January 2011

Kelso
General Sewer and Facilities Plan

PREPARED BY:

427.1017

Gibbs & Olson, Inc.

CERTIFICATE OF ENGINEER

KELSO
GENERAL SEWER and FACILITIES PLAN

January 2011

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

Mike Marshall, P.E
Project Manager
Gibbs & Olson, Inc.

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SECTION I

SUMMARY AND RECOMMENDATIONS

PURPOSE OF THIS GENERAL SEWER AND FACILITIES PLAN

This report is intended to serve as a General Sewer and Facilities Plan (GSP/FP) for the City of Kelso, Washington. This GSP/FP:

1) establishes the sewer service area and the physical and environmental conditions within the service area,
2) develops estimates of population and wasteloads for the service area that must be treated,
3) presents an inventory of the existing collection system and identifies future interceptors and pump stations that will be required to serve the planning area,
4) evaluates the performance and adequacy of the Three Rivers Regional Wastewater Plant (TRRWP) to handle sewage from Kelso,
5) evaluates the need for an Infiltration and Inflow (I/I) removal program,
6) presents an evaluation of the existing collection system and makes recommendations for required improvements to alleviate surcharging sewer mains, as well as required pump station upgrades.

A capacity evaluation of the Three Rivers Regional Wastewater Plant (TRRWP) indicates that sufficient capacity exists to accept the sewage load generated in Kelso and still meet all applicable treatment and Water Quality Standards. This plant has recently completed a major facility upgrade increasing liquid stream capacity for wet weather flows up to 26 MGD for a Maximum Monthly Average Daily (MMAD) flow and 62.4 MGD for a peak day flow as stated in the DOE Fact Sheet for the facility. The plant is comprised of a series of clarifiers, aeration basins, activated sludge processes and chlorine contact basins. The plant has also just completed upgrades to the solids processing to increase bio-solids treatment capacity and enable the facility to meet more stringent bio-solids reclamation standards. The new bio-solids treatment process treats up to 1,560 dry pounds of solids per hour to Class A bio-solids treatment standards.

FUNDING RECOMMENDATIONS

The project cost for the recommended collection system improvements including I/I reduction projects for Kelso is estimated at approximately $12.3 million (2010 Dollars). Projects of this magnitude are difficult to implement without financial assistance from state and/or federal funding agencies. As such, the City will need to seek grant and low-to-no-interest loan funding to implement this project. In order to get the best funding package possible, this GSP/FP recommends the following:

- The City should pursue a Centennial Clean Water Fund grant. If the City is not successful, the Base Revolving Fund Loan, Community Development Block Grant General Purpose Grant and Public Works Trust Fund Loan should be pursued.
- The City should consider raising sewer rates to the DOE hardship level for residential service to cover future capital improvements. The sewer rate increase will assist the City in getting the best loan and grant terms and it will raise funds for any local match that may be needed.

SUMMARY OF GSP/FP

The City of Kelso is located in Cowlitz County in Southwest Washington (see ***Figure III-1***). The City has an existing sewer service area of approximately 3,558 acres (see ***Figure III-2***) serving an approximate year 2009 population of 11,840.

In 1976, a new regional wastewater treatment facility, Three Rivers Regional Wastewater Plant (TRRWP), was constructed on Fibre Way to replace the City of Kelso Wastewater Treatment Plant and the Longview primary treatment plant. The Three Rivers Regional Wastewater Plant (TRRWP) consists of a headworks, bypass bar screen, primary clarification, aeration basins, secondary clarifiers and chlorine disinfection and dechlorination. In 2003 and 2005 the facility was upgraded to allow an increase in the MMAD flow treatment capacity from 15 MGD to 26 MGD, ensuring continued compliance with NPDES Permit limitations. The facility serves a portion of West Longview, East Longview, Beacon Hill Sewer District (BHSD), Kelso and portions of unincorporated Cowlitz County. Wastewater for a portion of West Longview is currently treated by a four cell lagoon system. The West Longview lagoon Plant is scheduled to be abandoned in 2011 with the flow being diverted to the TRRWP. The Three Rivers Regional Wastewater Plant (TRRWP) is owned and operated by the Three Rivers Regional Wastewater Authority (TRRWA).

Existing and future populations and wasteloads are evaluated in ***Section V*** of this Plan. The City of Kelso has projected a population growth rate of 1% annually. The future populations and wasteload estimates are summarized in ***Section V.***

The Three Rivers Regional Wastewater Plant (TRRWP) serves a number of significant industrial and commercial dischargers to the wastewater collection system. The DOE issues and manages the industrial user pre-treatment permit process in cooperation with the Three Rivers Regional Wastewater Authority (TRRWA). The Three Rivers Regional Wastewater Authority (TRRWA) has excess treatment capacity available to local municipalities, industries and commercial entities. The Three Rivers Regional Wastewater Authority (TRRWA) staff actively track and manage the facility to ensure adequate treatment capacity and to provide a means to manage significant industrial or commercial discharges. An evaluation (see ***Section VI***) was performed to determine whether the Three Rivers Regional Wastewater Plant (TRRWP) would have sufficient capacity for area growth through the year 2030. The evaluation shows that the Three Rivers Regional Wastewater Plant (TRRWP) does possess sufficient capacity to meet DOE Water Quality Standards through the year 2030.

The Kelso sewage collection system contains approximately 343,000 feet of interceptor and main sewer pipe (refer to ***Section VII***). The City has historically experienced problems due to infiltration and inflow (I/I). Since 1987, Longview, Kelso and BHSD have been actively engaged in I/I reduction programs. As new collection systems are extended into the future service areas, modern piping methods using PVC and HDPE lines will reduce the proportion of I/I to the area served.

The future sewer areas will require collection system extensions summarized below (see ***Figure VII-5***):

Cedar Falls Road Extension: This area is approximately 144 acres and will most likely require approximately 4,100 feet of 8-inch line connected to the existing 8-inch line at Manhole K14:39A.

Three Rivers Golf Course Extension: This area is potentially 110 acres. Approximately 5,100 feet of sewer pipe will be required to serve this area: 1,800 feet will be 15 inch sewer pipe; 1,700 feet will be 10 inch; and 1,600 feet of 8 inch pipe. This extension will either connect directly into the Kelso Main Pump Station or just upstream of it.

Talley Way Extension: This area is approximately 80 acres. The main service route is not clear since the properties are completely undeveloped; however for the purposes of this Plan, it is assumed that approximately 3,400 feet of 8-inch gravity line and a new sewer pump station rated at 400 GPM would be needed to serve this area. In addition, approximately 1,700 feet of 6-inch forcemain will be required to pump the flows across State Route 432 and the Coweeman River and connect to the existing 10-inch sewer line at Manhole K17:55.

Rocky Point Extension: This area is potentially 169 acres. The extension will connect to Manhole K1:141. In total, approximately 5,900 feet of 15 inch sewer pipe and 1,300 feet of 8 inch sewer pipe will be required to serve the area.

Mt. Brynion Road Extension: The increased service area is potentially 148 acres. In total, approximately 4,000 feet of 8 inch sewer pipe will be required to serve the area.

East Allen Street Extension: The increased service area is potentially 405 acres. A pump station rated at approximately 900 GPM and 700 feet of 10-inch forcemain will be required to pump uphill to Manhole K10:31. Approximately 4,600 feet of 15-inch sewer pipe will be required to serve the area.

Valley View Extension: This extension could potentially serve 137 acres. The extension consists of 4,600 feet of 8-inch sewer pipe. Two pump stations rated at approximately 230 GPM and 90 GPM will also be required with a 4-inch forcemain at 1,800 feet and a 3-inch forcemain at 400 feet, respectively.

Walnut Street Extension: This extension could potentially serve 28 acres. The extension consists of 1,200 feet of 8-inch sewer pipe.

COLLECTION SYSTEM IMPROVEMENTS

Overall, the Kelso collection system is in good condition. However, there are several improvements recommended to alleviate collection system surcharging and upgrade pump stations to provide needed capacity.

- **Manasco Drive Interceptor**: This major sewer interceptor is undersized and requires 1400 feet of 36-inch pipe and 1000 feet of 30-inch pipe to replace the undersized lines. The estimated project cost is $2.7 million.
- **Allen Street Sewer Upgrade**: This sewer line is undersized and requires an upgrade to 12-inch diameter piping from 10-inch for approximately 1,800 feet. The estimated project cost is $0.95 million.
- **Donation Street Pump Station**: This pump station needs to be replaced to increase flow capacity to be able to handle storm flows and to address electrical safety and layout issues. Estimated project cost is $2.6 million.

I/I REDUCTION PROGRAM

Although most basins in Kelso do not have excessive I/I, there is one remaining basin that still has excessive I/I which is recommended for rehabilitation. The worst basin in terms of I/I is North Kelso '93 Flow Monitoring Basin K-1. The City has already replaced a large portion of faulty pipe in this basin and is currently seeking $1.5 million to fund Phase V of VI for replacement of 2665 feet of pipe along with manholes in this basin. After this work is complete, only Phase VI of Basin K-1 work still needs to be replaced from the 1993 study.

Table VII-11 provides an updated planning level cost estimate for the rehabilitation of this basin for this planning period. Phases I-IV in basin K1 have already been completed.

SECTION II
PURPOSE AND APPROACH

PROJECT PURPOSE

The purpose of this General Sewer and Facilities Plan (GSP/FP) is to guide the City of Kelso in providing sewer service through the year 2030. The information presented in this Plan is intended to be an update to the ***General Sewer Plan for the Longview-Kelso Urban Area*** dated February 1997 and prepared by the engineering firm KCM. This Plan has been prepared to comply with current Washington Department of Ecology (DOE) regulations and guidelines in the Washington Administrative Code (WAC) 173-240 and the Revised Code of Washington (RCW) 90.48.

APPROACH

A primary objective of sewer system planning is to ensure adequate wastewater treatment and conveyance facilities are provided to meet the community's needs, to ensure such facilities achieve required treatment standards and water quality standards to minimize adverse impacts on the environment, and to protect the health and safety of the community. An additional priority is to accomplish these goals in an economical and efficient manner. Minimum requirements for the management of wastewater collection and treatment facilities are set forth by the United States Environmental Protection Agency (EPA) and Washington State Department of Ecology (DOE). The primary instruments of these requirements are the National Pollution Discharge Elimination System (NPDES) Permit, and the Water Quality Standards (WAC 173-201A) for surface waters of the State of Washington. Kelso does not have its own wastewater treatment plant and sends all of its raw wastewater to the Three Rivers Regional Wastewater Authority's (TRRWA) treatment plant for processing and discharge to the Columbia River. The Three Rivers Regional Wastewater Authority (TRRWA) plant is co-owned by Longview, Kelso, Beacon Hill Sewer District and Cowlitz County. The current NPDES permit for the Three Rivers Regional Wastewater Plant (TRRWP) is included in ***Appendix A***. *The 2005 Revised and Restated Interlocal Agreement among City of Kelso, City of Longview, Beacon Hill Sewer District, and*

Cowlitz County for Wastewater Treatment and Disposal is included in ***Appendix B***. Since wastewater from Kelso is treated at the Three Rivers Regional Wastewater Plant (TRRWP), which was recently upgraded and expanded to meet future needs, this GSP/FP will primarily address issues related to collection and conveyance of wastewater within Kelso. It will also address Three Rivers Regional Wastewater Authority (TRRWA) NPDES permit requirements specific to Kelso.

The approach taken in preparation of this Plan is to:

1. Define environmental and physical conditions in the present and future planning area.
2. Prepare an inventory of the City's existing wastewater collection and conveyance system.
3. Summarize the Three Rivers Regional Wastewater Authority (TRRWA)'s compliance with its NPDES Permit.
   3a. Summarize Kelso's compliance with the Three Rivers Regional Wastewater Authority (TRRWA)'s NPDES permit.
4. Develop population, flow, and waste load projections for which wastewater facilities must be provided.
5. Estimate costs for recommended improvements to the existing and future sewer systems to plan for future growth.
6. Evaluate the need to remove infiltration and inflow (I/I) from the system and identify improvements to the existing sewer lines and pump stations that are needed to correct deficiencies and increase capacity.
7. Evaluate financial options for funding the recommended improvements and estimate the impact on sewer service rates.
8. Develop a schedule for implementing the recommended improvements.

The following planning documents were referenced in the development of this document:

1. Water System Plan for Longview-Kelso Urban Area, 2005.
2. City of Longview General Sewer and Facilities Plan, 2008.
3. Cowlitz Sewer Operating Board, System Improvements Project Facility Plan / Pre-Design Report, 1999.
4. General Sewer Plan for the Longview-Kelso Urban Area, Final Report, 1997.
5. Final Flow Monitoring Study for the Longview/Kelso/Beacon Hill Sewer District Sewer Rehabilitation Program, 1993.

It is intended that upon completion of the document, this GSP/FP will be reviewed and approved by the City, DOE and DOH.

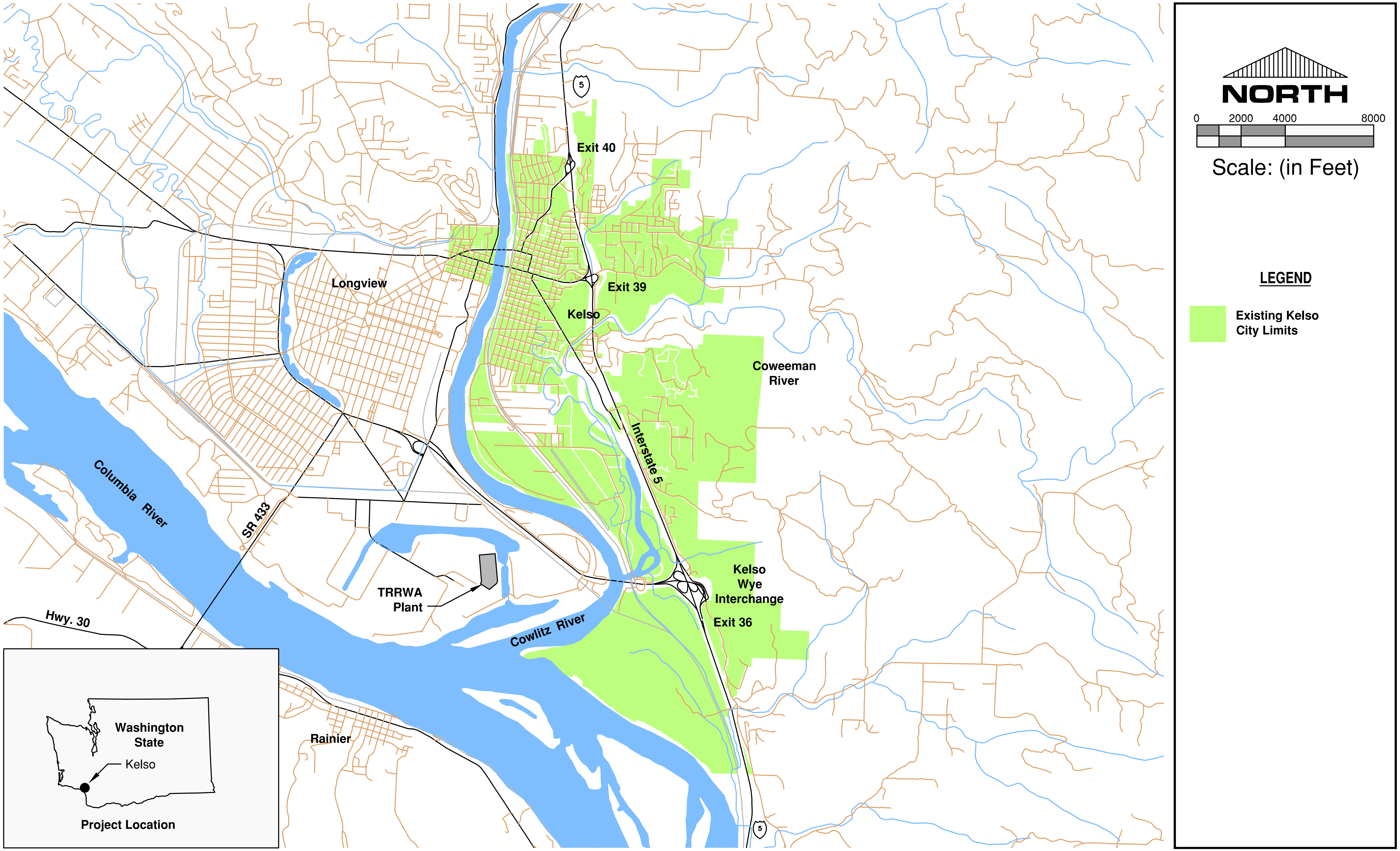
SECTION III
CONDITIONS IN THE PLANNING AREA

INTRODUCTION

The City of Kelso is located at the confluence of the Cowlitz, Coweeman and Columbia Rivers in the southwest portion of the State of Washington, see the vicinity map in ***Figure III-1***. The City was initially inhabited by Native Americans from the Cowlitz tribe. The present City of Kelso was founded by Peter Crawford of Kelso, Scotland in 1884. The June 2008 Zoning Map on the City of Kelso's website shows that Kelso is primarily comprised of medium-density residential with pockets of commercial and high-density residential land use throughout most of the City with large sections of industrial and low density residential land use in the southern portion.

