City of Aberdeen

Water System Plan

July 2012

DRAFT

Prepared By:

HDR Engineering, Inc.
606 Columbia Street NW, Suite 200
Olympia, WA 98501
(360) 570-4400

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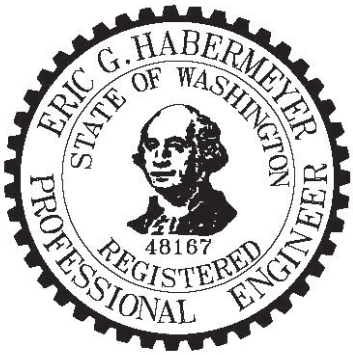
Certificates of Engineers

City of Aberdeen
Water System Plan

The material and data contained in this report were prepared under the direction and supervision of the undersigned, whose seals as professional engineers, licensed to practice in the State of Washington, are affixed below.



Jeffrey M. Hansen, P.E.
Project Manager
HDR Engineering, Inc.

Eric G. Habermeyer, P.E.
Project Engineer
HDR Engineering, Inc.

1. Description of Water System

1.1 Ownership and Management

The City of Aberdeen (City) owns and operates its domestic water system serving customers within its City limits, the nearby community of Cosmopolis, and adjacent areas within Grays Harbor County (County). The City's Water Facilities Inventory (WFI) is included in Appendix A. The City uses a Mayor/City Council form of government. Elected positions include those for the Mayor and each of the twelve Council members. Each of the following administrative departments is filled by appointment: Public Works, Police, Fire, Parks and Recreation, Finance, Legal, and Planning/Development. Department heads report directly to the Mayor. Of these, the Public Works Department has responsibility for the management and operation of the City's water system.

The Public Works Department, located at City Hall, is headed by the Director of Public Works. Responsibilities of this position include overall management of all water, wastewater, transportation, and engineering services including implementation of City policy.

The Water Systems Manager, under the direction of the Public Works Director, organizes and administers the day-to-day operations and maintenance of the water system.

1.2 System Background and History

The first city-owned water system in Aberdeen was established in 1892 and built around a number of small private systems, utilizing Stewart Creek as its source. In 1918, the Wishkah Gravity Water System was completed, providing the City with adequate supply for the central Aberdeen area as well as north and south Aberdeen. Storage for the system was the Fairview Reservoir No. 1 with 9.5 million gallons (MG) capacity, built in 1915. Fairview Reservoir No. 2, providing 15.5 MG of storage, was constructed in 1925.

In 1961, a conventional mass concrete dam was constructed at the Wishkah headworks, creating 120 acre-feet of storage. In the mid-1960s a 22-mile, 28-inch diameter steel and concrete cylinder pipe transmission main was installed between the headworks and the Fairview reservoirs, replacing the original wood stave transmission main which was subsequently abandoned.

During the 1970s and 1980s additional storage tanks were added to service the upper pressure zone and south Aberdeen.

City crews constructed the majority of the water distribution system as development occurred. Although some pipelines, especially the river crossings, have been upgraded, the majority of the distribution piping is at least 70 years old.

In the late 1990s, the City built its water filtration plant, added covers to the Fairview reservoirs, and installed customer meters.

1.3 Service Area

1.3.1 General

The City's boundaries are bisected by the confluence of the Chehalis River and the tidally influenced Grays Harbor Estuary in southwestern Washington. The community, located approximately 25 miles east of the Pacific Ocean is centered between the Cities of Hoquiam and Cosmopolis.

The Wishkah River flows into Grays Harbor from the north through the east central portion of Aberdeen. This creates three separate developed City areas fronting on the Chehalis, Grays Harbor, and Wishkah watercourses. The City is accessed from the east by U.S. Highway 12 and the Puget Sound and Pacific Railroad.

Due to its proximity to the ocean and the prevailing westerly wind, the community has a mild, cool climate, recording a mean annual temperature of 50 degrees Fahrenheit while receiving an average annual precipitation of 83 inches. The City's topography is representative of a tidal river flood plain where the contours vary from wide tidal flats to gentle slopes upland of the river channels where they meet bordering hills that rise at steep slopes to an elevation of 400 feet above sea level.

The City shares its western water service area boundary with the City of Hoquiam, and a portion of its southeastern boundary with the City of Cosmopolis. The economic base for the Grays Harbor area has been forest product-oriented since the arrival of the first settlers. A fishery was developed in years earlier, which has now been reduced to a minor industry in the City, while tourism plays a role in the local economy.

1.3.2 Service Area Policies and Duty to Serve

The City's water system policies and regulations are included in Chapter 13.56 and 13.60 of the Aberdeen Municipal Code, which is included in Appendix B, and also found at the following internet address.

http://aberdeenwa.gov/code.php

Aberdeen provides water service to properties abutting a water main, upon acceptance of an application and payment of a deposit from the property owner. Properties not abutting a City water main may receive service, provided an application is accepted and services lines from the main to the property are installed and maintained by the property owner.

Service may be provided outside of City Limits. Application and connection procedures are the same as stated above.

The City has a duty to serve all new connections located within its Retail Service Area, so long as the following four threshold factors are met, as described in WAC 246-290-106:

1) The City has sufficient capacity to provide water in a safe and reliable manner.
2) The service request is consistent with the City's adopted plans and development regulations.

3) The City has sufficient water rights to provide service.
4) The City can provide service in a timely and reasonable manner.

1.3.3 Retail Service Area

The City's Retail Service Area is shown in Figure 1-1. The Retail Service Area lies within the corporate City limits of Aberdeen with the exception of some water service provided in unincorporated areas of the County. According to water account records, the number of services outside the City are: 13 services in Junction City, which lies east of the City and 276 services are provided in the Wishkah Valley along the 28-inch diameter potable water transmission main to the north of the City. The Bishop Field Complex is served by the transmission main to SCCC. A group of homes outside of the City Limits on Bigelow Drive are served by a private pump station and the City reads the meter usage at each connection. There is also a group of homes east of the City along Hwy 12 served by a single 2-inch waterline connected to the City's System.

The City supplies water to Cosmopolis as a wholesale customer, and Cosmopolis meters and bills the individual customers beyond the City's point of service. The Stafford Creek Correctional Center (SCCC) which has an inmate population of 1,936, is also served as a wholesale customer.

No other water systems are located within the City service area.

1.3.4 Future Service Area

City policy and available land resources encourage additional connections to the system to occur within the City Limits and along the potable water transmission main. One exception occurs with the property owned by the City that includes Aberdeen Lake. This land is currently used for harvesting timber and the City will not provide water service in the future.

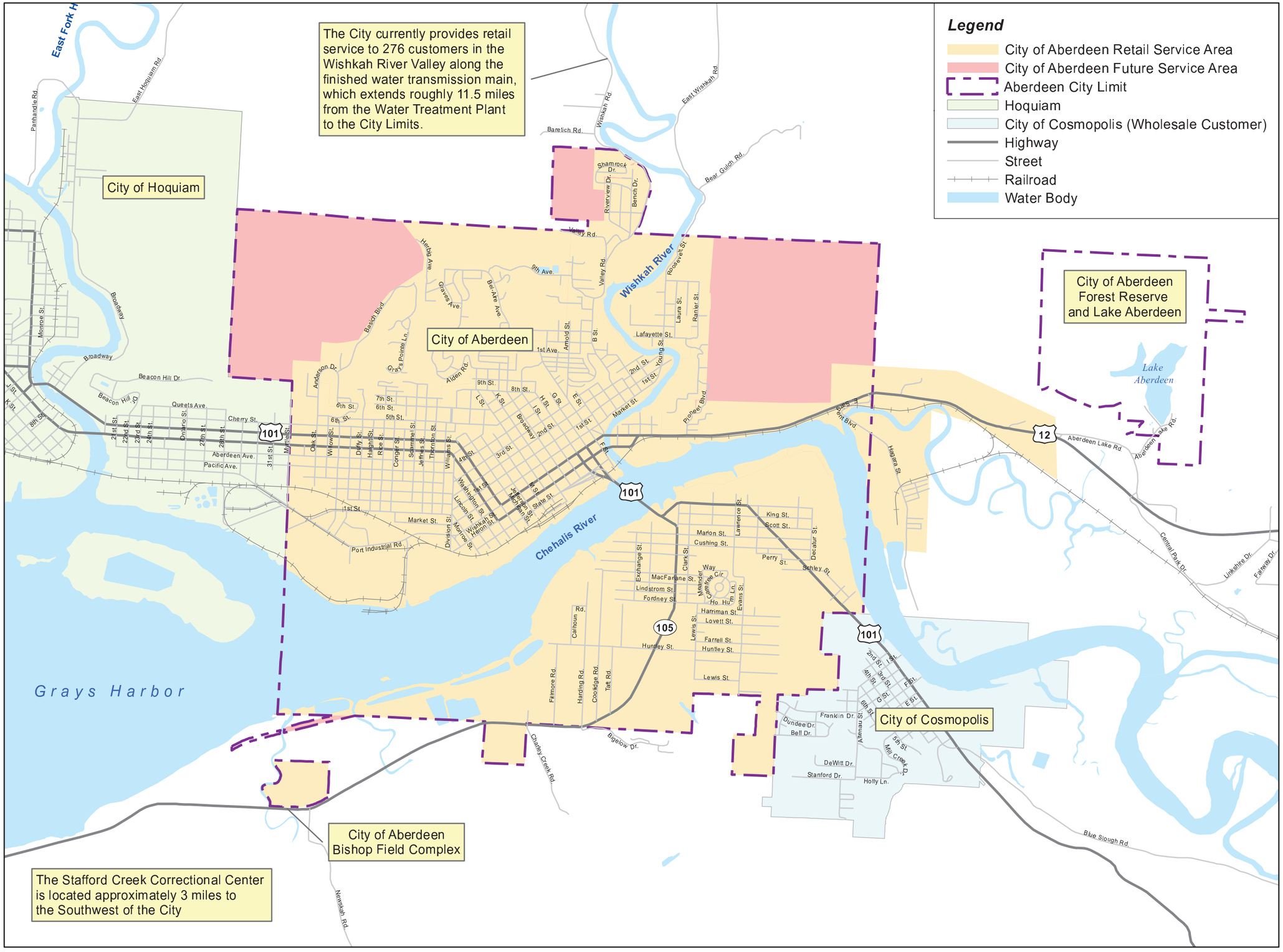
Additional development in Cosmopolis will increase the amount of water used by this wholesale customer. The City has an abundant supply of water and will continue to support increases in development and provide water service.

1.4 Adjacent Purveyors

The service areas of three other water purveyors abut the City's Retail Service Area: the City of Hoquiam to the west, the City of Cosmopolis to the south, and Central Park to the east.

The City's water system has interties with the Hoquiam water system and the Cosmopolis water system at four locations. The Hoquiam interties are located near the intersection of Aberdeen Avenue and Myrtle Street and near the Industrial Road and Murphy Street intersection. The City has a formal written interlocal agreement with the City of Hoquiam to supply water during emergency situations. A copy of this agreement is included in Appendix C.

One of the Cosmopolis interties is located near H and 5th Streets and the other is on Southwest Boulevard at its intersection with Tyler Street. The City has a formal agreement to provide a supply of potable water to the City of Cosmopolis. Cosmopolis relies upon the City exclusively for its potable water.



Source of Data: Water system service area boundaries obtained from City of Aberdeen

Figure 1-1
Water Service Area
CITY OF ABERDEEN
WATER SYSTEM PLAN
July 2012

N

0 750 1,500 3,000 Feet

The City coordinated planning efforts with adjacent purveyors during this Water System Plan process. Documentation of this coordination is included in Appendix D. The City also participates in the WRIA 22/23 Chehalis Basin Watershed Plan process.

1.5 Inventory of Existing Facilities

Key water system facilities and pressure zones are shown in Figure 1-2. A hydraulic schematic of the system is provided in Figure 1-3, which shows the hydraulic relationship among pressure zones, reservoirs, pump stations, and PRVs.

1.5.1 Transmission System

Water drawn from the Wishkah River source is delivered to the Aberdeen Water Treatment Plant via a 10-mile gravity transmission main. The 28-inch diameter gravity main starts at Malinowski Dam and runs almost due south or southwesterly along the Wishkah River valley. Once treated, water can travel to two different sections of the distribution system. Most of the water is returned to the transmission main and continues another 11.5 miles en route to its terminus at the Fairview reservoirs (See Figure 1-4). The Fairview reservoirs are the primary finished water supply reservoirs for the City. The rest of the treated water is stored in a tank at the treatment plant, which provides water to a small number of customers along Wishkah River Road.

The original wood stave transmission main was constructed in 1916. It was replaced twice with piping of similar construction, which served the City until the entire main was replaced with steel and concrete pipe in the early 1960s.

The present pipeline was constructed in three phases along the same general route as the original line. Phase I begins at the Wishkah headworks and was installed in 1958 using tar-coated pipe constructed of ¼-inch thick steel. The remainder was constructed of concrete cylinder pipe, specified to meet federal specification SS-P-381, and was installed between 1961 and 1963. The alignment, elevations, pipe lengths, materials, and year of construction for each section of pipe are shown on the drawing depicted in Figure 1-4. The capacity of the pipeline is 7.5 mgd based on the hydraulic gradients shown on Figure 1-4.

According to City Water Department staff, both steel and concrete sections of the main are in good condition, requiring low maintenance. Air valves, observation manholes, and blow-offs were installed during construction. However, the transmission main has no in-line valves to isolate sections or control flow, except at the headworks, the terminal reservoir, and the treatment plant. At the headworks either of two valves can be used for throttling flow to achieve the desired flow rate. One valve is a control valve that automatically shuts down during high turbidity events. Both valves can be operated remotely from the treatment plant or manually.

Prior to June 2000, when the filtration plant was completed, disinfectant was applied at the headworks. During that time, approximately 272 customers along the Wishkah River Road received water directly from the transmission main. Since disinfectant is no longer applied above the treatment plant, 20 customers are now served by a new distribution main drawing water from Wishkah tank located on-site at the City filtration plant.

1.5.2 Treatment Facilities

The City's membrane filtration plant began serving customers in June 2000. Raw water is delivered from the Wishkah River by the 10 mile, 28-inch transmission line. At the plant, water

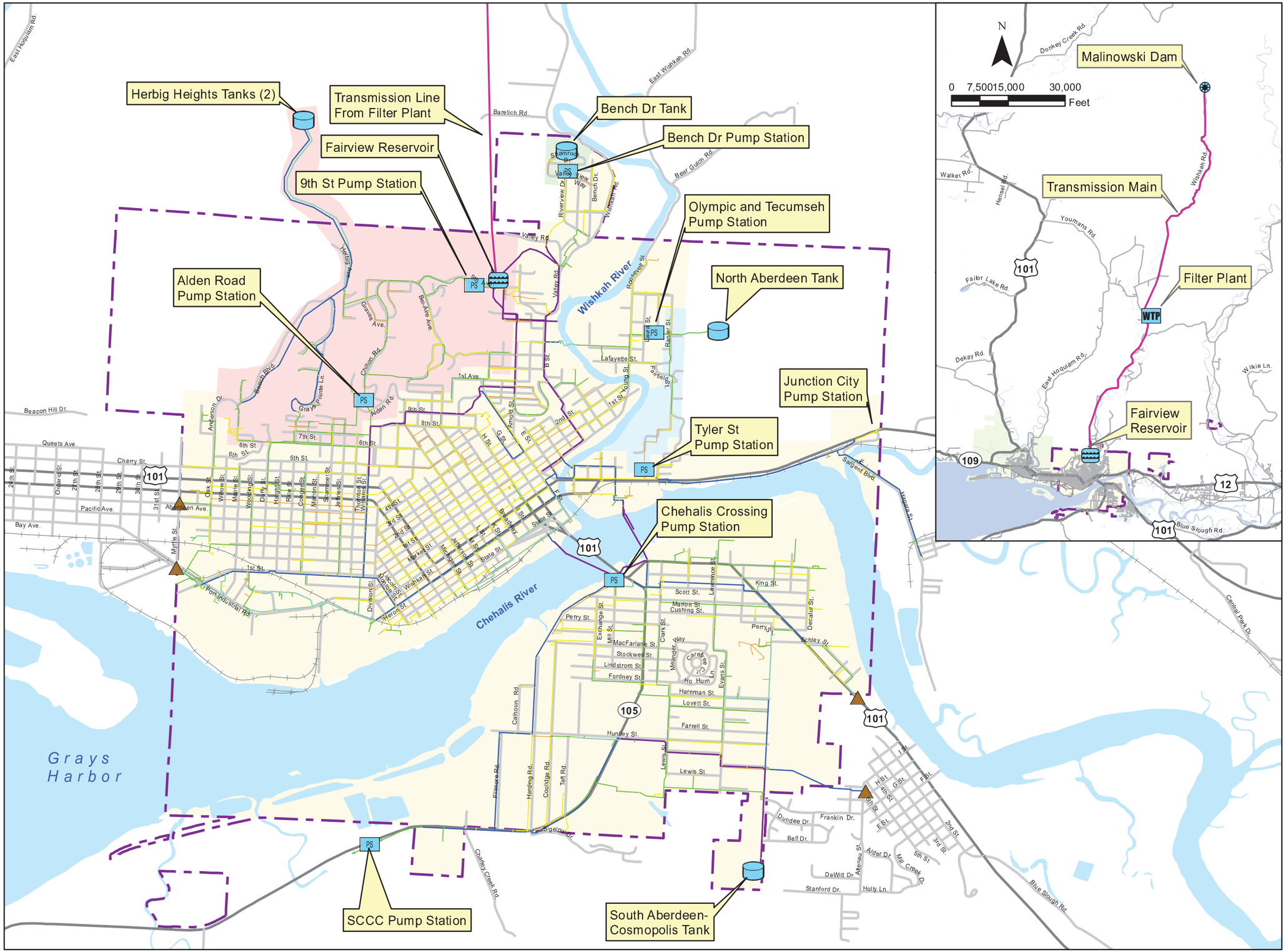
is filtered by eight membrane microfiltration modules, chlorinated using chlorine gas, held in a clearwell to obtain adequate disinfection contact time, and then adjusted for corrosion control with the addition of caustic soda. Fluoride is applied at the outlet of the treatment plant. The finished water is then either returned to the transmission main or pumped to the Wishkah tank for distribution to customers along Wishkah River Road. Figure 1-5 is a schematic of the City's membrane filtration plant system. One full-time employee is needed to operate the treatment facility.

The fully automated treatment plant has a rated filtration capacity of 6.5 mgd and contains a total filter surface area of more than 116,000 square feet. The filtration system includes a compressed air system for filter backwashing, a chemical feed system for periodic cleaning of the membranes, and an automatic membrane integrity testing system. A backup 150-200 hp diesel generator, capable of supplying power to all treatment plant auxiliary systems, is located on-site and automatically starts in the event of a power failure. The filtration system also has an uninterruptible power supply source that can power the plant long enough for proper shut down procedures in the event of generator failure.

Chlorine is added to filtered water prior to its entry into the 310,000 gallon clearwell. The chlorination system consists of two 1-ton gas cylinders with automatic flow-paced control. Each gas cylinder is enclosed in a secondary vessel to provide for physical containment in the event of a gas leak. Sodium hydroxide is added to the last clearwell chamber to reduce lead and copper levels at the customers' taps by increasing the water pH. Fluoride is added to the finished water using a saturator to enhance customer dental health.

The treatment plant has a backwash recycle system. Water that is used to clean the filters is recovered in a basin and pumped through a secondary microfiltration module. The recovered water is then returned to the main treatment flow ahead of the primary microfiltration modules. The backwash recycle system recovers 80-90 percent of the backwash water. Any backwash that is not recovered is pumped into a spray irrigation area for disposal via land application/infiltration.

The entire treatment facility is surrounded by a fence, and is gated and locked. All entrances are equipped with intrusion alarms, and the building has heat and smoke detectors. In the event of a source water quality emergency, valves at the intake can be shut-down automatically or manually from the treatment plant. The treatment plant can be bypassed in the event of a facility-related water quality emergency.



Legend

- Intertie
- Pump Station
- Reservoir
- Tank

Waterline (in)

- 4-inch
- 6-inch
- 8-inch
- 10-inch
- 12-inch
- >12-inch
- Transmission Line
- Highway
- Street
- Railroad
- Aberdeen City Limit
- Water Body

Pressure Zone

- Aberdeen Main
- Herbig Heights
- Bench Drive
- North Aberdeen

HDR

Figure 1-2
Water System Map
CITY OF ABERDEEN
WATER SYSTEM PLAN
July 2012

N
0 750 1,500 3,000
Feet

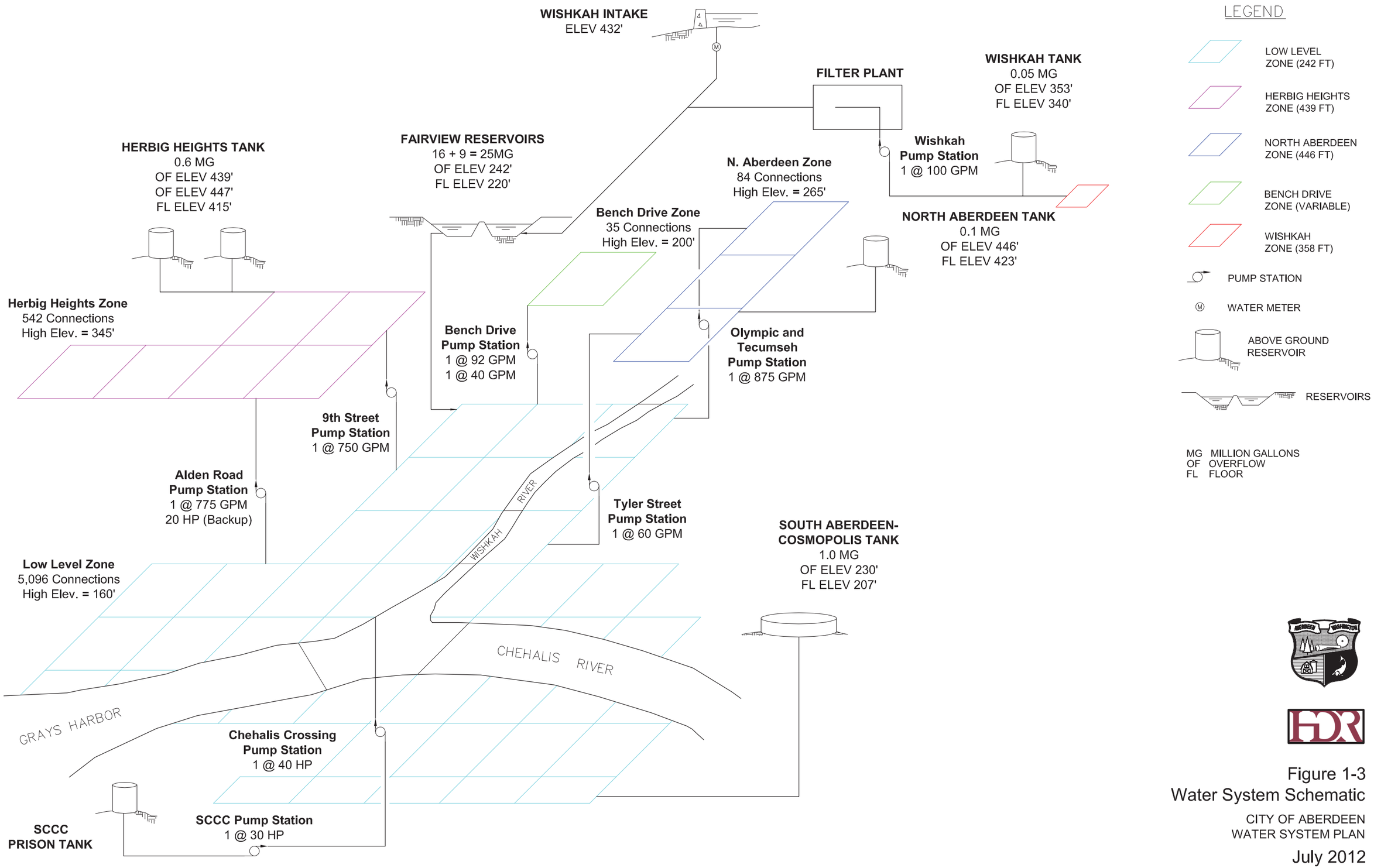


Figure 1-3
Water System Schematic

CITY OF ABERDEEN
WATER SYSTEM PLAN

July 2012

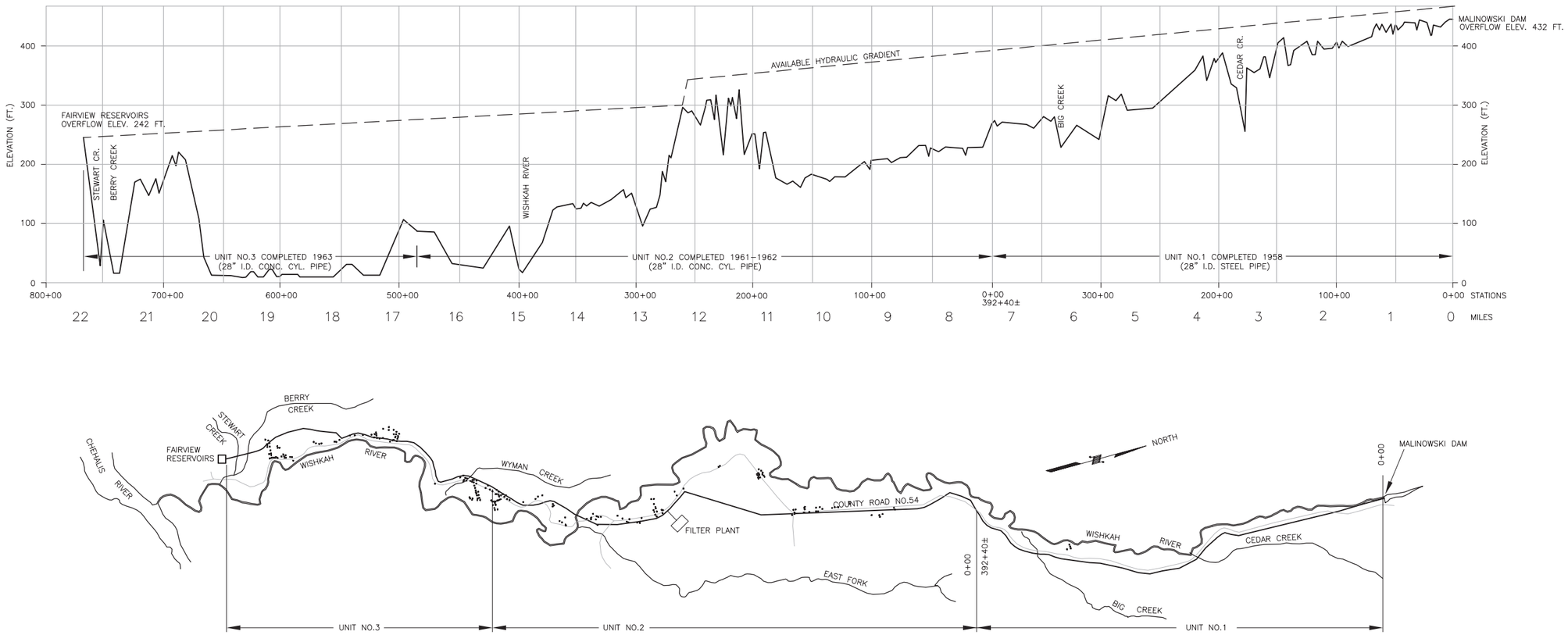


Figure 1-4
Gravity Transmission Line

CITY OF ABERDEEN
WATER SYSTEM PLAN

July 2012

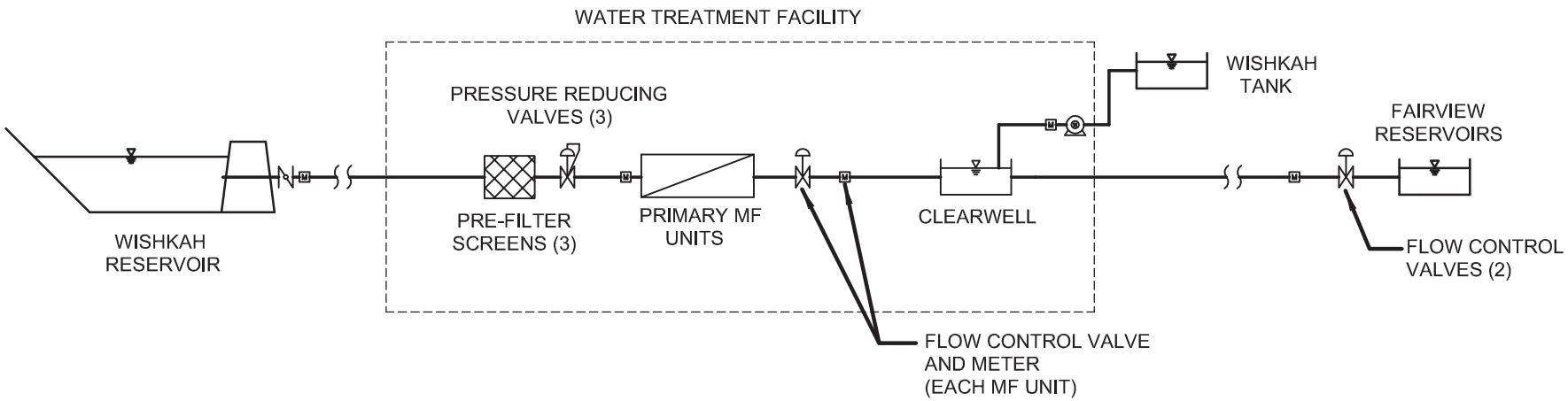


Figure 1-5
Filter Plant Schematic

CITY OF ABERDEEN
WATER SYSTEM PLAN

July 2012

1.5.3 Finished Water Storage Facilities

The City currently has seven storage reservoirs with a combined capacity of over 27 million gallons (MG). Figure 1-3 shows the elevations and volume of each reservoir, as well as its schematic relationship to other components of the water system. Reservoir characteristics are also described below and summarized in Table 1-1. Elevations are according to Aberdeen City Datum (i.e., equal to NVGD 1929 Datum + 4.78 feet).

Table 1-1. Description of Gravity Storage Facilities

	Fairview 1	Fairview 2	Herbig Heights 1	Herbig Heights 2	N. Aberdeen	S. Aberdeen	Wishkah Tank
Capacity	9,500,000	15,500,000	250,000	350,000	100,000	1,000,000	50,000
Elevations (ft)							
Overflow	242	242	439	447	446	230	353
Floor	220	220	415	415	423	207	340
Dimensions (ft)							
Plan	200 x 220	450 x 240	43 diameter	43 diameter	28 diameter	85 diameter	26 diameter
Height	22	22	24	32	23	23	15
Year Constructed	1914	1926	1996	1996	1990	1996	2000
Enclosed/covered	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Site Fenced	Yes	Yes	No	No	No	No	Yes
Pressure Zone Served	Lower Aberdeen	Lower Aberdeen	Herbig Heights	Herbig Heights	N. Aberdeen	S. Aberdeen	Wishkah Valley

Fairview Reservoirs

Two reservoirs, located on Fairview Hill, are the key storage facilities of the City water system. The gravity transmission main feeds water into a metered piping network that can divert the water to either reservoir. Water is drawn from the reservoirs and enters the distribution system of the lower Aberdeen pressure zone through one of three mains, which are 16-inch, 20-inch, and 24-inch in diameter. Another 16-inch diameter line is used to remove overflow and enables the City to drain either reservoir for maintenance purposes.

Constructed in 1914, the Fairview Reservoir No. 1 is a rectangular structure with a capacity of 9.5 MG. The inlet pipe connected to the weir box is located near its western edge. Outlets are 16 inches and 20 inches in diameter and located at the southeast and northeast corners, respectively. The embankment along the north side of the reservoir has a history of slope failures. Records indicate that the first evidence of instability occurred as early as 1920 and a drainage system was installed within the embankment. The most recent occurrence was in 1976 when the slope slumped, causing several concrete panels and the parapet wall along the affected area to drop approximately 8 inches. This failure was investigated and an earth buttress was constructed at the toe of the slope to provide stability.

Constructed in 1926, Fairview Reservoir No. 2 measures 450 feet long by 240 feet wide with a capacity of 15.5 MG and is located to the west of Reservoir No. 1. Water enters the reservoir from the weir box near its east side through the 24-inch inlet. The outlet is also 24 inches in diameter and draws water from a point near the reservoir's southwest corner.

Both reservoirs were lined and covered in 2003.

Herbig Heights Tanks

The Herbig Heights tanks, located north of the City Limits, serve the Herbig Heights pressure zone. The floats in the tanks are connected to a radio transmitter, which then signals water level information to two booster pumping stations on 96th Street and Alden Road. High and low level alarms transmit to the Water Department shop.

The first Herbig Heights tank is a 24-foot tall by 43-foot diameter steel structure. Elevations of the overflow pipe and tank floor are 439 and 415 feet above mean sea level, respectively. Total tank capacity is 250,000 gallons.

The second Herbig Heights tank is a 32-foot tall by 43-foot diameter steel structure. Elevations of the overflow pipe and tank floor are 447 and 415 feet above mean sea level, respectively. Total tank capacity is 350,000 gallons. The usable tank volume is 250,000 gallons because the top 8 feet in this tank is unusable as it is above the overflow elevation of the Herbig Heights tank 1.

North Aberdeen Tank

The North Aberdeen tank, located west of the intersection at Pearson and Tecumseh, is a 28-foot diameter by 23-foot tall welded steel tank serving the north Aberdeen pressure zone. The floor elevation is 423 feet and overflow occurs when water reaches the 446-foot level. Floats in the tank are connected to a radio transmitter which signals water level information to the booster pumping station at Tecumseh and Olympic. High and low level alarms transmit to the Water Department shop. Total tank capacity is 100,000 gallons. The Tyler Street pump station also serves this tank.

