to implement.

Water Conservation Progress Report (OAR 690-86-150 (1))

As the City does not have a previously approved plan, a progress report for previously implemented conservation measures is not required. However, existing conservation measures are described later in this section.

Water Use Measurement and Reporting Program (OAR 690-86-150(2))

As part of the proposed improvements to the WTP, flowmeters with flow totalizers will be installed on

the influent line to the WTP. The City's water diversion will be measured with this device. This flow measurement system complies with the measurement standards in OAR 690-085.

Current Conservation Practices (OAR 690-86-150(3))

The current conservation practices employed by the City of Port Orford are metering and rate structure. The vast majority of the existing water system is metered, enabling the City to charge its users according to consumption. The meters are read on fixed intervals and can be used for audits and accounting practices.

The City current rate method assesses a fee for basic service (which includes the first 2,000 gallons). The customer is billed the base rate regardless of whether or not the water is used. Thereafter, the customer is billed on a sliding scale for additional 2001 to 5000 gallons used, 5001 to 10,000 gallons used, 10,000 to 20,000 gallons used, and over 20,000 gallons. This rate structure is in conformance with the requirements of OAR 690-086-150(4d). This water rate structure provides excellent revenue stability, is a good conservation tool, provides good equity, and is simple to administer and explain.

Planned Conservation Program Activities (OAR 690-86-150(4,6))

This section describes the City of Port Orford's planned water conservation program activities for the Years 2015 to 2020. A table of conservation benchmarks, as required in the Division 86 rules, is at the end of each section. These conservation benchmarks are specific commitments that the City will implement according to the schedule in each table. The Year 2015 to 2020 time period is the focus of the conservation benchmarks, as the proposed submission of a revised Water Management and Conservation Plan for the City is the Year 2020.

Annual Water Audit (OAR 690-086-150(4a))

The purpose for a water audit is to track the efficiency of the system, monitor water consumption levels, determine effectiveness of conservation measures, and gather system performance data. The OAR requires determination of the level of water loss as communities seek to reach efficiency goals of 90 percent or greater.

The City will compile an annual water audit of its system, since it currently does not perform one. Installation of water meters is recommended for those services not currently metered. A spreadsheet and method for incorporating this data into the spreadsheet will need to be developed to incorporate the various water measurement data and perform the necessary calculations in a reasonable time frame.

The City will also develop estimates of known uses and losses on a monthly basis and maintain records of this water use. Known uses and losses will include estimating quantities of water used for flushing mains, loss due to major leaks or water main replacement, and water utilized through hydrant meters. In addition, the City will need to implement a system to track water used for fire suppression and training through its hydrants. This auditing will be implemented as soon as possible even though all of the components may not be in place.

In addition to annual audits, the City will implement a monthly water audit within its raw and treated water systems. This monthly audit will prove to be helpful in detecting irregular water use patterns that may be attributable to leaks, malfunctions, and other system problems. Performance of monthly audits will provide the City with relatively "fast" feedback on the performance of its system and the response of

specific repairs or improvements that have been developed. Conservation benchmarks for annual water audits are listed in Table 10.3.1.

TABLE 10.3.1
ANNUAL WATER AUDIT BENCHMARKS – YEAR 2015-2020

Benchmark	Start Date	Frequency or Completion
Install new meters & read existing water meters as described under Metering Benchmarks (Table 9.3.2)	2018	Dec. 2019
Develop electronic spreadsheets & procedure for implementing audits	2018	Dec. 2019
Collect & record monthly meter readings, complete monthly audits	2018	Monthly
Perform annual water audit	2018	Annual

Metering (OAR 690-086-150(4b))

City facilities are mostly metered and usage is being tracked for some uses.

Metering Testing and Maintenance Program (OAR 690-086-150(4c))

Water meters are a water provider's cash register used to equitably charge for provided water. Yet many providers rely on old, poorly maintained meters that can be inaccurate by as much as 10 to more than 50 percent of the actual water flowing through the meters. Inaccurate water meters usually are providing flow readings in favor of the customer. The water that is able to "slip" through the meter undetected becomes not only lost revenue, but also lost water.

The City has replaced some-of the ¾-inch and 1-inch meters throughout the years; however, most of the meters are old and may be inaccurate. Typically the meter testing schedule for these size meters ranges from 5 years (for 2-inch) to 8 years (for ¾-inch). Thus, the 2-inch meters were tested in Year 2010 and the ¾-inch meters beginning in the Year 2011. However due to the number of meters to be tested, it is recommended that meter testing be done on one-quarter of the system meters every year for four years.

The large meters (2-inch and larger) will be calibrated annually and a program will be implemented.

The City will verify the WTP source meters at least every two years, or as needed, by using the drawdown or fill up method. With this method, a known or calculated amount of water flows through the meter and then a comparison is done between the calculated and metered amounts. The source meter can be verified by calculating the amount of water that is filling up the floculation basin and two sediment basins (with no outputs). For both methods, at least two to three drawdowns or fillups will be conducted and the results averaged to verify the source meter accuracy.

Meter testing and maintenance program conservation benchmarks are shown in Table 10.3.2.

TABLE 10.3.2
METER TESTING & MAINTENANCE PROGRAM BENCHMARKS – YEAR 2010-2015

Benchmark	Start Date	Frequency or Completion
Verify 2-inch Meters within system	2015	Every 5 years
Verify ¾-inch Meters	2015	¼ of total meters, Annually from 2010-2012
Verify Large Meters (>2-inch)	Ongoing	Annually
Source Meters	2015	Every 2 years or as needed

Rate Structure (OAR 690-086-150(4d))

The City of Port Orford currently charges customers for their water based upon a standard base rate plus a sliding scale consumption rate. The customer is billed the base rate regardless of whether or not the water is used. The City current rate method assesses a fee for basic service (which includes the first 2,000 gallons). The customer is billed the base rate regardless of whether or not the water is used. Thereafter, the customer is billed on a sliding scale for an additional 2001 to 5000 gallons used, 5001 to 10,000 gallons used, 10,000 to 20,000 gallons used, and over 20,000 gallons. This rate structure is in conformance with the requirements of OAR 690-086-150(4d).

Leak Detection Program (OAR 690-086-150(4e))

No annual water audits have been carried out to determine the amount of leakage in the City's system due to the number of unmetered services. Consequently, the City is not able to determine at this time if system leakage exceeds 10 percent. However, the City's percent of non-account water losses discussed in Section 9.2 is at a level that suggests implementation of a leak detection program would be prudent. A leak detection program makes use of planned strategy and various techniques and technologies to efficiently and effectively locate leaks in the system and identify pipelines requiring repair or replacement.

Leak Detection Measures

Leak detection measures may include regular on-site testing using computer-assisted leak detection equipment, sonic leak detection surveys, or another acceptable method for detecting leaks along water distribution mains, valves, services, and meters. The inspections can also include the internal inspection of water tanks and reservoirs. The City staff or an outside consultant can perform leak detection of the City's water system.

A number of different methods are available for locating leaks in a water system. The simplest method of leak detection is to search for and locate wet spots or green areas that might indicate the presence of a leak. This technique would be especially suited for water mains that are not under buildings or paved surfaces.

The next level of leak detection is to use listening devices that amplify vibrations caused by a leak. The simplest device is a steel bar held against a pipe or valve. To detect leaks, listening devices (such as geophones) will be placed on fire hydrants, valves, meters, mains and services. If a leak sound is detected, a detailed investigation will be initiated by listening to each meter in the area of the leak sound. Listening on the meter allows one to check the meter coupling and curb stop for leakage and may indicate whether the leak is on the service or main.

For more sophisticated detection techniques, the City may wish to bring in leak-detection consultants to scan the water system for leakage. These detection techniques include the use of electronic leak detectors and leak noise correlators. A typical leak detection survey costs anywhere from $100 to $400 per mile of main surveyed, depending on the size of the system, the material of mains to be surveyed, and the distance traveled (Fenney 1999). Leaks from PVC and PE pipes and appurtenances are difficult to detect because sound does not travel very far through these materials. Special listening equipment may be needed for these pipes. General surveying equipment costs from $2,000 to $5,000, while leak noise correlators can cost from $35,000 to $60,000 (Ibid 1999).

Another method that the City may employ to detect leaks is the isolation method. This method includes the isolation of short piping sections utilizing existing and newly installed mainline valves. The mainline

is isolated under "line" pressure and all services are turned off at the meters with prior notice to customers. A pressure gauge is attached to one service and the pressure is monitored over a period of time. If the pressure falls off relatively quickly, it is likely that a major leak is located within that section of piping. Pressurizing the isolated main to a higher pressure than normal can increase the sensitivity of this method. Once a pipe segment has been identified to be leaking, listening or electronic devices can be used to pinpoint the location of the leak.

Leak Detection Strategy

The recommended strategy for leak detection within the City of Port Orford is to focus on the portions of the water system that are the most likely, or have been observed, to leak. This strategy will rely primarily on the age and material of water mains within the system. For example, older piping made of asbestos concrete, steel and cast iron is anticipated to be more susceptible to leak problems than newer PVC pipe. With respect to service lines, galvanized pipe is considered more prone to leakage than poly or copper pipe. Consequently, leak detection efforts will concentrate on the most susceptible portions of the City's water system.

A list of the City's distribution piping and associated location for leak detection within the City is presented in Table 10.3.3.

TABLE 10.3.3
PRIORITY AREAS FOR LEAK DETECTION

Pipe Size & Material	Length (LF)[1]	Location
2-inch AC	1,550	Lakeshore Drive to Hamlet Place
4-inch AC	2,500	Hamlet Place
6-inch AC	530	Wyoming
6-inch AC	1,960	Jackson Street
6-inch AC	2,250	9th Street
6-inch AC	1,020	7th Street / Sweep Way
6-inch AC	820	Pinehurst Drive

[1] – Approximate lengths, pipe material as per City staff

The City will develop a map that will allow them to graphically document and track their progress and findings. Items recommended on this map include: 1) areas monitored or tested for leaks; 2) location of service lines that are of older materials or AC; and 3) areas where water mains and/or service lines have been repaired or replaced.

The recommended schedule for a leak detection program for initiation and completion of the systematic leak detection is dependent upon the results of the comprehensive Annual Water Audit to be completed in 2016. If the system leakage is greater than 10 percent based on this Annual Water Audit, then the leak detection program of Priority No. 1 areas will be initiated. Once Priority No. 1 areas have been completed, then leak detection will be initiated on Priority No. 2 areas, and thence to Priority No. 3 areas once Priority No. 2 is completed. This time frame for implementation of the leak detection program is considered both feasible and appropriate since the City will be seeking to simultaneously implement this leak detection program and other water conservation measures, make necessary pipe repairs, and proceed with recommended measures and capital improvements presented in this Master Plan. If a substantial number of the Priority 1 mains are replaced, then the City will move to suspect leak detection of Priority 2 and 3 mains unless system leakage still remains above 10 percent.

A summary of leak detection program benchmarks is presented in Table 10.3.4.

TABLE 10.3.4
LEAK DETECTION PROGRAM BENCHMARKS – YEAR 2011-2016

Benchmark	Start Date	Frequency or Completion
If System Leakage is shown to be >10%, perform leak detection of areas	2015	January 2016
Leak Occurrence Map of City's Water Distribution System	2015	Ongoing

Public Education Program (OAR 690-086-150(4f))

The goal of a public information program on water use efficiency is to develop a conservation ethic among water users. A public information and education program on water conservation is recommended as a means of influencing water consumption practices and patterns within the system. An informed public will also be more likely to support changes in the rate structure and management practices if they feel they are part of the conservation effort. Public education may take the form of mailers, workshops, school programs, and individual conservation reviews.

Public information programs can educate consumers on a wide variety of conservation issues including the following.

- Toilet flushing and fixture efficiency,
- Detecting and fixing leaks,
- Efficient use of water when washing cars or other outdoor use,
- Landscape efficiency and irrigation practices,
- Low water use landscaping (Xeriscape™),
- Rebates and other incentives promoting conservation practices,
- Potential curtailment activities,
- General conservation awareness.

A significant amount of education materials have been developed at little or no cost to the water provider by such organizations as AWWA and OSU Extension Service. Pamphlets, videos, CD-ROM computer programs, and other materials are available to assist the water provider in their public education efforts. Information is available on a variety of topics, and materials can be obtained for practically any age group, demographic, or purpose.

The effectiveness of public education programs, in terms of conservation, is difficult to predict. During periods of drought, public awareness is high and public education may result in significant water consumption reductions. During other periods, the effectiveness will depend greatly on the program itself. Studies have suggested that a four to five percent reduction in water consumption could be expected from a comprehensive public education program.

The City will implement an ongoing public education program on water conservation. During the fall and winter months, it is recommended that the educational efforts target indoor water use. The educational focus in the spring and summer months will shift and emphasize conservation of outdoor uses. Of the focus areas, the City will focus most of its efforts on outdoor water use, as it is the highest and most critical time period. Increase in water consumption during the summer months is attributed to outdoor recreation, gardening, and landscaping water use brought on by mild or warm summer weather. Outdoor water usage drives maximum-day demand, which in turn drives system capacity requirements for water system components. Reduction of landscape water demand can play a positive role in a water conservation program by reducing the overall water demand in the dry season months.

Specific tasks recommended include the following:

- Creation of a water conservation web page on the City's web site. This page will contain information about how to conserve water, any technical and financial assistance available to customers, and a link to American Water Works Association's (AWWA) Waterwiser® site. http://esa21.kennesaw.edu/activities/water-use/awwa-drip-calculator.htm

- Publish water conservation articles in the City's quarterly newsletter. The topics of these articles will include tips on reducing seasonal peak usage (outdoor measures), suggestions to reduce base demand (indoor measures), introduction of water conservation information on the City's web page, any technical and financial assistance available to customers, and any other pertinent conservation information.

- Provide water conservation brochures at City Hall and the Library. Copies of or ideas for brochures can be obtained from AWWA or other municipalities with an existing water conservation program (e.g. Cities of Ashland and Bend. In keeping with the recommended focus of reducing outdoor water usage, recommended brochure topics include lawn-watering guide, low water landscaping (i.e. Xeriscaping™), and drip irrigation.

TABLE 10.3.5
PUBLIC EDUCATION PROGRAM BENCHMARKS – YEAR 2005-2010

Benchmark	Start Date	Frequency or Completion
Creation of a water conservation web page on City's web site	2015	December 2016
Provide water conservation brochures at City Hall & Library	2015	Ongoing

Leak Repair or Line Replacement Program (OAR 690-086-150(6a))

The intent of a leak detection and repair program is to reduce the amount of water that leaves mains, tanks, or other system components through cracks, openings, and defects. The goal of this program will be to reduce leakage to 15 percent of the total diverted water. If the reduction to 15 percent is found to be feasible and appropriate, additional measures will be implemented to reduce leakage to 10 percent or less.

The impact of water leakage can be measured in terms of water volumes as well as the associated costs required to treat, store, and distribute water to the consumers—"lost" water produces no revenue for the utility. Repairing leaks can result in significant savings and additional revenues for the water system.

The City currently makes repairs to its water system when leaks have been found or reported. However, there is not a formal program to systematically detect and repair leaks. A leak detection program has been proposed and is discussed above. Results from this leak detection will assist the City in determining which pipe segments will be replaced. Pipe segments with leaks will be repaired as soon as practical. Mains that are determined to be impractical to repair will be temporarily patched and slated for replacement.

Much of the distribution system consists of cast iron and AC piping. The Capital Improvement Plan presented in Section 7 includes several improvements that will replace a number of existing mains with larger diameter pipe. With the replacement of these water mains, the services off these mains will also be replaced from the water main to the meter. For additional details on these improvements, please refer to Section 7.

