CITY OF PHILOMATH
Water System Master Plan,
Philomath, Oregon

Section 4

Existing System

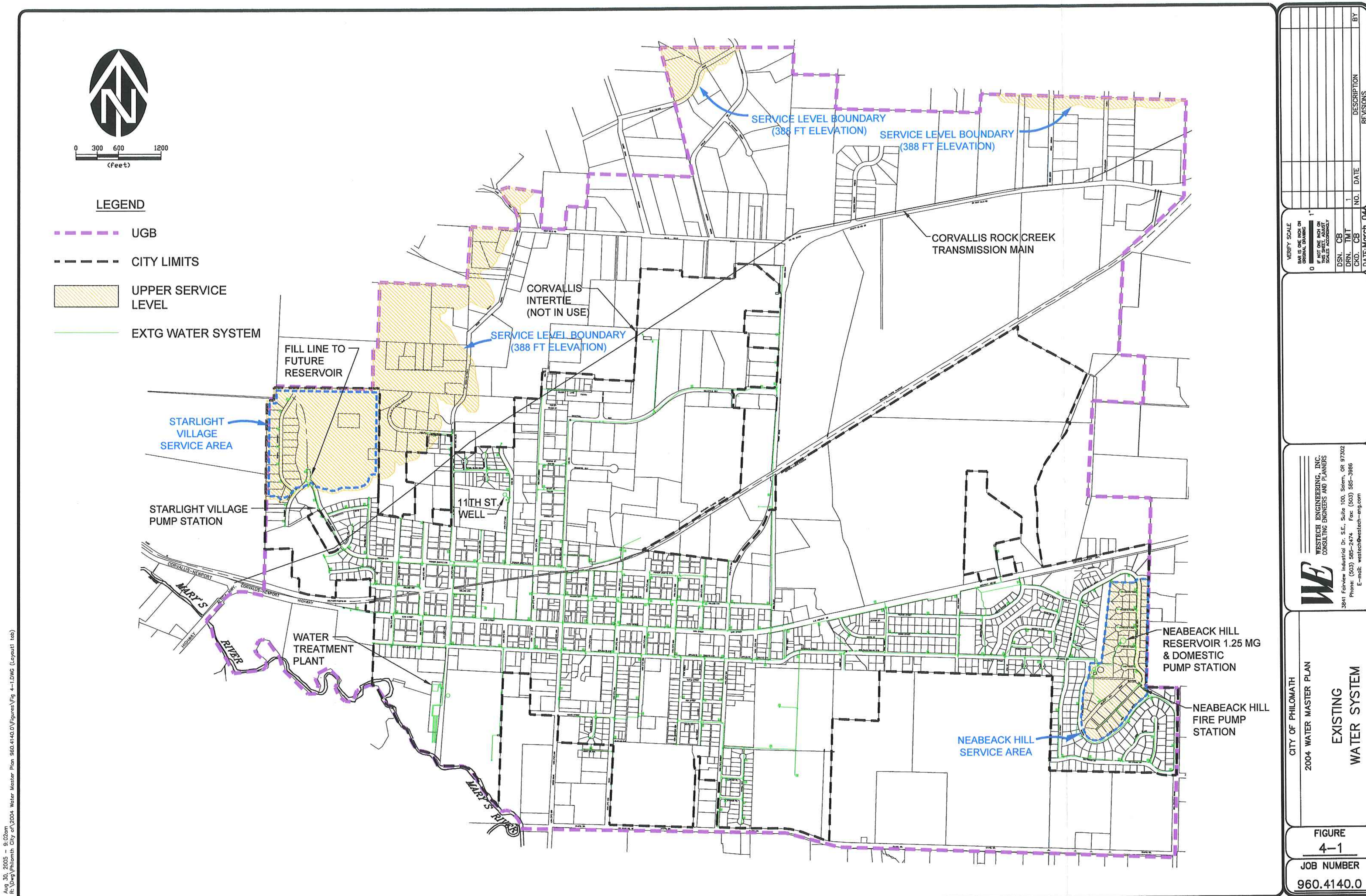
SECTION 4 EXISTING SYSTEM

4.1. General Overview

Philomath's original water system was designed to distribute water from Corvallis' Rock Creek Facility. For many years all water for Philomath's system was purchased from Corvallis. As demand due to population growth in the Corvallis-Philomath area increased beyond the capacity of the Rock Creek facility, both Corvallis and Philomath began to seek alternate water sources. Corvallis constructed the Taylor Water Treatment Plant and now draws most of its water from the Willamette River. In the 1970's Philomath drilled two municipal wells. For a time, these wells served as the primary water source for the City. Due to quality problems in the wells and the rising costs of purchasing water from Corvallis, the City of Philomath decided to construct a new water treatment facility and use the Marys River as its primary source.

The City currently obtains municipal drinking water from two sources. These are the Marys River and the 11th Street well. Water from the Marys River is withdrawn and treated at the City's water treatment plant (WTP) constructed in 1985. The 11th Street well was developed in 1977. The Marys River serves as the City's primary water source and the 11th Street well is used as a backup source only.

Storage is provided in a 1.25 million-gallon cast-in-place concrete reservoir that was constructed in 1994. The reservoir is located atop Neabeack hill on the east end of the City. Most of the City's transmission and distribution piping is constructed of cast iron, ductile iron, and PVC pipe. While there are some 12 and 16-inch transmission lines capable of delivering major fire flows, the majority of the distribution system piping is 6 and 8-inches in size. The major components of the water system are shown in **Figure 4-1**. Detailed water system maps are included in **Appendix A**. A schematic representation of the water system is presented in **Figure 4-2**.