Wishkah Tank

The Wishkah Tank is a 26-foot diameter by 15-foot tall steel tank located on the premises of the Aberdeen Water Filtration Plant. Elevations of the overflow pipe and tank floor are 353 feet and 340 feet above mean sea level, respectively. The tank serves the Wishkah valley customers upstream of the treatment plant, which were previously served by the transmission main from the Wishkah River. Booster pumps at the treatment plant maintain tank levels. The total tank capacity is 50,000 gallons.

South Aberdeen-Cosmopolis Tank

The south Aberdeen-Cosmopolis tank, located south of the City Limits off of Farragut Street, in the lower Aberdeen pressure zone, is an 85-foot diameter by 23-foot high welded steel tank. The tank enables the City to provide peak demands to customers in south Aberdeen and supplies customers of Cosmopolis. The elevations of the overflow pipe and tank floors are 230 and 207 feet above mean sea level, respectively. It is a 1,000,000 gallon capacity tank that fills by gravity from Fairview reservoirs or from the Chehalis Crossing pump station. Since its overflow is 14 feet lower than that of Fairview reservoirs, an altitude valve is used to limit the maximum water level at 228 feet.

Bench Drive Pressure Tank

A horizontal hydro pneumatic tank measuring 5 feet in diameter by over 12 feet long serves the Bench Drive pressure zone with 35 residential connections. Fabricated of carbon steel with an epoxy coating on the interior, the tank is filled from the nearby booster pumping station on Shamrock Drive. The pumping operations are controlled on an automatic basis by signals from water level sensors in the tank. Pump settings are presently set at the following levels:

	Depth (In.)
• Both Pumps off	24”
• Small Pump on	18”
• Large Pump on	17”

The level sensors are directly connected to pump starters and there are no alarms on this system.

Stafford Creek Correctional Center

The City supplies water to the Stafford Creek Correctional Center (SCCC) located west of the City Limits. The SCCC operates and maintains a 1.6 MG finished water storage tank at the facility for water supply. The City owns the transmission line and pump station that feed the SCCC tank. Tank levels are maintained by a booster pumping station located approximately three miles east of the correctional facility.

1.5.4 Pumping Stations

The City has eight booster pump stations. These are necessary to boost water from the lower Aberdeen pressure zone to outlying zones that are too high in elevation for adequate gravity pressure from the Fairview reservoirs. Pertinent characteristics of the City's booster pump stations are described below.

9th Street Pump Station

The 9th Street station, located near the Fairview reservoirs, is the primary pumping facility for the Herbig Heights pressure zone and contains a 60 hp centrifugal pump with a capacity of 750 gpm. The pump is automatically activated by a signal from the water level sensor in the Herbig Heights tanks. The 9th Street pump station is equipped with a control valve, which slowly opens when the pump comes on to avoid pressure surges.

Alden Road Pump Station

Should the 9th Street pump fail, a 75 hp backup pump with a capacity of 775 gpm at the booster station on Alden Road actuates automatically according to a radio signal from the Herbig Heights tanks. A second, 20 hp, pump is also located at this station although it is presently not in use. The pump station is equipped with a control valve, which slowly opens when the pump comes on to avoid pressure surges.

Olympia and Tecumseh Pump Station

The Olympic and Tecumseh station, located north of the City Limits, serves the north Aberdeen pressure zone and is equipped with a 100 hp centrifugal pump with a capacity of 875 gpm that is started and stopped automatically according to a radio signal from north Aberdeen tank.

Tyler Street Pump Station

The Tyler Street station is used to serve the north Aberdeen pressure zone when the Olympic and Tecumseh station is not operational. It has a 15 hp pump with a capacity of 60 gpm which is not adequate to meet water demand on a sustainable basis. Currently, the Tyler Street station pump is offline and must be started manually.

Bench Drive Pump Station

The Bench Drive station, located at Shamrock Drive, serves a small, residential area referred to as the Bench Drive pressure zone. Two pumps are contained within the pump station with a capacity of 40 gpm for the first call pump and 92 gpm for the second call pump. The two pumps are controlled by the water level in the Bench Drive pressure tank.

Chehalis Crossing Pump Station

A booster pump, located near the Chehalis Bridge in south Aberdeen, supplies additional pressure to residents of south Aberdeen during peak demand periods. The 40 hp pump can also be used to provide additional water to feed the south Aberdeen tank during periods of peak demands and fire hydrant use.

SCCC Pump Station

The SCCC pump station is used to convey water to the SCCC tank. It is located approximately three miles southwest along the correctional facility transmission main from the Chehalis Crossing pump station. The 30 hp pump is operated automatically according to water level signals from the correctional facility tank.

Wishkah Pump Station

The Wishkah pump station serves a small pressure zone north of the Aberdeen filtration plant. A 3 hp pump, located at the filtration plant, provides finished water from the treatment plant, to

the Wishkah Valley customers via the Wishkah tank, also located at the treatment plant. The pump is started and stopped automatically according to radio signals from the Wishkah tank.

1.5.5 Distribution System

The City's distribution system is a looped network of piping and appurtenances designed to deliver a reliable supply of water at adequate pressure to meet customer and fire fighting needs. The City's distribution system has approximately 119 miles of waterline. Table 1-2 below lists the total length of waterlines in the distribution system. Figure 1-2 shows the existing distribution network.

Table 1-2. Distribution Network

Diameter (in)	Total Length (ft)	Percent (%)
<4	157,621	25.1%
4	57,265	9.1%
6	161,180	25.7%
8	115,521	18.4%
10	28,461	4.5%
12	72,539	11.6%
14	12,085	1.9%
16	21,605	3.4%
20	1,166	0.2%
24	460	0.1%
Total	627,904	

1.5.6 Pressure Zones

The City water service area supplies potable water for commercial and residential customers, located for the most part on the Chehalis River flood plain at an elevation of approximately 20 feet. The City also extends service to customers in several adjacent residential highland areas. Due to the location of the potable water source, the configuration of system components, and topography within the City's Retail Service Area, the distribution system is divided into six pressure zones.

Table 1-1 lists the pressure zones. The description of the pressure zones follows.

Table 1-3. Pressure Zone Boundaries

Zone	Pressure Source	Maximum Elevation
Low Level	Fairview Hill Reservoirs	242 ft.
Herbig Heights	9th Ave and Alden Rd Pump Station	439 ft.
North Aberdeen	Olympic Street Pump Stations	446 ft.
Bench Drive	Fairview Hill Reservoirs	Variable
Upper Wishkah	Wishkah Tank	353 ft.
Lower Wishkah	Treatment Plant Clearwell	300 ft

The City Water Department maintains four pressure reducing valves (PRVs) to reduce pressures in localized areas. Two are located in the north Aberdeen pressure zone at either end of a 2-inch diameter line along Fairview Street between Clinton and Sherman. The other

two are in the Herbig Heights pressure zone. They reduce water pressure in two dead-end, 2-inch diameter pipes adjacent to the Fairview reservoirs.

Low Level

This zone covers most of the City's total service area, including the tidal flats and lower hillsides. The zone serves 5,096 of the City's 6,033 residential and commercial customers, from two concrete-lined reservoirs located adjacent to one another (elevation 247) on Fairview Hill in north Aberdeen. Topography ranges from 20 feet to 220 feet above mean sea level. In addition, water is pumped from the low level zone into each of the higher pressure zones.

Herbig Heights

This zone is located in northwestern Aberdeen and serves 542 residential and commercial customers as well as Grays Harbor Community Hospital. The zone, consisting of the more recent residential developments, is located in the rolling highlands area and is bordered on the north by undeveloped land. The topography of this tract of the City is replete with hills and draws. Ground elevations vary between 40 feet and 345 feet above mean sea level. Two pump stations that draw from the low level zone pressurize the zone. Pressures within the Herbig Heights zone reach as high as 130 pounds per square inch (psi) in some locations. As a result, a number of service connections have pressure-reducing valves installed.

North Aberdeen

This zone serves a small, higher elevation residential area east of the Wishkah River with 84 connections. The zone is bounded roughly by: Olympic Street to the west, Mitchell Street to the north, to the east the City Limits, and Henry Street to the south. A pump station near the intersection of Olympic Street and Tecumseh Street pressurizes the north Aberdeen zone. Another backup pump station, located at Tyler Street, north of Wishkah Boulevard, can be utilized should the Olympic Street station fail. The Olympic Street pump station draws water from the low level zone and boosts the pressure to supply the north Aberdeen zone as well as fill a 100,000 gallon ground level reservoir.

Bench Drive

This zone serves a small residential area in the northern most extreme of the low level zone. There are 35 service connections served by a pressure tank and the Bench Drive pump. The zone is situated in an upland area where ground contours range between 120 feet to 200 feet above mean sea level.

Upper Wishkah

This zone serves 20 customers near the treatment plant. The Wishkah pump station supplies the zone from the treatment plant clearwell. The pump station fills the Wishkah Tank which provides storage for the zone.

Lower Wishkah

This zone serves 256 residential connections that are supplied by the transmission main between the treatment plant and the Fairview Reservoirs. The zone is supplied by gravity from the Treatment Plant Clearwell.

Other Pressure Zones

In addition to the pressure zones described above, service to two additional zones is provided: Cosmopolis and SCCC.

The City's system provides water to the City of Cosmopolis from the Fairview reservoirs and Chehalis Crossing Pump Station. The south Aberdeen-Cosmopolis reservoir enables the City to provide peak demands to customers in south Aberdeen and supplies customers of Cosmopolis. Since the overflow elevation of the south Aberdeen-Cosmopolis reservoir is 14 feet lower than that of the Fairview reservoirs, an altitude valve is used to limit the maximum water level.

The City also supplies water to the SCCC. SCCC operates and maintains its own storage tank for water supply to the facility. The City owns the transmission line and pump station that feed the SCCC tank.

1.5.7 Interties

The City of Aberdeen has two emergency interties with the City of Hoquiam. There is an 8-inch connection at Myrtle Street and Aberdeen Avenue and a 10-inch connection at the intersection of Port Industrial Road and 1st Avenue. The Port Industrial Road Intertie includes a 500 gpm booster pump station that is owed and operated by the City of Aberdeen. Starting this pump requires both Hoquiam and Aberdeen staff, due to issues with bleeding air in the connection pipes and flushing water from the stagnant pipes. A copy of the City's Intertie Agreement is included in Appendix B.

The City has two interties with the City of Cosmopolis. There is a 12-inch connection near Altenau Street and H Street and a 10-inch connection on Highway 101. Both interties are metered.

note to City: Is the description of the Cosmopolis interties correct about location and metering?

1.5.8 Industrial Water System

The City of Aberdeen owns and operates the Wynoochee Industrial Water System with management responsibilities shared with Grays Harbor County. The Industrial Water System provides a source of non-potable water supply to industrial facilities in Aberdeen, Cosmopolis, and Hoquiam, with the potential to serve other sites in the vicinity. The water is diverted from the Wynoochee River, conveyed through a tunnel to Lake Aberdeen, and then is fed by gravity (the Hoquiam pipeline has an inactive pump station at Lake Aberdeen) into two transmission lines leading to customer sites in Cosmopolis and Hoquiam.

Two pipelines on the City's industrial water system currently serve the Weyerhaeuser Mill in Cosmopolis and Grays Harbor Paper (GHP) in Hoquiam. Additional customers include the Sierra Pacific lumber mill in Junction City and the Port of Grays Harbor, which uses industrial water for log yard washing and dust control. The industrial water pipeline serving Sierra Pacific, the Port of Grays Harbor, and Grays Harbor Paper is a 7-mile long, 48-inch diameter pipeline with 16 MGD capacity, extending from the east of Aberdeen, through downtown and the Port, ending at GHP in Hoquiam. The pipeline includes fire hydrants for use as backup fire fighting supply for the City Fire Department (the pipeline has less than the minimum 20 psi pressure capability for fire fighting).

The Industrial Water System is not connected to the City's potable distribution system and is not being reviewed in this Water System Plan update. However, this source does affect the potential demand on the existing distribution system as new industry develops in the City. It is assumed any large scale industrial development will be served by the Industrial Water System.

2. Related Plans and Agreements

2.1 Related Plans

Several plans and studies were reviewed and considered during the update of this Water System Plan (WSP). These are:

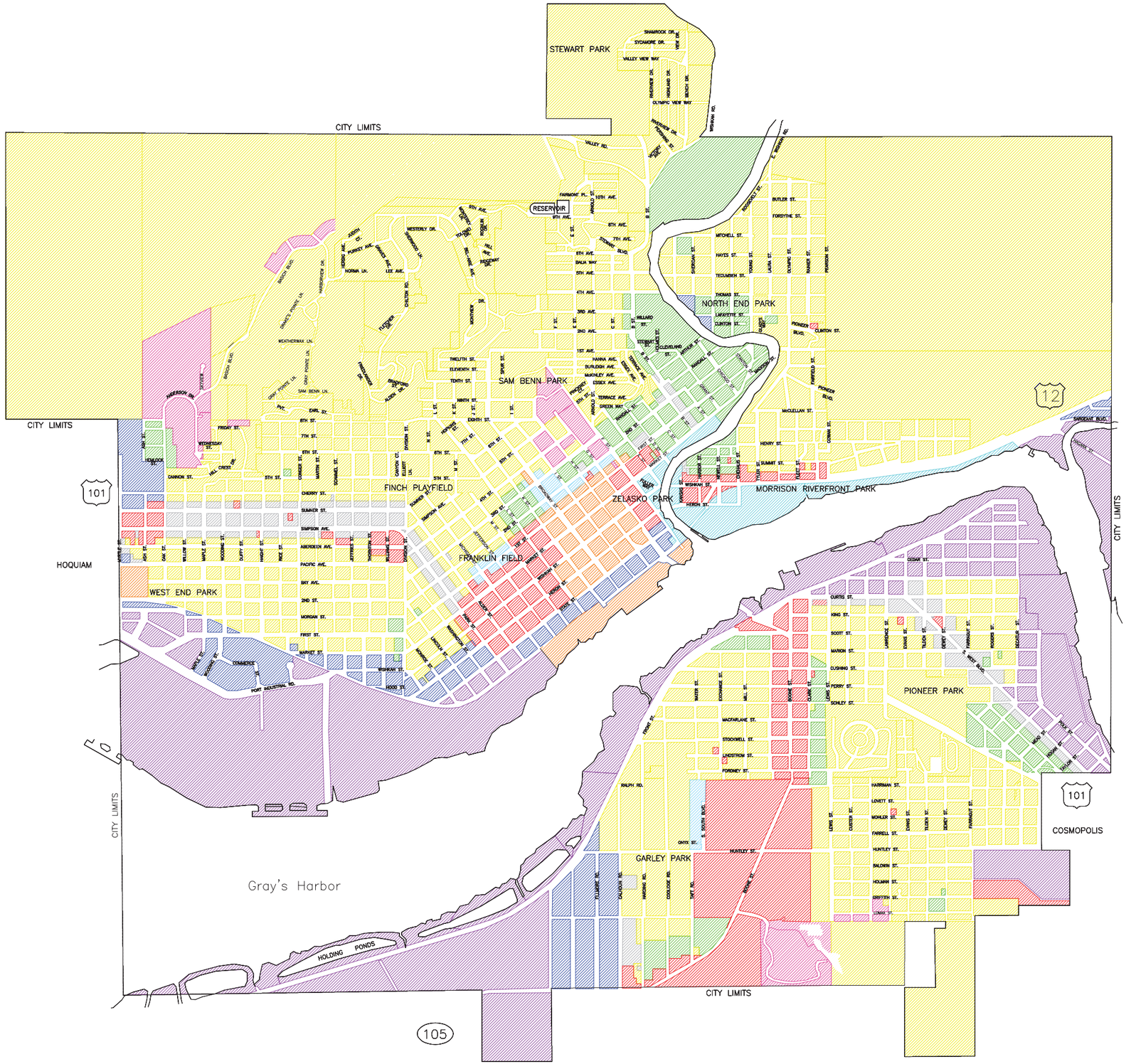
- *City of Aberdeen Comprehensive Plan,* 2001
- *Chehalis Basin Watershed Management Plan, 2004*
- *City of Cosmopolis Water System Plan, 2005*
- *City of Hoquiam Water System Plan (Draft), 2012*

2.2 Service Area Agreements

The City does not have signed service area agreements with adjacent water systems because the existing infrastructure for the City's system and adjacent systems currently abut, not allowing for expansion (Central Park to the east, Cosmopolis to the south, and Hoquiam to the west). The City provides wholesale water to Cosmopolis and has an existing intertie with Hoquiam, so these agreements exist and coordination occurs with these systems. The area of expansion for the City's system will be within City Limits, as described in Chapter 1. Grays Harbor County has reviewed the City's service area and provided the water system plan program consistency statement in Appendix D. The City does not intend to pursue formal service area agreements with adjacent water systems.

2.3 Zoning

City zoning is shown in Figure 2-1. Zoning outside of the City Limits along the water transmission main is primarily General Development (G-5) or Agricultural (A-1) with some areas that are zoned as Residential (R-2). The Land use along the water transmission main is primarily forestry and residential with some areas of unimproved and public land use.



LEGEND:

- RS SINGLE FAMILY RESIDENTIAL
- RM MULTIPLE FAMILY RESIDENTIAL
- RP RESIDENTIAL PROFESSIONAL
- CR COMMERCIAL/RESIDENTIAL
- CD DOWNTOWN COMMERCIAL
- CG GENERAL COMMERCIAL
- MI MAJOR INSTITUTIONAL
- LI LIGHT INDUSTRIAL
- I INDUSTRIAL
- WD WATERFRONT DEVELOPMENT

NOTE:
The accuracy of this map may be subject to zoning changes, please check with the City of Aberdeen for actual zoning decisions and accuracy.

Ord. 6458 02/13/08
Ord. 6457
Ord. 6051
Ord. 6079
Ord. 6089
Ord. 6090
Ord. 6111
Ord. 6119
Ord. 6136
Ord. 6218
Ord. 6219
Ord. 6377
Ord. 6380
Ord. 6387
Ord. 6388
Ord. 6398
Ord. 6400
Ord. 6432
Ord. 6441
Revised to Ord. 6447 10/05/07

0 1000' 2000'

Figure 2-1
Zoning Map

CITY OF ABERDEEN
WATER SYSTEM PLAN

July 2012

3. Water Demand Forecast

Water demand projections help identify the magnitude of supply and infrastructure improvements needed by a water utility. The City of Aberdeen's (City) long-term quantity of water available, water rights, treatment plant and transmission pipeline capacity all need to support the City's long-term water demand. The quantity of water needed depends on potential residential, commercial, and industrial growth.

The forecast sets 2012 as the Base planning year, 2018 as the 6-Year planning period, and 2032 as the 20-Year planning period.

3.1 Water Production

The City obtains its municipal water supply from the Wishkah River. Surface water is impounded by the Malinowski Dam, diverted to the Water Treatment Plant (WTP), and then routed to the distribution system. There are two interties with the City of Hoquiam for emergency use.

The total water produced from the WTP for 2005-2010 is presented in Table 3-1, based upon the master meter records at the treatment plant. The most recent data indicates that in 2010, the total system production was 942 million gallons (MG).

The trend over the past 10 years has been a decline in production. In 2000, the total production was 1,383 MG. In 2005, it was 1,122 MG. Each successive year exhibits some variability in production; however, declining production is the average trend.

Table 3-1 summarizes the annual and monthly water production from the City's WTP for 2005-2010. Figure 3-1 provides a monthly comparison for 2005 to 2010.

Table 3-1. Monthly Water Production (2005 – 2010)

	Monthly Production (MG)					
	2005	2006	2007	2008	2009	2010
January	97	97	101	96	83	84
February	84	90	86	80	72	70
March	90	94	96	81	87	78
April	88	93	88	79	81	75
May	93	102	94	84	81	77
June	91	100	95	84	91	76
July	101	108	95	95	97	89
August	111	110	93	90	90	85
September	100	97	93	82	82	76
October	88	92	85	86	78	75
November	87	85	86	77	75	78
December	92	102	101	94	96	78
Total	1,122	1,171	1,114	1,027	1,013	942

MG = million gallons

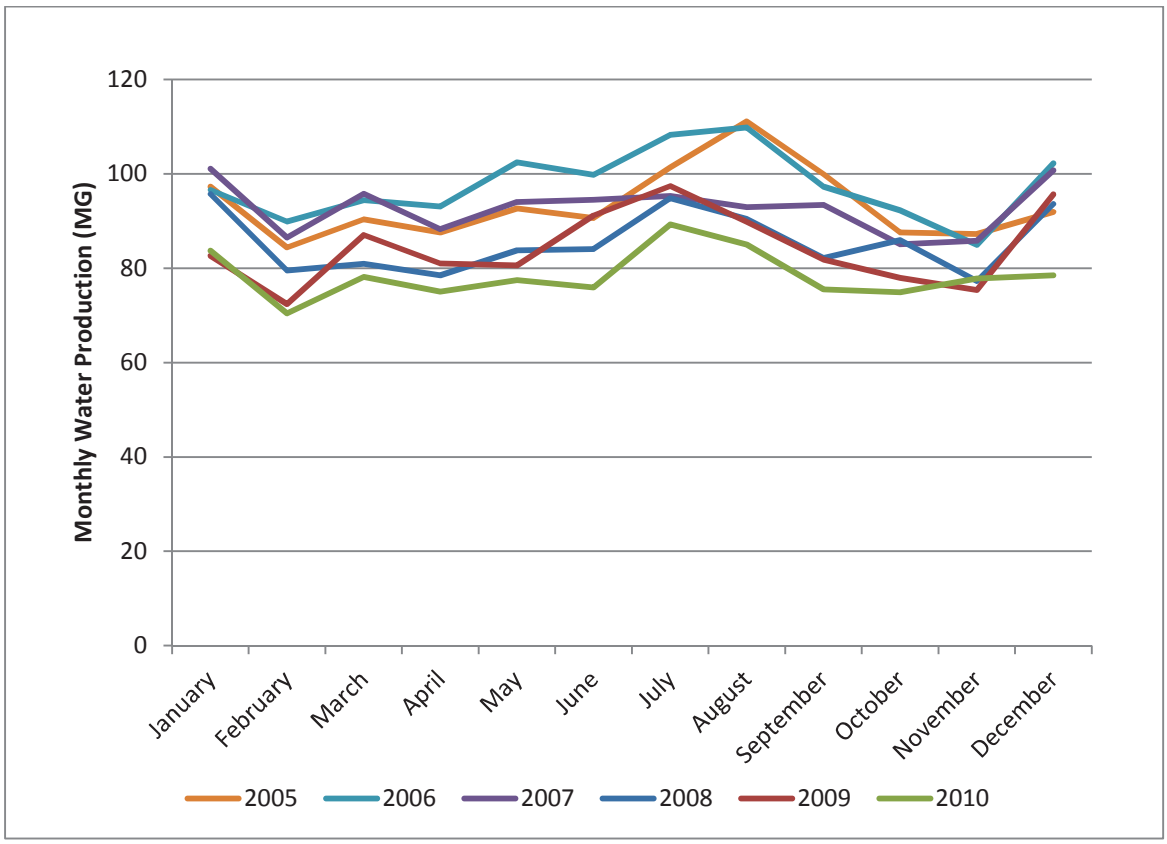


Figure 3-1. Monthly Water Production (2005 – 2010)

3.1.1 Average Day Demand and Maximum Day Demand

A comparison of historical average daily demand (ADD) and maximum day demand (MDD) is provided in Table 3-2. In 2010, ADD was approximately 2.6 million gallons per day (mgd), while MDD was 4.0 mgd. The average peaking factor for 2005-2010 was 1.6; however, in the demand projection (see Section 3.5), a peaking factor of 1.9 is used to account for the maximum value observed during the last six years.

Table 3-2. Maximum Day Demand and Peaking Factor (2005 – 2010)

Year	2005	2006	2007	2008	2009	2010	6-Year Average
ADD (mgd)	3.1	3.2	3.1	2.8	2.8	2.6	2.9
MDD (mgd)	5.3	4.7	4.6	4.2	5.2	4.0	4.7
Peaking Factor	1.7	1.5	1.5	1.5	1.9	1.5	1.6

mgd = million gallons per day

3.2 Customer Categories, Connections, and Consumption

The City maintains billing record summaries that include the monthly water sold in each customer category. There are eight customer categories: Single Family, Duplex, Multi-Family, Commercial, Outside City Limits, City Facilities, Irrigation, and Metered Fire Service. Customers

served along Wishkah Road to the north of the City comprise the Outside City Limits category. The City of Cosmopolis and Stafford Creek Correctional Center are wholesale customers located outside City Limits but are included in the Commercial category.

The number of connections from 2005 to 2010 is provided in Table 3-3. At the end of 2010, the City had 6,033 connections. The vast majority (78%) were single family. The total annual demand (i.e., billed consumption) from 2005 to 2010 by each customer class is shown in Table 3-4.

Table 3-3. Total Connections by Customer Category (2005 – 2010)

	Service Connections					
	2005	2006	2007	2008	2009	2010
Single Family	4,711	4,704	4,701	4,738	4,718	4,685
Duplex	189	190	190	186	182	185
Multi-Family	199	195	193	192	188	185
Commercial*	585	573	596	597	597	583
Outside City Limits	310	311	318	323	324	324
City Facilities	11	12	12	25	45	47
Irrigation	3	5	3	8	8	23
Metered Fire Service	1	1	1	1	1	1
Total	6,009	5,991	6,014	6,070	6,063	6,033

* Cosmopolis and Stafford Creek Correctional Center included in Commercial although both are outside of City Limits.

Table 3-4. Annual Consumption by Customer Category (2005 – 2010)

	Total Consumption (MG)					
	2005	2006	2007	2008	2009	2010
Single Family	308	309	297	299	291	274
Duplex	20	19	19	19	18	17
Multi-Family	71	66	67	67	63	60
Commercial*	335	351	358	347	301	266
Outside City Limits	24	25	24	25	25	26
City Facilities	51	69	42	67	73	67
Irrigation	4.3	3.4	4.2	4.8	4.9	3.2
Metered Fire Service	0.0	0.3	0.5	0.0	0.1	4.5
Total	813	844	813	828	775	718

* Cosmopolis and Stafford Creek Correctional Center included in Commercial.

The annual water consumption, by customer category and by month, for the last six years combined is provided in Table 3-5. The monthly distribution of actual water use may differ somewhat from this representation since billing numbers are based on meter read dates, which lag behind actual use. Various subsets of these data are shown graphically in Figure 3-2.

Table 3-5. Average Monthly Consumption by Customer Category (2005 – 2010)

Month	Single Family	Duplex	Multi-Family	Commercial	Outside City Limits	City Facilities	Irrigation	Metered Fire Service
January	23.8	1.6	6.0	27.6	2.0	4.2	0.1	0.0
February	22.9	1.5	5.3	26.9	1.8	4.0	0.0	0.0
March	23.4	1.5	5.3	27.3	1.9	4.3	0.0	0.1
April	23.1	1.5	5.4	25.7	1.8	4.5	0.0	0.1
May	24.4	1.5	5.5	27.0	1.9	4.7	0.1	0.1
June	24.8	1.5	5.2	26.5	2.1	4.9	0.4	0.1
July	27.5	1.6	5.2	27.4	2.5	6.6	0.8	0.1
August	29.4	1.6	5.7	30.7	2.5	6.0	1.0	0.1
September	25.5	1.6	5.3	28.6	2.2	5.8	1.0	0.1
October	24.3	1.6	5.5	26.7	2.1	5.9	0.4	0.0
November	23.2	1.5	5.3	24.8	2.0	5.5	0.1	0.1
December	24.0	1.6	6.3	27.2	2.0	5.0	0.1	0.0
Total	296.3	18.6	65.9	326.5	24.7	61.5	4.1	0.9

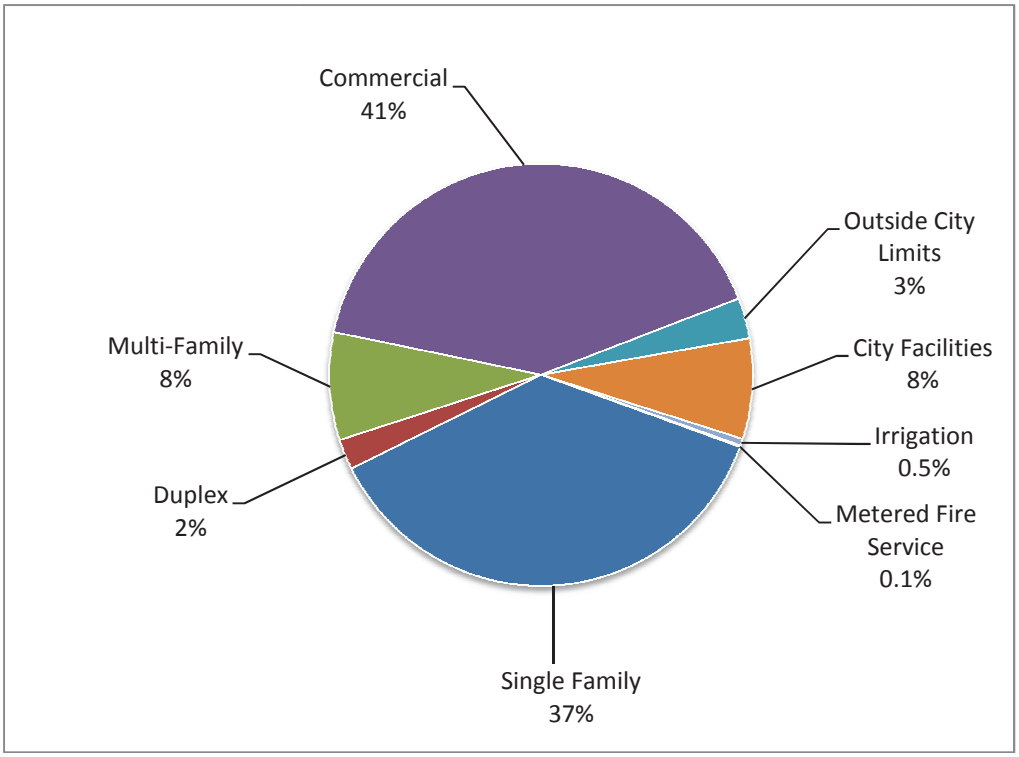


Figure 3-2. Consumption Distribution by Customer Category (2005-2010 Average)

Monthly distribution of water consumption is shown in Figure 3-3. As noted previously, the monthly distribution of actual water use may differ somewhat from this representation since billing numbers are based on meter read dates, which lag behind actual use.

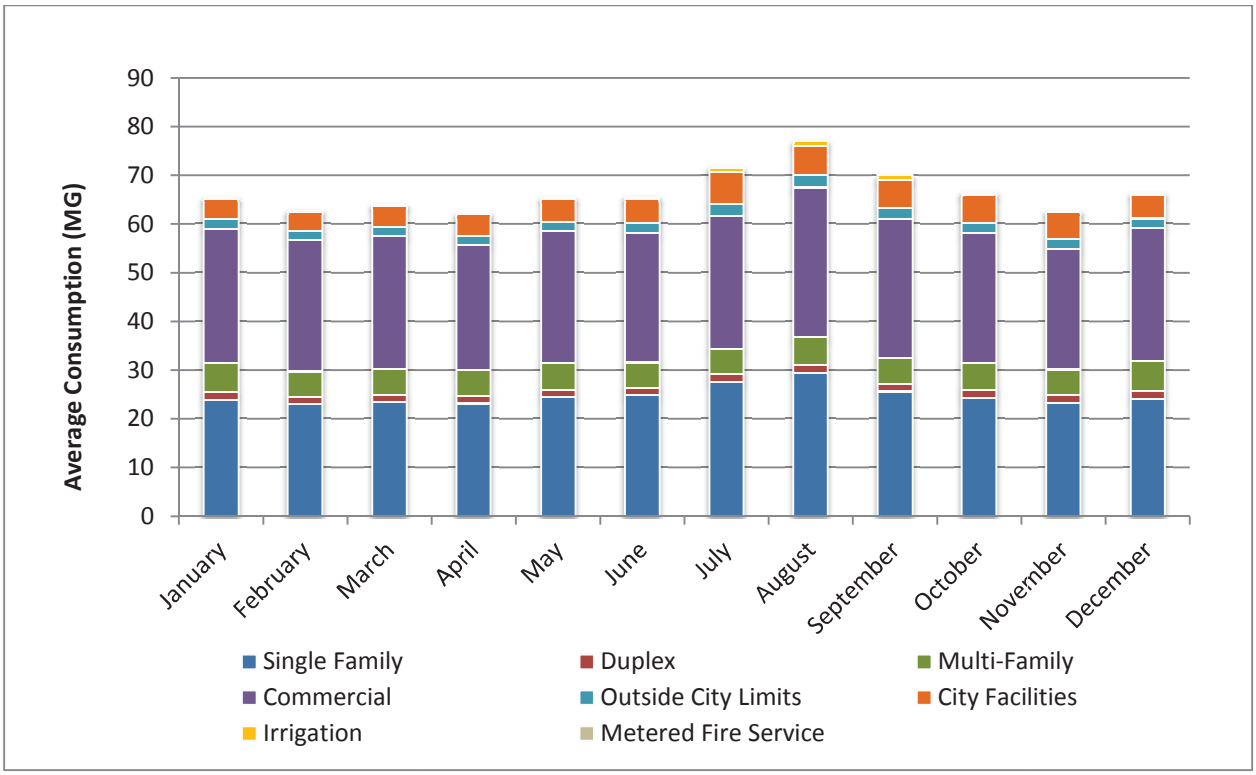


Figure 3-3. Monthly Distribution of Consumption by Customer Category (2005-2010 Average)

The top ten largest retail users in the City's water system were determined based on billing records. Table 3-6 provides the consumption data for those customers, which are multi-family and commercial accounts. The ten largest customers consumed an average of 84 MG from 2005 to 2010, which is equal to approximately 10% of total consumption for the period.

