The final order states *"that on June 7, 2005, the City requested partial perfection of permit G-9890 and issuance of a water right certificate. The request was accompanied by the survey required under ORS 537.230(3). The survey showed, to the satisfaction of the Director, that the appropriation had been partially perfected in accordance with the provision of the Water Rights Act. ORS 537.260 allows, without loss of priority or cancellation to the permit, the incremental perfection of the water right permit in an amount of not less than 25 percent, pursuant to ORS 537.260 and OAR 690-320-0040, without loss of priority or cancellation of the permit.*

*The Department found that the City had perfected 0.56 cfs and that the quantity of water was equal or greater than the 25 percent of the original quantity of water allowed under permit G-9890. OAR 690-320-0040(5) allows municipal suppliers that incrementally perfect less than the full quantity of water to request further extension of time to complete construction and apply water to beneficial use for the remaining, unperfected quantity of water.*

*As of the date of the order, the City had not filed for an extension of time for permit G-9890. The City is now entitled to a certificate in the amount of 0.56 cfs. The Director had determined the permittee has complied with the requirements to partially perfect permit G-9890 pursuant to ORS 537.250 and 537.260. The Department found that there was 0.22 cfs remaining to be perfected and that a certificate in the amount of 0.56 cfs was issued to the City of Aurora."* A copy of this final order is attached in Appendix B.

The City appears to be in a favorable position with current water rights to meet current and near-future water demands. However it is recommended that the City continue in its efforts to obtain additional water rights, in addition to fully developing unused capacity on existing water rights, to meet future anticipated demands. More discussion on this is provided in Section 6.

## Pending Water Rights Processes

As can be seen from Table 2-3, the majority of the City's municipal water rights are in the midst of one regulatory process or another at OWRD. In 2005, steps were taken by the City to add an additional new well (Well No. 5) to the City's existing water rights for Wells No. 3 and 4. This will ultimately allow for maximum development of Wells No. 3 and 4's water rights and provide greater flexibility in how the City appropriates and delivers water.

According to OWRD final orders, on May 12, 2005, the City filed a water right transfer application (T-9927) for Well No. 3 to add two additional points of appropriation (Well No. 4 and Well No. 5) and change the place of use under Certificate 36316. In addition, the City also filed a water right transfer (T-9944) for Well No. 4 to add two additional points of appropriation (Well No. 3 and Well No. 5) and change the place of use under Certificate 81591.

The final transfer orders for each added the corresponding wells, which cancelled the wells existing water rights certificates. The deadline associated with adding and using Well No. 5 is shown to be October 1, 2010, with a requirement that a COBU prepared by a CWRE must be submitted before October 1, 2011. Once satisfactory proof of the completed changes is received and approved by OWRD, a new certificate confirming the rights transferred will be issued.

# Water Treatment Practices

The City provides chlorine disinfection of all its ground water sources as a barrier against microbial contamination. Sodium hypochlorite is supplied by local vendors and stored in a 200 gallon polyethylene tank located in a separate room at Well No. 3. Chemical deliveries are typically needed every 3 – 4 weeks during the summer months and approximately 4-5 weeks during the winter months. The disinfectant is injected into the well discharge piping by means of a small chemical feed pump. The City currently maintains a minimum target residual of 0.2 to 0.3 milligrams per liter (mg/L) within its distribution system. The City does not currently conduct any other water treatment practices.

# Supply Transmission Main

Wells No. 3 and 4 deliver groundwater directly to the storage tank by means of a 6-inch PVC supply main. Other than the wells, there are no services or laterals connected to this supply main. The discharge pipe from the new Well No. 5 has also been connected to this main. The length of supply main between Well No. 3 and Well No. 4 is approximately 300 feet. The length between Well No. 3 and the Well No. 5 connection point is approximately 900 feet. The length between the Well No. 5 connection point and the storage tank is approximately 1,350 feet. This results in a total length between Well No. 3 and the storage tank of approximately 2,250 feet. Between Well No. 5 and its connection point to the supply transmission main is approximately 1,000 feet, resulting in a total length between Well No. 5 and the storage tank of approximately 2,350 feet.

# Pressure Zones

Pressure zones are generally defined by ground topography and designated by overflow elevations of water storage facilities or discharge hydraulic grades of pressure reducing or booster pump stations serving the zone. With ground elevations between approximately 100 feet to 180 feet, the City of Aurora is able to operate on a single pressure zone with a closed pump system. Constant system pressure is maintained by the booster pump station with typical system pressures throughout the majority of the City ranging between approximately 50 psi and 70 psi.

# Storage Facilities

The City of Aurora currently has a single storage facility for finished water storage. The nominal 300,000 gallon above-ground, glass-fused bolted-steel storage tank was built shortly before the booster pump station in 1991.

Table 2 – 4 below provides a summary of the storage tank parameters.

| Table 2 – 4<br>Storage Tank Summary | | | | | | | |
|---|---|---|---|---|---|---|---|
| Year Built | Type | Inside Diameter (ft) | Wall Height (ft) | Nominal Capacity (gallons) | Calculated Capacity (gallons) | Approx. Capacity Used (gallons) | Approx. Overflow Height (ft) |
| 1991 | Glass-Fused Bolted-Steel | 41.9 | 28.4 | 300,000 | 294,000 | 240,000 | 27.5 |

The storage tank is located at the west end of Ottaway Road, adjacent to the booster pump station (see Figure 2-3 – Existing Water System). Prior to the construction of the booster pump station and storage tank, the City depended upon an elevated 25,000 gallon steel water tower. This tower is still standing, but is not being used due to its age. Figure 2–8 below shows both storage facilities and booster pump station.

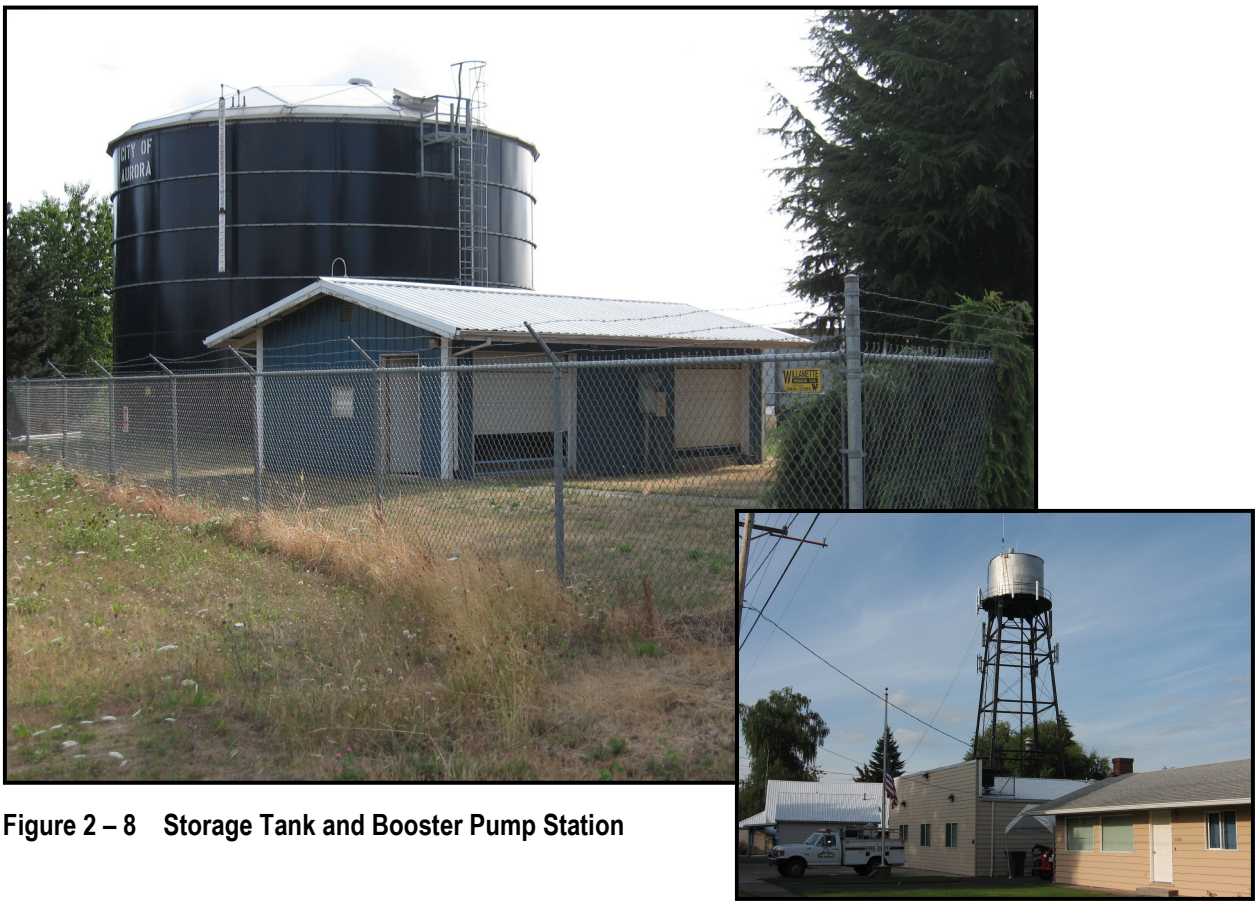



**Figure 2 – 8 Storage Tank and Booster Pump Station**

In general, the ground level storage tank has received very little maintenance since it was constructed, with the last interior inspection performed in 2004. The 6-inch diameter inlet is located approximately 90-degrees from the 10-inch outlet, which has worked well over the years to prevent stagnation and loss of chlorine residual. For security measures, this facility,

along with the booster pump station, is enclosed by a chain-link fence with a locked gate. Street lighting provides some lighting for the booster pump station and storage tank facilities.

Level monitoring for the storage tank is provided by means of a level transmitter, which is connected to the SCADA system. In addition, a liquid level indicator on the exterior of the tank, attached to an interior float, is also provided. In general, the storage tank level controls when to start and stop existing and future well pumps supplying water to the tank. Additional information on the storage tank level monitoring is subsequently shown under Instrumentation and Controls below.

## Pump Station

The City's water system pressures are currently maintained by the use of two small booster pumps and one large fire pump, which run and cycle as needed to meet the system demands. The entire distribution system is served by a single pressure zone with an average system pressure maintained at approximately 66 psi.

**Figure 2 – 9 Booster Pump Station**

The distribution system supply and pressure is generated from a single booster pump station constructed in 1992. The pump station is housed in a control building approximately 16 feet by 32 feet. The booster pump station uses three centrifugal pumps as summarized in Table 2-5.

**Table 2 – 5**
**Booster Pump Station Summary**

| Pump No. | Use | Motor | Design Capacity (gpm) | Pump Type |
|---|---|---|---|---|
| 1 | Lead/Lag | 15 hp 3600 rpm | 300 | Centrifugal |
| 2 | Lead/Lag | 15 hp 3600 rpm | 300 | Centrifugal |
| 3 | Fire | 60 hp 1800 rpm | 1,200 | Centrifugal |

The pumps are controlled by the SCADA system and come on at set points manually set by the operator, which are further described under the Instrumentation and Controls section below. The pumps are equipped with variable frequency drives (VFD), which adjusts the speed of the motors by modulating the power being delivered. VFDs typically offer many benefits to pumping systems including increased motor life, pressure control, and energy savings.

The supply pumps (Pumps No. 1 and 2) provide for normal system demands. However, should a fire or other high demand occur, the supply pumps shut-off and the fire pump is automatically activated. A copy of the existing pump station information is provided in Appendix C.

The booster pump station is also equipped with a 150 KW, 250 hp Cummins diesel engine backup generator (shown above) to operate the pumps should a power failure occur. However, it is recommended that in order to ensure its reliability that the City exercise and maintain this generator on a regular basis.

# Water Distribution System

An overview of the City's water distribution system is presented in Figure 2-3 – Existing Water System. The City's water distribution system is a combination of pipe sizes and materials. The backbone of the distribution system consists primarily of a 10-inch PVC main from the booster pump station east along Ottaway Road to Liberty Street, then north along Liberty Street to Highway 99E.

Gridding of the system in the downtown area is provided primarily by smaller 2-inch, 4-inch, and 6-inch pipes. Although these smaller pipes may be adequate for normal domestic water service, they are not capable of providing for adequate fire flows, nor do they provide for proper gridding of the system. Gridding in the more recent subdivisions are provided by 8-inch diameter mains, which are adequate for both domestic water service and residential fire flows.

Service lines typically consist of ¾ and 1-inch diameter pipe. The most prevalent pipe size within the distribution system consists of 6-inch diameter pipe. Isolation valving of the newer

portions of the distribution system appears to be adequate, while the existing downtown core area currently does not allow for proper isolation.

In addition to the varying diameter, the water distribution system is also composed of a variety of pipeline materials. The material that was used to construct water lines over the years depended primarily on the accepted and available materials of the time. Historically, in the 1940's and 1950s, cast iron and steel piping was commonly used. In the 1960's and 1970's, ductile iron and asbestos-cement piping was more commonly used. Today, ductile iron and polyvinyl chloride pipe materials are used almost exclusively in the construction of new water lines in the City. A summary of the distribution system piping is shown in Table 2-6 below.

**Table 2 – 6**
**Distribution System Pipe Summary**

| Pipe Diameter (in) | PVC (ft) | Ductile Iron (ft) | Asbestos Cement (ft) | Steel (ft) | Galvanized (ft) | Cast Iron (ft) | Total Estimated (ft) | % of Total |
|---|---|---|---|---|---|---|---|---|
| **Current System Piping** | | | | | | | | |
| 2 | 821 | | | | 2,638 | | **3,459** | 8% |
| 4 | 916 | | 1,307 | 896 | | | **3,119** | 7% |
| 6 | 12,524 | 75 | 3,165 | 2,189 | | 175 | **18,128** | 42% |
| 8 | 11,011 | 2,814 | | | | | **13,825** | 32% |
| 10 | 4,653 | | | | | | **4,653** | 11% |
| Total Est. | **29,925** | **2,889** | **4,472** | **3,085** | **2,638** | **175** | **43,184** | 100% |
| % of Total | 69% | 7% | 10% | 7% | 6% | 0% | 100% | - |
| **Abandoned System Piping** | | | | | | | | |
| 1-1/4 | | | | | 459 | | **459** | 7% |
| 2 | | | | | 1,674 | | **1,674** | 25% |
| 4 | | | 1,219 | 2,910 | | | **4,129** | 62% |
| 6 | | | | | | 356 | **356** | 5% |
| Total Est. | | | **1,219** | **2,910** | **2,133** | **356** | **6,618** | 100% |
| % of Total Abandoned | | | 18% | 44% | 32% | 5% | 100% | - |

The current distribution system piping consists of an estimated 8.2 miles of pipeline, from 2-inch to 10 inches in diameter. At the time of the 1996 water master plan, there was an estimated 4.2 miles of pipeline. The additional piping added to the system over the last 12 years consists mainly of 8-inch PVC grids where residential development has occurred and a 10-inch PVC

main down Liberty Street. Approximately 1.3 miles of existing pipeline within the system are shown to be abandoned.

The City is currently planning to construct a new 10-inch main to replace an old 2-inch steel pipe along Highway 99E from Bob's Avenue to Third Street, then along Third Street to Main Street. This replacement will greatly enhance flows along this Commercial and Low-Density Residential area. Continuation of this 10-inch main in the future is anticipated both along Highway 99E to Ottaway Road and along Third Street to Liberty Street to connect to existing 10-inch mains. Ultimately, this will provide much needed fire flows and gridding of the system.

# Fire Protection

## Fire District

The Aurora Rural Fire Protection District provides fire protection for properties within and around the City. The Fire District is a special service district within Marion County originally organized in 1948 by volunteer firefighters, but has grown to be a full-service fire and rescue agency comprised of career employees, volunteer firefighters, and explorer scouts who serve the District.

## Current Fire Protection Rating

The City's Public Protection Classification, or sometimes referred to as Fire Protection Rating, is a key factor that affects the cost of homeowner's insurance and the cost of operating fire departments. Fire Protection Ratings are issued by the Insurance Services Office, Inc (ISO). In general, ISO evaluates and measures the quality of the City's public fire protection system.

The City's current Fire Protection Rating, as established by ISO is a Class 5/9. The classification is on a scale of 1 to 10 and is based on the fire district, fire alarm system, and water supply system. The lowest value of 1 represents the highest quality fire protection system and the highest value of 10 represents a City that does not meet the minimum criteria having no organized fire district and no fire hydrants.

The City's Class 5 rating applies to properties in the City within 1,000 feet of a fire hydrant, 5 road miles of a fire station, and with a needed fire flow of 3,500 gpm or less. Class 9 applies to properties within 5 road miles of a fire station, but beyond 1,000 feet of a fire hydrant. Class 10 applies to properties beyond 5 road miles of a fire station. The private and public protection at properties with larger fire flows is individually evaluated and may vary from the Fire District classification. A copy of the ISO letter to the Fire District is provided in Appendix D.

Formerly, the City had a Class 7/9 rating primarily because prior to the most recent December 1996 rating, the City was using a rating that was established back in 1979. Since the 1979 evaluation, the City had undergone some major modifications and improvements to the water system. This included the addition of the storage tank and booster pump station in 1991-1992, as well as, increasing water line sizes in several areas.

## Improving the Fire Protection Rating

Communities with higher quality fire protection services have lower fire losses than communities whose fire protection services are not as comprehensive. According to the ISO website, the majority of communities within Oregon have Class 5 ratings followed closely by communities having a better Class 4 rating. There are no communities shown as having the highest quality Class 1 rating.

ISO evaluates small communities such as Aurora on a 15-year cycle and larger communities on a 10-year cycle. The City may request a reevaluation during that cycle if the City has made major improvements to its system.

A large portion of the City's classification is based on the water system capability with the needed fire flow and takes into account the worst case of the system's supply, main, and hydrant capacities. System capacities are evaluated based on an actual test at a single point in time and does not take into account components that are in the planning stage or are out of service for maintenance. As such, it is best not to evaluate a system when a major system component is out of service.

A city with a less than perfect rating should review the weakest component if it desires to improve its rating. For example, if the needed fire flow at a location is 1,200 gpm and the existing supply, main, and hydrant capacities were tested at 2,000, 800, and 1,500 gpm, respectively, the city should evaluate improvements to the water main if it wants to improve its rating. If all three tested higher than the needed fire flow, then any water system improvements that were made would not affect the insurance ratings.

The City's classification is also based on if the water supply and fire district are of similar quality. The City can loose points if the water supply is substantially better than the fire district, or vice versa.

# Instrumentation and Controls

In 2005, the City completed installation of a new Supervisory Control and Data Acquisition (SCADA) system located in the booster pump station control building. This system is used to control and monitor the wells, storage tank, booster pumps, and other components of the water system. The SCADA system records flows, pressures, elevations, and other information that is useful in controlling daily operations, making comparisons, and preparing system plans.

Unfortunately, it wasn't until during the preparation of this master plan that it was found that the new SCADA system was not properly tracking and recording some of the more important water system data. The City just recently corrected the reporting issues and the SCADA system is now tracking and recording the necessary water system information.

Well operation is automatically controlled at the central control station. Each well is set to turn on or off based on water levels in the storage tank. High and low tank water level set-points controlling the wells are selected by the operator and vary, depending on the expected demand conditions. Typical storage tank water level settings used are presented in Table 2-7 below.

| Table 2 – 7<br>Storage Tank Settings for Well Operations | | | |
|---|---|---|---|
| High Level Set-point (feet above ground) | Pump Stop Level (feet above ground) | Pump Start Level (feet above ground) | Low Level Set-point (feet above ground) |
| 27.5 | 23 | 17 | 12 |

For the supply pumps, the selection of the lead and lag pump is controlled by the operator. The selected pump runs continuously at variable speed to maintain the system pressure at a set-point controlled by the operator, currently set at 66 psi. The current flow range for the supply pumps individually is approximately 0-280 gpm and together approximately 0-500 gpm.

If the lead pump cannot maintain the set-point pressure due to a demand greater than the capacity of the lead pump, the lag pump starts and operates in parallel. This is determined by a low pressure set-point, currently set at 58 psi. The lag pump stops when the demand drops back to within the capacity of one pump. This is determined by a flow rate that is less than the capacity of one pump, currently set at 220 gpm.

The fire pump starts when the system demand exceeds the capacity of the supply pumps, currently set at 500 gpm. A condition of low pressure, currently set at 55 psi, initiates the start of the fire pump. The fire pump will remain on until the system demand is back within the capacity of the supply pumps for at least 15 minutes. This is determined by a set point and flow rate less than 480 gpm. The adjustable time delay of 15 minutes prevents stopping the fire pump under temporary conditions of low flow to prevent cycling of the pump. If the fire pump fails for any reason, the supply pumps will operate continuously and an alarm is initiated and transmitted over the alarm dialer system to notify the operator.

System flows are monitored by a Dynasonics Series TFXL ultrasonic flow meter installed on the pump station discharge pipe. The ultrasonic flow meter utilizes two transducers that function as both ultrasonic transmitters and receivers. The transducers are clamped on the outside of the pipe at a specific distance depending on pipe diameter and liquid characteristics. The flow rates, along with system pressures are used in sequencing the pumps.

# Water Meters

There are approximately 415 water meters throughout the water system. Approximately 360 of these meters are residential 5/8-inch – 3/4-inch meters. Most of the remaining meters are 1-inch, 1 ½ -inch, and 2-inch meters which serve commercial, industrial, and public facilities.

# Water Rates

The City's water rates are defined by the current resolution shown in Appendix E. The City currently bills its customers once every other month for the total amount of water used. A typical residential home has a 3/4-inch meter with the standard unit of measure being in cubic feet (1 cubic foot = 7.48 gallons). The monthly charge by water meter size is shown in Table 2-8. As can be seen, the City's current water rate fee structure is uniform for all classes of users.

Monthly services outside the City limits are billed at double the normal rates shown, while bulk water is sold under a City issued permit at a rate of $0.03 per cubic foot.

**Table 2 – 8**
**Monthly Domestic Water User Rates**

| Size of Service | Minimum Charge | Residential (Single Family & Multifamily) | Commercial Industrial |
|---|---|---|---|
| 5/8" – 3/4" | $9.00 | $.03 per cubic foot | $.03 per cubic foot |
| 1" | $11.50 | $.03 per cubic foot | $.03 per cubic foot |
| 1 ½" | $11.50 | $.03 per cubic foot | $.03 per cubic foot |
| 2" | $23.00 | $.03 per cubic foot | $.03 per cubic foot |

# Existing Standards and Codes

The City has several standards and codes that are important for the long-term operation of the water system. The City has Water System Design and Construction Standards originally developed by Public Works that govern the installation of pipelines, fire hydrants, and other system components by developers and others who build portions of the public water system.

There have been many changes since development of the standards; therefore, it is recommended that the City undergo a process to review and update these water system standards accordingly. These water standards, as well as all the other divisions of public works, are currently supplemented by Marion County, followed by the Oregon Department of Transportation/American Public Works Association (ODOT/APWA) standards.

The City also maintains ordinances and resolutions which describe such items as water rates, water shut-off procedures, and cross connection control requirements. A copy of the most recent resolution establishing the City's water rates, impact fees, finance charges, installation charges, and connection fees is shown in Appendix E.

SECTION 3

# Planning Considerations

## Objective

The objective of this section is to discuss the planning and study area, planning period, current land use, and population estimates for the City of Aurora. Population forecasts were developed using previous City planning reports, current land use designations, regional information, and discussions with City staff.

## Study Area

The City of Aurora is a small community located in a National Historic District along State Highway 99E, approximately 26 miles northeast of Salem, 8 miles north of Woodburn, and 13 miles southwest of Oregon City. The City is situated at the northern end of Marion County in the Mid-Willamette Valley. Most of Aurora is situated on a ridge between two rivers and lies just south of the confluence of Mill Creek and the Pudding River.

The study area for this master plan includes the area that lies within the City Limits and within the City of Aurora's Urban Growth Boundary (UGB). A review of existing land use and population growth trends indicates that the City's UGB may approach complete build-out shortly after the planning period. Complete build-out, also referred to as complete infill or saturation development, occurs when all existing developable land within the study area has been developed.

Recognizing this, the City is currently studying expansion possibilities. However, the areas currently within the UGB are the City's highest priority planning areas at this time. As the City finalizes its planning efforts, the demands and assumptions presented in this master plan should be reviewed and updated if needed.

## Planning Period

As described in Section 1, the Oregon Administrative Rules for Public Water Systems has established planning criteria which requires master plans to evaluate the needs of the water system for at least a 20-year period. Therefore, the City's water system will be planned for 20 or more years, ending in year 2030. A 20-year period is short enough for current users to benefit from system improvements, yet long enough to provide reserve capacity for future growth and increased demand.

# Land Use

Existing land uses within the study area generally include residential, commercial, industrial, and flood hazard areas. The majority of the City is zoned Low-Density Residential. A small section zoned Moderate-Density Residential is located adjacent to Highway 99E, southeast of the intersection of Ottaway Rd and Highway 99E. The City's Commercial zoning occurs along Highway 99E. The area west of this and adjacent to the Southern Pacific Railroad is the City's Industrial zoning.

Existing zoning designations for the study area are shown in Figure 3-1 at the end of this Section, which are based on the City's Comprehensive Plan, current Marion County Assessor Tax Maps, and City planning figures prepared by the Mid-Willamette Council of Government, the current City Planners. Overall, zoning for the City is expected to stay relatively the same.

# Population Estimates

Population estimates were developed using information from the 1996 WSMP, 2001 City's Comprehensive Plan update, U.S. Census Bureau, Portland State University Population Research Center (PRC), 2005 Public Works door-to-door survey, and other City planning reports. The information presented below summarizes both the historical population and projected populations.

## Historical Population

Historically, the City has experienced two periods of rapid growth. In the 1970's to the 1980's, the City experienced a 7.1 percent increase per year. Much of this period's increase was attributed to a common growth experienced statewide, as well as, the result of a major annexation to the City in 1973. The lagging economy experienced nationwide in the 1980's drastically slowed down the City's growth.

In the 90's the City's growth slightly increased, but was constrained due to the lack of a public sewer system, which impacted the minimum lot sizes needed to accommodate septic tank sewer systems. Even with the addition of a public sewer system in 2001, the City's growth rate remained constant, according to figures published by the PRC.

With the development of numerous partitions and large subdivisions in 2004 and 2005, the City experienced an incredible increase in growth, substantially more than the City had ever experienced. The PRC estimated the 2005 population to be approximately 785 residents. To the disbelief of the City's Public Works Department, they conducted an actual door-to-door survey to accurately determine the City's population. It was found that approximately 870 people resided in the City, which was 85 more residents than estimated by the PRC.

The City's growth slowed down between 2005 and 2008, but still experienced an increase in growth with an estimated current 2008 population of approximately 975 people. Table 3 –1 shows a summary of the City's historical and current populations. A copy of the PRC information and the 2000 Census by the U.S. Census Bureau is shown in Appendix F.

| Table 3 – 1<br>Historical and Current Population Summary | | | | |
|---|---|---|---|---|
| Year | Source | Population | Change | Change/Year |
| 1940 | 2001 Comprehensive Plan | 228 | - | - |
| 1950 | 2001 Comprehensive Plan | 242 | 6.1% | 0.6% |
| 1960 | 2001 Comprehensive Plan | 274 | 13.2% | 1.3% |
| 1970 | 2001 Comprehensive Plan | 306 | 11.2% | 1.2% |
| 1980 | 2001 Comprehensive Plan | 523 | 70.9% | 7.1% |
| 1990 | U.S. Census Bureau | 567 | 8.4% | 0.8% |
| 2000 | U.S. Census Bureau | 655 | 15.5% | 1.6% |
| 2001 | PSU Population Research Center | 660 | 0.8% | 0.8% |
| 2002 | PSU Population Research Center | 660 | 0% | 0% |
| 2003 | PSU Population Research Center | 660 | 0% | 0% |
| 2004 | PSU Population Research Center | 660 | 0% | 0% |
| 2005 | Public Works Door-Door Survey | 870 | 31.8% | 31.8% |
| 2006 | PSU Population Research Center | 920 | 5.7% | 5.7% |
| 2007 | PSU Population Research Center | 955 | 3.8% | 3.8% |
| 2008 | Public Works (Estimated) | 975 | 2.1% | 2.1% |

## Population Projections

As confirmed by the Public Works 2005 survey, the population had increased by 215 people since the 2000 census (655 people), which was a 32.8 percent population increase over the 5 years. The average growth rate experienced was 6.6 percent per year. The rate of population growth was higher in the last two to three years than it was in the beginning. The average growth rate experienced from 2005 to 2008 is approximately 4 percent.

With an estimated current population of 975, and by assuming a growth rate of the City at the previously noted rate of 6.6 percent per year, the population of Aurora in the year 2028 would be approximately 3,500 people. Due to the growth limitations within the current City limits, this growth rate is highly unlikely and would not be possible without major infrastructure upgrades to the City for both the water and wastewater systems.

Through a review of the various past studies and reports prepared on behalf of the City of Aurora, the previously projected growth rates are further summarized as follows.

- A growth rate of approximately 3 percent per year (15 percent over 5 year blocks) - 1996 Water System Master Plan.
- A growth rate of 2.43 percent per year - 1996 Wastewater Facilities Plan.
- A growth rate of 2.8 percent per year - 2001 Comprehensive Plan.

With the recent population growth rates being tempered by the fact that the City has a relatively new wastewater treatment plant resulting in some recent major developments, a review of adjacent Cities growth rates within the County was performed to better define an average growth rate anticipated within the area.

The overall growth rate for Marion County from the years 2000 to 2007 was approximately 1.3 percent per year, based on figures from Population Research Center. Similarly, adjacent cities within the County which have established utility infrastructure such as Gervais, Hubbard, Mt. Angel, and Donald, have experienced growth rates at 1.7 percent, 3.4 percent, 2.8, and 8.2 percent per year, respectively. The City of Aurora is shown as having the second highest growth rate experienced in the County at 6.3 percent between these years.

In general, it is anticipated that Aurora will continue to experience a high growth rate within the next five years until complete infill within approved lots occurs (dependant on the economy and the demand for housing). After this, it is anticipated that the growth rate will decline based on the need for voter approved annexations and major infrastructure upgrades. During the course of development of this WSMP, the City formally adopted an average annual growth rate of 2.8 percent per year to be used for all their current and near-future master planning documents. This growth rate follows the projections used in the City of Aurora's 2001 Comprehensive Plan.

Growth rate refers to the change in population over a unit time period, and is often expressed as a percentage of the number of individuals in the population at the beginning of that period. The estimated population growth rate is one of the most critical factors used in projecting future water demands. As a result, if the City experiences a higher growth rate over the planning period than projected in this WSMP, then the population at a given year will be higher than projected and the recommended growth related improvements will need to be made sooner than expected. With a slower growth rate, the population at a given year will be lower and the growth related improvements will need to be made later than expected.

Table 3-2 below presents the population projections in five year increments throughout the planning period at an average growth rate of 2.8 percent.

| Table 3 – 2<br>Population Projections | | |
|---|---|---|
| Year | Population Estimate | Additional Residents |
| 2008 | 975 | - |
| 2010 | 1,030 | 55 |
| 2015 | 1,183 | 153 |
| 2020 | 1,358 | 175 |
| 2025 | 1,559 | 201 |
| 2030 | 1,790 | 231 |

## Build-out of Approved Lots

In 2007, there was a population of approximately 955 residents and as further discussed in Section 4, there were approximately 356 residential service connections. This results in an average number of people per household of approximately 2.68 people. A cursory review of existing residential lots within the City limits that are not physically constrained and have the potential to be developed, as well as developed lots in Keil Park that are currently vacant, indicates that there are approximately 65 – 70 additional residential lots. With a current population of 975, this equates to a total population of approximately 1,163 residents.

A Public Works Capacity Report performed in 2005 by EAS Engineering estimated the City population to be approximately 1,214 in 2008, which took into account build-out of all existing approved lots, normal infill, and other factors. However, the build-out of these lots has not yet occurred. At the projected growth rate and a total estimated build-out population of approximately 1,163 residents noted above, build-out is anticipated to occur within the year 2015.

## Build-out of Current UGB

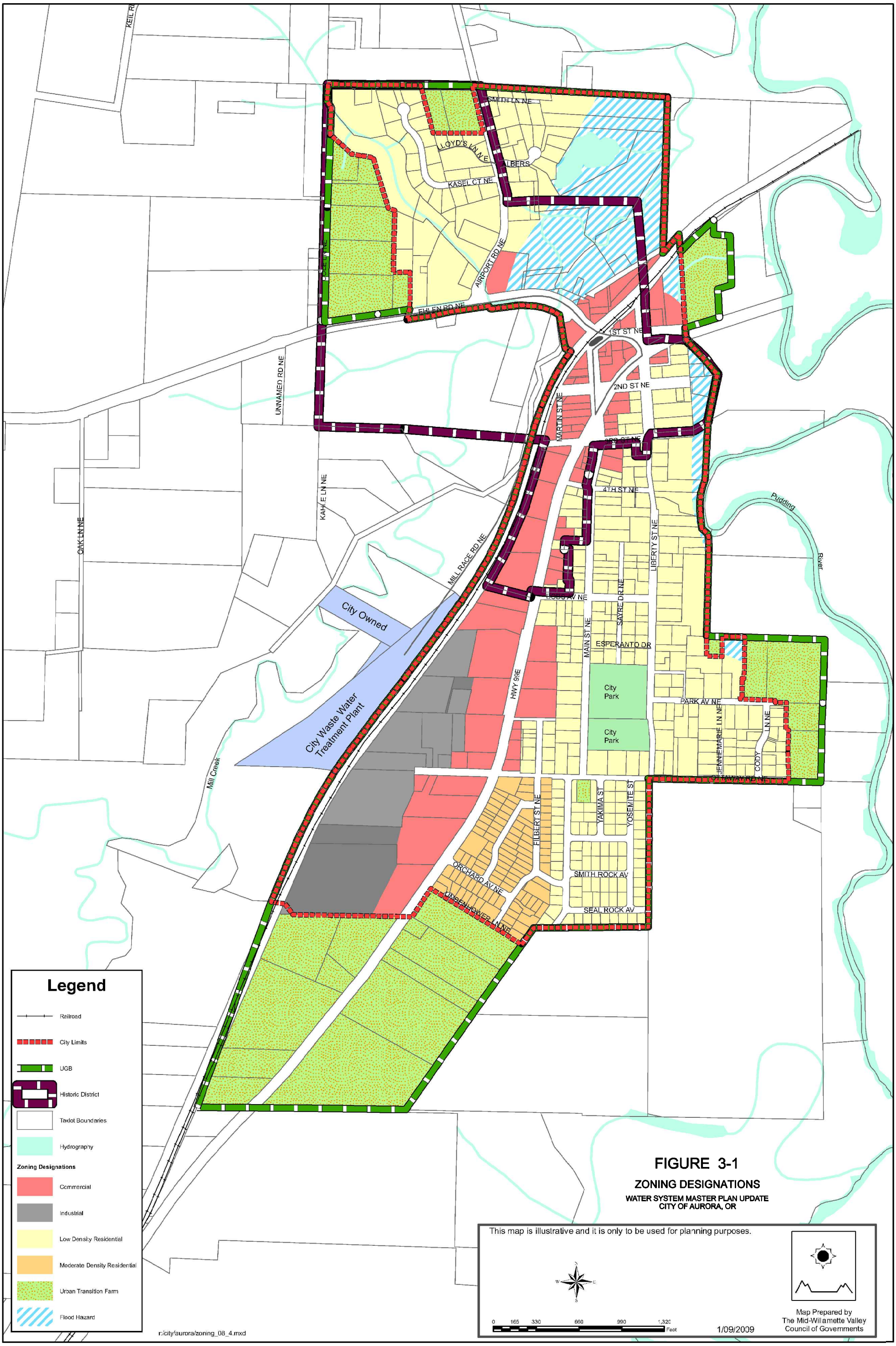
A review of available lands outside the City limits, but within the current UGB was performed. Assuming future zoning will follow the current zoning trend for these areas, the results indicate that there are approximately 15 acres to be zoned low-density residential along Ehlen Road and approximately 35 acres to be zoned moderate-density residential along Highway 99E. Table 3-3 presents the maximum number of lots that can be developed on this vacant land in accordance with the Aurora Municipal Code.

| Table 3 – 3<br>Vacant Land within UGB Potential Zoned Residential | | | |
|---|---|---|---|
| Zoning | Approximate Vacant Acres | Maximum [1] Zoning Density | Maximum Potential Lots |
| Low Density Residential | 15 | 5.8 | 87 |
| Moderate Density Residential | 35 | 8.7 | 305 |

[1] Per Chapter 16.10 and Chapter 16.12 of the Aurora Municipal Code.

From Table 3-3, there are approximately 392 additional lots that may potentially be developed as residential along these areas within the current UGB at the maximum zoning density. Assuming 2.68 people per household, this represents approximately 1,050 additional residents. With a current population of 975, an additional 188 residents from build-out of the City limits, this equates to a total population of 2,213 residents. With a 20 percent reduction in maximum zoning density, there would be approximately 838 additional residents and a total population of approximately 2,001. Build-out of the current UGB is anticipated to occur after the planning period of this Water System Master Plan.

# City of Aurora Zoning Designations



ASHLEY
ENGINEERING DESIGN

# SECTION 4

## Water Use and Projected Demands

SECTION 4

# Water Use and Projected Demands

## Objective

The objective of this section is to present historical and existing water demands, water consumption, and projected water demands based on population projections presented in Section 3. Projected water demand requirements will be used to establish water system component adequacy and sizing needs.

## Definitions of Terms

Discussions on water use and projected demands in this section will refer to various terms relating to water use. Many of these terms are defined as follows:

### Demand (Production)

Demand is total water use; consumption plus system losses. Water demand is generally expressed in gallons per minute (gpm), gallons per day (gpd), or million gallons per day (mgd). Demands can be divided by the population, which results in a demand per person (per capita). This is typically expressed in gallons per capita per day (gpcd). Per capita demands can be multiplied by population projections to determine future water demands.

Water demand varies seasonally with the lowest usage in winter months and the highest usage during summer months. Variations in water demand also occur with respect to time of day (diurnal) with higher usage occurring during the early morning and evening periods and lowest usage during night-time hours. Demand is usually measured at the water supply sources or system's master flow meter and consumption is measured at the customers' water meters.

When discussing daily or annual water use, the terms demand and production are synonymously used in this plan. Both refer to all the water that is being supplied from the groundwater wells to the storage tank, then to the distribution system.

### Consumption (Metered Use)

The water actually delivered to the customers through metered service connections (residential, commercial, industrial, and City/Public). Consumption is less than the total demand with the difference being system loss.

### System Loss

The unaccounted-for water (unmetered use, leaks, meter inaccuracies). It is the difference between demand and consumption. All systems have an amount of leakage or loss that cannot

be economically reduced or eliminated. However, system loss is not necessarily the same as leakage. The unaccounted-for water may be the result of leaks, meter inaccuracies, or other consumption tracking errors and unmetered uses such as fire fighting, hydrant flushing, park irrigation, system maintenance, etc.

### Average Annual Demand (AAD)

The total volume of water delivered to the system in a full year (total annual water production), expressed in gallons.

### Average Day Demand (ADD)

The total volume of water delivered to the system over a period of one year, divided by 365 days. This results in an average use in a single day, expressed in gallons per day (gpd).

### Maximum Monthly Demand (MMD)

The largest volume of water delivered in a single month during a calendar year, expressed in gallons per day (gpd). The highest monthly usage typically occurs during a summer month.

### Maximum Day Demand (MDD)

The largest volume of water delivered to the system in a single calendar day (24 hours), expressed in gallons per day (gpd). The MDD is commonly used to size facilities to provide capacity for periods of high demand. The MDD usually occurs during the warmest part of the year when lawn irrigation and recreational uses of potable water are at their greatest. This day is commonly associated with summer holidays, such as July 4$^{th}$, or during City events.

MDD is especially important for well production, as the wells must be capable of meeting the MDD. If the MDD exceeds the combined supply capacity on any given day, storage levels will decline. Consecutive days at or near MDD would result in a water shortage.

### Peak Hour Demand (PHD)

The largest volume of water delivered to the system in a single hour, expressed in gallons per day (gpd). Distribution systems should be designed at minimum to adequately handle the peak hour 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.

# Existing Water Demands

The existing and current water demand for the City of Aurora can primarily be considered residential, with minor proportions being used for commercial and industrial consumption. The overall water use by commercial and industrial users is steadily declining.