N
0 300 600 1200
(feet)
LEGEND
UGB
CITY LIMITS
UPPER SERVICE LEVEL
EXTG WATER SYSTEM
SERVICE LEVEL BOUNDARY (388 FT ELEVATION)
SERVICE LEVEL BOUNDARY (388 FT ELEVATION)
SERVICE LEVEL BOUNDARY (388 FT ELEVATION)
CORVALLIS ROCK CREEK TRANSMISSION MAIN
CORVALLIS INTERTIE (NOT IN USE)
FILL LINE TO FUTURE RESERVOIR
STARLIGHT VILLAGE SERVICE AREA
STARLIGHT VILLAGE PUMP STATION
11TH ST. WELL
CORVALLIS-NEWPORT HIGHWAY
MARY'S RIVER
WATER TREATMENT PLANT
MARY'S RIVER
NEABEACK HILL RESERVOIR 1.25 MG & DOMESTIC PUMP STATION
NEABEACK HILL FIRE PUMP STATION
NEABEACK HILL SERVICE AREA
VERIFY SCALE
DSN. CB
DRN. TMT
CKD. CB
DATE: March 04
NO. DATE DESCRIPTION BY
REVISIONS
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CITY OF PHILOMATH
2004 WATER MASTER PLAN
EXISTING WATER SYSTEM
FIGURE 4-1
JOB NUMBER 960.4140.0
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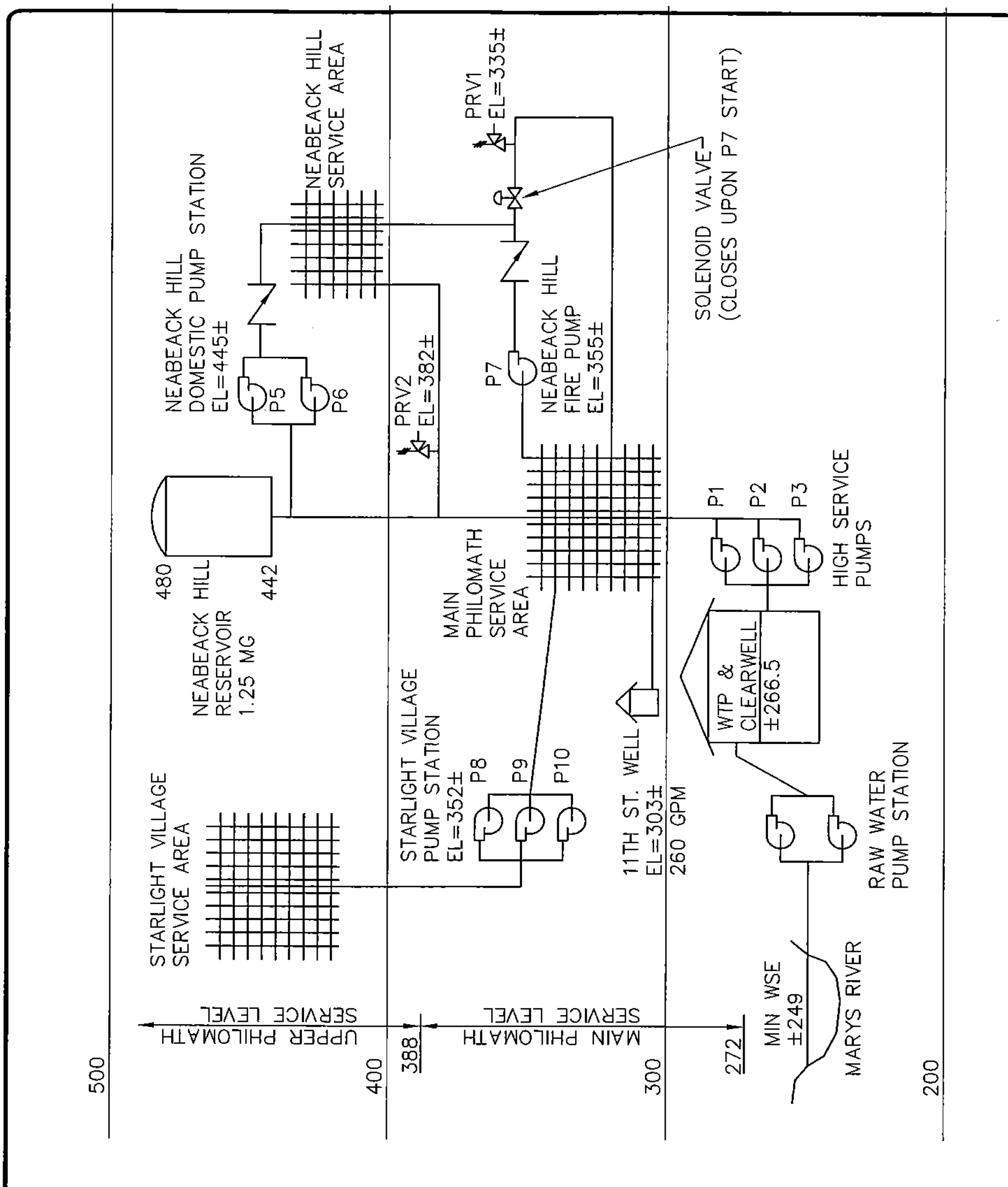

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SCALE	
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DATE.	March 2004

CITY OF PHILOMATH

2004 WATER MASTER PLAN

EXISTING WATER SYSTEM SCHEMATIC

FIGURE 4–2

JOB NUMBER 960.4140.0

4.2. Water Supply Sources

4.2.1 Current Water Rights

Currently the City's primary source of water is the Marys River. The City's presently owns four separate water rights to draw water from the river. Two of these are irrigation rights. A transfer application for these two irrigation rights is under review by the Oregon Water Resources Department. As part of the transfer application, the City is seeking to move the point of diversion to the water treatment plant and to change the usage category from irrigation to municipal. The City utilizes the 11th Street well as a back-up water source and holds two water rights for this source.

Table 4-1 is a summary of the City-owned water rights.