Table 3-6. Largest Water Consumers (2005 – 2010)

Customer	2005 (MG)	2006 (MG)	2007 (MG)	2008 (MG)	2009 (MG)	2010 (MG)	6-Yr Average (MG)
Weyerhaeuser	49.7	48.0	38.5	35.5	7.5	14.2	32.2
Leisure Manor	10.9	8.2	9.7	11.9	13.0	8.6	10.4
Port of Grays Harbor	5.3	4.9	9.0	6.8	10.9	6.5	7.2
Harpo Inc	3.0	2.9	2.8	4.3	7.5	9.7	5.0
Port of Grays Harbor	2.9	6.3	2.7	3.4	10.1	7.2	5.4
Grays Harbor Health and Rehab Center	5.5	6.0	6.0	6.4	5.0	4.8	5.6
Grays Harbor Community Hospital	6.9	6.3	4.2	5.9	5.4	4.3	5.5
Safeway	3.3	3.9	4.2	4.9	5.0	4.7	4.3
Housing Authority of Grays Harbor	3.9	4.4	4.6	4.7	4.6	3.0	4.2
General Growth Properties - SS Mall	4.7	4.8	4.6	2.9	3.2	3.0	3.9
Total	91.4	90.9	81.7	86.5	72.1	66.0	83.8

The City of Cosmopolis and the Stafford Creek Correctional Center are wholesale customers that are served by Aberdeen. The consumption for these two customers is provided in Table 3-7. The total annual consumption by Cosmopolis and SCCC averaged 152 MG between 2005

and 2010, which is approximately 16% of the total consumption in the City. Both these customers are described in more detail in Section 3.5.

Table 3-7. Wholesale Water Consumers (2005 – 2010)

City of Cosmopolis	Total Consumption (MG)						
	2005	2006	2007	2008	2009	2010	6-Yr Average
City of Cosmopolis	68	79	94	79	64	57	73.6
Stafford Creek Correctional Center	74	78	86	90	76	69	78.9
Total	143	157	180	169	140	126	152.5

3.3 Water Use Factors and Equivalent Residential Units

ERUs are a method of representing all types of water use as an equivalent number of single-family households. The ERU value represents the average amount of water consumption by a single family household and is calculated by dividing the single family water consumption by the number of single family connections. Table 3-8 summarizes the single family water consumption, the number of single family connections, and the calculated ERU value between 2008 and 2010. The three-year average for 2008-2010 is 167 gpd.

Table 3-8. ERU Value Calculation

	2008	2009	2010	3-Year Average
Single Family Consumption (MG)	299	291	274	288
Single Family Connections	4738	4718	4685	4714
ERU Value (gpd)	173	169	160	167

1. Calculated as annual Single Family consumption divided by Single Family Connections and converted to gpd.

3.4 Water Balance and Distribution System Leakage

A water balance is an accounting for all water that is produced. The City's 2010 water balance is shown in Table 3-9. The table is a slightly modified version of the format recommended for use by the American Water Works Association.

The water balance allocates the Water Produced to different categories at four different levels.

Level 1 allocates the water to either Revenue Water or Non-Revenue Water. As implied by the names, Revenue Water generates income while Non-Revenue Water does not. This is helpful in understanding what percent of water production generates income for the City. Additionally, non-revenue water needs to be factored into the demand forecast. The City's 2010 water production is divided into 76% Revenue Water and 24% Non-Revenue Water.

Table 3-9. Water Balance (2010)

	Level 1	Level 2	Level 3	Level 4	Volume *(mg)*	% of Produced and Purchased Water
Water Produced	Revenue Water	Authorized Consumption	Billed Consumption	1. Billed Water Exported	126.1 [1]	13.4%
				2. Billed Metered Consumption	592.1 [1]	62.9%
				3. Billed Unmetered Consumption	0.0 [2]	0.0%
	Non-Revenue Water		Unbilled Consumption	4. Unbilled Metered Consumption	0.0 [2]	0.0%
				5. Unbilled Unmetered Consumption	21.9 [3]	2.3%
		Distribution System Leakage	Apparent Losses	6. Unauthorized Consumption	0.0 [4]	0.0%
				7. Customer Metering Inaccuracies	0.0 [4]	0.0%
			Known Losses	8. Known Leakage	0.0 [4]	0.0%
				9. Assumed Leakage	129.6 [5]	13.8%
		Known Transmission Leakage		10. Known Leakage on Transmission System	72 [6]	7.7%
TOTAL					**942** [7]	**100.0%**

1. Data Source: "4-3 HDR Data" spreadsheet provided by City staff.
2. This does not apply to Aberdeen
3. Hydrant usage estimated by the City.
4. City staff do not track this number, therefore zero was used in the water balance.
5. Water Production minus all other categories.
6. Known Transmission Leakage is taken as the difference between the source meters at the Filter Plant and the master meter at the Fairview Reservoirs minus the consumption at the services along Wishkah Rd.
7. Data Source: "Aberdeen Production" spreadsheet provided by City staff.

Level 2 splits water production into three sub categories: Authorized Consumption, Distribution System Leakage, and Known Transmission Leakage. Authorized Consumption includes customer usage, hydrant, and other uses tracked by the City. Distribution System Leakage (DSL) is water lost or unaccounted for in the distribution system. The Known Transmission Leakage is water losses in the transmission main.

Level 3 splits Non-Revenue Water into the following three sub-categories, which are useful in identifying potential additional revenue sources and identifying the magnitude of leaks or other losses that could be addressed:

- **Unbilled Authorized Consumption:** Includes uses such as water system flushing, firefighting, and unbilled contractor use. Typically, it is standard practice not to charge for uses falling into this sub-category. However, it is always a prudent idea to review these uses to ensure that a legitimate revenue opportunity is not missed.
- **Apparent Losses:** Includes unauthorized uses and customer meter inaccuracies, both of which are lost revenue opportunities.
- **Real Losses:** Includes various types of system leaks. A certain level of leakage is unavoidable; however, leakage beyond that level should be repaired to avoid unduly burdening both the natural resource and the physical infrastructure. Any amount that cannot be assigned to another category is considered a real loss under the American Water Works

Association's protocol, as well as per the formula for calculating distribution system leakage under Washington State's Water Use Efficiency Rule.

Level 4 further splits water into additional sub-categories to support further estimation and water management.

A longer history of other water balance elements, namely distribution system leakage and non-revenue water is provided in Table 3-10.

Table 3-10. Distribution System Leakage and Non-Revenue Water

Year	Water Produced[1]	Authorized Consumption		Transmission Leakage[4]		Distribution System Leakage[5]		Non-Revenue Water		
		Billed Consumption[2]	Unbilled Consumption[3]	Qty	Percent of Production	Qty	Percent of Production	Qty	Percent of Production	Percent of Consumption[6]
2005	1,122	813	33	45	4.0%	230	20.5%	309	27.5%	38.0%
2006	1,171	844	33	68	5.8%	226	19.3%	327	27.9%	38.8%
2007	1,114	813	33	42	3.7%	226	20.3%	301	27.0%	37.0%
2008	1,027	828	33	31	3.0%	136	13.2%	199	19.4%	24.1%
2009	1,013	775	44	23	2.3%	170	16.8%	237	23.4%	30.6%
2010	942	718	22	72	7.7%	130	13.8%	224	23.7%	31.1%
2008-2010 Average[7]	**994**	**774**	**33**	**42**	**4.3%**	**145**	**14.6%**	**220**	**22.2%**	**28.6%**

1. Data Source: "Aberdeen Production" spreadsheet provided by City staff.
2. Data Source: "4-3 HDR Data" spreadsheet provided by City staff.
3. For 2009 and 2010, this number was estimated by City staff. For all other years, unbilled consumption is based on the 2009 and 2010 average consumption.
4. Known Transmission Leakage is taken as the difference between the source meters at the Filter Plant and the master meter at the Fairview Reservoirs minus the consumption at the services along Wishkah Road.
5. Distribution system leakage is defined in the Water Use Efficiency Rule as water production minus authorized consumption and known transmission leakage.
6. Used for developing the demand forecast. Note this is intentionally different than non-revenue as a percent of production.
7. Six years of data was analyzed, however the average uses the most recent three years in order to focus on current trends.

Between 2008 and 2010, the DSL averaged 14.6% of production. The known leakage along the transmission main between the Filter Plant and the Fairview Reservoirs averaged 4.3% of total production. The City calculates the leakage in the transmission main by taking the difference between the source meter at the WTP and the Fairview Reservoirs, while also subtracting the consumption of the services located along Wishkah Road north of City Limits. As the DSL is greater than 10% of production, DOH requires that the City develop a Water Loss Control Plan. This is prepared as part of the water system plan update and included in the conservation chapter.

3.5 Wholesale Customers

The City of Cosmopolis and the Stafford Creek Correctional Center are two wholesale customers served by the City of Aberdeen. The information presented below was obtained from

demand projections developed by each customer and interviews with Cosmopolis and SCCC staff.

3.5.1 City of Cosmopolis

The City of Cosmopolis is a public water system that is a wholesale customer of the City of Aberdeen. Cosmopolis submitted its last WSP in 2005. The demand forecast prepared as part of that WSP showed a 20-year ADD projection of 0.21 mgd which corresponds to a planning year of 2025. Extrapolating to Aberdeen's planning year of 2031, Cosmopolis' ADD is projected to be 0.22 mgd.

In August 2011, the City of Aberdeen and Cosmopolis signed a municipal water supply contract by which Aberdeen is required to provide a maximum water supply of 12,350 CCF (100 cubic feet) per month. A copy of this contract is included in Appendix B.

3.5.2 Stafford Creek Correctional Center

The Stafford Creek Correctional Center (SCCC), owned and operated by the State Department of Corrections (DOC), is another wholesale customer of the City. It has its own demand projections, which are used in developing its contribution to the City's demand forecast. SCCC began receiving water service in the year 2000, and between 2005 and 2010, SCCC used an average of 79 MG per year. The maximum amount SCCC used during this period was 90 MG in 2008.

SCCC staff reported that the prison reached its full capacity in March 2004. Since then, the population has varied, but remains close to its full capacity. There is a proposal to expand the facility by 300 additional beds, but funding limitations have reduced the priority for this action. As such, staff report that there is no anticipated expansion of capacity at SCCC in the near future. One action that is likely to occur in the next decade is the installation of a fish farm on the facility. This will not result in additional water usage from Aberdeen since DOC plans to utilize an existing well for that water supply. Staff report that no additional water needs from Aberdeen, beyond current levels, are currently planned for at SCCC.

3.6 Water Demand Forecast

The methodology of the water demand forecast is to combine demographic data with water use factors in the case of single family customers, and historic consumption for other categories, to project the billed consumption demands. Demands are also developed for non-revenue water. The billed consumption and the non-revenue demands are summed to create the total average day demand. To generate the total maximum day demand, a peaking factor is applied to the average day demand. More details on each step are provided below.

- **Step 1 – Billed Consumption.** Consumption is divided into ten components: Single family, duplex, multi-family, commercial, outside city limits, city facilities, other (irrigation and metered fire service), large users, City of Cosmopolis, and Stafford Creek Correctional Center. With the exception of the large users, Cosmopolis, and SCCC, demand projections increase according to the annual growth rates based on the 2007 State Office of Financial Management (OFM) Low Population Projections for Grays Harbor County which are 0.23% between 2010 and 2015, 0.21% from 2015 to 2020, 0.12% from 2020 to 2025, and 0.00% from 2025 to 2031.

Single family projections begin with the number of 2010 Single Family Connections, and then increase using the annual growth rate from the 2007 OFM Population Projections. The number of connections is then multiplied by the ERU value of 167 gpd.

Duplex, multi-family, commercial, outside City Limits, City facilities, and other demand projections begin with 2005 – 2010 average consumption and increase using the annual growth rate from the 2007 OFM Population Projections. The 10 largest users are evaluated separately from these categories, with their demands based on average 2008-2010 consumption and held constant through the planning period, as there are no significant changes anticipated with respect to water usage by these customers. In the future, large scale industrial or commercial development is assumed to be served by the Industrial Water System which can provide up to 16 MGD from the Wynoochee River.

The City of Cosmopolis demand projection is based on the current contracted amount that the City of Aberdeen is required to provide.

The Stafford Creek Correctional Center projection begins with the 2008 consumption, which is the highest consumption observed between 2005 and 2010, and is held constant through the planning period.

- **Step 2 – Non-Revenue Water.** Projected non-revenue water is 28.6% of consumption. This includes distribution system leakage, transmission leakage, and other unbilled water usage.

- **Step 3 – Average Day Demand.** The total average day demand is the sum of the total billed consumption and non-revenue demand projections.

- **Step 4 – Maximum Day Demand.** The projected maximum day demand is the average day demand multiplied by the MDD:ADD peaking factor of 1.9. This is the maximum peaking factor between 2005 and 2010.

- **Step 5 – Conservation Adjustment.** Non-revenue water will decrease to 21.9% of consumption by 2015 to represent meeting the goal to reduce distribution system leakage to 10% of production. In addition, residential water use will be reduced by 53 gallons per household to achieve the conservation goal for a reduction of seasonal water usage.

Table 3-11. Demand Forecast

Calendar Year Water System Plan Year	2012 (Base)	2013 (1)	2014 (2)	2015 (3)	2016 (4)	2017 (5)	2018 (6)	2032 (20)
Equivalent Residential Units (ERUs)[1]	17,673	17,700	17,727	17,754	17,779	17,804	17,828	17,950
Annual Growth Rate[2]	0.23%	0.23%	0.23%	0.23%	0.23%	0.21%	0.21%	varies
Average Day Demand (mgd)								
Base System								
Single Family[3]	0.79	0.79	0.79	0.79	0.79	0.79	0.80	0.80
Duplex[4]	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Multi-Family[5]	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.16
Commercial[6]	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28
Outside City Limits[7]	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07
City Facilities[7]	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17
Other[7]	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Large Users[8]	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23
Wholesale Customers								
City of Cosmopolis[9]	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
Stafford Creek Correctional Center[10]	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Total Average Day Consumption [11]	**2.30**	**2.30**	**2.31**	**2.31**	**2.31**	**2.32**	**2.32**	**2.33**
Non-Revenue Water[12]	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.67
Total Average Day Demand [13]	**2.96**	**2.96**	**2.97**	**2.97**	**2.97**	**2.98**	**2.98**	**3.00**
Maximum Day Demand (mgd)								
Total Maximum Day Demand[14]	**5.62**	**5.63**	**5.63**	**5.64**	**5.65**	**5.66**	**5.67**	**5.70**

1. ERUs calculated as Total Average Day Demand divided by the ERU value of 167 gpd.
2. Annual Growth Rate based on the OFM Low Population Projections for Grays Harbor: 0.23% between 2010 and 2015, 0.21% from 2015 to 2020, 0.12% from 2020 to 2025, and 0.00% from 2025 to 2031.
3. Began with the number of 2010 Single Family Connections, increased using the annual growth rate from the 2007 OFM Population Projections, and multiply by ERU value 167 gpd
4. Began with 2005 - 2010 average consumption, then increased using the annual growth rate from the 2007 OFM Population Projections.
5. Began with 2005 - 2010 average consumption, subtracted the one large multi-family user, then increased using the annual growth rate from the 2007 OFM Population Projections.
6. Began with 2005 - 2010 average consumption, subtracted the large commercial users, then increased using the annual growth rate from the 2007 OFM Population Projections.
7. Began with 2005 - 2010 average consumption, then increased using the annual growth rate from the 2007 OFM Population Projections.
8. Uses the 2008-2010 average consumption for the City's 10 largest customers. This number is held constant throughout the planning period.
9. 2011 Municipal Water Supply Contract between the City of Aberdeen and the City of Cosmopolis.
10. Stafford Creek Correctional Center is operating at maximum capacity. The projected ADD is assumed to be constant based on the 2008 actual demand of 0.25 mgd which is the highest usage between 2005 and 2010.
11. Total of all billed consumption.
12. Non-revenue water is 28.6% of billed consumption based on the 2008-2010 average.
13. The sum of billed consumption and non-revenue water.
14. The average day demand multiplied by the MDD:ADD peaking factor of 1.9 based on the maximum peaking factor between 2005 - 2010.

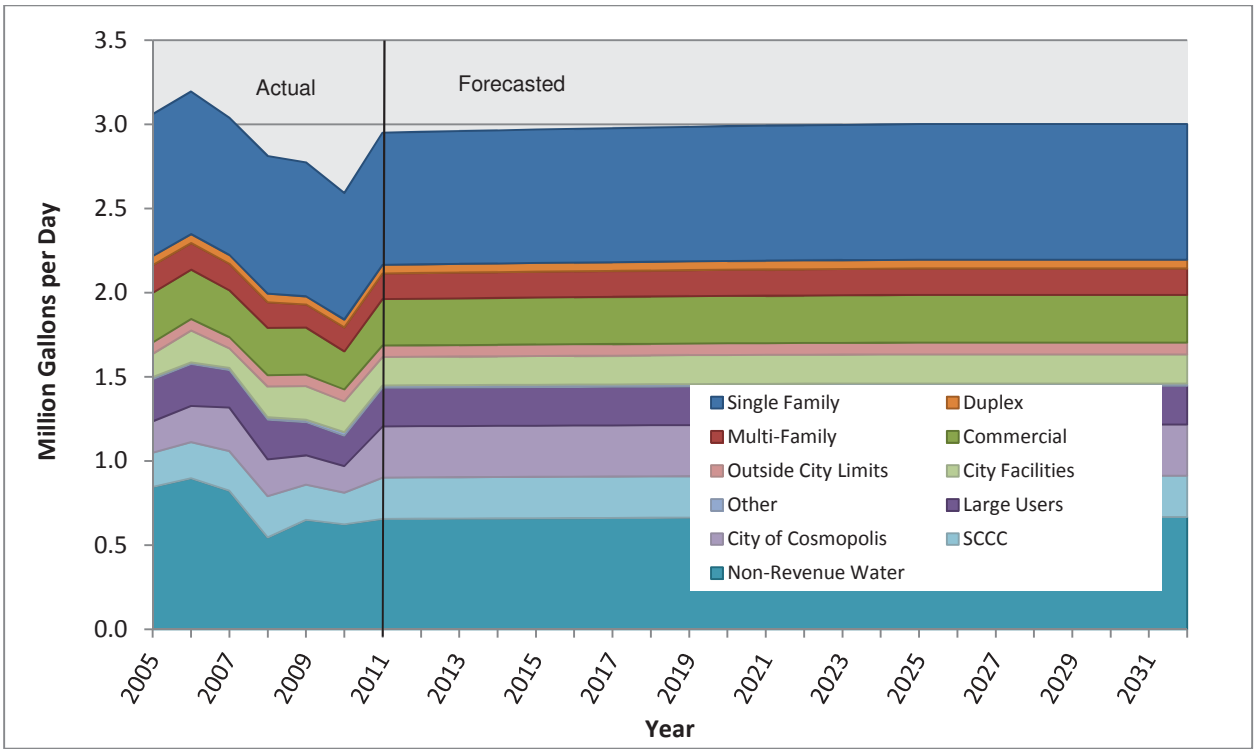


Figure 3-4. Demand Forecast ADD Details

Table 3-12. Water Demand Forecast Summary With and Without Additional Conservation

Year	Demand Without Additional Conservation		Demand With Additional Conservation	
	Average Day Demand (mgd)	Max Day Demand (mgd)	Average Day Demand (mgd)	Max Day Demand (mgd)
2012 (Base Planning Year)	2.96	5.62	2.94	5.58
2018 (Planning Year 6)	2.98	5.67	2.81	5.33
2032 (Planning Year 20)	3.00	5.70	2.82	5.37

4. Water Conservation Program

This chapter summarizes the City's compliance with conservation planning requirements, actions the City has taken to promote water use efficiency, and the conservation program the City will implement from 2013 through 2018.

4.1 Conservation Requirements and Compliance Summary

The conservation planning requirements that must be addressed in water system plans are contained in the following Washington State Department of Health (DOH) documents and State law:

- State of Washington Water Use Efficiency Rule (January 2007)
- Department of Health Water Use Efficiency Guidebook (January 2011)

The Water Use Efficiency Rule has several requirements and corresponding compliance dates. Some of the requirements are associated with water system plans, while other requirements are independent of the six-year water system planning cycle.

Table 4-1 lists the requirements of the Water Use Efficiency Rule and shows that the City is in compliance with these requirements. There are seven main categories of requirements: 1) water meters, 2) data collection, 3) distribution system leakage (DSL), 4) water use efficiency goals, 5) water use efficiency program, 6) demand forecast, and 7) performance reports.

Table 4-1. Compliance with Water Use Efficiency Rule Requirements

Category	WAC[1] Section	Compliance Date	Requirement	Aberdeen in Compliance?
1. Meters	246-290-496	Fully metered by January 22, 2017. Submit metering plan by July 1, 2008.	1. Meter all sources.	Yes. The meter at the WTP measures source production.
			2. Meter all service connections.	Yes. All service connections are metered.
			3. For systems not fully metered: Create meter installation plan, perform activities to minimize leakage until fully metered, and report annually on installation and leak minimization actions.	N/A
2. Data Collection	246-290-100	WSPs submitted after January 22, 2008.	1. Provide monthly and annual production/purchase numbers for each source.	Yes. See section 3.1
			2. Provide annual consumption by customer class.	Yes. See Section 3.2
			3. Provide "seasonal variations" consumption by customer class.	Yes. See Section 3.2
			4. Evaluate reclaimed water opportunities.	Because of the abundant source, transmission capacity, and locations of the City's existing industrial and domestic water systems, the City does not have the need to pursue opportunities in reclaimed water during the six-year planning period. The infrastructure required to convey reclaimed water from the treatment plant to potential customers is unnecessary given the current benefits available from the existing industrial water system.
			5. Provide annual quantity supplied to other public water systems.	Yes. The City meters water delivered to the City of Cosmopolis, Stafford Creek Correctional Center, and Hoquiam through an intertie during emergencies. (No water has been provided through interties with Hoquiam during the past six year period.)
			6. Consider water use efficiency rate structure.	Yes. The City has conservation based rates.

Category	WAC[1] Section	Compliance Date	Requirement	Aberdeen in Compliance?
3. Distribution System Leakage	246-290-820	First report completed by July 1, 2008. First compliance determination made by July 1, 2010.	1. Calculate annual volume and percent using formula defined in the Rule.	Yes. The City has calculated water loss in 2008, 2009, and 2010 for performance reports submitted to DOH.
			2. Report annually: annual leakage volume, annual leakage percent, and, for systems not fully metered, meter installation progress and leak minimization activities.	Yes. The City submitted annual reports to DOH for calendar years 2008, 2009, and 2010. See Appendix E for 2010 report.
			3. Develop water loss control action plan (if leakage is over 10% for 3 year average).	Yes. The City is tracking water loss and the average DSL (2008-2010) is 14.6%. A water loss control action plan is included in Section 4.6
4. Goals	246-290-830	Goals established by January 22, 2008.	1. Establish measurable (in terms of water production or usage) conservation goals and re-establish every 6 yrs. Provide schedule for achieving goals.	Yes. Goals were established in 2008. This is included in the annual WUE Reports submitted in 2008, 2009, and 2010.
			2. Use a public process to establish the goals.	
			3. Report annually on progress.	
5. Efficiency Program	246-290-810	WSPs submitted after January 22, 2008.	1. Describe existing conservation program.	Yes. Included in this WSP chapter.
			2. Estimate water saved over last 6 years due to conservation program.	
			3. Describe conservation goals.	
			4. Describe how customers will be educated on efficiency practices.	
			5. Describe conservation programs for next 6 years including schedule, budget, and funding mechanism.	
			6. Describe how efficiency program will be evaluated for effectiveness.	
			7. Implement or evaluate 1-12 measures, depending on size. (6 measures for systems like Aberdeen having 2,500 to 9,999 connections.)	Yes. The City has implemented and evaluated more than 6 measures.
			8. Estimate projected water savings from selected measures.	
			9. Estimate leakage from transmission lines (if not included in DSL).	Yes. There is a source meter at the WTP and a master meter at the transmission connection to the Fairview Reservoirs. Transmission leakage is calculated in Section 3.4.

Category	WAC[1] Section	Compliance Date	Requirement	Aberdeen in Compliance?
6. Demand Forecast	246-290-100	WSPs submitted after January 22, 2008.	1. Provide demand forecast reflecting no additional conservation. 2. Provide demand forecast reflecting savings from efficiency program. 3. Provide demand forecast reflecting all "cost effective" evaluated measures.	Yes. See Section 3.5 for water demand forecast. The City's conservation goals are to reduce distribution system leakage to 10% of production and reduce seasonal household water usage by 53 gallons per household.
7. Performance Reports	246-290-840	First report completed by July 1, 2008.	1. Develop annual report including: goals and progress towards meeting them, total annual production, annual leakage volume and percent, and, for systems not fully metered, status of meter installation and actions taken to minimize leakage. 2. Submit annually by July 1 to DOH and customers and make available to the public.	Yes. The City submitted annual reports for calendar years 2008 through 2010 as required.

[1] WAC = Washington Administrative Code

4.2 Conservation Goals

The Aberdeen City Council adopted water-use efficiency goals on May 13, 2009. These goals were to:

1) To reduce seasonal outdoor water use during the months June through August by one percent or approximately 53 gallons per household for in-city customers by 2015. This reduction is a total of 53 gallons from the three month summer period.
2) To reduce distribution system leakage to less than 10% of production by 2015.

4.3 Existing Conservation Program

In order to meet the City's conservation goals listed above, the following conservation measures have been employed in the City's conservation program:

- **Program Promotion**: The City promotes conservation through informational pamphlets inserted with customer bills, providing consumption information to customers compared with average residential consumption and historic consumption data of water usage. The annual Consumer Confidence Report includes water conservation practices for outdoor water use.
- **Customer Assistance**: The City assists customers in identifying leaks on the customer side of the meter and suggests improvements to repair the leaks. If the City identifies a leak on the customer side of the meter or if customer consumption data indicates water usage different than normal, the City alerts customers, who are encouraged to detect and fix leaks through a program offering bill adjustment to customers proving that they repaired a leak.
- **Conservation Rate Pricing**: The City established a conservation rate in January 2007; which customers could reduce their water bill by conserving water. A reduced monthly rate is charge for water usage below 4 CCF.
- **Customer Outreach**: The City provides rain gages, low flow valves, and educational outdoor conservation water use materials to encourage water conservation and reduce residential irrigation.
- **Water Meters**: The City completed a program in 2010 to install meters at every connection in the system and installed source meters and pressure zone meters. It is currently fully metered and tracking water loss. The City also setup a meter replacement schedule for the larger, out-dated commercial and industrial water meters which was completed in 2012. The City took steps to verify the collection of the monthly data and to have the source meters calibrated for accuracy.
- **Water Loss Management:** The primary focus of the City's conservation program is reducing supply side water loss through leak detection and repair. After becoming fully metered, the City increased its ability to track distribution leakage and actively repairs again piping and leaking valves.

4.4 Conservation Effectiveness Evaluation

The conservation measures employed by the City to meet established goals can be evaluated by comparing meter data. The City has source meters to monitor production, incoming and outgoing meters on its Fairview Reservoirs, and meters into each pressure zone. When compared with billing data collected for customer meters, historical water usage and

distributional system leakage is tracked to quantify the effectiveness of the City's conservation program.

The City began tracking seasonal water use in 2009 and found a reduction in seasonal water usage between 2009 and 2010. The City observed that the total household water usage for the months of June through August declined from 5,445 gallons in 2009 to 5,243 gallons in 2010. The reduction can be attributed to a less than average summer temperatures during 2010. Continued monitoring in the following years will provide more data to determine progress towards the City's seasonal water use reduction goal. To help meet that goal, educational outdoor conservation water use material was provided to the customers in July 2010.

DSL is tracked by comparing meter data at the Fairview Reservoir, pressure zone meters, and customer meters. Between 2008 and 2010, the average distribution leakage was 14.6%. While this is still above the goal of 10% DSL, the City has observed a significant reduction in DSL over the last 6 years from 20.5% (2005) to 13.8% (2010). An aggressive program to install new meters and repair aging pipe has resulted in this reduction. The City plans to continue monitoring its DSL and actively repair leaks and replace aging pipes to accomplish its goal.

4.5 2013-2018 Conservation Program

The City's water system changed dramatically in the past 10 years. Until recently, the service connections were unmetered and consumption and leakage was not able to be tracked accurately. After completing an aggressive program in 2010 to install meters in throughout its system, the City's ability to document DSL increased substantially. More accurate consumption data combined with an aggressive program to identify leaks and repair aging pipes and valves has result in substantive decreases in DSL.

The City's existing program is proactive and resulted in progress towards reaching its established goals. The City will continue its existing program to accomplish the goals to reduce seasonal water use and reduce DSL below 10% by 2015.

Measures that will be part of the City's 2013-2018 conservation program are described below.

- **Educational Materials:** The City will provide conservation information to customers in the form of educational material on conservation water use practices. Included in this program,
- **Rain Gauges:** The City will provide free rain gauges to encourage conservation of lawn watering.
- **Leak Notification*:*** The City will alert customers of abnormal water use determined on a monthly basis. The City will provide support to assist customers to repair leaks and credits for bill adjustment if leaks are repaired.
- **Conservation Rate Structure:** The City will use an inclining block rate structure for residential customers, which provides a strong incentive to manage water use.
- **Consumption History:** The City will provide consumption histories on customer bills for residential and commercial customers, enabling customers to track and manage their water use. This counts two measures because it is employed for both residential and commercial customers.
- **Water Meters:** The City will continue the mandatory measure to calibrate its source meters annually and replace aging meters to maintain accurate production and consumption data.

- **Water Loss Management:** This is a a major focus area for the City. Key activities include:
  - Continued identification of leaks in the distribution system
  - Replace aging piping and valves.

Implementation of additional measures will continue to be considered by the City in the future, in the context of available resources and competing priorities. Program accomplishments and City water demands will be reviewed annually in conjunction with preparation of the annual DOH Water Use Efficiency Performance Report.

4.6 Water Loss Control Action Plan

The City plans to reduce distribution system leakage from its present level (14.6 percent of production) to 10 percent of production by 2015.

The City recently completed a program to fully meter its system. The City is tracking DSL and intends to replace aging piping and leaking valves in the next six years to reduce its DSL. Pressure zone meters allow the City to track DSL in each pressure zone. The City contracted a leak detection service in the past and if necessary will perform leak detection in the future to identify leaks.

As a result of past activity, the City has repaired leaking infrastructure that reduced distribution system leakage from 20.5% in 2005 to 13.8% in 2010. The City will continue to repair leaks and replace piping to reduce DSL below 10% by 2015. The City budgets annually for pipeline renewal and replacement and identifies other aging mains that will be replaced in the next six years. These projects are included in Table 9-1.

5. Water Rights and Source Reliability

Since 1914, the City has relied on the Wishkah River as its potable water supply. This chapter describes the watershed, diversion facility, water availability, water rights in general, and water rights associated with this source.

5.1 Watershed Control Program

Watershed Description and Characteristics

The Wishkah River, at the point of diversion, drains a 7,400 acre basin in the foothills of the Olympic Mountains. The watershed ranges from 432 feet in elevation at the point of diversion to as high as 1,500 feet along the divide. It is predominantly second growth forest.

The City owns approximately 1,200 acres within the 7,400 acre watershed. A significant portion of the watershed not owned by the City is under the jurisdiction of the U.S. Forest Service, and the remainder is owned by ITT Rayonier, Simpson Timber Company, and Robert Reiner. The City's portion of the watershed is in the vicinity of the diversion structure and access is not granted to the public. Entry onto City and private property in the watershed is controlled in accordance with Grays Harbor County (County) Ordinance No. 50, which prohibits entry except for authorized purposes. The Forest Service property is closed to motorized vehicles but foot traffic, including hunting, is permitted. The perimeter of the watershed, except the Forest Service area, is posted with signs and yellow markings. During hunting season the watershed is patrolled frequently by Water Department personnel. During the remainder of the year it is randomly patrolled.

Much of the original timber in the watershed was harvested in the early 1900s and harvesting of mature second growth by the private landowners is ongoing. Most of the Forest Service property was logged in recent years. The City has not conducted timber sales on any of its 1,200 acres within the watershed boundary.

The City updated its Watershed Control Plan in 2011 and is approved by DOH. A copy is located in Appendix J.

Inventory of Potential Contaminant Sources

In July 2012, an inventory of potential contaminant sources was developed using Ecology's Facility/Site Identification Database (FSID). This database lists any operation that is a potential or active source of pollution. This includes gas stations, automotive stores, dry cleaners, gravel pits, waste management sites, and industrial facilities. Table 5-1 summarizes the review of the database, identifying all sites that were located within the 7,400 acre watershed area. The only sites identified in the database include the City's dam structures and headworks facilities (which are not really potential contaminant sources, but are listed here nonetheless since they are noted in the FSID).

Table 5-1. Potential Contaminant Sources

FID	DOE Facility ID	Site Name	Type of Point Source	Ecology Program
0	26946483	Wishkah Reservoir No 3 Dam	Dam Site	WATRES
1	45541625	ABERDEEN CITY WISHKAH HEADWORKS	Emergency/Haz Chem Rpt TIER2	HAZWASTE
2	75598245	Wishkah Reservoir No 2 Dam	Dam Site	WATRES
3	92457742	Malinoski Dam	Dam Site	WATRES

5.2 Diversion Facility

Water is drawn from an impoundment behind Malinowski Dam, a concrete gravity structure constructed in the early 1960s. The reservoir has an estimated storage capacity of 120 acre feet (AF). Although it can be drained through the Dam, the reservoir is generally operated with water flowing over the spillway crest to skim debris from the surface. The Dam appears to be well maintained and in excellent condition with few operational problems reported by City staff. Day-to-day maintenance, monitoring, and treatment operations are carried out by one operator that resides at the diversion facility site.

