City of Chehalis

2011 Water System Plan

(Adopted February 2012)

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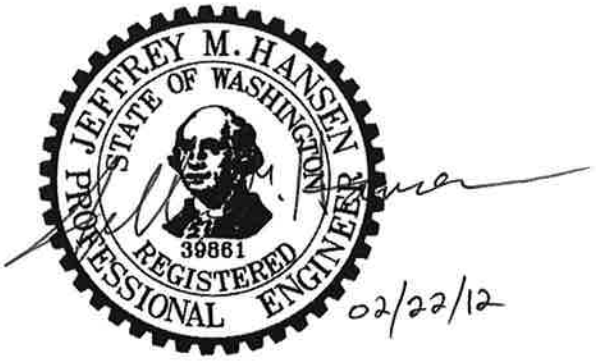
Certificate of Engineer

City of Chehalis
Water System Plan

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



Jeff Hansen, P.E.
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Section 1
Introduction

1. Introduction

The City of Chehalis (City) distributes drinking water within a large area in Lewis County, Washington. The City has prepared this 2011 Water Comprehensive Plan (WCP)[1] reflecting its continued commitment to providing safe and reliable water supplies to its retail and wholesale customers.

As required by the State of Washington (Chapter 246-290-100 Washington Administrative Code), this Plan describes the City's water distribution facilities, operations and compliance with state and federal drinking water regulations. It identifies capital project needs for the next six years and 20 years, as well as the City's financial plan to fund these needs.

1.1. System Overview

Prior to 1914, the Washington Oregon Corporation, the Chehalis Water Company and the Lewis County Water Company, all under private ownership, furnished water for the City. The water was obtained from wells and from the Newaukum River south of the City. The water was pumped to an open reservoir located above NE Franklin Street.

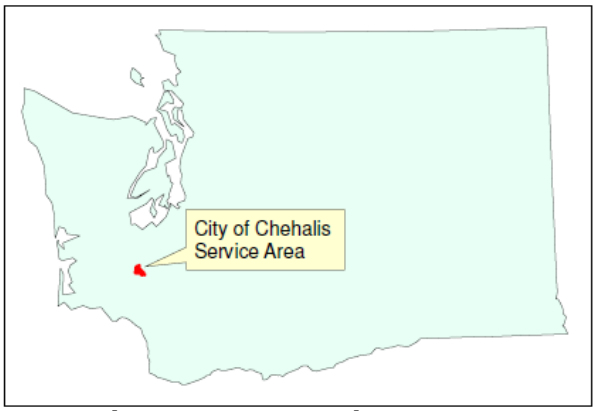


Figure 1-1. Location Map

Because the existing sources suffered from water quality and quantity problems, in 1909 the City started working on acquiring another source of supply. In 1912, the citizens of Chehalis approved a bond issue to provide funds to construct a supply line from the North Fork of the Newaukum River (North Fork) to the City, construct a new reservoir, make improvements in the distribution system, and buy out the existing water suppliers.

Since its original construction in 1914, the City's water distribution system has continued to evolve. Much of the system has been replaced and upsized to meet growing demands. The original wood stave transmission line from the North Fork was replaced with ductile iron pipe. Additional storage, pumping and distribution facilities have been added to accommodate growth. In response to the passage of the Federal Safe Drinking Water Act (SDWA), the City was required to eliminate customers that were receiving raw water from the transmission line. This was accomplished in 1979 by installing a "return line" to provide treated water to those customers previously connected to the transmission line. In addition, in order to improve water quality and disinfection capabilities and to ensure compliance with provisions of the SDWA, the City covered the five million gallon Main Reservoir in 1994.

Further information on the City's service area, facilities and operations is presented in subsequent chapters of this WCP.

[1] This WCP is dated 2011 as that is the year it was submitted to the State Department of Health. However, the development of the WCP occurred primarily in 2009 and 2010. As such, 2009 is considered the base (or planning year), with 2015 considered the six-year planning horizon and 2029 considered the 20-year planning horizon. This is reflected in the demand forecast, system analysis, and capital improvement and financial programs.

1.2. Planning Objectives

This WCP updates the previous Plan issued in January 2004 and has the following objectives:

- Provide updated estimates of expected population growth in the City's retail and wholesale service area, to enable planning for new facilities or upgrades to existing facilities.
- Update the City's computerized model of the distribution system to reflect construction of new mains and other facilities in recent years. This model is a key working tool to evaluate adequacy of City facilities and plan for improvements.
- Update the City's Capital Improvement Plan (CIP) and review financial needs for implementation.
- Reflect new conditions and operating controls related to installation of the 18th St Booster Pump Station with its effect on the southern portion of the system and the Kennicott and Yates Reservoirs.
- Address new provisions of State Law enacted in the Municipal Water Law (MWL) of 2003. These provisions include a new rule on water-use efficiency planning by municipal water systems; new requirements for documenting consistency of water system plans with local land-use plans; and other elements.

1.3. SEPA Review

The City has prepared an Environmental Checklist under provisions of the State Environmental Policy Act (SEPA). Based on the checklist, a Determination of Non-Significance (DNS) has been issued. The Checklist and DNS are attached as Appendix A.

1.4. Organization of Water Comprehensive Plan

This Water Comprehensive Plan is organized in the following chapters:

Chapter 1: Introduction

Chapter 2: System Description

Chapter 3: Related Plans, Agreements and Policies

Chapter 4: Planning Data and Demand Forecast

Chapter 5: Conservation Program

Chapter 6: Distribution Facilities Design and Construction Standards

Chapter 7: System Analysis

Chapter 8: Water System Reliability and Source Protection

Chapter 9: Water Quality Compliance

Chapter 10: Maintenance and Operations

Chapter 11: Capital Improvement Program

Chapter 12: Financial Program

In addition to these chapters, the Appendices to this Plan contain extensive information related to the topics listed above.

Section 2
System Description

2. System Description

This chapter provides a general overview of the water system, including information on the City's management, water service area, history, wholesale customers and adjacent purveyors. A detailed description of the City's existing water facilities is also included in this chapter.

2.1. Ownership and Management

The City of Chehalis provides water service to customers both inside and outside Chehalis City Limits. Specific data about the system can be found in the Water Facilities Inventory (included in Appendix B) that the City files annually with the Washington State Department of Health (DOH). Pertinent information from the City's most recent Water Facilities Inventory is summarized in Table 2-1.

Table 2-1 Water System Information

System Name:	City of Chehalis
System Type:	Group A Community Water System
System ID Number:	12250P
Type of Ownership:	Local Government
Location:	Lewis, WA
Service Connections:	3,540
Population Served:	7,185
Source:	N. Fork Newaukum – 2,300 gpm Chehalis River – 4,860 gpm

Chehalis' water division is managed within the Public Works Department under the direction of the Public Works Director. The Director provides overall management and policy direction, and coordinates internal and external communication. The actual day-to-day operation of the utility is performed by staff in the Water Division under the direction of the Water Superintendent.

2.2. System Background

Prior to 1914, the Washington Oregon Corporation, the Chehalis Water Company and the Lewis County Water Company, all under private ownership, furnished water for the City. The water was obtained from wells and from the Newaukum River south of the City. The water was pumped to an open reservoir located above NE Franklin Street.

Because the existing sources suffered from water quality and quantity problems, in 1909 the City started working on acquiring another source of supply. In 1912, the citizens of Chehalis approved a bond issue to provide funds to construct a supply line from the North Fork of the Newaukum River (North Fork) to the City, construct a new reservoir, make improvements in the distribution system, and buy out the existing water suppliers.

As the City of Chehalis was starting to develop a water source on the North Fork, the City of Centralia was proceeding along similar lines. This concurrent development raised the question as to which city had initial rights to the river water. Although the State Supreme Court ruled in 1913 that Chehalis had prior right to the water from the North Fork, this issue continued to plague the two cities. In ensuing years, the North Fork began experiencing periods of low flows, which caused Chehalis to install a booster pump on the gravity line to increase the capacity from the North Fork source. Although the booster pump increased the flows for Chehalis, it also decreased the flows available to Centralia since their intake facilities were immediately downstream. This resulted in the City of Centralia suing Chehalis to prevent the use of the pumping facility. In 1954, the Washington Supreme Court ruled that:

- The City of Chehalis was entitled to the first 2.8 mgd of water from the North Fork.
- The City of Centralia was entitled to the next 4.8 mgd.
- The City of Chehalis was entitled to any remaining available water from the North Fork (in excess of 7.6 mgd).
- Chehalis had a period of five years to develop an alternative source to supplement the water from the North Fork.

The City's attempts to find wells of sufficient quantity and quality to meet the supplemental needs failed. The City began to pursue plans to construct a water intake on the Chehalis River. Since the quality of the Chehalis River water was determined to be unacceptable without treatment, plans also included the construction of a water treatment plant. The alternate source on the Chehalis River was completed in 1961 along with the transmission line and treatment plant. Since completion of the treatment plant, all water entering the water system from both sources has received treatment.

Since its original construction in 1914, the City's water distribution system has continued to evolve. Much of the system has been replaced and upsized to meet growing demands. The original wood stave transmission line from the North Fork was replaced with ductile iron pipe. Additional storage, pumping and distribution facilities have been added to accommodate growth. In response to the passage of the Federal Safe Drinking Water Act (SDWA), the City was required to eliminate customers that were receiving raw water from the transmission line. This was accomplished in 1979 by installing a "return line" to provide treated water to those customers previously connected to the transmission line. In addition, in order to improve water quality and disinfection capabilities and to ensure compliance with provisions of the SDWA, the City covered the five million gallon Main Reservoir in 1994.

The City last completed a WSP in 2004. That plan proposed over $10,430,000 of improvements composed of pump stations, water lines, reservoirs and treatment plant improvements. The following list of major improvements has since been completed:

- 18th St Raw and Finished Water Booster Pump Station
- Controls and Automation of Filter Plant (Phases I - IV)
- Reconstruct the drain line at Kennicott and High Level Reservoirs, and replace altitude vault at Kennicott Reservoir to provide access

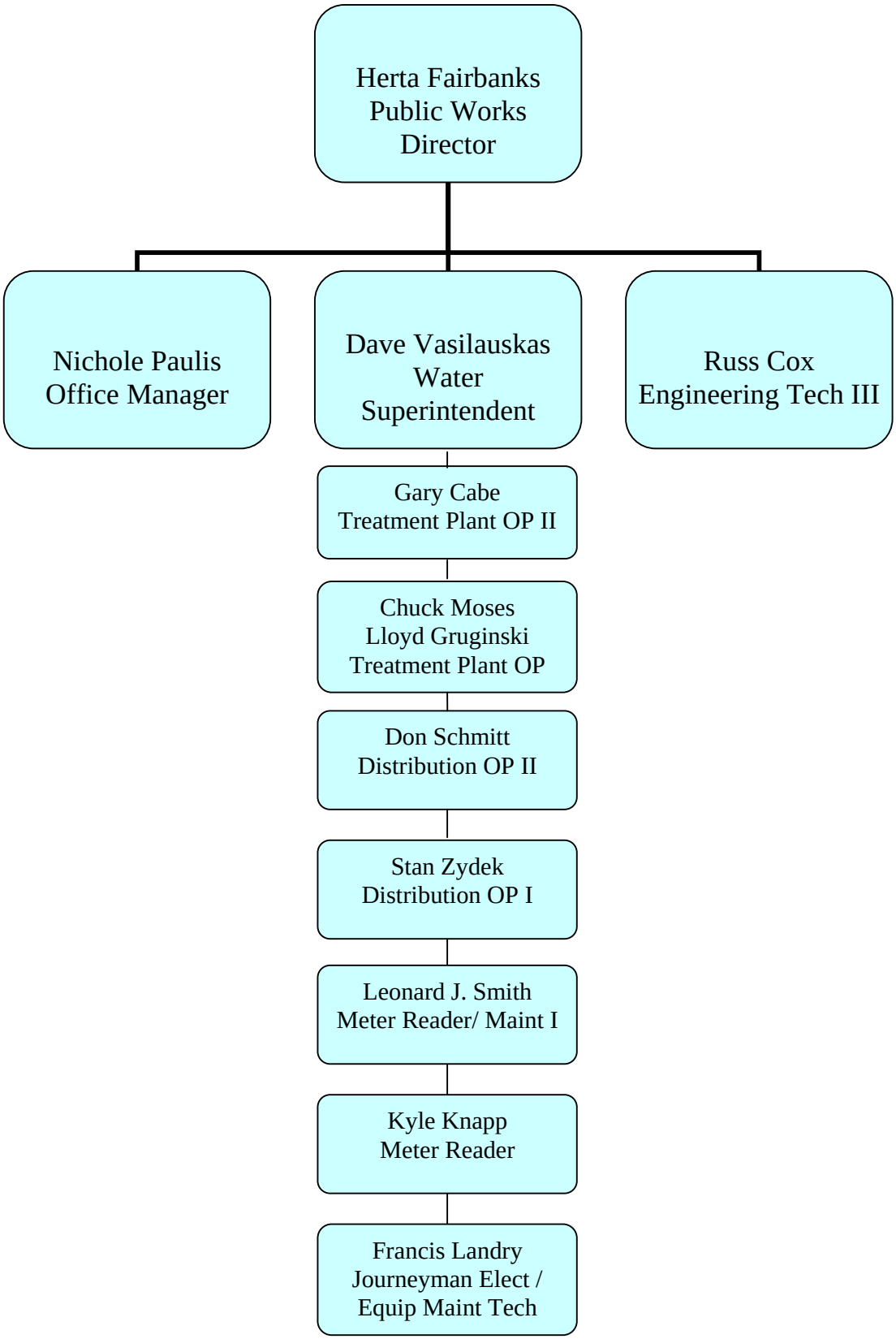


Figure 2.1 Organization Chart

2.3. Service Area

The City of Chehalis Water System currently (as of January 2010) serves 3,540 water services, of which 2,790 are residential services. The exact acreage of the City's water service area cannot be easily determined since there are some large parcels outside the City (along Jackson Highway and North Fork Road) that are served by the Chehalis Water System. The service area includes approximately 2,895 acres inside the City Limits and approximately 2,464 additional acres in the Urban Growth Area (UGA). Figure 2.2 shows the City of Chehalis Water System Retail Service Area, which is coincident with the UGA boundary, with the exception that approximately 230 additional customers outside of the UGA (i.e., in the South End and Centralia-Alpha pressure zones, along Jackson Highway and North Fork Road) receive service from the City. At this time, the City's Future Service Area is the same as its Retail Service Area. The City's Existing Service Area (i.e., where service is currently provided to customers) is defined as all areas where distribution piping currently exists, as depicted on Figure 2.5.

Other utilities provided within the Chehalis water service area include a sewerage collection and treatment system, telephone, electrical, cable TV, and natural gas. For most of the area, the sewerage utility is owned and operated by Chehalis and serves connections both inside and outside the City Limits. Local telephone services are provided by QWEST. Lewis County PUD No. 1 is the local electrical provider. Puget Sound Energy provides natural gas. Comcast provides cable TV in the area.

2.4. Land Use and Zoning

Various land uses are present within the City of Chehalis. Table 2-2 summarizes the land uses within the City, and the amount of land comprised by each, both inside City Limits and within the UGA. Figure 2.3 shows the City's land use graphically.

Table 2-2 City of Chehalis Land Use

	City Limits			UGA	
Type	Area (ac)	% of Service Area		Area (ac)	% of Service Area
Agriculture	266	7.5%		485	15.2%
Industrial	89	2.5%		259	8.1%
Commercial	284	8.0%		172	5.4%
Mining/Forestry	76	2.1%		214	6.7%
Public	437	12.3%		59	1.8%
Residential	638	18.0%		881	27.7%
Transportation/Utility	474	13.3%		60	1.9%
Undeveloped	744	20.9%		789	24.8%
Roads	545	15.3%		26	8.0%
No data		-		10	0.3%
Total	3,554			3,185	

Source: Lewis County, 2010 parcel data

Similarly, Table 2-3 and Figure 2.4 present the zoning within Chehalis' City Limits and in the UGA.

Table 2-3 City of Chehalis Zoning

	City Limit			UGA	
Type	Area (ac)	% of Service Area		Area (ac)	% of Service Area
Industrial	366	10.3%		1224	38.4%
Commercial	1471	41.4%		707	22.2%
Residential	878	24.7%		1226	38.5%
Public Facility	839	23.6%		28	0.9%
Total	3,554			3,185	

Source: City of Chehalis, 2009 Official Zoning Map

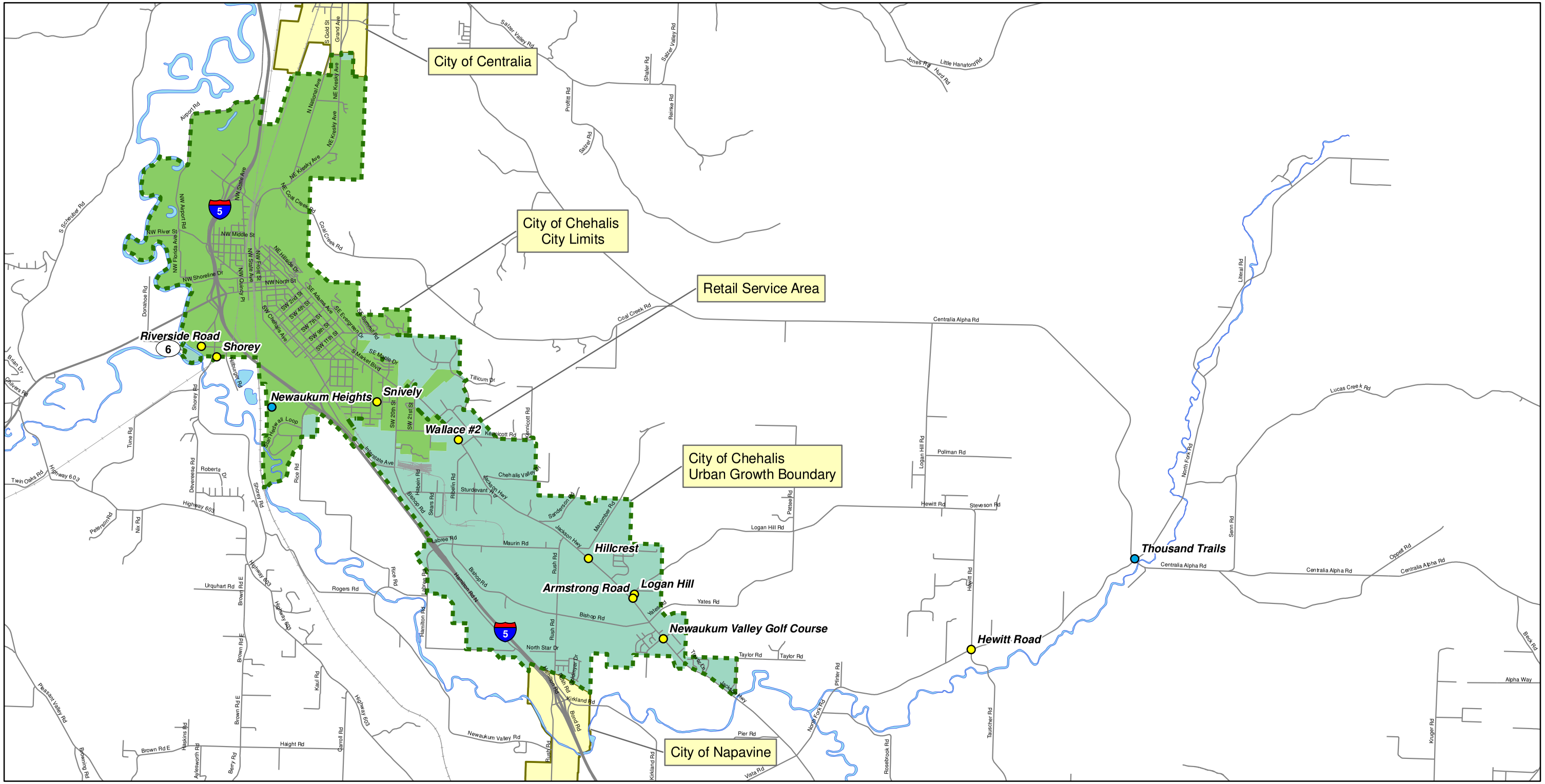


Figure 2.2
Service Area

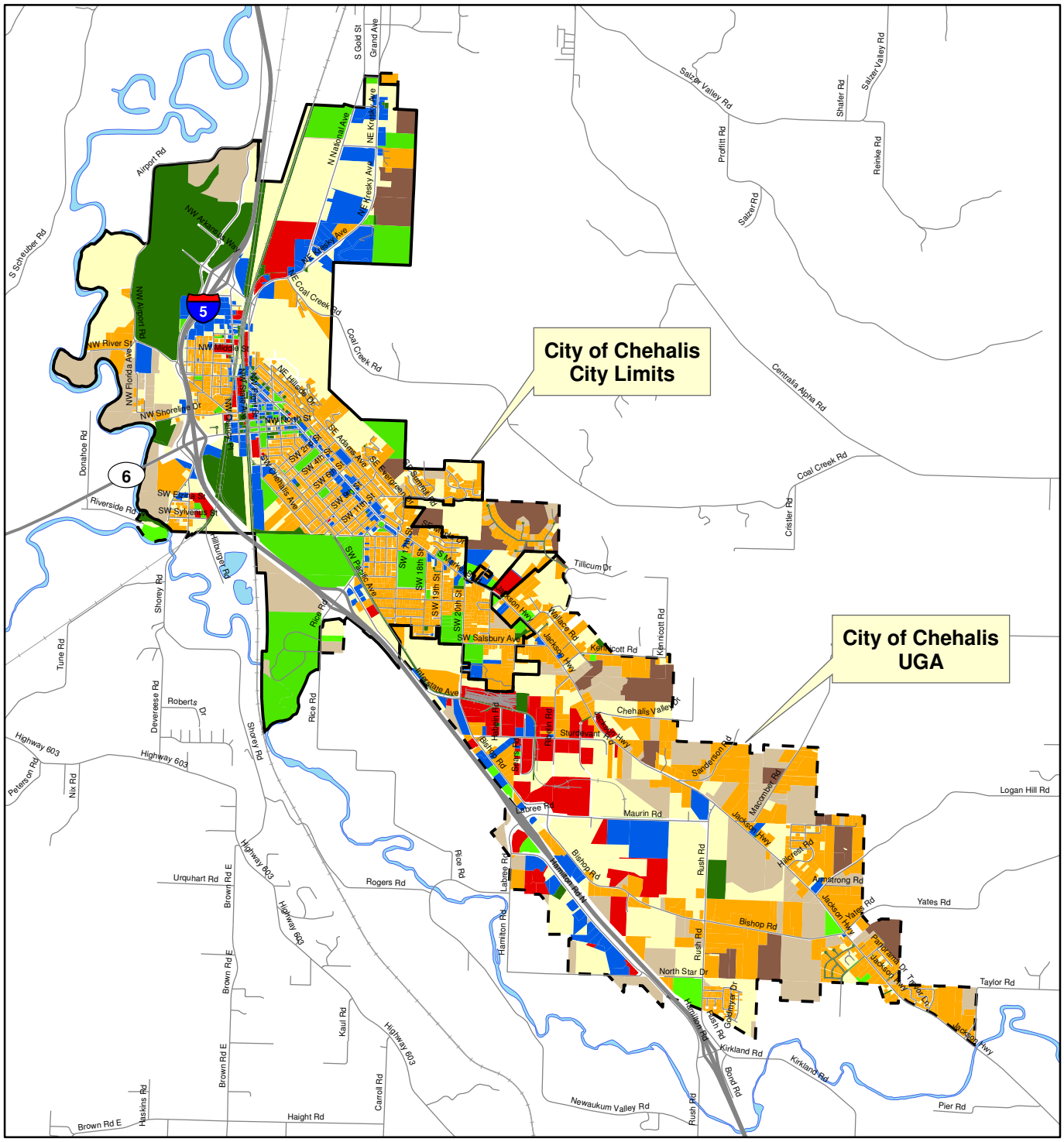
CITY OF CHEHALIS
WATER SYSTEM PLAN

Legend

- Chehalis Urban Growth Boundary
- Chehalis City Limits
- Adjacent City
- Wholesale Customers (No Water Purchase Agreement)
- Wholesale Customers (With Water Purchase Agreement)
- Highway
- Road
- Retail Service Area

N

0 2,500 5,000 10,000 Feet



Source of Data: Lewis County, 2010 Parcel Data

Figure 2.3
Land Use Map

CITY OF CHEHALIS
WATER SYSTEM PLAN

Legend

- No Data
- Agriculture
- Industrial
- Commercial
- Mining / Foestry
- Residential
- Public / Quasi Public
- Transportation / Utility
- Undeveloped

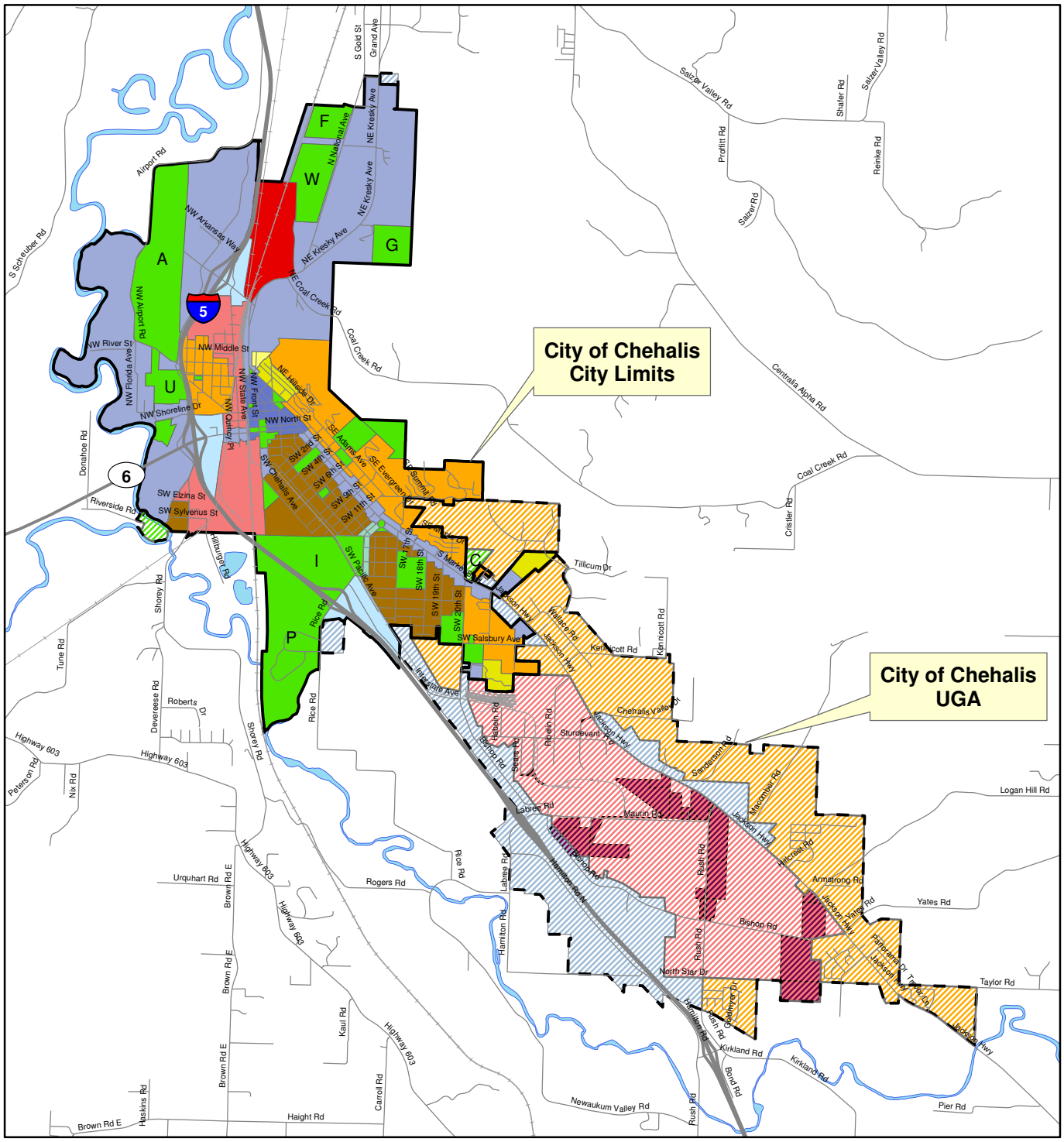
- Highway
- Road
- Chehalis
- Chehalis UGA

HDR

1883 CHEHALIS, WASHINGTON

N

0 1,250 2,500 5,000 Feet



Source of Data: City of Chehalis, 2009 Official Zoning map

Legend

- Chehalis
- Chehalis UGA
- Single Family - Low Density
- Single Family - Med Density
- Multi Family - Med Density
- Multi Family - High Density
- Light Industry
- Heavy Industry
- Public Facility

A = Airport
C = Cemetery
F = Fairgrounds
G = Government
H = Hospital
I = Institution
P = Park/Playground
S = School
U = Utility
W = Wetland

- Office Commercial
- Freeway Oriented Commercial
- General Commercial
- Central Business District
- Residential UGA
- Light Industry UGA
- Public Facility UGA
- Commercial UGA
- Port Boundary

Figure 2.4
Zoning Map
CITY OF CHEHALIS
WATER SYSTEM PLAN

N

0 1,250 2,500 5,000 Feet

2.5. System Facilities

The City of Chehalis operates a water treatment plant that receives its water supply from the North Fork Newaukum and Chehalis Rivers. In the distribution system, there are five pressure zones served by the water treatment plant, six reservoirs, five pump stations, and a pipeline distribution network. The City's major distribution system facilities are shown on Figure 2.5. A schematic profile of the existing system is shown in Figure 2.6. The City's booster stations include four primary booster stations, which transfer water from one pressure zone to another, and one which only boosts pressure internally within the southern portion of the main pressure zone.

2.5.1. Source of Supply

The City currently has two sources of supply, the North Fork of the Newaukum River and the Chehalis River.

North Fork of the Newaukum River

This supply system includes intake facilities and equipment consisting of a bar screen, traveling screen, turbidity monitoring and chlorination equipment, and approximately 17.5 miles of raw water transmission line and a booster pump station. The chlorination equipment is not currently in use. The North Fork is the City's primary source of water. The intake site is situated approximately 17 miles from the City, approximately 10 miles east of Jackson Highway, in Section 20, Township 14 North, Range 1 East, W.M. The watershed of the intake encompasses an area of about 18 square miles, predominately owned by the Weyerhaeuser Company.

Chehalis owns the property immediately around the intake and an easement for the pipeline through Weyerhaeuser property to a County road. Elevations in the watershed range from 600 to 2,800 feet. The area has been logged and is now covered with brush, alder, and Douglas Fir forests of various ages. Re-logging of the seasoned second growth timber has taken place in portions of the watershed.

Until 1993, the Cities of Centralia and Chehalis conducted the intake operations jointly and shared operational costs. Provisions of the SDWA prohibited the City of Centralia from using "untreated water" from this source. In 1993, the City of Centralia curtailed their operations and in 1994 ceased their participation in sharing costs associated with the intake.

The WTP Operators monitor and report on water quality and are responsible for daily operation and maintenance of intake facilities.

Chehalis River

The Chehalis River pump station and intake were constructed on the bank of the Chehalis River near Riverside Road in 1961-62. This supply system includes an intake, consisting of a wooden crib lined with rock to act as a screen through a 4-foot diameter steel pipe (CMP) to a reinforced concrete wet well, an automatically cleaned traveling screen, a pump station and 8,000 feet of raw water transmission line. The watershed encompasses a large area and is under multiple ownerships and land uses.

The system is manually operated and serves to augment flow from the North Fork during peak use periods. This source also provides a backup in the event of a failure or problem with the North Fork Supply.

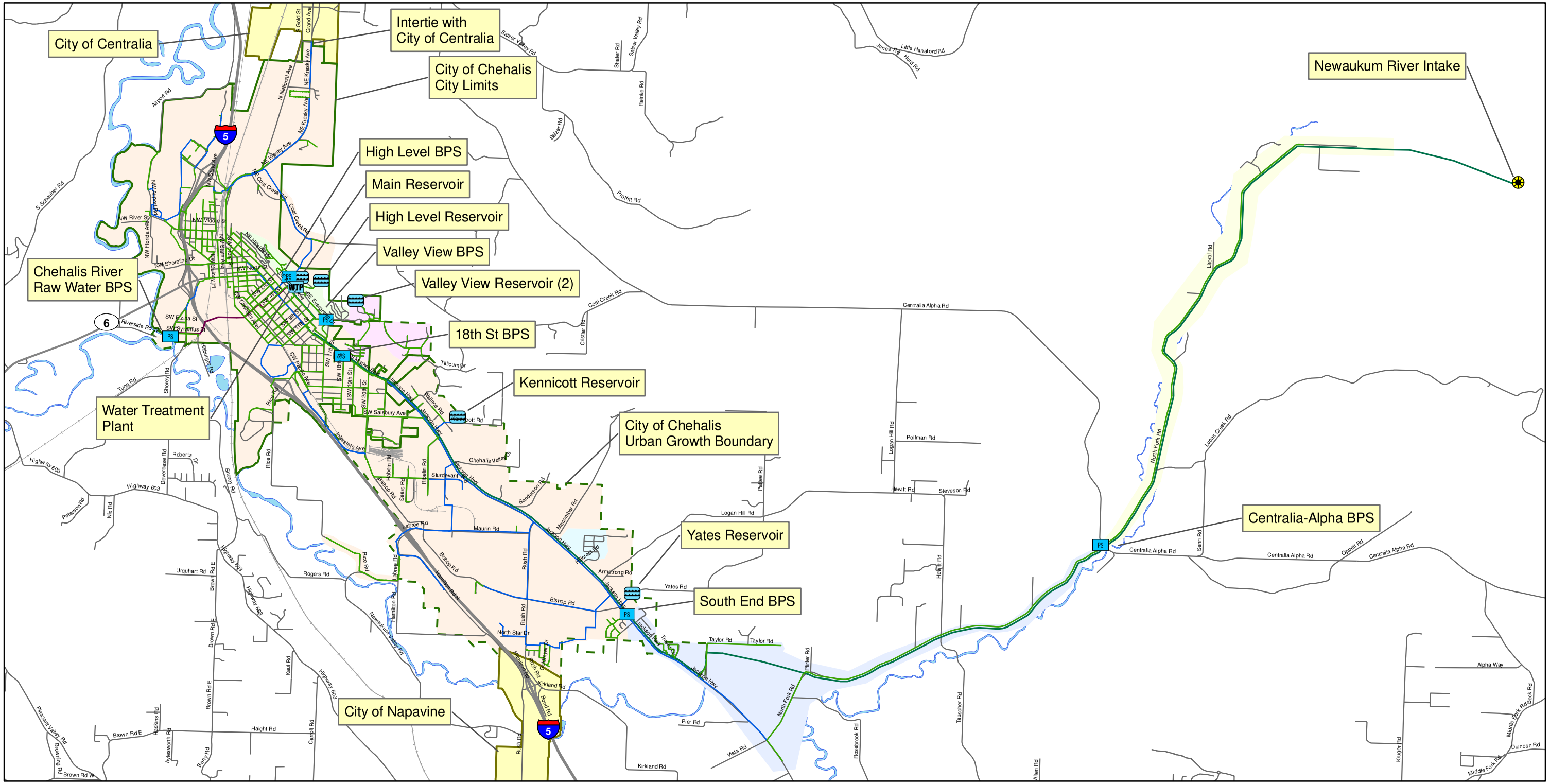


Figure 2.5
Water System Facilities

CITY OF CHEHALIS
WATER SYSTEM PLAN

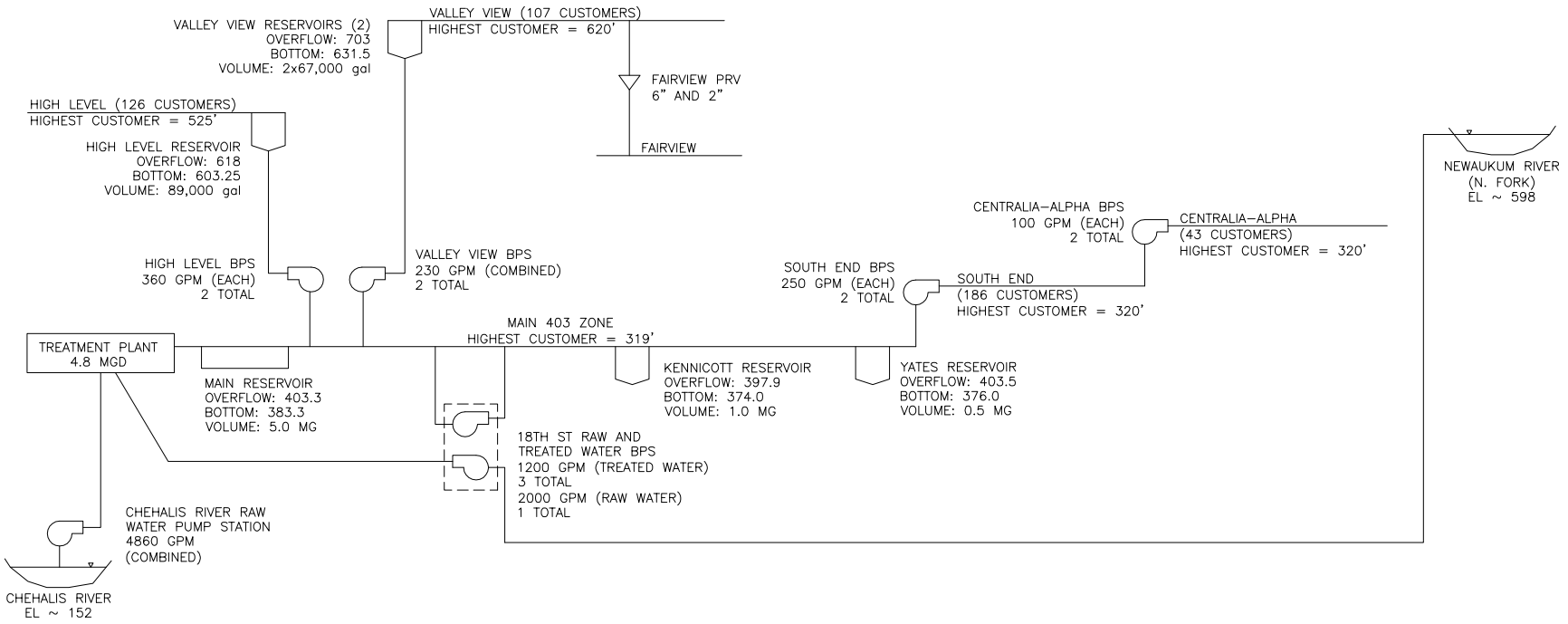


Figure 2.6
Water System Hydraulic Profile

CITY OF CHEHALIS
WATER SYSTEM PLAN

2.5.2. Pressure Zones

Elevations within the City's Retail Service Area range from 166 to 620 feet, as shown in Figure 2.7. Topographic considerations are significant because the City seeks to maintain normal service pressures between 30 and approximately 100 psi. In areas with higher operating pressures, individual customers are responsible for installing and maintaining their own pressure reducing valves (PRVs) to reduce pressures to an acceptable range.

The nominal hydraulic gradelines (HGLs) and the range of service elevations and pressures for each of the City's pressure zones are summarized in Table 2-4. Pressure zone boundaries and major water system facilities are shown in Figure 2.5, and the hydraulic relationship among pressure zones, reservoirs, pump stations and PRVs is shown in Figure 2.6.

Table 2-4 Pressure Zones

Pressure Zone	Minimum Service Elevation (ft)	Maximum Service Elevation (ft)	Minimum Static Service Pressure (psi)	Maximum Static Service Pressure (psi)
Main	166	319	32	102
High Level	288	525	34	143
Valley View/Fairview	514	620	31	81
South End	262	320	79	104
Centralia Alpha	300	320	118	127

Main Zone

The Main Zone is provided storage by the Main, Kennicott, and Yates reservoirs. This pressure zone supplies water to all other zones in the system.

High Level Zone

The High Level Zone is supplied by the High Level Reservoir via the High Level Booster Pump Station.

Valley View/Fairview Zone

The Valley View Zone is supplied by Valley View Reservoirs No. 1 and 2 via the Valley View (Prospect) Booster Pump Station. The Fairview Zone is supplied via a PRV from the Valley View Zone.

South End Zone

The South End Zone is supplied by the South End Booster Pump Station. There is no reservoir in this zone, and system pressures are determined by the operation of the pump station. This zone also provides water to the Centralia-Alpha Zone.

Centralia-Alpha Zone

The Centralia-Alpha Zone is supplied by the Centralia-Alpha Booster Pump Station. There is no reservoir in this zone, and system pressures are determined by the operation of the pump station.

City of Centralia

City of Chehalis
City Limits

City of Chehalis
Urban Growth Boundary

City of Napavine

5

6

Legend

Contour

100 ft

25 ft

Adjacent City

Chehalis City Limits

Chehalis UGA

Pressure Zone

Centralia Alpha

High Level

Hillcrest Private Water

Main

South End

Valleyview/Fairview

Figure 2.7
Topography

CITY OF CHEHALIS
WATER SYSTEM PLAN

N

0 2,500 5,000 10,000
Feet

2.5.3. Storage Facilities

The City has six reservoirs that serve five pressure zones throughout the City for a total of 6,656,000 gallons of storage. A summary of these facilities is presented in Table 2-5.

Main Reservoir

The Main Reservoir has a capacity of five million gallons and is located adjacent to the water treatment plant at Dobson Park on SE Parkhill Drive. It was constructed in 1927 as an open facility with an overflow elevation of 403 feet. The reservoir is divided in half by a concrete wall and either half can operate independent of the other. In 1994, a counter balanced Hypalon floating cover was installed in anticipation of increased regulations and the need to improve water quality to meet disinfection requirements. A polyethylene fabric was installed at the same time to enhance the reservoir's reliability.

This reservoir is the primary storage facility for the distribution system and its pressure zones. The water level is controlled by regulating water volumes through the treatment plant and adjusting flows from the intakes. The reservoir is fenced and all hatches are secured and locked.

Kennicott Reservoir

The Kennicott Reservoir is a concrete reservoir with a capacity of one million gallons. It was constructed off of Kennicott Road in 1983. The reservoir serves the Main Zone and has an overflow of 398 feet. There is an altitude valve installed to prevent overflow. The valve is located in a vault below the reservoir. The reservoir was installed to alleviate low fire flows and high demand spikes in the southerly portion of the City.

Yates Reservoir

The Yates Reservoir is a riveted steel reservoir with a capacity of 500,000 gallons. It was constructed in 2002 off of Yates Road to serve the Main Zone. The overflow elevation is 403.5 feet. The reservoir was constructed to offset demands placed on the system by the new electric generation plant on Bishop Road.

High Level Reservoir

The concrete High Level Reservoir has a capacity of 89,000 gallons. It was constructed in 1947 in McFadden Park to serve a higher pressure zone. The reservoir has an overflow of 618 feet and is supplied by the High Level Pump Station. The pumps are signaled to start when the reservoir level drops four feet below the overflow. The reservoir can be bypassed to provide water to the High Level Zone customers directly from the pump station during reservoir maintenance.

Valley View Reservoirs

There are two steel reservoirs that serve the Valley View Zone. One was installed in 1979 with a capacity of 67,000 gallons to serve a new development. A second 67,000 gallon reservoir was installed in 1996 to allow development of additional residential sites adjacent to the original subdivision. Both reservoirs are located at the top of the hill east of South Market Boulevard, southeast of McFadden Park, and have an overflow of 703 feet.

Water is supplied to the reservoirs by the Valley View (Prospect) Pump Station. The pumps are signaled to start when the water level drops by 3.5 feet from the maximum level. The two reservoirs can be individually isolated to continue to provide water to customers during maintenance.

Table 2-5 Storage Facilities

Facility	Type	Location	Year Built	Capacity (mg)	Diameter (ft)	Base Elevation (ft)	Overflow Elevation (ft)	Zone Served	Supply Source
Main Reservoir	Concrete	SE Parkhill Dr	1927	5.0	Varies	383	403	Main	Water Treatment Plant
Kennicott Reservoir	Concrete	Kennicott Rd	1983	1.0	84	374	398	Main	18th St Booster PS
Yates Reservoir	Steel	Yates Rd	2002	0.5	56	376	403	Main	18th St Booster PS
High Level Reservoir	Concrete	McFadden Park	1947	0.089	32	603	618	High Level	High Level Booster PS
Valley View Reservoir No. 1	Steel	SE Prospect St	1979	0.067	12.67	631	703	Valley View, Fairview	Prospect Ave Booster PS
Valley View Reservoir No. 2	Steel	SE Prospect St	1996	0.067	12.67	631	703	Valley View, Fairview	Prospect Ave Booster PS

2.5.4. Pump Stations

High Level Pump Station

The high-level pump station is located in Dobson Park, adjacent to the water treatment plant. The pump house is constructed of concrete block and although it is over fifty years old, the structure is in good shape. The station is equipped with two 30 hp centrifugal pumps which according to manufacturer's documentation, are rated at 265 gpm. However, flow and hour meter records indicated the pump capacity is between 320 and 360 gpm. The pumps draw water from the Main Zone between the Main Reservoir and the meter to the Main Zone. Only one pump is operated at a time. The pumps are manually rotated on a monthly basis. Both pumps have been rebuilt in recent years. The pumps operate automatically and are controlled by a level sensor in the High Level reservoir.