TABLE 10.3.6
LEAK REPAIR & LINE REPLACEMENT PROGRAM BENCHMARKS – YEAR 2010-2015

Benchmark	Start Date	Frequency or Completion
Design & construct proposed water line replacement presented in the Capital Improvement Plan	2015 est.	2019 est.
Repair leaky pipe segments determined from Leak Detection Program and observed or reported.	Ongoing	Ongoing

Technical & Financial Assistance Programs (OAR 690-086-150(6b))

One of the keys to a successful water conservation program is participation of the water users. Conservation is achieved at the customer level by changing consumption habits via the knowledge of water usage and means to implement conservation measures. Technical and financial assistance water conservation programs can play a significant role in encouraging water users implement conservation ideas and make conservation measures a reality. Examples of technical and financial assistance measures include the following:

- Providing technical water conservation educational materials to interested customers,
- Partnering with large water users in evaluating current usage and options to reduce consumption.

Measures for conducting water audits, entering into partnerships, and implementing rebates are discussed below. Public educational materials and measures were previously discussed above under the Public Education Program.

Audits/Partnerships

As the City's water conservation program is in its infancy, it is recommended that the City first concentrate on auditing and/or entering into partnerships with existing large commercial and industrial water users. Depending on the experience and success of these initial partnerships, the City may wish to enlarge their approach to include other commercial and industrial users, and even residential customers.

Retrofit/Replacement Program of Inefficient Fixtures (OAR 690-086-150(6c))

One incentive to encourage users to conserve water is to provide retrofit kits to increase the efficiency of their existing plumbing fixtures. Retrofit kits usually consist of toilet tank inserts, low-flow shower heads, faucet flow restriction devices, toilet leak detection dye tablets, and an informational guide. The cost of a retrofit kit varies from $10.00 to $16.00, depending upon the number and specific items included. Only showerheads and faucet restrictions will be needed for new residences. One limitation of retrofits is that the long-term effectiveness is questionable because 1) the resident may not install them; 2) installed retrofits can easily be removed; and 3) some devices (e.g. toilet tank displacement devices) have a limited life of three to five years.

The potential cost and water savings for the City to procure and distribute retrofit kits is not cost-effective for the City of Port Orford.

Adoption of Rate Structures, Schedules, Programs That Support and Encourage Water Conservation (OAR 690-086-150(6d))

A proper water rate structure can support and encourage water conservation. Water rates can take many forms. Five basic types include blanket, uniform, declining block, inclining block, and seasonal rate

structures. A number of different factors are generally considered in selecting a rate structure. These factors can include revenue stability, water conservation, equity to customers, and simplicity in terms of implementation and customer understanding. A comparison of the five basic types of rate structures with respect to these factors is given in Table 10.3.7 (NRWA 1990, AWWA 2000).

TABLE 10.3.7
COMPARISON OF WATER RATE STRUCTURES

Type of Structure	Revenue Stability	Conservation	Equity	Simplicity
Blanket	Poor	Poor	Poor	Excellent
Uniform	Excellent	Good	Good	Excellent
Declining Block	Fair	Poor	Fair	Fair
Inclining Block	Fair	Excellent	Fair	Fair
Seasonal	Fair	Excellent	Fair	Fair

The ideal conservation rate structure would be one that encourages maximum participation in the conservation efforts while providing revenue stability, user equality, and easy implementation and administration.

The City currently utilizes a base rate with uniform charges for consumption. This water rate structure provides excellent revenue stability, is a good conservation tool, provides good equity, and is simple to administer and explain. In reviewing potential rate structures, we recommend that the City review its current rate structure and consider the possibility of implementing an inclining block or seasonal water rate structure.

The inclining block rate structure most effectively encourages efficient water use as it is set up to charge higher unit prices to customers who place a higher demand or strain on the water supply system, and to charge lower unit prices to customers who use average or below-average amounts of water. The seasonal rate structure provides a conservation price signal when moving from winter to summer and can be made more effective for water conservation if the seasonal rate incorporates inclining block rates. Both the inclining block and seasonal rate structures are excellent water conservation tools while being fair in providing revenue stability, equity among customers and in administration. The rate structure program benchmarks are provided in Table 10.3.8.

TABLE 10.3.8
RATE STRUCTURE PROGRAM BENCHMARKS – YEAR 2015-2020

Benchmark	Start Date	Frequency or Completion
Evaluate Inclining Block and Seasonal Rate Structures	2015	January 2017
Adoption of Alternate Rate Structure, if accepted	2017	April 2020

Other Conservation Measures Identified by the Water Supplier to Improve Water Use Efficiency (OAR 690-086-150(6f))

The water supplier has identified no other conservation measures to improve water use efficiency at this time.

10.4 Water Conservation Benchmarks

All of the actions or "benchmarks" that the City plans to implement during the period 2012 to 2017 are presented in Table 10.4.1. The City anticipates submitting an updated Water Management and

Conservation Plan in 2014 with conservation actions for the time after 2012 based on the experience gained during the 2008 to 2011 time period. The City believes that these benchmarks fully comply with the State's requirements for the water conservation element of the required Water Management and Conservation Plan.

TABLE 10.4.1
SUMMARY OF ALL CONSERVATION BENCHMARKS – YEAR 2015 -2020

Benchmark	Start Date	Frequency or Completion
Annual Water Audit		
Install new meters & read existing water meters as described under Metering Benchmarks (Table 9.3.2)	2015	December 2016
Develop electronic spreadsheets & procedure for implementing audits	2021	Dec. 2020
Collect & record monthly meter readings, complete monthly audits	2021	Monthly
Perform annual water audit	2021	Annual
Metering		
Install new meters	2021	Dec. 2020
Collect water usage data from existing meters not currently being read	2021	Dec. 2020
Install meter on WTP backwash stream	2017	Feb. 2017
Meter Testing & Maintenance		
Verify 2-inch Meters within system	2020	Every 5 years
Verify ¾-inch Meters	2016	¼ of total meters, Annually from 2008-2012
Verify Large Meters (>2-inch)	Ongoing	Annually
Source Meters	2017	Every 2 years or as needed
Leak Detection Program		
If System Leakage is shown to be >10%, perform leak detection of	2015	January 2022
Leak Occurrence Map of City's Water Distribution System	2015	Ongoing
Public Education		
Creation of a water conservation web page on City's web site	2015	Dec. 2016
Provide water conservation brochures at City Hall & Library	2015	Ongoing
Leak Repair & Replacement		
Design & construct proposed water line replacements presented in the Capital Improvement Plan	2020 est.	2021 est.
Repair leaky pipe segments determined from Leak Detection Program and observed or reported.	Ongoing	Ongoing
Rate Structure		
Evaluate Inclining Block and Seasonal Rate Structures	2015	Dec. 2017
Adoption of Alternate Rate Structure, if accepted	2017	April 2020

10.4.1 Public Education Programs

Public education and acceptance are critical to the success of any conservation program. Not only will an education program assist the public in changing their water-use habits, it will also affect how water consumers respond to a change in the water rates or increased billing amounts due to new and accurate water meters. Generally, customers that are informed and involved are more likely to support the water system's conservation planning goals.

A public information and education program on water conservation is recommended as a means of influencing water consumptive practices and patterns within the service area. Utilities can provide a variety of methods to disseminate information and educate the public on water conservation.

Systems can provide information on water conservation and encourage the use of water conservation practices through a variety of school programs. Contacts through schools can help socialize young people about the value of water resources and conservation techniques aimed at protecting those resources.

Workshops can be held to provide education materials to the public as well as plumbing contractors, builders, industrial clients, and others who may play a direct role in future conservation efforts.

Public education programs are a cost-effective method of obtaining the support of the water users within the system. The City of Port Orford may wish to develop a public education program for the benefit of the consumers within the service area.

10.4.2 Informative Water Bill/ Water Bill Inserts

An informative water bill goes beyond a simple request for payment. Additional items that may be included on the bill are a comparison to previous bills to show increases or decreases in water use patterns, tips for reduced water consumption, and other information relevant to the customers' water consumption.

The water provider may wish to identify the top ten residential water consumers within the system each month. Their bill could alert them to the fact that they are among the highest water users in the system and that retrofit kits, residential conservation information, or other assistance is available by calling the water provider. Each month, a handful of water consumers may begin to reconsider their water use practices.

Another efficient method of getting information to the consumers includes water bill inserts or mailings of brochures, pamphlets, and guides. Brochures, suitable for mailings, cost anywhere from $0.10 to $0.25 each. Mailing information packets every summer can identify household conservation measures along with explaining the potential for a future water curtailment situation within the water system. These occasional inserts may be an appropriate step to remind customers not to waste water.

10.4.3 Water Conservation Advisory Committee

A water conservation advisory committee can involve the public in the conservation process. Potential committee members include elected officials, local business people, interested citizens, agency representatives, and other interested parties. The committee can provide feedback to the utility concerning its conservation plan and develop new material and ideas about public information and support for conservation within the community.

10.4.4 Analysis of Nonaccount Water

Nonaccount water includes all water that is metered but not billed as well as all water use that is not metered. This may include City of Port Orford water use, fire system flushing, and training, nonprofit water use, and other public water uses. Nonaccount water also includes unauthorized water uses, water theft, accounting or meter reading errors, inaccurate meters, leaks and all other forms of water loss. Much of the nonaccount water usage is identifiable. If the water usage is not measurable or identifiable, the water is referred to as unaccounted-for water.

Nonaccount water use will be analyzed to identify potential revenue-producing opportunities as well as recoverable losses and leaks. Some utilities may consider charging for water that was previously given away for public or non-profit use. A special category and rate structure may be developed for this purpose. Through these efforts, water records can be kept and water use tracked where it may have previously been ignored.

Analysis of nonaccount water will be a regular part of the yearly water audits. The City of Port Orford will work to reduce the volume of nonaccount water usage to zero. (All water use throughout the system

will be accounted for.)

To identify areas with badly deteriorated and leaking pipelines, it is also proposed that metering vaults be placed on mains within the distribution system. Four metering vaults locations have been identified as part of the recommended improvements and are shown in Figure 6.5.

10.4.5 System-Wide Pressure Management

Reducing excessive pressures within a system can have a significant impact on water losses. Reducing water pressure can reduce leakage in the piping network, reduce the flow through open faucets and valves, and reduce the stresses on pipes and joints that may result in future leaks.

For residential areas, pressures exceeding 80 psi will be assessed for reduction. Pressure management and reduction strategies must be consistent with state and local regulations and standards, as well as take into account the system condition and needs.

In order to reduce high-pressure zones, pressure-reducing valves may be installed on water mains as well as individual service connections.

Water-Use Standards and Regulations
Regulations and ordinances will be in place to effectively manage water use during drought or other water-supply emergencies. These regulations and ordinances typically fall within the scope of a water curtailment plan. In some cases, utilities may find it desirable to declare voluntary or mandatory water-use regulations to promote conservation during non-emergency situations.

Examples of water use regulations may include:

- Restrictions on nonessential uses such as lawn watering, car washing, filling swimming pools, washing sidewalks, and irrigating golf courses;
- Restrictions on commercial car washes, nurseries, hotels, and restaurants;
- Standards for water-using fixtures and appliances;
- Bans or restrictions on once-through cooling water;
- Bans on non-recalculating car washes, laundries, and decorative fountains;
- Bans on certain types of water use or practices.

The City of Port Orford will implement a water curtailment plan. See Section 10 of this Master Plan for recommendations for the City of Port Orford Water Curtailment Plan.

Section

11

Water Curtailment Plan

Section 11

Water Curtailment Plan

11.0 Water Curtailment Plan (OAR 690-86-160)

11.1 Background

A water curtailment plan is defined as a short-term mandatory program intended to drastically reduce water consumption, usually due to an emergency, catastrophic event, or serious water shortage. A water provider is to develop a water curtailment plan that would provide planning criteria, specific operating guidelines, and the enforcement measures that may be required in the event of a serious emergency or water shortage (OAR 690-86-160).

Such crises may last from a few hours to days, weeks or months. As part of a comprehensive water management and conservation plan, a curtailment plan would assist the City in managing a short-term supply deficiency crisis.

In addition to a water curtailment plan, the City should have an ordinance in place for declaration of an emergency and implementation of the curtailment plan in the event of an emergency water shortage. Once the water shortage is over, the City would return to providing normal water service to its customers.

Most water systems have critical components, which if damaged or destroyed, could cripple or prevent the water system from providing potable water to their consumers. As part of a comprehensive water management and conservation plan, a curtailment plan would provide the City of Port Orford with the planning and information necessary for managing a supply deficiency crisis.

From time to time and following sustained turbidity, drought conditions, equipment failure, or other water system problems, the water supply may become significantly and seriously depleted. The deficiency could be serious enough that there is not enough water to provide for the needs of the community. Being prepared for curtailment situations will allow a water system to survive serious supply deficiencies.

The following sections provide information required by OAR 690-86-160 for water curtailment plans. The City of Port Orford may wish to develop a comprehensive emergency plan for all City operations. This curtailment plan can be used as the water supply element of a comprehensive emergency plan.

An example water curtailment ordinance can be found in the Appendix of this Master Plan. The ordinance should be used as a framework for the City of Port Orford new water curtailment ordinance and tailored for the specific needs of the local system.

11.2 Historical Water Supply Deficiencies (OAR 690-86-160 (1))

A history of supply deficiencies or emergency water conditions would suggest the need to prepare for future water supply deficiencies. If drought, contamination, system breakdown, or some other event has interrupted or hampered water supply efforts in the past, they are likely to hamper water supply efforts in

the future. The severity of historical events can also suggest the relative importance of planning for future events.

The City of Port Orford has experienced periods of limited supply, the most recent of which was during the 2002 drought in late summer 2002. The Hubbard Creek impoundment level dropped to a level where no stream flow was discharged through the weir structure. At that time stream flow was reported to be approximately equal to the amount of water withdrawn by the City. Recommendations for constructing a raw water storage reservoir have been proposed as part of this Master Plan Update; meanwhile the City needs to be prepared for this type of critical supply problem.

11.3 Stages of Alert (OAR 690-86-160 (2))

Curtailment plans typically contain both voluntary and mandatory water use restrictions. These restrictions become more numerous and severe in nature as the water shortage becomes more pressing. In the early stages of a shortage, curtailment plans usually rely on public education and customers implementing voluntary curtailment actions. Specific and mandatory measures are reserved for when the shortage situation becomes increasingly dire.

Water shortage emergencies may occur suddenly or gradually over time. Short-term emergency water supply shortage can come in the form of sudden interruptions, such as loss of power, mechanical or equipment failures, pipeline failures, contamination of the water supply or distribution system, natural disasters (e.g. earthquakes, high winds), and man-made disasters. For immediate shortages, specific measures need to be implemented quickly to reduce water demand and avert a more critical situation. Other shortages, such as supply shortages, may be more gradual in nature, as in the case of a drought. In these circumstances, curtailment measures can be gradually implemented to correspond with the progression of the shortage.

A water curtailment plan should contain at least three levels or stages of alertness or restrictions. The levels should range from an *initial level of concern* to a *severe level-of-alertness* to a *final critical level.* Each level should include predetermined indicators that will invoke a specific level of alertness requiring predetermined actions and an associated list of recommended curtailment measures.

The following are recommended stages of alert for the City of Port Orford's Water Curtailment Plan.

