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2012 Water System Plan Update

March 2013

Prepared for

City of Kelso
203 South Pacific Avenue, Suite 205
Kelso, Washington 98626

K/J Project No. 1197012.00

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List of Acronyms

Acronym	Description
AC	asbestos cement
ac-ft/yr	acre-feet per year
ADD	Average Day Demand
AL	Allowable Limit
AMCL	Alternative Maximum Contaminant Level
AMR	Automated Meter Reading
APWA	American Public Works Association
bgs	below ground surface
BHWSD	Beacon Hill Water and Sewer District
CCL3	Contaminant Candidate List
CCR	Consumer Confidence Report
CDBG	Community Block Development Grant
CERB	Community Economic Revitalization Board
CFS	cubic feet per second
CFR	Code of Federal Regulations
cfu/100 ml	coliform-forming units per 100 milliliters
CIP	Capital Improvement Program
City	City of Kelso
CMP	Coliform Monitoring Plan
Corps	U.S. Army Corps of Engineers
Cowlitz PUD	Cowlitz County Public Utility District No. 1
County	Cowlitz County
DAQ	Data Acquisition System
D/DBPR	Disinfectant/Disinfection By-Product Rule
DBP	Disinfection By-Product
DOH	Washington State Department of Health
DS	Dead Storage
DSL	Distribution System Loss
DTWA	Davis Terrace Water Association
DWSRF	Drinking Water State Revolving Funds

Acronym	Description
Ecology	U.S. Department of Ecology
EPA	U.S. Environmental Protection Agency
ERU	Equivalent Residential Unit
ES	Equalizing Storage
FBRR	Filter Backwash Recycling Rule
fps	feet per second
FSK	Frequency-Shifted Key
FSS	Fire Suppression Storage
gpcd	gallon per capita per day
gpd	gallons per day
gpm	gallons per minute
GWI	groundwater under the influence of surface water
HAA5	five haloacetic acids
HHS	Federal Department of Health and Human Services
HMI	human-machine interface
HP	horsepower
IDSE	initial distribution system evaluation
IESWTR	Interim Enhanced Surface Water Treatment Rule
IOC	inorganic compound
IFC	International Fire Code
KCM	Kelso's Municipal Code
KEDM	Kelso Engineering and Design Manual
Kelso	City of Kelso
kW	kilowatt
LCFRB	Lower Columbia Fish Recovery Board
LCR	Lead and Copper Rule
LF	linear feet
LID	low impact development
LRAA	Locational Running Annual Average
LT1ESWTR	Long Term 1 Enhanced Surface Water Treatment Rule
LT2ESWTR	Long Term 2 Enhanced Surface Water Treatment Rule
MCL	Maximum Contaminant Limit
MCLG	Maximum Contaminant Limit Goal
MDD	Maximum Day Demand

Acronym	Description
µg/L	micrograms per liter
MFL	million fibers per liter
MFRWTP	Mint Farm Regional Water Treatment Plant
MG	million gallons
MGD	million gallons per day
mg/L	milligram per liter
MMM	multimedia mitigation
MPA	microscopic particulate analyses
MRDL	Maximum Residual Disinfectant Level
mrem/yr	millirems per year
MTBE	methyl tertiary butyl ether
NDMA	N-Nitrosodimethylamine
NTU	nephelometric turbidity unit
ODW	Office of Drinking Water
OFM	Office of Financial Management
OH&P	overhead and profit
OS	Operational Storage
PCE	tetrachloroethylene
pCi/l	picocuries per liter
PHD	Peak Hour Demand
PLC	programmable logic controller
ppb	parts per billion
ppm	parts per million
PRV	pressure relief valve
psi	pounds per square inch
PUD	Cowlitz County Public Utility District No. 1
PVC	polyvinyl chloride
PWTF	Public Works Trust Fund
RC	Reliable Capacity
RWTP	Regional Water Treatment Plant
SB	Standby Storage
SCADA	Supervisory Control and Data Acquisition
SDC	System Development Charges
SDWA	Safe Drinking Water Act

Acronym	Description
sf	square feet
SMCL	Secondary Maximum Contaminant Level
SOC	synthetic organic compound
SS	Standby Storage
SWTR	Surface Water Treatment Rule
TC	Total Capacity
TCE	trichloroethylene
TCR	Total Coliform Rule
TOC	total organic carbon
TRRWTP	Three Rivers Regional Wastewater Treatment Plant
TTHM	total trihalomethane
UCMR	Unregulated Contaminant Monitoring Regulation
UCMR1	first round unregulated contaminant monitoring
UCMR2	second round unregulated contaminant monitoring
UCMR3	third round unregulated contaminant monitoring
ULID	Utility Local Improvement District
VOC	volatile organic compound
WAC	Washington Administrative Code
WQMA	Water Quality Management Area
WQMR	Water Quality Monitoring Report
WRIA	Watershed Resource Inventory Area
WSP	Water System Plan
WTP	water treatment plant
WUE	Water Use Efficiency

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Executive Summary

The Kelso 2012 Water System Comprehensive Plan (WSP) provides the City of Kelso (City) guidance for the 6- and 20-year planning periods to address long-term water supply, storage, transmission, and treatment needs for Kelso's service area. The WSP is a tool for the City to make decisions and implement programs that allow for the community's future water needs. The document has been prepared to meet the requirements of the Washington State Department of Health (DOH) as established in WAC 246-290.

This WSP is an update of the 2005 Longview-Kelso Urban Area Water System Comprehensive Plan (2005 Plan). The previous plan was developed for the Cities of Longview and Kelso, and Cowlitz County Public Utility District No. 1 (PUD). It should be noted that ownership of the PUD's water system was transferred to Beacon Hill Water and Sewer District in December 2010. For the 2012 WSP update, DOH encouraged each of the purveyors to develop their own stand-alone Water System Plan Update. Therefore, the 2012 WSP is primarily focused on the City of Kelso's system but also illustrates how the three systems are interconnected.

Kelso is the sole owner and operator for the Kelso distribution system, and owns and operates the Kelso Water Treatment Plant (WTP). The City currently serves 13,914 Equivalent Residential Units (ERUs) and is expected to serve 17,055 by the year 2032. The majority, approximately 85 percent, of the City's ERUs are served from the Main 188 Zone. The area growth rate has been stable over the past 6 years and is estimated to be 0.97 percent over the current 6- and 20-year planning window. The current Average Day Demand and Maximum Day Demand are 2.15 and 3.18 million gallons per day (MGD), respectively. ADD and MDD are expected to be 2.83 and 4.35, respectively, by 2032.

While the City has ample water rights to meet future demands, the City's 20-year projected demand is approaching the capacity of the City's WTP and source of supply. The City's WTP has a rated capacity of 4.8 MGD but is limited to 4.08 MGD by the capacity of the Ranney Collector Well, located on the bank of the Cowlitz River. The City is currently investigating an additional source of supply to allow for future growth.

The City has an adequate storage, pumping, and distribution capacity to meet the anticipated 20-year planning requirements. A storage deficiency identified in 2005 Plan has been addressed with the completion of the Paxton Road reservoir. However, the City's other primary storage facility, Minor Road, has reached the end of its useful life and requires either substantial repairs or replacement. Replacement is the recommended option. The City meets all applicable water quality standards. The 3-year average distribution system loss is 11.8 percent. It is estimated that approximately 3 percent of the total calculated system losses are a result of the leaking Minor Road reservoirs. The City is actively pursuing measures to reduce distribution system losses, such a meter replacement program, metering of upper re-pump zones, and leak detection program.

The Capital Improvement Program (CIP) has identified 13 projects with a total capital cost of $8.6 million over the 6-year planning period. Financial projections completed for this WSP indicate that the City is financially stable and has the ability to fund the CIP projects identified. The CIP projects will address the following issues:

- Development of an additional (supplemental) source of supply
- Replacement of aging, leaking reservoir
- Aging infrastructure concerns
- Undersized mains to improve fire flow
- Pump station upgrades to improve reliability
- Improvement of metering and telemetry capability
- Accommodation for future growth and development in the Kelso area.

Section 1: Water System Description

1.1 Introduction

The City of Kelso (City) is in the process of updating the 2005 Longview-Kelso Urban Area Comprehensive Water System Plan (2005 Plan) developed for the Cities of Longview, Kelso, and Cowlitz County Public Utility District No. 1 (PUD). The Washington State Department of Health (DOH) encouraged each of the purveyors covered in the 2005 Plan to develop their own stand-alone Water System Plan Update in 2012. Therefore, this 2012 Water System Plan (WSP) update primarily will address the City's system but will also illustrate how the three systems are interconnected.

The purpose of this WSP is to assist the City in developing a long-term planning strategy for its water utility. The WSP evaluates the existing system and its ability to meet anticipated requirements for water source, quality, transmission, storage, and distribution over a 20-year planning horizon. The WSP recommends water system improvements to meet the changing demands of regulatory impacts, population growth, development, and repair/replacement needs. The WSP also estimates the costs of the recommended improvements and determines their impact on water utility rates for the City. This Comprehensive WSP has been prepared in accordance with the requirements of Washington Administrative Code (WAC) 246-290-100 - Water System Plan and considers the requirements set forth in HB1338, the Municipal Water Law.

1.2 Ownership History

Kelso is located in Cowlitz County in southwestern Washington. The City's water service area covers approximately 8.8 square miles within the City and adjacent portions of unincorporated Cowlitz County. Water service to the Longview-Kelso Urban Area is supplied by three major purveyors: Kelso, Longview, and the Beacon Hill Water and Sewer District (BHWSD). BHSWD took ownership over Cowlitz PUD's water system on 1 January 2011; BHSWD also assumed partial ownership of the Mint Farm Regional Water Treatment Plant (MFRWTP). Kelso (ID No. 38000L) owns and operates the Kelso distribution system and the Kelso Water Treatment Plant (WTP).

Two small, private independent water associations also operate in the urban area. The Carrolls Water Association uses groundwater to serve an area southeast of Kelso. The Davis Terrace Water Association (DTWA), located adjacent to the Kelso city limits, receives its water from Kelso's distribution system.

The City began supplying water to customers in the 1920s. Initially, the City obtained water from the Cowlitz River, treating the water through a surface WTP. In 1979, the City replaced the surface WTP with a Ranney collector. Initially, the water quality was considered good, requiring little additional treatment. Iron and manganese levels increased significantly after the Mount St. Helens eruption in 1980, and the City constructed an iron/manganese removal plant in 1984. The plant was upgraded in 2002 to comply with surface water treatment requirements established by the DOH.

1.3 Related System Plans

System plans related to this Comprehensive WSP include:

- Longview-Kelso Urban Area Comprehensive Water Plan and Appendix (2005)
- City of Kelso, General Sewer and Facilities Plan (2011)
- Beacon Hill Water and Sewer District Water System Plan (2012)
- City of Longview Water System Plan (2012)
- City of Kelso Comprehensive Plan, (Update in progress)
- Cowlitz County Comprehensive Plan (1981) (currently being updated)
- Grays-Elochoman and Cowlitz River Watershed Planning WRIAs 25/26, Watershed Management Plan (Draft) September 2004.

1.4 Service Area Description

Table 1-1 and Figure 1-1 illustrates a number of important planning features, including service area, pressure zones, and City limits. The pressure zones shown on Figure 1-1 are distributed as follows:

Table 1-1: Service Area Summary

Service Zone	Source of Supply Description	WTP	Pump Station	Reservoir	PRV
188 (Main Zone)	Water Treatment Plant and Main Zone reservoirs	X		X	
301 (Rocky Point)	Re-pump Zone from 188		X		
322 (Williams-Finney)	Williams Finney Reservoir via gravity		X	X	
443 (Behshel Heights)	Behshel Heights Reservoirs via gravity		X	X	
522 (Mt. Brynion Estates)	Re-pump Zone from 443		X		
264 (Sunrise Street/ Stardust Street)	443 via pressure relief valve (PRV)				X
320	443 via PRV				X
410 (Highland Park)	544 via PRV				X
544 (Tybren Heights)	Tybren Heights Reservoirs via gravity		X	X	
517 (Carrolls Road)	Carrolls Reservoir via gravity		X	X	
311 (Lower Carrolls Road)	517 via PRV				X
297	544 via PRV				X

The existing and future service area boundaries are shown on Figure 1-1. The existing and future services areas coincide with the City's retail service areas. The service areas utilized in the 2005 Plan have been adjusted to be more consistent with City policies for other utility extensions. The retail/future service area outside the City limits is defined as 300 feet from the City's existing water infrastructure and is parcel inclusive. Thus, if a portion of a parcel is within the City's established service area, then the entire parcel is considered to be within the retail/future service area. Potential customers whose property is located more than 300 feet beyond the City's existing infrastructure may apply for service and inclusion within the defined service area. If an application is approved, the City would modify the service area and notify DOH, as necessary, to accommodate the service request. A new ordinance is planned to reflect this policy with regard to the future water service area.

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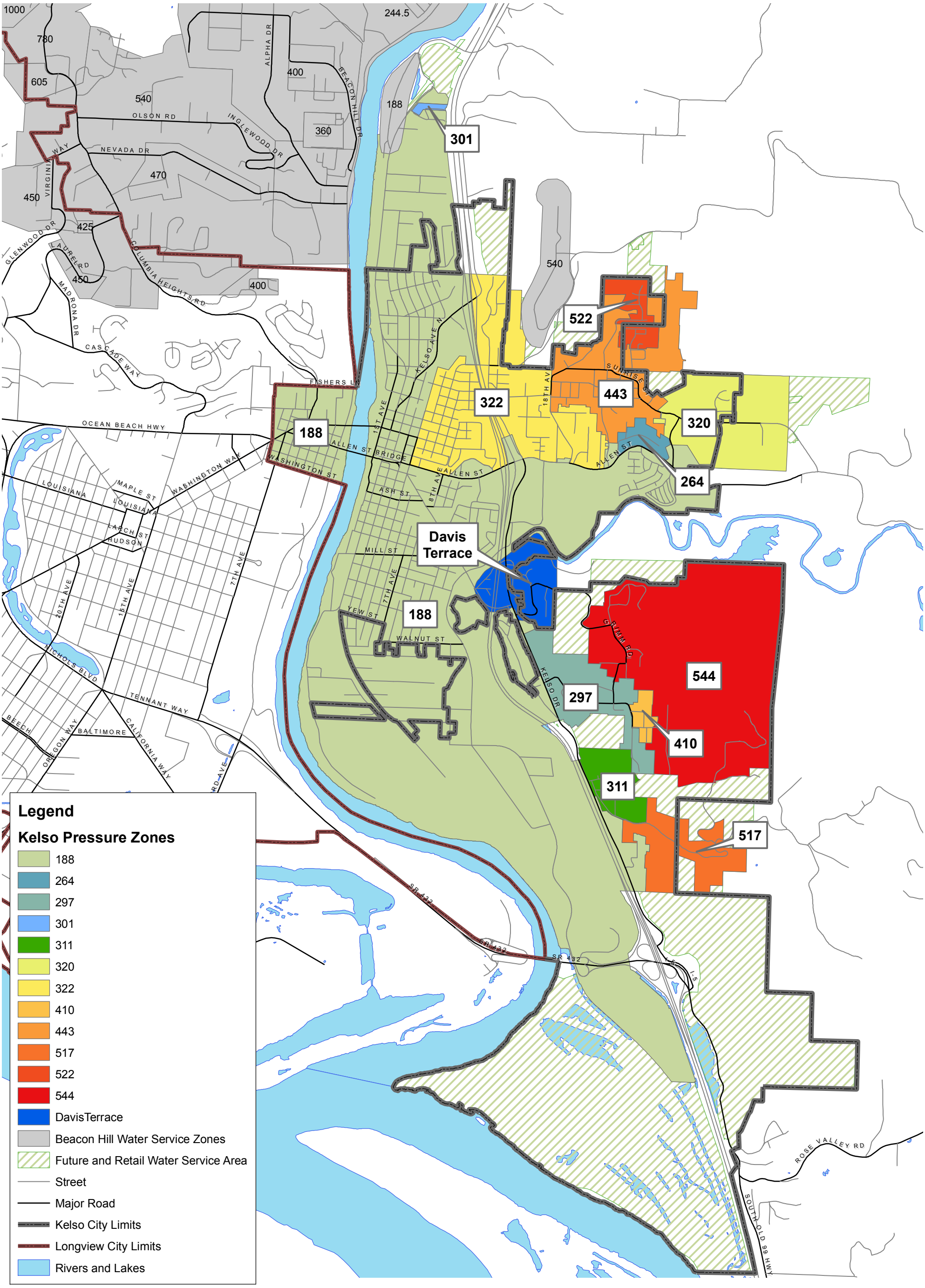

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Kelso, Washington

Service Area Overview
Existing, Future, and Retail

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Figure 1-1

1.4.1 Topography

The service area topography varies from steep slopes to gently rolling terrain, sloping south and west to the generally flat areas along the Cowlitz and Columbia Rivers. The Columbia River borders the service area to the south. The area near the confluence of the Cowlitz, Coweemen, and Columbia Rivers is flat. Hilly uplands surround the urban area to the north and east.

1.4.2 Land Use

Land use planning in the City's water service area is controlled by and under the jurisdiction of the City of Kelso and Cowlitz County (County). The approximate existing land uses for the Kelso service area are shown on Figure 1-2, Land Use and Zoning, obtained from the City's Public Works Engineering Division. The approximate areas of major land use categories for the future service area are summarized in Table 1-2.

Table 1-2: Land Use in Existing and Future Service Areas

	Incorporated [(a)]	Unincorporated [(a)]	Combined [(a)]
Airport Industrial	126.2		126.2
Commercial Neighborhood	16.4	3.5	19.9
General manufacturing	820.7		820.7
Light Industrial	356.3	18.5	374.8
Major Retail Area	122.9		122.9
Open Space	560.5		560.5
Residential Single	2,184.9	718.4	2,903.3
Residential Multi	295.8	22.1	317.9
Special Retail District	173.3	1.8	175.1
Town Center Community	36.4		36.4
West Kelso Community	49.3		49.3
Government/Utility		99.3	99.3
	4,742.7	**863.6**	**5,606.3**
		Service Area in Square Miles	**8.8**

Note:

(a) Totals are shown acres.

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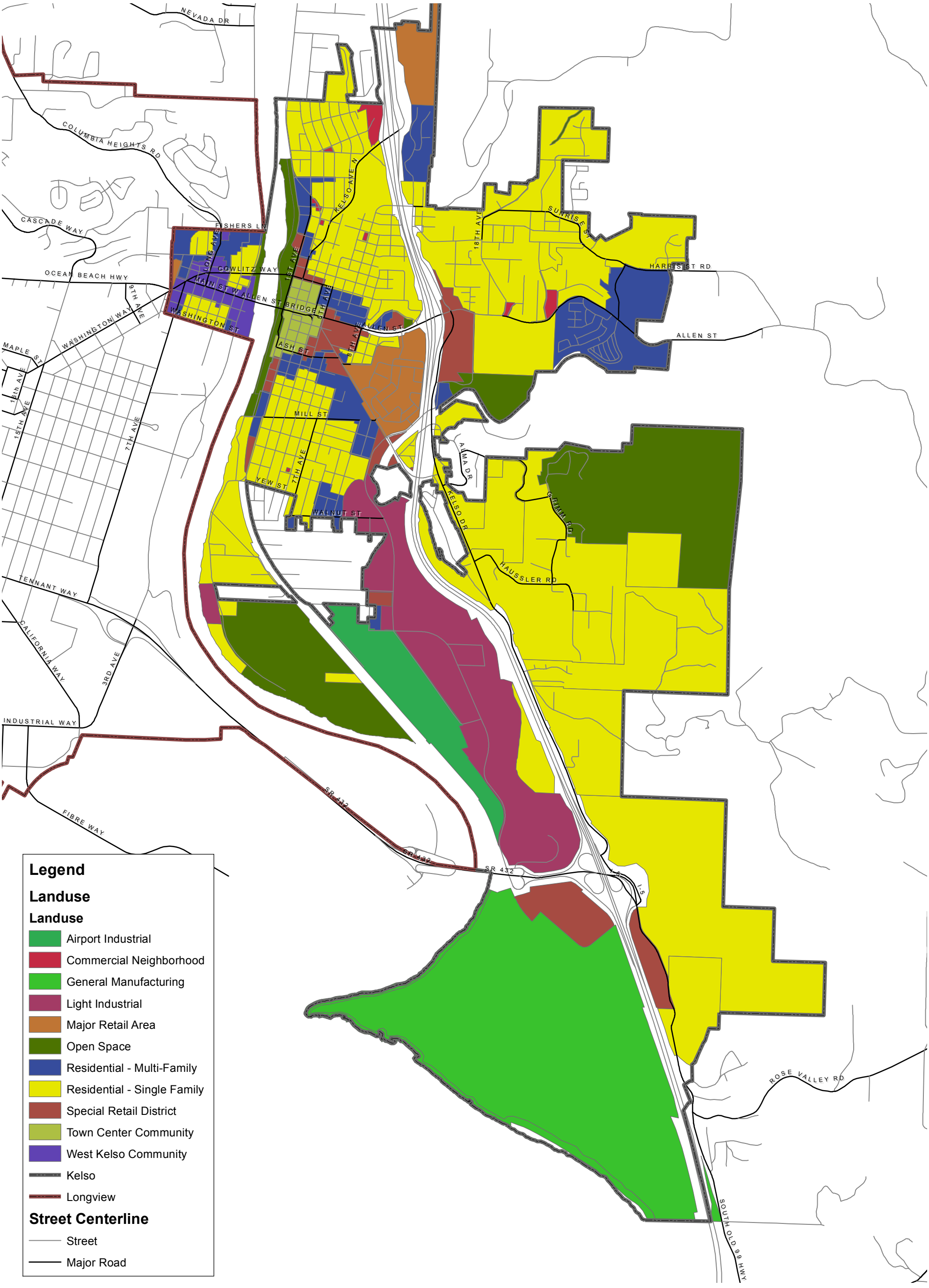

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Kelso, Washington

Kelso Landuse and Zoning

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Figure 1-2

1.5 Service Area and Water Wheeling Agreements

This section summarizes service area and water wheeling agreements currently in force for the three purveyors. Copies of the agreements are included in the appendices. BHWSD assumed responsibility for maintaining the following agreements with the transfer of ownership from the PUD on 1 January 2011.

- Water Services Area Agreement - March 1977: The City, Longview, and the PUD entered into an agreement to provide water to the urban area, to plan orderly system improvements to meet growth, and to provide a basis for decision-making on how to serve new customers without costly duplication of facilities. The following emergency agreements are in place in the event that normal water service is interrupted by an unforeseen event:
  - Water Utilities' Mutual Assistance Plan - 1971: This is a plan among the Cities of Kelso, Longview, Castle Rock, and Woodland; and the BHWSD, Carrolls Water Association, and Cloverdale Water Users' Association. The plan includes the exchange of assistance, emergency aid, equipment charges, labor charges, and equipment damage or loss between the water utilities.
- Water Service Agreement (Davis Terrace) – August 1991: Provides water service from Kelso to Davis Terrace granted acceptable assessment with upgrades of the Davis Terrace's existing system to meet Kelso standards.
- Water Wheeling Agreements: The three purveyors established long-term wheeling agreements that allow the utilities to use each other's facilities to move water from the treatment facility to the service area point of delivery; without duplication of facilities. Water wheeling agreements include:
  - Agreement, Kelso and Beacon Hill Water & Sewer District - 28 December 2010: Provides for wheeling service by the City for the BHWSD to deliver water to Cowlitz Gardens and William-Finney.

1.6 Service Area Policies

This section summarizes current policies applicable to the Comprehensive WSP. As was discussed previously in Section 1.4, a new ordinance to establish the future water service area boundary is planned. Chapter 13 of Kelso's Municipal Code (KCM) addresses the City's current Water System Service Policies, such as latecomer's agreements, new connections, annexation agreements, oversizing, and water main extensions. The full text of KCM Chapter 13.04 is included in the appendices. Design and construction of water system components is governed by the Kelso Engineering and Design Manual. Design and construction standards will be discussed in Section 8 of this WSP.

The City's Comprehensive Plan is currently being updated, but will not be finalized before the completion of this WSP. Policies concerning water service from the existing 1992 Comprehensive Plan are described below:

- **General Policy 1**: The City should be the principal provider of sewer and water services within the Kelso Urban Service Area.

- **General Policy 6**: All sewer and water lines and related equipment needed to service new development should be the responsibility of the developer and/or provided through an agreeable Local Improvement District.

- **General Policy 7**: Water and sewer charges for areas adjoining the City shall be at least one and one-half times those of City residents.

- **Water Policy 2**: Eventually, all public or private water systems should be acquired and operated by the City.

1.7 Inventory of Existing Facilities

This section presents an inventory of the existing facilities for Kelso.

Interties

There are four interties in the City's water system. Two interties connect the City with BHWSD to provide continuous water service for BHWSD service areas. One two-way intertie connects Longview, BHWSD, and the City. The fourth intertie is with DTWA to provide a point of continuous delivery for wholesale water to Davis Terrace. The interties are described in Table 1-3.

All of Kelso's interties to neighboring purveyors have a master meter with the exception of the intertie between Kelso and BHWSD for Cowlitz Gardens. Water wheeled to Cowlitz Gardens is calculated using the area's service meters. Per the 2010 Water Wheeling Agreement, this intertie will have a master meter in place by the end of 2012 to improve the water demand records for this area.

Table 1-3: Intertie and Water Service Agreements

Carrier [(a)]	Receiver	Agreement Date	Connection Location	Description of Service
Longview	Kelso and BHWSD	March 1977	Fishers Lane directly in front of the Longview Regional Water Treatment Plant (RWTP).	• Two-way intertie between the three service providers. Kelso to Longview connection would only work if Longview's system experiences very low pressure. • 6-inch service through a 6-inch meter [approximately capacity of 1,000 gallons per minute (gpm)].
Kelso	BHWSD: Cowlitz Gardens	December 2010	50 feet north of Intersection of North Pacific and Williams Avenue.	• Continuous use as a point of delivery for either wholesale purchase or wheeling of water. Services Cowlitz Gardens from Minor Road Reservoir.
Kelso	BHWSD: Williams Finney	December 2010	200 feet west of Williams Finney Reservoir, east of cemetery.	• Continuous use as a point of delivery for either wholesale purchase or wheeling of water. Services BHWSD Williams-Finney from Kelso's Williams-Finney reservoir.
Kelso	Davis Terrace Water Association	August 1991	Corner of Grade Street and Coweeman Drive.	• Continuous use as a point of delivery for wholesale purchase.

Note:

(a) Carrier is defined as supplier of water.

A schematic of the City's water system hydraulic profile is presented on Figure 1-3. A map of the existing water system is presented on Figure 1-4. The City's facilities are described below.

- **Treatment Plant**: The City owns and operates a Group 3 WTP (Kelso WTP), which is located adjacent to the Cowlitz River. The treatment plant filters have recently been re-rated by DOH and are capable of producing up to 4.8 million gallons per day (MGD). However, the Ranney collector can produce only 4.08 MGD under ideal conditions (i.e., collector has recently been cleaned). Raw water is pumped from a Ranney collector on the bank of the Cowlitz River to the WTP. The treatment process consists of coagulation, pressure filtration, iron, arsenic and manganese removal, chlorination, fluoridation, and pH adjustment for corrosion protection. The water is then pumped to the distribution system from the treatment plant.

- **Booster Pump Stations**: The City operates seven booster pump stations. Characteristics of the booster pump stations are summarized in Table 1-4.

- **Water Storage**: The City currently has eight water storage facility sites; capacities range from 20,000 gallons to 2 million gallons (MG). Characteristics of the water storage facilities are summarized in Table 1-5. All water storage facilities are covered.

- **Pressure Reducing Stations**: Pressure reducing stations in the City's system are listed in Table 1-6.

- **Pipe**: An inventory of the piping material for the City is summarized in Table 1-7. The system has approximately 74.9 miles of water mains (2 inches and larger). The majority of the system is cast iron (28.6 miles) and ductile iron (30.3 miles); approximately 10 miles of asbestos cement (AC) pipe remain in the system. The remained of the pipe in the system is copper, galvanized, polyvinyl chloride (PVC), and steel.

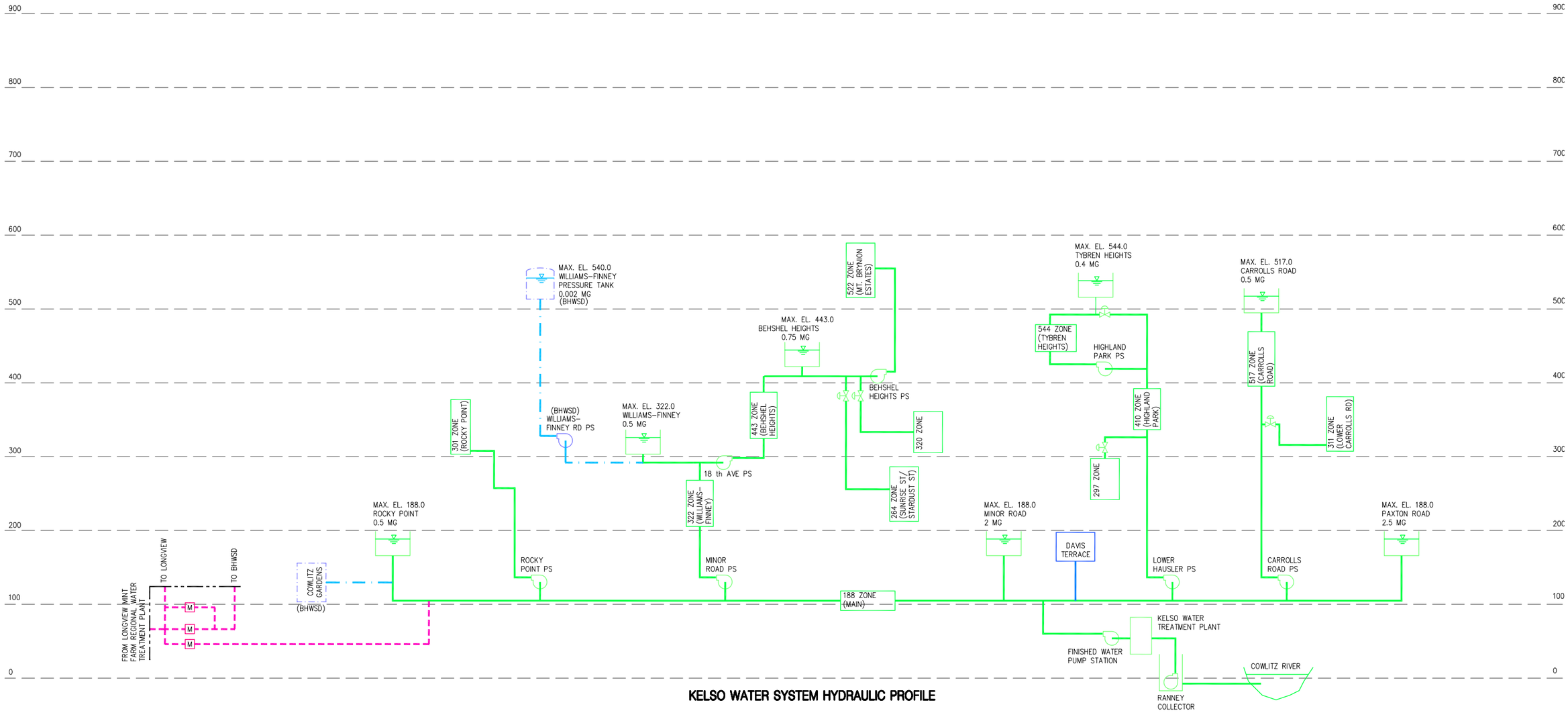
1.8 Conditions of Service

The City's water distribution system consists of all facilities used in the transmission of potable water. The water distribution system terminates at the customer's connection to the City's water meter. The City intends to maintain responsibility for the water supply only from the water distribution system to the point of connection at the meter. Thereafter, the customer is responsible for the water supplied. If all of the City's service area policies are met, the City will provide water service within the identified service boundaries.

1.9 Customer Concern Process

The City refers to Customer complaints as "Customer Concerns". When a concerned customer contacts the Public Works Department, a Citizen Concern Form is completed at the time of the call. The City then has 10 days to correct the concern if within the City's responsibilities and notify the concerned customer as to the resolution.

All Citizen Concern Forms are forwarded daily to the Public Works Department Assistant for central filing. When the concern is settled, an updated final copy of the form is added to the files. All Citizen Concern Forms are kept on file for a minimum of 3 years. A copy of a blank Citizen Concern Form is included in the appendices.



KELSO WATER SYSTEM HYDRAULIC PROFILE

NOTE: For Graphical Clarity, Actual Ranges Of Ground Elevations Served By Each Pressure Zone Are Not Accurately Illustrated.

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City of Kelso, Washington

Water System Hydraulic Profile

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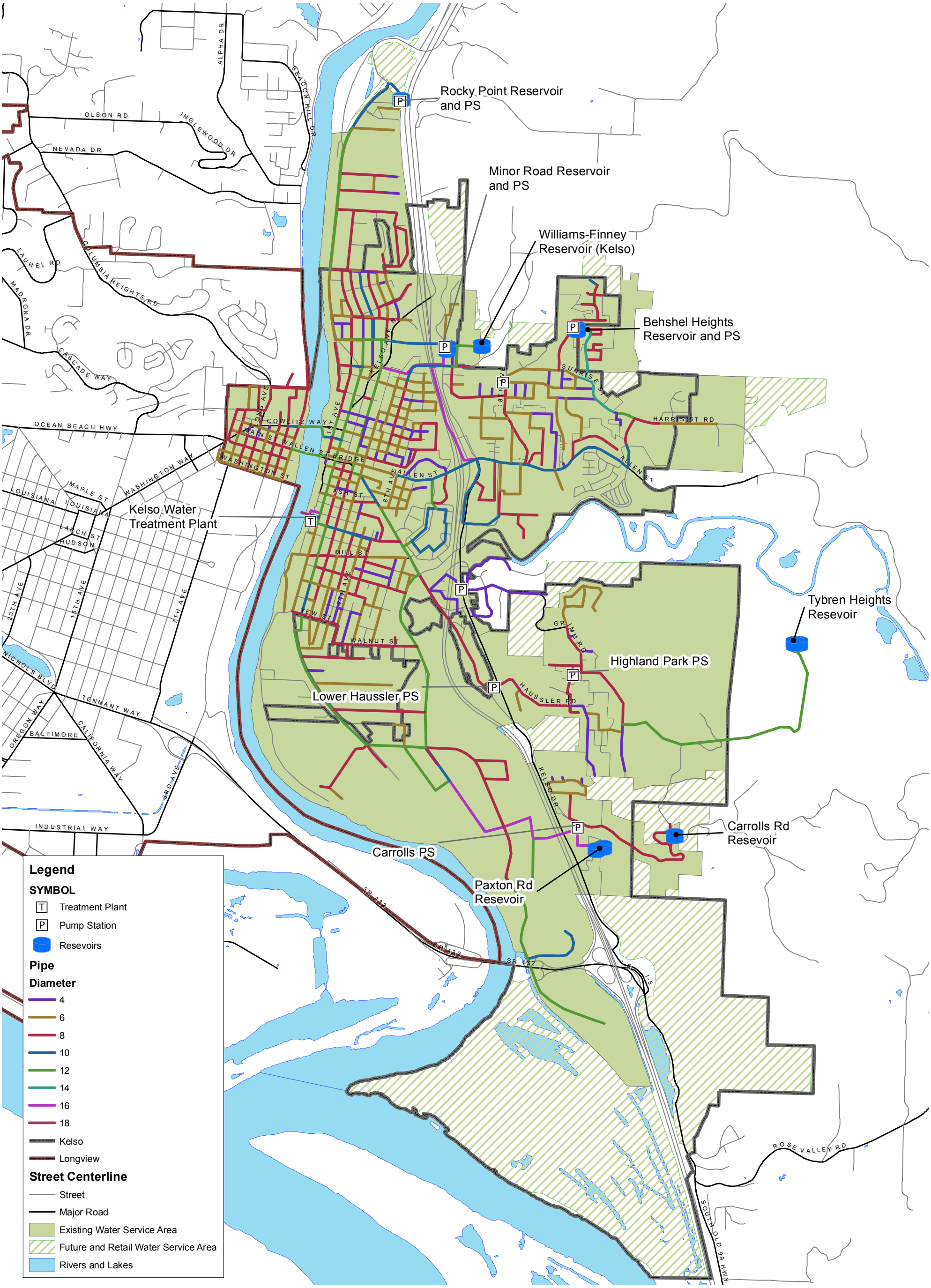
Figure 1-3



Legend

SYMBOL

- T Treatment Plant
- P Pump Station
- Resevoirs

Pipe

Diameter

- 4
- 6
- 8
- 10
- 12
- 14
- 16
- 18
- Kelso
- Longview

Street Centerline

- Street
- Major Road
- Existing Water Service Area
- Future and Retail Water Service Area
- Rivers and Lakes

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Comprehensive Water System Plan
Kelso, Washington

Kelso Water System Overview

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Figure 1-4

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Table 1-4: Booster Pump Stations

Pumping Station Name and Location	Pumps From	Pumps To	Serves	Control	Horsepower and Approximate Capacity
Minor Road 200 Minor Road (Minor Road Reservoir)	Main Pressure Zone 188	Williams-Finney Reservoir	Zone 322	Supervisory Control and Data Acquisition (SCADA) Ethernet Radio.	Two Pumps No. 1 50 HP 800 gpm No. 2 50 HP 800 gpm
Carroll Road [(a)] 517 Carroll Road	Main Pressure Zone 188	Carroll Road Reservoir (El 517)	Zone 517 Zone 311	SCADA Ethernet Radio.	Two Pumps No. 1 25 HP 130 gpm No. 2 25 HP 130 gpm
18th Ave. 18th Ave., next to Butler Acres Grade School	Williams-Finney Pressure Zone 322	Behshel Heights Reservoir (El 443)	Zone 443 Zone 320 Zone 264	SCADA Ethernet Radio.	Two Pumps No. 1 50 HP 600 gpm No. 2 50 HP 600 gpm
Rocky Point Rocky Point Reservoir	Main Pressure Zone 188 ft.	Rocky Point Pressure Zone 301	Zone 301	Pressure switch at the station. Pumps run in series.	Two Pumps No. 1 5 HP 75 gpm No. 2 5 HP 75 gpm
Behshel Heights 1418 Behshel Heights Road	Behshel Heights Pressure Zone (El. 443 ft.)	Mt. Brynion Estates Pressure Zone	Zone 522	Pressure switch at station. Pumps run continuously in parallel. Backed up by a standby generator.	Three Pumps No. 1 5 HP 100 gpm No. 2 15 HP 400 gpm No. 3 40 HP 1,120 gpm
Lower Haussler Pump House Kelso Drive	Kelso Main Pressure Zone 188	Highland Park Pump Station (El 410)	Zone 410 Zone 297	Pressure switch and SCADA controlled on Ethernet Radio. Pumps operate as lead / standby.	Two Pumps No. 1 15 HP 150 gpm No. 2 15 HP 150 gpm
Highland Park Highland Park Drive	Pressure Zone 410 (Equalization Tank)[(b)]	Tybren Heights Reservoir (El 544)	Zone 410 Zone 544	Reservoir Level SCADA Radio telemetry controlled using equalizing tank with float controls adjacent pump station. Pumps operate with one lead and two standbys.	Three Pumps No. 1 15 HP 175 gpm No. 2 15 HP 175 gpm No. 3 15 HP 175 gpm

Notes:

(a) System has a pressure relief valve (PRV) that serves the Lower Carroll Road Area (311).
(b) Equalization tank is for pump station only, does not provide any storage for system.
HP = horsepower

Table 1-5: Water Storage Facilities

Storage Location	Capacity (MG)	Construction	Approximate Construction Year	Maximum Water Surface Elevation (feet)	Minimum Water Surface Elevation (feet)	Last Inspected / Cleaned
Minor Road						
No. 1	1.00	Concrete	1924	188	180	2009
No. 2	1.00	Concrete		188	180	2009
Williams-Finney	0.50	Welded Steel	1965	322	305	2009
Behshel Heights						
No. 1	0.25	Welded Steel	1957	443	422	2009
No. 2	0.50	Bolted Steel	1988	443	422	2009
Carrolls Road	0.50	Welded Steel	1978	517	495	2000
Rocky Point	0.50	Welded Steel	1978	188	180	2009
Paxton Road	0.50	Welded Steel	1973	188	180	2012
	2.0	Prestressed Concrete	2012	188	180	2012
Tybren Heights						
No. 1	0.20	Bolted Steel	2000	544	535	2009
No. 2	0.20	Bolted Steel	2000	544	535	2009
Highland Park [(a)]	0.02.	Bolted Steel	1998	410	410	2009

Note:

(a) Tank is for equalization purposes and does not provide any storage for the zone.