The station has an auxiliary generator with a manual transfer switch located in a wood structure next to the pump station.

The pumps and related facilities are inspected twice per week. Remote-sensing flow meters are installed at the station with the remote reader located at the treatment plant. The facility is fenced.

Valley View Pump Station (Prospect)

The Valley View pump station is located on Prospect Street near Evergreen Drive. There are two 30 hp centrifugal pumps rated at 125 gpm each. Level sensors in the Valley View reservoir control the pumps that alternate automatically.

The pump station is checked on a daily basis. The station is equipped with telemetry and meters for recording pump use and water pumped. The pump station has auxiliary power.

South End Pump Station

The South End pump station is located on Jackson Highway near Yates Road in a modern above ground structure. There are two 10 hp centrifugal pumps rated at 300 gpm each. Both pumps are variable speed and operate off a pressure sensor, which is set to maintain approximately 90 psi. This pressure zone has no storage and fire hydrants; therefore, the pumps must run continuously and have a capacity to meet peak hour demand. The pump station is fenced and is equipped with an auxiliary generator. The station is equipped with both an hour meter and flow meter.

Centralia-Alpha Pump Station

This pump station is located on the North Fork Road at the intersection of the Centralia-Alpha Road. The station is housed in a concrete block building. There are two 10 hp centrifugal pumps rated at 100 gpm each that provide water to customers on the easterly end of the North Fork Road. Both pumps are variable speed and operate off a pressure sensor which is set to maintain approximately 90 psi. No storage is provided with the system; therefore, the pumps must run continuously. In order to maintain chlorine residuals beyond the station, a hypochlorite injection system is operated based on incoming chlorine residual. The pump station is fenced and is equipped with an auxiliary generator. The station is equipped with both an hour and flow meter.

18th Street Pump Station

This pump station is located at the southwestern corner of the intersection of S Market Blvd and SW 18th St. The station was constructed in 2008 inside a concrete building and provides both raw and finished water pumping with separate facilities for each. The raw water pump is rated at 2,300 gpm and is used to augment conveyance of flow from the North Fork Intake into the water treatment plant. The finished water pumps, three in total, are rated at a combined 1,200 gpm. These pumps are variable speed and manually operated by the City based on the level in the Yates Reservoir, with typically two pumps operating at a time.

Table 2-6 Pump Stations

Facility	Year Station Built/(Pump Replaced)	Supply HGL	Pressure Zone Served	Pump No.	Pump Manufacturer	Pump Model	Capacity (gpm)	Rated Head (ft)	Speed (rpm)	Motor Power (hp)	Backup Power
High Level Pump Station	1947/(1996)	403	High Level	1	Gould Century	Berkely B2EPBLS	265	300	3,600	30	Yes
	1947/(1996)	403	High Level	2	Gould Century	Berkely B2EPBLS	265	300	3,600	30	Yes
Valley View (Prospect) Pump Station	1979/(2006)	403	Valley View, Fairview	1	American Marsh	2L1X2-10A/RV	128	417	3,500	28	Yes
	1979/(2006)	403	Valley View, Fairview	2	American Marsh	2L1X2-10A/RV	128	417	3,500	28	Yes
South End Pump Station	/(1999)	403	South End	1	Aermotor	GF300-10T	300	110	3,450	10	Yes
	/(1999)	403	South End	2	Aermotor	GF300-10T	300	110	3,450	10	Yes
Centralia-Alpha Pump Station	1978 - 9	Varies	Centralia-Alpha	1	Siemens	C810A	118	180	3,500	10	Yes
		Varies	Centralia-Alpha	2	Siemens	C810A	118	180	3,500	10	Yes
18th St Pump Station	2008	403	Main	1	Grundfos	CR90-2-2	440	155	3,540	25	
	2008	403	Main	2	Grundfos	CR90-2-2	440	155	3,540	25	
	2008	403	Main	3	Grundfos	CR90-2-2	440	155	3,540	25	
	2008	598	Raw Water	1			2,300		1,750	40	
Chehalis River Pump Station	1961/(1961)	246'-272'	Raw Water	1	Worthington Corporation	12H110 W5	1,200		1,770	100	Yes
	1961/(1991)	246'-272'	Raw Water	2	Jacuzzi	14LC	1,940	68	1,760	150	Yes
	1961/(1993)	246'-272'	Raw Water	3	Fairbanks Morse	Pomona Turbine 6927	1,950		1,770	150	Yes

2.5.5. Treatment Facilities

The treatment plant, constructed in 1960 and 1961, was designed for a peak production of 4.8 MGD. The treatment plant can receive raw water form either the North Fork or the Chehalis River. The plant is a conventional treatment process, consisting of flash mixing, flocculation, sedimentation, filtration and chlorination. The plant also provides pH adjustment/control and fluoridation. The water surface elevation (maximum) at the treatment plant is 415.7 feet.

2.5.6. Pressure Reducing Valve Stations

Table 2-7 summarizes the pressure reducing valves (PRVs) installed in the system.

Table 2-7 Pressure Reducing Valves

Station/Location	Zone		Size (in)	Setting (psi)	Elevation (ft)	HGL (ft)[1]
	From	To				
Fairview PRV	Valley View	Fairview	2	52	347	467
			6	52	347	467
Interstate Ave PRV[2]	Main	Main	8	NA	191	NA
Snively Ave PRV[2]	Main	Main	8	NA	198	NA
18th St Pump Station PRV[2]	Main	Main	8	NA	223	NA

1. Hydraulic grade line (HGL) calculated based on pressure setting and elevation.
2. These PRVs are in combination with check valves dividing the portion of the Main Zone that is boosted by the 18th St Pump Station.

2.5.7. Transmission and Distribution Pipe

Transmission and distribution consists of pipes ranging in size from 2-inches to 18-inches in diameter that carry water through a network of over 100 miles of pipe. The transmission lines from the North Fork and Chehalis River are 17.5 miles of ductile and cast iron pipe and 1.5 miles of tar wrapped steel pipe, respectively. The North Fork transmission line was installed in 1976 and the Chehalis River transmission line in 1961-62.

The distribution system contains over 82 miles of pipe and ranges in age from one to over 100 years. Most of the lines installed prior to the late 1960s are gray cast iron. Those installed since the late 1960s are made of ductile iron. Distribution system piping six inches and more in diameter is shown on Figure 2.3.

Table 2-8 Water System Piping

Diameter (inches)	Total Length (feet)	AC	CI	DI	PVC	Tar Wrapped Steel
2	3,114			3,089	25	
4	43,711	5,215	36,190	2,305		
6	144,751		94,983	49,768		
8	107,436		31,357	75,775	304	
10	29,702		14,172	15,530		
12	134,490		1,333	133,158		
14	17,305		17,305			
16	88,131			84,032	4,099	
18	7,812					7,812
Total	**576,451**					

Notes:
Transmission Lines are included and consist of 16" DI and 18" tar wrapped steel pipes.
AC = asbestos cement
CI = cast iron
DI = ductile iron
PVC = polyvinyl chloride

2.5.8. Service Connections

There are currently 3,540 service connections served by Chehalis, of which 2,790 are residential services for an active residential population of 7,185.

2.5.9. Interties

The cities of Centralia and Chehalis have constructed an emergency intertie on Kresky Avenue just north of Salzer Creek, connecting the two cities' water systems. The intertie is currently unmetered, but has two valves, one operated by each city. Operation requires cooperation and specific action by both cities. The purpose of this intertie is to provide each city with a source of water, although limited, from the other's water system, during emergency conditions. This intertie cannot supply either city with all the water it normally requires. It can, however, help mitigate each city's supply shortages during emergency conditions. Chehalis will coordinate with the City of Centralia in submitting the necessary information to request approval of this intertie in 2012.

The static pressures of the two cities' water systems are not equal but they are compatible. Chehalis' main zone reservoir overflow is 403 feet in elevation; Centralia's reservoir elevation is 417 feet. It is anticipated that during emergencies a portion of the water system in need will be isolated and served by the other city's system. The cities have a formal agreement requiring notification and both cities operating their respective valves in order to use the intertie. The Centralia Intertie Agreement is included in Appendix C.

Table 2-9 Interties with Adjacent Purveyors

Purveyor	Location	Valve Size (in)	Purpose
City of Centralia	Kresky Ave and Scott-Johnson Rd	12	Emergency Supply

Section 3
Related Plans, Agreements and Policies

3. Related Plans, Agreements and Policies

3.1. Related Plans and Agreements

Several plans and studies are related to the Water System Plan and elements contained within these related plans can have an impact on the planning required in this plan. The Washington State Growth Management Act of 1990 (GMA) is the most significant and is discussed below. A list of other related plans follows in Table 3-1. In accordance with the Municipal Water Law, the City has obtained signed consistency statement checklists from the City's community development department and Lewis County, to document that this WSP's planning is consistent with local area planning. Copies are provided in Appendix N.

Table 3-1 Plans Reviewed

No.	Planning Document
1	City of Chehalis, Water System Plan (2004)
2	City of Centralia, Comprehensive Water Plan (2006)
3	Lewis County Comprehensive Plan (1999, updated 2009)

The City is a party to three agreements for the purchase of City water. These agreements and some basic information about them are provided in Table 3-2. The agreements are discussed further in Section 3.1.3. A fourth agreement, that has not yet been exercised, was signed in 2004, regarding future provision of water to Lewis County Water and Sewer District No. 5.

Table 3-2 City Water Purchase Agreements

#	Agreement Type	Year of Formal Agreement	Party to Agreement
1	Water Purchase Contract	1973	Newaukum Hill Water Association
2	Municipal Services Agreement	2001	PacifiCorp (formerly Chehalis Power)
3	Water Service Agreement	1983X	Thousand Trails, Inc.
4	Interlocal Agreement	2004	Lewis County Water and Sewer District No. 5

In addition to the water purchase agreements identified in Table 3-2, the City also has entered into an agreement with the City of Centralia for an emergency intertie (Table 3-3) on the extreme north end of the City's system where the two water system boundaries convene. This intertie is only to be used for emergency purposes. The full agreement can be found in Appendix C.

Table 3-3 Other City Agreements

#	Agreement Type	Year of Formal Agreement	Party to Agreement
1	Agreement for Water System Intertie	1999	City of Centralia

3.1.1. Growth Management Act

The Growth Management Act (GMA) requires that county and city governments in rapidly growing counties develop plans for managing anticipated growth. The GMA provides a framework for coordination and comprehensive planning to help local communities manage their growth in a manner that makes sense for each community. The GMA calls for urban growth areas where growth will be encouraged and can be supported with adequate facilities. At the same time, it encourages setting aside other areas for rural uses and resource protection. Establishing these urban growth areas is a major step for local communities to take in managing their growth. Local communities are required to design urban growth areas to include "areas and densities sufficient to accommodate the county's expected growth for the succeeding 20 years" (GMA, Section 12, RCW 36.70A.12O). Communities will then review and revise their plan every ten years to assure that projected growth for the next ten years can be accommodated. To provide for this growth, local communities will need a thorough understanding of what land is available, is suitable for growth with their communities and may realistically be developed.

The GMA required those counties either mandated to perform growth planning or those counties volunteering to perform such planning to develop a comprehensive plan addressing county growth. Cities within each county were required to establish urban growth areas within which urban levels of utility service would be provided. Each comprehensive plan was expected to set figures for existing and future populations, as well as establish land use policies. Such policies encourage future growth within these urban growth areas for reducing sprawl and its attendant utility and transportation problems.

The cities of Centralia and Chehalis have established urban growth areas to aid in the GMA planning effort. Within these boundaries, efforts will be made to meet urban levels of service established by urban standards. Outside of the urban growth area, only rural standards will need to be met. This structure will provide the most efficient way to spend limited resources in trying to provide high quality and safe water service to the residents of Chehalis and Lewis County.

3.1.2. Related Plans

The following plans were used in the preparation of this Water System Plan:

- **City of Chehalis, Water System Plan, 2004.** This plan evaluated the Chehalis water system and made recommendations for improvements to meet anticipated growth. The plan is required to account for the 20-year horizon. It evaluated in detail the growth requirements for the first 6-year period and on a more general basis, the balance of the 20 years. All of the recommendations made in this plan have been implemented or are currently being implemented. This plan is mandated by the Washington State

Department of Health (DOH) and is required to be updated every 6 years. This plan was reviewed to obtain system history. Information contained in the plan that is still current has been incorporated into this update.

- **City of Centralia, Comprehensive Water Plan, 2005.** This plan focused on the City of Centralia's service area and was reviewed to ensure that the City's planning efforts do not conflict with those in effect for this adjacent jurisdiction.
- **Lewis County Comprehensive Plan, 1999, updated 2009.** This plan was coordinated under the Urban Growth Management Program. This plan deferred UGA designations to the nine incorporated cities within Lewis County (Centralia, Chehalis, Morton, Mossyrock, Napavine, Pe Ell, Toledo, Vader, and Winlock).

3.1.3. City Water Purchase Agreements

The City currently provides water to three entities under a contractual arrangement. The first is Newaukum Hill Water Association (Newaukum Hill), serving the subdivision of Newaukum Heights. The second is PacifiCorp (formerly Chehalis Power), serving a steam generating power plant on the south end of the City's system. The third is Thousand Trails Campground, which receives North Fork Newaukum water from the City's raw water line. A fourth agreement is in place, regarding Lewis County Water and Sewer District No. 5 (District), which has not yet been exercised.

Newaukum Hill Water Association

This agreement was originally entered into by the City and Newaukum Hill in 1973. The contract states:

> "Whereas, the Seller owns and operates a water supply distribution system with a capacity currently capable of serving the present customers of the Seller's system and the estimated number of water users to be served by the said Purchaser as shown in the plans of the system now on file in the office of the Purchaser…"

The City is currently providing water service under the terms of this agreement.

PacifiCorp

The City provides water to PacifiCorp (formerly Chehalis Power) under a contract entered into in 2001. This contract allows PacifiCorp to use water on demand up to an established contract limit, which is set on a not-to-exceed basis on both a maximum day demand and an annual demand amount. The maximum terms of this contract have been used in developing the demand forecast for the City which can be found in Chapter 4 of this Plan. The City is currently providing water service under the terms of this agreement.

Thousand Trails

Thousand Trails Campground is served directly from the North Fork Newaukum raw water line. This service is metered but is charged a reduced rate to reflect the lower cost of supplying the untreated water. The Water Service Agreement with Thousand Trails is included as Appendix G. The City is currently providing raw water service under the terms of this agreement

Water District No. 5

The City signed an interlocal agreement (ILA) with Lewis County Water and Sewer District No. 5 in 2004. This ILA outlines the District's request for the purchase of water to aid in meeting the water supply needs associated with a large proposed development (i.e., the Birchfield Fully Contained Community). The proposed development is located to the south and east of the City, and is not within the City's Retail or Future Service Area.

The proposed development has not yet been approved by Lewis County. It is awaiting further review and action at the County level, as of the writing of this water system plan update. At this time, it is unclear as to whether or not the City will provide water to the District. If it does, the amount and timing of such water provision is uncertain. The City will only serve District No. 5 if doing so has no adverse effect on the City's ability to serve the current and future customers within its service area.

3.2. Future Service Area and Service Area Agreement

The service area, which is the urban growth area designated for the City of Chehalis, is not anticipated to change in the foreseeable future. It is shown on Figure 1.1.

3.3. Service Area Polices

The City's formally established water system policies are defined in Ordinance Numbers 865-B and 866-B, 2011. These ordinances can be found in Appendix D. In addition, the City has established a number of administrative, operational and development policies. The policies and this ordinance address general system responsibilities, rates and charges, connection and construction standards, water services, administration, application procedures, water uses, etc. They have developed slowly over time, as the City Council has needed to address specific issues. The City has developed a "guidance document" titled Water/Sewer/Storm Application Process which can be found in Appendix E. Specific applications for service and current fee schedules are included in Appendix F.

3.3.1. Duty to Serve

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.

In keeping with this requirement, typically new developments occurring within City Limits apply for water service from the City, following the process described in 13.04.020(B) of Ordinance 866-B (see Appendix D), and in more detail in the Water/Sewer/Storm Application Process outlined in Appendix E. An applicant may be required to obtain a building or plumbing permit for the premises where water is being requested.

Ordinance 866-B and the Water/Sewer/Storm Application Process also address the approach to assessing when and where service will be provided to applicants whose premises are located within or outside the UGA. If the proposed service is outside City Limits but within the UGA, a Utility Service Annexation Agreement must be obtained from the City. If the proposed service is not within either City Limits or the UGA, water service is not available except under special circumstances, as determined by the Public Works Department.

3.3.2. Wholesaling of Water

The City currently has no specific policy on wholesaling of water. The City provides water to a number of small water systems, as depicted on Figure 2.2. With one exception (Thousand Trails), all water provided is metered and charged at the standard commercial rate.

3.3.3. Wheeling of Water

"Wheeling" refers to the practice of transferring or allowing the transfer of water from one water distribution system through another purveyor's transmission line(s) or distribution system in order to deliver water from one location to another. Typically, wheeling occurs on larger systems where distribution systems are close together and where service areas are expansive.

The City of Chehalis does not presently wheel water to/from any other entity, has no policy on wheeling of water, and it is highly improbable that the issue or opportunity would present itself.

3.3.4. Annexation Policy

The City of Chehalis has established an annexation policy whereby any property outside the corporate limits of the City desiring water and/or sewer service must sign and execute an annexation agreement. This annexation agreement provides that the property owner will not block any attempts by the City to annex the property requesting water and/or sewer service.

3.3.5. Satellite/Remote Systems

Noncontiguous or separate (often-remote) water systems that use separate facilities and infrastructure and may be served by a different source are referred to as satellite systems. The City of Chehalis currently does not operate nor has responsibilities associated with any satellite water systems. The City has further established a policy whereby they will not provide water to proposed satellite systems within or adjacent to the existing service area. Developments or areas requesting water service that are accepted by the City for connection to the City's existing infrastructure are responsible for providing improvements and infrastructure that meet City standards prior to connection. Such improvements and infrastructure shall be turned over to the City for ownership and operation after construction and approval.

3.3.6. Design and Performance Standards

The City has established Development Guidelines and Public Works Standards that provide directions for property owners, developers and others connected to or desiring connection to the Chehalis water system.

Contained within the Development Guidelines and Public Works Standards are the water system construction standards. These Standards have been approved by DOH. Copies of

these Development Guidelines and Public Work Standards are available at the Public Works Department.

3.3.7. Rates for Outside Retail Customers

The City of Chehalis has established rates for retail water customers located outside the city limits. This rate structure follows the City's inside the city limits rate structure with a 10% increase. The rationale for this difference is that travel time for operational and maintenance tasks are generally greater outside the City and the connection densities are generally less reducing the efficiency of general operations and maintenance of the outside the city limits system components.

3.3.8. Formation of Local Improvement Districts Outside City Limits

The City is supportive of working cooperatively with property owners outside the city limits to develop financing strategies which includes providing technical assistance in the formation of local improvement districts (LID) for the provision of water and/or sewer service when and where an LID is the most feasibly option.

3.3.9. Urban Growth Areas

The City has adopted an urban growth area, which has been accepted by Lewis County. The City plans land use and utilities infrastructure for this area. Developers and end users will finance line extensions and other required infrastructure.

3.3.10. Latecomer Agreements

The City has a policy whereby developers and property owners required to install improvements can establish latecomer agreements to provide for reimbursement as subsequent connections are made. In order to establish a latecomer agreement and fee structure, the developers or property owners must submit a proposal supporting such fees and charges to the Public Works Director. If accepted, the Public Works Director will establish the latecomer fees and require their collection at the time water connections are made to these improvements. The City will then pass on such payments to the developers or property owners that originally provided for the utility improvements.

3.3.11. Oversizing

In accordance with state law, the City has established minimum waterline sizing criteria. In the event future development may require a larger line than the standards might otherwise dictate, the City may require the individual(s) providing for such line extensions to increase the size to the level that it has determined to be necessary to provide for future services. The City may also elect to participate in such line extension oversizing by paying the difference in costs or a portion of the difference in costs over the line size that meets city standards. Latecomer agreements may also be implemented to facilitate the reimbursement of oversizing costs by those future developments that could directly benefit form such work.

3.3.12. Cross-Connection Control Program

The City has developed a Cross-Connection Control Program in accordance with state regulations. The Cross-Connection Control Program is detailed in Section 10.7 of this plan. This program provides the City with the means of controlling and preventing cross connections by either removing the cross-connection or requiring the installation of an approved backflow prevention assembly to protect the City's water supply.

The City's cross connection control program requires that an initial evaluation take place at the time application for new service is reviewed. System-wide surveys are conducted and those services where the potential for cross connection exists are required to provide back-flow prevention devices. The City will inspect all premises where the potential for cross connection exists. Owners/operators of the facilities that have cross connection control devices are required to annually test them and demonstrate to the City that they are in satisfactory working order.

3.3.13. Extension Policy

The Development Guidelines and Public Works Standards clearly delineate that developers and/or property owners as responsible for the costs to extend water lines. These guidelines and standards also identify specific requirements with which such line extensions must comply.

Section 4
Planning Data and Demand

4. Planning Data and Demand

This chapter discusses planning data and the City of Chehalis' demand forecast. The information is presented in three main sections: the first section summarizes historical and projected demographic data for Chehalis; the second section summarizes Chehalis' water use characteristics including production, consumption, water balance, and water use factors; and the third section combines the demographics and the water supply characteristics to develop Chehalis' demand forecast for the next 20 years and provides a longer term estimate of demand needs for a 50 year time horizon.

4.1. Demographics – Historical and Projected

Two demographic units were analyzed for this water system plan. The demographic units are listed below and information is provided regarding how the demographic units relate to the demand forecast.

- **Population:** Population growth is presented to provide the growth context, and is used as the basis for growth projections where other variables are not forecasted directly.
- **Single Family Households:** The number of single family households is the demographic unit used for the residential component of the demand forecast.

Table 4-1 presents recent demographic data as well as projections for the forecasting period. The demographics are for Chehalis' retail service area and reflect the timing of providing service within that area, as described in Chapter 2. The population and single family household demographics are based on data from the Washington State Office of Financial Management (OFM), which develops demographic projections for all of Washington State. The most recent data set from OFM is based upon the 2000 Census. The OFM data was used to develop population numbers for the years 2003 through 2009. Population numbers for 2010 and beyond are based upon the 2007 through 2009 average growth rate of the OFM data. Single family household figures for the years 2003 through 2009 are based on actual number of reported single family connections from the City. Data for single family connections in 2010 and beyond was based upon the actual growth rate experienced by the City of Chehalis for single family connections from 2008 to 2009.

Table 4-1 Demographics for Chehalis Retail Service Area

Calendar Year	Plan Year	Population		Single Family (SF) Households	
		Total		Total	
		Qty[1]	Annual Increase[2]	Qty[3]	Annual Increase[4]
2003	n/a	7,010	n/a	n/a	n/a
2004	n/a	6,980	-0.4%	2,574	n/a
2005	n/a	6,990	0.1%	2,599	1.0%
2006	n/a	7,025	0.5%	2,629	1.2%
2007	n/a	7,045	0.3%	2,658	1.1%
2008	n/a	7,215	2.4%	2,737	3.0%
2009	n/a	7,185	-0.4%	2,790	1.9%
2010	1	7,240	0.8%	2,844	1.9%
2011	2	7,295	0.8%	2,899	1.9%
2012	3	7,350	0.8%	2,955	1.9%
2013	4	7,406	0.8%	3,012	1.9%
2014	5	7,462	0.8%	3,071	1.9%
2015	6	7,519	0.8%	3,130	1.9%
2016	7	7,576	0.8%	3,191	1.9%
2017	8	7,634	0.8%	3,253	1.9%
2018	9	7,692	0.8%	3,316	1.9%
2019	10	7,751	0.8%	3,380	1.9%
2020	11	7,810	0.8%	3,445	1.9%
2021	12	7,869	0.8%	3,512	1.9%
2022	13	7,929	0.8%	3,580	1.9%
2023	14	7,989	0.8%	3,649	1.9%
2024	15	8,050	0.8%	3,720	1.9%
2025	16	8,111	0.8%	3,792	1.9%
2026	17	8,173	0.8%	3,865	1.9%
2027	18	8,235	0.8%	3,940	1.9%
2028	19	8,298	0.8%	4,017	1.9%
2029	20	8,361	0.8%	4,094	1.9%
2059	50	10,495	0.8%	7,279	1.9%

1. Quantity (Population): 2003-2009 historical population based upon WA State Office of Financial Management Population Estimates. 2010 population and beyond calculated based upon average annual increase 2007-2009 of this data.
2. Annual Increase (Population): 2003-2009 growth based on actual percentage increase calculated from OFM Population Estimates. 2010 and beyond based upon average of 2007-2009 growth for this same data.
3. Quantity (SF Households): 2003-2009 historical number of connections provided by City. 2010 and beyond based upon actual 2008-2009 growth for City-reported SF connections.
4. Annual Increase (SF Households): 2003-2009 growth based on actual percentage increase calculated from City-reported SF connections. 2010 and beyond based upon 2009 growth for City-reported SF connections.

4.2. Water Use Characteristics

4.2.1. Production and Peaking Factor

Chehalis' water source is surface water from the Newaukum and Chehalis Rivers. The Newaukum River is Chehalis' primary source and the Chehalis River is used primarily for the summer peak season. Figure 4.1 shows the percent of supply from each source, for the most recent three years.

Figure 4.1 Production by Source (2007–2009)

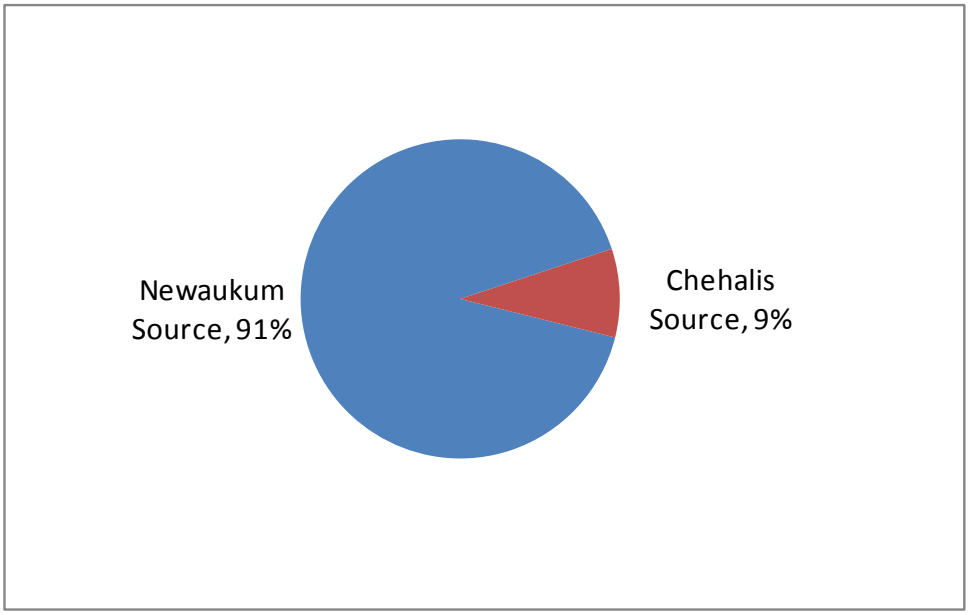


Figure 4.2 shows an eleven year history of Chehalis' water production. Water production has ranged from a low of 651 million gallons (mg) in 2006 to a high of 788 mg in 2000. Table 4-2 shows the 2007-2009 average production from each Chehalis source. The total 2007–2009 average production was 684 mg. The most recent 3-year average production by month is shown in Figure 4.3. As with most water utilities, Chehalis' production increases in the summer months due to irrigation use.

Figure 4.2 Annual Production (1999–2009)

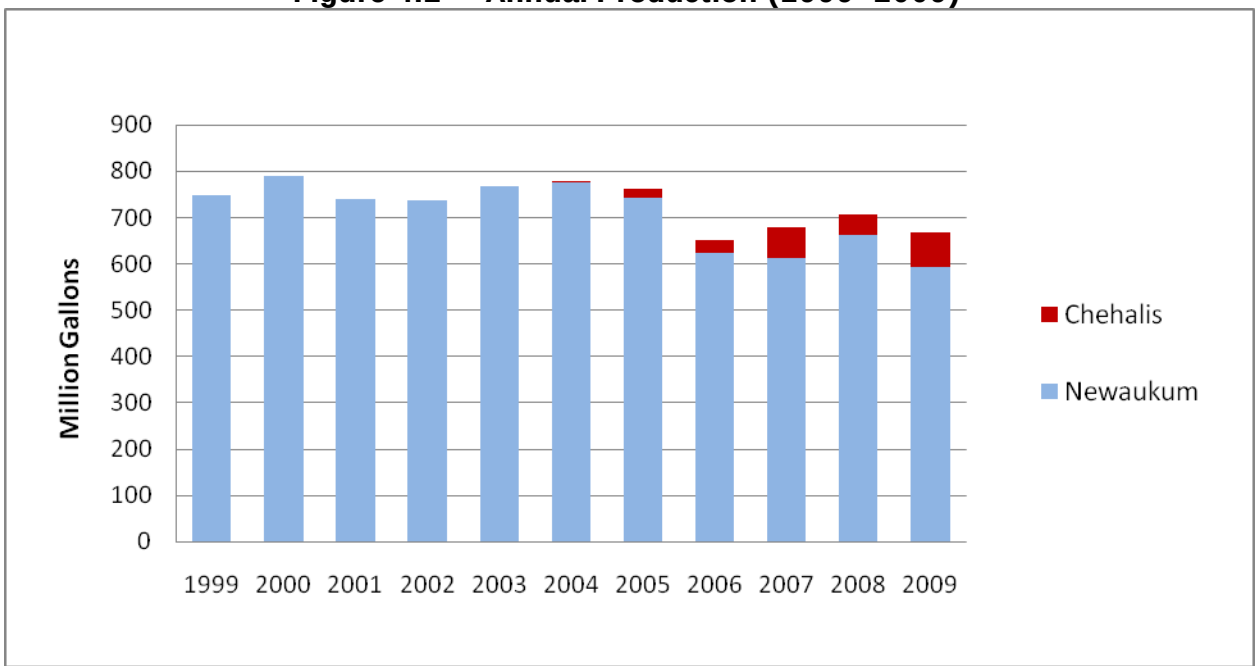


Table 4-2 2007-2009 Average Production (million gallons)

Month	Newaukum Source	Chehalis Source	Total	Percent
Jan	41.1	7.0	48	7%
Feb	44.2	0.0	44	6%
Mar	46.7	2.9	50	7%
Apr	41.4	2.1	44	6%
May	41.9	4.8	47	7%
Jun	47.0	6.0	53	8%
Jul	63.3	10.0	73	11%
Aug	74.6	10.4	85	12%
Sep	67.6	5.3	73	11%
Oct	55.1	10.0	65	10%
Nov	50.1	0.0	50	7%
Dec	50.1	3.0	53	8%
Total	**623.1**	**61.4**	**684**	**100%**
Percent	**91%**	**9%**	**100%**	

Figure 4.3 Monthly Production (2007–2009 Average)

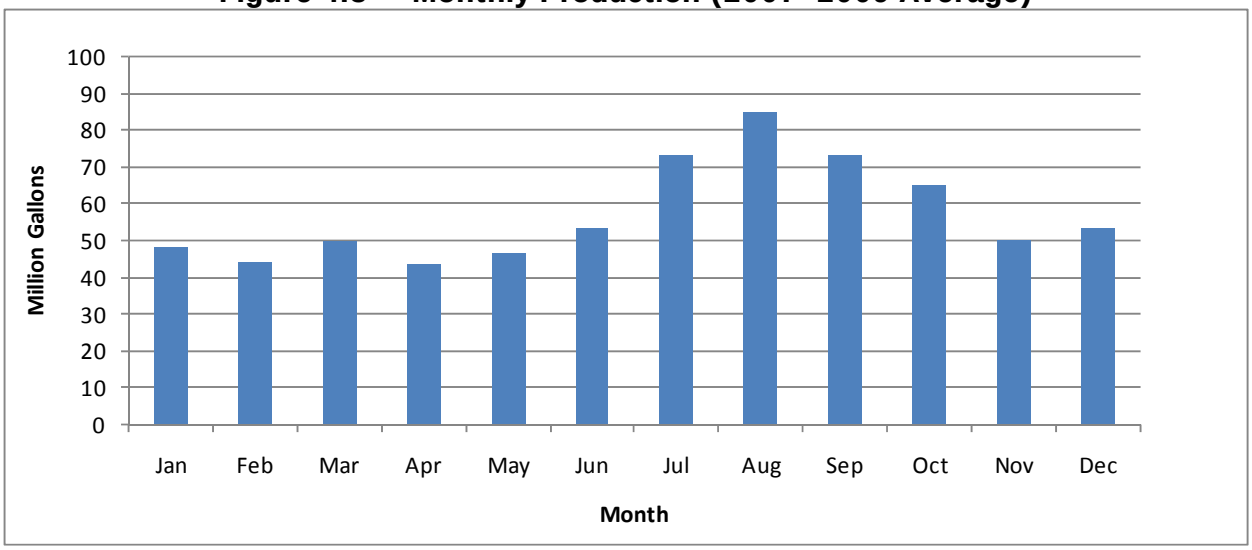


Table 4-3 shows the maximum day versus average day peaking factors for the most recent three years. The maximum day peaking factor has ranged from 1.7 to 2.72, however the City experienced a major main break in 2007; therefore, 2007 was excluded from the calculation of system-wide peaking factor. The average peaking factor for 2008 – 2009 was 1.98.

Table 4-3 Peaking Factor – Average Day to Maximum Day

	Peak Day MGD	Average Day MGD	Peaking Factor
2007	5.07	1.86	2.72
2008	3.30	1.94	1.70
2009	4.12	1.83	2.26
2008-2009 avg peaking factor[1]			**1.98**

1. The City experienced a major main break in 2007; therefore 2007 was excluded from the peaking factor calculation to normalize results.

4.2.2. Customer Categories, Connections, and Consumption

Chehalis has the following two customer categories:

- **Residential:** Single family residential buildings that are within Chehalis' service area.
- **Commercial:** All non-residential customers and multi-family customers that are within Chehalis' service area.

Table 4-4 provides the number of connections from 2004 to 2009. At the end of 2009, Chehalis had 3,540 connections, the vast majority of which (77%) were single family residential. Chehalis experienced a 12% decrease in the number of commercial connections in 2009, reducing the total number of connections from 3,592 in 2008 to 3,540 in 2009. This decline is due to the current economic conditions causing several smaller businesses in the area to close their doors. The average number of connections for the three year period of 2007 – 2009 was 3,544.

Table 4-4 Number of Connections

Customer Category	2004	2005	2006	2007	2008	2009	2007-2009 Average #	2007-2009 Average %
Number of Connections								
Residential	2,574	2,599	2,629	2,658	2,737	2,790	2,728	77%
Commercial	801	820	833	843	855	750	816	23%
Total	3,375	3,419	3,462	3,501	3,592	3,540	3,544	100%
Annual Increase in Number of Connections by Year								
Residential		1.0%	1.2%	1.1%	3.0%	1.9%		2.0%
Commercial		2.4%	1.6%	1.2%	1.4%	-12.3%		-3.2%
Total		1.3%	1.3%	1.1%	2.6%	-1.4%		0.8%

Table 4-5 provides the average consumption by customer category and by month, over the last 3 years.

Table 4-5 2007-2009 Average Water Consumption (million gallons)

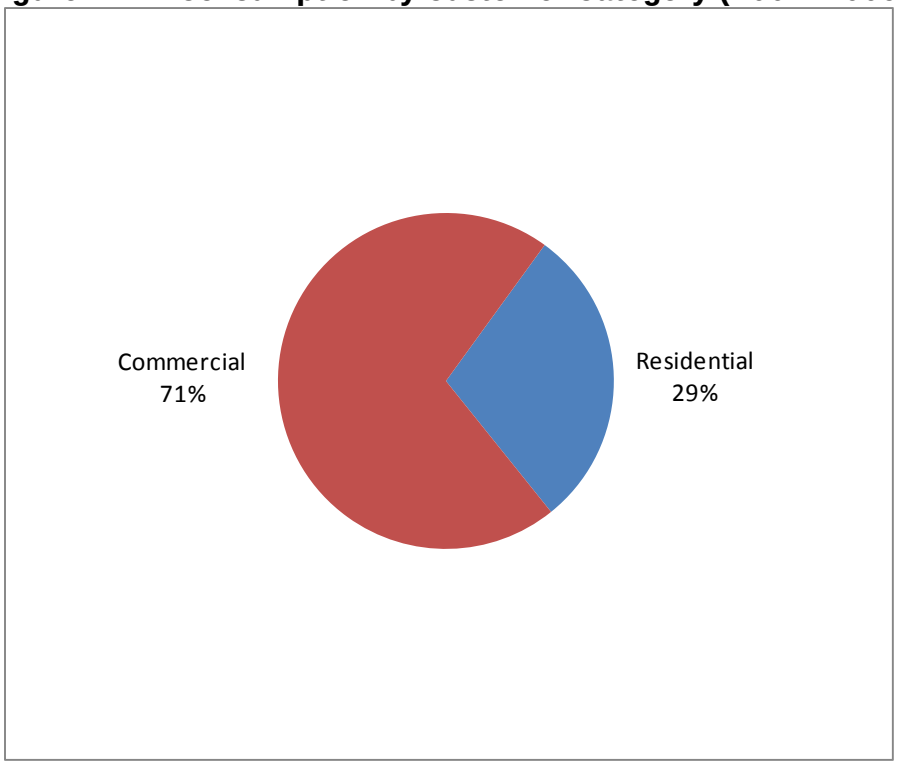
Customer Category	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	Percent
Residential	9.0	11.5	7.6	10.8	8.8	11.8	7.7	18.8	15.8	15.5	10.0	11.7	139	29%
Commercial	19.2	18.6	19.3	21.2	19.5	22.6	29.0	33.9	52.4	40.4	38.8	21.8	337	71%
Total	28	30	27	32	28	34	37	53	68	56	49	33	476	100%
% of Total	6%	6%	6%	7%	6%	7%	8%	11%	14%	12%	10%	7%	100%	

The monthly distribution of actual water use may differ somewhat from this representation since consumption numbers are based on meter read dates.

Consumption for some months was normalized using the average of all available data from the same months of other represented years.

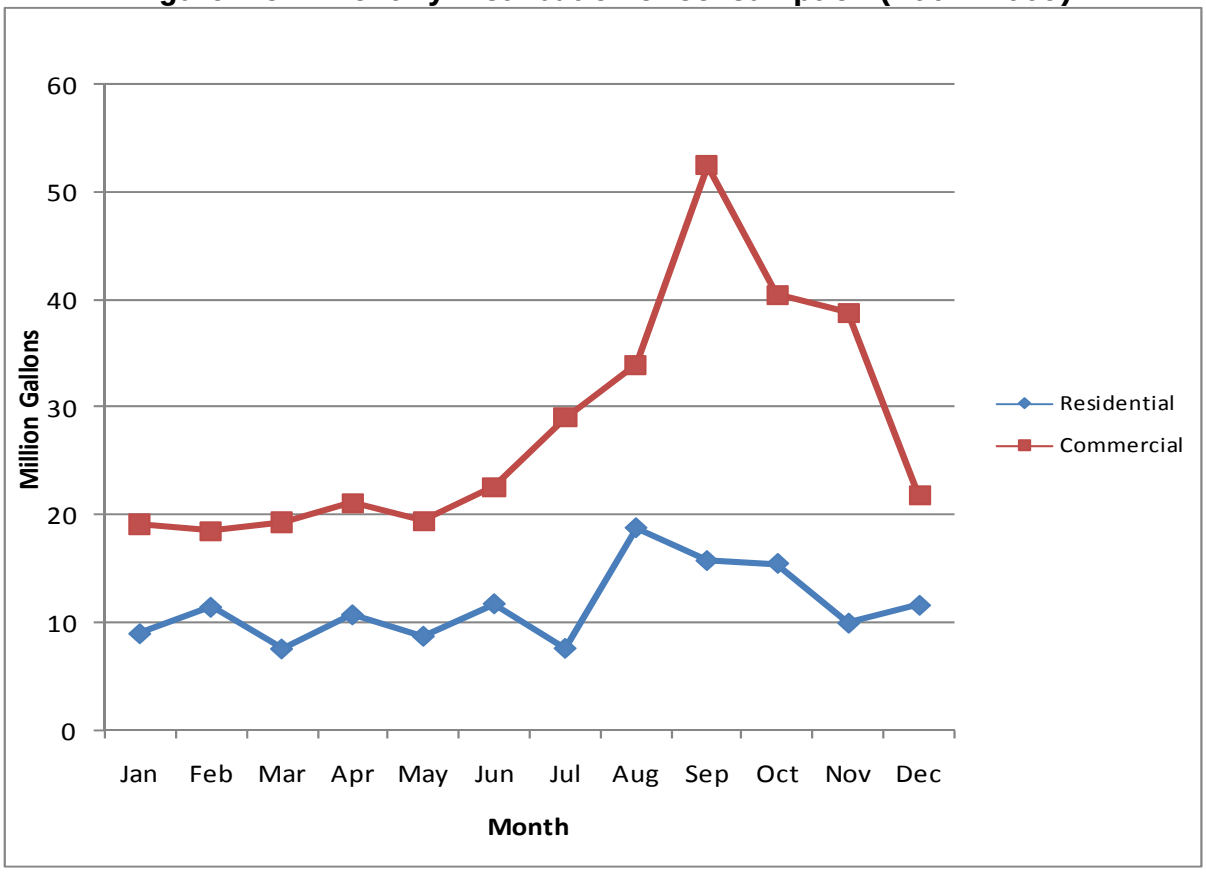
Figure 4.4 shows the allocation between the customer categories. The majority (71%) of Chehalis' water is used by commercial customers. The residential customers account for 29% of the consumption.

Figure 4.4 Consumption by Customer Category (2007–2009)



The peaking aspect of Chehalis' production was discussed in Section 4.2.1. Both customer categories were examined to evaluate their contribution to system-wide peaking. The commercial category drives most of the system's peaking profile. The residential customers contribute to the same peaking period as the commercial customers; however, their peak is not as significant as the commercial category. Figure 4.5 graphically represents each customer category's peaking characteristic.

Figure 4.5 Monthly Distribution of Consumption (2007–2009)



Customers with large water demands are of interest because their demand could have significant impact on the overall demand for Chehalis. Therefore, Chehalis' 20 largest customers from 2003 to 2009 were reviewed to determine whether they require special treatment for the demand forecast. Special treatment was deemed appropriate for one customer, Chehalis Power, which is one of Chehalis' largest customers. Chehalis Power is the only customer with a water purchase contract that could have significant impacts on the City's water production if the full contract terms are exercised since the contract defines a maximum amount of water to be made available on demand for Chehalis Power. Water use by Chehalis Power constitutes approximately 5% of Chehalis' production and approximately 8% of the non residential consumption. However, under the contract terms for water purchase, Chehalis Power could represent up to 9% of Chehalis' production. Therefore, the full contract terms were used to represent Chehalis Power's demand component in this forecast.

4.2.3. Water Balance, Non-Revenue, and Leakage

A water balance is an accounting for all water that is produced. Table 4-6 shows Chehalis' 2009 water balance. The table is a slightly modified version of the format recommended for use by the American Water Works Association's Water Loss Committee.

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

Level 1 simply allocates the water to either Revenue Water or Non-Revenue Water. Revenue Water generates income while Non-Revenue Water does not. Chehalis' 2009 water production is divided into 78% Revenue Water and 22% Non-Revenue Water.

Table 4-6 Water Balance (2009)

	Level 1	Level 2	Level 3	Volume *(mg)*	% of Production
Water Production	Revenue Water	Billed Authorized Consumption	1. Billed Water Exported	0	0%
			2. Billed Metered Consumption	517[1]	77.5%
			3. Billed Unmetered Consumption	0	0%
	Non-Revenue Water	Unbilled Authorized Consumption	4. Unbilled Metered Consumption	29[2]	4.4%
			5. Unbilled Unmetered Consumption	11[3]	1.6%
		Apparent Losses	6. Unauthorized Consumption	0[4]	0%
			7. Customer Metering Inaccuracies	0[4]	0%
		Real Losses	8. Known Leakage at Filter Plant	5	0.8%
			9. Assumed Leakage	105[5]	15.7%
TOTAL				**667**[6]	**100%**

1. Data Source: "Utility Data - Water" spreadsheet provided by City staff.
2. Provided by City Staff as "Other Authorized Consumption" and includes filter plant backwash, contractor hydrants, and City owned facilities.
3. Includes hydrant flushing
4. The City does not have an estimate of these categories; therefore "0" was used.
5. Water Production minus all other categories.
6. Data Source: "Well Production Totals" spreadsheet provided by City staff.