## Existing Water Use

All water currently used by the City is provided by groundwater Wells No. 3 and 4, each supplied with individual flow meters for tracking flow. In addition to being integrated with the

City's SCADA system, the total water produced from the wells is continually recorded by City staff. The monthly flows are then summarized and sent to the Oregon Water Resources Department on the required annual water use report forms. Table 4-1 provides a summary of the City's monthly and annual water production based on the information from the annual water use reports.

**Table 4 – 1**
**Water Production Summary**

| Year | 2001 – 2002 | 2002 – 2003 | 2003 – 2004 | 2004 – 2005 | 2005 – 2006 | 2006 – 2007 |
|---|---|---|---|---|---|---|
| **Population** | **660** | **660** | **660** | **870** | **920** | **955** |
| October | 2,030,980 | 1,983,837 | 1,711,206 | 2,156,937 | 2,425,089 | 2,648,606 |
| November | 1,704,410 | 1,606,194 | 1,657,144 | 1,862,273 | 1,529,613 | 1,976,520 |
| December | 1,664,417 | 1,739,006 | 1,567,437 | 2,047,712 | 823,017 | 1,522,798 |
| January | 1,650,751 | 1,596,470 | 1,726,162 | 2,718,262 | 1,975,866 | 2,302,348 |
| February | 631,820 | 1,474,486 | 1,701,260 | 1,945,805 | 1,680,022 | 3,859,587 |
| March | 1,820,779 | 1,958,895 | 1,789,922 | 2,034,201 | 2,091,249 | 3,664,421 |
| April | 1,856,758 | 1,784,288 | 2,075,371 | 2,161,157 | 1,934,748 | 3,484,897 |
| May | 2,249,638 | 2,253,838 | 2,454,371 | 2,101,808 | 3,035,020 | 4,606,486 |
| June | 3,041,304 | 3,620,512 | 3,198,387 | 2,325,727 | 3,517,952 | 4,233,097 |
| July | 3,910,401 | 4,853,108 | 5,007,275 | 5,927,892 | 5,647,617 | 5,007,587 |
| August | 4,344,719 | 4,173,555 | 4,063,837 | 4,524,726 | 5,041,230 | 5,728,971 |
| September | 2,941,927 | 2,907,894 | 2,213,590 | 3,240,130 | 3,661,410 | 3,507,888 |
| **Total (gal)** | **27,848,564** | **29,952,743** | **29,166,622** | **33,047,500** | **33,363,753** | **42,544,161** |
| Average Day Demand[(1)] (gpd) | 76,300 | 82,100 | 79,900 | 90,500 | 91,400 | 116,600 |
| ADD Per Capita (gpcd) | 116 | 124 | 121 | 104 | 99 | 122 |

(1) Rounded figures.

As shown in Table 4-1, there has been a steady increase over the years in the total amount of water that was produced by the City to accommodate the population growth. A summary of the City of Aurora's historical average day demands (ADD) is shown in Figure 4-1 below. The information presented is based on the 1996 WSMP in addition to the current data from Table 4-1. To summarize, the 1996 WSMP showed an approximate range of ADD between 71,000 gpd to 82,000 gpd from the years 1990 to 1995. Current calculations show that the City's ADD has increased substantially, with the 2006-2007 information showing an ADD of approximately 116,600 gpd.

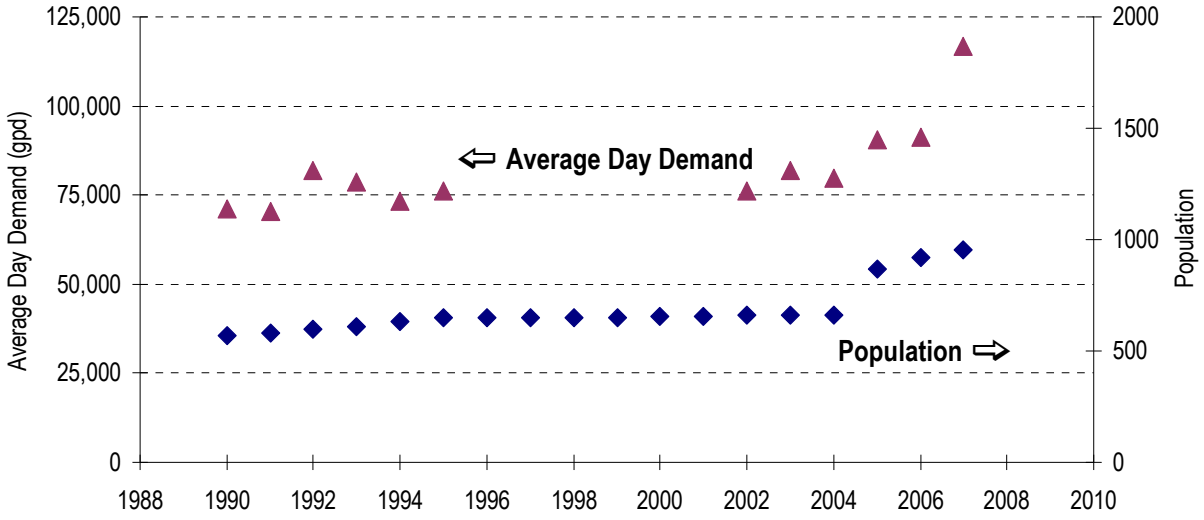



**Figure 4 – 1 Historical Average Day Demand Summary**

## Existing Water Consumption

Existing water consumption information was provided by the City and was based on previous utility billing information. The City of Aurora tracks customer use according to two main categories; single family residential and commercial. Figure 4-2 presents monthly consumption per billing cycle (every two months) from October 2005 through October 2007.

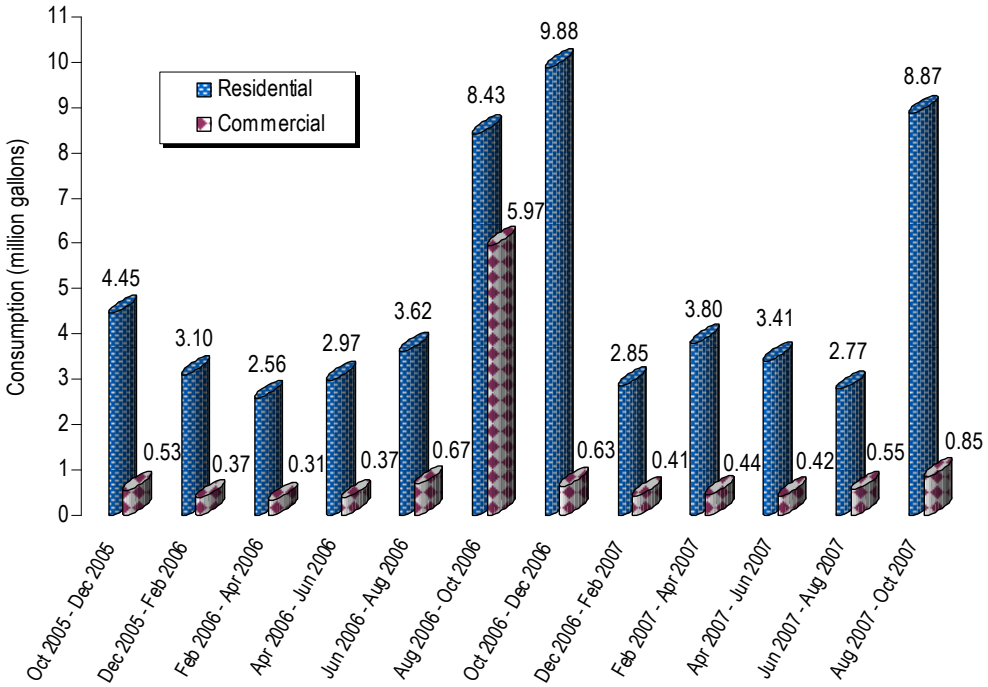



**Figure 4 – 2 Water Consumption by Customer Category**

Due to limitations of the City's current utility billing software, water consumption reports and summaries could not easily be generated. All existing water consumption data was calculated by hand through the efforts of City staff. Not only is this very time consuming for the City, but this method of tracking and analyzing water consumption data can be rather difficult to accurately perform on a continual basis. It is recommended that the City review and update their current utility billing software to at minimum include system summarizing and reporting capabilities by account type. Having readily available consumption data and reporting capabilities is not only important for customers, but is especially important when analyzing and performing water system planning.

## Unaccounted-for Water

Water consumption information allows for determination of the amount of actual water consumed by the users and provides measurement of unaccounted-for water when compared with production information. Total water consumption information provided was based on consumption records for the years 2005 to 2007. Utilizing this information, Table 4-2 shows a comparison between the total water produced to the total amount of water consumed.

**Table 4 – 2**
**Water Produced versus Water Consumed**

| Year | 2005-2006 | | 2006-2007 | |
|---|---|---|---|---|
| | (gallons) | (million gallons) | (gallons) | (million gallons) |
| Water Produced | 33,363,753 | 33.36 | 42,544,161 | 42.54 |
| Water Consumed | 30,395,100 | 30.40 | 37,142,331 | 37.14 |
| % Water Loss | 9% | | 13% | |

The percentage of unaccounted-for water in the system is the total production minus the metered consumption, divided by the total production. Figure 4-3 below graphically shows the system loss information for the years 2005 to 2007.

The average amount of unaccounted-for water in the City over the years has varied. The 1996 water master plan indicated that the percentage of unaccounted-for water within the City was reported as 13 percent in 1992, 27 percent in 1993, 8 percent in 1994, and 23 percent in 1995. Based on the most recent production and consumption information, the average system loss is approximately 11 percent. As previously mentioned, potential sources for system losses include the following:

- System leakage.
- Inaccuracies of water meters.
- Inaccuracies in calculating total meter consumption.
- Unauthorized water use or connections without meters.
- Unmetered water for fire-fighting, City park irrigation, public car washing, and public works operations such as street cleaning, water main flushing, and fire hydrant testing.
- Other approved, but unmetered water uses (construction water main testing, water trucks, etc.).

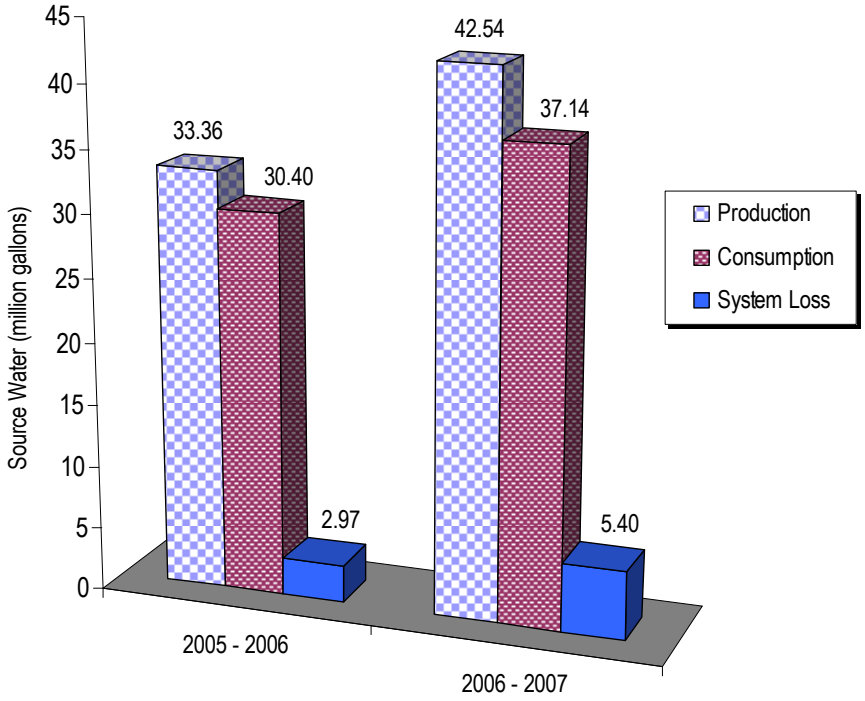



**Figure 4 – 3 Unaccounted-for Water (System Loss)**

As described in Section 7 regarding Water Conservation and Management Plans, OAR 690-86 states that all water systems should work to establish a system-wide leak repair program or line replacement to reduce system leakage to 15 percent, and if the reduction of system leakage to 15 percent is found to be feasible and appropriate, to reduce system leakage to 10 percent.

Reductions in system losses can result in reduced operation and maintenance expenses, increased revenues for the City, and improved water system performance. Therefore, it is recommended that the City make every effort to establish a system-wide leak repair program in order to minimize system losses. Reducing system losses will need to be emphasized by the City as they prepare their Water Management and Conservation Plan.

## Equivalent Dwelling Units

For water service, one equivalent dwelling unit (EDU) is the amount of water an average single family residence uses. Typically, EDUs are used by regulatory and funding agencies for comparing costs with other communities. Since the City of Aurora's water system consists of residential, commercial, and industrial users, the most common method of calculating an EDU is to evaluate each connection on the basis of water consumption relative to a typical residential account.

Residential consumption is determined by subtracting commercial and industrial users from the total water consumption information. The average water consumption per EDU is then calculated by dividing the residential consumption by the total number of residential service connections within the City. The total number of EDUs is then determined by dividing the total water consumption information by the average water consumption per EDU.

For Aurora, the following account categories were used to calculate the EDUs for the City.

- Residential (single family, mobile homes, multi-family, etc.).
- Commercial/Industrial (post office, bank, stores, restaurants, etc.)

The estimated number of EDUs based on the total water consumed is summarized in Table 4-3

**Table 4 – 3**
**Calculated EDUs based on Water Consumed**

| Category | Average Number of Connections | Estimated Water Consumed (gpy) | EDUs based on Consumption | % of Usage |
|---|---|---|---|---|
| 2005-2006 Average EDU Consumption = 70,600 gallons per year (gpy) | | | | |
| Residential | 345 | 24,358,656 | 345 | 80% |
| Commercial / Industrial | 52 | 6,036,444 | 86 | 20% |
| **Total** | **397** | **30,395,100** | **431** | **100%** |
| 2006-2007 Average EDU Consumption = 88,900 gallons per year (gpy) | | | | |
| Residential | 356 | 31,661,137 | 356 | 85% |
| Commercial / Industrial | 55 | 5,481,193 | 62 | 15% |
| **Total** | **411** | **37,142,331** | **418** | **100%** |

As can be seen from the percent of usage, the water consumption of commercial and industrial users has been declining, while residential consumption has been increasing. Commercial and Industrial users accounted for approximately 20 percent of all water consumed within the City in the year 2005-2006, but only accounted for approximately 15 percent in year 2006-2007.

The average EDU consumption of 88,900 gpy presented in Table 4-3 for 2006-2007 is based on average water consumed. This consumption does not include any of the unaccounted-for water previously identified. When planning for design of water systems, all water produced from the source needs to be analyzed and considered as total water consumption.

Table 4-4 below presents the estimated average water consumed in 2006-2007 per category, if taking into account the previous identified system loss for this reporting period. As can be seen, the average water consumed including system losses for a typical single family residence is estimated to be approximately 101,900 gpy. This equates to approximately 279 gallons of water consumed per day per residential meter. A typical Commercial / Industrial consumption rate per meter for the City is approximately 313 gallons per day.

| Table 4 – 4<br>Estimated Average Water Use per Meter with System Losses | | | | | | |
|---|---|---|---|---|---|---|
| Category | Average Number of Service Meters | Estimated Water Consumed (gpy) | Estimated System Loss per Category (gpy) | Estimated Total with System Losses (gpy) | Gallons per year (gpy) per Meter | Gallons per day (gpd) per Meter |
| Residential | 356 | 31,661,137 | 4,604,668 | 36,265,805 | 101,870 | 279 |
| Commercial / Industrial | 55 | 5,481,193 | 797,163 | 6,278,356 | 114,152 | 313 |
| **Total** | **411** | **37,142,331** | **5,401,830** | **42,544,161** | **103,514** | **284** |

The average number of people per EDU can be calculated based on the total number of residents divided by the total number of residential service connections. The average number of people per household per year is shown in Table 4-5.

| Table 4 – 5<br>Average Number of People per EDU | | | |
|---|---|---|---|
| Year | Population | Number of Residential Service Connections (EDUs) | Average Number of People per Household |
| 2006 | 920 | 345 | 2.67 |
| 2007 | 955 | 356 | 2.68 |

With the average number of people per household from Table 4-5, the total estimated number of residential EDUs can be calculated from the projected population. From Table 4-3 for 2005-2006, there were 431 total EDUs with only 345 being residential. For 2006-2007 there were 418 total EDUs with only 356 residential. Combined, this averages a ratio of approximately 1.21 times the estimated number of residential EDUs to account for Commercial/Industrial water users. The total estimated EDUs for the projected population is shown in Table 4-6.

| Table 4 – 6<br>EDU Projections based on Water Consumed | | | | |
|---|---|---|---|---|
| Year | Population Estimate | Estimated Number of Residential EDUs (2.68 people per EDU) | EDU Ratio to account for Commercial / Industrial Users | Total Number of EDUs based on Consumption |
| 2008 | 975 | 364 | 1.21 | 440 |
| 2010 | 1,030 | 384 | 1.21 | 465 |
| 2015 | 1,183 | 441 | 1.21 | 534 |
| 2020 | 1,358 | 507 | 1.21 | 613 |
| 2025 | 1,559 | 582 | 1.21 | 704 |
| 2030 | 1,790 | 668 | 1.21 | 808 |

## Per Capita Demands

With the addition of the new water SCADA system in 2005, the City has been able to analyze the periods of peak demands. Based on the limited water system data that was obtainable from the SCADA system, the maximum day demand in 2006 occurred on 7/24/2006. This resulted in an average day to maximum day demand peaking factor of approximately 2.6. In 2007, the maximum day demand occurred on 8/9/2007, which resulted in a peaking factor of 2.35.

The City also experiences peak hour demand factors of approximately 2 to 3 times the maximum day demand. Periods of peak hour use varies with typical highs occurring in the summer months between the hours of 5 and 7 am in the morning and between 6 to 9 pm in the evening.

The average day demand per capita for the entire system can be determined by averaging the total annual production volume over the year and then applying it to the entire service area population. This represents a system-wide water demand; therefore, the demand includes all residential, commercial, and industrial use. Table 4-7 summarizes the 2005 – 2007 average and maximum day demands per capita.

**Table 4 – 7**
**Average and Maximum Day Demands, 2005-2007**

| Year | Population | Total Annual Production (gallons) | ADD (gpd) | ADD Per Capita (gpcd) | ADD:MDD Peaking Factor | MDD Per Capita (gpcd) |
|---|---|---|---|---|---|---|
| 2005 – 2006 | 920 | 33,363,753 | 91,400 | 99 | 2.60 | 257 |
| 2006 – 2007 | 955 | 42,544,161 | 116,600 | 122 | 2.35 | 287 |

From the most recent data, the average day demand per capita use has varied over the last few years, but appears to be within the 100 to 125 gpcd range, as shown in Table 4-1. Also, recent SCADA information has shown that the system's maximum day demand ranges from 2.35 to 2.6 times the average day demands. These two numbers averaged results in an average day to maximum day demand peaking factor of approximately 2.5. However, with greater emphasis being placed on conservation, it is reasonable to assume that future maximum day demands are likely to decrease. This should be emphasized by the City as they prepare their Water Management and Conservation Plan.

For the purposes of projecting future demands in this master plan, the estimated average day, maximum day, and peak hour demands per capita will be based on the following:

- ADD per capita = 120 gpcd
  - *ADD to MDD peaking factor = 2.4*
- MDD per capita = 288 gpcd
  - *MDD to PHD peaking factor = 2.5*
- PHD per capita = 720 gpcd

# Projected Water Demands

Future water demands are projected in order to analyze and evaluate the capability of the existing system to accommodate anticipated demands and to present information necessary to size system improvements and new facilities. These estimated projections are based on previous records of water produced, water consumed, estimated system peaking factors, and projected population estimates.

The estimated population growth rate is one of the most critical factors used in projecting future water demands. Another major factor is the role of water conservation measures on future water consumption. When completed, the City's new Water Management and Conservation Plan may result in overall water savings, resulting in a decline of both water produced and consumed.

Projected water demands along with the population growth estimates from Section 3 are shown in Table 4-8.

**Table 4 – 8**
**Projected Water Demands**

| Year | Population Estimate | Projected Water Demands[1] | | |
|---|---|---|---|---|
| | | Average Day Demand (gpd) *(based on 120 gpcd)* | Maximum Day Demand (gpd) *(based on 288 gpcd)* | Peak Hour Demand (gpd) *(based on 720 gpcd)* |
| 2008 | 975 | 117,000 | 280,800 | 702,000 |
| 2010 | 1,030 | 123,600 | 296,600 | 741,600 |
| **2015**[2] | 1,183 | 142,000 | 340,700 | 851,800 |
| 2020 | 1,358 | 163,000 | 391,100 | 977,800 |
| 2025 | 1,559 | 187,100 | 449,000 | 1,122,500 |
| 2030 | 1,790 | 214,800 | 515,500 | 1,288,800 |

[1] Rounded figures.
[2] Approximate build-out year within current City Limits.

These projected water demands along with City historical values are presented in Figure 4-4 below.

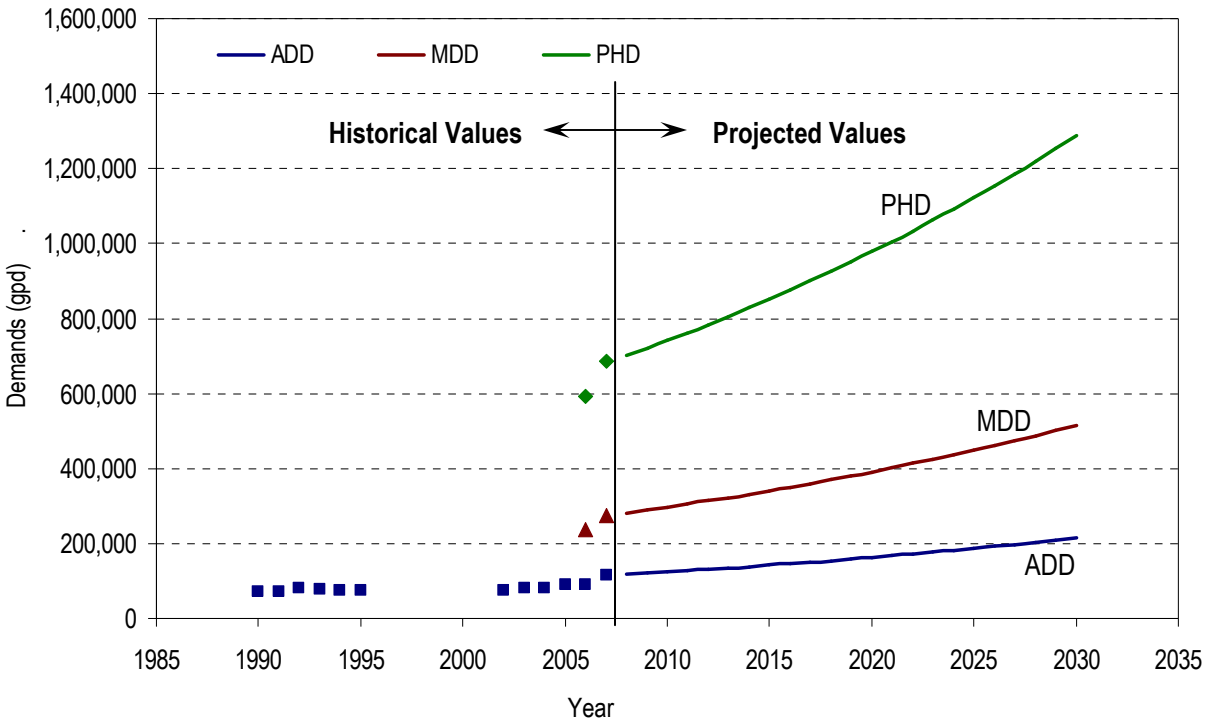



**Figure 4 – 4 Projected and Historical Water Demands**

SECTION 5

# Water System Design Criteria

## Objective

The objective of this section is to present the water system design criteria used for the analysis of the City's water system. The minimum design criteria addressed in this section will include water supply and treatment, storage volume, pump station capacities, and distribution system capacities. Establishing water system design and operating criteria is important for the City to assure standardization and consistency of the water system as improvements are made.

## General

A City's water system typically is comprised of various elements including groundwater wells and other water sources, treatment plants, pumping facilities, storage facilities, transmission lines, and distribution systems. As a whole, these various elements must be designed so that in combination they will optimize the water system and at minimum, provide for the demand conditions at service pressures established, at any given time, in all parts of the system. The water demand conditions used to design the various parts of the water system consist of the average daily demand (ADD), the maximum daily demand (MDD), and the peak hour demand (PHD). These demands for the City were previously discussed in Section 4.

Much of the system design criteria and performance guidelines provided in this section are summarized from recommendations provided in American Water Works Association (AWWA) acceptable practice guidelines, National Drinking Water Clearinghouse (NDWC) information, Insurance Services Office, Inc. (ISO) guidelines, various State guidelines and requirements including the Oregon Department of Human Services (DHS) and Washington Department of Health (DOH), and standard engineering practices.

In addition to the more general criteria discussed below, Table 5-3 at the end of this section summarizes the key elements of the water system design and operating criteria recommendations. The criteria presents design requirements, general guidance for evaluating design of water system improvements, and criteria relating to general maintenance of existing facilities. The recommended design and operating criteria presented in this master plan are not to replace specific State or Federal regulations for the design of public water systems, but should be used to supplement them in the more general areas not specifically identified or discussed. It is recommended that the City continue to evaluate, develop, and finalize appropriate water system criteria as the City updates their water system design and construction standards.

## State Regulations and Criteria

As further discussed in Section 7, under the Oregon Drinking Water Quality Act, the Department of Human Services (DHS) has broad authority over public water systems to set

water quality standards necessary to protect public health through insuring safe drinking water within a public water system. In general, the State's rules govern the quality of water and not the manner in which it is distributed.

DHS has set design and construction criteria for public water systems, which can be found in the Oregon Administrative Rules (OAR) Chapter 333, Division 61-0050, Construction Standards (OAR 333-061-0050), and is included in Appendix G for reference by City Staff. The standards apply to the construction of new public water systems and to major additions or modifications to existing public water systems and are intended to assure that the system facilities, when constructed, will be free of public health hazards and will be capable of producing water which consistently complies with the maximum contaminant levels.

The standards set both design and construction criteria for such items as groundwater, surface water and groundwater under direct surface water influence source facilities, water treatment facilities (other than disinfection), facilities for continuous disinfection, finished water storage, pumping facilities, distribution systems, crossings-sanitary sewers and water lines, and disinfection of facilities.

## Reliability Considerations

Enhancing the reliability of the system under all conditions is an important part of maintaining high quality water service. AWWA presents general guidelines to address reliability concerns of a water supply system. In generally, the reliability of a water system depends on the reliability of all the system components comprised within that system. Multiple water sources in combination with appropriately sized storage facilities are especially important during emergency situations. Pump stations containing multiple pumps of sufficient capacity to meet the required demands with the largest pump out of service is also important. Having auxiliary power capabilities are also necessary where adequate gravity storage is not provided.

Reliability and water quality can also be improved by designing a looped water distribution system and avoiding dead-end distribution mains, whenever possible. Having a pipe network comprised of looped pipeline configurations substantially reduces the potential for stagnant water and the associated problems of poor taste and low chlorine residuals. In addition, proper valve placement is necessary to permit small isolated areas of the system to be shut down for repairs while the majority of the system is still in operation. Through a combination of all of these system design features, overall system reliability can be achieved.

## Source and Treatment

Water supply sources and treatment systems must be able to reliably provide sufficient water to meet maximum day demands, based on the source's firm capacity. Firm capacity is defined as the total source's maximum production capacity with the largest source (or well) out of service. This standard engineering practice minimizes risks associated with planning a system that has insufficient capacity within the various system components. In addition, the supply source should also be able to replenish fire storage within 72 hours during maximum day demands.

If water supply sources are not able to meet or exceed maximum day demands, storage capacities will severely be diminished. This will leave the City rather vulnerable during fire events and emergency situations by not having adequate multiple day storage. If water supply sources are not able to meet or exceed peak hour demands, then equalization storage (defined below) must be provided to meet diurnal demands.

# Storage Facilities

The Washington DOH has developed general guidelines and requirements for the sizing of water storage facilities. In general, the storage facility must meet minimum operational, equalization, emergency, and fire suppression storage requirements. The minimum volume required is determined by the number of sources and their capacity, average day and peak hourly demands, local fire suppression requirements, and the manner in which reliability requirements (including back-up power) are achieved.

Proper water storage system designs must evaluate each of the following components of a storage system in order to determine the effective volume of storage available to the water system:

- Operational Storage (OS), if any;
- Equalization Storage (ES);
- Emergency Standby Storage (ESB);
- Fire Suppression Storage (FSS); and
- Dead Storage (DS), if any.

A brief discussion on each of these typical storage components and how they apply to storage facilities for the City of Aurora is provided below. Specific storage volume recommendations for the City of Aurora are presented in Section 6.

## Operational Storage (OS)

Operational storage often becomes combined and/or sometimes confused with equalization storage. Operational storage is the volume of the tank devoted to supplying the water system while, under normal operating conditions, the source(s) of supply are in "off" status. This volume will vary according to two main factors:

1. The sensitivity of the water level sensors controlling the source pumps; and
2. The configuration of the tank designed to provide the volume required to prevent excessive cycling (starting and stopping) of the pump motor(s).

The definition specifies that OS is an additive quantity to the other components of storage. This provides an additional factor of safety to the ES, ESB, and FSS components if the tank is full when that component of storage would be needed. However, operational storage does not apply to non-gravity storage systems operating with booster pump stations, as would be the case for the City of Aurora. Storage systems such as this are often referred to as pumped storage.

## Equalization Storage (ES)

Equalization storage (ES) is required when the supply source pump capacity becomes less than the peak system demands. ES volume should be sufficient to meet normal system demands in excess of maximum day demands (MDD) and is generally considered as the difference between peak hour demand (PHD) and MDD (based on a 24-hour duration). In other words, ES is the volume of water available to meet peak system demands, when demands exceed the capacity of the supply source. ES must be provided as a part of the total storage for the system.

Equalization storage is replenished during off-peak hours when the demand is lower than the source production rate. The volume of ES depends upon several factors, including peak diurnal variations in system demand, source production capacity, and the mode of operation (either continuous pumping for a selected period of time or by "call-on-demand" through use of tank level control switches). Maximum daily demand rates determine the required volume, compared to the average daily demand (ADD) and source capacity. In general, an equalization storage volume equal to 25 percent of the MDD is considered appropriate (.25 x MDD).

Figure 5 – 1 below illustrates the hourly variation in daily water use (diurnal variation) that occurs in a typical residential community. Equalization storage is needed during the higher peak demands so that water production facilities can operate at a relatively constant rate.

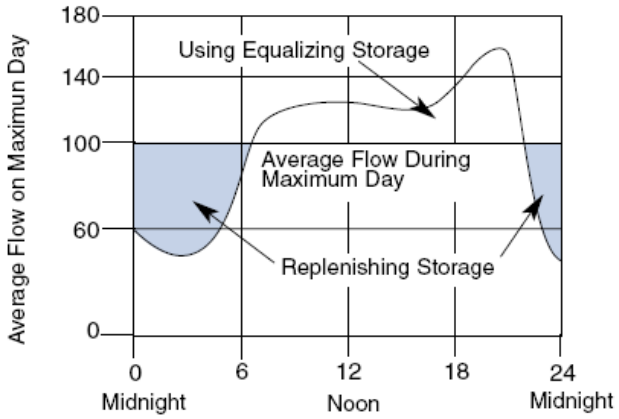



**Figure 5 – 1 Typical Diurnal Curve for a Small Residential Community**
Source: NDWC, Tech Brief: Tanks, Towers, and Tanks.

## Emergency Standby Storage (ESB)

Emergency standby storage is often provided to supply water from storage during emergencies such as pipeline failures, equipment failures, power outages, or natural disasters. The amount of emergency storage provided can be highly variable depending upon an assessment of risk and the desired degree of system reliability.

Provisions for emergency storage systems vary from none to a volume that would supply a maximum day's flow or higher. Factors that are considered in determining ESB are water systems with single vs. multiple source of supply, historical records of water allocated during emergencies, and the amount of time required to make facility repairs or to arrange for an alternative water supply.

With multiple sources and with all the groundwater wells located reasonably close to the storage tank, the City has good source reliability. However, Well No. 4 is currently the only well equipped with an outside backup power connection capability. If a power failure were to occur, the City has a portable 75 KW generator available to connect to this well. In addition, all the sources are connected to a common supply main. Failure of this main severs the source's ability to supply the storage tank during an emergency, therefore reducing the overall system's reliability.

With the backup generator for Well No. 4, combined with a 150 KW standby generator at the booster pump station, the City can operate for a reasonable amount of time during emergencies, given the storage tank can be supplied with water and pipes have not failed.

Typically, the recommended ESB volume for systems served by a single source of supply or with source reliability concerns can be upwards of two times the system's average day demand (ADD) to one times the system's maximum day demand. With multiple sources of supply, the recommended volume depends on many variables including; the sum of all installed and continuously available source of supply capacities; the largest capacity source available to the system; and the time that remaining sources are pumped on the day when the largest source is not available.

ESB must be provided as a part of the total storage for the system and must be available at minimum 20 psi to all service connections. The City's ability to serve the community during an emergency hinges upon Well No. 4's ability to be operated by backup generator, the supply main's ability to convey the source water to the tank, and the ability of the booster pump station to be operated by the standby generator. With the City of Aurora having pumped storage, it is recommended that the volume for emergency standby storage be one times the maximum day demand (1 x MDD).

## Fire Suppression Storage (FSS)

Fire Suppression Storage volume varies amongst Cities. Generally, fire flows will be based on the requirements set by the Fire Suppression Rating Schedule (FSRS) from the Insurance Services Office, Inc. (ISO). Within the FSRS, a section called "Needed Fire Flow" outlines the methodology for determining the amount of water necessary for providing fire protection at representative locations throughout the community.

ISO calculates the needed fire flow for an individual building based on the building's area, construction, occupancy, and exposure. The water supply must be able to deliver water at 20 psi residual pressure and at the specified rate of flow, for a specified period of time. The rate of flow and the duration of flow required may be specified by the simple equation: quantity = flowrate x duration.

To evaluate the community's water supply, ISO calculates the needed fire flow for selected locations. They then determine the water-flow capabilities at those locations and calculate a ratio considering the need (needed fire flow) and the availability (water-flow capability). They use that ratio in calculating the credit points identified in the FSRS to develop a numerical

grading called a Public Protection Classification or sometimes referred to as a Fire Protection Rating. As previously discussed in Section 2, the City's current fire protection rating is a Class 5/9.

Table 5 – 1 shows the minimum fire flow rates, the recommended fire flow durations, and the resulting fire suppression storage volumes according to the various land use zoning designations. The recommended minimums were developed through a review of fire flow criteria adopted by similar communities and fire flow guidelines, as developed by AWWA. In general, it is recommended that the largest zoning classification be used in determining the recommended fire suppression storage volume.

**Table 5 – 1**
**City of Aurora Recommended Fire Flows, Duration, and FSS**

| Zoning Designation | Recommended Fire Flow Rates (gpm) | Recommended Duration[1] (hours) | Recommended Fire Suppression Storage Volume (FSS)[2] (Gallons) |
|---|---|---|---|
| Low-Density Residential | 1,500 | 2 | 180,000 |
| Moderate Residential | 1,500 | 2 | 180,000 |
| Commercial | 2,500 | 2 | 300,000 |
| **Industrial** | **3,500** | **3** | **630,000** |

[1]Recommended duration based on AWWA M31 1998, Table 1-1: 2,500 or less = 2hrs; 3,000 to 3,500 = 3hrs.
[2]Volume is recommended fire flow rate x 60 minutes/hour x recommended duration.

## Dead Storage (DS)

Dead storage (effective only to provide adequate pressure) is the volume of stored water not available to all consumers at the minimum design pressure. DS volume is excluded from the volumes provided to meet OS, ES, ESB, FSS requirements. Excluding interior piping and outlet configurations, dead storage does not typically apply to systems operating under a pumped storage situation, as would be the case for the City of Aurora.

## Total Storage Volume

As mentioned above, storage facilities are designed based on the key storage components. The total storage volume needed is the sum of all of these components. Therefore,

Total Storage Volume = (OS) + (ES) + (ESB) + (FSS) + (DS)

*Where,*
Operation Storage (OS) = *0, not applicable for Aurora's pumped storage.*
Equalization Storage (ES) = *0.25 times Maximum Day Demand (MDD).*
Emergency Standby Storage (ESB) = *1 times the Maximum Day Demand (MDD).*
Fire Suppression Storage (FSS) = *3500gpm, for a 3 hour duration.*
Dead Storage (DS) = *0, not applicable for Aurora's pumped storage.*

In addition to sizing storage facilities in accordance with the previous discussion, all inlet and outlet piping shall be designed in accordance with State requirements to facilitate adequate turnover of stored water in the storage facility and avoid water quality problems. Storage facility management techniques such as lowering tank levels during periods of low demand will also ensure the freshness of the water supply and eliminate the need for rechlorination.

# Pump Stations

Pump station capacity requirements vary depending on system demands, safe yield of available supply, storage volumes, and the number of pump stations that serve a particular pressure zone. In accordance with AWWA M31 guidelines, pump stations should be designed based on the pump station's firm pumping capacity that can be consistently provided. Firm pumping capacity is the total pump station's maximum pumping capacity with the largest pump out of service.

It is recommended that three pumps (two active, one standby) be provided at pump stations. In no case shall pump stations be equipped with less than two pumps. This is required in order to provide flexibility and system redundancy.

Pump stations with a constant pressure pumping system (pumps to a closed system with no gravity storage), such as the City of Aurora, should be sized for the larger of peak hour demand or maximum day demand plus fire flows at firm pumping capacity. On the other hand, pump stations that serve pressure zones with adequate gravity storage should be sized to supply the pressure zone's maximum day demand at firm pumping capacity. However, additional capacity or redundancy should be considered for purposes of expansion or reliability if the pump station constitutes a critical part of the water system.

In general, all pump stations should be equipped with an emergency generator of sufficient capacity to operate the pump station at its rated capacity.

# Transmission and Distribution Systems

A system must be able to reliably provide peak hour demand flows or maximum day demand plus fire flow and meet or exceed minimum pressure requirements for all system users. Transmission and distribution mains normally represent the largest portion of the initial cost of a water system and are basically unseen upon completion. Proper engineering and construction of these facilities is paramount to delivering a safe, adequate, reliable supply as economically as possible. The major design factors are the size, type of materials, and location of the facilities with respect to meeting the demands of the customers within the service area.

## Piping Definitions

A transmission main (usually larger diameter pipe) is used to convey the majority of flow from source, treatment, and/or storage facilities to the distribution system. A transmission main, although it may have a small number of service connections on it, is intended to deliver water to the distribution mains where the majority of service connections are located. A distribution main is the delivery system to individual customer service lines and provides water for fire protection through fire hydrants.

## System Pressure Requirements

Under normal operating conditions, water pressures in the distribution system should be approximately 65 psi, with a normal operating range between 40 and 80 psi. A maximum pressure of 100 psi is recommended. The lower end of this pressure range is intended to ensure that adequate pressure is available for the service connection at the highest elevation during maximum day demand conditions. The higher end of this pressure range is intended to minimize system repairs, lower the potential for surge damage, and minimize water leakage rates.

All service lines in higher pressure areas must be equipped with individual private pressure reducing valves to keep service pressures under 80 psi, as required by plumbing codes. Under maximum day demand plus fire flow conditions, the minimum system pressure shall be 20 psi, as measured at the meter service connection, in accordance with DHS requirements.

## Pipe Sizes, Pressures, and Velocities

Water system main sizing should consider a number of factors including pumping costs, system demand, land use, friction losses, and flow velocities. These factors are interrelated and their relative influences in the selection of optimum piping arrangements should be recognized.

Mains are generally sized with the ability to provide flow rates required to serve the anticipated land use in that vicinity of the system. It is recommended that all water mains be 8-inch minimum diameter for residential areas and 10-inch minimum diameter in commercial and industrial areas. In special cases, 6-inch diameter mains in residential areas are acceptable if no fire hydrant connection is required, there are limited service connections, the main is dead-ended and looping or future extension of the main is not anticipated. Water mains should generally be sized using a hydraulic analysis to adequately convey the larger of peak hour demands at 40 psi residual pressure or maximum day demand plus fire flows at 20 psi residual pressure, measured at any service connection throughout the distribution system.

Velocities in mains should normally range from 3 to 6 feet per second for maximum day demand, to a maximum of 8 to 10 feet per second for maximum day demand plus fire flows. It is recommended that head loss calculations, as determined by the Hazen-Williams equation, be performed based on the coefficients shown in Table 5 – 2.