TABLE 4-1
WATER RIGHTS SUMMARY

Source Name	Permit Rate cfs (gpm)	Appl #	Perm #	Cert#	Priority Date
Marys River	1.00 (449)	N/A	S13556	TO5623	3/11/1939
Marys River (1)	1.00 (449)	T8527	NA	NA	12/8/1952
Marys River (1, 2)	0.19 (86)	T8527	NA	NA	11/5/1964
Marys River	3.5 (1571)	S68266	S49245	N/A	1/28/1985
11th Street Well	0.56 (250)	G7903	G8108	62441	3/9/1977
11th Street Well	0.22 (100)	G10613	G9728	N/A	12/15/1981

(1) An application has been submitted to the WRD to transfer the point of diversion to the Water Treatment plant and to change the use from irrigation to municipal.
(2) The City owns a portion of this right. The total withdrawal rate is 0.32 CFS.

4.2.2 Surface Water Supply

Most of the year there is sufficient water in the Marys River to supply all of the City's Water Demands. However, river flows in the late summer during dry years can become very low. There are many claims for river water for irrigation and other purposes. Together these claims are greater than the available water during some low flow periods. Further, the State of Oregon reserved a water right for 10 CFS with a priority date of June 22, 1964 to maintain flows for aquatic life. Nevertheless, minimum stream flows of less than 10 CFS have occurred once every five years on average. Therefore, although there is enough water available in the Marys River most of each year, during the critical low flow periods, usually occurring in August and September, there is sometimes little water in the river. As the lowest stream flows may coincide with the maximum demands for municipal water, the availability of adequate water during the low flow periods is imperative. To date, the City has been able to meet demands without limiting water use. However, as the population continues to grow, shortages may become more likely. The alternatives for addressing the potential shortages are discussed in **Section 6**.

4.2.2.1 Raw Surface Water Quality

The raw water quality of the Marys River is generally good. The only notable problem with the quality of Marys River water is its tendency to have high turbidity levels in response to large winter storms. During these periods, the City has historically stopped the production of water from the WTP and utilized the 11th Street well and stored water to meet demands. Based on discussions with the City, the plant is typically shut down for one to six days each year in response to high turbidity. This strategy is successful largely due to the short duration of the high turbidity events and the fact that demands are typically lowest during wet winter periods.

4.2.3 Groundwater Supply Sources

The City currently has two municipal wells, the 11th Street well and the 9th Street well. For many years, the 9th Street well served as a backup raw water source at the WTP, but has since been disconnected and is no longer in service. The 11th Street well currently serves as a back-up water supply source.

4.2.3.1 11th Street Well

The 11th Street well is utilized as a supplemental water supply source during periods of high demand or low WTP production. During large storm events, high turbidity in the Marys River can make treatment difficult. During these times, the City has used the 11th Street Well together with stored water to meet demands until the turbidity in the river drops to levels that are more easily treated.

The 11th Street Well discharges directly into the distribution system. The 11th Street well was drilled in 1977. The upper 77 feet of this well was drilled through terrace deposits, and from 77 to 267 feet the well penetrates basalt rock. A 12-inch casing extends from above the surface of the ground to the 80-foot depth, and is perforated at the 76-80 foot level. Static water levels were originally at 17 feet. The well was test pumped at 320 gpm for three days shortly after it was drilled. The well pump is a 50 horsepower pump. From 1977 to late 1983 the 11th Street well served as a primary water source for Philomath. Static water level problems were encountered in the early years of the well, and consequently the production rate was decreased. The City currently pumps the well at approximately 300 gpm on an intermittent basis with no problems. However, extended pumping for several months at this rate has caused excessive drawdown. As such, the firm capacity of the well is more appropriately taken as 260 gpm on a continuous basis. Nonetheless, the City has been able to pump the well at a rate of 500 gpm on an intermittent basis (i.e., one to two weeks) with no problems. Therefore, during periods when the WTP is unavailable, the City may increase production from this well on a short-term basis to provide water to the users.

4.2.3.2 11th Street Well Raw Water Quality

The quality of water from the 11th Street well is problematic. The well water is relatively hard and has iron concentrations near the EPA secondary water quality limits. When the well is pumped heavily for long periods of time, groundwater levels decreased, and the water quality worsens. The City now adds polyphosphates to sequester iron. Chlorine is also added to the well water to prevent contamination of the water in the distribution sytem. This treatment scheme is still in use.

4.2.4 Corvallis Intertie

The City's former intertie with the City of Corvallis' water system is no longer in use, but should be considered at a last-resort, emergency supply source. The intertie originally consisted of a below-grade concrete vault that housed isolation valves, a flow meter, and associated piping. The flow meter has been removed. As such, there is no physical connection between the two water systems. In addition, the City's 1.25 MG reservoir was constructed at a higher elevation than the pre-existing reservoir. Therefore, the pressure in the City's system is higher than the pressure in Corvallis' system. As such, water would no longer flow by gravity from the Corvallis system to the Philomath system if a physical connection existed. Therefore, it is physically impossible to convey water from the Corvallis system to the Philomath system at the present time. Furthermore, the agreement between the two City's has expired. Nonetheless, the existence of the intertie is worth noting. In the event that a prolonged water supply shortage were to occur, the City may wish to consider refurbishing the intertie to provide water to the City on a short-term, emergency, basis. For example, a chemical spill into the Marys River, could render the river water unusable for several weeks. Should such an event occur, the City would first need to obtain a new agreement with the City of Corvallis. Upon execution of a new agreement, the City would need to install a pump to pump water from the Corvallis water system into the Philomath system. This type of mechanical modification could be performed in a matter of days.

4.3. Water Treatment Facilities

4.3.1 Marys River Water Treatment Plant

The water treatment plant was constructed in 1985 as part of a large-scale water system improvement project. This was Philomath's first full-scale water treatment plant and was built to replace existing problem well sources and greatly reduce, if not eliminate, the cost of purchasing additional water from the City of Corvallis. Prior to the construction of the WTP, the City obtained a large portion of its water from Corvallis' Rock Creek facility. Water from the Rock Creek Watershed is conveyed to Corvallis by a 16-inch transmission main that runs through the City of Philomath. Water was withdrawn from this transmission main for use in Philomath. After the construction of the WTP, Rock Creek water was no longer needed.