Level 2 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, filter plant backwashing, firefighting, City-owned facilities, and unbilled contractor use. Chehalis' 2009 unbilled authorized consumption is estimated at 6%.
- **Apparent Losses:** Includes unauthorized uses and customer meter inaccuracies, both of which are lost revenue opportunities. Chehalis had no quantitative information to estimate these quantities and therefore zero was used as a default.
- **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. Chehalis' 2009 real losses are estimated at 15.7%.

Level 3 simply further splits water into additional sub-categories to support further estimation and water management.

Table 4-7 shows a longer history of some of the water balance elements, namely distribution system leakage and non-revenue water. The table shows numbers from 2003 to 2009.

Washington State's Water Use Efficiency Rule defines distribution system leakage as water production (and purchases, if applicable) minus authorized consumption. Under the Rule, distribution system leakage cannot exceed 10%, based on a 3-year rolling average. Chehalis began reporting its annual distribution system leakage in 2009 (for the 2008 calendar year), and compliance will be determined in 2011, when the 2010 leakage numbers are known. The average from the most recent 3 years shows that the 2007–2009 average distribution system leakage has been 24% of water production. In 2007, Chehalis experienced a major main break that resulted in significant water losses. Therefore, the 2007 leakage number was very high (30% of production). The 2008 and 2009 leakage numbers were much lower (26% and 16% of production, respectively). Chehalis' ability to meet the leakage standard for the 2007-2009 compliance period will be impacted by the high 2007 number. However, the longer range data suggests that leakage is approaching the DOH standard of 10%.

Non-revenue water as a percent of billed consumption is used to develop the non-revenue component of the demand forecast. Since 2007 was an anomalous year in terms of non-revenue water and the amount of non-revenue water has been steadily and significantly decreasing since 2004, the 2009 non-revenue water percentage was used to develop the demand forecast. The 2009 non-revenue water was 29% (note this is a different value than leakage, which was 16% in 2009).

Table 4-7 Distribution System Leakage and Non-Revenue Water (million gallons)

Year	Water Produced[1]	Authorized Consumption		Distribution System Leakage[4]		Non-Revenue Water[5]	
		Billed Consumption[2]	Unbilled Consumption[3]	Qty	Percent of Production	Qty	Percent of Billed Consumption
2003	768	412	51.9	304	40%	356	87%
2004	779	391	52.7	336	43%	388	99%
2005	761	392	51.4	318	42%	369	94%
2006	651	420	44.0	188	29%	232	55%
2007	679	432	45.8	201	30%	247	57%
2008	708	479	47.8	182	26%	229	48%
2009	667	517	45.1	105	16%	150	29%
2007-2009 Average[6]	**684**	**476**	**46.2**	**162**	**24%**	**209**	**44%**

1. Data Source: "Water Use" spreadsheet provided by City staff.
2. Data Source: "Residential-Commercial Users" spreadsheet provided by City staff, results normalized for meter misreads.
3 For 2009, this number was estimated by City staff. For the other years, the 2009 percent of unbilled consumption as a percent of water produced (6.8%) was applied to the water production.
4. Distribution system leakage is defined in the 2007 Water Use Efficiency Rule as water production minus authorized consumption.
5. This calculation is water production minus billed consumption. These numbers are used to develop the non-revenue portion of the demand forecast. Note that the demand forecast uses the 2009 number, which is more indicative of anticipated future non revenue water trends.
6. Data is presented for six years to show a lengthy history; however the average uses 2007 - 2009 to focus on current trends.

4.2.4. Water Use Factors and Equivalent Residential Units

Water use factors were calculated for three customer categories: residential, non residential and large non residential. Table 4-8 shows the inputs and the results of the calculations. For the residential category, the water use factor is 140 gallons per day (gpd) per household. For the non residential category, the water use factor is 385 gpd per connection, and for large non residential the water use factor is 30,810 gpd per connection.

Table 4-8 Water Use Factors and ERUs (2007-2009 Average)

Customer Category	Sales (gpd)[4]	Connections	Consumption Per Connection (gpd)	Number of ERUs[8]
Residential[1]	381,006	2,728[5]	140[7]	2,728
Non Residential[2]	306,286	796[6]	385	2,188
Large Non Residential Users[3]	616,198	20	30,810	4,401
Total	1,303,490	n/a	n/a	9,317

1. This includes single family residential.
2. This includes commercial, industrial, and multi-family uses, but does not include the top 20 users.
3. Large Non Residential Users represent the top 20 non residential users connected to the system.
4. Data Source: "Utility Data - Water" and "Top 20 users" spreadsheet provided by City staff.
5. This is the number of single family households and is based on data in Table 4-4.
6. This is the number of non-residential connections and is based on data in Table 4-4.
7. This number, 140 gallons per day, is the City of Chehalis' ERU value. ERUs, or equivalent residential units, are a method of representing water use by non-residential customers as an equivalent number of residential customers. Chehalis' ERU value is the average amount of water used by a residential connection, calculated by dividing residential consumption by the number of residential connections.
8. The number of ERUs in any customer category is calculated by dividing that customer category's water sales by the ERU value.

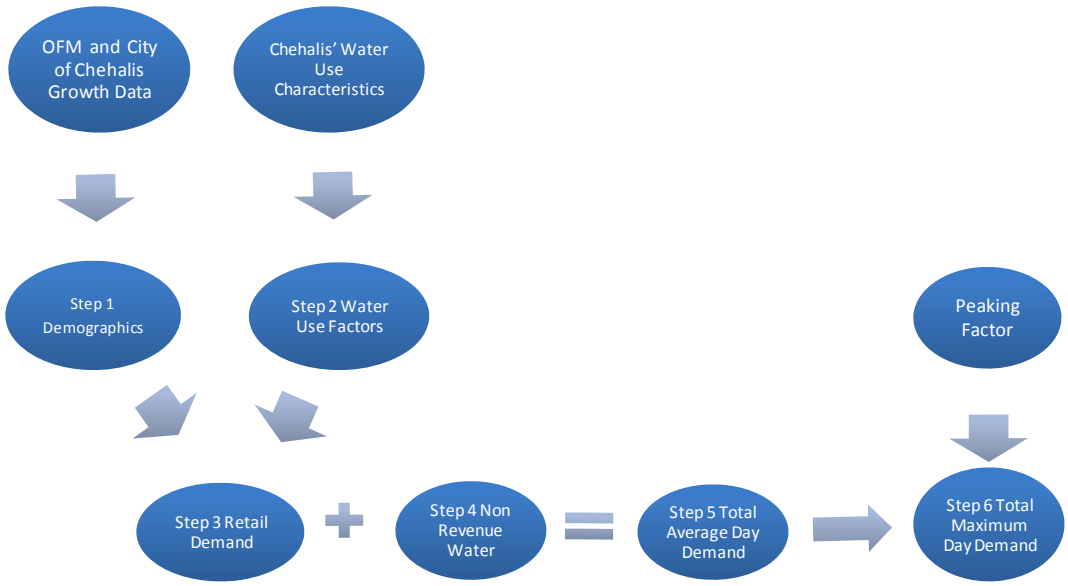
Table 4-8 also shows the number of Equivalent Residential Units, or ERUs, in each customer category. ERUs are a method of representing water use by non-residential customers as an equivalent number of residential customers. Chehalis' ERU value is 140 gallons per day, which is the average amount of water used by a single family household. Chehalis' ERU value is calculated by dividing residential consumption by the number of single family households. The number of ERUs for each customer category is obtained by dividing the consumption for a customer category by 140. The 2007-2009 average number of ERUs was 9,317.

4.3. Demand Forecast

4.3.1. Demand Forecast Methodology

The methodology used to develop the demand forecast is shown in Figure 4.6. The basic process is to combine demographic data with water use factors to develop the retail demands. Demands are also developed for non-revenue water. The retail 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.

Figure 4.6 Demand Forecast Methodology



Step 1 Demographics

Demographics were developed per the methodology described in Section 4.1.

Step 2 Water Use Factors

Water use factors were developed per the methodology described in Section 4.2.4.

Step 3 Retail Demand

The demographic projections (from Step 1) were multiplied by the water use factors (from Step 2) to generate the demand for the residential and non-residential customer categories. Key assumptions used in developing the non-residential demand forecast include:

- The maximum allowable usage by Chehalis Power, per the existing water purchase contract, is assumed.
- An allowance for large industrial demands is included, to reflect the possibility of unspecified water use associated with industrial expansion. For planning purposes, this allowance is calculated by applying an industrial unit demand factor of 1,500 gpd[1] per acre to all industrial zoned land within the City Limits and UGA (1,590 acres). This arrives at an allowance of 2.4 mgd. This amount is assumed to be same for both ADD and MDD (i.e., the maximum day peaking factor is not applied to it).

[1] Source: *Wastewater Engineering Treatment and Reuse, Fourth Edition*; Metcalf and Eddy. From pages 162-163, typical design values for industrial developments range from 1,000 to 1,500 gpd per acre for light industrial, to 1,500 to 3,000 gpd per acre for medium industrial. For planning purposes, Chehalis has assumed potential future industrial development at the upper end of light and lower end of medium industrial water usage (1,500 gpd per acre).

Demands were developed for the large non residential category, influenced by the maximum allowable usage by Chehalis Power per the existing water purchase contract.

Step 4 Non-Revenue Demand

The sum of all demands was multiplied by the 2009 “non-revenue water as % of billed consumption" from the water balance table, which is 29%.

Step 5 Total Average Day Demand (ADD)

The average day demand was calculated by adding the demands from all preceding steps.

Step 6 Total Maximum Day Demand (MDD)

To generate the total maximum day demand, a peaking factor was applied to the average day demand. A peaking factor of 1.98 was used, which is the peaking factor developed from Chehalis’ 2008 – 2009 average day to maximum day demand.

Step 7 Conservation Adjustment

The methodology outlined in Steps 1 through 6 creates a baseline demand forecast. This baseline forecast was then adjusted for conservation.

The conservation adjustment was accomplished by reducing the water use factors in future years by 10%. The residential water use factor shifts from 140 gpd per household without conservation to 126 gpd per household assuming conservation. Non residential and large non residential (less Chehalis power) were each also reduced by 10% to reflect conservation.

Chehalis plans to continue conservation efforts throughout the planning period, therefore the water use factors are held constant for all years within the planning period.

4.3.2. Demand Forecast Results

The projected demands are provided in Table 4-9 and Table 4-10. Table 4-9 shows the demand without additional conservation while Table 4-10 incorporates conservation. The tables show the demand forecast for years 1 through 6, as well years 7 through 20, for the planning period of 2010 through 2029. In addition, projections have been included for year 50 (2059). The tables also include historical demands for 2003 to 2009. The demands for 2009 were projected, although 2009 is not within the 20-year planning period for this water system plan.

Table 4-9 shows the total average day demand increasing from 1.9 mgd in 2010 which is Year 1 of the water system planning period to 4.7 mgd in 2029 which is Year 20 of the water system planning period. The maximum day demand is expected to increase from 4.3 mgd in 2010 to 7.5 mgd in 2029.

Figure 4.7 shows a graph of the average day and maximum day demands. Figure 4.8 shows the various components of the average day demand in order to provide information about the relative impact of each component. Both of these figures use the demand without additional conservation, in order to be conservative.

Table 4-9 Demand Forecast (Without Additional Conservation)

Calendar Year	Plan Year	Demographics		Water Use Factors (gpd)[3]	Demand											
					Average Day Demand (ADD mgd) [4]											
						Non-Residential										
		Population[1]	Single Family Households (SF HH)[2]	Per Single Family Household	Residential[5]	Small Non Residential[6]	Large Non Residential[7]	Chehalis Power[8]	Large Industrial Allowance[9]	Total Non Residential[10]	Subtotal[11]	Non-Revenue[12]	Total[13]	MDD less Chehalis Power	MDD Chehalis Power	Maximum Day Demand (MDD mgd)[14]
1999	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	2.05			3.78
2000	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	2.16			3.69
2001	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	2.03			3.60
2002	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	2.02			3.49
2003	n/a	7,010	n/a	n/a	0.26	0.33	0.48	0.06	0.00	0.86	1.13	0.98	2.10			4.51
2004	n/a	6,980	2,574	n/a	0.30	0.31	0.44	0.03	0.00	0.77	1.07	1.06	2.14			4.12
2005	n/a	6,990	2,599	n/a	0.28	0.27	0.49	0.03	0.00	0.79	1.07	1.01	2.09			4.23
2006	n/a	7,025	2,629	n/a	0.35	0.16	0.63	0.01	0.00	0.80	1.15	0.64	1.78			3.43
2007	n/a	7,045	2,658	n/a	0.33	0.27	0.54	0.04	0.00	0.85	1.18	0.68	1.86			5.07
2008	n/a	7,215	2,737	n/a	0.39	0.30	0.53	0.08	0.00	0.92	1.31	0.63	1.94			3.30
2009	n/a	7,185	2,790	140	0.42	0.35	0.57	0.09	0.00	1.00	1.42	0.41	1.83	3.45	0.85	4.30
2010	1	7,240	2,844	140	0.40	0.35	0.57	0.16	0.00	1.09	1.48	0.43	1.91	3.47	0.85	4.32
2011	2	7,295	2,899	140	0.41	0.35	0.58	0.16	0.00	1.09	1.50	0.43	1.93	3.51	0.85	4.36
2012	3	7,350	2,955	140	0.41	0.36	0.58	0.16	0.00	1.10	1.51	0.44	1.95	3.54	0.85	4.39
2013	4	7,406	3,012	140	0.42	0.36	0.58	0.16	0.00	1.11	1.53	0.44	1.97	3.58	0.85	4.43
2014	5	7,462	3,071	140	0.43	0.36	0.59	0.16	0.00	1.11	1.54	0.45	1.99	3.62	0.85	4.47
2015	6	7,519	3,130	140	0.44	0.37	0.59	0.16	0.00	1.12	1.56	0.45	2.01	3.66	0.85	4.51
2016	7	7,576	3,191	140	0.45	0.37	0.60	0.16	0.00	1.13	1.58	0.46	2.03	3.70	0.85	4.55
2017	8	7,634	3,253	140	0.46	0.37	0.60	0.16	0.00	1.14	1.59	0.46	2.05	3.74	0.85	4.59
2018	9	7,692	3,316	140	0.46	0.37	0.61	0.16	0.00	1.14	1.61	0.47	2.07	3.78	0.85	4.63
2019	10	7,751	3,380	140	0.47	0.38	0.61	0.16	0.00	1.15	1.62	0.47	2.09	3.83	0.85	4.68
2020	11	7,810	3,445	140	0.48	0.38	0.62	0.16	0.00	1.16	1.64	0.48	2.12	3.87	0.85	4.72
2021	12	7,869	3,512	140	0.49	0.38	0.62	0.16	0.00	1.17	1.66	0.48	2.14	3.91	0.85	4.76
2022	13	7,929	3,580	140	0.50	0.39	0.63	0.16	0.00	1.17	1.67	0.49	2.16	3.96	0.85	4.81
2023	14	7,989	3,649	140	0.51	0.39	0.63	0.16	0.00	1.18	1.69	0.49	2.18	4.00	0.85	4.85
2024	15	8,050	3,720	140	0.52	0.39	0.64	0.16	0.00	1.19	1.71	0.50	2.20	4.04	0.85	4.89
2025	16	8,111	3,792	140	0.53	0.39	0.64	0.16	0.00	1.20	1.73	0.50	2.23	4.09	0.85	4.94
2026	17	8,173	3,865	140	0.54	0.40	0.64	0.16	0.00	1.20	1.75	0.51	2.25	4.14	0.85	4.99
2027	18	8,235	3,940	140	0.55	0.40	0.65	0.16	0.00	1.21	1.76	0.51	2.27	4.18	0.85	5.03
2028	19	8,298	4,017	140	0.56	0.40	0.65	0.16	0.00	1.22	1.78	0.52	2.30	4.23	0.85	5.08
2029	20	8,361	4,094	140	0.57	0.41	0.66	0.16	2.40	3.63	4.20	0.52	4.72	6.68	0.85	7.53
2059	50	10,495	7,279	140	1.02	0.51	0.83	0.16	2.40	3.90	4.92	0.73	5.65	8.51	0.85	9.36

1. From Table 4-1.
2. From Table 4-1.
3. From Table 4-8.
4. ADD for 2003-2009 are based on actual data.
5. This category represents demand for single-family residential customers only and is calculated by multiplying the number of single family households by the average water use factor per household.
6. This represents all non-single-family residential customers of the City except for the 20 top users. This category includes multi-family since they are charged and tracked as commercial customers. The average 2007 - 2009 growth rate for all customer connections (0.8% annual increase) was used rather than for just commercial customers since this class of customers was significantly impacted by the present economic conditions and this impact is not expected to continue throughout the planning period.
7. Large non-residential demand is projected to increase at the same rate as small non-residential demand (0.8% annual increase).
8. Demand forecast based on maximum allowable usage by Chehalis Power per existing contract.
9. Reflects an allowance for unspecified large industrial demands. Beginning in 2029, this allowance is 2.4 mgd, based upon a unit demand factor of 1,500 gpd per acre applied to all industrial zoned land within the City Limits and UGA (1,590 acre).
10. Total of all non-residential demands.
11. The sum of residential and non-residential demands.
12. The subtotal ADD demand multiplied by the 2009 non-revenue water as a percent of consumption.
13. The sum of the retail demands, plus the non-revenue water.
14. The total ADD for all water use (except Chehalis Power and the Large Industrial Allowance) multiplied by a peaking factor of 1.98, which is the average peaking factor of 2008 - 2009, plus the total maximum contract amount for Chehalis Power and the Large Industrial Allowance. 2007 was excluded from this calculation due to a major line break.

Table 4-10 Demand Forecast (With Additional Conservation)

Calendar Year	Plan Year	Demographics		Water Use Factors (gpd)[3]	Demand											
					Average Day Demand (ADD mgd)[4]											
						Non-Residential										
		Population[1]	Single Family Households (SF HH)[2]	Per Household	Residential[5]	Small Non Residential[6]	Large Non Residential[7]	Chehalis Power[8]	Large Industrial Allowance[9]	Total Non Residential[10]	Subtotal[11]	Non-Revenue[12]	Total[13]	MDD less Chehalis Power	MDD Chehalis Power	Maximum Day Demand (MDD mgd)[14]
1999	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a				0.00
2000	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a				0.00
2001	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a				0.00
2002	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a				0.00
2003	n/a	7,010	n/a	n/a	0.26	0.33	0.48	0.06	0.00	0.86	1.13	0.98	2.10			4.46
2004	n/a	6,980	2,574	n/a	0.30	0.31	0.44	0.03	0.00	0.77	1.07	1.06	2.14			4.53
2005	n/a	6,990	2,599	n/a	0.28	0.27	0.49	0.03	0.00	0.79	1.07	1.01	2.09			4.42
2006	n/a	7,025	2,629	n/a	0.35	0.16	0.63	0.01	0.00	0.80	1.15	0.64	1.78			3.78
2007	n/a	7,045	2,658	n/a	0.33	0.27	0.54	0.04	0.00	0.85	1.18	0.68	1.86			3.94
2008	n/a	7,215	2,737	n/a	0.39	0.30	0.53	0.08	0.00	0.92	1.31	0.63	1.94			4.11
2009	n/a	7,185	2,790	140	0.39	0.30	0.57	0.09	0.00	0.95	1.34	0.39	1.73	3.26	0.85	2.99
2010	1	7,240	2,844	139	0.39	0.30	0.57	0.16	0.00	1.03	1.43	0.41	1.84	3.33	0.85	3.05
2011	2	7,295	2,899	137	0.40	0.27	0.52	0.16	0.00	0.95	1.35	0.39	1.74	3.13	0.85	2.95
2012	3	7,350	2,955	136	0.40	0.28	0.52	0.16	0.00	0.96	1.36	0.39	1.75	3.15	0.85	2.97
2013	4	7,406	3,012	134	0.40	0.28	0.53	0.16	0.00	0.97	1.37	0.40	1.77	3.18	0.85	2.99
2014	5	7,462	3,071	133	0.41	0.28	0.53	0.16	0.00	0.97	1.38	0.40	1.78	3.20	0.85	3.00
2015	6	7,519	3,130	132	0.41	0.28	0.53	0.16	0.00	0.98	1.39	0.40	1.79	3.23	0.85	3.02
2016	7	7,576	3,191	132	0.42	0.28	0.54	0.16	0.00	0.98	1.40	0.41	1.81	3.26	0.85	3.05
2017	8	7,634	3,253	132	0.43	0.29	0.54	0.16	0.00	0.99	1.42	0.41	1.83	3.30	0.85	3.08
2018	9	7,692	3,316	132	0.44	0.29	0.55	0.16	0.00	1.00	1.43	0.42	1.85	3.34	0.85	3.11
2019	10	7,751	3,380	132	0.44	0.29	0.55	0.16	0.00	1.00	1.45	0.42	1.87	3.38	0.85	3.14
2020	11	7,810	3,445	132	0.45	0.29	0.55	0.16	0.00	1.01	1.46	0.42	1.89	3.41	0.85	3.17
2021	12	7,869	3,512	132	0.46	0.29	0.56	0.16	0.00	1.02	1.48	0.43	1.91	3.45	0.85	3.20
2022	13	7,929	3,580	132	0.47	0.30	0.56	0.16	0.00	1.02	1.49	0.43	1.93	3.49	0.85	3.23
2023	14	7,989	3,649	132	0.48	0.30	0.57	0.16	0.00	1.03	1.51	0.44	1.95	3.53	0.85	3.26
2024	15	8,050	3,720	132	0.49	0.30	0.57	0.16	0.00	1.04	1.52	0.44	1.97	3.57	0.85	3.29
2025	16	8,111	3,792	132	0.50	0.30	0.58	0.16	0.00	1.04	1.54	0.45	1.99	3.61	0.85	3.32
2026	17	8,173	3,865	132	0.51	0.31	0.58	0.16	0.00	1.05	1.56	0.45	2.01	3.66	0.85	3.36
2027	18	8,235	3,940	132	0.52	0.31	0.58	0.16	0.00	1.06	1.57	0.46	2.03	3.70	0.85	3.39
2028	19	8,298	4,017	132	0.53	0.31	0.59	0.16	0.00	1.06	1.59	0.46	2.05	3.74	0.85	3.42
2029	20	8,361	4,094	132	0.54	0.31	0.59	0.16	2.40	3.47	4.01	0.47	4.47	6.19	0.85	7.04
2059	50	10,495	7,279	132	0.96	0.39	0.74	0.16	2.40	3.69	4.65	0.65	5.30	7.83	0.85	8.68

1. From Table 4-1.
2. From Table 4-1.
3. 2009 from Table 4-8. 2011 through 2015 reflect a water use factor reduced by a total reduction of 4,167 gpd per year for the 6-yr planning period for the residential class of customers to reach the City's water use efficiency goal of 25,000 gpd by 2015. Water use factors after 2015 are not changed from 2015 levels and will be adjusted at the next update to reflect current goals.
4. ADD for 2003-2009 are based on actual data.
5. This category represents demand for single-family residential customers only and is calculated by multiplying the number of single family households by the average water use factor per household.
6. This represents all non-single-family residential customers of the City except for the 20 top users. This category includes multi-family since they are charged and tracked as commercial customers. The average 2007 - 2009 growth rate for all customer connections (0.8% annual increase) was used rather than for just commercial customers since this class of customers was significantly impacted by the present economic conditions and this impact is not expected to continue throughout the planning period.
7. Large non-residential demand is projected to increase at the same rate as small non-residential demand (0.8% annual increase).
8. Demand forecast based on maximum allowable usage by Chehalis Power per existing contract.
9. Reflects an allowance for unspecified large industrial demands. Beginning in 2029, this allowance is 2.4 mgd, based upon a unit demand factor of 1,500 gpd per acre applied to all industrial zoned land within the City Limits and UGA (1,590 acre).
10. Total of all non-residential demands.
11. The sum of residential and non-residential demands.
12. The subtotal ADD demand multiplied by the 2009 non-revenue water as a percent of consumption.
13. The sum of the retail demands, plus the non-revenue water.
14. The total ADD for all water use (except Chehalis Power and the Large Industrial Allowance) multiplied by a peaking factor of 1.98, which is the average peaking factor of 2008 - 2009, plus the total maximum contract amount for Chehalis Power and the Large Industrial Allowance. 2007 was excluded from this calculation due to a major line break.

Figure 4.7 Demand Forecast Summary (Without Conservation)

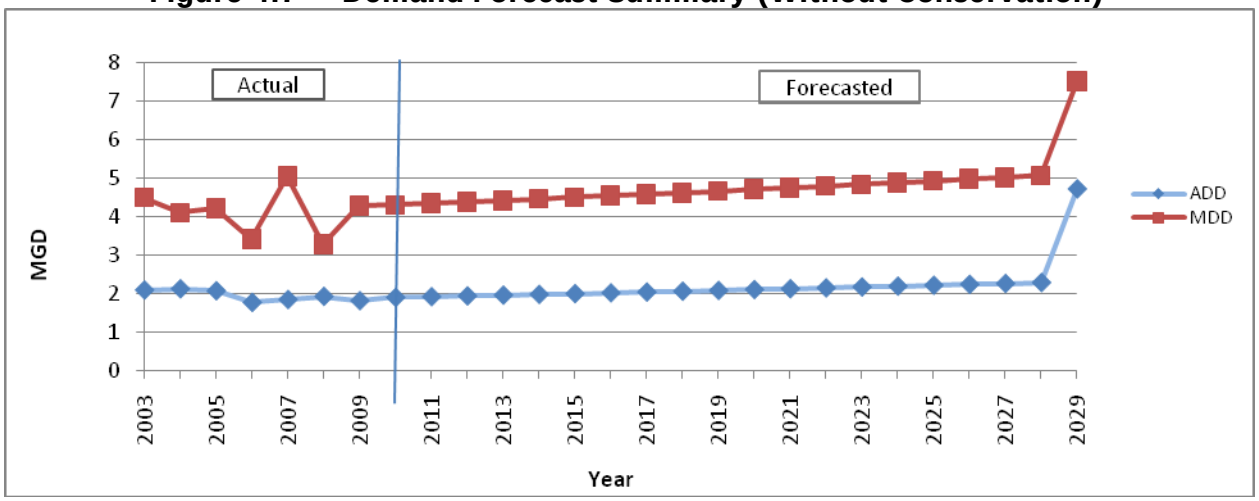
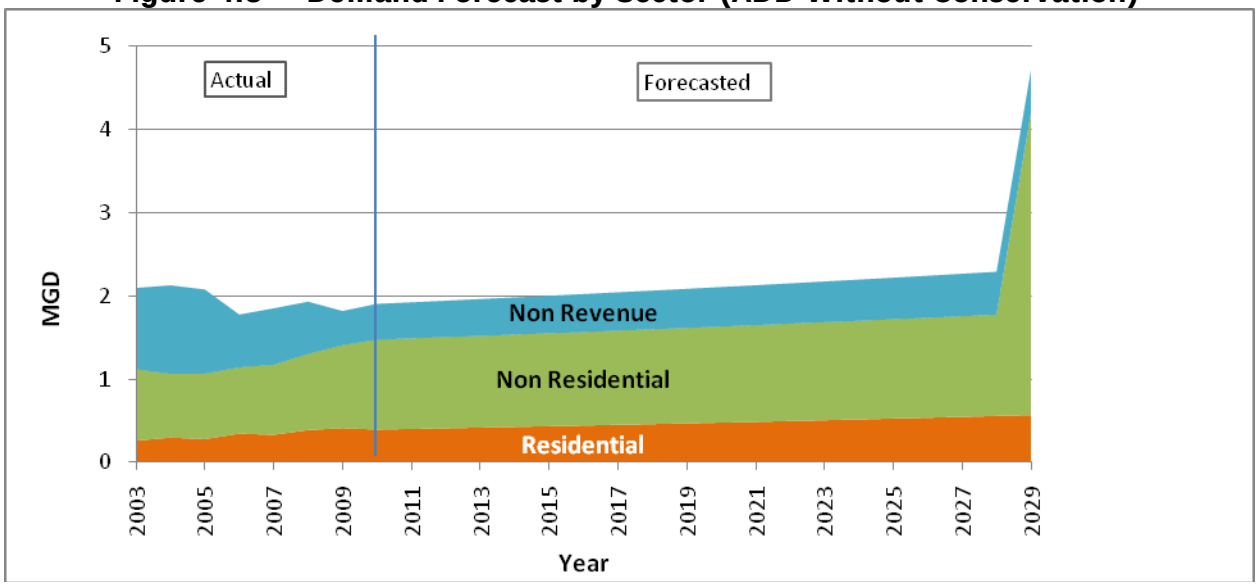


Figure 4.8 Demand Forecast by Sector (ADD Without Conservation)



Section 5
Conservation Program

5. 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 2010 through 2015.

5.1. 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:

- Water Use Efficiency Rule (January 2007)
- Water Use Efficiency Guidebook (DOH, July 2007)

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 5-1 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, 4) water use efficiency goals, 5) water use efficiency program, 6) demand forecast, and 7) performance reports.

Table 5-1 Compliance with Water Use Efficiency Rule Requirements

Category	WAC[1] Section	Compliance Date	Requirement	Chehalis 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. All sources are metered.
			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, since Chehalis is fully metered.
2. Data Collection	246-290-100	WSPs submitted after January 22, 2008.	1. Provide monthly and annual production/purchase numbers for each source.	Yes. These data are provided in this water system plan update.
			2. Provide annual consumption by customer class.	Yes. These data are provided in this water system plan update.
			3. Provide "seasonal variations" consumption by customer class.	Yes. These data are provided in this water system plan update.
			4. Evaluate reclaimed water opportunities.	Yes. This information is provided in this water system plan update.
			5. Provide annual quantity supplied to other public water systems.	Yes. The Springbrook system records water delivered to Newaukum Heights (listed as a commercial customer).
			6. Consider water use efficiency rate structure.	Yes. This information is provided in this water system plan update.
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 and 2009 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 and 2009.
			3. Develop water loss control action plan (if leakage is over 10% for 3 year average).	Yes. The City is tracking water loss and has taken significant steps toward reducing distribution system leakage over the first 3 yr period studied (2007-2009) and will continue to do so.
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. The City Council adopted Resolution No. 4-2009 establishing a water use efficiency goal. The annual Performance Report submitted for calendar year 2009 addressed progress towards
			2. Use a public process to establish the goals.	

Category	WAC[1] Section	Compliance Date	Requirement	Chehalis in Compliance?
			3. Report annually on progress.	achieving the goal.
5. Efficiency Program	246-290-810	WSPs submitted after January 22, 2008.	1. Describe existing conservation program.	Yes. This information is contained in the conservation chapter of this water system plan update.
			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 Chehalis having 2,500 to 9,999 connections.)	Yes. The City evaluated seven measures, as reported in this water system plan update.
			8. Estimate projected water savings from selected measures.	
			9. Estimate leakage from transmission lines (if not included in distribution system leakage).	Yes. This information is included in the conservation chapter of this water system plan update.
6. Demand Forecast	246-290-100	WSPs submitted after January 22, 2008.	1. Provide demand forecast reflecting no additional conservation.	Yes. This information is included in the demand chapter of this water system plan update.
			2. Provide demand forecast reflecting savings from efficiency program.	
			3. Provide demand forecast reflecting all "cost effective" evaluated measures.	
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.	Yes. The City submitted annual reports for calendar years 2008 and 2009 as required.
			2. Submit annually by July 1 to DOH and customers and make available to the public.	

[1] WAC = Washington Administrative Code

5.2. Existing Conservation Program

The City's current conservation program includes the following activities:

Water Meters: The City fully meters water production and water sales to all customers. Large customer meters are tested regularly; and 10% of service meters are replaced each year.

Customer Outreach: The City provides water consumption history on customer bills; lists water conservation tips in the City's annual Consumer Confidence Report distributed by mail to all customers; and makes DOH conservation brochures available to the public at City Hall. In addition the City's quarterly newsletter includes promotional information on water conservation.

Water Supply Characteristics Information: The City informs its customers of water supply characteristics, using the Consumer Confidence Report.

Schools Outreach: The City sponsors a module on water conservation for the 5th-Grade science curriculum in the Chehalis School District. The curriculum uses the WaterWise™ Program, purchased from Resource Action Programs in Modesto, CA. The City also holds an annual class with 10-grade students in the School District to promote awareness of water use and water conservation opportunities. This class includes a take-home exercise to measure common uses of water in the home.

Residential Kits: Water saving kits are distributed via the 5th Grade science curriculum described above. The WaterWise™ curriculum includes a kit with several water-saving devices, including: high-efficiency showerhead, bathroom faucet aerator, kitchen faucet aerator, rain gauge, toilet leak-detection tablets and instructions, a flow-rate test bag; and assorted water information and kit instructions. Approximately 350 kits were distributed from 2006-2009.

Rate Structure: The City has a uniform rate structure that bills customers for every unit of consumption.

Reclaimed Water: The City produces Class A reclaimed water at its wastewater treatment plant. Currently this water is delivered to a poplar tree farm for irrigation use during periods of low flow in the river (less than 1,000 cfs). The basis for this activity is described in an excerpt from the City's wastewater facilities plan, as provided in Appendix H. The discussion in this excerpt also considers other potential future uses of reclaimed water within the City (e.g., irrigation of City parks and school areas). At this time, the City has no plans to expand its reclaimed water program, due to the significant costs involved with conveying reclaimed water to other use sites. However, such program expansion will be periodically reviewed, particularly in light of pending regulatory changes associated with the State's Reclaimed Water Rule Revision process, which is ongoing as of 2011.

Water Loss Management: The 2004 Water System Plan identified measuring and managing water losses as a key element of the City's water use efficiency program. Data collected at that time suggested water losses could be in excess of 30% of water produced. The plan recommended investments in large meters in the supply system and treatment plant to improve quantification of water produced and treated; replacement of customer meters to improve quantification of water sold; leak detection for water distribution piping; and corrective actions based on the outcomes of these efforts. Several of these recommended actions have been implemented since 2004. Since 2004 City staff have determined that inadequate accounting of

uses at the water filter plant explained most of the difference between water production and water sales identified at that time. These uses are now measured and accounted for.

Leak detection efforts in recent years have identified some leaks in the distribution system, at levels typical of many water systems. The State standard for distribution system leakage is no more than 10% of water produced and purchased, calculated on a rolling three-year basis beginning with years 2007-09. Chehalis' most recent three year average indicates a distribution system leakage of 24% which is above the state standard; however, the City has been working to further define all authorized uses of both metered and unmetered water including fire fighting, construction, flushing, treatment plant uses, and uses at City facilities and is honing in on distribution system leakage that is actually indicative of realized leaks. Table 4-7 in Chapter 4 presents the historical distribution system leakage.

During the most recent four years (2006 – 2009), 10 to 20 miles of piping were surveyed each year. Leaks that have been identified have been repaired.

The Newaukum River transmission line is routinely monitored for potential leakage by comparing diversion data from the intake with metered inflows at the water treatment plant. Transmission line leaks are occasionally identified and promptly repaired. For example, a leak estimated at 500 gpm was identified and repaired in 2008.

5.3. Conservation Measure Evaluation

The combination of conservation program actions described above likely have reduced the City's total water use somewhere in the range of 1% to 5% over the past six years, compared with consumption that would have occurred without these actions. It is difficult to fully quantify the actual impact of conservation efforts because of a number of situations that have impacted the City data. The two most significant impacts to City data include a billing system conversion that significantly enhanced the reliability of the City's consumption data and the increased level of awareness by City staff to more closely track unmetered but authorized water use.

The City hired HDR Engineering in 2007 to provide an evaluation of water conservation opportunities. A range of conservation measures was evaluated, targeting the City's largest customer class, single-family residential customers. Results of the evaluation are summarized as follows:

Table 5-2 Conservation Measure Evaluation

Conservation Measure	Potential New Participants	Water Savings at Full Implementation (gpd)	Water Savings Over Measure Lifetimes (ccf)	Total Cost over Plan Period	Average Cost per Year	Cost per ccf saved
Toilets - 1.6 gpf ultra low flow toilets (ULFT)	96	5,539	8,107	$32,948	$4,707	$4.06
Toilets - 1.0 gpf high efficiency toilets (HET)	258	3,483	42,488	$59,340	$8,477	$1.40
Toilets - leak detection	646	3,069	10,480	$1,885	$269	$0.18
Showerheads - 2.0 gpm	1,291	4,358	31,898	$7,746	$1,107	$0.24
Faucet aerators bathroom - 1.0 gpm	1,170	5,967	43,670	$2,925	$418	$0.07
Clotheswashers - residential capacity (in unit)	401	5,785	36,693	$44,500	$6,357	$1.21
Outdoor Irrigation Kits	878	2,167	7,402	$11,414	$1,631	$1.54

Of these conservation measures, three are being implemented under the existing conservation program. Toilet leak detection, faucet aerators and showerheads are distributed in water saving kits through the Schools program.

The evaluation included development of a cost-effectiveness standard. The Chehalis River source is more expensive to operate per unit of water produced, compared with the Newaukum River source. Reduced need for water in the summer months would permit less water to be produced from the Chehalis River source. Operational costs of the Chehalis River source from 2007 were assessed, including power costs for pumping, and treatment chemical costs (alum, chlorine, fluorosilicate, and lime). Based on this evaluation, the total per-unit cost of production from this source was estimated to be $0.11 per ccf. Most of the water conservation measures evaluated have a per-unit cost that was considerably higher than this standard, meaning that implementation costs would be greater than money saved due to reduced water production. On this basis, the conservation measures were judged not to be cost effective on a pure financial basis.

Consideration has been given to whether the measures considered would be cost effective if costs were shared with another jurisdiction, such as the City of Centralia. While marketing and administrative costs would be reduced, the majority of the costs shown above are unit costs for equipment, and those costs would not change significantly due to cost sharing. With such a large differential between the cost-effectiveness standard of $0.11 per ccf and the unit costs shown above, cost-sharing would not make these measures cost-effective.

The City Council considered the range of measures evaluated, and determined that costs for most of the measures were too high and would not provide social or community benefits commensurate with these costs. Therefore an expanded program with additional conservation measures was not selected for implementation. The City will instead continue implementing its current conservation program.

5.4. 2010-2015 Conservation Program

The Chehalis City Council adopted a water-use efficiency goal in 2009 (Resolution 4-2009). This goal is to achieve a year-round average reduction of 25,000 gallons per day by 2015. This is to be measured compared with what demand would be in 2015 if the City's conservation program were not continued.

During the six-year planning period for this Water System Plan update, the City will continue to implement the conservation program described in Section 5.2. It is estimated that this program will be sufficient to achieve the City's adopted goal for water savings. Program accomplishments and City water demands will be reviewed annually in conjunction with preparation of the annual Performance Report to DOH required under the Water Use Efficiency Rule.

Section 6
Distribution Facilities Design and Construction Standards

6. Distribution Facilities Design and Construction Standards

This chapter provides an overview of the City's design and construction requirements for new facilities.

6.1. Project Review Procedures

For new water system facilities, the City has specific project review procedures. These review procedures are described in detail in the Section 12.04, Development Engineering Standards, of the City's Municipal Code. The general steps that must be followed for project review are summarized below.

- Applicant submits a written request for water and/or sewer availability.
- After completing a review, the City will return a written response to the applicant summarizing the requirements and conditions for water service.
- Applicant submits an application for a developer extension agreement with payment of an administration fee.
- City's written response will either deny the application, approve the application, or approve the application subject to specific conditions.
- Upon approval of the application the applicant and the City enter into a formal agreement.
- Project designs are submitted to the City by the applicant's engineer for review. All designs must include a current Professional Engineer's (PE) stamp and signature.
- Upon final approval of the construction drawings, and submittal of required permits and fees, a pre-construction conference will be held.
- Construction may begin following the pre-construction conference.

Individual water system project designs must be forwarded to the Washington State Department of Health (DOH) for additional review and approval, except those distribution-related projects that are eligible for the alternative review process. As defined in WAC 246-290-125(2), projects related to the construction of new or upsized distribution mains do not need to be submitted to DOH if the utility meets the following criteria:

1. An approved updated WSP is on file with DOH that includes standard construction specifications for distribution mains; and,
2. A completed Construction Completion Report for Distribution Main Projects for each project is maintained on file.

The City meets both of these criteria and does not typically submit plans to DOH for new or replacement distribution mains.

6.2. Construction Standards

The City's water distribution facility design and construction standards, including standard detail drawings, are contained in its Development Engineering Standards (Section 12.04 of the City's Municipal Code). The most up-to-date version of the Code is available on the City's website. The current version of Section 12.04, as of the preparation of this water system plan update, is provided in Appendix I.

Section 7
System Analysis

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 identified capital improvements presented in Chapter 11.

7.1. Water Rights Analysis

The City has two surface water sources for their water rights, the North Fork Newaukum River and the Chehalis River. Table 7-1 (Existing Water Rights Status), shows the details for each of the water rights, the City's existing water consumption, and the current excess in water rights. Tables 7-2 through 7-4 show the same information for the water rights, with the 6-year, 20-year, and 50-year projected demands and the differences between the City's existing water rights and the projected demands for each of these planning periods. The City has no plans at this time for any increases or changes in their existing water rights for these planning periods.

The City's Chehalis River water right is Surface Water Certificate No. 11303, and is for 11.6 cubic feet per second (cfs) and 980 acre-feet per year (AF/yr). This certificate has a priority date of November 26, 1957, and was issued by the Department of Ecology on February 18, 2009. This recently issued certificate was reduced significantly from the City's Surface Water Permit for this water use that was issued in 1959 for 15 cfs, with no specified annual quantity. This permit had received a number of extensions of time to put the authorized amount of water to beneficial use. By their letter dated May 9, 2008, Ecology informed the City that they would issue the certificate for this reduced amount based on the amount of water that the City had put to beneficial use.

The City has two documents for their North Fork Newaukum water rights. The first is Water Right Claim No. 302347, in the amounts of 4.34 cfs and 3,136 AF/yr. This claim was filed by the City on June 30, 1998 during the open period for filing and registering Water Right Claims, and stated that the date of first putting water to use was in 1914. This 1914 date of first putting this water to use is considered as the priority date for this water right claim. Since this date of first putting water to beneficial use preceded the State Surface Water Code adopted in 1917, this claim is considered as a vested water right. The other document the City has for the North Fork Newaukum River is Surface Water Certificate No. 1185 and is for 10 cfs as an instantaneous quantity with no specified annual quantity. This certificate was issued in May 1930 with a priority date of February 6, 1923.

As is shown in Tables 7-1 through 7-4, the total amounts of the City's two surface water certificates and water right claim exceed the City's existing and projected demands, including the 50-year projections, on both an instantaneous and annual basis. There are however, other conditions which can impact the amount of water that the City can withdraw under their existing water rights.

One of these restrictions is that the City's total existing and projected demands far exceed, on an annual quantity basis, their water right for 980 AF/yr from the Chehalis River. In addition, on this source, there is a low flow limitation on the City's water right which states the use of water

under this right be regulated so that the flow in the Chehalis River shall not be reduced to 50 cfs or less immediately below the pump intake as a result of pumping from this water right.

Under normal operating conditions, the North Fork Newaukum River provides the primary source of supply, with the Chehalis River supplementing this supply during peak demand periods. However, if operational conditions were to change and the Chehalis River would be considered the primary supply, it would be necessary for at least a portion of the City's water rights from the North Fork Newaukum River be utilized in order to meet the City's existing and projected demands on an annual quantity basis.

In addition, there are other limitations associated with the City's source of supply on the North Fork Newaukum, one being the limited amount of source water available at certain times of the year, and the other being the capacity of the existing pipeline to the water treatment plant, both on an instantaneous basis. The City's total instantaneous quantity of their water right certificate and water right claim on the North Fork is 14.34 cfs while the current pipeline capacity to the plant is only approximately 5.1 cfs.

Since the water from the Chehalis and Newaukum sources is combined before entering the water treatment plant, the capacity of the water treatment plant is also a limitation on the amount of water that can be processed for treatment. The current effective capacity of the water treatment plant is 4.8 mgd (7.44 cfs), so this is the maximum rate of flow on an instantaneous basis that can be processed through the water treatment plant currently. This 4.8 mgd (7.44 cfs) is much less than the City's total instantaneous water rights of 25.94 cfs. In 20 years, the treatment plant capacity is projected to be 7.0 mgd. However, maximum day demands are projected to potentially exceed this capacity if additional large industrial growth is realized. Therefore, additional plant capacity, and/or additional sources of supply, will be needed to meet long-term maximum day needs.

In summary, the City's total water rights are not limiting factors for system operation relative to existing and projected demands.