Table 1-6: Pressure Reducing Stations

Location	Size (inches)	Pressure Zone [a] Elevation (feet)		Pressure Setting (psi)		Elevation (feet)
		From [b]	To [c]	High	Low	
Carroll Road	2	517	311	155	48	149
	6	517	311	152	48	149
Sunrise Street & Sunburst Ct.	1.5	443	320	150	94	102
	6	443	320	148	94	102
18th Avenue & Harris Street	6	443	--	Off	Off	166
19th Avenue & Allen Street	6	322	--	Off	Off	29
Barr Drive & Allen Street	4	322	--	Off	Off	32
North Crescent Drive (Behshel Heights)	2	443	264	150	36	98
	6	443	264	146	36	98
Apple Lane & Haussler Road (Tybren Heights)	2	410	297	80	34	240
	4	410	297	80	34	240
West Vista Way	2	544	410	108	47	335
	4	544	410	102	47	335
Highland Park	1.5	544	297	108	0	335
	4	544	297	108	0	335
Corduroy	4	443	--	Off	Off	25

Notes:

(a) The pressure zones correspond to the zones shown on Figures 1-1 and 1-3.
(b) Maximum overflow elevation of the reservoir from which the PRV is served.
(c) Pressure of the PRV on the reduced-pressure side, expressed in feet (the effective elevation of the PRV).
psi = pounds per square inch

Table 1-7: Inventory of Water Mains

Diameter (inches)	Copper	Galvanized Iron	Cast Iron	Ductile Iron	PVC	Steel	AC	Total (Feet)
2	1,205	11,498	3,826	1,647	3,832	520	337	22,865
4	141	269	27,912	3,927	19	517	6,726	39,512
6	-	151	64,790	26,350	4,614	-	13,449	109,353
8	-	672	28,896	77,302	2,612	-	14,135	123,615
10	-	-	14,394	11,355	-	-	2,418	28,167
12	-	-	12,932	18,127	3,998	-	9,777	44,834
14	-	-	178	3,086	-	-	-	3,264
16	-	-	2,341	3,656	-	375	6,744	13,116
Miscellaneous	-	-	4,367	5,500	-	-	786	10,652
Total Feet	**1,346**	**12,590**	**159,635**	**150,949**	**15,075**	**1,412**	**54,371**	**395,378**
Total Miles	**0.3**	**2.4**	**30.2**	**28.6**	**2.9**	**0.3**	**10.3**	**74.9**

Note:

Data are approximate in some cases; lengths shown are in feet.

Source: City of Kelso, Engineering Department, August 2012.

Section 2: Basic Planning Data

2.1 Introduction

Water demand projections are necessary to plan for capital improvements and evaluate water resource needs. This section summarizes current water demands for the City and presents the methodology and results of water demand projections. The basic planning information provided in this section forms the foundation of the Comprehensive WSP and will be utilized in subsequent sections to assess the current state and anticipated future needs of the water system relative to existing and proposed regulations and requirements. The section is organized into five areas: existing water demands, existing and forecast populations, existing per capita water demand, future water demand, and fire flow demand.

2.2 Existing Water Demands

Establishing the existing water demand for the City is the basis for forecasting future demands. Water demand data for the years 2006 to 2011 was obtained for the City and the Kelso WTP. The demands for the distribution system and the WTP are discussed in more detail below.

Water demands for the Kelso WTP are summarized in Table 2-1. Water losses range from 10.2 percent in 2007 to 14.1 percent in 2006. The City is currently taking several steps to decrease the amount of Distribution System Losses (DSLs). The City's Minor Road reservoirs are currently leaking; it is estimated that these leaks account for at least 3 percent of the total annual DSL. The City routinely repairs the leaks readily visible and accessible to divers. The City is currently evaluating either a more comprehensive rehabilitation or replacement project for these reservoirs. The City is actively working to reduce DSLs throughout the system through their annual leak detection program and by testing and replacing large customer meters. The planned Automated Meter Reading (AMR) program included in the City's Capital Improvement Program (CIP) and resulting improvement in data collection should also allow the City to identify and repair leaks. Additional loss reduction measures will be discussed in Section 5: Water Use Efficiency of this WSP.

Average day demand (ADD) and maximum day demand (MDD) are two of the primary system design parameters utilized to assess current water system performance and forecast for the future. The ADD and MDD information for Kelso's WTP are summarized in Table 2-2. From 2006 to 2011, the City's ADD ranged from 2.15 to 2.35 MGD; the MDD ranged from 3.18 to 3.67 MGD. The historical ADD:MDD ratios were calculated to evaluate system performance and forecasting purposes. The ADD:MDD ratio is a measure of demand peaking seen on a seasonal basis. A larger ratio indicates larger seasonal demands. Per the DOH Water System Design Manual, ADD:MDD ratios in Washington generally range from 1.5 to 3.0. For Kelso, the highest ADD:MDD ratio from 2006 to 2011 was 1.61 with a 5-year average of 1.54.

Table 2-1: Annual Water Demand 2006 to 2011 (MG)

Component	2006	2007	2008	2009	2010	2011
Treatment Plant Raw Water	894	867	865	868	845	795
Production Operation Water	20	20	19	21	16	- [(a)]
Backwash[(b)]	18	17	17	16	11	8.9
Treatment Plant Finished Water to City of Kelso Water System	856	830	829	831	818	786
Water Billed to Kelso Customers	735	745	725	733	705	690
Water Wheeled	5.8	4.7	4.5	6.4	4.4	4.0
Distribution System Losses (DSLs)	121	85	104	98	113	96
Percent DSL[(c)]	14.1%	10.2%	12.6%	11.8%	13.9%	12.2%

Notes:

(a) 2011 Production Operation Water is included in backwash total.
(b) Changes in chemical feed system resulted in a reduction in backwash (2010) from increased filter runs times and reduced backwash water and filter to waste water requirements.
(c) Minor Road reservoir losses are estimated to account for 3 percent of the total calculated system losses.

Table 2-2: Water Treatment Plant – Demands from 2006 to 2011

	Average Day Demand (ADD) (MG)		Maximum Day Demand (MDD) (MG)		Month when MDD Occurred	Treated ADD:MDD Ratio
Year	Raw ADD	Treated ADD	Raw MDD[(a)]	Treated MDD		
2006	2.45	2.35	3.77	3.60	July	1.54
2007	2.38	2.27	3.68	3.52	May	1.55
2008	2.37	2.27	3.46	3.32	July	1.46
2009	2.38	2.28	3.83	3.67	July	1.61
2010	2.32	2.24	3.71	3.59	July	1.60
2011	2.18	2.15	3.22	3.18	August	1.48 [(b)]
					5-Year Average:	**1.54**

Notes:

(a) Calculated from ADD:MDD Raw Water Ratio and Treated Water MDD.
(b) 2011 had above average precipitation and below average temperatures.

The City provided estimated demands by area as percentages based on the best available information from their current telemetry system. The City is in the process of updating their SCADA system to provide more accurate data in the future. As shown in Table 2-3, approximately 87 percent of the system demand is from the Main service area (Zone 188). The outlying pump zones comprise only a small percentage of the overall demand for the City.

Table 2-3: Estimates of Annual Water Usage by Reservoir Zones

Reservoir Zone	Pressure Zones Served	Percent Total Demand [(a)]	Demand (MG per year)					
			2006	2007	2008	2009	2010	2011
Minor Road, Paxton Road and Rocky Point[(b)]	188, 301	87.1%	745	723	722	724	712	684
Williams Finney[(c)]	322	7.7%	66	64	64	64	63	60
Behshel Heights	264, 320, 443, 552	2.6%	23	22	22	22	22	21
Carrolls Road	311, 517	0.9%	8	7	7	7	7	7
Highland Park/Tybren Heights	297, 410, 544	1.7%	15	14	14	14	14	13

Notes:

(a) Estimates provided by City of Kelso.
(b) Volumes do not include water wheeled from Longview/BHWSD to Cowlitz Gardens.
(c) Volumes do not include water wheeled from Longview/BHWSD to Williams-Finney.

The analysis of average water demand by customer class and equivalent residential unit (ERU) for the City is summarized in Table 2-4. Customer classes include single-family, multi-family commercial, industrial (Foster Farms), and other. As shown in Table 2-4, the 2011 average unit demand per single family for the City's service area is approximately 155 gallons per day per connection (gpd/connection). Kelso's water usage is skewed toward commercial and industrial users (approximately 56.1 percent of overall demand), while single-family residences account for approximately 27.8 percent of the total demand.

Table 2-4: Residential Equivalence by Connection Type for 2011

Customer Class	Annual Demand Per Customer Class (MG)	Number of Connections	Percent of Total Demand	Equivalent Residential Unit (ERU)
Residential	218.6	3,872	27.8%	3,872
Multifamily [(a)]	22.8	58	2.9%	403
Commercial [(b)]	123.9	365	15.8%	2,195
Industrial	316.6	1	40.3%	5,607
Davis Terrace	7.7	1	1.0%	136
Losses	96.0	-	12.2%	1,700
Totals [(c)]	**786**	**4,297 [(d)]**	**100%**	**13,914**
Average Demand Per Single-Family Residence (gpd) [(b)] =155				

Notes:

(a) Connections 1-inch and larger assumed to be multi-family. Some duplexes may be served by meter smaller than 1 inch and may be included with residential connections.
(b) Commercial includes schools, health care facilities, and other public uses.
(c) Total does not include water wheeled.
(d) The 12 February 2013 WFI update reports current total service connections as 4,292 based on a recent reduction of six commercial and addition of two residential connections. Davis Terrace connection is not included in WFI total.

ERUS for Kelso from 2006 to 2011 are summarized in Table 2-5. As can be seen from the table, the City's total ERU's has remained relatively constant while the annual gallon per day usage per ERU has been trending downward. *For forecasting purposes and to compensate for weather and economic variables, the 5-year average gpd/ERU was utilized.*

Table 2-5: Residential Equivalence (ERU) by Year

Year	Average Demand per ERU (gpd)	Total ERUs
2006	174	13,494
2007	176	12,956
2008	169	13,439
2009	167	13,622
2010	162	13,830
2011	155	13,914
5-Year Average Demand per ERU (gpd) = 166		

2.3 Existing and Forecast Population

Development of future water demand projections, assessment of the water system's ability to fulfill those demands, and development and planning of future water system improvements depend on accurate growth estimates. Growth forecasting was performed using Equation 2-1, the exponential growth formula shown below:

$$P = P_O * \exp(r * t) \quad \textbf{(2-1)}$$

Where P = Population at time (t) in years
P_o = Initial population
r = Annual Growth Rate
t = Years elapsed from basis year

Growth rates shown in the General Sewer Plan for the Longview-Kelso Urban Area Final Report (May 1996) have formed the basis for every population forecast since that time. Updated population growth rates are currently being analyzed using the most recent census data (2010) for the County. The City has traditionally been the slowest growing area within the Kelso Longview Urban area. The 2005 WSP utilized a growth rate of 0.5 percent for the City. The actual growth rate over the last 10 years, from the 2000 census to the 2010 census, for the City was only 0.3 percent.

Forecast growth rates were calculated from population projections from the Office of Financial Management (OFM). OFM offers projections of high, medium, and low growth rates. All three projections were calculated for the immediate future and a longer planning period. All growth rates are shown in Table 2-6. The January 2011 Kelso General Sewer and Facilities Plan indicates growth for the Kelso area is expected to be 1 percent annually. Given the area's historically low growth rate, the average projected low growth rate of 0.97 percent was used for population forecasting in this plan.

Table 2-6: Projected Growth Rates for Cowlitz County

Cowlitz County Area	Average Projected Growth Rate 2010-2030	Projected Annual Growth Rate 2010-2015	Projected Annual Growth Rate 2010-2030
HIGH	2.17%	2.26%	2.07%
MEDIUM	1.53%	1.61%	1.46%
LOW	0.97%	1.06%	0.88%

Source: US Census Bureau and Office of Financial Management.

Table 2-7 presents the existing and future population for the City. Population projections are based on the 2010 census data for the City and County's growth rate established above.

Table 2-7: Population Forecast for Kelso Service Area

Level of Forecast	2010[(a)]	2018	2032
HIGH	11,925	14,289	18,824
MEDIUM	11,925	13,569	16,435
LOW	11,925	12,978	14,459
Current Growth Rate [(b)]	11,925	12,887	14,760

Notes:

(a) Source: http://www.cubitplanning.com/city/15005-kelso-city-census-2010-population.
(b) The Current Growth Rate is used for all projections in this Water System Plan.

2.4 Existing Per Capita Water Demand

Per capita water demands for the City are listed in Table 2-8. These demands were calculated based on the 2010 population and 2010 total water demand. Per capita demands are presented for informational purposes only.

Table 2-8: Per Capita Water Demands

2010 Population	2010 Demand (gpd)	Per Capita Demand (gpcd)[(a)]
11,925	2,241,096	187.9

Note:

(a) gpcd = gallons per capita per day.

2.5 Future Water Demands

Evaluation of future water source, storage, transmission, and distribution system needs requires the estimate of anticipated future water demands. Future water demand projections can best be estimated from population projections, recent demand trends and projected conservation savings.

2.5.1 ADD and MDD

Review of 5 years of Kelso WTP and water system billing records allowed for the determination of ADD, MDD, and ADD:MDD ratio for the City's system. Table 2-9 shows the forecast ERUs for the 6- and 20-year planning periods along with the associated demand per ERU. For forecasting purposes and to compensate for weather and economic variables, the 5-year average ADD per ERU was utilized. The 5-year average MDD was calculated based on the 5-year average ADD:MDD ratio. The forecasted ERUs include current distribution system losses expressed as ERUs. As the City repairs known DSLs and implements conservation measures discussed in Section 5: Water Use Efficiency of this Plan, it is expected DSL will decrease.

Table 2-9: Projected ERUs

	2011	2018	2032
Projected ERUs	13,914	14,891	17,055
Demand per ERU (gpd/ERU) [a]			
ADD[b]	155	166[c]	166
MDD[b]	229	255	255

Notes:

(a) For forecasting purposes, the 2018 and 2032 calculated gpd/ERU values were used.
(b) Without conservation.
(c) 5-year average from 2007-2011.

ADD for the 6- and 20-year planning periods was estimated by using the forecast ERUs and the 5-year average demand per ERU, as shown in Table 2-5. MDD for the 6- and 20-year planning periods were estimated using the 5-year average ADD:MDD ratio, shown in Table 2-2. Table 2-10 shows the forecast future water demands for the distribution system. Figure 2-1 shows the projected future water demands for the City and the WTP. Conservation effects will be discussed in Section 5: Water Use Efficiency of this Plan.

Table 2-10: Future Water Demands (MGD)

	2011		2018		2032	
	ADD	MDD	ADD	MDD	ADD	MDD
Water to Distribution System [a]	2.15	3.18	2.47	3.80	2.83	4.35

Note:

(a) Water demands reflect treated water delivered to the distribution system and do not include any projected conservation savings or new industrial developments.

Figure 2-1: Kelso Projected Future Water Demands

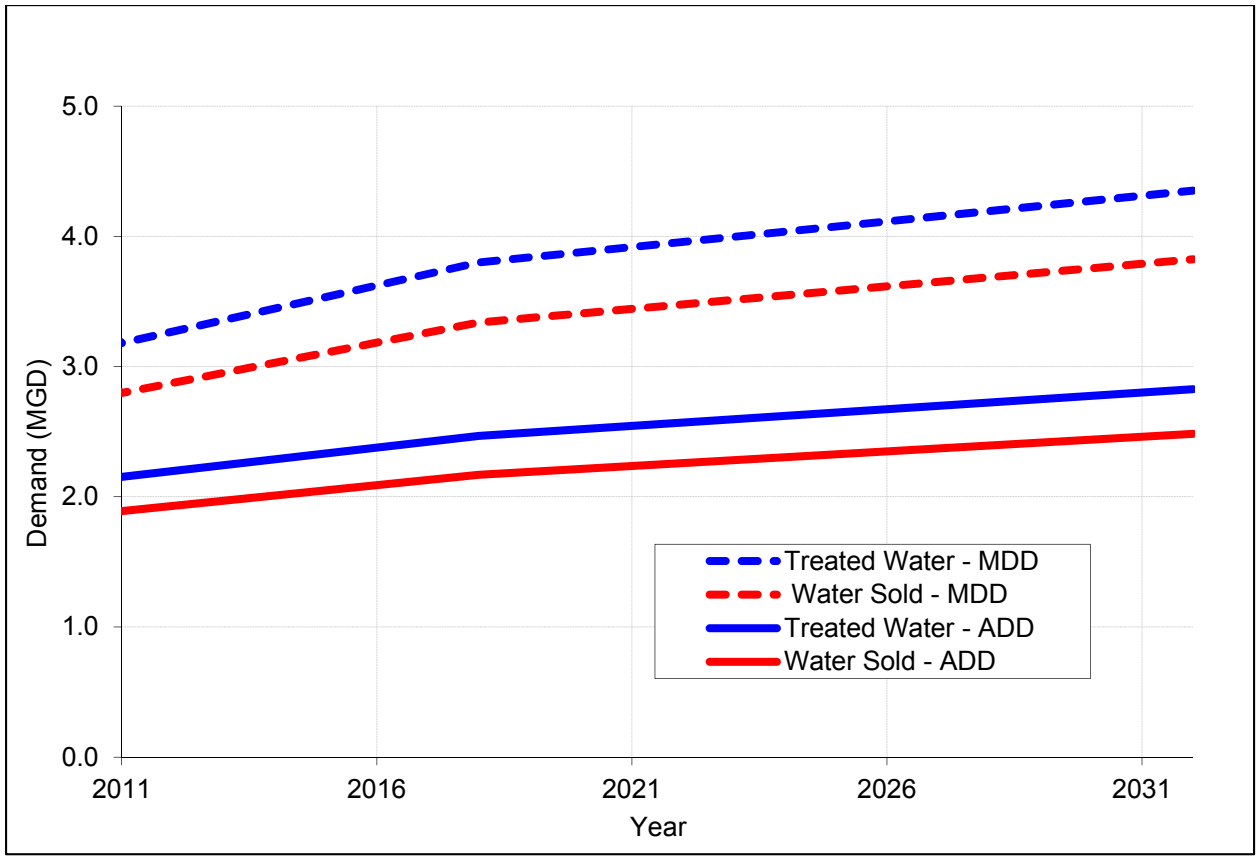


Table 2-11 provides ERU projections by zone. The values shown in the table are used to perform the source, treatment capacity, pump station capacity, and storage analyses discussed in Section 4: System Analysis. Calculations to obtain ERUs (in gpd) are explained previously in this section. The number of ERUs by zone was estimated by dividing the 2011 water demand by zone by the 2011 demand per ERU. ERU by zone forecasting utilizes the previously established as growth rates as growth is relatively uniform throughout the City's service areas.

Table 2-11: ERU Projection by Zone

Pressure Zones[a]	Estimated % Growth Rate by Zone	Demand 2011 (MG)	Number of Connections by Zone in 2011 [b]	ERU by Zone		
				2011 [c]	2018	2032
Minor Road, Paxton Road, and Rocky Point (188)	0.97%	684.0	3,741	12,115	12,965	14,850
Williams Finney (322)	0.97%	60.5	331	1,071	1,147	1,313
Behshel (443, 264)	0.97%	20.7	113	366	392	449
Carrolls Road (311, 517)	0.97%	7.0	38	124	133	152
Highland Park/Tybren Heights (544, 416)	0.97%	13.4	73	238	255	292
Totals [d]		**786**	**4,297**	**13,914**	**14,891**	**17,055**

Notes:

(a) Pressure zones are grouped based on the reservoir(s) that serve each zone.
(b) Number of connections by zone is approximated from zone demand percentages provided by City.
(c) Based on calculated 2011 ERUs.
(d) Totals include distributed DSLs based on percentage of demand for each zone.

2.5.2 Peak Hour Demand (PHD)

Peak Hour Demand (PHD) is the maximum rate of water use, excluding fire flow, that can be expected to occur within a defined service area over a continuous 60-minute time period. Typically, the peak hour occurs during the evening and is approximately 170 percent of the maximum demand for that day. The following equation from the DOH Water System Design Manual was used to calculate PHD for 2011. Future PHD was forecast using projected MDD and ERU values from above for 2018 and 2032. Further discussion of this formula appears in Section 4: System Analysis.

$$PHD = \frac{MDD}{1440} * (C * N + F) + 18$$

Where: PHD = Peak Hourly Demand (gpm)
C = Coefficient associated with ranges of ERUs (C=1.6 for ERU>500)
N = Number of ERUs
F = Factor associated with ranges of ERUs (F=225 for ERU>500)
MDD = MDD (gpd/ERU)

Table 2-12: Peak Hourly Demand Projections (MGD)

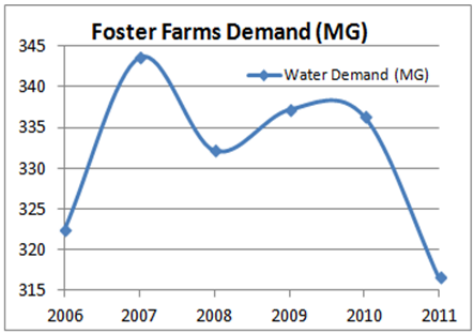
Description	2011	2018	2032
Peak Hourly Demand (MGD)	5.2	6.2	7.0
PHD:MDD Ratio	1.62	1.62	1.62

2.5.3 Industrial Demand

Currently, the City's only industrial user is Foster Farms. Table 2-13 show the historical water demands for Foster Farms. Foster Farms' demand does not vary seasonally, but is shown to vary from year to year.

Table 2-13: Historical Water Demands for Foster Farms (MG)

Year	Water Demand (MG)
2006	322.5
2007	343.6
2008	332.2
2009	337.2
2010	336.4
2011	316.6



Demands from Foster Farms can vary greatly throughout the day, depending on where they are in their process. In an effort to mitigate these fluctuations and to reduce their water usage, Foster Farms has undertaken a water reuse program within their facilities that is expected to reduce their demands by 15 percent in 2011, 2012, and 2013. The initial impacts of the Foster Farms reuse program are reflected in the 2011 usage records which indicate Foster Farms reduced their demand by nearly 20 MG in 2011. The conservation program at Foster Farms is discussed further in Section 5.

The City plans to develop an industrial park to the south of the City but as of yet, there are not any established users for the proposed industrial park.

2.6 Fire Flow Demand

Fire flow demand refers to the rate of water flow necessary to control major fires within the service areas. Per WAC 246-290-420, water transmission and distribution systems are designed to maintain a minimum pressure of 20 psi at the point of fire flow delivery as well as throughout the rest of the system during fire flow delivery.

2.6.1 Fire Flow Standards

Several standards are available for establishing fire flow:

- International Fire Code (IFC)
- Cowlitz County Ordinance No. 04-136. (A copy of the ordinance is included in the appendices).
- Washington Survey and Rating Bureau Standard.

The City is currently served by Cowlitz 2 Fire and Rescue. Unincorporated areas are served by the County. Interlocal agreements between Longview and Cowlitz 2 Fire and Rescue include Sharing Services of Administration and Command Personnel (Draft 12 November 1996), Fires Services Study and Analysis (27 August 1994), and Mutual Aid Agreement (19 January 1995). Copies of these agreements are included in the appendices.

2.6.2 Fire Flow Requirements

Actual fire flow requirements for specified projects depend on several circumstances:

- Size of the structure(s)
- Location of the structure/project
- Type of construction material (wood vs. concrete/brick, etc.)
- Number of stories
- Building fire protection systems (sprinklers, automatic fire doors, etc.)
- Proximity of adjacent structures
- Type of occupancy/building use (storage of flammable chemicals, etc.).

Fire flow demand requirements and standards for land use classification and structural type are summarized in Table 2-13. The standards require fire flows to be delivered at a minimum of 20 psi during MDD. The residential zones contain multiple zone classes; therefore, all zones default to the greater fire flows of 1,500 gpm for 3 hours, with the exception of the main zone (188), which requires 4,000 gpm for 5 hours. The design fire flows shown in Table 2-13 will be used in the hydraulic analysis of the distribution system using the City's computer model. Results of the computer modeling will identify areas that require improvement in order to meet fire flow demands.

Table 2-14: Fire Flow Demand Requirements

Class	Pressure Zones Inside City Limits	Pressure Zones Outside City Limits
Residential/ Single-Family	188, 264, 297, 311, 322, 410, 443, 517, 544	301, 320, 322, 410, 517,522
Residential/Multi-Family	188, 311, 322, 410, 443, 517, 544	322, 410, 517
Commercial	188	N/A
Schools	188	N/A
Industrial	188	N/A

Class	Jurisdiction	Fire Flow (gpm)/ Duration (hrs)
Residential/Single Family (Less than 3,500 sf)	County	500 gpm for 0.5 hr[(a)]
Residential/Single Family (Less than 3,600 sf)	City	1,000 gpm for 2 hr[(b)]
Residential/Multi-Family	City County	1,500 gpm for 2 hrs[(b)] 1,500 gpm for 3 hrs[(b)]
Commercial	City	1,500 gpm for 3 hrs
Commercial	County	1,500 gpm for 2 hrs[(b)]
Schools	City	1,500 gpm for 3 hrs[(b)]
Industrial	City	4,000 gpm for 5 hrs[(b)]

Notes:

(a) County Ordinance. Refer to full ordinance and 2009 IFC, Table B105.1 for larger dwellings and other building classes.
(b) IFC estimated minimum required fire flow based on typical construction type and size for each building class and including sprinkler system deductions. Actual fire flow requirements are determined based on the 2009 IFC, Table B105.1.

sf = square feet

Section 3: Water Quality Analysis

3.1 Introduction

A water utility's ability to meet current and anticipated demands is the principal consideration in water system planning. In addition to demand considerations, water quality, facilities planning, and regulatory requirements influence how a water system must be analyzed. To address these influences, the following components are examined in Sections 3 and 4:

- General Facility Standards
- Water Quality Regulations and Standards
- Analysis of Water Quality and Treatment.

Water quality analyses evaluate existing facilities according to pre-identified design standards.

3.2 Water Quality Regulations and Standards

This section discusses the following:

- Regulatory Framework
- Applicable Drinking Water Regulations
- Existing Drinking Water Quality Standards
- Water Quality Monitoring Requirements
- Potential Future Drinking Water Regulations.

3.2.1 Regulatory Framework

In the State of Washington, the U.S. Environmental Protection Agency (EPA) and the DOH establish drinking water standards in accordance with EPA requirements. In general, water quality standards can be separated into primary and secondary standards. Primary standards are established for the protection of public health, while secondary standards cover aesthetic considerations. Current drinking water regulations attempt to manage two distinct kinds of risk: microbial and chemical. The City uses surface water as its source of supply and is subject to increasingly stringent surface water regulations with the goal of minimizing risks posed by pathogens and chemicals.

3.2.2 Applicable Regulations

The Safe Drinking Water Act (SDWA) is the foundation for all state and local government water quality standards. Present regulatory approaches and health effect assessment methodologies largely focus on individual contaminants. The State Drinking Water Regulations are revised regularly to incorporate new EPA rules.

The basic regulatory requirements for drinking water quality in the State of Washington are published in the Drinking Water Regulations (WAC 246-290) and administered and enforced by DOH. The City is a Group A Public Water System and is regulated under WAC 246-290, which was last updated August 2011. In most cases, the regulations adopted by DOH are the minimum requirements established by the EPA. However, DOH has the option to adopt and enforce standards that are more stringent than the federal regulation. These regulations provide oversight for the design, construction, and operation of public water systems in Washington. Existing regulations cover bacteriological contaminants, inorganic compounds (IOCs), physical characteristics, lead and copper, disinfection by-products (DBPs), volatile organic chemicals (VOCs), synthetic organic chemicals (SOCs), and radionuclides.

3.2.3 Water Quality Standards

This section discusses applicable drinking water regulations and the impacts on the City. The Groundwater Rule does not apply to the City as their source is considered a Groundwater Under the Influence of Surface Water (GWI), and is subject to surface water regulations. The regulations discussed include the following:

- Surface Water Treatment Rules
- Filter Backwash Rule
- Stage 1 and 2 Disinfectant/Disinfection By-Product Rules (D/DBPR)
- Inorganic and Organic Compound Monitoring
- Radionuclides
- Total Coliform Rule and Revisions
- Lead and Copper Rule
- Consumer Confidence Reports.

3.2.3.1 Surface Water Treatment Rules

Rule Summary: A series of successive rules are applicable to utilities that use surface water as the drinking water supply.

Surface Water Treatment Rule (1989)

The Surface Water Treatment Rule (SWTR) applies to all public water systems that use surface water (or groundwater under the direct influence of surface water). The SWTR sets treatment technique criteria rather than Maximum Contaminant Limits (MCLs) for several microbial contaminants. For those utilities with conventional (or direct) filtration treatment processes, it required removal/inactivation of 4-logs of virus and 3-logs of *Giardia*, it required a minimum disinfectant residual of 0.2 milligrams per liter (mg/L) for more than 4 hours at the entry point to the distribution system and a detectable disinfectant residual in the distribution system. It also

created a turbidity performance criterion for system using conventional treatment or direct filtration of 0.5 nephelometric turbidity unit (NTU) for the combined filter effluent in 95 percent of the monthly measurements. It also contained more rigorous turbidity monitoring and reporting requirements for combined and individual filter effluents.

Interim Enhanced Surface Water Treatment Rule (1998)

The Interim Enhanced Surface Water Treatment Rule (IESWTR) applies to all public water systems serving more than 10,000 people and increased the stringency of the SWTR turbidity monitoring, recording, reporting, and follow up requirements. It reduced the performance criteria for the turbidity of the combined filter effluent to 0.3 NTU in at least 95 percent of the monthly measurements. It also required turbidity monitoring of individual filters. It also set an MCL Goal of (MCLG) of zero for *Cryptosporidium*, required 2-log *Cryptosporidium* removal for systems with conventional (or direct) filtration (with compliance based upon achieving turbidity requirements), contained disinfection profiling and benchmarking provisions to comply with new DBP standards, required covers on new finished water reservoirs, and required sanitary surveys.

Long Term 1 Enhanced Surface Water Treatment Rule (2002)

The Long Term 1 Enhanced Surface Water Treatment Rule (LT1ESWTR) expanded many of the requirements of the IESWTR to systems that serve fewer than 10,000 people. It also established guidelines for State approval of systems that use an alternate treatment technology (other than conventional, direct, slow sand, or diatomaceous earth filtration) based on filter demonstration data submitted by the system.

Long Term 2 Enhanced Surface Water Treatment Rule (2006)

The Long Term 2 Enhanced Surface Water Treatment Rule (LT2ESWTR) is intended to reduce illness linked with the contaminant *Cryptosporidium* (and other pathogenic microorganisms) in drinking water and applies to both filtered and unfiltered water systems. The LT2ESWTR classified filtered water systems into one of four treatment categories (bins) based on raw water *Cryptosporidium* monitoring results. Systems classified in the lowest treatment bin are not required to provide additional treatment beyond the IESWTR. Systems classified in higher treatment bins must provide 90 to 99.7 percent (1.0 to 2.5-log) additional treatment for *Cryptosporidium*. Systems can select from a wide range of treatment and management strategies in the "microbial toolbox" to meet their additional treatment requirements. It also required unfiltered water systems to provide at least 99 or 99.9 percent (2 or 3-log) inactivation of *Cryptosporidium*, depending on the results of their monitoring. Other requirements include either covering open finished water reservoirs or treating the discharge from the reservoir to achieve inactivation/removal of at least 4-logs of virus, 3-logs of *Giardia lamblia*, and 2-logs of *Cryptosporidium*.

Anticipated Impacts: The City continues to comply with these SWTRs, with its low turbidity source water. The Kelso Ranney collector has been designated in the lowest bin classification, per the LT2ESWTR; therefore, no additional *Cryptosporidium* removal/ inactivation is required. The City will need to complete additional *Cryptosporidium* source monitoring starting in October 2016 in order to maintain the lowest bin classification.

3.2.3.2 Filter Backwash Recycling Rule (2001)

Rule Summary: The Filter Backwash Recycling Rule (FBRR) applies to all systems that use conventional or direct filtration treatment and that recycle spent filter backwash water, thickener supernatant, or liquids from dewatered processes. All recycle flows must be returned to the head of the plant so that the recycle stream is completely treated. The FBRR also specifies notification and reporting requirements to gain State approval for a backwash recovery treatment process.

Anticipated Impacts: Backwash recycle is not practiced at the Kelso WTP, and as such, this rule does not currently apply. The City's filter backwash is currently sent to the Regional Three Rivers Wastewater Treatment Plant. The City is considering initiating recovery of its backwash water and will develop a plan to do so that is in compliance with the requirements of the FBRR.

3.2.3.3 Stage 1 Disinfectant/Disinfection By-Product D/DBP Rule

Rule Summary: The Stage 1 D/DBP Rule applies to all community water systems and nontransient, noncommunity water systems that add a disinfectant during any part of the treatment process. Major features of the Stage 1 D/DBPR include: limits and monitoring requirements for DBPs and established Maximum Residual Disinfectant Levels (MRDLs); and total organic carbon (TOC) removal requirements. Large surface water systems (i.e., serving 10,000 or more) were required to comply by December 2001. Smaller surface water systems and all groundwater systems were required to comply with the Stage 1 D/DBPR by December 2003. Specific DBP MCLs of concern to Kelso include 80 micrograms per liter (µg/L) of Total Trihalomethanes (TTHM) and 60 µg/L of Five Haloacetic Acids (HAA5).

Anticipated Impacts: The City has submitted a DBP Monitoring Plan to DOH for review and approval and is performing sampling per the plan.

3.2.3.4 Stage 2 Disinfectant/Disinfection By-Product D/DBP Rule

Rule Summary: The Stage 2 D/DBP Rule is designed to reduce the occurrence of peaks in DBPs by changing the calculation method from a system wide average to a Locational Running Annual Average (LRAA). Under this rule, each location in the distribution system must comply with the MCLs for DBPs. Compliance monitoring is preceded by an initial distribution system evaluation (IDSE) study to select site-specific sample points to capture peaks. The effective date for this rule is June 2006.

Anticipated Impacts: The City has received 40/30 certification waiver from EPA and does not need to complete the IDSE under the Stage 2 BDP Rule. It is anticipated that the City will be able to maintain their reduced monitoring requirements for Stage 2. A revised Stage 2 DBP Monitoring Plan will be completed prior to implementing Stage 2 requirements on 1 October 2013.

3.2.3.5 Inorganic and Organic Compound Monitoring Requirements

Rule Summary: WAC 246-290-300 establishes the inorganic and organic monitoring regulations for water systems in Washington. The contaminant groups included are IOCs, VOCs, and SOCs, as well as the individual contaminants asbestos, nitrate, and nitrite. WAC 246-290-100 lists the primary and secondary MCLs for inorganic chemicals and by reference MCLs for VOCs and SOCs.

Anticipated Impacts: Table 3-1 presents typical monitoring requirements for organic and inorganic compounds for systems serving a population greater than 3,300. Repeat monitoring is based on initial results and vulnerability. If a contaminant is not detected (or is detected at very low levels), then the frequency of monitoring is reduced. However, if a contaminant is found above the "trigger," then the purveyors may be required to temporarily perform quarterly sampling.

Results of the analyses must be reported to the DOH within 10 days after the end of the required monitoring period, unless the results exceed the MCL. In that case, the results must be reported to the DOH within 24 hours, or by the next business day after the results are reported to the utility.

Table 3-1: Inorganic and Organic Compound Monitoring Requirements

Contaminant	Sampling Frequency[(a)]	Trigger that Increases Sampling	Requirements for Waivers
Asbestos	1 sample every 9 years, not required for source approval	> MCL	Based on vulnerability assessment.
Nitrate	Annual	≥ 50% MCL	No waivers allowed.
Nitrite	1 sample every 3 years	≥ 50% MCL	No waivers allowed.
Inorganic Compounds (IOCs)	1 sample every 3 years	> MCL	Includes arsenic standard of 10 ppb.
Volatile Organic Compounds (VOCs)[(b)]	Quarterly sampling required for first 3 years of operation, then 1 sample every 3 years	Detection	If first sample is non-detect additional samples in first 3 years may be waived.
Synthetic Organic Compounds (SOCs) [(b)] - Dioxin - Endothal - EDB - Diquat - Glyphosphate	Quarterly sampling required for first 3 years of operation, then 1 sample every 3 years	Detection	If first sample is non-detect additional samples in first 3 years may be waived
SOCs - Herbicides - Pesticides - Insecticides	Quarterly sampling required for first 3 years of operation, then 1 sample every 3 years	Detection	If first sample is non-detect additional samples in first 3 years may be waived.

Notes:

(a) Sampling location is source water after treatment for all analytes.
(b) Well casing must be > 200 feet; sampling frequency assumes low rating in the Susceptibility Assessment.
ppb = parts per billion

3.2.3.6 Arsenic Rule

Rule Summary: Arsenic is most often present as a naturally occurring element in rocks and soil, water, air, plants, and animals. Volcanic activity, the erosion of rocks and minerals, and forest fires are natural sources that can release arsenic into the environment. Arsenic is also used by various industries. Health effects include both cancerous and non-cancerous effects (cardiovascular, pulmonary, immunological, neurological, and endocrine effects).

Anticipated Impacts: On 22 January 2001, EPA adopted a standard for arsenic in drinking water at 10 parts per billion (ppb), replacing the old standard of 50 ppb. The rule became

effective on 22 February 2002. The rule was adopted by DOH in 2006. Arsenic is sampled as part of the IOC group of chemicals. Results to date have shown that compliance with the lower MCL has not been problematic with arsenic typically below 2 ppb.

3.2.3.7 Radionuclides

Rule Summary: DOH has adopted the standards for radionuclides under WAC 246-290-310 (7) presented in Table 3-2.