Three Rivers Regional Wastewater Authority: In 1972, Cowlitz County, the Cities of Longview and Kelso and the Beacon Hill Sewer District (BHSD), entered into an agreement for regional treatment of wastewater. The Cowlitz Sewer Operating Board (CSOB) was formed to oversee and manage the planning, design, construction, and operation of a new wastewater collection and treatment system. In 2005, the CSOB was renamed the Three Rivers Regional Wastewater Authority (TRRWA). The Three Rivers Regional Wastewater Plant (TRRWP) is administered by Mr. Duane Leaf, Plant Superintendent, and can be contacted at the following address and telephone number:

Three Rivers Regional Wastewater Authority
207 Fourth Avenue North
Kelso, Washington 98626
360-577-2040



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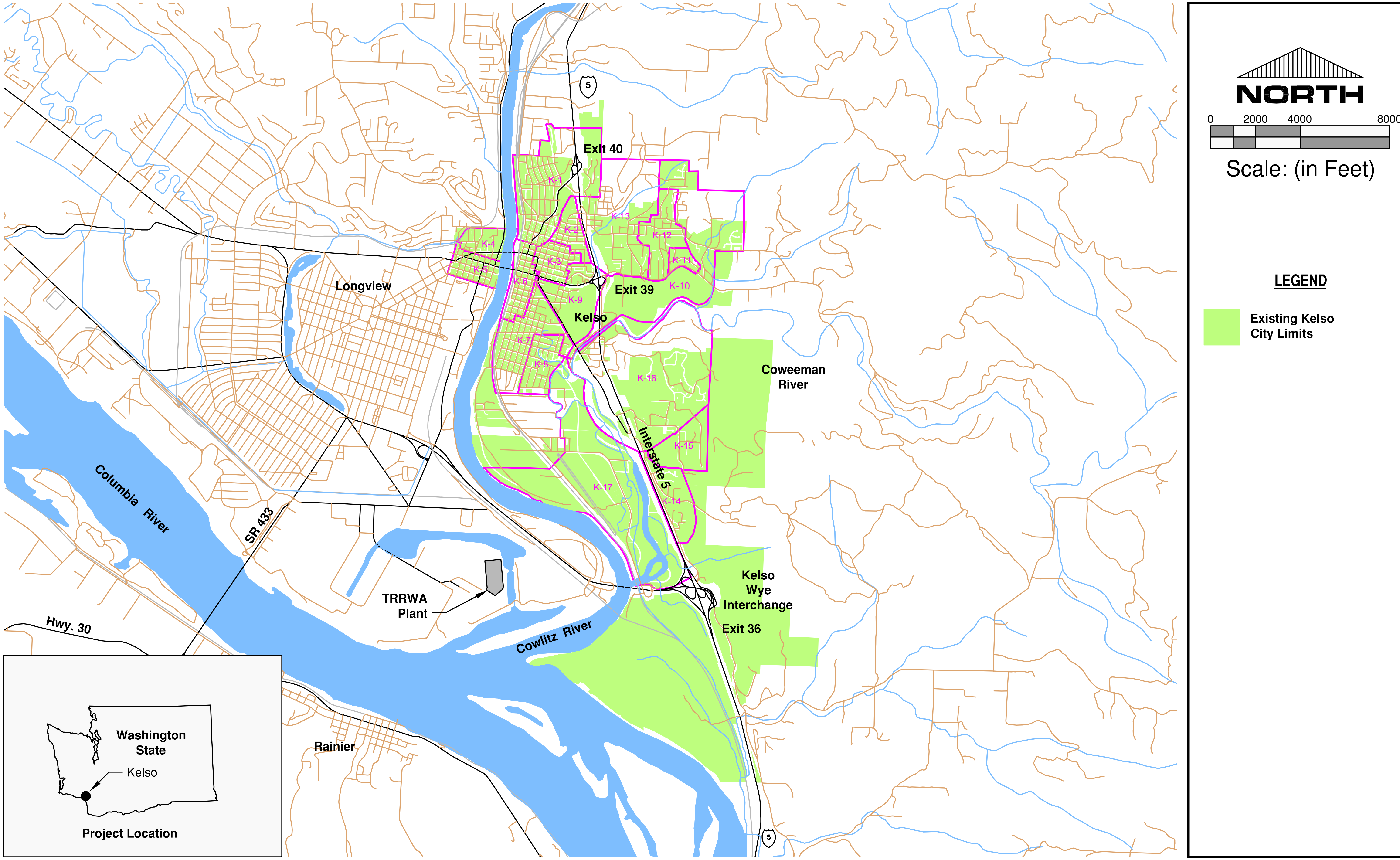
City of Kelso
General Sewer and Facilities Plan
Vicinity Map
Figure III-1

Three Rivers Regional Wastewater Plant: In 1976, a new regional wastewater treatment facility, Cowlitz Water Pollution Control Plant (CWPCP), was constructed on Fibre Way to replace the City of Kelso Wastewater Treatment Plant and the Longview primary treatment plant. The CWPCP treatment train consisted of a headworks, bypass bar screen, two primary clarifiers, four aeration basins, two secondary clarifiers, chlorination facilities and dechlorination. The CWPCP blended primary and secondary solids, used a belt press to remove water and the resultant cake was incinerated onsite. Later, the cake was composted and stockpiled as top coat closure amendment for the Cowlitz County Landfill. In 2005 the CWPCP was renamed the Three Rivers Regional Wastewater Plant (TRRWP).

In 2003 and 2005 the facility was upgraded to allow an increase in the Maximum Monthly Average Daily (MMAD) flow treatment capacity from 15 Million Gallons per Day (MGD) to 26 MGD and the peak day capacity from 27 MGD to 62.4 MGD thus ensuring continued compliance with NPDES Permit limitations. In 2009 the solids treatment process was replaced with an RDP solids treatment process that uses lime and heat to produce a Class A biosolids. The facility serves east Longview, Beacon Hill Sewer District (BHSD), Kelso and portions of unincorporated Cowlitz County. The Three Rivers Regional Wastewater Plant (TRRWP) is owned and operated by the Three Rivers Regional Wastewater Authority (TRRWA). Wastewater for a portion of West Longview is currently treated by a four-cell lagoon system. The West Longview Lagoon plant is scheduled to be abandoned in 2011 with the flow diverted to the Three Rivers Regional Wastewater Plant (TRRWP).

KELSO SEWER SERVICE AREA

The Kelso Service Area consists of approximately 3,558 acres and currently serves approximately 3,935 connections. Some properties within the service area continue to use residential on-site disposal systems. On-site sewer systems will be phased out as development proceeds and sewers become available. ***Figure III-2*** shows the 17 sewer basin boundaries that comprise the Kelso sewer service area.



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City of Kelso
General Sewer and Facilities Plan
Existing Sewer Service Areas Map
Figure III-2

PAST PLANNING EFFORTS

General Sewer/Facility Plan: The engineering firm of KCM prepared the final version of the **General Sewer Plan for the Longview-Kelso Urban Area** in February of 1997. Substantial improvements to increase the capacity of both the Three Rivers Regional Wastewater Plant (TRRWP) and the regional interceptor sewer were recommended in that plan and those improvements have been implemented. The GSP/FP also identified several sewer extensions to serve undeveloped areas. Those extensions were recommended to be constructed over time by developers as needed for development. The GSP/FP also identified several basins thought to be responsible for a considerable amount of I/I. An I/I removal program was presented and is discussed in greater detail in Section VIII herein.

ECONOMY

Over the past three decades, Cowlitz County employment trends have continued to be dominated by a downturn in the forest industry coupled with the recent broader decline in manufacturing activity that has impacted communities across the nation, particularly since 2000. In 2003, the county encompassed roughly 39,500 jobs, an increase of just over 2,100 jobs since 1990. This equates to a 5.6% growth rate over this 13 year period which is about one-fifth of the 24% job growth experienced by the State of Washington as a whole during the same time period. A summary of Cowlitz County and State Unemployment Rates are presented in ***Table III-1***.

Table III-1
Summary of State and Cowlitz Co. Unemployment Data

Year	State Data	Cowlitz Co. Data	Difference Δ	Year	State Data	Cowlitz Co. Data	Difference Δ
	Annual Average	Annual Average	(Cowlitz - State)		Annual Average	Annual Average	(Cowlitz - State)
2009	8.7	13.2	4.5	**2000**	5.0	6.4	1.4
2008	5.5	8.6	3.1	**1999**	4.8	6.6	1.8
2007	4.5	6.3	1.8	**1998**	4.8	6.7	1.9
2006	4.9	6.5	1.6	**1997**	4.9	6.5	1.6
2005	5.5	7.3	1.8	**1996**	5.9	7.4	1.5
2004	6.2	8.5	2.3	**1995**	6.3	7.3	1.0
2003	7.4	9.9	2.5	**1994**	6.5	8.5	2.0
2002	7.3	10.6	3.3	**1993**	7.1	10.3	3.2
2001	6.2	9.4	3.2				

The five largest employment sectors within Cowlitz County are presented in ***Table III-2***. These five sectors accounted for 70% of the county's employment in 2009. All sectors with 10% or more of the county's total employment were included in the table.

Government (including federal, state and local) represents the county's single largest employment sector in 2009, accounting for 28% of all jobs. Within the time period reported, the manufacturing sector fell to the number two position within the county's job base, with only 17% of countywide jobs in 2009 (down from 24% in 1990). Cowlitz County continues to support a slightly stronger concentration of manufacturing jobs than does the state as a whole (17% versus 16%). With the exception of education and health services, no single sector countywide reported concentrated gains to offset the county's loss of manufacturing jobs.

The sector which experienced the largest countywide job gains during this 13 year period is education and health services, adding close to 2,300 jobs. The government sector reported growth of approximately 1,150 jobs and a third tier of sectors reporting employment growth – each adding about 500 to 600 jobs – includes leisure and hospitality and retail trade. The remaining growth sectors are broadly distributed and include both commercial and industrial sector jobs such as "professional and scientific" and "wholesale trade".

Table III-2[1]
Dominant Industrial Sectors (1990, 2009)

	Cowlitz, 1990		**Cowlitz, 2009**		**State, 2009**	
Sector	**Number**	**Distribution**	**Number**	**Distribution**	**Number**	**Distribution**
Total government	8,752	23%	9,900	28%	530,100	20%
Manufacturing	8,879	24%	6,200	17%	444,000	16%
Education & Health Services	2,939	8%	5,200	15%	367,300	13%
Retail trade	3,826	10%	4,300	12%	314,700	11%
Leisure & Hospitality	2,649	7%	3,300	9%	286,900	10%

[1] Source: Washington Department of Employment Security

LAND-USE

The City of Kelso presently encompasses approximately 8.04 square miles of which about 69% is served by their sanitary sewer system. The present land use composition for the City of Kelso is comprised of:

- transportation, communication, and utility areas
- west Kelso commercial
- single family residential homes
- multifamily
- commercial land
- industrial land
- vacant lands

Figure III-3 shows the zoning map for Kelso

Figure III-3
Land Use Zoning

OTHER SERVICES

Utilities provided within the City include water and sewer. Transportation is provided by the Community Urban Bus Service (CUBS), managed by the Cowlitz Transit Authority. Stormwater is provided by the Consolidated Diking Improvement District Number 3, the Drainage Improvement District Number 1 and the City of Kelso. Telephone service is provided by Qwest and electrical service is provided by PUD of Cowlitz County. Cable television service is provided by Comcast. Fire protection is provided by Cowlitz 2 Fire & Rescue and police protection is provided by the Kelso Police Department. Regular garbage collection is contracted to Waste Control, Inc. by the City and Natural Gas is provided by Cascade Natural Gas. Other regional services are provided by Cowlitz County Sheriff's Office and the Washington State Patrol. Primary access into Kelso is via U.S. Interstate 5. From the south, the mainline of the Burlington-Northern Railroad bisects the industrial area and south Kelso, and then follows the Cowlitz River through the entire length of the City. There is an Amtrak station in Kelso that also serves the Greyhound Bus line and the Regional Airport (KLS) also services Washington's southwest region for general aviation in Kelso.

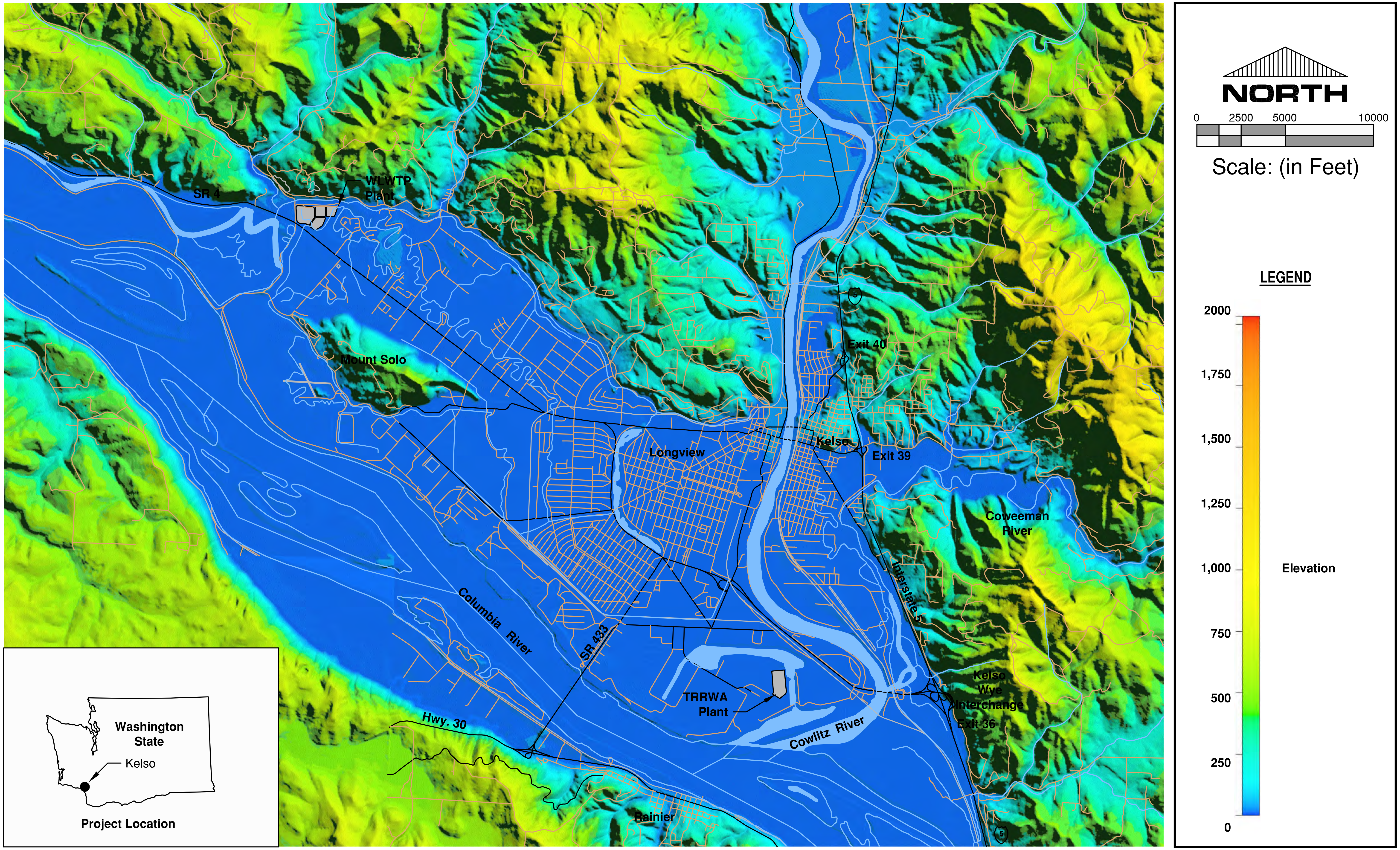
PHYSICAL CONDITIONS

Topography

Southwest Kelso is located on a flat low alluvial delta near the confluence of the Cowlitz, the Coweeman and the Columbia Rivers. The City extends up a series of hills and terraces to the east. The service area is primarily located on the alluvial plain, but also extends into the foothills and benches to the northeast. The Three Rivers Regional Wastewater Plant (TRRWP) is located south of Longview on reclaimed land that is in the County. ***Figure III-4*** presents a topographic relief map of the Kelso, Beacon Hill Sewer District service area and Longview service area, and indicates the location of the Three Rivers Regional Wastewater Authority (TRRWA) Plant.