The Water Treatment Plant is located on the north bank of the Marys River at the south end of 9th Street. The site consists of approximately 2.29 acres on a single tax lot. The river intake, intake pump station, and piping to the WTP are located in easements on the west side of the site.

Raw water is drawn directly from the Marys River and flows by gravity to the intake pump station. Water is pumped into the treatment plant where chemicals are applied before being discharged into one of two packaged treatment units. After passing through the packaged treatment units chlorine is injected and the treated water is discharged into a clearwell. Water is pumped from the clearwell into through a chlorine contact chamber and into the distribution system.

4.3.1.1 Plant Flow Capacities

The nominal capacity of the plant is 694 gpm (1 MGD). The plant was designed to operate at three different rates depending on demand. Those rates are 375 gpm (0.540 MGD), 750 gpm (0.855 MGD), and 1050 gpm (1.512 MGD). The plant was designed to automatically operate at each of the three production rates depending on the water system demand. As demand increased, the water level in the City's storage reservoir decreased and the plant would respond by increasing production. Currently, the high service pumps are started simultaneously rather than sequentially. In essence, the plant is either "on" or "off" and the production rate is more or less constant. The City has the ability to reprogram the control system to start the pumps sequentially as originally designed. However, the more straightforward operational scheme currently used is preferred. Operators have found that they can produce better quality finish water with fewer man-hours by starting the pumps simultaneously rather than sequentially. Sequentially starting the pumps requires varying the chemical feed rates. An automated control system was installed when the plant was constructed to vary the chemical feed rates in response to plant production rates. Plant operators found that keeping the control system in calibration was difficult, and they determined that starting the pumps simultaneously simplified operation and reduced the number of man-hours required to operate the plant.

Table 4-2 outlines some of the design parameters of the City's Water Treatment Plant followed by a brief discussion of the equipment at the WTP.

TABLE 4-2
WATER TREATMENT PLANT DATA

Date Constructed	1985
RAW WATER SUPPLY	
Supply Source	Marys River
Intake Structure	Johnson 16" Ø by 51" long stainless steel intake tee screen with a protective bar screen on the upstream side Open area = 63.8%, Slot opening = 0.125 in. Clean screen capacity = 1050 GPM at maximum through slot velocity of 0.5 ft/sec and pressure drop = 0.1 PSI.
Raw Water Pumps	Peabody Floway Multistage Vertical Turbine
• Number	3
• Size & Speed	20 hp, 3500 RPM
• Design Discharge Rate	375 gpm @ 70' head (each)
• Discharge Line	12" Ductile Iron
WATER TREATMENT PLANT	
Rated Capacity	1050 gpm (1.5 MGD)
Finished Floor Elevation	268.50'±
Raw water flow meter	6" turbo meter
Raw water turbidimeter	Hach, Surface Scatter 5
Static Mixer	Koflo model #12-40-2-6-5 inj.
Number of Clarifier/Filter Units	2 Microfloc Trident Units (TR 210)
Clarifier Area per Unit	35 ft^2
Filter Area per Unit	70 ft^2
Backwash	Filters are backwashed in response to headloss through the filter. Backwash rate is adjustable.
Clearwell volume	40,000 gallons
Effluent flow meter	Sparling 10" tube propeller meter
HIGH SERVICE (FINISHED WATER) BOOSTER PUMPS	
• Type	Peabody Floway Model 10 LMK 4-stage Vertical Turbine
• Number	3
• Size & Speed	40 hp, 1750 RPM
• Static Pressure (Storage Reservoir Full)	214 ft (92 psi)
• Design discharge rate	375 GPM @ 240 ft TDH

4.3.1.2 Intake Structure and Pump Station

The intake structure collects raw water from the Marys River through a screened intake. Water flows by gravity to the intake pump station wet well where it is pumped into the treatment facility. Three raw water pumps operate as system demand increases.

The screened intake is equipped with a 200 gallon air tank that stores air to clean the screen. The screen is cleaned by a blast of air to remove debris. A second emergency intake is provided if the screened intake or air cleaning system fails.

Three vertical turbine pumps provide raw water supply to the treatment plant. Two pumps operate in a "lead-lag" sequence with a third pump dedicated to supply high water demands. Each pump is equipped with isolation and check valves. A level switch in the intake structure protects the pumps from low water levels. Level switches in the clearwell also control the raw water pumps. As the water level in the clearwell lowers, the raw water pumps are sequentially turned on and as the water level rises, the pumps are sequentially turned off. The first two raw water pumps are in a "lead-lag" sequence and alternate in operation as the "first-on" raw water pump.

Based on discussions with the City, in recent years sediment is beginning to accumulate around the intake screen. To prevent clogging, City personnel must remove sediment from the area around the screen on an annual basis.

4.3.1.3 Chemical Feed Equipment

Five chemical feed systems are used at the plant:

1. Liquid Alum (Aluminum Sulfate)
2. Sodium Carbonate (Soda Ash)
3. Polyelectrolyte
4. Chlorine (Gas)
5. Fluorosilisic Acid

Each chemical feed system is equipped with an isolation valve, chemical injector, and calibration column. The calibration column is a graduated cylinder used to check the feed rate of each chemical feed pump. All chemicals are added to the raw water at a static mixer before the packaged treatment units. The static mixer is a baffled pipe section that induces turbulence as water flows through. The liquid alum feed system has one pump each, while the soda ash, polyelectrolyte, and fluorosilisic acid have two. Chlorine gas is injected into the water solution and is pumped to the treatment facility. The plant was originally designed to allow for the addition of activated carbon. However, this equipment was not used and has been removed.