Table 3-2: Radionuclide Standards

Radionuclide	MCL (5 pCi/L)
Combined Radium – 226 and 228	5 picocuries per liter (pCi/l)
Gross Alpha (excludes radon and uranium)	15 pCi/l
Beta Particles and Photo Emitters	4 millirems/year (mrem/yr)
Uranium	0.030 mg/L

Anticipated Impacts: Currently, the DOH requires monitoring for gross alpha activity every 4 years. Compliance is based on analysis of an annual composite of four consecutive quarterly samples, or the average of the analyses of four quarterly samples. If the gross alpha activity exceeds 5 pCi/L, the same or an equivalent sample must be analyzed for Radium-226 and Radium-228. The City is in compliance with this rule. Recent results show Radium-226 and gross alpha were not detected, and beta particles and Radium-228 were well below the respective MCLs.

3.2.3.8 Total Coliform Rule (TCR)

Rule Summary: The TCR, which became effective on 31 December 1990, includes requirements to monitor distribution systems for bacteriological parameters. It applies to all types of systems and establishes an MCL goal of zero for total coliform, fecal coliform, and *E. coli*.

In 2010, proposed revisions to the TCR were finalized. EPA expects to publish the final Revisions to the TCR in fall 2012. The proposed revisions to the TCR will:

- Require public water systems that are vulnerable to microbial contamination to identify and fix problems
- Establish criteria for systems to qualify for and stay on reduced monitoring, thereby providing incentives for improved water system operation.

The proposed rule links monitoring frequency to water quality and system performance. It also establishes an MCLG and an MCL similar to the current rule of zero for *E. coli*, a more specific indicator of fecal contamination and potential harmful pathogens than total coliform. The proposed revisions eliminate the current MCLG and MCL of zero for total coliform and replace it with a treatment technique. A system that exceeds a specified frequency of total coliform occurrence must conduct an assessment to determine if any sanitary defects exist and, if found, correct them.

In addition, under the proposed treatment technique requirements, a system that incurs an *E. coli* MCL violation must conduct an assessment and correct any sanitary defects found.

Anticipated Impacts: The TCR requires the system to maintain and carry out a Coliform Monitoring Plan (CMP), which includes a system map and narrative that describes the system.

3.2.3.9 Lead and Copper Rule

Rule Summary: Published June 1991, the Lead and Copper Rule (LCR) sets treatment technique requirements for lead and copper. The LCR calls for monitoring to establish compliance with action levels of 0.015 mg/L for lead and 1.3 mg/L for copper based on the 90th percentile level of targeted tap water samples. If either action level is exceeded, the utility must assess corrosion control alternatives and implement an "optimal" corrosion control program and/or treat the source water.

Anticipated Impacts: If a system meets lead and copper action levels during each of two consecutive monitoring periods, the system may request the DOH to reduce the required monitoring frequency to once per year. The City met the lead and copper action levels during the initial 3 consecutive years of monitoring and has now reduced the frequency of monitoring from annually to once every 3 years. A copy of their Lead and Copper Monitoring results is included in the appendices.

3.2.3.10 Consumer Confidence Reports (CCRs)

Rule Summary: This rule requires the City to prepare and provide annual Consumer Confidence Reports (CCRs) to their customers reporting the quality of the water delivered by the system. CCRs are intended to provide information to the public regarding the quality of the water delivered and to characterize the risks (if any) from exposure to contaminants in the drinking water.

Anticipated Impacts: Each system must mail a copy of the CCR to every customer. The City currently prepares and issues annual CCRs. The City also posts the Annual Water Quality Reports online.

3.2.4 Summary of Monitoring Requirements

The most pertinent monitoring plans are summarized below:

- **Water Quality Monitoring Report (WQMR):** Issued annually by the DOH to the City, the WQMR describes the water quality parameters that must be collected and sampled.

- **CMP:** A plan developed by the City that stipulates the number of monthly bacteriological samples to be collected and the location where the sampling shall be conducted. Chlorine residuals at sampling points are to be reported too. The City must maintain a copy of the CMP for DOH review, if requested. A copy of the City's CMP is included in the appendices of this WSP.

- **DBP Monitoring Plan**: A plan developed by the City that stipulates the number of DBP samples to be collected and the location where the sampling shall be conducted. The plan must be approved by the DOH prior to implementation. A copy of the City's DBP Monitoring Plan is included in the appendices of this WSP.

- **Surface Water Treatment Plant Report:** A monthly form documenting turbidity monitoring results, level of *Giardia* inactivation achieved, residual disinfectant concentration entering the distribution system, total level of removal and inactivation and summary of water quality complaints received from customers.

Table 3-3 summarizes the most significant water quality rules applicable to the City.

3.2.4.1 Unregulated Contaminant Monitoring

Rule Summary: EPA proposed a third round of unregulated contaminant monitoring (UCMR3) in February 2011. For UCMR3, all systems serving more than 10,000 people and 800 representative systems serving 10,000 or fewer people will monitor for 28 "List 1" Assessment Monitoring chemicals during a 12-month period from January 2013 through December 2015. A Screening Survey was required for the first and second rounds of UCMR (UCMR1 and UCMR2); however, no such monitoring is proposed for UCMR3. Pre-screen testing relies on newer analytical methods not commonly used by drinking water laboratories. As proposed for UCMR3, EPA will select 800 representative systems serving 10,000 or fewer people. These systems will monitor for two "List 3" viruses twice during their designated 12-month period from January 2013 through December 2015.

Anticipated Impacts: The City will continue to coordinate with DOH and/or EPA as appropriate.

Table 3-3: Summary of Significant DOH Monitoring Requirements

Required Monitored Parameter	Monitoring Frequency and Location	Summary of Existing Results[(a)]
D/DBPR-1	Established in D/DBP Monitoring Plan.	TTHM = 28 micrograms per liter (µg/L) HAA5 = 12 µg/L
D/DBPR-2	Anticipated the City will maintain the reduced monitoring established in the D/DBP - Stage 1 Plan.	Complete Stage 2 D/DPB Monitoring Plan by October 2013
LT2	Additional Monitoring required October 2016.	Current Result: Lowest Bin Classification.
Total Coliform Rule (TCR)	Representative points throughout distribution system, established in CMP.	In compliance with CMP
Lead and Copper Rule (LCR)	Established in WQMR. Initially 60 samples every 6 months, then reduced based upon results.[(b)]	Copper <0.01 mg/L (at WTP) 0.317 (homes) Lead < 0.01 mg/L (at WTP) 0.003 (homes)
Chemical Monitoring (see Table 3-4)	Source after treatment, prior to entrance to distribution system. Established in WQMR.	IOCs < MCLs VOCs, SOCs not detected
Radionuclides (see 3-4)	Source after treatment, prior to entrance to distribution system. Established in WQMR.	Beta emitters = 1.8 pCi/L Radium 228 = 0.42 pCi/L

Notes:

(a) From 2010 Water Quality Report.
(b) Sampling frequency reduced to 30 samples every 6 months, if 90th percentile copper is greater than 0.65 mg/L but less than the allowable limit (AL) (1.3 mg/L) and 90th percentile lead is greater than 0.005 mg/L but less than the AL (0.05 mg/L). Sampling frequency reduced to 30 samples every 3 years, if 90th percentiles for copper and lead are less than 0.65 mg/L and 0.005 mg/L, respectively.

3.2.5 Future or Potential Regulations

The following future potential regulations will be briefly discussed:

- Fluoride
- Radon
- Perchlorate
- Methyl tertiary butyl ether (MTBE)
- N-Nitrosodimethylamine (NDMA)
- 1,4- Dioxane
- Contaminant Groups.

3.2.5.1 Fluoride

Summary: The current primary MCL for fluoride is 4.0 parts per million (ppm). The EPA has also set a secondary maximum contaminant level (SMCL) for fluoride at 2.0 ppm based on aesthetics. In September 2010, the Federal Department of Health and Human Services (HHS) convened a panel of scientists from the across the U.S. government to review new information related to fluoride intake and to develop new recommendations for community water fluoridation. This new information led HHS to propose changing the recommended level for community water systems to 0.7 ppm. The current recommended level is a range of 0.8 to 1.3 ppm. An announcement about the proposed change was published in the Federal Register. This optimal level recommendation is voluntary and not an enforceable regulation.

Anticipated Impacts: Some water systems have begun lowering fluoride levels in light of the new recommendation, although the EPA has not changed its regulatory levels for fluoride. The City may consider reducing fluoride dosing in anticipation of a reduction in the fluoride dose requirements of the EPA.

3.2.5.2 Radon

Summary: The EPA withdrew the 1991 proposed MCL for radon in 1997. In November 1999, the EPA released the currently proposed Radon Rule separate from the overall Radionuclides Rule. During the late 1990s and early 2000, the EPA held several regional facilitated workshops with representatives of state drinking water and radon programs to gather information and to discuss implementation issues. During fall 2003, the EPA held additional information gathering meetings with select state drinking water and radon program officials regarding consideration of a single MCL. No additional action by the EPA has taken place since those sessions were held.

Anticipated Impacts: The proposed MCLG for radon in drinking water is zero. This is a non-enforceable goal. The proposed regulation provides two options for the maximum level of radon that is allowable in community water supplies. The proposed MCL is 300 pCi/L and the proposed Alternative Maximum Contaminant Level (AMCL) is 4,000 pCi/L. The drinking water standard that would apply for a system depends on whether or not the state or system develops a multimedia mitigation (MMM) program.

3.2.5.3 Perchlorate

Summary: Perchlorate is both a naturally occurring and man-made chemical that is used to produce rocket fuel, fireworks, flares, and explosives. Perchlorate may have adverse health effects and can disrupt the thyroid's ability to produce hormones needed for normal growth and development. Two states have established regulatory standards for perchlorate in drinking water. In July 2006, Massachusetts promulgated a drinking water standard of 2 µg/L for perchlorate, and California established an MCL of 6 µg/L in October 2007. The EPA has developed an interim health advisory level of 15 µg/L and is moving forward with development of a federal MCL. The final MCL is anticipated within several years.

Anticipated Impacts: Perchlorate can form in liquid hypochlorite (bleach) solutions, along with bromate and chlorate, and could thus be inadvertently added during treatment at the WTP. Guidance is available to minimize the formation of perchlorate in hypochlorite storage tanks at drinking water treatment plants and should be followed at the WTP.

3.2.5.4 Metyl Tertiary Butyl Ether (MTBE)

Summary: MTBE is a member of a group of chemicals commonly known as fuel oxygenates. MTBE has been added to gasoline throughout the United States to reduce carbon monoxide and ozone levels caused by auto emissions. MTBE replaced the use of lead as an octane enhancer in 1979. MTBE causes a strong kerosene odor in drinking water. In December 1997, the EPA issued a Drinking Water Advisory that advised MTBE in the range of 20 to 40 ppb or below will probably not cause unpleasant taste and odor for most people.

Anticipated Impacts: The EPA determined that MTBE needs more health effects research and occurrence data before a regulatory determination can be made. Research to date has shown that at high levels, MTBE is a potential human carcinogen but the health effects at low levels are not known. As such, MTBE has been included in the Contaminant Candidate List (CCL3). In addition, MTBE was included in the UCMR in 2001.

3.2.5.5 N-Nitrosodimetylamine (NDMA)

Summary: NDMA has been used in the production of rocket fuels, is used as an industrial solvent, in rubber manufacturing, as an antioxidant, and it is also a disinfection by-product, especially in chloraminated systems and in wastewater disinfection. It was included in the UCMR2. Exposure to high levels of NDMA may cause liver damage in humans. Symptoms of overexposure include headache, fever, nausea, jaundice, vomiting, and dizziness. NDMA is classified as reasonably anticipated to be a human carcinogen.

Anticipated Impacts: Although NDMA is listed as a priority pollutant in the Code of Federal Regulations (CFR) (40 CFR 136.36), no federal MCL has been established for drinking water.

3.2.5.6 1,4-Dioxane

Summary: 1,4-Dioxane is primarily used as a stabilizer for 1,1,1-trichloroethane for storage and transport in aluminum containers and is also used as a solvent in the manufacture and processing of paper, cotton, textiles, cosmetics, and shampoos. It has recently been detected in products marketed as ‘organic’ or ‘natural’. It is a probable human carcinogen. It has been detected in some groundwater, although low-level detection methods are still being developed.

Anticipated Impacts: It has been included on the CCL3 and has been short-listed for further regulatory study.

3.2.5.7 Regulating Contaminant Groups

Summary: The EPA is in the early stages of developing regulations for groups of contaminants, as opposed to establishing MCLs for individual chemicals, as has been the standard practice. The EPA has decided to address as a group up to 16 VOCs that may cause cancer. This group will include trichloroethylene (TCE) and tetrachloroethylene (PCE). The EPA determined in March 2010 that the drinking water standards for these two currently regulated contaminants need to be revised. By addressing these VOCs as a group, the new rule is intended to help reduce exposure to these contaminants. Promulgation of this new rule is expected to take 2 to 3 years.

3.3 Analysis of Water Quality and Treatment

The City operates a water distribution system that includes 74.9 miles of water pipe, seven pump stations, 11 reservoirs (eight sites), and 12 pressure zones, in addition to the Kelso WTP. The City's Kelso WTP was rehabilitated and improved prior to the previous Water System Plan Update, so a detailed inspection of the plant was not warranted for this update. The plant remains in good working order and continues to meet all applicable water quality regulations.

A summary of recent water quality testing results is presented in Table 3-4.

Table 3-4: Treated Water Quality Data Summary

Contaminant	Unit	Detected Level	MCL	MCLG
Antimony	ppb	<1	6	6
Arsenic	ppb	<2	10	0
Asbestos	MFL[(a)]	<0.20	7	7
Barium	ppm	<0.005	2	2
Beryllium	ppb	<1	4	4
Cadmium	ppb	<1	5	5
Chlorine Residual	ppm	0.4 to 1.41	4[(b)]	1[(c)]
Chromium	ppb	<1	100	100
Copper/ WTP	ppm	<0.01		
Copper/ Homes	ppm	0.317	Action Level = 1.3[(d)]	
Fluoride	ppm	0.93	4	4
Lead / WTP	ppm	<0.001		0
Lead / Homes	ppm	0.003	Action Level = 0.015[(d)]	
Nitrate	ppm	0.2	10	10
Nitrite	ppm	<0.2	1	1
Beta	pCi/l	1.8	50	
Radium 228	pCi/l	0.14	5	
Selenium	ppb	<5	50	50
Sulfate	ppm	12.5	250	250
Thallium	ppb	<1	2	0.5
TOC	ppm	0.74		
TTHMs	ppb	29	80	
HAA5	ppb	13	60	

Notes:

Source: City of Kelso, 2010 Water Quality Report.

(a) MFL = million fibers per liter, with fiber length > 10 µm.
(b) Maximum residual disinfectant level (as CL_2).
(c) Maximum Residual Disinfectant Level Goal (as CL_2).
(d) 90th Percentile tap sample.

The 2005 Plan identified the need for a tracer study to determine the plant's true chlorine contact time, which was completed in May 2007 The Tracer Study and Detention Evaluation indicates that the baffling installed in the clear well has allowed the plant to achieve the required contact time under normal operating conditions. During high flow or peak conditions, the plant may need increase the chlorine dosage in order to maintain compliance. The tracer study report is included in the appendices.

Section 4: System Analysis

4.1 Introduction

The objective of this section is to determine whether the existing system facilities can meet the current and projected demands identified in Section 2: Basic Planning Data. This section addresses the following:

- General Facility Standards
- System Analysis
  - Source Capacity
  - Treatment Plant Capacity
  - Booster Pump Station Capacity
  - Storage Capacity
- Summary of System Deficiencies.

Existing facilities were evaluated according to pre-identified design standards. The results of these analyses provide a summary of water system deficiencies and basis for recommended improvements at the end of this section.

4.2 General Facility Standards

Performance and design criteria typically address sizing and reliability requirements for source, storage, distribution, fire flow, and water quality. The DOH relies on various publications, agencies, and the utility itself to establish appropriate design criteria. WAC 246-290-200 - Design Standards detail the various criteria recognized by the DOH. Following are brief descriptions of the two most widely recognized performance and design standards: Water Systems Design Manual and the Recommended Standards for Water Works. Developer design requirements, including materials, sizing, and construction standards, are presented in Section 8: Design and Construction Standards.

- **Water System Design Manual, DOH (August 2009)**. These standards serve as a guideline for preparing plans and specifications for Group A public water systems in accordance with WAC 246-290 and build and expand on the current standards published in DOH's *Sizing Guidelines for Public Water Supplies.* Where these documents specify standards different from the Ten States Standards, provisions of the DOH Standards will govern. The design manual also includes procedures for establishing system capacity based upon ERUs.
- **Recommended Standards for Water Works, A Committee Report of the Great Lakes – Upper Mississippi River Board of State Public Health and Environmental Manager (2007).** Commonly known as the "Ten States Standards," this document formalizes the design standards recommended by a water supply committee representing 10 Midwestern and Upper Great Lake states and the Province of Ontario.

First published in 1953, the Water Supply Committee report has been revised and reissued numerous times, most recently in 2007. The report presents recommendations for both design and construction standards; however, the construction standards are somewhat general in nature, with minor emphasis on materials specifications. Because surface water treatment is common in the Midwest and Upper Great Lakes, the committee report tends to concentrate on WTP design and operation.

Table 4-1: DOH - General Facility Requirements

Standard	DOH Requirements	Comments
ADD and MDD	ADD determined by historical water use data generated by accurate production and consumption meters. MDD is estimated by the use of historical data.	
PHD is in gpm MDD is in gpd/ERU C = Coefficient associated w/ERUS N = Number of ERUs F = Factor associated w/ERUs	$PHD = \frac{MDD}{1440}[(C)(N)+F]+18$ If ERUs > 500, C = 1.6, F = 225 If ERUs >250 and < 500; C = 1.8, F = 125 If ERUs >100 and < 250; C = 2.0 and F = 75 If ERUs > 50 and < 100; C = 2.5, F = 25 If ERUs > 15 and < 50; C = 3.0, F = 0	
Water Quality and Treatment	As established in WAC 246-290, effective 27 April 2003, last updated 2011	
Storage Requirements	The sum of: Operational Storage (OS, gallons) OS depends on reservoir settings Equalizing Storage (ES, gallons) ES = (PHD-Qs)*150, where Qs = sum of all non-emergency sources of supply in gpm Standby Storage (SB, gallons) SB = (2)(ADD) or 200 gallons/ERU minimum and /or the larger of: Fire Suppression Storage (FSS, gallons) FSS is calculated based on the required fire flow for each zone. Dead Storage (DS, gallons) DS is the volume corresponding to the water level in a reservoir when 20 psi cannot be maintained in the system.	• Nest fire storage and standby storage. Choose larger of two for storage requirement. • Standby storage to be based on 200 gallons/ERU.
Source of Supply	Water system source, treatment, and storage facilities must be designed so that together they meet MDD (WAC 246-290-222). DOH recommends source alone be able to meet MDD.	Treatment plant unit processes will meet MDD. Unit Process capacity is based on reliable capacity. Reliable capacity is the capacity of a treatment plant with the largest unit out of service.
Minimum System Pressure	The system should be designed to maintain a minimum of 30 psi in the distribution system under PHD and 20 psi throughout the system under fire flow conditions.	

Standard	DOH Requirements	Comments
Minimum Pipe Sizes	The minimum size for a transmission line should be determined by hydraulic analysis. The smallest distribution system line shall not be less than 6 inches in diameter. Distribution mains must deliver PHD with 30 psi residual pressure, and fire flow at MDD with 20 psi system-wide. Pipe must be sized so that the maximum velocity of 8 fps is not exceeded under PHD conditions.	Minimum pipe diameter as established in the City's Design and Construction Standards.
Backup Power Requirements	Onsite back-up power equipment or gravity standby storage shall be provided unless the power grid meets the minimum reliability criteria established in Section 7.7, "Water System Design Manual."	In cases where gravity standby storage is unavailable or insufficient, onsite backup power generator will be provided.
Booster Pump Requirements	Per WAC 246-290-230, open system booster pumps must meet MDD for the system at a minimum pressure of 30 psi. The recommended reliability standard is MDD with the largest pump out of service. Closed system booster pumps must meet PHD with a minimum pressure of 30 psi.	For this WSP, booster pump capacity will be analyzed with the largest booster pump out of service.
Water System Physical Capacity	Determine the water system physical capacity of each system component in terms of ERUs, as required by WAC 246-290-222.	City will adopt DOH criteria for determining ERUs as established in the Waterworks Design Manual.

4.3 System Analysis

Current and projected average and peak demands for the City (developed in Section 2: Basic Planning Data) are summarized in Table 4-2. These projections were used for the system analysis.

Table 4-2: Summary of Water Demands

Year	ADD (MGD)[(a)]	MDD (MGD)	PHD (MGD)	ERUs[(b)]	ADD ERU Demand (gpd/ERU)	MDD ERU Demand (gpd/ERU)
Raw Water						
2011	2.18	3.22	--	--	--	--
2018	2.56	3.94	--	--	--	--
2032	2.93	4.51	--	--	--	--
Finished Water						
2011	2.15	3.18	5.2	13,914	155	229
2018	2.47	3.80	6.2	14,891	166	255
2032	2.83	4.35	7.0	17,055	166	255

Notes:

(a) From WTP.
(b) ERUs include DSLs, based on ADD for the system.

4.3.1 Source Capacity

The current source of supply for the Kelso WTP is the Cowlitz River. The City's water right allows them to withdraw 5.0 MGD [5,600 acre-feet per year (ac-ft/yr)] from this source. The City withdraws water from the Cowlitz River using a Ranney collector, but the current facility is not capable of maximizing the available water rights. The conditions and considerations pertaining to the Ranney collector will be discussed later in this section. To supplement the supply from the Ranney collector, the City is evaluating the feasibility of developing a wellfield on Mill Street along the Cowlitz River, approximately a quarter mile downstream from the existing Ranney collector. Figure 4-1 depicts the potential location. The City plans to drill a test well to determine water quality and hydrogeologic conditions at this site.

Figure 4-1: Mill Street Test Well Location

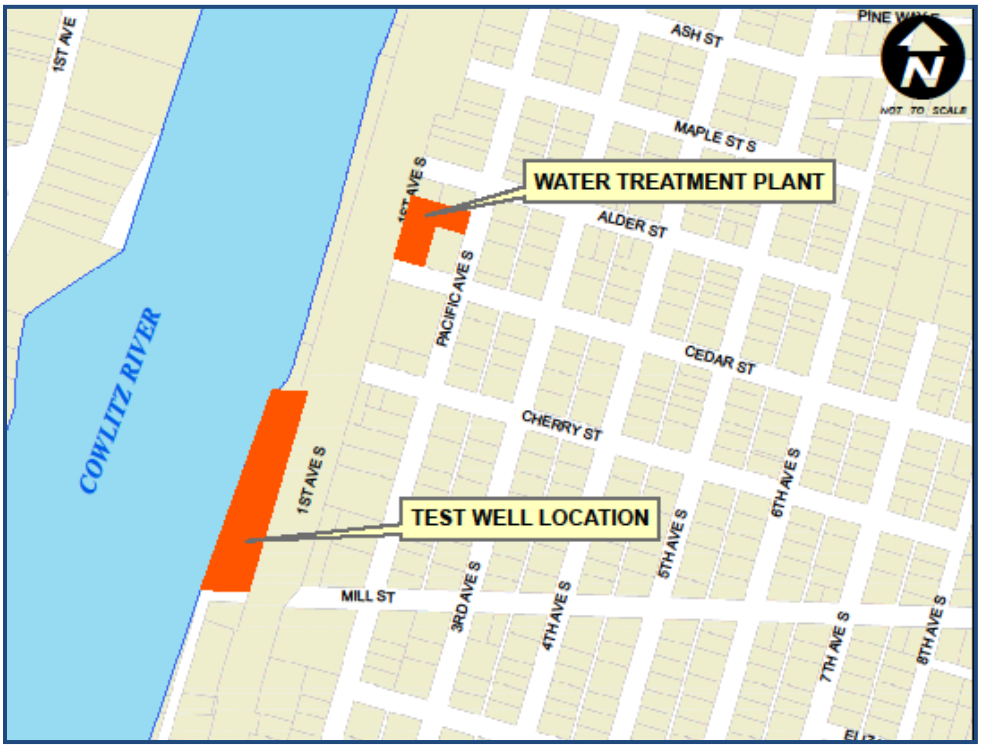


Table 4-3 summarizes maximum instantaneous withdrawal rates and sustainable withdrawal as shown on the water right permits. The City's water rights permits will be discussed in more detail in Section 5: Water Use Efficiency. More detailed water right information is available on the Water Rights Self-Assessment forms (Exhibit 5).

Table 4-3: Summary of Available Water Rights

Water Source	Annual Source (ac-ft/yr)	Annual Source (MGD)	Instantaneous Maximum Source	Instantaneous Maximum Source (MGD)
Cowlitz River and Ranney Collector[a]	5,600	5.0	18.57 (CFS) [b]	12.0
Three Wells [c]	1,128 Primary 1,272 Supplemental	1.0	1,500 GPM	2.16
Three Wells [d]	3,200	2.9	2,000 GPM	2.88
Total [c,d]	6,728	6.0	11,835 GPM	17.0

Notes:

(a) S2-29856P (includes S2195, S2-01119C, G2-24762C and S2-29856).
(b) CFS = cubic feet per second [18.57 CFS = 8,335 gallons per minute (GPM)].
(c) G2-29813P (Limited to 6,728 acre-ft/yr. from S2195, S2-01119C, G2-24762C, S2-29856, G2-29813 and G2-29815).
(d) G2-29815P (Limited to 6,728 acre-ft/yr. from S2195, S2-01119C, G2-24762C, S2-29856, G2-29813 and G2-29815).
ac-ft/yr = acre-feet per year
ac-ft/yr = 0.0008927 MGD

The available source capacity was compared to current and projected demands to determine source adequacy for ADD and MDD. Projected demands and source capacity were converted to ERUs. The results of the analysis are shown in Tables 4-4 and 4-5. The tables show that the City has adequate water rights to meet demand through the 20-year planning period.

Table 4-4: Allowable ERUs for Raw Water Maximum Source Capacity (ADD Approach)

Year	Projected Raw Demand (MGD)	Annual Source Water Right (MGD)	Projected ERUs	Available Source ERUs [a]	Excess Source ERUs
2011	2.18	5.0	13,914	32,322 [b]	18,409
2018	2.56	5.0	14,891	30,179 [c]	15,288
2032	2.93	5.0	17,055	30,179 [c]	13,124

Notes:

(a) Available ERUs = Average Daily Water Right / ADD ERU Demand.
(b) Available ADD ERU based on 2011 demand.
(c) Available ADD ERU demand based on the 5-year average.

Table 4-5: Allowable ERUs for Raw Water Instantaneous Source Capacity (MDD Approach)

Year	Projected Raw Demand [(a)] (MGD)	Instantaneous Maximum Source Water Right (MGD)	Projected ERUs	Available Source ERUs[(b)]	Excess Source ERUs
2011	3.22	12.0	13,914	52,504 [(c)]	38,590
2018	3.94	12.0	14,891	47,026 [(d)]	32,135
2032	4.51	12.0	17,055	47,026 [(d)]	29,971

Notes:

(a) Projected total system demand.
(b) Available ERUs = Instantaneous Maximum Water Right / MDD ERU Demand.
(c) Available MDD ERU based on 2011 demand.
(d) Available MDD ERU based on the 5-year average.

4.3.2 Water Treatment Facility

4.3.2.1 Facility Description

Raw water is delivered to the treatment train via a Ranney collector located on the eastern bank of the Cowlitz River. The water supply is considered to be GWI as the source is the Cowlitz River. The treatment system was designed to remove particulate matter, iron, manganese, and arsenic. The Ranney collector was installed in 1979 and the current iron/manganese facility constructed in 1984. The filter plant has under gone various upgrades through the years to meet treatment requirements. The facility consists of the following primary elements:

- Ranney Collector - Capacity is estimated between 3.5 and 4.08 MGD depending on how recently the iron bacteria have been removed from the screens and laterals. This element is discussed in more detail later in this section.
- Vertical pressure filters – Seven Tri-media filters, originally rated at 3 gpm per sf (3.6 MGD), DOH rerated the capacity in February 2012 to 4.0 gpm/sf (4.8 MGD) provided current plant optimization status is maintained.
- Filter booster pumps – Each pressure filter has a dedicated booster pump [7.5 horsepower (HP)]. The booster pump primary operating point is 320 gpm with an upper end of 360 gpm; however, the pumps can produce up to 400 gpm during periods of high demand. When operated at 360 gpm or above, booster pumps are operating beyond the recommended amperage. To improve plant reliability, the booster pump motors should be upsized to a minimum of 10 HP.
- Finished (treated) water delivery – Three pumps and clearwell, up to two pumps can operate simultaneously. One pump operation produces approximately 2,400 gpm; two-pump operation produces approximately 3,600 gpm.
- Chemical feed systems for chlorination, fluoridation, coagulation, and finished water pH adjustment.

Overall, the condition of the WTP is good and the operators continually strive to improve and streamline the plant processes. For example in 2010, modifications were made to the particulate removal process that resulted in longer filter run times and lower backwash water usage. The City is also considering the possibility of adding backwash recycle to the treatment process to reduce the discharge to sewer and increase operation efficiency. Prior to design of a backwash recovery system, an evaluation to determine the feasibility and cost versus benefit should be completed.

The existing treatment plant was designed and rated at a capacity of 3.6 MGD (3.0 gpm/sf filter capacity). Due to optimized WTP operating conditions, DOH recently approved the City's request to rerate the filters to produce 4.8 MGD (4.0 gpm/sf filter capacity), provided the City continues to meet the stated reporting requirements and current turbidity standards are maintained. For planning and forecasting purposes, the originally rated capacity of 3.6 MGD is used.

Ranney Collector:

The Ranney collector, constructed in 1979, is situated on the bank Cowlitz River between the river and the dike and was originally designed to produce between 3 and 5 MGD. However, due to the growth of iron bacteria in the laterals, the maximum the Ranney collector can now produce is 4.08 MGD. Monthly cleanings are necessary in order to maintain the Ranney collector's capacity.

The WTP staff have done a great job maintaining and optimizing the Ranney collector; however, there are a number of factors to consider that impact the Ranney collector's long-term reliability:

- Age of the facility
- Vulnerability to the 100-year flood
- Expansion limitations
- Ongoing maintenance requirements
- Installation/availability of emergency power for Ranney collector and filter plant.

Since the eruption of Mount St. Helens, sedimentation in the Cowlitz River has raised the level of the river and floodplain which necessitated raising the height of the flood protection dike. The Ranney collector equipment is now below the level of the 100-year flood. During larger flood events, it has been necessary to sand bag the facility and run the well pumps to sewer to avoid swamping the facility.

Two raw water carrier pipes (10-inch- and 12-inch-diameter) run from the Ranney to the filter plant. Portions of 10-inch pipe are broken; therefore, only the 12-inch pipe is available to convey raw water to the plant. The 10-inch pipe is 20 feet below ground surface (bgs) making possible repair/replacement difficult. Restoring the 10-inch or constructing a new pipeline would be necessary to provide redundancy from the Ranney to the WTP. The depth of the 10-inch pipe is not the only challenge associated with repair/replacement of the pipe; it would also be necessary to negotiate with the US Army Corps of Engineers (Corps) with regard to excavation within the flood protection dike.

To improve system reliability, the City would like to provide emergency power at the Ranney site and the filter plant. As the sites are supplied from different locations on the City power grid and are separated by some distance, it is unlikely that it would be possible to install a single emergency power source to supply both sites. It would be likely be necessary to install a generator and transfer switch at each location. The Ranney site is space constrained between the river and railroad grade. It would be necessary to penetrate the flood protection dike and cross three railroad tracks to install any improvement. Further consideration needs to be given to the feasibility of providing emergency power at the Ranney site. Emergency power at the filter plant site would likely be contingent on the presence of emergency power at the Ranney collector. It is not necessary to have emergency power at the filter plant if it is not possible to provide it at the Ranney collector.

The above discussion raises concerns with regards to the vulnerability and long-term viability of the Ranney collector as the City's sole source of supply. Other alternatives available to the City include development of groundwater source at the Mill Street site or purchase water from Longview. These alternatives will be discussed in more detail in later in this section and as they relate to the CIP.

4.3.2.2 Treatment Facility Capacity Analysis

In order to determine the WTPs limiting factors, the capacity of the four main treatment plants, components of the treatment plant, Ranney collector, filters, filter booster pumps, and high-lift pumps, were analyzed. Raw water demands were considered for the WTP capacity analysis. Table 4-2 summarizes the anticipated raw water demand of the WTP. The WTP component capacity is summarized in Table 4-6. As shown in Table 4-7, the filter booster pumps are the limiting factor of the WTP with a flow of 3.23 MGD, under normal conditions. The plant must operate the filter booster pumps outside of recommended parameters to produce 3.6 MGD. Historical data (Table 2-2) show the plant occasionally needs to operate above 3.6 MGD to produce the MDD. Even with the filter booster pumps operating above the recommended parameters, they are not able to fully utilize the available Ranney collector capacity. If the WTP rerated capacity of 4.8 MGD is considered, the Ranney collector is the next limiting factor as it is only capable of producing 4.08 MGD under optimal conditions.

Table 4-6: Water Treatment Plant Filter Capacity

Year	Projected Raw Water MDD (MGD)	Treatment Plant Filter Capacity (MGD)	Projected ERUs	ERU Capacity Based on MDD Approach	Remaining Capacity ERUs
2011	3.22	4.8	13,914	21,002 [(a)]	7,088
2018	3.94	4.8	14,891	18,813 [(b)]	3,922
2032	4.51	4.8	17,055	18,813 [(b)]	1,758

Notes:

(a) Available MDD ERU based on 2011.demand.
(b) Available MDD ERU based on the 5-year average.

Table 4-7: Water Treatment Facility Capacity by Component

WTP Components	Capacity (MGD)	Capacity (gpm)
Ranney Collector		
Normal [(a)]	3.6	2,500
Maximum [(a)]	4.08	2,833
Filter Booster Pumps [(b)]		
Normal	3.23	320/pump or 2,240
Mid-range [(c)]	3.63	360/pump or 2,520
Maximum [(c)]	4.03	400/pump or 2,800
Pressure Filters [(a)]		
3.0 gpm/sf (Normal)	3.6	2,500
4.0 gpm/sf (Maximum)	4.8	3,333
High-Lift Pumps to Distribution System		
1-Pump Operation	3.46	2,400
2-Pump Operation	5.18	3,600

Notes:

(a) Maximum condition occurs after monthly cleaning of Ranney laterals.
(b) Assume seven filters in operation.
(c) Pumps operating over recommended amperage at this flow.

The WTP capacity for the current, 6-year, and 20-year planning periods was analyzed using the two limiting factors (Ranney collector and Filter booster pumps) identified in Table 4-6 above. As can be seen from Table 4-8, using the filter booster pumps as the limiting factor (under normal operating conditions), the WTP is currently near its limiting capacity. If the Ranney collector is considered as the limiting factor, then the plant reaches its limiting capacity sometime between 2018 and 2032. The WTP filter booster pump capacity and the source capacity need to be increased in order to continue to meet the City's long-term needs.

Table 4-8: Water Treatment Plant Component Capacity

Component	Year	Projected Raw Water MDD (MGD)	Reliable Capacity	Excess Capacity (MGD)	Excess Treatment Capacity [(a)] (ERUs)
Filter Booster Pumps	2011	3.22	3.23 [(b)]	0.01	44
	2018	3.94	3.23 [(b)]	(0.71)	(2,785)
	2032	4.51	3.23 [(b)]	(1.28)	(5,020)
Ranney Collector	2011	3.22	4.08 [(c)]	0.86	3,756
	2018	3.94	4.08 [(c)]	0.14	550
	2032	4.51	4.08 [(c)]	(0.43)	(1,687)

Notes:

(a) ERU Capacity = Treatment Capacity / MDD ERU Demand. Refer to Table 4-2.
(b) Based on the filter booster pumps as the capacity limiting factor (Table 4-6).
(c) Based on the Ranney collector as the capacity limiting factor (Table 4-6).

4.3.2.3 Water Treatment Facility Recommendations

WTP capacity can be maximized by implementing the following improvements:

- Upsize the filter booster pump motors. This would also entail an evaluation of the current power supply to the booster pumps and a determination as to the remaining service life of the existing booster pumps.
- Increase the supply to the filters. This can be accomplished by either increasing the capacity of the Ranney collector or developing another source of supply for the WTP. The following are two possible options:
    1. Complete a more detailed evaluation of the Ranney collector facility to determine the viability of making improvements to this facility. Postpone implementation of emergency power CIP for filter plant until results of Ranney evaluation have been completed.
    2. Determine viability/feasibility of developing a groundwater source at the Mill Street site.
- Alternative Source of Supply
    1. Determine viability of developing either a wellfield or second Ranney Collector Well on the Mill Street site.
    2. Improve existing intertie with Longview. The current intertie is able to provide 1,000 gpm (1.44 MGD) to the City. In an emergency situation, this would be approximately two-thirds of the City's ADD and less than half of the MDD based on current conditions. It is recommended that the City upsize the existing intertie connection with Longview to increase the potential capacity and secure a reliable alternative source of supply to meet the City's needs.

3. Evaluate the purchase water from Longview, either as wholesale purchaser or as partner in new MFRWTP.

The City should perform a cost-benefit analysis on the above alternatives to determine the most cost effective, long-term solution. The Mill Street production well alternative will be discussed in more detail in the CIP section. Given the many water supply alternatives for the City, a source of supply analysis has been added to the CIP to evaluate the most cost effective, reliable source of supply for the City to meet future demands.

4.3.3 Pumping and Storage Capacity Analysis

Pumping and storage requirements were calculated for each pumping and storage zone for 2011, 2018 (6-year planning period), and 2032 (20-year planning period) based on demands. The demands for the system were provided in terms of the reservoirs that serve each of the pressure zones. As such, a lower zone served through a PRV was grouped with the upper pressure zone serving the PRV. The pumping demands were allocated based on the information provided for each of the reservoir service zones.

4.3.3.1 Pumping Capacity

Allocation of Source by Zone

The next step in the planning process is water allocation by zone. This allocation is an important consideration when determining the required pumping capacity for each zone. As defined below, total operating capacity and reliable operating capacity must be evaluated to determine pump station capacity required to meet anticipated demands.

- Total Operating Capacity (TC): Total pump station production with all pumps in service based on operational knowledge from the City.

- Reliable Operating Capacity (RC): Total pump station production with the largest pump out of service based on operational knowledge from the City. RC is used for pump station capacity analysis.

4.3.3.1.1 Supply and Pumping Analysis

A pump station capacity analysis was performed to determine each station's current and future ability to meet ADD and MDD. Source volume was allocated to each zone as described in Table 4-9. Table 4-10 shows the current and projected ADD, MDD, and PHD demands for each zone.

Table 4-9: Available Supply Allocation by Zone

Pump Station	Pressure Zone Served	Total Operating Capacity (gpm)	Reliable Operating Capacity (gpm)
Treatment Plant Finished Water Pumps	**Main Zone** (188)	3,600	3,600
Rocky Point	**Rocky Point** (301)	75 [(a)]	75
Minor Road	**Williams Finney** (322)	1,600 [(b)]	800
18th Avenue	**Behshel** (443, 320, 264)	1,200	600
Behshel Heights	**Mt. Brynion** (522)	1,620 [(c)]	500
Carrolls Road	**Carrolls Road** (517, 311	200	130
Lower Hausler	**Highland Park** (410, 297)	150	150
Highland Park	**Tybren Heights** (544)	150	150

Notes:

(a) Pumps run in series.
(b) Total operating capacity is estimated.
(c) Total includes high-flow pump for fire protection.