Soils

Soil information regarding the study area was taken from the National Soil Conservation Service's website and their publication, **Soil Survey of Cowlitz County, Washington** and is shown in ***Figure III-5.*** The alluvial delta is primarily composed of Caples Silty Clay Loam, 0 to 3 percent slopes, Newberg Fine Sandy Loam, 0 to 3 percent slopes, Pilchuck loamy fine sand, 0 to 8 percent slopes and Kelso Silt Loam, 0 to 8 percent slopes. The silty clay loams are very deep, artificially or well drained soils located on flood plains. They typically extend to a depth of 60 inches, possess slow permeability and a high available water capacity. Newberg fine sandy loam is also a very deep, well drained soil located on flood plains typically extending to a depth of 60 inches or more but with moderately rapid permeability and a moderate available water capacity. Pilchuck loamy fine sand is a very deep soil located on flood plains and extending to a depth of 60 inches or more as well but is somewhat excessively drained with rapid permeability and low available water capacity. Kelso silt loam is very deep, moderately well drained soil located on terraces. It typically extends to a depth of 60 inches or more and has slow permeability and high available water capacity.



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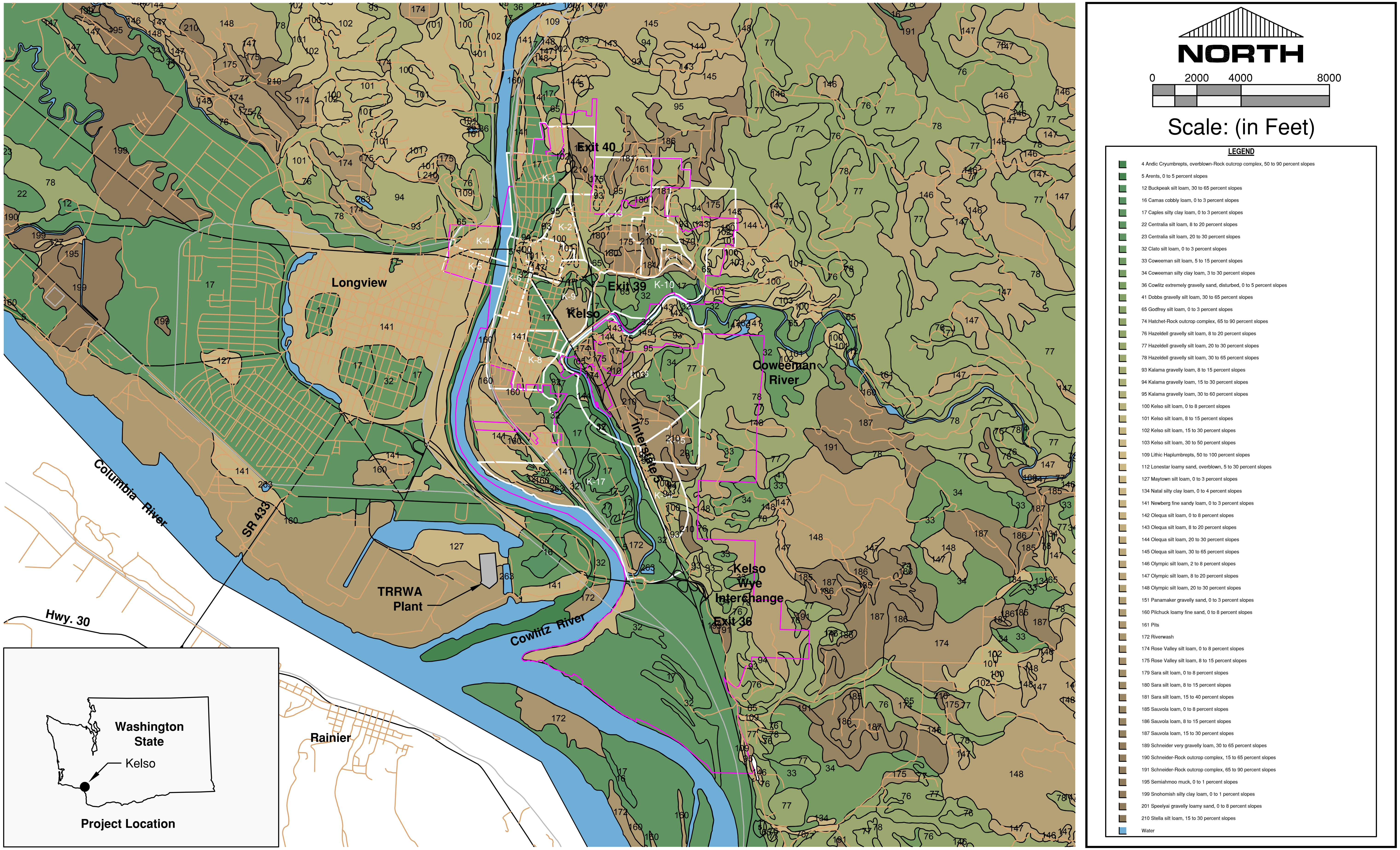
Topographic Map
Figure III-4



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City of Kelso
General Sewer and Facilities Plan
Soils Map
Figure III-5

Climate

The climate for the Kelso area is typical of the Pacific Northwest west of the Cascade Mountains. Summers are cool and dry. Winters are wet and cloudy, but mild. Though weather data is also collected at the Kelso Airport, Western Regional Climate Center provides climate data for the Kelso/Longview region that is collected at the Longview weather station. Average annual rainfall, as measured at the Longview weather station, is 45.30 inches[2] with measurable rainfall occurring an average of 175 days per year. Average annual snowfall is 5.3 inches. Average monthly maximum and minimum temperatures are presented in ***Table III-3***, below. Temperature extremes reach 105°F maximum and 1°F minimum.

Table III-3
Summary of Longview/Kelso Climate Data: 7/ 1/1925 to 4/7/2009

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average Max. Temperature (F)	45.2	50.4	55.2	60.8	67.2	71.9	77.5	77.9	73.2	63.1	52.2	46.3	61.7
Average Min. Temperature (F)	32.9	34.2	36.4	39.1	43.6	48.3	51.4	51.7	48.7	43.3	37.9	34.6	41.7
Average Total Precipitation (in.)	6.26	4.78	4.60	3.28	2.52	2.03	0.82	1.34	2.06	3.98	6.62	7.19	45.30
Average Total Snow Fall (in.)	3.2	0.8	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.6	5.3

Air Quality

The U.S. Environmental Protection Agency (EPA) and the Washington State Department of Ecology (DOE) have set regulations for air quality. The City of Kelso has an air quality station that is monitored by the Southwest Clean Air Agency (SWCAA). According to the SWCAA, the city of Kelso meets federal health-based clean air standards. The latest southwest Washington regional air quality report is in the Southwest Clean Air Agency *Annual Report, 2007*.

[2] Data taken from Western Regional Climate Center website at the flowing web address: http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?wa4769

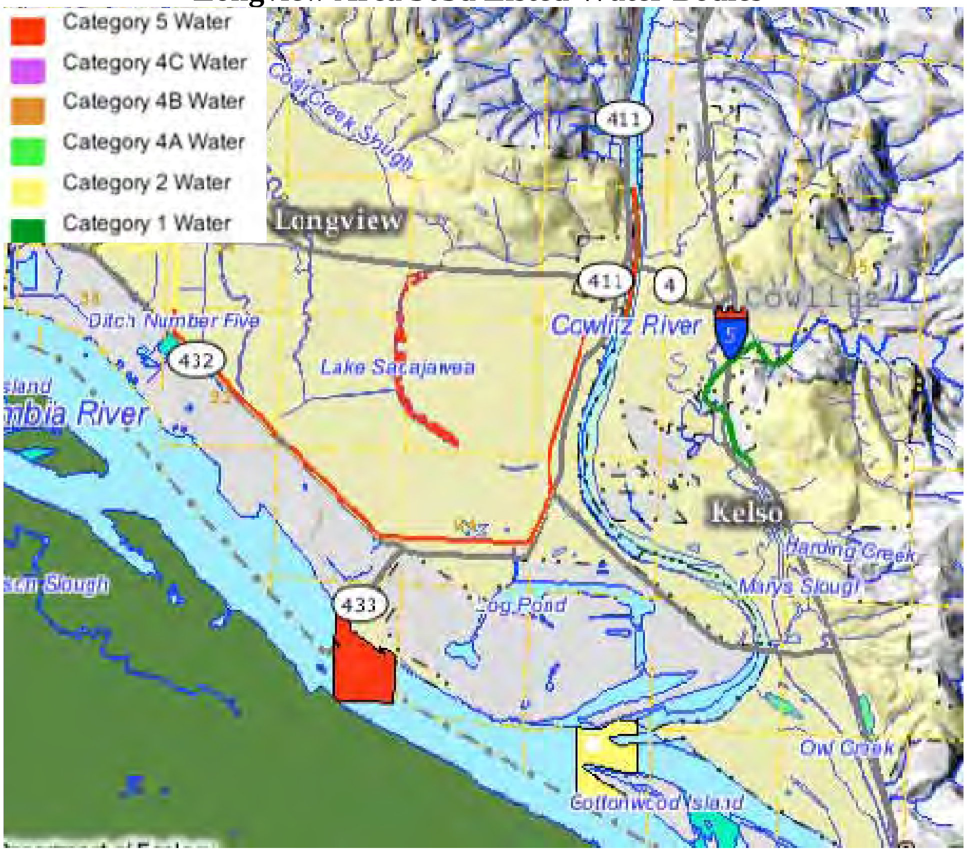
Surface Waters

There are three rivers and several perennial streams in the Kelso/Longview area. The major river to the south is the Columbia River. The Cowlitz River enters the Kelso/Longview area from the north and creates the west bank of Kelso, prior to joining the Columbia River. The Coweeman River enters Kelso from the east and enters the Cowlitz River just prior to the confluence with the Columbia. As designated under WAC 173-201A, Aquatic Life Uses for the described surface waters include core summer salmonid habitat and salmonid spawning, rearing and migration. The rivers are also designated for primary water contact use and for water supply including domestic, industrial, agriculture and stock watering. Miscellaneous uses include wildlife habitat, fish harvesting, commerce/navigation, boating and aesthetic values.

Figure III-6 presents the water bodies within the study area that are on the State's *Water Quality Assessment List* (303d) for impaired water bodies.

Figure III-6

Longview Area 303d Listed Water Bodies[3]



Water bodies that are on the 303d list are divided into one of five categories as described below:

- ***Category 1*: These waters meet tested standards for clean waters**. Placement in this category does not necessarily mean that a water body is free of all pollutants. Most water quality monitoring is designed to detect a specific array of pollutants, so placement in this category means that the water body met standards for all the pollutants for which it was tested. Specific information about the monitoring results may be found in the individual listings.

- ***Category 2*: Waters of concern** is for waters where there is some evidence of a water quality problem but not enough to require production of a TMDL at this time. There are several reasons why a water body would be placed in this category. A water body might have pollution levels that are not quite high enough to violate the water quality standards, or there may not have been enough violations to categorize it as impaired according to Ecology's listing policy. There might be data showing water quality violations, but the data was not collected using proper scientific methods. In

[3] From DOE's Environmental Information Management System available at http://www.ecy.wa.gov/eim/. Map legend only shows 303d classified water body categories and not topographical or administrative features.

any of these situations further testing of the waters is warranted.

- ***Category 3*: No data** is a category that will be largely empty. Water bodies that have not been tested will not be individually listed, but if they do not appear in one of the other categories, they are assumed to belong here.

- ***Category 4*: Polluted waters that do not require a TMDL** is for waters that have pollution problems that are being solved in one of three ways.
  - ***Category 4*a- has a TMDL** is for water bodies that have an approved TMDL in place that is being actively implemented.
  - ***Category 4*b- has a pollution control plan** is for water bodies that have a plan in place that is expected to solve the pollution problems. While pollution control plans are not TMDLs, they must have many of the same features and there must be some legal or financial guarantee that they will be implemented.
  - ***Category 4*c- is impaired by a non-pollutant** is for water bodies impaired by causes that cannot be addressed through a TMDL. These impairments include low water flow, stream channelization, and dams. These problems require complex solutions to help restore streams to more natural conditions.
- ***Category 5*: Polluted waters that require a TMDL**. The 303(d) list is the traditional list of impaired water bodies. Placement in this category means that Ecology has data showing that the water quality standards have been violated for one or more pollutants, and there is no TMDL or pollution control plan. TMDLs are required for the water bodies in this category.

The stretch of the Coweeman River within the planning area was tested and meets the standard for fecal coliform. The portion of the Cowlitz River shown in red is listed for temperature violations. The Longview Ditches are listed as polluted due to fecal coliform and dissolved oxygen and as waters of concern for turbidity. Lake Sacajawea is listed for PCB tissue and fecal coliform violations. The section of the Columbia River shown in red has experienced fecal coliform violations and has a TMDL in place to handle Dioxin and the portion in yellow is shown as an area of concern because of Bis (2-ethylhexyl) Phthalate in tissue samples.

<u>Flood Plains</u>

South Kelso is located near the alluvial delta formed by the confluence of the Cowlitz, Coweeman and Columbia Rivers. Although the capacity of the Cowlitz River channel is constantly changing because of the Mount St. Helens volcanic eruption, the Corps of

Engineers and others indicate that the area is protected against at least a 100 year flood. The Coweeman is shown on FEMA's FIRM map as being protected by levees against a 500 year flood. The map presented in ***Figure III-7*** is taken from National Resource Conservation Service digital data and portrays relative flood hazard information. The majority of the Kelso area is considered to have one flooding event in 500 years.

Groundwater / Regional Geology

The primary sources of recharge for the aquifer are the infiltration of precipitation and from the surrounding streams. Well water levels typically rise in October through March in response to the wet season. The flow of the Cowlitz River is also augmented by releases of water from hydropower reservoirs. Due to the low elevation of much of the area, relative to the river systems and water table, soils can become saturated without anthropogenic (man made) intervention. Local well locations are presented in ***Figure III-8***.

Ground water from the area is lost mainly from seepage to stream channels, through evapotranspiration in the shallow water tables, and anthropogenic removal. The region possesses the most productive deep aquifer in the county and supports a number of water dependent industries resulting in numerous domestic and industrial wells. The alluvial plain resides on top of a permeable gravel-based sub-structure that is hydrologically connected to the Columbia and Cowlitz Rivers. Groundwater from the deep aquifer is typically high in quality while groundwater in the shallow aquifer is typically characterized by high concentrations of dissolved iron in the water.

The southern portions of Kelso are situated on an alluvial plain and the eastern portion extends uphill onto a series of terraces and low hills. The approximate service area in relation to the underlying geology is illustrated in ***Figure III-9.*** The information in this discussion was taken from the publication, ***Availability of Ground Water in Western Cowlitz County*** (1970), which is the most recent publication on the subject authored by the USGS[4].