5.3 Water Rights

The availability of water from the Wishkah River for use by the City is dependent upon legal rights to withdraw and beneficially use the water, the hydrologic yield of the river, and the capacity of the transmission main. Previous studies have shown that the hydraulic yield is sufficient to meet the projected demands. Hydraulic analysis of the transmission main presented in Section 1.5.1 show that it has sufficient capacity to meet projected demands. The following sections are a discussion of existing water rights and an evaluation to meet projected demands.

5.3.1 Existing Water Rights

The City's water rights, as summarized on Table 5-2, include two claims to vested right, three reservoir certificates, and five surface water certificates. This table includes all sources, including the industrial water supply from the Wynoochee River.

The two claims are for 8.9 cubic feet per second (cfs) and 55 cfs from Stewart Creek and the Wishkah River, respectively. As indicated in Section 5.4, these are not confirmed water rights.

One of the reservoir certificates (48 AF) relates to the Wishkah River; a second (600 AF) for Lake Aberdeen; and the third (70,000 AF) for storage behind the Wynoochee Dam on the Wynoochee River.

Appropriations from the Wynoochee River are under two certificates for 110 cfs and 25 cfs and one for 1,400 cfs (this is for power purposes). The City also has a certificate for 0.03 cfs from "C" Creek and 5.0 cfs from Elliott Slough Creek.

Table 5-2. Summary of Water Rights

Source	P.O.D. Location[1]	Water Right Identifier[2]	Date of Priority	cfs	Quantities		Comments
					MGD	AF/yr	
Stewart Creek	T.17N.R09W-04C	Claim #002922	12/1891	8.9	5.75	6,450	(3)
Wishkah River	T.21N.R08W-33F&M	Claim #002299	12/12/16	55	35.54	40,000	(4)
Wishkah River	T.21N.R08W-28N	C-327	04/12/28			48	(5)
"C" Creek	T.21N.R08W-33E	SWC-434	11/16/29	0.03	0.02		(6)
Elliott Slough	T.17N.R09W-01	SWC-5345A	01/15/27			600	(7)
Van Winkle Creek	T.18N.R09W-36	SWC-5345B	01/15/27	5	3.23		
Wynoochee River	T.22N.R07W-20E	R2-00905C	01/18/29			70,000	(8)
Wynoochee River	T.18N.R08W-28	SWC-7097	01/15/27	110	71.09		(9)
Wynoochee River	T.18N.R08W-28F	S2-00140A	03/24/55	25	16.16	18,372	(10)
Wynoochee River	T.22N.R07W-20C	S2-25765C	11/26/80	1,400			(11)
			Total	195.03	126.04	129,020	(12)

(1) The location of point of diversion (POD) is given by township, range, section, and where possible from the water right printout, the 40-acre tract within the section. For example, in the POD location T.17N.R09W-04C, the part preceding the hyphen indicates the township and range north and west of the Willamette base line and meridian, respectively. The number following the hyphen indicates the section (4) and the letter (C) gives the 40-acre tract within the section which corresponds to the NE 1/4 of the NW 1/4 of Section 4, as shown in the schematic below:

D	C	B	A
E	F	G	H
M	L	K	J
N	P	Q	R

(2) The water right identifier numbers represent claim numbers, certificate numbers, and/or permit numbers. The number R2-00905C is a reservoir certificate.

(3) This is a claim of water right filed in 1971 pursuant to Chapter 90.14 RCW. The purpose of use is described as municipal supply (emergency use) with the place of use being: within the boundaries of the city limits of the City of Aberdeen T.17N.R9W.W.M.

(4) This claim identifies two points of diversion, one authorized by Certificate of Change No. 259, which moved 10.5 cfs of the originally appropriated 55 cfs to the SE 1/4 of the NW 1/4 of Sec. 33, T.21N.R8W.W.M. The purpose of use is municipal supply and the place of use is described as: within the boundaries of the city limits of the City of Aberdeen T.17N.R9W.W.M.

(5) This certificate authorizes the storage of 48 acre-feet for domestic and industrial use within the City of Aberdeen.

(6) This certificate does not identify an annual authorization. The purpose of use is domestic and operation of a chlorine feeder and the place of use is the SE 1/4 of the NW 1/4 of the SW 1/4 of Sec. 33, T.21N.R8W.W.M.

(7) This certificate authorizes an appropriation of 5 cfs for manufacturing and domestic supply purposes and the storage of 600 acre feet in Lake Aberdeen. The purpose of use for the stored waters is identified as domestic supply and industrial water supply. The place of use is "City of Aberdeen, Grays Harbor County, Washington."

(8) This reservoir certificate authorizes the storage and use of waters for municipal and industrial supply with the place of use described as: area served by City of Aberdeen."

(9) This certificate does not have an annual quantity identified. The purpose of use is identified as industrial and domestic use and the place of use is: "City of Aberdeen."

(10) This certificate is for municipal and industrial supply with the place of use shown as: Area served by City of Aberdeen. Use of this authorized 25 cfs during low flow periods is constrained by a complex set of minimum flow conditions on the water right. A Superseding Certificate was issued by Ecology in 2000 to reduce the original right from 45 to 25 cfs. The remaining 20 cfs was transferred to the Grays Harbor Public Development Authority to be diverted from Ranney Collectors adjacent to the Chehalis River.

(11) The purpose of use is "hydroelectric power" and permit is conditioned with minimum flow requirements pursuant to Chapter 173-522 WAC.

(12) Quantity on the Stewart Creek Claim No. 002922 has not been included in totals because it is identified for emergency use; quantity under S2-25765C not included because it is only for power generation purposes.

5.3.2 Water Rights Evaluation

Chapter 3, and specifically Table 3-11, contains information on existing and projected residential and commercial water use by the City for the areas currently served by the City's domestic water supply system. The source for this water use is the Wishkah River. No analysis of this nature is being performed under this update to the WSP for the industrial water use, which has the Wynoochee River as the source. This section will therefore only address the water rights evaluation for the Wishkah River source.

As discussed in Section 5.3 - Water Availability, and shown in Table 5-1, the City has a water right claim to support the diversion from the Wishkah River for domestic/municipal supply. This claim is for 55 cfs (35.54 mgd) and 40,000 acre-feet per year (AF/yr) and is shown to have a priority date of December 12, 1916. The basis for this claim is that the initial diversion of water from this source predated the 1917 Surface Water Code. The City has complied with the requirements of the Water Code by filing a water right claim for this use of water.

Tables 5-3 and 5-4 show the City's existing and forecasted water rights status, respectively. The City's average day and peak day existing and projected water use were converted to AF/yr and cfs, respectively, to equate the terms to those normally used to describe water rights, then compared to the quantities shown for the City's water right claim for water use from the Wishkah River. This comparison shows a surplus in water rights for the 20-year projection for both the average day and peak day basis. The surplus in water rights shown in Table 5-4 amount to over 35,000 AF/yr and over 44 cfs for the 20-year projection period.

Table 5-1. Existing Water Rights Status

Permit, Certificate or Claim #	Name of Rightholder or Claimant	Priority Date	Source Name/ Number	Primary or Supplemental	Existing Water Rights		Existing Consumption		Current Water Right Status (Excess/Deficiency)	
					Maximum Instantaneous Flow Rate(Qi) gpm/cfs	Maximum Annual Volume(Qa) AF/yr	Maximum Instantaneous Flow Rate (Qi) gpm/cfs	Maximum Annual Volume (Qa) Af/yr	Maximum Instantaneous Flow Rate (Qi) gpm/cfs	Maximum Annual Volume (Qa) AF/yr
002299	City of Aberdeen	12/12/1916	Wishkah River	Primary	55	40,000	9.8	4,246	45.2	35,754
							6.35 Peak Day (mgd)	3.79 Average Day (mgd)		

Intertie Name/Identifier	Name of Purveyor Providing Water	Existing Limits on Intertie Water Use		Existing Consumption through Intertie		Current Intertie Supply Status (Excess/Deficiency)	
		Maximum Instantaneous Flow Rate (Qi)	Maximum Annual Volume (Qa)	Maximum Instantaneous Flow Rate (Qi)	Maximum Annual Volume (Qa)	Maximum Instantaneous Flow Rate (Qi)	Maximum Annual Volume (Qa)
Hoquiam Emergency Intertie	City of Hoquiam	1.5	--	0	--	1.5	--
		1 mgd					

Pending Water Right Applications	Name on Application	Date Submitted	Primary or Supplemental	Maximum Instantaneous Flow Rate (Qi) Requested	Maximum Annual Volume (Qa) Requested
None					

Table 5-2. Forecasted Water Right(s) Status

Permit, Certificate or Claim #	Name of Rightholder or Claimant	Priority Date	Source Name /Number	Primary or Supplemental	Existing Water Rights		Forecasted Water Use From Sources (20 Year Demand)		Forecasted Water Rights Status (Excess/Deficiency – 20 Year Demand in Water Right)	
					Maximum Instantaneous Flow Rate(Qi) gpm/cfs	Maximum Annual Volume(Qa) AF/yr	Maximum Instantaneous Flow Rate (Qi) gpm/cfs	Maximum Annual Volume (Qa) AF/yr	Maximum Instantaneous Flow Rate (Qi) gpm/cfs	Maximum Annual Volume (Qa) AF/yr
002299	City of Aberdeen	12/12/1916	Wishkah River	Primary	55	40,000	10.8	4,649	44.2	35,351
							6.98 (Peak Day mgd)	4.15 (Average Day mgd)		

Intertie Name/Identifier	Name of Purveyor Providing Water	Existing Limits on Intertie Water Use		Existing Consumption through Intertie		Current Intertie Supply Status (Excess/Deficiency	
		Maximum Instantaneous Flow Rate (Qi)	Maximum Annual Volume (Qa)	Maximum Instantaneous Flow Rate (Qi)	Maximum Annual Volume (Qa)	Maximum Instantaneous Flow Rate (Qi)	Maximum Annual Volume (Qa)
Hoquiam Emergency Intertie	City of Hoquiam	1.5	--	0	--	1.5	--

Pending Water Right Applications	Name on Application	Date Submitted	Primary or Supplemental	Maximum Instantaneous Flow Rate (Qi) Requested: gpm or cfs	Maximum Annual Volume (Qa) Requested: AF/yr
None					

5.4 Reclaimed Water

As noted in the previous water rights sections, the City of Aberdeen has an abundant source for water. The existence of the City's industrial water system, combined with capacity of the City's domestic water system, has limited the City's need to investigate reclaimed water opportunities.

With additional improvements, the City's wastewater treatment plant could potentially produce reclaimed water. However, the infrastructure required to convey reclaimed water from the treatment plant to potential customers is unnecessary given the current benefits available from the existing industrial water system.

For the long term, if needed, the City will consider opportunities for use of industrial water to help offset demands on the domestic water system. Potential transfers of domestic water users to industrial water may include City parks, playgrounds, and schools in the vicinity of the existing industrial water line. The cost of infrastructure to serve these customers types from the industrial water line, including pipelines and pump stations, will be evaluated and compared with the cost of additional domestic water system capacity, if needed.

6. Water Quality

This chapter provides a review of current state and federal drinking water quality regulations to assess Aberdeen's compliance with these regulations between 2005 and 2010. In addition, this chapter describes the City's efforts in responding to customer complaints and the conducting of additional monitoring for the purpose of customer acceptability. Finally, this chapter reviews proposed and possible future regulations and the City's needs in planning for future compliance.

6.1 System Overview and Water Quality Compliance Responsibility

The City has one active source of supply: The Wishkah River. The City treats the surface water from this source at the Water Treatment Plant (WTP) through treatment processes consisting of coagulation, pre-filtration, micro filtration, and addition of chlorine (to provide disinfection and a disinfectant residual in the transmission and distribution systems) and fluoride. The WTP also provides alkalinity and pH adjustment for corrosion control.

As a Group A public water system, the City is required to follow Chapter 246-290 WAC which implements the Safe Drinking Water Act (SDWA). The City is required to comply with the monitoring requirements according to this chapter unless DOH allows the City to reduce these requirements. The monitoring frequency may be decreased by DOH if the previous results show the concentrations of a particular contaminant are below 50% of its maximum contaminant level (MCL).

6.2 Drinking Water Regulatory Framework

Washington State drinking water suppliers are subject to both federal and state drinking water regulations. At the federal level, the SDWA (1974) and SDWA Amendments (1986 and 1996) give the United States Environmental Protection Agency (USEPA) the responsibility of developing and administering national standards for drinking water quality. Table 6-1 presents a list of federal drinking water regulations that have been developed as part of the SDWA and amendments that were in effect between 2005 and 2011, which is the period under review for this Water System Plan (WSP) update. Proposed regulations that are anticipated to become effective in the future are discussed later in this chapter.

The Department of Health (DOH) is the primacy agency responsible for ensuring that drinking water laws are implemented and enforced. Washington State must adopt laws at least as stringent as federal regulations. When a federal drinking water law has yet to be included in state drinking water codes, drinking water suppliers are responsible for meeting federal regulatory requirements as put forth by the USEPA.

The City is a Group A system: A drinking water system that provides water to 15 or more service connections used by year-round residents for 180 or more days within a calendar year, or regularly serving at least 25 year-round residents.

Table 6-1. Federal Drinking Water Regulations Applicable to Aberdeen

Rule and Date Rule Became Effective	Parameters Regulated
National Primary Drinking Water Requirements (1976)	Physical and chemical
Radionuclides Rule (1976)	Gross alpha and beta emitters, radium-226, and radium-228
Total Trihalomethane Rule (1979) (1)	Trihalomethanes
Phase I (VOCs) and Phase II and Phase V (IOCs and SOCs) - 1989 and 1993, respectively	Volatile organic chemicals (VOCs), inorganic chemicals (IOCs), and synthetic organic chemicals (SOCs)
Surface Water Treatment Rule (1990)	Turbidity, disinfection, viruses, *Giardia lamblia*, and disinfectant residual
Total Coliform Rule (1990)	Coliform bacteria
Lead and Copper Rule (1992) and Lead and Copper Rule Minor Revisions (2000)	Lead and copper and treatment for corrosion control
Consumer Confidence Rule (1998)	Water quality compliance reporting to customers
Interim Enhanced Surface Water Treatment Rule (1999)	Turbidity and *Cryptosporidium*
Unregulated Contaminant Monitoring Rule (2000) (2)	Monitoring for contaminants included on assessment and screening lists
Public Notification Rule (2000)	Notification of public after water quality violation
Stage 1 Disinfectants/Disinfection By-Products Rule (2002)	Disinfectant residual, total trihalomethanes (TTHMs), and haloacetic acids (HAA5)
Radionuclides Rule (2003)	Radionuclides
Arsenic Rule (2006)	Arsenic
Stage 2 D/DBP Rule (2006)	TTHMs, HAA5
Long Term 2 Enhanced Surface Water Treatment Rule (2006)	Cryptosporidium
Unregulated Contaminant Monitoring Rule 2 (UCMR2) (2007)	Monitoring for contaminants included on assessment and screening lists

(1) Replaced by the Stage 1 Disinfectants/Disinfection By-Products Rule in 2002.
(2) Replaced by the Unregulated Contaminant Monitoring Rule 2 in 2006.

6.3 Overview of Drinking Water Regulations and Aberdeen's Compliance

The regulations listed in Table 6-1 have been incorporated into WAC 246-290. The descriptions of these regulations in this section of the water system plan are organized to reflect how they apply to the City's drinking water processes:

- Treatment Regulations – Surface Water Treatment Rule (SWTR), Interim Enhanced SWTR, Long Term 2 Enhanced Surface Water Treatment Rule (LT2ESWTR).
- Finished Water Regulations – Phase I, II, and V Rules (including asbestos which is monitored in the distribution system), Radionuclides Rule, and Unregulated Contaminant Monitoring Rule.
- Distribution System Regulations – Total Coliform Rule, Lead and Copper Rule, and Stage 1 Disinfectants/Disinfection By-Products (D/DBP) Rule, Stage 2 D/DBP Rule.
- Consumer Confidence and Public Notification – Consumer Confidence Rule and Public Notification Rule.

The City's compliance with state and federal regulations in each of these categories between 2005 and 2011 is described below.

6.3.1 Treatment Regulations

The Surface Water Treatment Rules apply to drinking water treatment processes. Compliance with these regulations is based on treatment techniques instead of Maximum Contaminant Levels (MCLs).

Surface Water Treatment Rules

Regulatory Requirements

The Surface Water Treatment Rule (SWTR) was issued in 1989 and applies to water systems using surface water or groundwater under the influence of surface water (GUI). The SWTR applies to filtration and disinfection as treatment techniques to regulate the presence of turbidity, *Giardia lamblia,* viruses, *Legionella*, and disinfectant levels in finished drinking water. A minimum three log-removal/inactivation of Giardia (99.9%) and four log-removal/inactivation of viruses (99.99%) are required under this rule.

In addition to treating water to meet removal/inactivation requirements for *Giardia* and viruses, systems must meet performance criteria for turbidity and disinfection. With respect to turbidity, systems must produce water with a turbidity of less than 0.5 nephelometric turbidity units (NTUs) in 95 percent of the samples collected each month. This requirement is superseded by IESWTR requirements discussed later in this section. To meet disinfection performance criteria, systems must provide at least 0.2 milligrams per liter (mg/L) of residual disinfectant at the distribution system entry point and a detectable level of disinfectant must be present throughout the distribution system. WAC 246-290-654 provides compliance guidance pertinent to the SWTR, and includes operating requirements for filtration treatment plants (coagulation, flocculation, sedimentation and filtration). Finally, the SWTR and WAC 246-290-668 require purveyors to develop and implement a DOH-approved watershed control program.

The Interim Enhanced Surface Water Treatment Rule (IESWTR) was issued in 2001 and builds upon the SWTR without replacing it. The IESWTR strengthened filtration requirements for combined filter effluent turbidity performance, requiring turbidity to be less than 0.3 NTU in at least 95 percent of turbidity measurements per month. The maximum allowable finished water turbidity was established as 1.0 NTU. Finally, the IESWTR requires systems to conduct monitoring of individual filter effluent in addition to combined filter effluent monitoring, and all new finished water storage facilities to be covered.

In addition, the IESWTR establishes a maximum contaminant level goal of zero for *Cryptosporidium* and requires 2-log *Cryptosporidium* removal. If the PWS meets filtered water turbidity criteria, it is assumed to achieve 2-log *Cryptosporidium* removal.

Aberdeen's Status

Aberdeen demonstrates treatment effectiveness for *Giardia lamblia* cyst and *Cryptosporidium* oocysts removal by filtration using the turbidity reduction method specified in WAC 246-290-654. This method requires systems to demonstrate either 1) an 80% reduction in source water turbidity based on an average of daily turbidity reductions for each calendar month; or 2) an average daily filtered turbidity less than or equal to 0.1 NTU.

Between the years 2005 and 2010, Aberdeen's WTP recorded an average daily measurement of turbidity that is consistently 0.03 NTU. Source water turbidity is typically 1-2 NTU but may vary depending on the season. The WTP achieves a reduction in source water turbidity that is consistently above 97%.

Aberdeen had no treatment violations between 2005 and 2010 and is in compliance with the Surface Water Treatment Rules.

Long Term 2 Enhanced Surface Water Treatment Rule

The Long Term 2 Enhanced Surface Water Treatment Rule (LT2 Rule) was promulgated in January 2006 and became effective on March 6, 2006. This regulation applies to public water systems using surface water or groundwater under the influence of surface water sources. This rule was developed to protect drinking water consumers from microbiological pathogens, especially *Cryptosporidium*. *Cryptosporidium*, which can be found in surface water supplies, is of particular concern because it can cause cryptosporidiosis, a gastrointestinal illness that can have severe impacts on people with weakened immune systems. Additionally, *Cryptosporidium* is resistant to chlorination.

The rule bolstered prior regulations and provides a higher level of protection of the drinking water supply by:

- Targeting additional Cryptosporidium treatment requirements to higher risk systems
- Requiring provisions to reduce risks from uncovered finished water storage facilities
- Ensuring that systems maintain microbial protection as they take steps to reduce the formation of disinfection byproducts.

The LT2 Rule establishes the following types of requirements:

- Two distinct rounds of source water monitoring for *Cryptosporidium* and *E. coli*
- Profiling and benchmarking requirements
- Treatment technique requirements
- Microbial toolbox for meeting inactivation requirements
- Covering finished water storage facilities
- Sanitary surveys.

Filtered and unfiltered systems must conduct 12 or 24 months of source water monitoring for Cryptosporidium to determine treatment requirements. To reduce monitoring costs, small filtered water systems will first monitor for *E. coli*–a bacterium that is less expensive to analyze than *Cryptosporidium*–and will be monitor for *Cryptosporidium* only if their *E. coli* results exceed specified concentration levels. Bigger water systems need to monitor both *E. coli* and *Cryptosporidium.*

Treatment: Filtered water systems are classified in one of four treatment categories (bins) based on their monitoring results. Most systems are expected to be classified in the lowest bin and will face no additional requirements. Systems classified in higher bins must provide additional water treatment to further reduce Cryptosporidium levels by 90 to 99.7 percent (1.0 to 2.5-log), depending on the bin. Systems will select from different treatment and management options in a "microbial toolbox" to meet their additional treatment requirements. All unfiltered water systems

must provide at least 99 or 99.9 percent (2 or 3-log) inactivation of Cryptosporidium, depending on the results of their monitoring.

Uncovered Finished Water Reservoirs: Systems that store treated water in open reservoirs must either cover the reservoir or treat the reservoir discharge to inactivate 4-log virus, 3-log *Giardia lamblia*, and 2-log *Cryptosporidium*. These requirements are necessary to protect against the contamination of water that occurs in open reservoirs.

Disinfection Benchmarking: Systems must review their current level of microbial treatment before making a significant change in their disinfection practice. This review will assist systems in maintaining protection against microbial pathogens as they take steps to reduce the formation of disinfection byproducts under the Stage 2 Disinfection Byproducts Rule, which EPA is finalizing along with the LT2ESWTR.

Monitoring starting dates are staggered by system size. The largest systems (serving at least 100,000 people) began monitoring in October 2006 and the smallest systems (serving fewer than 10,000 people) began monitoring in October 2008. After completing monitoring and determining their treatment bin, systems generally have three years to comply with any additional treatment requirements. Systems must conduct a second round of monitoring six years after completing the initial round to determine if source water conditions have changed significantly.

Systems that are consecutive systems, purchasing some or all of their water from another system, and systems that sell water wholesale must comply with the LT2 Rule on the same schedule based on the largest system in the combined distribution system. A combined distribution system consists of the interconnected wholesale systems and consecutive systems that receive finished water from those wholesale system(s).

Aberdeen's Status

The City of Aberdeen began source water (untreated) monitoring for Cryptosporidium, E. coli, and turbidity on April 8, 2008, and concluded on March 9, 2010. Following the 24 months of sampling, the City calculated the initial Cryptosporidium bin concentration and reported the initial bin classification to DOH on July 28, 2010.

Based on the results of the 24 months of monitoring for LT2, the Wishkah River source had 0.017 oocysts/L, placing the source in a bin 1 classification. Under this classification, no additional treatment for Cryptosporidium is required.

A second round of source monitoring is required as part of the LT2ESWTR. The sampling plan for round two is due July 1, 2016, and sampling must start by October 1, 2016.

Table 6-2. Timeline for LT2 Compliance

Milestone	Date (for Schedule 3 Water System)	City's Status
Submit *E. coli* monitoring results for data to have grandfathered	June 1, 2008	None Submitted
Complete initial round of E. coli monitoring and assess bin classification	March, 2010	July 28, 2010
Begin second round of monitoring for *E. coli* and re-assess bin classification	October 1, 2016	Pending

6.3.2 Finished Water Regulations

The Phase I, II, and V, Radionuclides, and Unregulated Contaminant Monitoring Rules apply to drinking water after it has been treated (except for asbestos, which is regulated under Phase II and is actually monitored in the distribution system). With the exception of the Unregulated Contaminant Monitoring Rule, these regulations establish Maximum Contaminant Levels (MCLs) for inorganic chemicals, synthetic and volatile organic chemicals, and radionuclides.

Phase I, II, and V Rules

Regulatory Requirements

Monitoring requirements and MCLs for inorganic (IOC), synthetic organic (SOC), and volatile organic (VOC) chemicals are addressed by federal Organic, Synthetic Organic and Inorganic Chemicals Phases I, II, and V Rules and WAC 246-290-300. Under Phases II and V, MCLs are set for 16 inorganic, 30 synthetic, and 21 volatile organic contaminants. Required testing is determined by DOH based on a vulnerability assessment. WAC 246-290-300 requires monitoring of IOCs, VOCs, and SOCs at each source on 12- to 36-month sampling cycles, depending on the contaminant and source type.

Table 6-3 presents a list of the inorganic chemicals (except asbestos) that Washington systems must monitor for each year and the MCL for each parameter. These parameters are monitored after treatment, before entering the distribution system. Systems that have a significant amount of asbestos-cement piping must monitor for asbestos once every nine years. Nitrate and nitrite are measured each year and monitoring cannot be waived.

With respect to SOCs, systems are required to conduct monitoring twice every three years after treating the water and before it enters the distribution system, unless DOH issues waivers. Table 6-4 lists the SOCs and MCLs.

Table 6-5 presents a list of the VOCs and MCLs. These samples are collected once per year after treatment and before the water enters the distribution system.

Aberdeen's Compliance Status

Inorganic Chemicals (IOCs)

The City's monitoring results for inorganic chemicals are compared to the regulatory requirements in Table 6-3. As shown, none of the monitoring results for these parameters exceeded the MCL. Between 2005 and 2010, the City collected one sample per year. Furthermore, for the compliance period from 2011 to 2013, one sample per year is required to be collected.

With respect to asbestos, a sample was taken in 2009 with no detection. Currently, Aberdeen has a monitoring waiver through December 2019 for this parameter.

Synthetic Organic Chemicals (SOCs)

SOCs include testing for herbicides (test method 515.1), pesticides (test method 525.2), and carbamates (test method 531.1). DOH regulations require that the SOC sample location be located from a point representative of the source after treatment and prior to entry to the distribution system. A summary of test results is located in Table 6-4. There were no detections of any SOC from 2005 to 2010.

A DOH waiver was issued for monitoring of insecticides, and no sample was required during the 2008-2010 compliance period. For the compliance period from 2011 to 2013, all SOCs require two samples to be collected.

There is a waiver for Dioxin, Endothall, EDB and other soil fumigants, Glyphosphate, and Disquat that requires no sampling through 2013.

Volatile Organic Chemicals (VOCs)

The testing for VOCs, which began in 1989, included eight chemicals. Phase II increased the requirements to 18 contaminants. This group includes solvents, degreasers, and industrial chemicals. The frequency for VOC sampling is one per year.

Aberdeen has conducted the required annual VOC monitoring. Samples at the water treatment plant were collected annually in May. Results are shown in Table 6-5. VOCs were not detected in any of the samples. There have been consistent detections of Chloroform and Bromodicholoromethane. These are listed as EPA unregulated VOCs.

Table 6-3. Primary Inorganic Chemicals - Regulatory Levels and Monitoring Results

Parameter	MCL	Units	Observed Range (2005 – 2011)
EPA Regulated (Primary)			
Antimony	0.006	mg/L	<0.005 mg/L
Arsenic	0.05	mg/L	<0.002 mg/L
Asbestos	7	million fibers/liter (longer than 10 microns)	State Waiver through 2019
Barium	2	mg/L	<0.01 mg/L
Beryllium	0.004	mg/L	<0.003 mg/L
Cadmium	0.005	mg/L	<0.002 mg/L
Chromium	0.1	mg/L	<0.01 mg/L
Cyanide	0.2	mg/L	<0.05 mg/L
Fluoride	4.0	mg/L	0.7 - 1.1 mg/L
Mercury	2	µg/L	<0.0005 mg/L
Nickel	0.1	mg/L	<0.04 mg/L
Nitrate-N	10.0	mg/L (as N)	<0.2-0.2 mg/L
Nitrite-N	1.0	mg/L (as N)	<0.2 mg/L
Selenium	0.05	mg/L	<0.005 mg/L
Thallium	0.002	mg/L	<0.002 mg/L
EPA Regulated (Secondary) (1)			
Iron	0.3	mg/L	<0.1 mg/L
Manganese	0.05	mg/L	<0.001 mg/L
Silver	0.1	mg/L	<0.001 mg/L
Chloride	250	mg/L	4 mg/L
Sulfate	250	mg/L	<1-1 mg/L
Zinc	5	mg/L	<0.2 mg/L
State Regulated			
Hardness	NA	mg/L	20-34 mg/L
Conductivity	700	Umhos/cm	48-72
Sodium(1)	NA	mg/L	8-8 mg/L
Color	15	Color units	<5

mg/L = milligrams per liter
µg/L = micrograms per liter
N = Nitrogen
Umhos/cm = micromhos per centimeter
MCL = Maximum Contaminant Level
ND = Not detected
(1) The USEPA has established a recommended drinking water equivalent level 20 mg/L for sodium. This is a non-enforceable guidance level. Additionally, in 2003, the USEPA made a regulatory determination for sodium, indicating that setting an MCL would not provide "a meaningful opportunity to reduce health risk."

Table 6-4. Synthetic Organic Chemicals - Regulatory Levels and Monitoring Results

Parameter (EPA Regulated)	MCL (mg/L)	Observed Range (2005-2010)
Alachlor (Lasso)	0.002	ND
Aldicarb (Temik)	Not Applicable	ND
Aldicarb sulfone	Not Applicable	ND
Aldicarb sulfoxide	Not Applicable	ND
Atrazine	0.003	ND
Benzo[a]pyrene	0.0002	ND
Carbofuran (1)	0.04	ND
Chlordane	0.002	ND
2,4-D	0.07	ND
Dalapon	0.2	ND
Di(2-ethylhexyl)adipate	0.4	ND
Di(2-ethylhexyl)phthalate	0.006	ND
Dibromochloropropane (1)	0.0002	Not Analyzed
Dinoseb	0.007	ND
2,3,7,8-TCDD (Dioxin) (1)	$3x10^{-8}$	State waiver through 2013
Diquat (1)	0.02	State waiver through 2013
Endothall (1)	0.1	State Waiver through 2013
Endrin	0.002	ND
Ethylene dibromide (1)	0.00005	State Waiver through 2013
Glyphosate(1) (Rodeo, Round-up)	0.7	State Waiver through 2013
Heptachlor	0.0004	ND
Heptachlor epoxide	0.0002	ND
Hexachlorocyclopentadiene	0.05	ND
Hexacholorbenzene	0.001	ND
Lindane (BHC-gamma)	0.0002	ND
Methoxychlor	0.04	ND
Oxamyl (Vydate)	0.2	ND
Pentachlorophenol	0.001	ND
Picloram	0.5	ND
Polychlorinated biphenyls	0.0005	Not Analyzed
Simazine	0.004	ND
Toxaphene	0.003	ND
2,4,5-TP (Silvex)	0.05	ND

mg/L = milligrams per liter
MCL = Maximum Contaminant Level
NA = Not applicable
ND = Not detected
(1) Waived until December 2010.

Table 6-5. Volatile Organic Chemicals - Regulatory Levels and Monitoring Results

Parameter	Units	MCL	Observed Range (2005-2010)
1,1 – Dichloroethylene	mg/L	0.007	ND
1,1,1-Trichloroethane	mg/L	0.2	ND
1,1,2-Trichloroethane	mg/L	0.005	ND
1,2,4-Trichlorobenzene	mg/L	0.07	ND
1,2-Dichloroethane	mg/L	0.005	ND
1,2-Dichloropropane	mg/L	0.005	ND
Benzene	mg/L	0.005	ND
Carbon tetrachloride	mg/L	0.005	ND
cis-1,2-Dichloroethylene	mg/L	0.07	ND
Dichloromethane (methylene chloride)	mg/L	0.005	ND
Ethylbenzene	mg/L	0.7	ND
Monochlorobenzene (chlorobenzene)	mg/L	0.1	ND
o-Dichlorobenzene	mg/L	0.6	ND
p-Dichlorobenzene	mg/L	0.075	ND
Styrene	mg/L	0.1	ND
Tetrachloroethylene	mg/L	0.005	ND
Toulene	mg/L	1	ND
trans-1,2-Dichloroethylene	mg/L	0.1	ND
Trichloroethylene	mg/L	0.005	ND
Vinyl chloride	mg/L	0.002	ND
Xylenes (total)	mg/L	10	ND

mg/L -= milligrams per liter
MCL = Maximum Contaminant Level
ND = Not Detected.

Radionuclides

Regulatory Requirements

Regulatory requirements for radionuclides changed between 2000 and 2005. The original Radionuclides Rule, which went into effect in 1978, was revised in December 2000, with these revisions becoming effective during December 2003. Before 2003, WAC 246-290 required systems to monitor gross alpha particle activity, radium-226, and radium-228. Systems were required to conduct monitoring every 4 years for four consecutive quarters. If a system could demonstrate that gross alpha activity was below 5 picocuries per liter (pCi/L), then the system did not need to conduct monitoring for radium-226 and radium-228.

The new rule includes MCLs for the sum of radium-226 and radium-228 (5 pCi/L), adjusted gross alpha emitters (15 pCi/L), gross beta and photon emitters (4 millirems per year [mrem/year]), and uranium (0.03 mg/L). Systems are required to conduct initial monitoring between 2003 and 2007, unless earlier radionuclide data can be used as grandfathered data. Under the new rule, monitoring for radionuclides must be conducted at each entry point to the

distribution system. The required monitoring frequency will depend on system contaminant levels seen during initial monitoring.

Aberdeen's Compliance Status

Current monitoring frequency for radium 228 is one sample every three years for radium-228 and gross alpha particle activity. The City monitors water from the treated water line at the WTP.

Samples collected on January 24, 2005 at the water treatment plant were tested for Radium 228. On August 19, 2010, samples were collected for Gross Alpha and Radium 228. Radiological parameters were not detected in any samples. Because the level of gross alpha emitters was below 15 pCi/L, Aberdeen was not required to monitor uranium levels. The City maintained compliance with these monitoring requirements and associated MCLs between 2005 and 2010.