Table 4-10: Summary of Demands by Area

	Current (2011)			2018			2032		
Reservoir Zone	**ADD (MGD)**	**MDD (MGD)**	**PHD (gpm)**	**ADD (MGD)**	**MDD (MGD)**	**PHD (gpm)**	**ADD (MGD)**	**MDD (MGD)**	**PHD (gpm)**
Minor Rd., Paxton Rd., and Rocky Point (188, 301) [(a)]	1.87	2.77	3,130	2.15	3.31	3,734	2.46	3.79	4,268
Williams Finney (322) [(b)]	0.17	0.24	326	0.19	0.29	383	0.22	0.34	430
Behshel (264, 443, 320, 522)	0.06	0.08	147	0.06	0.10	169	0.07	0.11	185
Carrolls Rd. (311, 517)	0.02	0.03	85	0.02	0.03	95	0.03	0.04	101
Highland Park/Tybren Heights (297, 410, 544)	0.04	0.05	114	0.04	0.06	130	0.05	0.07	141
Total	**2.15**	**3.18**	**N/A**	**2.47**	**3.80**	**N/A**	**2.83**	**4.35**	**N/A**

Notes:

(a) BHWSD Cowlitz Gardens is supplied by 188 (Main Zone).
(b) BHWSD Williams-Finney is supplied by 322 Zone reservoir.

The City's system has several zones which re-pump water from a lower zone to a higher zone pump station. In instances where a lower pump station supplies another pump station, the combined ADD and MDD totals were used in the analysis of the lower pump station. For example, water is pumped from the main zone (Minor Road pump station) to the Williams-Finney Reservoir, and then re-pumped from Williams Finney to Behshel Heights. In this case, the ADD and MDD values for the individual zones were combined to determine whether the Minor Road pump station can meet the combined demand.

The pump capacity analysis shows that all pump stations have sufficient capacity to meet current and future demand. However, there are a couple of pump stations where the installation of a redundant pump is recommended; Rocky Point (Zone 301) and Behshel Heights (Zone 443). At Rocky Point, the pumping capacity analysis indicates that the pump station has sufficient capacity to meet demands but both pumps must operate in order to supply Zone 301. Given the age of the Rocky Point facility, it is recommended that the pump station be reconstructed to provide redundancy and address pumping configuration issues. It is also recommended that the City install an additional pump capable of supplying the entire zone demand to provide redundancy. Furthermore, a redundant service pump is recommended for normal operating conditions, at Behshel Heights pumps station. The results of the pump capacity analysis are summarized in Table 4-11.

Table 4-11: Pump Station MDD Capacity Analysis

Current Condition (2011)

Pump Station	ERUs	ADD (gpm)	MDD (gpm)	Capacity (gpm) [(a)]	ADD Excess Capacity (gpm)	MDD Excess Capacity (gpm)	MDD Capacity in ERUs	Remaining Capacity in ERUs
Treatment Plant Finished Water Pumps (All Zones)	13,914	1,495	2,208	3,600	2,105	1,392	22,682	8,768
Minor Rd [Williams Finney (322) and Behshel (264, 320, 443, 522)]	1437	154	228	800	646	572	5,040	3,603
18th Ave [Behshel (264, 320, 443, 522)]	366	39	58	600	561	542	3,780	3,414
Carrolls Rd (311, 517)	124	13	20	130	117	110	819	695
Lower Hausler [Highland Park/Tybren Heights (297, 410, 544)]	238	26	38	150	124	112	945	707

2018 [(b)]

Pump Station	ERUs	ADD (gpm)	MDD (gpm)	Capacity (gpm)[(a)]	ADD Excess Capacity (gpm)	MDD Excess Capacity (gpm)	MDD Capacity in ERUs	Remaining Capacity in ERUs
Treatment Plant Finished Water Pumps (All Zones)	14,891	1,713	2,639	3,600	1,887	961	20,315	5,425
Minor Rd [Williams Finney (322) and Behshel (264, 320, 443, 522)]	1538	177	273	800	623	527	4,514	2,976
18th Ave [Behshel (264, 320, 443, 522)]	392	45	69	600	555	531	3,386	2,994
Carrolls Rd (311, 517)	133	15	23	130	115	107	734	601
Lower Hausler [Highland Park/Tybren Heights (297, 410, 544)]	255	29	45	150	121	105	846	592

2032 [(c)]

Pump Station	ERUs	ADD (gpm)	MDD (gpm)	Capacity (gpm)[(a)]	ADD Excess Capacity (gpm)	MDD Excess Capacity (gpm)	MDD Capacity in ERUs	Remaining Capacity in ERUs
Treatment Plant Finished Water Pumps (All Zones)	17,055	1,962	3,022	3,600	1,638	578	20,315	3,260
Minor Rd [Williams Finney (322) and Behshel (264, 320, 443, 522)]	1762	203	312	800	597	488	4,514	2,753
18th Ave [Behshel (264, 320, 443, 522)]	449	52	79	600	548	521	3,386	2,937
Carrolls Rd (311, 517)	152	17	27	130	113	103	734	582
Lower Hausler [Highland Park/Tybren Heights (297, 410, 544)]	292	34	52	150	116	98	846	555

Notes:

(a) Pump Station capacity is based on reliable capacity.
(b) ADD ERU based on 2011 demand (155 gpd/ERU).
(c) ADD ERU based on the 5-year average (166 gpd/ERU).

4.3.3.2 Storage Capacity

The DOH Design Manual (December 2009) for Group A Public Water Systems requires the following storage criteria to be met per WAC 246-290-235. A storage reservoir consists of five component volumes:

- Operational storage (OS)
- Equalizing storage (ES)
- Standby storage (SB)
- Fire suppression storage (FSS)
- Dead storage (DS).

Operational Storage (OS)

OS is the volume of water devoted to supplying the water system when the pump facility is at rest. The OS volume, which varies by system, must be sufficient to prevent excessive pump cycling. The OS requirement is in addition to the equalizing and standby/fire storage requirements. Kelso strives to maintain its reservoirs within 1 foot of the overflow level. Kelso's OS depends on its largest water customer, Foster Farms. Demands from Foster Farms fluctuate unpredictably throughout the day. Historically, the City had a storage deficiency in Zone 188 that necessitated Zone 188 reservoirs were kept near the overflow levels in order to meet the unpredictable Foster Farms demands. The City brought a new 2.0 MG reservoir online in December 2011 that allows them more operational flexibility. OS volumes for the upper reservoirs are provided by the City.

Equalizing Storage (ES)

ES is provided to meet seasonal and/or daily variations in demand that exceed the source pumping capacity. Diurnal peaks, which vary significantly from the average daily flow, typically occur during the morning and early evening. ES volume depends on PHD, source production capacity, and mode of operation (i.e., continuous pumping or call-on-demand).

If actual water records are unavailable, DOH recommends the following equation to estimate the required ES volume. Therefore, the ES for each pressure zone was calculated as follows:

ES (gallons) = (PHD – Qs)(150 min), where:

PHD = PHD (gpm)

Qs = Source Production Rate (gpm)

Standby Storage (SS)

The main purpose of standby storage is to provide a measure of reliability for the system in case of unusual operating conditions (e.g., source production interruption or power failure). The volume of standby storage recommended varies depending upon whether the system is

considered a single or multiple source system. However, when excessive water is stored, quality degradation may occur as the water ages. Kelso is considered to be single-source system for this analysis. The recommended single-source standby storage volume is twice the ADD, as shown in the following equation (DOH 2009):

SB (gallons) = (2 days) (ADD)(N), where:

ADD is measured in gpd/ERU

N = Number of ERUs

Standby storage is to be provided to all service connections at 20 psi, and in no case can it be less than 200 gallons/ERU. For analysis purposes, 200 gallons/ERU was used.

Fire Suppression Storage (FSS)

The water delivery system (pumps, pipes, and reservoirs) must deliver the minimum fire suppression flows in accordance with established requirements while maintaining 20 psi throughout the distribution system [WAC 246-290-211(5)]. FSS is the product of the required fire flow (gpm) and duration (hours). For example, Kelso requires 4,000 gpm for 5 hours (1.2 MG) of FSS be available for industrial areas in the City. Required design fire flow requirements were summarized in Section 2: Basic Planning Data.

Dead Storage (DS)

DS is the volume of stored water that is not available to all consumers at the minimum design pressure. DS is excluded from the volumes provided to meet OS, ES, SS, and FSS. The total storage capacity of a reservoir minus the DS is the volume of effective storage.

Required Storage Volume

The total required storage volume for each pressure zone is equal to the sum of the OS, ES, and the larger of either SS or FSS. The required storage volume is based on effective storage and does not include DS.

4.3.3.2.1 Storage Capacity Analysis

The results of the storage capacity analysis are presented in Table 4-12. The analysis includes the current condition and projected storage needs for the 6-year (2018) and 20-year (2032) planning period. As shown in Table 4-12, Kelso has ample storage in all zones for the 6- and 20-year planning periods.

The City recently addressed the Main zone storage deficiency identified in the 2005 Plan with the completion of a new 2.0 MG reservoir located at Paxton Road. However, the condition of the Minor Road reservoirs (Zone 188), situated in the middle of the 188 service zone east of the freeway, are of concern to the City. The reservoirs were originally constructed in 1924 and are beyond their recommended service life. There are concerns with regard to the tanks' ability to survive a sizeable seismic event, and they currently leak, accounting for a minimum of 3 percent of the City's total DSL. The City has commissioned the completion of a structural evaluation for the Minor Road reservoirs that will identify failure thresholds and provide recommendations for

either rehabilitation or replacement. It is expected that replacement will be the most cost efficient alternative. With the completion of the Paxton Road reservoir, the City now has the operational flexibility to remove the Minor Road reservoirs from service, thus, allowing for the construction of a new facility without disruption to the City's current level of service. A CIP project will be included in Section 9: Capital Improvement Program for the replacement of the Minor Road reservoirs. The City will not be adding any additional capacity in the main zone as the storage currently available is sufficient to meet the projected 2032 demands.

Rocky Point Zone 301 was included in the Main zone for analysis of storage needs, but it should be noted that Rocky Point does not have any existing storage. Rocky Point is zoned for residential use, and required fire flows for this area is 1,000 gpm for 2 hours. In order to assure adequate fire protection for Zone 301 either 120,000 gallons of storage is required or a 1,000 gpm high-flow pump and emergency power receptacle should be installed. The recommended CIP, discussed in Section 8, for Rocky Point will include upgrading the pump station and provisions for the high-flow pump and emergency receptacle. Behshel Heights has a 1,120 gpm pump and emergency onsite generator installed to provide fire flow to this zone.

Table 4-12: Summary of Available Storage

Current Condition (2011)

Reservoir (Zone)	ERUs	FSS (gal)	SB Storage (gal)	ES (gal)	OS (gal)	Total Required Storage (gal)	Dead Storage (gal)	Effective Storage (gal)	Existing Storage as ERUs	Remaining Storage (gal)	Additional Required Storage (gal)
Minor Rd, Paxton Rd, and Rocky Point (188, 301)	12,115	1,200,000	2,422,910	-	500,000	2,922,910	416,816	4,583,184	29,569	1,660,274	-
Williams Finney (322)	1,071	270,000	214,269	-	32,000	302,000	3,672	496,328	3,202	194,328	-
Behshel (264, 320, 443, 522)	366	270,000	73,185	-	52,000	322,000	25,285	724,715	4,676	402,715	-
Carrolls Rd (311, 517)	124	270,000	24,766	-	59,000	329,000	3,971	496,029	3,200	167,029	-
Highland Park/Tybren Heights (297, 410, 544)	238	270,000	47,584	-	54,000	324,000	20,726	379,274	2,447	55,274	-

2018

Reservoir (Zone)	ERUs	FSS (gal)	SB Storage (gal)	ES (gal)	OS (gal)	Total Required Storage (gal)	Dead Storage (gal)	Effective Storage (gal)	Existing Storage as ERUs	Remaining Storage (gal)	Additional Required Storage (gal)
Minor Rd, Paxton Rd, and Rocky Point (188, 301)	12,965	1,200,000	2,593,038	20,088	500,000	3,113,126	416,816	4,583,184	27,610	1,470,058	-
Williams Finney (322)	1,147	270,000	229,314	-	32,000	302,000	3,672	496,328	2,990	194,328	-
Behshel (264, 320, 443, 522)	392	270,000	78,324	-	52,000	322,000	25,285	724,715	4,366	402,715	-
Carrolls Rd (311, 517)	133	270,000	26,505	-	59,000	329,000	3,971	496,029	2,988	167,029	-
Highland Park/East Hills (297, 410, 544)	255	270,000	50,926	-	54,000	324,000	20,726	379,274	2,285	55,274	-

2032

Reservoir (Zone)	ERUs	FSS (gal)	SB Storage (gal)	ES (gal)	OS (gal)	Total Required Storage (gal)	Dead Storage (gal)	Effective Storage (gal)	Existing Storage as ERUs	Remaining Storage (gal)	Additional Required Storage (gal)
Minor Rd, Paxton Rd, and Rocky Point (188, 301)	14,850	1,200,000	2,969,971	100,243	500,000	3,570,213	416,816	4,583,184	27,610	1,012,971	-
Williams Finney (322)	1,313	270,000	262,648	-	32,000	302,000	3,672	496,328	2,990	194,328	-
Behshel (264, 320, 443, 522)	449	270,000	89,710	-	52,000	322,000	25,285	724,715	4,366	402,715	-
Carrolls Rd (311, 517)	152	270,000	30,358	-	59,000	329,000	3,971	496,029	2,988	167,029	-
Highland Park/East Hills (297, 410, 544)	292	270,000	58,328	-	54,000	324,000	20,726	379,274	2,285	55,274	-

Notes:

Existing ERU demand for each zone shown in Section 2, Table 2-3.
The bottom 1 foot of each reservoir was assumed to be dead storage, with the exception of Paxton Road which is 3 feet.

4.3.3.3 System Capacity and Limiting Criteria Analysis

The capacity for each of the major elements of the water system, water rights, treatment plant, source of supply, pump and storage capacity, are summarized in Tables 4-13, 4-14, and 4-15. The City has ample water rights, storage, and pumping capacity. The limiting element of the City's water system is the water treatment facility; more specifically, two components of the water treatment facility, the filter booster pumps, and the Ranney collector. Table 4-13 illustrates that under average day operating conditions, the City has sufficient capacity in all system components. However, as shown in Tables 4-14 and 4-15, under maximum day conditions, the system is limited by the capacity of the filter booster pumps and the Ranney collector. As was discussed previously in this section, the filter booster pumps have been operating above recommended parameters. CIPs have been recommended to upgrade the filter booster pumps and determine an adequate supplemental source of supply.

Table 4-13: Limiting Criteria and System Capacity- ERU Analysis

Criteria	Capacity ADD (ERU) [a]	Current System 2011 ERUs [b]	Projected System 2018 ERUs [c]	Projected System 2032 ERUs [c]
Water Rights				
Maximum Water Right	30,179	13,914	14,891	17,055
Instantaneous Water Right	72,430	13,914	14,891	17,055
Treatment Facility Maximum Capacity[d]	28,916	13,914	14,891	17,055
Filter Booster Pumps (normal operation)	**19,458**	13,914	14,891	17,055
High-Lift Pumps at WTP (2-pump operation)	31,290	13,914	14,891	17,055
Source of Supply (Ranney Collector)[d]	**24,626**	13,914	14,891	17,055
Reliable Distribution System Booster Pump Capacity[e]	9,369	1,799	1,925	2,205
Storage Capacity	40,238	13,914	14,891	17,055

Notes:
(a) Based on 5-year average day ERU demand.
(b) Available ADD ERU based on 2011 demand.
(c) Available ADD ERU based on the 5-year average.
(d) Based on WTP and source of supply limiting capacity analysis.
(e) Based on distribution system pump stations only, excludes WTP high-lift pumps and upper re-pump zones.

Table 4-14: Limiting Criteria and System Capacity- MDD Analysis

Criteria	Capacity (MGD)	Current System 2011 MDD (MGD)	Projected System 2018 MDD (MGD)	Projected System 2032 MDD (MGD)	Year of Potential Capacity Impact
Water Rights					
Maximum Water Right	5.0	3.22	3.94	4.51	Beyond 2032
Instantaneous Water Right (18.57 CFS)	12.0	3.22	3.94	4.51	Beyond 2032
Treatment Facility Maximum Capacity[(a)]	4.8	3.22	3.94	4.51	Beyond 2032
Filter Booster Pumps (normal operation)	**3.23**	**3.22**	**3.94**	4.51	2012-2018
High-Lift Pumps at WTP (2-pump operation)	5.18	3.22	3.94	4.51	Beyond 2032
Source of Supply (Ranney Collector)[(a)]	**4.08**	3.22	**3.94**	**4.51**	2018-2032
Reliable Distribution System Booster Pump Capacity (GPM) [(b)]	1,080	286	341	391	Beyond 2032
Effective Storage Capacity (MG)	6.68	4.2	4.39	4.85	Beyond 2032

Notes:
(a) Based on WTP and source of supply limiting capacity analysis.
(b) Based on distribution system pump stations only, excludes WTP high-lift pumps and upper re-pump zones.

Table 4-15: Limiting Criteria and System Capacity- MDD Analysis

Criteria	Capacity MDD (ERU)[(a)]	Current System 2011 ERUs	Projected System 2018 ERUs	Projected System 2032 ERUs
Water Rights				
Maximum Water Right	19,646	13,914	14,891	17,055
Instantaneous Water Right	47,032	13,914	14,891	17,055
Treatment Facility Maximum Capacity[(b)]	18,824	13,914	14,891	17,055
Filter Booster Pumps (normal operation)	**14,105**	13,914	14,891	17,055
High-Lift Pumps at WTP (2-pump operation)	20,369	13,914	14,891	17,055
Source of Supply (Ranney Collector)[(b)]	**16,031**	13,914	14,891	17,055
Reliable Distribution System Booster Pump Capacity[(c)]	6,099	1,799	1,925	2,205
Storage Capacity	26,194	13,914	14,891	17,055

Notes:
(a) Based on 5-year maximum day ERU demand.
(b) Based on WTP and source of supply limiting capacity analysis.
(c) Based on distribution system pump stations only, excludes WTP high-lift pumps and upper re-pump zones.

4.4 Telemetry and Controls

The City's SCADA system provides automated control of the distribution system. The SCADA system serves six of eight reservoir sites and five pump stations. The City Water Department currently uses a mixture of hardwired telemetry and radio telemetry to monitor and control the water system. Siemens/TI programmable logic control (PLC) hardware is connected to the tone communication system. The newer hardware uses the Allen Bradley SLC line of PLCs and ViPR Data Radio Ethernet radios. The City's goal is to convert all tone systems to radio within the 6-year planning window.

The City's ViPR radio system supports Ethernet communications and mesh networking. Therefore, neighboring sites can relay Ethernet communications if a site lacks clear direct communications with the master site. The City currently has licenses for six locations that provide radio telemetry for the system. Repeater stations are added as necessary and do not require licenses.

For monitoring and control, the City currently uses Rockwell RSView32 SCADA software running on two terminals for the human machine interface (HMI) to the controls for data logging/trending and for alarm monitoring. The RSView32 Messenger alarm dialer software module, along with a modem in one of the terminals, is configured to call out system failures when the plant is unattended. The City relies on outside system integrators to maintain the SCADA application.

The City's long-range plan includes converting its current data acquisition system (DAQ) equipment to an Ethernet radio system. Support for the outdated DAQ equipment is expensive and not timely; the goal is to eventually convert all sites to licensed radio. An all-Ethernet communication system is preferred to a mixture that includes frequency-shifted key (FSK) leased line tone links. The Ethernet segments could be provided by an all-radio system or a mixture of radio, T1, and cellular links. Radio is the preferred and least expensive option if clear communication paths are available.

4.5 Emergency Power

The following discusses the water system's current emergency power provisions, future objectives, and recommendations. The PUD's power grid, which serves Kelso, has many built in redundancies and widespread power outages are rare; however, the City would like to be prepared in the event that a widespread outage does occur.

4.5.1 Distribution System

The City's goal is to have emergency power provisions installed at each of the pumps stations within the 6-year planning window. Currently, the City's only onsite emergency generator is at the Behshel Heights pump station. It is recommended the City provide either an onsite generator or emergency power receptacle for each pump station in the system capable of powering the telemetry and largest pump for each pump station. For planning purposes, it was assumed the City would install transfer switches and emergency power receptacles at each pump station.

As can be seen from Table 4-13, the power needs vary by pump station. Generator sizing was developed to accommodate the largest pump in service plus pump station heating, lighting, and telemetry system requirements. The exception to this is Rocky Point; both pumps must operate at Rocky Point to provide service to this area. As a CIP placeholder, the Rocky Point generator was sized to accommodate both pumps in operation at this station. However, the City plans to upgrade this pump station and replace the existing pumps with new pumps (see CIP), the generator receptacle sizing will be revisited during that design process. The Behshel Heights pump station has an existing 75 kilowatt (kW) onsite generator. Evaluation results for Behshel Heights indicate that a 40 kW generator would be necessary to run pump No. 2 (15 HP) and 80 kW to power pump No 3 (40 HP); therefore, no changes are necessary at Behshel Heights. It is recommended the City standardize on two portable generator sizes, 60 kW and 100 kW; a 60 kW generator to supply the 40 kW and 60 kW pump stations, and 100 kW to supply the 100 kW pump stations.

Table 4-16: Emergency Power at Pump Stations

Pump Station	Current Pump Station Capacity (gpm)	Pump Power (HP)	Existing Onsite Generator/ Transfer Switch	Minimum Generator size [(a)] (kW)	Minimum Generator / Receptacle Requirements
Minor Road	No. 1: 800 gpm No. 2: 800 gpm	No. 1: 50 HP No. 2: 50 HP	None	100	100 kW 200 Amp
Carrolls Road	No. 1: 130 gpm No. 2 : 130 gpm	No. 1: 25 HP No. 2: 25 HP	None	60	60 kW 100 Amp
18th Ave	No. 1: 600 gpm No. 2: 600 gpm	No. 1: 50 HP No. 2: 50 HP	None	100	100 kW 200 Amp
Rocky Point [(b)]	No. 1: 75 gpm No. 2: 75 gpm	No. 1: 5 HP No. 2: 5 HP	None	40	40 kW 100 Amp
Behshel Heights	No. 1: 100 gpm No. 2: 400 gpm No. 3: 1,120 gpm	No. 1: 5 HP No. 2: 15 HP No. 3: 40 HP	75 kW [(c)]	80	80 kW [(c)] 200 Amp
Lower Haussler	No. 1: 150 gpm No. 2: 150 gpm	No. 1: 15 HP No. 2 :15 HP	None	40	40 kW 100 Amp
Highland Park	No. 1: 175 gpm No. 2: 175 gpm No. 3: 175 gpm	No. 1: 15 HP No. 2: 15 HP No. 3: 15 HP	None	40	40 kW 100 Amp

Notes:

(a) Generator and receptacle sizing based on demands for largest pump in service, heating lighting and telemetry system.
(b) Rocky Point generator sized to power both pumps as pumps run as series.
(c) Behshel Heights' existing generator adequately sized.

4.5.2 Treatment Plant and Ranney Collector

Currently, neither the Ranney collector nor the treatment plant has backup emergency power available; however, projects to install emergency power at each the Ranney collector and at the treatment plant are on the City's CIP. The Ranney collector and the treatment plant are each supplied from a different part of the PUD's power grid. It is likely not feasible to supply both from a single emergency power source given the distance between the Ranney and filter plant and the need to cross the railroad and penetrate the flood dike. The discussion in Section 4.3.2.1 identified difficulties associated with installing emergency power at the Ranney collector site. The treatment plant is dependent on receiving water from the Ranney collector; therefore, the benefits of having emergency power available at the treatment plant are diminished if the Ranney collector is not able to supply water to the treatment plant. To optimize the City's CIP budget, the City should complete a more detailed evaluation of the Ranney collector facility, recommended previously in this section, before installing emergency power at the treatment plant.

4.6 Distribution System Hydraulic Modeling

The City's water distribution system was analyzed separately using Bentley's WaterCAD modeling software. WaterCAD offers graphical capabilities to display node and junction input information (pipe lengths and diameters, elevations, demands, etc.) and results (velocities, fire flows, hydraulic grades, pressure contours, etc.) on top of the mapping layers. The City's model is currently built on the Version 8i release of WaterCAD.

4.6.1 Model Development

The most recent version of the City's model was utilized. Before the distribution system was analyzed, four sequential steps were performed to update the models to a level that could more accurate depict current system conditions:

1. Facilities Update*:* Distribution facilities that had been constructed or modified since the last Plan were incorporated into the computer model. The City's staff provided a series of redlined maps showing new pipes, including pipe diameters, length, and material information either translated onto the plans or relayed by attached as-built information. Examples of facilities added since the last update include:

    - New distribution system water lines/transmission mains
    - Line replacement
    - New or revised pumps/pump curves within existing pump stations
    - New reservoir
    - Changed PRV settings
    - Changed operational control parameters, including valve settings and reservoir set points
    - Storage facilities that changed from fixed head reservoirs to actual dimensioned tanks.

2. Demand Dispersal: Existing and future demand projections, as discussed in Section 2: Basic Planning Data, were distributed among specific service areas correlating to pressure zones. This data was used to create demand files for system nodes for existing and projected year 2018 and 2032 demands. Demand was dispersed evenly across the nodes within each area, with the exception of the nodes representing known high demand users such as the Allen Street Apartments, Foster Farms, and the Davis Terrace.

3. Calibration: Water system model calibration involves recording actual field hydrant flow test data within specific pressure zones. The field-recorded data includes measured static and residual pressures at the hydrant before and during flowing, as well as the measured flow rate from the hydrant. Simultaneous testing pressures at other locations within the zone are preferred, with an optimal targeted pressure drop of at least 10 psi at the hydrant. Zone boundary conditions that must also be established and recorded during testing periods include:

   - Reservoir levels
   - Settings and flow rates through all system PRVs within the pressure zone being tested
   - Pumping rates for well or booster pumps in operation during testing that either contribute water to or take water from the pressure zone being tested.

   Recorded field testing conditions are then replicated within the computer model, with the zone demand condition estimated according to the season and time of day when testing is performed. Other model characteristics that are frequently discovered to be inaccurate during calibration are:

   - Node elevations that have been incorrectly entered or are based on conflicting data
   - Incorrect PRV settings within the model
   - Artificially entered, inaccurate pump curves that cause abnormal pumping flow rates within the model
   - Inaccurate field measurement equipment, including uncalibrated or insensitive flow measurement and pressure gauges
   - Discovery of a partially or fully closed distribution system valve.

   Typically, if the static pressures between model and field data are markedly different, but the pressure drop is similar, another modeling condition such as those listed above should be checked and evaluated. Calibration is typically considered successful when pressures match to within 3 or 4 psi.

   The City's model was calibrated during the 2012 WSP update by using acquired hydrant flow data collected by utility staff. The model C factor, which has a range of values between 105 and 140, required minimal adjustment during calibration. The final calibrated model was within 3 psi of all hydrant flow pressures.

4. Scenario Creation: The modeling software program used allows for the creation and easy manipulation of varying databases representing physical, control, and demand input data. In order to more efficiently analyze the systems under specified design criteria used to determine deficiencies, the following datasets and scenarios were created:

    - 2011, 2018, and 2032 ADD scenarios set at the base of equalizing volume and pumps in service to represent operation under average day conditions.

    - 2011, 2018, and 2032 PHD scenarios with reservoirs set at the base of equalizing volume and pumps in service to represent operation under peak hour conditions.

    - 2011, 2018, and 2032 MDD scenarios with reservoirs set at the base of fire volume and pumps in service to represent operation under maximum day conditions and at the conclusion of a fire flow event.

4.6.2 Hydraulic Evaluation Design Criteria

The design criteria utilized to evaluate the distribution system are based on maintaining ranges of system pressures and velocities as defined in the DOH WAC 246-290-230 and in the December 2009 DOH Water System Design Manual. The models were run with varying conditions to adhere to these criteria for distribution system design, including:

- Maintain a minimum pressure of 30 psi at all service connections within the distribution system during PHD conditions.

- Maintain a minimum pressure of 20 psi at all service connections in the distribution system during fire flows under system MDD conditions.

- Limit pipe velocities to approximately 8 feet per second (fps) under PHD conditions.

- Limit pressure within the distribution system to 100 psi.

- Reservoir levels were assumed to be at the minimum water elevation as shown in the summary tables in Section 1.

The City established the required fire flow rates and durations for different customer classes established in accordance with the Fire Marshal's requirements (see Section 2: Basic Planning Data).

4.6.3 Modeling Results

The model was run in the static mode under appropriate scenarios to compare pressure, velocity, and available fire flow results against the design criteria. The results and deficiencies discussed below are independent of ongoing programs with annual replacement of undersized (4 inches and smaller) water lines, as well as for water lines made of materials nearing their useful life (AC, unlined cast iron and steel, and others).

Pressure Deficiencies

Kelso handles elevation ranges within its service area well through different pressure zones and PRV operational settings. Due to a moderate 20-year growth projection period with demands to be dispersed as discussed previously in Section 4.6.1, the pressure deficiencies between existing conditions and projected years 2018 and 2032 are the same.

Pressures greater than 100 psi in localized areas of many distribution systems are common and typically managed by utilities through water line construction design standards and individual service PRVs. The City manages these high pressures by using individual PRVs.

Pressures greater than 30 psi occur throughout the distribution system under all conditions with the exceptions of a few homes next to the Paxton Road and Carrolls Road reservoirs; owner-provided booster pumps are used to provide water at the needed pressure. The City's CIP includes the installation of a packaged booster pump station for the Paxton Road service area to address this issue.

An additional area that was added to the model in this revision was along Edinburgh Court off of Harris Street. The model indicates pressures in this area fall below the required 30 psi at the upper elevations of this development. This area is supplied via a PRV; further field investigation of this deficiency is planned to determine if PRV adjustment or additional model calibration is required. Other exceptions are under certain fire flow conditions and are discussed under Fire Flow Deficiencies.

Velocity Deficiencies

Aside from a few velocities over 8 fps in or around the pump stations, all velocities remained under 8 fps with the exception of the 2032 PHD. The velocity in the line on Talley Way and in Corduroy Road, were above 8 fps at 8.9 and 8.8 ft/sec, respectively. The projected 2032 PHD demand associated with Foster Farms and the Allen Street Apartment in these areas is causing the increased velocities. Demand from large users should be monitored in the future to determine accurate usage and the need for larger lines in areas of high commercial and industrial use. New high-use developments should also be analyzed to determine the appropriate sizing of lines to serve each development.

Fire Flow Deficiencies

The City recognizes the need to replace 2-inch, 4-inch, and long runs of 6-inch distribution system mains. As part of this planning process, the City developed a formal pipeline replacement program where a set amount of funds is allocated each year to address known problem areas. The CIP in Section 9 includes a pipeline replacement program, initially funding is established at the $125,000 level but will escalate to the goal amount of $300,000 annually by 2017.

An analysis of the City's distribution and transmission system revealed the following deficiencies. The following areas are identified as having insufficient pressures available to meet the required fire flow rates established by customer class within Section 2: Basic Planning Data:

- Any current fire hydrants located off existing dead-end, unlooped water lines 4 inches and smaller, as well as 6-inch water lines generally longer than 500 feet. These are present throughout the distribution system, but particularly in the Williams-Finney Zone 322 east of Minor Road, central Zone 188, Zone 410, and along Mt. Brynion Drive. Numerous pipelines replacement projects have been identified in the CIP.

- The Rocky Point area within the boosted Zone 301, cannot meet the 500 gpm residential fire flow requirement due to undersized booster pumps. A CIP has been identified to address this issue.

- Within the Airport/Industrial-zoned area of South Kelso, several existing industries being served by the 8-inch line along Talley Way cannot to meet the 4,000 gpm fire flow requirement. Many small, dead-end water lines currently run from west to east within this zoned area between Willow and Hazel streets. As development occurs, efforts should be made to create looping and increase the size of the lines to meet the fire flow requirements for developed facilities.

4.7 Summary of System Deficiencies and Recommendations

Table 4-17 summarize the deficiencies and recommendations for Kelso developed throughout this section. These recommendations will be further explored in Section 9 – Capital Improvement Program.

Table 4-17: Summary of System Deficiencies and Recommendations

Location	Deficiency	Planning Period	Recommendation
Treatment / Source:			
Filter Booster Pumps	Undersized pump motors	6-yr	Upsize filter booster pump motors. Evaluate existing power supply and remaining service life of existing pumps.
Mill Street Test Well	Supplement Source of Supply	6-yr	Construct a test well to determine water quality and hydrogeologic characteristics
Ranney Collector	Inadequate source of supply	6-yr	Conduct Source of Supply analysis to determine the most cost effective and reliable source of supply for the City.
Backwash Recovery	Water Efficiency	6-yr	Complete feasibility/cost/benefit evaluation to determine if installation of backwash recovery system would be beneficial.
Distribution / Transmission:			
Multiple Locations	Flow and Pressure	6- and 20-yr	Prioritize and replace distribution and transmission mains contributing to fire flow deficiencies as identified by the hydraulic modeling.
Multiple Locations	2-, 4-, and 6-inch water mains	6- and 20-yr	Continue annual system-wide replacement of 2-, 4-, and 6-inch distribution mains.
Storage:			
Minor Road Reservoirs	Structural Integrity and Reliability	6-yr	Replace or rehabilitate based reservoirs.
Rocky Point Zone 301	Reliability	20-yr	Provide 1,000 gpm high flow pump with permanent emergency standby generator at the Rocky Point Pump Station.
Pumping:			
Booster Pump Stations	Reliability	6-yr	Provide standby power provisions for all booster pump stations in the system.
Rocky Point Pump Station	Reliability	20-yr	Provide redundant duty pump as part of reconstruction of station.
Mt. Brynion Pump Station	Reliability	6-yr	Provide redundant duty pump.

Section 5: Water Resources/Water Use Efficiency Program

5.1 Introduction

Reliable sources of good water quality are essential to every public water system. This section discusses various aspects of the two existing sources of water for the City (Ranney collector and Longview intertie), possible future sources, and the City's Water Use Efficiency (WUE) Program in the following sub-sections:

- Water Supply Characteristics
- System Reliability Efforts
- Water Shortage Contingency Measures
- Water Right Evaluation
- Past Conservation Program
- Current Water Use Efficiency (Conservation) Program
- Goals
    - Education and Other Measures
    - Meters
    - Distribution System Leakage
    - Water Loss Control Action Plan
    - Rate Structure
    - Water Reclamation
    - Water Use Program Modifications
    - Demand Forecast with Projected Savings.

5.2 Water Supply Characteristics

The primary source of water for the City is a Ranney collector located on the eastern bank of the Cowlitz River. The Cowlitz River originates from glaciers on the southeastern slopes of Mount Rainier and flows south through the Longview-Kelso Urban area, joining the Columbia River south of Kelso. The Cowlitz River is considered a consistently reliable source for Kelso. According to watershed planning documents, the area of the Ranney collector is in a tidally influenced zone, which means water levels in the river will be fairly consistent (see Section 6: Source Water Protection). With recent changes in the U.S. Army Corps of Engineers' river management strategy, river levels are in fact increasing, thus creating more available drawdown in the Ranney collector.

Initially, Kelso withdrew water directly from the Cowlitz River and operated a WTP. In 1979, the City replaced the surface WTP with a Ranney collector. Initially, the water quality was considered good, requiring little additional treatment. Iron and manganese levels increased significantly after the Mount St. Helens eruption in 1980, and the City constructed an iron/manganese removal plant in 1984. The Ranney collector was determined to be GWI by DOH. The plant was upgraded in 2002 to comply with surface water treatment requirements established by DOH.

The existing treatment plant had been rated at a capacity of 3.6 MGD but the filter capacity was recently increased by DOH to 4.8 MGD, provided the City meets the stated reporting requirements and the current turbidity standards are maintained. However, the maximum the plant can produce is 4.08 MGD due to limitations associated with the Ranney collector. The limiting factors were discussed in Section 4.3. In order maintain 4.08 MGD in the Ranney collector, the well laterals must be cleaned on a regular basis. The filter booster pumps were identified as another limiting factor; the booster pump capacity should be increased to fully utilize the available capacity of the Ranney collector. Raw water is pumped from the Ranney collector on the bank of the Cowlitz River to the WTP. The treatment process consists of coagulation, pressure filtration, iron, arsenic and manganese removal, chlorination, fluoridation, and pH adjustment for corrosion protection. The water is then pumped to the distribution system from the treatment plant.

The City also has an intertie with the City of Longview through which it routinely wheels water for BHWSD to two small service areas. This intertie is capable of providing water directly to the City if the need should arise. The volume of water available is approximately 1,000 gpm due to the size of Kelso's connecting 6-inch-diameter pipeline.

5.3 System Reliability Efforts

Although the intertie with the City of Longview can provide an emergency source of water for Kelso, the City relies on the Ranney collector as their primary source of supply. Over the years, the City has considered a variety of options for increasing their water supply including expanding the existing Ranney collector, or developing a new Ranney collector, utilizing surface water from a number of possible sources in the area, or developing groundwater wells. Purchasing water from the City of Longview on a permanent basis may be another option.

5.3.1 Ranney Collector

In May 1996, a study evaluated options to increase the yield of Kelso's Cowlitz River Ranney collector. One option included the installation of new laterals to enlarge the effective radius. A second option considered was construction of a new Ranney collector at a site 1,000 feet downstream from the existing collector. The design yield of this well would be 4.0 MGD. In order to install new laterals, the existing Ranney collector would have to be removed from operation. Therefore, it was decided that if Kelso were to expand the WTP, construction of a second Ranney collector would be the most feasible option. Since this study was conducted prior to the source being declared GWI, necessary water treatment upgrades to meet increased demands have not been evaluated. A wellfield in this same general area also has been discussed. A new Ranney collector or shallow wells located near the river would be considered GWI unless microscopic particulate analyses (MPA) indicated otherwise. As a GWI source,

DOH water filtration and disinfection that meet surface water requirements (WAC 246-290-660 and 662) must be provided.

5.3.2 Surface Water

Only the Cowlitz River is considered a viable source of surface water. Other surface waters considered in past studies are the Coweeman River, Kalama River, Minor Streams, or the Columbia River. None of these surface water sources were considered viable for various reasons.

5.3.3 Groundwater

The City has assessed groundwater for industrial uses in lieu of immediate expansion/ upgrades to the existing Ranney collector and WTP. The City received groundwater water right permits (G2-29813 and G2-29815) in December 2001 to withdraw groundwater from six wells in South Kelso near the confluence of the Coweeman and Cowlitz Rivers near Talley Way. Initial water quality samples obtained from a production-capable test well drilled at Talley Way indicate that the groundwater in this well contains greatly elevated iron and manganese levels. The City pumped the Talley Way well at 1 MGD for a year in hopes that the high metals levels would decrease over time. While the hoped for decrease in metals concentration did not occur, the City was able to confirm well has good capacity and consistent water quality. Currently, the City has decided to investigate other potential well sites but may use the information gathered during the 1-year pumping test as the basis for further investigation of the Talley Way site. The groundwater permits (G2-29813 and G2-29815) have been extended to 1 December 2013 to allow the City to explore other groundwater options.