**Table 5 – 2**
**Hazen-Williams Coefficients**

| Pipe Diameter | C-Value |
|---|---|
| 8 inches | 100 |
| 10 to 12 inches | 110 |
| Greater than 12 inches | 120 |

All new piping must be pressure tested to a minimum of 150 psi or 1.5 times working pressure for a minimum of one hour and shall be disinfected and bacteriological tested according to DHS requirements before being placed into service.

## Pipe Separation Distances

Minimum horizontal and vertical separation distances between water mains and sanitary sewer systems shall be 10 feet horizontally when the mains are parallel, and the water main shall be a minimum of 1.5 feet above the sanitary sewer when crossing, in accordance with DHS guidelines. It is recommended that at minimum, a separation distance of 5 feet horizontally be maintained between water mains and storm drain systems.

## Pipe Material and Cover

There are two standard pipe materials typically used in municipal water systems today; ductile iron and PVC. Smaller communities such as Aurora, typically use AWWA C-900 PVC since it is more cost effective to install. Regardless of pipe material selected, all water mains must have a minimum cover of 36 inches over the top of the pipe.

## Pipe Networks

Water mains should be configured in segmented grids and loops, and should be located within the established right-of-way or utility easement. Looping of distribution mains should be done if at all possible, avoiding as many situations with dead ends as possible. Dead-end mains should only be installed if:

- Looping is impractical due to topography, geology, unavailability of easements or locations of users; or
- The main is to be extended in the near future and the planned extension will eliminate the dead-end conditions.

If dead ends cannot be avoided, blow-offs shall be provided to allow adequate flushing and cleaning of those mains. The installation of permanent dead-end mains providing fire protection and/or serving large areas typically is not permitted.

## Valves

The installation and proper spacing of isolation valves are important elements of the water distribution system. The distribution system must have an adequate number of properly located valves to allow for the isolation of pipeline segments in the event of maintenance or new construction. Generally, valves should be installed at intersections with a maximum spacing of 500 feet in commercial, industrial, and multi-family areas, 500 feet in residential areas, 1/4 mile in transmission mains, and as necessary.

All water mains shall be valved such that removal of any single line segment from service will not result in more than one fire hydrant being taken out of service. A general guideline for locating valves in the distribution system is that smaller branch mains should be equipped with a valve so that any service problem on the branch pipeline does not require a shut-off of the

major transmission or distribution main. Within the distribution grid, placement of a valve on all legs of tees and crosses will minimize the extent of a service disruption during system work.

A blow-off assembly or fire hydrant shall be installed on all dead-end runs and at designated points of low elevation to provide a means for adequate flushing of the system. Combined air-vacuum relief valves are to be installed at appropriate points of high elevation in the system with piping sloped to permit the release of any entrained air.

### Thrust Restraint

With construction of new water mains, thrust restraint shall be considered. New water mains should be mechanically restrained with an internal, push-on joint restraint system or restrained externally with retainer glands. All mechanical restraints shall be compatible with the pipe manufacture. Poured-in-place concrete thrust blocking shall typically be used only as approved by the City Engineer.

### Fire Hydrants

Fire hydrants are located throughout the distribution system to provide for the fire protection needs of the City. The requirements for spacing fire hydrants are defined by Fire Codes and Fire District standards. Recommended hydrant spacing is 500 feet maximum in residential areas and 200 feet to 500 feet maximum in commercial, industrial, and other high-value districts. Typically, a hydrant is to be located within 250 feet from the furthest point of any building and within 100 feet of a fire department connection.

No hydrant shall be installed on a water main with less than an 8-inch inside diameter and the hydrant lateral shall be minimum 6-inch inside diameter. Hydrants shall be located at the corner of street intersections if possible, and shall be located as close to the distribution main as possible. In areas where required fire flows exceed 1,500 gallons per minute, the water supply must be provided by more than one hydrant.

## Cross-Connection Control

Where the possibility of contamination of potable water exists, water services shall have appropriate backflow prevention devices in accordance with OAR 333-061-0070. Backflow prevention devices must be installed and tested in accordance with OAR 333-061-0071 by a State-certified backflow prevention device tester.

It is recommended that the City review DHS's most recent (Jan. 2006) cross-connection / backflow prevention program, which summarizes the Oregon Administrative Rules relating to cross-connection control requirements, in order to compare them to the City's current requirements. This document can be downloaded from the DHS Drinking Water Program website at www.oregon.gov/DHS/ph/crossconnection/ docs/333-061final.pdf.

# System Operation and Maintenance

Water system operations and maintenance activities are designed to improve, operate, and maintain the water system to ensure reliable delivery of high quality water to the customers. OAR 333-061-0065, Operation and Maintenance has requirements on how public water systems shall be operated and maintained. In addition to the ones identified in the OARs, general system operation and maintenance activities should include:

## Supply Source Facilities

- Check equipment efficiency and capacity annually.
- Maintain mechanical system per manufacturer's recommendations.
- Clean, inspect, and repair as needed.
- Test and calibrate system instrumentation.
- Maintain building and grounds.

## Storage Facilities

- Maintain system per manufacturer's recommendations.
- Inspect hatches, screens, and alarms quarterly.
- Inspect exterior annually and clean interior every three to five years.
- Recoat and repair tanks as needed.
- Test and calibrate system instrumentation.

## Pump Stations

- Check efficiency of all equipment annually.
- Maintain system per manufacturer's recommendations
- Clean, inspect, and repair as needed.
- Test and calibrate system instrumentation.
- Maintain buildings and grounds.

## Transmission and Distribution System

- Detect and repair leaks as necessary.
- Identify system piping that is reaching the end of serviceability.
- Identify and locate all cross country mains and their easements or right-of-way requirements.
- Test and calibrate system instrumentation.
- Replace AC (asbestos-cement) pipe as funding is available.

## Fire Hydrants and Valves

- Exercise and test operation of each hydrant every two years, maintain, repair and paint as needed.
- Replace all two-port hydrants and all hydrants on main lines less than 6-inches in diameter.
- Have backflow prevention devices tested annually in accordance with State regulations.

- Maintain, operate and exercise each valve every two years (includes air release valves, blow-off valves and pressure-reducing valves).
- Add or replace valves based on condition, distance between valves, and overall location.

## Service Lines and Meters

- Replace after repeated leaks or to correct flow or pressure problems.
- Move existing services and meter boxes as necessary to comply with City standards.
- Test and repair residential service connection meters every three to five years.
- Test and repair 1½ -inch and larger meters every two to three years.

**Table 5 – 3**
**Recommended Water System Design and Operating Criteria**

| Item | Recommended Criteria | Standard Practice | Basis/Comments | Applicable Regulations |
|---|---|---|---|---|
| **General** | | | | |
| Water System Components and Chemicals | Comply with AWWA standards and ANSI/NSF Standard 60 and 61. | Same as Recommended Criteria. | Meet Oregon drinking water regulations. | Comply with ANSI/NSF Standard 60 and 61. |
| Water Use Record Keeping | Track average day, maximum day, and monthly total demands. Document and summarize annually. Develop monthly and annual numbers for unaccounted water. | Same as Recommended Criteria. | This information is very helpful for planning purposes, and is very time-consuming or impossible to generate if not recorded on a regular basis. | Oregon DHS-DWP has some O&M and record-keeping requirements. (333-061-0065). |
| **Fire Flows** | | | | |
| Residential Fire Flows | 1,500 gpm minimum. Must meet Fire Code and Fire District Standards. | Same as Recommended Criteria. | ISO downgrades a community's insurance rating unless at least 1,000 gpm is available for 2 hours for spacing between houses of 11 to 30 feet. ISO requires 1,500 gpm for 2 hrs if spacing is ≤ 10 ft). | Oregon has no flow requirements, but does require 20 psi at all times. ISO standards also call for residual pressure of 20 psi. |
| Commercial Fire Flows | 2,500 gpm minimum. Must meet Fire Code and Fire District Standards. | 3,500 gpm (minimum) for 3 hr, at a minimum residual pressure of 20 psi superimposed over maximum day demands; located in zone where need occurs. | ISO downgrades a community's insurance rating unless at least 3,500 gpm is available for 3 hr for buildings such as schools, care centers, and light commercial. | Oregon has no flow requirements, but does require 20 psi at all times. ISO standards also call for residual pressure of 20 psi. |

**Table 5 – 3 (Continued)**
**Recommended Water System Design and Operating Criteria**

| Item | Recommended Criteria | Standard Practice | Basis/Comments | Applicable Regulations |
|---|---|---|---|---|
| Industrial Fire Flows | 3,500 gpm minimum. Must meet Fire Code and Fire District Standards. | 3,500 gpm (minimum) for 3 hr, at a minimum residual pressure of 20 psi superimposed over maximum day demands; located in zone where need occurs. | ISO downgrades a community's insurance rating unless at least 3,500 gpm is available for 3 hr. | Oregon has no flow requirements, but does require 20 psi at all times. ISO standards also call for residual pressure of 20 psi. |
| **Supply Source** | | | | |
| Emergency Backup Generator Connections for Wells | Provide for all Wells. | Provide for all Wells which are a critical part of the system. | Provides reliability during emergency conditions. | |
| **Storage Facilities** | | | | |
| Equalization Storage Volume | 25% of MDD. | Same as Recommended Criteria. | A typical value for community water systems. | Only general guidance is provided by states, indicating that equalization storage should consider daily use patterns. |
| Fire Suppression Storage | 630,000 gallons (3,500 gpm for 3 hr). | Varies on a case by case basis. | Equal to 3,500 gpm for 3 hr, based on ISO criteria. | |
| Emergency Standby Storage Volume | 1 x MDD. | Varies from 1 x ADD to 1 x MDD, depending on reliability of a system's supply. | Overall source and supply transmission reliability is critical in determining emergency storage. | |

**Table 5 – 3 (Continued)**
**Recommended Water System Design and Operating Criteria**

| Item | Recommended Criteria | Standard Practice | Basis/Comments | Applicable Regulations |
|---|---|---|---|---|
| Storage Tank Inlet/Outlet Piping | Provide separate inlet/outlet piping for all new storage tanks; include inlet riser pipe (keep top below normal operating level so as not to introduce extra pumping head) and separate inlet and outlet horizontally. | Same as Recommended Criteria. | | Oregon Department of Human Services(DHS) 'When a single inlet/outlet pipe is installed and the reservoir floats on the system, provisions shall be made to insure an adequate exchange of water to prevent degradation of the water quality..."OAR 333-061-0050(7) |
| Storage Tank Inspection / Cleaning | Inspection (and possible cleaning) every 3-5 years. | Inspections every 5 years using divers, cleaned only as inspection shows need. | Follow manufacturer's recommendations. | |
| Storage Tank Turnover | Set goal as 3-5 days, but realize that it may not be feasible to achieve this goal. | Same as Recommended Criteria. | AWWA recommends complete turnover every 3-5 days. | Depends on water quality. Probably not as critical in Aurora because supply transmission and quality of groundwater. |
| **Booster Pump Stations** | | | | |
| Booster Pump Station Sizing | Provide larger of PHD or MDD plus Fire Flows at 20 psi over 24 hours, with largest pump out of service. | Same as Recommended Criteria. | A typical value for community water systems. | |
| Number of Pumps In Booster Pump Stations | A minimum of three (two active, one standby). | Same as Recommended Criteria. | A typical value for community water systems. | |

**Table 5 – 3 (Continued)**
**Recommended Water System Design and Operating Criteria**

| Item | Recommended Criteria | Standard Practice | Basis/Comments | Applicable Regulations |
|---|---|---|---|---|
| Emergency Backup Generators for Pump Stations | Provide for all pump stations. | Only provide for pump stations pumping to closed systems (those serving an area without gravity storage). | Provides reliability for closed systems, otherwise, gravity storage tank/reservoirs provide needed reliability. | |
| **Transmission And Distribution System** | | | | |
| Operating Pressures | Normal (any time except during fire flows): 40-80 psi., 100 psi maximum. Minimum 20 psi for fire flows. Pressures measured at service connection (water meters). | Same as Recommended Criteria. | Oregon requires a minimum of 20 psi at all times, as do most states. The 40-80 psi normal range is a reasonable target, recognizing that it may be acceptable in some cases for the minimum to drop below 40 psi or exceed 80 psi and still provide acceptable service. | Oregon is silent on pressure except for the 20 psi minimum. Washington requires 30-100psi. |
| Transmission Main Sizing | Evaluate on a case-by-case basis, based on allowable head loss. Limit velocities to approximately 3 - 6 fps for MDD. Up to 8-10 fps for larger of PHD or MDD plus Fire Flow. Minimum pipe size for Commercial and Industrial areas is 10-inch. | Same as Recommended Criteria. | Same as Recommended Criteria. | Washington states that transmission lines shall be designed to maintain ≥ 35 psi, except when directly adjacent to storage tanks. |
| Pipe Materials | Ductile Iron or C-900 PVC. | Same as Recommended Criteria. | Ductile iron pipe is the industry standard, with C-900 PVC also commonly used. | |

**Table 5 – 3 (Continued)**
**Recommended Water System Design and Operating Criteria**

| Item | Recommended Criteria | Standard Practice | Basis/Comments | Applicable Regulations |
|---|---|---|---|---|
| Distribution System Pipe Networking | Minimum mainline size is 8 inches. Fire hydrant and/or blow-offs are required at end. Looping required wherever possible. Limit velocities to approximately 3 - 6 fps for MDD. Up to 8-10 fps for larger of PHD or MDD plus Fire Flow. | 10-inch or 12-inch diameter outer loops (for ≤ 1-mile square), 8-inch diameter internal grid. Limit velocities to approximately 3 - 6 fps. | Follows Washington Administrative Code (for sizes; silent on velocities Meets OARs (minimize dead ends). | Several states require a minimum of 6-inch diameter mains if looped, and indicate that dead end lines shall be minimized. |
| Hydrant Spacing | Varies by Fire District, 500 feet maximum in residential, 200-500 feet in commercial / industrial. | Same as Recommended Criteria. | ISO credits hydrants for up to 1,000 gpm if located within 300 ft of structure, for 670 gpm if located 301 to 600 ft from structure, and for 250 gpm if located from 601 to 1,000 ft from structure. | No Oregon requirements. |
| Hydrant Type | Comply with AWWA C502 with one 4.5-inch steamer and two 2.5-inch hose nozzles. | Provide at least one large pumper outlet. | ISO downgrades fire hydrants that do not have at least one large pumper outlet. | |
| Isolation Valving | Minimum of 2 valves on legs of Tees or 3 valves on legs of Crosses in order to isolate segments. | Same as Recommended Criteria. | Typical water system practice. | |
| Number of Services on an Isolation Segment | Not more than 30 homes maximum. | Same as Recommended Criteria. | Typical water system practice. | |
| Valve Exercising | Exercise all valves on a 2 – 4 year cycle. | Once per year for valves ≥ 12 inches. | Annual valve exercising is commonly recommended for all valves; however, this is probably not practical. Focus on critical valves. | States do not provide guidance on valve exercising. |

**Table 5 – 3 (Continued)**
**Recommended Water System Design and Operating Criteria**

| Item | Recommended Criteria | Standard Practice | Basis/Comments | Applicable Regulations |
|---|---|---|---|---|
| Mainline Flushing | Set goal to flush 1/3 of the system each year. | Every 6 months for dead end and problem areas, goal for entire system is once every 4 years. | | |
| Installation of Blow-offs on Dead End Mains in Cul-De-Sacs | Use blow-offs or fire hydrants for dead end mains. | Same as Recommended Criteria. | Good practice to reduce stagnant water. | |
| **Cross-Connection Control** | | | | |
| Backflow Prevention Standards | Comply with State Requirements. | Same as Recommended Criteria. | Oregon's backflow prevention requirements are comprehensive. | Comply with current DHS-DWP Cross Connection Program |
| **Water System Planning** | | | | |
| Master Plan Update Schedule | Annual minor updates, more significant review every 5 years; comprehensive review every 10 years. | Same as Recommended Criteria. | Typical water system practice. | |
| 5-Year Capital Improvements Plans (CIP's) | Annual minor updates; ensure that 5-year plans follow general guidelines of the master plan. Plan shall be within financial guidelines of City and shall be balanced and prioritized so that rate increases are justified. | Same as Recommended Criteria. | Typical water system practice. | |

SECTION 6

# Water System Analysis

## Objective

The objective of this section is to present an analysis of the existing water system based on the system criteria presented in Section 5. Population estimates from Section 3 and water use and projected demands from Section 4 were used in the analysis.

Existing supply sources were evaluated with comparisons made between current demands, available water sources and water rights, and future projected demands. The need for any additional supply sources and associated water rights were also determined. An analysis of the existing storage tank to determine its ability to meet current and future projected demands was performed and recommendations were given for future storage improvements.

An analysis of the existing distribution system was also performed. A computer model was developed and used to evaluate the adequacy of the existing distribution system to convey current and future projected demands. Recommendations for necessary distribution system improvements were also made.

Section 8 presents a prioritized plan of recommended improvements to correct any system deficiencies identified in the analysis.

## Water Rights and Supply Analysis

A complete description of the City of Aurora's water rights, source of supply, and other supply system components were presented in Section 2. Water quality production issues and concerns are further summarized in Section 7.

### Water Rights

Under currently held registrations and water rights, the City is authorized to appropriate 675 gpm. A comparison of the current Wells No. 3 and 4 pumping flow rates (approximately 305 gpm), to the authorized water right capacity of these two wells which Well No. 5 will share (approximately 475 gpm), to the total amount of water authorized under currently held registrations and water rights (675 gpm), to the total available to the City (774 gpm), is shown in Table 6-1 below.

**Table 6 – 1**
**Water Rights and Supply Comparison and Limitations**

| Well No. | City Water Rights/Groundwater Registrations | | | | Well Production | |
|---|---|---|---|---|---|---|
| | Total Available Water Rights (gpm) | Current Amount Authorized by OWRD (gpm) | Remaining Not Currently Authorized by OWRD (gpm) | Amount Authorized, but not currently useable (gpm) | Total Well Pumping Flowrate (gpm) | Current Well Pumping Flowrate (gpm) |
| 1 | 200(1) | 200 | - | 200 | Not Used | Not Used |
| 3 | 224 | 224 | - | - | 145 | 145 |
| 4 | 350 | 251 | 99(2) | - | 160 | 160 |
| 5 | - | - | - | - | 170 | Not yet in production |
| Totals | 774 | 675 | 99 | 200 | 475 | 305 |

(1)Groundwater Registration.
(2) Water Right amount yet to be perfected.

As can be seen, the City's source limitations begin with the lack of additional wells followed by available City water rights. With the anticipated addition of Well No. 5's long-term pumping capacity of 170 gpm, the remaining water rights authorized to be shared between Wells No. 3, 4, and 5 will be maximized. The total amount of City water rights available, but not currently used will then be 299 gpm.

The City's recent transfer of rights discussed in Section 2 added additional points of appropriation and changed the place of use for Wells No. 3 and 4 to include Well No. 5. However, even with this transfer, the City will not be able to maximize the City's full potential of available water rights. Once Well No. 5 is placed online, the total well production capacity that can collectively be used between Wells No. 3, 4, and 5 will only be 475 gpm (224 gpm + 251 gpm).

Since water rights are restricted to the terms and conditions described in the water right certificate for the place of use, point of diversion, and type of use, this means that the 200 gpm of rights associated with Well No. 1 will remain unusable unless a transfer of right is granted by OWRD. Including the additional 99 gpm from Well No. 4 that has yet to be perfected, a total of 299 gpm (774 gpm – 475 gpm), or approximately 40 percent of available rights will be unusable after Well No. 5 is put into production.

Documents obtained from City staff shows that a letter dated April 27, 2005 to OWRD was sent on behalf of the City by Groundwater Solutions, Inc. to document three additional points of appropriation and revise the place of use for Groundwater Registration (Claim) No. GR-659 (Well No. 1). The three additional points of appropriation added by the letter was for the

inclusion of Wells No. 3, 4, and 5. These were added to provide flexibility and redundancy to the City of Aurora municipal water production system. The Well No. 1 groundwater registration has an authorized withdrawal rate of 200 gpm, which is to be appropriated in full from any one point of appropriation or cumulatively from several or all of the points of appropriation. However at the time of this WSMP, a review of the final transfer orders included in Appendix A does not reflect the addition of Well No. 1.

Being that Well No. 1 was constructed in 1920, this well has a groundwater registration rather than a water right certificate. Ground water registrations are claims for rights to use ground water established prior to 1955 and for which the OWRD has issued certificates of registration. The OWRD may recognize a change in use, place of use, or point of appropriation for a ground water registration if the OWRD determines that the change will not injure other water rights.

Based on these issues, it is recommended that further research by a CWRE be performed and a water rights strategic plan be put together for the City to identify all the issues associated with their water rights, appropriately prioritize certification of their water rights, identify activities necessary to secure Well No. 4's remaining rights, and provide a complete analysis of future water rights that may be obtainable by the City.

It is further recommended that all current water right processes be diligently tracked and completed by the City to ensure the protection of its existing water rights. Additional discussions with Groundwater Solutions and OWRD by the City may be necessary in order to clarify the status of rights pertaining to Well No. 1. Securing water right certificates from OWRD will protect the City's existing water rights by locking them in place along the water appropriation line. **Additionally, the City has until October 1, 2011 to submit the required Claim of Beneficial Use (COBU). The difficulty of this is that the City is limited on their production capabilities because of Well No. 4 and Well No. 5 are above the maximum contaminant levels for arsenic, as further discussed below. An extension of this deadline may be necessary to be obtained by the City from the OWRD so that a water treatment system can be in place and full production of the wells can be established, prior to submitting a COBU.**

## Supply and Treatment

In general, the existing wells currently in operation have consistently provided the City with a reliable long-term public water supply. The aquifer that provides groundwater to the City's wells appears to show some long-term decline in water level based on the previous calculated static water level trends in Section 2. The overall quality of groundwater produced has adequately served the City over the years; however, there are some current water quality concerns associated with iron, manganese, and arsenic with Well No. 4 and potentially with Well No. 5. These water quality issues and concerns for all the wells are further discussed in Section 7.

Wells No. 3 and 4 are currently the only active wells in production that supply groundwater for the City. However, Well No. 4 can only be utilized 50 – 60 percent of the time since City staff has to blend the water produced with Well No. 3 due to arsenic levels being just above maximum contaminant levels (see Section 7). Well No. 5 is the City's newest well, but has not

yet been put into production. Water quality testing for Well No. 5 is still in the preliminary stages, but has shown to have similar arsenic issues to that of Well No. 4. Well No. 1 has not been used since 1993 and has since been disconnected from the system due to water quality issues and from its close proximity to the Pudding River. Well No. 2 has not been used since 1987 due to cancelled water rights.

Currently, the total existing groundwater supply peak pumping capacity for the City is approximately 305 gpm (Wells No. 3 and 4). As discussed in Section 5, water supply sources and treatment systems must be able to reliably provide sufficient water to meet maximum day demands, based on the source's firm capacity. The term "firm capacity" is defined as the total source's maximum production capacity with the largest source (or well) out of service. Since Well No. 4 is currently the largest well, the current firm capacity is approximately 145 gpm. As can be seen in Figure 6-1, using only Well No. 3 does not adequately provide for maximum day demands.

By including the anticipated capacity of Well No. 5, the total source capacity will then be approximately 475 gpm. Since Well No. 5 will then be the largest well, the resulting firm capacity of the source will be approximately 305 gpm. However, the City's current water quality limitations of Well No. 4 and anticipated limitations with Well No. 5, will not allow source production to meet system demands without some form of arsenic treatment system installed within the next few years. The well capacity chart shown in Figure 6-1 below, illustrates that under current well operations, an arsenic water treatment system is needed to be installed sometime before the year 2013.

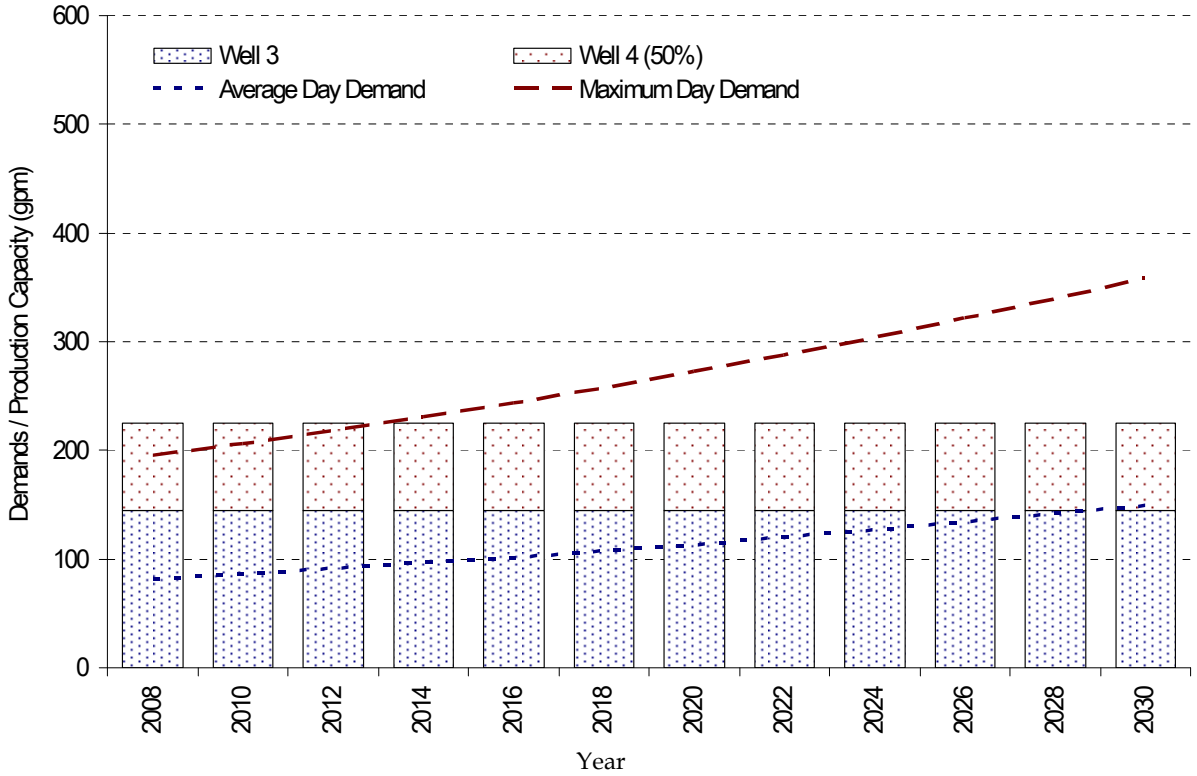



**Figure 6 – 1 Current Well Capacity Chart**

Figure 6-2 below shows the City's potential well production capacities if an arsenic water treatment system capable of treating the capacity of the wells is provided.

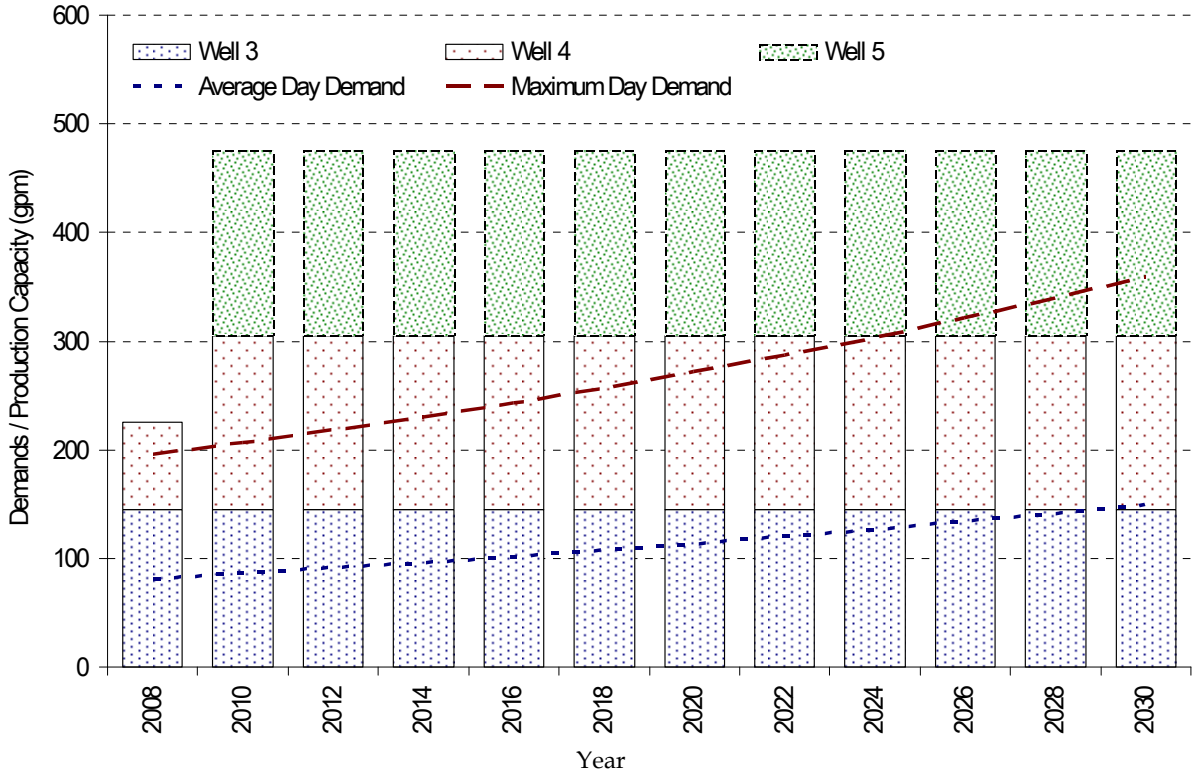



**Figure 6 – 2 Well Capacity Chart with Arsenic Treatment**

In addition to the need to comply with required drinking water standards for arsenic, the high levels of iron and manganese associated with Well No. 4 and anticipated from Well No. 5 will result in reddish-orange and black staining of plumbing fixtures and clothes if left untreated. This also tends to encourage the growth of iron and manganese bacteria in the supply transmission main, storage tank, and distribution system, resulting in sloughing of debris to the customers. Normal levels of disinfectant residuals are also difficult to achieve due to the chlorine demand of these bacteria. A water treatment system is critical to the current and future operation of the groundwater wells and should be the City's top priority for required short-term improvements. A further discussion regarding water treatment is shown in Section 7.

The existing wells will be able to meet current and projected future demands if treated. However, even with the addition of Well No. 5, the City will need to be careful not to over-utilize the wells by using them for extended periods without sufficient down-time. The City will need to plan to incrementally expand its source as system demands increase. As illustrated in Figure 6-2 with a firm capacity of 305 gpm (with the largest well out of service, Well No. 5), the City's supply capacity will need to be expanded before year 2024. Source expansion is further discussed in the subsection below.

The 2002 Source Water Assessment Report identified the need for additional source improvements. Specifically, both Wells No. 3 and 4 render their respective sources highly sensitive based on the inappropriate casing seal depth. Both wells are sealed at 35 feet or less,

yet tap groundwater that is in the 200 foot range. In the case of the Well No. 4, there is a drop in head between the shallower and deeper groundwater suggestive of two separate aquifers being exploited. The commingling of aquifers is not permitted under the current rules of the Oregon Water Resources Department because of the potential for contaminated shallow groundwater gaining access to the deeper aquifer.

In addition to the previous noted source improvements, the following management action by the City is recommended to help protect the quality of the groundwater supply:

- Develop and implement a drinking water protection plan to reduce the potential for contamination. Drinking water protection plans include strategies that focus on public education and implementation of best management practices (BMPs) for businesses and households.

  The Oregon Department of Human Services – Drinking Water Program has many tools, tips, fact sheets, and bulletins associated with drinking water protection. In addition, semiannual newsletters have been prepared for communities in Oregon to help them develop drinking water protection strategies. These newsletters give these communities tools they can use to address specific issues related to their specific drinking water sources. Each issue describes resources available to communities as well as examples where communities in Oregon have worked with stakeholders, identified site-specific strategies, and overcome challenges to minimize the risk of contamination of their drinking water source(s). These newsletters can be downloaded from the DHS Drinking Water Program web site at www.oregon.gov/DHS/ph/dwp/dwpb.shtml. A copy of some of the lastest bulletins are provided in Appendix I.

  Oregon does not currently require a formal protection program; however, many communities in Oregon have been implementing these drinking water protection programs on a voluntary basis.

## Planned Source Expansion

The previous master plan discussed options for source expansion including the option of surface water from the Pudding River. However, this was not considered as an alternative mainly due to possible permitting restrictions from low summer flows, extensive treatment requirements, and the relatively high project costs. The City is not presented with many other cost effective options for source expansion other than by the addition of groundwater wells. As such, it is recommended that the City plan to incrementally expand its well supply in order to meet projected water demands.

Future source expansion should be based on firm capacity. Planning based on firm capacity provides the City with a greater amount of redundancy should one well be offline for mechanical repairs, rehabilitation, or if contamination is found in a well. This would allow the City to remove such a well from service while still having capacity to meet system demands.

The exact location of future groundwater wells will be based on criteria such as hydrogeological factors, property availability, location of growth, wellhead protection zoning and concerns, and

location of storage facilities and distribution mains. However, it is recommended that well sites be acquired many years prior to the projected dates for when the wells are needed in order to obtain sites that are favorable for meeting these criteria.

In addition, due to the size of the existing supply transmission main, any additional flow from future wells will exceed the maximum velocity criteria. Therefore, modifications will be necessary to the existing supply main or an additional main will need to be constructed as part of any future source expansion.

# Storage Analysis

Existing water storage is currently accomplished by the use of a nominal 300,000 gallon above ground bolted-steel storage tank. The existing tank appears to generally be in good condition. Although the existing storage tank does not appear to have any observed deficiencies, the storage tank has not had a structural inspection since being built in 1991. The last interior inspection was by LiquiVision Technology in February 2004, which was performed by an underwater 3-man dive team. The preliminary inspection report, included in Appendix C, identified that the interior ladder was in poor condition and needed to be replaced, the interior walls needed to be cleaned, and that the tank had accumulated approximately 1-inch of sediment on the bottom. Therefore, it is recommended that a seismic and condition assessment be performed and the noted maintenance and repairs be made, the tank be cleaned, and routine inspections be performed on a regular basis in accordance with the manufacturer and State's requirements.

In general, additional storage needs for the City will be achieved by either; constructing a separate storage tank on the north end of the City with a new booster pump station; or by adding a new storage tank adjacent to the existing tank with a connection to the existing pump station. A new storage tank with a new pump station on the north end of the City is recommended as it will provide the best solution for improving system pressures at this higher elevated northwest area, provide for future development that is targeted in this area, as well as provide greater redundancy and reliability for the system.

## Total Recommended Storage Volume

As discussed in Section 5, storage facilities are designed based on the key storage components with the sum being the total required storage volume. For the City of Aurora with pumped storage (closed system), the total recommended storage volume is based on the reduced following equation:

Total Storage Volume = (ES) + (ESB) + (FSS)

*Where,* Equalization Storage (ES) = *0.25 times Maximum Daily Demand (MDD).*
Emergency Standby Storage (ESB) = *1 times the Maximum Daily Demand (MDD*).
Fire Suppression Storage (FSS) = *3500gpm, for a 3 hour duration.*

The total recommended storage volume requirements for the various 5-year increments throughout the planning period are further summarized in Table 6-2 below.

| Table 6 – 2<br>Recommended Storage Volume | | | | | | |
|---|---|---|---|---|---|---|
| | Projected Water Demands | | Storage Requirements (gallons) | | | |
| Year | Average Day Demand (gpd) | Maximum Day Demand (gpd) | Equalization (0.25 x MDD) | Emergency (1 x MDD) | Fire[1] (3,500gpm x 3 hours) | Total Storage Requirements (million gallons) |
| 2008 | 117,000 | 280,800 | 70,200 | 280,800 | 630,000 | 0.98 |
| 2010 | 123,600 | 296,600 | 74,200 | 296,800 | 630,000 | 1.00 |
| 2015 | 142,000 | 340,700 | 85,200 | 340,700 | 630,000 | 1.06 |
| 2020 | 163,000 | 391,100 | 97,800 | 391,200 | 630,000 | 1.12 |
| 2025 | 187,100 | 449,000 | 112,300 | 449,100 | 630,000 | 1.19 |
| 2030 | 214,800 | 515,500 | 128,900 | 515,600 | 630,000 | 1.27 |

[1]Recommended duration based on AWWA M31 1998, Table 1-1: 2,500 or less = 2hrs; 3,000 to 3,500 = 3hrs.

With the nominal 300,000 gallon storage tank currently in operation, the total storage volume requirements can be reduced appropriately. The total storage needs are shown in Table 6-3 below.

| Table 6 – 3<br>Storage Capacity Needs | | | |
|---|---|---|---|
| Year | Total Storage Requirement (MG) | Existing Storage Capacity (MG) | Total Storage Capacity Needs (MG) |
| 2008 | 0.98 | 0.30 | 0.68 |
| 2010 | 1.00 | 0.30 | 0.70 |
| 2015 | 1.06 | 0.30 | 0.76 |
| 2020 | 1.12 | 0.30 | 0.82 |
| 2025 | 1.19 | 0.30 | 0.89 |
| 2030 | 1.27 | 0.30 | 0.97 |

The previous 1996 WSMP recommended that a 100,000 gallon storage tank be constructed as part of the water system improvements to account for future storage needs through the planning year 2015. The information presented above in Table 6-3 illustrates that a 100,000 gallon storage tank would not be sufficient to meet current or future storage needs of the City.

The result of the storage capacity analysis indicates that the capacity of the existing storage tank is inadequate, as the storage capacity to meet future needs is more than three times the existing storage tank capacity. It is recommended that a nominal 1 million gallon (MG) storage tank be constructed as part of the water system improvements to account for future storage needs through the planning period.

## Storage Tank Facility Siting

It is anticipated that the new storage tank will be an above ground storage facility at a higher ground elevation than the existing tank, located along Airport Road on the north end of the City. Since the new storage tank will only provide very minimal pressures by gravity at this higher elevation, it is anticipated that the new facility will also need to utilize a new small booster pump station to continuously pump to the distribution system.

During the early preliminary stages of the engineering design for the storage tank, a suitable location to site the facility will need to be determined. In general, storage tank siting considerations should at minimum include the following:

- Accessibility, including sufficient area to construct and maintain the tank, as well as allow room to site additional storage if required to meet projected growth.
- Distance to the existing distribution and transmission system.
- The need to upgrade existing distribution and transmission pipelines in order to meet size and pressure standards.
- Existing ground surface elevation, site, and roof drainage concerns.
- Operation and maintenance access, anticipating potential seasonal limitations.
- Geotechnical engineering field investigations including:
  - Foundation design requirements.
  - Soil type, soil bearing strength.
  - Ground water table elevation.
- Seismic and existing fault line locations.
- Overflow and drain discharge locations.
- Availability of power.
- Proximity to potential source of contamination like sanitary sewers, drains, standing water and flood plains, etc.
- Security, vulnerability, etc.
- Other considerations as necessary.

## Storage Tank Types

Below are five types of storage tanks that are typically used for potable water storage facilities. Each type has various advantages and disadvantages from initial construction to long-term maintenance.

- Welded Steel Tank
- Bolted Fused Glass Steel
- Conventional, Cast-in-place Reinforced Concrete
- Wire or Strand-Wound, Prestressed Concrete
- Pre-Cast, Post Tensioned Concrete Tank

Some of the available water standards and manuals used for the design and construction of storage tanks by the American Water Works Association (AWWA) are listed below.

- *D100-05: Welded Steel Tanks for Water Storage*
- *D102-03: Coating Steel Water Storage Tanks*

- *D103-97: Factory Coated Bolted Steel Tanks for Water Storage*
- *D104-04: Automatically Controlled, Impressed-Current Cathodic Protection for the Interior of Steel Water Tanks*
- *D110-04: Wire- and Strand-Wound, Circular, Pre-stressed Concrete Water Tanks*
- *D115-06: Tendon-Prestressed Concrete Water Tanks*
- *Manual M42, Steel Water Storage Tanks*

In addition, ANSI/NSF 61 (National Sanitation Foundation 1996) is a nationally accepted standard that protects stored water from contamination from products which come into contact with water. Products covered by NSF 61 include pipes and piping appurtenances, nonmetallic potable water materials, coatings, joining and sealing materials (i.e. gaskets, adhesives, lubricants), mechanical devices (i.e. water meters, valves, filters), and mechanical plumbing devices. NSF 61 was reviewed and certified by the American National Institute of Standards (ANSI) which permitted the use of the standard by other independent testing agencies such as Underwriters Laboratories. With the development of this ANSI/NSF-61 Standard, the approval and reporting for tank coatings process is now standardized. State agencies that previously had independent coating approval programs discontinued these programs and adopted the ANSI/NSF 61 Standard.