Arsenic Rule

The original arsenic MCL of 0.05 mg/L was established as part of the 1975 National Interim Primary Drinking Water Regulations. After additional health effects research and cost/benefit analysis, the USEPA published the final Arsenic Rule in January 2001. The rule, which became effective January 2006, revises the arsenic MCL downward to 0.010 mg/L and identifies several best available treatment technologies (BATs) for compliance. Compliance with the new MCL is based on the running annual average of monitoring results at each entry point to the distribution system. The rule makes arsenic monitoring requirements consistent with monitoring for other IOCs regulated under the Phase II/V standardized monitoring framework. However, if arsenic is detected above the MCL in any individual sample, the system must increase the frequency of monitoring at that sampling point to quarterly monitoring.

Aberdeen's Status

The City's IOC monitoring has not found detectable levels of arsenic in the source of supply.

Unregulated Contaminant Monitoring Rule 2 (UCMR2)

The Unregulated Contaminant Monitoring Regulation supporting the second cycle (UCMR 2) of monitoring was signed on December 20, 2006. The UCMR 2 requires monitoring for two lists of 25 contaminants using five analytical methods during 2008-2010. UCMR is a tool for the U. S. Environmental Protection Agency (EPA) to find unregulated contaminants of concern in the nation's drinking water.

All public water systems (PWSs) serving more than 10,000 people, and 800 representative PWSs serving less than 10,001 people are required to monitor for the 10 "List 1" contaminants during a 12-month period between January 2008-December 2010. Systems serving more than 100,000 people (including both retail and wholesale customers) and selected smaller systems will be required to conduct screening monitoring for 15 "List 2" contaminants on the Screening Survey List. This list includes contaminants that will be monitored at distribution system entry points and within the distribution system.

Aberdeen's Status

The City monitored for "List 1" Contaminants between 2008 and 2009 at the water treatment plant. A total of four samples for each contaminant were collected on August 19, 2008, November 5, 2008, February 11, 2009, and May 7, 2009. None of the samples resulted in a detection of any "List 1" contaminant. Table 6-6 displays the results of the tests.

Table 6-6 Unregulated Contaminant Monitoring Rule 2 Regulatory Levels and Monitoring Results

Parameter	Units	MRL	Observed Range (2008-2009)
Dimethoate	µg/L	0.7	ND
Terbufos Sulfone	µg/L	0.4	ND
Hexabromobiphenyl	µg/L	0.7	ND
BDE – 47	µg/L	0.3	ND
BDE – 99	µg/L	0.9	ND
BDE – 100	µg/L	0.5	ND
BDE - 153	µg/L	0.8	ND
1, 3 – Dinitrobenzene	µg/L	0.8	ND
2,4,6 – Trinitrotoluene (TNT)	µg/L	0.8	ND
RDX	µg/L	1.0	ND

µg/L -= micrograms per liter
MRL = Maximum Reporting Level
ND = Not Detected.

6.3.3 Distribution System Regulations

The Total Coliform, Stage 1 Disinfectant/Disinfection By-products, and Lead and Copper Rules apply primarily to the quality of drinking water present in the distribution system. These regulations establish monitoring, MCLs, Maximum Residual Disinfectant Levels (MRDLs), and action levels for regulated parameters.

Total Coliform Rule

Regulatory Requirements

The Total Coliform Rule (TCR) requires systems to monitor their distribution system for coliforms, which are bacteria used to indicate the presence of potentially harmful bacteria, such as *E. coli O157:H7*. If coliform bacteria are present, pathogenic organisms may also be present. The pathogenic bacteria are usually in very low numbers, which may not be detected in routine analysis, so are screened with the total coliform analysis. This total coliform monitoring is required to ensure the distribution system is operated and maintained to prevent regrowth of bacteria.

Under this rule, there are two types of violations: acute and non-acute.

- An acute MCL violation for coliform is the presence of fecal coliform or *E. coli* in a repeat sample, or, coliform presence in a repeat sample collected as a follow-up to a sample indicating the presence of fecal coliform or *E. coli*.
- A non-acute MCL violation for coliform occurs when a system that collects 40 or more coliform samples per month has more than 5.0 percent of the routine samples taken in 1 month test positive for the presence of total coliform.

Aberdeen's Status

The City is required to collect a minimum of 15 samples per calendar month. These samples, analyzed for total coliform, must be collected at locations representative of each pressure zone. The City was in compliance with the TCR for the 2005 to 2010 period.

On October 18, 2007, the Grays Harbor County Environmental Lab notified the City that one sample was Total Coliform Present, but E. coli absent. The sample was collected at a sampling station at the 1700 Block of Coolidge Rd. Three more samples were collected within 24 hours of the notification from the same location and sent to the lab to be analyzed. All the three samples came back with no coliform present. There have been no other positive coliform samples between 2005 and 2010.

Stage 1 Disinfectant and Disinfection By-Products Rule

Regulatory Requirements

Disinfection byproducts (DBPs) result from the reaction of natural organic matter (NOM) and various inorganic precursors with chemical disinfectants. Some DBPs, such as trihalomethanes, have been shown to cause cancer and negative reproductive health effects. The Stage 1 DBPR is the first of a staged set of rules that will reduce the allowable levels of DBPs in drinking water.

Disinfection byproduct sampling requirements began in 1979 with the Total Trihalomethanes (TTHMs) Rule, which had a Maximum Contaminant Level (MCL) for TTHMs of 100 µg/L based on a running annual average of samples collected within the distribution system. TTHMs is the summation of chloroform, bromodichloromethane, dibromochloromethane, and bromoform. This rule was replaced by with the Stage 1 DBP Rule in 2001. In 2004, the federal Stage 1 Disinfectant/Disinfection By-Product Rule came into effect for surface water systems with less than 10,000 customers, and the TTHM MCL was reduced from 100 to 80 µg/L and an MCL was added for the total of five haloacetic acids (HAA5) at 60 µg/L.

The HAA5 MCL applies to the summation of five HAAs: monochloroacetic acid, dichloroacetic acid, trichloroacetic acid, bromoacetic acid, and dibromoacetic acid. Both MCLs are based on a running annual average of quarterly samples collected within the distribution system. Systems are required to collect samples based on water system type (surface or groundwater) and number of treatment plants, and are required to develop a DBP monitoring plan.

Finally, the Stage 1 DBP Rule established a Maximum Residual Disinfectant Level (MRDL) for chlorine of 4.0 mg/L, to be sampled at the same locations and frequency as TCR sampling. As adopted in WAC 246-290, the Stage 1 DBP requirements were applied only to systems that add a disinfectant to the drinking water supply.

The Rule also uses a treatment technique to reduce disinfection byproduct precursors and to minimize the formation of unknown DBPs. This treatment technique is termed Enhanced Coagulation or Enhanced Precipitate Softening. It requires that a specific percentage of influent total organic carbon (TOC) be removed during treatment.

Systems should also strive to meet at least one of the “alternative compliance criteria” if their filter plant cannot achieve the specific TOC removal. The treatment technique uses TOC as a surrogate for natural organic matter, the precursor material for DBPs.

To maximize the probability of remaining in compliance, staff at a conventional treatment plant should monitor and track all possible water quality parameters specified in the alternative compliance criteria. In addition, the system should also calculate the percent removal of TOC between the raw water and the treated water. The percent removal of TOC is called “Step 1.”

The specific percentages of TOC removal required under Step 1, through an enhanced coagulation process, must occur between the raw water monitoring point and the treated water monitoring point (also called "post-sedimentation"). The required removal of TOC ranges from a 15 percent reduction to as high as a 50 percent reduction. These percentages depend on the source water TOC and the source water alkalinity levels at the time of sampling. The percentage of TOC removal is calculated monthly. Since source water conditions will change throughout the year, the removal requirements will likely change from month to month. Table 6-7, also called the “3-by-3 matrix,” shows these TOC removal percentages:

Table 6-7 Source Water TOC Matrix

Source Water TOC (mg/L)	Source Water Alkalinity (mg/L)		
	0-60 mg/L	>60-120 mg/L	>120 mg/L
>2.0 to 4.0	35%	25%	15%
>4.0 to 8.0	45%	35%	25%
>8.0	50%	40%	30%

mg/L -= milligrams per liter
TOC = total organic carbon

If the plant values fall within the table above, the filter plant has met the Step 1 requirements for that month. However, overall compliance cannot be determined until a running annual average has been completed.

The system is not required to remove TOC if they can meet one of the following six “alternative compliance criteria”:

1. If the source water TOC is less than 2.0 mg/L (based on a running annual average) or
2. If the treated water TOC is less than 2.0 mg/L (based on a running annual average) or
3. If the source water Specific Ultraviolet Absorbance (SUVA) values are 2.0 L/mg-m or less (annual average) or
4. If the treated water SUVA values are 2.0 L/mg-m or less (annual average) or
5. If the Total Trihalomethane (TTHM) levels are 0.040 mg/L or less <u>and</u> Haloacetic Acids (HAA5) levels are 0.030 mg/L or less (annual averages) and the system uses only chlorine for primary and residual disinfection or

6. If the following three running annual averages are met: source water TOC is 4.0 mg/L or less, the source alkalinity is >60 mg/L, and the distribution system TTHM levels are 0.040 mg/L or less and HAA5 levels are 0.030 mg/L or less.

In relation to the sixth alternative compliance criteria (listed above), if the system meets these TOC and alkalinity levels but not the TTHM and HAA5 levels, they may choose to make a clear and irrevocable financial commitment to use technologies that limit TTHM to 0.040 mg/L or less and HAA5 0.030 mg/L or less.

If a water system cannot meet the required annual averages for TOC removal or the alternative compliance, DOH must approve the system's request for "Step 2." This is also called the "alternative minimum TOC removal" requirement. Step 2 is a series of quarterly jar tests conducted over a year to determine the best possible TOC removal.

A system must apply for Step 2 requirements within 3 months of not meeting Step 1 requirements. Systems cannot apply for Step 2 without collecting at least one full year of TOC and alkalinity data as outlined under Step 1. The reference of step 2 is in Chapter 3 of EPA's "Enhanced Coagulation and Enhanced Precipitate Softening Manual."

Aberdeen's Status

The City chlorinates before the clearwell at the outlet of the WTP. The clearwell provides the detention time necessary to comply with disinfection requirements of the SDWA. The City currently collects a quarterly sample at 1700 Block of Coolidge Rd, representing maximum residence time and tests for TTHMs and HAAs. The City developed a Disinfection By-Products Monitoring Plan which is included in Appendix G.

Table 6-8 summarizes the City's DBP monitoring results. Since initiating monitoring in 2005, there have been no samples of total HAAs or TTHMs that exceeded the MCL.

Table 6-8 Stage 1 D/DBP Rule – Regulatory Levels and Monitoring Results (2008 to 2010)

Parameter	Units	MCL	RAA 2005[1]	RAA 2006[1]	RAA 2007[1]	RAA 2008[1]	RAA 2009[1]	RAA 2010[1]
1700 Block of Coolidge Rd – Sample Port								
TTHM	µg/L	80	9.8	16.7	10.2	11.4	14.0	15.8
HAA5	µg/L	60	12.1	12.8	8.3	10.7	9.5	7.9

RAA = Running Annual Average
(1) Quarterly samples are represented as an annual average

Stage 2 Disinfection/Disinfection By-Products Rule

The final Stage 2 DBP Rule was promulgated on January 4, 2006. The Stage 2 D/DBP Rule has been developed by the USEPA to further reduce exposure to DBPs linked to bladder, rectal, and colon cancers. This rule applies to community water and nontransient, noncommunity water systems that serve drinking water treated with a primary or secondary disinfectant other than ultraviolet (UV) treatment. The Stage 2 Rule does the following:

- Changes the method of calculating DBP regulatory compliance to a locational running annual average (LRAA) of quarterly samples, in which the system calculates a running

annual average for each DBP monitoring location instead of calculating a running annual average for the entire system.

- Re-establishes the location and number of DBP monitoring sites. The rule requires systems to conduct an Initial Distribution System Evaluation (IDSE) to select Stage 2 DBP monitoring locations in areas of the distribution system with elevated DBP levels. Additionally, the final Stage 2 DBP Rule requires systems to determine monitoring requirements based on retail population.
- Establishes DBP operational evaluation levels. Systems are to calculate a system-specific operational evaluation level which provides early warning, indicating a system could exceed the MCL within the next year. A system with an operational evaluation level greater than the MCL is required to conduct an operational evaluation, i.e., evaluating their distribution system operations to determine ways to reduce DBP levels. The system is required to notify the State of an operational evaluation level exceedance and submit evaluation results within 90 days of the exceedance. Consecutive systems that purchase drinking water carrying a disinfectant are required to implement Stage 2 DBP requirements on the same schedule as the largest water system in their combined distribution system.

The first step in complying with the Stage 2 D/DBP Rule is conducting an IDSE. The goal of the IDSE is to identify areas that have routinely higher DBP concentrations than other areas in the distribution system and use this information to select monitoring locations for long-term Stage 2 D/DBP compliance monitoring. The IDSE requirement can be met in four ways:

1. *Very Small System Waiver* – Systems serving less than 500 customers that qualify for this waiver are exempt from IDSE requirements.

2. *40/30 Certification* – This approach allows systems to meet the IDSE requirement by certifying that all individual Stage 1 total trihalomethanes (TTHM) and haloacetic acids (HAA5) compliance monitoring results or equivalent DBP data collected over a specified 2-year period have met the following criteria:

   $$\text{TTHM} \leq 40\ \mu g/L$$
   $$\text{HAA5} \leq 30\ \mu g/L$$

   Systems must submit the required documentation to the primacy agency.

3. *Standard Monitoring Program (SMP)* – Systems conduct 1 year of monitoring in the distribution system to identify high DBP locations. Systems must submit an SMP plan and IDSE report to the primacy agency as part of the IDSE process.

4. *System Specific Study (SSS)* -

   - SSS Using Existing Monitoring Data - Systems can meet IDSE requirements using existing monitoring data. The USEPA has established criteria that the existing data must meet in order to be used to meet the SSS requirement. Systems must submit an SSS plan and/or IDSE report to the primacy agency as part of the IDSE process.
   - SSS Using Hydraulic Model - Systems can meet IDSE requirements using a water distribution system hydraulic model. The USEPA has established criteria that the hydraulic model must meet in order to be used for IDSE compliance. Systems must submit an SSS plan and IDSE report to the primacy agency as part of the IDSE process.

Systems that are consecutive systems, purchasing some or all of their water from another system, and systems that sell water wholesale must comply with the Stage 2 Rule on the same *schedule* based on the largest system in the combined distribution system. A combined distribution system consists of the interconnected wholesale systems and consecutive systems that receive finished water from those wholesale system(s). However, Stage 2 *sampling requirements* are based on the retail population served by each individual system, not on the combined distribution system.

Aberdeen's Status

The City applied for a 40/30 Certificate based on their Stage 1 TTHMs and HAAs compliance monitoring results. The City was granted the certification and was not required to submit an IDSE report. The City will be required to complete their Stage 2 D/DBP Compliance Monitoring Plan by October 1, 2013.

Note to City: Is the above correct? Was a 40/30 Certificate granted?

Lead and Copper Rule

Regulatory Requirements

Lead and copper are metals that may be found in household plumbing materials and water service lines. Lead can cause a variety of negative health impacts, including delaying physical and mental development in infants and children. Copper can cause aesthetic issues in addition to short-term and long-term negative health impacts.

The Lead and Copper Rule (LCR) establishes action levels, monitoring, and compliance requirements for lead and copper levels at customers' taps. To meet the established action levels, 90 percent of all samples must have lead levels equal to or less than 0.015 mg/L and copper levels equal to or less than 1.3 mg/L. If these action levels cannot be met, systems must implement public education and a corrosion control treatment strategy for meeting these levels.

In 2004, the EPA initiated a review of LCR implementation across the nation. This effort was focused on determining whether national lead levels are increasing. As a result of this effort, the EPA identified several targeted changes to the existing regulation that would meet short-term goals for improving implementation of the LCR. These revisions, which were finalized in October 2007 and became effective in December 2007, are intended to enhance LCR implementation in the areas of monitoring, treatment, customer awareness, and lead service line replacement. Additionally, these revisions focus on improving compliance with public education requirements to ensure that consumers receive meaningful and timely information that assists in limiting exposure to lead in drinking water. Table 6-9 provides a summary of the LCR revisions.

Table 6-9. 2007 Lead and Copper Rule Revisions

Activity	Rule Revision
Monitoring	• Clarify language in the rule regarding the number of samples required and the number of sites from which samples should be collected. • Modify definitions for monitoring and compliance periods to make it clear that all samples must be taken in the same calendar year. • Clarify the reduced monitoring criteria that would prevent small and medium water systems above the lead action level or large systems deemed to no longer meet Optimum Corrosion Control Treatment from remaining on a reduced monitoring schedule.
Treatment or Source Water Changes	• Requires water systems to provide advanced notification to the primacy agency of intended changes in treatment or source water that could impact long-term water quality. • The primacy agency must approve the planned changes using a process that will allow the states and water systems to take as much time as needed for systems and states to consult about potential problems.
Customer Awareness and Public Education	• Requires utilities to provide a notification of tap water monitoring results for lead to owners and/or occupants of homes and buildings that are part of the utility's sampling program. • Changes to the content, delivery, and time frame of public education regarding lead action level exceedances. Systems must partner with additional organizations to disseminate the message to at-risk populations. • Requires educational statements about lead in drinking water to be included in all Consumer Confidence Reports.
Lead Service Line Replacement	• Requires utilities to reconsider previously "tested-out" lead service lines when resuming lead service line replacement programs.

Aberdeen's Status

In July 2006, the City was required to collect 30 tap samples, per LCR compliance monitoring. A list was compiled of the 30 sample sites and the results from each location, along with the 90th percentile for both Lead and Copper. None of the samples exceeded the Action Level for both lead (0.015 mg/L) and Copper (1.3 mg/L). The 90th percentile for Lead was 0.003 mg/L and Copper was 0.22 mg/L.

In May 2009, the City was required to collect 30 tap samples. None of the samples exceed the Action level. The 90th percentile for Lead was 0.003 mg/L and Copper was 0.31 mg/L. Table 6-10 shows the results of the tests.

Table 6-10. Lead and Copper Regulatory Levels and Monitoring Results (90th Percentiles)

Parameter	MCL (mg/L)	2006 (mg/L)	2009 (mg/L)
Lead	0.015	0.003	0.003
Copper	1.3	0.22	0.31

6.3.4 Consumer Confidence and Public Notification Rules

The Consumer Confidence and Public Notification Rules require systems to provide customers with water quality information on an annual basis, and when a regulatory violation occurs.

Regulatory Requirements

Under the Consumer Confidence Report (CCR) Rule promulgated in 1998, community water systems are required to provide an annual CCR on the source of their drinking water and levels of any contaminants found. The annual report must be supplied to all customers and must include:

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

While the CCR provides an annual "state-of-the-water" report, the Public Notification Rule (PNR) directs utilities in notifying customers of acute violations when they occur. The PNR was revised in May 2000 and 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 "serious adverse effect," consumers and the State must be notified within 24 hours of the violation. The notice must explain the violation, potential health effects, corrective actions, 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 within 30 days in an annual report, or by mail or direct delivery service within 1 year, depending on the severity of the violation.

Aberdeen's Status

The City distributes CCRs on an annual basis. The CCR summarizes the water quality in the system and is compliant with DOH guidelines. A copy of the City's 2011 CCR is provided in Appendix H.

6.3.5 Recently Promulgated and Anticipated Drinking Water Regulations

Since 2007, two new drinking water regulations have been promulgated that will have a direct impact on the City. Additional applicable regulations are anticipated over the next several years. Table 6-11 presents a list of anticipated regulations, dates (some anticipated) of regulatory milestones, and regulated parameters. In addition to these anticipated regulations, the City can track potential regulations by keeping up-to-date with the Contaminant Candidate List (CCL). The CCL is the primary source used by the USEPA for establishing priority contaminants that may face future regulation. In February 2005, the USEPA issued the second CCL, which is comprised of 51 contaminants (9 microbial and 42 chemical) included on the previous list. The

CCL-2 includes at least three parameters that the drinking water industry anticipates will be regulated in the future: atrazine, methyl-t-butyl ether (MTBE), and perchlorate.

Table 6-11. Recently Promulgated and Anticipated Drinking Water Regulations

Regulation	Anticipated Date	Parameters
Radon Rule	Proposed: 1999 Final: unknown	Radon
Revised Total Coliform Rule/Distribution System Rule	Promulgation after 2012	Total Coliforms Fecal Coliforms E. coli Potentially other distribution system contaminants and sources

Radon Rule

A proposed Radon Rule was released in 1999 that provides two options for the maximum level of radon allowable in public drinking water supplies. The SDWA has directed the USEPA to propose and finalize an MCL for radon in drinking water, but also to make available a higher alternative MCL (AMCL) accompanied by a multimedia mitigation (MMM) program to address risks of radon exposure due to its occurrence in air. The proposed MCL and AMCL for radon are 300 pCi/L and 4,000 pCi/L, respectively. The drinking water standard that would apply to the District depends on whether or not DOH develops an MMM program. Development of a final radon rule has been delayed numerous times since the rule was first proposed. At present, it is unclear when it will be finalized.

Aberdeen's Status

The City will keep track of the Radon Rule and determine the best manner of compliance. Since there has been a significant amount of time between the Rule's proposal and when it may be finalized, it is possible that the final regulation will be significantly different from the proposed Radon Rule.

Anticipated Revised Total Coliform Rule/Distribution System Rule

As part of its 6-year review of existing regulations, the USEPA has determined the need to revise the TCR. Revisions may include requirements to address finished water quality in the distribution system as well as to evaluate additional or alternative monitoring strategies that would be more cost-effective and maintain or improve public health. As part of the USEPA's process for determining the appropriate revisions to this rule and the need for a future Distribution System Rule, a series of white papers were developed by the USEPA and other groups in 2002 to describe potential health risks in the distribution system. These papers cover the topics of:

- Intrusion
- Cross-connection control
- Aging infrastructure and corrosion
- Permeation and leaching

- Nitrification
- Biofilms and bacterial growth
- Covered storage
- Decay in water quality over time
- New or repaired water mains

In addition, the USEPA and the American Water Works Association (AWWA) are currently preparing 10 papers related to the development of revisions to the current TCR. These papers will cover the distribution system topics of:

- Indicators of water quality
- Effectiveness of disinfectant residuals
- Compliance with the existing TCR
- Assessment of distribution systems
- Optimization of monitoring strategies
- Hazard analysis and control strategies
- Accumulation of inorganic contaminants
- Nutrient availability
- Causes of contaminant events and positive coliform samples
- Total coliform sample invalidation

In September 2008, a Total Coliform Rule/Distribution System Rule Federal Advisory Committee (FAC) reached an agreement-in-principle on revisions to the TCR and on what information about distribution systems is needed to better understand and address possible public health impacts from degradation of drinking water quality in distribution systems. It is unlikely that a revised TCR will be promulgated prior to the end of 2012.

With regard to a potential future Distribution System Rule, the FAC is considering the following: (1) evaluation of available data and research on aspects of distribution systems that may create risks to public health, (2) identification of priority data gaps, and (3) identification of data collection approaches (such as a data collection rule and/or additional research).

Aberdeen's Status

It is likely that any developments with either rule will have an impact on the City. Revisions to the TCR are intended to reduce monitoring and reporting burdens while maintaining current levels of public health protection. It is possible that these rules will require the use and documentation of best management practices within the distribution system, and/or monitoring associated with some of the topics covered in the issue papers listed above. Cross-connection control program implementation and documentation may be a primary focus. As part of the agreement-in-principle signed in September 2008, the most significant potential revision to the TCR includes elimination of the non-acute MCL for total coliform. Rather, systems that exceed 5% positive total coliform results in a given month will need to conduct a system assessment to identify and correct any deficiencies that may have contributed to the positive results.

The City will continue to follow developments with the TCR revisions process, as well as any potential developments associated with a future Distribution System Rule.

6.4 Labs Used for Sample Analyses

The City uses four laboratories to perform water quality testing. Except for Lab/Cor, Inc., these laboratories are certified by the DOH drinking water laboratory certification program for analyses methods. Lab/Cor, Inc. has EPA approval for conducting EPA Method 1623 for *Giardia* and *Cryptosporidium* analysis. The contact information is listed below.

Water Management Laboratories
1515 80th St. E
Tacoma, WA 98404
Phone: 253-531-3121

Grays Harbor County Drinking Water Lab
100 W. Broadway
Suite 31
Montesano, WA 98563
Phone: 360-249-4413

Lab/Cor, Inc.
7619 6th Ave. NW
Seattle, WA 98117
Phone: 888-522-2674

Washington State Public Health Laboratory
1610 NE 150th St
Shoreline WA 98155
Phone: 206-418-5486

6.5 Response to Customer Inquiries and Complaints

The City keeps good documentation of all orders that are generated by a customer call to Public Works. When a call for inquiry or complaint received, the information is disseminated from the Public Works office to the WTP. Depending on the nature of the issue, a work order is generated to deal with the situation. In case of a water taste, smell, color or odor complaint, actions are initiated as soon as possible within the next available time line. Usually it turns out to be a water filter system in a customer's home making the odor or smell.

6.6 Summary of Regulatory Status and Monitoring Requirements

A review of the City's monitoring and compliance procedures and water quality monitoring results indicates that Aberdeen was in full compliance with all State and Federal regulations during the review period. Table 6-12 summarizes the City's regulatory status from 2005 to 2010, including regulatory requirements and recommendations for continued compliance.

Table 6-13 presents a summary of water quality monitoring requirements. The table includes the parameters to be monitored, sampling location, and frequency for existing and applicable future regulations.

Table 6-12. Summary of Applicable Regulations and Compliance Status

Regulation	Requirements	Status	Compliance?	Recommendations
Surface Water Treatment Rules	Operate treatment such that removal credit requirements are met. Meet turbidity performance criteria Monitor chlorine residuals throughout the distribution system. Maintain Watershed Control Plan.	Aberdeen operates the Water Treatment Plant in a manner to meet removal requirements. Aberdeen has met turbidity and chlorine requirements. Aberdeen has a documented watershed control program.	Yes	Continue with existing monitoring. Maintain an updated watershed control plan.
Phase I, II, V Rules	Monitor finished water for IOCs, SOCs, and VOCs. Monitor distribution system for asbestos.	Conducted required monitoring.	Yes	Continue with existing monitoring.
Radionuclide Rule	Monitor for regulated radionuclides.	Conducted required monitoring.	Yes	Monitor per requirements established by DOH.
UCMR	Monitor for listed contaminants.	Conducted required monitoring.	Yes	Continue with existing monitoring.
UCMR 2	No Required monitoring for systems <10,000 people	Conducted required monitoring.	Yes	Continue with existing monitoring.
Total Coliform Rule	Written Plan; Monitoring.	Conducted required monitoring and has plan.	Yes	Continue with existing monitoring.
Total Trihalomethane Rule (1)	Monitoring.	Monitored at two distribution system locations. Met MCL.	Yes	No longer required.
Stage 1 D/DBP Rule	Written Plan; Monitoring.	Monitors at four distribution system locations quarterly, has levels below MCL, and has developed a plan.	Yes	Continue with existing monitoring.
Stage 2 D/DBP Rule	Written Plan, Monitoring	Granted a 40/30 certificate.	Yes	Compliance monitoring to begin in December 2013.
Lead and Copper Rule	Written Plan; Monitoring.	Monitors as part of regional program. Meets action levels.	Yes	Continue with existing monitoring.
CCR and Public Notification Rules	Annual Reports. Reporting as needed.	Consumer Confidence Reports published annually.	Yes	Continue with existing reporting.
Arsenic Rule	Monitor for Arsenic	Conducted required monitoring.	Yes	Continue with existing reporting.

(1) This regulation was replaced with the Stage 1 D/DBP Rule in 2002.

Table 6-13. Summary of Monitoring Requirements

Parameter	Regulatory Requirement	Location	Frequency
Turbidity	Surface Water Treatment Rule	Before and after treatment	Continuously
Giardia lamblia inactivation	Surface Water Treatment Rule	Treatment process	Continuously
Chlorine Residual	Surface Water Treatment Rule	Distribution system entry point	Continuously
Chlorine Residual	Surface Water Treatment Rule and Stage 1 D/DBP	Throughout distribution system	Monthly
Inorganic chemicals – except asbestos	Phase II, V Rules	After treatment	1 sample per year
Asbestos	Phase II Rule	In distribution system	Once every 9 years
Synthetic organic chemicals	Phase II, V Rules	After treatment	2 samples from 2011 to 2013 (except for waived SOCs)
Volatile organic chemicals	Phase I, II, V Rules	After treatment	One sample every year
Radium-226, Radium-228, gross alpha emitters, and gross beta emitters	Radionuclides Rule	After treatment	1 sample every 3 years
Total coliform	Total Coliform Rule	Throughout distribution system	15samples per month as per Coliform Monitoring Plan
Disinfection By-Products (TTHMs and HAA5)	Stage 1 D/DBP	Throughout distribution system	Quarterly 1 sample
Disinfection By-Products (TTHMs and HAA5)	Stage 2 D/DBP – IDSE requirement Stage 2 Compliance	Throughout distribution system Throughout distribution system	Depends on selected IDSE compliance approach Based on IDSE findings
Lead and copper	Lead and Copper Rule	Customers' taps throughout the distribution system	20 samples every 3 years
pH, alkalinity, and temperature	Lead and Copper Rule	Customers' taps throughout the distribution system	Every 3 years (coinciding with tap samples)
pH	Lead and Copper Rule	Distribution system entry point	Daily
Assessment List Screening Survey List (10 'list 1" contaminants)	UCMR2	Distribution system entry point and within distribution system (depending on parameter)	Quarterly for 12 months during 2008 to 2010
Radon (Future Regulations)	Radon Rule	Distribution system entry point	Annually

7. System Analysis

This chapter provides an evaluation of the City's ability to meet current and projected water supply needs. Source and storage capacity analyses are presented, followed by an evaluation of the distribution system piping network. System deficiencies are described throughout the chapter, and how they relate to capital improvements presented in Chapter 9.

7.1. Source Capacity Analysis

7.1.1. Design Criteria

According to DOH planning requirements, sources of supply must be sufficient to meet maximum day demands (MDD). This must hold true for each pressure zone within a system, as well as for the system as a whole. In addition, for any "closed" pressure zone (i.e., a zone that has no storage, and for which pressure is maintained by pumping), sources must be sufficient to meet peak hour demands (PHD). The source capacity analyses presented below examine the ability of the City's existing sources of supply to meet these requirements. Tables 7-1 through 7-5 summarize the evaluation of source capacities for the City's total system and the Herbig Heights, North Aberdeen, Bench Drive, and Wishkah zones respectively. These analyses are conducted by comparing the City's water demand forecast, presented in Chapter 3, with current source capacities. All evaluations assume 24-hour-per-day source operation.

7.1.2. Source Capacity Evaluation

Total System

The City's water treatment plant is the sole source of water into the distribution system. The current rated capacity of the plant is 6.5 MGD based on the capacity of the filters. Based on demand projections developed in Chapter 3, the treatment plant can provide a sufficient quantity of water to meet the maximum day demand through 2032. However, if the water demand increases beyond the capacity of the plant, additional filters may be installed to increase the production capacity of the plant.

While the treatment plant capacity is the limiting condition in this analysis, there are two other factors to consider: the transmission main capacity and the watershed yield. Section 1.5.1 describes the capacity of gravity transmission main based on a hydraulic analysis conducted in the prior water system plan. The transmission main is rated with a capacity of 7.5 mgd.

Table 7-1. Source Capacity Analysis for the Total System

	Year			
	2012	2018	2032	Max[3]
Projected ERUs and Demand [(1)]				
Equivalent Residential Units (ERU's)	17,725	17,844	17,964	20,485
Average Day Demand gpd)	2,960,000	2,980,000	3,000,000	3,421,053
Maximum Day Demand (gpd)	5,620,000	5,670,000	5,700,000	6,500,000
Evaluation of Existing Sources				
Available Existing Source (gpd) [(2)]				
Water Treatment Plant (6.5 mgd)	6,500,000	6,500,000	6,500,000	6,500,000
Total Available Source - (gpd)	6,500,000	6,500,000	6,500,000	6,500,000
Source Surplus/(Deficiency) - Existing Sources (gpd)	**880,000**	**830,000**	**800,000**	**0**

Notes:
(1) Projected demands taken from Chapter 2. ERUs calculated as Average Day Demand / ERU water use factor (167 gpd/ERU).
(2) Water Treatment Plant is operating at the maximum production rate (i.e., for 24 hours per day).
(3) Maximum ERUs to be served with current sources, based on maximum production rate (i.e., 24 hours per day).
Max ERUs = Total Available Source / Maximum Day Demand per ERU (317 gpd/ERU).

Boosted Pressure Zones

Source capacity evaluations were conducted independently for each of the City's boosted pressure zones, which are supplied water through booster pump stations. Tables 7-2 through 7-5 present the results of these analyses. Because the Herbig Heights, North Aberdeen, and Wishkah Zones are "open" zones and have storage reservoirs that provide for equalization to aid in meeting peak hour demands, source capacities in these zones are compared against MDD. By contrast, the Bench Drive Zone is a "closed" zone, meaning there is no storage present to support any portion of demand. Therefore, source capacities in this zone are compared against PHD.

In each case, existing source capacities at the pump stations are sufficient to meet current and projected demands. Therefore, no source capacity improvements are identified to address any such deficiencies.