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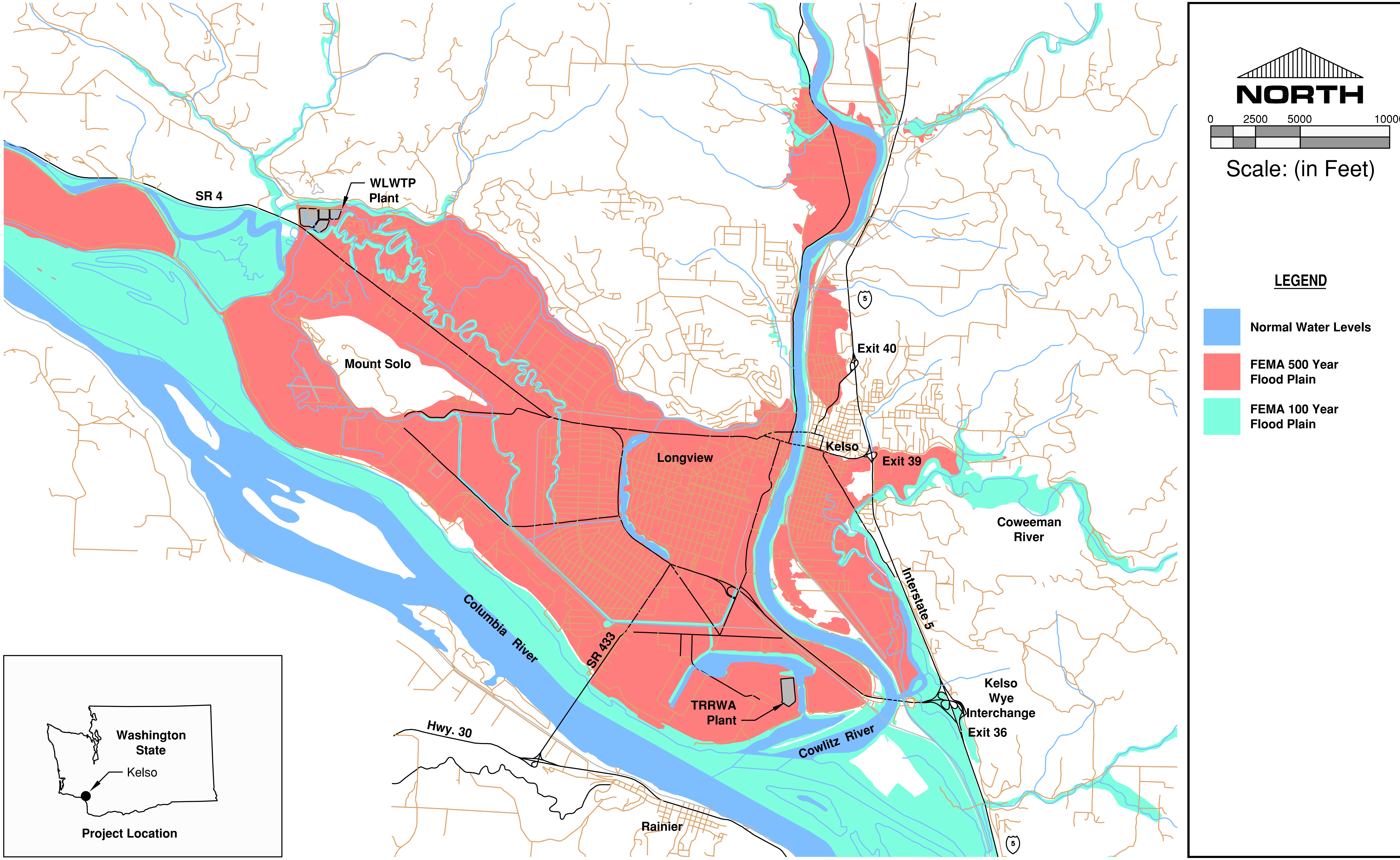
[4]Meyers, D.A., (1970), *Water Supply Bulletin No. 35; Availability of Ground Water in Western Cowlitz County, Washington*. Washington Department of Ecology, Figure No. 6.



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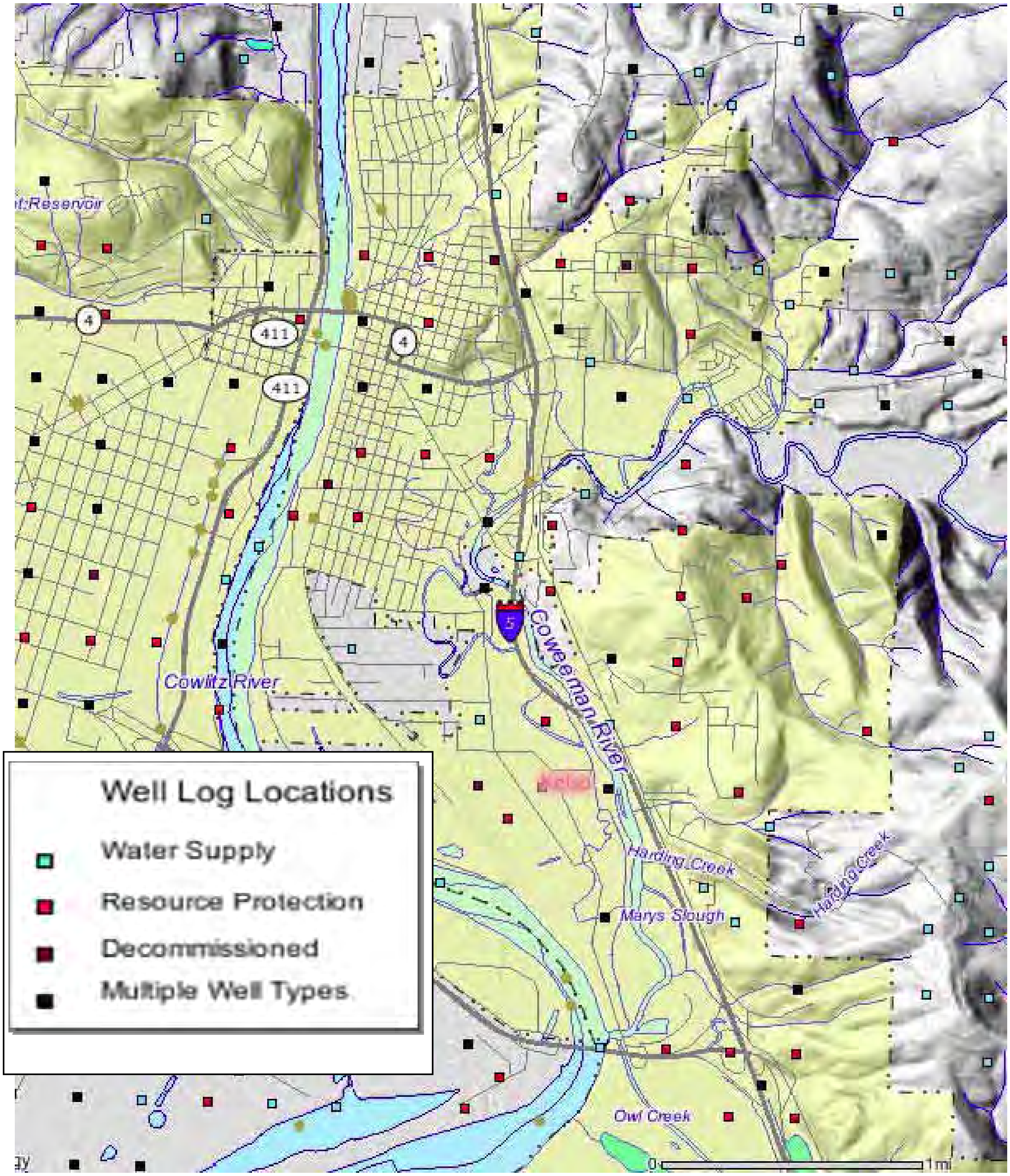
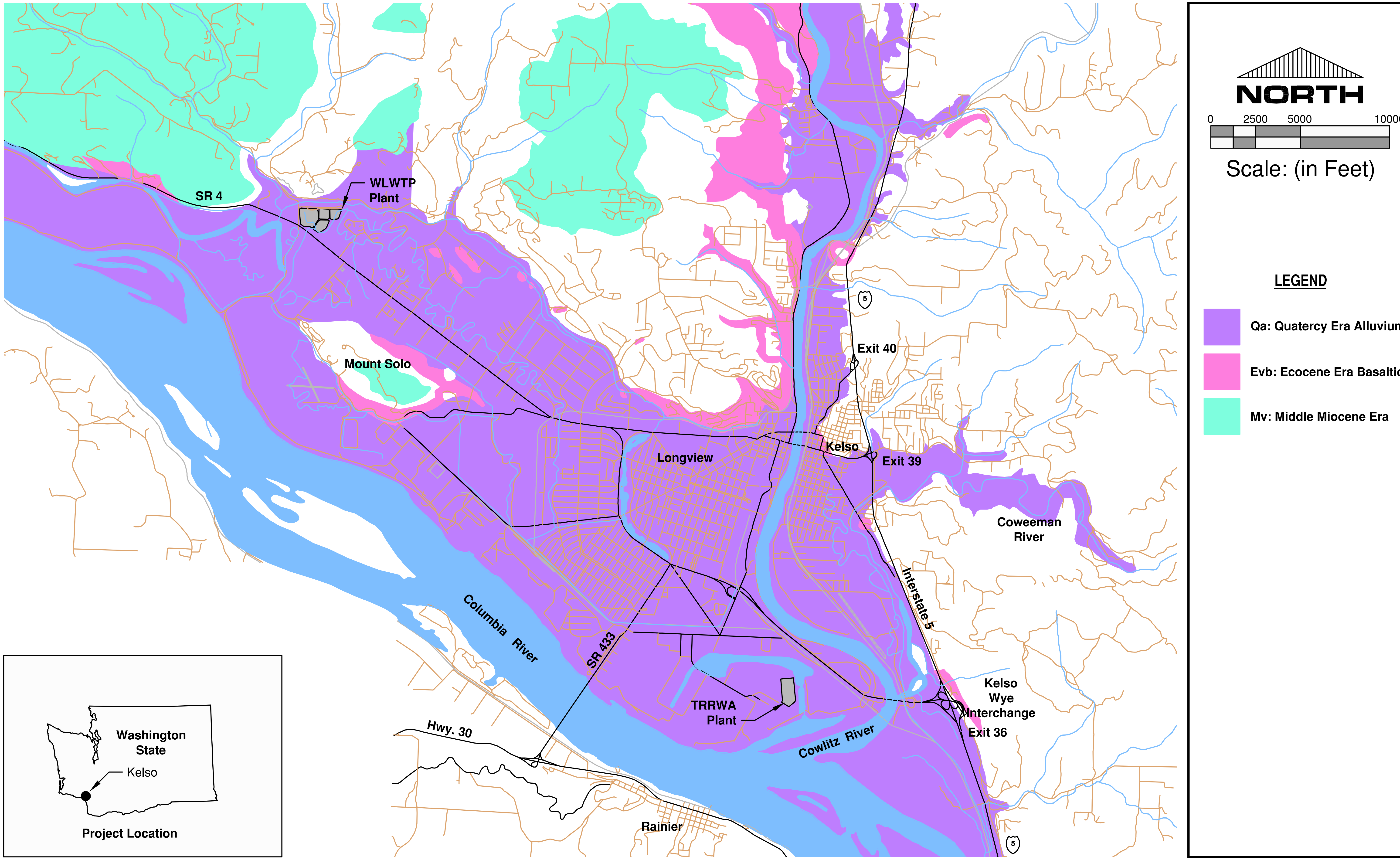
City of Kelso
General Sewer and Facilities Plan
Flood Plain Map
Figure III-7

Figure III-8

Kelso Area Well Locations[5]



[5] From DOE's Environmental Information Management System available at http://www.ecy.wa.gov/eim/.



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City of Kelso
General Sewer and Facilities Plan
Geology Map
Figure III-9

Alluvial Area: The alluvial area generally consists of Holocene epoch, unconsolidated gravel, sand and silt that range in thickness from 10 to 300 feet. Review of driller's well logs from within the service area indicates the alluvium is highly stratified with layers of the aforementioned materials in varying proportions. The sediments possess high permeability with well pump rates up to 3000 gallons per minute (gpm).

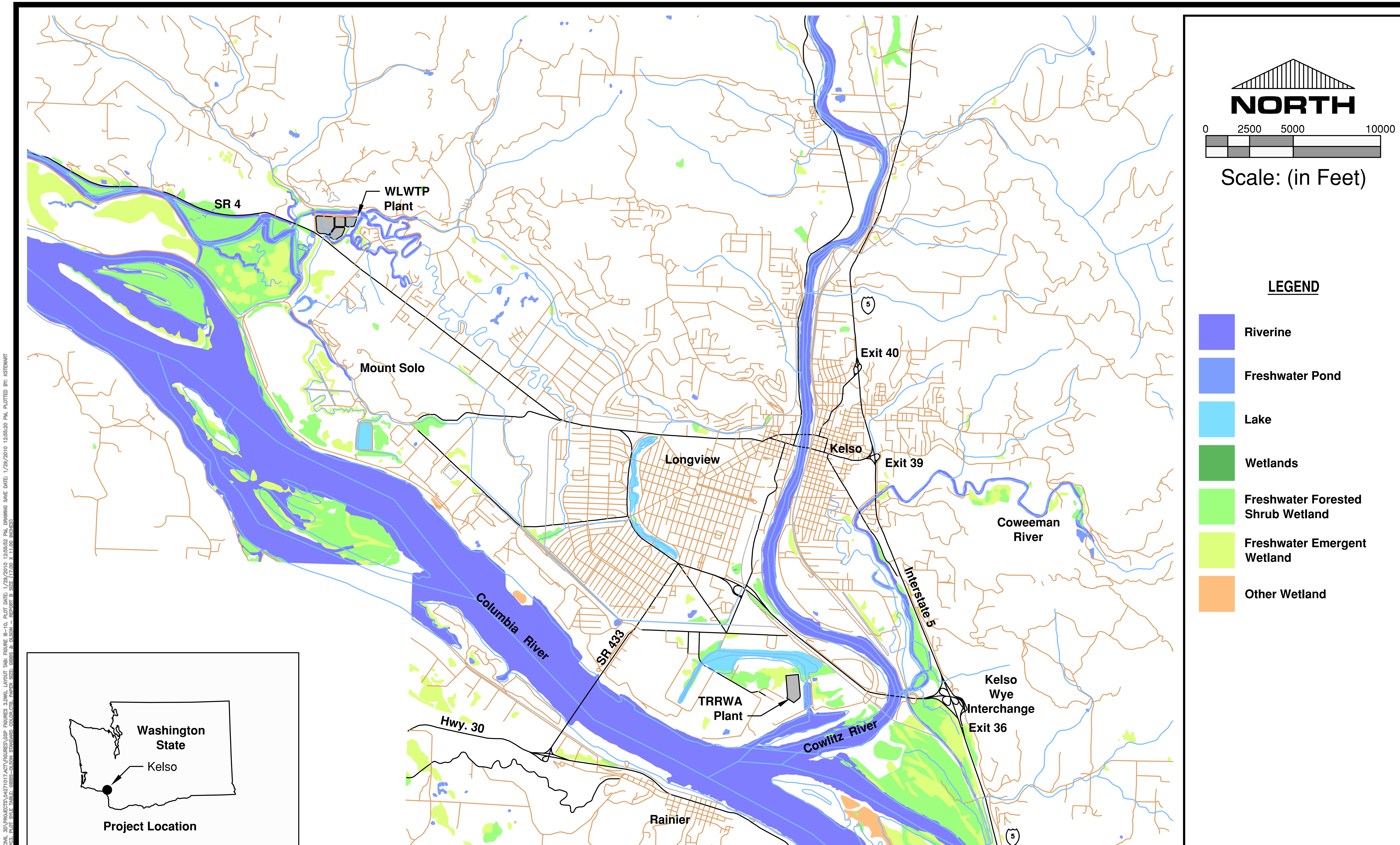
Terrace Area: The eastern portions of the service areas are comprised of sedimentary and volcanic rocks of the Eocene epoch. The weathered bedrock has low permeability. Water bearing zones are typically associated with fracture zones and vary in depth and water yield.

Wetlands and Shorelines

Wetlands have been identified in the National Wetlands Inventory developed and maintained by the U.S. Department of Interior Fish and Wildlife Service. Wetland locations are available from the Washington State Department of Fish and Wildlife's (WDFW) Public Data Release Maps. There are several wetlands within the Kelso boundaries as shown in ***Figure III-10***. Within the more heavily populated areas of Kelso there are fewer wetlands than in the southern industrial section. Both the Columbia and Cowlitz rivers have substantial protected shoreline zones.

FISH AND WILDLIFE, THREATENED AND ENDANGERED SPECIES

Kelso is made up of urban, suburban and manufacturing/industrial areas with a mixture of native and non-native plant and animal species. Wetland areas within the sewer service areas have been identified by WDFW as *Priority Habits* for wildlife (see ***Table III-4***). There is a very large Palustrine Wetland covering the southeastern portion of Kelso and a series of small Palustrine Wetlands interspersed throughout the northern portion. There are also a series of Riverine Wetlands bordering the Cowlitz River and the Carroll Channel of the Columbia River as they pass through Kelso. The northeastern portions of the Kelso area are comprised of forested uplands interspersed with suburban development, where the dominant plant species include Douglas Fir, Western Hemlock and Western Red Cedar.