Table 7-1. 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) cfs/mgd	Maximum Annual Volume(Qa) AF/yr	Maximum Instantaneous Flow Rate (Qi) cfs/mgd	Maximum Annual Volume (Qa) Af/yr	Maximum Instantaneous Flow Rate (Qi) cfs/mgd	Maximum Annual Volume (Qa) AF/yr
Permit/ Certificate										
1.SWC 1185	Chehalis	02/06/23	North Fork Newaukum	Primary	10/6.45	2,240[1]	NA[2]	NA[2]	NA[2]	NA[2]
2.SWC 11303	Chehalis	11/26/57	Chehalis R.	Primary	11.6/7.48	980	NA[2]	NA[2]	NA[2]	NA[2]
Claims										
1. S2-302347 CL	Chehalis	1914	North Fork Newaukum	Primary	4.34/2.8	3,136	NA[2]	NA[2]	NA[2]	NA[2]
Total					25.94 cfs/ 16.73 mgd	6,356 AF/yr 5.67 mgd	7.44 cfs/ 4.8 mgd[3]	2,051 AF/yr[4] 1.83 mgd	18.5 cfs/ 11.93 mgd	4,305 AF/yr 3.84 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)
1.Chehalis/ Centralia		City of Centralia	Emergency only	Emergency only	NA	NA	NA	NA
Total								

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

1) No Qa specified on SWC 1185. 2,240 AF/yr shown in 2004 Water System Plan
2) Consumption from the Newaukum and Chehalis River sources varies based upon river levels, water quality conditions, etc. Therefore, total consumption is compared against total water rights.
3) Based on current effective plant capacity of 4.8 mgd.
4) Demand forecast from Chapter 4.

Table 7-2. Forecasted Water Rights Status-6 Years

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 (6 Year Demand)		Forecasted Water Right Status (Excess/Deficiency)	
					Maximum Instantaneous Flow Rate(Qi) cfs/mgd	Maximum Annual Volume(Qa) AF/yr	Maximum Instantaneous Flow Rate (Qi) cfs/mgd	Maximum Annual Volume (Qa) Af/yr	Maximum Instantaneous Flow Rate (Qi) cfs/mgd	Maximum Annual Volume (Qa) AF/yr
Permit/ Certificate										
1.SWC 1185	Chehalis	02/06/23	North Fork Newaukum	Primary	10/6.45	2,240[1]	NA[2]	NA[2]	NA[2]	NA[2]
2.SWC 11303	Chehalis	11/26/57	Chehalis R.	Primary	11.6/7.48	980	NA[2]	NA[2]	NA[2]	NA[2]
Claims										
1. S2-302347 CL	Chehalis	1914	North Fork Newaukum	Primary	4.34/2.8	3,136	NA[2]	NA[2]	NA[2]	NA[2]
Total					25.94 cfs/ 16.73 mgd	6,356 AF/yr 5.67 mgd	7.44 cfs/ 4.8 mgd[3]	2,253 AF/yr 2.01 mgd[4]	18.5 cfs/ 11.93 mgd	4,103 AF/yr 3.66 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)
1.Chehalis/ Centralia		City of Centralia	Emergency only	Emergency only	NA	NA	NA	NA
Total								

Pending Water Right Applications	Name on Application	Date Submitted	Primary or Supplemental	Maximum Instantaneous Flow Rate (Qi) Requested	Maximum Annual Volume (Qa) Requested
1. NA					

1) No Qa specified on SWC 1185. 2,240 AF/yr shown in 2004 Water System Plan
2) Consumption from the Newaukum and Chehalis River sources varies based upon river levels, water quality conditions, etc. Therefore, total consumption is compared against total water rights.
3) Based on current effective plant capacity of 4.8 mgd.
4) Demand forecast from Chapter 4.

Table 7-3. Forecasted Water Rights Status-20 Years

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)		Current Water Right Status (Excess/Deficiency)	
					Maximum Instantaneous Flow Rate(Qi) cfs/mgd	Maximum Annual Volume(Qa) AF/yr	Maximum Instantaneous Flow Rate (Qi) cfs/mgd	Maximum Annual Volume (Qa) Af/yr	Maximum Instantaneous Flow Rate (Qi) cfs/mgd	Maximum Annual Volume (Qa) AF/yr
Permit/ Certificate										
1.SWC 1185	Chehalis	02/06/23	North Fork Newaukum	Primary	10/6.45	2,240[1]	NA[2]	NA[2]	NA[2]	NA[2]
2.SWC 11303	Chehalis	11/26/57	Chehalis R.	Primary	11.6/7.48	980	NA[2]	NA[2]	NA[2]	NA[2]
Claims										
1. S2-302347 CL	Chehalis	1914	North Fork Newaukum	Primary	4.34/2.8	3,136	NA[2]	NA[2]	NA[2]	NA[2]
Total					25.94 cfs/ 16.73 mgd	6,356 AF/yr 5.67 mgd	11.65 cfs/ 7.53 mgd[3]	5,291 AF/yr 4.72 mgd[3]	14.29 cfs/ 9.20 mgd	1065 AF/yr 0.95 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)
1.Chehalis/ Centralia		City of Centralia	Emergency only	Emergency only	NA	NA	NA	NA
Total								

Pending Water Right Applications	Name on Application	Date Submitted	Primary or Supplemental	Maximum Instantaneous Flow Rate (Qi) Requested	Maximum Annual Volume (Qa) Requested
1. NA					

1) No Qa specified on SWC 1185. 2,240 AF/yr shown in 2004 Water System Plan
2) Consumption from the Newaukum and Chehalis River sources varies based upon river levels, water quality conditions, etc. Therefore, total consumption is compared against total water rights.
3) Demand forecast from Chapter 4.

Table 7-4. Forecasted Water Rights Status-50 Years

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 (50 Year Demand)		Current Water Right Status (Excess/Deficiency)	
					Maximum Instantaneous Flow Rate(Qi) cfs/mgd	Maximum Annual Volume(Qa) AF/yr	Maximum Instantaneous Flow Rate (Qi) cfs/mgd	Maximum Annual Volume (Qa) Af/yr	Maximum Instantaneous Flow Rate (Qi) cfs/mgd	Maximum Annual Volume (Qa) AF/yr
Permit/ Certificate										
1.SWC 1185	Chehalis	02/06/23	North Fork Newaukum	Primary	10/6.45	2,240[1]	NA[2]	NA[2]	NA[2]	NA[2]
2.SWC 11303	Chehalis	11/26/57	Chehalis R.	Primary	11.6/7.48	980	NA[2]	NA[2]	NA[2]	NA[2]
Claims										
1. S2-302347 CL	Chehalis	1914	North Fork Newaukum	Primary	4.34/2.8	3,136	NA[2]	NA[2]	NA[2]	NA[2]
Total					25.94 cfs/ 16.73 mgd	6,356 AF/yr 5.67 mgd	14.48 cfs/ 9.36 mgd[3]	6333 AF/yr 5.65 mgd[3]	10.85 cfs/ 7.37 mgd	23 AF/yr 0.02 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)
1.Chehalis/ Centralia		City of Centralia	Emergency only	Emergency only	NA	NA	NA	NA
Total								

Pending Water Right Applications	Name on Application	Date Submitted	Primary or Supplemental	Maximum Instantaneous Flow Rate (Qi) Requested	Maximum Annual Volume (Qa) Requested
1. NA					

1) No Qa specified on SWC 1185. 2,240 AF/yr shown in 2004 Water System Plan
2) Consumption from the Newaukum and Chehalis River sources varies based upon river levels, water quality conditions, etc. Therefore, total consumption is compared against total water rights.
3) Demand forecast from Chapter 4.

7.2. Source Capacity Analysis

7.2.1. 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 7-5 through 7-9 summarize the evaluation of source capacities for the City's total system and the High Level, Valley View, South End, and Centralia-Alpha Zones, respectively. These analyses are conducted by comparing the City's water demand forecast, presented in Chapter 4, with current source capacities. All evaluations assume 24-hour-per-day source operation.

7.2.2. Source Capacity Evaluation

Full System

There are multiple factors and system components that impose limitations upon the source capacity of the City's water system. To adequately consider all such factors, three analyses were prepared to evaluate full system source capacity.

Source Capacity Analysis 1 – Water Treatment Plant Capacity (Maximum Day Demand)

All water supplied to the City's distribution system currently passes through the water treatment plant (WTP). Therefore, this source capacity evaluation for the system as a whole considers the capacity of the WTP compared against full system-wide demands. The current rated capacity of the WTP is 4.8 mgd. As noted in Table 7-5(a), this is sufficient to meet the current and projected 6-year MDD. However, the WTP capacity is unable to meet the projected 20-year MDD. At this point a supply deficiency of approximately 2,730,000 gpd is identified. The deficiency increases to 4,560,000 gpd by 2059.

However, in addition to this assessment, a more detailed analysis of WTP operations was conducted in conjunction with the preparation of this WSP. That analysis indicated that operation of the WTP at or near the rated capacity is difficult to maintain for extended periods of time. This is due primarily to a lack of automation associated with the control of flow through the WTP. Currently, rates of influent raw water and filter effluent flow are managed with manually-adjusted valves. This, combined with very little hydraulic freeboard or equalization throughout the plant, results in challenging operations at high flow rates. As discussed in Chapter 11, the City is planning to address this issue through implementation of flow control automation. Additional capacity increases are also discussed in Chapter 11, associated with plant improvements that have the potential to result in capacity re-ratings up to approximately 7.0 MGD, the original design flow rate for the plant, in the future.

As shown in Table 7-5(a), this increased plant capacity is still not adequate to fully support potential 20-year demand projections, due primarily to the large increase in demand represented by the large industrial allowance. The supply deficiency in 2029 is approximately 0.5 mgd. It is possible that during the plant re-rating process, additional modifications may be identified that can increase plant capacity to meet this additional level of demand. The City will evaluate such expansions in more detail during the re-rating process. This, in conjunction with

continued tracking of the likelihood for large industrial demand growth, will inform the City's decisions regarding additional potential treatment plant modifications in the long-term.

Source Capacity Analysis 2 – Raw Water Transmission System Capacities (Maximum Day Demand)

The City's primary water source in recent years has been the North Fork Newaukum River. Water is conveyed to the WTP from the intake via gravity in 17.5 miles of mostly 16-inch diameter, mostly ductile iron, transmission main. The 18th Street Booster Pump Station contains a 2,000 gpm raw water pumping facility that boosts capacity of the transmission system. Previous analyses, summarized in the 2004 WSP, have determined that the capacity of the transmission line is approximately 2.8 mgd (without pumping). With booster pumping, capacity of the transmission line is maximized at 3.31 mgd. Since there have been no material modifications to this transmission system in recent years, these capacity values were not re-assessed during development of this WSP Update. Therefore, the capacity of the system to convey water from the North Fork source is assumed to be 3.31 mgd, a value which is noted as being significantly less than the water rights associated with the North Fork, as described in Section 7.1.

Water from the Chehalis River source is pumped to the WTP via a raw water pump station with a capacity of 4,860 gpm (7.0 mgd), through an 18-inch welded steel pipeline. Cursory analysis of pipeline capacity, based upon steel pipe pressure ratings, indicates that theoretically the pipeline capacity should be greater than the pump station capacity, although it is noted that historically the pipeline has never conveyed more than approximately 4.0 mgd at peak periods, and that flows have rarely reached even this amount. Therefore, the integrity of this aging transmission main is unproven at high flow rates.

Therefore, this capacity analysis considers the ability of the two raw water transmission systems to meet MDD. As noted in Table 7-5(b), the transmission systems are sufficient to meet the MDD throughout the 50-year planning period.

Source Capacity Analysis 3 – Raw Water Transmission System Capacities and Water Rights (Average Day Demand)

While the above analysis indicates that the raw water transmission system capacities of the two surface water sources (considered in combination) are sufficient to meet current and projected MDD needs, it is important to note that the City's Chehalis River water right has an annual quantity (Q_a) that is significantly more limiting than its instantaneous quantity (Q_i). The City's Q_a is 0.87 mgd (based on 980 AF/yr), as opposed to a Q_i of 7.48 mgd (based on 11.6 cfs). Therefore, by considering the most limiting factor for each raw water transmission system (water line capacity for the North Fork, and annual water rights for the Chehalis), an analysis is made of the ability of these capacities to support Average Day Demand (ADD).

As noted in Table 7-5(c), the capacities are sufficient to meet the current and projected 6-year ADD. However, the system is unable to meet the projected 20-year ADD. At this point a capacity deficiency of approximately 0.5 mgd is identified, similar to the deficiency noted under Analysis 1 regarding the re-rated treatment plant's deficiency in meeting MDD. The average day deficiency increases to 1.5 mgd by 2059.

The possibility of increasing North Fork transmission system capacity, without the need for upsizing the transmission main, will be further evaluated in conjunction with potential 18th Street

Booster Pump Station improvements and the possibility of an additional treatment plant located closer to this source, as noted in Projects PS-4 and S-7 in Chapter 11. This, in conjunction with continued tracking of the likelihood for large industrial demand growth, will inform the City's decisions regarding the nature and timing of such long-term improvements.

Table 7-5(a). Source Capacity Analysis for Total System (Treatment Plant – Maximum Day Demand)

	Year				
	2009	**2015**	**2029**	**2059**	**Max[3]**
Projected ERUs and Demand [1]					
Equivalent Residential Units (ERU's)	13,071	14,357	33,714	40,357	15,407
Average Day Demand gpd)	1,830,000	2,010,000	4,720,00	5,650,000	2,156,949
Maximum Day Demand (gpd)	4,300,000	4,510,000	7,530,000	9,360,000	4,800,000
Evaluation of Existing Sources					
Available Existing Source (mgd) [2]					
Water Treatment Plant					
Current Capacity (4.8 mgd)	4,800,000	4,800,000	4,800,000	4,800,000	4,800,000
Total Available Source - (gpd)	4,800,000	4,800,000	4,800,000	4,800,000	4,800,000
Source Surplus/(Deficiency) - Existing Source (gpd)	**500,000**	**290,000**	**(2,730,000)**	**(4,560,000)**	**0**
Evaluation of Future Sources					
Available Future Source (mgd)					
Water Treatment Plant					
Future Potential Capacity (7.0 mgd)	NA	NA	7,000,000	7,000,000	NA
Total Available Source - (gpd)	NA	NA	7,000,000	7,000,000	NA
Source Surplus/(Deficiency) – Future Source (gpd)	**NA**	**NA**	**(530,000)**	**(2,360,000)**	**NA**

Notes:
(1) Projected ERUs and demands from Chapter 4. ERUs calculated as Average Day Demand / ERU water use factor (140 gpd/ERU).
(2) Source pumps are operating at the current stated production rate (i.e. 4.8 mgd).
(3) Maximum ERUs to be served with current sources, based on maximum production rate (i.e., 24 hours per day).

Table 7-5(b). Source Capacity Analysis for Total System (Raw Water Transmission Systems – Maximum Day Demand)

	Year				
	2009	**2015**	**2029**	**2059**	**Max[3]**
Projected ERUs and Demand [1]					
Equivalent Residential Units (ERU's)	13,071	14,357	33,714	40,357	43,784
Average Day Demand gpd)	1,830,000	2,010,000	4,720,00	5,650,000	6,129,798
Maximum Day Demand (gpd)	4,300,000	4,510,000	7,530,000	9,360,000	10,310,000
Evaluation of Existing Sources					
Available Existing Source (mgd) [2]					
North Fork Newaukum Transmission Line (3.31 mgd)	3,310,000	3,310,000	3,310,000	3,310,000	3,310,000
Chehalis Raw Water Pump Station (7.0 mgd)	7,000,000	7,000,000	7,000,000	7,000,000	7,000,000
Total Available Source - (gpd)	10,310,000	4,800,000	10,310,000	10,310,000	10,310,000
Source Surplus/(Deficiency) - Existing Source (gpd)	**6,010,000**	**5,800,000**	**2,780,000**	**950,000**	**0**

Notes:
(1) Projected ERUs and demands from Chapter 4. ERUs calculated as Average Day Demand / ERU water use factor (140 gpd/ERU).
(2) Capacities at the current stated rate.
(3) Maximum ERUs to be served with current sources, based on maximum production rate (i.e., 24 hours per day).

Table 7-5(c). Source Capacity Analysis for Total System (Raw Water Transmission System & Water Rights – Average Day Demand)

	Year				
	2009	**2015**	**2029**	**2059**	**Max[3]**
Projected ERUs and Demand [1]					
Equivalent Residential Units (ERU's)	13,071	14,357	33,714	40,357	29,857
Average Day Demand gpd)	1,830,000	2,010,000	4,720,00	5,650,000	4,180,004
Evaluation of Existing Sources					
Available Existing Source (mgd) [2]					
North Fork Newaukum Transmission Line (3.31 mgd)	3,310,000	3,310,000	3,310,000	3,310,000	3,310,000
Chehalis Raw Annual Water Rights (0.87 mgd)	870,000	870,000	870,000	870,000	870,000
Total Available Source - (gpd)	4,180,000	4,800,000	4,180,000	4,180,000	4,180,000
Source Surplus/(Deficiency) - Existing Source (gpd)	**2,350,000**	**2,170,001**	**(539,998)**	**(1,469,997)**	**0**

Notes:
(1) Projected ERUs and demands from Chapter 4. ERUs calculated as Average Day Demand / ERU water use factor (140 gpd/ERU).
(2) Capacities at the current stated rate.
(3) Maximum ERUs to be served with current sources, based on maximum production rate (i.e., 24 hours per day).

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 7-6 through 7-9 present the results of these analyses. Because the High Level and Valley View 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 South End and Centralia-Alpha Zones are "closed" zones, meaning there is no storage present to support any portion of demand. Therefore, source capacities in these zones are compared against PHD. The South End Zone analysis includes the demands of the Centralia-Alpha Zone, since all water conveyed to these two zones is supplied through the South End Booster Pump Station.

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 7-6. Source Capacity Analysis for High Level Zone

	Year			
	2009	**2015**	**2029**	**Max[3]**
Projected ERUs and Demand [1]				
Equivalent Residential Units (ERU's)	177	194	224	>500
Average Day Demand (gpd)	24,714	27,195	31,418	NA
Maximum Day Demand (gpd)	48,933	53,846	62,207	NA
Evaluation of Existing Sources				
Available Source (mgd)[2]				
High Level Booster Pump Station (360 gpm)	518,400	518,400	518,400	518,400
Total Available Source - (gpd)	518,400	518,400	518,400	518,400
Source Surplus/(Deficiency) - (gpd)	**469,467**	**464,554**	**456,193**	**NA**

Notes:
(1) Projected ERUs and demands from Chapter 2. ERUs calculated as Average Day Demand / ERU water use factor (140 gpd/ERU).
(2) Source pumps are operating at the maximum production rate (i.e., for 24 hours per day). Assumes only one pump is operational.
(3) Maximum ERUs to be served with current sources, based on maximum production rate (i.e., 24 hours per day).

Table 7-7. Source Capacity Analysis for Valley View Zone

	Year			
	2009	**2015**	**2029**	**Max[3]**
Projected ERUs and Demand [1]				
Equivalent Residential Units (ERU's)	150	165	191	>500
Average Day Demand (gpd)	20,987	23,094	26,680	NA
Maximum Day Demand (gpd)	41,554	45,726	52,827	NA
Evaluation of Existing Sources				
Available Source (mgd)[2]				
Valley View (Prospect) Booster Pump Station (125 gpm)	180,000	180,000	180,000	180,000
Total Available Source - (gpd)	180,000	180,000	180,000	180,000
Source Surplus/(Deficiency) - (gpd)	**138,446**	**134,274**	**127,173**	**NA**

Notes:
(1) Projected ERUs and demands from Chapter 4. ERUs calculated as Average Day Demand / ERU water use factor (140 gpd/ERU).
(2) Source pumps are operating at the maximum production rate (i.e., for 24 hours per day). Assumes only one pump is operational.
(3) Maximum ERUs to be served with current sources, based on maximum production rate (i.e., 24 hours per day).

Table 7-8. Source Capacity Analysis for South End Zone

	Year			
	2009	**2015**	**2029**	**Max[3]**
Projected ERUs and Demand [1]				
Equivalent Residential Units (ERU's)	321	353	408	775
Average Day Demand (gpd)	44,916	49,425	57,100	108,494
Maximum Day Demand (gpd)	88,934	97,862	113,059	214,819
Peak Hour Demand (gpm)	153	164	183	300
Evaluation of Existing Sources				
Available Source [2]				
South End Boosted Pump Station (300 gpm)	300	300	300	300
Total Available Source - (gpm)	300	300	300	300
Source Surplus/(Deficiency) - (gpm)	**147**	**136**	**117**	**0**

Notes:
(1) Projected ERUs and demands from Chapter 4. ERUs calculated as Average Day Demand / ERU water use factor (140 gpd/ERU).
(2) Source is defined as operating at maximum rate to meet peak hour demands. Assumes only one pump is operational.
(3) Maximum ERUs to be served with current sources, based on maximum production rate (i.e., 24 hours per day).

Table 7-9. Source Capacity Analysis for Centralia-Alpha Zone

	Year			
	2009	**2015**	**2029**	**Max[3]**
Projected ERUs and Demand [1]				
Equivalent Residential Units (ERU's)	60	66	77	160
Average Day Demand (gpd)	8,434	9,281	10,722	22,455
Maximum Day Demand (gpd)	16,699	18,376	21,229	44,460
Peak Hour Demand (gpm)	52	55	60	100
Evaluation of Existing Sources				
Available Source [2]				
Centralia-Alpha Booster Pump Station (100 gpm)	100	100	100	100
Total Available Source - (gpm)	100	100	100	100
Source Surplus/(Deficiency) - (gpm)	**48**	**45**	**40**	**0**

Notes:
(1) Projected ERUs and demands from Chapter 4. ERUs calculated as Average Day Demand / ERU water use factor (140 gpd/ERU).
(2) Source is defined is operating at maximum rate to meet peak hour demands. Assumes only one pump is operational.
(3) Maximum ERUs to be served with current sources, based on maximum production rate (i.e., 24 hours per day).

7.3. Storage Capacity Analysis

7.3.1. 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.

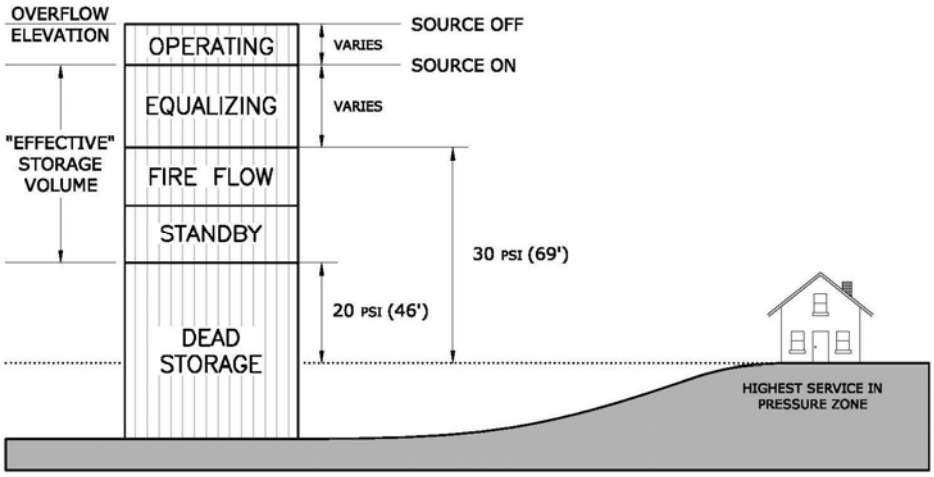


Figure 7.1 Storage Components

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. More detail is provided below in Section 7.3. The maximum fire flow volume considered in this analysis is 3,000 gpm for 3 hours, within the main pressure zone.

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.

7.3.2. Storage Capacity Evaluation

Main Zone

The Main, Kennicott, and Yates Reservoirs provide storage to the Main Zone. As indicated in Table 7-10, the largest storage volume requirement for this zone is for standby storage (which includes standby storage associated with the South End and Centralia-Alpha pressure zones). Because the system has only one source of supply (the WTP), no multi-source credit is applicable to the zone.

While there is sufficient storage capacity to accommodate current and six-year demand projections, there is a deficiency of 5.08 million gallons associated with the 20-year planning horizon, due primarily to a significant standby storage need related to the large industrial allowance factored into the demand forecast. A large storage reservoir will be needed in the Main Zone to address this deficiency, if standby storage is to be provided to future high water-use industrial customers. Also as noted in the High Level and Valley View Zone evaluations (see below), the City has plans to develop new storage facilities in these boosted zones. During design of such facilities, the City will explore the possibility of making storage volumes in these zones available to the Main Zone (via pressure reducing valve connections between the zones). Through such measures, the City will increase the reliability of storage provided to the Main Zone.

Table 7-10. Storage Capacity Analysis for Main Zone

	Year			
	2009	**2015**	**2029**	**Max[11]**
Projected ERUs and Demand[1]				
Equivalent Residential Units (ERU's)	12,745	13,998	33,299	17,654
Average Day Demand (gpd)	1,784,299	1,959,711	4,661,902	2,471,607
Maximum Day Demand (gpd)	4,209,513	4,410,428	7,414,966	5,423,021
Available Source (gpd)[2]				
Water Treatment Plant				
Current Capacity (4.8 mgd)	4,800,000	4,800,000	4,800,000	4,800,000
Total Available Source (gpd)	4,800,000	4,800,000	4,800,000	4,800,000
Multi-Source Credit (gpd)[3]	0	0	0	0
Required Storage Calculations (gal)				
Operational Storage [4]	986,360	986,360	986,360	986,360
Equalizing Storage [5]	193,750	253,310	1,147,883	442,577
Standby Storage [6]	3,568,599	3,919,422	9,323,804	4,943,213
Fire Flow Storage [7]	540,000	540,000	540,000	540,000
Required Storage				
Greater than 30 psi at highest meter [8]	1,180,110	1,239,670	2,134,243	1,428,937
Greater than 20 psi at highest meter [9]	4,748,709	5,159,093	11,458,047	6,372,151
Existing Storage Greater Than 30 psi (gal)[10]				
Main Reservoir	3,767,308	3,767,308	3,767,308	3,767,308
Kennicott Reservoir	389,237	389,237	389,237	389,237
Yates Reservoir	146,820	146,820	146,820	146,820
Total Existing Storage at 30 psi	4,303,365	4,303,365	4,303,365	4,303,365
Storage Surplus/(Deficiency) at 30 psi (gal)	**3,123,254**	**3,063,694**	**2,169,122**	**2,874,427**
Existing Storage Greater Than 20 psi (gal)[10]				
Main Reservoir	5,000,000	5,000,000	5,000,000	5,000,000
Kennicott Reservoir	1,000,000	1,000,000	1,000,000	1,000,000
Yates Reservoir	372,151	372,151	372,151	372,151
Total Existing Storage at 20 psi	6,372,151	6,372,151	6,372,151	6,372,151
Storage Surplus/(Deficiency) at 20 psi (gal)	**1,623,442**	**1,213,058**	**(5,085,896)**	**0**

Notes:

(1) Projected ERUs and demands from Chapter 4. ERUs calculated as Average Day Demand / ERU water use factor (140 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 typical tank levels fluctuations.

(5) Required Equalizing Storage is equal to [(PHD - Total Available Source) x 150 minutes].
PHD : (Main Zone Maximum Day Demand per ERU / 1440) * [(C) * (N) + F] + 18+ South End PHD + High Level BPS Capacity + Valley View BPS Capacity
(C & F values obtained from Table 5-1 in DOH 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 = 3,000 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, 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 (~319 ft).

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

High Level Zone

The 89,000 gallon High Level Reservoir provides gravity storage to the High Level Zone. As noted in Table 7-11, this reservoir is not sufficient to meet current or projected future needs. A deficiency of approximately 55,000 gallons exists.

The largest storage volume requirement for this zone is for fire suppression (120,000 gallons). Because this is the cause of the deficiency, the City has two options by which to address this situation. Fire suppression requirements can be satisfied through a combination of storage and/or pumping capacity. Therefore the City's options are:

1. Construct new/additional storage capacity to provide at least 55,000 gallons of additional storage volume.
2. Upgrade the High Level Booster Pump Station to provide pumping capacity that can make up the 55,000 gallon deficiency. This would involve replacing the current 360 gpm pumps with ones having a capacity of approximately 510 gpm. This is based on the following calculations:
    a. The fire suppression storage deficiency of 55,000 gallons equates to a flow need of 460 gpm over a 2-hour period (assumed fire duration). (The existing available fire suppression storage volume satisfies the remainder of the 1,000 gpm fire flow need over the 2-hour period.)
    b. The 2029 MDD flow rate is 43 gpm (calculated as the MDD of 62,207 gpd divided by 24 hours and 60 minutes per hour).
    c. Therefore, if pumping capacity at the High Level Booster Pump Station were to satisfy the storage volume deficiency, the total capacity of each pump would be 506 gpm (460 gpm for fire flow plus 46 gpm for domestic needs).

As presented in Chapter 11, the City has scheduled both the reservoir and pump station improvements in its capital improvement program. This recognizes that the pump station option would be less costly and may be more feasible to implement in the near-term, while acknowledging that the new reservoir option is a more reliable solution, and may offer other benefits such as increased zone pressures if the new reservoir were located at a higher elevation. The City will continue to explore both options, with implementation informed by the nature and pace of development in the zone.

Table 7-11. Storage Capacity Analysis for High Level Zone

	Year			
	2009	2015	2029	Max[11]
Projected ERUs and Demand[1]				
Equivalent Residential Units (ERU's)	177	194	224	NA
Average Day Demand (gpd)	24,714	27,195	31,418	
Maximum Day Demand (gpd)	48,933	53,846	62,207	
Available Source (gpd)[2]				
Pump 1 (360 gpm)	518,400	518,400	518,400	
Pump 2 (360 gpm)	518,400	518,400	518,400	
Total Available Source (gpd)	1,036,800	1,036,800	1,036,800	
Multi-Source Credit (gpd)[3]	518,400	518,400	518,400	
Required Storage Calculations				
Operational Storage (mg)[4]	24,136	24,136	24,136	
Equalizing Storage (mg)[5]	0	0	0	
Standby Storage (mg)[6]	35,305	38,850	44,882	
Fire Flow Storage (mg)[7]	120,000	120,000	120,000	
Required Storage				
Greater than 30 psi at highest meter (mg)[8]	24,136	24,136	24,136	
Greater than 20 psi at highest meter (mg)[9]	144,136	144,136	144,136	
Existing Storage Greater Than 30 psi (mg)[10]				
High Level Reservoir No. 1	89,000	89,000	89,000	
Total Existing Storage at 30 psi (mg)	89,000	89,000	89,000	
Storage Surplus/(Deficiency) at 30 psi (mg)	**64,864**	**64,864**	**64,864**	
Existing Storage Greater Than 20 psi (mg)[10]				
High Level Reservoir No. 1	89,000	89,000	89,000	
Total Existing Storage at 20 psi (mg)	89,000	89,000	89,000	
Storage Surplus/(Deficiency) at 20 psi (mg)	**(55,136)**	**(55,136)**	**(55,136)**	

Notes:

(1) Projected ERUs and demands from Chapter 4. ERUs calculated as Average Day Demand / ERU water use factor (140 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 current operating levels (i.e., first source is called when reservoir level drops 4').

(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 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 = 1,000 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.
This assumes standby and fire flow storage are nested, as allowed by the City Fire Department.

(10) The storage volume available in existing reservoirs at 30 and 20 psi is based on the elevation of the highest customer (~525 ft).

(11) Maximum ERUs served by Available Storage located solely in the High Level Zone. Not calculated as there is presently a deficiency.

Valley View Zone

The two 67,000 gallon Valley View Reservoirs provides gravity storage to the Valley View Zone. As noted in Table 7-12, these reservoirs are not sufficient to meet current or projected future needs. A deficiency of approximately 71,000 gallons exists.

The primary cause for the deficiency is the elevation of available storage relative to the highest customer service elevations. Only a portion of the reservoirs (approximately the top 40 percent) are available at elevations that can provide 20 psi to the highest connections. Therefore, more than half of the current reservoir volume is dead storage, providing the lift needed to support 20 psi.

Because these reservoirs operate with separated inlet/outlet pipes (meaning there is a dedicated transmission main from the Valley View Booster Pump Station to the reservoirs), the City has two options by which to address this storage deficiency. Those options are:

1. Construct new/additional storage capacity to provide at least 71,000 gallons of additional storage volume available via gravity to the pressure zone. This would require substantial dead storage volumes if a traditional standpipe reservoir design were employed.

2. Install a new booster pump station located at or near the existing reservoirs, which would operate to boost water from the reservoirs into the distribution system only under situations when reservoir water level drops to a certain point (e.g., primarily under fire flow conditions). Therefore, under normal operating conditions, this new booster pump station would not be utilized, since the upper-most portions of the reservoirs are sufficient to meet operational and equalizing needs of the zone. However, the existing dead storage volumes would be put to beneficial use when needed for fire suppression or standby needs.

As presented in Chapter 11, the City has scheduled both the reservoir and pump station improvements in its capital improvement program. This recognizes that the pump station option would be less costly and may be more feasible to implement in the near-term, while acknowledging that the new reservoir option is a more reliable long-term solution. The City will continue to explore both options, with implementation informed by the nature and pace of development in the zone.

Table 7-12. Storage Capacity Analysis for Valley View Zone

	Year			
	2009	**2015**	**2029**	**Max[11]**
Projected ERUs and Demand[1]				
Equivalent Residential Units (ERU's)	150	165	191	NA
Average Day Demand (gpd)	20,987	23,094	26,680	
Maximum Day Demand (gpd)	41,554	45,726	52,827	
Available Source (mgd)[2]				
Pump 1 (125 gpm)	180,000	180,000	180,000	
Pump 2 (125 gpm)	180,000	180,000	180,000	
Total Available Source (gpd)	360,000	360,000	360,000	
Multi-Source Credit (gpd)[3]	180,000	180,000	180,000	
Required Storage Calculations				
Operational Storage (mg)[4]	6,610	6,610	6,610	
Equalizing Storage (mg)[5]	0	0	0	
Standby Storage (mg)[6]	29,981	32,991	38,114	
Fire Flow Storage (mg)[7]	120,000	120,000	120,000	
Required Storage				
Greater than 30 psi at highest meter (mg)[8]	6,610	6,610	6,610	
Greater than 20 psi at highest meter (mg)[9]	126,610	126,610	126,610	
Existing Storage Greater Than 30 psi (mg)[10]				
Valley View Reservoir No. 1	5,920	5,920	5,920	
Valley View Reservoir No. 2	5,920	5,920	5,920	
Total Existing Storage at 30 psi (mg)	11,839	11,839	11,839	
Storage Surplus/(Deficiency) at 30 psi (mg)	**5,230**	**5,230**	**5,230**	
Existing Storage Greater Than 20 psi (mg)[10]				
Valley View Reservoir No. 1	27,709	27,709	27,709	
Valley View Reservoir No. 2	27,709	27,709	27,709	
Total Existing Storage at 20 psi (mg)	55,419	55,419	55,419	
Storage Surplus/(Deficiency) at 20 psi (mg)	**(71,191)**	**(71,191)**	**(71,191)**	

Notes:

(1) Projected ERUs and demands from Chapter 4. ERUs calculated as Average Day Demand / ERU water use factor (140 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 current operating levels (i.e., first source is called when reservoir level drops 3.5').

(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 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 = 1,000 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.
This assumes standby and fire flow storage are nested, as allowed by the City Fire Department.

(10) The storage volume available in existing reservoirs at 30 and 20 psi is based on the elevation of the highest customer (~620 ft).

(11) Maximum ERUs served by Available Storage located solely in the Valley View Zone. Not calculated as there is presently a deficiency.

7.4. Distribution System Analysis

7.4.1. Analysis Methodology

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

7.4.2. 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 800 pipes and 600 junction nodes, along with a pressure reducing station, 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 layout CAD file. Elevations in the model were adjusted with County topographic data.

In addition, dimensions of the reservoirs and configuration of the pump stations were checked and adjusted based on record drawings and discussions with City staff regarding facility controls and operations. The PRV settings were also adjusted according to staff input.

7.4.3. Water Demand Allocation

Chapter 4 presents information on water demands for the City's water system for the existing system and provides an estimate of projected water demands for the 6-year and 20-year planning horizons. For the hydraulic model, the demand forecast was used to determine the total demand for customers within the City's service area.

Demand allocation (i.e., spatial distribution of demand within the system) was determined by zoning within the distribution system with demand nodes being either residential or non-residential demands depending on the associated land use. Demands were assigned values for residential or non-residential based upon pressure zone. The total number of customers was taken into account to ensure that each zone had a total water demand that resembled actual water use in a particular zone.

As such, demands were allocated across every node in the model with the exclusion of some nodes that were located on a transmission line or near a storage reservoir, pump station or PRV station. A thorough review of the system was conducted, checking 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 4. Demands were developed for average day, maximum day and peak hour conditions. Model demands include a global adjustment for non-revenue water. Demand allocation was assumed to be the same for the existing system, 6-year and 20-year planning horizons.

7.4.4. 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 steady-state calibration, a total of 17 hydrant tests were conducted by City staff during the week of December 28, 2009. 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 or boundary conditions are recorded during the time the hydrant tests are conducted. Boundary conditions of concern typically include system demands, reservoir levels, pump station flows, and PRV settings (or flows if recorded).

For the City, the levels in the Main, Kennicott, and Yates Reservoirs were recorded for each hydrant test occurring in the system with the levels in the High Level and Valley View tank recorded only for the hydrant tests that occurred in the elevated zones. The flow rates were recorded for the High Level, Valley View, and South End Pump Stations during each flow test, as well. Demands were allocated as described above, with total demand adjusted to match the calculated average demand for the day of the field testing.

Adjustments of model demands, controls and friction factors (based on pipe age and material) were made within the system to achieve steady state calibration. Table 7-13 contains the field data collected for the hydrant tests and the results of the model simulations. Three of the 17 tests were not used for steady state calibration because the field measurements were not reasonable for their location in the system. These tests included a test on a 4" water main and two tests on dead end lines in the extremities of the system. These tests were regarded as outliers and omitted from the calibration.

Comparing the model results with the field measurements for static pressures indicates the overall accuracy of the model node elevations, tank elevations and PRV settings under normal demand conditions. As shown in Table 7-13, the simulated model pressures, with the exception of three, were within four psi of the observed field pressures, which indicates a reasonable match between modeled and observed conditions. The three tests for which the static pressure did not closely match between the field and model occurred in areas with varied topography. The two-foot contours used to set all the model nodes is not detailed enough to capture the localized terrain variations in such areas.

Comparing the modeled and observed drop in pressure between static conditions and those when a hydrant is flowing aids in determining whether the model piping is connected correctly and whether appropriate friction factors have been used. Table 7-13 shows that for the twelve tests, only one of the tests had a difference of five psi or greater. For the purposes of comprehensive planning, the City's model is considered to be well calibrated for steady state conditions.

Table 7-13. Calibration Results

Hydrant Test No.	Gage Node ID	Pressure Zone	Gage Node Elev (ft)	FIELD Static Pressure (psi)	MODEL Static Pressure (psi)	Static Pressure Difference (psi) [1]	Fireflow (gpm)	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-584	Main	176.0	104	96.4	-7.6	1395	85	77.7	-7.3	19.0	18.7	-0.3
2	J-588	Main	173.9	99	97.2	-1.8	1313	67	65.9	-1.1	32.0	31.3	-0.7
3	J-590	Main	174.0	99	97	-2.0	834	81	79.8	-1.2	18.0	17.2	-0.8
4	J-120	Main	170.0	106	96.3	-9.7	1320	89	80	-9.0	17.0	16.3	-0.7
5	650	Main	178.4	95	95.1	0.1	1344	86	81.8	-4.2	9.0	13.3	4.3
6	2680	High Level	405.3	79	95.9	16.9	250	63	78.4	15.4	16.0	17.5	1.5
7	J-596	Main	178.0	96	95.2	-0.8	1237	86	83.4	-2.6	10.0	11.8	1.8
8	J-602	Main	191.8	90	89	-1.0	1149	80	79.3	-0.7	10.0	9.7	-0.3
9	J-83	Valley View	585.8	47	50.1	3.1	400	35	38.2	3.2	12.0	11.9	-0.1
10	2080	Main	203.5	84	81.2	-2.8	698	51	46.8	-4.2	33.0	34.4	1.4
11	2300	Main	221.2	74	75.2	1.2	1119	68	62	-6.0	6.0	13.2	7.2
12	J-616	Main	228.7	69	71.7	2.7	951	63	63	0.0	6.0	8.7	2.7
13	J-620	Main	253.4	60	61	1.0	834	55	54.9	-0.1	5.0	6.1	1.1
14	J-510	Main	266.0	56	55.2	-0.8	300	52	54.2	2.2	4.0	1.0	-3.0

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)

7.4.5. Modeling Scenarios

The City has a distribution system with approximately 110 miles of pipe. Some of these pipes were installed more than 50 years ago and are reaching the end of their useful lives. Aging infrastructure, inadequately sized pipes and increasing demands all contribute to areas of low pressure during peak hour demands and substandard fire flows at locations or areas where the existing system cannot provide adequate service during existing and future maximum day demand conditions. The model was used to identify improvements that would increase the 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 total pipe and facility additions.

A number of steady state hydraulic analyses were completed for each pressure zone for existing (2009), six-year (2015), and twenty-year (2029) demand conditions. These considered peak hour demand and fire flow demand (MDD plus fire flow) conditions. Table 7-14 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 7-14. Modeling Scenarios

Description	Demand	Purpose
Existing Year Peak Hour	2009 Peak Hour Demand	Evaluate system
Existing Year Fire Flow	2009 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

7.4.6. Peak Hour Analysis Results

Figures 7.2 through 7.4 present the PHD pressure results for 2009, 2015, and 2029 respectively. Table 7-15 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 (>80 psi).

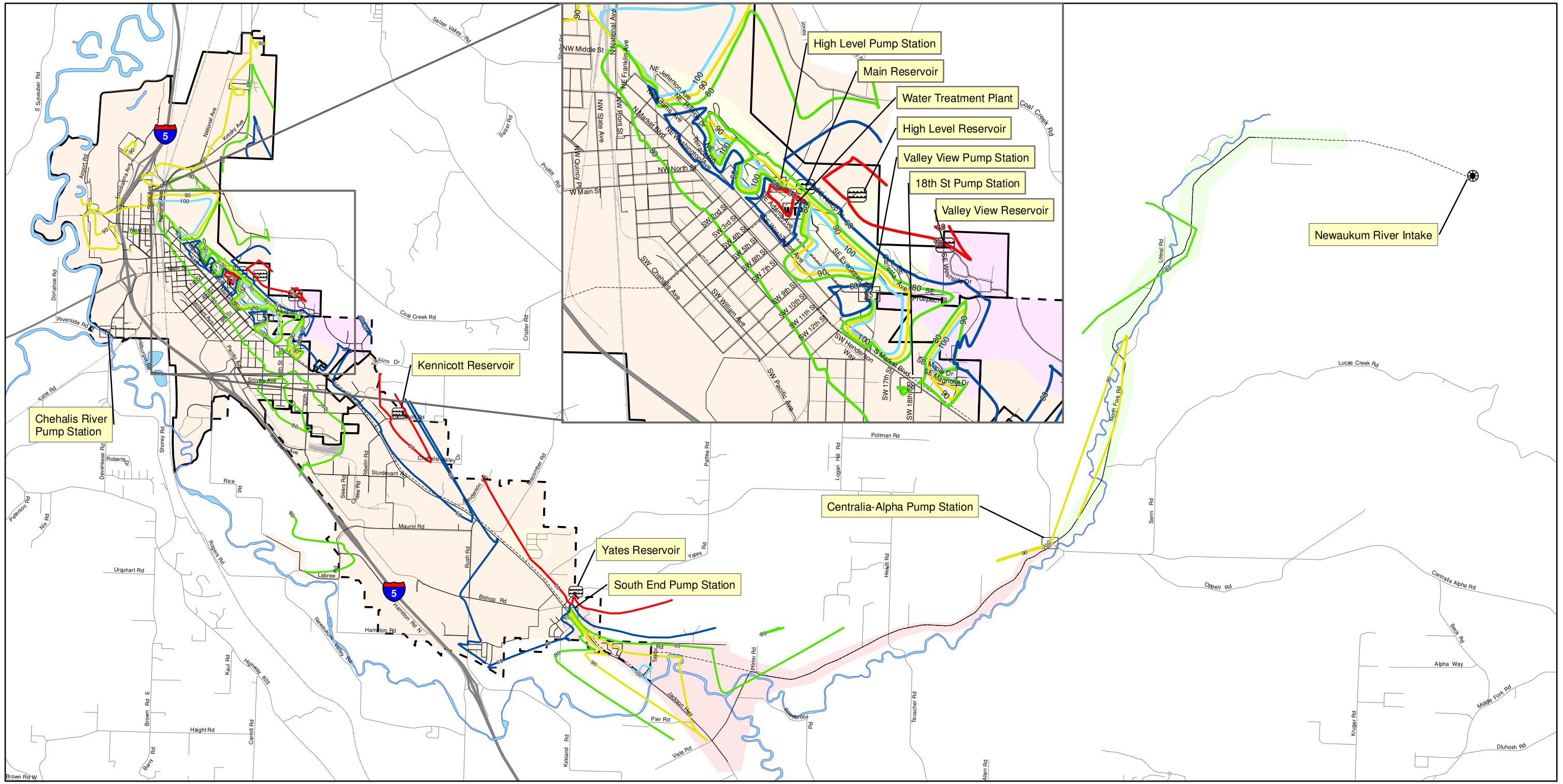
As readily observed in the figures, the only areas of low pressure (<30 psi) during PHD are directly around the reservoirs (where there are no services) and at one node in the Main Zone in proximity to the WTP (where again there are no services). Therefore, no significant areas of low pressure are observed throughout the system.