5.4 Water Shortage Contingency Measures

A water shortage contingency plan provides a systematic response, should the need arise, to reduce customer demands during a water supply emergency. The City's plan establishes a strategy to enable maintain essential public health and safety and minimize adverse impacts if an emergency occurs.

In the event of emergency, or whenever the public health, safety, or the equitable distribution of water so demands, the Kelso's City Code (13.04.400 Emergency interruption of service) authorizes the Public Works Director to change, reduce, or limit the time for, or temporarily discontinue the use of water. Before implementing such actions, the City will notify all water consumers affected as described above whenever possible.

The elements of a water shortage contingency plan are similar to those within a conservation program. However, long-term water conservation measures differ from water curtailment actions. Curtailment actions are designed to quickly reduce water use, are relatively short-lived, and usually involve some tradeoffs or hardship for customers.

The City's Emergency Response Plan (2004) includes a section on drought which is presented below. The measures presented in that plan are applicable whenever there is a water shortage regardless of the cause (drought, decline in Ranney production, pumping or treatment related issues).

Quick Response Summary:

1. Discuss situation and plan response with BHWSD and the City of Longview.
2. Contact DOH and Cowlitz County Health Department.
3. Issue water rationing notice.
4. Investigate alternative water supplies.
5. Contact Critical Customers and Fire Districts.
6. Track water supply with Longview and Beacon Hill and revise public notices as necessary.

Water conservation regulations are put into effect as required. The extent of water rationing implemented should be in proportion to the extent of the anticipated water shortage. When responding to a drought, the City will face the uncertainty of not knowing how severe it will become before it ends. For this reason, it is difficult to say exactly when certain measures must be taken, such as initiating water conservation measures. Three levels will be used for the City's rationing procedures:

1. Minor - Where less than a 10 percent reduction in water consumption is needed.
2. Moderate - Where a 10 to 20 percent reduction in water consumption is needed.
3. Severe - Where close to a 30 percent reduction in water consumption is needed.

The Public Works Superintendent is responsible for making all changes in the condition or service, with the approval of the Public Works Director. Other specific water conservation regulations can be put into effect as required. The extent of water rationing implemented should be in proportion to the extent of the water shortage. The following are some of the measures for each of the three levels of rationing:

Minor Shortage

- Implement voluntary water use reductions
- Distribute additional water conservation materials
- Distribute additional conservation retrofit kits
- Promote intensive leak detection and repair program
- Issue a news release to the media.

Moderate Shortage

- Continue with the minor shortage procedures
- Adopt landscape irrigation restrictions, incorporation of one or more of the following:
  - Time of day (i.e., 7:00 a.m. to 7:00 p.m.)
  - Weekly frequency (i.e., odd/even days, etc.)
  - Sprinkler bans (hand watering only)

- Implement a resolution banning water waste
- Continue news releases to the media.

Severe Shortage

- Continue with the other water shortage procedures.
- Implement an ordinance allowing the City to declare a water emergency and to require rationing.
- Times of day restrictions implemented and enforced.
- Permissible watering hours and weekly frequency for landscaping irrigation further reduced. Eliminate if deemed appropriate.
- Continue news releases to the media.

Public notifications should be made as required. Sample public notifications for curtailing water use are included in Chapter 3 (Communications) of the Emergency Response Plan.

5.5 Water Rights Evaluation

The City has two surface water and one Ranney water right certificates that have been united in the most recent permit (S2-29856). This permit limits the City to an annual total withdrawal of 5,600 ac-ft and an instantaneous flow rate of 18.57 CFS.

Two additional groundwater permits for a total of six wells were granted to the City in December 2001 to accommodate expected growth within Kelso's southern urban growth boundary. These groundwater right permits allow the City to withdraw a maximum of 3,500 gpm, and 5,600 ac-ft/yr from groundwater sources south of the City. The development schedule for these wells has been extended to 1 December 2013. The total annual withdrawal by the City from all sources is limited to 6,728 ac-ft/yr as stated on both of the newest groundwater permits. The Water Right Self-Assessment Forms for existing and projected uses for Kelso are provided in Exhibit 5A. Table 5-1 provides a summary of the currently available water rights for the City.

Table 5-1: Summary of Available Water Rights

Water Source	Annual Source (ac-ft/yr)	Annual Source (MGD)	Instantaneous Maximum Source	Instantaneous Maximum Source (MGD)
Cowlitz River and Ranney Collector[a]	5,600	5.0	18.57 (CFS)[b]	12.0
Three Wells [c]	1,128 Primary 1,272 Supplemental	1.0	1,500 GPM	2.16
Three Wells [d]	3,200	2.9	2,000 GPM	2.88
Total [c,d]	6,728	6.0	11,835 GPM	17.0

Notes:

(a) S2-29856P (includes S2195, S2-01119C, G2-24762C, and S2-29856).
(b) CFS = cubic feet per second [18.57 CFS = 8,335 gallons per minute (GPM)].
(c) G2-29813P (Limited to 6,728 ac-ft/yr from S2195, S2-01119C, G2-24762C, S2-29856, G2-29813, and G2-29815).
(d) G2-29815P (Limited to 6,728 ac-ft/yr from S2195, S2-01119C, G2-24762C, S2-29856, G2-29813, and G2-29815).
ac-ft/yr = acre-feet per year
ac-ft/yr = 0.0008927 million gallons per day (MGD)

5.6 Past Conservation Programs

Water conservation is an important and ongoing component of water resource management. Not only does efficient water use benefit natural resources, it also benefits water utilities and local governments by conserving water to meet economic and population growth and by lowering water demands that could require investment in new source development.

An urban area conservation plan was adopted by the Cities of Longview and Kelso and the PUD in 1999, and was updated in the 2005 Water System Comprehensive Plan. Since that time, ownership of the PUD's water system has been transferred to BHWSD. The Cities of Longview and Kelso and BHWSD are currently discussing working together to jointly produce and distribute WUE-related public information and to enhance their other various outreach programs.

The conservation program in the 2005 WSP for the City of Kelso included:

- Reduce ADD and MDD by 3 percent over the next 6 years.
- Promote conservation program by distributing brochures during peak usage months.
- Meter and record upper zone pump station usage. Establish true ADD and MDD usage within each zone.
- Continue leak detection program and meter replacement program.
- Conduct a bi-annual system leak detection survey.

- Allocate $100,000 per year to replace deteriorating 2-, 4-, 6-, and 8-inch water lines of any material (mainly AC, cast iron, and galvanized steel).

After the DOH's adoption of the WUE regulations in 2007, the City held a public forum on 28 December 2007 to discuss the WUE program as presented in the 2005 WSP. An advertisement for the forum was placed in the local newspaper and posted at City Hall. The only attendee questioned the City staff about the number of measures required. The City Council adopted the program as presented in the 2005 WSP.

Although the 2005 format listed goals and objectives, the first item (reduce ADD and MDD by 3 percent over the next 6 years) also meets the WUE requirement for a measurable demand goal and schedule. The 2005 program does not identify all of the measures the City is implementing; they are identified in Section 5.7.2, WUE Measures. A copy of the City notice, a summary of the forum and Council Action are included in the appendices.

5.7 Current Water Use Efficiency Program Status

This section discusses the individual elements of the City's current WUE Program.

5.7.1 Water Use Efficiency Goals

The results of the City's WUE program can be seen in Table 5-2. The program has been especially successful in reducing the ADD. For comparison purposes, the changes from the 1999 figures are also presented.

Table 5-2: ADD and MDD Reduction from 1999 to 2011

Year	ADD (MGD)	MDD (MGD)
1999[(a)]	2.25	3.51
2003[(b)]	2.33	3.27
2011	2.15	3.18
Percent Change by Period		
1999 to 2003	+ 3.6%	- 6.9%
2003 to 2011	- 7.7%	- 2.8%
1999 to 2011	- 4.4%	- 9.4%

Notes:

(a) Based upon demands from the 1999 Water System Plan.
(b) Based upon demands from the 2005 Water System Plan.

Another way to gauge the effectiveness of a WUE program would be to compare the ADD and MDD in gpd/ERU. Table 5-3 compares the ADD and MDD as expressed in gpd/ERU and shows a significant reduction in consumption over the past 11 years. The City has exceeded their initial 10-year goal of a 5 percent reduction in both ADD and MDD. The reduction in ADD has been steady over the time period. The overall percentage reduction in both ADD and MDD in the past 11 years has been dramatic.

Table 5-3: ADD and MDD Reduction from 1999 to 2011 (gpd/ERU)

Year	ADD/ERU (gpd)	MDD/ERU (gpd)
1999[(a)]	231	395
2003[(b)]	189.4	265.9
2011	157	232
Percent Reduction by Period		
1999 to 2003	18.0%	32.7%
2003 to 2011	17%	13%
1999 to 2011	32%	41%

Notes:

(a) Based upon demands from the 1999 Water System Plan.
(b) Based upon demands from the 2005 Water System Plan.

The large reduction in MDD may be partially attributed to Foster Farms internal conservation efforts which resulted in a reduction of 20 MG less in 2011 than they have the previous 3 years. It should also be noted that summer 2011 was relatively wetter and cooler than in previous years.

5.7.2 Water Use Efficiency Measures

The City has continues to refine and enhance its program to promote conservation and WUE as shown below. The italicized items indicate new measures to be included in City's current WUE program:

- Billing program enhanced to show consumption history for all categories:
  - Residential
  - Commercial
  - Industrial.
- Customer education messages such as:
  - Billing inserts to provide customers with the tools to identify and repair leaks in and around their homes and other water saving tips
  - *Participation in the Annual Job Fair*
  - *Provide demonstrations and materials to local and regional high school students.*
- Web site – will be updated to include links from "Water Sense".
- Water saving tips included in CCR (annual water quality report) for residential customers.

- Sewer rates include an overage charge for all industrial customers (per Ordinance 19-3373).
- Sewer rates include an overage charge for all those commercial customers that use more than 1,300 cubic feet per bi-month (per Ordinance 19-3373).
- *Become a Water Sense Partner and utilize their education materials to inform customers about the Water Sense Program.*

On the supply side, the City has continued their bi-annual leak detection program and has also implemented more efficient backwash processes at the WTP which has resulted in a reduction in water usage. The City continues to strive towards the measure of metering and recording upper zone pump station usage and establishing more accurate ADD and MDD usage within each zone. Four of the City's seven booster stations have meters. The remaining stations (Behshel Heights, Minor Road, and 18th Street) are included in the CIP.

5.7.3 Metering

Both of the City's water sources (treatment plant and intertie with Longview) are metered; as are all of the service connections, including City-owned facilities.

The service meters are read by a private contractor and reported to the City's Finance Department for billing. The City relies on historical water usage at each connection to validate the accuracy of the meter readings. In the event that a reading appears to differ from the norm, the finance department notifies the water supervisor. The water staff then promptly investigate and either repair or replace suspect meters as necessary.

The City implemented a service meter replacement program in 2006, with the goal of replacing 200 meters per year. The program has exceeded its annual meter replacement goals. For example, the City replaced 442 meters in 2011 and had replaced 90 meters by June of 2012. Service meters are replaced based on age (20 years or older), reading errors or if the connected waterline is replaced. The City is pursuing the installation of a system wide automated reading system; this project has been included in the City's 6-year Capital Improvement Program and is estimated to take 3 years to fully implement.

The City's large meter replacement program (1-½ inches and larger) is in the process of implementation. Full implementation is schedule for the year 2013. During the implementation process, the large meters are investigated or replaced based on changes in historical water usage.

5.7.4 Distribution System Losses

Table 5-4 shows the Distribution System Losses for 2007-2011 as reported in the City's WUE Annual Performance Reports. The 3-year annual average is also reported stating with the report for the 2009 figures.

Table 5-4: Distribution System Losses for 2007-2010 [a]

Reporting Period (Jan. 1 – Dec. 31)	Distribution System Loss Volume (gallons)	Distribution System Loss Percentage	3-Year Annual Average Percentage
Jan. 2007 – Dec. 2007	61,000,000	7.5%	-
1 Jan. 2008 – 31 Dec. 2008[a]	81,000,000	10%	-
1 Jan. 2009 – 31 Dec. 2009	92,500,000	11%	9.5%
1 Jan. 2010 – 31 Dec. 2010	101,260,000	12.9%	11.2%
1 Jan. 2011 – 31 Dec. 2011	91,000,000	11.7%	11.8%

Note:

(a) Due to meter malfunction, the largest distribution meter was estimated until repairs could be made.

Source: City Performance Reports.

It is estimated that at least 3 percent of the DSL is the result of leakage from the two 1924 Minor Road reservoirs. A structural evaluation for the Minor Road reservoirs has recommended replacement.

5.7.5 Water Loss Control Action Plan

Since the 3-year DSL average exceeds 10 percent, a Water Loss Control Action Plan is required. The City's plan to reduce the DSL is to continue to implement their supply side measures including the following:

- Meter and record upper zone pump station usage. Establish true ADD and MDD usage within each zone.
- Continue their meter replacement program.
  - Conduct an annual system leak detection survey. The City is divided into four sections: north, south, east, and west. Each year 25 percent of the City is tested for leakage. The City generally locates and repairs one to five leaks each year.
- Replace deteriorating and undersized 2-, 4-, 6-, and 8-inch water lines of any material (mainly AC, cast iron, and galvanized steel. Annual spending for water line replacement has increased in the last few years to take advance of lower interest rates and lower construction costs. The City awarded contracts for replacement of over 11,500 feet of pipe ($1.7 million) in 2011 and $700,000 in 2010.
- Upon approval of this WSP, the City intends to apply for a State Revolving Fund and/or Public Works Trust Fund (PWTF) loan to replace the Minor Road reservoirs.

In addition, the City will fully implement the larger meter testing and replacement program.

5.7.6 Rate Structure

The City has a fixed bi-monthly base rate which varies with the size of meter and type of use. In addition to the base rate, each customer class has a uniform block rate for every 100 cubic feet of water consumed. The current rates were adopted in September 2010 (Ordinance 10-3733) with both the base rate and the consumption rate increasing yearly through 2014. Table 5-5 summarizes the water rates for the average residential connection with in the City limits from 2005 to 2014. Rates for service outside the City limits are 1.5 times the in-City rate. A copy of Ordinance 10-3733 showing the rates for all customer classifications is included in the appendices.

Table 5-5: Water Rates (2005-2014)

Year	3/4 x 5/8 Residential Base Rate	Block Rate / 100 cu. ft.
2005	$12.67	$1.85
2009	$15.46	$2.27
2010	$16.62	$2.44
2011	$17,87	$2.62
2012	$19.21	$2.82
2013	$20.65	$3.03
2014	$22.20	$3.26

The majority of residents residing in a single-family home inside the City limits will use a ¾-inch water meter, pay a fixed bi-monthly charge of $19.21, and pay an additional sum equal to $2.82 per every 100 cubic feet of water consumed. With typical household usage of 1,300 cubic feet per month, based on the above, a typical resident would pay $46.27 per month.

The increase in water rates has contributed to the 17 percent reduction in gpd/ERU since 2003. The City's approach to water and sewer rates is to evaluate and modify the rate schedule every 4 to 5 years. The City may consider establishing an inclining block rate by setting additional tiers for high water users, and/or season rates to help address MDD.

5.7.7 Water Reclamation

The City is a partner in the Three Rivers Regional Wastewater Treatment Plant (TRRWTP), located across the Cowlitz River, southwest of the City. The TRRWTP treats sewage from the cities of Longview and Kelso, BHWSD, and the County. The Washington State Department of Ecology (Ecology) and DOH have established four classes of effluent that may be used for various beneficial uses ranging from Class A standards for use in public contact areas or food production, to Class D for surface irrigation of trees with restricted access. The TRRWTP is permitted to produce Class A effluent but currently treats to a secondary level. TRRWTP currently uses reclaimed water for onsite for irrigation and wash down water.

The Three Rivers Regional Wastewater Authority has evaluated other potential reclaimed water uses, such as irrigation, impoundments, groundwater recharge, and industrial/commercial uses.

However, none of the options evaluated are economically feasible at this time due to the expense associated with the installation of the reclaimed water infrastructure and increased operational costs associated with the production and delivery of reclaimed water.

Foster Farms represents Kelso's largest user and plays a major role in the City's future demands. Foster Farms has undertaken a water reuse program within their facilities that is expected to reduce their demands by 15 percent for 2011, 2012, and 2013. The initial impacts of the Foster Farms reuse program are reflected in the 2011 usage records that indicate Foster Farms reduced their demand by nearly 20 MG in 2011. The City continues encourages water reuse in other areas where possible.

5.7.8 Water Use Efficiency Program Modifications

The City revised its WUE goals and measures concurrently with the adoption of this WSP update. A WUE public forum was held on 19 March 2013, in conjunction with the public meeting for discussion of the WSP. In order to account for a possible increase in commercial and industrial development in the City, a goal expressed in gpd/ERU was approved.

The City has retained the customer goal of reducing MDD by 3 percent by 31 December 2017, but will measure progress by comparing MDD per ERU. The WUE measures outlined in Section 5.7.2, both new and existing, will be utilized to help the City achieve their WUE goal. Consideration was given to add measures relating to rate evaluation by the end of 2014, and other measures directed at summertime water use.

The supply side utility goal is to achieve the 10 percent distribution system loss standard or better. Measures to achieve this goal include completion of the booster pump metering project, and continue the leak detection and pipe line replacement programs.

5.7.9 Demand Forecast with Projected Savings

The following table and figures summarize a continued MDD projected water savings of 3 percent over the next 6 years as a result of continued conservation efforts. Figure 5-1 graphically illustrates the data presented in Table 5-6.

Table 5-6: Future Water Demands with Conservation (MGD)

	2011		2018		2032	
Future Demands	**ADD**	**MDD**	**ADD**	**MDD**	**ADD**	**MDD**
Without Additional Conservation Efforts	2.15	3.18	2.47	3.80	2.83	4.35
With Additional Conservation Efforts	2.15	3.18	2.39	3.69	2.54	3.92
Projected Conservation Program Water Savings	N/A	N/A	0.07	0.11	0.28	0.43

Figure 5-1: Future Project Water Demand with 3 Percent Conservation

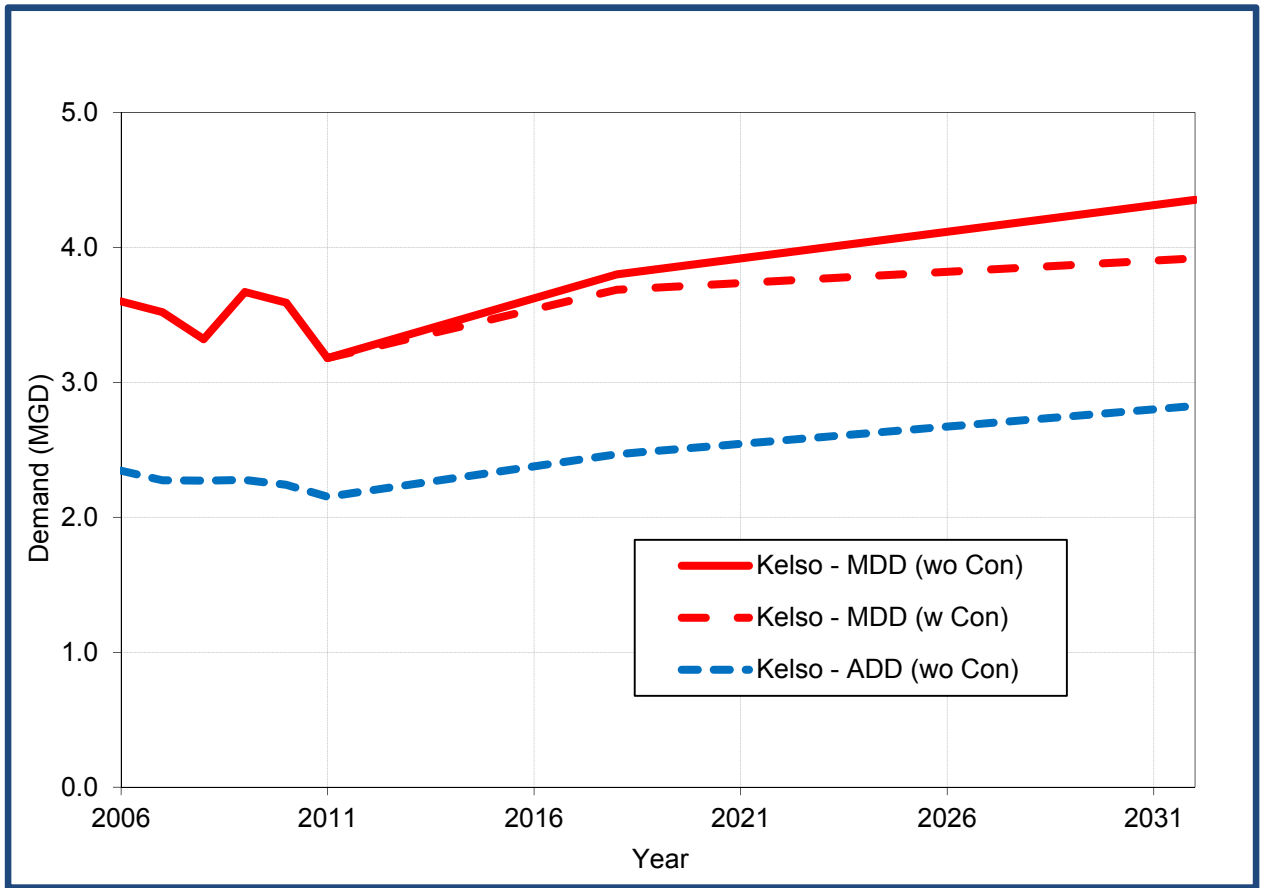


EXHIBIT 5A: WATER RIGHT SELF-ASSESSMENT FORMS

Washington State Department of Health
Division of Environmental Health
Office of Drinking Water

EXHIBIT 5A-1
WATER SYSTEM PLAN
WATER RIGHTS SELF ASSESSMENT – EXISTING STATUS

PERMIT CERTIFICATE OR CLAIM #	NAME ON DOCUMENT	PRIORITY DATE (List oldest first)	SOURCE NAME/ NUMBER	ANY PORTION SUPPLEMENTAL? (If yes, explain in footnote)	EXISTING WATER RIGHTS		EXISTING CONSUMPTION		CURRENT WATER RIGHT 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)
Permits/ Certificates 1. S2-29856P	City of Kelso	3 June 1999	Cowlitz River		18.57 CFS (8,334 GPM)	5,600 AF (1,825 MG)	3,611 GPM	795 MG	4,723 GPM	1,030 MG
S2195C, S2-01119C, G2-24762C are reflected in Maximum values for permit # S2-29856P										
2. 2195C	City of Kelso	13 Apr 1945	Cowlitz River		3.0 CFS	-				
3. S2-01119C	City of Kelso	01 Mar 1982	Cowlitz River		10 CFS	2,380 AF				
4. G2-24762C	City of Kelso	28 Dec 1977	Ranney Well		2,500 GPM (5.57 CFS)	2,800 AF				
5. G2-29813P	City of Kelso	20 Nov 1998	Three Wells	Yes	1,500 GPM (3.34 CFS)	1,128 AF(P) 1,272 AF(S)				
6. G2-29815P	City of Kelso	20 Nov 1998	Three Wells	Yes	2,000 GPM (4.46 CFS)	3,200 AF				
Claims 1.										
TOTAL	**********	*******	*******	**********	21.91 CFS (9,834 GPM)	6,728 AF (2,192 MG)	3,611 GPM	795 MG	4,723GPM	1,030MG

INTERTIE NAME/ IDENTIFIER	NAME OF PURVEYOR PROVIDING WATER	EXISTING LIMITS ON INTERTIE 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.							
2.							
3.							
4.							
TOTAL	**********						

PENDING WATER RIGHT APPLICATION (New/Change)	NAME ON APPLICATION	DATE SUBMITTED	ANY PORTION SUPPLEMENTAL? (If yes, explain in footnote)	PENDING WATER RIGHTS	
				Maximum Instantaneous Flow Rate (Qi) Requested	Maximum Annual Volume (Qa) Requested
1.					
2.					
3.					
4.					

Washington State Department of Health
Division of Environmental Health
Office of Drinking Water

EXHIBIT 5A-2
WATER SYSTEM PLAN
WATER RIGHTS SELF ASSESSMENT – 6-YEAR FORECAST

PERMIT CERTIFICATE OR CLAIM #	NAME ON DOCUMENT	PRIORITY DATE (List oldest first)	SOURCE NAME/ NUMBER	ANY PORTION SUPPLEMENTAL? (If yes, explain in footnote)	EXISTING WATER RIGHTS		FORECASTED WATER USE FROM SOURCES (6-year Demand)		FORECASTED WATER RIGHT 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)
Permits/ Certificates 1. S2-29856P	City of Kelso	3 June 1999	Cowlitz River		18.57 CFS (8,334 GPM)	5,600 AF (1,825 MG)	4,305 GPM	934 MG	4,029 GPM	891 MG
S2195C, S2-01119C, G2-24762C are reflected in Maximum values for permit # S2-29856P										
2. 2195C	City of Kelso	13 Apr 1945	Cowlitz River		3.0 CFS	-				
3. S2-01119C	City of Kelso	01 Mar 1982	Cowlitz River		10 CFS	2,380 AF				
4. G2-24762C	City of Kelso	28 Dec 1977	Ranney Well		2,500 GPM (5.57 CFS)	2,800 AF				
5. G2-29813P	City of Kelso	20 Nov 1998	Three Wells	Yes	1,500 GPM (3.34 CFS)	1,128 AF(P) 1,272 AF(S)				
6. G2-29815P	City of Kelso	20 Nov 1998	Three Wells	Yes	2,000 GPM (4.46 CFS)	3,200 AF				
Claims 1.										
TOTAL	**********	*******	*******	**********	21.91 CFS (9,234 GPM)	6,728 AF (2,192 MG)	4,305 GPM	934 MG	4,029 MGD	891 MG

INTERTIE NAME/ IDENTIFIER	NAME OF PURVEYOR PROVIDING WATER	EXISTING LIMITS ON INTERTIE USE		FORECASTED CONSUMPTION THROUGH INTERTIE		FORECASTED 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.							
2.							
3.							
4.							
TOTAL	**********						

PENDING WATER RIGHT APPLICATION (New/Change)	NAME ON APPLICATION	DATE SUBMITTED	ANY PORTION SUPPLEMENTAL? (If yes, explain in footnote)	PENDING WATER RIGHTS	
				Maximum Instantaneous Flow Rate (Qi) Requested	Maximum Annual Volume (Qa) Requested
1.					
2.					
3.					
4.					

Washington State Department of Health
Division of Environmental Health
Office of Drinking Water

EXHIBIT 5A-3
WATER SYSTEM PLAN
WATER RIGHTS SELF ASSESSMENT – 20-YEAR FORECAST

PERMIT CERTIFICATE OR CLAIM #	NAME ON DOCUMENT	PRIORITY DATE (List oldest first)	SOURCE NAME/ NUMBER	ANY PORTION SUPPLEMENTAL? (If yes, explain in footnote)	EXISTING WATER RIGHTS		FORECASTED WATER USE FROM SOURCES (20-year Demand)		FORECASTED WATER RIGHT 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)
Permits/ Certificates 1. S2-29856P	City of Kelso	3 June 1999	Cowlitz River		18.57 CFS (8,334 GPM)	5,600 AF (1,825 MG)	4,861 GPM	1,070 MG	3,473 GPM	755 MG
S2195C, S2-01119C, G2-24762C are reflected in Maximum values for permit # S2-29856P										
2. 2195C	City of Kelso	13 Apr 1945	Cowlitz River		3.0 CFS	-				
3. S2-01119C	City of Kelso	01 Mar 1982	Cowlitz River		10 CFS	2,380 AF				
4. G2-24762C	City of Kelso	28 Dec 1977	Ranney Well		2,500 GPM (5.57 CFS)	2,800 AF				
5. G2-29813P	City of Kelso	20 Nov 1998	Three Wells	Yes	1,500 GPM (3.34 CFS)	1,128 AF(P) 1,272 AF(S)				
6. G2-29815P	City of Kelso	20 Nov 1998	Three Wells	Yes	2,000 GPM (4.46 CFS)	3,200 AF				
Claims 1.										
TOTAL	**********	*******	*******	**********	21.91 CFS (9,234 GPM)	6,728 AF (2,192 MG)	4,861 GPM	1,070 MG	3,473 GPM	755 MG

INTERTIE NAME/ IDENTIFIER	NAME OF PURVEYOR PROVIDING WATER	EXISTING LIMITS ON INTERTIE USE		FORECASTED CONSUMPTION THROUGH INTERTIE		FORECASTED 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.							
2.							
3.							
TOTAL	**********						

PENDING WATER RIGHT APPLICATION (New/Change)	NAME ON APPLICATION	DATE SUBMITTED	ANY PORTION SUPPLEMENTAL? (If yes, explain in footnote)	PENDING WATER RIGHTS	
				Maximum Instantaneous Flow Rate (Qi) Requested	Maximum Annual Volume (Qa) Requested
1.					
2.					
3.					

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Section 6: Source Water Protection

6.1 Source Protection

Under WAC 246-290 -135, -688, and 690, Group A water systems are required to develop either a watershed protection program or wellhead protection program. The purpose of this program is to protect and perhaps even improve the source waters for the Kelso urban area. Protection is accomplished by identifying, monitoring, limiting, and controlling, to the extent possible, facilities and activities within the watershed or zone of contribution.

The Kelso WTP obtains water via a Ranney collector located adjacent to the Cowlitz River. Due to the collector's proximity to the river, it is considered to be GWI. Therefore, the Kelso water is evaluated as surface water rather than groundwater, and the City must also develop and implement a watershed control program. This section presents the watershed control program for the Kelso urban area, which includes the following elements:

- Watershed Description/Characteristics
- Identification of Activities/Land Uses Detrimental to Water Quality
- Monitoring Program
- Watershed Management and Control Measures and System Operations
- Recommendations.

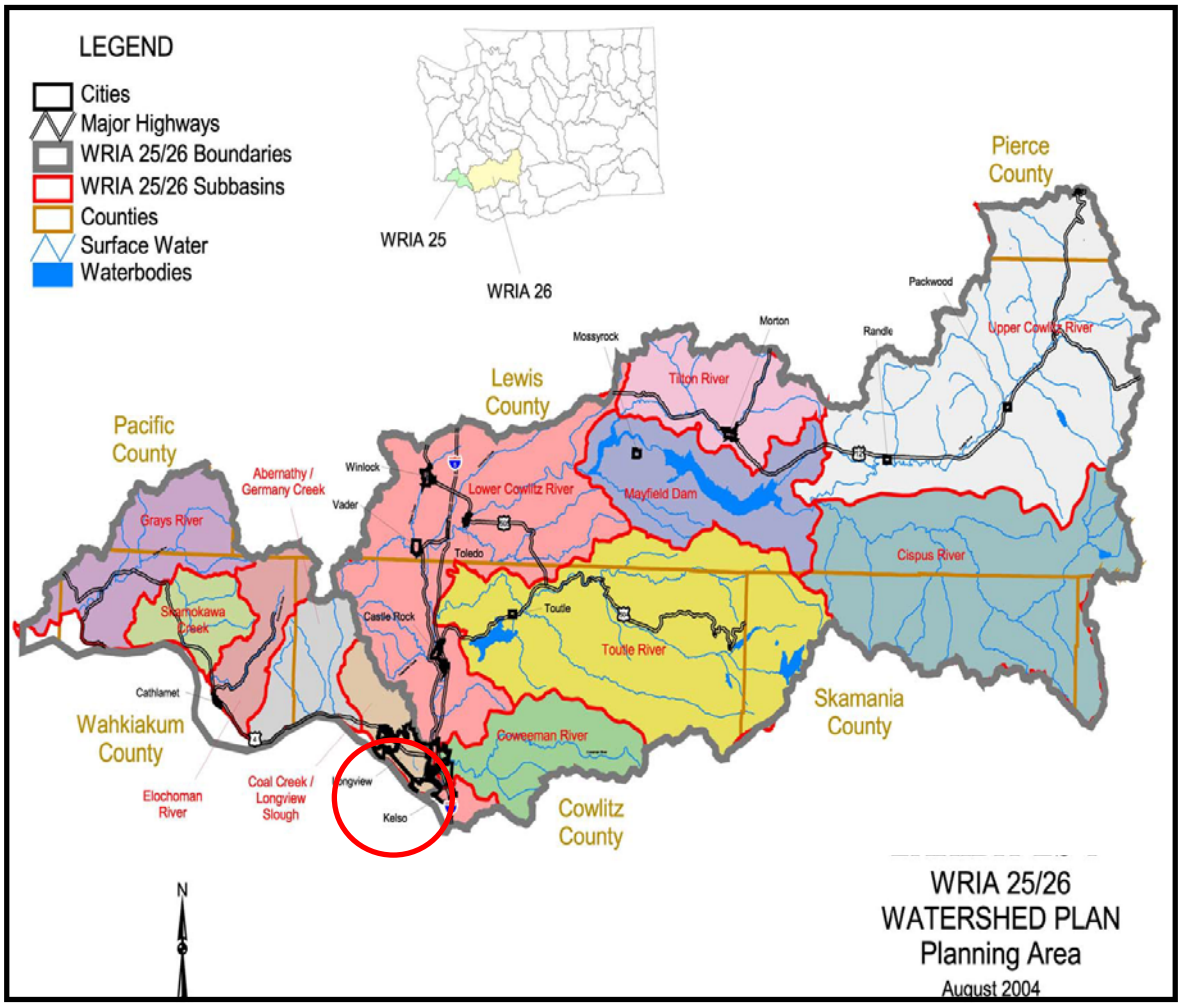
The watershed control program must also incorporate the applicable Watershed Resource Inventory Area (WRIA) management policies and recommendations as they pertain to the Kelso urban area. The WRIA covers access to water supplies, stream flow protection in developing areas, flow monitoring, and restrictions on new water rights. WRIA requirements for the Kelso urban area will be discussed in this section.

This section also includes information from the Needs Assessment Report for the Lower Columbia Basin Water Quality Management Area (Needs Assessment Report), which was prepared as part of the Ecology Watershed Approach Study. The Needs Assessment Report summarizes known problems, identifies problems that need further study, and sets priorities for further action for the Water Quality Management Area (WQMA).

6.1.1 Watershed Description/Characteristics

The Kelso urban area straddles two WRIAs: the Grays-Elochoman (WRIA 25) and Cowlitz (WRIA 26), but is primarily influenced by the Cowlitz Basin (WRIA 26). The Watershed Management Plan for these areas was completed in July 2006 (2006 Watershed Plan). The City is one of the stakeholders that participated in the local, regional, state, and federal planning effort. The City's policies are in close alignment with the guidelines and recommendations put forth in the 2006 Watershed Plan. The Kelso area is circled in red on Figure 6-1.

Figure 6-1: Washington State WRIA – Major Public Lands of Washington



Source: WRIAs 25 and 26 Watershed Management Plan (2006)

WRIA 26, the Cowlitz River Basin, consists of two Hydrologic Units #17080004 and #170080005 as defined by the U.S. Geological Survey. The Cowlitz River Basin extends from the crest of the Cascades to the Columbia River. The basin includes portions of Cowlitz, Lewis, and Skamania counties. The Cowlitz Sub-basin drains an area of approximately 2,480 square miles. Precipitation ranges from an annual mean of 40 inches at the mouth of the Cowlitz River to 130 inches along the Coast Range and Cascade crest.

WRIA 25, the Grays-Elochoman basin, is Hydrologic Unit #17080003 as defined by the U.S. Geological Survey. The Grays-Elochoman Basin is located west of WRIA 26 and encompasses parts of Cowlitz, Lewis and Pacific counties and most of Wahkiakum County. The Grays-Elochoman Subbasin drains an area of approximately 460 square miles.

The Cowlitz Watershed is part of the Lower Columbia WQMA as designated by Ecology, which also includes Willapa (WRIA 24) and Grays-Elochoman (WRIA 25/26).

The Kelso urban area is situated downstream of the Mayfield Dam, which is operated by Tacoma Power as part of the Cowlitz River Project. Mayfield Dam creates controlled flow conditions downstream of the dam. Ecology maintains a water quality monitoring station in Kelso at the Allen Street Bridge (#26B070). The Kelso WTP intake, condition, and protection provided are discussed in Section 4: System Analysis.

A large portion of the Upper Cowlitz River Basin is publicly-owned land. Forestry is the dominant land use in the Upper Cowlitz Basin, with more than 70 percent of the land managed as public and private commercial forestland. The Upper Cowlitz also has a substantial amount of land in non-commercial forest and reserved forest, owing primarily to the large public land holdings (Gifford Pinchot National Forest and Mt. Rainier National Park) in the basin. Much of the private land in the river valleys is agricultural and residential, with substantial impacts to riparian and floodplain areas in places.

6.1.2 WRIA Watershed Management Policies and Recommendations

The July 2006 WRIA 25 and 26 Watershed Management Plan discusses management of water supplies, stream flows, and habitat. Management methods include restrictions on issuing new water rights, seasonal low flow restrictions, conservation, and reuse. A primary purpose of the WRIA is to ensure adequate in-stream flows to maintain aquatic habitat. One management approach is to limit surface water sources through either stream closures or low flow conditions on new water rights. An exception to the water right restriction relates to tidally influenced reaches, whose water levels are controlled by the Columbia River at times during the day. The WRIA Planning Unit states that stream closures and low flow conditions shall not apply to tidally influenced stream reaches in WRIA 25 and 26. The Kelso urban area will be affected as described in the following paragraph.

The Kelso urban area is situated near the mouth of the Cowlitz River, draining into the Columbia River. It has been determined that this area is tidally influenced. Because the Kelso urban area is in a tidally influenced area, it will not be affected by stream closures or flow limitations. However, the urban area is also a part of the Lower Columbia Fish Recovery Board (LCFRB) zone. The LCFRB is leading a collaborative effort to restore sub-basin habitat conditions for threatened salmonid populations in conjunction with the WRIA 25/26 Watershed Plan. It is up to each water purveyor to identify staff who will be responsible for reporting to management and to the WRIA Planning Unit. The City has named representatives for the Planning Unit. The approximate land use area in the Cowlitz River watershed is summarized in Table 6-1.

Table 6-1: Land Use in the WRIA 25 and 26 Watershed

Land Use	Land Use (percent of area)	
	WRIA 25	WRIA 26
Forested Land	77	67
Non-Forested/Logged	11	26
Agriculture	8	5
Urban Development	2	0.5
Surface Water	2	1.5

Source: WRIA 25 and 26 Watershed Management Plan (2006).

6.1.3 Identification of Activities/Land Uses Detrimental to Water Quality

Activities and facilities upstream of the Kelso urban area that are potentially detrimental to water quality in the Cowlitz River include the following:

- **Wastewater treatment plant discharges:** Potential for contamination as a result of treatment plant failures.
- **Interstate 5 and Railroads Crossings** (Weyerhaeuser, Union Pacific, and BNSF Railway Company): Potential for contamination as the result of an accident.
- **Agricultural land uses** and associated soil erosion and chemical usage.
- **Conversion of forested lands to developed lands** and the accompanying stormwater runoff from construction sites and impervious surfaces.
- **Upstream dairy farms**, most of which are situated near rivers and streams, present the possibility of bacteriological contamination.
- **1980 Mt. St. Helens eruption:** Increased suspended solids and turbidity.
- **Forest fires, floods, landslides, and mining operations:** Potential for increased suspended solids and turbidity.