4.3.1.4 Adsorption Clarifier/Filter

At the heart of the treatment plant are two large steel tanks, each containing an adsorption clarifier and mixed media filter. The chemically dosed raw water enters the units and flows upward through the adsorption clarifier. The clarifier contains a granular, buoyant media that provides rapid mixing, flocculation, and clarification in a single treatment step. Contact flocculation and clarification occur as the coagulated particles move through the adsorption media.

The effluent from the clarifier flows into a trough and to the mixed-media filters. The filters are composed of materials that are sized form coarse to fine in the direction of flow.

To clean the clarifier, diffused air from an air blower is injected into the bottom of the clarifier. The air reduces the adsorption media's buoyancy, causing an expansion and scouring of the adsorption media. Raw water continues to enter the clarifier and accumulated solids are flushed to waste. Since the majority of solids removal is done in the clarifier, this compartment is normally cleaned two or more times during a filter run.

The mixed media filter is backwashed by reversing the flow direction, expanding the media bed, and flushing solids to waste. A surface wash system is also provided to break-up any layer of accumulated solids on the surface of the media.

Both the clarifier and filter cleaning cycles are automatically controlled in response to flow through the units. The system includes a filter to waste line to waste the high turbidity filtered water spike common after backwash cycles.

4.3.1.5 Clearwell and High Service Pumps

The clearwell is located in the WTP building beneath the high service pump motors. It is approximately 40,000 gallons in total volume and has access through a hatch in the northeast corner of the building. The clearwell contains the level switches controlling the backwash and raw water pumps.

The high service pumps pump water from the clear well into the distribution system. When the original WTP was constructed, 20 hp pumps were installed. These were replaced with 40 hp pumps when the new storage reservoir was constructed. This was done because the new storage reservoir was constructed at a higher overflow elevation than the original reservoir. This changed the head conditions on the high service pumps rendering the 20 horsepower pumps insufficient. The high service pumps are controlled by the water level in the storage reservoir.

The clearwell contains enough water to backwash each filter once before refilling is necessary. However, if the backwash water volume is insufficient to complete one backwash, the level controls will not allow the filters to backwash until the clearwell is sufficiently full.

4.3.1.6 Backwash Waste Ponds

The backwash waste ponds, located just south of the treatment plant, are for settling solids from the backwash wastewater prior to discharging to the river. Each pond has an overflow and isolation valves so each pond can be used separately. The overflow from each pond is routed to an overflow box that has a V-notch weir. The weir allows a varying discharge as the pond rises, but also keeps the pond at a fairly constant level. The ponds are designed to be used for a few weeks at a time before sludge drying and removal is required.

4.3.1.7 Chlorine Contact Chamber

The Oregon Department of Human Resources Health Division – Drinking Water Section evaluated the Water Treatment Plant. The filtration equipment is credited with a 2.5-log Giardia removal credit for treatment thus requiring 0.5-log removal by disinfection. The required 0.5-log removal by disinfection is provided in a chlorine contact chamber downstream of the filter units. The contact chamber was designed to provide 55 minutes contact time at the maximum plant production rate of 1050 gpm. The chamber consists of 10 and 12 inch diameter pipe that provides approximately 7,525 gallons and 24" diameter pipe that provides approximately 52,590 gallons of contact volume. The piping is configured to allow for future expansion.

4.3.1.8 Raw Water Flow Measurement

Flow of raw water into the treatment plant is measured after the raw water pumps. The flow meter is a 6" turbine water meter. A second meter is installed on the backwash line from the filters to record the volume of water used in backwashing.

4.3.1.9 Finish Water Flow Measurement

Flow of finish water into the distribution system is measured after the high service pumps. The flow meter is a Sparling 10" in line turbine water meter.

4.3.1.10 Disinfection

Disinfection is achieved by chlorine injection either downstream of the raw water pumps or directly into the filter discharge piping. The chlorine injection rate is varied depending on the turbidity, with more chlorine used when the turbidity is higher. Typical rates of chlorine injection are near 1 ppm. Injection rates of 3-4 ppm may be used for short periods during heavy rains.

4.3.1.11 Auxiliary Power

The plant does not have auxiliary power.

4.3.1.12 Finished Water Quality

The finished water quality from the treatment plant is generally of good quality. As required by the OHD and under OAR 333-61-036, water from the City water system is tested periodically for bacteriological contamination, organic and inorganic chemical contaminants, disinfection byproducts, and a variety of radioactive compounds.

Based on conversations with City personnel there does not currently appear to be any known problems with water quality under normal conditions. To date, finish water has met all applicable treatment standards. The City has also been able to meet the Lead and Copper rules through pH control at the WTP.

4.3.2 11th Street Well Treatment Facilities

Water from the 11th Street well requires a modest amount of treatment. As previously described, polyphosphates are added to the well water to sequester iron and manganese and to control pipe corrosion. A gas chlorine system is used to disinfect the well water prior to being discharged to the distribution system.

4.4. Existing Distribution System

The major components of the water transmission and distribution system for the City are shown in **Figure 4-1**. Detailed water system maps are included in **Appendix A**. The current transmission system is a mixture of many different pipe materials and ages, with sizes primarily of 6" and 8". Some larger 12" and 16" transmission lines are also included. Water services on the City water system are metered, with the meters being read monthly by the City.

4.4.1 Distribution System Layout

The layout of the existing water system appears to be adequate to deliver the required domestic flowrates to the community. However, large portions of the system do not have the capacity to deliver required fire flows while maintaining the required 20 psi residual pressure at all service connections. This lack of capacity is the result of pipe sizes which are too small and the configuration of the distribution system.

Overall the valve and hydrant arrangement for the system appears to function satisfactorily for the City in most circumstances. The valve arrangement provides the ability to isolate most sections of pipe to a reasonably small area. The hydrants are well distributed around the system providing some level of coverage to nearly all parts of the developed areas. However, in a number of locations hydrant spacing exceeds the current standards calling for hydrants no more than 500 feet apart.