By contrast, there are many nodes (more than half) which experience pressures greater than 80 psi. The highest system pressures are observed in the lower elevation portions of the High Level Zone. This is of concern to the City due to the presence of aging AC pipe in this portion of the system, which is susceptible to failure at high pressures. This is the primary driver for pipe replacement projects planned for in this zone, as described in Chapter 11.

No other improvements have been identified solely to address pressure-related deficiencies.

Table 7-15. Peak Hour Demand Pressure Results

2009 Node Pressure by Pressure Zones			
Pressure Zone	**<30 psi**	**30-80 psi**	**>80 psi**
Main Zone	1	170	270
High Level Zone	0	8	22
Valleyview Fairview	0	29	2
Centralia Alpha Zone	0	0	7
South End Zone	0	1	14
Total	**1**	**208**	**315**
2015 Node Pressure by Pressure Zones			
Pressure Zone	**<30 psi**	**30-80 psi**	**>80 psi**
Main Zone	1	173	267
High Level Zone	0	8	22
Valleyview Fairview	0	29	2
Centralia Alpha Zone	0	0	7
South End Zone	0	1	14
Total	**1**	**211**	**312**
2029 Node Pressure by Pressure Zones			
Pressure Zone	**<30 psi**	**30-80 psi**	**>80 psi**
Main Zone	1	174	266
High Level Zone	0	8	22
Valleyview Fairview	0	29	2
Centralia Alpha Zone	0	0	7
South End Zone	0	1	14
Total	**1**	**212**	**311**



Legend

Pressure (psi)
- 30
- 60
- 80
- 90
- 100

- North Fork Diversion
- Reservoir
- Pump Station
- Water Treatment Plant
- Raw Water
- Waterline

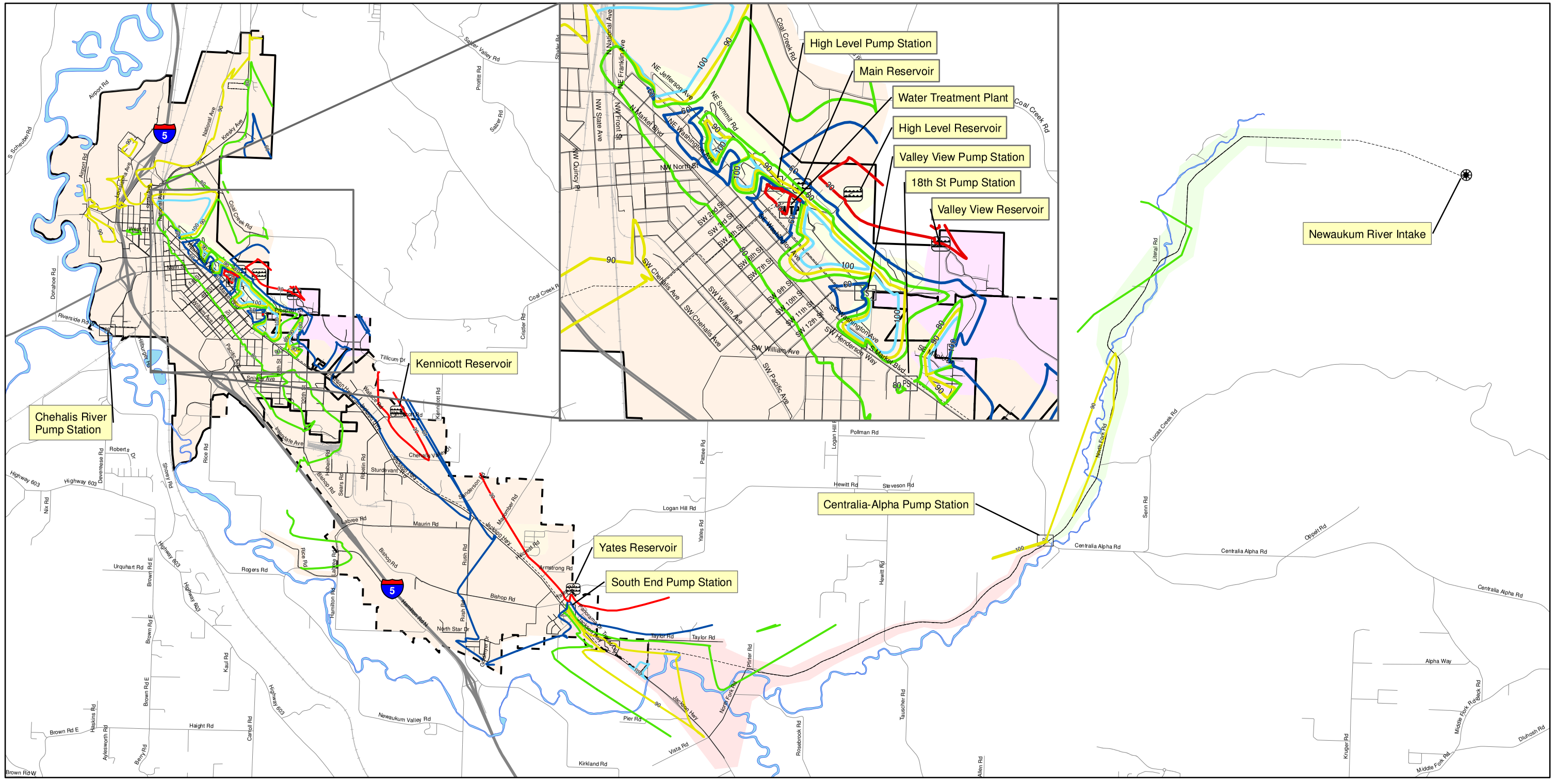
- Water
- Railroad
- Highway
- Road
- Chehalis City Limits
- Chehalis UGA

Pressure Zone
- Centralia Alpha
- High Level
- Hillcrest Private Water
- Main
- South End
- Valleyview/Fairview

Figure 7.2
2009 Peak Hour Pressure Map
CITY OF CHEHALIS
WATER SYSTEM PLAN

N

0 2,500 5,000 10,000 Feet



Legend

Pressure (psi)
- 30
- 60
- 80
- 90
- 100

- North Fork Diversion
- Reservoir
- Pump Station
- Water Treatment Plant
- Raw Water
- Waterline

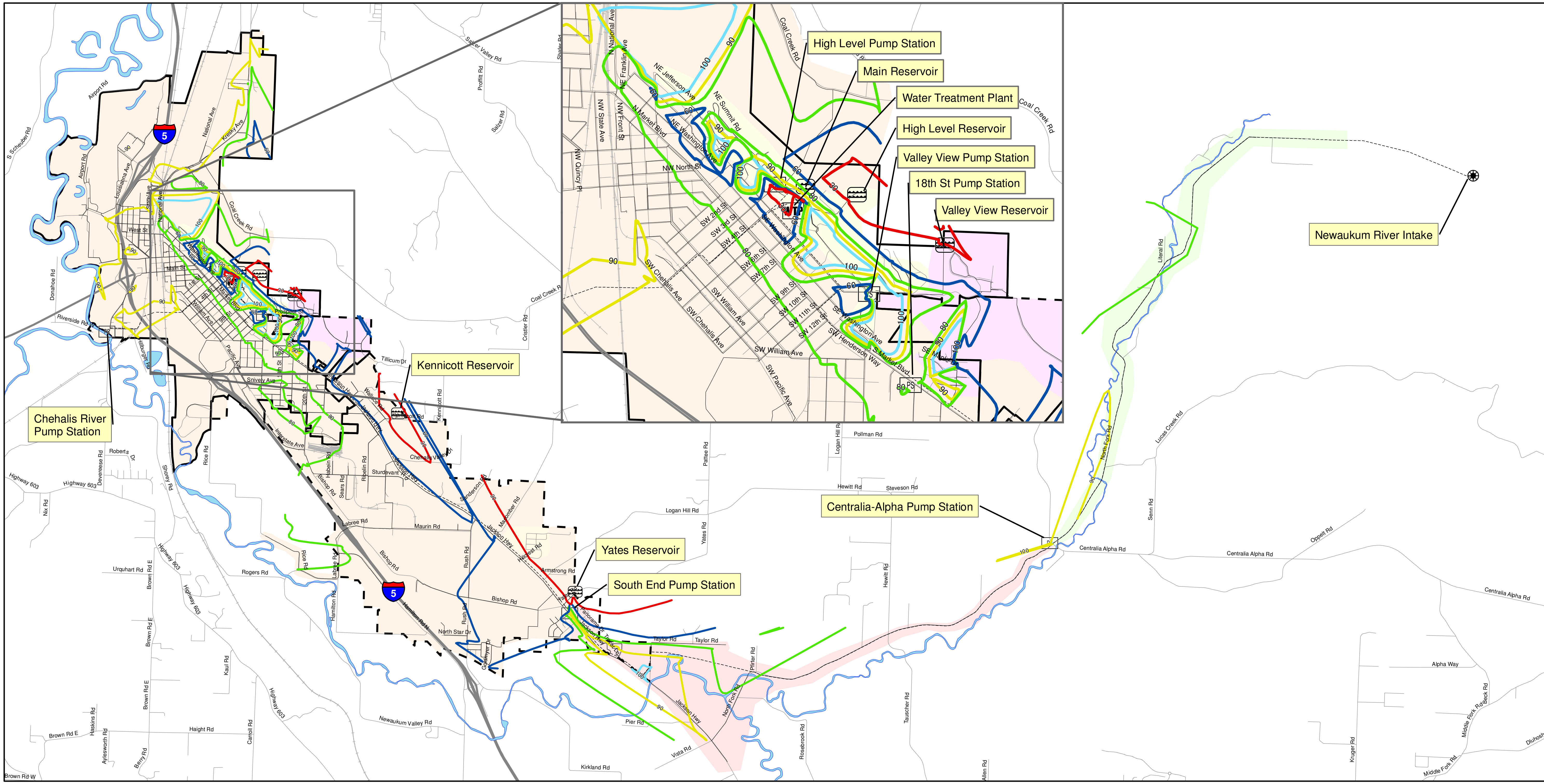
- Water
- Railroad
- Highway
- Road
- Chehalis City Limits
- Chehalis UGA

Pressure Zone
- Centralia Alpha
- High Level
- Hillcrest Private Water
- Main
- South End
- Valleyview/Fairview

Figure 7.3
2015 Peak Hour Pressure Map
CITY OF CHEHALIS
WATER SYSTEM PLAN

N

0 2,500 5,000 10,000 Feet



Legend

Pressure (psi)	
30	North Fork Diversion
60	Reservoir
80	Pump Station
90	Water Treatment Plant
100	Raw Water
	Waterline

Water
Railroad
Highway
Road
Chehalis City Limits
Chehalis UGA

Pressure Zone
Centralia Alpha
High Level
Hillcrest Private Water
Main
South End
Valleyview/Fairview

Figure 7.4
2029 Peak Hour Pressure Map
CITY OF CHEHALIS
WATER SYSTEM PLAN

N

0 2,500 5,000 10,000 Feet

7.4.7. Fire Flow Analysis Results

Fire flow analysis results are provided in Figures 7.5 through 7.7 for 2009, 2015, and 2029, respectively. These figures indicate the locations and magnitudes of fire flow deficiencies throughout the system. Detailed results for select, key locations are summarized in Table 7-16.

Improved fire flow conditions in the future at the select locations are a result of planned capital improvement projects, which are described in detail in Chapter 11. The improvements that are related to fire flow are specifically called out in Chapter 11, and are comprised primarily of pipeline looping and upsizing.

No improvements are planned for certain areas of dead end or small diameter piping, since no significant development is anticipated in these locations. Examples include Coal Creek Road (ID D) and the dead end 4" main off of Airport Road (ID H).

High Level Pump Station

Main Reservoir

Water Treatment Plant

High Level Reservoir

Valley View Reservoir

Valley View Pump Station

18th St Pump Station

Kennicott Reservoir

Chehalis River Pump Station

Yates Reservoir

South End Pump Station

Legend

2009 Fire Flow Deficiency (gpm)

- >2000
- 1500-2000
- 1000-1500
- 500-1000
- <500

Waterline

- 4"
- 6"
- 8"
- 10"
- >=12"
- Raw Water

- North Fork Diversion
- Reservoir
- Pump Station
- Water Treatment Plant
- Water
- Railroad
- Highway
- Road
- Chehalis City Limits
- Chehalis UGA

Pressure Zone

- Centralia Alpha
- High Level
- Hillcrest Private Water
- Main
- South End
- Valleyview/Fairview

Figure 7.5
2009 Fire Flow Deficiency Map

CITY OF CHEHALIS
WATER SYSTEM PLAN

N

0 1,250 2,500 5,000 Feet

High Level Pump Station

Main Reservoir

Water Treatment Plant

High Level Reservoir

Valley View Reservoir

Valley View Pump Station

18th St Pump Station

Kennicott Reservoir

Chehalis River Pump Station

Yates Reservoir

South End Pump Station

Legend

2015 Fire Flow Deficiency (gpm)

- >2000
- 1500-2000
- 1000-1500
- 500-1000
- <500

Waterline

- 4"
- 6"
- 8"
- 10"
- >=12"
- Raw Water

- North Fork Diversion
- Reservoir
- PS Pump Station
- WTP Water Treatment Plant
- Water
- Railroad
- Highway
- Road
- Chehalis City Limits
- Chehalis UGA

Pressure Zone

- Centralia Alpha
- High Level
- Hillcrest Private Water
- Main
- South End
- Valleyview/Fairview

Figure 7.6
2015 Fire Flow Deficiency Map

CITY OF CHEHALIS
WATER SYSTEM PLAN

N

0 1,250 2,500 5,000 Feet

High Level Pump Station
Main Reservoir
Water Treatment Plant
High Level Reservoir
Valley View Reservoir
Valley View Pump Station
18th St Pump Station
Kennicott Reservoir
Chehalis River Pump Station
Yates Reservoir
South End Pump Station

Legend

2029 Fire Flow Deficiency

- >2000
- 1000-1500
- 500-1000
- <500

Waterline

- 4"
- 6"
- 8"
- 10"
- >=12"
- Raw Water

- North Fork Diversion
- Reservoir
- PS Pump Station
- WTP Water Treatment Plant
- Water
- Railroad
- Highway
- Road
- Chehalis City Limits
- Chehalis UGA

Pressure Zone

- Centralia Alpha
- High Level
- Hillcrest Private Water
- Main
- South End
- Valleyview/Fairview

Figure 7.7
2029 Fire Flow Deficiency Map

CITY OF CHEHALIS
WATER SYSTEM PLAN

N

0 1,250 2,500 5,000 Feet

Table 7-16. Selected Fire Flow Location Results

Pressure Zone	ID	Location	Pipe Diameter	Notes	Fire Flow Goal (gpm)	2009 Available Fire Flow (gpm)	2015 Available Fire Flow (gpm)	2029 Available Fire Flow (gpm)
Main	A	Kresky Ave	12"	Dead end 12" - Multiple hydrants	3000	~2590	~2550	~2870
Main	B	NE Grove St and Kresky Ave	8"	Dead end 8" - Multiple hydrants	3000	1660-1960	1580-1940	1660-2080
Main	C	National Ave north of Kresky Ave	8"	Dead end 8"-multiple hydrants	3000	1670-2734	1670-2740	3200-4000
Main	D	Coal Creek Rd	4"	Small diameter piping - Multiple hydrants	1000	~750	~750	~750
Main	E	Multiple Locations along Louisiana Ave	8" & 12"	Dead end portion of system	3000	1990-2880	2200-2850	2440-5000
Main	F	NE State Ave	6"	Dead end 6"	3000	1350	4000	5000
Main	G	Airport Rd	8"	Dead end 8" - Multiple hydrants	3000	1920-2790	1965-2230	2030-3150
Main	H	Airport Rd	4"	Dead end 4"	3000	660	660	660
Main	I	Downtown Central business district	4" & 6"	Small diameter piping - Multiple hydrants	3000	1000-2300	1000-2300	3400-5000
High Level	J	Jefferson Ave and Cascade Ave	4"	Dead end 4"	1500	442	442	1430
Main	K	Louisiana Ave and Airport Rd	6"	Dead end 6"	3000	1595	1624	1660
Main	L	Multiple Hydrants along Florida Ave and Shoreline Dr	4"	4" waterline not sufficient to provide flow	1000	400-600	400-600	400-600
High Level	M	Multiple locations	6" & 8"	Deficiency due to pipe diameter	1000	500-760	500-760	820-1700
Valley View	N	Multiple locations	6" & 8"	Deficiency due to available head and pipe diameter	1000	500-800	500-800	750-1200
Main	O	17th St and Market Blvd	6"	Dead end 6"	3000	1510	1510	3550
Main	P	13th St and Interstate Ave	6"	Dead end 6"	3000	1500	1500	3925
Main	Q	SW 18th St	6"	Dead end 6"- Multiple hydrants	1000	~600	~600	~580
Main	R	Sturdevent Rd from Sears Rd to Habien Rd	8"	Dead end 8" - Multiple hydrants	3000	2150-2545	2200-2670	1950-2370
Main	S	Bishop Rd and Borovec Rd	8"	Dead end 8" - Multiple hydrants	3000	2141-2714	3000-5000	2500-4100
Main	T	North Star Dr and Rush Rd	12"	Dead end 12" - Multiple hydrants	3000	2460-2500	4000-5000	3500-4600
Main	U	State Ave and Prindle St	6"	Small diameter piping	3000	2200	2200	2300

7.5. Impacts of Potential District No.5 Demands

As presented in Section 3.1.3, the 2004 interlocal agreement (ILA) with Lewis County Water and Sewer District No. 5 (District) regarding a request by the District for the purchase of wholesale water supply from the City would aid the District in meeting the future water supply needs associated with a large proposed development (i.e., the Birchfield Fully Contained Community). As further noted in Section 3.1.3, the nature and extent of any supply obligations in the ILA and the amount and timing of such wholesale water provision are uncertain at this time. However, in order to responsibly plan for potential future stresses upon the City's water system, the evaluation below considers the possible impacts of District water demands on the City's system capacity analyses presented earlier in this chapter. The following discussion and analysis of potential wholesale water supply to the District is for planning purposes only and does not constitute or imply a water supply or contractual commitment in any respect.

The following are key assumptions used in this evaluation:

- **District Water Demands at Buildout.** In a letter from the District to the City dated March 7, 2011, the District presents a buildout projected average day demand (ADD) water supply need of 0.4 mgd that cannot be met by the District's own supplies. The associated maximum day demand (MDD) need is projected to be 0.7 mgd. These are the flow rates the District plans to request of the City. The District plans to accommodate peak diurnal, instantaneous demands through the District's own equalizing storage. Therefore, the peak hour demand (PHD) that the District would exert upon the City's water system at full buildout is calculated as 486 gpm (i.e., MDD evenly provided over the course of 24 hours).
- **Timing of District Water Demands.** As noted above there is uncertainty regarding the timing of the potential District water demands. So as not to presume what the rate of growth will be, the analyses below simply consider what the impacts to the City's system would be if full buildout were to occur within the City's 20-year planning horizon (i.e., by 2029). No estimation of intermediate levels of demand in interim years is made. The purpose of this approach is to evaluate potential system impacts at the 20-year horizon, as well as the longer-term 50-year horizon where applicable.

The following analyses utilize the assumptions above in exploring potential impacts of the District's buildout demands upon various components of the City's water system.

7.5.1. Water Rights

Table 7-17 provides a summary evaluation of the ability of the City's existing water rights[1] to support its own demands, and those of the District, into the future. While water rights are sufficient to support the City's long-term needs through the 50-year planning horizon, the existing annual water rights (Qa) are not sufficient to accommodate the full buildout of the District during this same time period.

[1] It is important to note that this analysis pertains to water rights, and does not consider other potential source limitations, such as actual surface water availability. It is recognized that under certain low flow conditions, there may not be sufficient water physically available at the point of the City's diversions to fully realize existing water rights. A detailed analysis of such conditions and potential associated limitations has not been prepared in conjunction with this water system plan.

Table 7-17. Water Rights Analysis with District No. 5

	Year			
	2009	2015	2029	2059
Annual (Qa) Water Rights Analysis				
Considering City Demands [1]				
Existing Annual Water Rights, Qa (mgd)	5.67	5.67	5.67	5.67
City Water Demand, ADD (mgd)	1.83	2.01	4.72	5.65
Water Rights Surplus/(Deficiency) (mgd)	3.84	3.66	0.95	0.02
Considering City and District Demands [2]				
Existing Annual Water Rights, Qa (mgd)	5.67	5.67	5.67	5.67
City Water Demand, ADD (mgd)	1.83	2.01	4.72	5.65
District Water Demand, ADD (mgd)	0	0	0.40	0.40
Water Rights Surplus/(Deficiency) (mgd)	3.84	3.66	0.55	(0.38)
Instantaneous (Qi) Water Rights Analysis				
Considering City Demands [1]				
Existing Instantaneous Water Rights, Qi (mgd)	16.73	16.73	16.73	16.73
City Water Demand, MDD (mgd)	4.80	4.80	7.53	9.36
Water Rights Surplus/(Deficiency) (mgd)	11.93	11.93	9.20	7.37
Considering City and District Demands [2]				
Existing Instantaneous Water Rights, Qi (mgd)	16.73	16.73	16.73	16.73
City Water Demand, MDD (mgd) [3]	4.80	4.80	7.53	9.36
District Water Demand, MDD (mgd)	0	0	0.70	0.70
Water Rights Surplus/(Deficiency) (mgd)	11.93	11.93	8.50	6.67

Notes:
(1) Water rights and City demand information taken from Tables 7-1 through 7-4.
(2) Water rights and City demand information taken from Tables 7-1 through 7-4. District demand information based on assumptions described earlier in Section 7.5.
(3) As noted in Tables 7-1 through 7-4, the MDD depicted for 2009 and 2015 is the current rated capacity of the water treatment plant. In future years, the MDD is the actual projected MDD for the City, given that it will exceed the current plant capacity.

7.5.2. Source Capacity

Table 7-18 provides a summary evaluation of the ability of the City's existing source capacity to support its own demands, and those of the District, into the future. As presented in Section 7.2.2, the City has evaluated three source capacity scenarios, reflecting different limitations imposed by various system elements. These are as follows.

- **Scenario 1 – Water Treatment Plant Capacity (MDD).** This analysis compares the treatment plant capacity with MDD. As noted in Table 7-18, and previously in Section 7.2.2, the treatment plant capacity (even assuming it is rerated to 7.0 mgd in the near future) is not sufficient to meet the City's own projected long-term demands. There is a supply deficiency of 0.53 mgd and 2.36 mgd at the 20-year and 50-year planning horizons, respectively, should no improvements be made. This deficiency is increased to 1.23 mgd (20-year) and 3.06 mgd (50-year) with the addition of District buildout demands.
- **Scenario 2 – Raw Water Transmission System Capacity (MDD).** This analysis compares the capacities of the raw water transmission systems associated with the City's two sources with MDD. As noted in Table 7-18, and previously in Section 7.2.2, the raw water transmission systems are sufficient to meet the City's own projected long-term demands. These capacities are also sufficient to support District buildout demands.

- **Scenario 3 – Raw Water Transmission System Capacity and Annual Water Rights (ADD).** This analysis compares the average day limiting factor for both sources with ADD. For the North Fork Newaukum, the limiting factor is the transmission system capacity, while for the Chehalis the limiting factor is annual water rights. As noted in Table 7-18, and previously in Section 7.2.2, the City's combined average day source capacity is not sufficient to meet the City's own projected long-term demands without system improvements. There is a supply deficiency of 0.54 mgd and 1.47 mgd at the 20-year and 50-year planning horizons, respectively. This deficiency is increased to 0.94 mgd (20-year) and 1.87 mgd (50-year) with the addition of District buildout demands.

Table 7-18. Source Capacity Analysis with District No. 5

	Year			
	2009	2015	2029	2059
Source Capacity Analysis 1 (Treatment Plant, MDD)				
Considering City Demands [1]				
Treatment Plant Capacity (mgd) [3]	4.80	4.80	7.00	7.00
City Water Demand, MDD (mgd)	4.30	4.51	7.53	9.36
Treatment Plant Capacity Surplus/(Deficiency) (mgd)	0.50	0.29	(0.53)	(2.36)
Considering City and District Demands [2]				
Treatment Plant Capacity (mgd) [3]	4.80	4.80	7.00	7.00
City Water Demand, MDD (mgd)	4.30	4.51	7.53	9.36
District Water Demand, MDD (mgd)	0	0	0.70	0.70
Treatment Plant Capacity Surplus/(Deficiency) (mgd)	0.50	0.29	(1.23)	(3.06)
Source Capacity Analysis 2 (Raw Water Transmission, MDD)				
Considering City Demands [4]				
Raw Water Transmission System (mgd) [6]	10.31	10.31	10.31	10.31
City Water Demand, MDD (mgd)	4.30	4.51	7.53	9.36
Raw Water Transmission Capacity Surplus/(Deficiency) (mgd)	6.01	5.80	2.78	0.95
Considering City and District Demands [5]				
Raw Water Transmission System (mgd) [6]	10.31	10.31	10.31	10.31
City Water Demand, MDD (mgd)	4.30	4.51	7.53	9.36
District Water Demand, MDD (mgd)	0	0	0.70	0.70
Raw Water Transmission Capacity Surplus/(Deficiency) (mgd)	6.01	5.80	2.08	0.25
Source Capacity Analysis 3 (Raw Water Transmission & Water Rights, ADD)				
Considering City Demands [7]				
Raw Water Transmission System/Water Rights, Qa (mgd) [9]	4.18	4.18	4.18	4.18
City Water Demand, ADD (mgd)	1.83	2.01	4.72	5.65
Transmission / Water Rights Surplus/(Deficiency) (mgd)	2.35	2.17	(0.54)	(1.47)
Considering City and District Demands [8]				
Raw Water Transmission System/Water Rights, Qa (mgd) [9]	4.18	4.18	4.18	4.18
City Water Demand, ADD (mgd)	1.83	2.01	4.72	5.65
District Water Demand, ADD (mgd)	0	0	0.40	0.40
Transmission / Water Rights Surplus/(Deficiency) (mgd)	2.35	2.17	(0.94)	(1.87)

Notes:

(1) Treatment plant capacity and City demand information taken from Table 7-5(a).

(2) Treatment plant capacity and City demand information taken from Table 7-5(a). District demand information based on assumptions described earlier in Section 7.5.

(3) Current rated capacity (4.8 mgd) is assumed for years 2009 and 2015. Planned future rated capacity (7.0 mgd) is assumed for years 2029 and 2059.

(4) Raw water transmission system capacity and City demand information taken from Table 7-5(b).

(5) Raw water transmission system capacity and City demand information taken from Table 7-5(b). District demand information based on assumptions described earlier in Section 7.5.

(6) As presented in Section 7.2.2, the raw water transmission system is comprised of the following primary elements:
North Fork Newaukum Transmission Line: 3.31 mgd capacity (assuming 18th Street BPS is operating)
Chehalis River Water Pump Station: 7.0 mgd capacity

(7) Raw water transmission system and water rights capacity and City demand information taken from Table 7-5(c).

(8) Raw water transmission system and water rights capacity and City demand information taken from Table 7-5(c). District demand information based on assumptions described earlier in Section 7.5.

(9) On an average day basis, the North Fork Newaukum Transmission Line capacity (3.31 mgd) is the limiting factor for that source, while annual water rights (0.87 mgd) are the limiting factor for the Chehalis River source. See Section 7.2.2 for details.

7.5.3. South End Booster Pump Station Capacity

If the City were to supply water to the District, all such water would pass through the South End Booster Pump Station (BPS). Table 7-19 provides a summary evaluation of the ability of the South End BPS to support the City's own demands, and those of the District, into the future. This analysis is only done through the 20-year planning horizon, as detailed 50-year City demand projections were not established for the South End pressure zone. While the current BPS capacity is sufficient to support the City's needs through the 20-year planning horizon, it is not sufficient to accommodate the full buildout of the District during this same time period.

Table 7-19. South End BPS Capacity Analysis with District No. 5

	Year		
	2009	2015	2029
South End BPS Analysis			
Considering City Demands [1]			
South End BPS Capacity (gpm) [3]	300	300	300
City Water Demand, PHD (gpm)	153	164	183
South End BPS Capacity Surplus/(Deficiency) (gpm)	147	136	117
Considering City and District Demands [2]			
South End BPS Capacity (gpm) [3]	300	300	300
City Water Demand, PHD (gpm)	153	164	183
District Water Demand, PHD (gpm)	0	0	486
South End BPS Capacity Surplus/(Deficiency) (gpm)	147	136	(369)

Notes:
(1) South End BPS capacity and City demand information taken from Table 7-8.
(2) South End BPS capacity and City demand information taken from Table 7-8. District demand information based on assumptions described earlier in Section 7.5.
(3) The South End BPS currently contains two pumps, each with an approximate capacity of 300 gpm. In order to maintain redundancy, only one pump is assumed operational in this analysis.

7.5.4. Storage Capacity

The ILA indicate that the City is not envisioned to support the District's storage capacity needs. The primary storage components of fire suppression and standby storage are to be provided entirely by the District to meet their own needs. Furthermore, because the District's PHD draw upon the City's system will be no greater than its MDD withdrawn evenly over a 24-hour period, the District's demands have no impacts upon the City's equalizing storage. Therefore, District demands at the levels described earlier impose no impacts to the City's storage volume capacities.

7.5.5. Distribution System Capacity

As noted in Section 7.5.3, all water potentially provided to the District would be conveyed from the City through the southern portion of its water system. Existing hydraulic conditions in that part of the system limit the amount of water that can be transmitted from the treatment plant to the south without adversely impacting velocities and system pressures. As noted in Chapter 11 (Capital Improvement Program), the City is planning for improvement projects to address this issue in order to meet its own future needs through the 20-year planning horizon. Those projects include:

- **Project PS-4 (18th Street BPS Upgrade).** A capacity upgrade of approximately 2,000 gpm is needed to support 20-year demand growth in the southern portion of the system. To accommodate the additional demands potentially imposed by the District, this capacity upgrade would need to be increased by an additional 486 gpm.

- **Project D-16 (16" Main from 11th St and Market Blvd to Yates Reservoir).** This project involves installation of 21,000 feet of 16-inch transmission main, and is required in conjunction with Project PS-4, to meet 20-year City demands. To accommodate the additional demands potentially imposed by the District, this capacity upgrade would likely involve a 24-inch main instead of a 16-inch main, based on hydraulic modeling done as part of this water system plan update. As demand conditions change in the future, further hydraulic modeling will be necessary to re-evaluate this issue and confirm pipe upsizing needs.

7.5.6. Summary of Potential Impacts

The analyses presented above are summarized below. It is noted that the City's Capital Improvement Program (CIP), presented in Chapter 11, contains projects that are defined to address City needs. The magnitude and timing of those projects may be impacted if the City were to provide water to the District at the levels described in this chapter. Such impacts are described in the summary below, along with other needed improvements that are not on the City's CIP, as they are not required to solely address City needs.

- **Water Rights.** There is a deficiency of approximately 0.38 mgd in the ability of the City's existing annual water rights to support 50-year City demand growth and that of the District.
    - Potential CIP Impact/Need: Acquisition of additional water rights. This is not currently on the City's CIP, as it is not needed to address City needs alone.
- **Supply Capacity (Treatment Plant, MDD).** There is a deficiency of approximately 3.0 mgd in the ability of the City's existing treatment plant to support 50-year maximum day City demand growth and that of the District.
    - Potential CIP Impact/Need: The City's CIP Projects S-4 and S-7 are two possible alternatives that can address the City's needs. The addition of District demands would increase the scope/magnitude of the projects and would likely accelerate the implementation time frame.
- **Supply Capacity (Transmission System / Water Rights, ADD).** There is a deficiency of approximately 1.87 mgd in the combined ability of the City's existing raw water transmission system and annual water rights to support 50-year average day City demand growth and that of the District.
    - Potential CIP Impact/Need: Acquisition of additional Chehalis River water rights and/or upgrades to the North Fork Newaukum River transmission system capacity may be required to resolve this deficiency. However, this need may be lessened if the City pursues CIP Project S-7, as discussed further below.
- **South End BPS Capacity.** There is a deficiency of approximately 370 gpm in the ability of the City's existing South End BPS to support 20-year City demand growth and that of the District.

- Potential CIP Impact/Need: Increase capacity of the South End BPS. This is not currently on the City's CIP, as it is not needed to address City needs alone.

- **Distribution System Capacity.** Hydraulic conditions limit the flow of water that can be conveyed from the treatment plant to the southern portion of the system without adversely impacting system velocities and pressures. The City has identified potential projects to address this issue, as noted below. Each project would require an increase in its capacity to accommodate District demands in addition to City demands.
  - Potential CIP Impact/Need: Two strategies have been evaluated by the City, as follows. The strategies will be further evaluated as growth occurs in the City, to determine the most cost-effective approach for the City.
    - CIP Projects S-4, PS-4, and D-16. Collectively these projects would serve to increase the capacities of the existing treatment plant, the 18th St BPS, and the transmission piping extending into the southern portion of the system. This resolves supply deficiencies noted earlier and addresses the hydraulic limitations associated with moving water south. Each of these projects would be impacted if the City were to meet District buildout demands in addition to its own.
    - CIP Project S-7. This project involves development of a second treatment facility located in the southern portion of the system. Implementation of this project may lessen the magnitude of the three projects noted above, or eliminate the need for them, due to water supply being provided in close proximity to significant future demands in the southern portion of the system, as opposed to that water needing to come from the northern location of the existing treatment plant. The capacity of such a plant would need to be increased if the City were to meet District buildout demands in addition to its own.

Section 8
Water System Reliability and Source Protection

8. Water System Reliability and Source Protection

This chapter provides an evaluation of system reliability, with respect to the ability of the City's supply strategy to meet system demands under a variety of conditions, including during emergency situations. Descriptions of the City's source protection efforts are also included in this chapter.

8.1. Source Reliability

8.1.1. Summary of System Reliability Characteristics

Water Right Adequacy

As discussed in Section 7, the City's water rights are more than adequate to meet water demands within the 20-year planning horizon and beyond.

Source Reliability

The City's sources of supply have a high degree of redundancy. Either the North Fork intake or the Chehalis River intake can independently supply the average day demand and in most cases the maximum day demand. Although water quality in the North Fork is better than that in the Chehalis River, both sources meet DOH requirements.

An intertie with Centralia provides additional reliability, in that a portion of the City demands could be met with supply from Centralia under emergency conditions.

Facility Reliability

An analysis of the City's source, pumping and storage facilities is provided in Section 7. As noted in that analysis, the City's distribution storage reservoirs provide sufficient standby storage to meet more than two days of average day demand. Pump stations serving boosted pressure zones contain two pumps, with each capable of meeting maximum day (and where necessary in closed pressure zones, peak hour) demands.

8.1.2. Water Shortage Response Planning

Emergency response planning is a key component of overall water system reliability. Part of emergency response is the development of a Water Shortage Response Plan (WSRP) that details actions taken during various levels of water shortages. During minor water shortages, only public information and voluntary conservation measures may be necessary to ensure adequate water supply. During extreme shortages, mandatory curtailment and rationing may be required.

Having a WSRP plan in place provides the City with an established plan on how to address shortages. It assists customers in understanding what they can do to reduce water usage and what to expect if the shortages become more severe.

The City's recently developed WSRP is provided in Appendix J. The plan provides a four-stage approach to addressing a water supply shortfall event. Each stage provides an increasingly aggressive set of actions to be implemented as drought conditions become more severe. The four stages are:

- **Advisory Stage**. The public is informed that a water shortage may occur and is encouraged to use water wisely.
- **Voluntary Stage**. This stage relies on voluntary cooperation to meet demand-reduction goals. During this stage, the City will implement supply-side actions and recommend voluntary actions for their retail customers.
- **Mandatory Stage**. The City will implement more aggressive supply-side actions and will limit or prohibit certain retail water use activities.
- **Emergency Stage.** If supply conditions worsen and the mandatory stage does not meet the required demand reduction, this stage will establish emergency restrictions, which may include rate surcharges.

8.1.3. Watershed Planning

The mission of the Chehalis Basin Partnership is to coordinate local, tribal, state, federal and private efforts to reduce the effects of flooding and maintain/enhance beneficial water uses while at all times recognizing the relationship to economic health and sustainability within the basin. The City of Chehalis has actively participated in the Partnership since its inception in 1997. Through the Partnership, the City has been able to provide input and influence the development of regulations and standards that impact water quality and water rights appropriations within the basin. Recent efforts completed by the Partnership that provide a framework for water resource management in the basin include:

- Chehalis Basin Watershed Management Plan (April 9, 2004)
- Detailed Implementation Plan (June 2009 Update)

8.2. Source Protection

All Group A water systems must develop source water protection programs to protect, and if possible, improve source waters used by public water systems. Identifying, monitoring, limiting and controlling, to the extent feasible, all facilities and activities within the watershed or zone of contribution that may adversely affect source water quality, accomplish this protection. This source water protection is required under WAC 246-290-135, -668, and –690.

Purveyors utilizing groundwater must prepare a wellhead protection program, while those that utilize surface water for their source water must prepare a watershed control program plan. The term "watershed" refers to the hydrologic drainage basin up gradient of the utility's surface water intake. Since the City sources are both surface water sources, this chapter will detail each watershed.

8.2.1. Watershed Control Program Requirements

Community water systems that use surface water can benefit by developing a watershed control program to protect their water supply from current and future contamination. Control of the watershed helps protect the land over which the water travels. The quality of water that becomes the source water for the City is ultimately impacted by land uses of that watershed.

Increasing population and expanding economy are placing pressure on the land of both watersheds. Although growth and land use changes may be inevitable in many communities, the way in which growth takes place affects its impact on water quality. Two important questions must be included in decisions regarding these watersheds. They are, "How will increased development affect the quality of our water sources?" and, "How can we make decisions that will allow our community to grow while protecting our water"?

With careful planning and a commitment to protect streams, rivers, and groundwater, land use practices can be implemented that balance the need for jobs and economic development with protection of the natural environment. Development that takes place without such considerations, however, can lead to significant degradation of streams and ground water, and loss of aquatic life.

All land uses have an effect on water quality, whether positive or negative. In forests and other areas with adequate vegetative cover and little disturbance from humans, most rainfall soaks into the soil rather than running off the ground, stream flows are steady, and water quality is high. In built-up areas with pavement and buildings, little rainfall soaks into the soil causing high runoff, stream flows with high peaks and low flows in between, and poorer water quality.

The watershed control program, according to WAC 246-290, must address, at a minimum, the following elements:

1. Watershed Description and Characteristics;
2. Identification of Activities and Land Uses Detrimental to Water Quality;
3. Watershed Management and Control Measures;
4. Monitoring Program; and
5. System Operations.

Each of these elements is described in the following sections for the City's two sources.

8.2.2. North Fork Newaukum Watershed Control Program

Watershed Description and Characteristics

The Newaukum River watershed is within State Water Resource Inventory Area (WRIA) number 23, as shown in Figure 8-1. The Newaukum source is designated by DOH as source 1 (S01). The intake is located on the following property: Beginning at the point located 600 feet North of the Southwest corner of the Southeast quarter of Section 20, Township 14 N Range 1E of W.M., running North 500 feet; thence East 283 feet; thence South 45 degrees East 283 feet; thence South 350 feet; thence West 500 feet to the place of beginning. The property at the source intake is approximately 5.9 acres located in Lewis County, Washington. The Newaukum River travels northwest and enters the Chehalis River about three-quarters of a mile west of the City of Chehalis.

The Newaukum River watershed is about 155 square miles and the headwaters are in forestlands about 25 miles East of Chehalis. The watershed of the source intake itself is an area about 18 square miles that is owned by the Weyerhaeuser Company. The City owns the previously described land around the intake and has an easement for the raw water pipeline through Weyerhaeuser property to North Fork Road. The elevation of the intake is 598 feet and is the beginning of 17.6 miles of pipe that carries the raw water by gravity to the treatment plant. A detailed discussion of water rights and infrastructure capacity is included in Section 7.

Identification of Activities and Land Uses Detrimental to Water Quality

The land owned by Weyerhaeuser is used primarily as a timber resource. Therefore, logging is the major activity in this watershed. The areas that have been logged have been since replanted with evergreens and are covered with brush, alder and other deciduous trees. This will eventually regenerate the source of timber but can have an immediate impact on the water quality unless care is taken to reduce runoff and erosion before the ground cover is established. In the early 1990's a landslide resulted from a 100-year storm event. This caused the river to become temporarily unsuitable as a source for the City. The City relied on the alternate source (S02), the Chehalis River, until repairs were completed at the North Fork and the turbidity lowered to treatable levels.

Such adverse impacts of heavy rains were observed more recently during the heavy storms of 2007-2008, which resulted in flooding and significant erosion in the Chehalis Basin.

A review of Ecology's Facility/Site Identification Database in January 2011 revealed no point sources of potential contamination located within the Newaukum's watershed area.

Watershed Management and Control Measures

The most recent Watershed Plan agreement with Weyerhaeuser, Department of Natural Resources, City of Centralia, and City of Chehalis was signed in 1990 (see Appendix K). The City keeps a copy of the Weyerhaeuser forest practices applications on file. Further controls on the watershed are as follows:

- **Wildlife Control**. Wildlife populations are kept under control by Weyerhaeuser. The Department of Fisheries monitors the fish population and streams.
- **Hazardous Material Control**.- Weyerhaeuser has on file a copy of the City's emergency response procedures in the event of any release of hazardous materials.
- **Security.** Weyerhaeuser has locked gates that restrict all but authorized personnel. The only human activities authorized in the watershed are the Weyerhaeuser and City employees and hunters. Signs are also posted listing watershed restrictions.

Monitoring Program

Monitoring of the intake is by a combination of continuous turbidity readings and source water E coli, or fecal coliform, bacteria samples. The frequency of source water samples must be at least 10% of the Total Coliform Rule samples as covered in the Coliform Monitoring Plan. If at anytime the turbidity exceeds 5.0 NTU, staff must collect additional raw water samples for E coli.

System Operations

Water quality at the Newaukum River intake is monitored on a daily basis. A river-monitoring log is kept which records the data, time, river elevations, weather, temperature and rainfall. Alarms at several key points alert City staff of readings outside the normal range for turbidity, river level, and power outage.

8.2.3. Chehalis River Watershed Control Program

Watershed Description and Characteristics

The Upper Chehalis sub basin above the Newaukum River drains about 450 square miles and is shown in Figures 8-1 and 8-2. The watershed is located in Lewis, Pacific and Cowlitz Counties. The main tributaries include the Main Fork, the South Fork, Elk Creek and Stillman Creek.

The Chehalis River originates in the Willapa Hills, which are part of the Coast Range. Generally, the elevation is below 2,400 feet with Baw Faw Peak being the highest point at 3,110 feet. The river valley on the main fork broadens out below Pe Ell and on the South Fork at the Lewis County/Cowlitz County line. The elevation at Centralia is 185 feet.

The Chehalis River is the principal river in this sub basin. Its headwaters are south of Pe Ell. The river flows northeast toward Chehalis then turns northwest and eventually empties into Grays Harbor. The mean annual discharge of the upper Chehalis River at the U.S. Geological Survey (USGS) gauging station near Doty is 575.4 cfs. A peak flow of 27,500 cfs was recorded here on January 9, 1990. A low mean flow recorded for the Chehalis River at this station was 18 cfs in 1953 (USGS, 1992).

Identification of Activities and Land Uses Detrimental to Water Quality

Various studies conducted in conjunction with development of the Chehalis Basin Watershed Management Plan have summarized existing water quality data in the Chehalis River Basin, and added to the available data through additional monitoring. A most recent such effort is documented in the *State-of-the-River Report for the Chehalis River Basin, 2006-2009* (Green, et al.; September 14, 2009). Through this work, which began in 2006, water samples were collected and analyzed at 83 sites on a monthly basis, with the following parameters evaluated: dissolved oxygen, pH, temperature, turbidity, and fecal coliform. All of these parameters have historically been of concern in the basin due to the high degree of sediment runoff that is observed, particularly during times of heavy rainfall.

In this work, dissolved oxygen levels varied widely across the basin, with lowest levels in the mainstem Chehalis and at the downstream ends of tributaries near their confluence with the Chehalis.

Turbidity tended to be highest during the winter months, particularly after storms and flood events, and lowest during the summer months. Two different categories of high stream turbidity conditions in Chehalis Basin streams were observed: 1) ongoing above-average but not extreme turbidity, and 2) extreme high turbidity over a shorter interval during and following storm events. Turbidity in the Chehalis River headwaters and other upper reaches was reflective of the second category, and is what is observed at City's Chehalis River source water.