11.3.1 Alert Stage No 1: Water Watch Status

The level-of-alert serves primarily as a tool to inform the pubic that a potential problem exists. The problem does not yet warrant mandatory water conservation, but does suggest voluntary conservation. If the public is aware of the potential for problems, they will be more likely to accept and abide by more serious requirements should the alert status be increased.

11.3.2 Alert Stage No 2: Water Warning Status

This level-of-alert serves as the first level of action for the City of Port Orford to enact mandatory water use requirements within the system. This level would include all planned activities requiring temporary conservation including construction and maintenance activities as well as preparing for expected drought conditions.

This level-of-alert could be declared if a water shortage or equipment failure poses a serious threat to the ability of the water system to meet the demands of its customers. It may also be appropriate to declare

this alert stage if a component within the water system breaks down or is taken off-line for an extended period of time. This would include major repairs or renovations within the water treatment plant, major renovation of a reservoir, or another major improvement project.

Scenarios that would require this level-of-alert would typically be those that could be planned and prepared for. This alert stage could be instituted as a follow-up status to Level 1 after the public has been informed of potential problems and given an opportunity to carry out voluntary conservation activities.

11.3.3 Alert Stage No 3: Water Emergency Status

This level-of-alert serves to raise the alert status from a warning to emergency status. A wider range of water use activities is affected. This is the most restrictive level of mandatory water conservation activities with higher penalties to enforce the curtailment status.

This level-of-alert could be declared if a water shortage or equipment failure poses a severe and immediate threat to the ability of the water system to meet the demands of its customers. Indicators may include an eminent loss of a portion or total source of supply. Other indicators could include a chemical spill in a water supply, severe equipment failure, and other severe water supply issues.

11.3.4 Alert Stage No 4: Critical Water Supply Status

This level-of-alert serves to assist the water system in supplying the minimum amount of water to the consumers to sustain life. This level would likely include rationing of drinking water. This extreme level-of-alert is reserved for very serious water supply problems and would likely include Draconian-type measures, such as terminating water service from the City's distribution system and water rationing.

This final level-of-alert is necessary if scenarios from Level 3 result in disaster conditions that make it impossible for the water system to continue functioning under normal parameters. Indicators of this level include the inability of the water plant to produce additional water or the distribution system to deliver potable water to the consumers. This status is only for the most extreme cases where resources must be managed carefully and water rationed to consumers for the purpose of sustaining life.

See Section 11.5 for a discussion of the various actions required of both the City and of the water users for each Alert Stage.

11.4 Indicators of Water Shortage Severity (OAR 690-86-160 (3))

Good management practices would include being prepared for many levels of problems from minor operational difficulties to critical water supply issues. The management guidelines required for these water supply issues can be neatly packaged in a water curtailment plan.

The City of Port Orford must plan and prepare for the contingency of a water supply deficiency. This planning will include conservation planning as well as emergency curtailment planning. See the Water Conservation Plan section of this Master Plan for a detailed discussion of a recommended conservation plan. The following sections outline the necessary components for developing a water curtailment plan for the City of Port Orford.

A water curtailment plan will include a list of predetermined levels of severity or indicators that would invoke or "trigger" a predefined level of water curtailment alert. Triggers provide the City an ability to legally impose restrictions once the emergency conditions of the trigger have been satisfied. In addition,

triggers are predetermined reference points that can avoid any guesswork about when to impose restrictions during an emergency.

For most alert stages, one or more indicators are incorporated into a plan to serve as potential triggers for implementation of an alert stage of a curtailment plan. In some cases, one trigger may be sufficient to implement a curtailment alert phase. In other instances, a multiple trigger "and/or" approach to curtailment provides the City with the reference points in assessing an emergency and the flexibility in determining the most appropriate response to a particular water shortages crisis.

A number of different potential indicators may be utilized for determination of water storage severity and the appropriate alert stage. For the City of Port Orford, potential water shortage indicators include Palmer Index, Surface Water Supply Index, stream and/or diverted flow, and elevation or capacity of the City's finished water storage tanks. The suitability of these potential indicators of water storage severity are evaluated and discussed below.

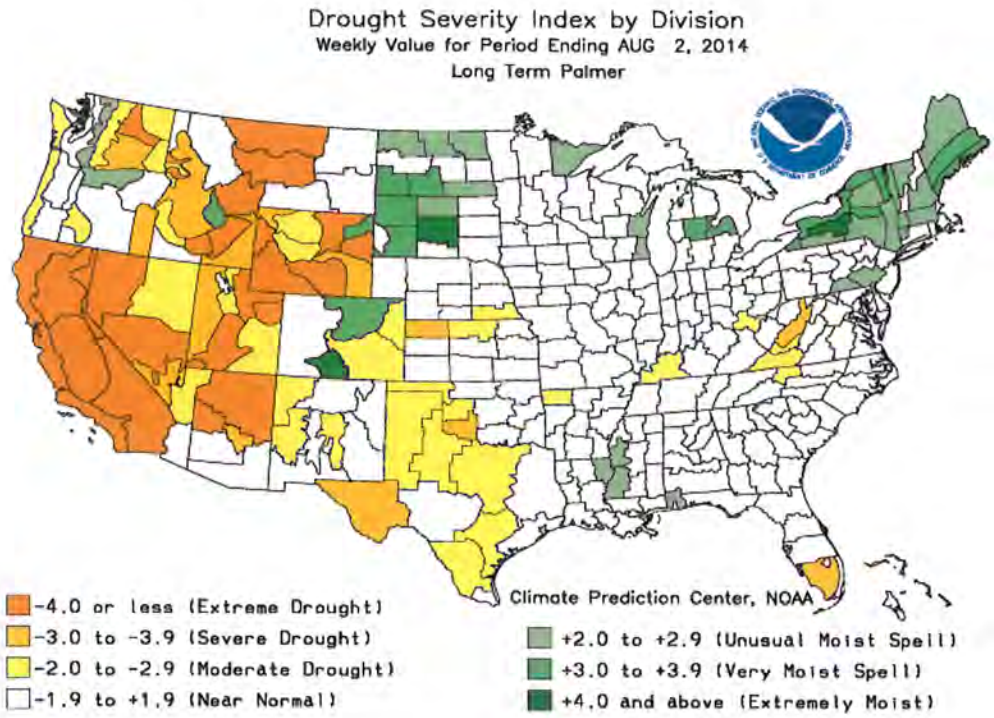
Palmer Index

The Palmer drought index (PI) is a widely used scale for measuring drought conditions. This index uses long-term records of temperature and precipitation to determine dryness and is tabulated by the National Weather Service on a weekly basis. PI calculations are made for 350 climate divisions in the United States and posted on the NOAA and National Weather Service websites. The PI is updated weekly and is easily accessible at the following website:
http://www.cpc.noaa.gov/products/analysis_monitoring/regional_monitoring/palmer.gif

A PI of zero is representative of normal weather in all seasons and in any climactic region. Droughts are depicted as negative index values while wet periods are shown with positive values. Consecutive negative values from week to week can provide initial warning of an impending drought. The magnitude of long-term negative values can assist the City in determining the severity of the drought condition. A copy of the PI for August 2014 is shown in Figure 11.4.1. For this time period, Port Orford is in the yellow band (moderate drought conditions) along the Oregon coast. Even though the PI is not necessarily supply specific, this index can provide valuable information to forecast and assess the severity of a potential or actual water supply crisis.

For its water curtailment plan, the City would be interested in the negative or drought index regime. Conveniently, the negative PI regime is divided into three drought levels: moderate drought (-2 to –3), severe drought (-3 to –4), and extreme drought (-4 and lower). Theses three tiers of the negative PI are recommended as triggers for the first three levels of the curtailment plan.

FIGURE 11.4.1
ILLUSTRATION OF PALMER DROUGHT INDEX



Stream and/or Diverted Flow

Stream flow and/or the amount of water taken from the point of diversion are potential indicators of water severity. During a drought, the City may be restricted in the amount of water that can be diverted from North Fork Hubbard Creek due to fisheries requirements.

The largest user on North Fork Hubbard Creek is the City for municipal use and these rights have seniority. The net water available at the 50% exceedance level, from May to October, is less than or equal to zero for the Hubbard Creek basin. However, this source is limited by fisheries requirements, which require continuous flow to be maintained through the fish ladder and downstream of the impoundment.

If there is a possibility that drought conditions may occur, the City will monitor the stream flow in the Creek at a minimum of every two weeks during the months of July through October. If drought conditions exist, the City may wish to monitor stream flows in the Creek sooner in the season (prior to July) or later in the season (beyond October) and more frequently (e.g. weekly).

Level in Finished Water Tanks / Disruption of Water Production and Delivery

Treated water storage tanks are designed to provide equalization storage, emergency storage, and reserves

for fire suppression. In the event that the potable water from the treatment plant is not available, the City's treated water tanks would become the source of water for the community. There are a number of situations that would potentially affect the treatment plant's ability to supply water to the City's distribution system, including the following.

- A break in the City's 8-inch diameter Raw Water Transmission Main,
- A break in the City's 10-inch diameter Treated Water Transmission Main,
- A mechanical breakdown or scheduled maintenance at the treatment plant,
- Contamination of raw or treated water by pesticides, chemical spills, sabotage, etc.
- Extended power outage,
- Inability to obtain raw water for basic service due to sustained turbidity or extreme drought conditions.

If anticipated delivery of treated water to the distribution system is to be disturbed for a period of more than 24 hours, than the City may wish to initiate its curtailment plan. However, the decision to initiate the plan and selection of the most appropriate Alert Stage will depend upon a combination of factors such as the available storage in the treated water tanks, time of year or seasonal usage and the anticipated length of the outage or disruption in water production. Consequently, the decision to initiate a specific Alert Stage would depend on how long the existing water storage would satisfy recent water demand and whether water delivery would be restored in this time period.

Reservoir tanks are typically designed for equalization, emergency and fire flow storage. The emergency portion of the finished water storage capacity is typically equal to three days of average daily demand. Any water delivery disruption anticipated to be greater than three days will trigger an Alert Stage No. 3 or No. 4 depending on the available forecast storage. Other recommended criteria related to finished water storage and disrupted delivery are presented in Table 11.4.1.

TABLE 11.4.1
RECOMMENDED INDICATORS FOR DISRUPTION OF WATER DELIVERY

Alert Stage	Indicator
No. 1	Delivery disruption > 24 hrs., available forecasted storage > 3 days
No. 2	Delivery disruption > 24 hrs., available forecasted storage between 2 & 3 days.
No. 3	Delivery disruption > 24 hrs., available forecasted storage between 1 & 2 days. Delivery disruption > 3 days, available forecasted storage > 3 days.
No. 4	Delivery disruption > 24 hrs, available forecasted storage < 1 day Delivery disruption > 3 days, available forecasted storage < 3 days.

11.4.1 Water Curtailment Ordinance

A sample water curtailment ordinance is located in the Appendix of this Master Plan. The City of Port Orford will use the guidelines developed in this Section and in this Master Plan to develop a water curtailment plan complete with an adopted ordinance.

The sample water curtailment ordinance can be used as an outline for the City of Port Orford is new ordinance. Efforts will be made to tailor it to meet the specific needs of the City of Port Orford. "Triggers" for each level of alert status will be linked directly to a reservoir level, the water treatment production rate, or other critical system parameter.

11.5 Water Use Curtailment Actions (OAR 690-86-160 (4))

Each level-of-alert will include a description of conservation measures appropriate to that level. These measures will provide guidelines, define acceptable and prohibited water usage, and describe the penalties for not abiding by the declaration of water curtailment. A description of potential water curtailment actions that may be employed by the City is described below.

City's Public Informational Measures

To successfully implement and achieve substantial water-use reductions within the community, the public must be involved, informed and willing to participate with the proposed curtailment measures. An effective public outreach program will be developed to accomplish the following four results (AWWA 1992).

- Keep the public informed about the supply situation,
- What actions are being proposed and being taken,
- How those actions will mitigate the water severity situation,
- How well the public is doing in terms of meeting the plan's goals.

Information measures to be implemented will depend upon the severity (i.e. Alert Stage), and anticipated duration of the water curtailment. The following discussion provides suggestions for informing the public, dealing with the media, and presentation. Portions of this discussion originated from *Drought Management Planning* by AWWA (1992).

Ideas for Informing and Educating the Public

Each community will have to tailor its public outreach to the specific needs and special requirements of its residents. The City may wish to implement one or more of the following suggestions for reaching out to the public during a water curtailment situation.

- Construct and erect a sign indicating the current status of the City's water system by Alert Stage. The City may wish to use a different color and brief description for each Alert Stage. The sign will be on display in a non-hazardous location that would be easily visible to the public. A potential location would be in front of City Hall.

- Provide periodic notices at various Alert Stages to the keep the public informed in a timely manner. These notices will specify such information as when Alert Stages are triggered or terminated, and what actions will be taken or discontinued. The City may wish to use a newsletter-type notice that is printed on distinguishable color paper for added recognition. The notices can accompany bills or be distributed by hand.

- Write a fact sheet describing the situation, anticipated time duration of any measures, and actions that the water users can take to help bring relief. The recommended actions for the users will describe the appropriate curtailment measures and also suitable water conservation measures and/or devices. This sheet could be distributed to both the media and the public.

- Conduct public meetings as needed to convey information and enhance the community's participation in dealing with the situation. The City may wish to schedule these meetings at times other than the regularly scheduled times in order to provide enough time for discussion of the water situation.

- Public service advertising will be utilized where possible. Take advantage of large group gatherings in your community (e.g. high school football games, church services, etc.) to relay the City's message. It may also be advantageous for the City to use its staff and/or volunteers to conduct personal visits to residences to discuss water conservation measures and general concerns of the public.

Dealing with the Media

The media can be a great asset in promoting and informing the public in a water crisis. The easiest way to utilize the media is to keep them informed. When dealing with the media, the City will have one person speak for the City and remain as the contact during the entire water crisis in order to prevent inconsistencies in communicating information.

Media inquiries will be responded to immediately to maintain communication and to avoid the media from seeking information from less informed sources. The City may wish to compile a fact sheet (see above) or press packet prior to implementing a water curtailment, and, once a curtailment is in place, to schedule regular press briefings. Effective communication with the media provides the City an opportunity to present an accurate account of the water crisis.

Presentation

It is critical that the City maintain a credible public image at all times, but especially during a water crisis. The kind of information that is released and to whom it is released will be unbiased. Information that is embarrassing or detrimental to the City will be presented openly and frankly just as favorable and supportive information would be. The City will strive to be the best, most complete and reliable source of information during a water crisis. As such, the City will not withhold information or keep it "confidential".

It is important for the City to communicate precisely and not exaggerate the serious nature of the situation. The City's water users must understand what events will trigger various responses and how their actions can aid themselves and the community to deal with the water crisis.

Non-Essential-Use Restrictions and Bans

Non-essential-use restrictions and bans are used to eliminate some uses of waters and restrict others. Examples of non-essential-use restrictions and bans include the following.

- Restaurants discontinue routinely offering water to customers unless specifically requested.
- Prohibiting the use of water for scenic and recreational fountains, ponds and lakes, except for the minimum amount required to support fish.
- Prohibiting the use of water from hydrants for construction purposes (including dust control), fire drills, line flushing, or any purpose other than fire fighting.
- Prohibiting the use of water to a wash any motorbike, motor vehicle, boat, trailer, airplane, or other vehicle, except at a commercial fixed washing facility.

- Prohibiting the use of water to wash down any sidewalks, walkways, driveways, parking lots, streets, or other hard surfaced areas, or building, or structure. Prohibition against water running to waste in any gutters or drains.