A partial list of direct discharges into the watershed, located upstream of the Kelso urban area, is shown in Table 6-2. Those listed are the primary discharges of concern. A complete list of discharges can be found in Ecology's online database of permitted discharges.

Table 6-2: Discharges to Cowlitz Watershed Upstream of Kelso Urban Area

Sewerage Systems	Mining - Sand and Gravel
City of Mossyrock	Various locations, Castle Rock, and Kelso
City of Vader	
City of Winlock	**Power Generation**
City of Morton	Mayfield Dam Tacoma Public Utilities
City of Castle Rock	Mossyrock Dam Tacoma Public Utilities
City of Toledo	
Cowlitz Co. - Woodbrook Lagoon, Kelso	**Hatcheries**
Cowlitz County - Toutle STP	Cowlitz Salmon Hatchery
Cowlitz County - Ryder STP	Cowlitz Trout Hatchery

Source: EPA 2011.

Based on raw water quality data for the Cowlitz River, the following observations have been made regarding the impact of activities and facilities on raw water quality:

- Storms and Flooding: Storms and flooding have a significant impact on raw water turbidity and color in the Cowlitz River. The Cowlitz River watershed is fed by glacial melt from Mt. Rainier, Mt. St. Helens, and tributaries such as the Toutle River. Since the 1980 eruption, suspended solids concentrations and turbidity have occasionally been extremely high in the Cowlitz River because of silt remaining from the eruption. Because the Toutle River is fed directly from Mt. St. Helens runoff, the Cowlitz River can become very turbid during high runoff periods. These high periodic concentrations have been declining over time (Ecology 1997).

- Mt. St. Helens began erupting again in 2004. These eruptions caused short-term turbidity spikes and required operation changes to account for the low alkalinity levels. However, water service was not interrupted, and the Kelso WTP provided water to customers as usual.

- Farming or Dairy Farms: Reported findings from two ambient monitoring stations (near Kelso and Toledo) on the Cowlitz River indicate that farming and dairy farms have a potential influence on the watershed. The monitoring indicated potential problems with total phosphorus, suspended sediment, turbidity, fecal coliform, and temperature, with higher levels for total phosphorus, suspended sediment, turbidity, and fecal coliform at the Kelso monitoring station. Median fecal coliform was approximately 20 coliform-forming units per 100 milliliters (cfu/100 ml) at Kelso, with a few observations of 100 cfu/100 ml. Ecology's Water Quality Impacts from Dairies in Washington State: a Literature Review cites the Cowlitz River as a water body that experiences one of the most direct water quality impacts from dairy farms (February 2003).

6.1.4 Monitoring Program

Cowlitz River water quality in the Kelso urban area is monitored from a station located in Kelso at the Allen Street Bridge #26B070. According to Ecology's 2011 water year assessment, water quality at the Kelso monitoring station is of moderate concern, receiving an overall Water Quality Index Rating of 77 out of 100 (40 to 79 is moderate quality; 80 and above is considered good). Table 6-3, obtained from Ecology's water quality monitoring website (December 2011), shows water quality trends since 1992. Influent water quality for the Kelso WTP is monitored in accordance with the SWTR. The monitoring program is described in Section 3: Water Quality.

Table 6-3: Cowlitz River at Kelso – Water Quality Trends

	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
fecal coliform bacteria	78	88	94	89	77	75	76	88	44	85
oxygen	93	93	89	95	91	92	93	93	91	93
pH	86	80	88	90	94	96	92	94	99	95
suspended solids	48	82	72	43	40	44	20	46	71	34
temperature	89	90	85	84	82	83	91	91	81	86
total persulf nitrogen	n/a	90	96	86	88	92	82	93	93	90
total phosphorus	73	83	74	52	48	58	26	56	76	32
turbidity	67	81	71	30	51	35	29	60	83	57
overall WQI	**65**	**90**	**88**	**63**	**63**	**67**	**53**	**72**	**61**	**68**
adjusted for flow	**47**	**73**	**74**	**75**	**72**	**72**	**67**	**81**	**48**	**75**

	2002	2003	2004	2005	2006	2007	2008	2009	2010
fecal coliform bacteria	85	89	85	86	93	82	90	93	80
oxygen	93	93	93	92	93	94	95	92	93
pH	95	97	89	95	97	92	98	96	97
suspended solids	34	51	37	29	60	24	32	51	53
temperature	86	81	82	84	84	81	86	74	87
total persulf nitrogen	90	97	93	85	92	93	96	93	95
total phosphorus	32	58	45	32	75	38	33	50	67
turbidity	57	68	57	49	75	39	41	61	69
overall WQI	**68**	**79**	**69**	**64**	**84**	**65**	**70**	**75**	**77**
adjusted for flow	**75**	**75**	**72**	**70**	**75**	**70**	**73**	**75**	**74**

KEY

blue - good beige - moderate red - poor n/a - not sampled or not calculated

higher scores -> better water quality, maximum possible score: 100

Source: Washington State Department of Ecology Website 2011.

6.1.4.1 Army Corps of Engineers (Corps) Monitoring

The Corps is responsible for flood control management along the Cowlitz and Toutle Rivers. Both rivers were impacted by the 1980 Mt. St. Helens eruption. Part of the flood management effort requires the Corps to monitor the average bed elevations in the Cowlitz River. A 2002 report published by the Corps (*Mount St. Helens Engineering Reanalysis Hydrologic, Hydraulic, and Sedimentation Analysis*, West Consultants, Inc. April 2002) suggests that sediment deposits are increasing more rapidly in the Cowlitz River than previously estimated. Bed depths are expected to increase, on average, by 7 to 10 feet over the next 35 years. An increase in the Cowlitz River bed depth would negatively impact the Kelso Ranney collector by increasing the vulnerability to flooding.

The Corps maintains a Sediment Retention Structure (SRS) on the North Fork Toutle River as part of their flood management program. The Corps continues to monitor the situation and implement measures to mitigate silt loading on the Toutle River and thus, Cowlitz River sediment loading. On 11 May 2012, the Corps released a Draft Environmental Impact Assessment for raising the SRS spillway in order to maintain required flood risk reduction for communities along the lower Cowlitz River. The Water Resources Act of 2000 authorizes the Corps to maintain flood damage reduction benefits through 2035. This work is being completed under the 1986 Local Cooperation Agreement between the Corps and the Cowlitz County Diking District. To stay abreast of current events pertaining to Corps activities, the City is indirectly involved with the Corps through their interaction with the local diking districts for north and south Kelso. The City also stays current with applicable Public Notices issued by the Corps.

6.1.5 Watershed Management, Control Measures, and System Operations

Because others own the watershed, the purveyors themselves have limited control. Measures initiated by the purveyors for system operations include:

- Call-Down Lists for Emergencies: Kelso is on the call down list for facilities located upstream of the Ranney Collector.
- Emergency Supply: Kelso has an intertie with Longview that could be used during an emergency.
- Treatment Plant Operation: Kelso responds to increased turbidity and color from flooding by adjusting treatment plant operations.
- Flood Plan: The City's Emergency Response Plan (December 2004) addresses procedures during a flood emergency. The City also utilizes the flood plan developed by the Cowlitz County Department of Emergency Management. The plans include early warning and notification systems, management and supervisory rosters, general policies and procedures, specific plans for each warning level, and specific procedures for various city departments. The plan is reviewed regularly.

6.1.6 Recommendations

Because the City does not own the watershed, their ability to control it is limited. It is recommended that the City:

- Continue current practices of monitoring, control measures, and system operations.
- Review corridor emergency action plans for Union Pacific, BNSF Railway Company, Washington State Department of Transportation, U.S. Geographical Survey, Federal Emergency Management Agency, and upstream dischargers to verify that the purveyors are on their contact lists.
- Review and update the City's Emergency Plans as necessary.
- Keep apprised of current watershed planning and management activities through Ecology's website and by remaining involved with watershed planning and management committees.
- Remain an active participant in the Corps' proposed flood management strategies for the Cowlitz River.

Section 7: Operation and Maintenance Program

7.1 Introduction

This section summarizes the City's operation and maintenance programs. The major elements of each program include:

- Organization
- System Operation and Control
- Cross Connection Control
- Sanitary Survey Findings
- Emergency Response
- Safety Procedures
- Customer Concerns Process
- Recordkeeping.

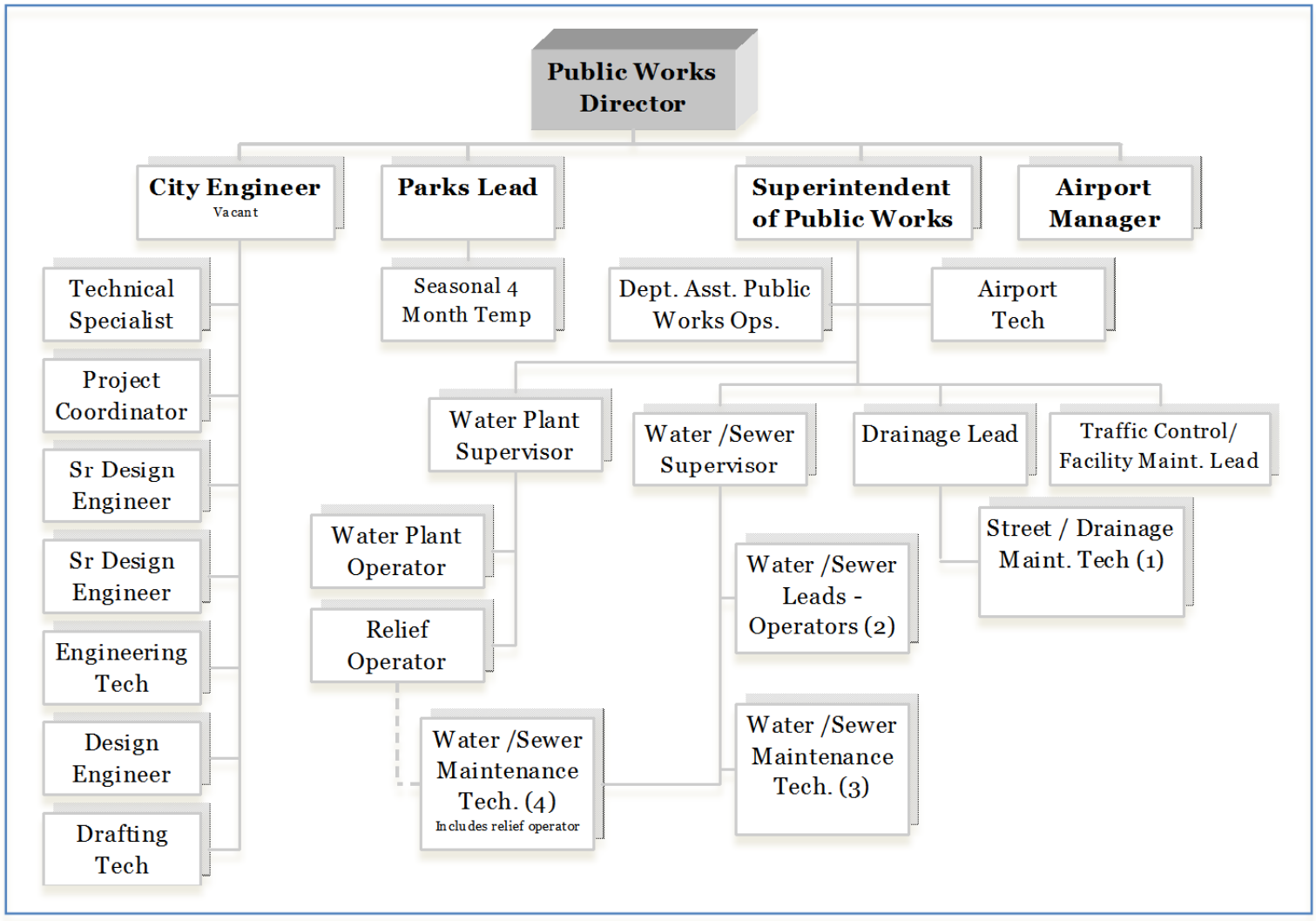
7.2 Organization

7.2.1 Responsibilities

The City Water Department is part of the Public Works Department. Its functions are carried out within the framework of the Water Department. The organizational relationship between the Water Department and Public Works Department is shown on Figure 7-1.

The primary responsibilities of the Water Department are to supply, treat, distribute, and store of the public drinking and firefighting water supply. The Water Department is responsible for maintaining the City water supply and water treatment systems, water mains, fire hydrants, pumping stations, and reservoirs. Water meter reading, installation, and maintenance are also functions of the Water Department. A private company reads all service meters and reports to the Finance Department. Primary functions of the lead staff positions are summarized in Table 7-1.

Figure 7-1: Kelso Public Works Organizational Structure



7.2.2 Certification

The DOH classifies the City's water distribution system as a Group 2 facility and the WTP as a Group 3 facility. The City's certification level requirements (see Table 7-1) currently meet or exceed the DOH certification level requirements. To maintain professional growth, staff must either advance in certification level or obtain 3.0 continuing education units every 3 years by attending appropriate workshops and seminars. Table 7-1 lists the certification levels of the City's operation and maintenance staff.

Table 7-1: Water System Maintenance and Operation Staff Positions

Position	DOH Required Certification Level	Essential Job Functions
Superintendent of Public Works	WDM 2	Administrative duties Supervises the operation of the WTP and Distribution System And Sewer Collection Supervisors.
WTP Supervisor	WTP 3	Administrative duties. Maintains and operates Ranney collector water supply and treatment plant, including all plant equipment, plant telemetry, and reservoir telemetry. Collects DOH-required water quality samples. Performs tests for chlorine residual, turbidity, and fluoride levels.
Water Distribution and Sewer Collection Supervisor	WDM 2	Supervises the installation and maintenance of all metered services, water mains, pumps and pumping stations, reservoirs, hydrants, and valves. Supervises the purchase and inventory of equipment and material. Supervises water locates. Investigates, diagnoses, and responds to customer comments.

7.3 System Operation and Control

7.3.1 System Components

The City's existing pump stations, storage facilities, piping materials, and pressure-reducing stations are described in Section 1. Details of the Kelso WTP system and components are documented in the Kelso WTP and Water System Operations Program, which is maintained at the City's Engineering Department. The document is amended as necessary to show changes made to the water system.

The water supply and water treatment operations operate automatically. A telemetry system located at the water treatment plant monitors reservoir levels and the level in the finished water clearwell; approximately 90 percent of the City's reservoirs are currently monitored via SCADA. It is anticipated that all the City's reservoir levels will be monitored via SCADA by the end of 2013.

- **Treatment System:** The Ranney collector and treatment system currently operate 24 hours per day. Plant operation capacity is demand dependent; therefore, plant flow varies as necessary to maintain desired reservoir levels. The plant shuts down automatically if the treatment plant operates outside set water quality parameters or if the reservoir level reaches the high level sensor. The plant operators initiate plant start-up manually.

- **Distribution System:** Two of the three high-lift distribution pumps pump the finished water from the clearwell to the distribution system. The high-lift distribution pumps are activated with the level of the clearwell. A differential pressure switch at each reservoir controls the booster pump stations. Control for each pump station is summarized in Section 1.

- **Alarm Indicators:** Remote alarm indicators, connected to the City's water alarm system via an auto phone dialer system, allow continuous monitoring and early detection of problems in the water supply system. The master alarm indicator panels are located at the City's WTP, where they receive information from ten of the City's 12 water reservoirs, seven booster pump stations, and all major WTP equipment. Alarms include pump failure, reservoir high or low water, power failure, line failure, turbidity level, and low well water.

7.3.2 Routine System Operation

Operators manage the water treatment plant 7 days per week. Daily duties include:

- Inspect water supply and treatment plant for obvious leaks, broken parts, or other abnormality.

- Check for messages from previous day's operators.

- Examine charts showing reservoir levels and high head pumping frequency.

- Check filter differential pressure (indicating degree of filter capacity).

- Check the chlorine and fluoride scales for chemical usage.

- Verify operation of filters.

- Conduct plant testing and perform laboratory work.

- Reservoirs are inspected twice per week.

- Booster pump stations are inspected twice a week, provided that reservoir level indicators are positive during the period.

7.3.3 Emergency Repairs

Situations may occur that would be considered routine emergency's such as a line break or a power outage. The City's Emergency Response Plan addresses these routine emergencies as

well as more serious emergencies. In the event of a line break and pressure loss event, the City would respond as follows:

- Identify the cause of the problem, isolate mains and bypass where possible.
- Notify customers affected by the outage, issue health advisory if necessary.
- Close outlets to reservoirs if main rupture could lead to water loss from the reservoirs.
- Initiate immediate repairs.
- Disinfect impacted and repair area in accordance with Office of Drinking Water (ODW) requirements. Collect investigate coliform samples as appropriate.
- Flush all mains and associated services in vicinity of repair and restore service.

For instances where the area may be impacted for longer than 24 hours, a significant pressure loss occurs, or the risk of contamination is present, the City will notify the ODW.

7.3.4 Water Quality Program

The water quality requirements are discussed in detail in Section 3. The WTP Supervisor is responsible for ensuring that all required water quality monitoring is conducted at the WTP and within the distribution system. Source monitoring requirements are identified in the DOH annual Water Quality Monitoring. Water treatment monitoring is performed in accordance with the SWTR. Specific monitoring plans have been developed for the following distribution system related monitoring, current copies of these plans are included in teh appendices:

- Coliform Monitoring
- Lead and Copper
- Disinfection By-Products.

Chlorine residuals are collected from throughout the distribution system when coliform samples are collected. The City currently monitors asbestos as their distribution system contains more than 10 percent AC pipe. The City is actively working to replace the remaining asbestos pipe in their system.

7.3.5 Equipment, Supplies, and Chemical Inventory

Water Distribution System: The Water Distribution Supervisor maintains an adequate and appropriate inventory of construction and maintenance/repair supplies. A partial list of materials follows.

- Water main, ductile iron, 4-, 6-, 8-, 10-, 12-, 16-inch
- Pipe fillings and couplings, 4-, 6-, 8-, 10-, 12-, 16-inch
- Tapping tees, 4-, 6-, 8-, 10-, 12-, 16-inch

- Repair clamps, all sizes
- Service pipe, copper, 3/4-, 1-, 1-1/2-, 2-inch
- Service meters, 3/4-, 1-, 1-1/2-, 2-inch
- Miscellaneous fittings and valves
- Spare parts
- Fire hydrants and valves
- Tapping tool
- Van with welder, parts bins, and power take-off.

7.3.6 Water Supply and WTP

The Senior WTP Operator maintains the inventory for the spare parts and water treatment process/chemicals. The chemicals are bid annually and delivered on request throughout the year. A list of chemicals and representative spare parts follows.

- Aluminum sulfate, 4,200-gallon loads (ordered as needed)
- Sodium fluoride, 50-pound sacks (ordered as needed)
- Sodium hypochlorite, 4,800-gallon loads
- Sodium hydroxide, 4,800-gallon loads
- Pump seals
- Filter media
- Oil and grease
- Strip charts
- Laboratory supplies
- See Table 7-2: Summary of Distribution Preventive Maintenance for a list of maintenance supplies.

7.3.7 Preventive Maintenance Program

The preventive maintenance schedules are summarized in Tables 7-2 and 7-3. Routine maintenance of the water supply, treatment, and distribution system includes cleaning, lubricating, adjusting, repairing, painting the equipment, and keeping adequate maintenance

records. All equipment is inspected regularly to detect conditions that may indicate future mechanical problems. The interval between inspections varies depending on the type of equipment and the frequency of service.

Table 7-2: Summary of Distribution Preventive Maintenance

System Component	Maintenance	Frequency
Pumps	Lubricate, inspect mechanical seals	Regularly
	Measure total suction and discharge heads	Annually
	Monitor temperature	Monthly
	Inspect pump bearings	Quarterly
Water Mains	Flush	Recommended Annually
Valve	Exercise	Annually
Meters	Test 4-inch or larger meters	Every 5 years
Reservoirs	Clean and Inspect	Every 5 years
Telemetry	Winterize	Annually

Table 7-3: Summary of Supply and WTP Preventive Maintenance

System Component	Maintenance	Frequency
Electric Motors	Lubricate; inspect motors;	Regularly
	Inspect grease quantity, oil level in oil-lubricated bearings	As required
	Check for excessive vibration and repair as necessary	Regularly
	Measure motor amp readings	Semi-annually
	Run thermal imaging scan	As required (every 4 to 5 years)
Valves	Exercise	Annual
Starters	Inspect	As required
Ranney Collector	Chlorinate and backflush laterals	Monthly
	Well draw-down test	Three times per year
Filters	Inspect	Two times per year, or more as required

7.4 Cross-Connection Control Program

The City implements its Cross-Connection Control Program in accordance with DOH regulations as specified in WAC 246-290-490 and submits its Annual Summary Report to DOH. A copy of the City's 2012 Annual Summary Report is included in the appendices.

7.4.1 Authority

The City's Cross-Connection Control Program is authorized by the Kelso Municipal Code, Chapter 13.04.060. A copy of this Municipal Code is located in the appendices.

7.4.2 Responsibility

The Director of Public Works is responsible for enforcing the Kelso Municipal Code, Chapter 13: Water Systems and compliance with WAC 246-290-490. Compliance and enforcement shall include the following elements:

- Survey and determine any potential cross-connections.
- Monitor and inspect all approved backflow prevention assemblies in service.
- Test all approved backflow prevention assemblies in service.
- Maintain cross-connection control device records, including a separate record of each device.
- Discontinuing service to any premises affected by the cross-connection until the problem is eliminated or controlled.

7.4.3 Procedures

The current cross connection control procedures for Kelso include:

- Cross-connections are identified by a currently certified cross control specialist who is employed by the City or under contract with the City.
- If the cross-connection cannot be eliminated, a backflow prevention device must be installed. All backflow prevention devices must be inspected and approved by the Department of Public Works.
- All backflow prevention devices will be tested in accordance with WAC 2464-290-490.
- Installation, inspection, and testing of all backflow prevention devices are conducted according to the City's Standard Operating Procedure Manual.
- A detailed report is maintained for each approved backflow prevention assemblies in service that describes its use, installation, and testing history.

7.5 Emergency Response Program

The City has a Water System Emergency Response Plan developed in 2004 in response to EPA and Department of Home Land Security requirements. Copies of the plan are kept at City Hall and at the WTP. It is recommended that the City review the existing plan to verify the information is current.

7.5.1 Call-Up List

The Call-Up List, in the appropriate call order, for the City in case of an emergency is shown in Table 7-4. Every employee has a copy of the City's emergency call-up list. Additional communication numbers and information can be found in the City's Water System Emergency Response Plan (2004).

Table 7-4: Emergency Call-Up List

Position	City Key Personnel
Public Works Superintendent	Randy Johnson
Director of Public Works	David Sypher
Water Treatment Plant Supervisor	Paul Reebs
Water Treatment Operator	Lamont Salte
Water Distribution and Sewer Collection Supervisor	Devin Mackin
Water Distribution Lead	Chad Smith
Water Distribution Lead	Ed Pardue

7.5.2 Vulnerability Analysis

- **Distribution System:** As described in Section 1, the City's system comprises a mixture of very old and relatively new water mains. Most (78.5 percent) of the piping in the system is cast and ductile iron. Other materials include galvanized iron, copper, PVC, steel, and AC. The age and various materials require the City to maintain a wide assortment of replacement parts. The City has implemented an aggressive pipeline replacement program.

- **Reservoirs:** The City's reservoirs are located primarily in remote areas. All reservoirs are covered. All reservoirs sites are fenced. Adequate lighting of the compound area and intermittent police patrols help reduce vandalism and/or human entry.

- **Booster Pumping Stations:** Booster pumping stations, both buildings and sites, are subject to occasional vandalism. Adequate design has been sufficient to curtail intrusion.

- **Water Supply and Treatment System:** The Ranney collector and WTP are totally enclosed within a fenced area with locked buildings.

7.5.3 Contingency Plan

- **Emergency Water Supply:** An emergency two-way intertie connects Longview and Kelso. Historically, the water has been wheeled to Beacon Hill or sold primarily by Longview to Kelso. The 8-inch main through a 6-inch meter has an approximate capacity of 1,000 gpm.

7.6 Safety Procedures Program

The City ensures that all WTP and distribution staff have and maintain the appropriate safety training and certifications and have proper safety equipment available. In addition, the City's safety program includes the following:

- Training employees in proper equipment operation before they assume responsibility for its operation and maintenance.
- Instructing all employees in first aid procedures.
- Providing emergency telephone numbers to every employee.
- Performing all routine inspection and maintenance of manufactured equipment in accordance with manufacturer's instructions.
- Obtaining the advice of a qualified person when there is doubt regarding proper operation or maintenance procedures and the appropriate safety precautions that need to be observed.
- Assuring that maintenance personnel lock out electrical equipment before maintaining it.

7.7 Customer Concern Process

As noted in Section 1, the City refers to customer complaints as "Customer Concerns." When a concerned customer contacts the Public Works Department, a Citizen Concern Form is completed at the time of the call. The City then has 10 days to correct the concern if within the City's responsibilities and notify the concerned customer as to the resolution.

All Citizen Concern Forms are forwarded daily to the Public Works Department Assistant for central filing. When the concern is settled, an updated final copy of the form is added to the files. All Citizen Concern Forms are kept on file for a minimum of 3 years. An example of the Citizen Concern Form is included in the appendices.

7.8 Recordkeeping

Records and reports maintained by the City are summarized in Table 7-5.

Table 7-5: Kelso – Recordkeeping Procedures

Record	Comments	Minimum Years Maintained
WTP Report	Submitted monthly to DOH Maintained at WTP	3
SWTR Disinfection Report	Submitted monthly to DOH Maintained at DOH	Life of facility
Water Supply and High Head Pump Pumping Hours	Maintained at WTP	3
Quantity of Chemicals Used	Maintained at WTP	3
Fluoridation Report	Submitted monthly to DOH Maintained at WTP	3
Reservoir levels, pumping and plant flow telemetry strip charts	Maintained at WTP	3
Water Facilities Inventory Report	Submitted annually to DOH Maintained at WTP	3
Disinfection Byproducts Monitoring Report	Submitted Monthly to DOH Maintained at WTP	10
Supplemental Reporting – Individual Filter Turbidity for Conventional, Direct or In-Line Filters	Submitted Monthly to DOH Maintained at WTP	5
Customer Concerns	Maintained at Public Works (City Hall)	3
Cross Connection Control Annual Summary Report	Submitted Annually to DOH Maintained at WTP	3
Consumer Confidence Report	Submitted Annually to DOH Maintained at WTP	3
Annual Water Use Efficiency Report	Submitted Annually to DOH Maintained at WTP	3
Sanitary Survey	Maintained at WTP	10

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Section 8: Design and Construction Standards

8.1 Introduction

This section of the WSP contains information pertaining to the design and construction standards for the City. It is intended to assist the City and design engineers in preparing detailed construction plans and specifications. The following elements will be discussed: design and construction standards, policies and requirements for outside parties, project review procedures, and construction inspection procedures.

8.2 Design Standards

Design standards identify the performance standards and sizing criteria to be used in designing each water system improvement. Standards for treatment facilities, fire flow demands, storage requirements, pipeline size, and water quality will be discussed. Design guidelines for many different system components can be found in the Washington State DOH's *Water System Design Manual* (2009).

8.2.1 Treatment Facilities

The capacity of the Kelso WTP was assessed based on projected ADD and MDD in Section 4: System Analysis. The demand projection methodology is presented in Section 2: Basic Planning Data. Treatment facilities are typically designed to meet MDD demands for the water system on a reliable capacity basis (i.e., one treatment train out of service).

8.2.2 Pump Station Facilities

The capacity of the City's pump stations are described in Section 4: System Analysis. Pump stations are typically sized to meet MDD for their pressure zone on a reliable capacity basis (i.e., largest pump out of service).

8.2.3 Fire Flow Demands

Design fire flow demands were used in the hydraulic analysis of the distribution systems and to determine fire storage requirements. Fire flow demand is discussed in more detail in Section 2: Basic Planning Data.

8.2.4 Storage Requirements

The City is classified as a Group A Public Water System. According to the *Water System Design Manual* (December 2009), Group A reservoirs must be designed to provide stability, durability, and protection of water quality while being compatible with existing and future facilities. Five storage components - Operational, Equalizing, Standby, Fire Suppression, and Dead Storage - must be considered in each reservoir design and in the analysis of existing storage facilities. Each component is discussed in detail in Section 4: System Analysis. The City has decided to combine or "nest" standby and fire flow storage requirements.

8.2.5 Pipeline Size

Hydraulic evaluation criteria are based on maintaining system pressure and velocity as defined in the DOH WAC 246-290-230 and in *Group A Public Water Systems Waterworks Standards*. The following criteria are recommended when new distribution mains are constructed or old mains replaced:

- Maintain a minimum pressure of 30 psi at any point in the distribution system during PHD conditions.
- Maintain a minimum pressure of 20 psi at any point in the distribution system during fire flows under MDD conditions.
- Limit pipe velocities to 8 fps.
- Limit main pressures in the distribution system to 100 psi.
- Use a hydraulic pipe model to verify system conditions and pipe size requirements.

The distribution system was evaluated for both existing and forecasted future (2032) conditions. Existed and forecasted demands are discussed in more detail in Section 2: Basic Planning Data.

8.2.6 Water Quality Standards

Treated water quality from the City's Ranney collector must conform to the Federal SDWA as amended and the DOH criteria as specified in the Drinking Water Regulations (Chapter 246-290 WAC current edition). Part 4 of these regulations identifies water quality requirements that must be met. These regulations define monitoring requirements, maximum primary and secondary contaminant levels, follow-up action, and conditions that require public notification. Water quality requirements are presented in detail in Section 3: Water Quality.

8.3 Construction Standards

The City maintains design and construction standards in the Kelso Engineering and Design Manual (KEDM). The Standards contained in the KEDM apply to the design and construction of all new and upgraded facilities. Per Chapter 6 of the KEDM, all water system work and materials shall comply with the latest edition of City specifications, and the latest edition of Washington State Department of Transportation American Public Works Association (APWA) Specifications for Road, Bridge and Municipal construction and the Washington State Division of Administrative Rule Chapter 333, in that order. Chapter 6 of the KEDM contains standard drawings for water utility. Copies of the KEDM Chapter 5 Water System and Chapter 6 Water Standards are included in the appendices. The KEDM is also located online at the City's website: http://www.kelso.gov/sites/default/files/docs/kedm.pdf

8.4 Policies and Requirements for Outside Parties

Policies and requirements for outside parties are contained within the body of the City's Municipal Code Chapter 13.04.

8.5 DOH Project Report and Construction Document Submittal Exceptions

8.5.1 Applicable State Regulations

WAC 246-290-125 provides an exception to the requirement that public water systems submit certain project reports and construction documents to DOH for review and approval. DOH allows exceptions through a three-tiered policy defined in the following regulatory subsections.

- WAC 246-290-125(1) provides an exception to all utilities for the submittal and approval of valves, meters, fittings, backflow assemblies and hydrants, and maintenance of painted surfaces not contacting potable water.

- WAC 246-290-125(2) provides an exception to utilities for the submittal of new distribution main provided the utility has an approved water system plan that includes standard specifications for distribution mains. It also requires the utility to maintain on file a construction completion report.

- WAC 246-290-125(3) provides an exception to purveyors for the submittal of major projects such as transmission mains, storage tanks, and booster pump stations provided that:
  - A current department-approved water system plan is on file.
  - A professional engineer licensed in the State of Washington reviews the project. The review engineer and design engineer must not be the same individual.
  - The project is identified in the capital improvement section of the WSP.
  - The project is in accordance with the other applicable portions of WAC 246-290-125(3), Sections e, f, g, and h.

While a complete project report is not required for exceptions, all water purveyors must submit a Project Approval Application to DOH for review and approval prior to construction of the project, per WAC 246-290-120. Source-of-supply projects, interties, and water quality treatment-related projects are not eligible for submittal exception procedures. The utility intends to submit major projects to DOH for review and approval. The City complies with options 1 and 2 of the WAC for project reporting.

8.5.2 Projects Identified for Exceptions

The utility maintains sufficient resources, both in-house and with the use of private consultants, to meet the project submittal exceptions for all project groups defined in Section 8.5.1.

8.6 Construction Inspection Procedures

A Construction Report for Public Water System Projects, per WAC 246-290-040 is required upon completion of all water system improvement projects. The form must be completed by the purveyor and submitted to DOH upon project completion.

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Section 9: Capital Improvement Program

9.1 Introduction

This section summarizes the recommended 20-year capital improvements and their respective costs as developed throughout the previous sections. Organized by category, the section describes improvements for prioritized improvements for water supply and treatment, transmission and distribution system, booster pump stations, storage facilities, and planning, controls and general system improvements (system control, data acquisition, emergency response). Recommended projects are developed based on the analyses presented in Sections 2 and 4. A summary table indicating project type, number, description, and benefit is included for each category.

The project recommendations presented in this section are intended to assist the City in identifying and prioritizing necessary water system improvement projects. Projects not included in the adopted 6-year CIP are identified as long-range projects that may be included in subsequent 6-year CIPs. The capital improvements will be funded primarily through the City's existing reserve and replacement funds, bonding, or through debt financing. Projects were selected and prioritized on the schedule using the following criteria:

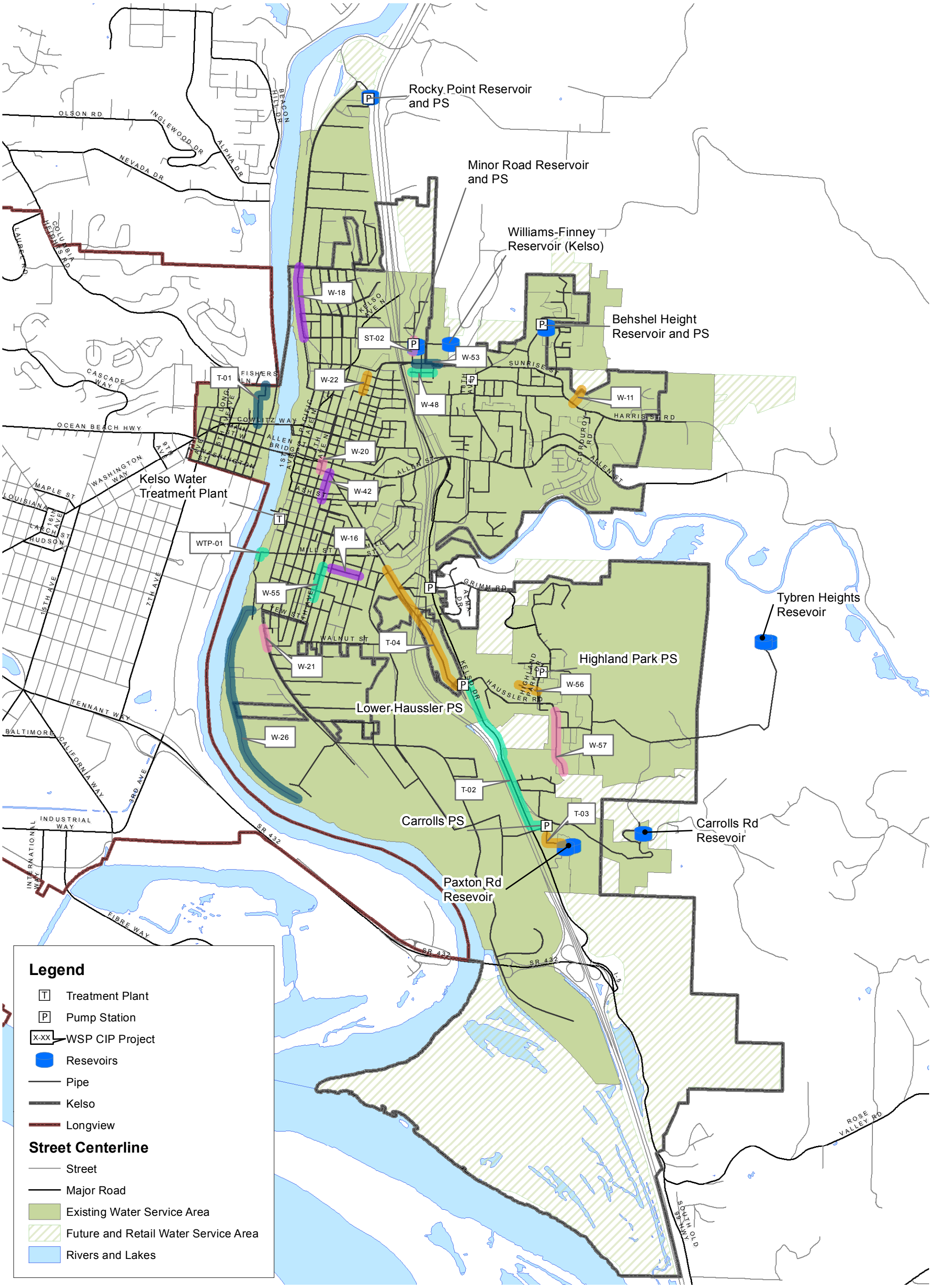
- Compliance with regulatory/health and public safety requirements.
- Transmission, distribution, and storage improvements.
- System reliability/repair.
- Scheduling of project budgets for financing.
- Sources of supply to meet projected growth.

The recommended 6-year capital improvements include source and treatment facility replacement, distribution upgrades, booster pump station improvements, telemetry and controls, pressure control, and miscellaneous activities. Figure 9-1 shows the location of the recommended improvements in the 6-year planning window.

9.1.1 Planning Level Cost Estimates

Planning level cost estimates were developed for the projects identified in the 6- and 20-year window. These estimates include sales tax (7.9 percent), contractor overhead and profit (OH&P) (15 percent), planning level estimate contingency (25 percent), and engineering/design and construction management (25 percent).

The transmission and distribution main planning level cost estimates consist of unit and lump sum prices based upon a recent bid tabulation process for public works projects in western Washington. Cost estimates include furnishing and installation of piping, valves and fittings, gravel, asphalt repair, fire hydrant assemblies, as well as sales tax, construction contingency, engineering and administration. The following assumptions were used to develop the cost estimates:



Legend

- Treatment Plant
- Pump Station
- WSP CIP Project
- Resevoirs
- Pipe
- Kelso
- Longview

Street Centerline

- Street
- Major Road
- Existing Water Service Area
- Future and Retail Water Service Area
- Rivers and Lakes

This map is for information purposes only. Data was compiled from multiple sources. The data sources do not guarantee this data is accurate or complete. There may have been updates to the data since the publication of this map. All locations are approximate.

N

0 0.5 1

Miles

Kennedy/Jenks Consultants

Comprehensive Water System Plan
Kelso, Washington

Capital Improvement Program Project Overview

K/J 1197012*00
March 2013

Figure 9-1

Document Path: Q:\Projects\2011\1197012.00 Kelso WSP Update\GIS\Events\20120207-WaterSystemOverview\Kelso_Figure9-1_v2.mxd

- All pipe is ductile iron, cement-mortar lined, AWWA Class 52.
- Pipe bedding will consist of 6 inches of crushed rock above and below the pipe.
- Ten percent of the pipeline trench length is backfilled with select imported backfill.
- Along arterials, 80 percent of the pipeline trench length is filled with controlled density backfill to a depth of 4 feet.
- Hydrant assemblies are installed every 400 feet.
- Isolation valves are installed every 600 feet.