A brief description of each of the storage tank alternatives is shown below.

## Welded Steel or Bolted Steel Tank

Welded Steel or Bolted Steel tanks (manufacturers/contractors such as Chicago Bridge & Iron, T. Bailey, Inc., Superior Tank, Aquastore) are constructed using a series of steel sheets that are either welded or bolted together with various gaskets and sealants to make it watertight. Bolted steel tanks typically come with a factory applied coating for corrosion resistance, whereas, a coating and corrosion protection system will need to be applied to the welded steel. With both tanks, proper construction is critical to having a long-term, leak-free storage facility.

Historically in this region, welded steel tanks were the most common type of tank used for public water storage. In more recent years, water suppliers have begun using other types of tanks due to the increasing maintenance costs associated with the repair and recoating of welded steel tanks. At the same time, coating systems have improved and corrosion protection systems have been developed to increase durability. Still, the need for periodic repair and recoating of welded steel tanks is a concern for many water suppliers. In general, regular maintenance will most likely include the following:

- Tank inspection at least every five years by a certified inspector. AWWA Manual M42 (1998) recommends that tanks be drained and inspected at least once every three years or as required by State regulatory agencies.
- Interior spot repairs, exterior cleaning and recoating at approximately ten years.
- Complete renovation including cleaning and recoating of the interior and exterior at approximately twenty years.
- Process gets repeated.

The process of recoating involves complete dewatering, repair (if needed), cleaning, surface preparation and possibly complete sandblasting, coating, curing, disinfection, and filling,

resulting in significant downtime for the facility, sometimes in excess of more than 30 days. Steel tanks can be constructed to various dimensions and can be designed using various roof styles and architectural treatments to enhance aesthetics.

### Conventional, Cast-in-place Reinforced Concrete

Cast-in-place Reinforced Concrete tanks are constructed using conventional concrete construction methods. However, there are many steps and applicable codes that must be followed both during design and construction of the storage tank to ensure a leak-free, high quality, long-life structure.

Conventional reinforced concrete tanks crack. Tension cracking is required in concrete for flexural, conventional reinforcing to perform. Cracks may eventually lead to deterioration, appearance degradation, and/or more risk of future leaking. Depending on the structural detailing, slightly larger footings may be required to maintain acceptable bearing pressures.

### Wire or Strand-Wound, Prestressed Concrete

Wire or Strand-Wound Prestressed Concrete tanks (manufacturers/contractors such as DYK, Natgun, Crom, and Preload) are constructed depending on the various design method chosen, consisting of reinforced cast-in-place concrete or an embedded steel diaphragm within a concrete wall, and then prestressed with individual layers of wire or strands surrounded by a layer of shotcrete. Initial prestressing and post-tensioning of the walls lead to no tension being developed within the walls; therefore, there will be no initial or anticipated future cracking. The absence of no net tension eliminates the detrimental cracking effects associated with conventional reinforcing previously mentioned.

Prestressed concrete tanks have a proven history of being low-maintenance in various environments and compared to other concrete tanks for the first 50-years of life, historically have been the most maintenance-free structure type. A prestressed concrete tank is not totally maintenance free, but typically the interior does not need recoating and the exterior can be repaired or refurbished without taking the tank out of service.

Prestressed concrete tank manufacturers offer attractive architectural treatments to enhance aesthetics and unlike steel tanks, the tank can be partially buried to maintain existing ground contours.

### Precast Post-Tensioned Concrete Tank

Precast, Post-Tensioned Concrete Tanks (manufacturers such as Dutchland, Morse Bros) are constructed of precast, post-tensioned concrete panels, and typically utilize precast concrete columns and a concrete roof. Like prestressed concrete tanks, long-term maintenance costs are relatively low, especially when equipped with stainless steel or aluminum accessories. Also, the tank can be partially buried to maintain existing ground contours.

### Construction Type Costs

Comparing storage tank costs alone, the estimated cost for this size of tank is approximately $0.50 and $2.00 per gallon of storage capacity depending on the tank type. Section 8 shows the

estimated cost of the proposed storage tank improvement project. A detailed cost estimate can be found in Appendix K.

With the higher level of construction effort needed for the prestressed and precast post tensioned concrete tanks, the welded steel tanks typically have less initial construction costs. However, do to the long-term maintenance costs associated with welded steel, results in a significantly lower cost-effectiveness over the life of the tank. Conventional reinforced concrete and bolted steel tanks also have less initial construction costs, but require special attention, structural detailing, and proper construction to ensure leak-free structures. As to which type of tank is more superior, the industry has wrestled with this matter for many years. For most water systems, it comes down to budget, a matter of preference, local vendor support, specific site conditions, and other various parameters.

Since the existing storage tank is a glass-fused bolted steel tank, which has remained leak-free and has required very little maintenance over the years, it is assumed that this type of facility will most likely be the tank of choice for the new storage facility in Aurora.

# Pump Station Analysis

As discussed in Section 5, pump stations in general should be designed based on the pump station's firm pumping capacity that can be consistently provided. Firm pumping capacity for a pump station is defined as the total pump station's maximum pumping capacity with the largest pump out of service.

Pump stations pumping to a closed system with no gravity storage, as is the case for Aurora, should be sized for the larger of peak hour demand or maximum day demand plus fire flows at firm pumping capacity.

## Existing pump station

The City's water system pressures are currently maintained by the use of two small booster pumps and one large fire pump, which run and cycle as needed to meet the system demands. The two small lag and lead pumps currently meet average day demands, but struggle to meet maximum day demands during the summer months. Peak hour demands and residential fire flows are currently provided by the single fire pump.

However, the existing fire pump does not have the capacity to meet commercial and industrial fire flows. In addition, the existing pump station severely lacks redundancy and reliability for fire protection. If the existing fire pump is out of service, the City has no capacity to provide for required fire flows. Normally, this type of system is used to supply small residential areas. With the current pumping limitations and with the more recent interest by developers to develop the City's industrial and commercial areas, it is recommended that the pump station be expanded to at minimum meet the needs of commercial fire flows.

From Table 4-8, the projected maximum day demand at the end of the planning period is approximately 360 gpm and a peak hour demand is approximately 895 gpm. As previously noted, since the City's pump station is not served by gravity storage, the pump station must be capable of supplying the larger of peak hour demand or maximum day demand plus fire flows.

Based on the planning criteria with the largest pump out of service (fire pump), the existing firm pumping capacity and recommended firm pumping capacity of the existing booster pump station is shown in Table 6-4. This is shown for both commercial and industrial fire flows.

Having a pump station that is capable of providing for industrial fire flows is ultimately desired as industrial development increases. However, the City currently has minimal industrial users and providing such a large pump station and associated infrastructure upgrades would not be economically feasible for the City. Therefore, it is recommended that the pump station be capable of providing for a commercial fire flow of 2,500 gpm.

**Table 6 – 4**
**Pump Station Capacity Summary at Projected Demands**

| Minimum Fire Flow (gpm) | Projected Water Demands[1] (gpm) | | | Recommended Firm Capacity (MDD plus Fire Flow) | Existing Firm Pumping Capacity[2] (gpm) | Additional Pump Capacity Needed (gpm) |
|---|---|---|---|---|---|---|
| | Average Day Demand | Maximum Day Demand | Peak Hour Demand | | | |
| Residential or Commercial w/Sprinklers 1,500 | 150 | **360** | 895 | 1,860 | **600** | 1,260 |
| **Commercial 2,500** | | | | **2,860** | | **2,260** |
| Industrial 3,500 | | | | 3,860 | | 3,260 |

[1] Rounded figures.
[2] Based on existing pump capacities of 300 gpm each.

With commercial developments and buildings other than one and two-family dwellings that have automatic fire sprinklers installed in accordance with NFPA and Oregon Fire Code requirements, the fire flows can be reduced appropriately. However, the 2007 Oregon Fire Code (B105.3.1) states that in no case shall the resulting fire flow be less than 1,500 gallons per minute at 20 psi residual flow. In this scenario, for commercial developments with automatic sprinklers installed, the pump station will need to meet a minimum combined maximum day demand plus fire flow of 1,860 gpm. For commercial applications without sprinklers, the pump station will need to meet a minimum flow of 2,860 gpm.

In any case, the existing pump station is not adequate to meet the anticipated pumping capacity requirements for the City based on the planning period projections. The outlet pipe from the storage tank to the pump station is currently a 10-inch diameter pipe; however, the existing pump station is equipped with an 8-inch diameter common header for all three pumps. It is anticipated that reconstruction of the existing pump station will be needed in order to meet the higher demand and fire flow requirement of the recommended 2,860 gpm at firm pumping capacity. With the addition of a new storage tank and second booster pump station, the overall system pumping capacity requirements needed by the existing pump station can be reduced accordingly.

## Future Pump Station

It is anticipated that a new small booster pump station will be required to supply water from the new storage tank to the distribution system. In addition, an altitude valve vault assembly will also be required. Altitude valve vaults use various valves and controls to allow water to flow into the storage tank to a predetermined level and at controlled flow rates. This will allow water from the existing supply and future treatment system to supply water for the new storage tank.

With a new proposed pump station adjacent to the new proposed storage tank, pumping capacity requirements placed on the existing pump station can be reduced. It is recommended that when the preliminary planning of the future pump station occurs, that consideration be given to the necessary improvements needed for the existing pump station, so that in combination, they can provide the required pumping capacity to meet system needs.

# Distribution System Analysis

The distribution system was evaluated under existing and future conditions using a hydraulic computer model. The computer model developed includes the supply sources, pump station, storage tank, and distribution system piping. The model was used to predict flows, pipe friction losses, pressures, and hydraulic grades at different points within the system.

## Model Development

Initially, the City did not have electronic base mapping of the existing water system. Therefore, a base map of the City's existing system was first developed in order to input the proper system components into the computer model. Using Marion County's assessor map information, digitized topography and utility information from the wastewater treatment plant drawings, and updated utility and base mapping from record drawings, an electronic base map and computer model was constructed.

The computer model was developed using EPANET (Environmental Protection Agency public software), which is the industry standard. EPANET performs extended period simulation of hydraulic and water quality behavior within system networks. A typical system network consists of pipes, nodes (pipe junctions), pumps, valves, storage tanks and/or reservoirs. The City's developed model includes all pipes with the exception of service laterals.

With an EPANET computer model, City staff will be able to effectively track the anticipated flow of water in each pipe, the pressure at each node, the height of water in the storage tank, and the concentration of a chemical species throughout the network during a simulation period comprised of multiple time steps. In addition to chemical species, water age and source tracing can also be simulated. For the purposes of this study, the model was used primarily to analyze the system under various demand scenarios to determine system deficiencies.

Specific system component information was collected for each facility and input into the model. This information included well groundwater levels, pump curves for the booster pumps, storage tank dimensions, and operational set points at pumps. Table 6-5 below outlines the typical system component information input into the model.

| Table 6 – 5<br>Typical System Component Information for Model | |
|---|---|
| **Input** | **Description** |
| Reservoirs | Name, Head |
| Tanks | Name, Elevation, Initial Level, Minimum Level, Maximum Level, Diameter |
| Pumps | Name, Pump Curve |
| Pipes | Name, Length, Diameter, Hazen-Williams C-Factor, Status (open, closed) |
| Nodes | Name, Elevation, Base Demand |

Nodal and storage tank elevations were assigned using 2-foot contour information obtained from the previous wastewater collection system drawings, supplemented by USGS mapping. Since individual customer meter records with their corresponding locations were not available, system demands were allocated to the computer model for existing conditions by assigning an average residential and commercial demand to the nearest model node.

Maximum and peak day demands were developed using historical system information presented in Section 4. Future demands were allocated by estimating where growth was likely to occur both within the existing service area and within the UGB. Based on previous development trends and availability of vacant land within the UGB, growth was anticipated to most likely occur on the northwest portions (Ehlen Road) and southwest portions (Highway 99E) of the City.

## Model Calibration

Model calibration is a very critical element in the development of a hydraulic model. This is done to ensure that the modeled conditions and simulation results are similar to the actual conditions. This process often identifies incorrect pipe diameter information, locations where pipe networks are incorrectly represented, or where valves may be closed or partially closed.

Information needed from the existing system was obtained through the assistance of City staff. Pressure and flow data from hydrant flow tests were collected during July 2008 to supplement available data. The distribution of demands and pipe friction factors were adjusted based on pipe size and material type in order to get an agreement between the model and actual field conditions. Typically, an acceptable level of calibration for planning purposes is approximately 5 to 10 percent. With only a 4 percent difference, the City's model predicted very similar pressures and flows compared to those observed in the field. The model calibration results are shown below in Table 6-6.

| Table 6 – 6<br>Model Calibration Results | | | | | |
|---|---|---|---|---|---|
| | Field-Observed[1] | | | Model Results | |
| Location | Static Pressure (psi) | Residual Pressure (psi) | Observed Flow (gpm) | Static Pressure (psi) | Residual Pressure (psi) |
| Ottaway Rd & Hwy 99E | 71 | 59 | 1,300 | 71 | 57 |
| Filbert St & Orchard Ave | 68 | 52 | 1,250 | 70 | 52 |
| Park Ave & Cody Ln | 95 | 70 | 1,405 | 96 | 70 |
| Second St & Liberty St | 75 | 23 | 795[2] | 76 | 23 |
| 14783 Ehlen Rd | 88 | 30 | 920 | 88 | 30 |
| 14645 Kasel Ct | 70 | 10 | 530 | 73 | 10 |

[1] Static pressures were observed at static pressure test hydrant locations while residual pressures were observed at both the static pressure test and flow test hydrant locations.
[2] Potential location where existing valves may be closed.

As can be seen from the hydrant flow tests results observed in the field, there are certain areas within the existing system that currently do not meet the required capacity for minimum fire flows.

## Model Analysis

The City's water distribution system primarily consists of a 10-inch PVC water main along Ottaway Road and Liberty Street, which serves as the backbone of the system, with many smaller 2-inch, 6-inch, and 8-inch pipes of varying materials serving as the grid for the City.

Using the water system criteria presented in Section 4, the model network was analyzed for existing and future conditions for the various average, maximum, peak hour, and fire flow demands. Based on the results, the City has two main barriers to the movement of water within the system. In addition, the calibration process has identified two possible areas where distribution valves may be closed or partially closed. City staff is currently investigating the valving within this identified area.

The first and most significant restriction within the existing system is the lack of flow to the higher elevated north end of the City near Kasel Court. The City currently has an 8-inch ductile iron crossing over Mill Creek Bridge tied to a 6-inch steel water line along Ehlen Road and Airport Road, which does not provide adequate flow capacity. This also greatly affects future development, which has been targeted for this northwesterly area of the City. In addition, it is understood from talking with City staff that the 6-inch steel waterline in Ehlen Road is nearing its useful design life and may possibly have been partially damaged during the installation of the Mill Creek Bridge. In order to provide the required fire flows, the existing waterlines will need to be upsized accordingly. With the addition of the new storage tank and pump station, together with a new 12-inch transmission/distribution main along Ehlen Road and Airport

Road, flows will be greatly enhanced. This will also provide much needed redundancy for this area.

The second restriction is the downtown core of the City, which contains older deteriorating pipelines that are undersized since they were installed when fire flow requirements and demands were much lower. The pipeline grid in this area will be strengthened by a new north-south main along Highway 99E and some localized 8-inch water line replacement improvements.

## Existing Conditions Modeling Results

The results of the hydraulic analysis show that during existing average day and maximum day demand conditions, the customers' service pressure are all generally between 70 to 90 psi, which well exceeds the 40 psi minimum service pressure requirement. The minimum service pressure identified was 73 psi.

The modeling results and associated figures for existing maximum day and peak hour demand conditions are presented in Appendix H. The areas with the lowest pressure are north along Kasel Court at the higher elevations. Many locations in the system exhibited pressures greater than 80 psi during maximum day demands with the highest pressures around 100 psi.

The peak hour demand analysis indicated that all areas are generally between 50 to 70 psi, which is above the minimum requirement. The minimum service pressure identified was 53 psi. Based on the assigned nodal demands, no pipes exceeded the maximum velocity criteria during average day, maximum day, or peak hour demand scenario.

The City is served by a variable speed pump station that could be adjusted to provide a higher or lower pressure. However, if increased, customers on the lower edges of the pressure zone could experience pressures well above 100 psi and if decreased, customers on the higher edges could experience low pressures. Overall, the system pressure set points appear to be relatively balanced in its current configuration.

Due to the limited number of customers located within the isolated lower elevated areas with the higher system pressures, there are currently no plans to install a system pressure reducing valve (PRV). Future installation of PRVs may be warranted depending on future growth of these lower areas.

## Future Conditions Modeling Results

The future service area and future pipeline grid is presented in Figure 8-1 in Section 8. As shown, the new areas will be served by proposed 10-inch distribution mains and 8-inch grids. From existing demands, a typical consumption for each land use type was developed. This water consumption was applied to undeveloped and future service areas using the proposed land use. The future conditions and build-out assumptions were previously discussed in Section 3.

The modeling results for future average day, maximum day, and peak hour demand conditions show adequate service pressure for all service connections (greater than 40 psi). No pipes

exceeded the maximum velocity criteria during average day, maximum day, or peak hour demand for this future scenario.

### *Fire Flow Modeling Analysis*

Recommended fire flows have steadily increased to meet Fire Code and ISO requirements, AWWA guidelines, and increased development within the City of Aurora. The distribution system must be capable of maintaining acceptable velocities and system pressures while delivering maximum day demands plus fire flows.

The criteria presented in Section 5 recommended fire flows of 1,500 gpm in residential areas, 2,500 gpm in commercial areas, and 3,500 gpm in industrial areas. However, due to the current number of industrial users and anticipated limited number of users during the planning period, 2,500 gpm was recommended for this commercial/industrial zoned area.

During fire flow simulations, the single fire pump was operated during the analysis. In its current configuration, the existing water system is only limited to providing for residential fire flows at limited areas. The downtown core area that has older, smaller diameter piping and the northwest area past the Mill Creek Bridge are two locations that did not meet the minimum residential fire flow requirement. Exhibit 3 in Appendix H presents the maximum fire flow available for existing conditions, while maintaining 20 psi during maximum day demand conditions. Due to pumping capacity limitations, the existing system is not capable of meeting commercial fire flow requirements.

Fire flow deficiencies were evaluated with a number of proposed improvements to address these areas. Improvements were prioritized within the CIP shown in Section 8, based on the extent of the deficiency and the number of impacted customers. If all improvement projects that have been identified as part of this analysis are implemented, the fire flow criteria will be met. However, as previously mentioned, current pumping limitations greatly affect the systems ability to meet the higher commercial fire flows.

## Fire Hydrant Placement Analysis

A review of fire hydrant placement throughout the distribution system shows some deficiencies. There are a number of areas within the system that exceed the 500 feet maximum spacing requirement between hydrants for residential areas and 200 feet to 500 feet within commercial/industrial areas. In addition, some hydrants have exceeded their useful design life and need to be replaced. Some hydrants are being supplied by 4-inch laterals, which does not provide for adequate fire flows. It is recommended that the City establish a fire hydrant replacement plan to inventory and update the existing hydrants and laterals to comply with current standards.

## Existing Asbestos Cement Pipe Concerns

Asbestos-cement pipe (ACP) is a mixture of portland cement and asbestos fibers. ACP was introduced in the early 1930s and by the early 1950s, the American Water Works Association (AWWA) had established standards for ACP. As a result, there were many miles of ACP installed in distribution systems nationwide, with a good majority still in service. In the 1970s,

attention was focused on the health hazards associated with asbestos in the environment, including in water distribution systems. Subsequently, the Environmental Protection Agency (EPA) determined that asbestos, in an airborne condition, is a hazardous material and established laws/guidelines for the handling and disposal of the material.

Asbestos is an inorganic chemical that is unlikely to appear suddenly in a system's water. If a system has asbestos-cement water mains and water of a certain corrosiveness, or if asbestos is present naturally in an area, the system might detect asbestos in its water. Otherwise, a system which has never detected asbestos must test for asbestos only once every nine years. If the system were ever to detect asbestos, it would have to begin more frequent monitoring.

The City's existing water distribution system includes approximately 4,472 feet of ACP. In general, ACP may potentially be a health risk to the City's drinking water system during the following conditions:

- Damage to the pipe caused by internal corrosion may result in asbestos being released into the distribution system. Sampling and testing can be performed to determine if asbestos is present in the water system. If asbestos is present, the AC pipe should be replaced.

- When working with ACP, such as connecting new waterlines to existing, making service taps or pipe repairs, asbestos can be released into the air as dust, creating a health hazard for maintenance workers. Appropriate safety precautions can be taken to protect workers from exposure to asbestos in these situations. The Oregon DEQ has set regulations when working with ACP and requires that all asbestos-containing materials be kept wet during removal and disposal. These asbestos regulations are identified in OAR 340-248.

## Recommended Distribution System Improvements

The distribution system evaluation indicates that the City needs a number of system improvements to the storage, pumping, and distribution system in order for the system to provide the needed fire flows. Section 8 presents specific distribution projects that are proposed over the planning period that will enable the City to provide reliable service to their customers.

Figure 8-1 in Section 8 provides a map of the system showing the proposed projects. The facility locations shown on this figure are approximate. The City may revise the locations and sizes based on property ownership, conflicts with other utilities, development patterns, or other factors that are in the City's best interests.

ASHLEY
ENGINEERING DESIGN

# SECTION 7

## Water Quality, Conservation, and Regulatory Review

SECTION 7

# Water Quality, Conservation, and Regulatory Review

## Objective

The objective of this section is to present a review of the Oregon Administrative Rules (OAR) Chapter 333, Division 61 regarding public water systems, the Federal drinking water regulations pursuant to the Safe Drinking Water Act (SDWA), and overall compliance status of the City of Aurora's water system. In addition, anticipated regulations have been reviewed to assess future implications for the City. A review of current water treatment practices, water quality conditions, monitoring and waiver status, and non-compliance issues is also presented.

## Water Quality and Regulatory Review

National primary drinking water regulations were established in 1974 with the signing of the Safe Drinking Water Act (SDWA). The Environmental Protection Agency (EPA) was authorized to set standards and implement the SDWA. Since its inception, the SDWA and associated regulations have been amended a number of times.

Public water systems are governed by rules developed by the EPA for implementation of the SDWA. There are now drinking water quality standards for some 91 different contaminants established by the EPA. In general, they can be grouped into the following categories:

- **Primary Standards**
  - **Inorganic Chemicals (IOCs) –** such as salts or metals, which can be naturally-occurring or result from urban stormwater runoff, industrial or domestic wastewater discharges, oil and gas production, mining, or farming. This also includes lead and copper leached into the water from household plumbing and fixtures.
  - **Organic Chemicals, Volatile and Synthetic (VOCs, SOCs) –** such as pesticides and herbicides which may come from a variety of sources, such as agriculture, urban stormwater runoff, and residential uses. This also includes synthetic and volatile chemicals which are by-products of industrial processes and petroleum production, and can also come from gas stations, urban stormwater runoff, and septic systems.
  - **Disinfectants and Disinfection Byproducts –** such as chlorine, chloramines, and chlorine dioxide, which are water additives used to control microbes. Disinfection of drinking water results in some potentially harmful byproducts such as bromate, chlorite, etc.
  - **Radionuclides –** which can be naturally occurring or result from oil and gas production and mining operations.
  - **Microbiological and Turbidity –** such as viruses and bacteria which can come from sewage treatment plants, septic systems, agricultural and livestock

operations, and wildlife. Turbidity is caused by suspended matter or impurities that interfere with the clarity of the water. These impurities may include clay, silt, finely divided inorganic and organic matter, soluble colored organic compounds, and plankton and other microscopic organisms.

- **Additional Rules & Requirements** – such as public notifications, reporting requirements, operator certification requirements, etc.

❖ **Secondary Standards**

- **Secondary Contaminants** – such as contaminants, which, at the levels generally found in drinking water, do not present an unreasonable risk to health, but do have adverse effects on the taste, odor and color of water; and/or produce undesirable staining of plumbing fixtures; and/or interfere with treatment processes applied by water suppliers. This includes contaminants such as iron (red/orange staining), manganese (black/brown staining), fluoride (tooth discoloration), aluminum, pH, etc….

❖ **Unregulated**

- Unregulated Contaminants

National Primary Drinking Water Regulations (NPDWRs or Primary Standards) are legally enforceable standards that apply to public water systems. The EPA set these primary drinking water regulations to protect public health by limiting the levels of these contaminants in drinking water. The maximum allowable level of a contaminant in water delivered to the users of a public water system is termed maximum contaminant levels (MCL). 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. The MCL's have been set at levels to ensure that the health of the general population is not adversely impacted by ingestion of water. In general, if the listed contaminants in drinking water exceed the MCL's, a risk of adverse health effects is suspected.

National Secondary Drinking Water Regulations (NSDWRs or Secondary Standards) are non-enforceable standards. These Secondary Standards are guidelines regulating contaminants that may cause cosmetic effects (such as skin or tooth discoloration) or aesthetic effects (such as taste, odor, or color) in drinking water, and therefore public acceptance. EPA recommends Secondary Standards to water systems, but does not require systems to comply. However, states may choose to adopt them as enforceable standards. These Secondary Standards are termed maximum contaminant level goals (MCLG).

The Safe Drinking Water Act directs EPA to identify and list unregulated drinking water contaminants suspected to be present in drinking water and that may require a national drinking water regulation in the future. EPA must periodically publish this list of contaminants, called the Contaminant Candidate List (CCL). EPA uses the CCL to prioritize research and data collection efforts to help determine if specific contaminants should be regulated. Water suppliers are called upon to participate and contribute to the data collection effort through the Unregulated Contaminant Monitoring Rules (UCMR). All water suppliers serving more than 10,000 people must conduct UCMR monitoring, use EPA-approved labs, and report results to EPA. Selected water suppliers serving 10,000 or fewer people are sampled at EPA expense. All validated results are stored in and accessible through the National

Contaminant Occurrence Database (NCOD). EPA must decide whether or not to regulate at least five or more contaminants on each CCL list, called Regulatory Determinations.

This process is designed to support development of future standards for those contaminants based on the following three criteria:

- The projected adverse health effects from the contaminant, and
- The extent of occurrence of the contaminant in drinking water, and
- Whether the regulation of the contaminant would present a "meaningful opportunity" for reducing risks to health.

Because Aurora's water system uses only groundwater and is not directly under the influence of surface water, the applicable regulations are those related to groundwater and the distribution system. Table 7-1 provides a list of applicable regulations. Aurora is currently in compliance with all the current State and Federal regulated standards.

**Table 7 - 1**
**Applicable Regulations**
**under the Safe Drinking Water Act**

| Regulation/Rule | Parameters Regulated | Approximate Published Date |
|---|---|---|
| Phase I Rule | Volatile Organic Chemicals | July 1987 |
| Total Coliform Rule | Bacteriological, Disinfection | June 1989 |
| Phase II Rule | Inorganic, Volatile Organic, and Synthetic Organic Chemicals | January 1991 |
| Lead and Copper Rule | Lead and Copper | June 1991 |
| Phase V Rule | Inorganic, Volatile Organic, and Synthetic Organic Chemicals | July 1992 |
| Wellhead Protection | Source water protection | 1986 SDWA Requirements, with EPA Program Approval for Oregon in September 1996 |
| Consumer Confidence Report Rule | Requires annual report addressing drinking water quality | August 1998 |
| Stage 1 DBP Rule | Trihalomethanes, Haloacetic Acids, Disinfectant Residuals | December 1998 |
| Operator Certification Rule | Operators must have state certification for classification of system being operated | February 1999 |
| Unregulated Contaminant Monitoring Rule | Monitoring for 12 unregulated organic chemicals | September 1999 |
| Public Notification Rule (Revised) | Stipulates reporting protocol for acute violations | May 2000 |
| Radionuclide Rule | Radionuclides | December 2000 |
| Arsenic Rule | Arsenic | January 2001 |
| Stage 2 DBP Rule | Trihalomethanes, Haloacetic Acids, Disinfectant Residuals | January 2006 |

A brief summary of the applicable regulations are identified below, as well as proposed regulations to assess any future implications for the City. Much of the information on the technology, training, and regulatory and policy issues regarding the State's public water system is summarized from information presented in the Pipeline newsletter, published by the Oregon Department of Human Services - Drinking Water Program. The following summary of current standards should not be a substitute for the actual statutes and regulations that govern public water supply in Oregon. In addition, the proposed regulations are still under development at the Federal level, and are subject to change.

# State Regulations

In Oregon, public drinking water systems are subject to the Oregon Drinking Water Quality Act. The primary purpose of the 1981 Oregon Act is to "assure all Oregonians safe drinking water". According to the Oregon Act, safe drinking water means water which is sufficiently free from biological, chemical, radiological, or physical impurities such that individuals will not be exposed to disease or harmful physiological effects."

Under the Oregon Act, the Oregon Department of Human Services (DHS) has broad authority to set water quality standards necessary to protect public health through insuring safe drinking water within a public water system. To accomplish this, DHS is directed under the Act to require regular water sampling by water suppliers. These samples must be analyzed in laboratories approved by DHS, and the results of laboratory tests on those samples must be reported to DHS by the water supplier. DHS must investigate water systems that fail to submit samples, or whose sample results indicate levels of contaminants that are above maximum allowable levels. Water suppliers who fail to sample the water or report the results or whose water contains contaminants in excess of allowable levels, must take corrective action and notify water users.

Since 1986, DHS has exercised primary responsibility for administering the Federal Safe Drinking Water Act in Oregon, an arrangement called "Primacy". DHS adopts and enforces standards that are no less stringent than the Federal standards, and in return, the EPA gives DHS the regulatory responsibility for public drinking water systems and partial financial support for the Oregon program operation. In practice, the Oregon drinking water standards match the national standards established under the Safe Drinking Water Act by the EPA. This is because setting maximum levels for drinking water contaminants to protect human health involves considerable development of health effects information and other scientific research that is best carried out at the national level. DHS concentrates its efforts on implementing the national standards at Oregon public water systems.

The Oregon standards are outlined in the Oregon Administrative Rules (OAR) Chapter 333, Division 61. OAR 333-061-0020 (Effective 2-15-2008), defines a "Public Water System" as a system for the provision to the public of piped water for human consumption, if such system has more than three service connections, or supplies water to a public or commercial establishment that operates a total of at least 60 days per year, and that is used by 10 or more individuals per day. Public water system also means a system for the provision to the public of water through constructed conveyances other than pipes to at least 15 service connections or

regularly serves at least 25 individuals daily at least 60 days of the year. A public water system is a "Community Water System", a "Transient Non-Community Water System", a "Non-Transient Non-Community Water System", or a "State Regulated Water System".

"Community Water Systems" means a public water system that has 15 or more service connections used by year-round residents, or that regularly serves 25 or more year-round residents. These systems perform the most frequent water sampling for the greatest number of contaminants, because the people served have the most ongoing exposure to the drinking water. "Non-Transient Non-Community Water Systems" means a public water system that is not a Community Water System and that regularly serves at least 25 of the same persons over 6 months per year, such as a school or workplace with its own independent water supply system. "Transient Non-Community Water Systems" means a public water system that serves a transient population of 25 or more persons, such as campgrounds, parks, or restaurants with their own independent water supply systems. "State Regulated Water Systems" means a public water system, which serves 4 to 14 service connections or serves 10 to 24 people a day at least 60 days a year. Monitoring requirements for these systems are the same as those for Transient Non-Community Water Systems.

The City of Aurora's water system serves a current population of approximately 975 residents and approximately 418 service connections. Therefore, the water system is defined by OAR 333-061-0020, as a Community Water System. The City is responsible for the monitoring and compliance with all SDWA and DHS regulations pertaining to ground water and distribution system water quality.

Maximum Contaminant Levels and water quality monitoring requirements are addressed in Sections 333-061-0030 and 333-061-0036 of the OAR, respectively. These monitoring requirements are minimum requirements and DHS maintains the authority to require additional monitoring when necessary to determine whether an unreasonable risk to health exists. DHS may also require monitoring requirements for additional contaminants not included in OAR 333-061-0030 (Maximum Contaminant Levels) when necessary for public health protection.

The State's rules also include other important construction standards that apply to the construction of new public water systems and to major additions or modifications to existing public water systems. They are intended to assure that the system facilities, when constructed, will be free of public health hazards and will be capable of producing water which consistently complies with the MCLs. A complete list of construction standards for public water systems can be found in OAR 333-061-0050 and is included in Appendix G.

## Responsibilities of Water Suppliers

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 assure that water system facilities are free of public health hazards, and to assure 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, when the maximum contaminant levels have been exceeded;

- Notify all customers served by the system 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, to the Department, plans 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 333-061-0205 relating to certification of water system operators.

- Assure that Transient 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.

# Federal Regulations

Currently, there are approximately 91 contaminants regulated by the EPA established drinking water quality standards. This includes 7 microbiological and turbidity, 7 disinfectants and disinfection byproducts, 16 inorganic chemicals (including lead and copper), 56 synthetic and

volatile organic chemicals, and 5 radiological contaminants. These standards either have established maximum contaminant levels (MCLs) or treatment techniques, which are further summarized below. According to the DHS database, the City of Aurora's current routine sampling schedule is summarized in Table 7-2. Water quality and sampling schedule information obtained from the DHS online database is shown in Appendix I.

**Table 7 - 2**
**Current Routine Sampling Schedule**

| Sample Location | Test Group | Samples Required | Sampling Interval | Notes/Comments |
|---|---|---|---|---|
| Park Wells (Well No. 3 and Well No. 4) | Arsenic (As) | 1 | Quarterly | Exceeded MCL 9-7-06, Min 2 quarters |
| | IOCs | 1 | 9 years | Schedule reflects granted monitoring reduction |
| | Nitrate | 1 | Yearly | |
| | Nitrite | 1 | 9 years | |
| | SOCs | 1 | 3 years | |
| | VOCs | 1 | 3 years | |
| | Radionuclides | 1 | 6 years | |
| Distribution System | Coliform | 1 | Monthly | Measure the Maximum Residual Disinfection Levels (MRDL) at the same points in the system and at the same time when total coliforms are sampled |
| | Maximum Residual Disinfectant Level | 1 | Monthly | |
| | HAA5 & TTHM | 1 | Yearly | Sample during the month of warmest water temperature |
| | Lead & Copper | 10 | 3 years | Sample between June 1st and Sept 30th |

## Inorganic Chemicals

Monitoring requirements and MCLs for inorganic chemicals (IOCs) were established under the final Phase II and Phase V Rules. The City is required to collect samples from Wells No. 3 and 4 for a complete IOC analysis every nine years. Purveyors of community systems are required to prepare an inorganic chemical monitoring plan and base their routine monitoring on the plan.

Based on available historical data, the following water quality concerns related to inorganic chemicals have been identified.

### Well No. 1

Well No. 1 was completed in 1920 and is Aurora's oldest well. Aurora has not used this well as a regular municipal groundwater source since 1992. Since discontinuing its regular use, it was used only for emergencies due to its taste and odor issues, as well as from its close proximity to the Pudding River. Current drinking water regulations prohibit the use of this well and it was disconnected from the water distribution system around year 2004.

### Well No. 3

Well No. 3 was completed in 1966 and is considered as the main groundwater supply for Aurora. Together with Well No. 4, they provide the main water source for the system. The overall water quality with regards to arsenic, iron, manganese, and other IOC concentrations have essentially been non-detectable. The well does exhibit some Sodium concentrations at around 9.6 mg/L (sample date of 9-12-07) and Nitrate levels as high as 4.8 mg/L (10-05-06), but are still within range of their respective secondary MCLs of 20 mg/L and 10 mg/L.

### Well No. 4

Well No. 4 was completed in 1981 and typically is used year round. However, since the reduction of the arsenic MCL in 2006 to 1/5 of the previous level, City staff has had to vary its use in order to keep the blended levels of arsenic below the MCL. With regards to overall water quality, Well No. 4 is not as beneficial for the City, as is Well No. 3. With an Arsenic concentration level as high as 0.014 mg/L (9-07-06), it is consistently at or just above the 0.010 mg/L MCL. The 2002 Source Water Assessment Report, prepared by DHS and DEQ, states that the occurrence of Arsenic is likely of natural origin, given that the alluvium that makes up the Willamette Aquifer at this location was derived from the volcanic rocks of the Cascades. Unlike Well No. 3, the well's Nitrate levels have been very low to non-detectable.

The well also occasionally exhibits relatively high Iron and Manganese concentrations above the secondary MCLs. Recent samples (8-28-07) have shown Iron concentrations at 0.32 mg/L and Manganese at 0.17 mg/L, which is above their respective secondary MCLs of 0.30 mg/L and 0.05 mg/L. These concentrations do not pose health concerns, but does have adverse effects on the taste, odor and color of water; and/or produce undesirable staining of plumbing fixtures.

The well also exhibited sodium concentrations of 33.8 mg/L, which is above the secondary MCL of 20 mg/L.

### Well No. 5

Well No. 5 is the newest well having been completed in 2005. This well has not yet been put into production. Preliminary water quality test results for Arsenic indicates that the well exhibits varying concentration levels from non-detectable (9-12-07) to 0.0099 mg/L (2-15-07), which is just below the 0.010 mg/L MCL. Once in production, City staff will likely need to vary its use in order to keep the level of arsenic below the MCL. Preliminary testing for Nitrate levels has not yet been performed.

Preliminary test results (9-12-07) have also shown high Iron concentrations at 0.66 mg/L and Manganese at 0.05 mg/L, which is above their respective secondary MCLs of 0.30 mg/L and 0.05 mg/L. Similar to Well No. 4, these levels will have adverse effects on the taste, odor and color of water; and/or produce undesirable staining of plumbing fixtures.

The well also exhibits high sodium concentrations of 66.4 mg/L, which is above the secondary MCL of 20 mg/L. However as previously mentioned, these concentrations are not likely to pose a health concern, but residents who are on a physician-prescribed low-sodium diet should notify their doctors of this sodium level.

For comparison, according to the EPA website regarding Sodium in drinking water, A Food and Drug Administration publication, "Scouting for Sodium and Other Nutrients Important to Blood Pressure" (FDA 95-2284) states that most American adults tend to eat between 4,000 and 6,000 mg of sodium per day, "and therapeutic sodium restricted diets can range from below 1,000 mg to 3,000 mg per day." It lists the following nutrient guidelines for food labeling:

- **Low-sodium:** 140 mg or less per serving (or, if the serving is 30 g or less or two tablespoons or less, 140 mg or less per 50 g of the food)
- **Very low-sodium:** 35 mg or less per serving (or, if the serving is 30 g or less or two tablespoons or less, 35 mg or less per 50 g of the food)
- **Sodium-free:** Less than 5 mg per serving

Assuming that an average adult living in Aurora weighing 150 pounds (about 70 kilograms), drinks 8 glasses (about 2 liters) of water per day, he or she would typically ingest approximately 132 mg of sodium per day from drinking water at this level. Based on this data, an 8-ounce glass serving (about a 1/4-liter) would contain less than 16.6 mg of sodium, well within FDA's "very low sodium" category. The Food and Nutrition Board of the National Research Council recommends that most healthy adults need to consume at least 500 mg/day, and that sodium intake be limited to no more than 2400 mg/day.

## Lead and Copper

The Lead and Copper Rule (LCR) applies to all community water systems. The rule developed MCLGs and action levels for both lead and copper in drinking water. The major difference between this regulation and other regulations is that the water must be monitored at customers' taps, not at sampling stations. The LCR requires that public water systems conduct lead and copper monitoring at customer taps to determine if the 90th percentiles of homes tested exceed action levels of 0.0155 mg/L for lead and 1.35 mg/L for copper. Source water sampling is only required if at-the-tap concentrations exceed action levels. The LCR sets out required actions of corrosion control treatment, source water monitoring/treatment, public education, and lead service line replacement for systems exceeding the 90$^{th}$ percentile levels.

Aurora has consistently complied with the Lead and Copper Rule. Since 1993, the City has conducted five rounds of sampling. The highest 90th percentile concentration for lead was 0.0032 mg/L (8-18-97), well below the action level of 0.0155 mg/L. The highest 90th percentile copper concentration was 0.765 mg/L (8-18-97), well below the action level of 1.35 mg/L. Because of compliance with the lead and copper action levels, Aurora is on a reduced sampling schedule. Repeat sampling is required only every 3 years. Table 7-3 summarizes the results of LCR monitoring originally conducted in 1993 and 1994.