Temperatures in excess of 18°C have been observed throughout the Chehalis River system in most years. Since human activities have had a significant impact on the environment of the Chehalis Basin for over a century, it is difficult to say whether the elevated temperatures that have been observed represent "natural" conditions of the river.

As land uses change from forests and shorelines with riparian cover to developed lands, siltation increases due to the increased erosion and runoff. This increased siltation is detrimental to fish and other aquatic life. Siltation can affect water treatment by increasing the demand on the clarification process. With increased siltation comes the increased risk of microbiological contamination.

Inventory of Potential Contaminant Sources

In January 2011, an inventory of potential contaminant sources was developed using Ecology's Facility/Site Identification Database. 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 8-1 summarizes the review of the database, identifying all sites that were located within the 390,000 acre watershed area. The table notes those sites located within the following areas of most notable concern:

- Within a 0.25 mile buffer from the river or any major tributary.
- Within the 100-year floodplain.
- Within the City's UGA.

The locations of all sites are noted on Figures 8-1 and 8-2. Following the database analysis, City staff conducted a windshield survey to confirm information associated with approximately 30 sites located within the City, along the stretch of the Newaukum River, from its confluence with the Chehalis upstream to the point where I-5 crosses the river.

Watershed Management and Control Measures

Watershed management actions that have already been taken or are underway in the Chehalis River Basin include:

- A non-point source pollution plan was completed by consensus of river basin users in December 1992.
- The Chehalis Basin Resources Alliance (a nonprofit organization not eligible for tax-deductible gifts) was formed for fund raising and grant applications.
- The Chehalis Basin Resource Trust (a nonprofit organization eligible for tax-deductible gifts, easements, and bequests) was formed.
- The Department of Ecology performs total maximum daily load (tmdl) studies on the middle Chehalis River and tributaries.
- Development of Chehalis Basin Watershed Management Plan (2004) and associated Detailed Implementation Plan (2009)

System Operations

The system operations of the Chehalis River intake are patterned after the Newaukum River intake. The operator monitors the turbidity on a daily basis when the intake is in operation and records this value. An additional river-monitoring log is kept which records the data, time, river elevations, weather, temperature and rainfall.

8.2.4. Future Watershed Protection Efforts

The City will periodically update its inventory of potential contaminant sources. In addition, the City will develop an approach for notifying owners of those sites that are located within the following geographical areas of interest:

- Within a 0.25 mile buffer from the river or any major tributary.
- Within the 100-year floodplain.
- Within the City's UGA.

Table 8-1. Inventory of Potential Contaminant Sources

FID	DOE Facility ID	Site Name	Type of Point Source	Ecology Program	Within 1/4 Mile River Buffer	Within 100-yr Flood Plain	Within UGA
0	208	AMERICAN CROSSARM & CONDUIT	Federal (Superfund) Cleanup St	Toxics		Y	Y
1	4610	Patricia Dobyns	Non Enforcement Final	Water Reservoirs			
2	5495	KC TRUCK PARTS INC	Industrial SW GP	Water Quality			
3	5503	ALUMINITE NORTHWEST	Industrial SW GP	Water Quality			Y
4	5694	AKA ROCKSCAPES CERES HILL QUARRY	Sand and Gravel GP	Water Quality			
5	5772	HOLLOWAY SPRINGS PHASES 2 & 3	Construction SW GP	Water Quality			Y
6	6182	HAMPTON LUMBER MILLS NAPAVINE RELOA	Industrial SW GP	Water Quality			
7	6441	WALSH TRUCKING CO LTD NAPA	Industrial SW GP	Water Quality			
8	6875	PE ELL STP	Municipal IP	Water Quality	Y	Y	
			Biosolids	Waste to Resource	Y	Y	
			Enforcement Final	Water Quality	Y	Y	
9	6999	RIBELIN RD PROJECT	Construction SW GP	Water Quality			Y
10	8538	Brunoff Farms Inc	Dairy	Water Quality	Y		
11	9021	FORMER ZIGLER DUMP SITE	State Cleanup Site	Toxics			
12	9317	Altaquip	Revised Site Visit Program	Hazardous Waste			Y
13	9542	WILLAPA HILLS TRAIL (Construction Complete)	Construction SW GP	Water Quality	Y	Y	
14	9773	CHANDLER ROAD BRIDGE REPLACEMENT 55 CRP 2124	Construction SW GP	Water Quality	Y		
15	10261	LEWIS COUNTY PW BUNKER PIT	Sand and Gravel GP	Water Quality	Y		
16	1160	UTILITY TRANSFORMER SERVICE	State Cleanup Site	Toxics			
17	1171	EXTINE PETROLEUM	State Cleanup Site	Toxics			
18	1181	EAGLE TRUCK STOP	Underground Storage Tank	Toxics			
			LUST Facility	Toxics			
			State Cleanup Site	Toxics			
19	1970	RUSH ROAD PLAT	Construction SW GP	Water Quality			
20	3150	MEZA PAVING ASPHALT PLANT	Sand and Gravel GP	Water Quality			
21	3432	BTI TRUCK & DIESEL	Revised Site Visit Program	Hazardous Waste		Y	
22	3516	LEWIS COUNTY PW MESKILL PIT	Sand and Gravel GP	Water Quality	Y		
23	3657	Loves Travel Stop	Construction SW GP	Water Quality	Y	Y	
24	10813	Chehalis Port	Revised Site Visit Program	Hazardous Waste			Y
25	12527	BUTTEVILLE LUMBER COMPANY	Industrial SW GP	Water Quality			
26	12980	FIRST CHRISTIAN CHURCH CHEHALIS	Construction SW GP	Water Quality			Y

FID	DOE Facility ID	Site Name	Type of Point Source	Ecology Program	Within 1/4 Mile River Buffer	Within 100-yr Flood Plain	Within UGA
27	13651	Johnson Contracting Inc Wood Recycling Facility	Recycling	Waste to Resource			
28	13727	INTERCITY ASSOCIATES	Construction SW GP	Water Quality			
29	14519	HOLBROOK CHEHALIS LOG YARD	Industrial SW GP	Water Quality			Y
30	14626	LAKESIDE INDUSTRIES BG DM70	Sand and Gravel GP	Water Quality			
31	15075	FORMER CHRISTIAN PROPERTY	State Cleanup Site	Toxics			
32	15261	FRED MEYER DISTRIBUTION CENTER	Industrial SW GP	Water Quality			Y
33	15400	HAMILTON RUSH ROAD FILL	Construction SW GP	Water Quality	Y	Y	
34	16758	SHAFER RESIDENCE	Revised Site Visit Program	Hazardous Waste			
35	17242	NEWAUKUM BRIDGE REPLACEMENT 20CRP2072	Construction SW GP	Water Quality	Y	Y	
36	17473	HAMILTON LABREE RD PCE	Federal (Superfund) Cleanup St	Toxics		Y	Y
			Minor Industrial	Water Quality		Y	Y
37	17837	LEWIS COUNTY FOREST PRODUCTS	Industrial SW GP	Water Quality			
38	17899	WA DOT QS L-107 RIVER ROAD QUARRY	Sand and Gravel GP	Water Quality			
39	18739	PE ELL WTP	Water Treatment Plant GP	Water Quality	Y		
40	19986	NORTH FORK TIMBER CO	Industrial SW GP	Water Quality			Y
41	21203	Ritchie Bros Napavine Lewis Co	Construction SW GP	Water Quality			
42	22031	MCFARLAND CASCADE CURTIS POLE	Industrial SW GP	Water Quality	Y		
43	22211	Willapa Hills Trails Adna to PeEll	Construction SW GP	Water Quality	Y		
44	22403	Industrial Fabrication and Testing	Industrial SW GP	Water Quality			Y
45	22876	TNT Radiator Service	Revised Site Visit Program	Hazardous Waste			Y
46	23419	KIRKLAND ROAD PROJECT	Construction SW GP	Water Quality			Y
47	23441	GOOD CRUSHING INC HALE RD	Sand and Gravel GP	Water Quality			
48	23781	GOODS QUARRY TENNESSEE RD	Sand and Gravel GP	Water Quality			
49	24336	LEWIS CO WORK OPPORTUNITY	Industrial SW GP	Water Quality			Y
50	24868	BROWN RD QUARRY	Sand and Gravel GP	Water Quality			
51	27355	HARDEL MUTUAL PLYWOOD CORP CHEHALIS	Underground Storage Tank	Toxics			Y
			Emergency/Haz Chem Rpt TIER2	Hazardous Waste			Y
			Air Qual Local Authority Reg	Air Quality			Y
			Industrial SW GP	Water Quality			Y
52	51246	Rosecrest Farm	Dairy	Water Quality	Y		
53	131290	Fred Meyer Regional Distribution Center	Enforcement Final	Ecology Action Site			Y
			401CZM Project Site	Ecology Action Site			Y

FID	DOE Facility ID	Site Name	Type of Point Source	Ecology Program	Within 1/4 Mile River Buffer	Within 100-yr Flood Plain	Within UGA
54	206825	United Rentals Northwest Inc Chehalis	Emergency/Haz Chem Rpt TIER2	Hazardous Waste	Y	Y	
		(Note: Site currently vacant, 2011.)					
55	261456	BOISTFORT STORE PROPERTY	Underground Storage Tank	Toxics			
			State Cleanup Site	Toxics			
56	609632	Centralia Coal Mine Pond 46A Dam	Dam Site	Water Reservoir			
57	850351	TransAlta Centralia LLC Mining Pond 46	401CZM Project Site	Ecology Action Site			
58	1038862	JACK RASMUSSEN	Non Enforcement Final	Water Reservoir			
59	1065194	JB Leonard Logging & Trucking	Enforcement Final	Spills			
60	1253292	MFSA Columbia River	Enforcement Final	Spills			
61	1342693	LEWIS COUNTY JAIL	Underground Storage Tank	Toxics			Y
62	1346639	ALASKA PACFIIC POWDER CO CHEHALIS	Emergency/Haz Chem Rpt TIER2	Hazardous Waste			
63	1445133	OSBORN DAIRY	Dairy	Water Quality			Y
64	1451927	JOHNSON QUALITY ROCK	Sand and Gravel GP	Water Quality			
65	1634907	KOCH PROPERTY	State Cleanup Site	Toxics			
66	1705108	Maple Water Farm	Dairy	Water Quality	Y		
67	1759295	Alliance Carpet Cushion	Toxics Release Inventory	Hazardous Waste			Y
68	1795886	Northfork Construction Inc	Enforcement Final	Spills			
69	1972223	Robert Feuchter	Non Enforcement Final	Water Reservoir	Y		
70	1998222	CHRIS CHENEY	Non Enforcement Final	Water Reservoir			
71	2066756	SR 508 Emergency Repair Mit	401CZM Project Site	Ecology Action Site			
72	2105675	Javier Dominguez	Enforcement Final	Spills			
73	2422484	Olympic Tug & Barge Columbia River	Enforcement Final	Spills			
74	2519956	WA ECY Meskill Drop Box Staging Area	Recycling	Waste to Resource	Y	Y	
75	2536497	JASON DIX	Non Enforcement Final	Water Reservoir	Y	Y	
76	2567610	ALDERBROOK QUARRY INC	Enforcement Final	Water Quality			
			Sand and Gravel GP	Water Quality			
77	2615349	MACMILLAN REST HOME TAP	State Cleanup Site	Toxics	Y		
78	2717237	Pe Ell Central Office	Emergency/Haz Chem Rpt TIER2	Hazardous Waste	Y	Y	
79	3106166	GUY BAUMAN	Non Enforcement Final	Water Reservoir	Y		
80	3121063	Hill Dairy	Dairy	Water Quality	Y		
81	3129697	FIRE MOUNTAIN FARMS MAINTENANCE FAC	General Permit Storm Water Ind	Water Quality			
			Enforcement Final	Waste to Resource			

FID	DOE Facility ID	Site Name	Type of Point Source	Ecology Program	Within 1/4 Mile River Buffer	Within 100-yr Flood Plain	Within UGA
82	3336951	Chehalis Power LP Generation Facility	Toxics Release Inventory	Hazardous Waste			Y
			Air Qual Local Authority Reg	AIRQUAL			Y
			Emergency/Haz Chem Rpt TIER2	Hazardous Waste			Y
			Industrial SW GP	Water Quality			Y
83	3478711	Level 3 Communications Chehalis 2	Emergency/Haz Chem Rpt TIER2	Hazardous Waste			
84	3780419	GLACIER NORTHWEST CHEHALIS PLANT	Toxics Release Inventory	Hazardous Waste			Y
			Emergency/Haz Chem Rpt TIER2	Hazardous Waste			Y
			Sand and Gravel GP	Water Quality			Y
			Underground Storage Tank	Toxics			Y
			State Cleanup Site	Toxics			Y
			Voluntary Cleanup Sites	Toxics			Y
85	3970661	WA DOT I5 Rush Rd to 13th St	401CZM Project Site	Ecology Action Site	Y	Y	
		(Note: Project is complete, 2011.)	Non Enforcement Final	Ecology Action Site	Y	Y	
86	4053632	DANIEL CRISCOLA	Non Enforcement Final	Water Reservoir			
87	4129347	NEWAKUM VALLEY GOLF COURSE	Non Enforcement Final	Water Reservoir	Y		
88	4253285	ABX AIR AIRBORNE EXPRESS WWH	General Permit Storm Water Ind	Water Quality			Y
			Minor Industrial	Water Quality			Y
89	4411187	Elmer Cook	Enforcement Final	Spills			
90	4426366	Business Enterprises Unlimited Inc	Dairy	Water Quality	Y		
91	4628664	John & Mary Mallonee Dairy	Dairy	Water Quality	Y		
92	4688227	CLARY LUMBER CO	State Cleanup Site	Toxics			
			Industrial SW GP	Water Quality			
93	4882102	Doelman Curtis Dairy	Dairy	Water Quality	Y	Y	
94	5090679	DEAN & VIOLA HAMILTON	Non Enforcement Final	Water Reservoir			
95	5199325	360NETWORKS AMPLIFICATION FAC CHEHALIS	Emergency/Haz Chem Rpt TIER2	Hazardous Waste			
			Emergency/Haz Chem Rpt TIER2	Hazardous Waste			
96	5246439	NATIONAL FROZEN FOODS REPACK CORP	Emergency/Haz Chem Rpt TIER2	Hazardous Waste			Y
			Enforcement Final	Water Quality			Y
			Industrial IP	Water Quality			Y
			Industrial SW GP	Water Quality			Y
97	5343293	GARY HOLGATE	Underground Storage Tank	Toxics			Y
98	5350746	CRESLINE NORTHWEST LLC	Industrial IP	Water Quality			Y
			Industrial SW GP	Water Quality			Y

FID	DOE Facility ID	Site Name	Type of Point Source	Ecology Program	Within 1/4 Mile River Buffer	Within 100-yr Flood Plain	Within UGA
99	5628017	IMPERIAL FABRICATING CO CHEHALIS	Emergency/Haz Chem Rpt TIER2	Hazardous Waste			Y
			Industrial SW GP	Water Quality			Y
100	5706820	TIM BOWERS PROPERTY	State Cleanup Site	Toxics			
101	5930594	Rush Road Development	401CZM Project Site	Ecology Action Site			
			Non Enforcement Final	Ecology Action Site			
102	6029991	JOESPH BALMELLI - Dairy	Non Enforcement Final	Water Reservoir	Y		
103	6171496	ANDREW & LINDA STYGER	Dairy	Water Quality			
104	6184334	JACKPOT STATION 385	Underground Storage Tank	Toxics			Y
105	6226476	Level 3 Communications Chehalis 3	Emergency/Haz Chem Rpt TIER2	Hazardous Waste			
106	6424090	BALMELLI FAMILY LTD PARTNERSHIP - Dairy	Non Enforcement Final	Water Reservoir	Y		
107	6496113	Lester Creek Dam	Dam Site	Water Reservoir			
108	6585978	DARYL GERMANN FARMS	Dairy	Water Quality			
109	6760508	SKIP & JULIE VOETBERG	Non Enforcement Final	Water Reservoir			
110	6785917	WILLIAM WOOTON	Non Enforcement Final	Water Reservoir	Y		
111	6802807	Onalaska Drop Box	Recycling	Waste to Resource			
112	6826421	BUFFORD LAWSON	Non Enforcement Final	Water Reservoir	Y		
113	6878779	CHEHALIS CARDLOCK	Underground Storage Tank	Toxics			
			Industrial SW GP	Water Quality			
114	7429066	Kesting Dairy Inc	Dairy	Water Quality			
115	7457884	CENTURYTEL CURTIS	Emergency/Haz Chem Rpt TIER2	Hazardous Waste	Y	Y	
116	7586652	Doelman Chehalis Dairy	Dairy	Water Quality	Y	Y	
117	7703608	Sun Ton Dairy	Dairy	Water Quality	Y		
118	8595768	Rush Road Extension	401CZM Project Site	Ecology Action Site			Y
			Non Enforcement Final	Ecology Action Site			Y
119	8649410	BOISFORT VALLEY WATER CORPORATION	Non Enforcement Final	Water Reservoir			
120	8810012	RAY JOHNSTON	Non Enforcement Final	Water Reservoir	Y		
121	8817759	WEYERHAEUSER CO OFFICE PROPERTY	LUST Facility	Toxics	Y	Y	Y
			Underground Storage Tank	Toxics	Y	Y	Y
			Emergency/Haz Chem Rpt TIER2	Hazardous Waste	Y	Y	Y
122	9207593	NOW TRUCK STOP	State Cleanup Site	Toxics			
123	9524376	HARMON PROPERTY	State Cleanup Site	Toxics	Y		
124	9540653	PETE F DE YOUNG DAIRY	Dairy	Water Quality			
125	9554002	ROGER SCHANG	Non Enforcement Final	Water Reservoir	Y		
126	9803253	REED PROPERTY	State Cleanup Site	Toxics			Y

FID	DOE Facility ID	Site Name	Type of Point Source	Ecology Program	Within 1/4 Mile River Buffer	Within 100-yr Flood Plain	Within UGA
127	9811992	LEWIS COUNTY WATER DIST NO 2	Enforcement Final	Waste to Resource			
			Enforcement Final	Water Quality			
			Municipal IP	Water Quality			
			Biosolids	Waste to Resource			
128	9893012	B & P Dairy	Dairy	Water Quality	Y		
129	9968638	PRYOR GIGGEY CO	Toxics Release Inventory	Hazardous Waste			Y
			Industrial SW GP	Water Quality			Y
130	9986210	SR 508 Emergency Repair Mitigation	401CZM Project Site	Ecology Action Site			
			Non Enforcement Final	Ecology Action Site			
131	11511688	National Frozen Foods Corp	Hazardous Waste Generator	Hazardous Waste			Y
132	11754555	WA DOT ZELLER PROPERTY	Underground Storage Tank	Toxics	Y		
			LUST Facility	Toxics	Y		
133	12479761	UPS Chehalis	Hazardous Waste Generator	Hazardous Waste			Y
			Industrial SW GP	Water Quality			Y
134	13252812	JANICE COX	Underground Storage Tank	Toxics			
			LUST Facility	Toxics			
135	13571948	INLAND MARKET	Underground Storage Tank	Toxics			
			State Cleanup Site	Toxics			
			Voluntary Cleanup Sites	Toxics			
			Enforcement Final	Toxics			
136	15579632	FREY PROPERTY	Underground Storage Tank	Toxics			
137	16597985	WA DOT Chehalis Maintenance Facility	Emergency/Haz Chem Rpt TIER2	Hazardous Waste	Y		
138	16997539	NAPAVINE SCHOOL DIST 14	Underground Storage Tank	Toxics			
139	17392422	BRENDAS COUNTRY MARKET	Underground Storage Tank	Toxics	Y	Y	
140	17843758	French Cleaners Chehalis	Emergency/Haz Chem Rpt TIER2	Hazardous Waste			Y
141	17851175	PE ELL MINI MART	Underground Storage Tank	Toxics			
142	18456994	LEWIS COUNTY UST 12399	Underground Storage Tank	Toxics			Y
			Hazardous Waste Generator	Hazardous Waste			Y
143	19684758	Larson Dairy	Dairy	Water Quality		Y	
			Non Enforcement Final	Water Reservoir		Y	
144	21581514	Foseco Inc	Emergency/Haz Chem Rpt TIER2	Hazardous Waste			Y
			Toxics Release Inventory	Hazardous Waste			Y
			Toxics Release Inventory	Hazardous Waste			Y
			Hazardous Waste Generator	Hazardous Waste			Y

FID	DOE Facility ID	Site Name	Type of Point Source	Ecology Program	Within 1/4 Mile River Buffer	Within 100-yr Flood Plain	Within UGA
145	22529455	Greenbrier Rail Services	Hazardous Waste Generator	Hazardous Waste			Y
			Industrial SW GP	Water Quality			Y
			Enforcement Final	Water Quality			Y
146	23134466	DOWNEYS SUBARU	Underground Storage Tank	Toxics			Y
147	26338351	CHEHALIS LAM INC	Emergency/Haz Chem Rpt TIER2	Hazardous Waste			Y
			Hazardous Waste Generator	Hazardous Waste			Y
			Enforcement Final	Spills			Y
148	27413953	AUSTIN POWDER CO	Emergency/Haz Chem Rpt TIER2	Hazardous Waste	Y		
149	31298872	WEYERHAEUSER WA TRUCK OPERATIONS	Emergency/Haz Chem Rpt TIER2	Hazardous Waste			Y
		(Note: Currently Tyle Equip. Rentals, 2011.)					
150	31322271	Quali Cast Inc A Div of Atlas Foundry	Toxics Release Inventory	Hazardous Waste			Y
			Emergency/Haz Chem Rpt TIER2	Hazardous Waste			Y
			Industrial SW GP	Water Quality			Y
			Hazardous Waste Generator	Hazardous Waste			Y
151	31446544	Qualex Inc	Industrial IP	Water Quality			Y
152	34254664	PPG Industries Inc Chehalis	Emergency/Haz Chem Rpt TIER2	Hazardous Waste			Y
153	34486189	QWEST COMMUNICATIONS CO NAPAVINE	Emergency/Haz Chem Rpt TIER2	Hazardous Waste			
154	36379963	Klein Bicycles Corp	Emergency/Haz Chem Rpt TIER2	Hazardous Waste	Y		
155	37191343	Follette Dam	Dam Site	Water Reservoir			
156	37389283	WALSH DOUBLE DIAMOND RANCH	Dairy	Water Quality	Y	Y	
157	39118225	CASCADE HARDWOOD LLC	Air Qual Local Authority Reg	AIRQUAL			Y
			Voluntary Cleanup Sites	Toxics			Y
			Industrial SW GP	Water Quality			Y
158	43754785	AMERICAN CROSSARM & CONDUIT CO	Underground Storage Tank	Toxics		Y	Y
159	44481543	WA DOT Chehalis William	LUST Facility	Toxics			Y
160	44675548	PLEASANT VALLEY AREA 3	Sand and Gravel GP	Water Quality			
161	47445233	ALLENS GROCERY	Underground Storage Tank	Toxics			
			State Cleanup Site	Toxics			
162	49366643	Aristocratic Cabinets Inc Chehalis	Hazardous Waste Generator	Hazardous Waste			Y
			Hazardous Waste Planner	Hazardous Waste			Y
			Industrial SW GP	Water Quality			Y
163	49951617	MARKET ST MARKET	Underground Storage Tank	Toxics			Y
			LUST Facility	Toxics			Y
164	51685491	DESKINS DAIRY	Dairy	Water Quality			

FID	DOE Facility ID	Site Name	Type of Point Source	Ecology Program	Within 1/4 Mile River Buffer	Within 100-yr Flood Plain	Within UGA
165	51976976	SHELTON LAM & DECK	Industrial SW GP	Water Quality			Y
166	53198956	LINCOLN PROPERTY	LUST Facility	Toxics	Y		
167	55172369	COAL CREEK SITE	LUST Facility	Toxics			
			Underground Storage Tank	Toxics			
168	55615446	ADNA GROCERY	Underground Storage Tank	Toxics	Y		
			State Cleanup Site	Toxics	Y		
169	55886223	Lewis Cnty Central Shop	State Cleanup Site	Toxics			
			Underground Storage Tank	Toxics			
			Enforcement Final	Toxics			
170	57847147	LEWIS COUNTY CAR POOL	LUST Facility	Toxics			Y
			Underground Storage Tank	Toxics			Y
171	57914337	WEST COAST MILLS UST 497002	Underground Storage Tank	Toxics			Y
172	58393465	DOTY GENERAL STORE	Underground Storage Tank	Toxics	Y		
173	59292584	AMERIGAS CHEHALIS	Emergency/Haz Chem Rpt TIER2	Hazardous Waste			Y
174	59922731	WEYERHAEUSER CO PE ELL	Emergency/Haz Chem Rpt TIER2	Hazardous Waste	Y		
			Industrial IP	Water Quality	Y		
			Industrial SW GP	Water Quality	Y		
175	61299173	CURTIS GENERAL STORE	Voluntary Cleanup Sites	Toxics	Y	Y	
176	61797592	DASHMESH PETROLEUM	Underground Storage Tank	Toxics		Y	
177	62871853	RUSH ROAD TRAVEL CENTER	Underground Storage Tank	Toxics	Y	Y	
		(Note: Being demolished, 2011.)					
178	63722174	FERRELLGAS CHEHALIS	Emergency/Haz Chem Rpt TIER2	Hazardous Waste			Y
179	65762992	WA STATE PATROL BAW FAW	Underground Storage Tank	Toxics			
180	66967357	OLD GRADER SHOP	Underground Storage Tank	Toxics			
181	68742314	LEWIS COUNTY UNION SHOP	Underground Storage Tank	Toxics	Y	Y	
			Sand and Gravel GP	Water Quality	Y	Y	
182	73187952	CHEHALIS SCHOOL DISTRICT 302	LUST Facility	Toxics		Y	Y
			Underground Storage Tank	Toxics		Y	Y
183	74687269	USWCOM Napavine Co	Emergency/Haz Chem Rpt TIER2	Hazardous Waste			
184	74941111	Arco 4371	Underground Storage Tank	Toxics		Y	Y
185	74959386	Conrad Industries	Emergency/Haz Chem Rpt TIER2	Hazardous Waste			Y
			Industrial SW GP	Water Quality			Y
			Industrial IP	Water Quality			Y
			Energy Recovery	Waste to Resource			Y

FID	DOE Facility ID	Site Name	Type of Point Source	Ecology Program	Within 1/4 Mile River Buffer	Within 100-yr Flood Plain	Within UGA
186	74997943	WA DOT UST 6683	Underground Storage Tank	Toxics		Y	
187	75867481	Claquato Farms Inc	Dairy	Water Quality			
188	76334979	Providence Centralia Hospital	Emergency/Haz Chem Rpt TIER2	Hazardous Waste			Y
			Underground Storage Tank	Toxics			Y
			Hazardous Waste Generator	Hazardous Waste			Y
189	79784917	Centralia Coal Mine Pond 46 Dam	Dam Site	Water Reservoir			
190	81384988	Carlisle Lake Dam	Dam Site	Water Reservoir			
191	81654784	Ethan Allen Farms	Dairy	Water Quality		Y	
			CAFO GP	Water Quality		Y	
192	83451612	WORLDCOM CHEHALIS	Emergency/Haz Chem Rpt TIER2	Hazardous Waste	Y		
193	83483826	NORTHWEST ENERGETIC SVS CHEHALIS	Emergency/Haz Chem Rpt TIER2	Hazardous Waste			
194	84653941	ANNE J BROWN DBA BROWN MORTUARY SVC	Underground Storage Tank	Toxics			Y
195	87318335	WEST COAST OIL CO PACIFIC PRIDE	Underground Storage Tank	Toxics			Y
196	92683143	ROSBURG MIDDLE SCHOOL	Underground Storage Tank	Toxics	Y		
197	93652375	RUSH ROAD SHELL	Underground Storage Tank	Toxics			
			LUST Facility	Toxics			
			Voluntary Cleanup Sites	Toxics			
198	93988422	Silverado Waterski Pond	Dam Site	Water Reservoir		Y	
199	97631448	INTERSTATE CHEVRON FOOD MART	Underground Storage Tank	Toxics		Y	Y
200	99131648	QWEST Chehalis Co	Emergency/Haz Chem Rpt TIER2	Hazardous Waste			Y
201	25692844	DOTY GARAGE TOWING	Underground Storage Tank	Toxics	Y		

City of Centralia

North Fork River Intake

Chehalis River Intake

See Figure 8-2

City of Napavine

Legend

- Potential Contiminant Source
- River Intake
- WWTP
- Northfork Intake Watershed
- Chehalis Intake Watershed
- WRIA 23
- Highway
- Road
- railroad
- Adjacent City
- Chehalis City Limits
- Chehalis UGA
- 100 Year Flood Plain
- 1/4 Mile River Buffer

Figure 8-1
Inventory of Potential Contaminant Sources

CITY OF CHEHALIS
WATER SYSTEM PLAN

N

0 10,000 20,000 40,000 Feet

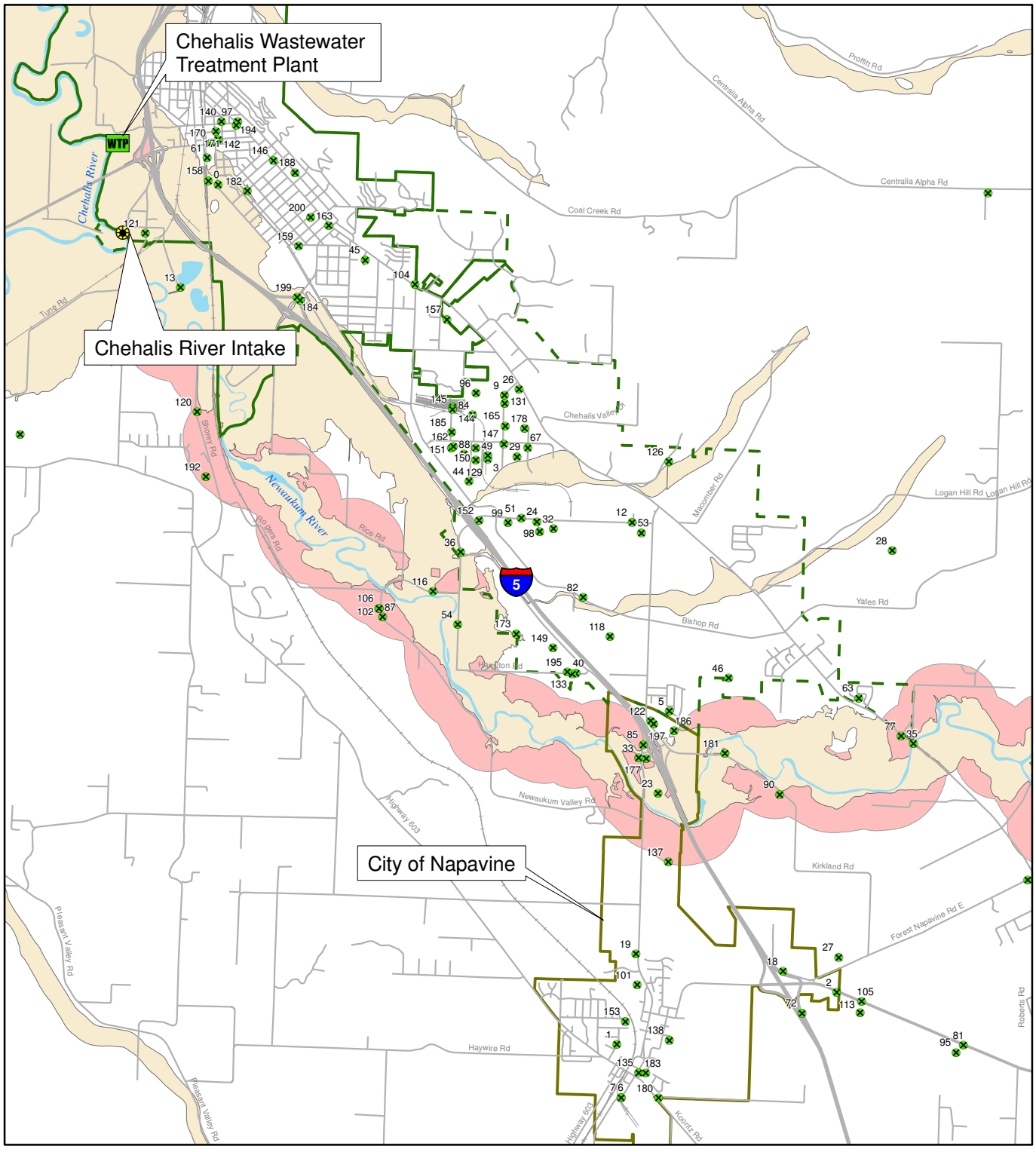


Figure 8-2
Inventory of Potential Contaminant Sources - UGA

CITY OF CHEHALIS
WATER SYSTEM PLAN

Legend

- Potential Contiminant Source
- River Intake
- WWTP
- 100 Year Flood Plain
- 1/4 Mile River Buffer
- Highway
- Road
- railroad
- Adjacent City
- Chehalis City Limits
- Chehalis UGA

N

0 1,250 2,500 5,000 Feet

Section 9
Water Quality

9. Water Quality

9.1. Introduction and Approach

This section reviews current state and federal drinking water quality regulations to assess Chehalis' compliance with these regulations between 2004 and 2008, based on water quality data and information provided by the City. In addition, this section describes Chehalis' efforts in responding to customer complaints and to conduct additional monitoring for the purpose of customer acceptability. Finally, this section reviews proposed and future possible regulations and Chehalis' needs in planning for future compliance.

The review includes the following:

- System overview
- Review of source water quality
- Framework for regulating drinking water quality
- Water quality regulations and compliance
- Certified laboratories used for sample analysis
- Response to customer complaints
- Water quality monitoring conducted for customer acceptability
- Regulations in effect after 2005 and anticipated regulations
- Summary of Chehalis' monitoring requirements

9.2. System Overview and Water Quality Compliance Responsibility

The City of Chehalis has two sources of supply: the North Fork of the Newaukum River and the Chehalis River. The Newaukum River provides the majority of the City's supply and is augmented with water from the Chehalis River intake during peak use periods. The City treats this water at the Water Filtration Plant (WFP) through conventional treatment process consisting of coagulation, flocculation, sedimentation, filtration, and addition of chlorine (to provide disinfection and a disinfectant residual in the transmission and distribution systems). The plan also provides pH adjustment/control and fluoridation (for dental health).

As a Group A public water systems, the City is required to follow Chapter 246-290 WAC that 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 various contaminants are below 50% of the MCL for that contaminant.

9.3. Drinking Water Regulatory Framework

Washington State drinking water suppliers are subject to both federal and state drinking water regulations. At the federal level, the Safe Drinking Water Act (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 9-1 presents a list of federal drinking water regulations that have been developed as part of the SDWA and amendments that are currently in effect between 2004 and 2009, which is the period under review for this Water System Plan (WSP) update. Additional regulations that are recently being promulgated and anticipated to become effective in future are discussed later in this chapter.

The Washington State 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 Washington State law incorporating federal drinking water requirements is Washington Administrative Code (WAC) 246-290 - Group A Public Water Systems. The City of Chehalis 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 9-1 Effective Federal Drinking Water Regulations Applicable to Chehalis

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.

9.4. Overview of Drinking Water Regulations and Chehalis' Compliance

The regulations listed in Table 9-1 have been incorporated into WAC 246-290. The descriptions of these regulations have been organized to reflect how they apply to Chehalis' 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 following sub-sections describe Chehalis' compliance with state and federal regulations between 2004 and 2008.

9.4.1. 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 uses 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 required 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.

Chehalis' Status

Chehalis 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.

Chehalis operates their filtration plant to meet the 0.1 NTU criteria and easily meets the IESWTR turbidity requirement of less than 0.3 NTU in 95 percent of measurements each calendar month for systems with direct filtration and has not exceeded the maximum allowable turbidity level of 1.0 NTU.

A review of turbidity performance summaries from 2007 to 2009 shows that average finished water turbidity is typically less than 0.06 NTUs. Chehalis receives a 2.5-log removal credit for *Giardia* and 2.0-log removal credit for *Cryptosporidium* for filtration at a rate up to 6 gallons per minute per square foot (gpm/ft^2). The data show that the City has very high inactivation ratios and contact times and all monthly finished turbidity readings are below 0.1 NTU.

With respect to disinfectant residual, Chehalis continuously monitors disinfection residual, chlorine at the distribution system entry point to ensure it stays above 0.2 mg/L, and at sites throughout the distribution system to ensure the presence of a disinfectant residual. A Chem-Trac chlorine analyzer is used to monitor the chlorine levels and alerts the operator at the plant if the levels drop below 0.2-mg/L free chlorine. This data is monitored through the SCADA system that controls the treatment plant. The lowest residual for the 24-hour period is part of the monthly Surface Water Treatment Rule report.

The City is required to maintain a detectable residual throughout the distribution system or collect heterotrophic bacteria cultures (HPC). This is to be done daily unless approved by DOH. At a minimum, Chehalis is also required to measure a residual at the same time and location of routine or repeat total coliform samples. Between 2004 and 2009, Chehalis' disinfectant residual sampling, which was conducted at the same sites and times as total coliform monitoring, has indicated the presence of a disinfectant residual in all samples.

Chehalis had no treatment technique violations between 2004 and 2009 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 will bolster existing regulations and provide a higher level of protection of your drinking water supply by:

- Targeting additional Cryptosporidium treatment requirements to higher risk systems
- Requiring provisions to reduce risks from uncovered finished water storage facilities
- Providing provisions to ensure 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 will be 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).

Chehalis' Status

The City has submitted *E. coli* monitoring data collected between August 2005 and September 2007. These data were provided in lieu of collecting source monitoring data to comply with LT2SWTR and were approved for the purpose of grandfathering. Based on the results, the City's initial bin classification is Bin 1.

Chehalis initiated the monitoring program for *Cryptosporidium* in April 2010. The sampling location is just upstream of river intake at the Chehalis River. Sampling will continue until March 2012, taking one sample every month. The samples were collected and analyzed using USEPA method 1623. In April, two samples were collected and analyzed. *Cryptosporidium* was not detected in those samples. The monitoring will be conducted to determine whether Chehalis would need to add any treatment under the proposed LT2. The monitoring will continue to develop data that could be grandfathered for compliance with the initial monitoring requirement of the LT2 Rule. Table 9-2 provides a schedule of the LT2 Rule requirements for Chehalis.

Table 9-2 Timeline for Chehalis' LT2 Compliance

Milestone	Date (for Schedule 4 Water System)
Final LT2 Rule is issued	January 4, 2006
Submit *E. coli* monitoring results for data to have grandfathered	December 1, 2008
Uncovered finished water storage facilities must be covered or implement additional treatment	April 1, 2009
Must begin 12 or 24 months of source water monitoring for *Cryptosporidium*	April 2010
Complete initial round of source water monitoring for *Cryptosporidium*	March 2012
Submit bin classification	September 2012
System must install and operate additional treatment in accordance with their bin classification	September 30, 2014
Begin second round of monitoring for *E. coli* and re-assess bin classification	October 1, 2017
Begin second round of monitoring for *Cryptosporidium* and re-assess bin classification	April 1, 2019

9.4.2. 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 9-3 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 9 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 3 years after treating the water and before it enters the distribution system, unless DOH issues waivers. Table 9-4 lists the SOCs and MCLs.

Table 9-5 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.

Chehalis' Compliance Status

Inorganic Chemicals (IOCs)

Chehalis' monitoring results for inorganic chemicals are compared to the regulatory requirements in Table 9-3. Chehalis monitors these parameters once every three years. The table shows results of the samples collected from 2006 through 2009. As shown, none of these parameters exceeded the MCL.

With respect to asbestos, Chehalis needs to monitor one sample every 9 years from distribution system. Chehalis conducted monitoring in 2003 and will conduct the next round of monitoring in 2012.

Synthetic Organic Chemicals (SOCs)

SOCs include testing for herbicides (test method 515.1), pesticides (test method 525.2), carbamates (test method 531.1) and paraquat (test method 549). 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. In 1995 through 1996 the City reported several positive synthetic organic chemical analysis results several of which were false positives and should not have been reported. Later in 1997 and 2000, samples from the Newaukum River (S01) found no detection of synthetic organic chemicals. From 2002 through 2004 the City had sampling waiver on SOC's. From 2004 through 2009, the monitoring schedule was 2 sample(s) every 3 years for both Newaukum River (S01) and Chehalis River (S02). In 2009 DOH granted waivers for sampling herbicides and insecticides (paraquat and carbamates) through December 2010 for both sources. However, for general pesticides the sampling schedule remained 2 sample(s) for every 3 years. The samples taken at the Main Reservoir (multiple sources) in 2007 and 2009 and at High Level Pumphouse (for S01) in 2009 were tested for pesticides (PEST1) and all results were non-detect (ND).

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 1 per 3 years unless the City has detection, then the frequency becomes quarterly with an annual review. After 3 years without detection, the City would be eligible for 1 sample per 3 years again. This frequency is currently to collect one sample every three years for both Newaukum River (S01) and Chehalis River (S02). Chehalis River water is added only during summer months to supplement Newaukum River water during peaking period. A blended sample of both sources is, therefore, collected for Chehalis River water.

Chehalis has conducted the required annual VOC monitoring. For the Newaukum River, water samples were collected annually in September through November months. To monitor Chehalis River water (S02), one blended sample of multiple sources (S01+S02) were collected annually in summer months (June through August). Results are shown in

Table 9-5; all samples have had undetectable levels of VOCs.

Table 9-3 Primary Inorganic Chemicals - Regulatory Levels and Chehalis' Monitoring Results

Parameter	MCL	Units	Observed Range (2004 – 2009)
EPA Regulated			
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)	N/A
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	0.8 – 1.0 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)	0.3 – 2.3 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	.05	mg/L	<0.001 mg/L
Silver	0.1	mg/L	<0.001 mg/L
Chloride	250	mg/L	4-5 mg/L
Sulfate	250	mg/L	<1 mg/L
Zinc	5	Mg/L	<0.2 mg/L
STATE Regulated			
Hardness	NA	mg/L	32-36 mg/L
Conductivity	700	Umhos/cm	68-85
Sodium	NA	mg/L	<5 mg/L

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 9-4 Synthetic Organic Chemicals - Regulatory Levels and Chehalis' Monitoring Results

Parameter (EPA Regulated)	MCL (mg/L)	Chehalis' Monitoring Results - Range Shown for 2004 – 2009
Alachlor (Lasso)	0.002	ND
Aldicarb (Temik) (2)	Not Applicable	Not Analyzed
Aldicarb sulfone (2)	Not Applicable	Not Analyzed
Aldicarb sulfoxide (2)	Not Applicable	Not Analyzed
Atrazine	0.003	ND
Benzo[a]pyrene	0.0002	ND
Carbofuran (1)	0.04	Not Analyzed
Chlordane	0.002	ND
2,4-D	0.07	Not Analyzed
Dalapon	0.2	Not Analyzed
Di(2-ethylhexyl)adipate	0.4	ND
Di(2-ethylhexyl)phthalate	0.006	ND
Dibromochloropropane (1)	0.0002	Not Analyzed
Dinoseb	0.007	Not Analyzed
2,3,7,8-TCDD (Dioxin) (1)	$3x10^{-8}$	State waiver through Dec 2010
Diquat (1)	0.02	State waiver through Dec 2010
Endothall (1)	0.1	State waiver through Dec 2010
Endrin	0.002	ND
Ethylene dibromide (1)	0.00005	State waiver through Dec 2010
Glyphosate[1] (Rodeo, Round-up)	0.7	State waiver through Dec 2010
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	Not Analyzed
Pentachlorophenol	0.001	ND
Picloram	0.5	Not Analyzed
Polychlorinated biphenyls	0.0005	Not Analyzed
Simazine	0.004	ND
Toxaphene	0.003	ND
2,4,5-TP (Silvex)	0.05	Not Analyzed

NA = Not applicable
ND = Not detected
(1) Waived until December 2010.

Table 9-5 Volatile Organic Chemicals - Regulatory Levels and Chehalis' Monitoring Results

Parameter	Units	MCL	Observed Range (2004-2008)
1,1 – Dichloroethylene	mg/L	0.007	ND[1]
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

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.

Chehalis' Compliance Status

Current monitoring frequency for radium 228 is 1 sample every three years for radium-228 and gross alpha particle activity. The City has to monitor raw water from both the Newaukum and Chehalis Rivers.

Samples collected on October 18, 2007 at the Main Reservoir after treatment and on June 28, 2007 at High Level Pumphouse – leaving the Main Reservoir were tested for Radium 228. Another sample was collected on July 27, 2006 at the water treatment plant after treatment but before the Main Reservoir and tested for Gross Alpha and Radium 228. All of these initial samples indicated non-detectable levels of these radiological parameters. Because the level of gross alpha emitters was below 15 pCi/L, Chehalis was not required to monitor uranium levels. The City maintained compliance with these monitoring requirements and associated MCLs between 2004 and 2009.

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 years of 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.

Chehalis' Status

Chehalis' IOC monitoring has not found detectable levels of arsenic in the source of supply. Compliance with the lower arsenic MCL should not present a problem.

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.