Table 7-2. Source Capacity Analysis for the Herbig Heights Zone

	Year			
	2012	2018	2032	Max (4)
Projected ERUs and Demand (1)				
Equivalent Residential Units (ERU's)	999	1,010	1,020	3,404
Average Day Demand gpd)	166,756	168,687	170,300	568,421
Maximum Day Demand (gpd)	316,836	320,507	323,573	1,080,000
Evaluation of Existing Sources				
Available Existing Source (gpd) (2)				
9th Ave Pump Station (750 gpm)	1,080,000	1,080,000	1,080,000	1,080,000
Alden Rd Pump Station (775 gpm) (3)	0	0	0	0
Total Available Source - (gpd)	1,080,000	1,080,000	1,080,000	1,080,000
Source Surplus/(Deficiency) - Existing Sources (gpd)	**763,164**	**759,493**	**756,427**	**0**

Notes:
(1) Projected demands taken from Chapter 2. ERUs calculated as Average Day Demand / ERU water use factor (167 gpd/ERU).
(2) Source pumps are operating at the maximum production rate (i.e., for 24 hours per day).
(3) Alden Rd Pump Station is an emergency back-up source.
(4) Maximum ERUs to be served with current sources, based on maximum production rate (i.e., 24 hours per day).
Max ERUs = Total Available Source / Maximum Day Demand per ERU (317 gpd/ERU).

Table 7-3. Source Capacity Analysis for the North Aberdeen Zone

	Year			
	2012	2018	2032	Max (4)
Projected ERUs and Demand (1)				
Equivalent Residential Units (ERU's)	118	120	121	3,971
Average Day Demand gpd)	19,782	20,023	20,224	663,158
Maximum Day Demand (gpd)	37,585	38,043	38,426	1,260,000
Evaluation of Existing Sources				
Available Existing Source (gpd) (2)				
Olympic St Pump Station (875 gpm)	1,260,000	1,260,000	1,260,000	1,260,000
Tyler St Pump Station (60 gpm) (3)	0	0	0	0
Total Available Source - (gpd)	1,260,000	1,260,000	1,260,000	1,260,000
Source Surplus/(Deficiency) - Existing Sources (gpd)	**1,222,415**	**1,221,957**	**1,221,574**	**0**

Notes:
(1) Projected demands taken from Chapter 2. ERUs calculated as Average Day Demand / ERU water use factor (167 gpd/ERU).
(2) Source pumps are operating at the maximum production rate (i.e., for 24 hours per day).
(3) Tyler St Pump Station is an emergency back-up source.
(4) Maximum ERUs to be served with current sources, based on maximum production rate (i.e., 24 hours per day).
Max ERUs = Total Available Source / Maximum Day Demand per ERU (317 gpd/ERU).

Table 7-4. Source Capacity Analysis for the Bench Drive Zone

	Year			
	2012	2018	2032	Max (3)
Projected ERUs and Demand (1)				
Equivalent Residential Units (ERU's)	69	70	70	182
Average Day Demand gpd)	11,510	11,640	11,748	30,394
Maximum Day Demand (gpd)	21,869	22,115	22,321	57,749
Peak Hour Demand (gpm)	92	92	92	132
Evaluation of Existing Sources				
Available Existing Source (gpm) (2)				
Bench Dr Pump 1 (92 gpm)	92	92	92	92
Bench Dr Pump 2 (40 gpm)	40	40	40	40
Total Available Source - (gpm)	132	132	132	132
Source Surplus/(Deficiency) - Existing Sources (gpm)	**40**	**40**	**40**	**0**

Notes:
(1) Projected demands taken from Chapter 2. ERUs calculated as Average Day Demand / ERU water use factor (167 gpd/ERU).
(2) Source pumps are operating at the maximum production rate (i.e., for 24 hours per day).
(3) Maximum ERUs to be served with current sources, based on maximum production rate (i.e., 24 hours per day).
Max ERUs = Total Available Source / Peak Hour Demand (317 gpd/ERU).

Table 7-5. Source Capacity Analysis for the Wishkah Zone

	Year			
	2012	2018	2032	Max[3]
Projected ERUs and Demand (1)				
Equivalent Residential Units (ERU's)	20	20	20	454
Average Day Demand gpd)	3,340	3,340	3,340	75,789
Maximum Day Demand (gpd)	6,340	6,340	6,340	144,000
Evaluation of Existing Sources				
Available Existing Source (gpd) (2)				
Wishkah Pump Station (100 gpm)	144,000	144,000	144,000	144,000
Total Available Source - (gpd)	144,000	144,000	144,000	144,000
Source Surplus/(Deficiency) - Existing Sources (gpd)	**137,660**	**137,660**	**137,660**	**0**

Less Largest
(1) Projected demands taken from Chapter 2. ERUs calculated as Average Day Demand / ERU water use factor (167 gpd/ERU).
(2) Source pumps are operating at the maximum production rate (i.e., for 24 hours per day).
(3) Maximum ERUs to be served with current sources, based on maximum production rate (i.e., 24 hours per day).
Max ERUs = Total Available Source / Maximum Day Demand per ERU (317 gpd/ERU).

7.2. Storage Capacity Analysis

7.2.1. Design Criteria

According to DOH requirements, water system storage volume is comprised of five separate components:

- Operating volume
- Equalizing volume
- Fire flow volume
- Standby volume
- Dead volume

These required volume components are illustrated in Figure 7-1. All storage components are described in more detail below.

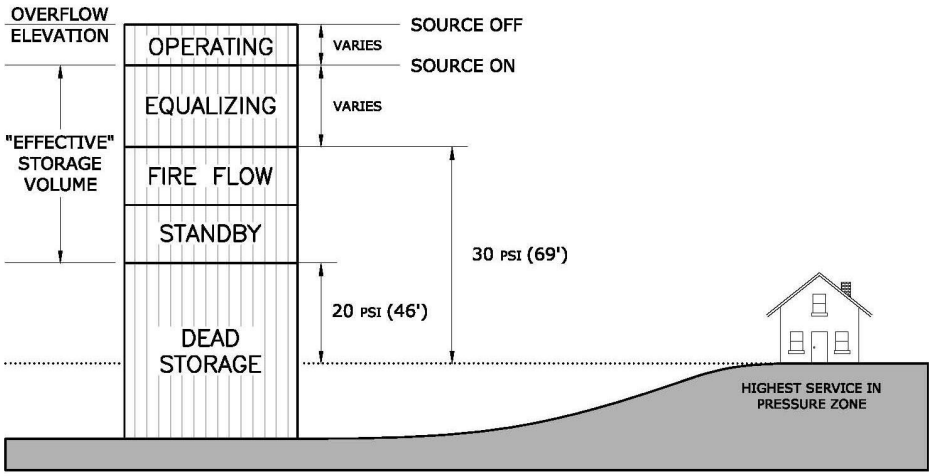


Figure 7-1. Storage Components

Operating and Dead Storage Volumes

Operating volume is the water that lies between low and high water storage elevations set by City operations staff to control system pumps and flow control valves. Dead volume is the volume at the bottom of the tank that cannot be used because it is physically too low to provide sufficient pressures. Operational and dead volumes are subtracted from total storage to determine the effective storage available for equalizing, standby, and fire flow.

Equalizing Volume

Equalizing volume is the total volume needed to moderate daily fluctuations in diurnal demands during periods when the demand exceeds the capacity of the supply system. Equalizing volume requirements are greatest on the day of peak demand. Operation of a properly balanced system results in replenishment of storage facilities during times of day when the demand curve is below the capacity of the supply system, and depletion of storage facilities when the demand exceeds the supply capacity. The equalizing volume of a storage tank must be located at an

elevation that provides a minimum pressure of 30 pounds per square inch (psi) to all customers served by the tank.

Fire Flow Volume

The required fire flow volume for a given pressure zone is calculated as the required fire flow multiplied by the required duration, as established by the local fire authority. Required fire flows and durations vary across the City's service area, as it includes multiple zoning designations. The maximum fire flow volume considered in this analysis is 3,000 gpm for 3 hours, within the Low Level pressure zone, based on information provided by the City Fire Department (see Appendix I).

The fire flow volume of a storage tank must be located at an elevation that provides a minimum pressure of 20 psi to all customers served by the tank. DOH allows for the "nesting" of standby and fire flow storage, with the larger used for the storage volume. For the purpose of this plan, the standby and fire flow storage volumes are nested, as the City Fire Department has approved of this practice.

Standby Volume

Standby volume is required to supply reasonable system demands during a foreseeable system emergency or outage. A key concept is that establishing standby volume involves planning for reasonable system outages – those that can be expected to occur under normal operating conditions, such as a pipeline failure, power outage or valve failure. Major system emergencies, such as those created by an earthquake, are intended to be covered by emergency system operations planning, since construction of sufficient reserve volume to accommodate sustained system demands under emergency conditions is not economically feasible.

DOH has established guidelines for determining minimum required standby volume. This component is calculated as the greater of: two times the average day demand, less multi-source credit; or 200 gallons times the number of ERUs served by the storage facility. The multi-source credit is applicable only for pressure zones that have multiple sources of supply, and allows the required standby storage volume in such instances to be reduced. The credit assumes the largest source of supply is out of service; thus, it is calculated as the total source available to a particular pressure zone, or zone combination, less the capacity of the largest source. No credit is allowed for zones having only one source of supply.

7.2.2. Storage Capacity Evaluation

Low Level Zone

The Fairview Reservoirs and South Aberdeen Tank provide storage to this zone. As indicated in Table 7-6, the largest storage volume requirement for this zone is for standby storage (which includes standby storage associated with the boosted pressure zones). Because the system has only one source of supply (the WTP), a multi-source credit is not applicable to the zone.

Based upon the results of the calculation, there is a surplus of storage for the overall system to meet projected demands. If problems occur where water cannot be distributed throughout the system quickly enough during an emergency event, the City can draw water through the Hoquiam/Aberdeen intertie.

Herbig Heights Zone

The two Herbig Heights tanks have a combined storage volume of 600,000 gals and serve approximately 542 residential and commercial customers. Table 7-7 provides the storage capacity analysis for the Herbig Heights Zone.

There is no storage deficiency in the zone. In these tanks, the operational storage volume is 38% of the total volume or 226,000 gals. This is defined as the volume above the elevation at which the 9th Ave pump station starts. Part of this component of volume is the tanks have different overflow elevations with one tank being eight feet taller than the other. There is approximately 87,000 gals of unusable storage volume in the taller tank above the overflow elevation of the other one.

Fire flow and standby storage are nested. In this zone, the fire flow storage requirement is partially met by the capacity of the 9th Ave pump station. The City has a portable generator to operate the pump station during emergency situations when there is a loss of power. DOH allows a reduction in fire flow storage if there is backup power and a redundant source available. This reduction is applied to the zone.

North Aberdeen Zone

The storage volume of the North Aberdeen Tank is 100,000 gals and it serves 84 residential customers in the North Aberdeen Zone. There is no deficiency determined from the storage capacity analysis shown in Table 7-8. There is a surplus of storage available through the 20-year planning period. Fire flow and standby storage are nested in this zone.

Upper Wishkah Zone

The Wishkah Tank is 50,000 gals and serves 20 residential customers near the water treatment plant. There is no deficiency determined from the storage capacity analysis shown in Table 7-9. There is a surplus of storage available through the 20-year planning period. Fire flow and standby storage are nested in this zone.

Table 7-6. Storage Capacity Analysis for Low Level Zone

	Year			
	2012	2018	2032	Max [11]
Projected ERUs and Demand[1]				
Equivalent Residential Units (ERU's)	16,842	16,995	17,121	57,671
Average Day Demand (gpd)	2,812,654	2,838,167	2,859,237	9,631,074
Maximum Day Demand (gpd)	5,344,217	5,392,705	5,432,740	18,299,041
Available Source (gpd)[2]				
Water Treatment Plant	6,500,000	6,500,000	6,500,000	6,500,000
Total Available Source (gpd)	6,500,000	6,500,000	6,500,000	6,500,000
Multi-Source Credit (gpd)[3]	0	0	0	0
Required Storage Calculations				
Operational Storage (mg)[4]	3,814,958	3,814,958	3,814,958	3,814,958
Equalizing Storage (mg)[5]	223,727	231,806	238,479	2,382,894
Standby Storage (mg)[6]	5,625,309	5,676,335	5,718,475	19,262,148
Fire Flow Storage (mg)[7]	540,000	540,000	540,000	540,000
Required Storage				
Greater than 30 psi at highest meter (mg)[8]	4,038,685	4,046,765	4,053,437	6,197,852
Greater than 20 psi at highest meter (mg)[9]	10,203,994	10,263,099	10,311,912	26,000,000
Existing Storage Greater Than 30 psi (mg)[10]				
Fairview 1	5,513,986	5,513,986	5,513,986	5,513,986
Fairview 2	8,996,503	8,996,503	8,996,503	8,996,503
S Aberdeen	33,445	33,445	33,445	33,445
Total Existing Storage at 30 psi (mg)	14,543,934	14,543,934	14,543,934	14,543,934
Storage Surplus/(Deficiency) at 30 psi (mg)	**10,505,249**	**10,497,170**	**10,490,498**	**8,346,083**
Existing Storage Greater Than 20 psi (mg)[10]				
Fairview 1	9,500,000	9,500,000	9,500,000	9,500,000
Fairview 2	15,500,000	15,500,000	15,500,000	15,500,000
S Aberdeen	1,000,000	1,000,000	1,000,000	1,000,000
Total Existing Storage at 20 psi (mg)	26,000,000	26,000,000	26,000,000	26,000,000
Storage Surplus/(Deficiency) at 20 psi (mg)	**15,796,006**	**15,736,901**	**15,688,088**	**0**

Notes:

(1) Projected demands taken from Chapter 2. ERUs calculated as Average Day Demand / ERU water use factor (167 gpd/ERU).

(2) Available source assumes source pumps are on for 24 hours in a day, at the maximum production rate.

(3) Multi-source credit assumes largest source is out of service.

(4) Required operational storage is based on observed tanks levels fluctuations.

(5) Required Equalizing Storage is equal to [(PHD - Total Available Source) x 150 minutes] .
PHD : (Maximum Day Demand per ERU / 1440) * [(C) * (N) + F] + 18
(C & F values obtained from Table 5-1 in DOH Dec 2009 WSDM)

(6) Required Standby Storage is the greater of (2*ADD less multi-source credit) or (200 gallons per ERU).

(7) Required Fire Flow Storage = 3000 gpm x 3 hours.

(8) Total required storage greater than 30 psi is equal to the total of operational and equalizing storage.

(9) Total required storage greater than 20 psi is equal to the total of operational, equalizing, standby, and fire flow storage.

(10) The storage volume available in existing reservoirs at 30 and 20 psi is based on the elevation of the highest customer. (160 ft - Fairview)

(11) Maximum ERUs served by Available Storage located solely in the Low Level Zone.

Table 7-7. Storage Capacity Analysis for Herbig Heights Zone

	Year			
	2012	2018	2032	Max (11)
Projected ERUs and Demand(1)				
Equivalent Residential Units (ERU's)	999	1,010	1,020	1,868
Average Day Demand (gpd)	166,756	168,687	170,300	312,038
Maximum Day Demand (gpd)	316,836	320,507	323,573	592,872
Available Source (gpd)(2)				
9th Ave Pump Station (750 gpm)	1,080,000	1,080,000	1,080,000	1,080,000
Alden Rd Pump Station (775 gpm)	1,116,000	1,116,000	1,116,000	1,116,000
Total Available Source (gpd)	2,196,000	2,196,000	2,196,000	2,196,000
Multi-Source Credit (gpd)(3)	1,116,000	1,116,000	1,116,000	1,116,000
Required Storage Calculations				
Operational Storage (mg)(4)	226,302	226,302	226,302	226,302
Equalizing Storage (mg)(5)	0	0	0	0
Standby Storage (mg)(6)	199,708	202,020	203,953	373,698
Fire Flow Storage (mg)(7)	300,000	300,000	300,000	300,000
Required Storage				
Greater than 30 psi at highest meter (mg)(8)	226,302	226,302	226,302	226,302
Greater than 20 psi at highest meter (mg)(9)	526,302	526,302	526,302	600,000
Existing Storage Greater Than 30 psi (mg)(10)				
Herbig Heights 1	250,000	250,000	250,000	250,000
Herbig Heights 2	350,000	350,000	350,000	350,000
Total Existing Storage at 30 psi (mg)	600,000	600,000	600,000	600,000
Storage Surplus/(Deficiency) at 30 psi (mg)	**373,698**	**373,698**	**373,698**	**373,698**
Existing Storage Greater Than 20 psi (mg)(10)				
Herbig Heights 1	250,000	250,000	250,000	250,000
Herbig Heights 2	350,000	350,000	350,000	350,000
Total Existing Storage at 20 psi (mg)	600,000	600,000	600,000	600,000
Storage Surplus/(Deficiency) at 20 psi (mg)	**73,698**	**73,698**	**73,698**	**0**

Notes:

(1) Projected demands taken from Chapter 2. ERUs calculated as Average Day Demand / ERU water use factor (167 gpd/ERU).

(2) Available source assumes source pumps are on for 24 hours in a day, at the maximum production rate.

(3) Multi-source credit assumes largest source is out of service.

(4) Required operational storage is based on observed tanks levels fluctuations.

(5) Required Equalizing Storage is equal to [(PHD - Total Available Source) x 150 minutes] .
PHD : (Maximum Day Demand per ERU / 1440) * [(C) * (N) + F] + 18
(C & F values obtained from Table 5-1 in DOH Dec 2009 WSDM)

(6) Required Standby Storage is the greater of (2*ADD less multi-source credit) or (200 gallons per ERU).

(7) Required Fire Flow Storage = 2,500 gpm x 2 hours.

(8) Total required storage greater than 30 psi is equal to the total of operational and equalizing storage.

(9) Total required storage greater than 20 psi is equal to the total of operational, equalizing, and the greater of standby or fire flow storage.

(10) The storage volume available in existing reservoirs at 30 and 20 psi is based on the elevation of the highest customer. (345 ft)

(11) Maximum ERUs served by Available Storage located solely in the Herbig Heights Zone.

Table 7-8. Storage Capacity Analysis for North Aberdeen Zone

	Year			
	2012	2018	2032	Max (11)
Projected ERUs and Demand(1)				
Equivalent Residential Units (ERU's)	118	120	121	304
Average Day Demand (gpd)	19,782	20,023	20,224	50,826
Maximum Day Demand (gpd)	37,585	38,043	38,426	96,570
Available Source (gpd)(2)				
Olympic St Pump Station (875 gpm)	1,260,000	1,260,000	1,260,000	1,260,000
Tyler St Pump Station (60 gpm)	86,400	86,400	86,400	86,400
Total Available Source (gpd)	1,346,400	1,346,400	1,346,400	1,346,400
Multi-Source Credit (gpd)(3)	86,400	86,400	86,400	86,400
Required Storage Calculations				
Operational Storage (mg)(4)	39,130	39,130	39,130	39,130
Equalizing Storage (mg)(5)	0	0	0	0
Standby Storage (mg)(6)	23,690	23,979	24,221	60,870
Fire Flow Storage (mg)(7)	30,000	30,000	30,000	30,000
Required Storage				
Greater than 30 psi at highest meter (mg)(8)	39,130	39,130	39,130	39,130
Greater than 20 psi at highest meter (mg)(9)	69,130	69,130	69,130	100,000
Existing Storage Greater Than 30 psi (mg)(10)				
N Aberdeen	100,000	100,000	100,000	100,000
Total Existing Storage at 30 psi (mg)	100,000	100,000	100,000	100,000
Storage Surplus/(Deficiency) at 30 psi (mg)	**60,870**	**60,870**	**60,870**	**60,870**
Existing Storage Greater Than 20 psi (mg)(10)				
N Aberdeen	100,000	100,000	100,000	100,000
Total Existing Storage at 20 psi (mg)	100,000	100,000	100,000	100,000
Storage Surplus/(Deficiency) at 20 psi (mg)	**30,870**	**30,870**	**30,870**	**0**

Notes:

(1) Projected demands taken from Chapter 2. ERUs calculated as Average Day Demand / ERU water use factor (167 gpd/ERU).

(2) Available source assumes source pumps are on for 24 hours in a day, at the maximum production rate.

(3) Multi-source credit assumes largest source is out of service.

(4) Required operational storage is based on observed tanks levels fluctuations.

(5) Required Equalizing Storage is equal to [(PHD - Total Available Source) x 150 minutes] .
PHD : (Maximum Day Demand per ERU / 1440) * [(C) * (N) + F] + 18
(C & F values obtained from Table 5-1 in DOH Dec 2009 WSDM)

(6) Required Standby Storage is the greater of (2*ADD less multi-source credit) or (200 gallons per ERU).

(7) Required Fire Flow Storage = 500 gpm x 1 hours.

(8) Total required storage greater than 30 psi is equal to the total of operational and equalizing storage.

(9) Total required storage greater than 20 psi is equal to the total of operational, equalizing, and the greater of standby or fire flow storage.

(10) The storage volume available in existing reservoirs at 30 and 20 psi is based on the elevation of the highest customer. (265 ft)

(11) Maximum ERUs served by Available Storage located solely in the North Aberdeen Zone.

Table 7-9. Storage Capacity Analysis for Wishkah Zone

	Year			
	2012	2018	2032	Max (11)
Projected ERUs and Demand(1)				
Equivalent Residential Units (ERU's)	20	20	20	177
Average Day Demand (gpd)	3,340	3,340	3,340	29,627
Maximum Day Demand (gpd)	6,340	6,340	6,340	56,291
Available Source (gpd)(2)				
Wishkah Pump Station (100 Gpm)	144,000	144,000	144,000	144,000
Total Available Source (gpd)	144,000	144,000	144,000	144,000
Multi-Source Credit (gpd)(3)	0	0	0	0
Required Storage Calculations				
Operational Storage (mg)(4)	10,000	10,000	10,000	10,000
Equalizing Storage (mg)(5)	0	0	0	4,519
Standby Storage (mg)(6)	6,680	6,680	6,680	35,481
Fire Flow Storage (mg)(7)	30,000	30,000	30,000	30,000
Required Storage				
Greater than 30 psi at highest meter (mg)(8)	10,000	10,000	10,000	14,519
Greater than 20 psi at highest meter (mg)(9)	40,000	40,000	40,000	50,000
Existing Storage Greater Than 30 psi (mg)(10)				
Wishkah Tank	50,000	50,000	50,000	50,000
Total Existing Storage at 30 psi (mg)	50,000	50,000	50,000	50,000
Storage Surplus/(Deficiency) at 30 psi (mg)	**40,000**	**40,000**	**40,000**	**35,481**
Existing Storage Greater Than 20 psi (mg)(10)				
Wishkah Tank	50,000	50,000	50,000	50,000
Total Existing Storage at 20 psi (mg)	50,000	50,000	50,000	50,000
Storage Surplus/(Deficiency) at 20 psi (mg)	**10,000**	**10,000**	**10,000**	**0**

Notes:

(1) Projected demands taken from Chapter 2. ERUs calculated as Average Day Demand / ERU water use factor (167 gpd/ERU).

(2) Available source assumes source pumps are on for 24 hours in a day, at the maximum production rate.

(3) Multi-source credit assumes largest source is out of service.

(4) Required operational storage is based on observed tanks levels fluctuations.

(5) Required Equalizing Storage is equal to [(PHD - Total Available Source) x 150 minutes] .
PHD : (Maximum Day Demand per ERU / 1440) * [(C) * (N) + F] + 18
(C & F values obtained from Table 5-1 in DOH Dec 2009 WSDM)

(6) Required Standby Storage is the greater of (2*ADD less multi-source credit) or (200 gallons per ERU).

(7) Required Fire Flow Storage = 500 gpm x 1 hours.

(8) Total required storage greater than 30 psi is equal to the total of operational and equalizing storage.

(9) Total required storage greater than 20 psi is equal to the total of operational, equalizing, and the greater of standby or fire flow storage.

(10) The storage volume available in existing reservoirs at 30 and 20 psi is based on the elevation of the highest customer.

(11) Maximum ERUs served by Available Storage located solely in the Upper Wishkah Zone.

7.3. Distribution System Analysis

7.3.1. Analysis Methodology

As required by DOH, the City's water distribution system was analyzed for the following two conditions: peak hour demands (PHD), and maximum day demands (MDD) plus fire flow. All hydraulic calculations were performed within the City's water distribution model, which was developed using WaterCAD v8i software produced by Bentley.

7.3.2. System Components

The WaterCAD software allows all pipes and junction nodes in the City's distribution system to be entered into one complete model, which consists of approximately 780 pipes and 600 junction nodes, along with reservoirs and pump stations.

As part of this WSP update, the City's existing model was updated to include recent changes to the system. Pipe and node locations were adjusted according to the City's current piping CAD file. Elevations in the model were adjusted with County topographic data.

In addition, dimensions of the reservoirs, configuration of the pump stations, and facility controls were checked and adjusted based on record drawings and discussions with City staff. The transmission system and Upper Wishkah Zone were not included in the modeling analysis. The City's model includes the complete distribution system downstream of the Fairview Reservoirs.

7.3.3. Water Demand Allocation

For the hydraulic model, the demand forecast presented in Chapter 3 was used to define the total demand for customers within the City's service area. Spatial distribution of demand within the system was determined by zoning, with demand nodes being categorized as residential, multi-family, or non-residential depending on the associated land use. All multi-family and non-residential demands are in the Low Level and Herbig Heights Zone. The North Aberdeen and Bench Drive Zones contain only residential customers.

As such, demands were allocated across every node in the model with the exclusion of some nodes that were located near a storage reservoir or pump station where there is no known connection. A thorough review of the system was conducted, to see if demands were assigned to nodes in a reasonable manner.

After the demand allocation process was conducted, the total historical system demand was adjusted with multipliers for each pressure zone to match the demand forecast numbers presented in Chapter 3. Demands were developed for average day, maximum day and peak hour conditions. Model demands include a global adjustment for non-revenue water. Demand allocation, on a percentage basis, was assumed to be the same for the existing system, 6-year and 20-year planning horizons.

7.3.4. Calibration

A critical step in the development of a hydraulic model, prior to using it as a tool to analyze system performance, is calibration. Calibration consists of measuring pressure and flows in the

field and comparing them with the same pressures and flows simulated in the model. For the City's steady-state calibration, a total of seventeen hydrant tests were conducted by City staff between late March and early April 2012. The test locations were selected to provide adequate coverage for each pressure zone and to maximize the friction losses across the system by placing the test locations as far from sources of water for each pressure zone as possible.

For the hydrant test, a pressure gage was placed on the "residual" hydrant and pressure was measured under normal operating (where no hydrant was flowing) or "static" conditions. Once the pressure was recorded, a second hydrant was opened and the flow at this hydrant was measured using a pitot gage. While the second hydrant was open, the pressure was observed and recorded (once the gage readings stabilized) at the residual hydrant.

To conduct calibration, the system operations and boundary conditions are recorded during the time the hydrant tests are conducted. Boundary conditions of concern typically include system demands, reservoir levels, and pump station flows. Demands were allocated as described above, with total demand adjusted to match the calculated average demand for the day for the system.

Adjustments of pipe friction factors (based on pipe age and material) were made within the system to achieve steady state calibration. Table 7-10 contains the field data collected for the hydrant tests and the results of the model simulations.

In Test No 6, the residual hydrant was leaking and an accurate residual pressure could not be obtained. During Test No 7, the residual pressure in the field was considerably lower than that predicted in the model. It was discovered that field mapping indicated a 6-inch line was present that was thought to be 10-inch. Field crews investigated the area for closed valves that might restrict flow but no reasonable explanation was found. In Test No 10, the field drop in pressure was much greater than predicted by the model. The test was revised to another hydrant on a neighboring street, and the results between the field and the model were consistent. In Test No 12, the measured drop in pressure was much larger than predicted by the model. The location of the test is on a dead end 6-inch main and no reasonable explanation is found for the difference between the measured data and the model output. These tests were deemed as outliers and not used to calibrate the City's hydraulic model.

14 of the 17 tests yield consistent results with minor adjustments to friction factors in the model. Only Test No 4 had a difference between the field and modeled pressure drop greater than 5 psi at 5.1 psi. For the purposes of comprehensive planning, the City's model is considered to be well calibrated for steady state conditions.

Table 7-10. Calibration Results

Hydrant Test No.	Gage Node ID	Pressure Zone	Gage Node Elev (ft)	Fire flow (gpm)	FIELD Static Pressure (psi)	MODEL Static Pressure (psi)	Static Pressure Difference (psi) [1]	FIELD Residual Pressure (psi)	MODEL Residual Pressure (psi)	Residual Pressure Difference (psi)	Field Pressure Drop (psi) [2]	Model Pressure Drop (psi) [3]	Difference in Field and Model Pressure Drops (psi)[4]
1	J-7	Herbig Heights	329.05	1000	45	45.1	-0.1	30	32.6	-2.6	15	12.5	2.5
2	J-90	Herbig Heights	317.94	1100	50	51.1	-1.1	40	42	-2	10	9.1	0.9
		Second Hydrant		1000									
3	J-89	Herbig Heights	318	880	52	54.8	-2.8	34	39.4	-5.4	18	15.4	2.6
4	J-993	Main - North	49.56	880	78	79.3	-1.3	44	50.4	-6.4	34	28.9	5.1
5	Hydran t #3	Low Level	10.74	1130	94	96.8	-2.8	66	65.4	0.6	28	31.4	-3.4
6	J-2220	Low Level	14.47	530	90	95.5	-5.5	36	80	-44	54	15.5	38.5
7	J-364	Low Level	12.99	400	93	95.6	-2.6	32	77.2	-45.2	61	18.4	42.6
		Second Hydrant		400									
8	J-1222	Low Level	65.91	600	62	73.6	-11.6	37	49.3	-12.3	25	24.3	0.7
9	J-272	Low Level	86.61	800	62	64.8	-2.8	52	54	-2	10	10.8	-0.8
10	J-995	Low Level	2.24	700	92	97	-5	20	49.7	-29.7	72	47.3	24.7
10a	J-468	Low Level	25	530	95	89.7	5.3	70	63.1	6.9	25	26.6	-1.6
11	J-566	North Aberdeen	215.31	1525	100	99	1	65	64.7	0.3	35	34.3	0.7
12	J-494	Low Level	14.19	590	90	92.3	-2.3	38	69.1	-31.1	52	23.2	28.8
13	J-952	Low Level	157.14	800	32	35.2	-3.2	8	6.5	1.5	24	28.7	-4.7
14	C-999	Low Level	10	1300	92	95.2	-3.2	77	81.8	-4.8	15	13.4	1.6
15	J-814	Low Level	78.55	880	70	63.4	6.6	55	47.1	7.9	15	16.3	-1.3
16	J-135	Low Level	10.72	1250	90	93.5	-3.5	66	66.2	-0.2	24	27.3	-3.3
		Second Hydrant		800									
17	J-916	Low Level	10	1325	86	94.2	-8.2	70	73.9	-3.9	16	20.3	-4.3
		Second Hydrant		1350									

Notes:

(1) Calculated: Model Static Pressure (psi) minus Field Static Pressure (psi)

(2) Calculated: Field Residual Pressure (psi) minus Field Static Pressure (psi)

(3) Calculated: Model Residual Pressure (psi) minus Model Static Pressure (psi)

(4) Calculated: Model Pressure Drop (psi) minus Field Pressure Drop (psi)

7.3.5. Modeling Scenarios

The City has a distribution system with approximately 119 miles of pipe. The model was used to assess distribution system capacity to meet the required level of service for static pressures and fire flows.

In accordance with WAC 246-290-230, a minimum pressure of 30 psi must be maintained at all customer connections under peak hour demand (PHD) conditions with equalizing storage depleted in the reservoirs. A minimum of 20 psi must be maintained for fire flows under MDD conditions with equalizing and fire flow storage depleted. If these criteria could not be met, improvements were identified and through an iterative trial-and-error process, implemented until pressure criteria could be satisfied with a minimum of pipe and facility additions.

Steady state hydraulic analyses were completed for each pressure zone for existing (2012), six-year (2018), and twenty-year (2032) demand conditions. These considered peak hour demand and fire flow demand (MDD plus fire flow) conditions. Table 7-11 describes the modeling scenarios conducted, and the sequence within which they were performed. The results of the peak hour and fire flow analyses are described in greater detail below.

Table 7-11. Modeling Scenarios

Description	Demand	Purpose
Existing Year Peak Hour	2012 Peak Hour Demand	Evaluate system
Existing Year Fire Flow	2012 Maximum Day Demand plus fire flow	Evaluate system
Plan Year 6 Peak Hour	Plan Year 6 Peak Hour Demand	Evaluate system performance and develop CIP for peak hour conditions
Plan Year 6 Fire Flow	Plan Year 6 Maximum Day Demand plus fire flow	Evaluate system performance and develop CIP for Plan Year 6 fire flow conditions
Plan Year 20 Peak Hour	Plan Year 20 Peak Hour Demand	Evaluate system and develop CIP for Plan Year 20 peak hour conditions
Plan Year 20 Fire Flow	Plan Year 20 Maximum Day Demand plus fire flow	Evaluate system performance and develop CIP for Plan Year 20 fire flow conditions

7.3.6. Peak Hour Analysis Results

Figures 7-2 and 7-3 present the PHD pressure results for 2012 and 2032 respectively. Table 7-12 provides a summary of the pressure distribution amongst the model nodes, organized by pressure zone. These results are used to identify areas of low pressure (<30 psi) and areas of high pressure (>100 psi).

The majority of the City's water distribution system (approximately 79% of system nodes) experiences pressures greater than 80 psi. 73 percent of the system has peak hour pressures between 80 to 100 psi, while 6% of the system is above 100 psi. There is a large area of high pressure in the southern portion of the Herbig Heights Zone along 7th Ave. Also, there are high pressures above 100 psi in the North Aberdeen Zone. In cases where a customer is concerned

about high pressure and potentially adverse effects on in-premise plumbing, it is the customer's responsibility to install and maintain their own individual pressuring reducing valve on their side of the meter. Typically City customers implement this approach only when pressures are frequently in excess of 100 psi.