**Table 7 - 3**
**Lead and Copper Monitoring Results**

| Period | Lead | | Copper | |
|---|---|---|---|---|
| | 90$^{th}$ Percentile | Action Level | 90$^{th}$ Percentile | Action Level |
| Spring 1993 | ND@0.002 mg/L | 0.015 mg/L | 0.338 mg/L | 1.3 mg/L |
| Spring 1994 | ND@0.002 mg/L | | 0.194 mg/L | |

On October 10, 2007, EPA published the latest changes to the LCR. These changes include some clarifications of some provisions and also include seven major revisions to the previous LCR. These revisions are intended to better ensure that at-risk populations receive information quickly and are able to act to reduce their exposure. It is believed that these changes will also help water systems to better comply with the public education requirements.

### Nitrite and Nitrate

The City is required to collect an annual sample from each source for nitrate analysis and a sample from each source every nine years for nitrite analysis. Monitoring requirements for these parameters cannot be waived. The City continues to collect these samples from all of their source wells, as required by DHS.

Since 1992, nitrate levels have not exceeded 4.8 mg/L (10-05-06), and have been typically below 2.0 mg/L in each of the wells. The 2002 Source Water Assessment Report states that although this is below the drinking water standard of 10.0 mg/L, these values are still in excess of what can be considered from natural sources. Nitrite concentrations have essentially been non-detectable. For reference, the MCL for Nitrite is 1.0 mg/L.

### Arsenic Rule

On January 22nd, 2001, the US Environmental Protection Agency (EPA) established a MCL of 10 micrograms of Arsenic per liter of water (µg/L, also referred to as parts per billion or ppb). Formerly, the limit was 50 ppb but EPA reduced the MCL to 10 ppb because of epidemiological studies which demonstrated increased risk of cancers were associated with chronic exposure to high levels of arsenic in drinking water. Community and non-transient non-community systems in Oregon had to begin monitoring and be in compliance with the new standard by January 23, 2006. At minimum, water systems with surface water sources must sample annually, and systems with ground water sources must sample every three years.

The regulation requires compliance with the arsenic limit on a running four-quarter average, limiting an individual's chronic exposure to the chemical. Arsenic must be monitored at each entry point to the distribution system as part of the IOC monitoring framework. If any sampling point is in violation of an MCL, the system is in violation.

Monitoring conducted in 9-07-06 revealed that arsenic was present in Well No. 4. Concentrations of Arsenic ranged from non-detected to as high as 0.014 mg/L. The City will continue monitoring arsenic trends at each of the sources and consider investigating Arsenic treatment. A brief discussion on possible treatment methods is subsequently described below in the Water Treatment subsection.

## Organic Chemicals

### Volatile Organic Chemicals

Monitoring requirements and MCLs for 21 volatile organic chemicals (VOCs) were established under the final VOC Phase I and SOC/IOC Phase II and Phase V Rules. The City is required to collect samples from each source for VOC analysis in accordance with the required routine

sampling schedule. The City most recently collected VOC samples from all of their wells in production in 2007.

All VOC levels in Aurora have consistently been below analytical detection limits and their respective MCLs. As previously mentioned in Table 7-2, the City is currently on the following reduced monitoring schedule:

- Well No. 3 – One sample every 3 years
- Well No. 4 – One sample every 3 years

### *Synthetic Organic Chemicals*

Monitoring requirements and MCLs for 35 SOCs were established under the final SOC/IOC Phase II and Phase V Rules. The City is required to collect samples from each source for SOC analysis in accordance with the required routine sampling schedule. The City most recently collected SOC samples from all of their wells in production in 2007.

All SOC levels in Aurora have consistently been below analytical detection limits and their respective MCLs. As previously mentioned in Table 7-2, the City is currently on the following reduced monitoring schedule:

- Well No. 3 – One sample every 3 years
- Well No. 4 – One sample every 3 years

## Disinfectants and Disinfection By-Products

### *Stage 1 Disinfectants and Disinfection By-Products Rule*

The Disinfectants and Disinfection By-Products Rule (DBP) Rule was developed in two Stages. Stage 1 was promulgated in December 1998 and became effective in January 2004 for Aurora. Stage 2 was promulgated in January 2006 and will become effective in various stages.

The Stage 1 DBP Rule replaced the former Trihalomethane Rule and applies to all community water systems (CWSs) using a chemical disinfectant for either primary or secondary disinfection. The DBP Rule sets MCLs for chlorite and bromate, and the sum of four trihalomethanes (TTHMs), and the sum of five haloacetic acids (HAA5).

The Stage 1 Rule also sets Maximum Residual Disinfectant Levels (MRDLs) for disinfectants added to drinking water including chlorine (free chlorine residual), chloramines (total chlorine residual) , and chlorine dioxide. An MRDL is defined as the level of a disinfectant added for water treatment that may not be exceeded without an unacceptable possibility of adverse health effects. Stage 1 MCLs and MRDLs are summarized in Table 7-4 below.

| Table 7 - 4<br>Summary of Stage 1 DBP Rule MCLs and MRDLs | | |
|---|---|---|
| **Parameter** | **MCL (mg/L)** | **MRDL (mg/L)** |
| **Disinfection By-Product** | | |
| TTHMs | 0.080 | |
| HAA5 | 0.060 | |
| Bromate(1) | 0.010 | |
| Chlorite(1) | 1.0 | |
| **Disinfectant** | | |
| Chlorine (as $Cl_2$) | | 4.0 |
| Chloramines (as $Cl_2$) | | 4.0 |
| Chlorine Dioxide(1) (as $CLO_2$) | | 0.8 |

(1) The City is not required to monitor for bromate, chlorite, or chlorine dioxide since neither chlorine dioxide nor ozone are being used in the treatment process.

Chlorine residual monitoring is applicable to all Community and Non-Community Water Systems that use chlorine or chloramines as a disinfectant. Since Aurora uses chlorine as a disinfectant to control microbes, chlorine residual monitoring is required. Aurora must take samples at the same location in the distribution system as those locations used for total coliform sampling. This is a separate requirement from the daily monitoring and recording of the disinfectant residual. Compliance with Stage 1 MCLs and MRDLs is based on a running annual average (RAA) of samples collected, as required by the Stage 1 Rule.

## *Stage 2 Disinfectants and Disinfection By-Products Rule*

The Stage 2 Disinfectants and Disinfection Byproducts Rule (Stage 2 DBP) Rule was published in the Federal Register on January 4, 2006 and builds upon the Stage 1 DBP Rule to address higher risk public water systems for protection measures beyond those required for existing regulations.

Under the Stage 2 DBP Rule, systems will conduct an evaluation of their distribution systems, known as an Initial Distribution System Evaluation (IDSE), to identify the locations with high disinfection byproduct concentrations. These locations will then be used by the systems as the sampling sites for Stage 2 DBP Rule compliance monitoring.

Compliance with the maximum contaminant levels for two groups of disinfection byproducts (TTHM and HAA5) will be calculated for each monitoring location in the distribution system. This approach, referred to as the locational running annual average (LRAA), differs from current Stage 1 requirements, which determine compliance by calculating the running annual average of samples from all monitoring locations across the system. The Stage 1 averaging meant that some geographic locations could occasionally or even regularly exceed the MCLs for

DBPs, and yet the system remained in compliance. The Stage 2 DBP Rule eliminates this possibility by requiring compliance at all geographic locations.

The Stage 2 DBP Rule also requires each system to determine if they have exceeded an operational evaluation level, which is identified using their compliance monitoring results. The operational evaluation level provides an early warning of possible future MCL violations, which allows the system to take proactive steps to remain in compliance. A system that exceeds an operational evaluation level is required to review their operational practices and submit a report to their state that identifies actions that may be taken to mitigate future high DBP levels, particularly those that may jeopardize their compliance with the DBP MCLs.

There are four options shown below that are available to systems to meet IDSE requirements and will depend on technical resources, existing monitoring results, size, and preference.

- **Very Small System (VSS) Waiver.** Systems serving fewer than 500 people that have TTHM and HAA5 data automatically receive the VSS waiver unless they are notified by EPA or DHS that they must conduct an IDSE. Systems receiving the VSS waiver have no further IDSE requirements.

- **40/30 Certification.** Systems can fulfill the IDSE requirements by certifying that all individual TTHM and HAA5 monitoring results for compliance with the Stage 1 DBP Rule are less than or equal to 0.040 mg/L for TTHM and 0.030 mg/L for HAA5 during a prescribed 2-year time period. In addition, the system must not have had any Stage 1 DBP Rule monitoring violations for TTHM and HAA5 during the same period. The system must submit the required 40/30 certification and, unless told otherwise by EPA or DHS, they have no further requirements under the IDSE.

- **Standard Monitoring.** Any system can choose to conduct standard monitoring, even if they receive a VSS or qualify for the 40/30 certification. Standard monitoring entails 1 year of distribution system monitoring at multiple locations (in addition to Stage 1 DBP Rule monitoring). The required sampling frequency and minimum number of sample locations depend on population served and source water type. Systems conducting standard monitoring must prepare a standard monitoring plan and IDSE report.

- **System Specific Study (SSS).** Systems can meet IDSE requirements using existing monitoring results or a hydraulic model if their data or model meets certain minimum criteria. Systems conducting an SSS must prepare an SSS plan and IDSE report.

Aurora should qualify for a 40/30 certification because the highest RAA values measured to date are 0.00780 mg/L for TTHMs (9-07-06) and 0.0050 mg/L for HAA5s (8-29-07). Stage 2 DBP Rule compliance deadlines are based on the size of the public water system. For Aurora, compliance activities are outlined in the following Table 7-5.

| Table 7 - 5<br>Stage 2 DBP Rule Compliance Deadlines | | | | |
|---|---|---|---|---|
| Public Water System | Actions | | | |
| | Submit one of the four IDSE Requirements | Complete an IDSE | Submit IDSE Report | Begin Stage 2 compliance monitoring |
| CWSs serving fewer than 10,000 people (schedule 4) | April 1, 2008 | March 31, 2010 | July 1, 2010 | October 1, 2013 |

As mentioned, Stage 2 DBP Rule requires compliance with TTHM and HAA5 MCLs of 0.080 and 0.060 mg/L, respectively, based on a locational running annual average (LRAA). Aurora should comply with these requirements based on the historically low values that have been measured in the system.

## Radionuclides

All community systems are subject to initial monitoring requirements of revised EPA rules beginning in 2004 and ending in 2007. The City conducted radionuclide analyses in 2003 (9-23-03) and had no detections for Gross Alpha particles, 1.4330 pCi/L for Combined Radium, and 0.0000350 mg/l for Uranium. These concentrations levels are below their corresponding MCLs, as shown in Table 7-6. Because the City conducted radionuclide sampling between June 2000 and December 2003 which included Gross Alpha, the system qualified for a grandfathering provision of the revised rule.

The revised Radionuclide Rule was promulgated in December 2000 and became effective in December 2003. This Rule establishes reduced MCLs for several radioactive elements, as identified in Table 7-6. The monitoring locations and frequency will remain identical to that required under the existing Radionuclide Rule.

| Table 7 - 6<br>Radionuclide Rule Conditions | |
|---|---|
| Contaminant | MCL |
| Gross Alpha Particles | 15 pCi/L |
| Gross Beta Particles and Photon Emitters | 4 mrem(1)/yr |
| Combined Radium - 226 and 228 | 5 pCi/L |
| Uranium | 30 µg/L |
| Tritium | 20,000 pCi/L(2) |
| Strontium-90 | 8 pCi/L(2) |

(1) Millirems per year, effective dose to the body.
(2) picoCuries per liter, as an annual average.

# Microbiological and Turbidity

## Total Coliform Rule

The total coliform rule's (TCR) primary goal is to improve the protection of public health by reducing fecal pathogens to minimal levels through control of total coliform, including both fecal coliform and E. coli. The maximum contaminant level goal (MCLG) for total coliform was set to zero. Compliance with the maximum contaminant level (MCL) is based on the presence or absence of total coliform in a sample (as opposed to coliform density as in previous rules). Based on a service population of 975, Aurora is currently required to collect a minimum of 1 sample per month from representative points within the distribution system. Since Aurora collects fewer than 5 routine samples per month, the TCR states that Aurora must have a sanitary survey performed by DHS every 5 years. The last sanitary survey performed by the Marion County Health Department was in June 2006.

Since October 10, 2003, there have been no positive coliform samples within the distribution system. The presence of total coliforms indicates potential problems with water system operations or maintenance that require attention and correction by the water supplier. Fecal coliforms and E. coli are bacteria whose presence indicates that the water may be contaminated with human or animal wastes, and urgent action is require to protect public health including advising water users to boil drinking water or use alternate supplies.

For Aurora, a monthly MCL violation is triggered if the system has greater than 1 routine/repeat sample per month, which is total coliform-positive. An acute MCL violation is triggered if the system has any fecal coliform or E. coli-positive routine/repeat sample followed by a total coliform-positive repeat sample.

For a monthly MCL violation, the violation must be reported to the State no later than the end of next business day after the system learns of the violation and the public must be notified within 14 days. For an acute MCL violation, the violation must be reported to the State no later than the end of next business day after the system learns of the violation and the public must be notified within 72 hours. Systems with routine or repeat samples that are fecal coliform or E. coli-positive must notify the State by the end of the day they are notified of the result or by the end of the next business day if the state office is already closed.

The City will need to increase its monthly routine coliform sampling requirements as the service population grows. Table 7-7 below provides minimum monthly routine coliform sampling requirements based on service population.

| Table 7 - 7<br>Routine Coliform Sampling Requirements | |
|---|---|
| Service Population | Required Coliform Samples per Month |
| Up to 1,000 | 1 |
| 1001 - 2500 | 2 |
| 2501 - 3300 | 3 |

## Source Water Protection Rule

The Source Water Protection Rule requires the completion of State Source Water Quality Assessments by August 2003. The purpose of the assessment is to delineate boundaries to water supplies, identify origin of contaminants, and the system's susceptibility to contamination. As mandated by the 1996 SDWA amendments, a Source Water Assessment consists of the following:

- The identification of the area that directly overlies the part of the aquifer supplying drinking water to the well or spring;
- An inventory of potential sources of contamination within that area, and;
- The evaluation of the susceptibility of the water system to contamination from those sources.

Funding for assessments was provided to the States through the Act as part of the State's Drinking Water Revolving Loan Fund. A Source Water Assessment Report was completed by DHS and DEQ in December, 2002. A copy of the City's Source Water Assessment Report is included in Appendix J.

## Ground Water Rule

The Environmental Protection Agency (EPA) promulgated the final GWR in October 2006 and was published in the federal register on November 8, 2006. The goal of the GWR is to set disinfection requirements for ground water sources that are not under the influence of surface water to reduce the risk of exposure to fecal contamination that may be present in public water systems. Under the SDWA, the EPA was required to set disinfection requirements for all public water systems. The Surface Water Treatment Rule (SWTR) did this for surface water and for ground water under the direct influence of surface water (GWUDI). The GWR establishes a risk-targeted strategy to identify ground water systems that are at high risk for fecal contamination. The GWR also specifies when corrective action (which may include disinfection) is required to protect consumers who receive water from ground water systems from bacteria and viruses. The GWR addresses risks through a risk-targeting approach that relies on four major components:

- Sanitary Surveys
- Source Water Monitoring
- Corrective Action
- Compliance Monitoring

All of Aurora's water supply is obtained from groundwater. The city currently uses two wells, with a third to begin service sometime in 2008-2009. All of the Aurora's wells withdraw from the same aquifer, but at different water-bearing zones at shallow (Well No. 4) and intermediate depths (Well No. 3). The City's groundwater source is subject to the recently adopted federal Ground Water Rule and requires the following actions:

- **Sanitary Surveys.** This rule requires States, as a condition for primacy, to perform regular comprehensive sanitary surveys in order to identify significant deficiencies (e.g., a well located near a leaking septic system) in the system. The last Sanitary Survey for the City of Aurora was performed in June 2006.

  States must complete the initial survey by December 31, 2012 for most community water systems (CWSs) and by December 31, 2014 for CWSs with outstanding performance and for all non-community water systems (NCWSs). Following the initial sanitary survey cycle, States must conduct these surveys every three years for CWSs. and every five years for all NCWSs and CWSs that meet certain performance criteria.

  The GWR states that significant deficiencies include, but are not limited to, defects in design, operation, or maintenance, or a failure or malfunction of the sources, treatment, storage, or distribution system that the State determines to be causing or have the potential for causing the introduction of contamination into the water delivered to consumers. The GWR further goes on to state that significant deficiencies may include, but are not limited to, the following for the eight critical components to the extent that they apply to the individual water system being surveyed:

  - **Source**
    - Well near a source of fecal contamination (e.g., failing septic systems or a leaking sewer line).
    - Well in a flood zone.
    - Improperly constructed well (e.g., improper surface or subsurface seal).
    - Spring boxes that are poorly constructed and/or subject to flooding.
  - **Treatment**
    - Inadequate application of treatment chemicals (e.g., disinfection contact time is inadequate).
    - Lack of redundant mechanical components where disinfection is required.
    - Unprotected cross-connections with treatment chemical systems.
    - Inadequate treatment process monitoring.
  - **Distribution System**
    - Negative pressures that could result in the entrance of contaminants.
    - Inadequate disinfectant residual monitoring, when required.
    - Unprotected cross-connections.
  - **Finished Water Storage**
    - Inadequate internal cleaning and maintenance of storage tanks.
    - Lack of proper screening of overflow pipes, drains, or vents.
    - Storage tank roofs or covers need repair (e.g., holes or hatch of improper construction).

- **Pumps, Pump Facilities, and Controls**
  - Inadequate pump capacity.
  - Inadequate maintenance.
  - Inadequate/inoperable control system.
- **Monitoring, Reporting, and Data Verification**
  - Failure to properly monitor water quality.
  - Failure to meet reporting requirements.
  - Inadequate recordkeeping.
- **System Management and Operation**
  - Failure to meet water supply demands/interruptions to service (e.g., unreliable water source or lack of auxiliary power).
  - Lack of approved emergency response plan.
  - Inadequate follow-up to deficiencies noted in previous assessment/survey.
- **Operator Compliance with State Requirements**
  - Operator is not certified as required by the State.
  - Lack of operator training.

Although EPA received comments during the rule development that indicated the word "potential" was too general and that the sanitary survey requirement allowed for individual states to interpret the rule differently from one another, the sanitary survey component was included in the final rule. The implications of this aspect of the rule are uncertain because of the subjectivity that is involved.

- **Source Water Monitoring** to test for the presence of E. coli, enterococci, or coliphage in the sample. There are two monitoring provisions:

  - Triggered monitoring for systems that do not already provide treatment that achieves at least 99.99 percent (4-log) inactivation or removal of viruses and that have a total coliform positive routine sample under Total Coliform Rule sampling in the distribution system.
  - Assessment monitoring. As a complement to triggered monitoring, a State has the option to require systems, at any time, to conduct source water assessment monitoring to help identify high risk systems.

- **Corrective Actions** required for any system with a significant deficiency or source water fecal contamination. The system must implement one or more of the following correction action options:

  - Correct all significant deficiencies,
  - Eliminate the source of contamination,
  - Provide an alternate source of water, or
  - Provide treatment which reliably achieves 99.99 percent (4-log) inactivation or removal of viruses.

- **Compliance Monitoring** to ensure that treatment technology installed to treat drinking water reliably achieves at least 99.99 percent (4-log) inactivation or removal of viruses.

The City of Aurora currently introduces chlorine disinfection into a common 6-inch PVC transmission main for the wells at Well No. 3. This configuration allows water to be pumped from the wells through the storage tank first and not directly to customers. Valving options do allow the wells to pump directly to customers, if so required. The current piping configuration allows adequate chlorine contact time before reaching customers. However, if pumped directly to customers from the wells, the contact time between the point of chlorine addition and point of use will be insufficient to guarantee a 4-log inactivation of viruses.

It is anticipated that overall, the GWR will have an impact on the City of Aurora. Corrective actions, consisting of treatment improvements, wellhead improvements, storage improvements, etc. will be required if significant deficiencies are identified. These deficiencies may either be determined by the State during the sanitary survey process or based on the presence of fecal coliform in source water sampling. The possibility of the presence of fecal contamination is somewhat remote since the City has not had any recent total coliform positive samples (last positive sample on 10-07-03).

However, as described in the Source Water Assessment Report, some corrective action to the wells may be required. The report stated that the wells were constructed having casing seals, which restricts any surface water exposure, but they do not extend far enough. The well casing seals are only sealed to around 30 - 35 feet, but they tap ground water at approximately 200 feet deep. This allows the shallower water-bearing zones to communicate with the deeper main water bearing zone.

## Additional Rules and Requirements

### *Operator Certification*

The 1996 SDWA amendments put in place the requirement for states to develop and implement an operator certification program. The regulation sets out minimum guidelines for such a certification program including operator classification and qualifications. These sections of the regulation require that:

- Each treatment facility and/or distribution system be placed under the direct supervision of a certified operator;
- Operator certification must be equal to or greater than the system classification being operated;
- All process control personnel be certified;
- At least one certified operator be available on every shift;
- Operators must sit for, and pass, a validated exam demonstrating skills, knowledge, ability, and judgment necessary for the system classification; and
- Each operator has a high school diploma, graduation equivalency diploma (GED), or State-approved experience and training.

While the responsibility for developing the program lies with DHS, the City will be required to bring all operators up to the level of certification as required. The "grandfathering" clause of the regulation will address existing operators; however, new operators will be required to meet

guidelines of the legislation. Aurora currently complies with the State requirement for certified operators.

## Public Notification Rule

The purpose of the Public Notification Rule (PNR) is to direct utilities in providing customers with notification of an acute violation when they occur. The existing PNR (effective 1989) outlines public notification requirements for violations of MCLs, treatment techniques, testing procedures, monitoring requirements, and violations of a variance or exemption. If violations have the potential for adverse health effects, consumers and the State must be notified within 24 hours of the violation. The notice must explain the violation, potential health effects, what the system is doing to correct the problem, and whether consumers need to use an alternate water source. Notice must be made by appropriate media or posted door-to-door. Less serious violations must be reported to consumers in the first bill after the violation, in an annual report, or by mail or direct delivery service within one year.

The promulgated PNR (November 2000) revises the form, manner, and timing of notifications. Further, the promulgated rule provides the Rule Administrator with the option to require the notification of the public of unregulated contaminants.

## Consumer Confidence Reports

Under the amended SDWA, community water systems are required to provide an annual Consumer Confidence Report (CCR) on the source of their drinking water and levels of any contaminants found. The annual report must be mailed to all customers and include:

- Information on the source of drinking water;
- A brief definition of terms;
- If regulated contaminants are found, the maximum contaminant level goal (MCLG), the MCL, and the level detected;
- If an MCL is violated, information on health effects; and,
- Information on levels of unregulated contaminants.

### New Lead Reporting Requirements for the 2008 CCR

The EPA has added important mandatory language about lead that will need to be incorporated into future CCRs. According to the DHS pipeline newsletter, this change will become effective starting with the 2008 CCR.

- Starting with the 2008 report **(due by July 1, 2009),** the following statement about the lead in drinking water and its effects on children is required — regardless of lead levels occurring in any samples: "*If present, elevated levels of lead can cause serious health problems, especially for pregnant women and young children. Lead in drinking water is primarily from materials and components associated with service lines and home plumbing. {NAME OF WATER UTILITY} is responsible for providing high quality drinking water, but cannot control the variety of materials used in plumbing components. When your water has been sitting for several hours, you can minimize the potential for lead exposure by flushing your tap for 30 seconds to 2 minutes before using water for drinking or cooking. If you are concerned about lead in your water, you may wish to have your water tested. Information on lead in drinking water,*

*testing methods, and steps you can take to minimize exposure is available from the Safe Drinking Water Hotline or at www.epa.gov/safewater/lead."*

If so desired, the City of Aurora may write its own statement in consultation with DHS. If this is done, it must be pre-approved by the program prior to distribution. Additional facts on lead in drinking water may be included in the CCR.

# Proposed Regulations

Several new or revised regulations are expected by 2010 under the SDWA. It is important that the City remain informed of the development of these regulations and any possible newly proposed regulations in order to strategically plan to meet them. Under the primacy agreement with EPA, DHS has up to 2 years to adopt each Federal Rule after it is finalized, with a possible extension of 2 additional years. Water suppliers generally have at least 3 years to comply with each Federal Rule after it is finalized. Table 7-8 summarizes the applicable proposed and anticipated regulations.

**Table 7 - 8**
**Proposed Rules/Regulations**

| Proposed Regulation(1) | Action | Proposed | Parameters | Comments |
|---|---|---|---|---|
| Radon Rule | Proposed | 1999 | Radon | Multiple MCLs: 300 pCi/L or 4,000 pCi/L if State conducts multimedia mitigation plan. |
| | Promulgated | 2009 | | |
| Sulfate Rule | Decision to Regulate | 2001 | Sulfate | EPA decided not to regulate. |
| Total Coliform Rule (TCR) Revisions and Distribution System Requirements | Proposed | 2008 | Total Coliform | EPA plans to assess the effectiveness of the current rule in reducing public health risk and to address requirements for distribution system issues related to significant health risks. |
| | Promulgated | 2010 | | |
| Perchlorate | Proposed | 2005 | Perchlorate | Two states have established regulatory criteria for perchlorate (Massachusetts MCL of 0.0020 mg/l and California public health goal (PHG) of 0.006 mg/l), It is uncertain whether or not EPA will regulate Perchlorate in drinking water. |
| | Promulgated | Unknown | | |

(1) As of April 2008.

## Radon Rule

Radon is a gas that has no color, odor, or taste and comes from the natural radioactive breakdown of uranium in the ground. Exposure to radon can be by two main sources:

- Radon in the air (frequently called "radon in indoor air"). Most of the Radon in indoor air comes from soil underneath structures. As Uranium breaks down, Radon gas forms and seeps into the building. Radon from soil can get into any type of building - homes, offices, and schools - and build up to high levels in the air inside the building.

- Radon in drinking water. Radon gas can also dissolve and accumulate in water from underground sources, such as wells. When water that contains Radon is used (showering, washing dishes, cooking, etc.), Radon gas escapes from the water and goes into the air. Some Radon also stays in the water. Radon is not a concern in water that comes from surface water, because the Radon is released into the air.

The Radon Rule was proposed with the intent of reducing exposure to harmful Radon gas in the air. The Rule would consist of the following Radon MCLs:

- 300 picoCuries per liter (pCi/L) without a multimedia mitigation plan (MMM)
- 4,000 pCi/L with an MMM

The EPA delayed promulgation of the Rule while discussion of the structure and development of the MMM option continue. Final rule is scheduled sometime in 2009 and may need to be re-proposed.

## Sulfate Rule

Sulfate is currently listed under the Secondary Drinking Water Regulations as an aesthetic contaminant (taste). Under the 1996 SDWA amendments, the EPA and Centers for Disease Control (CDC) are required to conduct joint sulfate health effects studies. A sulfate MCLG was last proposed in December 1994 at 500 mg/L. Due to resource limitations, action on the proposal was deferred.

## Total Coliform Rule Revisions and Distribution System Requirements

The 1996 amendments to the Safe Drinking Water Act require the Administrator to review and revise, as appropriate, each national primary drinking water regulation not less often than every 6 years. EPA published as part of its National Primary Drinking Water Regulation (NPDWR) Review its decision to revise the TCR in July 2003. In response to recommendations from the Stage 2 M/DBP Federal Advisory Committee, the Agency also decided to consider whether it would be appropriate to add new requirements to address risks associated with distribution systems.

EPA, in association with distribution system experts, has begun to compile existing information regarding potential health risks that may be associated with distribution systems in nine "white papers". In addition, EPA is involved in the development of a series of ten TCR issue papers. All distribution system white papers and TCR issue papers will be used to inform EPA and stakeholders of areas of potential TCR revisions and distribution system requirements.

The Total Coliform Rule revisions are scheduled for proposal late 2009 or early 2010, with a final rule expected to be released in 2011 or 2012. The EPA has formally seated the Total Coliform Rule/Distribution System Advisory Committee.

## Perchlorate

Perchlorate is a man-made anion commonly associated with the solid salts of ammonium, potassium, and sodium. Ammonium perchlorate is the mostly widely used perchlorate

compound. It has also been found to occur naturally in certain highly arid environments. These salts are highly soluble in water, and because perchlorate adheres poorly to mineral surfaces and organic material, it can be very mobile in surface and subsurface aqueous systems. Also, since it is relatively inert in typical groundwater and surface water conditions, perchlorate contamination may persist for extended periods of time.

Perchlorate interferes with iodide uptake into the thyroid gland. Because iodide is an essential component of thyroid hormones, perchlorate disrupts how the thyroid functions. Drinking water contaminated with perchlorate is the most likely way that perchlorate can be ingested.

EPA has established an official reference dose (RfD) of 0.0007 mg/kg/day of perchlorate, which is a Drinking Water Equivalent Level (DWEL) of 24.5 ppb. This was established in 2005 as part of the Integrated Risk Information System (IRIS). A reference dose is a scientific estimate of a daily exposure level that is not expected to cause adverse health effects in humans.

Because there are two states which have established regulatory criteria for perchlorate (Massachusetts MCL of 0.0020 mg/l and California public health goal (PHG) of 0.006 mg/l), there is some pressure on the EPA to regulate this contaminant nationwide. It is uncertain whether or not EPA will regulate Perchlorate in drinking water.

# Water Treatment

## Current Water Treatment Practices

As previously mentioned in Section 2, the City provides chlorine disinfection of all its ground water sources as a barrier against microbial contamination. This is needed to maintain compliance with State disinfectant requirements. Under OAR 333-061-0050(5)(d), DHS requires that the disinfectant applied shall be capable of effectively destroying pathogenic organisms, is applied in proportion to flow, and shall be capable of leaving a residual in the water which can be readily measured throughout the system and which continues to serve as an active disinfectant.

In addition, DHS requires that the primary disinfection treatment is sufficient to ensure at least 99.99 percent (4-log) inactivation and/or removal of viruses as determined by the Department, or that there is sufficient contact time provided to achieve disinfection under all flow conditions between the point of disinfectant application and the point of first water use. When chlorine is used as the primary disinfectant, as is the case for Aurora, the system shall be constructed to achieve a free chlorine residual of 0.2 mg/l after 30 minutes contact time under all flow conditions before first water use.

## Proposed Water Treatment System

Due to the water quality issues with arsenic, iron and manganese, and other water quality concerns noted above, a water treatment system is recommended. As previously shown in Section 6, the current well capacity chart shows that the City will no longer be able to meet maximum day demands and still comply with State and Federal drinking water regulations unless some form of arsenic treatment system is installed by year 2013.

## Iron and Manganese forms

The forms of iron and manganese commonly found in drinking water are ferrous, ferric, organic, and iron bacteria. The two predominant forms are either the soluble ferrous iron or the insoluble ferric iron. Water containing ferrous iron is clear and colorless because the iron is completely dissolved. When exposed to air, the water turns cloudy and a reddish brown substance begins to form, which then becomes oxidized or the ferric form of iron that will not dissolve in water.

Organic and ferric iron colors the water; however, unlike the ferric iron which precipitates or settles out, organic iron does not. Iron bacteria occur in soil, groundwater, and some surface waters and are considered harmless to health; however, they may give water an off-taste, produce splotchy yellow stains on laundry, and clog water systems. Manganese is similar to iron but forms a brownish-black precipitate and stains. Manganese is less commonly found in groundwater than iron, rarely found alone in a water source, and generally found with dissolved iron.

As previously mentioned, the presence of iron and manganese in water is not considered a health concern. However, high concentrations of iron and manganese may give the water an unpleasant metallic taste while still being safe to drink. When iron and manganese combines with beverages such as tea or coffee, it produces a black appearance and a harsh, offensive taste. Some vegetables cooked in iron and manganese-laden water will turn dark that may appear unappetizing.

## Arsenic Forms

Arsenic usually exists in two different forms, or valence states, in a natural setting depending on the amount of oxygen available in groundwater. In shallow aquifers with higher levels of oxygen, arsenic will usually exist as arsenate, As(V). In deeper, anoxic groundwater, arsenic usually occurs as arsenite, As(III). In the pH range of 4 to 10, the predominant As(III) compound is neutral in charge, while As(V) species are negatively charged.

Removal efficiencies for As(III) are significantly less than those of As(V) because As(V)'s negative charge allows for it to be attracted to positively charged coagulants and adsorptive media. In general, pretreatment of As(III) to oxidize it to As(V) is necessary to effectively remove arsenic from drinking water.

Common oxidants include liquid chlorine (bleach), hydrogen peroxide (H2O2), ozone, or potassium permanganate. In addition, the ratio of arsenic species may not always be constant in the wells throughout the year and pre-oxidation may be required in some months and not others.

## Common Water Quality Measurements

In general when dealing with various water quality parameters, several different units of measurement are commonly used. Below is a list of several common measurements used to describe concentrations of substances in drinking water.

- Part per billion = ppb = microgram per liter = µg/L
- Part per million = ppm = milligram per liter = mg/L
- 1 mg/L = 1 ppm = 1,000 ppb = 1,000 µg/L

To summarize, with an MCL of 10 parts per billion for arsenic in water means that there are 10 molecules of arsenic for every 999,999,990 molecules of water. The EPA puts this in relative terms by stating that this is roughly equivalent to a few drops of ink in an Olympic-sized swimming pool.

## Water Quality Testing Information

Water quality testing is necessary when considering the installation of an arsenic treatment system. Certain water quality parameters can interfere with arsenic treatment, while some treatment technologies require specific water quality conditions to be most effective. At minimum, the water quality parameters shown in Table 7 – 9 are recommended to be tested in order to determine the appropriate treatment method.

**Table 7 - 9**
**Water Quality Parameters Necessary for Arsenic Treatment**

| Standard IOCs | Recommended |
|---|---|
| Arsenic (Total)<br>Chloride<br>Iron<br>Manganese<br>Sulfate | pH<br>Alkalinity<br>Hardness (Ca, Mg)<br>Vanadium<br>Phosphate<br>Silica<br>Arsenic (III)<br>Arsenic (V)<br>Total Organic Carbon<br>Total Dissolved Solids |

It is also recommended that the samples be analyzed by the testing lab by doing a metals (EPA 200), anions (EPA 300), and conventional chemistry parameters. Many of the water quality parameters shown above are analyzed during routine regulatory inorganic chemical (IOC) analysis, generally required every three years. The recommended parameters are not routinely analyzed and determination of their concentrations will require additional monitoring.

Speciation testing for arsenic is also needed to determine if oxidation of As(III) to As(V) will be required. Speciation testing needs to be done using preserved samples so that oxidation does not occur during storage and transport of the samples to the testing lab. It is recommended that all of the wells in question be sampled and each specific well's water quality parameters determined.

## Pilot Testing

It is recommended that the selected treatment alternative be pilot tested to verify suitability of the technology. Pilot testing the potential mitigation strategies is a normal procedure to

optimize treatment variables and avoid implementing a strategy that may not work for unforeseen reasons.

Pilot testing consists of setting up and operating a small-scale system to verify its performance using the actual field conditions and raw water that will be treated at full-scale. Pilot testing is generally necessary for most large treatment systems. However, in some cases, where the cost of pilot testing would approach the cost of installing the full-scale equipment, the pilot-testing phase may generally be included in the start-up process for the technology.

Pilot testing for adsorptive media sometimes may be time-intensive and in some cases can be a rather expensive process. With many smaller systems such as Aurora's, pilot testing may sometimes be performed by the vendor.

## *Applicable Arsenic Treatment Alternatives*

With any water treatment process, there are variables that are unique to a specific system. The presence of naturally occurring iron may prove to be beneficial for the City in the removal of arsenic. The EPA has issued many reports, bulletins, and guidelines to assist communities with the treatment of arsenic. One of these EPA issued bulletins has been included in Appendix I for reference by City staff. A brief summary of some available arsenic treatment alternatives applicable to the City of Aurora is further summarized below.

- **Non-Treatment Alternatives –** When feasible, non-treatment alternatives are typically less burdensome and less costly than treatment. This includes alternatives such as the blending of sources prior to the distribution system, inactivating the problem source, connecting to an adjacent water system, and/or developing a new source.

  City staff has previously explored many of these non-treatment alternatives. Currently, the City blends Well No. 4 (arsenic source) with Well No. 3 (non-detectable) to reduce the overall arsenic levels to within the MCL before being delivered to its customers. A new groundwater source (Well No. 5) was recently completed in 2005 and preliminary test results have shown signs of arsenic at concentrations just below the MCL. The blending of Well No. 5 with Well No. 4 will not likely reduce the arsenic concentrations below the MCL. Without the operation of Well No. 3, the City will not be able to comply with the primary drinking water regulations, which substantially reduces the systems reliability.

- **Iron Oxidation/Filtration –** This process involves the oxidation of naturally occurring iron, which binds (coagulates) to arsenic and is then removed by filtration. The process is most effective when pH is less than 7.5 and the concentration of iron to arsenic is 20:1, or greater. The key criterion is that there is sufficient iron to bind the arsenic. In general, the process is the same as treatment to remove iron and manganese. The oxidant is injected prior to the filters with sufficient time to allow for the oxidation of the iron and arsenic. The filters then remove the arsenic and iron together. A number of different filter media can be used, including sand, greensand, solid manganese dioxide such as pyrolucite, and manganese dioxide coated sand.

Typically, the backwash waste produced contains highly stable iron-arsenic sludge that can usually be disposed of in a landfill.

- **Coagulation/Filtration –** This process is similar to the iron oxidation/filtration removal process except that iron oxides are added as a coagulant to the water prior to filtration. Laboratory, pilot-plant tests and full-scale operating plants have shown coagulation/filtration to be an effective treatment process for arsenate, iron and manganese removal. Pre-oxidation is necessary for arsenite-laden water supplies.

  Naturally occurring iron, where available, helps remove arsenic and, as a result, reduces the amount of coagulant used. Similarly, water conditions may affect the process reaction time, and additional detention prior to filtration may be required. Ferric salts such as ferric chloride or ferric sulfate are the most common coagulants used.

  As with oxidation/filtration, the backwash waste produced contains highly stable iron-arsenic sludge that can typically be disposed of as non-hazardous waste in a sanitary landfill.

- **Adsorptive Media –** This process uses a sand-like iron impregnated media to adsorb arsenic from the water. The media is placed in a pressurized treatment vessel in a fixed bed adsorber. Raw water passes through the media that adsorbs the arsenic, which means that the arsenic adheres to the surface of the media. Backwash is performed infrequently to prevent compaction and to remove any particulates that may be present in the supply.

  This process requires minimal operator attention compared to other arsenic removal processes. The frequency of replacement will vary depending upon the media used, pH, and other water quality parameters. All adsorptive media needs to be National Sanitation Foundation (NSF) 61 approved.

  Variants of iron-based media include granular ferric hydroxide, granular ferric oxide, iron hydroxide-coated sand, metallic iron (referred to as zero valent iron), sulfur/iron mixtures (referred to as sulfur-modified iron) and many others. Several of the ferric-based materials can sufficiently adsorb arsenite (As(III)), making pre-oxidation unnecessary.

In general, arsenic treatment will produce three different types of wastes depending on the selected treatment alternative: brines, sludges, and spent media. Waste disposal must be considered as part of the arsenic treatment process selection. Arsenic laden wastes have the potential to be considered a hazardous waste and are subject to stringent disposal regulations.

The hazardous waste threshold is called the Toxicity Characteristic (TC), which is 5 mg/L for arsenic. If liquid wastes exceed the TC, they are considered a hazardous waste. For solids, the waste is put through a process called the Toxicity Characteristic Leaching Procedure (TCLP). If the liquid extract from the TCLP test exceeds 5 mg/L of arsenic, the solid would be considered a hazardous waste. Solids that pass a TCLP test can generally be disposed of in a non-hazardous waste landfill.

Research by the EPA and other organizations indicates that spent sorbents and the solids from oxidation/filtration backwash water pass the TCLP test. In general, the main disposal option for liquid wastes is sewer discharge only if the liquid and solid waste does not exceed the TC and the discharge meets the requirements of the sewer agency.

### *Proposed Arsenic Treatment Work Plan*

1. Evaluate feasibility of each treatment alternative.
2. Collect and analyze water samples from each well.
3. Send water samples to testing lab and obtain water quality parameters for use in determining appropriate treatment options.
4. Identify the needed treatment system capacity in gallons per minute for average and maximum day demands.
5. Develop a preliminary study/conceptual design report for the proposed Arsenic treatment system. It is recommended that a conceptual design report be completed before the City seeks funding alternatives (e.g., one-stop meeting). This report will provide the City with a more defined number on costs and demonstrate to the funding agencies the need and that the City is "willing and ready to move forward".
6. Seek funding options, such as a Safe Drinking Water Revolving Loan Fund (SDWRLF) loan, and secure funds to complete the project.
7. If practical, pilot test the selected treatment option to confirm that it will perform as expected for the water being treated.
8. Implement the project (e.g., final design, state approvals, construction, inspections, etc.).
9. Start-up treatment system and train operators.
10. Monitor, identify, and document successful operating criteria and processes through piloting after initiating full-scale treatment.
11. Continuously operate the treatment plant with trained operators.