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City of Kelso
General Sewer and Facilities Plan
Wetland Areas Map
Figure III-10

Table III-4
Summary of WDFW: Description of Priority Habitat within Service Areas

Priority Habitat	
Name	**Description of Listed Habitat within Service Area**
Palustrine Wetlands	Wetlands are extensive in the southwestern portion of the City but small and dispersed throughout the northwestern portion of the Service Area
Riverine Wetlands	Wetlands are located along Cowlitz River and Carroll Channel of the Columbia River
Wetlands and Riparian Habitat	Wetlands in south city limits along Coweeman River.
Elk Range	Rocky Mountain and Roosevelt Elk winter range located in the far eastern portions of Kelso.

Because North Kelso is highly urbanized, there are few areas of wetlands. The majority are freshwater forested and scrub shrub intertidal wetlands located in the southern portion of Kelso, primarily associated with the Coweeman River.

In addition to the Priority Habitat, the Washington State Department of Fish and Wildlife has provided Species Polygon Reports, Wildlife Heritage Point Reports and Priority Fish Reports for Townships T07 R02-W, T08 R03-W and T08 R02-W. These reports identify important habitats and describe state and federally listed and proposed threatened and endangered species, candidate species and species of concern that may be present within the indicated townships. The reports and associated maps are considered privileged information and cannot be published but were reviewed to determine the presence of habitat or species within or in close proximity to Kelso. The results are presented below in ***Table III-5, Table III-6 and Table III-7.***

Table III-5

Summary of WDFW: Description of Species Polygons

Township	No. / Form #	Description
T08R02W	10 / 902184	High quality forested and scrub shrub inter-tidal wetlands associated with Coweeman River.
T08R02W	7 / 902176	Emergent and scrub shrub wetlands associated with the lower Coweeman River, support regular large concentrations of wintering waterfowl, Great Blue Herons, Dilated Woodpeckers, Bald Eagles, Orioles, and Nesting Redtailed Hawks. Species are considered a WDFW priority and are on the priority Habitat and Species List and/or Species of Concern List.
T08R02W	6 / 918522	Rocky Mountain and Roosevelt Elk: Winter elk range, Mount St. Helens and Mount Rainier herds. Species are considered a WDFW priority and are on the priority Habitat and Species List and/or Species of Concern List.
T07R02W	4 / 918522	Rocky Mountain and Roosevelt Elk: Winter elk range, Mount St. Helens and Mount Rainier herds. Species are considered a WDFW priority and are on the priority Habitat and Species List and/or Species of Concern List.
T07R02W	6 / 902175	Riparian and wetlands habitat, supports cavity nesting ducks, and water fowl concentrations, previously documented heron rookery on the estate is now abandoned. Supports downy woodpeckers, green backed herons & short eared owls.
T07R02W	7 / 902182	Scrub shrub wetland, supports regular small concentrations of wintering waterfowl including Canada geese, hooded mergansers and mallards.
T07R02W	3 / 902184	High quality forested and scrub shrub inter-tidal wetlands associated with Coweeman River.
T07R02W	25	Seal and Sea Lion Haulout site: log booms anchored along Carroll Channel used intermittently during winter and spring by California Sea Lions. Species are considered a WDFW priority and are on the priority Habitat and Species List and/or Species of Concern List.

Table III-6
Summary of WDFW: Description of Priority Fish Reports

Priority Fish Reports		
Stream ID#	**Anadromous Fish Presence within Kelso Service Area**	
1229321460932	Coweeman River	Fall Chinook, Fall Chum, Coho Salmon and Winter Steelhead
1229155460956	Cowlitz River	Fall Chinook, Fall Chum, Spring Chinook, Summer Chinook, Coho Salmon, Dolly Varden, Pink Salmon, Sockeye Salmon and Summer and Winter Steelhead
1240483462464	The Columbia River	Fall Chinook, Fall Chum, Spring Chinook, Summer Chinook, Coho Salmon, Dolly Varden / Bull Trout, Pink Salmon, Sockeye Salmon, and Summer and Winter Steelhead
Stream ID#	**Resident Fish Presence within Kelso Service Area**	
1229321460932	Coweeman River	Resident Cutthroat
1229155460956	Cowlitz River	Resident Cutthroat, Largemouth Bass, Rainbow Trout
1240483462464	The Columbia River	Resident Cutthroat

Table III-7
Summary of WDFW: Description of Washington Wildlife Heritage Points

No. / Form #	Type of Point	Description
4612218040	Priority	Bald Eagle nest
4612218001	Priority	Great Blue Heron heronry
4612218033	Other	Osprey nesting location

HISTORICAL AND CULTURAL RESOURCES

A review of the Washington State Department of Archaeology & Historic Preservation WISAARD Database indicated the presence of the following Washington Historic Register sites reported in ***Table III-8***.

Table III-8
Kelso Area Washington Historic Register Sites

Name	Address
Catlin Place, Stegner Residence	202 NW Second Ave.
US Post Office, Main Kelso Branch	304 Academy St.
Rodman House (Smith, Nat, House)	110 West Grant Street

ADJACENT WASTEWATER FACILITIES

The Three Rivers Regional Wastewater Plant (TRRWP) serves East Longview Sewer Service Area (ELSA), Kelso, Beacon Hill Sewer District, Cowlitz County and some of the flow from the West Longview Sewer Service Area (WLSA). Other cities and towns within 20 miles with wastewater collection and treatment systems include Castle Rock WA, Prescott OR, Rainier OR, Clatskanie OR, Stella WA, Woodbrook WA and Kalama WA. Other nearby NPDES permitted industrial wastewater treatment systems include Foster Farms, Seaquest State Park, Port of Kalama, Noveon Inc., Longview Fibre and Weyerhaeuser. The Weyerhaeuser wastewater treatment plant also treats wastewater, under Washington State NPDES Discharge permits, from Equa-Chlor, Solvay Chemicals, Specialty Minerals Inc. and J.M. Huber Corp. An NPDES permit has been issued for a potential power generation facility described as “Mint Farm Generation LLC”. An NPDES permit has been issued for Longview Aluminum LLC and is being transferred to a private Port Facility that has acquired use of the old aluminum plant site.

EXISTING WATER SYSTEM

Information sources used to develop this water system summary are described below:

- ***Water System Plan for the Longview-Kelso Urban Area***. 2005, Kennedy/Jenks Consultants.

The City of Kelso operates its own water treatment plant using a Ranney collector under the Cowlitz River as its source of water, and provides treated water to its customers in West Kelso via water mains crossing the Cowlitz River.

Under a Water Service Area Agreement, the three water purveyors in the Longview-Kelso urban area (Longview, PUD, Kelso) have a long-term "wheeling" arrangement whereby the three agencies can share each other's facilities when necessary. This agreement provides backup resources in case of emergency, natural disaster, and for scheduled maintenance outages. After the May 18, 1980, Mount St. Helen’s eruption, Longview and Weyerhaeuser installed an emergency line connecting the city to the Weyerhaeuser water system, which comes from the Columbia River, to provide the city and the PUD another alternate source of water. Additionally, a second water main crossing of the Cowlitz River was constructed with the new Allen Street Bridge in 2000, increasing capacity and providing redundancy for the water main crossings connecting the Longview and Kelso systems.

The recommended 6-year water system capital improvement plan (CIP) that was prepared for the City by Kennedy/Jenks Consultants as part of the **2005 Comprehensive Water System Update** for the Longview-Kelso Urban Area is summarized below:

- Effluent manifold piping modifications
- Solids handling equipment
- Residuals basin rehabilitation
- Solids handling contingency and control system upgrades
- Increase raw water pipe size
- Improve pipe gallery

Kelso's distribution system consists of multiple zones of differing pressure regulated by gravity, booster pumps, and pressure reduction stations. The booster pump systems have been set to operate within the range of 30 to 170 psi, and the pressure reducing systems have been set to operate within the range of 15 to 140 psi. The system is ultimately designed to operate with a standard delivery pressure range of 30 to 100 psi.

WATER CONSERVATION

The development and implementation of a cost-effective water conservation program is required to obtain approval of a Water System Plan (WSP), when applying for new water rights from the Washington State Department of Ecology (DOE) and identified in the City's GSP/FP. Conservation program requirements, which depend on water system size, are listed in the Water System Planning Handbook and Conservation Planning Requirements. The City of Kelso is classified as a medium-sized (1,000 to 25,000 services) system. At a minimum, the City must evaluate the conservation measures recommended for its system size.

WATER USE EFFICIENCY PROGRAM

The following excerpt is from the Kelso Water Use Efficiency Program (12/28/07):

Background

The Water Use Efficiency Rule

New state regulations require adoption of our water conservation "goals" by public process.

In 2003, the Washington State Legislature passed Engrossed Second Substitute House Bill 1338, better known as the Municipal Water Law, to address the increasing demand on our state's water resources. The law established that all municipal water suppliers must use water more efficiently in exchange for water right certainty and flexibility to help them meet future demand. The Legislature directed DOH to adopt an enforceable Water use Efficiency (WUE) program, which became effective on January 22, 2007. Creating a regulatory WUE program is intended to achieve a consistently high level of stewardship among all municipal water suppliers.

Pressure on our state's water resources comes from many sources, including population growth, instream flows, industrial and business needs. As the potential for developing new sources of water within the state diminishes, the efficient use of water is necessary to meet future needs.

The WUE requirements support our common goal of ensuring safe and reliable drinking water in the following ways:

Contribute to long-term water supply reliability and public health protection.

Water systems must have a reliable supply of water to meet current and future needs. WUE requirement help municipal water suppliers operate efficiently to protect against:

- *Temporary water service interruptions during peak demand usage.*
- *Long-term or repeated water disruptions due to limited water supply.*
- *Contamination of the water supply due to leaky pipes.*
- *Unnecessary expense or shortage due to system leaks.*

Public health is always at risk during these events. Water systems position themselves to provide a reliable drinking water supply for their customers by implementing an effective WUE program.

Promote good stewardship of the State's water resources.

Pressure on the state's limited water supplies is steadily increasing. Water systems using their water efficiently allow growth in their communities and water for other environmental uses. The efficient use of water helps ensure reliable water supplies are available for your customers.

Ensure efficient operation and management of water systems.

For most water system, conserved water can be the least costly source of new supply. Water system managers have to balance operation and growth costs with customer revenue when making decisions on the future of their water system. The new requirements involve the customer and the public into the decision-making process through the goal setting public forum. This input help water system owners and manager make smart choices about how to use water efficiently.

Comparison of our existing water comprehensive plan to the requirements of the new state regulations for water use efficiency has shown that our existing program meets all the regulations contained within the new "Water Use Efficiency Rule" and therefore the Kelso Department of Public Works is requesting adoption of our 2005 comprehensive water plan by public process. Thus approving the Conservation Goals as outlined within our comprehensive water plan as they pertain to water conservation.

***Goals**: These current goals are listed on page 4-9, of our 2005 comprehensive water plan. Kelso*

- *Reduce Average Daily Demand (ADD) and Maximum Daily Demand (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 the zone.*
- *Continue leak detection program and meter replacement program.*
  - *Conduct a biannual system leak detection survey.*
  - *Allocate $100,000 per year to replace old 2-, 4-, 6-, and 8-inch water lines of any material (mainly AC, cast iron, and galvanized steel).*

The following check-list was taken from the, Washing State Department of Health, Water Use Efficiency Guidebook-July 2007*. This checklist was reviewed against our existing 2005 Comprehensive Water Plan where applicable.*

1. ***Current Water Conservation Program****: Kelso's current water conservation plan is outlined in our most recent,* 2005 Comprehensive Water Plan - Section 4*. Kelso has long been active in water conservation, one focus being on leak detection. Kelso completed a three year leak detection and repair program on our entire water system in 1998. The estimated total leakage found during the three surveys was 155 gpm, with $15,000 dollars spent on survey contract services. Kelso has continued to use leak detection surveys and this program is outlined in the Water Sewer Department's* Preventive Maintenance Program for Leak Detection*. Kelso has also been working on replacing old water lines that are prone to breakage. See* 2005 Comprehensive Water Plan Section 4: 4.2.4 page 4-9*. Also to help customers track water use, our water billing has been enhanced to show consumption history. Water saving tips are included in our* Annual Water Quality Report.

2. ***WUE Goals****: Our goals are going to be established thru a public process. Advertisements were placed in the local news paper and posted at city hall 12-14-07, for a citizen input meeting on December, 28th at 5:00PM in the Council Chambers. Public comments along with the pertinent sections of the 2005 Comprehensive Water Plan will be submitted to our City Council with department recommendation for adoption.*

3. ***Evaluation of water use efficiency measures for cost-effectiveness.***

i) A recent rate evaluation has been completed by Kelso Engineering and a prior evaluation was completed in the 2005 Comprehensive Water Plan -Section 4: 4.2.6 pages 4-12 & 4-13.

ii) Kelso has installed and maintains/calibrates production (source) meters & consumption (service) meters. See Water Sewer Department's Preventive Maintenance Programs for Master Meter Calibrations and 20 year residential Meter Replacement.

iii) Kelso has implemented a water loss control action plan and comparison of production and service meter readings is updated every two months for early leak detection. Contractor services are used for ongoing leak detection surveys and also on a case by case basis to facilitate difficult to pinpoint water leaks. See 2005 Comprehensive Water Plan - Section 4: 4.2.4 page 4-9.

iv) Customers receive water use education tips in our Annual Water Quality Report.

4. ***Additional measures that will remain or be funded to meet water conservation goals.***

- *Water bill showing consumption history for residential*
- *Water bill showing consumption history for industrial*
- *CCR wlWUE education for residential*
- *Meter all innerties*
- *Post water saving tips on Web site • Utilize seasonal rates*

5. *Customer education will take place on the Web page, in CCR, & With Water Billing.*

6. *Estimation of demand reduction through Conservation, See* 2005 Comprehensive Water Plan Section 4: 4.2.5 page4-10.

7. *We will evaluate our effectiveness of our WUE program by continuing to track our ADD and MDD along with our (gpm/ERU). We will report annually our progress on our goals outlined on page 4-9 within our water comprehensive plan.*

8. *We will continue to evaluate our distribution system leakage and will also report this on an annual basis,* see page Table 4-2 on page 4-3 in comprehensive water plan.

9. *We have evaluated and will continue to consider changes to our water rate structure that promote water use efficiency, targeting on our peak summer demand,* see pages 4-8 & 4-12 thru 4-13 in comprehensive water plan.