Chehalis' Status

As a system that supplies less than 10,000 people, Chehalis was required to conduct monitoring for 10 "list 1" contaminants for 12 months during 2008 to 2010. The City has initiated a monitoring program since 2009. Samples are taken at the entry point to the water treatment plant.

Table 9-6 UCMR2 Monitoring Results (data from 2009)

Parameter	Reported Value (ug/L)
BDE-100	<0.5
BDE-153	<0.8
BDE-47	<0.3
BDE-99	<0.9
Dimethoate	<0.7
HBB	<0.7
Terbufos sulfone	<0.4
1,3-dinitrobenzene	<0.8
RDX	<1.0
TNT	<0.8

Note: Reported values less than the Minimum Reporting Level (MRL) are displayed with a less than sign (<) and the MRL.

9.4.3. 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.

Chehalis' Status

The City is required to collect a minimum of 10 samples per calendar month. These samples, analyzed for total coliform, must be collected at locations representative of each pressure zone. Chehalis has been in compliance with the TCR for the 2005 to 2009 period. No positive total coliform samples were found. Chehalis' monitoring plan meets DOH requirements with respect to content included in the plan.

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) TTHM 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. The 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 disinfection byproducts (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 opportunity 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. The following table, also called the "3-by-3 matrix," shows these TOC removal percentages:

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%

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 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 and 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."

Chehalis' Status

Chehalis chlorinates at the inlet and outlet of the filtration treatment plant and rechlorinates at the Centralia/Alpha pump station. The City currently collects quarterly 2 samples – one from the main pressure zone and another one from Centralia/Alpha pressure zone representing maximum residence time and tests for TTHMs and HAAs.

Table 9-7 summarizes Chehalis' DBP monitoring results. Since initiating monitoring in 2004, the City has been in compliance with the Stage 1 D/DBP Rule.

Table 9-7 Stage 1 D/DBP Rule – Regulatory Levels and Chehalis' Monitoring Results (2004 to 2009)

Parameter	Units	MCL	RAA 2004	RAA 2005	RAA 2006	RAA 2007	RAA 2008	RAA 2009
Main Pressure Zone								
TTHM	µg/L	80	41	51	38	49	48	56
HAA5	µg/L	60	16	22	28	28	30	36
Centralia/Alpha Pressure Zone								
TTHM	µg/L	80	51	58	66	75	56	72
HAA5	µg/L	60	23	17	43	39	31	40

The City also monitors Total Organic Content (TOC) of raw water and finished water. Table 9-8 summarizes Chehalis' raw water TOC. Both raw water and finished water TOC is less than 2.0 mg/L (based on a running annual average). Therefore, the system is not required to remove TOC since they can meet "alternative compliance criteria" listed earlier in this section.

Table 9-8 Raw Water TOC (2004 to 2009)

Parameter	Units	RAA 2004	RAA 2005	RAA 2006	RAA 2007	RAA 2008	RAA 2009
Raw Water TOC	mg/L	1.41	1.07	1.1	1.22	1.04	1.23

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:

   $$TTHM \leq 40\ \mu g/L$$
   $$HAA5 \leq 30\ \mu g/L$$

   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.

Chehalis' Status

Chehalis does not meet the criteria for the Very Small System Waiver or 40/30 certification due to its system size and DBP monitoring results, respectively. Chehalis serves a population less than 10,000 people and as a Schedule 4 Water System will continue to meet the compliance schedule shown in Table 9-9.

Table 9-9 Timeline for Chehalis' Stage 2 DBP Compliance

Milestone	Date
Final Stage 2 DBP Rule is issued	January 4, 2006
IDSE Plan due to primary agency	April 1, 2008
Complete IDSE standard monitoring	March 31, 2010
Prepare and submit IDSE Report	July 1, 2010
Revise DBP monitoring plan	October 1, 2013
System must begin complying with rule requirements	July 2014

Compliance with the Stage 2 DBPR will be a complex process and will likely require significant planning and resources. Chehalis selected the standard monitoring plan (SMP) approach for the IDSE requirements of the rule and has recently completed and submitted its IDSE monitoring plan under the Stage 2 Rule.

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 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 9-10 provides a summary of the LCR revisions.

Table 9-10 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	• Require 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	• Require 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	• Require utilities to reconsider previously "tested-out" lead service lines when resuming lead service line replacement programs.

Chehalis' Status

In 1992, Chehalis collected forty samples for the initial lead and copper monitoring. The second "round" of samples in 1993 was also forty samples. The first reduced monitoring was twenty samples in 1994 and second (20) in 1995. After this period, Chehalis was granted a reduced monitoring approval of 20 samples each three years. Tap sample results collected by Chehalis in 2005, 2008, are presented in Table 9-11. This table demonstrates that Chehalis is in compliance with LCR requirements. The next set of data will be collected between January 2009 and December 2011.

Table 9-11 Lead and Copper – Regulatory Levels and Chehalis' Monitoring Results

Parameter		90th Percentile Results					
	MCL (mg/L)	2002 (mg/L)	2004 (mg/L)	2005 (mg/L)	2006 (mg/L)	2007 (mg/L)	2008 (mg/L)
Lead	0.015	0.006		0.0008	0.0008	<0.002	<0.002
Copper	1.3	0.050		0.12	0.12	0.060	0.03

9.4.4. 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.

Chehalis' Status

Chehalis did not have any MCL violations and has not needed to issue a public notification during the period of 2004 to 2009. CCRs are distributed on an annual basis.

9.5. 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 9-12 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 9-12 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 2010	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.

Chehalis' Status

The City will need to 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 issue 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 2010.

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).

Chehalis' Status

It is likely that any developments with either rule will have an impact on Chehalis. Revisions to the TCR are intended to reduce monitoring and reporting burdens while maintaining current levels of public health protection. Any developments with either rule will likely have some impact on the City. 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.

9.6. Labs Used for Chehalis' Sample Analyses

Chehalis uses five laboratories to perform water quality testing, including a City of Chehalis laboratory. Except for Lab/Cor, Inc. and Analytical Services, Inc., these laboratories are certified by the DOH drinking water laboratory certification program for analyses methods. Lab/Cor, Inc. and Analytical Services, Inc. have 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

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

State of Washington Department of Health Radiation Laboratory
PO Box 550501
1610 NE 150th St.
Shoreline, WA 98155
Phone: 206-361-2896

Lewis County Environmental Health Laboratory
360 NW. North St. Chehalis WA. 98532.
Phone: (360) 740-1231

Columbia Analytical Services Inc.
1317 South 13th. Ave. Kelso WA. 98626
Phone: (360) 577-7222

9.7. Response to Customer Inquiries and Complaints

The City of Chehalis 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 water filter plant. 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. On occasion a Bacteriological (Bac-T) sample from a customer's home and one close to their water connection off the water system are collected to verify that integrity of the water system. Once the tests are completed, customers are called in and given the results from the Bac-t test.

9.8. Summary of Regulatory Status and Monitoring Requirements

A review of Chehalis' monitoring and compliance procedures and water quality monitoring results indicates that Chehalis was in full compliance with all State and Federal regulations during the review period. Table 9-13 summarizes Chehalis' regulatory status from 2005 to 2009, including regulatory requirements and recommendations for continued compliance.

Table 9-14 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 9-13 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.	Chehalis operates the Water Filtration Plant in a manner to meet removal requirements. Chehalis has met turbidity and chlorine requirements. Chehalis 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.
Unregulated Contaminant Monitoring Rule [1]	Monitor for listed contaminants.	Conducted monitoring as required.	Yes	No longer effective.
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 effective.
Stage 1 D/DBP Rule	Written Plan; Monitoring.	Monitors at two distribution system locations quarterly, has levels below MCL, and has developed a plan.	Yes	Continue with existing monitoring.
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.

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

Table 9-14 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
Cryptosporidium and *E. coli*	LT2 Enhanced Surface Water Treatment Rule	Prior to treatment	24 consecutive months
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	Once in 3 years
Asbestos	Phase II Rule	In distribution system	Once every 9 years
Synthetic organic chemicals	Phase II, V Rules	After treatment	Every 3 years (except for waived SOCs)
Volatile organic chemicals	Phase I, II, V Rules	After treatment	Once in 3 years
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	Eight samples per month as per Coliform Monitoring Plan
Disinfection By-Products (TTHMs and HAA5)	Stage 1 D/DBP	Throughout distribution system	Quarterly 2 samples
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

Section 10
Maintenance and Operations Program

10. Maintenance and Operations Program

This chapter summarizes the programs and procedures used to ensure safe and reliable supply of potable water to the City's customers. It includes a description of water system management and personnel, system operations and control, the emergency response program, safety procedures, and the cross-connection control program.

10.1. Water System Management and Personnel

The Maintenance and Operations (M&O) Program of the Water System is the responsibility of the City of Chehalis and is managed by the Public Works Department. The City, as owner and operator of the water system, has the authority to set policy and rates for the system. Ordinances affecting Public Works and are reviewed and approved by the City Council, but it is the responsibility of the Public Works Department to implement policies and to maintain and operate the water system.

The Chehalis Public Works Department is responsible for the Water System, Sanitary Sewer System, Storm Water System, Street and Transportation Systems and Engineering and Mapping. The Public Works Department employs 31.5 full-time persons, and seasonal help is hired each summer to assist with maintenance and construction work.

Even though the Department's employees have their own specific duties, shifting and sharing of personnel and resources occurs regularly, as priorities and workload requirements dictate. An organizational chart, pertaining to water system, along with roles and responsibilities is provided as Figure 2-1. Water operations can be separated into three "branches" under the direction of the Director. These branches include:

- Water Division
- Engineering Division
- Administrative Support

The responsibilities for the Director and these branches, as they relate to the management of the water system, are described below.

Director

The Director is responsible for ensuring that the mission adopted for the Water Utility is carried out. The Director responsibilities include department administration, developing budgetary requirements, assuring effective performance of the water system, project management, and implementing City ordinances and utility policies regarding water service. The Director provides strategic guidance on regional issues and managing key initiatives for the water system, such as the Capital Improvement Program. Responsibilities also include dissemination of information throughout the utility, across departments and to the public, community relations, public information, purveyor communications, media relations, and employee communications.

Water Division

The Water Division is responsible, under the oversight of the Water Superintendent, for the normal day-to-day operation of the utility. Figure 2-1 shows the Water Division personnel and their roles and responsibilities.

The Water Division provides service to the customers of Chehalis 24 hours per day, 365 days per year. The Division operates, maintains, and improves the source, treatment, and water transmission and distribution system to protect public safety, public health, and the environment. Preventive maintenance is provided by almost all members of the division depending on their areas of expertise.

The Water Treatment Plant Operators are responsible for the operation of the filter plant, monitoring the intake facilities, and share duties with the Water Distribution Specialists including water quality monitoring, meter reading and repair, servicing customer accounts (connections and disconnections), customer service and facilities maintenance. The Water Distribution Specialists also are responsible for water service installation and repair, hydrant and valve testing and maintenance, cross-connection control inspections, customer service, water line repair and pump station operation and maintenance. These two classification share responsibilities as priorities require.

The Water Superintendent is responsible for the Cross-Connection Control Program, trouble shooting and maintenance of electrical and electronic components, circuitry and controls, hydraulic and mechanical repair and recordkeeping.

Engineering Division

The Engineering Division provides technical support for all utility functions. The responsibilities include project engineering, engineering inspection, development review coordination, AutoCAD/GIS/GPS oversight, technical documentation and customer service.

Administrative Support

The administrative support staff provides support for all of Public Works. Their responsibilities include administrative support, accounts payable, billing statements, payments, budget support, receptionist duties, dispatching, correspondence, records management and customer service.

10.2. Operator Certification

Chehalis is committed to meeting the requirements of the Water Works Operator Certification Program administered by the Washington State Department of Health (DOH). Under this program, water systems must employ certified operators to carry out various water system functions as part of their treatment and distribution systems.

Certification Requirements

Chehalis is classified as a “Group A” public water system. The Group A classification requires that Chehalis have certified operators in charge of all active, daily, and technical operations of the water system. In meeting this requirement, Chehalis maintains certified personnel throughout the utility for a variety of water system operations.

A system of Chehalis' size requires a Water Distribution Manager II or greater as the certified operator. The City is further required to have those employees associated with water treatment responsibilities certified as Water Treatment Plant Operator II. The Cross-Connection Control Program requires a certified Cross-Connection Control Specialist I. All personnel in the water division are certified at the level, or higher, appropriate for their responsibilities.

Table 10-1 shows all current water personnel and their certification level.

Table 10-1. Water System Certification Information

Position	Staff Member Name	Certification
Water Treatment Operator II	Gary Cabe	WDS, WTPO 3, WDM 3
Water Treatment Operator I	Chuck Moses	WTPO 3, WDM 3
Water Treatment Operator I	Lloyd Gruginski	WTPO 3
Meter Reader	Kyle Knapp	WDS, WDM 1, CCS
Equipment Maintenance Technician	Frances Landry	WPTO 2, CCs
Water Distribution Operator II	Donald Schmitt	WDM 2
Water Distribution Operator I	Stan Zydek	WDS, WTPO IT, WDM 3, CCS
Water Superintendent	Dave Vasilauskas	WTPO 1, WDM 2, CCS
Water Maintenance/Meter Reader I	John Smith	N/A

Certified operators are either on-site or on-call for all critical water system operations. Chehalis also ensures that certified operators are in charge of all segments of the water system as appropriate

Training

All certified personnel for Chehalis renew their certificates on an annual basis and enhance their professional growth in the field by accumulating at least three college-related credits or continuing education units (CEUs) every three years. Personnel meet the CEU requirements through a combination of state and AWWA sponsored classes. State-sponsored classes include those offered through Washington Environmental Training Resource Center (WETRC). Examples of classes offered through this program include "Chlorination System Operation and Maintenance" and "Basic Electrical" as well as many others.

10.3. System Operations and Control

The purpose of this element of the WSP is to provide a complete understanding of how Chehalis operates its water system. This general description begins with an overview of how Chehalis manages the water supplies from available sources and balances drinking water demands with filter plant capacity. This overview is followed by a general description of how Chehalis operates the filter plant, transmission and distribution system, including identification of major system components, routine system operation, preventive maintenance, and equipment supplies and chemical listings. It is important to note that the system operations and controls described in this section are not hard and fast rules but represent general management guidelines for operating the system.

10.3.1. Management and Operation of Water Supply Sources

Chehalis' water sources consist of surface diversions from the North Fork Newaukum and Chehalis Rivers. Operation of these sources to meet water demands varies with time of year,

hydrologic conditions, water quality and level of water consumption. Management of these resources is the responsibility of Chehalis Filter Plant personnel with oversight from the Water Superintendent.

North Fork Newaukum River

As described earlier, the North Fork intake is in a remote location 17 miles from the City and is the City's primary source of water. A simple weir structure diverts the water through a bar screen where heavy material is removed. The water then passes through a traveling screen and flows by gravity to the filter plant in town. A valve at the inlet to the filter plant controls the volume of flow from the North Fork. The valve at the filter plant is adjusted based on the usage within the system and water level in the main reservoir. The flow from the intake and through the filter plant is kept at as constant a rate as possible by utilizing the storage of the main reservoir as a buffer to system demands. Plant personnel read the flow meter, which is located at the filter plant.

Chehalis River

The Chehalis River intake and pump station are located west of the City Center on the bank of the Chehalis River. The Chehalis is used primarily as a backup to the North Fork and to augment system needs when the supply from the North Fork is insufficient to meet system demands. Filter plant personnel perform the operation of this station. The pumps are manually controlled and require an operator's presence for startup. To ensure its reliability and to purge stagnant water from the transmission line, the Chehalis intake system is operated at least once per month. At the same time, the auxiliary generator is operated under load. During monthly tests and during startup, the water bypasses the filter plant to the Water Treatment Residual Treatment Basin (WTRTB) to purge stagnant water. When used as a source, the pumps are turned on and off manually to meet system demands.

10.3.2. SCADA and Telemetry System

The water system's telemetry system is approximately 80% complete. The Chehalis River Pump Station is scheduled for completion in 2011, and the WTRRB is scheduled to be completed in the near future. The South End Pump Station and the Centralia/Alpha Pump Station have a complete system that transmits station status and alarms to the filter plant during normal working hours and to the alarm center when the plant is not staffed. The Valley View Pump Station and High Level Pump Station are controlled by their respective reservoirs but do not transmit information to a centralized control and data collection system.

10.3.3. Storage Reservoirs

The Main, Kennicott and Yates reservoirs provide storage to the main system. Their overflow elevations are 403, 399 and 403.5, respectively. Water flows from the treatment plant to the Main Reservoir and then into the system. The Kennicott and Yates reservoirs float off the system and help to equalize flows and pressures during high usage periods.

The Kennicott Reservoir overflow is constructed four-feet lower than the other two reservoirs. For this reason, an altitude valve was installed on the inlet of the Kennicott Reservoir to prevent it from overflowing. The altitude valve closes when the Kennicott Reservoir is full, allowing water to only flow out of the reservoir until the water level drops to a predetermined elevation.

Then the altitude opens to allow normal operation until the reservoir is again full. In the past, this situation caused long resident times in the reservoir, which depleted the chlorine residual. However, due to growth and increased usage within the system, turnover in the reservoir has increased and depleted chlorine residual is no longer a problem.

The Kennicott, Yates, and half of the Main Reservoir can be taken out of service for maintenance and inspection without interrupting service. However, half of the Main Reservoir must be on line for the filter plant to continue to operate. Maintenance requirements of these facilities are minimal. The altitude valve at the Kennicott Reservoir needs calibration at least once per year. Reservoirs are inspected regularly to ensure that all hatches are locked and secure, general condition is observed for any signs of vandalism and condition of over flows and vents are evaluated to make sure they are not blocked and that the screens are clean and in place.

10.3.4. Pump Stations

High Level Reservoir and Pump Station

The High Level Pump Station draws water from the outlet of the Main Reservoir prior to the meter and pumps to the High Level system. The output of this station is metered and is recorded at the filter plant. The reservoir has a low-level alarm at the filter plant. There are two pumps in the station but only one pump operates at any one time. The pumps are manually rotated on a monthly basis. The pump is signaled to start when the water in the reservoir drops 4 feet below the maximum level. Routine operation and maintenance of the pump station include cleaning the station, lubrication of pumps, reading and recording all meters, exercising the generator and monitoring its fuel supply, and verifying all control point settings and alarms. The reservoir is inspected regularly to ensure that all hatches are locked and secure, general condition is observed for any signs of vandalism and condition of over flows and vents is evaluated to make sure they are not blocked and that the screens are clean and in place.

Valley View Reservoirs and Pump Station

The Valley View Pump Station draws water from the main system and pumps through a dedicated 4-inch line to the Valley View Reservoirs. The pumps are signaled to start when the reservoir drops 3.5 feet below the maximum level. A new pump station was constructed to be enclosed within an above ground building. The new station includes both flow and hour meters. Meter information along with station status will be transmitted to the filter plant. Routine operation and maintenance of the pump station include cleaning the station, lubrication of pumps, reading and recording all meters, and verifying all control point settings and alarms. The reservoirs are inspected regularly to ensure that all hatches are locked and secure, general condition is observed for any signs of vandalism and condition of over flows and vents is evaluated to make sure they are not blocked and that the screens are clean and in place.

South End Pump Station

This station pumps from the Main Zone and supplies water to users south of the City. The zone has no storage therefore a pump must run continuously. The station has two variable speed pumps that operate off a pressure sensor which is set to maintain 90 psi. The station also includes an auxiliary generator. The station has an alternator, flow and hour meters, and pressure sensors. Pump run status, pump run time, system pressure, and alarms are transmitted to the filter plant. Routine operation and maintenance include cleaning the station,

lubrication of pumps, reading and recording all meters, exercising the generator and monitoring its fuel supply, and verifying all control point settings and alarms.

Centralia/Alpha Pump Station

This station pumps from the South End zone and supplies users along the North Fork Road. The zone has no storage therefore a pump must run continuously. The station has two variable speed pumps that operate off a pressure sensor, which is set to maintain 90 psi. The station also includes an auxiliary generator. The station has a hypochlorinator to maintain chlorine residual. The system monitors incoming chlorine residual and adds chlorine to maintain between a 0.5 and 1 ppm residual. The station has an alternator, flow and hour meters, intrusion alarm, chlorine residual analyzer, and pressure sensors. Pump run status, system pressure, chlorine residual, generator status and alarms are transmitted to the filter plant. Routine operation and maintenance include cleaning the station, lubrication of pumps, servicing & calibrating the chlorine analyzer, refilling chlorine solution, reading and recording all meters, exercising the generator and monitoring its fuel supply, and verifying all control point settings and alarms.

18th St Pump Station

This station was built to replace the Henderson pump station. It includes one pump for the Newaukum raw water supply and three variable speed pumps for finished water. The finished water pumps are a new development to the system which includes three PRV/Check Valve stations that divide the Main Zone when the pump station is operating. Its primary purpose is to boost pressures in the southern portion of the system and increase supply to the Yates Reservoir. The pump station is manually operated but is planned to be fully automated in the future.

10.3.5. Treatment Facilities

The Water Filter Plant, described in detail in Section 2, is operated 24 hours per day 7 days per week and is staffed at least 8 hours per day Monday through Friday. On weekends and holidays, operators perform essential treatment duties, including logging readings, record keeping, backwashing filters, and other operational and maintenance duties as required. During periods when no operating personnel are present, the alarms are forwarded to a 24-hour alarm center which alert on-call personnel.

The water flow into the plant is maintained at a steady rate utilizing the Main Reservoir to buffer the system demand. The current capacity of the plant is 4.8 mgd.

With the exception of the flocculation train, the filter plant has two separate equal capacity treatment trains. This allows routine maintenance and backwashing of filters without shutting down the treatment process.

As water enters the plant, chlorine is added followed by an injection into the flash mixer basin of a flocculent containing poly-aluminum hydroxide. The plant has a 5,000-gallon flocculent storage tank that provides over one year of capacity at average flow and over six months at peak flow. The water then flows to two flocculation basins operating in series where mixing is completed and floc is formed. The pre-settling basin follows the flocculation basin where the heavier sediments are deposited. This basin commonly has three to four inches of sediment buildup. These basins are cleaned semiannually by flushing the sediments out the mud valves.

Next, the water flows to the two sedimentation basins, which operate in parallel and have the ability to be operated independently. These basins also require semiannual cleaning.

The final treatment is provided by two anthracite coal and rapid sand filters operating in parallel. Either filter may be taken out of service while the other remains in use; this essentially divides the capacity in half. The frequency of backwashes relates directly to the turbidity of the water. Backwashes are prompted by filter head loss, reduction in filter flow velocities and turbidity breakthrough caused by the accumulation of captured material on/in the filters. The filters are generally backwashed at a frequency ranging from 48 to 72 hours. However, during high turbidity periods backwashes may be required more often than once every 24 hours. Backwashing is currently triggered and controlled manually by the operator. A project to automate the controls at the Water Filter Plant is designed and will be implemented within this WSP's six-year planning horizon.

Backwashing is accomplished by gravity from two reservoirs located above the plant. Each backwash requires one-half the capacity of the storage facility. The reservoirs are refilled between backwashes by pumping from the clearwell prior to the main reservoir. The backwash water flows by gravity to settling basins about a quarter of a mile from the plant after which the water is released to Coal Creek. The two settling basins are each equipped with decanters and can hold the equivalent of two backwashes.

After the filter, both lime and sodium silicofluoride are added to the water as slurry in the clearwell before being discharged to the reservoir. The plant uses an average of 60 pounds of lime per day. The source is readily available locally and the supply on hand is sufficient to last three to four weeks. The lime feed rate is adjusted manually as dictated by pH tests and flow.

The plant uses an average of 20 pounds per day of sodium silicofluoride. The plant has over a three months supply on hand. The chemical feed equipment is in good condition. Both lime and sodium silicofluoride require specialized respirators and protective clothing for handling. The treatment plant personnel are well versed in the use of this equipment and special handling requirements and the proper MSDS sheets are available and properly posted.

Gas chlorine is used to provide disinfection and is fed to the raw water prior to the flash mixer and again at the clearwell after treatment. Separate equipment is used at each of these locations. The plants average chlorine usage is 33 pounds per day.

The plant utilizes a one-ton cylinder, with two 150-pound cylinders for back up. These cylinders are connected with an automatic scale/switch-over system. The one-ton cylinder is received half full and they are stored outside to comply with chlorine gas storage requirements. This capacity equates to approximately 30 to 60 days of supply on hand depending on the time of year. The plant has a chlorine leak detector/alarm system. The chlorinators are serviced regularly and are in good condition.

Chlorine is highly corrosive and requires special handling. All plant personnel are well training in the handling and operation of the chlorine equipment. A self-contained breathing apparatus is available for emergency use. In addition, a repair kit for both the one-ton and 150-pound cylinders is available onsite. Strict guidelines are posted for handling and emergency procedure should a leak occur.

Laboratory chemicals are needed for a variety of required tests and analyses. Supplies are ordered well in advance, with some chemicals shipped on a routine schedule. Laboratory

equipment includes a pH meter, spectrophotometer, and tabletop turbidimeter. The City has backup lab equipment and access to this equipment at other City facilities. The proper MSDS on all chemicals used are available and properly posted.

The plant has three continually monitoring/recording Hach 1720 turbidimeters, one for each of the filters and one to monitor the water in the clearwell. These units are in good condition and receive regular maintenance and calibration. The plant's chart recorders are being phased out and this function is being incorporated into the SCADA system. Currently the SCADA system is used to collect data on plant and equipment operations.

The City is producing water of very high quality out of the current filter plant and has the capability of providing treatment to a wide range of raw water conditions from both of the City's sources.

10.3.6. Preventative Maintenance Program

Good preventative maintenance is both cost-effective and a deterrent to emergency conditions. By following a set schedule of maintenance activities, the City can ensure efficient and reliable system operation, extend life of equipment, and provide early warning of mechanical breakdown.

The City currently follows a schedule of monitoring and maintaining the facilities throughout the distribution system. A complete list of operation and maintenance tasks is included in Table 10-2.

Table 10-2. Current Maintenance Tasks

Operation and Maintenance Task	Frequency	Annual Quantity	Personnel Required	Average Hours	Total Hours Required
Intake Operations					
Inspect/security facilities and equipment	Daily	365	1	0.75	273.75
Recordkeeping	Daily	365	1	0.75	273.75
Conduct Routine Maintenance	Daily	365	1	0.50	182.5
Maintain Grounds and Facilities	Daily	365	1	2.50	912.5
Inspect Watershed/Forest Practices	Weekly	52	1	1.50	78
Raw Water Coliform Monitoring	Monthly	12	1	2.00	24
Road Maintenance	5 days	5	3	8.00	120
Subtotal					*1864.5*
Water Treatment Operations					
Water Quality Tests	Daily	365	1	1.50	547.5
Recordkeeping/Reporting	Daily	365	1	1.50	547.5
Adjust chemical feed, fill hoppers, backwash filters calibrate turbidity monitoring equipment, housekeeping, routine maintenance	Daily	365	1	2.00	730
New/Replace/Maintain Equipment	80 days	80	1	8.00	640
Clean Settling Basins (Semi-Annual)	2 days	2	3	8.00	48
Reservoir Cleaning	5 days	5	1	8.00	40
Operate Chehalis River Pumps	12 days	12	2	1.00	24
Coliform Sampling	96	96	1	2.00	192
Water Quality Monitoring		1	1	20.00	20
Subtotal					*2789*

Operation and Maintenance Task	Frequency	Annual Quantity	Personnel Required	Average Hours	Total Hours Required
Customer Service					
Meter Reading	1677/month	20124	1	0.05	1006.2
Delinquent Notification-Deliver Tags	100/month	1200	1	0.25	300
New Customer-Turn on	60/month	720	1	1.00	720
Close Customer Account	60/month	720	1	1.00	720
Emergency Turn-off/on	4/month	48	1	0.50	24
NSF Checks Turn-off/on	6/year	6	1	0.50	3
Delinquent Shut-off	300/year	300	1	0.25	75
Delinquent Lock-off/Turn-on	60/year	60	1	0.40	24
Subtotal					*2872.2*
Distribution					
Reservoir & Pump Station Checks	260 days	260	1	3.00	780
Meter Changes/Repairs	140/year	140	2	2.00	560
Miscellaneous Repair (lids, boxes etc)	100/year	100	1	1.00	100
New/Replace Water Mains	30 days	30	7	8.00	1680
Install New Services	50/year	50	3	8.00	1200
Upgrade Services	33/year	33	2	4.00	264
Replace Services	16/year	16	3	12.00	576
Hydrant Replace/New	6/year	6	3	24.00	432
Hydrant Maintenance	6/year	6	2	2.50	30
Hydrant Flushing (Semi-Annual)	362/year	362	2	0.40	289.6
Hydrant Meters (Install-on/off)	14/year	14	1	1.00	14
Valve Exercising	300/year	300	2	0.35	210
Valve Replacement					0
Blow-off Dead End Lines (Bi-Monthly)	18/month	108	1	1.00	108
Maintain Equipment/Housekeeping	260 days	260	2	0.50	260
Fire Flow Testing	10/year	10	2	1.00	20
Subtotal					*6523.6*
Cross-Connection Control					
Inspections	150/year	150	1	2.00	300
Administration	Weekly	52	1	1.00	52
Recordkeeping/Clerical	Weekly	52	1	1.00	52
Subtotal					*404*
Other					
Construction Inspections	3 projects	3	1	20.00	60
Review Construction Plans	3/year	3	7	1.00	21
Locates	660/year	660	1	1.00	660
Inventory Parts	Quarterly	4	2	8.00	64
Flagging/Traffic Control	36 days	36	2	8.00	576
Truck Driver	36 days	36	1	8.00	288
Safety Meetings	Monthly	12	7	1.00	84
Safety Training/CEU Classes	16 hr/emp.	16	7	1.00	112
Vacation	20 days	20	7	8.00	1120
Sick Leave	12 days	12	7	8.00	672
Holidays	13 days	10	7	8.00	560
					4217
				Total Hrs.	**18670.3**

Source facilities at the North Fork are monitored regularly for water quality, security and operation. The Chehalis River intake is monitored and tested monthly. The filter plant is staffed 8 hours per day, five days per week. On weekends and holidays, operators perform essential treatment duties including logging readings, recordkeeping, backwashing filters and other operational and maintenance tasks as required. The booster pumps and reservoirs are inspected, master meter read and recorded twice weekly. Chlorine residual and routine bacteriological sample are taken from the distribution system weekly and dead-end lines are blown-off bi-monthly.

Aside from the current routine and preventive maintenance performed by the City, there are additional practices which would aid the City in ensuring even more reliable water service. These practices include routine cleaning and inspection of all system reservoirs a least once every five years. In addition, it is desired that system valves be inspected and exercised at a minimum of once every three years. Fire hydrants should be maintained at least once every two years. In preparing this WSP, the City has updated its system maps to include pipe size and type, year of construction, valve location, hydrant location and significant system facilities such as reservoirs and pump stations. These maps will aid the City in planning and recording maintenance activities.

Service meters should be monitored and tested on a regular basis, and replaced as needed every ten to fifteen years. Master meters should be monitored and tested on a regular basis.

10.3.7. Equipment, Supplies, and Chemical Listing

The City must be ready at all times to respond to routine and emergency maintenance needs. Chehalis maintains a computerized inventory of repair and replacement parts that permit immediate repair of most system failures. This inventory is updated monthly as invoices are paid and work orders are processed. The City must also maintain sufficient operating chemicals to allow continuous operation of source and treatment facilities. Depending on the availability of the chemicals, sufficient supplies are stored to allow reasonable order and shipping times. A complete list of suppliers is kept on file at the City. Manufacturers' technical specifications on major system components, such as the traveling screen or filter media, are kept on file at the Public Works Office and at the filter plant.

10.4. Comprehensive Monitoring Program

The City's water quality monitoring program is described in detail in Section 9.

10.5. Emergency Response Program

The Washington State Department of Health (DOH) requires the inclusion of an Emergency Response Program (ERP) in the operations program under WAC 246-290. The purpose of an ERP is to guide personnel through potential system malfunctions, natural disasters, and other events that might alter routine system operation. The program is required to include a water system personnel emergency call-up list, notification procedures for water quality emergencies, a vulnerability analysis for the water system and contingency operational plans for the system when normal operating procedures are not available. The City has an existing ERP, which covers all departments.

10.5.1. Water System Personnel Emergency Call-up List

An Emergency Call Up Roster is shown in Table 10-3. An updated copy of this list with phone numbers is kept at the Public Works Office and Central Dispatch. During non-working hours, calls from the public are received at Central Dispatch. Depending on the nature of the

complaint, Central Dispatch contacts the appropriate on-call personnel. Alarms from the filter plant, South End Pump Station and Centralia/Alpha Pump Station are received at the filter plant during working hours and at a private alarm center after hours and on weekends. The alarm center contacts the on-call personnel.

Table 10-3. Emergency Call-up Roster

City of Chehalis	
City Hall	345-1042
Community Services	748-0271
Dispatch (aka Central Dispatch)	740-1105
Filter Plant	748-4955
Fire Services	748-3394
Police Department	748-8605
Wastewater Treatment Plant	767-6444
Water Treatment Plant (aka Filter Plant)	748-4955
City of Centralia	
Centralia Fire Department	736-3975
Centralia Police Department	330-7680
Centralia Public Works Department	330-7512
Centralia Street Department	330-7512
Centralia Water/Wastewater	330-7512
Lewis County	
Emergency Management	740-1151
Environmental Health	740-2745
Public Services	740-1122
Public Works	740-1123
Sheriff	748-9286
State	
DOH Southwest Regional Office	360-236-3030
Fax	360-664-8058
After Hours	800-833-6388
Dept. of Ecology's Spill Response	360-407-6300

Other	
Fire Dist. #5 Lewis Co. (raw water)	262-3320
Fire Dist. #6 Lewis Co. (raw water)	748-6019
Forest Manor (raw water)	748-7684
Locate, Inc.	206-943-8828
Emergency Pager	206-786-3286
One Call Locate	800-424-5555
Billing (Contract #0030)	206-454-8888
MCI	800-624-9675
PUD of Lewis County	748-9261
Pacific Cataract Laser Clinic	748-8632
Phone Repair Business Lines	800-214-8043
Residential Lines	800-954-1211
Providence Hospital	736-2803
Sprint	800-521-0579
Tacoma Eastern Railway	206-383-2626
Utility Underground Locate Center	800-424-5555
QWEST (Locate, Inc. Working hrs.)	800-954-1211
Emerg. Response during working hrs.	206-392-6412
Puget Sound Energy (Gas Division)	736-3383
	800-999-4964
Area Supervisor, Dave Lykken: Mobile	360-269-4292
Pager	330-9662
Home	740-9511
Burlington Northern Trouble Reports	800-832-5452 (Ext. 2)
Longview/Kelso	360-578-2361
Chehalis School District Office	807-7200
Comcast	800-266-2278

Chehalis Public Works Department Contact Phone Numbers				
		Phone	Mobile	Pager
During Business Hours:	Public Works Office	748-0238		
	Water Treatment Plant	748-4955		
After Business Hours:	Water Superintendent	360-740-1633	269-0953	
	Public Works Director		269-3372	330-6103
	Water On Call Person			330-3330
	Filter Plant On Call Person			330-3580
Emergency 911				
Problems Requiring Immediate Response (After Hours)		740-1105 (Central Dispatch)		
Non-Emergency (After Hours)		748-3921 (Voice Mail)		

City of Chehalis Public Works Department Employee's Home Phone Numbers				
	Radio	Phone	Pager	Cell
Administration				
Director of PW	801	(360) 459-0136	330-6103	
Public Works Dept.	800			
Water Division				
Vasilauskas, Dave, Water Superintendent	812	740-1633	330-6063	269-0953
Zydek, Stan, Water Dist. Specialist	813	983-3872	330-6440	269-2900
Cabe, Gary, W Treatment Operator	823	748-6245		269-1522
Gruginski, Lloyd	826	295-0321		269-0280
Moses, Chuck, W Treatment Operator	824	482-2012		
Landry, Francis, Equip/Maint Tech	825	748-3696		
Water Filter Plant	820	748-4955		
On Call				
Water			330-3330	269-3372
Public Works			748-0238	
Water Filter Plant			748-4955	

General Field Response

The initial reaction by City personnel to an emergency should be to take prompt action to eliminate any immediate threat to public health or safety. Where appropriate, bystanders may be warned, traffic diverted, valves shut off, dangerous materials removed, or other necessary action taken, provided it can be done without further risk to the public or City staff. Next, the Water Superintendent, or their designee, should be contacted, and a crew dispatched to assess the damage and determine the materials and resources necessary for correction. It is essential that the City's repair supplies inventory status report and list of material supplies be kept up-to-date and readily accessible to avoid any unnecessary delay in restoration of service. Throughout the emergency, contact should be maintained between work crews, the Water Superintendent, and other key participants to enhance coordination with the citywide response plan and to keep City administrators apprized of the emergency for proper public notification.

Responsibilities

The following responsibilities are suggested for administrative and technical personnel in the event of an emergency.

Public Works Director

- Keep City Manager and public informed
- Act as liaison between the Water Superintendent and the City Manager
- Assess disaster/damage
- Prepare warning information for users

Water Superintendent

- Oversee operations
- Assess system damage
- Assess available equipment and resources

- Formulate plan for corrective action
- Determine or authorize emergency response actions
- Document incident and response action taken
- Maintain contact with and approval from the Public Works Director

Field Staff

- Take immediate action to protect life and property
- Note damage and apparent cause
- Notify Public Works office
- Keep Water Superintendent informed
- Assist in taking correction action

Office Staff

- Contact County and other agencies as appropriate
- Answer incoming phone calls
- Maintain contact with crews

Police/Fire Chief

- Maintain crowd and traffic control
- Provide security
- Provide fire control
- Provide emergency aid

10.5.2. Notification Procedures

In general, the Water Superintendent or designee immediately notifies the DOH Regional Engineer in the event that water is expected or required to be shutdown for more than 24 hours, water quality is determined to be unacceptable, or whenever a public health risk associated with the water system is detected.

The Public Notification Rule revisions were implemented in June 2002. Included in these changes was a reduction of the time for the water system utility to notify its customers of a Tier 1 violation from 72 hours to 24 hours. The Tier 1 violations include: fecal coliform positive samples, failure to confirm a positive total coliform for fecal coliform bacteria, MCL violation for nitrates, a loss of treatment whether through filtration failure or loss of disinfectant residual, a turbidity reading exceeding 5.0 NTU, or a waterborne disease outbreak.

The City is developing a series of templates and fact sheets to provide all required language and definitions. The goal is for these notices and fact sheets to be able to be prepared within minutes of implementing emergency procedures developed and contained within the database. Prior approval of these templates by the State Department of Health and City management will enable the City staff to prepare any Tier 1 document containing all necessary language required by the Health Department and City policies within a 24-hour period.

Another source of important information is the State Department of Health Drinking Water homepage. This too contains templates that can be modified by City staff. Benefits of the city-

managed database include customized reports specific to the City, its treatment methods and water sources.

10.5.3. Vulnerability Analysis

This is a brief overview of the vulnerability of the water system for the City of Chehalis.

Water Sources

The North Fork intake and the Chehalis River intake supply all of the water to the system. As with all rivers, both of these sources are susceptible to both natural and manmade events and conditions that could affect water quantity and quality. Natural events include drought, earthquakes, landslides, flooding, fires and high rainfalls that could occur within the watersheds upstream of the intakes thus affecting the reliability of the supply. Both watersheds include a significant amount of forestry lands with timber management activities, logging and other forest practices taking place, which could affect both quality and quantity. The Chehalis River intake is also susceptible to flooding. All pumps and electrical controls are above record flood stage but the station would be surrounded by water and therefore difficult to reach.

The Chehalis River and its tributaries flow through extensive dairy, farm and croplands as the rivers meander along valley floors toward the location of the Chehalis River intake. These local farm uses pose a risk to the quality of the water due to the introduction of contaminated runoff and animal wastes into the rivers. The water quality of these river systems is potentially further jeopardized by possible failure of septic systems and drain fields in these rural areas. Responsible management of the water system requires the City to implement a watershed management program. Details of the source water protection are included in the Watershed Control Program, which is discussed in Chapter 8.

Both intakes are also susceptible to debris in the river, especially in the fall. Leaves and branches impact the intake screens thus decreasing flow. Leaves also increase the biological load to the water which may affect taste and odor, increase the risk of bacteria and increase the concentration of organic compounds. If not removed during the pretreatment and filtration process, these compounds may react with chlorine increasing the formation of disinfection byproducts. Winter storms may also interrupt power and communication to the intake facility.

These facilities are susceptible to mechanical failure as well as power and telephone outages. Mechanical failure is not a big concern because of the fact there are two separate sources of water. Failure of the traveling screen during the fall, when deciduous trees are losing their leaves, could disrupt or reduce flow. However, during most of the year it would have minimal effect. Redundancy of the pumps at the Chehalis River intake lessens the impact of pump failure. Both stations are equipped with auxiliary power, which will operate all of the equipment at the North Fork and one pump at the Chehalis intake. Neither intake is dependent on telephone lines for successful operation.

In the event that both intakes were out of service, the system could operate using water from the storage reservoirs for a period of time. The 6.7 million gallons of storage constitutes more than three days of average usage for the system. The intertie with the City of Centralia is also available assuming the event did not disrupt Centralia's water source as well. If the sources were out of service, the City would need to take steps to limit water use throughout the system and to notify fire personnel of the situation.

Reservoirs

Vulnerability concerns for a reservoir center around the potential for damage to the structure and/or contamination of its contents. The storage reservoirs were constructed and upgraded to reduce the potential for vandalism. Each is completely sealed with locked hatches. However, the reservoirs are susceptible to natural and man made disaster such as earthquakes and vandalism. The Yates Reservoir constructed in 2002 was built to meet current seismic codes. The seismic design of the other reservoirs is unknown and should be reviewed by a structural engineer.

Vandalism cannot totally be prevented, but can be deterred. To this end, all reservoirs are fenced and locked. The reservoirs sites are inspected on a frequent basis to ensure security. Fencing and other security measures are part of the infrastructure protection that will be looked at in the upcoming Vulnerability Assessment.

Booster Pump Stations

The booster pump stations are vulnerable to mechanical failure, vandalism, power and telephone outages and earthquake. All of the stations have redundant pumps and controls, standby power, and are fenced and locked.

Transmission and Distribution System

The transmission and distribution systems are susceptible to both man made and natural disaster such as vandalism, pressure surges, contamination, corrosion, erosion, earthquake and material failure. To reduce the number of breaks to the system construction standards regarding pipeline material and construction have been established and are required of new installations. In addition, standards are in place to require strategically place valves and looping of lines to facilitate isolation of broken pipes while maintaining water service. Chehalis has an up-to-date mapping system of pipes and valves and subscribes to the One-Call System that facilitates the locating of facilities to prevent accidental dig ups. Chehalis has developed and implemented a cross-connection control program to help eliminate foreign substances from being accidentally back-siphoned into the water system.

The transmission lines are vulnerable in that they are single lines connecting the sources to the filter plant. However, the sources are redundant so that either can be off line and the system has sufficient water to operate which minimizes the threat to the system. This threat is further reduced by the fact that the locations of the transmission lines are well documented which helps prevent accidental dig ups.

10.5.4. Contingency Operational Plan

The contingency plan presented herein is intended to serve as a guide to City personnel for developing response procedures. It provides an emergency roster, establishes DOH notification procedures, lists sources for locating and obtaining repair parts and materials, prioritizes the duties of response personnel, and presents a skeleton field response procedure.

Emergency Roster

Public Works employees' normal workweek is Monday through Friday. During off-hours, weekends and holidays, on-call personnel are available on a rotating basis for first call out in

case of an after hour call or emergency. An Emergency Call Up Roster is shown in Table 10-3. An updated copy of this list should be kept at the Public Works office, Central Dispatch, Fire and Police Departments, the City's emergency operations center (EOC) and other management dispatch and emergency stations. In the event of an emergency, additional personnel should be requested and assigned as deemed necessary by management.

Priority Service List

The City has developed a Priority Service List to protect individuals and/or organizations that are dependent upon an uninterrupted supply of water and/or strict water quality requirements. Public information/education concerning this service is important to enable those in need of continuous water service to contact the City for inclusion on this list. The list includes individuals on home care kidney dialysis equipment or other medical facilities, and organizations requiring uninterrupted water for specialized commercial or industrial processes.

DOH Notification

The Public Works Director, or designee, should immediately notify the DOH Regional Engineer in the event that water is expected or required to be shutdown for more than 24 hours, water quality is determined to be unacceptable, or whenever a public health risk associated with the water system is detected.

Material Supplies

The City maintains a computerized inventory of repair and replacement parts that permits an immediate determination of readiness to respond to an emergency. The inventory is updated monthly as purchase invoices are paid and work orders are processed.

Priorities

When used for drinking, all water served by the City should meet all applicable State and Federal drinking water quality standards. If the supply of water is not available to serve full water system demands, the water that is available should be allocated based upon the following usage ratings, which are listed from highest to lowest priority.