## Water Management and Conservation

Many areas in Oregon face periodic and increasingly frequent water shortages during summer months. Urbanization is resulting in a continually expanding need for municipal water supplies. In addition, many communities are faced with the need to reduce their impacts on the State's resources in response to State or Federal listings of stream-flow dependant species as sensitive, threatened or endangered, water quality problem, and other flow issues.

The need for a Water Management and Conservation Plan (WMCP) in Aurora is becoming more and more apparent and is most noticeable during the water restrictions experienced during the summer periods the last few years. To address this need, a WMCP is currently being planned to be prepared by the City. To assist the City with the preparation of this plan, the following water management and conservation information is provided.

The Oregon Water Resources Department (OWRD) has developed rules that govern water management and conservation plans for municipal water systems (Water Management and Conservation Plans; OAR Chapter 690, Division 86). The Water Resources Commission has adopted a statewide policy on Conservation and Efficient Water Use (OAR 690-410-0060). The policy requires major water users and suppliers to prepare WMCPs.

To summarize, the following elements at minimum, are to be included in the water management and conservation plan:

- Water Supplier Description
- Water Conservation Plan
- Water Curtailment Plan
- Water Supply Element

To better assist City staff with the development of the City's WMCP, the four major elements required of the WMCP are further summarized below.

## Water Supplier Description

The Water Supplier Description shall include water sources, storage, summary of water rights, description of customers served and water use summary, and other existing water system elements. According to OAR 690-086-140, the water supplier description element shall include at least the following information:

- A description of the supplier's source(s) of water; including diversion, storage and regulation facilities; exchange agreements; intergovernmental cooperation agreements; and water supply or delivery contracts;

- A delineation of the current service areas and an estimate of the population served and a description of the methodology(ies) used to make the estimate;

- An assessment of the adequacy and reliability of the existing water supply considering potential limitations on continued or expanded use under existing water rights resulting from existing and potential future restrictions on the community's water supply;

- A quantification of the water delivered by the water supplier that identifies current and available historic average annual water use, peak seasonal use, and average and peak day use;

- A tabular list of water rights held by Aurora that includes the following information:

    - Application, permit, transfer, and certificate numbers (as applicable);
    - Priority date(s);
    - Source(s) of water;
    - Type(s) of beneficial uses specified in the right;
    - Maximum instantaneous and annual quantity of water allowed under each right;
    - Maximum instantaneous and annual quantity of water diverted under each right to date;
    - Average monthly and daily diversions under each right for the previous year, and if available for the previous five years;
    - Currently authorized date for completion of development under each right; and
    - Identification of any streamflow-dependent species listed by a state or federal agency as sensitive, threatened or endangered that are present in the source, any

listing of the source as water quality limited and the water quality parameters for which the source was listed, and any designation of the source as being in a critical ground water area.

- A description of customers served including other water suppliers and the estimated numbers; general water use characteristics of residences, commercial and industrial facilities, and any other uses; and a comparison of the quantities of water used in each sector with the quantities reported in the water supplier's previously submitted water management and conservation plan and progress reports;

- Identification and description of interconnections with other municipal supply systems;

- A schematic of the system that shows the sources of water, storage facilities, treatment facilities, major transmission and distribution lines, pump stations, interconnections with other municipal supply systems, and the existing and planned future service area; and

- A quantification and description of system leakage that includes any available information regarding the locations of significant losses.

## 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. According to OAR 690-086-150, the water conservation element shall include at least the following:

- A progress report on the conservation measures scheduled for implementation in a water management and conservation plan previously approved by the Department, if any;

- A description of the water supplier's water use measurement and reporting program and a statement that the program complies with the measurement standards in OAR chapter 690, division 85, that a time extension or waiver has been granted, or that the standards are not applicable;

- A description of other conservation measures, if any, currently implemented by the water supplier, including any measures required under water supply contracts;

- A description of the specific activities, along with a schedule that establishes five-year benchmarks, for implementation of each of the following conservation measures that are required of all municipal water suppliers:

- An annual water audit that includes a systematic and documented methodology for estimating any un-metered authorized and unauthorized uses;
- If the system is not fully metered, a program to install meters on all un-metered water service connections. The program shall start immediately after the plan is approved and shall identify the number of meters to be installed each year with full metering completed within five years of approval of the water management and conservation plan;
- A meter testing and maintenance program;
- A rate structure under which customers' bills are based, at least in part, on the quantity of water metered at the service connections;
- If the annual water audit indicates that system leakage exceeds 10 percent, a regularly scheduled and systematic program to detect leaks in the transmission and distribution system using methods and technology appropriate to the size and capabilities of the municipal water supplier; and
- A public education program to encourage efficient water use and the use of low water use landscaping that includes regular communication of the supplier's water conservation activities and schedule to customers;

❖ If the municipal water supplier proposes to expand or initiate diversion of water under an extended permit for which resource issues have been identified under OAR 690-086-0140(5)(i), a description of the specific activities, along with a schedule that establishes five-year benchmarks, for implementation of a system-wide leak repair or line replacement program to reduce system leakage to no more than 15 percent or sufficient information to demonstrate that system leakage currently is no more than 15 percent.

❖ If the municipal water supplier serves a population greater than 1,000 and proposes to expand or initiate diversion of water under an extended permit for which resource issues have been identified under OAR 690-086-0140(5)(i), or if the municipal water supplier serves a population greater than 7,500, a description of the specific activities, along with a schedule that establishes five-year benchmarks, for implementation of each of the following measures; or documentation showing that implementation of the measures is neither feasible nor appropriate for ensuring the efficient use of water and the prevention of waste:

- A system-wide leak repair program or line replacement to reduce system leakage to 15 percent, and if the reduction of system leakage to 15 percent is found to be feasible and appropriate, to reduce system leakage to 10 percent;
- Technical and financial assistance programs to encourage and aid residential, commercial and industrial customers in implementation of conservation measures;
- Supplier financed retrofitting or replacement of existing inefficient water using fixtures, including distribution of residential conservation kits and rebates for customer investments in water conservation;
- Adoption of rate structures, billing schedules, and other associated programs that support and encourage water conservation;
- Water reuse, recycling, and non-potable water opportunities; and

- Any other conservation measures identified by the water supplier that would improve water use efficiency.

- 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.

- A description of specific activities required under OAR 690-086-0150 (5) and (6), if expansion or initiation of diversion of water under an extended permit for which resource issues identified under OAR 690-086-0140(5)(i).

## Water Curtailment Plan

A Water Curtailment Plan is a program to accomplish a specific reduction in the amount of water used or lost within a specific time in response to an emergency or other short-term shortage. The water curtailment element will help Aurora react quickly and effectively to meet the community's needs in the event of a water supply emergency, such as a supply shortage due to drought, contamination, or infrastructure failure. According to OAR 690-086-160, the water curtailment element shall include at least the following.

- A description of the type, frequency and magnitude of supply deficiencies within the past 10 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 caused by a natural disaster, source contamination, legal restrictions on water use, or other circumstances;

- A list of three or more stages of alert 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 pre-determined levels of severity of shortage or water service difficulties that 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.

## Water Supply Element

The Water Supply Element describes and supports future water supply needs of the municipal water supplier. The water supply element provides a long-range supply plan in which the supplier prepares a demand forecast and compares the projected demand to available supplies. Where additional water is needed, the water supplier should explain what sources it plans to use. According to OAR 690-086-170, the water supply element shall include at least the following:

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

- An estimated schedule that identifies when the water supplier expects to fully exercise each of the water rights and water use permits currently held by the supplier;

- Based on the information provided above, an estimate of the water supplier's water demand projections for 10 and 20 years, and at the option of the municipal water supplier, longer periods;

- A comparison of the projected water needs and the sources of water currently available to the municipal water supplier and to any other suppliers to be served considering the reliability of existing sources;

- If any expansion or initial diversion of water allocated under existing permits is necessary to meet the needs shown above, an analysis of alternative sources of water that considers availability, reliability, feasibility and likely environmental impacts. The analysis shall consider the extent to which the projected water needs can be satisfied through:

    - Implementation of conservation measures identified under OAR 690-086-0150;
    - Interconnection with other municipal supply systems and cooperative regional water management; and
    - Any other conservation measures that would provide water at a cost that is equal to or lower than the cost of other identified sources.

- If any expansion or initial diversion of water allocated under existing permits is necessary to meet the needs shown above, a quantification of the maximum rate and monthly volume of water to be diverted under each of the permits;

- For any expansion or initial diversion of water under existing permits, a description of mitigation actions the water supplier is taking to comply with legal requirements

including but not limited to the Endangered Species Act, Clean Water Act, Safe Drinking Water Act; and

- If acquisition of new water rights will be necessary within the next 20 years to meet the needs shown above, an analysis of alternative sources of the additional water that considers availability, reliability, feasibility and likely environmental impacts and a schedule for development of the new sources of water. The analysis shall consider the extent to which the need for new water rights can be eliminated through:

    - Implementation of conservation measures identified under OAR 690-086-0150;
    - Interconnection with other municipal supply systems and cooperative regional water management; and
    - Any other conservation measures that would provide water at a cost that is equal to or lower than the cost of other identified sources.

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# SECTION 8

## Recommendations and Capital Improvement Plan

SECTION 8

# Recommendations and Capital Improvement Plan

## Objective

The objective of this section is to present recommendations for water system improvements based on the findings presented in the previous sections and to summarize them in a 20-year Capital Improvement Plan (CIP). A CIP is a very important aspect of system planning and at minimum, typically includes the following information:

- A list of necessary capital improvement projects.
- A cost associated with implementing the recommended project.
- The recommend projects ranked in order of priority or preference.
- A timetable for the construction or completion of the project.

Capital improvements are needed to address system inadequacies, in addition to allowing for future growth. Because it is not possible to address all of the City's capital needs in one budget year, it is necessary to create a 20-year plan based on project priority and the anticipated funding needed each year to implement. In general, a CIP calls attention to the deficiencies of the City's water system and provides a systematic approach to dealing with the short-term and long-term infrastructure needs.

In addition, under ORS 223.309(1), prior to the establishment of a system development charge (SDC) by ordinance or resolution, a local government shall prepare a capital improvement plan, public facilities plan, master plan or comparable plan that includes a list of the capital improvements that the local government intends to fund, in whole or in part, with revenues from an improvement fee and the estimated cost, timing and percentage of costs eligible to be funded with revenues from the improvement fee for each improvement. It is important to note that the Oregon Revised Statutes discuss which improvements may be funded by SDC revenues (ORS 223.307) and what types of projects qualify for credit purposes. The CIP may be modified at any time pursuant to ORS 223.309 (2).

The system recommendations presented below include a water treatment system, additional storage facility and pump station, existing booster pump station capacity improvements, various distribution system modifications, and other system needs and improvements. All proposed water system improvement recommendations should be thoroughly evaluated and reviewed during the preliminary engineering efforts of each project.

The proposed water system improvements are presented in Figure 8-1 and the proposed water system schematic is shown in Figure 8-2.

# Improvements since Last Plan

Major system improvements that were completed since the 1996 WSMP are summarized below. These system improvements were previously described in Section 2.

- Submersible pumps for Wells No. 3 and 4 were replaced in 2004.
- Well No. 1 was formally disconnected from the distribution system in 2004.
- Installation of a new SCADA system was completed in 2005.
- Construction of a new Well No. 5 was completed in 2005.
- Approximately 4 miles of distribution system piping was added to the system mainly consisting of 8-inch and 10-inch mains where residential development has occurred.

# Improvement Projects Priority

To assist the City in its planning efforts, the proposed improvement projects summarized in Table 8-2 at the end of this section have been categorized based on project importance. A brief description of each improvement priority and the corresponding types of projects typically associated are shown below.

## *First Priority*

These short-term improvements are 0-5 year projects that are considered the most important and should be implemented as soon as funding can be secured. These projects include improvements that are considered necessary to maintain the quality of the system, maintain health guidelines, bring the system into regulatory compliance, and increase fire flow and storage capacity.

## *Second Priority*

These intermediate improvements are 5-10 year projects that are considered more important projects that should be implemented as funding becomes available. These improvements include further system improvements to upgrade the existing system and to address future system needs.

## *Third Priority*

These intermediate improvements are 10-15 year projects which should be implemented as needed to address increasing system demands, development of new water rights, new development and annexations, and/or to comply with new regulatory requirements.

## *Fourth Priority*

These long-term improvements are 15-20 year projects, should be implemented as needed to comply with future regulatory requirements and meet future system needs.

## LEGEND

- HYDRANT
- CITY LIMITS
- URBAN GROWTH BOUNDARY
- EXISTING WATER LINE
- " X " PVC — EXISTING SIZE AND MATERIAL
- "X" — PROPOSED PIPE AND SIZE
- "X" — AS DEVELOPMENT OCCURS

### TRANSMISSION AND DISTRIBUTION SYSTEM IMPROVEMENTS

| | |
|---|---|
| TDS-1 | 10" WATER LINE ~ 1,460 LF |
| TDS-2 | 12" WATER LINE ~ 580 LF |
| TDS-3 | 10" WATER LINE ~ 1,400 LF |
| TDS-4 | 12" WATER LINE ~ 2,200 LF |
| TDS-5 | 12" WATER LINE ~ 530 LF |
| TDS-6 | 12" WATER LINE ~ 850 LF |
| TDS-7 | 10" WATER LINE ~ 370 LF |
| TDS-8 | 8" WATER LINE ~ 400 LF |
| TDS-9 | 8" WATER LINE ~ 470 LF |
| TDS-10 | 8" WATER LINE ~ 370 LF |
| TDS-11 | 8" WATER LINE ~ 860 LF |
| TDS-12 | 8" WATER LINE ~ 450 LF |
| TDS-13 | 8" WATER LINE ~ 1,290 LF |
| TDS-14 | 8" WATER LINE ~ 470 LF |
| TDS-15 | 8" WATER LINE ~ 520 LF |
| TDS-16 | 8" WATER LINE ~ 430 LF |
| TDS-17 | 8" WATER LINE ~ 960 LF |

N

0 300 600 900
Scale In Feet

LOCATION TO BE DETERMINED SMM-9
PROPOSED 1MG STORAGE TANK SPS-2
PROPOSED BOOSTER PUMP STATION AND VALVE VAULT ASSEMBLY SPS-2
PROPOSED WELL #6 SST-6
PROPOSED 10" DISTRIBUTION MAIN ALONG EHLEN RD, AS DEVELOPMENT OCCURS DEV-1
PROPOSED 8" DISTRIBUTION GRID SYSTEM, AS DEVELOPMENT OCCURS DEV-2
CITY LIMITS
URBAN GROWTH BOUNDARY
MILL CREEK
MILL CREEK BRIDGE
PACIFIC HWY 99E
PUDDING RIVER
SOUTHERN PACIFIC RAILROAD
STORAGE LAGOON
WWTP BLDG
WELL #1
WELL #2
WELL #3
WELL #4
WELL #5
CITY PARK
STORAGE TANK AND PUMP STATION
PROPOSED 10" AS DEVELOPMENT OCCURS DEV-3 (PRIVATE RD)
PROPOSED 10" DISTRIBUTION MAIN ALONG HWY 99E, AS DEVELOPMENT OCCURS DEV-4
PROPOSED 8" DISTRIBUTION GRID SYSTEM, AS DEVELOPMENT OCCURS DEV-5

SUPPLY FROM WELLS 3, 4, & 5
WATER TREATMENT SYSTEM SST-1 SST-2
EXISTING PUMP STATION SPS-1
300K GAL

SUPPLY FROM WELLS 3, 4, & 5

# FIGURE 8-1

## PROPOSED WATER SYSTEM IMPROVEMENTS

WATER SYSTEM MASTER PLAN UPDATE
CITY OF AURORA, OR

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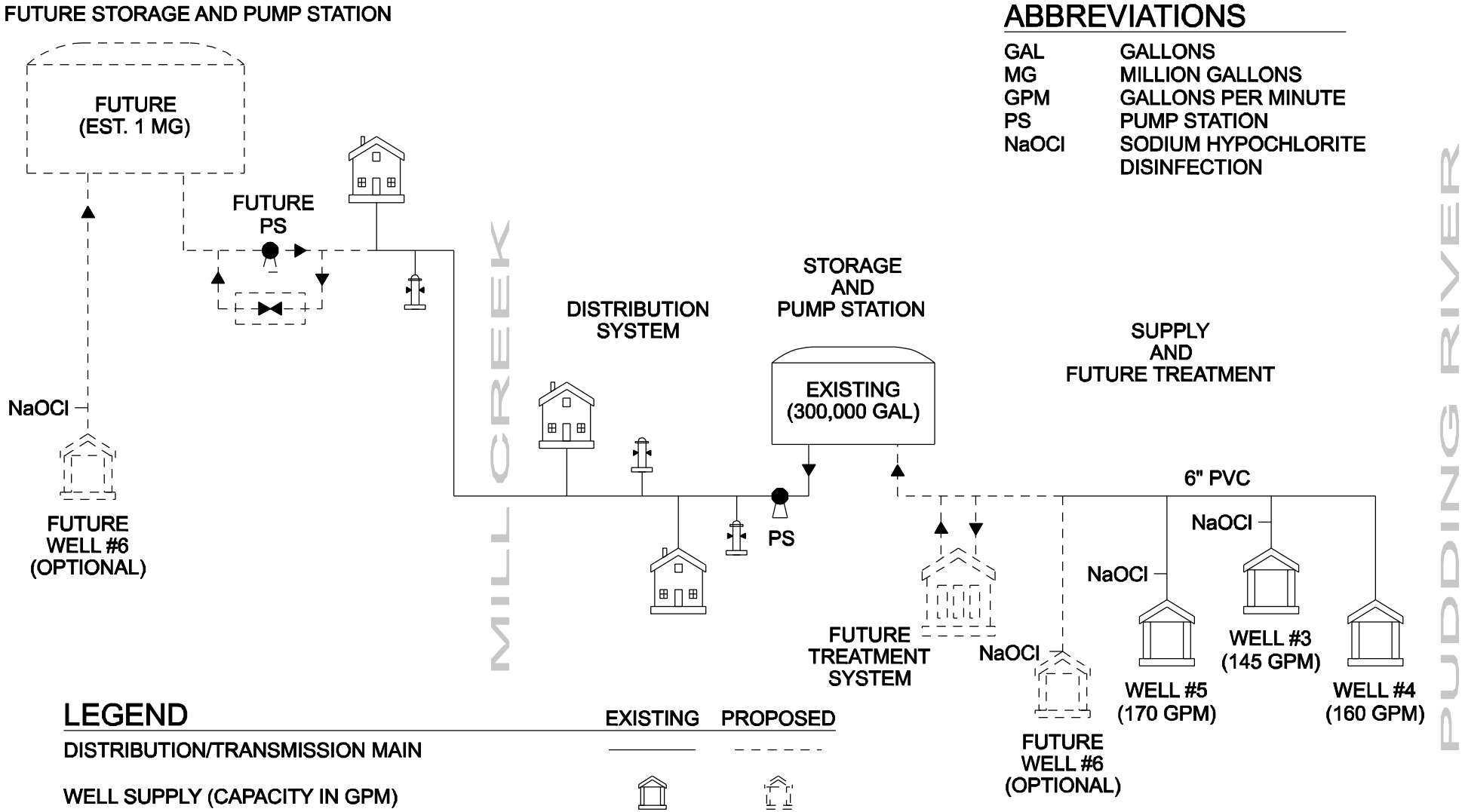


## ABBREVIATIONS

| | |
|---|---|
| GAL | GALLONS |
| MG | MILLION GALLONS |
| GPM | GALLONS PER MINUTE |
| PS | PUMP STATION |
| NaOCl | SODIUM HYPOCHLORITE DISINFECTION |

## LEGEND

| | EXISTING | PROPOSED |
|---|---|---|
| DISTRIBUTION/TRANSMISSION MAIN | ——— | - - - - - |
| WELL SUPPLY (CAPACITY IN GPM) | | |
| STORAGE TANK (CAPACITY) | | |
| PUMP STATION | | |
| VALVE VAULT ASSEMBLY | | |
| WATER SERVICE USERS | | |
| DISTRIBUTION SYSTEM FIRE HYDRANTS | | |

# FIGURE 8-2

PROPOSED WATER SYSTEM SCHEMATIC

WATER SYSTEM MASTER PLAN UPDATE
CITY OF AURORA, OR

ASHLEY
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# Cost Estimating Data

The recommended system improvements have been organized by project type, year of implementation, and assigned an estimated project cost. Project cost estimates are based on cost information supplied by guidance documents, published historical cost trends, and cost information from construction of similar work. Cost estimates were not based on detailed engineering designs; therefore, the project costs should be considered rough order-of-magnitude estimates. Rough order-of-magnitude cost estimates are typically associated with an accuracy of +50 percent to –30 percent to reflect the variability of costs.

The project cost estimates shown have been prepared for guidance in project evaluation and are for budgetary purposes only within the context of this WSMP. The final costs of the project will depend on actual labor and material costs, site conditions, competitive market conditions, regulatory factors, final project scope, implementation schedule, and other variable factors. Because of this, project feasibility and funding needs must be carefully reviewed prior to making specific financial decisions. The cost estimates assume no easements or land acquisition, no specialty construction work, and common excavation.

A cost estimate was developed for the new supply source and is based on construction of new groundwater well similar to that of Well No. 5. An estimated well construction depth of approximately 300 feet below ground surface was estimated.

Cost for the proposed arsenic water treatment systems is contingent upon the treatment capacity desired and type of treatment alternative selected. With any water treatment process, there are many variables that are unique to a specific system. Since there are so many variables associated with arsenic treatment, the costs identified is based on escalated overall capital cost curve that was developed for oxidation/filtration treatment systems presented in the Washington State Department of Health (DOH) guidance document for arsenic treatment for small water systems. This may or may not be the actual recommended alternative for treatment. Therefore, the estimated costs should be used for general project planning purposes.

Costs for storage tank facilities are influenced by several factors including site conditions, storage capacity, type of construction material, architectural treatment, and corrosion protection needs. Steel tanks are normally constructed above-ground, while conventional and prestressed concrete tanks can be constructed at or below ground. Below ground tanks require no architectural treatment, but have higher excavation and backfill costs. The estimated cost of the proposed storage tank is based on an above ground bolted-steel tank with a 1 million gallon nominal storage capacity.

Similar to storage tank facilities, pump station costs depend upon a variety of specific parameters including site conditions, pump type and pumping head, desired usage, and architectural and structural design. Costs developed for the proposed pump station is for a generic pump station. The costs assume no easements or land acquisition, no specialty construction work, and common excavation.

For the distribution system improvement costs, a typical unit cost of $8 per diameter-inch per foot of pipe length for AWWA C-900, Class 150 minimum was used. This results in a direct unit

cost of $64 per foot for an 8-inch pipe, $80 per foot for a 10-inch pipe, and $96 per foot for a 12-inch pipe. These typical direct unit costs assume no easements or land acquisition, no specialty construction work, and typical trench excavation.

In addition to the direct construction costs for all the projects identified, a total markup allowance of 40 percent was included to account for contingencies, engineering, administrative, and other project related costs. This allowance was applied to all projects equally and therefore does not take into account design or permitting complexities or other factors that might result in higher project related costs. For pipe replacement costs, the total unit cost including allowances is therefore $90 per foot for 8-inch, $112 per foot for 10-inch, and $134 per foot for 12-inch.

Since construction costs frequently change, the Engineering News-Record (ENR) Construction Cost Index (CCI) is a common method used to make adjustments for future costs. The closest city CCI provided by ENR is for Seattle, Washington. However, ENR states on their website that the 20-City average index is generally more appropriate to use because it takes into account more elements and results in a smoother trend. Indexes for individual cities, such as for Seattle, are more susceptible to price spikes. The 20-City average ENR-CCI for September 2008 is 8556.72. Cost adjustments can be made for each project in the future by taking the current ENR CCI divided by the September 2008 ENR CCI.

Costs for all proposed improvements are shown in the Capital Improvement Plan attached at the end of this section. These costs in the CIP include a 3 percent inflation factor from 2008 to the anticipated year of construction or project implementation. In addition, detailed cost estimates with basic project cost assumptions in 2008 dollars are shown in Appendix K. The unit costs for each item are listed to help facilitate costing of any portion of the project, as needed for funding limitations. Before finalizing the funding for a specific project, it will be necessary to update the proposed cost estimate to current costs and further define the project as necessary.

# Recommended Improvements

To effectively provide for current and future water system needs within the City, public investments are required to be made annually. If the necessary system improvements are not made annually or within a reasonable timeframe, the condition of the City's water system infrastructure will deteriorate to the point that eventually it can no longer be ignored. It is at this point that a project cost will become much greater due to the size and scope of the needed improvements.

The recommended improvements were categorized not only by priority, but by project improvement type under Supply Source and Treatment Improvements, Storage and Pump Station Improvements, Distribution System Improvements, and System Management, Maintenance, and Miscellaneous Improvements. Each recommended improvement was assigned a project number and an anticipated year of construction; however, some of the listed improvements will be necessary only as growth occurs. As such, the City has an estimated project cost and schedule that can be referenced and adjusted as needed to make project related decisions.

Given the fact that growth may be faster or slower than what is anticipated in this plan, the project improvement schedule is subject to change. Some projects may be implemented prior to their anticipated date, while others may be constructed after the date established in this plan. A brief description of each recommended improvement is further discussed below.

## Supply Source and Treatment Improvements (SST)

The following proposed supply source and treatment improvements have been identified.

### *Preliminary Arsenic Water Treatment Study / Pilot Testing (SST-1)*

With any water treatment process, there are variables that are unique to a specific system. This project includes the necessary actions to complete a recommended arsenic water treatment study and implement a pilot test program as previously discussed in Section 7. This project will identify which arsenic treatment alternative provides the City the best results for compliance with State and Federal drinking water regulations. Project costs for the study, water quality testing, and pilot testing equipment and management is estimated to be approximately $100,000.

### *New Arsenic Water Treatment System (SST-2)*

With the City's current arsenic issues and other water quality limitations of Well No. 4 and anticipated issues with Well No. 5, source production will not meet system demands without some form of arsenic treatment system installed within the next few years. The current well capacity chart previously shown in Section 6, illustrates that an arsenic water treatment system is needed to be in operation sometime before the year 2013.

It is anticipated that a treatment system, based on the findings of the preliminary treatment study/pilot test, will be located adjacent to the existing pump station and storage tank, which will minimize piping modifications and costs associated with land acquisition. The project estimated costs include all necessary treatment facilities including, a treatment building, filters, piping, valving and controls. Identified project costs were also based on escalated Oxidation/Filtration capital cost curves from the Washington Department of Health Publication #331-210 with an anticipated treatment capacity of 350 gpm, which is approximately 75 percent of the combined wells pumping capacity.

### *Wells No. 3 and 5 Emergency Backup Generator Connections (SST-3)*

Currently, Well No. 3 is supplied with a three-phase 240 volt delta connection system with no backup power connection capabilities, Well No. 4 is supplied with a three-phase 240 volt wye connection system, but does have outside backup power connection capabilities, and Well No. 5 is supplied with a three-phase 480 volt connection system with no backup power connection capabilities. Therefore, in order for all the City wells to have the ability to operate during emergency conditions, it is recommended that Wells No. 3 and 5 be equipped with backup power connection capabilities. Backup generator connection cost is estimated to be approximately $10,500 based on a recent quote.

### Well Emergency Backup Generator (SST-4)

The City currently is equipped with a 75 kilowatt portable generator should a power outage occur; however, the generator is well past its useful life expectancy and the City is in need of a replacement. Portable generator cost is estimated to be approximately $24,000 based on a recent quote.

### Wells No. 3 and 4 Casing Seal Replacement (SST-5)

Based on the 2002 Source Water Assessment both Wells No. 3 and 4 render their respective sources highly sensitive based on the inappropriate casing seal depth. Both wells are sealed at 35 feet or less, yet tap groundwater that is in the 200 foot range. In the case of the Well No. 4, there is a drop in head between the shallower and deeper groundwater suggestive of two separate aquifers being exploited. The commingling of aquifers is not permitted under the current rules of the Oregon Water Resources Department because of the potential for contaminated shallow groundwater gaining access to the deeper aquifer. Project cost for the seal replacement is estimated to be approximately $80,000.

### New Well No. 6 (SST-6)

A new Well No. 6 is recommended to be completed in the future using transferred water rights. This improvement project will be necessary in order to increase the City's overall supply capacity. As previously discussed in Section 6 with the recent addition of Well No. 5 combined with the new water treatment system (SST-1), the City's supply capacity will need to be expanded before year 2020 based on projected demands. The project estimated costs include all necessary well facilities including, a well building, piping, pump, disinfection, controls, and power. Project costs for a preliminary source study are included in System Management and Miscellaneous Improvements below.

### Supply Operation and Maintenance (SST-O&M-1)

Operation and maintenance costs are critical aspects of a supply facility and are important to ensure system reliability and overall peak performance. In general, these costs will increase due to aging equipment. In addition, periodic service and calibration of water system instrumentation, such as flow meters, alarms, and other related equipment is required.

Based on input from City staff, project annual O&M cost is estimated to be approximately $32,000 per year. This includes estimated cost for labor, power, maintenance and repairs, auto expenses and insurance, chemicals, testing and samples, billing and administration, and other operation and maintenance needs. Labor is estimated to be 8 - 10 hours a week of City staff's time. Supply O&M costs are further summarized below in Table 8-1.

| Table 8 – 1<br>Estimated Supply Operation and Maintenance Cost | | |
|---|---|---|
| **Item Description** | **Estimated Monthly Cost** | **Estimated Total Yearly Cost** |
| Labor | $800 | $9,600 |
| Power | $800 | $9,600 |
| Maintenance and Repair | $200 | $2,400 |
| Testing and Samples | $60 | $720 |
| Auto Expenses and Insurance | $150 | $1,800 |
| Miscellaneous Supplies | $100 | $1,200 |
| Billing and Administration | $125 | $1,500 |
| Chemicals - Chlorine | $450 | $5,400 |
| **Total Estimated Supply O&M Costs** | **$2,770** | **$32,220** |

## *Treatment Operation and Maintenance (SST-O&M-2)*

Operation and maintenance costs are very important elements to consider for filtration water treatment systems. In general, these costs are primarily associated with filter media replacement. In addition, periodic service and calibration of water system instrumentation, such as flow meters, alarms, and other related equipment is required.

Project annual O&M cost based on input from City staff is estimated to be approximately $13,000 per year. This O&M cost was also very comparable to the escalated Oxidation/Filtration arsenic treatment O&M cost curves from the Washington Department of Health Publication #331-210. This includes estimated cost for labor, media replacement, maintenance and repairs, auto expenses and insurance, chemicals, testing and samples, billing and administration, and other operation and maintenance needs. Labor is estimated to be 3 – 4 hours a week of City staff's time.

Arsenic treatment O&M costs assume that the backwash and waste will be considered non-hazardous. Hazardous waste disposal costs could significantly impact the final operation and maintenance costs for the system. Treatment O&M costs are further summarized below in Table 8-2.

| Table 8 – 2<br>Estimated Treatment Operation and Maintenance Cost | | |
|---|---|---|
| **Item Description** | **Estimated Monthly Cost** | **Estimated Total Yearly Cost** |
| Labor | $320 | $3,840 |
| Power | $50 | $600 |
| Maintenance and Repair | $50 | $600 |
| Testing and Samples | $60 | $720 |
| Auto Expenses and Insurance | $85 | $1,020 |
| Miscellaneous Supplies | $50 | $600 |
| Billing and Administration | $65 | $780 |
| Chemicals/Media | $400 | $4,800 |
| **Total Estimated Treatment O&M Costs** | **$1,080** | **$12,960** |

## Storage and Pump Station Improvements (SPS)

The following proposed storage and pump station improvements have been identified.

### *Existing Pump Station Improvements (SPS-1)*

Based on the water system analysis presented in Section 6, additional pumping capacity is currently needed to meet the recommended firm capacity of 2,860 gpm. It is anticipated that reconstruction of the existing pump station mechanical system and transmission system piping will be required to allow for larger pumps in order to meet the projected demands and fire flow requirements. However, if an additional storage tank and second booster pump station is provided, the overall system pumping capacity requirements needed by the existing pump station can be reduced. Project cost is a $75,000 allowance for upgrades to the existing pump station. Project costs for a study to perform a detailed pump station capacity analysis along with siting the new additional storage tank and pump station are identified in System Management and Miscellaneous Improvements below.

### *New Storage Tank and Pump Station (SPS-2)*

Based on the water system analysis presented in Section 6, additional storage is needed to meet the City's current and future water storage needs. This project consists of the construction of a new storage tank, pump station, associated piping and valve assemblies. It is anticipated that the storage tank will have a volume of 1 MG based on the water system analysis, which will be adequate to meet storage requirements through the planning period. It is assumed that the storage tank will be constructed at a higher elevation located up along Airport Road.

Currently, property has not been identified or acquired for the purpose of siting the new storage tank and pump station. Therefore, it is recommended that efforts begin as soon as funding becomes available to complete a study for identifying property acquisition needs.

Project costs for a study to identify potential sites for the new additional storage tank and pump station along with performing a pump station capacity analysis are identified in System Management and Miscellaneous Improvements below.

## *Storage Tank Repairs, Operation, and Maintenance (SPS-O&M-1)*

The last interior inspection was by LiquiVision Technology in February 2004, which was performed by an underwater 3-man dive team. The preliminary inspection report identified that the interior ladder was in poor condition and needed to be replaced, the interior walls needed to be cleaned, and that the tank had accumulated approximately 1-inch of sediment on the bottom. It is recommended that the noted maintenance and repairs be made and the tank be cleaned and inspected on a regular basis in accordance with the manufacturer and State requirements. Inspection repair cost is estimated to be $15,000.

Storage annual O&M cost is estimated to be approximately $8,000 per year based on input from City staff. This includes cost for labor, maintenance and repair, auto expenses and insurance, testing, billing and administration, and other operation and maintenance needs including an underwater inspection every three years. Labor is estimated to be 2 – 3 hours a week of City staff's time. Storage O&M costs are further summarized below in Table 8-3.

**Table 8 – 3**
**Estimated Storage Operation and Maintenance Cost**

| Item Description | Estimated Monthly Cost | Estimated Total Yearly Cost |
|---|---|---|
| Labor | $240 | $2,880 |
| Maintenance and Repair | $150 | $1,800 |
| Testing and Samples | $60 | $720 |
| Auto Expenses and Insurance | $85 | $1,020 |
| Miscellaneous Supplies | $50 | $600 |
| Billing and Administration | $65 | $780 |
| **Total Estimated Storage O&M Costs** | **$650** | **$7,800** |

## *Pump Station Operation and Maintenance (SPS-O&M-2)*

As previously stated, continuous operation and maintenance is important to ensure system reliability and overall peak performance and is especially important to pump stations. In addition, periodic service and calibration of all water system instrumentation, such as flow meters, level sensors, alarms, and other related equipment is required. Routine inspections and services for the pump station include, but not limited to the following items.

- Backup generator
- Motors
- Pumps
- Impellers
- Bearings and Seals
- Wear clearances
- Couplings
- Drives
- Valves
- Other related equipment

Based on input from City staff, project annual O&M cost is estimated to be approximately $24,000 per year. This includes estimated cost for labor, power, maintenance and repairs, auto expenses and insurance, testing and samples, billing and administration, and other operation and maintenance needs. Labor is estimated to be 8 - 10 hours a week of City staff's time. Pump station O&M costs are further summarized below in Table 8-4.

**Table 8 – 4**
**Estimated Pump Station Operation and Maintenance Cost**

| Item Description | Estimated Monthly Cost | Estimated Total Yearly Cost |
|---|---|---|
| Labor | $800 | $9,600 |
| Power | $600 | $7,200 |
| Maintenance and Repair | $200 | $2,400 |
| Auto Expenses and Insurance | $150 | $1,800 |
| Miscellaneous Supplies | $100 | $1,200 |
| Billing and Administration | $125 | $1,500 |
| **Total Estimated Pump Station O&M Costs** | **$1,975** | **$23,700** |

## Transmission and Distribution System Improvements (TDS)

The following proposed improvements to the distribution system have been identified.

### *Hwy 99E from Third and Main Street to Bobs Avenue (TDS-1)*

Install 1,460± lineal feet of 10-inch water line from the intersection of Third and Main Street, west along Third Street to Highway 99E, then south along Highway 99E to Bobs Avenue. This project is necessary to replace an undersized 2-inch galvanized pipe in poor condition and to improve fire flows and gridding of the system. Highway under crossings will be necessary.

### *Ehlen Road from Airport Road east to Mill Creek Bridge (TDS-2)*

Replace 580± lineal feet of 6-inch water line in poor condition with a 12-inch water line along Ehlen Road from Airport Road east to Mill Creek Bridge. This project is necessary to improve fire flows to the northwesterly area of the City and to connect the proposed new storage tank and pump station to the existing system.

### Hwy 99E from Bobs Avenue to Ottaway Road (TDS-3)

Install 1,400± lineal feet of 10-inch water line along Highway 99E from Bobs Avenue south to Ottaway Road. This project is necessary to replace an undersized 2-inch galvanized pipe and to improve fire flows and gridding of the system.

### Airport Road from Ehlen Road to new Storage Tank (TDS-4)

Replace 2,200± lineal feet of 6-inch water line with a 12-inch water line along Airport Road from Ehlen Road to the new storage tank. This project is necessary to improve fire flows to the northwesterly area of the City and to connect the proposed new storage tank and pump station to the existing system.

### Ehlen Road from Mill Creek Bridge east to Main Street (TDS-5)

Replace 530± lineal feet of 8-inch water line with a 12-inch water line from and across Mill Creek Bridge east along Ehlen Road to Main Street. This project is necessary to improve fire flows to the northwesterly area of the City and to connect the proposed new storage tank and pump station to the existing system. A bridge crossing and railroad crossing will be necessary.

### Main Street from Ehlen Road to Third Street (TDS-6)

Replace 850± lineal feet of 8-inch water line with a 12-inch water line along Main Street from Ehlen Road to the Third Street. This project is necessary to improve fire flows to the northwesterly area of the City and to connect the proposed new storage tank and pump station to the existing system.

### Third Street from Main Street to Liberty Street (TDS-7)

Install 370± lineal feet of 10-inch water line along Third Street from Main Street to Liberty Street. This project is necessary to improve fire flows and gridding of the system.

### Bobs Avenue from Hwy 99E to Main Street (TDS-8)

Replace 400± lineal feet of 4-inch water line with an 8-inch water line along Bobs Avenue from Highway 99E to Main Street. This project is necessary to improve fire flows and gridding of the system.

### Bobs Avenue from Main Street to Liberty Street (TDS-9)

Replace 470± lineal feet of 4-inch water line in poor condition with an 8-inch water line along Bobs Avenue from Main Street to Liberty Street. This project is necessary to improve fire flows and gridding of the system.

### Main Street from Third Street to Fourth Street (TDS-10)

Replace 370± lineal feet of 6-inch water line in poor condition with an 8-inch water line along Main Street from Third Street to Fourth Street. This project is necessary to remove existing asbestos-cement pipe and improve fire flows and gridding of the system.

### Main Street from Fourth Street to Bobs Avenue (TDS-11)

Replace 860± lineal feet of 6-inch water line in poor condition with an 8-inch water line along Main Street from Fourth Street to Bobs Avenue. This project is necessary to improve fire flows and gridding of the system.

### Fourth Street from Main Street to Liberty Street (TDS-12)

Replace 450± lineal feet of 6-inch water line in poor condition with an 8-inch water line along Fourth Street from Main Street to Liberty Street. This project is necessary to improve fire flows and gridding of the system.

### Main Street from Bobs Avenue to Ottaway Road (TDS-13)

Replace 1,290± lineal feet of 6-inch water line in poor condition with an 8-inch water line along Main Street from Bobs Avenue to Ottaway Road. This project is necessary to remove existing asbestos-cement pipe and improve fire flows and gridding of the system.

### North of City Park from Main Street to Liberty Street (TDS-14)

Replace 470± lineal feet of 6-inch water line in poor condition with an 8-inch water line between Main Street and Liberty Street north of the City Park. This project is necessary to remove existing asbestos-cement pipe and improve fire flows and gridding of the system.