Although all public waterlines within the study area are owned by the City, three entities have jurisdiction over the right-of-ways within which the water mainlines are located. In addition to the City, the Oregon Department of Transportation (ODOT) has jurisdictional oversight for facilities constructed within the right-of-ways along Highway 20/34, while Benton County has jurisdictional oversight for facilities constructed within County right-of-ways. The County typically defers to the City for review of water distribution facilities in County right-of-ways within City Limits.

4.4.2 Service Levels and Pumping Facilities

Water must be supplied to the customers at sufficiently high pressures to prevent contamination and to ensure that water using appliances operate correctly. Excessive pressures must also be avoided to prevent damage to components of the distribution system and private plumbing fixtures. City standards require a range of 40 to 100 psi. Where higher pressures are necessary for an isolated area within a service level, individual pressure reducing valves (PRV) can be installed by the customer on the affected services. If more than a few water services are affected, the installation of a public PRV should be considered.

Due to the difference in elevation and location within the City, there are two pressure service levels that provide service for customers. The Main Philomath Service Level serves the vast majority of the City. Some portions of the City are too high in elevation to be served by the Main Philomath Service Level. These areas are in the Upper Service Level. Individual pump stations boost pressures in these areas. Each pump station serves only a portion of the upper service level. In this way the service area of each pump station further subdivides the upper service area. There are currently two pump stations serving different areas of the upper service level. These pump stations create the Neabeack Hill service area and the Starlight Village service area. The vertical boundary between the Main Philomath Service Level and the Upper Service Level is the 388 foot elevation.

Figure 4-2 is a schematic representation of the water system showing the relationship between the various service levels and the pump stations that provide water to the service levels. **Table 4-3** contains an overview of the basic design criteria for the City's existing pump stations. A brief discussion of the service levels and pumping facilities follows.

TABLE 4-3 EXISTING HIGH SERVICE PUMPING FACILITIES (Based on District Records)					
Pump Station Name (Service Level)	WTP (Main Philomath)	11th Street Well (Main Philomath)	Neabeack Hill Domestic (Neabeack Hill)	Neabeack Hill Fire (Neabeack Hill)	Starlight Village (Starlight Village)
Pump Location Pump Designation	WTP Pumps 1, 2, & 3	11th St. near Quail Glenn Drive Pump 4	Near Storage Reservoir Pump 5 & 6	Benton View Dr. Near Neabeack Hill Dr. Pump 7	Pioneer St. near Canberra Drive Pumps 8, 9, & 10
Flows (Current Capacity)	±375 gpm each ± 1000 gpm combined	±320 gpm	±50 gpm each	±2000 gpm	2 @ ± 150 gpm 1 @ 2000 gpm
Pumps ▸ Type ▸ Number ▸ Motor Size ▸ Motor Speed ▸ Power	▸ Vertical Turbine ▸ 3 ▸ 40 HP ▸ 1750 rpm ▸ 480V, 3ø	▸ Vertical Turb. ▸ 1 ▸ 50 HP ▸ 1760 rpm ▸ 480V, 3ø	▸ Centrifugal ▸ 2 ▸ 1.5 HP ▸ 3500 rpm ▸ 230V, 1ø	▸ Centrifugal ▸ 1 ▸ 75 HP ▸ 3570 rpm ▸ 480V, 3ø	▸ Centrifugal ▸ 3 ▸ 15 & 200 HP ▸ 15 HP VFD 3500 rpm (max) 200 HP 1750 rpm ▸ 480V, 3ø
Discharge Cond. ▸ Intake HGL ▸ Discharge Loc. ▸ Discharge El. ▸ Static Head	▸ ±266.50' ▸ Main Philomath Service Level ▸ ±213.5'	▸ ±260' ▸ Main Philomath Service Level ▸ ±220'	▸ ±445' ▸ Neabeack Hill Service level ▸ NA	▸ ±355' ▸ Neabeack Hill Service level ▸ NA	▸ ±352' ▸ Starlight Village Service level ▸ NA
Pump Control ▸ On ▸ Off	▸ Reservoir call ▸ Reservoir call ▸ Clearwell low	▸ Reservoir call ▸ Reservoir call	▸ Pressure switch ▸ Pressure switch	▸ Pressure switch ▸ Pressure switch	▸ Pressure switch ▸ Pressure switch
Flow Measurement	In-line Turbine Meter	In-line Turbine Meter	None	None	Pump hour meter readings
Telemetry	Leased Line from reservoir	Leased Line from reservoir	None	None	None
Auxiliary Power	None	None	None	None	None

4.4.2.1 Main Philomath Service Level/WTP High Service Pumps

The main Philomath Service Level encompasses the vast majority of the service area. Historically this was the only service level in the City. However, growth in the higher elevations atop Neabeack Hill and in the hills on the west side of town has required the creation of separate service levels served by pump stations.

The high service pumps at the WTP and the 11th Street well pump feed directly into the main Philomath Service Level. These facilities are described above in greater detail. The City's storage reservoir atop Neabeack Hill is connected to this service level and maintains the static pressure. The water level in the reservoir provides the on/off control for the high service pumps at the WTP and the 11th Street well pump.

4.4.2.2 Neabeack Hill service area/Neabeack Hill Pump Stations

The Neabeack Hill service area serves those homes on the top of Neabeack Hill which are above the Main Philomath Service Level. Water is fed into the service area by two pump stations. A small duplex pump station located near the reservoir provides water to meet the domestic demand only. This pump station is known at the Neabeack Hill Domestic Pump Station. Fire flows are provided by a second pump station known as the Neabeack Hill Fire Pump Station. This station is located near the intersection of Neabeack Hill Drive and Benton View Drive. There is no gravity storage tank in this service level. Therefore, the pump stations maintain the system pressure.

The Neabeack Hill Domestic Pump Station includes two 1.5 horsepower constant speed pumps. At least one pump runs at all times. The lag pump turns on when the pressure in the system drops below a set level. The Neabeack Hill Fire Pump Station includes a single 75 horsepower constant speed end suction centrifugal pump that turns on when the pressure in the system drops below a set level.