- Restricting the type and time of watering lawns, bushes, shrubs, trees, vegetable or flower gardens, and fruit trees. Type of watering may be restricted to "by hand" using either a hose with self-closing nozzle, a container such as a bucket or sprinkler can, or a drip irrigation system. The time of watering may be limited by the hours of the day (e.g. 8 p.m. to 8 a.m.) or by the day of the week (e.g. even numbered addresses on even days, odd numbered addressed on odd days).

- Prohibiting the use of water to fill, refill, or add to any indoor or outdoor swimming pool, hot tub, Jacuzzi pools except where the use of the pool is required by a medical doctor's prescription.

- Prohibiting and/or restricting the use of water for irrigation of public parks and cemeteries.

- Prohibiting new hook-ups to the City's water system or sale of water to persons who are not customers of the City's water system.

- Restricting or prohibiting the use of water for revegetation unless required under an approved erosion and sediment control plan pursuant to NPDES Permit No. 1200-C.

The suitability of a particular measure for a specific Alert Level will depend on such criteria as anticipated water-use reduction, user acceptance, equity, cost, sustainability, legal and contractual issues, and ease of implementation.

As the water provider, the City will take the lead in reducing its water usage by either modifying or eliminating non-critical water use activities until the curtailment event has passed.

Rationing

Rationing measures can be an effective means of reducing water demand during a crisis if it provides equity among the users. Sometimes a percentage reduction or seasonal use allocations are utilized for rationing. The pitfalls of these forms of rationing include favoring historically heavy water users, penalizing customers that have conserved in the past, and additional staff time to research each user's previous water usage. An alternative rationing method is to set fixed allocations per household or capita, or per connection.

For residential users, communities have utilized both the percentage reduction and fixed allocation rationing methods to reduce water usage. The water allotment with the percentage reduction method is generally 70 to 80 percent of the previous year's (non-drought year) monthly account (AWWA 1992). With the fixed allotment method, the allotted water typically ranged from 200 to 400 gallons per day, with an average of approximately 250 gallons per day (AWWA 1992).

Pricing

Rate structures that encourage conservation are helpful, whether or not a water provider is in a water crisis. Pricing structures that can be beneficial during a water crisis include seasonal rates, curtailment water rates, excess-use surcharges, and penalties for wasting water. Some communities utilize seasonal rates that are higher in the summer months to promote water conservation during peak usage. For most communities with a drought management plan examined by AWWA (1992), a surcharging pricing

structure was used to penalize users who exceed their designated allotment. A "stepped" approach was typically used, with increasing charges per gallon for incrementally larger amounts of use over the designated allocation. The use of penalties for wasting water will be discussed below.

Enforcement Measures

The enforcement of mandatory water curtailment measures and water rationing must have a legal basis for implementation. For the City, the legal basis would be an ordinance addressing water curtailment. The ordinance empowers the City to implement surcharges and delegates authority to City staff to issue citations for noncompliance. Most water providers employ some sort of punishment for water waste or violation of prohibited practices. Penalties for non-compliance will be spelled out in the ordinance. Generally, most curtailment plans utilize a penalty fee and/or disconnection is used to penalize violators. The actual penalty for each violation would be decided upon by the City Council and incorporated into the ordinance.

Penalties with progressively more stringent consequences are employed for successive violations of water waste or prohibited practices. A response to a first violation may range from a warning with conservation education materials or retrofit kit to a nominal fine. In the case of a second offense, a nominal fee is typically imposed through a citation applied in the customer's bill. Other penalties that have been used for a second offense include installation of a flow restrictor and a 48-hour shutoff period (AWWA 1992). For a third offense, the penalties may include: 1) steeper fines; 2) installation of low-flow restrictors; and 3) cutting off the water supply to a user with charges for disconnection and reconnection of the service. Based on a survey of West Coast suppliers (AWWA 1992), a warning was usually sufficient to stop water waste. Second offenses were extremely rarely observed and third offenses were almost unheard of.

Most curtailment plans contain provisions for penalty variances for unusual or emergency circumstances. Granting a temporary variance, for prospective uses of water otherwise prohibited, will be determined such that due to unusual circumstances, failure to grant such variance would cause an emergency condition affecting health, sanitation, or fire protection of the applicant or public. It is recommended that the ordinance contain language stating that variance requests must be received by the implementing agency within a certain time period following notification of the violation (e.g. five working days).

Monitoring

If non-essential water use restrictions and bans are implemented, then active enforcement will likely be necessary to substantially decrease water demand. The City may wish to utilize reactive enforcement, which relies on customers to report violations. Under this scheme, City staff would be dispatched to respond to a complaint. The benefits of this type of monitoring include reduced personnel expense, participation of the entire customer base, and placement of the water provider one step removed from the negative customer contact.

The other general method of monitoring is proactive enforcement. This form of enforcement utilizes designated staff to actively patrol the service area and to issue warnings or citations when they discover a violation or prohibited use. The primary benefit of this type of enforcement is active enforcement of the curtailment plan and opportunities for conservation education. The disadvantages of proactive enforcement are the associated cost and potentially negative image with the public.

For a city such as Port Orford, it is most likely that both types of enforcement would be utilized. While a City staff member would probably not be dedicated to proactive enforcement, staff would likely discover

and issue penalties to violators in the course of performing their normal public works functions. The City would also rely on reactive enforcement to enforce the enacted curtailment measures.

11.6 Example of Implemented Curtailment Plan Actions and Results

It is one thing to propose a water curtailment plan. It is another thing to implement such a plan. The implementation of a water curtailment plan by a nearby community in the time of an emergency is provided in this study to demonstrate the effectiveness of such a plan. The following is a summary of the events leading to the curtailment, actions taken during the emergency, and results of implementing a curtailment plan.

Year: 2001
Community: City of Yoncalla

Because of a drought, the Governor declared a state of emergency for Douglas County in June 2001. In July 2001, the City of Yoncalla experienced some electrical problems at the Adams Creek Pump Station that resulted in this station being unable to convey water for a few days. As a result, the City Council asked the water users to curtail their water use by imposing a set of voluntary guidelines similar to the Alert Stage 1 actions shown in Table 11.6.1.

In the latter part of July 2001, the City discovered that a section of the Raw Water Transmission Main underneath Interstate 5 was leaking. Due to the size of the leak, the City Council convened a special meeting to establish mandatory water restrictions and raise user rates that became effective on August 1, 2001. These actions were deemed necessary by the City Council since a number of the users were not complying with the voluntary curtailment guidelines. The mandatory guidelines adopted by the Council restricted the following.

- Washing of vehicles, structures, or paved surfaces;
- Outside watering for even-numbered addresses on even-numbered days and odd-numbered addresses on odd-numbered days;
- Outside watering on Sundays;
- Any outside watering not done by hand with a hose fitted with a nozzle;
- Outside watering from 9 a.m. to 9 p.m.;
- Filling of swimming pools, ponds or hot tubs with water;
- Fire department's use of water for fire drills and truck washing;
- Sale of water to users not on the City's water system.

The City Council also adopted a $200 fine for violators of the mandatory water restrictions. In addition, the Council approved emergency water rates to further encourage water use curtailment. Normally, water users within the City pay $1.75 per 1,000 gallons in excess of 3,500 gallons. With the emergency rates, City water users were required to pay is given in Table 11.6.1

TABLE 11.6.1.
NORMAL AND EMERGENCY WATER RATES IN CITY OF YONCALLA
YEAR 2001

Monthly Usage (gallons)	Rate ($/1,000 gallons)	
	Inside City	Outside City
Normal Rates		
>3,500	1.75	3.50
Emergency		
3,500 to 5,000	3.50	7.00
5,000 to 7,000	5.25	10.50
>7,000	7.00	14.00

The implementation of the mandatory water curtailment measures resulted in a significant reduction of water usage in the month of August (highest demand month) as compared to other years. Overall, the daily amount of water produced in August 2001 was approximately 31 percent and 45 percent less than what was observed in August of 1999 and 2000. Consequently, the mandatory water curtailment measures were considered a success.

After a new section of the Raw Water Transmission Main was installed, the City Council lifted a number of the existing mandatory water curtailment measures and emergency water rates. Several of the mandatory curtailment measures remained in effect as of September 1, 2001 because of the drought conditions. These measures included the even-odd water days by address, prohibiting watering on Sundays and outside between 9 a.m. and 8 p.m., and watering with a hose fitted with a handheld nozzle only.

For the City of Yoncalla, the implementation of water curtailment measures allowed the City to effectively conserve water within its service area during the simultaneous occurrence of an emergency situation and drought conditions.

Appendix

A

Cost Estimates

Water Treatment Plant

Item	Description	Unit	Quantity	Unit Price		Total
1	Const. Facilities & Temporary Controls	LS	1	$61,500	$	61,500
2	Demolition	LS	1	$20,500	$	20,500
3	Floor Slab Settlement Correction (filter bay)	LS	1	$10,000	$	10,000
4	Filter media replacement/cleaning/ maintenance	LS	1	$300,000	$	300,000
5	Air scour system	LS	1	$100,000	$	100,000
	Total Construction Cost				$	492,000
	Engineering				$	98,000
	Contingency				$	89,000
	Environmental Review				$	25,000
	Administration				$	15,000
	Total Project Cost				$	719,000

No.: 1
Priority: 1
Phase: 1

Lakeshore (a) - *Replace unknown" with 6" , from end, east to Hamlet*

Item	Description	Unit	Quantity	Unit Price	Total
1	Const. Facilities & Temporary Controls	LS	1	$30,900	$ 30,900
2	Waterline Demolition & Abandonment	LS	1	$4,900	$ 4,900
3	Site Preparation	LS	1	$1,900	$ 1,900
4	Foundation Stabilization	CY	50	$50	$ 2,500
5	Gravel Surfacing - 3" Depth	LF	300	$15	$ 4,500
6	AC Pavement Trench R & R - Non-Hwy	LF	1600	$35	$ 56,000
7	6-inch Waterline, Class C Backfill	LF	1550	$50	$ 77,500
8	2" Connections	EA	1	$1,200	$ 1,200
9	1" Service Line - Class B, C, or Direct Place	LF	925	$30	$ 27,750
10	1" Service Connections	EA	38	$375	$ 14,250
11	6" Gate Valves	EA	2	$800	$ 1,600
12	6" 45 º Elbows	EA	2	$500	$ 1,000
13	6" 22 1/2 º Elbows	EA	7	$450	$ 3,150
14	6" Miscelleanous Fittings	EA	2	$475	$ 950
15	New Fire Hydrant & Connection	EA	1	$2,650	$ 2,650
16	Landscaping	LS	1	$1,900	$ 1,900
17	Traffic Control	LS	1	$4,000	$ 4,000
	Total Construction Cost				$ 236,650
	Engineering				$ 47,000
	Contingency				$ 28,000
	Environmental Review				$ 25,000
	Administration				$ 7,000
	Total Project Cost				$ 343,650

No.: *A*
Priority: *1*
Phase: *1*

Hamlet - *Replace 4" with 6", from Lakeshore, south to Calif., south to Wyo., east to Lakeshore Dr, east to Arizona*

Item	Description	Unit	Quantity	Unit Price	Total
1	Const. Facilities & Temporary Controls	LS	1	$47,200	$ 47,200
2	Waterline Demolition & Abandonment	LS	1	$14,700	$ 14,700
3	Site Preparation	LS	1	$2,900	$ 2,900
4	Foundation Stabilization	CY	75	$50	$ 3,750
5	Gravel Surfacing - 3" Depth	LF	300	$15	$ 4,500
6	AC Pavement Trench R & R - Non-Hwy	LF	3000	$35	$ 105,000
8	6-inch Waterline, Class C Backfill	LF	2500	$50	$ 125,000
9	1" Service Line - Class B, C, or Direct Place	LF	800	$30	$ 24,000
10	1" Service Connections	EA	32	$375	$ 12,000
11	6" Gate Valves	EA	2	$800	$ 1,600
12	6" 45 º Elbows	EA	1	$500	$ 500
13	6" 22 1/2 º Elbows	EA	8	$450	$ 3,600
14	6" Miscelleanous Fittings	EA	2	$475	$ 950
15	New Fire Hydrant & Connection	EA	4	$2,650	$ 10,600
16	Landscaping	LS	1	$2,900	$ 2,900
17	Traffic Control	LS	1	$2,400	$ 2,400
	Total Construction Cost				$ 361,600
	Engineering				$ 72,000
	Contingency				$ 43,000
	Environmental Review				$ 25,000
	Administration				$ 11,000
	Total Project Cost				$ 512,600

No.: B
Priority: 1
Phase: 1

Lakeshore (b) - *Replace 4" with 6" , from Lakeshore/Pinehurst, southeast to Hamlet*

Item	Description	Unit	Quantity	Unit Price	Total
1	Const. Facilities & Temporary Controls	LS	1	$21,000	$ 21,000
2	Waterline Demolition & Abandonment	LS	1	$6,500	$ 6,500
3	Site Preparation	LS	1	$1,300	$ 1,300
4	Foundation Stabilization	CY	25	$50	$ 1,250
5	Gravel Surfacing	LF	250	$15	$ 3,750
6	AC Pavement Trench R & R - Non-Hwy	LF	1400	$35	$ 49,000
7	6-inch Waterline, Class C Backfill	LF	1260	$50	$ 63,000
8	2" Connections	EA	1	$1,200	$ 1,200
9	1" Service Line - Class B, C, or Direct Place	LF	60	$30	$ 1,800
10	1" Service Connections	EA	2	$375	$ 750
11	6" Gate Valves	EA	2	$800	$ 1,600
12	6" 45 º Elbows	EA	2	$500	$ 1,000
13	6" 22 1/2 º Elbows	EA	3	$450	$ 1,350
14	6" Miscelleanous Fittings	EA	3	$475	$ 1,425
15	New Fire Hydrant & Connection	EA	1	$2,650	$ 2,650
16	Landscaping	LS	1	$1,300	$ 1,300
17	Traffic Control	LS	1	$2,400	$ 2,400
	Total Construction Cost				$ 161,275
	Engineering				$ 32,000
	Contingency				$ 19,000
	Environmental Review				$ 25,000
	Administration				$ 5,000
	Total Project Cost				$ 242,275

No.: C
Priority: 1
Phase: 1

Wyoming/12th/Arizona/13th - *Replace 6" with 6",*
from Hamlet, south to 12th St, east to Arizona, north to 13th, east to Oregon

Item	Description	Unit	Quantity	Unit Price	Total
1	Const. Facilities & Temporary Controls	LS	1	$47,300	$ 47,300
2	Waterline Demolition & Abandonment	LS	1	$14,700	$ 14,700
3	Site Preparation	LS	1	$2,900	$ 2,900
4	Foundation Stabilization	CY	15	$50	$ 750
5	Gravel Surfacing - 3" Depth	LF	300	$15	$ 4,500
6	AC Pavement Trench R & R - Non-Hwy	LF	3000	$35	$ 105,000
8	6-inch Waterline, Class C Backfill	LF	2860	$50	$ 143,000
10	2" Connections	EA	5	$1,200	$ 6,000
11	2" Service Line - Class B, C, or Direct Place	LF	100	$45	$ 4,500
12	1" Service Line - Class B, C, or Direct Place	LF	50	$40	$ 2,000
13	1" Service Line - Class B, C, or Direct Place	LF	175	$30	$ 5,250
14	1" Service Connections	EA	7	$375	$ 2,625
15	6" Gate Valves	EA	4	$800	$ 3,200
16	6" 45º Elbows	EA	2	$500	$ 1,000
17	6" Miscelleanous Fittings	EA	7	$475	$ 3,325
18	New Fire Hydrant & Connection	EA	4	$2,650	$ 10,600
19	Landscaping	LS	1	$2,900	$ 2,900
20	Traffic Control	LS	1	$3,000	$ 3,000
	Total Construction Cost				$ 362,550
	Engineering				$ 73,000
	Contingency				$ 44,000
	Environmental Review				$ 25,000
	Administration				$ 11,000
	Total Project Cost				$ 515,550