### Sayre Drive from Bobs Avenue to City Park (TDS-15)

Replace 520± lineal feet of 4-inch water line in poor condition with an 8-inch water line along Sayre Drive from Bobs Avenue to the City Park. This project is necessary to remove existing asbestos-cement pipe and improve fire flows and gridding of the system.

### Filbert Street from Ottaway Road north to existing hydrant (TDS-16)

Replace 430± lineal feet of 4-inch water line in poor condition with an 8-inch water line along Filbert Street from Ottaway Road north to the existing fire hydrant. This project is necessary to remove existing asbestos-cement pipe and improve fire flows.

### Kasel Court from Airport Road west to furthest existing hydrant (TDS-17)

Replace 960± lineal feet of 6-inch water line with an 8-inch water line along Kasel Court from Airport Road west to the furthers existing fire hydrant. This project is necessary to improve fire flows.

### Transmission and Distribution System Operation and Maintenance (TDS-O&M-1)

An amount is budgeted each year to account for the operation and maintenance of the transmission and distribution system. This transmission and distribution system operation and maintenance item includes cost for replacement of water lines based on maintenance records, age, pipe material, etc., and includes cost for servicing or replacing valves, fire hydrants, and other appurtenances in the system.

The replacement cost for water lines is based on the replacement of approximately 100 feet per year with 8-inch diameter AWWA C-900 Class 150 PVC. The typical pipe unit cost of $8 per diameter-inch per foot of pipe length was used with an allowance of 40 percent added to account for contingencies, administrative, and other project related costs. The total unit cost including allowances is $90 per foot.

Based on input from City staff, project annual O&M cost is estimated to be approximately $25,000 per year. This includes estimated cost for labor, maintenance and repairs, auto expenses and insurance, testing and samples, billing and administration, and other operation and maintenance needs. Labor is estimated to be 8 - 10 hours a week of City staff's time. Distribution O&M costs are further summarized below in Table 8-5.

**Table 8 – 5**
**Estimated Distribution Operation and Maintenance Cost**

| Item Description | Estimated Monthly Cost | Estimated Total Yearly Cost |
|---|---|---|
| Labor | $800 | $9,600 |
| Maintenance, Repair, and Replacement | $750 | $9,000 |
| Testing and Samples | $60 | $720 |
| Auto Expenses and Insurance | $150 | $1,800 |
| Miscellaneous Supplies | $150 | $1,800 |
| Billing and Administration | $125 | $1,500 |
| **Total Estimated Distribution O&M Costs** | **$2,035** | **$24,420** |

## System Management and Miscellaneous Projects (SMM)

The recommended system management and miscellaneous projects are shown below. The following summary of projects does not necessarily need to be implemented consecutively. Actual project priority and implementation will depend on various factors, including specific project needs and available City funding.

Table 8-6 below summarizes the recommended System Management and Miscellaneous Projects and their respective recurring costs.

| Table 8 – 6<br>System Management and Miscellaneous Project Estimated Cost | | | | |
|---|---|---|---|---|
| Project No. | Project Description | Initial Estimated Cost in 2008 dollars | Estimated Recurring Cost | Recurring Cost Frequency |
| SMM-1 | Annual Consumer Confidence Reports | - | $1,500 | Annual |
| SMM-2 | Water Quality Monitoring and Testing | - | $1,500 | Annual |
| SMM-3 | Water Rights Strategic Plan | $7,500 | - | One-time |
| SMM-4 | Financial Analysis and System Fees Study | | $20,000 | Every five years |
| SMM-5 | Update Water Billing Software | $15,000 | $3,500 | Every five years |
| SMM-6 | Storage Tank Seismic and Condition Assessment | $15,000 | - | One-time |
| SMM-7 | Water Management and Conservation Plan - Implementation | $2,500 | $1,000 | Annual |
| SMM-8 | Drinking Water Protection Program | $5,000 | $2,500 | Every three years |
| SMM-9 | Additional Storage and Pump Station Study | $15,000 | - | One-time |
| SMM-10 | Update Water System Design and Construction Standards | $15,000 | $500 | Annual |
| SMM-11 | GIS System and Update Water System Mapping | $20,000 | $2,500 | Every five years |
| SMM-12 | Water Meter Strategic Plan | $3,500 | - | One-time |
| SMM-13 | Update Water System Master Plan | - | $50,000 | Every ten years |
| SMM-14 | New Supply Source Study | $15,000 | - | One-time |

## *Annual Consumer Confidence Reports (SMM-1)*

This item accounts for actions necessary to complete a yearly required consumer confidence report, which is to be sent to customers describing the previous year of operation and documenting the overall quality of the water within the City's system. Project annual cost is estimated to be $1,500 per year.

## *Water Quality Monitoring and Testing (SMM-2)*

The City will need to develop formal monitoring plans for water quality components resulting from increased drinking water regulations based on the Safe Drinking Water Act (SDWA). In addition to the standard water quality testing requirements, the City is required to analyze for radionuclides and disinfection by-products (DBPs) in accordance with recent updates to the Safe Drinking Water Act (SDWA). Further details on this and other water quality concerns were previously discussed in Section 7. Project annual cost is estimated to be $1,500 per year.

### Water Rights Strategic Plan (SMM-3)

Based on the previous discussion on water rights in Section 6, it is recommended that further research by a certified water rights examiner be performed and a strategic plan be put together to identify all the issues associated with the City's water rights, appropriately prioritize certification of their water rights, possibly apply for an extension for the Claim of Beneficial Use for the wells, identify activities necessary to secure Well No. 4's remaining rights, and provide a complete analysis of future water rights that may be obtainable by the City. Project cost is estimated to be $7,500.

### Financial Analysis, Rates and Fees Study (SMM-4)

A long-term financial analysis and water system rates and fees study is needed in order to determine the actual costs of providing water service to customers, the required water system operating capital, and to establish updated fees necessary to support the recommended capital improvement plan. The study should include a complete cost-of-service analysis and update the City's various options for generating revenue. These options should include a review and update to the current system rates and fee structure, service connection fees, impact fees, system development charges, and others as deemed appropriate.

In addition, it is recommended that every three to five years, a study be conducted by a qualified rate analysis to review the City's current operating costs, depreciation, rate structure, system development costs, and other water system costs to assist in establishing adequate water rates and other system fees. The last SDC study was performed in 2000 and has since been outdated. Project cost is estimated to be $20,000 every five years.

### Update Water Billing Software (SMM-5)

This project includes costs for the purchase of water billing software upgrades to be used for water billings, tracking, and reporting water system use. Project initial cost is estimated to be $15,000, with an update and training cost of $3,500 every five years.

### Storage Tank Seismic and Condition Assessment (SMM-6)

Although the existing storage tank does not appear to have any observed deficiencies, the existing storage tank has not had a structural inspection since being built in 1991. This project includes costs for a storage tank seismic and condition assessment to assess the current condition of the floor, roof, vents, ladders, exterior structural sheeting, bolt fasteners, glass coating, sealants, and other structural items and overall seismic risk and develop recommended improvements as necessary to meet current seismic code requirements. Project cost is estimated to be $15,000 and is recommended to be completed within the next three to five years.

### Water Management and Conservation Plan – Implementation (SMM-7)

This includes costs associated with implementation of the Water Management and Conservation Plan developed by the City. An annual budget to implement public education and program promotion and conduct audits as necessary is included. Further details regarding water management and conservation plans were previously discussed in Section 7. Project initial cost is estimated to be $2,500, with an annual cost of $1,000 per year.

### Drinking Water Protection Program (SMM-8)

This item accounts for actions necessary to complete and implement a recommended drinking water protection program and the subsequent annual budget to maintain the program. The initial implementation cost would include initial notifications to agencies and owner/operators of protection areas and coordination with local emergency responders. Implementation activities would involve updating the contaminant inventory every two to three years and updating the plan every five to seven years. Project initial cost is estimated to be $5,000, with a recurring cost of $2,500 every three years.

### Additional Storage Siting and Pump Station Study (SMM-9)

This item refers to a study that will evaluate the details of various options for siting and development of an additional storage tank, pump station, and associated piping and valve assemblies to meet the needs over the 20-year planning period. In addition, this study will review and evaluate the need to increase the pumping capacity of the existing pump station both with and without the addition of the new pump station. Project cost is estimated to be $15,000.

### Update Water System Design and Construction Standards (SMM-10)

This project includes costs for the update of the City's water system design and construction standards needed for water system improvements. The existing standards are outdated and in desperate need of updating. Project initial cost is estimated to be $15,000, with an annual cost of $500 per year for minor review and updates.

### Update Water System Mapping and Model (SMM-11)

This item will provide the City with GIS mapping software and a portable GPS system to update and improve the existing water system mapping. In addition the City would transfer as-built drawings, plans, and other mapping records to digital format and maintain the mapping database. Once the mapping is updated, the hydraulic model would be updated accordingly. Project initial cost is estimated to be $20,000, with a cost of $2,500 every three years.

### Water Meter Strategic Plan (SMM-12)

Lack of standardization among the existing water meters makes maintenance and meter reading complex for the City. The meters are of varying ages, multiple brands, and the City has no routine testing or calibration schedule or meter replacement strategy. To address these concerns it is recommended that the City develop a water meter strategic plan with an emphasis on the following goals. Project cost to develop and implement a water meter strategic plan is estimated to be $3,500.

- Obtain accurate and reliable meter data.
- Be efficient in collecting and processing water meter data.
- Establish a strategy that allows the City to efficiently and cost-effectively acquire, replace, and maintain service meters.

- Effectively track, review, and summarize City revenue based on the quantity of water actually delivered to customers.

### Update Water System Master Plan (SMM-13)

It will be necessary for the City to update the WSMP every seven to ten years. A WSMP showing updated recommendations and capital improvement plan is proposed to be completed by year 2020 and again by year 2030. The new plans will be necessary for the planning, funding, and construction of future water system improvements in order to meet current and anticipated system demands. Project cost is estimated to be $50,000 every ten years.

### New Supply Source Study (SMM-14)

Although a general location for a new well was previously identified in 2005 for the purpose of constructing Well No. 5, an additional study will be necessary for any future wells. The exact location of future groundwater wells will be based on criteria such as property availability, location of growth, wellhead protection zoning and concerns, location of storage facilities and distribution mains, and more importantly hydrogeological factors. Project cost is estimated to be $15,000.

## Development-Related Projects (DEV)

Following are projects that will be implemented as part of development projects. The construction of these improvements will most likely be a requirement set forth as part of the development conditions and not constructed as part of a capital improvement by the City. Scheduling of these improvements will depend upon growth and on the timing of development activity.

### Ehlen Road west of Airport Road (DEV-1)

As development occurs, installation of a 10-inch water line extending from the proposed 12-inch main along the intersection of Airport Road and Ehlen Road. This will provide for adequate fire flows needed for future development anticipated along Ehlen Road.

### Cole Lane and North of Ehlen Road (DEV-2)

As development occurs, installation of an 8-inch water line along Cole Lane and 8-inch distribution grid system. This will provide for adequate fire flows and gridding of the system.

### Private Road north of Ottaway Road west of Hwy 99E (DEV-3)

As development occurs, installation of a 10-inch water line along the Private Easement Road. This will provide for adequate commercial fire flows and gridding of the system.

### Hwy 99E south of Umbenhower Lane (DEV-4)

As development occurs, installation of a 10-inch water line along Highway 99E. This will connect to the existing 8-inch water line and provide for adequate fire flows and future gridding of the system. Depending on the actual industrial and commercial water demand and

fire flow needs, upsizing of the existing 8-inch along Highway 99E to a 10-inch may be necessary at some time in the future.

### *West of Hwy 99E and south of Umbenhower Lane (DEV-5)*

As development occurs, installation of an 8-inch distribution grid system. This will provide for adequate fire flows and gridding of the system.

# Capital Improvement Plan

The various capital improvements projects with higher priorities are scheduled to be implemented by 2020. For those specific projects that were not identified by the City as planned for construction in the immediate future, the priority for earliest construction is given to those projects that are needed to meet current demands and to comply with drinking water regulations, followed by those that improve or address fire flow deficiencies, followed by improvements for growth, pipe networking, and other system needs. As previously discussed, many of the listed improvements are growth-related and therefore anticipated project schedules are subject to change.

A summary of all the recommended improvements is presented in Figure 8-3, attached at the end of this section. An expanded Capital Improvement Plan showing the various improvement project schedules by year through year 2020 is presented in Appendix K.

The total cost for all recommended capital improvement projects identified including a 3 percent inflation factor over the planning period is approximately $5.68 million. The highest cost projects consist of the following:

- The addition of an arsenic water treatment system *($0.10 million for the study/pilot test (approx. year 2010-2011) and $0.51 million for the treatment system (year 2012-2013)).*
- The replacement of old, undersized, and various asbestos-cement pipe with 8-inch mains within the downtown core area *($0.90 million, over 20 years).*
- The installation of several sections of 10-inch and 12-inch transmission/distribution mains *($1.3 million, over 20 years).*
- The addition of an estimated 1 million gallon storage tank facility and pump station *($2.10 million (approx. year 2018-2019)).*
- The addition of a future Well No. 6, as demands increase *($0.52 million (approx. year 2023-2024)).*

## Implementation

The following Capital Improvement Plan (CIP) implementation activity listing establishes the specific measures that will need to be taken by the City that will ultimately lead to plan achievement. The intent of this listing is to organize the short-term improvements (Years 0-5) and intermediate improvements (Years 5-10) shown in the CIP and prioritize them for timely completion. This stepped approach will provide the City with an easy to follow reference to begin implementation efforts for the recommended improvements and associated projects that are scheduled to be completed within the next ten years.

## *Implementation Activity Listing (Years 0-10)*

The prioritized projects identified below are organized by the following activity characteristics that allow strategic implementation of the recommended improvements and associated projects.

**Activity No.** - Identifies the activity number correlating to project priority.

**CIP Project No. & Description** - Identifies the Capital Improvement Plan project number and the description of the project.

**Implementation** - Identifies the anticipated year for implementation of the activity.

**Cost** - Identifies the escalated project cost identified in the Capital Improvement Plan.

**Objective** - Identifies the objective(s) to be achieved by the project.

**Purpose** - Identifies why the activity should be accomplished.

**Resources** - Identifies the potential mechanism(s) utilized by the City to finance or complete the activity.

The short-term and intermediate implementation activities shown in the Capital Improvement Plan have resulted in 26 projects identified to be accomplished by the year 2020. These projects are listed as follows:

| | | |
|---|---|---|
| **Activity Number 1** | CIP Project No. & Description | SMM-4<br>Financial Analysis, Rates, and Fees Study |
| | Implementation | 2009-2010 |
| | Cost | $20,000 |
| | Objective | To perform a complete cost-of-service analysis and update the City's various options for generating revenue. |
| | Purpose | To determine the actual costs of providing water service to customers, the required water system operating capital, and to establish updated fees necessary to support the CIP. |
| | Resources | • Local Funding Sources |

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|---|---|---|
| **Activity Number 2** | CIP Project No. & Description | SMM-3<br>Water Rights Strategic Plan |
| | Implementation | 2009-2010 |
| | Cost | $7,500 |
| | Objective | To perform research by a certified water rights examiner and a strategic plan be put together. |
| | Purpose | To appropriately prioritize certification of their water rights, identify activities necessary to secure Well No. 4's remaining rights, and provide a complete analysis of future water rights that may be obtainable by the City. |
| | Resources | • General Fund<br>• Oregon Economic and Community Development Department<br>• Oregon Water Resources Department |

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|---|---|---|
| **Activity Number 3** | CIP Project No. & Description | SST-1<br>Preliminary Arsenic Water Treatment Study / Pilot Testing |
| | Implementation | 2009-2010 |
| | Cost | $100,000 |
| | Objective | To perform an arsenic water treatment preliminary study and implement a pilot test program. |
| | Purpose | To determine which arsenic treatment alternative provides the City the best results to ensure compliance with State and Federal drinking water regulations. |
| | Resources | • Local Funding Sources<br>• Oregon Economic and Community Development Department<br>• Oregon Water Resources Department |

| | | |
|---|---|---|
| **Activity Number 4** | CIP Project No. & Description | SPS-O&M-1<br>Storage Tank Repairs |
| | Implementation | 2009-2010 |
| | Cost | $15,000 |
| | Objective | To make necessary repairs to the existing storage tank. |
| | Purpose | To replace the interior ladder, clean the interior walls, and remove the accumulated sediment on the bottom of the tank. |
| | Resources | • Local Funding Sources |

| | | |
|---|---|---|
| **Activity Number 5** | CIP Project No. & Description | TDS-1<br>10-inch – Hwy 99E from Third and Main Street to Bobs Avenue |
| | Implementation | 2009-2010 |
| | Cost | $229,000 |
| | Objective | Distribution system improvements. |
| | Purpose | To replace an undersized 2-inch galvanized pipe in poor condition and to improve fire flows and gridding of the system. |
| | Resources | • Local Funding Sources<br>• Oregon Economic and Community Development Department |

| | | |
|---|---|---|
| **Activity Number 6** | CIP Project No. & Description | SMM-5<br>Update Water Billing Software |
| | Implementation | 2009-2010 |
| | Cost | $15,000 |
| | Objective | To improve water billing software. |
| | Purpose | To update water billing software used for water billings, tracking, and reporting water system use. |
| | Resources | • Local Funding Sources |

| | | |
|---|---|---|
| **Activity Number** | CIP Project No. & Description | SST-3<br>Wells No. 3 and 5 Emergency Backup Generator Connections |

| | | |
|---|---|---|
| **7** | Implementation | 2010-2011 |
| | Cost | $11,100 |
| | Objective | To provide outside backup power connection capabilities. |
| | Purpose | To operate Well No. 3 and Well No. 5 during emergency conditions. |
| | Resources | • Local Funding Sources |

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| **Activity Number 8** | CIP Project No. & Description | SMM-6<br>Storage Tank Seismic and Condition Assessment |
| | Implementation | 2010-2011 |
| | Cost | $15,900 |
| | Objective | To perform seismic and condition assessment for the existing storage tank. |
| | Purpose | To assess the current condition of the floor, roof, vents, ladders, exterior structural sheeting, bolt fasteners, glass coating, sealants, and other structural items and overall seismic risk and develop recommended improvements as necessary to meet current seismic code requirements. |
| | Resources | • Local Funding Sources |

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| **Activity Number 9** | CIP Project No. & Description | SMM-7<br>Water Management and Conservation Plan – Implementation |
| | Implementation | 2010-2011 |
| | Cost | $2,700 |
| | Objective | To promote increased public awareness for reduced water use. |
| | Purpose | To implement public education and program promotion and conduct audits as necessary to ensure water conservation techniques are being used. |
| | Resources | • Local Funding Sources<br>• Oregon Water Resources Department |

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|---|---|---|
| **Activity Number 10** | CIP Project No. & Description | SMM-8<br>Drinking Water Protection Program |
| | Implementation | 2010-2011 |
| | Cost | $5,300 |
| | Objective | To complete and implement a recommended drinking water protection program and the subsequent annual budget to maintain the program. |
| | Purpose | To provide initial notifications to agencies and owner/operators of protection areas and coordination with local emergency responders for the protection of the City's well supply sources. |
| | Resources | • Local Funding Sources<br>• Oregon Water Resources Department |

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|---|---|---|
| **Activity Number 11** | CIP Project No. & Description | SST-4<br>Well Emergency Backup Generator |
| | Implementation | 2011-2012 |
| | Cost | $26,200 |
| | Objective | To provide a new well emergency backup generator. |
| | Purpose | To replace the existing generator that is well past its useful life expectancy. |
| | Resources | • Local Funding Sources |

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| **Activity Number 12** | CIP Project No. & Description | TDS-2<br>12-inch – Ehlen Road from Airport Road east to Mill Creek Bridge |
| | Implementation | 2011-2012 |
| | Cost | $85,200 |
| | Objective | Distribution System Improvements |
| | Purpose | To improve fire flows to the northwesterly area of the City and to connect the proposed new storage tank and pump station to the existing system. |
| | Resources | • Local Funding Sources<br>• Oregon Economic and Community Development Department |

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| **Activity Number 13** | CIP Project No. & Description | SMM-9<br>Additional Storage Siting and Pump Station Study |
| | Implementation | 2011-2012 |
| | Cost | $16,400 |
| | Objective | To identify the site for the new storage tank and pump station. |
| | Purpose | To complete and evaluate the details of various options for siting and development of an additional storage tank and pump station and evaluate the need to increase the pumping capacity of the existing pump station both with and without the addition of the new pump station. |
| | Resources | • Local Funding Sources |

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| **Activity Number 14** | CIP Project No. & Description | SST-2<br>Arsenic Water Treatment System |
| | Implementation | 2012-2013 |
| | Cost | $510,000 |
| | Objective | To construct an arsenic water treatment system. |
| | Purpose | To install a water treatment system to treat arsenic and other water quality issues associated with the City's Well No. 4 and Well No. 5. |
| | Resources | • Local Funding Sources<br>• Oregon Economic and Community Development Department<br>• Rural Utilities Services<br>• Oregon Water Resources Department |

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| **Activity Number 15** | CIP Project No. & Description | SMM-10<br>Update Water System Design and Construction Standards |
| | Implementation | 2012-2013 |
| | Cost | $16,900 |
| | Objective | To provide updated water system design and construction standards. |
| | Purpose | The existing standards are outdated and in desperate need of updating to establish a uniform set of standards for the design and construction of their water system. |
| | Resources | • Local Funding Sources |

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| **Activity Number 16** | CIP Project No. & Description | SPS-1<br>Existing Pump Station Improvements |
| | Implementation | 2013-2014 |
| | Cost | $86,900 |
| | Objective | To make necessary improvements to the existing pump station. |
| | Purpose | To provide additional pumping capacity necessary to meet current and future water demands and fire flow capabilities. |
| | Resources | • Local Funding Sources |

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| **Activity Number 17** | CIP Project No. & Description | SST-5<br>Wells No. 3 and 4 Casing Seal Replacement |
| | Implementation | 2013-2014 |
| | Cost | $92,700 |
| | Objective | To provide a new well emergency backup generator. |
| | Purpose | To replace the existing generator that is well past its useful life expectancy. |
| | Resources | • Local Funding Sources |

| | | |
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| **Activity Number 18** | CIP Project No. & Description | TDS-3<br>10-inch – Hwy 99E from Bobs Avenue to Ottaway Road |
| | Implementation | 2014-2015 |
| | Cost | $187,500 |
| | Objective | Distribution System Improvements |
| | Purpose | To replace an undersized 2-inch galvanized pipe and to improve fire flows and gridding of the system. |
| | Resources | • Local Funding Sources<br>• Oregon Economic and Community Development Department |

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| **Activity Number 19** | CIP Project No. & Description | SMM-11<br>Update Water System Mapping and Model |
| | Implementation | 2014-2015 |
| | Cost | $23,900 |
| | Objective | To provide the City with GIS mapping software and a portable GPS system. |
| | Purpose | To update and improve the existing water system utility mapping and hydraulic computer modeling. |
| | Resources | • Local Funding Sources |

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|---|---|---|
| **Activity Number 20** | CIP Project No. & Description | SMM-12<br>Water Meter Strategic Plan |
| | Implementation | 2014-2015 |
| | Cost | $4,200 |
| | Objective | To implement a plan to standardize the City's water meters. |
| | Purpose | To obtain accurate and reliable meter data, to be efficient in collecting and processing water meter data, to establish a strategy that allows the City to efficiently and cost-effectively acquire, replace, and maintain service meters, and to effectively track, review, and summarize City revenue based on the quantity of water actually delivered to customers. |
| | Resources | • Local Funding Sources |

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| **Activity Number 21** | CIP Project No. & Description | TDS-4<br>12-inch – Airport Road from Ehlen Road to new Storage Tank |
| | Implementation | 2015-2016 |
| | Cost | $364,000 |
| | Objective | Distribution System Improvements |
| | Purpose | To improve fire flows to the northwesterly area of the City and to connect the proposed new storage tank and pump station to the existing system. |
| | Resources | • Local Funding Sources<br>• Oregon Economic and Community Development Department |

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| **Activity Number 22** | CIP Project No. & Description | TDS-5<br>12-inch – Ehlen Road from Mill Creek Bridge east to Main Street |
| | Implementation | 2016-2017 |
| | Cost | $177,300 |
| | Objective | Distribution System Improvements |
| | Purpose | To improve fire flows to the northwesterly area of the City and to connect the proposed new storage tank and pump station to the existing system. |
| | Resources | • Local Funding Sources<br>• Oregon Economic and Community Development Department |

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| **Activity Number 23** | CIP Project No. & Description | TDS-6<br>12-inch – Main Street from Ehlen Road to Third Street |
| | Implementation | 2017-2018 |
| | Cost | $208,800 |
| | Objective | Distribution System Improvements |
| | Purpose | To improve fire flows to the northwesterly area of the City and to connect the proposed new storage tank and pump station to the existing system. |
| | Resources | • Local Funding Sources<br>• Oregon Economic and Community Development Department |

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| **Activity Number 24** | CIP Project No. & Description | SPS-2<br>New Storage Tank and Pump Station |
| | Implementation | 2018-2019 |
| | Cost | $2,104,600 |
| | Objective | To provide additional storage necessary to meet the City's current and future water storage needs. |
| | Purpose | To construct a new 1 million gallon storage tank, pump station, associated piping and valve assemblies. |
| | Resources | • Local Funding Sources<br>• Oregon Economic and Community Development Department<br>• Rural Utilities Services |

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| **Activity Number 25** | CIP Project No. & Description | TDS-7<br>10-inch - Third Street from Main Street to Liberty Street |
| | Implementation | 2019-2020 |
| | Cost | $56,800 |
| | Objective | Distribution System Improvements |
| | Purpose | To improve fire flows and gridding of the system. |
| | Resources | • Local Funding Sources<br>• Oregon Economic and Community Development Department |

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| **Activity Number 26** | CIP Project No. & Description | SMM-13<br>Update Water System Master Plan |
| | Implementation | 2019-2020 |
| | Cost | $69,200 |
| | Objective | To update the water system master plan and capital improvement plan. |
| | Purpose | To provide an update necessary for the planning, funding, and construction of future water system improvements in order to meet the current and anticipated system demands. |
| | Resources | • Local Funding Sources |

# Water System Capital Improvement Plan

## Project Priority and Schedule[1]

Cost in 2008 dollars and escalated at an average inflation rate of 3 percent per year.

| Project Category | | Project Number | Project Description | Budget Fiscal Year..... | 2009-2010 | 2010-2011 | 2011-2012 | 2012-2013 | 2013-2014 | 2014-2015 | 2009 - 2015 0 - 5 years | 2015 - 2020 5 - 10 years | 2020 - 2025 10 - 15 years | 2025 - 2030 15 - 20 years | Total Estimated Project Cost[2] | Comments & Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SST | Supply Source and Treatment Improvement Projects | *SST-1 | Preliminary Arsenic Water Treatment Study / Pilot Testing | | $ 100,000 | | | | | | $ 100,000 | $ - | $ - | $ - | $ 100,000 | Needed for study and testing for arsenic water treatment system. |
| | | *SST-2 | New Arsenic Water Treatment System | | | | | $ 510,000 | | | $ 510,000 | $ - | $ - | $ - | $ 510,000 | Needed for compliance with Drinking Water Regulations. |
| | | SST-3 | Wells No. 3 and 5 Emergency Backup Generator Connections | | | $ 11,100 | | | | | $ 11,100 | $ - | $ - | $ - | $ 11,100 | Needed for emergency preparation for water supply. |
| | | SST-4 | Well Emergency Backup Generator | | | | $ 26,200 | | | | $ 26,200 | $ - | $ - | $ - | $ 26,200 | Needed for emergency preparation for water supply. |
| | | SST-5 | Wells No. 3 and 4 Casing Seal Replacement | | | | | | $ 92,700 | | $ 92,700 | $ - | $ - | $ - | $ 92,700 | Needed for compliance with Drinking Water Regulations. |
| | | *SST-6 | Future Groundwater Well No. 6 | | | | | | | | $ - | $ - | $ 521,900 | $ - | $ 521,900 | Construct new well as necessary to meet City growth and demands. |
| | | | **SST PROJECTS SUB-TOTAL** | | **$ 100,000** | **$ 11,100** | **$ 26,200** | **$ 510,000** | **$ 92,700** | **$ -** | **$ 740,000** | **$ -** | **$ 521,900** | **$ -** | **$ 1,261,900** | Total SST project improvement costs including inflation to year shown. |
| SPS | Storage and Pump Station Improvement Projects | *SPS-1 | Existing Pump Station Improvements | | | | | | $ 86,900 | | $ 86,900 | $ - | $ - | $ - | $ 86,900 | Pump station capacity and reliability improvements. |
| | | *SPS-2 | New Storage Tank and Pump Station | | | | | | | | $ - | $ 2,104,600 | $ - | $ - | $ 2,104,600 | Current and future water storage needs, redundancy, and pump capacity improvement. |
| | | | **SPS PROJECTS SUB-TOTAL** | | **$ -** | **$ -** | **$ -** | **$ -** | **$ 86,900** | **$ -** | **$ 86,900** | **$ 2,104,600** | **$ -** | **$ -** | **$ 2,191,500** | Total SPS project improvement costs including inflation to year shown. |
| TDS | Transmission and Distribution System Improvement Projects | TDS-1 | 10-inch - Hwy 99E from Third and Main Street to Bobs Avenue | | $ 229,000 | | | | | | $ 229,000 | $ - | $ - | $ - | $ 229,000 | Fire flow improvement, undersized galv pipe, gridding of 10-inch main. |
| | | *TDS-2 | 12-inch - Ehlen Road from Airport Road east to Mill Creek Bridge | | | | $ 85,200 | | | | $ 85,200 | $ - | $ - | $ - | $ 85,200 | Additional storage tank supply main and fire flow improvements for NW area. |
| | | TDS-3 | 10-inch - Hwy 99E from Bobs Avenue to Ottaway Road | | | | | | | $ 187,500 | $ 187,500 | $ - | $ - | $ - | $ 187,500 | Fire flow improvement, undersized pvc pipe, gridding of 10-inch. |
| | | *TDS-4 | 12-inch - Airport Road from Ehlen Road to new Storage Tank | | | | | | | | $ - | $ 364,000 | $ - | $ - | $ 364,000 | Additional storage tank supply main and fire flow improvements for NW area. |
| | | *TDS-5 | 12-inch - Ehlen Road from Mill Creek Bridge east to Main Street | | | | | | | | $ - | $ 177,300 | $ - | $ - | $ 177,300 | Additional storage tank supply main and fire flow improvements for NW area. |
| | | *TDS-6 | 12-inch - Main Street from Ehlen Road to Third Street | | | | | | | | $ - | $ 208,800 | $ - | $ - | $ 208,800 | Additional storage tank supply main and fire flow improvements for NW area. |
| | | TDS-7 | 10-inch - Third Street from Main Street to Liberty Street | | | | | | | | $ - | $ 56,800 | $ - | $ - | $ 56,800 | Fire flow improvement, gridding of 10-inch distribution main. |
| | | TDS-8 | 8-inch - Bobs Avenue from Hwy 99E to Main Street | | | | | | | | $ - | $ - | $ 51,300 | $ - | $ 51,300 | Fire flow improvement, undersized pvc pipe. |
| | | TDS-9 | 8-inch - Bobs Avenue from Main Street to Liberty Street | | | | | | | | $ - | $ - | $ 59,900 | $ - | $ 59,900 | Fire flow improvement, undersized, and poor condition steel pipe. |
| | | TDS-10 | 8-inch - Main Street from Third Street to Fourth Street | | | | | | | | $ - | $ - | $ 48,500 | $ - | $ 48,500 | Fire flow improvement, undersized, and poor condition asbestos-cement pipe. |
| | | TDS-11 | 8-inch - Main Street from Fourth Street to Bobs Avenue | | | | | | | | $ - | $ - | $ 116,500 | $ - | $ 116,500 | Fire flow improvement, undersized, and poor condition steel pipe. |
| | | TDS-12 | 8-inch - Fourth Street from Main Street to Liberty Street | | | | | | | | $ - | $ - | $ 64,200 | $ - | $ 64,200 | Fire flow improvement, undersized, and poor condition steel pipe. |
| | | TDS-13 | 8-inch - Main Street from Bobs Avenue to Ottaway Road | | | | | | | | $ - | $ - | $ - | $ 191,700 | $ 191,700 | Fire flow improvement, undersized, and poor condition asbestos-cement pipe. |
| | | TDS-14 | 8-inch - North of City Park from Main Street to Liberty Street | | | | | | | | $ - | $ - | $ - | $ 71,500 | $ 71,500 | Fire flow improvement, undersized, and poor condition asbestos-cement pipe. |
| | | TDS-15 | 8-inch - Sayre Drive from Bobs Avenue to City Park | | | | | | | | $ - | $ - | $ - | $ 82,400 | $ 82,400 | Fire flow improvement, undersized, and poor condition asbestos-cement pipe. |
| | | TDS-16 | 8-inch - Filbert Street from Ottaway Road north to existing hydrant | | | | | | | | $ - | $ - | $ - | $ 70,400 | $ 70,400 | Fire flow improvement, undersized, and poor condition asbestos-cement pipe. |
| | | TDS-17 | 8-inch - Kasel Court from Airport Road west to furthest existing hydrant | | | | | | | | $ - | $ - | $ - | $ 160,000 | $ 160,000 | Needed fire flow improvement, undersized pvc pipe. |
| | | | **TDS PROJECTS SUB-TOTAL** | | **$ 229,000** | **$ -** | **$ 85,200** | **$ -** | **$ -** | **$ 187,500** | **$ 501,700** | **$ 806,900** | **$ 340,400** | **$ 576,000** | **$ 2,225,000** | Total TDS project improvement costs including inflation to year shown. |
| | | | **CAPITAL IMPROVEMENT PROJECTS TOTAL** | | **$ 329,000** | **$ 11,100** | **$ 111,400** | **$ 510,000** | **$ 179,600** | **$ 187,500** | **$ 1,328,600** | **$ 2,911,500** | **$ 862,300** | **$ 576,000** | **$ 5,678,400** | Total cost of improvements including inflation to year shown. |
| | | | **5-YEAR ANNUAL AVERAGE** | | | | | | | | **$ 265,720** | **$ 582,300** | **$ 172,460** | **$ 115,200** | | Average annual cost over each 5-year period. |
| | | | **TOTAL PLANNING PERIOD ANNUAL AVERAGE** | | | | | | | | | | | | **$ 283,920** | Average annual cost over the planning period. |
| SST | Supply Source and Treatment O&M | SST-O&M-1 | Supply Source Operation and Maintenance | | $ 32,000 | $ 33,000 | $ 34,000 | $ 35,000 | $ 36,100 | $ 37,200 | $ 207,300 | $ 203,200 | $ 235,700 | $ 273,200 | $ 919,400 | Needed for system operation and maintenance. |
| | | SST-O&M-2 | Water Treatment Operation and Maintenance | | | | | $ 13,000 | $ 13,400 | $ 13,800 | $ 40,200 | $ 75,300 | $ 87,500 | $ 101,500 | $ 304,500 | Needed for system operation and maintenance. |
| | | | **SST O&M SUB-TOTAL** | | **$ 32,000** | **$ 33,000** | **$ 34,000** | **$ 48,000** | **$ 49,500** | **$ 51,000** | **$ 247,500** | **$ 278,500** | **$ 323,200** | **$ 374,700** | **$ 1,223,900** | Total SMM project improvement costs including O&M and inflation to year shown. |
| SPS | Storage and Pump Station O&M | SPS-O&M-1 | Storage Tank Repairs and Operation and Maintenance | | $ 23,000 | $ 8,200 | $ 8,400 | $ 8,700 | $ 9,000 | $ 9,300 | $ 66,600 | $ 51,000 | $ 58,800 | $ 68,500 | $ 244,900 | Needed for system operation and maintenance. |
| | | SPS-O&M-2 | Pump Station Operation and Maintenance | | $ 24,000 | $ 24,700 | $ 25,400 | $ 26,200 | $ 27,000 | $ 27,800 | $ 155,100 | $ 152,000 | $ 176,300 | $ 204,600 | $ 688,000 | Needed for system operation and maintenance. |
| | | | **SPS O&M SUB-TOTAL** | | **$ 47,000** | **$ 32,900** | **$ 33,800** | **$ 34,900** | **$ 36,000** | **$ 37,100** | **$ 221,700** | **$ 203,000** | **$ 235,100** | **$ 273,100** | **$ 932,900** | Total SMM project improvement costs including O&M and inflation to year shown. |
| TDS | Distribution System O&M | TDS-O&M-1 | Transmission and Distribution System Operation and Maintenance | | $ 25,000 | $ 25,800 | $ 26,600 | $ 27,400 | $ 28,200 | $ 29,000 | $ 162,000 | $ 158,800 | $ 184,100 | $ 213,300 | $ 718,200 | Needed for system operation and maintenance. |
| | | | **TDS O&M SUB-TOTAL** | | **$ 25,000** | **$ 25,800** | **$ 26,600** | **$ 27,400** | **$ 28,200** | **$ 29,000** | **$ 162,000** | **$ 158,800** | **$ 184,100** | **$ 213,300** | **$ 718,200** | Total SMM project improvement costs including O&M and inflation to year shown. |
| | | | **SYSTEM OPERATION AND MAINTENANCE TOTAL** | | **$ 104,000** | **$ 91,700** | **$ 94,400** | **$ 110,300** | **$ 113,700** | **$ 117,100** | **$ 631,200** | **$ 640,300** | **$ 742,400** | **$ 861,100** | **$ 2,875,000** | Total cost of O&M including inflation to year shown. |
| SMM | System Management and Miscellaneous Projects | SMM-1 | Annual Consumer Confidence Reports | | $ 1,500 | $ 1,550 | $ 1,600 | $ 1,650 | $ 1,700 | $ 1,750 | $ 9,800 | $ 9,600 | $ 11,100 | $ 13,000 | $ 43,500 | Needed for compliance with Drinking Water Regulations. |
| | | SMM-2 | Water Quality Monitoring and Testing | | $ 1,500 | $ 1,550 | $ 1,600 | $ 1,650 | $ 1,700 | $ 1,750 | $ 9,800 | $ 9,600 | $ 11,100 | $ 13,000 | $ 43,500 | Needed for compliance with Drinking Water Regulations. |
| | | SMM-3 | Water Rights Strategic Plan | | $ 7,500 | | | | | | $ 7,500 | $ - | $ - | $ - | $ 7,500 | Necessary for tracking of existing and plan for obtaining new water rights |
| | | SMM-4 | Financial Analysis, Rates, and Fees Study | | $ 20,000 | | | | | | $ 20,000 | $ 18,400 | $ 21,400 | $ 24,800 | $ 84,600 | Necessary for identifying funding needs and establishing system fees. |
| | | SMM-5 | Update Water Billing Software | | $ 15,000 | | | | | | $ 15,000 | $ 3,500 | $ 3,500 | $ 6,000 | $ 28,000 | Necessary for tracking and reporting of water billing and consumption. |
| | | SMM-6 | Storage Tank Seismic and Condition Assessment | | | $ 15,900 | | | | | $ 15,900 | $ - | $ - | $ - | $ 15,900 | Necessary to determine structural integrity of tank. |
| | | SMM-7 | Water Management and Conservation Plan - Implementation | | | $ 2,700 | $ 1,100 | $ 1,130 | $ 1,160 | $ 1,190 | $ 7,300 | $ 6,600 | $ 7,600 | $ 8,800 | $ 30,300 | Necessary of implementing the new WMCP. |
| | | SMM-8 | Drinking Water Protection Program | | | $ 5,300 | | | | | $ 5,300 | $ 6,500 | $ 7,700 | $ 4,400 | $ 23,900 | Necessary for establishing plan for protection of drinking water |
| | | *SMM-9 | Additional Storage and Pump Station Study | | | | $ 16,400 | | | | $ 16,400 | $ - | $ - | $ - | $ 16,400 | Necessary for identifying land acquisition needs and new PS capacity requirements. |
| | | SMM-10 | Update Water System Design and Construction Standards | | | | | $ 16,900 | $ 580 | $ 600 | $ 18,100 | $ 3,300 | $ 3,800 | $ 4,400 | $ 29,600 | Necessary for design and construction of water system improvements. |
| | | SMM-11 | GIS System and Update Water System Mapping | | | | | | | $ 23,900 | $ 23,900 | $ 3,300 | $ 7,500 | $ 9,000 | $ 43,700 | Necessary for existing and future mapping needs of water system. |
| | | SMM-12 | Water Meter Strategic Plan | | | | | | | $ 4,200 | $ 4,200 | $ - | $ - | $ - | $ 4,200 | Necessary for standardizing and updating water meters. |
| | | SMM-13 | Update Water System Master Plan | | | | | | | | $ - | $ 69,200 | $ - | $ 93,000 | $ 162,200 | Necessary for updating water system master plan. |
| | | *SMM-14 | New Supply Source Study | | | | | | | | $ - | $ - | $ 21,400 | $ - | $ 21,400 | Necessary to identify possible well locations and land acquisition needs. |
| | | | **SYSTEM MANAGEMENT AND MISCELLANEOUS PROJECTS TOTAL** | | **$ 45,500** | **$ 27,000** | **$ 20,700** | **$ 21,300** | **$ 5,100** | **$ 33,400** | **$ 153,200** | **$ 130,000** | **$ 95,100** | **$ 176,400** | **$ 554,700** | Total cost of management including inflation to year shown. |
| | | | **WATER SYSTEM CAPITAL IMPROVEMENTS, O&M, AND MANAGEMENT TOTAL** | | **$ 478,500** | **$ 129,800** | **$ 226,500** | **$ 641,600** | **$ 298,400** | **$ 338,000** | **$ 2,113,000** | **$ 3,681,800** | **$ 1,699,800** | **$ 1,613,500** | **$ 9,108,100** | Total cost of improvements, O&M, and system management. |

Notes:

* Project or a portion of the project is influenced by City growth.