4.4.2.3 Starlight Village service Area/ Starlight Village Pump Station

The Starlight Village service area generally encompasses that portion of the Starlight Village development that is above the Main Philomath Service Level. This development is located in the northwest corner of town. The Starlight Village Pump Station located on Pioneer Street near the intersection of Canberra Drive feeds water into the service level. There is no gravity storage tank in this service level. Therefore, the pump station maintains the system pressure.

The Starlight Village Pump Station consists of two 15 horsepower vertical in-line centrifugal pumps that are started in a sequential manner as demand increase. A third 200 horsepower horizontal split case centrifugal pump provides fire flows. The two 15 horsepower pumps are controlled by a variable frequency drive that increases the pump speed to maintain system pressure. A constant speed motor drives the fire pump. If the system demand remains low for extended periods, all pumps will shut off. As the pressure drops, the first pump turns on. The variable frequency drive modulates the pump speed to maintain a constant pressure. If the first pump cannot maintain the system pressure at full speed the second pump starts. The speed of the second pump is then modulated to maintain system pressure. If the system pressure continues to drop the fire pump will start and the two domestic pumps will stop. The fire pump stops when the pressure in the system rises above a set pressure. Most of the pressure settings for the system are adjustable at an operator interface.

4.4.3 Distribution System Materials

4.4.3.1 Piping Materials

Most of the City's transmission and distribution piping is constructed of cast iron and ductile iron pipe and is in reasonably good condition. PVC piping serves some areas. Water system leakage is generally low.

It is generally desirable to use as few types of pipe within a water system as practical for the following reasons:

- Fewer types and sizes of repair bands, service saddles, and fittings need to be stocked.
- Fewer tools are required by maintenance personnel.

In July 1998 the City adopted public works design standards which are, in part, aimed at standardizing the type and size of piping materials being used in the expansion or rehabilitation of the distribution system. These new standards specify Class 52 ductile iron pipe conforming to AWWA C-151 as the material of choice for use in the water transmission and distribution system. **Table 4-4** gives a brief summary of the major requirements outlined in these standards, as well as current recommendations.

Many of the older components of the distribution system do not meet the current standards. In many cases the need to upgrade these portions of the distribution system is not critical enough to justify replacement. However, as extensions, repairs or alterations are made to these portions of the distribution system, it is advisable not only that the new components meet the standards, but that the portions of the distribution system which supply these components also be upgraded to conform with the standards.

TABLE 4-4 RECOMMENDED PIPING STANDARDS			
Component	Pipe Diameter	Pipe Material	Class
Transmission main and fire lines supplying more than 1500 gpm.	10-inch minimum	Ductile iron	Class 52 (AWWA-151)
Distribution:			
Private fire line serving single hydrant or building fire suppression system	6-inch minimum	Ductile iron	Class 52 (AWWA-151)
Dead end w/hydrant	8-inch minimum	Ductile iron	Class 52 (AWWA-151)
Looped runs	8-inch minimum	Ductile iron	Class 52 (AWWA-151)
Service Lines (public side of meter):			
Single Residential	1 inch minimum	Type K Seamless Copper	AWWA C-800, 160 psi
Triple Residential (triplexes only)	2 inch minimum	Type K Seamless Copper	AWWA C-800, 160 psi
Commercial/Industrial	1-inch min.	Type K Seamless Copper	AWWA C-800, 160 psi
Other services	Case by Case Basis	Case by Case Basis	Case by Case Basis

4.4.3.2 Fire Hydrants

Review of existing records indicate that the City has approximately 157 fire hydrants. While there are a variety of hydrants (e.g., Clow, Pacific States, Iowa, Waterous) in the system, the majority of the hydrants were manufactured by Pacific States and Clow. The Clow F-2500 with full size inlets was adopted in November 1998 as the City's standard hydrant.

Based on the City's Public Works Design Standards, the desired hydrant configuration is a three port hydrant with two 2½-inch ports and one 4-inch port (with pacific coast thread) fed from a 6-inch hydrant lead.

4.5. Storage Reservoir

The City presently has a single storage reservoir with a capacity of 1.25 million gallons. The reservoir is located atop Neabeack Hill as shown on the collection system maps. Water storage reservoirs provide at least five important functions as follows:

- They provide a reservoir of water to draw upon during short-term peak system consumption.
- They provide a reserve supply of water to meet fire demands.
- They allow water sources to be taken out of service for repairs or maintenance.

- They help in keeping system pressures reasonably constant.
- They add to system reliability generally.

The City's reservoir is a ground level, cylindrical, cast in place reinforced concrete structure. The inside diameter of the tank is 75 feet, and the walls are 39 feet tall. The overflow elevation is 480 feet and is set one foot below the top of the side walls. The tank is covered with a cast in place reinforced concrete roof that is supported by the tank walls and four interior columns. The reservoir is connected to the distribution system by a 16-inch diameter combination inlet/outlet. The reservoir has three floor penetrations; an inlet, an outlet, and an overflow. Check valves located in a valve vault outside of the reservoir control the flow of water into the inlet and out the outlet. The reservoir is drained by opening a valve that connects the overflow pipe and the outlet pipe. This valve is located in the valve vault. The overflow piping is equipped with an overflow sensor that detects the presence of water. The overflow/drain line discharges into a stormwater catch basin located near the intersection of Applegate and 31st Streets.

The reservoir has functioned as designed since construction. Over time, shrinkage cracks have opened causing visible leakage through the above grade tank walls. Periodically, the City has contracted to have the leaks sealed by pressure injecting grout. This work has successfully sealed existing leaks. However, as the tank continues to age new cracks are likely to develop. Therefore, sealing the leaks is likely to be an ongoing maintenance requirement. As part of the master planning effort, permanent solutions to eliminate the leakage problems were investigated. Recommendations are discussed in **Section 6.**

4.6. Telemetry

Telemetry refers to the monitoring and/or control of the system components from a remote location, such as a central control building. An analog signal produced by the instrumentation system components (e.g., pressure gage, flow meter, level transducer, etc.) is transmitted to a receiving station, where the signal is converted back to an instrument reading. Data transmitted to a central receiving station is more (and immediately) useful, as compared to data stored in a remote pumping station or reservoir. Telemetered alarms provide immediate warning of malfunctions and low water levels, reducing the time required to respond to emergency situations.