There are three areas of low pressure in the system. For a few services along Valley View Way in the vicinity of the Bench Drive pump station, pressures are regularly near or below 30 psi based on the elevation in the area. Project D-18 will extend a 2" new waterline from the Bench Drive zone along Valleyview Way to connect to these services to the elevated pressure zone.

A few services on Ranier Street in the Low Level Zone may experience system pressures less than 30 psi during peak hour conditions. This is based on the elevation of the area. Project D-14 will install a PRV from the North Aberdeen Zone along Ranier Street to reduce the impacts of drawdown during peak demands.

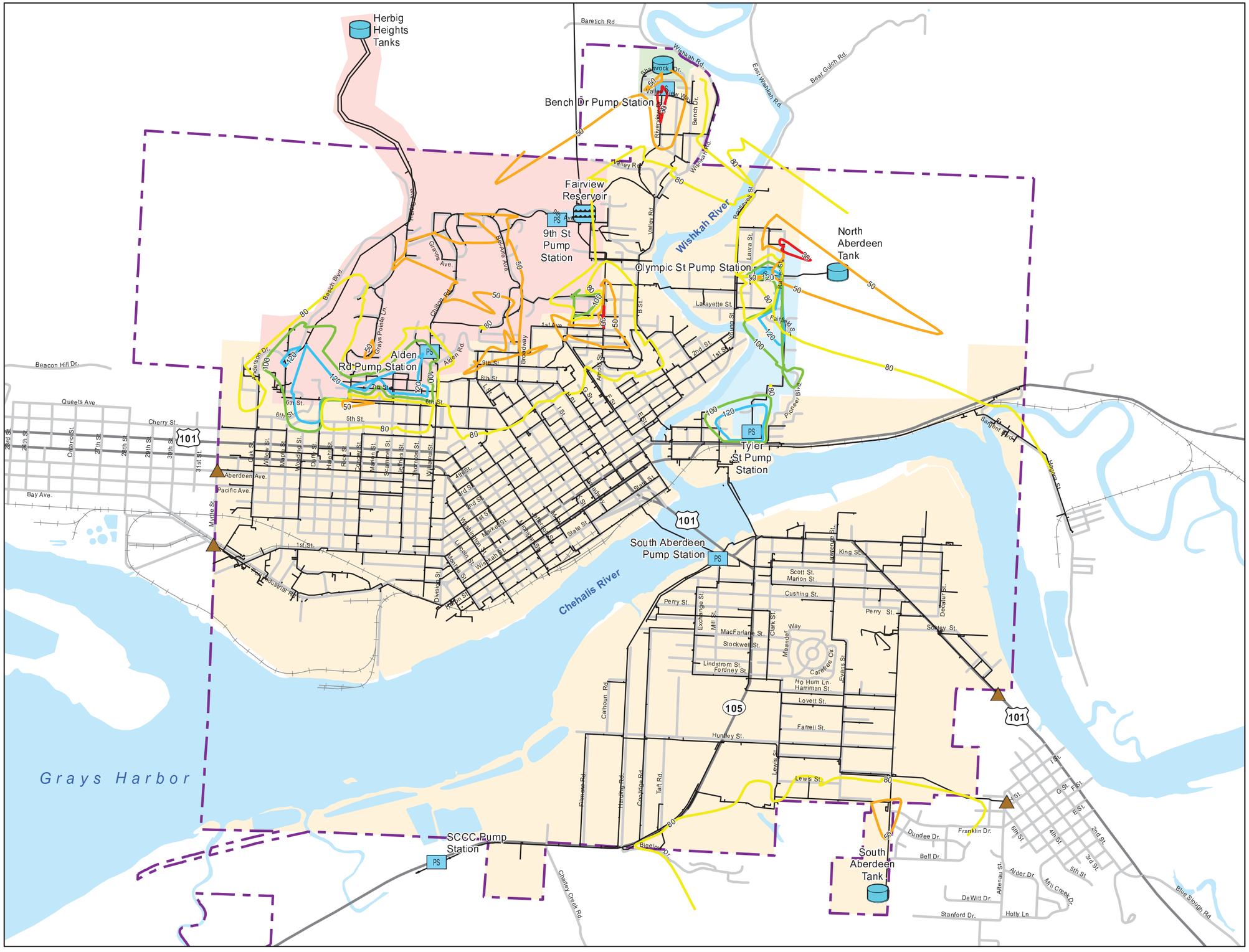
Another area of low pressure is at Arnold Street and 2nd Avenue. The model predicts that during peak hour conditions, the system pressure can drop below 30 psi at this location. No improvement is proposed to address the low pressure at this location as it is an existing condition that would be too costly to address.

The model's peak hour pressure results for the existing and future scenarios are shown in Table 7-12. With the exception of the Valley View Way area where the Bench Drive Zone will be extended to include more services, system pressures remain consistent as seen in the current system.

Table 7-12. Peak Hour Demand Pressure Results

2012 Node Pressure by Pressure Zones (1)				
Pressure Zone	**<30 psi**	**30-80 psi**	**80-100 psi**	**>100 psi**
Low Level	2	86	422	2
Herbig Heights	0	35	4	28
North Aberdeen	0	1	0	4
Bench Drive	0	3	0	0
Total	**2**	**125**	**426**	**34**
2032 Node Pressure by Pressure Zones (1)				
Pressure Zone	**<30 psi**	**30-80 psi**	**80-100 psi**	**>100 psi**
Low Level	3	80	430	1
Herbig Heights	0	35	4	28
North Aberdeen	0	0	1	4
Bench Drive	0	0	1	3
Total	**3**	**115**	**436**	**36**

Notes:
1. The values in each cell represent the number of nodes within a certain pressure range for a given pressure zone.



Legend

Pressure (psi)

- 120
- 100
- 80
- 50
- 30
- Pump Station
- Reservoir
- Tank
- Intertie
- Waterline
- Aberdeen City Limit
- Highway
- Street
- Railroad
- Water Body

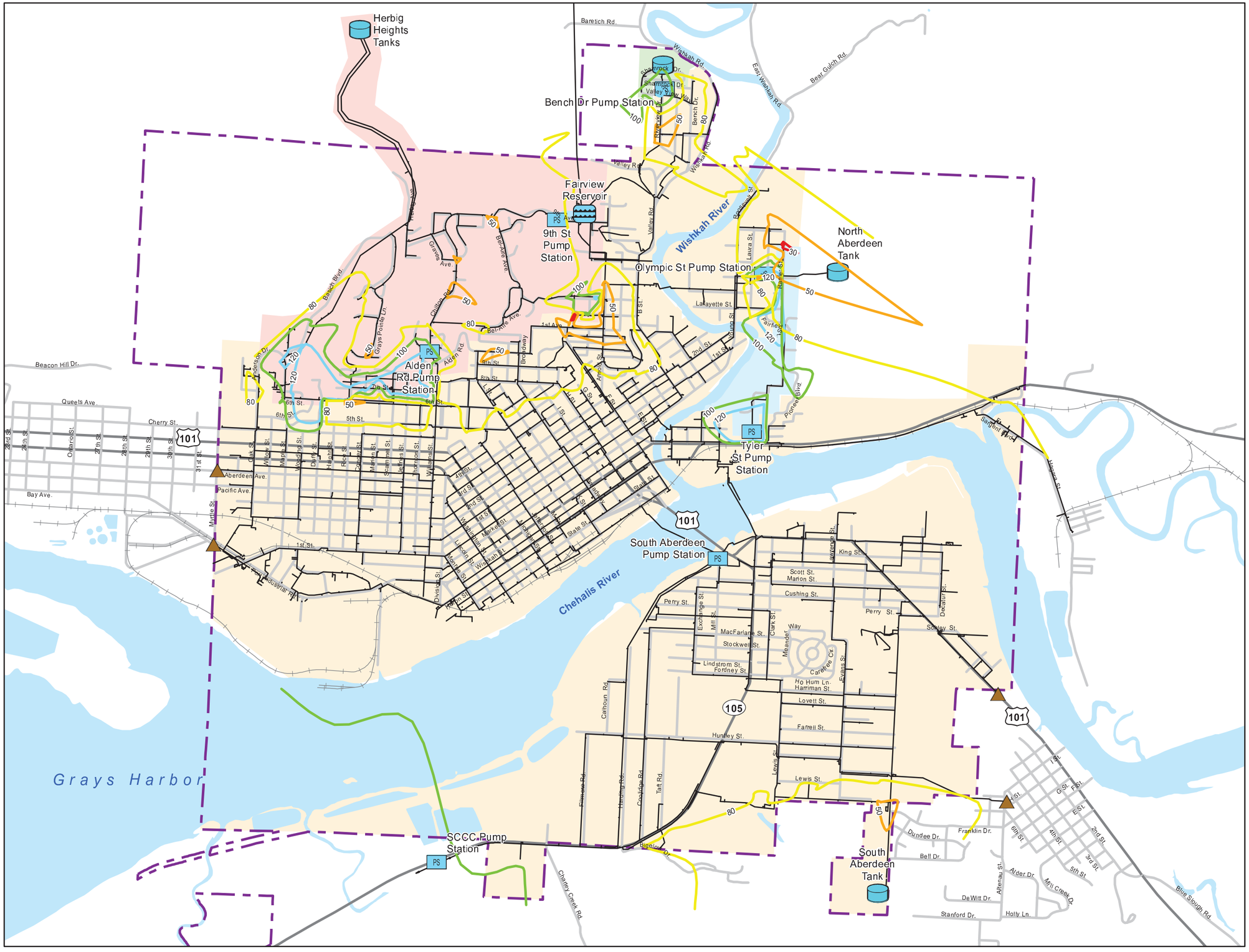
Pressure Zone

- Aberdeen Main
- Bench Drive
- Herbig Heights
- North Aberdeen

Figure 7-2
2012 Peak Hour Pressure Map
CITY OF ABERDEEN
WATER SYSTEM PLAN
July 2012

N

0 750 1,500 3,000 Feet



Legend

Pressure (psi)
- 120
- 100
- 80
- 50
- 30

- Pump Station
- Reservoir
- Tank
- Intertie
- Waterline
- Aberdeen City Limit
- Highway
- Street
- Railroad
- Water Body

Pressure Zone
- Aberdeen Main
- Bench Drive
- Herbig Heights
- North Aberdeen

Figure 7-3
2032 Peak Hour Pressure Map
CITY OF ABERDEEN
WATER SYSTEM PLAN
July 2012

N

0 750 1,500 3,000 Feet

7.3.7. Fire Flow Analysis Results

Fire flow analysis results are provided in Figures 7-4 and 7-5 for 2012 and 2032, respectively. These figures depict the locations where available fire flows are less than the established fire flow goals. Detailed results for select, key locations are summarized in Table 7-13.

Improved fire flow conditions in the future at the select locations are a result of identified capital improvement projects, which are summarized below and described in detail in Chapter 8. These projects are comprised primarily of the replacement of small diameter piping.

While fire flow related improvements have been identified, many of them are not scheduled for implementation until beyond the six-year planning horizon. This is because the differences between available and desired fire flows have existed for many years, would be costly to fix through infrastructure improvements, and the City Fire Department is aware of them. In the near-term, the City is directing its available resources at addressing source of supply concerns (as noted previously in this chapter). Thus, most of the fire flow related projects will be addressed further in the future as resources are available.

- At location A, the fire flow goal of 3,000 gpm is limited in the area on the western end of the distribution system along Highway 101. Flow is limited in the 6-inch and 8-inch water mains due to a lack of connection and looping in the area. There is no recommended improvement as the use of multiple hydrants can satisfy the goal.
- At location B, the fire flow goal of 3,000 gpm is limited on a dead end 8-inch water main. No improvement is identified as the hydrant meets 97% of the goal.
- At location C, the fire flow goal of 3,000 gpm in the vicinity of Division St and Port Industrial Road is limited in three hydrants on dead end 6-inch and 8-inch water mains. No improvement is identified as multiple hydrants are available to satisfy the fire flow goal.
- At location D, the fire flow goal of 3,000 gpm is limited in one hydrant on a dead end 6-inch water main. No improvement is identified as multiple hydrants are available to satisfy the fire flow goal.
- At location E, the fire flow goal of 3,000 gpm is limited in one hydrant by the capacity of the 6-inch water main. No improvement is identified as multiple hydrants are available to satisfy the fire flow goal.
- At location F, the fire flow goal of 3,000 gpm is limited by the capacity of the 4-inch and 6-inch water main. No improvement is identified as multiple hydrants are available to satisfy the fire flow goal.
- At location G, the fire flow goal of 3,000 gpm is limited in one hydrant by the capacity of the 6-inch water main. No improvement is identified as multiple hydrants are available to satisfy the fire flow goal.
- At location H, the fire flow goal of 500 gpm is limited by high elevations along Valley View Way and the capacity of the Bench Drive pump station. No improvement is indentified as the Fire Department currently marks these hydrants as having limited available fire flow. In lieu of distribution improvements, the fire flow can be supplied through pumper trucks filling from other hydrants.

- At location I, the fire flow goal of 500 gpm is limited in the dead end portion of the system and high elevations along Ranier Street. Project D-14 installs a PRV from the North Aberdeen zone on Ranier Street. This will increase fire flow in the area to satisfy the goal.
- At location J, the fire flow goal of 3,000 gpm is limited in the hydrants along Highway 12 east of Chehalis Street. The area is served by a dead end 6-inch water main that limits the available flow. Project D-16 installs a 12-inch water main parallel to the existing 6-inch water main on Highway 12. This will increase the available fire flow to satisfy the goal.
- At location K, the fire flow goal of 3,000 gpm is limited in the hydrants along Junction City Road and Hagara Street. The dead end 12-ich water main that serves the area is limited by the same 6-inch water main described above on Highway 12. Project D-15 would install a new river crossing between Curtis Street and Hagara Street, improving the available fire flow and providing redundancy. Project D-16 installs a new 12-inch water main to remove the hydraulic bottle neck along Highway 12. Both projects will improve the available fire flow to meet the goal.
- At location L, the fire flow goal of 3,000 gpm is limited in hydrants on dead end water mains along Curtis Street. No improvement is identified as multiple hydrants are available to satisfy the fire flow goal.
- At location M, the fire flow goal of 3,000 gpm is not available in hydrants along Highway 101 south of Schley Street. The available fire flow is limited by the capacity of the 6-inch and 8-inch water mains. There is no project identified as multiple hydrants are available to satisfy the goal.
- At location N, the fire flow goal of 3,000 gpm is not available in one hydrant on Harding Road. The available fire flow is limited by the capacity of the 6-inch water main. No improvement is identified as multiple hydrants are available to satisfy the goal.

Legend

- Pump Station
- Reservoir
- Tank
- Intertie

Waterline (in)

- 4-inch
- 6-inch
- 8-inch
- 10-inch
- 12-inch
- >12-inch
- Transmission Line
- Aberdeen_City_lim
- Highway
- Street
- Railroad
- Water Body

Pressure Zone

- Aberdeen Main
- Bench Drive
- Herbig Heights
- North Aberdeen

Fire Flow Goal Met (%)

- <25%
- 25-50%
- 50-75%
- >75%

Note:
Each location highlighted on the map represents an area where available fire flow is less than fire flow goal

Available Fire Flow (Red)
Fireflow Goal (black)

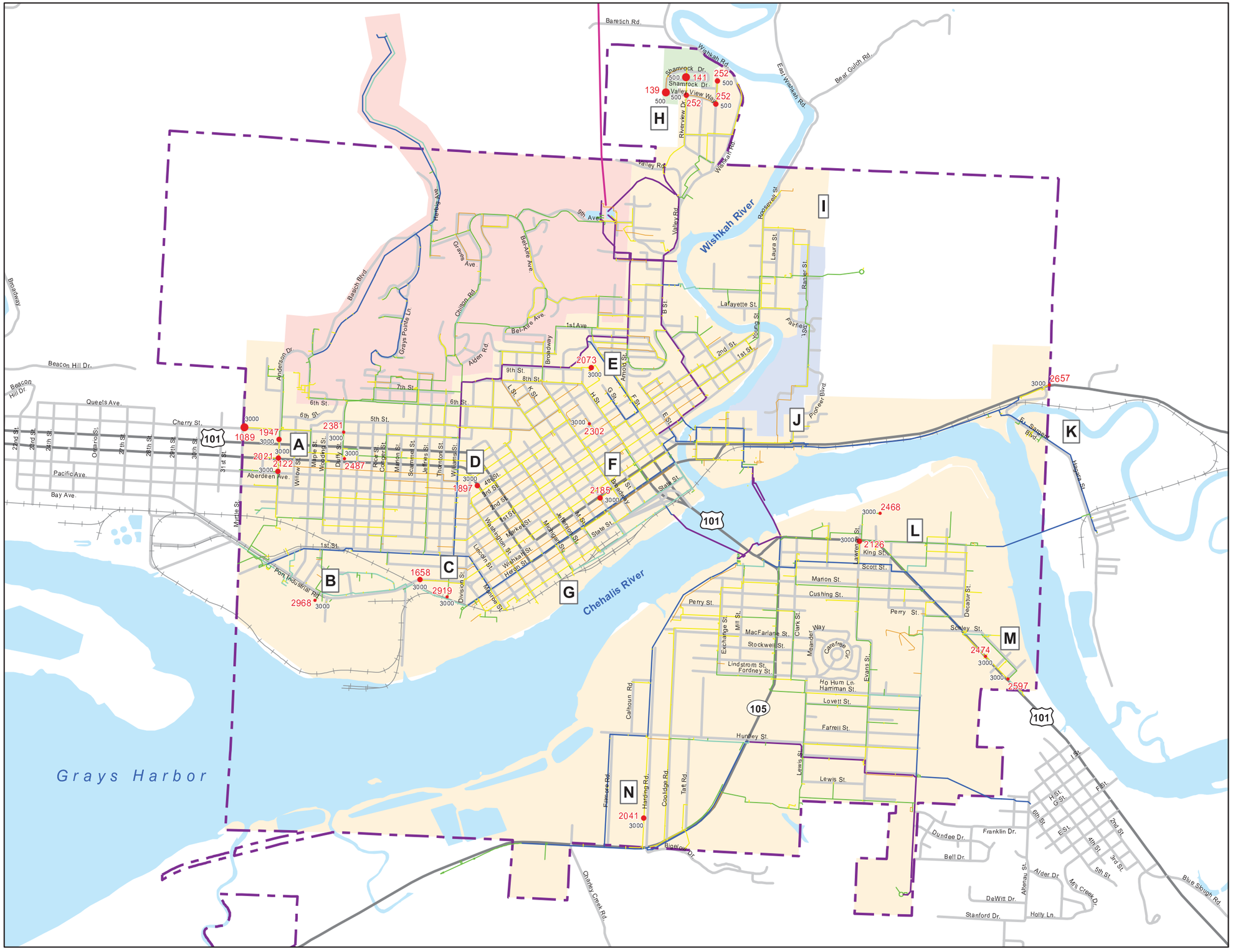
A Fire Flow Analysis Location ID

Figure 7-4
2012 Fire Flow Map
CITY OF ABERDEEN
WATER SYSTEM PLAN

July 2012

N

0 750 1,500 3,000 Feet



Legend

Fire Flow Goal Met (%)

- >75%
- 50-75%
- 25-50%
- Pump Station
- Reservoir
- Tank
- Intertie

Waterline (in)

- 4-inch
- 6-inch
- 8-inch
- 10-inch
- 12-inch
- >12-inch
- Transmission Line
- Aberdeen_City_lim
- Highway
- Street
- Railroad
- Water Body

Pressure Zone

- Aberdeen Main
- Bench Drive
- Herbig Heights
- North Aberdeen

Note:
Each location highlighted on the map represents an area where available fire flow is less than fire flow goal

Available Fire Flow (Red)
Fireflow Goal (black)

A Fire Flow Analysis Location ID

Figure 7-5
2032 Fire Flow Map
CITY OF ABERDEEN
WATER SYSTEM PLAN

July 2012

N

0 750 1,500 3,000 Feet

Table 7-13. Fire Flow Analysis Results at Key Locations

Pressure Zone	ID	Location	Pipe Diameter (in)	Notes	Fire Flow Goal (gpm)	2012 Available Fire Flow (gpm)	2032 Available Fire Flow (gpm) (1)	Improvements
Low Level	A	Multiple Hydrants along Hwy 101	6" and 8"	3000 gpm goal on 6" and 8" waterlines	3000	1,075-2,411	1,089 - 2,487	No improvement. Multiple hydrants available to satisfy goal.
Low Level	B	Port Industrial Rd	8"	Hydrant on dead end 8" waterline	3000	2,898	2,968	No improvement. Multiple hydrants available to satisfy goal.
Low Level	C	Wishkah St West of Division	6" and 8"	3000 gpm goal on 6" and 8" waterlines	3000	1,635-2,979	1,658-2,919	No improvement. Multiple hydrants available to satisfy goal.
Low Level	D	Hwy 101 S and 4th St	6"	Hydrant on dead end 6" waterline	3000	1,865	1,897	No improvement. Multiple hydrants available to satisfy goal.
Low Level	E	9th St and H St	6"	3000 gpm goal on 6" waterline	3000	2,020	2,073	No improvement. Multiple hydrants available to satisfy goal.
Low Level	F	Multiple Locations	6"	3000 gpm goal on 6" waterlines	3000	1,263-2,226	2,185-2,302	No improvement. Multiple hydrants available to satisfy goal.
Low Level	G	Alder St	6"	3000 gpm goal on 6" waterline	3000	2,937	>3,000	No improvement. Multiple hydrants available to satisfy goal.
Low Level	H	Valley View Way and Bench Dr - Multiple locations.	4" and 6"	Hydrants are limited by low available pressure and the Bench Dr pump station capacity.	500	140-234	139-252	No improvement. High elevations in area limit flow.
Low Level	I	Roosevelt St and Forsythe St - Multiple Locations	6"	Hydrants are limited by nearby service elevation	500	156-216	>500	D-14 installs PRV from North Aberdeen
Low Level	J	Hwy 12, Fleet St and Tyler St - Multiple Locations	6" and 12"	Dead end waterline along Hwy 12 is connected with a 6" waterline that limits fire flow capacity	3000	819-995	>3,000	D-16 installs 1,150 LF of 12" along Hwy 12 from Chehalis St to Fleet St. River
Low Level	K	Junction City Rd	12"	Hydrants are limited by 6" connection for this dead end waterline	3000	761-773	>3,000	D-15 installs river crossing from Curtis to Hagara and D-16 installs 1,150 LF of 12" along Hwy 12 from Chehalis St to Fleet St.
Low Level	L	Curtis St - Multiple Locations	6" and 8"	3000 gpm goal limited by 6" and 8' dead end water lines	3000	2,129-2,428	2,126-2,468	No improvement. Multiple hydrants available to satisfy goal.
Low Level	M	Hwy 101 and Polk St between Schley St and Taylor St	6" and 8"	3000 gpm goal on 6" and 8" waterlines	3000	2,442-2,974	2,474-2,597	No improvement. Multiple hydrants available to satisfy goal.
Low Level	N	Harding Rd	6"	3000 gpm goal on 6" waterline	3000	2,030	2,041	No improvement. Multiple hydrants available to satisfy goal.

(1) Fire flow available once improvements noted in next column are implemented.

8. Operations and Maintenance

8.1. Organizational Structure

The Public Works Department has responsibility for the management and operation of the City of Aberdeen's (City) water system. Exhibit 8-1 provides a diagram of the organizational structure of the Public Works Department.

The Public Works Department is headquartered at City Hall and is headed by the Public Works Director. Responsibilities of this position include overall management of all water, wastewater, engineering, and transportation services including implementation of City policy.

A Water Systems Manager, under the direction of the Public Works Director, organizes and administers the day-to-day operation and maintenance (O&M) of the water system.

The administrative department reviews each description on a periodic basis to ensure it is current and accurately describes the position within the existing organizational structure.

8.2. Personnel Certification

According to Chapter 248-55 Washington Administrative Code (WAC), Water Works Operator Certification, public water systems with more than 100 services are required to have a certified operator. Certified personnel are required for positions that are in direct charge of public water systems or major segments of a large system. These certified personnel are responsible for monitoring and/or improving water quality.

The City is in full compliance with all the laws and regulations regarding staff certification and training. The positions required to be filled by certified operators, the required classifications, and the individuals presently employed are shown in Table 8-1.

The City has a continuing education program to help employees qualify for higher levels of education and actively encourages employees to achieve the highest levels of certification possible.

**** Note to City: Is the following table current?****

Table 8-1. Certified Operator Positions, Required Classifications, and Personnel Presently Employed

Position	Classification	Employee
Water System Manager	WDM 3	Mike Randich
Customer Service Supervisor	WDM 2 and CCS	Brent Boone
Water Treatment Supervisor	WDM 2 and WTPO 2	Bodie Martin
Water Construction Supervisor	WDM 2	Leonard Graham
Shift Operator	WTPO 1	Bruce Davis
Shift Operator	WTPO 1	Dave Nelson
Shift Operator	WTPO 1	Brett Bradley

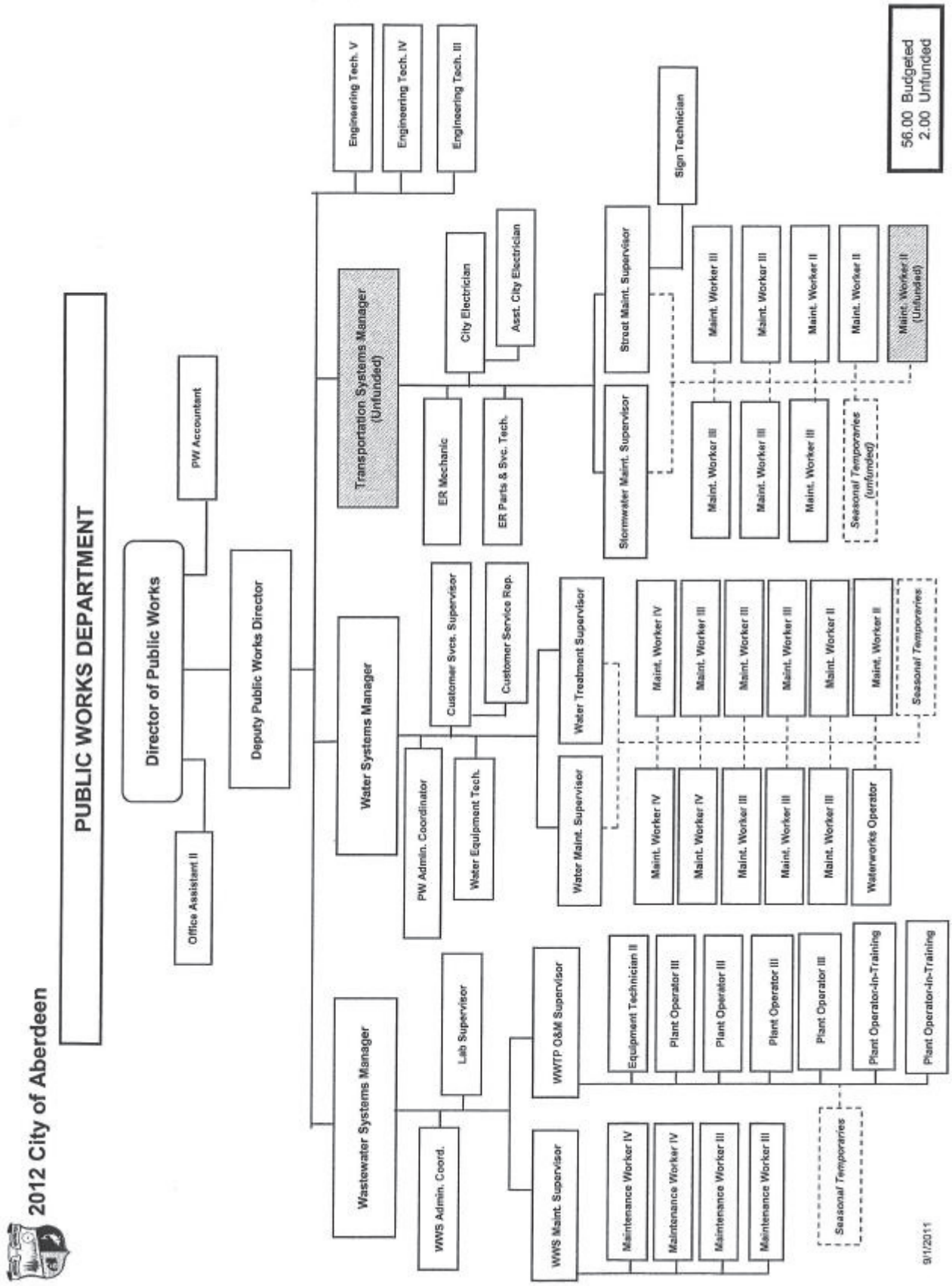


Figure 8-1. Organization Chart

8.3. Routine Operations

8.3.1. General

The City has a well-organized system of day-to-day monitoring and inspection to ensure the water system is kept in good operating condition. Troubleshooting, adjustments, and repairs are also a part of the daily operations program. The Water Systems Manager directs Water Department staff in carrying out daily O&M activities. Routine operational procedures for various system components are described as follows.

8.3.2. Source of Supply

The Wishkah Headworks is monitored by City staff that inspect the facility 2 times per week. There is a family that lives on the property that also performs grounds maintenance.

The City recently installed remote telemetry to monitor lake levels, intake screen blockage, ambient temperature, and precipitation. The telemetry unit also monitors and adjusts the position of two feed control valves, one at the headworks and one at the WTP. An associated telemetry system relays all essential information between Headworks, WTP, and the Water Department shop office. The 28-inch gravity supply line route from the headworks to the WTP is inspected twice a year and vegetation control is performed on an as-needed basis.

8.3.3. Treatment Operations

Daily WTP operations include testing, calibrating, and confirming the Supervisory Control and Data Acquisition (SCADA) readings for chlorine, pH, and fluoride residuals, as well as volumes used for sodium hydroxide, chlorine, and fluoride. Other daily operational items may include, but are not limited to, plant flow adjustments, individual membrane filter cleanings, maintenance on the air compressors, backup diesel generator, various feed and wastewater pumps, pre-screens, etc.

8.3.4. Finished Water Storage

Daily reservoir checks are carried out to monitor water levels and to verify physical security. Operators check fences, gates, and locks for evidence of intrusion. They also inspect chlorination systems and turbidity monitors at the Fairview reservoirs. All reservoirs are in a maintenance program that includes draining, cleaning, and inspection every three to five years.

8.3.5. Booster Facilities

Each booster pump station is inspected weekly. These inspections include checking pumps, pressure gauges, and controls as well as observing and documenting the overall physical condition of the station.

8.3.6. Service Meters

Water service meters are inspected in response to customer requests or when other evidence suggests a meter is malfunctioning. Larger meters (larger than 1-inch) are tested and calibrated on a regular basis as recommended by the manufacturer.

8.4. Emergency Response Plan

The Washington Department of Health (DOH) requirements for a Water System Plan (WSP) specify that an Emergency Response Plan (ERP) be included in the Operations Program. The purpose of an ERP is to guide personnel in anticipating and responding to system malfunctions, natural disasters, and other events affecting routine water system operations.

The major elements of an ERP include a description of system vulnerability, a contingency plan, and a summary of emergency response procedures. Because potential emergency situations are varied, it is important to develop a response plan that incorporates sufficient flexibility to adapt to a wide range of conditions. Proper staffing, training, and communication, as well as a suitable inventory of maintenance and repair parts, are also basic to a successful ERP.

The City establishes a weekend watch schedule to ensure that a responsible contact is available to handle system emergencies at any time.

8.4.1. Vulnerability Overview

A vulnerability assessment of the water system has been completed by the City. The assessment identifies major system components and describes conditions that could result when facilities fail to operate or perform as designed.

Contamination from land use practices, flooding, earthquakes, accidental spills, vandalism, power outages, mechanical failure of pumping equipment, and gravity main breaks are considered to be the more significant threats to water system facilities.

8.4.2. Emergency Notification

The Public Works Department has prepared and regularly updates an emergency notification information packet. A copy of this packet, with up-to-date telephone numbers, is displayed at the Public Works office at City Hall as well as the water shop, police department, fire department, and at the Wishkah headworks. In the event of an emergency, additional personnel are assigned as deemed necessary. The emergency contact list is shown in Table 8-2.

*****Note to City: Are the following phone number for the City correct?*****

Table 8-2. Emergency Contact list

Emergency Contact	Phone Number
Fire/Police/Medical	911
County Emergency Services	(360) 537-3721 (888) 541-5923
DOH Southwest Drinking Water Mainline	(360) 236-3030
DOH Emergency Contact (24 Hours)	(800) 525-0127
Department of Ecology Spill Response	(360) 407-6300
City Fire Department	(360) 532-1254
Call Before You Dig	(800) 424-5555
City Public Works Director	(360) 537-3228
City Water Systems Manager	(360) 537-3273
City Water System Administrative Assistant	(360) 537-3224

City Water Treatment Supervisor	(360) 533-2162
City Water Filtration Plant	(360) 533-2327
City Water Maintenance Supervisor	(360) 532-7302
City Water System Headworks (Wishkah)	(360) 532-1818
City Water System Customer Service	(360) 532-1317
City Mechanic	(360) 538-1798
City Engineering Department	(360) 533-4100
City Transportation Systems Manager	(360) 537-3241
City Wastewater Systems Manager	(360) 537-3285
City Electrical Division	(360) 532-3615
Grays Harbor PUD	(360) 532-4220

8.4.3. General Field Response

The initial reaction by City personnel to an emergency is to take prompt action to remove or mitigate any immediate threat to public health or safety. Where appropriate, bystanders may be warned, traffic diverted, valves shut off, dangerous materials isolated or removed, or other necessary action taken provided it can be done without further risk to the public or to City personnel.