(1) Project priority and schedules are proposed. Exact timing of improvements is uncertain and will depend on growth and available City funding.

(2) Costs include estimated construction costs in 2008 dollars (September 2008 20-City Avg ENR-CCI = 8556.72) plus 40 percent allowance for contingencies, engineering, legal, administration, and other project related costs plus 3 percent inflation to anticipated year of project. Costs do not include costs for bonds, financing, right-of-way, easement, or land acquisition.

SECTION 9

# Financial Planning

## Objective

The objective of this section is to present a collection of financing mechanisms available to finance the recommended capital improvements including financial assistance programs that offer various grants and loans and local funding sources such as bonds, system development charges, and water rates.

## Financial Assistance Programs

### Safe Drinking Water Financing Program

The Safe Drinking Water Fund is capitalized by annual grants from the U.S. Environmental Protection Agency (EPA) and matched with State resources. The program is managed jointly by the Department of Human Services - Drinking Water Program (DHS-DWP) and the Oregon Economic and Community Development Department (OECDD).

The Safe Drinking Water financing program provides low-cost financing for construction and/or improvements of public and private water systems. This is accomplished through two separate programs:

- Safe Drinking Water Revolving Loan Fund (SDWRLF) for collection, treatment, distribution and related infrastructure.
- Drinking Water Protection Loan Fund (DWPLF) for sources of drinking water prior to system intake, to help implement strategies designed to minimize the risk that contaminants might enter the drinking water supply.

#### *Safe Drinking Water Revolving Loan Fund (SDWRLF)*

**Eligible Applicants**

- Municipal, nonprofit and privately owned systems. The program's financing is available to all sizes of water systems, although 15 percent of the funds are reserved for systems serving a population fewer than 10,000.
- An eligible borrower is any water system (publicly, nonprofit or privately owned, but never federally owned or operated) that serves year-round residents numbering at least 25, or via 15 or more service connections (or a nonprofit with 25 or more regular users).

### Project Funding

- Maximum loan is $6,000,000.
- Loan term is 20-years or useful life of project assets, whichever is less.
- Loan interest rate is 80% of State/Local bond rate.
- If the annual water rate exceeds 1.25% of the local median household income, then the municipality qualifies for status as a disadvantaged community. This status provides for loan terms of up to 30-years at a 1% interest rate with the possibility of some principal forgiveness.

### Eligible Projects

- To ensure that a water system satisfies, or will continue to satisfy, applicable requirements.
- Alleviate risks or hazards to the drinking public. The most serious problems will receive the highest priority.
- Multiple non-compliance issues with the Safe Water Drinking Act.
- Multiple phase projects or a single phase of a project.
- Preliminary planning and engineering.

### Eligible Activities

- Construction, reconstruction, or modification of any drinking water tank necessary for source of supply, filtration, treatment, storage, transmission, or metering.
- Acquisition of property required for the proposed project including right-of-way, easements, tank sites, and equipment.
- Preliminary and final engineering, surveying, legal review and other necessary project support.
- Construction contingencies which require department approval.
- Environmental review services needed to evaluate impacts and implications of the project.
- Costs associated with project bidding for engineering and construction services.
- Capacity improvements based on future growth.
- Development of technical documentation, operations manual, software, and other information resources that is necessary for soundly maintaining the improvements and preserving the investment.
- Expenditures associated with security measures for the improvements.

The moneys may not be used for costs associated with constructing dams, acquiring water rights, paying for operations, maintenance and administration activities, or for projects primarily aimed at fire suppression or growth or purchases unrelated to requisite compliance problem.

Interested entities are required to write a letter of interest which will be rated and ranked for the Department priority list. The project priority list is based on criteria such as health risks, environmental compatibility, and affordability. Letters of interest are evaluated and ranked once a year. Each applicant must show the financial, managerial, and technical capacity to

maintain compliance with the Safe Water Drinking Act. Also, an underwriting is conducted to ensure creditworthiness.

## *Drinking Water Protection Loan Fund (DWPLF)*

### Eligible Applicants

- Entities eligible to receive funding from the DWPLF are the same as those identified for the SDWRLF above.
- The water system must have a completed delineation of a Drinking Water Protection Area and the project to be funded must focus on some portion of land within the Drinking Water Protection Area identified in the Source Water Assessment Report as moderately or highly sensitive to contamination.
- The water system must demonstrate that a direct link exists between the proposed project and maintaining or improving drinking water quality for a specific water-quality parameter or activity or for a specific condition of concern.

### Project Funding

- Maximum loan is $100,000 for each water system, per year, except with special approval of the Oregon Drinking Water Advisory Committee.
- Loan term is 20-years or useful life of project assets, whichever is less.
- Loan interest rate is 80% of State/Local bond rate.
- Loan increases may be awarded to previously funded projects to the extent necessary to fulfill the objectives of the project, but only up to the annual maximum loan amount of $100,000 per system/project. Loan underwriting guidelines must be met, and funds must still be available at the state level.

### Eligible Projects and Activities

Eligible activities are those that lead to a reduction in the threat of contamination or similar risks for an eligible applicant's drinking water source, as follows:

- Expenditures associated with security measures pertaining to protection of the source or supply of the drinking water. (This may be the sole basis of the application) All such security projects may be funded immediately upon application approval, on a first-come, first-serve basis.
- Both community and nonprofit, non-community water systems may purchase land or land easements, erect barriers or re-forest within a sensitive portion of the Drinking Water Protection Area.
- Only community water systems are eligible for assistance in implementing incentive/communication-based source-water protection activities, and these activities may include but are not limited to the following:
  - A program to properly abandon wells within sensitive areas in a Drinking Water Protection Area.
  - The reconstruction of a public water supply well (e.g., the addition, replacement or extension of the well casing seal) to enhance natural protection of the drinking water supply.
  - Implementation of erosion control practices within a watershed

- Refinement of the delineation, inventory, or sensitivity analysis of the Drinking Water Protection Area.
- Development of a pollution prevention technical assistance program for local businesses.
- Establishment of a household hazardous waste collection program.
- Public notification of the Drinking Water Protection Area (e.g., signs, information brochures).
- Activities designed to enhance or improve riparian areas along stream ways.
- Outreach activities directed at the general public (e.g., periodic news releases, information boards and displays, public forums), or to schools, (e.g., curriculum-targeted information regarding protecting water).
- Practices designed to reduce the potential impact of storm water on the quality of surface water and groundwater.
- Costs associated with the development of overlay zone, zoning ordinances, restrictions, or other types of local land use control for the purpose of protecting the public water system.
- Costs associated with the development of local partnerships or committees to develop or implement plans for protection activities within Drinking Water Protection Areas.
- Monitoring associated with the evaluation of a particular protection activity (e.g., monitoring nitrate loss across the root zone as a function of certain agricultural practices).

## Oregon Economic & Community Development Department

There are three primary sources of funding through the Oregon Economic & Community Development Department (OECDD). The following list summarizes these programs and describes funding limits and eligible projects.

### *Water/Wastewater Fund*

The Water/Wastewater Fund was created by the Oregon State Legislature in 1993. It was initially capitalized with lottery funds appropriated each biennium and with the sale of State revenue bonds since 1999. The purpose of the program is to provide financing for the design and construction of public infrastructure needed to ensure compliance with the Safe Drinking Water Act or the Clean Water Act.

#### Eligible Applicants

- Cities, Counties, County Service districts (organized under ORS Chapter 451), Tribal Councils of Indian tribes, Ports, and Special Districts (as defined in ORS 198.010).

#### Project Funding

- The maximum loan amount is $15,000,000 per project through a combination of direct and/or bond funded loans.
- Loans are typically repaid with utility revenues or voter approved bonds.

- A limited tax general obligation bond may be required.
- "Credit worthy" borrowers may be funded through sale of state revenue bonds.
- Maximum loan term is 25 years or the useful life of the infrastructure financed, whichever is less.
- Grant awards are limited to a maximum of $10,000 per hookup. Maximum Grant is $750,000 for a project in a severely distressed community (as defined under ORS Chapter 123, Div 43). This is in addition to the cost of issuance and debt service reserve in the case of a bonded loan.
- Grant and loan amounts are determined by a financial analysis of the applicant's ability to afford additional loans. An applicant is not eligible for grant funds if the applicant's annual median household income is equal or greater than 100 percent of the state average median household income for the same year.

### Eligible Projects

- Systems that have received, or are likely to receive, a notice of Non-Compliance with the Safe Drinking Water Act or the Clean Water Act.
- Project needed to meet other state or federal water quality statutes and standards.
- In addition, eligible projects must; be consistent with the acknowledged local comprehensive plan; the municipality will require the installation of meters on all new service connections to any distribution lines that may be included in the project; recipient shall certify that a registered professional engineer will be responsible for the design and construction of the project.

### Eligible Activities

- Water source, treatment, storage, and distribution.
- Wastewater collection and capacity.
- Stormwater system.
- Purchase of rights-of-way and easements required for infrastructure.
- Design and Construction Engineering.

### Additional Assistance for Municipalities

The department offers "Technical Assistance" financing for municipalities faced with the costs of studying and/or planning for an eligible project. The technical assistance funds can be used to finance preliminary planning, engineering studies and economic investigations. Municipalities with populations of less than 15,000 are eligible for awards from this program.

Technical Assistance projects must be in preparation for a construction project that is eligible and meets the criteria established by rule. The applicant must be ready to proceed with the project upon execution of a contract with the department.

- Grants up to $20,000 may be awarded per project.
- Loans up to $20,000 may be awarded per project.
- Interest shall be at 75 percent of the rate for other direct loans.

This program will not fund; privately owned facilities and infrastructure, purchase of property not related to infrastructure construction; or costs incurred prior to award of grants or loans, except costs for engineering and other support activities necessary to construction (department approval required).

## Special Public Works Fund

The Special Public Works Fund program provides funding for municipally-owned facilities that support economic and community development in Oregon. Established by the Legislature in 1985, the fund has grown into a revolving loan fund currently valued at about $160,000,000. Loans and grants are available to municipalities for planning, designing, purchasing, improving, and constructing municipally-owned facilities.

### Eligible Applicants

- Cities, Counties, County Service districts (organized under ORS Chapter 451), Tribal Councils of Indian tribes, Ports, and Special Districts (as defined in ORS 198.010).

### Project Funding

- Low interest loans on 20-year terms which can be extended to 25-year terms.
- Loans range in size from less than $100,000 to $15 million.
- Costs associated with debt issuance such as bond counsel and insurance are absorbed by the department.
- Grants are limited to $500,000 or 85 percent of the project cost, whichever is less.
- Grants, for approved projects, are based primarily on applicant need.

### Eligible Projects and Activities

- Water source, treatment, storage, and distribution facilities.
- Purchase of land, rights-of-way, and easements required for infrastructure improvements.

Grants and loans are available to finance preliminary planning, engineering studies, and economic investigations needed to determine project feasibility. Up to 85% of project costs are available for grants and for loans.

## Community Development Block Grant (CDBG)

Since the late 1980's the state of Oregon has administered the U.S. Department of Housing and Urban Development's Community Development Block Grant (CDBG) funds for the non-entitlement cities and counties of the State. The primary objective of the program is the development of viable (livable) urban communities by expanding economic opportunities and providing decent housing and a suitable living environment principally for persons of low- and moderate-income. Each year the State develops an annual "Method of Distribution" which establishes how the funds will be used for that calendar year.

There is a broad range of projects that may be assisted with CDBG funds. Under the 2008 Method of Distribution, improvements to water and wastewater system projects are eligible for funding. Listed below is a summary of eligibility and funding requirements.

### Eligible Applicants

- Only non-entitlement (non-metropolitan) cities and counties in rural Oregon can apply for and receive grants. Entitlement (urban) cities (Ashland, Bend, Corvallis, Eugene, Medford, Portland, Salem and Springfield) and counties (Clackamas, Multnomah and Washington) are not included in the State's 2008 Community Development Block Grant program because they receive CDBG funds directly from the U.S. Department of Housing and Urban Development (HUD).

### Project Funding

- It is not possible to determine how much, if any, grant funds may be awarded prior to an analysis of the application and financial information.
- Maximum grant possible for any individual project under the program is:
  - Economic Development: $750,000.
  - Microenterprise: $100,000.
  - Public Works—Water and Wastewater Improvements: $1,000,000, except for preliminary/engineering planning grants are capped at $150,000.
  - Public Works—Brownfield Redevelopment/Downtown Revitalization: $300,000.
  - Public Works—Off-site Infrastructure: $225,000.
  - Community/Public Facilities: $500,000 or $800,000 dependent upon project type.
  - Community Capacity Technical Assistance: No specific limit per award (but limited overall funds).
  - Emergency Grants: $500,000.
  - Regional Housing Rehabilitation: $400,000.
  - Housing Resource Centers: $48,000 to $60,000.
  - Emergency projects: $500,000.

### Eligible Projects

- Projects necessary to bring municipal water and sewer systems into compliance with the requirements of the Safe Drinking Water Act or the Clean Water Act administered by the Oregon Department of Human Services—Drinking Water Section and the Oregon Department of Environmental Quality.
- The preparation of water management and conservation plans as required by the Oregon Water Resources Department through permitting processes. These may be combined with projects for the preparation of Water System Master plans required by Oregon Health Services, Safe Drinking Water Program.
- Projects where the municipal system has not been issued a notice of non-compliance from the Oregon Health Services, Safe Drinking Water Program or the Department of Environmental Quality, but the department determines that a project is eligible for assistance upon finding that; A recent letter, within the

previous twelve months, from the appropriate regulatory authority (DHS, DEQ) or their contracted agent, indicating a high probability that within two years the system will be notified of non-compliance, and department staff deems it reasonable and prudent that program funding will assist in bringing the water or sewer system into compliance with current regulations or requirements proposed to take affect within the next two years.

- Planning, design and construction projects necessary for the provision of dependable and efficient water storage, treatment and/or transmission to meet domestic drinking water needs.
- Planning, design and construction projects necessary for the provision of dependable and efficient wastewater collection, treatment and disposal/re-use.

## Eligible Activities

- Wastewater treatment facilities including all facilities necessary for collecting, pumping, treating and disposing of sanitary sewage. Included is correction of infiltration and inflow (I&I) through replacement of lines or slip lining.
- Separation of storm drainage from sanitary sewers, if necessary to meet federal or state water quality statutes, rules, orders or permits.
- Domestic water systems including all facilities necessary for supply development, storage, filtration, treatment, transmission and metering.
- Equipment that is an integral and permanent part of a water or wastewater facility. Purchase or lease of other equipment, including vehicles is not eligible.
- The acquisition of real property, including permanent easements, necessary for the proposed water or wastewater project.
- Installation of water distribution or wastewater collection lines on private property (e.g., household laterals) and associated plumbing connections if necessary to ensure the overall system meets state and federal requirements. Only the direct capital construction costs for low- and moderate-income households are eligible under the Clearance, Rehabilitation, Reconstruction, and Construction of Buildings eligibility category under the national objective of the low- and moderate-housing. These activities are not eligible under the low- and moderate income area wide benefit national objective for publicly owned infrastructure systems.
- Television inspection and internal grouting of wastewater collection lines if approved in advance by the department. Since this work also can be a method of maintaining the lines, case-by-case determinations must be made because operation and maintenance expenses are considered not eligible under federal regulations for the Community Development Block Grant program.
- Preliminary planning (wastewater facilities plans, water system master plans and water management and conservation plans) and preliminary and final engineering, surveying, architectural and other support activities necessary to the construction of a water or wastewater project.
- Administrative costs necessary to ensure that federal requirements for the grant project are met.
- Construction contingencies.

Regarding public works, this program will not fund; projects primarily needed for capacity building purposes; projects that are needed solely to drill/develop wells (However, projects where well drilling/development is only a component of a much larger project and not the primary purpose will be eligible for funding. For example, a project that consists of distribution, treatment and well drilling improvements all in one phase would be eligible for funding); and projects primarily needed for fire suppression.

## U.S. Department of Agriculture (USDA) – Rural Development

The U.S. Department of Agriculture (USDA) was reorganized in 1994 and the various programs and functions of the Farmers Home Administration (FmHA) were divided into five parts. One of the five parts is Rural Development. The following three services operate under Rural Development.

### Rural Housing Service

The Rural Housing Service (RHS) has a staff that operates the housing and community facilities programs that were formerly administered by FmHA. Its mission is to improve the quality of life in rural America as it provides community facilities, technical assistance and outreach.

### Rural Business-Cooperative Service

Rural Business-Cooperative Services (RBS) includes the FmHA business and industry programs and USDA's cooperative programs. Its mission is to assist cooperative and other business development through partnership with rural communities.

### Rural Utilities Service

Rural Utilities Service (RUS) is comprised of the telephone and electric programs of the Rural Electrification Administration (REA) and the water and sewer programs of the Rural Development Administration (RDA). Its mission is to serve a leading role in improving the quality of life in rural America by administering its electrification, telecommunications, and water programs.

Below are the more common RUS programs which provide financial and technical assistance for development and operation of safe and affordable water supply systems. The USDA Rural Development website in Oregon is http://www.rurdev.usda.gov/or/ and provides contacts, forms, documents, and other information on the program.

### *Rural Utilities Service – Water and Waste Disposal Loans and Grants*

RUS provides loans, guaranteed loans, and grants for water, sewer, storm water, and solid waste disposal facilities in cities and towns up to 10,000 people and rural areas with no population limits. Grants are available to applicants who meet the median household income requirements. While eligible applicants must have a population less than 10,000, priority is given to public entities in areas smaller than 5,500 people. In addition, borrowers must meet the following stipulations:

- Must be unable to obtain needed funds from commercial sources at reasonable rates and terms.

- Have the legal capacity to borrow and to repay loans, to pledge security for loans, and to operate and maintain the facilities.
- Propose facilities that are consistent with any development plans of the State, multijurisdictional area, counties, or municipalities where the project is to be located. All facilities must comply with Federal, State, and local laws, including those involving zoning regulations, health and sanitation standards, and water pollution control.

### Eligible Applicants

- Population limitations of 10,000 or less.
- Public entities including municipalities, counties, special purpose districts, Indian tribes, and corporations not operated for profit, including cooperatives.
- A new entity may be formed to provide the needed service if an appropriate one does not already exist.
- Priority is given to public entities, in areas with less than 5,500 people.
- Applicants must be unable to obtain funds from other sources at reasonable rates and terms.
- Preference will be given to requests which involve the merging of small facilities and those serving low-income communities.

### Project Funding

- Grants available to applicants who meet the median household income requirements. Grants may be provided to reduce project costs to a reasonable level and can cover up to 75 percent of project costs.
- Loan guarantees may be available for up to 90 percent of any eligible loss incurred by the lender. Lenders pay a 1 percent guarantee fee, which may be passed on to the loan recipient.
- Maximum loan term is 40-years although this term may not exceed the useful life of the improvements.
- Collateral is required such as bonds, note pledging taxes, assessments, or revenues.

### Eligible Projects and Activities

- Construct, repair, modify, expand, or otherwise improve water supply and distribution systems and waste collection and treatment systems, including storm drainage and solid waste disposal facilities. Certain other costs related to development of the facility may also be covered.
- Acquire needed land, water sources, and water rights.
- Associated costs such as legal and engineering fees.

## Oregon Water Resources Department (OWRD)

### *Water Development Loan Fund (WDLF)*

The Water Development Loan Fund program serves a broad range of eligible borrowers in all regions of the State. The goal is to provide low-cost, long-term, fixed-rate financing incentives that promote projects that achieve the State's long-term water management goals.

## Eligible Applicants

- Individual residents of Oregon.
- Entities with principal income from farming including profit-making partnerships, profit-making corporations, nonprofit corporations, and cooperatives.
- Water-related districts including irrigation districts, water improvement districts, irrigation or drainage corporations, drainage districts, corporations, cooperatives, companies or other associations formed prior to 1917 for the purpose of distributing water for irrigation purposes, and port districts.
- Cities or counties.
- Organizations formed for the purpose of distributing water for community water supply.
- Local soil and water conservation districts.

## Project Funding

- All costs to operate the loan fund are paid by borrowers.
- Funds to finance a project are obtained through the issuance and sale of self-liquidating bonds. The bonds are repaid by participants in the program at no cost to the state or taxpayers.
- The amount and type of loan security required depends on the borrower and the type of project. A first lien on real estate is required security for all loans. Other security may also be required.
- Borrowers pay an application fee and a loan processing fee. The application fee is $100 and is non-refundable. The loan processing fee is $1,000 or one percent (1%) of the loan request, whichever is greater, up to $10,000. Additionally, borrowers pay closing costs and bond issuance costs.

## Eligible Projects

- Drainage project: facilities installed to provide for the removal of excess water to increase soil versatility and productivity.
- Irrigation project: facilities designed to provide water to land for the purpose of irrigation.
- Community water supply project: an undertaking, in whole or in part, in Oregon for the purpose of providing water for municipal use. A community is an incorporated or unincorporated town or locality with more than three service connections and a population of less than 30,000.
- Fish protection project: an undertaking, in whole or in part, in Oregon for the purpose of protecting fish or fish habitat.
- Watershed enhancement project: an undertaking, in whole or in part, in Oregon for the purpose of watershed enhancement.
- Multipurpose project: a water development project in Oregon which provides more than one use. The primary use of the project must be one of the uses listed above. Secondary uses may include other water uses which are compatible with the primary use.

# Typical Funding Process

The typical funding process for the various Oregon Economic & Community Development Department (OECDD) Programs mentioned above is shown in the various steps below. These steps are typical for all the Community Development Programs, except the Community Development Block Grant (CDBG) and the Safe Drinking Water Revolving Loan Fund (SDWRLF), which have their on specific steps and guidelines to follow.

Applications for all funding programs managed by the Community Development Division are accepted year-round. This is so that applicants can avoid reviewing all the different funding programs' eligibility criteria and unnecessarily completing multiple applications. The department will invite the applicant to submit an application after making a preliminary determination of the most appropriate funding program(s) for the project. The following steps obtained from the OECDD website, summarize the typical funding process:

## Step 1 – Application Process

The application process begins by contacting the regional coordinator for the area in which the proposed project is/will be located. The regional coordinator will obtain some basic information from the applicant about the proposed project and will either complete a Project Notification & Intake form or send the form to the applicant for completion.

Using the information in the Intake form, the department will then make a preliminary determination of the most appropriate funding program(s) for the project. When other state and federal agencies have funding programs that may be applicable to the project, the regional coordinator will schedule a "One-Stop" meeting to provide the applicant with an opportunity to discuss the project with additional potential funders.

Once the department has identified the most appropriate funding program(s) for the project, an application will be invited and the forms will be provided to the applicant. In the case of Safe Drinking Water Revolving Loan Fund, only projects that have submitted a Letter of Interest to the Department of Human Services (DHS) may be invited to submit an OECDD Safe Drinking Water application.

## Step 2 – Submit Application

When the department receives the application, they will conduct a programmatic analysis to ensure the project meets the eligibility criteria for the funding program and, in most instances, also will conduct a financial analysis to determine the applicant's ability to repay a loan and to verify the sufficiency of the collateral proposed to secure repayment of the loan.

## Step 3 – Receive Recommended Award

A letter will be sent to the applicant, notifying them of the award amount, the terms, and any conditions placed on the award. Shortly thereafter, contractual documents will be sent to the applicant for signature.

For most funding programs the applicant is allowed to begin work on the project once the

award has been made and prior to their contract being signed, as long as the applicant meets the requirements of the funding program.

If the applicant is considering beginning work before their contract is signed, it is recommended that the applicant please contact the regional coordinator for guidance, because there are several items to consider:

- Since cash cannot be disbursed until our contract has been executed, the applicant will need to have other sources of cash available to pay bills until such time as the contract is executed and reimbursement can be made.
- The applicant's governing body may be unwilling (and in some cases, unable) to incur expenses for which a contract, containing all the terms and conditions attached to the funding, has not been executed.
- The contract will contain a provision that the grant/loans funding is subject to the availability of funds in the funding program.

# "One-Stop" Finance Meetings

The outlined finance meeting information below, as well as other pertinent funding information, can be obtained from the OECDD website at http://econ.oregon.gov/ECDD/CD/program

## The Concept

To optimize discussions at one time and place of Federal and State financial assistance possibilities and related issues for local public infrastructure and community facilities. The informal meetings are held to help applicants learn about available funds and next steps for projects. No funding commitments are made at the meeting, but probable sources are provided to enable the best alternatives possible for local governments and most issues that must be addressed are raised in connection with the project. Meetings are requested by officials from cities, counties, ports, public water or sewer districts, service districts, and Tribal councils.

## Who Attends

Appropriate funding agencies of programs pertaining to the project such as:

### *Federal Agencies*

- United States Department of Agriculture-Rural Utilities Services and Community/Business Programs.
- U.S. Forest Service: United State Department of Commerce-Economic Development Administration—technical assistance providers.
- Other Federal agencies, as requested.

### *State Agencies*

- Economic and Community Development Department
- Department of Environmental Quality
- Department of Transportation

- Department of Energy—Small Scale Energy Loan Program
- Department of Human Services—Drinking Water Section
- Department of Land Conservation and Development
- Housing and Community Services
- Department of Aviation
- Water Resources Department
- Other State technical assistance providers and regulatory agencies for environmental laws, land use and public health, as requested

### *Other Participating Agencies*

- Oregon Association of Water Utilities
- League of Oregon Cities
- Rural Community Assistance Corporation
- Others, as requested.

### When and Where

90 minute meetings are held the second Tuesday of each month, at 9:00 A.M., 10:30 A.M., 1:00 P.M., and 2.30 PM. To schedule a meeting, the applicant shall contact their Federal or State regional project coordinator or call 503-986-0123. The location is at the Oregon Economic and Community Development Department (State Lands Building) 775 Summer Street N.E., Room 201, Salem, Oregon.

### Who to Bring

It is the applicant's decision regarding who to bring. They suggest the applicant consider person(s) involved with the project, such as an elected official(s), manager, recorder, public works superintendent, consulting engineer/architect, project's sponsor(s).

### What to Bring or Present

For technical assistance funding, such as master plans, preliminary engineering and facilities plans, applicants will need a verbal or written description of the problem they want to solve (is there a non-compliance issue with a law, etc), possible solution, scope of work, estimated cost (if available), why federal and/or state financial assistance is needed, sources of local funding and use of the money.

For construction funding, applicants will need preliminary engineering report, which includes documentation of need, project benefits, total estimated costs, possible sources of local financing, uses of funds, and a timetable showing readiness to proceed. Current monthly utility rates (e.g., average water rates are $---- per 7500 gallons per month) and number of connections are needed to determine most water/wastewater grants and loans. Estimated start and completion dates and readiness to proceed information is very important.

## Local Funding Sources

In addition to the various financial assistance programs mentioned above, the options that are available to the City to fund capital improvements are in general, those established for common

utility functions. The options include general obligation bonds, revenue bonds, taxes, system development charges, water rate charges, and other fees. Various references to the Oregon Revised Statutes (ORS) have been made in an attempt to direct the City to the related statute. As such, the following is intended to provide general information only and should not be construed as a legal opinion with respect to Oregon law. All applicable State and Federal requirements for each local funding source will need to be thoroughly reviewed by the City before specific decisions to pursue are made.

The following identifies the local funding sources and financing mechanisms that are most commonly used for water system capital improvements.

## General Obligation Bonds

General obligation bonds are bonds backed by the full faith and credit of the City, and as the name implies, is a general obligation of the City. General obligation bonds are secured by an unconditional pledge of the City to levy assessments, charges, or ad valorem taxes necessary to retire the bonds. 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 public acceptance.

The City is authorized to finance the capital improvement by issuing general obligation bonds pursuant to the authority of Oregon Revised Statutes (ORS) 287A.010 and ORS 287A.050 to 287A.350. According to ORS 287A.050, the City may issue general obligation bonds to finance capital construction or capital improvements upon approval of the electors of the City. Unless the City Charter provides a lesser limitation, a City may not issue or have outstanding at the time of issuance general obligation bonds in a principal amount that exceeds 3 percent of the real market value of the taxable property within its boundaries, calculated as provided in ORS 308.207.

However, this 3 percent limitation does not apply to general obligation bonds issued to finance the costs of local improvements assessed and paid for in installments under statutory or charter authority or to finance capital construction or capital improvements for the following:

- Water supply, treatment, or distribution.
- Sanitary or storm sewage collection, or treatment.
- Hospitals or infirmaries.
- Gas, power, or lighting.
- Off-street motor vehicle parking facilities.

With the City's total general obligation debt from all sources, (including water, wastewater, parks, transportation, etc.) being subject to a 3 percent limitation, funding needs that have a potential revenue source associated with them such as water, typically are not funded by Cities through general obligation bonds. If appropriate, Cities typically save their general obligation bonding capacity for those funding needs that do not have revenue sources available to them.

## Revenue Bonds

Revenue bonds are bonds issued for any public purpose, which are secured by revenues either pledged or designated to be payable for such public purpose of the City. The City is authorized to finance the capital improvement by issuing revenue bonds pursuant to the authority of Oregon Revised Statutes (ORS) 287A.010 and ORS 287A.150 to 287A.350. Under the Uniform Revenue Bond Act (ORS 288.805 to ORS 288.945), the City may authorize issuance of revenue bonds by resolution or nonemergency ordinance. Certain notice and posting requirements must be met and a 60 day waiting period is mandatory. A petition signed by five percent of the City's registered voters may cause the issue to be referred to an election.

Revenue bonds are most commonly retired with revenue collected from water rate 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. According to ORS 288.825, the City either may pledge to the payment of revenue bonds, or may make revenue bonds payable from, all or any portion of the following:

- The revenues of any revenue producing facility providing services related to the services financed by the public bonds.
- The revenues of a public utility or system, or an addition or extension to the public utility or system, where the improvements, projects or facilities financed by the revenue bonds are a portion of the public utility or system.
- All or any portion of the revenues of the public body.
- Any other legally available moneys.

In addition, if additional security to finance revenue bonds was needed, the City may mortgage grant security and interests in facilities, projects, utilities or systems owned or operated by the City.

There are no legal limitations on the amount of revenue bonds to be issued, however limitations are typically associated with the utility's ability to generate sufficient revenue to repay the debt and meet other security conditions. In addition, excessive bond amounts are generally unattractive to bond buyers because they represent high risks.

Many Cities prefer revenue bonding as opposed to general obligation bonding because it insures that no tax will be levied. Another advantage is that revenue bonds are considered "overlapping debt", which does not count against the City's direct debt. Since rating agencies closely evaluate the amount of direct debt when assigning credit ratings, this may be advantageous for a City near its debt limit.

## Local Improvement Districts

A Local Improvement District (LID) is a geographic area in which real property is taxed to defray all or part of the costs of a public improvement. In Oregon, LIDs are governed by local ordinances, but the Bancroft Bonding Act (ORS 223.205 to ORS 223.295) addresses the means by which local governments may finance public improvements. For a specific improvement, all property within the improvement district is assessed on an equal basis, regardless of whether it is developed or undeveloped. This assessment becomes a direct lien against the property and

owners have the option of either paying the assessment or applying for improvement bonds. If the improvement bond option is chosen, the City sells bonds to finance the construction.

Project assessments within a formed LID are typically determined either on a square-foot or a lineal-foot of frontage basis. Once the project assessments are determined, property owners are given an opportunity to review and object to the assessment. 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. For this purpose, temporary construction warrants are commonly issued and paid when the project is complete.

In general, an LID costs money to administer, as the interim financing incurs interest costs and the sale of bonds involves bond counsel, underwriters, and other costs. All these costs must be added to the share of project costs. Participants in the LID process will typically consist of a number of individuals including property owners and the general public, public works and finance department staff, city clerk, mayor, city council, city attorney, investment bankers, underwriters, financial advisors, engineers/architects, real estate appraisers, and bond counsel.

The Oregon Legislature has provided cities with a procedure for special assessment financing (ORS 223.387 to ORS 223.399), which applies when City Charter or City Ordinance provisions do not specify otherwise.

## Ad Valorem Taxes

Ad valorem property taxes are often used as a source of revenue for capital improvements. Historically, ad valorem taxes were the traditional means of obtaining revenue to support all local governmental functions. In general, the main advantage of ad valorem taxation is the simplicity, as it requires no monitoring program for developing charges, additional accounting and billing work is minimal, and default on payments is rare.

Ad valorem taxation provides a means of financing that reaches all property owners that benefit from a system, whether the property is developed or undeveloped. Costs are shared proportionally among all property owners based on the assessed value of each property. Ad valorem taxation is less likely to result in individual users paying their proportionate share of the costs as compared to their benefits.

## 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.

## System Development Charges

A system development charge (SDC) is as a reimbursement fee, an improvement fee or a combination thereof assessed or collected at the time of increased usage of a capital improvement or issuance of a development permit, building permit, or connection to the capital improvement. In general, SDCs are fees designed to recover a proportionate share of the costs associated with providing existing and expanding future system capacity from new development. The share that is to be recovered is proportionate to the capacity and capital needs created by the new development. Because these fees are only collected when and if development occurs, they cannot be relied upon to fund facilities in any particular year. However over the course of a period of time, SDCs will fund the proportionate share of improvement costs.

The Oregon Revised Statues (ORS) (223.297 to 223.314) provides the uniform framework for the imposition of system development charges by the City for specified purposes and to establish that the charges may be used only for capital improvements. As previously mentioned, an SDC is comprised of the following two components:

- *Reimbursement Fee* – a fee for costs associated with capital improvements already constructed or under construction.
- *Improvement Fee* – a fee for costs associated with capital improvements to be constructed.

By Statute, methodologies for deriving improvement and reimbursement fees must be documented and available to the public for review. As previously noted in Section 8 – Recommendations and Capital Improvement Plan, a CIP must also be prepared which lists the capital improvement, the estimated cost and schedule of each project. Revenue collected from SDCs can only be used to finance specific projects listed in a capital improvement plan. SDCs cannot be assessed on portions of the project paid with grant funding. In addition, operating, maintenance, and replacement costs cannot be financed through SDCs.

## Service Connection Fees

Unlike system development charges (SDC), which are collected to fund construction of infrastructure improvements to serve growth, service connection fees are collected as a type of assessment to reimburse the costs of constructing the existing water improvement abutting a property. Service connection fees are typically collected separate from and in addition to system development charges. This fee is generally equal to the cost of providing the service connection from the existing water main to the property and should constitute a portion of the costs of the entire improvement.

## Water Rate Charges

Water rate charges represent monthly charges to all residences, businesses, and other users that are connected to the water system. The monthly charges are usually based on a fee structure comprised of two components, the class of user and the quantity of water through a user's connection. The first fee component covers basic expenses which do not vary across users. These expenses typically include such items as the cost of meter reading and billing. The second fee component is the charge associated with the volume of water that is consumed. This

fee component can be uniform, increasing, or decreasing. With an increasing fee structure, where costs are higher the more water that is consumed, generally promotes water conservation better than other rate structures.

Water rate charges are normally established by resolution and can be modified as needed, to account for increased or decreased operating and maintenance costs. In general, these fees are commonly the sole source of revenue used to retire general obligation or revenue bonds and to finance operation and maintenance costs.

# Funding Recommendations

Depending on the financial qualifications of the City, there are several State and Federal assistance programs and local funding sources available. However, in order to effectively analyze the City's financial ability to meet infrastructure needs and to determine the feasibility of implementing this WSMP, a financial analysis, rates, and fees study will need to be completed by the City.

This study should determine the actual costs of providing water service to customers, the required water system operating capital, and establish the recommended fees necessary to support the CIP. The study should include options for generating revenue for the City, including an update to the current water system rates and fee structure, service connection fees, impact fees, system development charges, and others as deemed appropriate. **It is recommended that this study be completed as soon as it can be funded.**

The various financial assistance programs and local funding sources each have advantages and disadvantages. All of these will need to be considered as the City reviews and makes decisions regarding the available alternatives to finance the recommended capital improvements.

## Financial Assistance Programs

Based on the 2000 census by the U.S. Census Bureau, Aurora's median household income (MHI) was $55,938. Unfortunately with this MHI, it will be rather difficult for the City to obtain grants or low-interest loan money due to the various financial assistance program MHI eligibility requirements. Most likely, any needed financial assistance will come from available State and Federal loans obtained at current market interest rates. As of July 1, 2008, the current market interest rate for the U.S. Department of Agriculture's Rural Utilities Service Water and Waste Disposal Loan is shown on their website to be 4.5 percent.

Through the circuit rider program funded by the U.S. Department of Agriculture's Rural Utilities Service (RUS) and the Safe Drinking Water Revolving Loan Fund, the City can receive free on-site technical assistance. The circuit rider program provides assistance to water systems through leak detection assistance, operational matters such as water treatment, testing, and emergency management and provide valuable information on water rates, loan and grant applications, and other managerial issues.

In addition, the Rural Utilities Service provides funding to non-profit technical assistance organizations that offer direct training and one-on-one assistance to small rural water systems. Technical assistance providers that receive RUS support include:

- National Rural Water Association (NRWA);
- Rural Community Assistance Program (RCAP); and,
- National Drinking Water Clearinghouse (NDWC) at West Virginia University.

It is recommended that the City take advantage of these services offered by these organizations and from the circuit rider program.

## Local Funding Sources

In general, the type of local funding sources and obligations required for a capital improvement partially depends on the amount of grants anticipated and the requirements of potential loans. Water rates, connection fees, and system development charges typically serve as a valuable local revenue source for Cities. Many Cities that do not implement SDCs often choose to increase property taxes either separately, or in conjunction with, general obligation bonding to pay for infrastructure. Cities which do not prefer that taxes be levied, utilize revenue bonding.

Along with system water rates and service connection fees, the City has established system development charges. Ultimately, the goal with these funds is to allow the City to invest in improvements necessary for adequate water system infrastructure instead of falling into a cycle of deferred improvements impacting the overall integrity of the system.

It is recommended that the City examine the appropriate charges each year to determine the effect of interest costs and inflation. This is especially important for SDCs, as the methodology used to calculate SDCs takes into account these factors. The charges should be increased by an escalation factor each year to reflect the cost of borrowing and/or inflation. The method most commonly used for increases is based on changes in the Engineering News-Record Construction Cost Index (ENR-CCI). It is recommended that this method for escalation of the charge be used for no more than a 5-year period. After this, it is recommended that the City update the SDC based on the actual cost of infrastructure and new facilities, as determined by the updated WSMP or CIP.

As shown in Appendix E, the City's current water rate structure is uniform for all classes of users. As previously mentioned above, having an increasing water rate fee structure, where costs are higher the more water that is consumed, generally promotes better water conservation than other rate structures. An increasing water rate fee structure should be reviewed as part of the recommended financial analysis and water system fee study, as well as during the City's preparation of a Water Management and Conservation Plan.

Appendix A – Well Logs and Pump Data Sheets

Appendix B – Current Water Rights Information

Appendix C – Pump Station Information and Storage Tank Inspection Report

Appendix D – Insurance Services Office, Inc. – Fire Protection Rating

Appendix E – Current Water Resolutions and DHS-DWP Review Letter

Appendix F – Historical Population Information

Appendix G – OAR Construction Standards (OAR-333-061-0050)

Appendix H – Computer Model Analysis Results and Information

Appendix I – Water Quality Information and Drinking Water Protection Bulletins

Appendix J – Source Water Assessment Report

Appendix K – Expanded Capital Improvement Plan and Detailed Cost Estimates