Where pipeline is in a roadway, asphalt restoration includes an 8-foot-wide patch of asphalt, 3 inches thick, overlying 6 inches of crushed surfacing. Concrete restoration includes a 10.5-foot-wide patch of concrete 8 inches thick, overlying 6 inches of crushed surfacing.

9.2 Water Supply and Treatment

There are several improvement projects identified for the City's WTP and source of supply. Demand forecasting indicates that the City will require additional capacity within the 6-year planning window based on the original filter capacity of 3.6 MGD. As discussed previously in Section 4, the City received a conditional filter rerating of 4.8 MGD in 2012; this increased filter capacity would allow the City to meet its 20-year demand. However, there are other limiting factors that need to be addressed in order for the filters to produce at the higher capacity on a regular basis. The CIP identifies projects to address these limiting factors as discussed in Section 4.

The City's source of supply is of primary limiting factor. The capacity of the aging Ranney collector is no longer sufficient to meet the City's forecasted demands. The condition and vulnerability of the Ranney collector are also of concern. The City has identified an alternative source of supply well location on the bank of the Cowlitz River to either supplement or replace the existing Ranney collector. A CIP has been included for the installation of test well to determine hydrogeologic conditions and water quality at this site; scheduled for completion in 2012. A CIP to evaluate the cost versus benefits of the source of supply alternatives has also been included in the CIP. Table 9-1 summarizes the water treatment and source of supply CIP projects.

Table 9-1: Water Treatment and Source Improvement Projects

Project Number	Planning Window	Importance	Project Description	Project Benefit
WTP-01	6	Growth Reliability	TEST WELL - MILL STREET Install a test well on the City owned property at Mill St. & River Rd. to determine its suitability as an additional water source.	Provide an additional source of supply to allow City to meet future demands.

Project Number	Planning Window	Importance	Project Description	Project Benefit
WTP-02	6	Reliability	CLEAN RANNEY WELL LATERALS - COWLITZ RIVER RAW WATER SUPPLY Clean the Ranney Well laterals with divers to remove build-up of iron bacteria.	Maintain well capacity by removing accumulation of iron bacteria.
WTP-03	6	Reliability Efficiency	BACKWASH RECOVERY EVALUATION. Evaluate reuse and backwash recovery options.	Determine feasibility of adding backwash recovery and reuse to WTP to improve plant efficiency and reduce discharge to sewer. Evaluation should include space requirement/availability at plant and cost benefit analysis evaluation is necessary.
WTP-04	6	Growth Reliability	ALTERNATIVE SOURCE OF SUPPLY EVALUATION. Perform cost benefit analysis to determine the most cost effective, long-term alternative source of supply.	Provide information for decision makers. Determine cost-effective alternative source of supply.
WTP-05	20	Growth Reliability	RANNEY WELL SUPPLY LINE REPAIR - AT DIKE CROSSING Repair the 10-inch supply line from the Ranney well to the water treatment plant at the break under the dike.	Provide redundancy from Ranney Well to water treatment plant.
WTP-06	20	Growth Reliability	RANNEY WELL EMERGENCY GENERATORS - RANNEY WELL Install permanent generators for standby power.	Provide emergency power to Ranney well system in order to maintain water supply to City in event of long-term power outage.
WTP-07	20	Growth Reliability	WATER TREATMENT PLANT EMERGENCY GENERATORS WATER TREATMENT PLANT Install permanent generators for standby power. This project must be completed either in conjunction with or after completion of Ranney Well emergency Power CIP	Provide emergency power to water treatment facility in order to maintain water supply to City in event of long-term power outage.
WTP-08	20	Growth Reliability	INCREASE WATER CAPACITY WATER TREATMENT PLANT Increase the treatment capacity of the water treatment plant by adding an additional filter at the treatment plant.	Provide additional capacity to accommodate and allow for future growth

Project Number	Planning Window	Importance	Project Description	Project Benefit
WTP-09	20	Growth Reliability	DEVELOP ALTERNATIVE SOURCE OF SUPPLY. Project is dependent upon results for Alternative Source of Supply Evaluation (WTP-04). There are three possible alternatives: 1) Develop wellfield on Mill Street property, 2) Develop Ranney Collector Well on Mill Street Property, or 3) Purchase Water from Longview and establish additional intertie.	Provide an additional source of supply to allow City to meet future demands.
WTP-10	20	Growth Reliability	UPGRADE FILTER BOOSTER PUMP MOTORS. Upsize filter booster pump motor to operate within recommended operation parameters during periods of high demand. Project will include evaluation of current power supply to booster pumps and determination of remaining useful booster pump life.	Improved plant reliability. Increases filter booster pump capacity to correspond to filter capacity.

9.3 Transmission and Distribution Mains

The City has numerous transmission and distribution main projects identified on the CIP list. There are 13 transmission and distribution main projects identified; the majority of which are development driven and in the 20-year planning window. The CIP projects identified in the 6-year window are intended to improve system reliability, address critical needs, and replace deteriorated, leaking mains. Several transmission main projects have been identified to provide better connectivity between the storage at Paxton Road and the rest of the distribution system. The majority of the City's main zone storage is located on the eastern side of I-5 with Paxton Road at 2.5 MG and Minor Road at 2.0 MG. With the completion of the Paxton Road reservoirs, model results indicate the distribution system relies heavily on the WTP and Paxton reservoir for supply. There is a single 16-inch AC transmission line crossing the freeway to the Paxton Road site which could be vulnerable and difficult to fix in the event of a failure. Connectivity between the Minor Road and Paxton Road reservoirs should also be improved. It is recommended that a second distribution pipeline be installed along Kelso Drive to provide a more direct connection between the Minor Road and Paxton Road Reservoirs. Better connectivity between the Minor Road and Paxton Road areas will be beneficial when the Minor Road reservoirs are removed from service for replacement.

As part of this planning process, the City has established a pipeline replacement program to address deteriorated, leaking and undersized mains on an annual basis. A pipeline replacement program project (CIP D-01) has been included in this CIP. It is initially funded at $125,000 which will increase incrementally over 6 years until it reaches the target goal of $300,000 annually for pipeline replacement. Table 9-2 summarizes the possible transmission

main improvements and Table 9-3 summarizes the distribution main improvements. A separate list detailing potential pipeline replacement program projects (CIP D-01) is located in Table 9-8.

Table 9-2: Transmission System Improvements

Project Number	Planning Window	Importance	Project Description	Project Benefit	Pipe Size (inch)	Pipe Length (LF)
T-01	6	Reliability Growth	INTERTIE WITH LONGVIEW. Upsize intertie connection with Longview to increase flow capacity. Includes replacing 8" CI with 12" DI from Fisher's Lane to Cowlitz Way	• Increase capacity of intertie, capable of providing ADD in emergency situation. • Improved hydraulic connection between Kelso and Longview. • Replace critical infrastructure • Improved reliability.	12	1,100
T-02	6	Reliability Growth	S. KELSO DR - HAUSSLER PUMP STATION TO CARROLLS RD PUMP STATION Install 4,800 LF of 16-inch diameter pipe on Grade Street from Lower Haussler Pump Station to Carrolls Road Pump Station. Phase I - Improve Storage Transmission. Design package to consist of Schedule A and Schedule B.	• Improve service to Paxton Road Reservoir and industrial future service areas. • Improved hydraulic connection. • Redundant connection across freeway. • Provide distribution system loop. • Improved reliability.	16	4,800
T-03	6	Reliability Growth	PAXTON RES TRANSMISSION MAIN Replace existing 16-inch AC main with 16-inch ductile iron. Revise routing from Carrolls to pump station to Paxton reservoir to address easement encroachments issues. Project will require alignment analysis and possible easement acquisition. Phase II - Improve Storage Transmission.	• Improve reliability of only transmission main to Paxton Reservoir. • Replace critical infrastructure. • Resolve alignment and encroachment issues (structures built on top of pipeline). • Replace aging infrastructure (AC to DI).	16	1,500

Project Number	Planning Window	Importance	Project Description	Project Benefit	Pipe Size (inch)	Pipe Length (LF)
T-04	20	Reliability Growth	GRADE STREET MAIN REPLACEMENT Replace existing 6-inch AC and 8-inch DI with 12-inch DI from 13th Ave to Haussler Pump Station. Phase III - Improve Storage Transmission.	• Improve service to Paxton Reservoirs, Haussler & Carrolls pump stations. • Improves pipeline hydraulics and increase pipeline capacity. • Strengthens distribution backbone to Paxton Reservoir. • Improves system performance in Main zone. • Repair/replacement of aging infrastructure (AC pipe). • Improved distribution reliability.	12	1,800
T-05	20	Reliability Growth	S. KELSO DRIVE from intersection of S. Kelso Dr and 13th to Haussler Rd pump station. Install new 16-inch DI main connecting existing 10-inch at 13th/Manasco to 16" DI at Carrolls Road Pump Station. Phase IV - Improve Storage Transmission.	• Provide more direct redundant connection linking reservoirs in main service zone. • Improves system hydraulics. • Establish more direct connection between the City's twp primarily storage facilities.' • Improves reliability by creating distribution system looping.	16	4,800

Project Number	Planning Window	Importance	Project Description	Project Benefit	Pipe Size (inch)	Pipe Length (LF)
T-06	20	Reliability Growth Regulatory	CEDAR ST WATERLINE REPLACEMENT – S PACIFIC AVE TO GRADE ST. Replace 2,400 LF of 8-inch, 10-inch and 12-inch pipe with 16-inch pipe on Cedar Street from S. Pacific Avenue to Grade Street. Phase V - Improve Storage Transmission.	• Improves pipeline hydraulics, increase pipeline capacity. • Strengthens distribution backbone to Paxton Reservoir. • Repair/replacement of aging infrastructure (AC pipe). • Increase capacity to downtown grid. • Improved distribution reliability. • Provide supply capacity to future service areas.	16	2,400
T-07	20	Reliability Growth Regulatory	S RIVER RD WATER EXTENSION - ELKS GOLF COURSE TO YEW ST/S RIVER Extension of approximately 7,000 LF of 12-inch watermain along South River Rd., beginning at the end of the existing main located at Yew Street and extending Southerly along S. River Road to the Elks Golf Course.	• Provide service to future developments and service to existing well water users. • Future development dependent (high density residential). • Increase customer base (well users). • Improves reliability by creating distribution system looping.	8	7,000
T-08	20	Reliability Growth	HARRIS STREET WATERLINE EXTENSION - END OF LINE TO ALLEN ST Install approximately 7,700 linear feet of 8-inch water main easterly on Harris Street to provide water service to the area.	• Provide service to future developments. • Future development dependent (high density residential). • Increase customer base.	8	7,700

Project Number	Planning Window	Importance	Project Description	Project Benefit	Pipe Size (inch)	Pipe Length (LF)
T-09	20	Reliability Growth	KELSO DRIVE WATERLINE EXTENSION - PAXTON RD RESERVOIR TO SR 432 Install approximately 3,000 linear feet of 16-inch water main southerly on Kelso Drive to provide water service to the area.	• Provide improved service to the southern portion of the distribution system and extend service to area not currently served. • Future development dependent. • Increase customer base. • Potential to loop system (additional I5 crossing?).	16	3,000
T-10	20	Reliability Growth	MT BRYNION RD WATERLINE EXTENSION - FROM END OF LINE TO EAST Install 9,650 LF of 8-inch pipe east along Mt. Brynion Road.	• Provide service to future developments. • Future development dependent. • Increase customer base.	8	9,650
T-11	20	Reliability Growth	HOLCOMB ACRES WATERLINE EXTENSION - I-5 TO EAST Install 7,200 Lf of 8-inch diameter pipe on Holcomb Acres Road.	• Provide service to future developments. • Future development dependent. • Increase customer base	8	7,200
T-12	20	Reliability Growth	CARROLL ROAD WATERLINE EXTENSION - EAST ALONG CARROLL RD Install water main easterly approximately 2,100 linear feet on Carroll Road to provide water service to the area. (assume 8" for planning)	• Provide service to future developments. • Future development dependent. • Increase customer base.	8	2,100

Project Number	Planning Window	Importance	Project Description	Project Benefit	Pipe Size (inch)	Pipe Length (LF)
T-13	20	Reliability Growth Efficiency	TYBREN HEIGHTS TO CARROLLS RD. Install 2,500 LF of 12-inch DI from Tybren transmission main to 8-inch DI in Carrolls service zone. May include installation of PRV between service zones.	• Establish connection between Tybren Heights and Carrolls Service Area. • Eliminate need for Carrolls pump station and reservoir. • Provide distribution system looping. • Reduce required infrastructure in this area by eliminating need for Carrolls pump station and reservoir. • Allow for future development (between Tybren and Carrolls).	12	2,500

Notes:

LF = linear feet
DI = ductile iron

The distribution system improvements identified are presented in Table 9-3. The majority of the distribution system projects have been incorporated into the Pipeline Replacement Program. Projects were selected and prioritized based upon maintenance history and relative vulnerability to pipe failure resulting from age and material. These projects include replacement of deteriorated or undersized lines, which were selected based upon storage analysis and hydraulic model results. The selected projects will expand or improve the water main grid, providing increased flows and pressures to portions of the distribution area shown to be deficient. The hydraulic model identified a number of areas where the presence of 4-inch pipe limits system pressure and volume. The City is aware of these areas and intends to upgrade these pipes as part of their ongoing pipe replacement project included as project D-01.

Table 9-3: Distribution System Improvements

Project Number	Planning Window	Importance	Project Description	Project Benefit	Pipe Size (inch)	Pipe Length (LF)
D-01	6	Reliability Growth Regulatory	PIPE REPLACEMENT PROGRAM. Provides for the replacement of small diameter (2-, 4-, and 6-inch), undersized, deteriorating and AC piping.	• Improve flow, distribution characteristics and decrease maintenance or emergency callouts.	TBD	TBD
D-02	20	Reliability Growth Regulatory	ROCKY POINT PUMP STATION TO END OF ROCKY POINT RD. Replace existing 6-inch main with 700 LF of new 8-inch main. Install three fire hydrants and upgrade existing service laterals and meters to current standards.	• Address flow deficiencies. • Improve system reliability by providing distribution system looping. • Allow for future development in this area.	8	700

Note:

TBD = to be determined

9.4 Booster Pump Station Improvements

The City has a total of three booster pump station projects listed on the CIP; all of which fall into the 20-year planning period. Projects listed in the 20-year planning period must be reassessed based on the level of development that occurs. The booster pup station improvements are summarized in Table 9-4.

Table 9-4: Booster Pump Station Improvements

Project Number	Planning Window	Importance	Project Description	Project Benefit	Total Pump (HP)	Generator Capacity (Kw)
PS-01	20	Growth Reliability Regulatory	ROCKY POINT PUMP STATION UPGRADE - ROCKY POINT PUMP STATION. Replace existing pumps and install a backup generator. Sizing to be developed at the time of the project.	• Improve service to this area, provide redundancy. • Address flow deficiencies. • Provide for future development. • Hydraulic Improvement and Increase pump station capacity. • Replaces substandard, aging pumps. • Improved distribution reliability. • Meet City standards construction and minimum service requirements. • Regulatory Compliance.	TBD	TBD
PS-02	20	Reliability Regulatory	PAXTON RD SERVICE PRESSURE UPGRADE - PAXTON RD. Install a booster pump station to serve homes on Paxton Road- approximately nine homes.	• Address pressure deficiency near Paxton Road reservoir. • Regulatory Compliance with WAC 246-290-230(8).	1.5	TBD
PS-03	20	Growth Efficiency	LOWER HAUSSLER RD. Evaluate need to increase pumping capacity if Carrolls Road is taken offline.	• Provide necessary pumping capacity to accommodate system reconfiguration	TBD	TBD

Note:

TBD = to be determined

9.5 Storage Facilities

Storage facility CIP projects are summarized in Table 9-5. There are three storage projects listed in the City's CIP. With the completion of the new Paxton Road reservoir, the City has ample storage to meet system demands and the regulated storage requirements. A structural analysis of the existing Minor Road Reservoirs (Kenney/Jenks Consultants 2012) has shown these reservoirs are beyond their useful service life and are vulnerable to failure with potentially disastrous results. The results of the structural analysis further indicate that it is more cost effective to pursue replacement of the Minor Road reservoirs. The Minor Road reservoirs are an integral part of the City's infrastructure; therefore, a CIP has been included for the replacement of the Minor Road.

Table 9-5: System Storage Improvements

Project Number	Planning Window	Importance	Project Description	Project Benefit	Volume (MG)
ST-01	6	Growth Reliability Regulatory	PAXTON RD. Completion of Paxton Road Reservoir.	• Provide adequate storage capacity to meet water demand and to allow for future development. • Addresses deficiency identified in 2005 Plan.	2.0
ST-02	6	Growth Reliability	MINOR RD RESERVOIR REPLACEMENT. Replace two existing reservoirs with a single concrete reservoir.	• Replace critical at risk infrastructure • Address known problem area; minimize damage to roadway and emergency callouts. • Reduce distribution system losses. • Meet current codes and standards for critical infrastructure (structural and seismic). • Provide required standby storage for Main Zone. • Improved reliability.	2.0
ST-03	20	Growth Reliability Regulatory	HOLCOMB ACRES RESERVOIR - HOLCOMB ACRES RD. Construct new 0.3 MG reservoir on Holcomb Acres Road.	• Provide for future development. • Provide standby storage for Zone 301. • Meet City standards (minimum service requirements) • Regulatory Compliance for standby storage and fire flow.	0.3

9.5.1 Planning, Controls and General System Improvements

There are many planning, controls, and general system improvements scheduled within the 6-year planning window. The City has several metering related projects scheduled to improve

the system's efficiency, data tracking, and water loss accountability. As discussed in Section 4, the City continues to upgrade hardwired telemetry systems with radio telemetry. Another goal is to install emergency power provisions (receptacle for portable generator and transfer switch) for each pump station within the 6-year planning window. A rate study has also been included in the 6-year planning window. The City is in the process of evaluating the benefits of installing a system wide automated meter reading system with the goal of completing this upgrade in the 20-year planning window. Table 9-6 summarizes the identified planning, controls, and general system improvements.

Table 9-6: Planning, Controls and General System Improvements

Project Number	Planning Window	Importance	Project Description	Project Benefit
P-01	6	Reliability Efficiency	TELEMETRY - ALL RESERVOIRS AND PUMP STATIONS Provide wireless telemetry and SCADA system for Paxton Road Reservoir and Rocky Point Reservoir and Pump Station.	• Monitoring the system increase security and system reliability.
P-02	6	Reliability Efficiency	PUMP STATION FLOW METERS - ALL PUMP STATIONS Install flow meters at all water pump stations (seven stations).	• Provide a way to track water usage in all pressure zones and provide a way to identify problem areas within the distribution system.
P-03	6	Reliability Efficiency	EMERGENCY POWER PROVISIONS Provide either emergency power receptacle for portable generator or permanent generator for all pump stations.	• Improve safety and reliability.
P-04	6	Regulatory	PLANNING Water System Plan update.	• Meet State Planning Requirements for Class A water systems.
P-05	6	Financial	RATE STUDY. Complete rate study for both water and sewer systems. Total combined budget $50,000.	• Provide City with current information to determine appropriate cost of service rate adjustments.
P-06	20	Reliability Efficiency	AUTOMATED METER READING SYSTEM - ENTIRE SYSTEM Install an automated meter reading system. The project will include replacement of all meters and purchase and installation of required computer system.	• Improve meter reading efficiency and accuracy throughout system, reduce costs, and streamline billing.

9.5.2 Summary of Capital Improvements

The complete CIP list for the City is summarized in Table 9-7. These projects include a project description, CIP construction time frame, and benefit. Detailed cost estimates recommended 6-year projects, estimated at more than $400,000, are included in Exhibit 9 at the end of this section.

Table 9-8 summarizes potential pipeline replacement program projects. The projects shown in Table 9-8 are projects that already appear in the City's long-term CIP. They have been summarized in the Pipeline Replacement Program so that the City is able to select the most critical projects annually based on historical information and trouble calls for a particular area. The City's current CIP numbering has been retained in the summary tables to allow for better project tracking.

Table 9-7: Capital Improvement Program Project Summary 2012-2032

Capital Improvement Program List for 6- and 20-Year Planning Periods
Note: All costs are shown in 2012 dollars; no inflation applied to future years.

Project ID	City CIP Number	Planning Period	Related Projects	Project Description	Benefit	2012	2013	2014	2015	2016	2017	2018-2032
Water Treatment Plant												
WTP-01	W-07	6		TEST WELL - MILL STREET Install a test well on the City owned property at Mill St. and River Rd. to determine its suitability as an additional water source.	• Provide an additional source of supply to allow City to meet future demands.	$110,000						
WTP-02	W-09	6		CLEAN RANNEY WELL LATERALS - COWLITZ RIVER RAW WATER SUPPLY Clean the Ranney Well laterals with divers to remove build-up of iron bacteria.	• Maintain well capacity by removing accumulation of iron bacteria.		$25,000					
WTP-03	W-15	6		BACKWASH RECOVERY EVALUATION. Evaluate reuse and backwash recovery options.	• Determine feasibility of adding backwash recovery and reuse to WTP to improve plant efficiency and reduce discharge to sewer. Evaluation should include space requirement/availability at plant and cost benefit analysis evaluation is necessary.							$50,000
WTP-04		6		ALTERNATIVE SOURCE OF SUPPLY EVALUATION. Perform cost benefit analysis to determine the most cost effective, long-term alternative source of supply.	• Provide information for decision makers. • Determine cost-effective alternative source of supply.		$50,000					
WTP-05	W-02	20		RANNEY WELL SUPPLY LINE REPAIR - AT DIKE CROSSING Repair the 10-inch supply line from the Ranney well to the water treatment plant at the break under the dike.	• Provide redundancy from Ranney Well to water treatment plant.							$85,000
WTP-06	W-14	20	WTP-06	RANNEY WELL EMERGENCY GENERATORS - RANNEY WELL Install permanent generators for standby power.	• Provide emergency power to Ranney well system in order to maintain water supply to City in event of long-term power outage.							$80,000
WTP-07	W-17	20	WTP-07 WTP-05	WATER TREATMENT PLANT EMERGENCY GENERATORS - WATER TREATMENT PLANT Install permanent generators for standby power. This project must be completed either in conjunction with or after completion of Ranney Well emergency Power CIP.	• Provide emergency power to water treatment facility in order to maintain water supply to City in event of long-term power outage.							$185,000
WTP-08	W-30	20	WTP-06	INCREASE WATER CAPACITY - WATER TREATMENT PLANT Increase the treatment capacity of the water treatment plant by adding an additional filter at the treatment plant.	• Provide additional capacity to accommodate and allow for future growth.							$895,000
WTP-09		20	WTP-04	DEVELOP ALTERNATIVE SOURCE OF SUPPLY. Project is dependent upon results for Alternative Source of Supply Evaluation (WTP-04). There are three possible alternatives: 1) Develop wellfield on Mill Street property, 2) Develop Ranney Collector Well on Mill Street Property, or 3) Purchase Water from Longview and establish additional intertie.	• Provide an additional source of supply to allow City to meet future demands.							TBD
WTP-10		20		UPGRADE FILTER BOOSTER PUMP MOTORS. Upsize filter booster pump motor to operate within recommended operation parameters during periods of high demand. Project will include evaluation of current power supply to booster pumps and determination of remaining useful booster pump life.	• Improved plant reliability. • Increases filter booster pump capacity to correspond to filter capacity.							TBD

Capital Improvement Program List for 6- and 20-Year Planning Periods

Note: All costs are shown in 2012 dollars; no inflation applied to future years.

Project ID	City CIP Number	Planning Period	Related Projects	Project Description	Benefit	2012	2013	2014	2015	2016	2017	2018-2032
Transmission												
T-01	W-27	6	T-02 T-03 T-04 T-05 T-06	INTERTIE WITH LONGVIEW. Upsize intertie connection with Longview to increase flow capacity. Includes replacing 8-inch CI with 12-inch DI from Fisher's Lane to Cowlitz Way.	• Increase capacity of intertie, capable of providing ADD in emergency situation. • Improved hydraulic connection between Kelso and Longview. • Replace critical infrastructure. • Improved reliability.		$282,000					
T-02	W-23	6	T-01 T-03 T-04 T-05 T-06	S. KELSO DR - HAUSSLER PUMP STATION TO CARROLLS RD PUMP STATION Install 4,800 LF of 16-inch diameter pipe on Grade Street from Lower Haussler Pump Station to Carrolls Road Pump Station. Phase I - Improve Storage Transmission. Design package to consist of Schedule A and Schedule B.	• Improve service to Paxton Road Reservoir and industrial future service areas. • Improved hydraulic connection. • Redundant connection across freeway. • Provide distribution system loop. • Improved reliability.		$100,000	$500,000	$500,000			
T-03	W-24	6	T-01T-02T-04T-05T-06	PAXTON RES TRANSMISSION MAIN Replace existing 16-inch AC main with 16-inch ductile iron. Revise routing from Carrolls to pump station to Paxton reservoir to address easement encroachments issues. Project will require alignment analysis and possible easement acquisition. Phase II - Improve Storage Transmission.	• Improve reliability of only transmission main to Paxton Reservoir. • Replace critical infrastructure. • Resolve alignment and encroachment issues (structures built on top of pipeline). • Replace aging infrastructure (AC to DI).						$619,000	
T-04	W-25	20	T-01T-02T-03T-05T-06	GRADE STREET MAIN REPLACEMENT Replace existing 6-inch AC and 8-inch DI with 12-inch DI from 13th Ave to Haussler Pump Station. Phase III - Improve Storage Transmission.	• Improve service to Paxton Reservoirs, Haussler and Carrolls pump stations. • Improves pipeline hydraulics and increase pipeline capacity. • Strengthens distribution backbone to Paxton Reservoir. • Improves system performance in Main zone. • Repair/replacement of aging infrastructure (AC pipe). • Improved distribution reliability.							$461,000
T-05	W-29	20	T-01 T-02 T-03 T-03 T-06	S. KELSO DRIVE FROM INTERSECTION OF S. KELSO DR AND 13TH TO HAUSSLER RD PUMP STATION. Install new 16-inch DI main connecting existing 10-inch at 13th/Manasco to 16-inch DI at Carrolls Rd Pump Station. Phase IV - Improve Storage Transmission.	• Provide more direct redundant connection linking reservoirs in main service zone. • Improves system hydraulics. • Establish more direct connection between the City's two primarily storage facilities. • Improves reliability by creating distribution system looping.							$1,638,000
T-06	W-34	20	T-01 T-02 T-03 T-03 T-05	CEDAR ST WATERLINE REPLACEMENT - S PACIFIC AVE TO GRADE ST. Replace 2,400 LF of 8-inch, 10-inch, and 12-inch pipe with 16-inch pipe on Cedar Street from S. Pacific Avenue to Grade Street. Phase V - Improve Storage Transmission.	• Improves pipeline hydraulics, increase pipeline capacity. • Strengthens distribution backbone to Paxton Reservoir. • Repair/replacement of aging infrastructure (AC pipe). • Increase capacity to downtown grid. • Improved distribution reliability. • Provide supply capacity to future service areas.							$819,000
T-07	W-39	20		S RIVER RD WATER EXTENSION - ELKS GOLF COURSE TO YEW ST/S RIVER Extension of approximately 7,000 LF of 12-inch watermain along South River Rd., beginning at the end of the existing main located at Yew Street and extending Southerly along S. River Road to the Elks Golf Course.	• Provide service to future developments and service to existing well water users. • Future development dependent (high density residential). • Increase customer base (well users). • Improves reliability by creating distribution system looping.							$1,792,000

Capital Improvement Program List for 6- and 20-Year Planning Periods
Note: All costs are shown in 2012 dollars; no inflation applied to future years.

Project ID	City CIP Number	Planning Period	Related Projects	Project Description	Benefit	2012	2013	2014	2015	2016	2017	2018-2032
T-08	W-40	20		HARRIS STREET WATERLINE EXTENSION - END OF LINE TO ALLEN ST Install approximately 7,700 LF of 8-inch water main easterly on Harris Street to provide water service to the area.	• Provide service to future developments. • Future development dependent (high density residential). • Increase customer base.							$1,399,000
T-09	W-41	20		KELSO DRIVE WATERLINE EXTENSION - PAXTON RD RESERVOIR TO SR 432 Install approximately 3,000 LF of 16-inch water main southerly on Kelso Drive to provide water service to the area.	• Provide improved service to the southern portion of the distribution system and extend service to area not currently served. • Future development dependent. • Increase customer base. • Potential to loop system (additional I5 crossing?).							$1,024,000
T-10	W-43	20		MT BRYNION RD WATERLINE EXTENSION - FROM END OF LINE TO EAST Install 9,650 LF of 8-inch pipe east along Mt. Brynion Road.	• Provide service to future developments. • Future development dependent. • Increase customer base.							$1,744,000
T-11	W-44	20		HOLCOMB ACRES WATERLINE EXTENSION - I-5 TO EAST Install 7,200 LF of 8-inch diameter pipe on Holcomb Acres Road.	• Provide service to future developments. • Future development dependent. • Increase customer base.							$1,309,000
T-12	W-47	20		CARROLL ROAD WATERLINE EXTENSION - EAST ALONG CARROLL RD Install water main easterly approximately 2,100 LF on Carroll Road to provide water service to the area (assume 8-inch for planning).	• Provide service to future developments. • Future development dependent. • Increase customer base.							$400,000
T-13	W-35	20		TYBREN HEIGHTS TO CARROLLS RD. Install 2,500 LF of 12-inch DI from Tybren transmission main to 8-inch DI in Carrolls service zone. May include installation of PRV between service zones.	• Establish connection between Tybren Heights and Carrolls Service Area. Eliminate need for Carrolls pump station and reservoir. • Provide distribution system looping. • Reduce required infrastructure in this area by eliminating need for Carrolls pump station and reservoir. • Allow for future development (between Tybren and Carrolls).							$640,000
Distribution												
D-01	W-58 W-59	6		PIPE REPLACEMENT PROGRAM Provides for the replacement of small diameter (2-inch and 4-inch), undersized, deteriorating and asbestos cement piping.	• Improve flow, distribution characteristics and decrease maintenance or emergency callouts.		$125,000	$125,000	$200,000	$200,000	$300,000	$4,952,500
D-02	W-46	20		ROCKY POINT PUMP STATION TO END OF ROCKY POINT RD Replace existing 6-inch main with 700 LF of new 8-inch main. Install three fire hydrants and upgrade existing service laterals and meters to current standards.	• Address flow deficiencies. • Improve system reliability by providing distribution system looping. • Allow for future development in this area.							$156,000

Capital Improvement Program List for 6- and 20-Year Planning Periods
Note: All costs are shown in 2012 dollars; no inflation applied to future years.

Project ID	City CIP Number	Planning Period	Related Projects	Project Description	Benefit	2012	2013	2014	2015	2016	2017	2018-2032
Pumping												
PS-01	W-33	20		ROCKY POINT PUMP STATION UPGRADE - ROCKY POINT PUMP STATION Replace existing pumps and install a backup generator. Sizing to be developed at the time of the project.	• Improve service to this area, provide redundancy. • Address flow deficiencies. • Provide for future development. • Hydraulic Improvement and Increase pump station capacity. • Replaces substandard, aging pumps. • Improved distribution reliability. • Meet City standards construction and minimum service requirements. • Regulatory compliance.							$150,000
PS-02	W-60	20		PAXTON RD SERVICE PRESSURE UPGRADE - PAXTON RD Install a booster pump station to serve homes on Paxton Road - approximately nine homes.	• Address pressure deficiency near Paxton Road reservoir. • Regulatory compliance with WAC 246-290-230(8).						$80,000	
PS-03		20	T-13	EVALUATE LOWER HAUSSLER RD PUMP STATION Study to evaluate need to increase pumping capacity if Carrolls Rd pump station and reservoir is taken offline.	• Provide necessary pumping capacity to accommodate system reconfiguration.							TBD
Storage												
ST-01	W-01	6		PAXTON RD RESERVOIR Completion of Paxton Road Reservoir.	• Provide adequate storage capacity to meet water demand and to allow for future development. • Addresses deficiency identified in 2005 Plan.	$350,000						
ST-02	W-26	6		MINOR RD RESERVOIR REPLACEMENT Replace two existing reservoirs with a single concrete reservoir.	• Replace critical at risk infrastructure. • Address known problem area; minimize damage to roadway and emergency callouts. • Reduce distribution system losses. • Meet current codes and standards for critical infrastructure (structural and seismic). • Provide required standby storage for Main Zone. • Improved reliability.			$150,000	$2,350,000	$2,300,000		
ST-03	W-45	20		HOLCOMB ACRES RESERVOIR - HOLCOMB ACRES RD Construct new 0.3-MG reservoir on Holcomb Acres Road.	• Provide for future development. • Provide standby storage for Zone 301. • Meet City standards (minimum service requirements). • Regulatory Compliance for standby storage and fire flow.							$700,000

Capital Improvement Program List for 6- and 20-Year Planning Periods
Note: All costs are shown in 2012 dollars; no inflation applied to future years.

Project ID	City CIP Number	Planning Period	Related Projects	Project Description	Benefit	2012	2013	2014	2015	2016	2017	2018-2032
Planning, Controls and General System Upgrades												
P-01	W-05	6		TELEMETRY - ALL RESERVOIRS AND PUMP STATIONS Provide wireless telemetry and SCADA system for Paxton Road Reservoir and Rocky Point Reservoir and Pump Station.	• Monitoring the system increase security and system reliability.	$35,000						
P-02	W-06	6		PUMP STATION FLOW METERS - ALL PUMP STATIONS Install flow meters at all water pump stations (seven stations).	• Provide a way to track water usage in all pressure zones and provide a way to identify problem areas within the distribution system.		$50,000					
P-03		6		EMERGENCY POWER PROVISIONS Provide either emergency power receptacle for portable generator or permanent generator for all pump stations.	• Improve Safety and reliability.			$50,000	$30,000	$30,000		
P-04	W-04	6		PLANNING Water System Plan update.	• Meet State Planning Requirements for Class A water systems							$200,000
P-05		6		RATE STUDY Complete rate study for both water and sewer systems. Total combined budget $50,000.	• Provide city with current information to determine appropriate cost of service rate adjustments.		$25,000					
P-06	W-08	20		AUTOMATED METER READING SYSTEM - ENTIRE SYSTEM Install an automated meter reading system. The project will include replacement of all meters, and purchase and installation of required computer system.	• Improve meter reading efficiency and accuracy throughout system, reduce costs and streamlining billing.							$1,500,000
					Subtotal All Projects 2012-2017 (in 2012 $s).....	**$495,000**	**$657,000**	**$825,000**	**$3,080,000**	**$2,530,000**	**$999,000**	
					Subtotal All Projects 2018-2032 (in 2012 $s).....							**$20,179,500**
					Totals	**$495,000**	**$657,000**	**$825,000**	**$3,080,000**	**$2,530,000**	**$999,000**	**$20,179,500**
						2012	**2013**	**2014**	**2015**	**2016**	**2017**	**2018-2032**

Table 9-8: Pipeline Replacement Project Summary 2012-2032

Capital Improvement Program - Small Pipe Replacement Program

Note: Budgetary allowance included in Capital Improvement Program List. All costs are shown in 2012 dollars; no inflation applied to future years.

Project Type	City CIP Number	Planning Period	Related Projects	Project Description	Benefit	2012	2013	2014	2015	2016	2017	2018-2032
Transmission/Distribution												
Trans	W-18	6		N KELSO WATER TRANSMISSION MAIN - N PACIFIC AT REDPATH ST TO DIRK ST Project completes the replacement of existing 4-inch and 6-inch AC water main with approximately 2,100 LF of 12-inch transmission main along North Pacific Avenue from Redpath Street to Barnes Street.	• Improves pipeline hydraulics and increase pipeline capacity. • Enhances distribution backbone to North Kelso. • Repair/replacement of aging infrastructure. • Improved distribution reliability in North Kelso area. • Meet City Construction Standards. • Provides for future development possibility in North Kelso.				$100,000	$438,000		
Trans	W-21	6		S PACIFIC AVE WATERLINE REPLACEMENT (PHASE 1) - NELLA ST TO WILLOW ST Replace the existing 12-inch asbestos cement (AC) pipe with approximately 1,300 LF of new 12-inch main. Install five fire hydrants and upgrade existing service laterals and meters to current standards.	• Replace aging and deteriorating (AC) infrastructure. • Address known problem area; minimize damage to roadway and emergency callouts. • Reduce distribution system losses. • Improve distribution system reliability. • Meet City construction and minimum service standards. • Regulatory compliance related to fire protection.		$50,000		$283,000			
Dist	W-11	6		CLYDESDALE CT WATER LINE REPLACEMENT - CLYDESDALE CT. ENTIRE LENGTH Replace existing 2-inch main with 300 LF of 6-inch main and install a fire hydrant. Upgrade water service lines and meters to meet current standards.	• Replace aging infrastructure. • Address known problem area; minimize damage to roadway and emergency callouts. • Hydraulic Improvement; Increase pipeline capacity. • Reduce distribution system losses. • Improved distribution reliability. • Meet City construction standards. • Regulatory compliance related to protection.		$50,000					
Dist	W-16	6		ELIZABETH ST WATERLINE REPLACEMENT - 8TH AVE TO 11TH AVE Replace the existing 4-inch cast iron main with approximately 1,000 LF of new 8-inch main. Install four fire hydrants and upgrade existing service laterals and meters to current standards. Existing main was installed in 1951 and has begun to deteriorate.	• Repair/replacement of aging infrastructure. • Improve reliability by addressing known problem area; minimize damage to roadway and emergency callouts. • Hydraulic improvement; increase pipeline capacity. • Reduce distribution system losses. • Meet City construction standards. • Regulatory compliance related to protection.				$20,000	$193,000		
Trans	W-20	6		4TH AVE WATERLINE REPLACEMENT - ALLEN ST TO OAK ST Replace the existing 12-inch cast iron main with approximately 300 LF of new 12-inch main. This main was installed in 1924 and has exceeded its expected life.	• Replacement of aging infrastructure. • Improve reliability by addressing known problem area; minimize damage to roadway and emergency callouts. • Reduce distribution system losses. • Meet City construction and minimum standards. • Regulatory compliance related to protection.					$85,000		
Dist	W-22	6		N 6TH AVE WATERLINE REPLACEMENT - HARRIS ST TO BLOYD ST Replace the existing 6-inch cast iron main with 750 LF of new 8-inch main. Install three fire hydrants and upgrade existing service laterals and meters to current standards. Existing main has begun to deteriorate.	• Replacement of aging infrastructure. • Improve reliability by addressing known problem area; minimize damage to roadway and emergency callouts. • Reduce distribution system losses. • Meet City construction and minimum standards. • Regulatory compliance related to fire protection.					$23,000	$142,000	

Capital Improvement Program - Small Pipe Replacement Program

Note: Budgetary allowance included in Capital Improvement Program List. All costs are shown in 2012 dollars; no inflation applied to future years.