10. *Water Reclamation,* see page 4-2 in comprehensive water plan. *In addition to opportunities available at the Regional Sewer Treatment Facility we track the water use at the Kelso Water Treatment Plant in order to identify possible options for water recycling.*

11. *Within our water comp plan we have met all mandatory information requirements regarding water supply characteristics requested by the state.*

    • *Our existing water comprehensive plan meets the requirements of the Water Use Efficiency Rule. The ongoing tracking and reporting on our goals will allow us to evaluate our successes and gives us the flexibility to make changes where needed.*

SECTION IV

DESCRIPTION OF EXISTING WASTEWATER TREATMENT PLANT

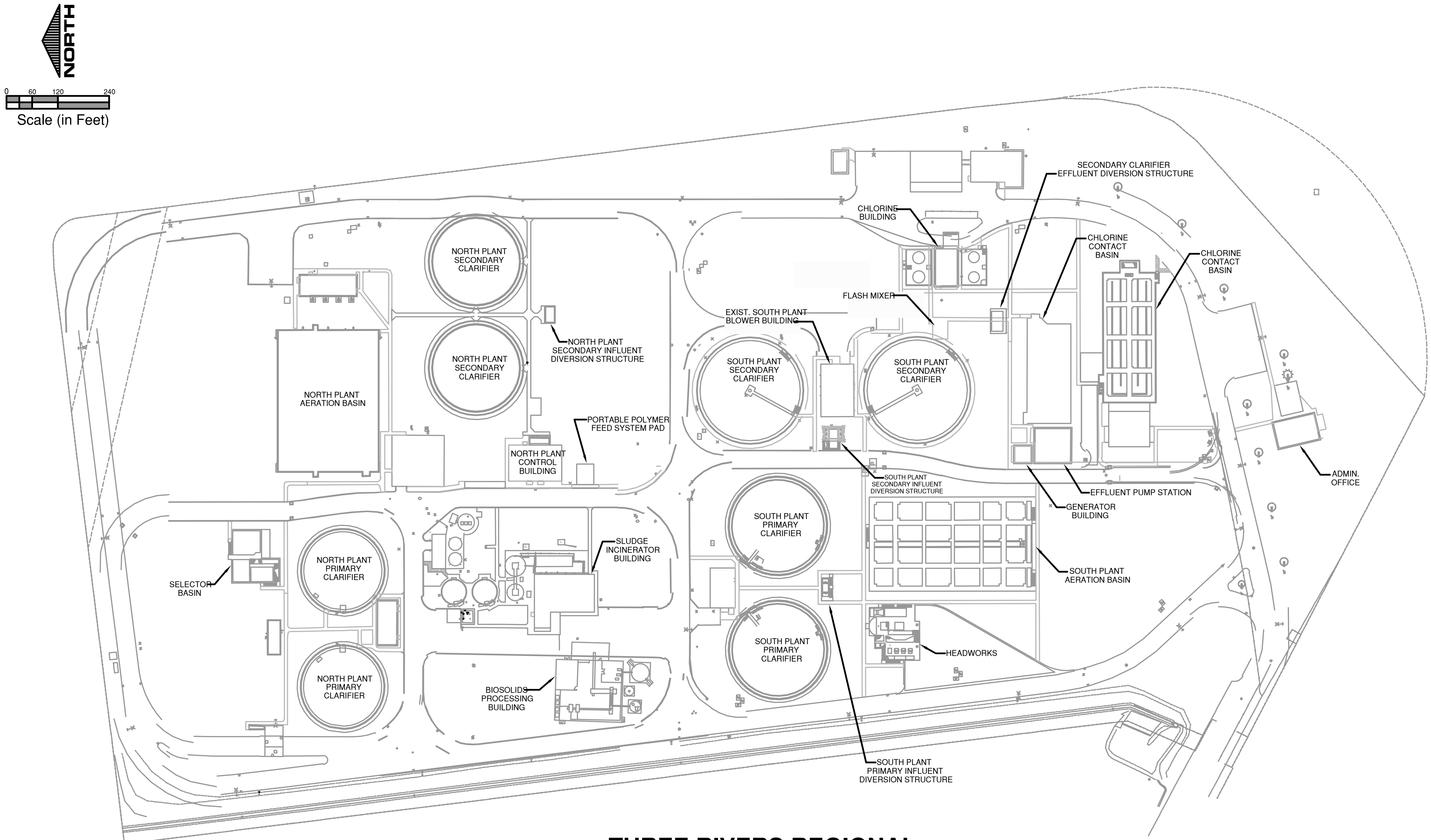
INTRODUCTION

Wastewater from the City of Kelso is treated at the Three Rivers Regional Wastewater Plant (TRRWP) where they are part owners along with Longview, Beacon Hill Sewer District and Cowlitz County. The 2005 revised and restated interlocal agreement among the City of Kelso, City of Longview, Beacon Hill Sewer District and Cowlitz County for Wastewater Treatment and Disposal details the relationship and is included in Appendix B.

DESCRIPTION OF EXISTING PHYSICAL PLANT

The original Three Rivers Regional Wastewater Plant (TRRWP) was constructed in 1976. A major upgrade in 2002 more than doubled the capacity of the plant. The plant site is shown in Figure IV-1 and the simplified process flow diagram is shown in Figure IV-2. The plant uses the conventional activated sludge process with secondary clarification. The plant is split between two separate plants; north and south. The original north plant has a design flow of 10 MGD and the new south plant has a design flow of 16 MGD. The combined total capacity is 26 MGD. The north plant is now used mainly to treat high flows with a peak day capacity of 62.4 MGD. The waste stream from both plants is recombined for disinfection with liquid sodium hypochlorite and then dechlorinated with sodium bisulfate prior to discharge into the Columbia River. Pumping of the effluent is required during times of high river flow.

The solids from the north end primary clarifiers go through a pair of gravity thickener basins before being sent to a sludge strainer. The solids from the south end primary clarifiers are sent directly to the sludge strainer. WAS from the secondary clarifiers from both plants is thickened in a gravity belt thickener with polymer addition and then sent to sludge blending. The waste sludge from all of these sources is then blended and sent to dewatering centrifuges where more polymer is added. A new RDP solids process completed in 2009 uses lime and heat to produce Class A biosolids.



THREE RIVERS REGIONAL
WASTEWATER TREATMENT PLANT

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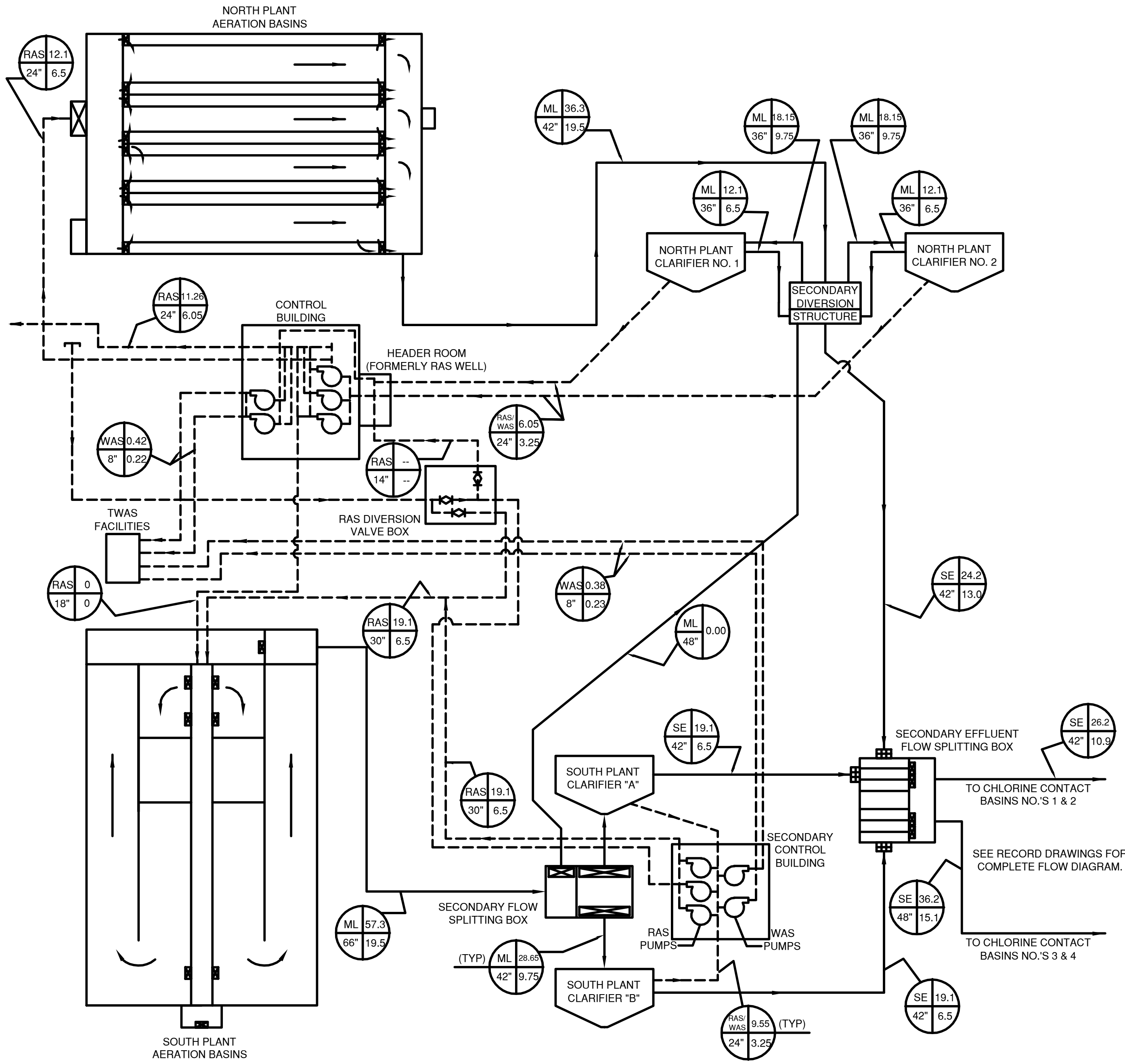
City of Kelso - GSP/FP
Site Plan
Figure IV-1
January 2011



FLOW SCHEMATIC #1 - STANDARD OPERATIONS

SCHEMATIC DESCRIPTION NOTES:

1. FLOWS ARE SHOWN FOR PEAK DAY AND MMA DAY.
2. BOTH THE SOUTH AND NORTH PLANTS ARE OPERATING INDEPENDENTLY OF EACH OTHER.
3. NO FLOW IS BEING DIVERTED FROM THE SOUTH PLANT SECONDARY FLOW SPLITTING BOX TO THE NORTH PLANT SECONDARY CLARIFIERS.

LEGEND

PUMP

VALVE: PLUG CONCENTRIC

ML = MIXED LIQUOR SUSPENDED SOLIDS

SE = SECONDARY EFFLUENT

RAS = RETURN ACTIVATED SLUDGE

TWAS = THICKENED WASTE ACTIVATED SLUDGE

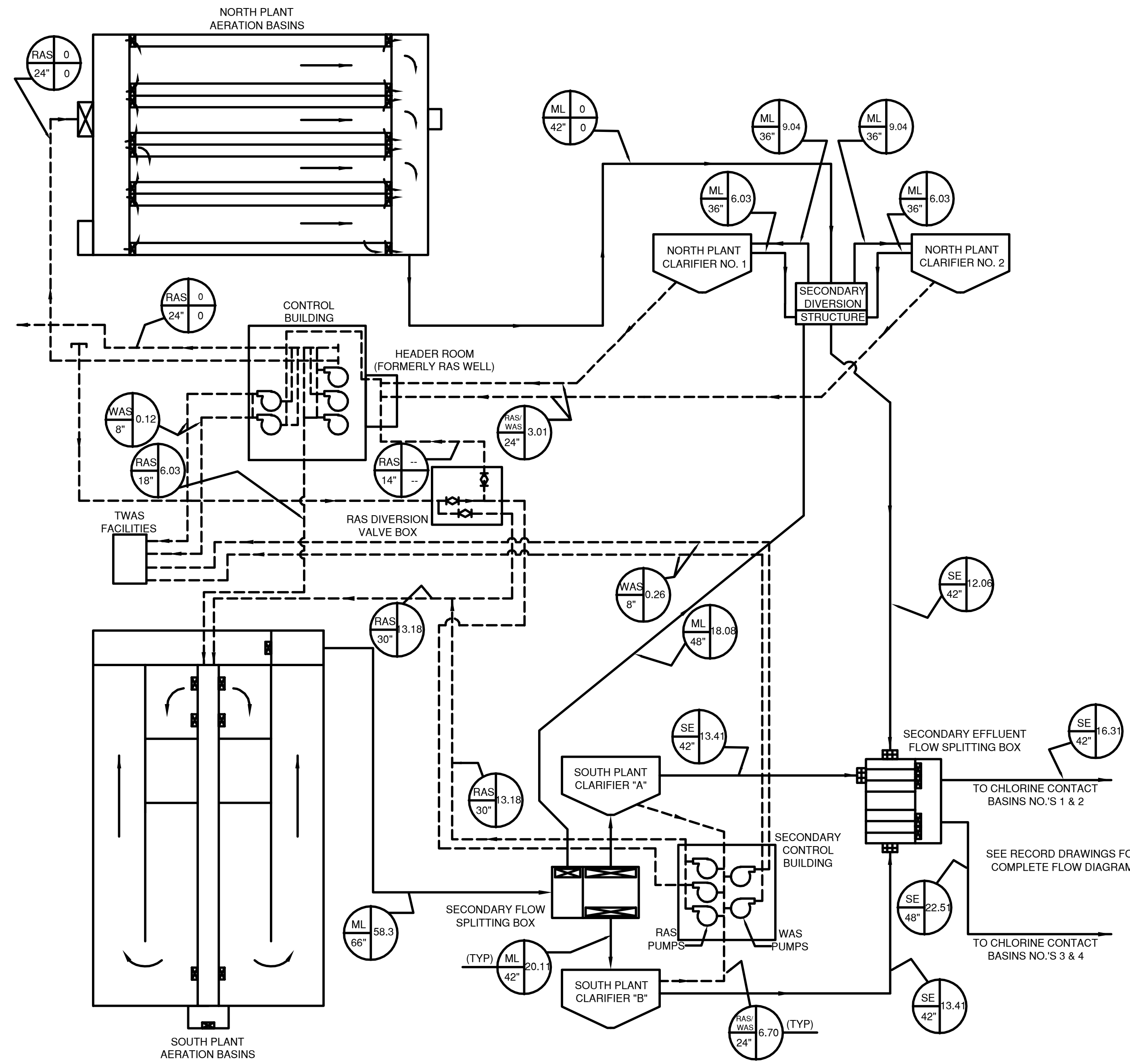
WAS = WAS ACTIVATED SLUDGE

LIQUID PIPING

SOLIDS PIPING

SERVICE — PEAK DESIGN FLOW (MGD)

DIAMETER (INCHES) — MAX. MONTH AVERAGE (MMA) DAY FLOW (MGD)



FLOW SCHEMATIC #2 - SOUTH PLANT MLSS DIVERSION TO NORTH PLANT SECONDARY CLARIFIERS

SCHEMATIC DESCRIPTION NOTES:

1. THIS FLOW SCHEME ALLOWS MLSS FROM THE SOUTH PLANT TO BE DIVERTED TO THE NORTH PLANT SECONDARY CLARIFIERS.
2. THE ABILITY TO DIVERT MLSS FROM THE SOUTH PLANT TO THE NORTH PLANT CLARIFIERS INCREASES OVERALL PLANT OPERATIONAL FLEXIBILITY BY:
   A. ALLOWING THE NORTH CLARIFIERS TO PROVIDE REDUNDANT OR ADDITIONAL SECONDARY CLARIFIER CAPACITY FOR THE SOUTH PLANT.
   B. ALLOWING FASTER SEEDING AND STARTUP OF THE FULL NORTH PLANT BY ALLOWING THE MLSS DIVERTED TO THESE CLARIFIERS TO BE RECYCLED DIRECTLY TO THE NORTH PLANT AERATION BASIN.
3. IF THE NORTH PLANT SECONDARY CLARIFIERS ARE OPERATING AS PART OF THE SOUTH PLANT ALL RAS FLOW FROM THESE CLARIFIERS IS RETURNED TO THE SOUTH PLANT AERATION BASIN.
4. FLOWS SHOWN IN THE SCHEMATIC ARE BASED ON THE SOTH PLANT PEAK DAY FLOW OF 38.2 MGD (57.3 MGD WITH RAS FLOW INCLUDED).
5. THE MAXIMUM FLOW THAT CAN BE DIVERTED TO THE NORTH PLANT CLARIFIERS IS 18.08 MGD INCLUDING 6.03 MGD OF RAS FLOW RETURNED TO THE SOUTH PLANT AERATION BASIN OR TRANSFERRED TO THE NORTH PLANT AERATION BASIN.

LEGEND

PUMP

VALVE: PLUG CONCENTRIC

ML = MIXED LIQUOR SUSPENDED SOLIDS

SE = SECONDARY EFFLUENT

RAS = RETURN ACTIVATED SLUDGE

TWAS = THICKENED WASTE ACTIVATED SLUDGE

WAS = WAS ACTIVATED SLUDGE

LIQUID PIPING

SOLIDS PIPING

SERVICE — FLOW (MGD)

DIAMETER (INCHES)

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City of Kelso - GSP/FP
Flow Schematic
Figure IV-2
January 2011

Three Rivers Regional Wastewater Plant (TRRWP) EFFLUENT

The following effluent characterization is from the NPDES Fact Sheet dated 1/8/2007.

SUMMARY OF COMPLIANCE WITH THE PREVIOUS PERMIT

The facility received its last inspection on February 22, 2006. No major problems with the facility operation were found at that time. The facility received an award from the Department for their performance in 2005.

During the history of the previous permit, the Permittee has remained in compliance, based on Discharge Monitoring Reports (DMRs) submitted to the Department and inspections conducted by the Department.