Concurrent with these initial steps, the Water Systems Manager is contacted and informed as to the damage and apparent cause. The Manager then dispatches a crew to isolate the problem or damaged facility. Meanwhile, on-site crew members perform a more thorough damage assessment to develop and evaluate potential courses of corrective action including which materials and equipment may be necessary to implement various alternatives. It is frequently necessary to decide between a temporary solution that can be accomplished quickly and a permanent one that may take more time. To support these essential evaluations, the City's repair supplies inventory and a list of materials suppliers is kept up-to-date and is readily accessible to avoid unnecessary delay in restoration of service.

Throughout any emergency, radio contact is maintained among work crews, the Water Systems Manager, and other key participants to enhance coordination of the corrective effort. City department heads are notified of emergencies and updated on progress towards restoration so that they may assess impacts to their jurisdictions and, if necessary, issue appropriate public notifications.

8.4.4. Emergency Response Actions

Actions to be taken in response to several emergency situations are described below.

Emergency: Earthquake

Description

A major earthquake, with a magnitude of 5.0 or greater on the Richter scale, and an intensity of 9 or greater on the Modified Mercalli scale, could disrupt the source, transmission, pumping, treatment, storage, and distribution components of the water system. In addition, power failures and interruption to conventional transportation and communication systems may occur.

Response

Water system personnel and facilities anticipate critical water use needs for fire fighting and medical facilities resulting from an earthquake. These critical needs are given due priority in assessing damage reports and organizing repair efforts. Crews are trained and equipped to maintain constant radio contact, barricade hazardous areas, close valves to isolate broken mains, move soil and debris, turn off water services, and make repairs. They are also trained and prepared to aid residents in securing temporary supplies of safe drinking water. The City's ample treated water storage capacity is an important resource. That storage can be utilized until sources that may have been inactivated by earthquake, flooding, or other natural disasters can be returned to service.

In the event of an earthquake, water system personnel are trained to perform thorough equipment and facility inspections and to research and identify any unexplained drop in line pressure, reduction in flow rate, pump failure, leakage, or other signs of damage. Pipelines and other buried facilities are hidden from view but are at least as susceptible to ground movement as aboveground structures. Thus, buried facilities require careful inspection following any earthquake.

Emergency: Treatment Plant Chemical Spills

Description

- Fluoride saturation tank or dosing pump leak
- Chlorine gas leak
- Sodium hydroxide tank or dosing pump leak

Response

The fluoride saturation and sodium hydroxide tanks are located in a separate chemical containment room at the WTP. In the event of an accidental spill or leak, the chemical solution flows into a catch basin. The solution is then pumped outside to a large ditched containment area, and when this sump pump is activated, an alarm is sent through the SCADA control system to all City staff on emergency call. The Washington State Department of Ecology (Ecology) - Hazardous Spills Division would also be notified.

The chlorine gas is delivered on-site in one-ton cylinders. These cylinders are then loaded into a separate cylinder containment vessel. This room is also isolated from the rest of the WTP. In the event of a chlorine gas leak, there are several gas detectors that are also connected to the SCADA control system which automatically shut-down the necessary valves connected to these containment vessels and activate a call-out alarm. Numbers posted to call are Emergency 911 and Aberdeen Fire Department and HazMat Team.

Emergency: Flooding

Description

The City location at the mouths of the Chehalis and Wishkah Rivers makes it potentially vulnerable to floods in either drainage basin. The largest potential flood impact on the City's water system is washout of key piping facilities, particularly at river crossings. Other problems can accrue from loss of power, high turbidity at the Wishkah source, and inundation of facilities. Important impacts include overload of the wastewater plant, inundation of other structures, transportation disruptions, and competing demands on City resources.

Response

Water personnel are trained to anticipate which facilities are most likely to be impaired by flooding. In the event of a flood, all major system components are checked thoroughly to assess physical damage as well as evidence of contamination. Particular attention is directed to areas where water mains cross flooded streams. Once collected, damage reports are evaluated and prioritized to focus on items that require immediate attention to assure continued water service.

Crews are trained and equipped to maintain constant radio contact, construct temporary diversion dams, barricade hazardous areas, shut off valves to isolate broken mains, pump or bail flooded facilities, move soil and debris, turn off individual water services, and make repairs. They are also trained and prepared to aid residents in securing temporary supplies of safe drinking water.

Emergency: Power Failure

Description

Short- and long-term interruptions in power supply can occur for a variety of reasons and may or may not be associated with emergencies that would otherwise affect the water system. In addition, power outages may be localized to one or more blocks or may affect the entire region. Facilities most affected by this type of emergency include: water treatment, booster pumping, telemetry equipment, and communications systems.

Response

In addition to staging appropriate field responses, water personnel are trained to immediately contact the Gray's Harbor Public Utility District to determine the nature, extent, and expected duration of a power outage. The WTP includes a diesel-powered generator sized to provide backup power for all essential treatment system equipment items. The presence of this backup generator, combined with the fact that source water and treated water flow by gravity in the City's system, supports a continued supply of treated water to the Fairview reservoirs during extended power outages.

Fairview reservoir storage is sufficient to enable more than a week of uninterrupted water service to the low level zone. Depending on usage, it is feasible that the Herbig Heights and north Aberdeen zones could also be served for several days from the existing reservoirs. Storage for the Bench Drive area, however, is more limited. Thus, it would be necessary to mobilize a source of temporary backup power to maintain water service for that area during any extended power outage.

Emergency: Contamination of Source of Supply

Description

Contamination can occur in the surface supply system and may be the result of man-made practices or natural occurrences. The Wishkah source is vulnerable to landslides or other erosional events in the watershed in conjunction with heavy precipitation and periods of high run-off that seasonally occur in the fall, winter, and spring months. Contamination may also result from petroleum or other chemical spill in the watershed.

Response

Initial response to source contamination includes isolating the source from the rest of the system. Next, an assessment is performed to determine the specific cause and remove it as quickly as possible. This may be a simple matter such as in the event of a minor spill or may require a long

period of time, resources, and specialized assistance for larger, more complicated problems. Appropriate measures for source removal and site cleanup are developed and evaluated according to the type, location, nature, and entry path of the contaminant.

In addition to their field response, City personnel are trained to ensure that appropriate health authorities are contacted. The health authorities, in turn, determine the extent of contamination in the system and guide the City in preparing and implementing an appropriate public information program.

Emergency: Gravity Line Failure

Description

Rupture or excessive leakage in the gravity supply lines from the Wishkah source to the WTP, and from the WTP to the Fairview reservoirs could result from corrosion, pressure surge, construction accident, vacuum collapse, earthquake, bomb blast, vandalism, stream erosion, or material failure. A major break would result in interruption to a major source of supply and present a flood and erosion threat to adjacent landowners.

Response

Such an event requires prompt action by City personnel to isolate the damaged section and thus minimize the impact to the rest of the system. The City has a large volume of reservoir storage, both in town and at the WTP for serving Wishkah valley customers. Thus, a temporary loss of either pipeline would usually not cause a water shortage for any system customer unless it occurred during peak demand periods.

Emergency: Fairview Hill Reservoir Failure

Description

A sudden failure of one or both Fairview reservoirs could present an immediate flooding threat to nearby residents. Such a failure of two smaller, yet similar, reservoirs owned by the City of Centralia occurred in October 1991. The Centralia event resulted in extensive damage to homes and property over an area of several blocks. Such a failure of the City's reservoirs could be caused by a foundation failure, washout, construction accident, earthquake, bomb blast, vandalism, or material failure. A sudden breach of storage facilities collectively containing 25 million gallons (MG) of water has a high flooding potential.

Response

Such an event requires prompt action by City personnel to warn and protect the public from harm as well as to notify appropriate health and safety agencies. Other necessary duties include isolating the rest of the system from the reservoirs, checking the distribution system for evidence of contamination, notifying DOH, and providing information to the public and media.

8.4.5. Public/Press Information

As a public water supplier, the City has an obligation to properly inform its customers of emergencies that may affect water service. It is essential that this information is clear, accurate, and expressed in

a responsible manner. Whenever possible, press releases and other public statements are prepared in advance and delivered to customers. The City also delivers information to customers through its annual CCR.

8.5. Source Water Protection Plan

The City's Watershed Control Plan has been approved by DOH (see Appendix J). A copy is available upon request.

8.6. Routine and Preventative Maintenance

The City follows an established schedule for monitoring and maintaining facilities throughout the treatment and distribution systems. Good preventative maintenance has proven to be cost-effective as well as an efficient means of avoiding emergency conditions. By following a set schedule of maintenance activities, the City ensures efficient and reliable system operation extends the service life of equipment items, and monitors for early signs of mechanical breakdown.

Records of maintenance activities are kept for treatment facilities, transmission lines, reservoirs, valves, hydrants, pumps, meters, and cross-connection control devices.

Preventative maintenance also encompasses security measures to prevent or discourage unauthorized use, theft, or vandalism of City facilities. All major equipment and facilities are enclosed and securely locked while unattended. This includes all buildings, vaults, reservoirs, material storage areas, and fences designed to secure such facilities. Major in-town facilities are also included in routine police department security patrols.

Security at the Wishkah source is important to minimize the possibility for accidental or deliberate contamination, to maximize the protection of system integrity, and to minimize liability to the City due to intruder/injury cases. The City will be installing security cameras and an improved communication system at the source. There is a caretaker living in onsite, and staff visit at least twice a week to perform maintenance and inspection.

8.7. Water Quality Violation Response Procedures

The City is required to take fifteen monthly samples as required by the DOH. Samples are normally taken the first and third weeks of the month, but this may vary depending on weather conditions.

The sample site locations are:

1. Cherry and Maple
2. Heron and Monroe
3. Chilton and Gordon
4. 800 Block of Shamrock
5. 4th Ave. and Robert Gray
6. 1800 Block of Young
7. 1300 Block of E Wishkah
8. Cosmopolis Utility Shop (Not required test-site.)
9. SW Blvd and Hogan
10. 1700 Block of Coolidge
11. Water Filtration Plant (Treated Water Line)
12. Headworks Raw Water (Raw Water Line at Filtration Plant

1st Week Sampling Sites: 1-2-3-4-6-8-9-10-11-12
2nd Week Sampling sites: 2-3-4-6-7-8-9-11-12

In the event of a bad sample, the test will be taken from the same dedicated sampling location for three consecutive days and all samples must pass. The City has previously coordinated with DOH

and DOH has approved that the City's repeat sample sites are the same as the routine sample sites (repeat samples are not taken from nearby locations within 5 upstream or downstream connections).

In the event of two violations (bad samples) in one month, a public notification is required. Public notification is discussed in Section 8.8.

In the month following the unsatisfactory sample, 15 repeat samples are required. The City meets this requirement by collecting 15 routine samples each month.

8.7.1. Inorganic and Organic Chemicals

When an average of four samples exceeds the maximum contaminant level (MCL), the City must report to State *within 48 hours* and notify the public, collect three additional samples within one month.

8.7.2. Turbidity

When turbidity exceeds the MCL, the City must resample the system within one hour. If the repeat sample confirms MCL exceedance, the City must report to DOH *within 24 hours.* Use repeat sample to calculate monthly average. If MCL is exceeded, the City must report to DOH *within 24 hours* and notify public.

8.7.3. Coliform

Initiate at least three consecutive daily check samples and continue check sampling until at least two consecutive daily check samples show no positive results. When the presence of coliform is confirmed in any check sample, the City must report to DOH *within 24 hours*. When the MCL is exceeded, the City must report to DOH *within 24 hours* and notify public. The City's Monitoring Plan (CMP) is presented in Appendix G.

8.7.4. Radionuclides, Pesticides and Trihalomethanes

When radionuclides or trihalomethanes exceed the State MCL, the City must report to DOH *within 48 hours* and notify public.

8.7.5. Corrosivity

In the event of corrosivity violation, the City must notify DOH, evaluate the situation, and establish corrective program. If daily sampling confirms MCL, the City must notify the public.

8.7.6. Summary

In any case of contamination violation or MCL exceedance, the City must perform verification procedures as required. If exceedance is confirmed, the City must identify the problem and initiate corrective action. The requirements identified in this section are subject to change based upon changes in water quality requirements.

8.8. Public Notification

Although each public notification should be developed with the assistance and concurrence of the DOH District Engineer, the example and samples illustrate important categories of information to be included. At a minimum, the notification should state the sampling criteria, identify what corrective measures have been taken, and inform the customers what, if any, precautionary steps should be taken. In all cases, the DOH District Engineer should be consulted before issuing public notices.

The City's public notification procedures and examples are included in Appendix G.

Following are sample notices to be used as a format example.

Sample Notification 1 **Unacceptable Coliform Bacteria Concentrations**	
State the Problem	The Department of Health Services has notified Aberdeen that water samples taken from the water system do not comply with water quality standards of the State of Washington under the Federal Safe Drinking Water Act. The samples contain unacceptable levels of coliform bacteria, and therefore, are considered to constitute a health hazard.
What to do?	It is therefore suggested that the users of the water system take the following precautions: ❑ Add four drops of household bleach to one gallon of drinking water, mix, and let stand 1 hour before using, *OR* ❑ Boil water used for drinking and cooking. Bring to a full rolling boil for 3-5 minutes and allow to cool as desired.
What Precautionary steps are being taken?	The City is presently taking steps to reduce the contamination. Continued testing will be done to monitor the problem and notification will be given when the contamination has been eliminated.
What corrective steps are being taken?	The City has increased the frequency of monitoring water quality to see if it is a recurring problem. The system is also being examined to identify and eliminate any potential cross-connections.
Further information?	If you have further questions, please contact the City at (360) 537-3274.

Sample Notification 2 **Insufficient Number of Samples**	
State the problem	The City has been notified by the Department of Health Services that an insufficient number of bacteriological water samples were taken during the month of [insert the month].
By what authority?	WAC 248-54-165 of the Rules and Regulations of the State Board of Health Regarding Public Water Supplies requires a water utility of the size of the City of Aberdeen to take a minimum of 15 bacteriological samples per month.
When?	During this time we experienced trouble in transporting the samples to the testing laboratory. Although all water samples taken before and after the month of [insert the month] were free from contamination, WAC 248-54-255 of the above regulations requires that we notify our customers of the situation.
What corrective steps are being taken?	Every step has been taken to correct the situation, and we have established alternate transportation methods for future use.
What precautionary steps should be taken?	Meanwhile, there is no occasion for alarm, and we will continue to serve you water of the highest quality.

Further Information	If you have any questions, please contact the City at: (360) 537-3274.

8.9. Recordkeeping

The City is also responsible for maintaining certain records for specified time periods. These requirements are listed in Table 8-3. The City has a standing policy to forward any recordkeeping issues directly to the DOH Regional Engineer.

Table 8-3 Retention of Operational and Analytical Records

Measurement or Event	Record Retention Period
Water Flow Meter Readings to and from the System	3 years
Bacteriological Analysis	5 years
Turbidity Analysis	5 years
Chemical Analysis	10 years
Records of Action (s) Taken to Correct an MCL Violation	3 years after the violation
Customer Complaints	3 years
Pipeline Flushing	3 years
Backflow Prevention Program and Devices	3 years
Sanitary Survey Data	10 years after survey completion
Records Regarding a Variance or Exemption	10 years following expiration of the Variance or exemption
Records Concerning Public Notification	3 years after the date of the Notification
Chlorine Residual	3 years
Maintenance and Construction Documentation	5 years

8.10. Customer Complaints

The City has developed and practices a systematic approach to handling water system customer complaints. Each call is handled by a knowledgeable staff member who is familiar with system components and who has information concerning typical as well as actual system operating conditions. Records are kept to document each customer complaint and the follow-up actions undertaken to correct the problem.

8.11. Cross-connection Control Program

The City's cross-control program was established on January 15, 1992. The ordinance requires that all cross-connections be eliminated or protected by an approved backflow preventer. It also holds "the owner of the property in which a cross-connection occurs...responsible for any property damage or personal injuries which result from backflow which occurs as a result of the cross-connection."

It directs that cross-connection control devices be inspected and tested at least annually be a certified tester at the expense of the utility customer. Completed test reports are to be submitted to the City Water Department. It further states that "failure of a water utility customer to cooperate in the installation, maintenance, repair, inspection or testing of backflow prevention devices shall be grounds for immediate termination of water services to the premises."

Categories of cross-connections requiring backflow prevention are defined by State law and the required backflow protection devices must be a model approved by the DOH.

A backflow prevention assembly in service, but not currently listed, may remain in service provided the assembly:

- Was listed on the DOH and/or USC list of approved backflow prevention assemblies at the time of installation
- Has been properly maintained
- Is a type appropriate for the degree of hazard
- Has been tested at least annually and has successfully passed the annual tests

The City's cross-connection control program is under the responsibility of the Customer Services Supervisor who is a certified Cross-connection Control Specialist I. The program consists of site inspections for potential cross-connections, plan review of new construction projects, and regular testing of the backflow preventers already installed within the system. The City's cross connection control program is presented in Appendix K.

8.12. Design and Construction Standards and Specifications

The Public Works Department conducts all construction of water mains and appurtenances in accordance with City standards, applicable American Water Works Association (AWWA) specifications, and Section 8-11 of the Washington Department of Transportation (WSDOT)/American Public Works Association (APWA) Standard Specifications.

These requirements are intended to meet or exceed the design and construction standards referenced in WAC 246-290. Use of these materials and application of this City policy is intended to meet the requirements of the DOH Submittal Exception Process for distribution main construction. By qualifying for this process and following the approved procedures and standards, the City is provided a waiver from the requirement of DOH approval of individual projects.

8.13. Consumer Confidence Reports

All Group A water systems are required to provide a report to their customers once a year. The Consumer Confidential Report (CCR) is basically a short, educational summary of the results of water quality monitoring that a system conducted during the previous year. This report is due July 1st of each year. An example of a previous report is available upon request.

8.14. Water Supply Contingency Plan

The City's Water System Contingency Plan is presented in Appendix L.

8.15. Operation and Maintenance Deficiencies

Annual O&M improvements identified by the City are budgeted in the O&M section of the water system budget.

9. Capital Improvement Program

This chapter describes the methodology used in developing the City's water system Capital Improvement Program (CIP), and presents the costs and schedules for projects planned for implementation between 2013 and 2032.

9.1. Development of CIP

The CIP was prepared by first identifying projects that address water system needs or deficiencies, as documented in earlier chapters of the water system plan. In addition, recurring or periodic capital projects related to system maintenance (e.g., reservoir maintenance and leak detection) have also been included in the list of improvements.

A 20-year implementation schedule of the projects was then developed. Generally, projects of higher priority (i.e., those that address current system needs) were scheduled for implementation within the six-year planning horizon (2013-2018). Projects that serve anticipated future needs associated with system growth, or are less critical to system operation, were scheduled for implementation between 2019 and 2032. Detailed scheduling of the higher priority projects was based primarily upon the City's existing forecast of project implementation timelines. Where applicable, the timing of water system projects has been coordinated with sewer and street improvements planned for the same locations.

Planning-level (AACE[1] Class 4) cost estimates have been developed for each capital project included in the 2013-2032 CIP. Generally, each project cost includes the following components:

- **Base construction cost.** Includes all labor and material costs needed to construct a project. For pipeline and valving projects, construction costs were estimated based upon unit construction costs derived from bid tabulations for recent and similar southwest Washington water distribution projects.
- **Sales tax.** Calculated as 8.4 percent (the July 2012 local tax rate) of the base construction cost.
- **Construction contingency.** Takes into account the uncertainties associated with estimating project costs at this planning level. Calculated as 30 percent of the total of base construction plus sales tax.
- **Design engineering.** Includes City and consultant design costs, and other related cost items, such as permitting and construction administration. For most projects, this is calculated as 25 percent of the base construction cost. However, a higher percentage of the base construction cost is used for projects with more complex design or permitting needs.

These elements are summed to determine the total project-level cost estimate for a project, as expressed in 2012 dollars. Planning-level cost estimates are summarized in Table 9-1 and project locations are indicated in Figure 9-1. Project D-1 does not appear on the map as it consists of many small projects in different locations.

[1] Association for the Advancement of Cost Engineering.

To account for inflation and the increase of construction costs over time, the base project-level costs have been escalated to their anticipated year of construction. It is impossible to predict accurately the rate at which construction costs will increase over the 2013-2032 period; however, a conventional method to estimate such increases is to examine cost index trends of past years.

Engineering News Record releases a monthly report on the construction cost index for the state of Washington. The 20 City indices indicate that construction costs increased at an average annual rate of approximately 3.4 percent per year between 2000 to 2012. This historic value is used to escalate construction project costs from base year (2012) dollars to costs in the anticipated year of construction.

Table 9-1. Capital Improvement Program (2013 – 2032)

Project No.	Description	Purpose of Project (2)	Financing Source(3)	Base Project Cost (2012 Dollars)	Schedule and Cost of Improvements (in thousands of dollars) (1)								
					2013	2014	2015	2016	2017	2018	6-yr CIP TOTAL	2019-2032 (4)	20-yr CIP TOTAL
Water Distribution System (Piping)													
D-1	Small Diameter Replacement Program (5)	Improve	OI	125	129	134	138	143	148	153	844	0	844
D-2	2nd St from A St to B St (257 LF 6-inch)	Improve	OI	24					28		28	0	28
D-3	A St from 2nd to 1st St (304 LF 6-inch)	Improve	OI	29					34		34	0	34
D-4	Friendlander Dr (537 LF 6-inch)	Improve	OI	49				56			56	0	56
D-5	Burleigh Ave from F and Hanna St to Arnold (959 LF 6-inch)	Improve	OI	86					102		102	0	102
D-6	Evans St between Curtis and King (129 LF 6-inch)	Improve	OI	12				14			14	0	14
D-7	Alley between Morgan and 2nd from Conger to Wooding (1,525 LF 6-inch)	Improve	OI	138				158			158	0	158
D-8	Mead St West of SR101 (57 LF 6-inch)	Improve	OI	6					7		7	0	7
D-9	Westerly Dr from Bel Aire Ave to Sherwood Ln (835 LF of 6-inch)	Improve	OI	76			84				84	0	84
D-10	Isabel West of Rice St (298 LF 6-inch)	Improve	OI	28					33		33	0	33
D-11	East Market from A St to Chicago (847 LF 6-inch)	Improve	OI	77				88			88	0	88
D-12	Saturday St from 6th and Thursday (1,000 LF 8-inch)	Improve	OI	120				137			137	0	137
D-13	8th St from Conger to Martin (353 LF 8-inch)	Improve	OI	43		46					46	0	46
D-14	Ranier and Hayes PRV (6-inch)	Improve	OI	87				99			99	0	99
D-15	East Aberdeen River Crossing (2,500 LF 12-inch)	Deficiency	OI	1,038							0	1,312	1,312
D-16	Hwy 12 - Chehalis St to Fleet St (1,200 LF 12-inch)	Deficiency	OI	216							0	273	273
D-17	Transmission Main Isolation Valves	Improve	OI	250							0	316	316
D-18	Bench Drive Pressure Improvements (500 LF of 2-inch)	Improve	OI	16	17						17	0	17
Water Maintenance and Operations													
M-1	Re-Coating South Aberdeen Tank	O&M	OI	25	26						26	0	26
M-2	Tank Inspection	O&M	OI	5	5						5	0	5
M-3	Wishkah Headworks Security and Communication Improvements	O&M	OI	10	10						10	0	10
M-4	Water System Plan Update	O&M	OI	75						92	92	249	341
Total Costs of Water System Improvements				**2,535**	**187**	**180**	**222**	**695**	**352**	**244**	**1,880**	**2,150**	**4,030**

Notes:

(1) Costs are escalated from Base Project Cost (2012 dollars) to stated year of construction, assuming a 3.4% annual increase in costs.

(2) Purpose of Project: Deficiency = Addresses deficiencies identified in the Water System Plan; Improve = Does not address a deficiency, but improves overall system operation; Growth = Required to address growth/expansion of the distribution system; O&M = Necessary for proper system maintenance.

(3) Source of Funding: OI = Operating Income (Rates); Dev = Developer Funded/Contributed; LT = Long Term Debt.

(4) Total costs associated with projects implemented in 2019 through 2032. Specific years of project implementation are noted where applicable.

(5) Includes annually budgeted amount to cover unspecified project costs. These costs are escalated per Note 1 to account for construction cost increases.

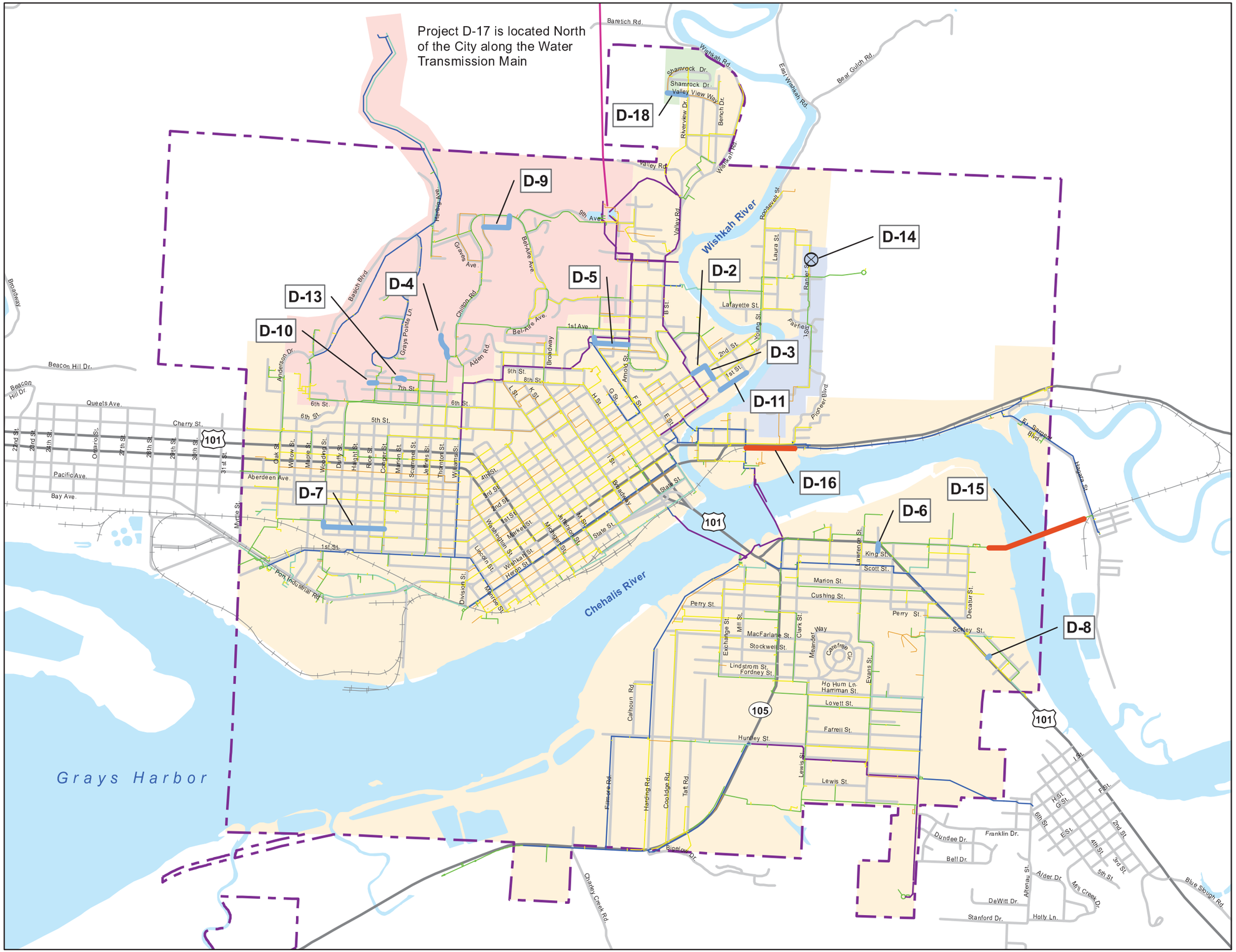


Figure 9-1
Capital Improvement Map
CITY OF ABERDEEN
WATER SYSTEM PLAN
July 2012

9.2. Planned Projects

9.2.1. Water Distribution System (Piping)

D-1: Small Diameter Pipe Replacement Program – This is an annual budgeted program to replace aging and small diameter piping in the system. The City has developed a list of piping targeted for improvement. Table 9-2 shows the list of projects identified for replacement between 2013 and 2018.

Table 9-2. Small Diameter Replacement Program

Address	Description
Riverview Dr	Replace 700 LF with 2" PVC
SR12 East of City Limits	Replace 1,500 LF with 2" PVC
Cushing St between Boone and Crockett	Replace 250 LF of 1" and 1-1/2" Steel with 2" PVC
West Blvd between Hogan and Mead	Replace 600 LF of 2" CI with 2" PVC
Farragut between Curtis and Wood	Replace 120 LF of 2" Steel with 2" PVC
McFarlane between Clark and Lewis	Replace 250 LF of 2" Steel with 2" PVC
Bigelow Dr west of pump station	Replace 200 LF of 1-1/2" Steel with 2" PVC
Haight between 7th and 8th	Replace 225 LF of 2" and 1" Steel with 2" PVC
Myrtle between Sumner and Simpson	Replace 275 LF of 2" and 1" Steel with 2" PVC
1st and Maple	Replace 80 LF of 3" Steel with 6" DI
3600 Wishkah Rd	Replace 1,100 LF of 2" Steel with 2"PVC
Willard to Stewart to Holmes	Replace 1,500 LF of Various Steel with 2" PVC
Between 1st and 2nd and Jefferies and Thorton	Replace 600 LF of 2" Steel with 2" PVC
Young and Mitchell	Replace 125 LF of 1-1/2" Steel with 2" PVC
Between Clark and Lewis and McFarlane and Schley	Replace 250 LF of 2" CI with 2" PVC
10th and Broadway and Spur	Replace 900 LF of Various Steel with 2" PVC
2nd between B and Grant	Replace 350 LF of CI with 2" PVC
2300 blk Victory Ave	Replace 275 LF of 1-1/2" Steel with 2" PVC
3700 Wishkah Rd	Replace 950 LF of 2" Steel with 2" PVC
Olympic Hwy east of City Limits	Replace 1,600 LF of 2" Steel with 2" PVC
Market and Williams	Replace 225 LF of 4" CI with 4" DI
2600 Wishkah Rd	Replace 650 LF of Various Steel with 2" PVC
Bench Dr between Highland and Wishkah Rd	Replace 550 LF of 2" Steel with 2" PVC
Between Valleyview Way and Olympic View and Bench Dr and Highland	Replace 1,200 of Various Steel with 2" PVC
Between Riverview and Highland and Olympic View and Valleyview	Replace 1,200 of 2" Steel with 2" PVC
Between Morgan and 2nd and Martin and Jefferies	Replace 900 of 2" Steel with 2" PVC
Valleyview Way between Shamrock and Riverview	Replace 600 LF 2" Steel with 300 LF of 4" PVC

D-2: 2nd Street – Install approximately 257 LF of 6-inch ductile iron (DI) water line on 2nd Street from A Street to B Street.

D-3: A Street – Install approximately 304 LF of 6-inch DI on A Street from 2nd Street to 1st Street.

D-4: Friendlander Drive – Install approximately 537 LF of 6-inch DI water line on Friendlander Drive.

D-5: Burleigh Avenue – Install approximately 959 LF of 6-inch DI water line on Burleigh Avenue from F and Hanna Street to Arnold Street.

D-6: Evans Street – Install approximately 129 LF of 6-inch DI water line on Evans Street between Curtis Street and King Street.

D-7: Morgan and 2nd Street – Install approximately 1,525 LF of 6-inch water line in Alley between Morgan and 2nd Street from Conger Street to Wooding Street.

D-8: Mead Street – Install approximately 57 LF of 6-inch DI water line on Mead Street west of SR101.

D-9: Westerly Drive – Install approximately 835 LF of 6-inch DI waterline on Westerly Avenue from Bel Aire Avenue to Sherwood Lane.

D-10: Isabel Way – Install approximately 298 LF of 6-inch water line on Isabel Way west of Rice Street.

D-11: East Market Street – Install approximately 847 LF of 6-inch DI water line on East Market Street from A Street o Chicago Avenue.

D-12: Saturday Street – Install approximately 1,000 LF of 8-inch DI water line on Saturday Street from 6th Street and Thursday Street.

D-13: 8th Street – Install approximately 353 LF of 8-inch DI water line on 8th Street from Conger Street to Martin Street.

D-14: Ranier Street PRV – Install PRV on Ranier Street at Hayes Street between North Aberdeen and Low Level Zones. This project will increase the available fire flow on Ranier Street.

D-15: East Aberdeen River Crossing – Install approximately 2,500 LF of 12-inch DI water line beneath the Chehalis River to connect the existing water line on Junction City Road to another on Curtis Street. This will create a second connection to the Junction City Road area. The project creates redundancy and address fire flow deficiencies along Junction City Road.

D-16: Highway 12 Fire Flow Improvement – Install approximately 1,200 LF of 12-inch DI waterline along Highway 12 from Chehalis Street to Fleet Street. This project addresses fire flow deficiencies at hydrants along Highway 12 east of Chehalis Street and along Junction City Road.

D-17: Transmission Main Improvements – This project will make improvements to the existing transmission main in active slide areas. The transmission main will be sliplined with new piping at the Cedar Creek and Wishkah River Crossing and isolation valves will be installed.

D-18: Bench Drive Pressure Improvements – This project will install approximately 500 LF of 2” PVC to extend the Bench Drive Pressure zone to serve customers along Valleyview Way that are currently in an area of low system pressure.

9.2.2. Water Maintenance and Operations

M-1: Tank Re-Coating – Several of the City's tanks will require re-coating and this project budgets for this expense.

M-2: Tank Inspection – This item budgets for inspection by divers of the City's reservoirs and tanks.

M-3: Wishkah Headworks Security and Communications Improvements – This item budgets for the installation of surveillance cameras, a satellite modem connection, and an improved communication system.

M-4: Water System Plan Update – DOH requires an update to the City's water system plan every 6 years.