The Telemetry in the existing City water system is limited to the level control probe mounted in the 1.25 million gallon reservoir and connected via dedicated phone line to the WTP.

The telemetry in the tank controls the operation of the WTP and the 11th Street Well. When the tank water level reaches the low water setting, the WTP high service pumps are started and the reservoir fills. Should the water level in the tank continue to fall, the tank level will eventually reach the "on" setting for the 11th Street Well.

The current telemetry system will likely become outdated and or insufficient by the end of the planning period. Telemetry improvements are discussed in **Section 6.**

4.7. Description of Existing System Deficiencies

The major deficiencies in the City water system are related to storage capacity, and the ability to deliver fire flows. The Water Treatment plant is currently operating satisfactorily, but the required demands will soon exceed the production capacity of the plant.

In general, deficiencies fall into several categories. System elements may be experiencing one or more of these problems at the same time. These categories are provided to clarify concerns with particular elements of the system outlined in the following sections, and present typical solutions for each category of problem.

- Lack of Capacity. This type of problem results from sources, pipes, reservoirs or pumps which are too small to deliver the peak water demands. Many of the pipes installed are too small to deliver the required fire flows. Although the water system may have capacity to deliver the domestic flows, it is unable to convey the flows during major demand periods such as fire flows. In either case, the undersized portions of the existing system need to be addressed, either by increasing the size of the existing system or constructing new waterlines.

- End of Useful Life. This type of problem is the result of old, damaged, or worn out pipes, reservoirs or pump stations that no longer function as designed. The most common example of this type of problem includes leaking pipes, broken fire hydrants, or reservoirs which have reached the end of their design life. The correction of these type of problems requires replacement or reconstruction of the existing system.

- Lack of Facility. Problems in this category are caused by the absence of a component of the water system, either entirely of in a particular area. Examples include areas where there are no existing waterlines, lack of control systems or telemetry, etc.

- Lack of Maintenance. Many components of the water system require periodic maintenance to remain functional. Valves and fire hydrants, in particular, must be exercised on a regular basis (typically once/year at a minimum) to ensure that they remain in operational condition. This type of problem can be prevented or minimized by routine inspection, exercising and maintenance of the water system. At this time it does not appear that routine maintenance issues are involved in any of the deficiencies that have been noted.

Table 4-5 outlines the major known problem areas identified during the preparation of this report or as reported by Public Works, as well as the category which the problem falls under.

TABLE 4-5 KNOWN WATER SYSTEM PROBLEM AREAS	
Condition	Problem Category
Inadequate Storage	Lack of Capacity
Inadequate Fire Flows	Lack of Capacity (insufficient storage) Lack of Capacity (undersized mains) Lack of Facility (lines not looped)

The following is a brief discussion of some of the items outlined above.

4.7.1 Transmission & Distribution System Capacity

Although the City's water transmission and distribution system appears to be adequately sized to deliver the required municipal demands, the current water system is not able to deliver the recommended fire flows to many areas of town. Based on information included in the City's previous Water Master Plan, the long range plan for the distribution system included a reservoir on the west side of town and large diameter transition mains around both the north and south ends of town. Without these facilities, the system lacks the ability to deliver fire flows to the core area of town. These deficiencies are discussed in more detail in the analysis of the hydraulic capacity of the system presented in **Section 6**

Another shortcoming relates to service lines constructed during the 1970's and early 1980's. During that time the City installed a number of services using polybutylene pipe. Over the years, this material has shown a propensity for premature failure. As a result, the City has had to replace these service lines on a fairly regular basis. The City's existing maintenance budget has allowed for this work. Therefore, a large-scale polybutylene service replacement project will not be incorporated into the water system capital improvement plan.

4.7.2 Water Storage Facilities (Reservoirs)

It is important that adequate storage capacity be available to meet peaking demands while simultaneously providing the required fire flows. The current reservoir capacity of 1,250,000 gallons falls short of fulfilling these goals. The required system storage will be discussed in detail in **Section 6**.

4.8. Existing Water System Funding Mechanisms

Funding for the City's existing water system comes from two major sources, user fees and SDCs. Since SDCs can't be used to finance operation, maintenance and replacement costs of a water system, the O&M and repair costs must be financed from user fees.

The City's water fund must provide sufficient revenues to properly operate and maintain the water system and provide reserves for normally anticipated replacement of key system components such as pumps, motors, hydrants, waterlines, valves, etc. Although the City relies exclusively on water fees for operation and maintenance of the water system, the water fund can not typically finance major capital improvements without outside funding sources.

The existing monthly user rates are determined by adding a fixed base charge to a volume charge per unit of water consumed. The base charge and volume charge depend on the user classification and the meter size for commercial and industrial users. The specific rates are listed in **Table 4-5**. Assuming an average per capita consumption rate of 100 gallons per day and an average household size of 2.85 residents per household, the typical monthly user charge is approximately $33.14 for a single family residence.

TABLE 4-6
EXISTING WATER RATES

User Class	Base Charge	Volume Charge [1]
Residential and Duplex	$12.00	$1.85
Multi-Residential	$12.00 x # units x 50%	$1.60
Commercial/Industrial		
5/8" or 3/4" meter	$13.10	(2)
1" meter	$18.65	(2)
1 1/2" meter	$31.60	(2)
2" meter	$50.65	(2)
3" meter	$102.40	(2)

(1) 1 Volume Unit = 100 cubic feet = 748 gallons
(2) Commercial = $2.12, Industrial = $1.45