WASTEWATER CHARACTERIZATION

The concentration of pollutants in the discharge was reported in the NPDES application and in discharge monitoring reports. The effluent is characterized as follows:

Table 1: Wastewater Characterization (for Jan 2002 – Dec 2005)

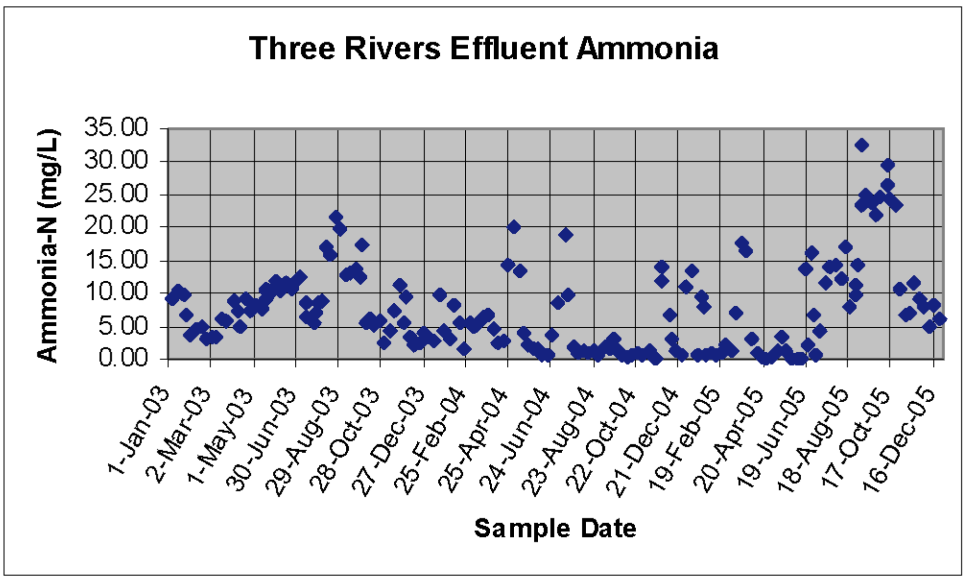
Parameter	***Concentrations and Loads***	***Limits and Design Standards***
Flow (mgd)	*12.3 mgd (avg for max month) 30.4 mgd (maximum day)*	*26 mgd (max month design flow) 62.4 mgd (peak day design flow)*
$CBOD_5$	*19 mg/L (max 30-day average) 28 mg/L (max 7-day average) 86% removal (5th percentile) 1,283 lbs/day (max 30-day average) 1,568 lbs/day (max 7-day average)*	*25 mg/L (average monthly) 40 mg/L (average weekly) 85% minimum removal 3,900 lbs/day (average monthly) 5,800 lbs/day (average weekly)*
TSS	*20 mg/L (max 30 day average) 31 mg/L (max 7 day average) 89% removal (5th percentile) 1,459 lbs/day (max 30 day avg) 2,535 lbs/day (max week)*	*30 mg/L (average monthly) 45 mg/L (average weekly) 85% minimum removal 4,815 lbs/day (average monthly) 7,223 lbs/day (average weekly)*
Fecal Coliform	*24 org/100 ml (max 30-day g-mean) 107 org/100 ml (max 7-day g-mean)*	*200 org/100 ml (average monthly) 400 org/100 ml (average weekly)*
pH	*6.5 S.U. (5th percentile) 5.9 max 7.4 S.U. (95th percentile) 8.1 max*	*shall not be less than 6 or greater than 9*
Total Residual Chlorine	*Less than 0.001 (95th percentile) 5.0 max*	*0.03 mg/L monthly, 0.09 mg/L weekly*
Total Ammonia (May-Oct) (Nov-Apr)	*24.5 mg/L (95th percentile) 23 (max monthly avg) 13.4 mg/L (95th percentile) 14.2 (max monthly avg)*	*15 mg/L (avg monthly) 22.8 mg/L (avg monthly)*
Copper	*6.25 μg/L (95th percentile of 27 samples after 6/30/04 when water supply corrosion controls started)*	*11.2 μg/L (avg monthly) 16.4 μg/L (max daily)*
Mercury	*0.10 μg/L (95th percentile of 21 samples)*	*0.21 μg/L (avg monthly) 0.31 μg/L (max daily)*
Lead	*0.0 μg/L (undetected in 41 samples)*	*3.1 μg/L (avg monthly) 4.5 μg/L (max daily)*

*Effluent characterization in table 1 above is intended to show facility operations over the last three to five years. **The facility operation has, for the most part, been good**.*

The facility has met its permit limits for ammonia in all but three (3) months. The average monthly limit was 15 mg/L (from May through October final permit limit); and limits were exceeded in August 2003 along with September and October 2005. The average ammonia was 23 mg/L in both September and October 2005. These sample exceedances occurred in warmer months of late summer and early fall. This is usually the period with greatest ammonia toxicity. (See ammonia graph below).

The flow was well within design limits. The $CBOD_5$ and TSS limits for concentrations (mg/L), loadings (lbs/day), and removal percentages were all well within limits.

The fecal coliform limits were easily met. The fecal coliform limits are based on a geometric-mean. Even though there were a couple of individual samples that were greater than 200 on a weekly basis and greater than 400 on a monthly basis, there were no limit violations. The disinfection system, which uses chlorine to disinfect, and uses sodium-bisufite to dechlorinate. The result is that the chlorine samples were mostly below detection (below 10 μg/L) and were therefore well within the chlorine limit of 30 μg/L monthly. Occasionally there have been residual chlorine samples of up to 40 μg/L; however, these have not caused an exceedance of limits on a monthly or weekly basis.



The effluent values for the three main metals (copper, mercury, and lead) were all below the limits. The copper was sampled many times throughout the sampling period. The water supply to the cities was changed in June 2004 which resulted in lower amounts of copper entering the treatment plant. Only the period after June 2004 was used to evaluate copper. The effluent samples for lead were all below detection. The effluent samples for mercury were mostly below detection and a 95th percentile was calculated at 0.10 μg/L. Other metals were sampled however all had values that were below detection or were not of concern.

Priority pollutant scans were required to be conducted annually. There have been four rounds of priority *pollutant sampling that have taken place since the new plant came on-line. The results showed either non-detection of the toxic substances or the amounts were not in toxic quantities.*

The possible sources of toxics are the significant industrial users. These include:

- *Cytec Industries which produces polymers and coagulants. This discharge has local limits;*
- *Foster Farms which processes chickens for market. This discharge has local limits;*
- *Toyocom Industries which produces synthetic quartz crystals. This industry uses natural quartz rock and 4 percent sodium hydroxide. This industry has local limits and categorical pretreatment standards.*
- *The Cowlitz County Landfill discharges leachate to the treatment works. This discharge has local limits.*

SECTION V

KELSO EXISTING AND FUTURE WASTELOADS

INTRODUCTION

The purpose of this section is to establish the existing population currently served by the Kelso sewer system and to estimate the future population for which sewer service must be provided. The population projections will be combined with wastewater loadings for flow, BOD_5 and TSS to estimate the treatment capacity that must be provided. Population data were taken from the Washington Office of Financial Management (OFM) and analyzed to project a future population that will be served by the Three Rivers Regional Wastewater Plant (TRRWP).

POPULATION PROJECTION

The City of Kelso has projected a population growth rate of 1% annually. The current population in 2009 is 11,840 based on information from the Washington Office of Financial Management (OFM).

For this report future population projections are based on a planning horizon to the year 2030. The sewer service area will remain as it was presented in the 1995 Cowlitz Sewer Operating Board GSP. The year 2030 population to be served is estimated to be 14,447.

FLOW

There are presently 3,598 residential and 337 commercial sewer service connections in Kelso. Flow from the City is determined by combining the flow measured at the Kelso Main Pump Station with the flow measured at the Catlin Pump Station. These data are recorded monthly by Three Rivers Regional Wastewater Plant (TRRWP) personnel for billing purposes.

Eight years of monthly Kelso flow data; from August 2001 through July 2009, was reviewed to determine the flow characteristics as shown below. Dry weather is from May 1 through October 31 and wet weather is from November 1 through April 30.

Average Annual Flow: 2.61 MGD

Average dry weather flow: 2.18 MGD

Average wet weather flow: 3.04 MGD

Max monthly average flow: 6.0 MGD (January 2006)

Foster Farms is included in the above flow values and on average discharges approximately 750,000 GPD into the Kelso collection system and on to the Three Rivers Regional Wastewater Plant (TRRWP) for final treatment and disposal.

INDUSTRIAL/COMMERCIAL SEWER USERS

According to the DOE NPDES Fact Sheet Kelso has three Significant Industrial Users (SIUs) which are:

- Foster Farms
- Columbia Analytical Services
- Kelso Water Treatment Plant

Foster Farms has its own pretreatment system which is used to separate solid waste streams from wastewater. The wastewater is then treated to reduce the pollutant loading on the Three Rivers Regional Wastewater Plant (TRRWP). Average flow is approximately 750,000 GPD. The Foster Farms treatment plant is regulated under the DOE State Waste Discharge Permit Number ST 6171.

Columbia Analytical Services is a commercial lab that conducts environmental tests, pharmaceutical tests and process and product testing. Columbia Analytical Services discharges directly to the collection system without a pretreatment facility.

The Kelso water plant discharges filter backwash water to the sanitary sewer on a daily basis. There is no pretreatment and the water is low in solids. Average monthly volume discharged is approximately 3.1 MG or 103,000 GPD.

There are also numerous small commercial users such as restaurants, retail stores, service stations, hotels, motels, laundromats, etc. A summary of existing and projected flow is found on ***Table V-1.*** The flows shown assure that significant amount of I/I will be removed.

Table V-1
Existing and Projected Wastewater Flow

		2009	2030
	Population	11,840	14,447
Average Annual Flow (Gal/Day)			
Existing Residential flow at 100[1] gpcpd		1,184,000	1,144,700
Foster Farms		750,000	750,000
Commercial , etc.= 48%[2] of residential		568,320	693,456
WTP Backwash		103,000	126,000
Existing I&I		4,680	169,116
		2,610,000	2,883,272
Average Dry Weather Flow (Gal/Day)			
Existing Residential flow at 80[3] gpcpd		947,200	1,155,760
Foster Farms		750,000	750,000
Commercial , etc.		379,800	421,512
WTP Backwash		103,000	126,000
Existing I&I		0	0
		2,180,000	2,453,272
Average Wet Weather Flow (Gal/Day)			
Existing Residential flow at 100 gpcpd		1,184,000	1,144,700
Foster Farms		750,000	750,000
Commercial, etc. = 48% of residential		568,320	693,456
WTP Backwash		103,000	126,000
Existing I&I		434,680	599,116
		3,040,000	3,313,272
Maximum Monthly Average Daily Flow (Gal/Day)			
Existing Residential flow at 100 gpcpd		1,184,000	1,144,700
Foster Farms		750,000	750,000
Commercial , etc.= 48% of residential		568,320	693,456
WTP Backwash		103,000	126,000
Existing I&I		3,394,680	3,559,116
		6,000,000	6,273,272

[1] Based on DOE Criteria for Sewage Works Design.
[2] Based on Table 2-13 of the Kelso 2005 Comprehensive Water System Plan Update. Commercial, etc. includes churches, hotels and schools.
[3] Based on DOE Criteria for Sewage Works Design without I/I

$CBOD_5$ AND TSS LOADING

There is very little BOD_5 and TSS analysis to characterize Kelso's sewage except for Foster Farms, which is required to under their state waste discharge permit. Section VI of this report presents an estimate of $CBOD_5$ and TSS loading for the entire Three Rivers Regional Wastewater Plant (TRRWP) service area including Kelso, Longview, BHSD and Cowlitz County. This analysis shows that the recently upgraded Three Rivers Regional Wastewater Plant (TRRWP) has more than enough capacity for $CBOD_5$ and TSS to handle Kelso's anticipated loading up to 2030.

In the absence of actual BOD_5 and TSS loadings, the Washington State Department of Ecology's Criteria for Sewage Works Design is used to approximate loading. The average loading rate for both BOD_5 and TSS from the above reference is 0.2 lbs/capita/day.

The estimate for future BOD_5 and TSS is shown below:

Population in 2030 = 14,447

BOD_5 and TSS mass = 14,447 x 0.2 lbs/day = 2889 lbs/day

48% allowance for commercial/industrial	1387 lbs/day
Foster Farms BOD_5	1750 lbs/day
Foster Farms TSS	600 lbs/day

BOD_5 load for Kelso in 2030 is estimated to be 6026 lbs/day.

TSS load for Kelso in 2030 is estimated to be 4876 lbs/day.

SECTION VI

EFFLUENT LIMITATIONS, WATER QUALITY MANAGEMENT GOALS AND END-USE REQUIREMENTS

INTRODUCTION

The purpose of this section is to present a discussion of how Kelso's anticipated growth over the next 20 years will impact the Three Rivers Regional Wastewater Plant (TRRWP). There are no plans for Kelso to discharge wastewater anywhere but the Three Rivers Regional Wastewater Plant (TRRWP).

Water bodies that receive treated effluent from the Three Rivers Regional Wastewater Plant (TRRWP) will be identified along with the current water quality conditions and effluent limitations. Secondary treatment requirements and effluent limitations will be described.

Description of Water Bodies

Columbia River: The Columbia River watershed includes areas in British Columbia and the Pacific Northwest of the United States. It is the largest river by volume flowing into the Pacific Ocean from North America, and the second largest in the United States. The Kelso/Longview area is situated approximately between river miles 60 and 68. As designated under WAC 173-201A, Aquatic Life Uses for the Columbia River include salmonid spawning, rearing and migration. The river is also designated for primary water contact use and for water supply including domestic, industrial, agriculture and stock watering. Miscellaneous uses include wildlife habitat, fish harvesting, commerce/navigation, boating and aesthetic values.

Description of Applicable Wastewater Treatment Facilities and NPDES Permits

The Three Rivers Regional Wastewater Plant (TRRWP) currently operates under a National Pollution Discharge Elimination System (NPDES) permit that establishes operational parameters and effluent limitations.

The Three Rivers Regional Wastewater Plant (TRRWP) is a Class IV waste activated sludge facility comprised of clarifiers, aeration basins and a chlorine contact basin which operates under

DOE Permit No. WA0037788 (see ***Appendix A***). The facility must meet effluent limits as presented in ***Table VI-1***. Please note that BOD_5 values are presented in units of Carbonaceous Biochemical Oxygen Demand (5 day) ($CBOD_5$).

Table VI-1
TRRWP NPDES Permit Effluent Limits

FINAL EFFLUENT LIMITATIONS: OUTFALL No. 1 *		
Parameter	**Average Monthly**	**Average Weekly**
$CBOD_5$	25 mg/L, 3978 lbs/day	40 mg/L, 5867 lbs/day
Total Suspended Solids	30 mg/L, 4815 lbs/day	45 mg/L, 7223 lbs/day
Fecal Coliform Bacteria	200 org/100 ml	400 org/100 ml
pH	Daily minimum is equal to or greater than 6 and the daily maximum is less than or equal to 9.	
Total Residual Chlorine	0.03 mg/L, 7 lbs/day	0.09 mg/L, 20 lbs/day
Total Ammonia (May-October) (November-April)	 15 mg/L, 3253 lbs/day 22.8 mg/L, 4944 lbs/day	 33.7 mg/L, 7308 lbs/day 51.5 mg/L, 11,167 lbs/day

*** Final Limitations** for the term after the facility completes the re-construction of both north-end secondary clarifiers.

The final effluent limitations will begin once the Department receives a Declaration of Construction of water pollution control facilities [Washington Administrative Code (WAC) 173-240-095] from the Permittee for the replacement of the north-end clarifiers. Beginning on the calendar month following the Department's receipt of this Notice and lasting until the expiration of this permit, the Permittee is authorized to discharge municipal wastewater at the permitted location subject to complying with the above limitations.

The Three Rivers Regional Wastewater Plant (TRRWP) discharges to the Columbia River, via a submerged diffuser. The acute dilution factor is 6.4 and the chronic dilution factor is 15.6[1] The chronic mixing zone boundary is not to exceed 235 ft beyond the upstream diffuser port in the upstream direction nor exceed 235 feet beyond the downstream diffuser port in the downstream direction. The width of the chronic mixing zone shall not exceed 25 percent of the width of the Columbia River at the diffuser location. The acute mixing boundaries are ten percent of the chronic mixing zone boundaries or

[1] NPDES Permit No. WA0037788, Cowlitz Water Pollution Control Plant, Washington Department of Ecology.

23.5 feet upstream and downstream of the outboard diffuser ports and not to exceed 2.5 percent of the width of the river.

WATER QUALITY CONCERNS AND APPLICABLE REGULATORY STANDARDS

Water Quality Standards need to be met to help ensure the protection of water quality and preserve the designated beneficial uses of Washington's surface waters described in WAC Chapter 173-201A. In 2006, a revised set of Water Quality Standards were issued by the Washington State Department of Ecology after being approved by the United States Environmental Protection Agency (EPA).