No.: D
Priority: 1

Jackson St. - *Replace 6" with 6", from 25th St., south to 18th St.*

Item	Description	Unit	Quantity	Unit Price	Total
1	Const. Facilities & Temporary Controls	LS	1	$31,100	$ 31,100
2	Waterline Demolition & Abandonment	LS	1	$4,900	$ 4,900
3	Site Preparation	LS	1	$1,900	$ 1,900
4	Foundation Stabilization	CY	50	$50	$ 2,500
5	Gravel Surfacing	LF	100	$15	$ 1,500
6	AC Pavement Trench R & R - Non-Hwy	LF	2000	$35	$ 70,000
7	6-inch Waterline, Class C Backfill	LF	1960	$50	$ 98,000
8	2" Connections	EA	2	$1,200	$ 2,400
9	2" Service Line - Class B, C, or Direct Place	LF	50	$40	$ 2,000
10	1" Service Line - Class B, C, or Direct Place	EA	400	$30	$ 12,000
11	1" Service Connections	LF	8	$375	$ 3,000
12	6" Gate Valves	EA	3	$800	$ 2,400
13	6" 45 º Elbows	EA	2	$500	$ 1,000
14	6" 22 1/2 º Elbows	EA	0	$450	$ -
15	6" Miscelleanous Fittings	EA	2	$475	$ 950
16	New Fire Hydrant & Connection	EA	1	$2,650	$ 2,650
17	Landscaping	LS	1	$2,000	$ 2,000
18	Traffic Control	LS	1	$400	$ 400
	Total Construction Cost				$ 238,700
	Engineering				$ 48,000
	Contingency				$ 29,000
	Environmental Review				$ 25,000
	Administration				$ 7,000
	Total Project Cost				$ 347,700

No.: E
Priority: 1

9th St. - *Replace 6" with 6", from Arizona, east to Jackson*

Item	Description	Unit	Quantity	Unit Price	Total
1	Const. Facilities & Temporary Controls	LS	1	$45,500	$ 45,500
2	Waterline Demolition & Abandonment	LS	1	$7,200	$ 7,200
3	Site Preparation	LS	1	$2,900	$ 2,900
4	Foundation Stabilization	CY	100	$50	$ 5,000
5	Gravel Surfacing	LF	100	$15	$ 1,500
6	AC Pavement Trench R & R - Non-Hwy	LF	20	$35	$ 700
7	AC Pavement Trench R & R - Hwy	LF	1800	$60	$ 108,000
8	Thermoplastic Markings - Stopbar	LF	20	$10	$ 200
9	6-inch Waterline, Class C Backfill	LF	1670	$50	$ 83,500
11	Highway Crossing - 6" Waterline	LF	110	$385	$ 42,350
12	2" Connections	EA	4	$1,200	$ 4,800
13	2" Service Line - Class B, C, or Direct Place	LF	150	$40	$ 6,000
14	1" Service Line - Class B, C, or Direct Place	LF	600	$30	$ 18,000
15	1" Service Connections	EA	24	$375	$ 9,000
16	6" Gate Valves	EA	2	$800	$ 1,600
17	6" 45 º Elbows	EA	2	$500	$ 1,000
18	6" Miscelleanous Fittings	EA	2	$475	$ 950
19	Pressure Relief Valves	EA	4	$160	$ 640
20	New Fire Hydrant & Connection	EA	1	$2,650	$ 2,650
22	Landscaping	LS	1	$2,890	$ 2,890
23	Traffic Control	LS	1	$4,600	$ 4,600
	Total Construction Cost				$ 286,880
	Engineering				$ 57,000
	Contingency				$ 34,000
	Environmental Review				$ 25,000
	Administration				$ 9,000
	Total Project Cost				$ 411,880

No.: F
Priority: 1
Phase: 1

7th St. - *Replace 6" with 6", from Coast Guard Rd, east across a wooded draw to 7th St., east to Oregon St.*

Item	Description	Unit	Quantity	Unit Price	Total
1	Const. Facilities & Temporary Controls	LS	1	$22,500	$ 22,500
2	Waterline Demolition & Abandonment	LS	1	$1,400	$ 1,400
3	Site Preparation	LS	1	$6,500	$ 6,500
4	Foundation Stabilization	CY	150	$50	$ 7,500
5	Gravel Surfacing	LF	5000	$15	$ 75,000
6	AC Pavement Trench R & R - Non-Hwy	LF	15	$35	$ 525
7	6-inch Waterline, Class C Backfill	LF	140	$50	$ 7,000
8	6-inch Waterline, Class B Backfill	LF	880	$35	$ 30,800
9	6" Gate Valves	EA	2	$800	$ 1,600
10	6" 45 º Elbows	EA	2	$500	$ 1,000
11	6" Miscelleanous Fittings	EA	2	$475	$ 950
12	New Fire Hydrant & Connection	EA	2	$2,650	$ 5,300
13	Concrete Slope Anchor	EA	2	$500	$ 1,000
14	Landscaping	LS	1	$10,300	$ 10,300
15	Traffic Control	LS	1	$800	$ 800

Total Construction Cost	$ 172,175
Engineering	$ 34,000
Contingency	$ 21,000
Environmental Review	$ 25,000
Administration	$ 5,000
Total Project Cost	$ 257,175

No.: G
Priority: 1
Phase: 1

Pinehurst - *Replace 6" with 6" , from Arizona St., east to Oregon St./Hwy 101*

Item	Description	Unit	Quantity	Unit Price	Total
1	Const. Facilities & Temporary Controls	LS	1	$16,000	$ 16,000
2	Waterline Demolition & Abandonment	LS	1	$900	$ 900
3	Site Preparation	LS	1	$900	$ 900
4	Foundation Stabilization	CY	50	$50	$ 2,500
5	Gravel Surfacing	LF	100	$15	$ 1,500
6	AC Pavement Trench R & R - Non-Hwy	LF	800	$35	$ 28,000
7	AC Pavement Trench R & R - Hwy	LF	20	$60	$ 1,200
8	Thermoplastic Markings - Stopbar	LF	10	$10	$ 100
10	6-inch Waterline, Class C Backfill	LF	820	$50	$ 41,000
11	2" Connections	EA	1	$1,200	$ 1,200
12	1" Service Line - Class B, C, or Direct Place	LF	275	$30	$ 8,250
13	1" Service Connections	EA	11	$375	$ 4,125
14	6" Gate Valves	EA	2	$800	$ 1,600
15	6" 45 º Elbows	EA	2	$500	$ 1,000
16	6" Miscelleanous Fittings	EA	2	$475	$ 950
17	New Fire Hydrant & Connection	EA	1	$2,650	$ 2,650
18	Landscaping	LS	1	$900	$ 900
19	Traffic Control	LS	1	$10,000	$ 10,000
	Total Construction Cost				$ 122,775
	Engineering				$ 25,000
	Contingency				$ 15,000
	Environmental Review				$ 25,000
	Administration				$ 4,000
	Total Project Cost				$ 191,775

No.: H
Priority: 1

Coast Guard Hill - *Replace 6" with 8" , from end, east to Sweet Way*

Item	Description	Unit	Quantity	Unit Price	Total
1	Const. Facilities & Temporary Controls	LS	1	$76,900	$ 76,900
2	Waterline Demolition & Abandonment	LS	1	$10,300	$ 10,300
3	Site Preparation	LS	1	$4,100	$ 4,100
4	Foundation Stabilization	CY	150	$50	$ 7,500
5	Gravel Surfacing - 3" Depth	SF	300	$2	$ 600
6	AC Pavement Trench R & R - Non-Hwy	LF	3950	$35	$ 138,250
7	8-inch Waterline, Class C Backfill	LF	3900	$60	$ 234,000
8	1" Service Line - Class B, C, or Direct Place	LF	300	$30	$ 9,000
9	1" Service Connections	EA	12	$375	$ 4,500
10	8" Gate Valves	EA	3	$800	$ 2,400
11	8" 90 º Elbows	EA	1	$550	$ 550
12	8" 45 º Elbows	EA	2	$500	$ 1,000
13	8" 22 1/2 º Elbows	EA	5	$450	$ 2,250
14	8" Miscelleanous Fittings	EA	2	$475	$ 950
15	New Fire Hydrant & Connection	EA	2	$2,650	$ 5,300
16	Pump Station	EA	1	$80,000	$ 80,000
17	Pressure Reducing Valves	EA	12	$160	$ 1,920
18	Combination Air Release Valve	EA	1	$2,200	$ 2,200
19	Landscaping	LS	1	$4,100	$ 4,100
20	Traffic Control	LS	1	$4,000	$ 4,000
	Total Construction Cost				$ 589,820
	Engineering				$ 118,000
	Contingency				$ 71,000
	Environmental Review				$ 25,000
	Administration				$ 18,000
	Total Project Cost				$ 821,820

No.: A
Phase: 1

Deady St. South - *Replace 6" with 10", from 9th, south to 6th*

Item	Description	Unit	Quantity	Unit Price	Total
1	Const. Facilities & Temporary Controls	LS	1	$14,900	$ 14,900
2	Waterline Demolition & Abandonment	LS	1	$2,400	$ 2,400
3	Site Preparation	LS	1	$900	$ 900
4	Foundation Stabilization	CY	50	$50	$ 2,500
5	Gravel Surfacing - 3" Depth	SF	100	$2	$ 200
6	AC Pavement Trench R & R - Non-Hwy	LF	750	$35	$ 26,250
8	10-inch Waterline, Class C Backfill	LF	700	$70	$ 49,000
9	1" Service Line - Class B, C, or Direct Place	LF	200	$30	$ 6,000
10	1" Service Connections	EA	8	$375	$ 3,000
11	10" Gate Valves	EA	1	$1,400	$ 1,400
12	10" 45 º Elbows	EA	2	$875	$ 1,750
13	10" 22 1/2 º Elbows	EA	0	$800	$ -
14	10" Miscelleanous Fittings	EA	2	$525	$ 1,050
15	New Fire Hydrant & Connection	EA	1	$2,650	$ 2,650
16	Landscaping	LS	1	$900	$ 900
17	Traffic Control	LS	1	$1,600	$ 1,600
	Total Construction Cost				$ 114,500
	Engineering				$ 23,000
	Contingency				$ 14,000
	Environmental Review				$ 25,000
	Administration				$ 3,000
	Total Project Cost				$ 179,500

No.: *B*
Priority: *2*
Phase: *1*

Deady N - *Replace 2" with 8" , from 9th, north to end*

Item	Description	Unit	Quantity	Unit Price	Total
1	Const. Facilities & Temporary Controls	LS	1	$31,500	$ 31,500
2	Waterline Demolition & Abandonment	LS	1	$3,100	$ 3,100
3	Site Preparation	LS	1	$1,200	$ 1,200
4	Foundation Stabilization	CY	25	$50	$ 1,250
5	Gravel Surfacing	SF	100	$15	$ 1,500
6	AC Pavement Trench R & R - Non-Hwy	LF	1000	$35	$ 35,000
7	8-inch Waterline, Class C Backfill	LF	1000	$60	$ 60,000
8	2" Connections	EA	0	$1,200	$ -
9	1" Service Line - Class B, C, or Direct Place	LF	300	$30	$ 9,000
10	1" Service Connections	EA	10	$375	$ 3,750
11	8" Gate Valves	EA	2	$1,200	$ 2,400
12	8" 45 º Elbows	EA	2	$750	$ 1,500
13	8" 22 1/2 º Elbows	EA	4	$675	$ 2,700
14	8" Miscelleanous Fittings	EA	2	$700	$ 1,400
15	New Fire Hydrant & Connection	EA	1	$2,650	$ 2,650
16	Pump Station	EA	1	$80,000	$ 80,000
17	Pressure Reducing Valves	EA	10	$160	$ 1,600
18	Standard Blowoff Assembly	EA	1	$1,200	$ 1,200
19	Landscaping	LS	1	$1,200	$ 1,200
20	Traffic Control	LS	1	$800	$ 800
	Total Construction Cost				$ 241,750
	Engineering				$ 48,000
	Contingency				$ 29,000
	Environmental Review				$ 25,000
	Administration				$ 7,000
	Total Project Cost				$ 350,750

No.: C
Phase: 1

6th/Jefferson/7th - *Replace 6" with 8",*
from Hamlet, south to 12th St, east to Arizona, north to 13th, east to Oregon

Item	Description	Unit	Quantity	Unit Price	Total
1	Const. Facilities & Temporary Controls	LS	1	$28,300	$ 28,300
2	Waterline Demolition & Abandonment	LS	1	$8,700	$ 8,700
3	Site Preparation	LS	1	$1,700	$ 1,700
4	Foundation Stabilization	CY	15	$50	$ 750
5	Gravel Surfacing - 3" Depth	SF	300	$2	$ 600
6	AC Pavement Trench R & R - Non-Hwy	LF	1050	$35	$ 36,750
7	AC Pavement Trench R & R - Hwy	LF	375	$60	$ 22,500
8	8-inch Waterline, Class C Backfill	LF	1400	$60	$ 84,000
9	2" Connections	EA	5	$1,200	$ 6,000
10	2" Service Line - Class B, C, or Direct Place	LF	100	$45	$ 4,500
11	1" Service Line - Class B, C, or Direct Place	LF	60	$30	$ 1,800
13	1" Service Connections	EA	3	$375	$ 1,125
14	8" Gate Valves	EA	4	$1,200	$ 4,800
15	8" 45º Elbows	EA	2	$750	$ 1,500
16	8" Miscelleanous Fittings	EA	7	$700	$ 4,900
17	New Fire Hydrant & Connection	EA	1	$2,650	$ 2,650
18	Landscaping	LS	1	$1,700	$ 1,700
19	Traffic Control	LS	1	$5,000	$ 5,000
	Total Construction Cost				$ 217,275
	Engineering				$ 43,000
	Contingency				$ 26,000
	Environmental Review				$ 25,000
	Administration				$ 7,000
	Total Project Cost				$ 318,275

No.: D

Phase: 1

Jefferson St. P.S - *Replace existing pump station*

Item	Description	Unit	Quantity	Unit Price	Total
1	Const. Facilities & Temporary Controls	LS	1	$20,400	$ 20,400
2	Waterline Demolition & Abandonment	LS	1	$11,300	$ 11,300
3	Gravel Surfacing	SF	100	$15	$ 1,500
4	6-inch Waterline, Class C Backfill	LF	25	$50	$ 1,250
5	6" Gate Valves	EA	2	$800	$ 1,600
6	6" 45 º Elbows	EA	2	$550	$ 1,100
7	6" Miscelleanous Fittings	EA	2	$525	$ 1,050
8	Pump Station	LS	1	$50,000	$ 50,000
9	Landscaping	LS	1	$300	$ 300
	Total Construction Cost				$ 88,500
	Engineering				$ 22,000
	Contingency				$ 11,000
	Environmental Review				$ 25,000
	Administration				$ 3,000
	Total Project Cost				$ 149,500