- Fire fighting (life threatening)
- Life sustaining
- Medical
- General drinking water needs
- Fire fighting (property threatening)
- Sanitary
- Industrial
- Commercial
- Recreational/landscaping needs

Earthquake Response

Description - A major earthquake, with the 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, storage and distribution components of the water system. In addition,

power failures and interruption to conventional transportation and communication systems may occur.

Response – Water personnel should anticipate critical water use needs for fire fighting or medical facilities resulting from an earthquake. These should be given due priority in assessing the emergency, preparing damage reports, and organizing repair efforts. Since they are hidden from view and at least as susceptible to ground movement as above ground structures, pipelines and other buried facilities require closer attention in the event of an earthquake. The system should be checked thoroughly for any unexplained drop in line pressure, reduction in flow rate, pump failure, leakage, or other signs of damage. Crews should be equipped to maintain constant contact with the public works office and other field personnel, barricade hazardous areas, shut off valves to isolate broken mains, turn off water services and make repairs. They should also be prepared to help residents secure a safe supply of drinking water.

Flooding Response

Description – The City's location in the Chehalis River valley makes it vulnerable to floods. The greatest potential flood impacts on the City are inundation of the Chehalis River intake, loss of power, high turbidity at the North Fork intake, and washed out mains. Other important impacts include overload of the wastewater plant, inundation of other structures, transportation disruption, and competing demands on City resources.

Response – Water personnel should anticipate the facilities that will most likely be impaired by flooding. All major system components, however, must be checked thoroughly to assess physical damage. Crews should be equipped to maintain constant contact with the public works office and other field personnel, barricade hazardous areas, shut off valves to isolate broken mains, turn off water services and make repairs. They should also be prepared to help residents secure a safe supply of drinking water.

Power Failure Response

Description – Short-term and long-term interruptions in power can occur for a variety of reasons and may or may not be associated with emergencies which would otherwise affect the water system. In addition, power outages may be localized to one or more city blocks or may affect the entire region. Facilities most affected by this type of emergency include: Chehalis River intake, Water Filter Plant, booster pumping stations, telemetry equipment, and communication systems.

Response – In addition to their field response, water personnel should immediately contact the Public Utility District to determine the nature, extent and expected duration of the power outage. The reservoir system capacity provides sufficient storage for several days at average usage. In addition, all pumping and source facilities have either onsite auxiliary power or connections for portable auxiliary power units. These auxiliary power sources should be brought on line and maintained until power is restored. In the case of facilities run by portable auxiliary power units, water personnel may need to operate them on a rotational basis due to limited availability of mobile generator. A list and schedule of rotational system operations should be developed to ensure service is maintained in priority areas of the system.

Contamination of Source of Supply Response

Description – Contamination can occur in the surface supplies and may be the results of man-made practices or natural occurrences. The North Fork source can experience high turbidity due to heavy run off and/or land slides up river from the intake. If the North Fork water is too high in turbidity for the Filter Plant to adequately treat, the Chehalis River source may be utilized. If a chemical spill or other chemical contamination occurs in the North Fork, the Chehalis River source may not be available for a backup source since the Newaukum River runs into the Chehalis River up stream of the Chehalis River intake. Distribution contamination could also occur, possibly through back siphoning. Additional sources of contamination include septic tank drain field effluent, urban storm runoff, pesticide leachate, landfill leachate, petroleum storage leakage, chemical or petroleum spills, animal wastes, vandalism, and volcanic fallout.

Response – Initial response should be to isolate the contaminated facility from the rest of the system. Other appropriate measures will be determined according to the type, location, nature and entry path of the contaminant. The area of contamination and specific cause should be determined as quickly as possible and removed if feasible. This may be a simple matter such as a minor spill or may be a more complicated problem requiring significant resources and specialized assistance.

In addition to their field response, City personnel should ensure that appropriate health authorities are contacted. At a minimum, this includes the DOH Regional Engineer and Lewis County Environmental Health Director. These personnel will then work together to determine, if possible, the extent of the contamination and prepare the appropriate public information program.

Water Transmission Line Failure Response

Description – Rupture or leakage in the transmission line from either the North Fork or Chehalis River intake could be the result of earthquake, pressure surge, vandalism, bomb blast, construction, soil scour, corrosion or material failure. A major break could result in interruption of the source 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 minimize the impacts to the rest of the system. The size and nature of the rupture must be evaluated promptly to ensure that adequate repair materials, excavation equipment, de-watering facilities, and proper personnel are deployed. Temporary loss of either the North Fork or the Chehalis River transmission line by itself would not present a water supply shortage because of the redundancy of the other source. If both transmission lines were out of use at the same time the storage capacity could supply the system for several days. In this event, the City of Centralia should be contacted for the potential activation of the intertie.

Distribution Line Break Response

Description – Water distribution line breaks could be the result of earthquake, pressure surge, vandalism, bomb blast, construction, soil scour, corrosion or material failure. Due to the strategically placed valves and looped systems, most line breaks can be isolated and minimize service outages.

Response – Such an event requires prompt action by City personnel to isolate the damaged section and minimize the impacts to the rest of the system. The size and nature of the rupture must be evaluated promptly to ensure that adequate repair materials, excavation equipment, de-watering facilities, and proper personnel are deployed. In most cases, the initial response person is capable of assessing the situation to determine the extent of the problem and course of action to make the repair. This person is also responsible for notifying emergency departments such as fire and police and the Water Superintendent if not already notified.

The repairs should be made in accordance with the standard procedure for water line repairs. The City typically has sufficient materials on hand to address line break emergencies. Such materials include repair clamps for all types and sizes of pipe that are in the system, ductile iron pipe, various sizes of water main valves, chlorine for disinfection of repairs, copper tubing and service fittings.

Gaseous Chlorine Leak

Description – Although the risk of chlorine leakage is low, there is a possibility that chlorine facilities could be ruptured and leak gaseous chlorine. The cause of the rupture could vary from a natural disaster to operator error or even vandalism.

Response – because chlorine gas is highly toxic, personnel who respond to such an emergency must wear a self-contained breathing apparatus. Fire and police should be notified immediately of the leak and potential danger. A repair kit for each size cylinder is kept on site and additional kits are located at the Wastewater Treatment Facility. After the leak is fixed, all areas in which the chlorine gas was dispersed should be fully ventilated. If large quantities of gas should leak, residents within the area may have to be notified as to the presence of chlorine gas and advised as to the proper precautionary measures.

No water should enter the City's water distribution system without receiving proper chlorination. Therefore, any failure of the chlorination facilities should be followed by a shut down of the filter plant until repairs are complete.

10.6. Safety Procedures and Programs

The City is committed to the safety of its maintenance and operations staff and ensuring the safe operation of all facilities. City personnel follow the safety procedures and training programs shown below:

- City Accident Prevention Program
- State Labor & Industries, Division of Occupational Safety and Health (DOSH) standards outlined in applicable sections of the WAC Chapters 296-24, 296-27, 296-45, 296-62, 296-155, and 296-800 including but not limited to:
    - Trenching and Shoring Safety, Confined Spaces Safety, and Flagger Certification
    - City Lock-Out Tag-Out Training
    - First Aid/AED/CPR Training based on current American Heart Association and DOSH guidelines
- Water and Sewer Risk Management Pool – endorsed programs
- Washington Environmental Training Center Certification Workshops
- Certification Upgrades

The City Accident Prevention Program is adopted by resolution and updated as needed by the City Safety Office, the Safety Committee, and the Management Team. City personnel are routinely and regularly trained on all aspects of the safety programs to include the standards, best practices, and safe work procedures. Safety training is provided in house and by subject matter experts that are contracted on a regular basis.

10.7. Cross-Connection Control Program

The City follows these procedures in implementing its cross-connection control program: Washington State Standards for Cross-Connections (WAC 246-290-490), the City of Chehalis cross-connection control plan, Manual of Cross-Connection Control published by the University of Southern California (USC Manual), and Cross-Connection Control Manual published by the Pacific Northwest Section of the American Water Works Association (PNWS-AWWA) as they presently exist and as they may, from time to time, be amended. The Cross-Connection Control program is listed as 13.04.070, of the City's Municipal Code (see Appendix L). Measures enacted by the City in compliance with the program include the following:

Notification of Existing Connections - In 1994 and 2005 a questionnaire was sent to every residential and commercial customer to determine locations that:

- Had backflow assemblies
- Needed to install backflow assemblies
- Required plumbing inspections
- Require additional investigation
- Needed no further action

These were reviewed and the highest risk locations were inspected and required to install or test existing backflow devices. A follow-up questionnaire was sent to commercial customers in August of 2011, and questionnaires are scheduled to be sent to residential customers in the first quarter of 2012.

The City has implemented the following practices and procedures:

- Obtaining and managing data on reverse (back) flow prevention devices, wide (ongoing).
- Inspecting and directing maintenance of privately owned devices (annually).
- Testing and maintaining City-owned devices (annually).
- Cross connection control focused on the most common and potentially harmful activities. Inspections are to be prioritized from high hazard to low hazard businesses and facilities. The hazard ranking is based on Table 9 in the WAC or in the USC Foundation Manual. High hazard facilities may cause a cross contamination of sewage, industrial chemicals or other wastes.

The City has recently developed a program to protect all of their customers and comply with the Cross Connection regulations of DOH including:

- Submit backflow reports to DOH (annually). This requirement began in 2002 with the City being required to submit reports on each backflow inspection, incident, and inventory of all backflow devices used within the water system. This report may be obtained from DOH or submitted directly online at the DOH Cross Connection web page.
- Implement a City water system tracking that is fully automated. Not having an up-to-date cross connection database leads to incomplete records that cannot be readily

shared or accessed by users. Record keeping and data management shortfalls can result in inadequate system maintenance and poor cost tracking. Newer versions of popular Cross Connection Management software include add-ons that will prepare the data for the annual DOH report.

- Continued inspection and maintenance oversight of privately owned devices. Use of a prioritized, risk-based approach by following Table 9 of the risk-based businesses has been initiated.
- Work with the local administrative authority and the City building inspectors, to ensure all new buildings, and remodeling, renovation, and changes of use for existing building are carefully reviewed to eliminate any potential cross connections.

A Washington State Certified Backflow Assembly Tester (BAT) must complete backflow assembly testing within the Chehalis system. The City of Chehalis keeps an up to date list of approved testers.

Chehalis occasionally uses water bill inserts to provide information to the public. Further outreach could include information in the annual drinking water report (CCR), surveys or additional mailings.

10.8. Record Keeping and Reporting

Water quality and compliance records must be retained by the water utility. Some data is required, while some is operational, maintenance or complaint response in nature. Record keeping requirements for the City are described in WAC 246-290-480.

- **Cross Connection.** Records of the master list of service connections and premises isolation shall be kept as long as the premises pose a hazard to the purveyor's system.
- Records regarding inventory shall be kept for five years or life of the approved backflow prevention device whichever is less.
- **Source and Distribution analysis.** Bacteriological and turbidity results shall be kept for five years.
- **Daily source meter readings.** These shall be kept for ten years. Other records of operation and analyses not specific to water treatment shall be kept for three years.
- **Sanitary Survey.** Correspondence and reports shall be kept for ten years after completion of the survey.
- **Project reports**. Construction document drawings and inspection reports shall be kept for the life of the facility.
- **Daily treatment records**. Chlorine residual, fluoride levels and other analysis must be kept for a minimum of three years.
- **Records of action taken to correct violations.** Violations of primary drinking water standards shall be kept for least three years after the correction.
- **Backflow incidents**. Backflow incidents and annual summary reports shall be kept for five years.

Section 11
Capital Improvement Program

11. 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 2010 and 2029.

11.1. 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 WCP. In addition, recurring or annual capital projects related to system maintenance (e.g., water main replacement programs) 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 (2010-2015). Projects that serve anticipated future needs associated with system growth, or are less critical to system operation, were scheduled for implementation between 2016 and 2029. 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 2010-2029 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 Lewis and Thurston County water distribution projects.
- **Sales tax.** Calculated as 7.9 percent (the 2010 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 2010 dollars. Planning-level cost estimates are summarized in Table 11-1 and project locations are indicated in Figure 11.1.

[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 2010-2029 period; however, a conventional method to estimate such increases is to examine cost index trends of past years.

The most comprehensive set of historical construction cost data in the United States is reflected in the RS Means Historical Cost Indexes. The Olympia, Washington indexes indicate that construction costs increased at an average rate of approximately six percent per year over the years 2004-2007. This historic value is used to escalate construction project costs from base year (2010) dollars to costs in the anticipated year of construction, recognizing that indices during the years 2008-2009 reflect the economic downturn and may not accurately predict potential future cost increases.

Where applicable, design costs are scheduled one year in advance of construction costs, to reflect the phasing typically used for larger projects.

Table 11-1. Capital Improvement Program (2010-2029)

Project No.	Description	Purpose of Project [2]	Financing Source[3]	Base Project Cost (2010 Dollars)	Schedule and Cost of Improvements (in thousands of dollars) [1]								
					2010	2011	2012	2013	2014	2015	6-yr CIP TOTAL	2016-2029 [4]	20-yr CIP TOTAL
Water Supply													
S-1	Water Treatment Plant Automation (Phase V)	Deficiency	OI/CF	400			449				449		449
S-2	Redundant Flocculation Basin	Deficiency	OI/CF	640				119	682		801		801
S-3	Water Treatment Plant Re-Rating	Growth	OI/CF & Dev	35							0	63	63
S-4	Water Treatment Plant Capacity Expansion	Growth	Dev	[6]								[6]	
S-5	Settling Basins Liner	Deficiency	OI/CF	380							0	606	606
S-6	North Fork Newaukum Intake Upgrades	Deficiency	OI/CF	500							0	1,198	1,198
S-7	South End Water Treatment Facility	Growth	OI/CF & Dev	5,000						100	100	7,969	8,069
Water Storage													
ST-1	New Valley View Reservoir	Deficiency	OI/CF & Dev	410								648	648
ST-2	New High Level Reservoir	Deficiency	OI/CF & Dev	330								521	521
ST-3	New Main Zone Reservoir (5 MG)	Growth	Dev	6,970								11,064	11,064
Water Pump Stations													
PS-1	High Level Pump Station Improvements	Deficiency	OI/CF & Dev	280					50	321	372		372
PS-2	Valley View Booster Pump Station (Fire)	Deficiency	OI/CF & Dev	740			124	750			874		874
PS-3	Centralia-Alpha Pump Station Upgrade	Deficiency	OI/CF	55							0	98	98
PS-4	18th St Pump Station Capacity Upgrade (2000 gpm)	Growth	Dev	450								638	638
Water Distribution System (Piping)													
D-1	Annual Water main Replacement[5]	O&M	OI/CF	150		159	169	179	189	201	896	4,259 Annual	5,155
D-2	Louisiana Ave Extension - (1,400 LF -12")	Growth	Dev	390		64	371				434		434
D-3	I-5 Crossing - State Ave to Louisiana Ave (2,500 LF - 12")	Growth	OI/CF & Dev	710					139	803	942		942
D-4	17th St Loop - Complete loop from 18th St to 17th St (500 LF - 8")	Deficiency	OI/CF	130		138					138		138
D-5	Bishop Rd - Sturdevant Rd to Maurin Rd (3,000 LF - 12")	Growth	Dev	850		901					901		901
D-6	Bishop Rd - Maurin Rd to Borovec Rd (4,300 LF - 12")	Growth	Dev	1,210		1,283					1,283		1,283
D-7	Rush Rd - Oeschili Rd to Bishop Rd (1,400 LF - 12")	Growth	OI/CF	390		413					413		413
D-8	Median St - National Ave to Kresky Ave (550 LF - 12")	Deficiency	OI/CF	150							0	224	224
D-9	Increase 6" Main on National Ave (2,800 LF - 10")	Deficiency	OI/CF	740							0	1,103	1,103
D-10	Central Business District Improvements (5,000 LF - 8")	Deficiency	OI/CF	1,240							0	1,848	1,848
D-11	Replace Main Reservoir Transmission Main (1,600 LF - 18")	Deficiency	OI/CF	590							0	879	879
D-12	Interstate Ave - Complete Loop (500 LF - 8")	Growth	Dev	130							0	194	194
D-13	Replace 4" and 6" mains in High Level Zone, Newgard Addition Ph I (Evergreen Dr., Parkhill to Prospect) & Additional Piping (7,000 LF - 10")	Deficiency	OI/CF	1,730		200					200	2,170	2,370
D-14	Replace 4" main in neighborhood, Newgard Addition Phase II & Additional Piping (2,600 LF - 8")	Deficiency	OI/CF	650			40	400			440	298	738
D-15	Replace 6" main in Valley View Zone (1,100 LF - 8")	Deficiency	OI/CF	270							0	403	403
D-16	Install 16" main from 11th St and Market Blvd to Yates Reservoir (21,000 LF - 16")	Growth	Dev	6,590							0	9,834	9,834
Water Maintenance and Operations													
M-1	Service Meter Replacement Program	O&M	OI/CF	25	25	25	25	25	25	25	150		150
M-2	Generator (North Fork Intake)	O&M	OI/CF	40						54	54		54
M-3	Water System Plan Update	O&M	OI/CF	150						201	201	689	889
Total Costs of Water System Improvements				**32,325**	**25**	**3,182**	**1,177**	**1,473**	**1,085**	**1,704**	**8,647**	**44,707**	**53,355**

Notes:

(1) Costs are escalated from Base Project Cost (2010 dollars) to stated year of construction, assuming a 6% 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/CF = Operating Income and Connection Fees; Dev = Developer Funded/Contributed; LT = Long Term Debt. Any project listed as OI/CF & Dev is assumed to be funded 50/50 by these two sources.
(4) Total costs associated with projects implemented in 2016 through 2029. 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.
(6) This project is to be defined during the course of implementing Project S-3. Costs have not yet been developed for this long-term project.

CAPITAL IMPROVEMENT PROJECTS

ST-1: New Valley View Reservoir
ST-2: High Level Reservoir
ST-3: New Main Zone Reservoir
PS-1: High Level Pump Station Improvements
PS-2: Valley View Fire and Domestic Pump
PS-3: Centralia-Alpha Pump Station Upgrade
PS-4: 18th St Pump Station Capacity Upgrade
S-1: Water Treatment Plant Automation
S-2: Redundant Flocculation Basin
S-3: Water Treatment Plant Re-Rating
S-4: Water Treatment Plant Capacity Expansion
S-5: Settling Basins Liner
S-6: North Fork Newaukum Intake Upgrades
S-7: South End Water Treatment Facility

D-1: Annual Water main Replacement
D-2: Louisiana Ave Extension- Extend 12" along Louisiana Ave to City Limit
D-3: I-5 Crossing, State Ave to Louisiana Ave- Install 12" under I-5 and replace exisitng 6"
D-4: 17th Ste Loop- 8" to complete loop in High School
D-5: Bishop Rd- Install 12" along Bishop Rd from Sturdevant Rd to Maurin Rd
D-6: Bishop Rd- 12" along Bishop Rd from Maurin Rd to existing 12" on Bishop Rd
D-7: Rush Rd- 12" along Rush Rd from Oescheli Rd to Bishop Rd
D-8: Median St- 12" on Median St from Kresky Ave to National Ave
D-9: National Ave-10" to replace existing 6" on National Ave
D-10: Central Business District- 8" to replace existing 6" in Downtown Central Business District
D-11: Main Reservoir- 18" to replace existing 14" transmission from Main Reservoir
D-12: Interstate Ave- 8" to complete loop on Interstate Ave
D-13 High Level Zone- Replace existing 4" and 6" piping with 10" in High Level Zone (Newgard Ph 1)
D-14: Neighborhood: Replace existing 4" with 8" in development (Newgard Phase 2)
D-15: Valley View Zone- Replace 6" from Valley View Reservoir with 8"
D-16: Install 16" main from 11th St and Market Blvd to Yates Reservoir

High Level Pump Station
Main Reservoir
Water Treatment Plant
High Level Reservoir
Valley View Reservoir
Valley View Pump Station
18th St Pump Station
Kennicott Reservoir
Chehalis River Pump Station
Yates Reservoir
South End Pump Station

Note: Locations for S-6, ST-3, PS-3 and D-1 are not depicted because project locations are to be determined or are outside the view of this map.

Legend

CIP
- 2015
- 2029

Waterline
- 4"
- 6"
- 8"
- 10"
- >=12"
- Raw Water

- Reservoir
- Pump Station
- Water Treatment Plant
- Water
- Railroad
- Highway
- Road
- Chehalis City Limits
- Chehalis UGA

Pressure Zone
- Centralia Alpha
- High Level
- Hillcrest Private Water
- Main
- South End
- Valleyview/Fairview

Figure 11.1
Capital Improvement Map

CITY OF CHEHALIS
WATER SYSTEM PLAN

N

0 1,250 2,500 5,000 Feet

11.2. Planned Projects

11.2.1. Water Supply

S-1: Water Treatment Plant Automation (Phase V) – Installation of automated flow control valves on the raw water influent line and filter effluent lines, so as to better control WTP flow and support operation at higher end of rated capacity. Includes associated controls, mechanical, and electrical upgrades.

S-2: Redundant Flocculation Basin – Design and construction of a redundant flocculation train, to enhance reliability and support potential rerating of the WTP.

S-3: Water Treatment Plant Re-Rating – Pilot testing and associated studies necessary to support re-rating the WTP to a higher flow rate of approximately 7.0 MGD, consistent with the original design flow rate for the plant.

S-4: Water Treatment Plant Capacity Expansion – Additional modifications and/or expansions at the water treatment plant to increase capacity above the 7.0 MGD that is anticipated to be achieved through projects S-2 and S-3. Such plant enhancements will be identified and evaluated during the re-rating process. This project may not be necessary is S-7 is implemented.

S-5: Settling Basins Liner – Design and installation of a liner to reduce leakage from the settling basins at the WTP.

S-6: North Fork Newaukum Intake Upgrades – This refers to potential future upgrades at the North Fork Newaukum intake, including the potential construction of an impoundment to aid in managing and maintaining flows during low flow periods.

S-7: South End Water Treatment Facility – This refers to construction of an additional water treatment facility, located in the southern portion of the City's UGA. With a projected capacity of approximately 3.5 mgd, such a facility could be used to treat water from the North Fork Newaukum River, without the need to convey raw water the entire distance it currently must travel before being treated and sent back south to meet demands in the UGA. Implementation of this project may resolve, at least in part, the current hydraulic limitation of raw water line capacity, due to a shorter distance between the intake and the treatment facility location. More detailed analysis of this potential future treatment facility will be conducted during the six-year planning period, to determine its cost-effectiveness relative to other improvements in the CIP (i.e., S-4, PS-4, and D-16) that would be required if this project not implemented.

11.2.2. Water Storage

ST-1: New Valley View Reservoir – A new reservoir, in addition to the two existing tanks, sized at 160,000 gallons would be installed to satisfy fire flow volume requirements. (This project would not be required if Project PS-2, below, is implemented.)

ST-2: New High Level Reservoir – A new reservoir (150,000 gallons) would be installed to replace the existing reservoir, so as to provide sufficient fire suppression storage volume. Further analysis is required to determine the optimum reservoir location and potential need for

PRVs to address higher pressures in the lower areas of the zone. (This project would not be required if Project PS-1, below, is implemented.)

ST-3: New Main Zone Reservoir – A new reservoir to be located in the Main Zone, sized at 5,000,000 gallons with the primary purpose of meeting needs associated with potential future large industrial demands and related storage requirements.

11.2.3. Water Pump Stations

PS-1: High Level Pump Station Improvements – Replacement of the existing high level pump station pumps would offset fire flow storage volume requirement in the High Level Reservoir which is currently deficient. New pumps would be sized at 510 gpm @ 250 ft of head. This improvement could be conducted in lieu of Project ST-2.

PS-2: Valley View Booster Pump Station (Fire) – Installation of a booster pump station to utilize the current dead storage of the existing two reservoirs in the Valley View Zone, so as to address the current fire flow deficiencies. The fire pump should be sized with a capacity of 1,000 gpm @ 100 ft of head. A smaller domestic pump would also be included to provide for operational flexibility. The project costs also assume auxiliary power is provided. This improvement could be conducted in lieu of Project ST-1.

PS-3: Centralia-Alpha Pump Station Upgrade – Upgrades to the pump station, including updating of mechanical and electrical systems.

PS-4: 18th Street Pump Station Upgrade – Capacity upgrade of 2,000 gpm to support 20-year demands, including potential high water use industrial development in the southern portion of the City and in the UGA. Consideration will also be given to potential upgrades on the raw water pumping side to increase capacity in the raw water transmission system. This project may not be necessary if S-7 is implemented.

11.2.4. Water Distribution System (Piping)

D-1: Annual Water Main Replacement – In order to routinely replace aging pipes in the system, an annual water main replacement program is established.

D-2: Louisiana Ave Extension – Installation of 1,400 ft of 12-inch DI pipe along Louisiana Ave, north of Walmart, to extend a waterline to the City Limits near Airport Road.

D-3: I-5 Crossing - State Ave to Louisiana Ave - Installation of 2,500 ft of 12-inch pipe to replace existing 6-inch northwest of National Ave and Chamber of Commerce Way and bore underneath I-5.

D-4: 17th St Loop - Complete loop from 18th St to 17th St – Installation of 500 ft of 8-inch pipe from a dead end main on 17th Street at the high school to 18th Street to improve fire flow at the hydrant on 17th Street.

D-5: Bishop Road - Sturdevant Road to Maurin Road – Install 3,000 ft of 12-inch DI pipe along Bishop Road from Sturdevant Road to Maurin Road.

D-6: Bishop Road - Maurin Road to Borovec Road – Installation of 4,300 ft of 12-inch DI pipe along Bishop Road from Maurin Road to Borovec Road.

D-7: Rush Road - Oeschili Road to Bishop Road - Install 1,400 ft of 12-inch DI along Rush Road from existing dead end 12-inch north of Bishop Road to an existing waterline on Oeschili Road.

D-8: Median Street - National Ave to Kresky Ave – Install 550 ft of 12-inch DI along Median Street from Kresky Ave to National Ave to improve fire flow to the hydrants along National Ave.

D-9: Increase 6" Main on National Ave – Replace the existing 6" along National Ave between West Street and Chamber of Commerce Way with 2,800 ft of 10-inch DI to improve fire flow in the area.

D-10: Central Business District Improvements – Replace approximately 5,000 ft of aging 6-inch waterlines along State Ave, Pennsylvania Ave, and Geary Street with 8-inch DI to improve fire flow, with additional looping north of Geary Street.

D-11: Replace Main Reservoir Transmission Main – Replace existing 14-inch transmission main from the Main Reservoir to Market Blvd with 1,600 ft of 18-inch DI. This project will improve capacity of transmission main.

D-12: Interstate Ave - Complete Loop – Complete a loop along Interstate Ave with 500 ft of 8-inch DI.

D-13: Replace 4" and 6" mains in High Level Zone, Evergreen Drive from Parkhill to Prospect (Newgard Addition Phase I and additional piping) – Replace aging 4-inch and 6-inch waterlines with approximately 7,000 ft of 10-inch DI. Project will improve fire flow deficiencies in the zone dues to small diameter piping.

D-14: Replace 4" main in neighborhood (Newgard Addition Phase II and additional piping) – In the neighborhood north of Prospect Ave which includes Canyon Drive, Summit Road, Carlesta Ave, Greenwood Ave, and Crestview Drive, replace existing small diameter piping with approximate 2,600 ft of 8-inch DI.

D-15: Replace 6" main in Valley View Zone – Replace 6-inch main from the Valley View Reservoirs along Prospect Ave to Valley View Way with 1,100 ft of 8-inch DI to improve fire flow in the Valley View Zone.

D-16: Install 16" main from 11th St and Market Blvd to Yates Reservoir – In conjunction with the increased capacity of the 18th St Pump Station (PS-4), 21,000 ft of 16" main is needed to convey water efficiently to the Kennicott and Yates Reservoirs while maintaining reasonable velocities and pressures in this portion of the distribution system. This project may not be necessary if S-7 is implemented, since a significant portion of future demands in the UGA would be met by the new treatment facility; thereby, reducing the amount of water that must be conveyed from the existing treatment plant to the south.

11.2.5. Water Maintenance and Operations

M-1: Service Meter Replacement Program – This project involves installation of touch-read capability on all service meters.

M-2: Generator (North Fork Intake) – This project involves installation of a replacement generator (15kW) at the North Fork Newaukum River intake.

M-3: Water System Plan Update – This project involves the update to the Water System Plan, required every six years.

Section 12
Financial Plan

12.Financial Plan

The City has a sound financial program in place to fund operations, maintenance activities and capital improvements. This chapter provides an overview of the financial position of the City's water system and develops a financial plan to implement the programs and improvements identified throughout this plan. This chapter reviews the sources of funds (revenues) and applications of funds (expenses) for the water system. A financial plan is presented with projected operating and capital costs of the system for the six-year period 2010 – 2015 (calendar years). The basis of the operating costs is the 2010 water system budget. The capital costs are based on the capital improvements plan presented in Chapter 11.

12.1. Past Financial History

Table 12-1 Summary of Five-Year Financial History (million $)

	2005	2006	2007	2008	2009
Sources of Funds					
Total Rate Revenue	$1.93	$2.09	$2.23	$2.35	$2.29
Total Miscellaneous Revenue	0.04	0.08	0.16	0.14	0.24
Total Revenue	**$1.97**	**$2.17**	**$2.39**	**$2.49**	**$2.53**
Expenses					
General O&M	$1.06	$1.39	$1.78	$1.91	$1.96
Taxes and Transfers	0.19	0.27	0	0	0
Debt Service	0.06	0.09	0.06	0.06	0.19
CIP from Rates	0	0.11	0.75	2.15	0.39
Total Expenses	**$1.31**	**$1.86**	**$2.59**	**$4.12**	**$2.54**
Balance/(Deficiency) of Revenue	**$0.66**	**$0.31**	**($0.20)**	**($1.63)**	**($.01)**

As can be seen in Table 12-1, the utility's revenues have not kept pace with the utility's expenditures, causing a deficiency of funds in the years 2007-2009.

12.2. Review of the City's Water Rates

The City's current water rates are based upon a monthly meter charge with a consumption rate for all water used. This rate structure is consistent with a conservation-based rate since customers are being charged for the amount of water consumed with no monthly allowance included in the monthly meter charge. The meter charge is assessed based upon the size of the meter, with larger sizes being charged at a higher rate than smaller sized meters. In addition, the City's rate schedule includes two classes of service: residential and commercial. The consumption rate is the same for both classes of customers and meter sizes. The City's current municipal code includes rates for residential and commercial classes of service, identified by year from 2005 through 2010, however, the City has not adjusted rates for either residential or commercial customers beyond the levels depicted for 2007. The current rates for residential and commercial customers are provided in Table 12-2.

Table 12-2 Overview of the City's Current Water Rates

	Meter Size	Minimum Charge
Meter Charge Per Month		
Residential	5/8 x ¾ inch	$14.10
	1 inch	20.23
	1 ½ inch	42.68
	2 inch	42.68
Commercial	5/8 x ¾ inch	$15.80
	1 inch	22.63
	1 ½ & 2 inch	47.66
	3 & 4 inch	125.03
	6 inch	238.81
	8 inch	375.34
Usage Charge Per CCF		$2.09

12.3. Development of the Financial Plan

A financial plan was developed to address projected revenues and expenses of the water system for 2010-2015. The six-year financial plan demonstrates the City's ability to meet its operational and capital improvement needs through rate revenue.

In developing the financial forecast, four cost components were reviewed; operating & maintenance (O&M) expenses, taxes and transfer payments, debt service, and capital improvements funded from rates. The City's 2009 historical data and 2010 water system budgets were used as a starting point. Projections for future years were obtained by applying annual escalation factors. The escalation factors ranged from three percent to four percent depending on the type of cost being escalated. Medical benefits were escalated at four percent due to the recent trends and increases. Revenues from rates were escalated based on the projected growth in demand for water through 2015 reported in Chapter 4 of this Plan.

Overall Revenues

The first component of the financial plan reviews the sources of funds of the water system. There are two primary types of revenues received for operations:

- Rate revenues – received from water sales to customers, and
- Miscellaneous revenues – received from water hookup fees, investment interest, and other miscellaneous revenue.

Rate revenues are projected to be $2.25 million in 2010. Revenue growth was projected at 0.8% during the planning period to match projected growth in demand from Chapter 4. This procedure results in projected rate revenue of approximately $2.32 million in 2015.

Miscellaneous revenues have had a very volatile history and as such, were forecast at a conservative level starting in 2011. The City's "Other Revenue" category of income accounts for $107,000 by 2015.

The total revenues, therefore, available to the operating and capital needs of the water system total $2.4 million in 2010 and stay relatively stable, ending at $2.4 million by 2015, as shown later in this chapter in Table 12-4.

The second part of the financial plan is a review of the applications of funds, or expenses, of the utility. Applications of funds include operating & maintenance expenses, taxes/transfer payments, debt service and capital improvement projects funded from rates. These costs are summarized below, and are provided in Table 12-4, later in this chapter.

Operation & Maintenance Expenses – The 2010 budget was used as a starting point for the O&M expenses of the water system. O&M expenses were categorized into operating expenses, and administration. As stated previously, escalation factors were applied to the 2010 costs to obtain projected costs for 2011 through 2015. It should be noted that no extraordinary costs were assumed as part of the projected costs. O&M expenses are projected to range from $1.8 million in 2010 to $2.2 million in 2015.

Taxes and Transfer Payments – The water system pays the state public utility tax which is calculated as 5.029% of the rate revenues of the utility. There is also a state B&O excise tax of 1.5% on various service fees. The City used to report taxes as a separately classified category on its financial statements, however began combining the tax obligations into a general operations category and therefore, no taxes are reflected in this section, but rather are accounted for under operations and maintenance.

The City transfers funds from/to its operating reserve annually to balance out any balance or deficiency of funds at the end of the year. Since the reserve fund is used to balance revenue requirements, the transfer amount fluctuates from year to year, sometimes representing a transfer to the reserve fund and in other years representing transfer from the reserve fund. In all, the transfers total a combined value of $147,000 over the six year period.

Debt Service – There are currently three outstanding debt issues related to the water system: two Public Works Trust Fund loans and one State Revolving Fund loan. The loans carry a debt obligation of approximately $190,000 per year.

To fund future capital this financial plan assumes one bond issue in the amount of $2 million in 2011. The debt service associated with this bond issue is $167,000, which would start in 2011.

As shown in Table 12-4, the combined debt service of the existing and future debt issues of the City total $358,000 per year.

Capital Improvement Projects Expenses and Funding – The capital improvement plan (CIP) of the utility contains needed infrastructure improvements. The modeling for this Plan identified a number of projects to improve overall system reliability. The CIP also contains a number of renewal and replacement and growth-related projects. Renewal and replacements are, as the name suggests, the replacement of existing and worn out (depreciated) facilities. Growth related facilities, on the other hand, are those related to system expansion and new customers. This financial plan has incorporated the capital projects outlined in the previous sections of this Plan.

The analysis developed herein assumes the City strives to fund capital projects from rates in an amount equal to or greater than the annual depreciation expense for the water utility.

The total capital project costs for the six-year plan equals $10.5 million, or an annual average of $1.8 million. Funding for the CIP will come from a mix of sources that include rate revenues, developer contributions, and bonds.

Developer contributions are assumed to equal the cost of the projects identified as being funded with developer contributions. Bonds finance $2 million in project costs over the projected six-year period. A summary, by type of improvement planned along with assumed funding sources, is presented in Table 12-3.

Table 12-3 Summary of Water Capital Improvement Projects (million $)

	2010	2011	2012	2013	2014	2015
Capital Improvements						
Water Maintenance and Operations	$0.03	$0.03	$0.03	$0.03	$0.03	$0.28
Water Distribution System	0	3.16	0.58	0.58	0.33	1.00
Water Supply	0	0	0.45	0.12	0.68	0
Water Pump Stations	0	0	0.12	0.75	0.05	0.32
Undefined Projects/Capital Reserve	0.57	1.41	0	0	0	0
Total Capital Improvements	**$0.60**	**$4.60**	**$1.18**	**$1.47**	**$1.09**	**$1.60**
Less: Outside Funding Sources						
Capital Contributions (Developer Funds)	$0	$2.25	$0.43	$0.37	$0.10	$0.56
Bonds	0	2.00	0	0	0	0
Reserve Funding	0	0	0.25	0.40	0.09	0.04
Total Outside Funding	$0	$4.25	$0.68	$0.77	$0.19	$.60
Capital Improvements Funded From Rates	**$0.60**	**$0.35**	**$0.50**	**$0.70**	**$0.90**	**$1.00**

This combination of financing capital is appropriate and prudent, balancing funding of projects between existing and future customers as the improvements benefit both. The funding of capital from rates, shown at the bottom of the table, is targeted toward funding at a level of annual depreciation expense. In 2006 that expense was $263,000. The CIP from rates figure was increased gradually over the planning period to reflect the impact of additional plant investment on the depreciation figure. This funding source helps the City maintain a strong debt service coverage ratio, which is important to maintaining lower interest rates on future revenue bonds. The City maintains a strong debt service coverage ratio throughout the review period.

12.3.1. Internal Sources of Funds

Capital contributions in the form of capital facility charges provide the means of balancing the cost requirements for new utility infrastructure to meet customer growth between existing customers and new customers. This charge is accessed to new customers as they "buy-in" to the system. By implementing fair and equitable CFCs, existing customers will not be burdened by the cost of growth as these fees are used to pay for growth related capital or to offset the debt payments related to the growth related capital.

12.3.2. External Sources of Funds

The City has been effective in the past at securing loan funds for CIP and should continue to closely monitor future opportunities to obtain these potential funding sources. These funding sources are listed and described below. It is important to note that these sources rarely provide

full funding of a construction project. As in the past, the City will need to supplement these funds with other sources of revenue to ensure implementation of the recommended capital improvement projects occurs.

- Centennial Clean Water Fund
- Drinking Water State Revolving Fund
- Public Works Trust Fund
- The Interagency Coordinating Council

Centennial Clean Water Fund (CCWF) – Managed by the Department of Ecology (Ecology) – The CWTF is available to local governments and tribes for measures to prevent and control water pollution. Both grants and loans are available on a yearly funding cycle.

CCWF is the largest State Grant Program. It provides grants for planning, design, and construction of facilities and other activities related to water quality. The primary focus of the program is pollution prevention and funding projects with a quantifiable water quality benefit. The CCWF funding cycle requires that applications be submitted by mid-February.

Each public body is limited to a maximum of five funded projects per year, with a maximum of $2.5 million available for each of two projects, and a limit of $250,000 per project for the remaining three projects. Grant funding of 50 to 75 percent of a project's cost is available depending on the type of project.

Previously, funding from this program was not available to provide excess capacity, but must be used to meet existing residential needs. The new language allows for projects which address water quantity issues if they will improve the water quality. However, funding cannot be used solely to provide a source of supply. Funds are available to protect a source of water supply, as well as funding of water conservation or water reuse projects, if they can be shown to be the cost-effective alternative to solve a water quality problem.

Drinking Water State Revolving Fund (DWSRF) – The Washington Department of Health (DOH) manages these funds. In August 1996 Congress reauthorized the Safe Drinking Water Act (SDWA) and appropriated funding for states to develop their Drinking Water State Revolving Fund (DWSRF) loan programs. Each state receives annual allocations in the form of a Capitalization Grant. In Washington State, the DWSRF is jointly managed by the Department of Health (DOH) Division of Drinking Water and the Public Works Trust Fund Board (Board), along with its partner, the Department of Community, Trade and Economic Development.

DWSRF loans are available to all community public water systems, and non-profit, non-community public water systems, except federally and state owned systems. The loans may be used to address SDWA health standard violations, replace infrastructure for SDWA compliance, or consolidate supplies and acquire property if needed for SDWA compliance.

The terms of the loan are generally one percent less on interest than municipal utility revenue bonds, and life of the loan can extend for the life of the facility up to a 20-year maximum. A ten percent local match is required on all projects. In addition, eligible systems must demonstrate "adequate operational, technical, and financial capability to maintain compliance," have an approved water system plan (WSP) to ensure the applicant project is included in the WSP Capital Improvement Program, and meet other eligibility criteria.

Public Works Trust Fund – The Public Works Trust Fund (PWTF) loan program is a loan program set up by the Legislature to assist cities, towns, counties, and special districts with funding for different types of public works projects. The projects can include streets, roads, drainage systems, water systems, and sanitary sewer systems. The emphasis of allocating funds for is based on replacement and/or repair of existing systems. No funds are allocated to install a new system. Rather, funds are granted to rehabilitate or replace an existing system serving an existing population.

The loans are issued at up to a two percent interest rate for a maximum term of 20 years for applications requesting 95 percent funding of the project. The interest rate decreases to 0.5 percent when the local government provides 15 percent of the project funding. A debt service coverage requirement is not imposed on the PWTF loan.

Infrastructure Assistance Coordinating Council – One key resource in identifying other funding programs is the Infrastructure Assistance Coordinating Council (Council). The Council is comprised of state and local organizations whose function is to provide funding for infrastructure repair and development. The purpose of the Council is to assist local governments in coordinating funding efforts for infrastructure improvements. This is an important resource as the Council will be aware of any new funding opportunities that may arise

Revenue Bonds – Revenue bonds are another external source of funding for capital projects. The sale of revenue bonds is the most common source of funds for construction of major utility improvements. Water rate and charges are the main source of funds for debt service (principal and interest) payments. A key benefit of revenue bonds is the exemption of interest paid on them from federal income taxes. A determination of the utility's ability to repay debt is an important consideration. A debt service coverage ratio (total revenue, less O&M and tax expenses, divided by debt requiring a coverage ratio) is calculated and the utility's finances are reviewed in order to verify payments feasible. Coverage ratios of 1.25 (25 percent more than the debt payment) are typical, but coverage of 1.5 is a more prudent financial target. The financial review generally includes both current and past budgets, financial statements, and budgetary practices and polices, and reserve level balances.

Similar to revenue bonds, other bond financing approaches include utility local improvement districts (ULIDs), special assessment districts (SADs) and other funding for projects that serve and benefit a limited service area within the City's total service area. Then the costs of those improvements are shared only by those customers benefiting from those improvements.

While the above list of possible grant, loan and other funding opportunities for the City is not exhaustive, it does however, highlight the most probable outside funding sources available to the City for its capital improvements.

12.4. Summary of the Financial Projections

Table 12-4 Summary of the City's Six-Year Financial Plan (million $)

	2010	2011	2012	2013	2014	2015
Sources of Funds						
Rate Revenues	$2.25	$2.25	$2.27	$2.29	$2.30	$2.32
Miscellaneous Revenues	0.21	0.04	0.07	0.08	0.11	0.11
Total Sources of Funds	**$2.46**	**$2.29**	**$2.34**	**$2.37**	**$2.41**	**$2.43**
Applications of Funds						
O&M and Taxes	$1.86	$1.91	$1.98	$2.05	$2.12	$2.19
Capital Imp. Funded Through Rates	0.60	0.35	0.50	0.70	0.90	1.00
Net Debt Service	0.19	0.36	0.36	0.36	0.36	0.35
Change in Working Capital	(0.19)	(0.03)	0.04	0.06	(0.02)	(0.01)
Total Applications of Funds	**$2.46**	**$2.59**	**$2.88**	**$3.17**	**$3.36**	**$3.53**
Balance/Deficiency of Funds	$0	($0.30)	($0.54)	($0.80)	($0.95)	($1.10)
Balance as a % of Rates	0.0%	14.1%	24.8%	36.7%	43.2%	50%
Other Financial Measures -						
Operating Reserve	$2.00	$1.97	$2.01	$2.07	$2.06	$2.04
Capital Reserve	$0	$1.42	$1.17	$0.77	$0.68	$0.64
Debt Service Coverage Ratios:						
Before Rate Adjustments	3.17	1.06	1.01	0.90	0.83	0.67
After Rate Adjustments	3.17	1.89	2.51	3.12	3.47	3.75

Table 12-5 Summary of the Six-Year Rate Adjustment Transition Plan

	2010	2011	2012	2013	2014	2015
Phased-in Rate Adjustments	0.0%	15.0%	10.0%	10.0%	5.0%	5.0%

12.5. Rate Impacts

Table 12-6 Summary of the Rate Impacts ($/Month) to a Typical Residential Customer [1]

	$/Month	Annual $ Change
Present Rate (2010)	$35.00	$0.00
2011	40.25	5.25
2012	44.28	4.03
2013	48.70	4.43
2014	51.14	2.44
2015	53.69	2.56

[1] Assumes a 5/8" x 3/4" meter @ 10 CF.

12.6. Summary

This chapter has presented the historical and projected financial data for the City's water utility, including developing a rate transition plan to allow the City to accomplish all of the goals and objectives listed in this plan. The required rate adjustments are not unusual or extraordinary in nature, however, it should be noted that the current state of the economy has had significant impacts on all utilities and the Lewis County area has been particularly affected by the downturn in the economy. Growth has slowed to nearly nothing and thereby has significantly impacted historical levels of customer growth. While this plan provides an estimate of costs and revenues for the City's system, the City will closely monitor and adjust this plan as necessary to ensure that the most critical of goals and objectives are met. Details regarding the financial analysis are provided in Appendix M.