Project Type	City CIP Number	Planning Period	Related Projects	Project Description	Benefit	2012	2013	2014	2015	2016	2017	2018-2032
Dist	W-48	6	ROAD	SUNRISE ST WATERLINE REPLACEMENT - MINOR RD TO DEAD-END Replace the existing 2-inch galvanized pipe with approximately 650 LF of new 8-inch main. Install fire hydrants and upgrade existing service laterals and meters to current city standards. Complete in conjunction with street reconstruction.	• Replacement of aging infrastructure. • Improve reliability by addressing known problem area; minimize damage to roadway and emergency callouts. • Reduce distribution system losses. • Meet City construction standards. • Regulatory compliance related to fire protection.		$34,000	$134,100				
Dist	W-53	6	ROAD	MT BRYNION RD WATERLINE REPLACEMENT – 13TH to 14th AVE Replace the existing 10-inch AC pipe with 400 LF of new 10-inch main. Complete in conjunction with road replacement	• Replacement of aging infrastructure. • Improve reliability by addressing known problem area; minimize damage to roadway and emergency callouts. • Reduce distribution system losses. • Meet City construction standards. • Regulatory compliance related to fire protection.				$124,100			
Dist	W-55	6	ROAD	S. 7TH AVE WATERLINE REPLACEMENT - ELM TO CHESTNUT Replace the existing 6-inch cast pipe with 500 LF of new 8-inch main. Pipeline has reached end of service life. Complete in conjunction with road replacement.	• Replacement of aging infrastructure. • Improve reliability by addressing known problem area; minimize damage to roadway and emergency callouts. • Reduce distribution system losses. • Meet City construction standards. • Regulatory compliance related to fire protection.					$129,300		
Dist	W-56	6	ROAD	SUNNYSIDE RD WATERLINE REPLACEMENT - HIGHLAND PARK RD TO DEAD-END. Replace existing 2-1/2-inch cast with 560 LF of new 8-inch pipe. Replace fire hydrants and upgrade existing service laterals and meters to current city standards. Complete in conjunction with road replacement.	• Replacement of aging infrastructure. • Improve reliability by addressing known problem area; minimize damage to roadway and emergency callouts. • Reduce distribution system losses. • Meet City construction standards. • Regulatory compliance related to fire protection.					$144,800		
Dist	W-57	6	ROAD	HAUSSLER RD WATERLINE REPLACEMENT - APPLE LN TO END OF RD Replace existing 4-inch AC with 1,900 LF of new 8-inch pipe. Replace fire hydrants and upgrade existing service laterals and meters to current City standards. Complete in conjunction with road replacement.	• Replacement of aging infrastructure. • Improve reliability by addressing known problem area; minimize damage to roadway and emergency callouts. • Reduce distribution system losses. • Meet City construction and minimum standards. • Regulatory compliance related to fire protection.						$491,000	
Dist	W-19	20	T-07?	S RIVER ROAD DIKE CROSSING REPLACEMENT – S RIVER ROAD Replace existing 2-inch line with new 8-inch main where it runs parallel to, then crosses the Cowlitz River Dike (approximately 100 feet of piping). Existing line in needs frequent repair and is undersized for area to be served. At this location, it crosses the Dike and if it fails, it has the potential to cause serious damage.	• Address known problem area; minimize damage to dike, roadway and emergency callouts. • Hydraulic improvement; increase pipeline capacity. • Repair/replacement of aging infrastructure. • Reduce distribution system losses. • Improved distribution reliability. • Meet City construction and minimum service standards.							$53,000
Dist	W-31	20		SUNRISE ST WATERLINE REPLACEMENT - JONES RD TO BURCHAM ST Replace the existing 4-inch and 6-inch cast iron mains with approximately 5,100 LF of new 8-inch main. Install fire hydrants and upgrade existing service laterals and meters to current standards. Existing main has begun to deteriorate.	• Repair/replacement of aging and deteriorating infrastructure. • Improve reliability by addressing known problem area; minimize damage to roadway and emergency callouts. • Reduce distribution system losses. • Meet City construction and minimum service standards. • Regulatory compliance related to protection.							$871,000

Capital Improvement Program - Small Pipe Replacement Program

Note: Budgetary allowance included in Capital Improvement Program List. All costs are shown in 2012 dollars; no inflation applied to future years.

Project Type	City CIP Number	Planning Period	Related Projects	Project Description	Benefit	2012	2013	2014	2015	2016	2017	2018-2032
Dist	W-42	20		GRADE ST WATERLINE REPLACEMENT - GRADE ST AT 5TH AVE TO ASH ST Replace the existing 10-inch cast iron main with approximately 720 LF of new 10-inch main. Install three fire hydrants and upgrade existing service laterals and meters to current standards. This main was installed in 1924 and has exceeded its expected life.	• Repair/replacement of aging infrastructure. • Improve reliability by addressing known problem area; minimize damage to roadway and emergency callouts. • Reduce distribution system losses. • Meet City construction and minimum service standards. • Regulatory Compliance related to fire protection.							$190,000
Trans	W-32	20		S PACIFIC AVE WATERLINE REPLACEMENT (PHASE 2) - WILLOW ST TO HAZEL ST Replace the existing 12-inch asbestos cement (AC) pipe with approximately 2,000 LF of new 12-inch main. Install seven fire hydrants and upgrade existing service laterals and meters to current standards. Existing main has begun to deteriorate.	• Replacement of aging and deteriorating infrastructure. • Improve reliability by addressing known problem area; minimize damage to roadway and emergency callouts. • Reduce distribution system losses. • Meet City construction and minimum service standards. • Regulatory compliance related to fire protection.							$512,000
Trans	W-37	20		ALLEN ST WATERLINE REPLACEMENT - PACIFIC AVE TO 8TH AVE Replace 1,900 LF of 6-inch pipe with 12-inch pipe on Allen Street from Pacific Avenue to 8th Avenue.	• Hydraulic Improvement; Increase pipeline capacity. • Repair/replacement of aging infrastructure. • Improve reliability by addressing known problem area; minimize damage to roadway and emergency callouts. • Reduce distribution system losses. • Meet City construction and minimum service standards.							$487,000
Trans	W-38	20		DONATION STREET WATERLINE REPLACEMENT - 2ND AVE TO 4TH AVE Replace 500 LF of 6-inch diameter pipe with 16-inch diameter pipe on Donation Street from 2nd Avenue to 4th Avenue.	• Hydraulic improvement; increase pipeline capacity. • Enhances distribution in NE Kelso. • Improved distribution reliability. • Meet City construction standards.							$171,000
Dist	W-36	20		7TH AVE WATERLINE REPLACEMENT - COWLITZ WAY TO I-5 Replace the existing 8-inch cast iron main with approximately 2,550 LF of new 8-inch main. Install nine fire hydrants and upgrade existing service laterals and meters to current standards. Existing main has begun to deteriorate.	• Replacement of aging infrastructure. • Improve reliability by addressing known problem area; minimize damage to roadway and emergency callouts. • Reduce distribution system losses. • Meet City construction and minimum service standards.							$482,000
Dist	W-28	20		ALLEN STREET WATERLINE REPLACEMENT (EAST KELSO) - 2437 ALLEN ST TO CORDUROY RD. Replace 650 LF of 10-inch AC with new 12-inch ductile pipe. In easement behind Brookhollow.	• Replacement of aging infrastructure. • Improve reliability by addressing known problem area; minimize damage to roadway and emergency callouts. • Reduce distribution system losses. • Meet City construction standards. • Regulatory compliance related to fire protection.							$180,000
Dist	W-49	20		17th AVE WATERLINE REPLACEMENT - CRAWFORD ST TO ALLEN ST Replace the existing 2-inch galvanized pipe with approximately 650 LF of new 8-inch main. Install fire hydrants and upgrade existing service laterals and meters to current City standards.	• Replacement of aging infrastructure. • Improve reliability by addressing known problem area; minimize damage to roadway and emergency callouts. • Reduce distribution system losses. • Meet City construction standards. • Regulatory compliance related to fire protection.							$168,100

Capital Improvement Program - Small Pipe Replacement Program

Note: Budgetary allowance included in Capital Improvement Program List. All costs are shown in 2012 dollars; no inflation applied to future years.

Project Type	City CIP Number	Planning Period	Related Projects	Project Description	Benefit	2012	2013	2014	2015	2016	2017	2018-2032
Dist	W-50	20		CHURCH STREET WATERLINE REPLACEMENT - DEAD-END WEST TO 17TH TO DEAD-END EAST. Replace the existing 2-inch pipe with approximately 350 LF of new 8-inch main. Install fire hydrants and upgrade existing service laterals and meters to current City standards.	• Replacement of aging infrastructure. • Improve reliability by addressing known problem area; minimize damage to roadway and emergency callouts. • Reduce distribution system losses. • Meet City construction standards. • Regulatory compliance related to fire protection.							$87,900
Dist	W-51	20		COWLITZ WAY WATERLINE REPLACEMENT - DEAD-END WEST TO 17TH TO DEAD-END EAST. Replace the existing 2-inch pipe with approximately 350 LF of new 8-inch main. Install fire hydrants and upgrade existing service laterals and meters to current City standards.	• Replacement of aging infrastructure. • Improve reliability by addressing known problem area; minimize damage to roadway and emergency callouts. • Reduce distribution system losses. • Meet City construction standards. • Regulatory compliance related to fire protection.							$134,400
Dist	W-52	20		TALLEY WAY WATERLINE REPLACEMENT - COLORADO ST TO 2500 TALLEY WAY Replace the existing 8-inch AC pipe with 4,250 LF of new 8-inch main. Replace fire hydrants and upgrade existing service laterals and meters to current City standards.	• Replacement of aging infrastructure. • Improve reliability by addressing known problem area; minimize damage to roadway and emergency callouts. • Reduce distribution system losses. • Meet City construction and minimum standards. • Regulatory compliance related to fire protection.							$1,099,000
Dist	W-54	20		N. & S. VISTA WATERLINE REPLACEMENT Replace the existing 4-inch AC pipe with 2,000 LF of new 8-inch main. Replace fire hydrants and upgrade existing service laterals and meters to current City standards.	• Replacement of aging infrastructure. • Improve reliability by addressing known problem area; minimize damage to roadway and emergency callouts. • Reduce distribution system losses. • Meet City construction standards • Regulatory compliance related to fire protection.							$517,100
				Subtotal All Projects 2012-2017 (in 2012 $s)…..		**$0**	**$134,000**	**$134,100**	**$527,100**	**$1,013,100**	**$633,000**	
				Rate Funded CIPs 2012-2017 (In 2012 $s)…..		$0	$134,000	$134,100	$527,100	$1,013,100	$633,000	
				Subtotal All Projects 2018-2032 (in 2012 $s)…..								$4,952,500
				Totals		**$0**	**$134,000**	**$134,100**	**$527,100**	**$1,013,100**	**$633,000**	**$4,952,500**
						2012	**2013**	**2014**	**2015**	**2016**	**2017**	**2018-2032**

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EXHIBIT 9: COST ESTIMATES

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City of Kelso
Capital Improvement Project Description

PROJECT SUMMARY

PROJECT TYPE: S Kelso Dr. – Haussler Pump Station or Carrolls Road Pump Station

PROJECT NUMBER: T-02

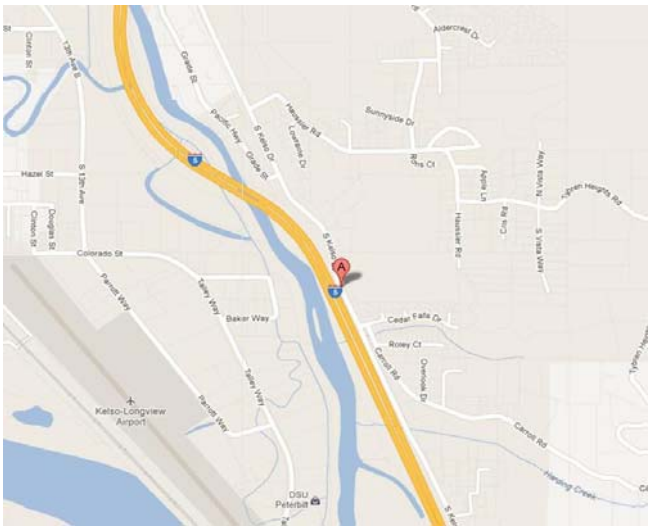
ESTIMATED COST: $ 1,000,000

PROJECT DESCRIPTION: Install 4,800 LF of 16" ductile iron pipe along S Kelso Dr. from Lower Haussler Pump Station to Carrolls Road Pump Station.

PROJECT BENEFIT: Project will increase reliability, redundancy and transmission to Paxton Reservoir, future and existing service areas.

COMMENTS: Alignment of the pipe will be in the ROW of Kelso Dr. or other city easement as necessary.

MAP:



SCHEDULE AND FUNDING PLAN

PROJECT COST

Land and Right of Way Acquisition	--
Engineering, Design and Construction Management	$ 100,000
Construction	$ 1,000,000
Total	**$ 1,100,000**

Funding Source: Rate payers, debt financing

City of Kelso
South Kelso Drive CIP T-02

Prepared by: Christopher Stoll Date Prepared: 14 February 2013

Estimate of Probable Cost - Summary by Division

DIV. No	ITEM DESCRIPTION		MATERIALS	INSTALLATION	TOTAL
1	General Requirements		$46,080	$11,981	**$58,061**
2	Site Work		-	-	**-**
3	Concrete		-	-	**-**
4	Masonry		-	-	**-**
5	Metals		-	-	**-**
6	Woods & Plastics		-	-	**-**
7	Thermal & Moisture Protect.		-	-	**-**
8	Doors and Windows		-	-	**-**
9	Finishes		-	-	**-**
10	Specialties		-	-	**-**
11	Equipment		-	-	**-**
12	Furnishings		-	-	**-**
13	Special Construction		-	-	**-**
14	Conveying Systems		-	-	**-**
15	Mechanical		$460,800	$119,808	**$580,608**
16	Electrical		-	-	**-**
17	Instrumentation		-	-	**-**
Subtotals			$507,000	$132,000	**$639,000**
Taxes	@	7.9%	$40,000	$10,000	**$50,000**
Subtotals			$547,000	$142,000	**$689,000**
Contractor OH&P	@	15%	$82,000	$21,000	**$103,000**
Subtotals			$629,000	$163,000	**$792,000**
Estimate Contingency	@	25%	$157,000	$41,000	**$198,000**
Subtotals			$786,000	$204,000	**$990,000**
Escalate to Midpt of Const.	@	1%	$8,000	$2,000	**$10,000**
Estimated Bid Price			$794,000	$206,000	**$1,000,000**
Engineering, Design & Const Mgmt	@	25%	$199,000	$52,000	**$100,000**
Easement Acquisition			$0	$0	**$0**
Total Estimate			**$993,000**	**$258,000**	**$1,100,000**

City of Kelso
Capital Improvement Project Description

PROJECT SUMMARY

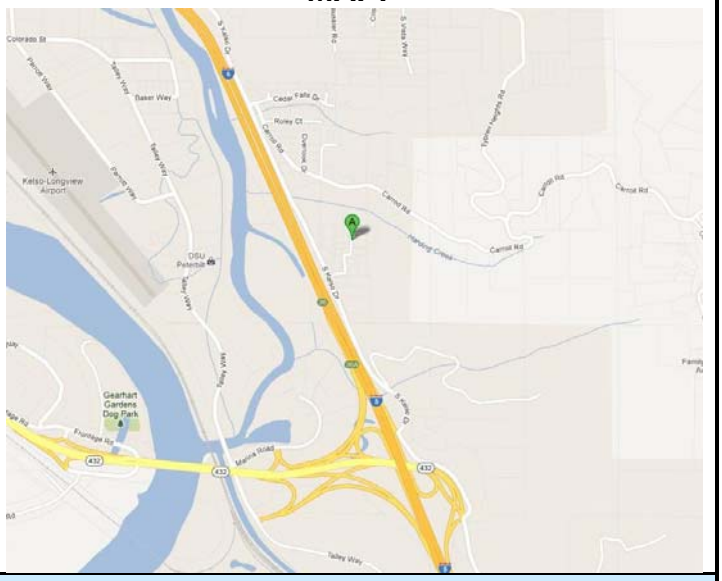
PROJECT TYPE: Paxton Reservoir Transmission Main

PROJECT NUMBER: T-03

ESTIMATED COST: $ 619,000

PROJECT DESCRIPTION: Replace existing 16" AC pipe with 1,500 LF of new 16" ductile iron pipe. Revise routing from Carolls pump station to Paxton reservoir.

MAP:



PROJECT BENEFIT: Project will eliminate current easement encroachment issues and improve transmission of water to the Paxton Reservoir.

COMMENTS: Alignment of the pipe will need to be determined with possible acquisition of easements.

SCHEDULE AND FUNDING PLAN

PROJECT COST

Land and Right of Way Acquisition	$ 50,000
Engineering, Design and Construction Management	$ 114,000
Construction	$ 455,000
Total	**$ 619,000**

Funding Source: Rate payers, debt financing

City of Kelso
Paxton Reservoir Transmission Main CIP T-03

Prepared by: Christopher Stoll Date Prepared: 29 January 2013

Estimate of Probable Cost - Summary by Division

DIV. No	ITEM DESCRIPTION		MATERIALS	INSTALLATION	TOTAL
1	General Requirements		$19,200	$7,200	**$26,400**
2	Site Work				
3	Concrete				
4	Masonry				
5	Metals				
6	Woods & Plastics				
7	Thermal & Moisture Protect.				
8	Doors and Windows				
9	Finishes				
10	Specialties				
11	Equipment				
12	Furnishings				
13	Special Construction				
14	Conveying Systems				
15	Mechanical		$192,000	$72,000	**$264,000**
16	Electrical				
17	Instrumentation				
Subtotals			$211,000	$79,000	**$290,000**
Taxes	@	7.9%	$17,000	$6,000	**$23,000**
Subtotals			$228,000	$85,000	**$313,000**
Contractor OH&P	@	15%	$34,000	$13,000	**$47,000**
Subtotals			$262,000	$98,000	**$360,000**
Estimate Contingency	@	25%	$66,000	$25,000	**$91,000**
Subtotals			$328,000	$123,000	**$451,000**
Escalate to Midpt of Const.	@	1%	$3,000	$1,000	**$4,000**
Estimated Bid Price			$331,000	$124,000	**$455,000**
Engineering, Design & Const Mgmt	@	25%	$83,000	$31,000	**$114,000**
Easement Acquisition			$0	$0	**$50,000**
Total Estimate			**$414,000**	**$155,000**	**$619,000**

City of Kelso
Capital Improvement Project Description

PROJECT SUMMARY

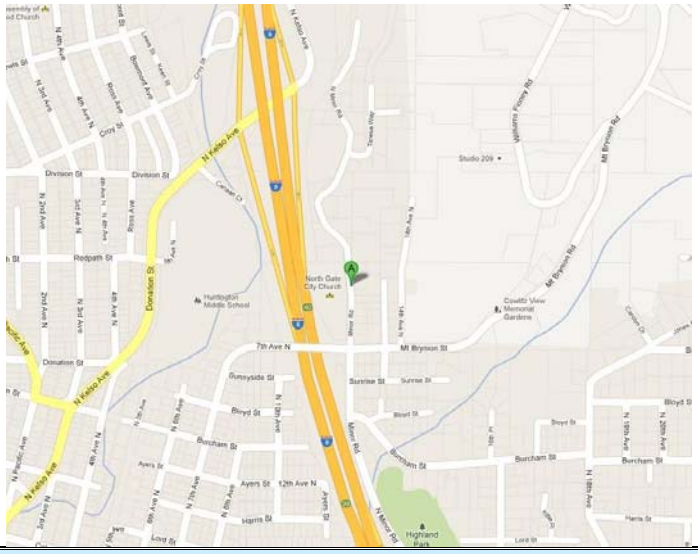
PROJECT TYPE: Minor Road Reservoir Replacement

PROJECT NUMBER: ST-02

ESTIMATED COST: $ 4,818,000

PROJECT DESCRIPTION: Demolish the existing two concrete reservoirs and construct a new 2 million gallon concrete reservoir.

MAP:



PROJECT BENEFIT: Address known problem area, replacement of critical infrastructure that has reached the end of it services life, decrease distribution system losses and increase reliability.

COMMENTS:

SCHEDULE AND FUNDING PLAN

PROJECT COST

Land and Right of Way Acquisition	$ 0
Engineering, Design and Construction Support	$ 800,000
Construction	$ 4,018,000
Total	**$ 4,818,000**

Funding Source: Rate payers, debt financing

City of Kelso
Minor Road Reservoir Replacement – CIP ST-02

Prepared by: Christopher Stoll Date Prepared: 29 January 2013

Estimate of Probable Cost - Summary by Division

DIV. No	ITEM DESCRIPTION		MATERIALS	INSTALLATION	TOTAL
1	General Requirements		-	-	-
2	Site Work		$104,062	$481,370	**$585,432**
3	Concrete		-	-	-
4	Masonry		-	-	-
5	Metals		-	-	-
6	Woods & Plastics		-	-	-
7	Thermal & Moisture Protect.		$7,700	$15,400	**$23,100**
8	Doors and Windows		-	-	-
9	Finishes		-	-	-
10	Specialties		-	-	-
11	Equipment		-	-	-
12	Furnishings		-	-	-
13	Special Construction		-	$1,625,000	**$1,625,000**
14	Conveying Systems		-	-	-
15	Mechanical		-	$150,000	**$150,000**
16	Electrical		$30,000	$30,000	**$60,000**
17	Instrumentation		$10,000	$20,000	**$30,000**
Subtotals			$152,000	$2,322,000	**$2,474,000**
Mobilization/Insurance @		8.0%	$12,000	$186,000	**$198,000**
Subtotals			$164,000	$2,508,000	**$2,672,000**
Taxes @		7.9%	$13,000	$198,000	**$211,000**
Subtotals			$177,000	$2,706,000	**$2,883,000**
Contractor OH&P @		15%	$27,000	$406,000	**$433,000**
Subtotals			$204,000	$3,112,000	**$3,316,000**
Estimate Contingency @		20%	$41,000	$622,000	**$663,000**
Subtotals			$245,000	$3,734,000	**$3,979,000**
Escalate to Midpt of Const. @		1%	$2,000	$37,000	**$39,000**
Estimated Bid Price			$247,000	$3,771,000	**$4,018,000**
Engineering and Design					**$500,000**
Construction Support (with support from City)					**$300,000**

Section 10: Financial Program

10.1 Introduction

The development of a financial plan is one of the most important aspects of the WSP. It establishes the total cost of providing water, outlines a utility improvement schedule, identifies potential funding sources, and evaluates adequacy of rates and fees. This section summarizes the financial status of the City and discusses financing of the capital improvement projects that were identified in Section 9: Capital Improvement Program. Although a rate analysis is not provided, the overall revenue stream is impacted by the proposed capital improvements identified. The financial plan is for the 6-year period from 2012 to 2018. The discussion for each purveyor includes:

- A 5-year summary of the Utility's financial status
- The current water rate structure
- Past methods used by the Utility to finance improvements
- A comparison of available funds to the recommended capital improvements.

The City currently maintains a joint Water and Sewer Fund, which also includes the City's WTP. The financial information pertaining to the water utility has been gathered for analysis in this plan. This section includes the recent combined financial history for the City's Water Utility and WTP.

10.2 Water Utility Financial Status

The City provided historical financial data for the period 2007-2011. Table 10-1 provides a summary for the Water Utility's range of operation (2007-2011). A summary of the City's Water Utility financial statements (2007-2011) is shown in Table 10-2. Revenues are generated form metered service fees, connection charges, miscellaneous fees, and non-operating revenues such as interest, grants and taxes. As shown by the historical data, the City's water utility is financially sound.

Table 10-1: Financial Range of Operation Water Utility Only

Item	Minimum	Maximum	Median
Total Operating Revenue	$2,275,524	$2,886,740	$2,568,099
Total Operating Expenses	$1,983,819	$2,323,711	$2,150,565
Net Income (Loss)	$318,384	$516,018	$390,236
Net Income (Loss) excluding depreciation	$670,021	$848,601	$743,338

Table 10-2: Water Utility Only Annual Financial Summary 2007-2011

Financial Summary -					
City of Kelso Water/Sewer Fund - Water Only	**2007**	**2008**	**2009**	**2010**	**2011**
Operating Revenue					
Charges for Services	$2,248,419	$2,293,348	$2,535,888	$2,643,123	$2,820,747
Miscellaneous Operating Revenues	$27,105	$27,979	$32,211	$43,776	$65,993
Total Operating Revenues	**$2,275,524**	**$2,321,327**	**$2,568,099**	**$2,686,899**	**$2,886,740**
Operating Expenses					
General Operations	$1,271,502	$1,218,672	$1,367,165	$1,405,964	$1,507,124
Maintenance	$66,343	$88,126	$99,310	$60,626	$96,261
Depreciation	$351,637	$369,848	$368,785	$332,583	$342,399
Taxes	$306,634	$307,173	$333,764	$351,392	$377,927
Total Operating Expenses	**$1,996,116**	**$1,983,819**	**$2,169,024**	**$2,150,565**	**$2,323,711**
Operating Income (Loss)	**$279,408**	**$337,508**	**$399,075**	**$536,334**	**$563,029**
Non-Operating Revenue (Expenses)					
Investment Earnings	$77,373	$52,671	$14,540	$5,370	$9,089
Intergovernmental	-	-	$7,435	-	$0
Other (capital recovery charges?)	$51,000	$43,319	$26,125	$23,628	$29,321
Asset Disposition	$0	-$1,339	$0	-$10,475	$0
Interest Expense	-$89,397	-$58,670	-$41,703	-$38,840	-$219,908
Total Non-Operating Revenue (Expenses)	**$38,976**	**$35,982**	**$6,397**	**-$20,317**	**-$181,498**
Income (Loss) before transfers					
Transfers in	$0	$0	$0	$0	$8,705
Transfers Out	$0	$0	$0	$0	$0
Net Income (Loss)	$318,384	$373,490	$405,472	$516,018	$390,236
Net Income excluding depreciation (Loss)	**$670,021**	**$743,338**	**$774,257**	**$848,601**	**$732,635**

10.3 Water Rate Structure

The City's rate structure consists of a fixed bi-monthly fee plus a unit rate for usage for the amount of water used. The City utilizes a uniform block rate structure which varies based on the size of meter. The City adopted a new rate ordinance (Ordinance 10-3733) on 7 September 2010 that establishes rate increase through 2014. Table 10-3 summarizes the City's residential/commercial rate structure for 2012. The City has separate rates for industrial users and private fire systems. A copy of the City's rate ordinance is provided in the appendices. The City also charges Capital Recovery fees as shown in Table 10-3.

Table 10-3: 2012 Water Rate Structure and Capital Recovery Fees

Purveyor	Service Area	Water Rate	Quantity (Cubic Feet)
Kelso	Inside City Limits	$19.21	Monthly Base Charge [(a)]
		$2.82/ 100 CF	Unit rate per 100 CF.
	Outside City Limits	$28.82	Monthly Base Charge [(a)]; 1.5 times the rate for Inside the City Limits.
		$4.2/ 100 CF	Unit rate per 100 CF; 1.5 times the rate for Inside the City Limits.

Meter Size (inches)	Minimum Bimonthly Charges as of 7 September 2010 [(b)]	Capital Recovery Fees
3/4 x 5/8	$ 19.21	$ 1,969
1	$ 39.68	$ 4,293
1-1/2	$ 74.31	$ 9,845
2	$ 115.50	$ 15,752
3	$ 225.58	$ 31,504
4	$ 349.73	$ 49,225
6	$1,107.75	$ 98,450
8	$1,539.87	$157,520
10	$2,215.54	$226,435

Notes:

(a) Monthly base charge is for ¾-inch and 5/8-inch meter. City's rate ordinance provides additional rate information for larger meters.

(b) Rates shown services within Corporate Limits; Rates outside Corporate Limits are 1.5 times inside rates.

10.4 Historical Capital Improvement Finance Methods

The City funds improvements through a combination of:

- Cash Reserves – The City has an equipment depreciation fund to build reserves for replacing equipment.
- Developer Financing - Developer financing is used for capital improvements that are installed by developers as mitigation of impacts to the City water system. Developer financing may include full or partial funding for reservoirs, pump stations, and water mains that serve the particular development.
- Revenue Bonds - Major capital improvements may be financed by issuance of revenue bonds. Revenue bond debt service is paid from monthly utility rates.
- Utility Local Improvement Districts (ULID) - These are typically used when property owners want to install water mains in an area where there is no service. In these instances, ULID bonds are paid off by assessments levied against all properties benefited by the improvements.
- Capital Recovery Charge – Fees are assessed for new water services, based upon meter size. These charges recover the cost of connecting the new customer to the utility and are sometimes referred to as connection charges.
- Public Works Board Loans – Public Works Trust Fund (PWTF) and Drinking Water State Revolving Fund (DWSRF) loans have previously been used to finance large capital improvement project.

10.5 Revenue Analysis

A revenue analysis was performed to assess the City's ability to finance the projects listed in the CIP developed in Section 9: Capital Improvement Program. The historical data provided by the City was analyzed to determine revenue and expense trends. These trends were then used to project the revenues and expenses though year 2018. The results of the revenue analysis are shown in Table 10-4.

Table 10-4: Kelso – Revenue Analysis

CITY OF KELSO - WATER DIVISION
PROJECTED OPERATING AND NON-OPERATING REVENUES AND EXPENSES
INCLUDING THE PROJECTED CAPITAL IMPROVEMENT PROGRAM

Sources and Uses of Funds	Projected 2012	2013	2014	2015	2016	2017
Operating Revenues (a)						
Charges for Services	$2,989,992	$3,214,241	$3,455,309	$3,714,457	$3,993,042	$4,292,520
Miscellaneous Operating Revenues	$69,953	$74,150	$78,599	$83,315	$88,314	$93,612
Total Operating Revenues	**$3,059,944**	**$3,288,391**	**$3,533,908**	**$3,797,772**	**$4,081,355**	**$4,386,132**
Operating Expenses						
General Operations (b)	$1,567,409	$1,630,105	$1,695,310	$1,763,122	$1,833,647	$1,906,993
Maintenance (c)	$102,037	$108,159	$114,648	$121,527	$128,819	$136,548
Depreciation (d)	$353,000	$353,000	$353,000	$353,000	$353,000	$353,000
Taxes (e)	$397,793	$427,491	$459,408	$493,710	$530,576	$570,197
Total Operating Expenses	**$2,420,238**	**$2,518,755**	**$2,622,366**	**$2,731,360**	**$2,846,042**	**$2,966,738**
Net Operating Income	**$639,706**	**$769,636**	**$911,542**	**$1,066,413**	**$1,235,313**	**$1,419,394**
Net Operating Income as % of Total Operating Revenues	**20.91%**	**23.40%**	**25.79%**	**28.08%**	**30.27%**	**32.36%**
Non-Operating Revenue (f)						
Investment Earnings	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000
Other (capital recovery charges)	$30,000	$30,000	$30,000	$30,000	$30,000	$30,000
New Loan Proceeds				$4,500,000		
Total Non-Operating Revenue	**$30,000**	**$30,000**	**$30,000**	**$4,530,000**	**$30,000**	**$30,000**
Non-Operating Expense (g)						
Debt Service						
2008 Revenue Bond - Principal	$85,000	$90,000	$95,000	$95,000	$100,000	$105,000
2008 revenue Bond - Interest	$25,620	$22,403	$18,863	$15,015	$10,920	$6,615
2008 Revenue Bond Total	$110,620	$112,403	$113,863	$110,015	$110,920	$111,615
2010 Revenue Bond - Principal	$100,000	$100,000	$100,000	$100,000	$100,000	$100,000
2010 Revenue Bond - Interest	$157,606	$156,256	$154,256	$151,756	$149,256	$146,256
2010 Revenue Bond Total	$257,606	$256,256	$254,256	$251,756	$249,256	$246,256
1999 SRF - Principal	$107,914	$107,914	$107,914	$107,914	$107,914	$107,914
1999 SRF - Interest	$24,281	$21,583	$18,885	$16,187	$13,489	$10,791
1999 SRF Total	$132,195	$129,497	$126,799	$124,101	$121,403	$118,705
2001 SRF - Principal	$79,592	$79,592	$79,592	$79,592	$79,592	$79,592
2001 SRF - Interest	$13,133	$11,939	$10,745	$9,551	$8,357	$7,163
2001 SRF Total	$92,725	$91,531	$90,337	$89,143	$87,949	$86,755
Total Bond/Loan Payments	$593,146	$589,687	$585,255	$575,015	$569,528	$563,331
Estimated New Debt Service Payments (h)						
New Loan - Principal & Interest		$0	$0	$0	$236,999	$236,999
Total Non-Operating Expense	**$593,146**	**$589,687**	**$585,255**	**$575,015**	**$806,527**	**$800,330**
Total Available for Capital Expenditures	**$76,560**	**$209,949**	**$356,287**	**$5,021,398**	**$458,787**	**$649,065**
Total Capital Expenditures (i)	**$495,000**	**$657,000**	**$825,000**	**$3,080,000**	**$2,530,000**	**$999,000**
Balance of Funds	**(418,440)**	**(447,051)**	**(468,713)**	**1,941,398**	**(2,071,213)**	**(349,935)**
Beginning Cash and Equivalents (j)	**2,007,539**	**1,589,099**	**1,142,048**	**673,336**	**2,614,734**	**543,520**
Ending Cash and Equivalents (k)	**1,589,099**	**1,142,048**	**673,336**	**2,614,734**	**543,520**	**193,585**
Basis of Projection - Percent Increase per Year in Costs based on historic trends						
Operating Revenues	6.0%	7.5%	7.5%	7.5%	7.5%	7.5%
General Operations	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%
Maintenance	6.0%	6.0%	6.0%	6.0%	6.0%	6.0%
Taxes	13.0%	13.0%	13.0%	13.0%	13.0%	13.0%

Source: City of Kelso, Income Statement - Actual and Budgeted Financial Summary, Water Division.

(a) Operating revenues are projected and escalated based on a anticipated rate increase and historic trends.
(b) General operations is projected based on an annual 4.0% increase in expenses, developed based on historic trend.
(c) Maintenance expenses are escalated at 6.0% based on historical and projected expenses.
(d) Depreciation basis: Straight Line, historic trends.
(e) Taxes are projected at 13.0% of annual operating revenue, based on historic trend.
(f) Capital Recovery charges and Interest Revenue are estimated to be constant during the planning period; based on historic trends.
(g) Source: City of Kelso, Debt Service Schedule.
(h) Assumes City will obtain PWTF or SRF funding for AMI and Minor Road Reservoir projects.
(i) Refer to Chapter 9 of this report for the City's draft CIP schedule.
(j) Beginning cash and equivalents balance is comprised of the portion of the City's Water/Sewer Fund and Water/Sewer Capital Reserve Fund, attributable to the water system. The 2012 beginning cash was estimated based on the 2011 year-end financial information provided by City and includes proceeds from ARRA Bond Reallocation proceeds. Allocation: Water Fund - $1,382,912; Water Capital Reserve Fund - $624,627.
(k) Ending Cash and Equivalents equals to the balance of the 'Beginning Cash and Equivalents' and the 'Balance of Funds'.

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10.6 Sources of Funding

In general, the City prefers to finance capital improvement projects on a "pay-as-you-go" basis. However, large capital projects generally require debt financing. The most common financing instruments available to municipalities are discussed as follows.

General Obligation and Revenue Bonds – Revenue bonds use the revenues of the issuing utility to secure the bond. The debt obligation does not extend to other City revenue sources. General Obligation bonds are secured based on the municipality's ability to repay the debt by generating tax revenues. There are bonding limits for General Obligation bonds based on assessed property value in the City and whether or not the bond is voter approved. Revenue bonds do not have a statutory bonding limit, only the utility's ability to generate sufficient revenue to repay the debt.

Washington State Public Works Board – Established in 1985 by the Washington Legislature to provide financial assistance to local governments for public works projects; the Board manages a number of loan programs. Chief among these are PWTF and DWSRF. Eligible projects include major capital construction projects, planning, rehabilitation and infrastructure replacement, and funds for emergency repairs. PWTF may fund projects up to $15 million per jurisdiction annually, with interest rates ranging from 0.0 percent to 2.0 percent and repayment periods of up to 20 or 30 years. DWSRF-funded projects have slightly different interest rates, 1.0 percent to 1.5 percent, with up to 50 percent loan forgiveness for qualifying communities and are limited to $12 million. More complete information pertaining to the Washington State Public Works Board can be found at www.pwb.wa.gov.

Drinking Water State Revolving Fund (DWSRF) - The DWSRF is the only fund strictly dedicated to drinking water infrastructure design and construction projects. DWSRF offers interest rates between 0 percent and 1.5 percent and terms of 20 or 30 years, all based on the City's proven financial need. The current funding limits are up to $6 million per City project or up to $12 million for jointly-owned projects.

System Development Charges (SDC) - Utilities experiencing substantial growth need to increase capacity without penalizing existing ratepayers. To do so, utilities often look to new customers to pay both the cost of existing facilities and some sort of capital contribution charge. This type of capital contribution is referred to as a System Development Charge or SDC. The City utilizes SDCs in the form of a Capital Recovery Fee for the water system.

Community Block Development Grant (CDBG) Fund - CDBG offers planning and design/construction grant funding for infrastructure. This grant fund is available to districts that benefit "low to moderate income" areas. The City has conducted a CDBG income survey to prove that their service area qualifies. The current funding limits for planning grants are up to $25,000 for a single entity or $40,000 for multiple entities. Design and construction projects may receive up to $1 million for projects costing less than $10 million, and up to $1.5 million for projects more than $10 million.

Community Economic Revitalization Board (CERB) - CERB offers planning only grant funding based on the economic development potential of a specific project. The City would need to

prove that a water infrastructure project is needed for a private sector industry development in the community. Grant funding limits are currently $25,000.

Developer Participation - The Developer Extension is a requirement that a developer install onsite and sometimes offsite improvements as a condition of extending service. These are in addition to the SDC required and must be built to City standards. Part of the agreement between the City and the developer for the developer to extend service might include a latecomer agreement, resulting in a latecomer charge to new connections to the developer extension.

Utility Local Improvement District (ULID) Financing - A ULID is established to provide for the construction of infrastructure improvements to benefit the properties within the City boundaries. This process allows the City to use long-term tax exempt financing to install infrastructure improvements to benefit properties within their boundaries. ULIDs assess the benefited properties based on the special benefit received by the construction of specific facilities. In addition, utility revenues are also pledged to the prepayment of the ULID debt. Most often used for local facilities, some ULIDs also recover related general facilities costs. Substantial legal and procedural requirements can make this a relatively expensive process, and there are mechanisms by which a ULID can be rejected.

10.7 Conclusions and Recommendations

The most significant problems facing the City include identifying and developing a reliable additional source of supply to meet future growth, the replacement of the Minor Road Reservoirs, providing redundant connections between the City's primary storage facilities and the replacement of undersized and deteriorating distribution system piping. It is the recommendation of this WSP that the City continue their efforts to identify an additional source of supply, replace the aging Minor Road reservoirs, establish better connectivity between the WTP, Minor Road and Paxton Road reservoirs, and implement their new annual pipe replacement program. Financial projections include the procurement of additional debt financing to fund the larger capital improvement projects, such as the Minor Road Reservoir replacement. The City plans to complete a rate study in 2013 to determine if the current rates are appropriate based on the City's current cost of service and are sufficient to offset the need for additional debt funding. It is further recommended that the City update their 2004 Emergency Response Plan to include current contact information and procedures.

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