No.: E
Priority: 2
Phase: 1

Dock Rd. - *Replace 4" with 8", 5th to end*

Item	Description	Unit	Quantity	Unit Price	Total
1	Const. Facilities & Temporary Controls	LS	1	$31,900	$ 31,900
2	Waterline Demolition & Abandonment	LS	1	$5,000	$ 5,000
3	Site Preparation	LS	1	$2,000	$ 2,000
4	Foundation Stabilization	CY	50	$50	$ 2,500
5	Gravel Surfacing	SF	100	$15	$ 1,500
6	AC Pavement Trench R & R - Non-Hwy	LF	1850	$35	$ 64,750
7	8-inch Waterline, Class C Backfill	LF	1800	$60	$ 108,000
8	2" Connections	EA	5	$1,200	$ 6,000
9	2" Service Line - Class B, C, or Direct Place	LF	150	$40	$ 6,000
10	1" Service Line - Class B, C, or Direct Place	LF	20	$30	$ 600
11	1" Service Connections	EA	1	$375	$ 375
12	8" Gate Valves	EA	2	$1,200	$ 2,400
13	8" 45 º Elbows	EA	2	$750	$ 1,500
14	8" Miscelleanous Fittings	EA	2	$700	$ 1,400
15	Residential Pressure Relief Valves	EA	1	$160	$ 160
16	Commercial Pressure Relief Valves	EA	7	$300	$ 2,100
17	New Fire Hydrant & Connection	EA	1	$2,650	$ 2,650
18	Landscaping	LS	1	$2,020	$ 2,020
19	Traffic Control	LS	1	$4,000	$ 4,000
	Total Construction Cost				$ 201,955
	Engineering				$ 40,000
	Contingency				$ 24,000
	Environmental Review				$ 25,000
	Administration				$ 6,000
	Total Project Cost				$ 296,955

Priority: 2

King St. - *Replace 2" with 6", from Coast Guard Rd, along King*

Item	Description	Unit	Quantity	Unit Price	Total
1	Const. Facilities & Temporary Controls	LS	1	$20,200	$ 20,200
2	Waterline Demolition & Abandonment	LS	1	$1,200	$ 1,200
3	Site Preparation	LS	1	$5,700	$ 5,700
4	Foundation Stabilization	CY	25	$50	$ 1,250
5	Gravel Surfacing	SF	50	$15	$ 750
6	AC Pavement Trench R & R - Non-Hwy	LF	1100	$35	$ 38,500
7	6-inch Waterline, Class C Backfill	LF	1060	$50	$ 53,000
8	1" Service Line - Class B, C, or Direct Place	LF	250	$30	$ 7,500
9	1" Service Connections	EA	8	$375	$ 3,000
10	6" Gate Valves	EA	2	$800	$ 1,600
11	6" 45 º Elbows	EA	2	$500	$ 1,000
12	6" Miscelleanous Fittings	EA	2	$475	$ 950
13	New Fire Hydrant & Connection	EA	2	$2,650	$ 5,300
14	Concrete Slope Anchor	EA	2	$500	$ 1,000
15	Pressure Reducing Valve	EA	10	$160	$ 1,600
16	New Fire Hydrant & Connection	EA	1	$2,650	$ 2,650
17	Landscaping	LS	1	$9,000	$ 9,000
18	Traffic Control	LS	1	$800	$ 800

Total Construction Cost	$ 155,000
Engineering	$ 31,000
Contingency	$ 19,000
Environmental Review	$ 25,000
Administration	$ 5,000
Total Project Cost	$ 235,000

Priority: 2

Idaho - *Replace 2" with 4" , from 14th to 18th*

Item	Description	Unit	Quantity	Unit Price	Total
1	Const. Facilities & Temporary Controls	LS	1	$16,900	$ 16,900
2	Waterline Demolition & Abandonment	LS	1	$1,100	$ 1,100
3	Site Preparation	LS	1	$1,100	$ 1,100
4	Foundation Stabilization	CY	50	$50	$ 2,500
5	Gravel Surfacing	SF	100	$15	$ 1,500
6	AC Pavement Trench R & R - Non-Hwy	LF	1175	$35	$ 41,125
7	4-inch Waterline, Class C Backfill	LF	1150	$40	$ 46,000
8	2" Connections	EA	1	$1,200	$ 1,200
9	2" Service Line - Class B, C, or Direct Place	LF	20	$45	$ 900
10	1" Service Line - Class B, C, or Direct Place	LF	200	$30	$ 6,000
11	1" Service Connections	EA	9	$375	$ 3,375
12	4" Gate Valves	EA	2	$500	$ 1,000
13	4" 45 º Elbows	EA	2	$300	$ 600
14	4" Miscelleanous Fittings	EA	2	$300	$ 600
15	New Fire Hydrant & Connection	EA	1	$2,650	$ 2,650
16	Landscaping	LS	1	$1,100	$ 1,100
17	Traffic Control	LS	1	$2,000	$ 2,000
	Total Construction Cost				$ 129,650
	Engineering				$ 26,000
	Contingency				$ 16,000
	Environmental Review				$ 25,000
	Administration				$ 4,000
	Total Project Cost				$ 200,650

No.: H
Priority: 2

20th - *Replace 4" with 6" , from Jackson to Tichenor*

Item	Description	Unit	Quantity	Unit Price		Total
1	Const. Facilities & Temporary Controls	LS	1	$26,300	$	26,300
2	Waterline Demolition & Abandonment	LS	1	$1,700	$	1,700
3	Site Preparation	LS	1	$1,700	$	1,700
4	Foundation Stabilization	CY	50	$50	$	2,500
5	Gravel Surfacing	SF	50	$15	$	750
6	AC Pavement Trench R & R - Non-Hwy	LF	1650	$35	$	57,750
7	6-inch Waterline, Class C Backfill	LF	1600	$50	$	80,000
8	2" Connections	EA	2	$1,200	$	2,400
9	2" Service Line - Class B, C, or Direct Place	LF	60	$45	$	2,700
10	1" Service Line - Class B, C, or Direct Place	LF	200	$30	$	6,000
11	1" Service Connections	EA	19	$375	$	7,125
12	6" Gate Valves	EA	2	$800	$	1,600
13	6" 45 º Elbows	EA	2	$500	$	1,000
14	6" Miscelleanous Fittings	EA	2	$475	$	950
15	New Fire Hydrant & Connection	EA	1	$2,650	$	2,650
16	Landscaping	LS	1	$4,200	$	4,200
17	Traffic Control	LS	1	$2,000	$	2,000
	Total Construction Cost				$	201,325
	Engineering				$	40,000
	Contingency				$	24,000
	Environmental Review				$	25,000
	Administration				$	6,000
	Total Project Cost				$	296,325

No.: I
Priority: 2

Beacon Hill/Flake - *Replace 2" & 4" with 4" &6" , on Beacon Hill and Flake*

Item	Description	Unit	Quantity	Unit Price	Total
1	Const. Facilities & Temporary Controls	LS	1	$15,100	$ 15,100
2	Waterline Demolition & Abandonment	LS	1	$900	$ 900
3	Site Preparation	LS	1	$900	$ 900
4	Foundation Stabilization	CY	50	$50	$ 2,500
5	Gravel Surfacing	SF	50	$15	$ 750
6	AC Pavement Trench R & R - Non-Hwy	LF	900	$35	$ 31,500
7	6-inch Waterline, Class C Backfill	LF	350	$50	$ 17,500
8	4-inch Waterline, Class C Backfill	LF	525	$40	$ 21,000
9	1" Service Line - Class B, C, or Direct Place	LF	300	$30	$ 9,000
10	1" Service Connections	EA	12	$375	$ 4,500
11	6" Gate Valves	EA	1	$800	$ 800
12	4" Gate Valves	EA	1	$500	$ 500
13	6" 45 º Elbows	EA	1	$500	$ 500
14	4" 45 º Elbows	EA	1	$300	$ 300
15	6" Miscelleanous Fittings	EA	2	$475	$ 950
16	4" Miscelleanous Fittings	EA	2	$300	$ 600
17	New Fire Hydrant & Connection	EA	1	$2,650	$ 2,650
18	Standard Blowoff Assembly	EA	1	$1,200	$ 1,200
19	Landscaping	LS	1	$2,300	$ 2,300
20	Traffic Control	LS	1	$2,000	$ 2,000
	Total Construction Cost				$ 115,450
	Engineering				$ 23,000
	Contingency				$ 14,000
	Environmental Review				$ 25,000
	Administration				$ 3,000
	Total Project Cost				$ 180,450

No.: J
Phase: 1

Agate Beach/California - *Replace 2" with 6" , from California/12th south to Agate Beach Rd.*

Item	Description	Unit	Quantity	Unit Price	Total
1	Const. Facilities & Temporary Controls	LS	1	$31,500	$ 31,500
2	Waterline Demolition & Abandonment	LS	1	$4,800	$ 4,800
3	Site Preparation	LS	1	$3,800	$ 3,800
4	Foundation Stabilization	CY	75	$50	$ 3,750
5	Gravel Surfacing - 3" Depth	LF	50	$15	$ 750
6	AC Pavement Trench R & R - Non-Hwy	LF	2050	$35	$ 71,750
7	6-inch Waterline, Class C Backfill	LF	2000	$50	$ 100,000
8	1" Service Line - Class B, C, or Direct Place	LF	20	$30	$ 600
9	1" Service Connections	EA	1	$375	$ 375
10	6" Gate Valves	EA	3	$800	$ 2,400
11	6" 90 º Elbows	EA	1	$500	$ 500
12	6" 45 º Elbows	EA	2	$500	$ 1,000
13	6" 22 1/2 º Elbows	EA	8	$450	$ 3,600
14	6" Miscelleanous Fittings	EA	2	$475	$ 950
15	New Fire Hydrant & Connection	EA	1	$2,650	$ 2,650
18	Combination Air Release Valve	EA	1	$2,200	$ 2,200
19	Landscaping	LS	1	$9,600	$ 9,600
20	Traffic Control	LS	1	$1,600	$ 1,600
	Total Construction Cost				$ 241,825
	Engineering				$ 48,000
	Contingency				$ 29,000
	Environmental Review				$ 25,000
	Administration				$ 7,000
	Total Project Cost				$ 350,825

No.: *A*
Priority: *3*
Phase: *1*

18th/Oregon - *Connect deadend 4" line at 18th/Oregon intersection*

Item	Description	Unit	Quantity	Unit Price		Total
1	Const. Facilities & Temporary Controls	LS	1	$4,900	$	4,900
2	Waterline Demolition & Abandonment	LS	1	$2,600	$	2,600
3	Foundation Stabilization	CY	5	$50	$	250
4	AC Pavement Trench R & R - Hwy	LF	150	$60	$	9,000
5	6-inch Waterline, Class C Backfill	LF	100	$50	$	5,000
6	6" Gate Valves	EA	1	$800	$	800
7	6" 45 º Elbows	EA	2	$500	$	1,000
8	6" Miscelleanous Fittings	EA	2	$475	$	950
9	Traffic Control	LS	1	$5,000	$	5,000
	Total Construction Cost				$	29,500
	Engineering				$	6,000
	Contingency				$	4,000
	Environmental Review				$	25,000
	Administration				$	1,000
	Total Project Cost				$	65,500

No.: *B*
Priority: *3*
Phase: *1*

Vista & PS - *Replace 4" with 6" , from Jefferson eastward and replace pump station*

Item	Description	Unit	Quantity	Unit Price	Total
1	Const. Facilities & Temporary Controls	LS	1	$20,800	$ 20,800
2	Waterline Demolition & Abandonment	LS	1	$2,100	$ 2,100
3	Site Preparation	LS	1	$800	$ 800
4	Foundation Stabilization	CY	25	$50	$ 1,250
5	Gravel Surfacing	LF	100	$15	$ 1,500
6	AC Pavement Trench R & R - Non-Hwy	LF	750	$35	$ 26,250
7	6-inch Waterline, Class C Backfill	LF	700	$60	$ 42,000
8	1" Service Line - Class B, C, or Direct Place	LF	80	$30	$ 2,400
9	1" Service Connections	EA	4	$375	$ 1,500
10	6" Gate Valves	EA	2	$1,200	$ 2,400
11	6" 45 º Elbows	EA	2	$750	$ 1,500
12	6" 22 1/2 º Elbows	EA	2	$675	$ 1,350
13	6" Miscelleanous Fittings	EA	2	$700	$ 1,400
14	Standard Blowoff Assembly	EA	1	$1,200	$ 1,200
15	Pump Station	LS	1	$50,000	$ 50,000
16	Landscaping	LS	1	$800	$ 800
17	Traffic Control	LS	1	$2,400	$ 2,400
	Total Construction Cost				$ 159,650
	Engineering				$ 32,000
	Contingency				$ 19,000
	Environmental Review				$ 25,000
	Administration				$ 5,000
	Total Project Cost				$ 240,650

No.: C
Priority: 3
Phase: 1

5th - *Replace 4" with 6", from Harbor Dr. to Idaho St.*

Item	Description	Unit	Quantity	Unit Price	Total
1	Const. Facilities & Temporary Controls	LS	1	$16,100	$ 16,100
2	Waterline Demolition & Abandonment	LS	1	$4,900	$ 4,900
3	Site Preparation	LS	1	$500	$ 500
4	Foundation Stabilization	CY	5	$50	$ 250
5	Gravel Surfacing - 3" Depth	LF	20	$15	$ 300
6	AC Pavement Trench R & R - Non-Hwy	LF	1050	$35	$ 36,750
8	6-inch Waterline, Class C Backfill	LF	1000	$50	$ 50,000
11	1" Service Line - Class B, C, or Direct Place	LF	80	$30	$ 2,400
13	1" Service Connections	EA	4	$375	$ 1,500
14	6" Gate Valves	EA	2	$800	$ 1,600
15	6" 45º Elbows	EA	2	$500	$ 1,000
16	6" Miscelleanous Fittings	EA	2	$475	$ 950
17	New Fire Hydrant & Connection	EA	1	$2,650	$ 2,650
14	Standard Blowoff Assembly	EA	1	$1,200	$ 1,200
18	Landscaping	LS	1	$2,000	$ 2,000
19	Traffic Control	LS	1	$1,600	$ 1,600
	Total Construction Cost				$ 123,700
	Engineering				$ 25,000
	Contingency				$ 15,000
	Environmental Review				$ 25,000
	Administration				$ 4,000
	Total Project Cost				$ 192,700

No.: D
Priority: 3
Phase: 1

Hwy 101 - new 8" from 6th/Deady to Qua-To-Mah

Item	Description	Unit	Quantity	Unit Price	Total
1	Const. Facilities & Temporary Controls	LS	1	$43,700	$ 43,700
2	Waterline Demolition & Abandonment	LS	1	$22,900	$ 22,900
3	Site Preparation	LS	1	$2,400	$ 2,400
4	Gravel Surfacing	LF	100	$15	$ 1,500
5	AC Pavement Trench R & R - Hwy	LF	900	$60	$ 54,000
6	8-inch Waterline, Class C Backfill	LF	875	$60	$ 52,500
7	8" Gate Valves	EA	2	$1,200	$ 2,400
8	8" 45 º Elbows	EA	2	$750	$ 1,500
9	8" 22 1/2 º Elbows	EA	2	$675	$ 1,350
10	8" Miscelleanous Fittings	EA	2	$700	$ 1,400
11	Landscaping	LS	1	$5,700	$ 5,700
	Total Construction Cost				$ 189,350
	Engineering				$ 47,000
	Permitting				$ 5,000
	Contingency				$ 24,000
	Environmental Review				$ 25,000
	Administration				$ 6,000
	Total Project Cost				$ 296,350

No.: E
Priority: 3
Phase: 1

Qua-To-Mah - *Replace2" with 6", Hwy 101 to end, and new pump station*

Item	Description	Unit	Quantity	Unit Price	Total
1	Const. Facilities & Temporary Controls	LS	1	$17,600	$ 17,600
2	Waterline Demolition & Abandonment	LS	1	$1,500	$ 1,500
3	Site Preparation	LS	1	$600	$ 600
4	Foundation Stabilization	CY	25	$50	$ 1,250
5	Gravel Surfacing	LF	750	$15	$ 11,250
6	6-inch Waterline, Class C Backfill	LF	750	$50	$ 37,500
7	1" Service Line - Class B, C, or Direct Place	LF	60	$30	$ 1,800
8	1" Service Connections	EA	3	$375	$ 1,125
9	6" Gate Valves	EA	2	$800	$ 1,600
10	6" 45 º Elbows	EA	2	$500	$ 1,000
11	6" Miscelleanous Fittings	EA	2	$475	$ 950
12	New Fire Hydrant & Connection	EA	1	$2,650	$ 2,650
13	Standard Blowoff Assembly	EA	1	$1,200	$ 1,200
14	Pump Station	LS	1	$50,000	$ 50,000
15	Landscaping	LS	1	$600	$ 600
16	Traffic Control	LS	1	$4,000	$ 4,000
	Total Construction Cost				$ 102,425
	Engineering				$ 20,000
	Contingency				$ 12,000
	Environmental Review				$ 25,000
	Administration				$ 3,000
	Total Project Cost				$ 162,425

No.: F
Priority: 3
Phase: 1

Hensley Hill - *Replace 6" with 8"*

Item	Description	Unit	Quantity	Unit Price	Total
1	Const. Facilities & Temporary Controls	LS	1	$13,500	$ 13,500
2	Waterline Demolition & Abandonment	LS	1	$1,600	$ 1,600
3	Site Preparation	LS	1	$1,600	$ 1,600
4	Foundation Stabilization	CY	5	$50	$ 250
5	Gravel Surfacing	LF	50	$15	$ 750
6	AC Pavement Trench R & R - Non-Hwy	LF	700	$35	$ 24,500
6	8-inch Waterline, Class C Backfill	LF	675	$60	$ 40,500
8	1" Service Line - Class B, C, or Direct Place	LF	60	$30	$ 1,800
9	1" Service Connections	EA	3	$375	$ 1,125
7	8" Gate Valves	EA	2	$1,200	$ 2,400
8	8" 45 º Elbows	EA	2	$750	$ 1,500
9	8" 22 1/2 º Elbows	EA	4	$675	$ 2,700
10	8" Miscelleanous Fittings	EA	2	$700	$ 1,400
13	New Fire Hydrant & Connection	EA	1	$2,650	$ 2,650
17	Landscaping	LS	1	$6,100	$ 6,100
18	Traffic Control	LS	1	$1,200	$ 1,200

Total Construction Cost	$ 103,575
Engineering	$ 21,000
Contingency	$ 12,000
Environmental Review	$ 25,000
Administration	$ 3,000
Total Project Cost	$ 164,575

No.: *G*
Priority: *3*
Phase: *1*

5th - *Replace 4" with 6" , from Jackson to Deady (thereabouts)*

Item	Description	Unit	Quantity	Unit Price	Total
1	Const. Facilities & Temporary Controls	LS	1	$7,400	$ 7,400
2	Waterline Demolition & Abandonment	LS	1	$400	$ 400
3	Site Preparation	LS	1	$400	$ 400
4	Foundation Stabilization	CY	5	$50	$ 250
5	Gravel Surfacing	LF	200	$15	$ 3,000
6	AC Pavement Trench R & R - Non-Hwy	LF	200	$35	$ 7,000
7	6-inch Waterline, Class C Backfill	LF	400	$50	$ 20,000
8	2" Connections	EA	3	$1,200	$ 3,600
9	2" Service Line - Class B, C, or Direct Place	LF	60	$45	$ 2,700
12	6" Gate Valves	EA	2	$800	$ 1,600
13	6" 45 º Elbows	EA	2	$500	$ 1,000
14	6" Miscelleanous Fittings	EA	2	$475	$ 950
16	Landscaping	LS	1	$7,500	$ 7,500
17	Traffic Control	LS	1	$800	$ 800
	Total Construction Cost				$ 56,600
	Engineering				$ 11,000
	Contingency				$ 7,000
	Environmental Review				$ 25,000
	Administration				$ 2,000
	Total Project Cost				$ 101,600

No.: H
Priority: 3
Phase: 1

Sweet - *Install new 6"*

Item	Description	Unit	Quantity	Unit Price		Total
1	Const. Facilities & Temporary Controls	LS	1	$6,300	$	6,300
2	Site Preparation	LS	1	$400	$	400
3	Foundation Stabilization	CY	5	$50	$	250
4	AC Pavement Trench R & R - Non-Hwy	LF	400	$35	$	14,000
5	6-inch Waterline, Class C Backfill	LF	400	$50	$	20,000
6	6" Gate Valves	EA	2	$800	$	1,600
7	6" 45 º Elbows	EA	2	$500	$	1,000
8	6" 22 1/2 º Elbows	EA	4	$450	$	1,800
9	6" Miscelleanous Fittings	EA	2	$475	$	950
10	Landscaping	LS	1	$1,000	$	1,000
11	Traffic Control	LS	1	$800	$	800
	Total Construction Cost				$	48,100
	Engineering				$	10,000
	Contingency				$	6,000
	Environmental Review				$	25,000
	Administration				$	1,000
	Total Project Cost				$	90,100

No.: I
Priority: 3
Phase: 1

Jackson - *Connect deadend 4" line at 6th*

Item	Description	Unit	Quantity	Unit Price		Total
1	Const. Facilities & Temporary Controls	LS	1	$7,900	$	7,900
2	Waterline Demolition & Abandonment	LS	1	$1,500	$	1,500
3	Site Preparation	LS	1	$1,500	$	1,500
4	Foundation Stabilization	CY	5	$50	$	250
5	AC Pavement Trench R & R - Hwy	LF	50	$60	$	3,000
6	AC Pavement Trench R & R - Hwy	LF	150	$60	$	9,000
7	6-inch Waterline, Class C Backfill	LF	300	$50	$	15,000
8	6" Gate Valves	EA	2	$800	$	1,600
9	6" 45 º Elbows	EA	2	$500	$	1,000
10	6" Miscelleanous Fittings	EA	2	$475	$	950
11	Landscaping	LS	1	$800	$	800
12	Traffic Control	LS	1	$5,000	$	5,000
	Total Construction Cost				$	47,500
	Engineering				$	10,000
	Contingency				$	6,000
	Environmental Review				$	25,000
	Administration				$	1,000
	Total Project Cost				$	89,500

No.: J
Priority: 3
Phase: 1

Pinehurst - *Install new 6" to loop*

Item	Description	Unit	Quantity	Unit Price		Total
1	Const. Facilities & Temporary Controls	LS	1	$5,700	$	5,700
2	Site Preparation	LS	1	$400	$	400
3	Foundation Stabilization	CY	5	$50	$	250
4	AC Pavement Trench R & R - Non-Hwy	LF	400	$35	$	14,000
5	6-inch Waterline, Class C Backfill	LF	400	$50	$	20,000
6	6" Gate Valves	EA	1	$800	$	800
9	6" Miscelleanous Fittings	EA	2	$475	$	950
10	Landscaping	LS	1	$900	$	900
11	Traffic Control	LS	1	$800	$	800
	Total Construction Cost				$	43,800
	Engineering				$	9,000
	Contingency				$	5,000
	Environmental Review				$	25,000
	Administration				$	1,000
	Total Project Cost				$	83,800

No.: K
Priority: 3
Phase: 1

Manzanita - *Replace 4" with 6" , from Arizona to Geer*

Item	Description	Unit	Quantity	Unit Price	Total
1	Const. Facilities & Temporary Controls	LS	1	$5,100	$ 5,100
2	Waterline Demolition & Abandonment	LS	1	$300	$ 300
2	Site Preparation	LS	1	$300	$ 300
3	Foundation Stabilization	CY	5	$50	$ 250
4	AC Pavement Trench R & R - Non-Hwy	LF	350	$35	$ 12,250
5	6-inch Waterline, Class C Backfill	LF	325	$50	$ 16,250
6	6" Gate Valves	EA	2	$800	$ 1,600
7	6" 45 º Elbows	EA	2	$500	$ 1,000
9	6" Miscelleanous Fittings	EA	2	$475	$ 950
10	Landscaping	LS	1	$800	$ 800
11	Traffic Control	LS	1	$800	$ 800
	Total Construction Cost				$ 39,600
	Engineering				$ 6,000
	Contingency				$ 5,000
	Environmental Review				$ 25,000
	Administration				$ 1,000
	Total Project Cost				$ 76,600

No.: *L*
Priority: *3*
Phase: *1*

Madrona - *Install new 6" to loop*

Item	Description	Unit	Quantity	Unit Price	Total
1	Const. Facilities & Temporary Controls	LS	1	$2,300	$ 2,300
2	Site Preparation	LS	1	$100	$ 100
3	Foundation Stabilization	CY	5	$50	$ 250
4	AC Pavement Trench R & R - Hwy	LF	50	$60	$ 3,000
5	AC Pavement Trench R & R - Non-Hwy	LF	100	$35	$ 3,500
6	6-inch Waterline, Class C Backfill	LF	100	$50	$ 5,000
7	6" Gate Valves	EA	1	$800	$ 800
8	6" Miscelleanous Fittings	EA	2	$475	$ 950
9	Landscaping	LS	1	$300	$ 300
10	Traffic Control	LS	1	$1,500	$ 1,500
	Total Construction Cost				$ 17,700
	Engineering				$ 3,000
	Contingency				$ 2,000
	Environmental Review				$ 25,000
	Administration				$ 1,000
	Total Project Cost				$ 48,700

No.: *M*
Priority: *3*
Phase: *1*

I daho - *Replace 2" with 4", between 10th and 12th*

Item	Description	Unit	Quantity	Unit Price		Total
1	Const. Facilities & Temporary Controls	LS	1	$8,600	$	8,600
2	Waterline Demolition & Abandonment	LS	1	$600	$	600
3	Site Preparation	LS	1	$600	$	600
4	Foundation Stabilization	CY	5	$50	$	250
5	AC Pavement Trench R & R - Non-Hwy	LF	650	$35	$	22,750
6	4-inch Waterline, Class C Backfill	LF	600	$50	$	30,000
7	4" Gate Valves	EA	2	$800	$	1,600
8	4" Miscelleanous Fittings	EA	2	$475	$	950
9	Landscaping	LS	1	$600	$	600
10	Traffic Control	LS	1	$800	$	800
	Total Construction Cost				$	66,750
	Engineering				$	10,000
	Contingency				$	8,000
	Environmental Review				$	25,000
	Administration				$	2,000
	Total Project Cost				$	111,750

No.: *N*
Priority: *3*
Phase: *1*

19th - *Replace 2" with 4", between Arizona and Oregon (Hwy 101)*

Item	Description	Unit	Quantity	Unit Price		Total
1	Const. Facilities & Temporary Controls	LS	1	$10,700	$	10,700
2	Waterline Demolition & Abandonment	LS	1	$700	$	700
2	Site Preparation	LS	1	$700	$	700
3	Foundation Stabilization	CY	5	$50	$	250
4	AC Pavement Trench R & R - Hwy	LF	50	$60	$	3,000
4	AC Pavement Trench R & R - Non-Hwy	LF	650	$35	$	22,750
5	4-inch Waterline, Class C Backfill	LF	800	$50	$	40,000
6	4" Gate Valves	EA	2	$800	$	1,600
9	4" Miscelleanous Fittings	EA	2	$475	$	950
10	Landscaping	LS	1	$700	$	700
11	Traffic Control	LS	1	$1,190	$	1,190
	Total Construction Cost				$	82,540
	Engineering				$	12,000
	Contingency				$	9,000
	Environmental Review				$	25,000
	Administration				$	2,000
	Total Project Cost				$	130,540

No.: *O*
Priority: *3*
Phase: *1*

Dee Terrace - *Replace 4" with 6"*

Item	Description	Unit	Quantity	Unit Price	Total
1	Const. Facilities & Temporary Controls	LS	1	$25,600	$ 25,600
2	Waterline Demolition & Abandonment	LS	1	$1,700	$ 1,700
2	Site Preparation	LS	1	$1,600	$ 1,600
3	Foundation Stabilization	CY	5	$50	$ 250
4	AC Pavement Trench R & R - Non-Hwy	LF	1850	$35	$ 64,750
5	6-inch Waterline, Class C Backfill	LF	1850	$50	$ 92,500
6	6" Gate Valves	EA	2	$800	$ 1,600
7	6" 45 º Elbows	EA	2	$500	$ 1,000
8	6" 22 1/2 º Elbows	EA	4	$450	$ 1,800
9	6" Miscelleanous Fittings	EA	2	$475	$ 950
10	Standard Blowoff Assembly	EA	1	$1,200	$ 1,200
11	Landscaping	LS	1	$4,100	$ 4,100
12	Traffic Control	LS	1	$800	$ 800
	Total Construction Cost				$ 197,850
	Engineering				$ 30,000
	Contingency				$ 23,000
	Environmental Review				$ 25,000
	Administration				$ 6,000
	Total Project Cost				$ 281,850

No.: *P*
Priority: *3*
Phase: *1*

14th - *Replace 2" with 4"*

Item	Description	Unit	Quantity	Unit Price	Total
1	Const. Facilities & Temporary Controls	LS	1	$5,200	$ 5,200
2	Waterline Demolition & Abandonment	LS	1	$300	$ 300
3	Site Preparation	LS	1	$600	$ 600
4	Foundation Stabilization	CY	75	$50	$ 3,750
5	Gravel Surfacing - 3" Depth	LF	400	$15	$ 6,000
6	4-inch Waterline, Class C Backfill	LF	400	$40	$ 16,000
7	1" Service Line - Class B, C, or Direct Place	LF	60	$30	$ 1,800
8	1" Service Connections	EA	3	$375	$ 1,125
9	4" Gate Valves	EA	3	$500	$ 1,500
10	4" 45 º Elbows	EA	2	$300	$ 600
11	6" Miscelleanous Fittings	EA	2	$300	$ 600
12	Landscaping	LS	1	$1,600	$ 1,600
13	Traffic Control	LS	1	$800	$ 800
	Total Construction Cost				$ 39,875
	Engineering				$ 8,000
	Contingency				$ 5,000
	Environmental Review				$ 25,000
	Administration				$ 1,000
	Total Project Cost				$ 78,875

No.: Q
Priority: 3
Phase: 1

Tichenor Cemetery - *Replace 2" with 6"*

Item	Description	Unit	Quantity	Unit Price		Total
1	Const. Facilities & Temporary Controls	LS	1	$7,100	$	7,100
2	Waterline Demolition & Abandonment	LS	1	$1,000	$	1,000
3	Site Preparation	LS	1	$800	$	800
4	Foundation Stabilization	CY	25	$50	$	1,250
5	Gravel Surfacing - 3" Depth	LF	50	$15	$	750
6	AC Pavement Trench R & R - Non-Hwy	LF	350	$35	$	12,250
7	6-inch Waterline, Class C Backfill	LF	325	$50	$	16,250
8	1" Service Line - Class B, C, or Direct Place	LF	80	$30	$	2,400
9	1" Service Connections	EA	4	$375	$	1,500
10	6" Gate Valves	EA	2	$800	$	1,600
11	6" 90 º Elbows	EA	1	$500	$	500
12	6" 45 º Elbows	EA	2	$500	$	1,000
14	6" Miscelleanous Fittings	EA	2	$475	$	950
15	New Fire Hydrant & Connection	EA	1	$2,650	$	2,650
10	Standard Blowoff Assembly	EA	1	$1,200	$	1,200
19	Landscaping	LS	1	$2,100	$	2,100
20	Traffic Control	LS	1	$800	$	800
	Total Construction Cost				$	54,100
	Engineering				$	11,000
	Contingency				$	7,000
	Environmental Review				$	25,000
	Administration				$	2,000
	Total Project Cost				$	99,100

No.: R
Priority: 3
Phase: 1

Stagecoach - *Replace 4" with 6"*

Item	Description	Unit	Quantity	Unit Price	Total
1	Const. Facilities & Temporary Controls	LS	1	$7,400	$ 7,400
2	Waterline Demolition & Abandonment	LS	1	$1,000	$ 1,000
3	Site Preparation	LS	1	$400	$ 400
4	Foundation Stabilization	CY	25	$50	$ 1,250
5	Gravel Surfacing	LF	20	$15	$ 300
6	AC Pavement Trench R & R - Non-Hwy	LF	350	$35	$ 12,250
7	6-inch Waterline, Class C Backfill	LF	325	$60	$ 19,500
8	1" Service Line - Class B, C, or Direct Place	LF	20	$30	$ 600
9	1" Service Connections	EA	1	$375	$ 375
10	6" Gate Valves	EA	2	$1,200	$ 2,400
11	6" 45 º Elbows	EA	2	$750	$ 1,500
13	6" Miscelleanous Fittings	EA	2	$700	$ 1,400
14	Standard Blowoff Assembly	EA	1	$1,200	$ 1,200
16	Landscaping	LS	1	$2,000	$ 2,000
17	Traffic Control	LS	1	$5,000	$ 5,000
	Total Construction Cost				$ 56,575
	Engineering				$ 11,000
	Contingency				$ 7,000
	Environmental Review				$ 25,000
	Administration				$ 2,000
	Total Project Cost				$ 101,575

No.: *S*
Priority: *3*
Phase: *1*

Sea Cliff - *Replace 2" with 4"*

Item	Description	Unit	Quantity	Unit Price		Total
1	Const. Facilities & Temporary Controls	LS	1	$3,600	$	3,600
2	Waterline Demolition & Abandonment	LS	1	$200	$	200
3	Site Preparation	LS	1	$400	$	400
4	Foundation Stabilization	CY	75	$50	$	3,750
5	Gravel Surfacing - 3" Depth	LF	50	$15	$	750
6	AC Pavement Trench R & R - Non-Hwy	LF	150	$35	$	5,250
7	4-inch Waterline, Class C Backfill	LF	150	$40	$	6,000
8	1" Service Line - Class B, C, or Direct Place	LF	60	$30	$	1,800
9	1" Service Connections	EA	3	$375	$	1,125
10	4" Gate Valves	EA	3	$500	$	1,500
12	4" 45 º Elbows	EA	2	$300	$	600
14	6" Miscelleanous Fittings	EA	2	$300	$	600
19	Landscaping	LS	1	$1,100	$	1,100
20	Traffic Control	LS	1	$800	$	800
	Total Construction Cost				$	27,475
	Engineering				$	5,000
	Contingency				$	3,000
	Environmental Review				$	25,000
	Administration				$	1,000
	Total Project Cost				$	61,475

No.: *T*
Priority: *3*
Phase: *1*

Water Treatment Plant

Item	Description	Unit	Quantity	Unit Price		Total
1	Const. Facilities & Temporary Controls	LS	1	$109,900	$	109,900
2	Demolition	LS	1	$36,600	$	36,600
3	Waterline Demolition & Abandonment	LS	1	$10,000	$	10,000
4	Foundation Stabilization	CY	10	$50	$	500
5	Standing Seam Metal Roof	SF	5900	$12.50	$	73,750
6	Seismic protection of entire plant	LS	1	$20,000.00	$	20,000
7	Floor Slab Drainage Correction (chem room)	LS	1	$3,000	$	3,000
8	Louvers for cooling pump room	EA	2	$210	$	420
9	VFDs for large pumps	EA	2	$1,000	$	2,000
10	VFDs for small pumps	EA	2	$500	$	1,000
11	Piping (includes supports)	LS	1	$50,000	$	50,000
12	Actuators	EA	6	$1,000	$	6,000
13	6" Butterfly valves	EA	6	$1,000	$	6,000
14	4" Butterfly valves	EA	4	$750	$	3,000
15	6" Flowmeters	EA	4	$7,500	$	30,000
16	4" Gate/Pinch	EA	2	$6,000	$	12,000
17	Solinoid valve (for shut off at tank)	EA	1	$3,000	$	3,000
18	Cathodic protection for tanks	LS	1	$20,000	$	20,000
19	Transducers for level control	EA	2	$1,500	$	3,000
20	Treated Water Pump (spare)	EA	1	$7,500	$	7,500
21	Mixing pump (chemical room)	EA	3	$1,200	$	3,600
22	Turbidimeters	EA	2	$2,500	$	5,000
23	Air dryer	EA	1	$5,000	$	5,000
24	Compressor	EA	1	$3,000	$	3,000
25	Electrical update (includes labor, conduits, wiring, panels, programmin	LS	1	$300,000	$	300,000
26	Emergency backup generator	EA	1	$100,000	$	100,000
27	Computer equipment	LS	1	$50,000	$	50,000
28	Landscaping	LS	1	$15,000	$	15,000
	Total Construction Cost				$	879,270
	Engineering				$	176,000
	Contingency				$	158,000
	Environmental Review				$	25,000
	Administration				$	26,000
	Total Project Cost				$	1,264,270

No.: 1
Priority: 1
Phase: 2

Raw Water Storage

Item	Description	Unit	Quantity	Unit Price		Total
1	Const. Facilities & Temporary Controls	LS	1	$116,700	$	116,700
2	Demolition	LS	1	$38,900	$	38,900
3	Site Preparation	LS	1	$0	$	-
4	Foundation Stabilization	CY	100	$50	$	5,000
5	Gravel Surfacing - 3" Depth	LF	500	$15	$	7,500
6	AC Pavement Trench R & R - Hwy	LF	4400	$60	$	264,000
7	AC Pavement Trench R & R - Non-Hwy	LF	4600	$35	$	161,000
8	8-inch Waterline, Class C Backfill	LF	9000	$60	$	540,000
9	Excavation & Embankment - Reservoir	LS	1	$75,000	$	75,000
10	Pond Liner	LS	1	$20,000	$	20,000
11	Excavation & Embankment - Access Roads	LS	1	$25,000	$	25,000
12	Pump Station	LS	1	$80,000.00	$	80,000
13	8" Gate Valves	EA	5	$695	$	3,475
14	8" Miscelleanous Fittings	EA	20	$475	$	9,500
15	Security Fence	LF	1000	$10	$	10,000
16	Landscaping	LS	1	$15,000	$	15,000
	Total Construction Cost				$	1,371,075
	Pre-engineering Studies				$	20,000
	Property Acquisition				$	500,000
	Permitting				$	15,000
	Geotechnical Engineering				$	20,000
	Engineering				$	274,000
	Contingency				$	247,000
	Environmental Review				$	25,000
	Administration				$	41,000
	Total Project Cost				$	2,513,075

No.: 1
Priority: 1
Phase: 2

Coast Guard Hill Treated Water Reservoir Improvements

Item	Description	Unit	Quantity	Unit Price		Total
1	Const. Facilities & Temporary Controls	LS	1	$40,700	$	40,700
2	Demolition	LS	1	$5,400	$	5,400
3	Site Preparation	LS	1	$5,000	$	5,000
4	Foundation Stabilization	CY	5	$50	$	250
5	Gravel Surfacing - 3" Depth, 12' width	LF	100	$65	$	6,500
6	Gauge	LF	1	$5,000	$	5,000
7	Mixer	LF	1	$50,000	$	50,000
8	Tank Maintenance / Exterior Coating	LF	1	$7,500	$	7,500
9	Valve Vaults	EA	1	$9,500	$	47,500
10	8-inch Butterfly Valves	EA	2	$3,000	$	47,500
11	Actuator	EA	1	$8,000	$	40,000
12	Earthquake Sensor	EA	1	$3,800	$	19,000
13	SCADA Upgrade	EA	1	$2,000	$	10,000
14	Automatic Transfer Switch	EA	1	$30,000	$	30,000
15	Electrical Site work	EA	1	$5,000	$	30,000
16	New Electrical Service	EA	1	$15,000	$	30,000
17	Landscaping	LS	1	$10,000	$	10,000
	Total Construction Cost				$	384,350
	Engineering				$	77,000
	Contingency				$	69,000
	Environmental Review				$	25,000
	Administration				$	12,000
	Total Project Cost				$	567,350

No.: *A*
Priority: *2*

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Fireflow Model Data

Appendix

B

	Elevation (ft)	Fire Flow (gpm)	Pressure (psi)
J-5	54.00	1,221.16	68.3
J-6	50.00	981.55	70.0
J-7	44.00	2,197.74	72.6
J-8	43.00	1,789.25	73.1
J-9	44.00	1,435.24	72.6
J-10	41.00	1,329.96	73.9
J-11	26.00	2,377.18	80.4
J-12	43.00	2,968.06	73.1
J-13	39.00	3,002.72	74.8
J-14	40.00	3,194.30	74.4
J-15	41.00	2,946.87	73.9
J-16	40.00	3,271.61	74.4
J-17	39.00	2,517.35	74.8
J-18	40.00	2,022.07	74.4
J-19	43.00	2,439.76	73.1
J-20	46.00	1,320.22	71.8
J-21	49.00	1,320.22	70.5
J-22	47.00	1,067.38	71.3
J-23	39.00	2,118.35	74.8
J-24	37.00	1,655.96	75.7
J-25	59.00	1,022.18	66.2
J-26	39.00	1,518.86	74.8
J-27	53.00	1,112.45	68.7
J-28	55.00	1,112.76	67.9
J-29	76.00	1,116.26	58.8
J-30	85.00	1,114.85	54.9
J-31	162.00	2,280.80	79.9
J-32	170.00	1,533.42	76.4
J-33	195.00	2,198.78	65.6
J-34	40.00	3,065.00	74.4
J-35	38.00	2,881.41	75.2
J-36	39.00	3,280.29	74.8
J-37	39.00	3,404.25	74.8
J-38	37.00	3,589.04	75.7
J-39	39.00	3,760.16	74.8
J-40	32.00	1,740.71	77.8
J-41	29.00	3,511.94	79.1
J-42	57.00	2,954.75	67.0
J-43	40.00	2,330.09	74.4
J-44	80.00	1,972.49	57.1
J-45	78.00	2,178.87	57.9
J-46	92.00	976.55	51.9
J-47	85.00	1,860.13	54.9
J-48	172.00	989.94	60.5
J-49	27.00	3,286.23	80.0
J-50	55.00	3,452.25	67.9
J-51	38.00	3,384.60	75.2
J-52	42.00	4,493.83	73.5
J-53	42.00	4,126.80	73.5

J-54	42.00	5,397.12	73.5
J-55	39.00	1,561.22	74.8
J-56	63.00	3,783.18	64.4
J-57	45.00	5,102.66	72.2
J-59	42.00	5,404.13	73.5
J-60	37.00	4,004.67	75.7
J-61	17.00	1,158.21	64.6
J-62	28.00	3,295.55	79.6
J-63	36.00	3,304.92	76.1
J-64	32.00	3,263.91	77.8
J-65	25.00	3,562.46	80.9
J-66	28.00	3,516.55	79.6
J-67	31.00	3,427.32	78.3
J-68	45.00	2,272.02	72.2
J-69	36.00	3,588.15	76.1
J-70	43.00	5,650.00	73.1
J-71	56.00	6,644.19	67.5
J-72	45.00	2,219.89	72.2
J-73	55.00	2,125.53	67.9
J-74	46.00	4,375.05	71.8
J-75	47.00	4,855.92	71.4
J-76	48.00	2,848.59	70.9
J-77	52.00	4,478.55	69.2
J-78	76.00	4,036.56	58.8
J-79	54.00	906.20	68.3
J-80	96.00	4,160.63	50.2
J-81	49.00	4,462.34	70.5
J-82	89.00	4,453.63	53.2
J-83	50.00	4,821.21	70.1
J-84	80.00	4,863.42	57.1
J-85	66.00	5,266.99	63.1
J-86	53.00	5,419.96	68.8
J-87	61.00	6,149.93	65.3
J-88	65.00	5,002.98	63.6
J-89	53.00	3,855.70	68.8
J-90	55.00	1,215.01	67.9
J-91	79.00	5,746.98	57.5
J-92	80.00	4,855.42	57.1
J-93	75.00	1,073.01	59.3
J-94	142.00	1,169.09	74.5
J-95	123.00	1,169.09	82.7
J-96	204.00	1,025.10	47.7
J-97	76.00	6,058.61	58.8
J-98	77.00	3,727.07	58.4
J-99	75.00	988.13	59.3
J-100	220.00	1,060.75	76.5
J-101	313.00	1,004.40	36.3
J-102	56.00	5,740.45	67.5
J-103	59.00	4,353.79	66.2
J-104	70.00	3,722.29	61.4

J-105	100.00	2,883.22	48.4
J-106	90.00	7,859.54	52.8
J-107	108.00	9,020.63	45.0
J-108	165.00	10,000.00	20.3
J-109	85.00	5,074.97	54.9
J-110	204.00	1,569.72	76.1
J-111	206.00	1,569.39	75.3
J-112	253.00	1,551.76	54.9
J-113	243.00	1,541.29	59.3
J-114	257.00	1,265.05	53.2
J-115	244.00	1,536.85	58.8
J-116	224.00	1,519.32	67.5
J-117	275.00	1,481.75	45.4
J-118	240.00	1,499.04	60.6
J-119	230.00	1,499.40	64.9
J-120	165.00	1,509.15	93.0
J-121	200.00	1,513.46	77.9
J-122	72.00	1,508.41	73.8
J-123	271.00	1,352.39	47.1
J-124	264.00	1,352.20	50.2
J-125	263.00	1,352.32	50.6
J-126	258.00	1,293.50	52.8
J-127	73.00	3,400.15	60.1
J-128	73.00	3,329.28	60.1
J-129	120.00	1,505.99	39.8
J-130	24.00	2,269.68	81.3
J-131	75.00	3,492.03	59.2
J-132	66.00	2,611.22	63.1
J-133	85.00	1,026.80	54.9
J-134	47.00	1,906.13	71.4
J-143	300.00	1,261.78	34.6
J-144	74.00	1,424.40	59.7
J-145	76.00	2,143.18	58.8
J-146	108.00	1,274.20	45.0
J-147	80.00	1,423.78	57.1
J-149	44.00	1,320.21	72.6
J-150	28.00	3,335.89	79.6
J-151	35.00	3,426.68	76.5
J-152	25.00	3,629.67	80.9
J-153	247.00	1,548.48	57.5
J-154	230.00	1,557.00	64.9
J-155	105.00	2,529.03	46.3
J-158	52.00	2,731.95	69.2
J-163	33.00	3,655.94	77.4
J-164	165.00	6,070.34	20.3
J-165	120.00	2,352.57	39.8
J-166	195.00	1,054.87	50.6
J-167	76.00	1,083.70	58.8
J-168	115.00	1,054.15	41.9
J-173	165.00	1,268.19	20.3

J-175	43.00	5,495.69	73.1