Pollutants in an effluent may affect the aquatic environment near the point of discharge (near-field) or at a considerable distance from the point of discharge (far-field). There are 30 toxic substances identified in WAC 173-201A which are, for the most part, near-field pollutants. The adverse effects of near-field pollutants are considered severe to the aquatic environment. Consequently, Water Quality Standards must be met at the edge of allowable mixing zones that are based on a relatively small portion of the receiving water. Conversely, a pollutant such as the 5-day biochemical demand (BOD_5), is a far-field pollutant whose adverse effect may occur further downstream of a discharge even after initial dilution has occurred.

WAC 173-201A authorizes the use of mixing zones around a point of discharge in establishing water quality based effluent limits. Both "chronic" and "acute" mixing zones may be authorized for pollutants that can have a toxic effect on the aquatic environment at the point of discharge. The concentration of pollutants at the edge of these mixing zones may not exceed the numerical criteria, or limits, for that type of zone. Mixing zones can only be authorized for discharges that are treated using "all known, available, and reasonable methods of prevention, control, and treatment (AKART)". The Three Rivers Regional Wastewater Plant (TRRWP) meets the definition of AKART.

General Discussion of Mixing Zones and Critical Conditions

WAC173-201A requires that the determination of acute and chronic mixing zone boundaries be based on 1) river flow volumes or 2) physical plume dimensions in the river, whichever is more stringent. A mixing zone is a small volume of the receiving water inside of which chronic or acute Water Quality Standards for toxics may be exceeded. Concentrations of toxics are diluted within the volume of water allowed, and the mixing zones are established such that Water Quality Standards are met at the boundary, or edge, of each mixing zone. If the Water Quality Standards cannot be met at the edge of the mixing zone for any given toxicant, then additional treatment must be provided and/or the toxicant must be controlled at the source prior to discharge into the City's sewer system.

WAC 173-201A-400 specifies the requirements for acute and chronic mixing zones in streams as the most restrictive of the following:

- Chronic Mixing Zone shall:
  1. Not extend in a downstream direction for a distance from the discharge ports greater than 300 feet plus the depth of the water over the discharge ports, or extend upstream for a distance of over 100 feet;
  2. Not utilize greater than 25 percent of the receiving water flow as measured during mean lower flow water; and/or
  3. Not occupy greater than 25 percent of the width of the water body as measured during mean lower flow water.
- Acute Mixing Zone shall:
  1. Not extend beyond 10 percent of the distance towards the upstream and downstream boundary of an authorized chronic mixing zone, as measured independently from the discharge points;
  2. Not utilize greater than 2.5 percent of the flow of the receiving stream; and/or
  3. Not occupy greater than 2.5 percent of the width of the receiving stream.

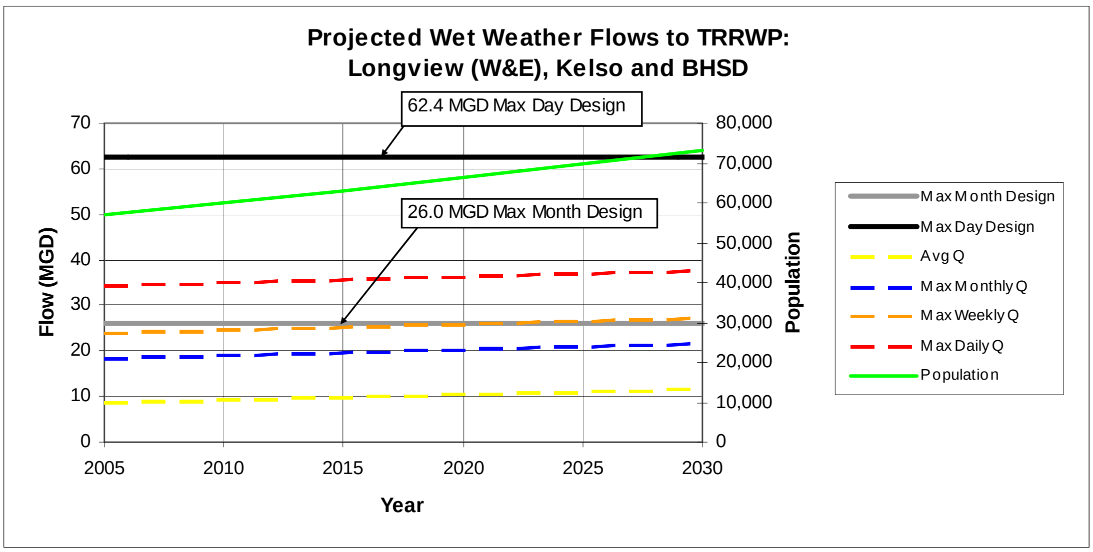
Flow and Loading Projections

The projected flow rate for the Three Rivers Regional Wastewater Plant (TRRWP) including East and West Longview, Kelso, Cowlitz County, and Beacon Hill Sewer District (BHSD) for the year 2030 is shown on Table VI-2 along with the flow rates that were used in the 1998 mixing zone study. The mixing zone study showed that water quality criteria would be met at Ultimate Buildout flows of 26.9 MGD for MMADF and 86.7 MGD for peak flow. Table VI-2 shows the year 2030 projected flows are well below those limits. Based on the mixing zone study and allowing for no significant reduction in treatment, water quality standards for the design criteria for the Three Rivers Regional Wastewater Plant (TRRWP)[2] (***Figures VI-1*** through ***VI-3***) will be met. The projected Longview, Kelso and BHSD flow rates were determined by the same population based methodology presented in *Section V* of this report.

Table VI-2
1998 Mixing Zone Report vs. Current Flow Projections

	Mixing Zone Study "2013" Design Values	Mixing Zone "Ultimate Build-out" Design Values (2030)	Projected 2030, *Longview (West & East)* + *Kelso* + *BHSD* Flow Rates
Max. Monthly Flow (MGD)	16.3	26.9	21.4
Max. Daily Flow (MGD)	62.4	86.7	37.8

Figure VI-1

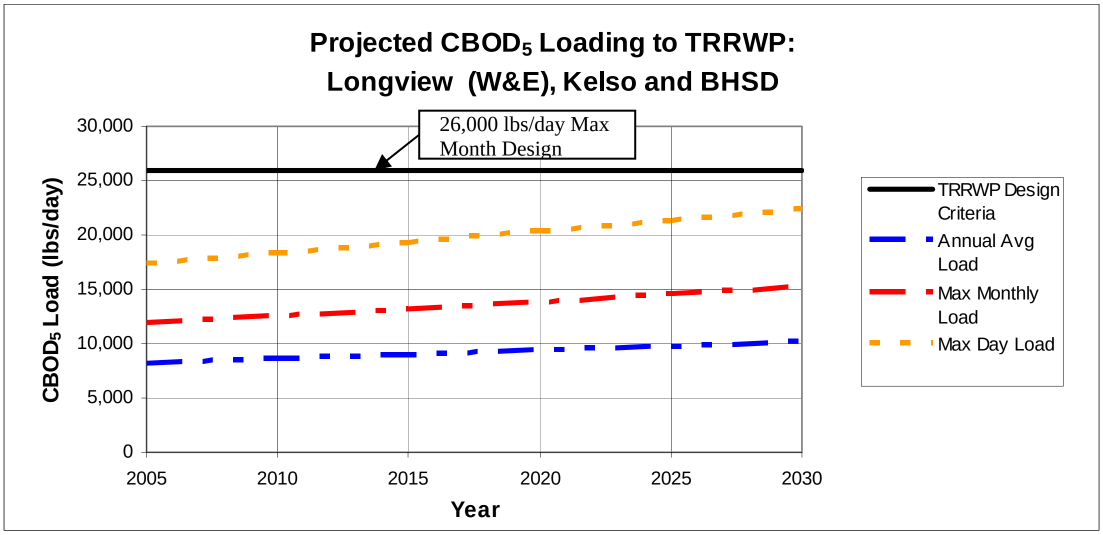


Analysis of the projected $CBOD_5$ loading rates from West Longview, East Longview, Kelso and BHSD service areas indicates that in 2030 the maximum daily, maximum monthly and average $CBOD_5$ loading rates would be approximately 22,000, 15,000 and 10,000 lbs/day, respectively. These numbers are compared to the Three Rivers Regional Wastewater Plant (TRRWP) $CBOD_5$ design criteria maximum monthly loading rate of 26,000 lbs/day (83% of the BOD design

[2] Design criteria obtained from Facility Plan (Table IV-2), dated November 1999, prepared by Gibbs & Olson, Inc. and Corollo Engineers.

loading rate of 31,200 lbs/day)[3]. This analysis assumes that industrial effluent rates from the service areas also increase proportionally to the population. A summary of the Three Rivers Regional Wastewater Plant (TRRWP) system capacity for $CBOD_5$ is presented below in ***Figure VI-2***.

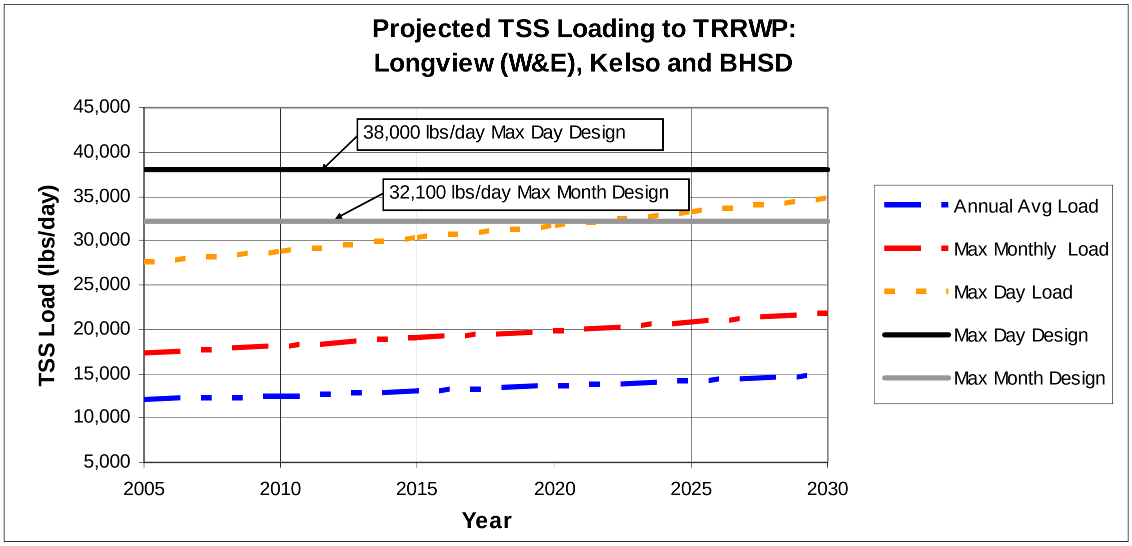
Figure VI-2



Analysis of the TSS projected loading rates from West Longview, East Longview, Kelso and BHSD service areas indicates that in 2030 the maximum daily, monthly and average TSS loading rates would be approximately 35,000, 22,000 and 15,000 lbs/day, respectively. These numbers are compared to the Three Rivers Regional Wastewater Plant (TRRWP) TSS design criteria loading rate of 32,100 lbs/day maximum monthly and 38,000 lbs/day maximum daily. This analysis assumes that industrial effluent rates from the service areas also increase proportionally to the population. A summary of the Three Rivers Regional Wastewater Plant (TRRWP) system capacity for TSS is presented below in ***Figure VI-3.***

[3] Fact Sheet for NPDES Permit No. WA0037788 Three Rivers Regional Wastewater Authority, by DOE, dated January 8, 2007, pg. 13.

Figure VI-3



Based upon the preceding discussion of the mixing zone study done by Cosmopolitan and the Three Rivers Regional Wastewater Plant (TRRWP) capacity analysis, it appears the existing Three Rivers Regional Wastewater Plant (TRRWP) has the necessary capacity to treat and discharge all wastewater from Kelso (through year 2030) to the required treatment standards and that Water Quality Standards will be met at the edge of the mixing zone. ***Appendix C*** presents a discussion of projected flows and loading from previous planning documents compared to the March 2008 Longview GSP. It should be noted that the mixing zone study is presently being re-evaluated to determine whether the TRRWP predominantly discharges to the Columbia or Cowlitz River. Depending on the outcome of this re-evaluation, stricter discharge requirements, including an ammonia limit, could be imposed on the plant. Should that happen, plant upgrades may be required.

SECTION VII

COLLECTION SYSTEM EVALUATION

INTRODUCTION

The purpose of this section is to describe the existing collection system and identify future sewer line extensions and pump station construction that will be needed to serve the future sewer service areas. This section also presents an inventory of the collection system, evaluates the system's overall condition including a computer model of flow conditions within the system, summarizes the results, identifies improvements that need to be made, and describes an Infiltration and Inflow (I/I) removal program. In summary, this section brings all the planning efforts to action.

DESCRIPTION OF EXISTING COLLECTION SYSTEM

The City of Kelso collection system consists of 10 pump stations and more than 58 miles of collection system piping ranging in size from 4 inches to 48 inches. The collection system is divided into 17 sewer sub-basins (K-1 through K-17). These sub-basins are shown in Figure III-2. An up-to-date sewer inventory map of the Kelso sewer collection system is shown on Figure VII-1 and VII-2 (see the map pocket at the end of this Plan). ***Appendix D*** contains a line-by-line sewer pipe inventory of the existing sewer piping. Dead-end cleanouts are currently being inventoried by the City.

The City of Kelso is served by the Three Rivers Regional Wastewater Plant (TRRWP), located near Fibre Way in Longview, Washington. The plant is owned and operated by the Three Rivers Regional Wastewater Authority (TRRWA), whose members are Longview, Kelso, Beacon Hill Sewer District, and Cowlitz County. Each entity is responsible for all costs to operate and maintain their individual collection systems, and they share the costs for the facilities owned by TRRWA, based on the proportion of flow they contribute.

The majority of the flows from the Kelso service area are pumped via the Kelso Main Pump Station (12.8 MGD firm capacity) located south of Kelso. The remaining flows (from the West

Kelso area) are pumped by the Catlin Pump Station to the 3rd Avenue Interceptor, which is shared by the Beacon Hill Sewer District and a portion of the City of Longview's sewer service area. The 3rd Avenue Interceptor, which is owned by the City of Longview, can flow to either the Kelso-Longview Pump Station (27 MGD firm capacity) or to the West Industrial Way Pump Station (38 MGD firm capacity). Both of these pump stations pump directly to the TRRWP. The Kelso Main Pump Station pumps to the Kelso-Longview Pump Station. All three pump stations are owned and operated by the Three Rivers Regional Wastewater Authority (TRRWA).

FLOW MONITORING PROGRAM (1988-1993)

From 1987 to 1993 a flow monitoring study and sewer line rehabilitation program was conducted by Gibbs and Olson, Inc. The study area included Kelso, East Longview, and the Beacon Hill Sewer district (BHSD). The program was divided into four phases. The first phase from October 1987 to February 1988 consisted of an initial flow study. The sewer collection systems of Kelso, Longview and BHSD were divided up into 33 flow monitoring basins, where flows were recorded and logged. Kelso had 11 flow monitoring basins (K1-K11). After the initial flow study, the basins were prioritized according to the amount of I/I each contributed. Flow monitoring basin K4 (which is essentially sewer main and branch piping along Mill St.) was determined to be one of the worst basins based on the I/I contribution in terms of gallons per day per inch-mile (GPD/in-mi)[1].

Long-term flow monitoring of the other sewer basins was conducted from 1988-1991 to verify the I/I amounts. During the same period, flow monitoring basin K4 was rehabilitated. The rehabilitation work consisted of replacing mainlines, manholes, and side sewers from the mainline to the property line. Side sewers from the property line to the building were replaced by property owners. After the rehabilitation work was finished post rehabilitation monitoring was conducted from 1991-1993 to evaluate the effectiveness of the I/I removal. The result was that the I/I was reduced from 76,000 gpd/ in-mi to 5,900 gpd/ in-mi or a 92% removal.

[1] The inch-mile is the length of the pipe in miles multiplied by the diameter. This unit of measurement is commonly used in I/I studies so that sub-basins having vastly different amounts and sizes of pipe can be directly compared to each other.

The study provided projections of 2, 5, 10, 25, 50 and 100 year storm events by using regression analysis on flow data and the two-day rainfall that occurred on the day of and day prior to the flow event. Using this information, a hydraulic analysis of the collection system was conducted to determine if the sewer sub-basins had adequate capacity for a two-day, 10-year storm event after the rehabilitation work. At that time, it was determined that Kelso's sewer system had adequate capacity without any additional I/I removal.

No additional improvements were recommended for Kelso, although several flow monitoring basins still had marginally high amounts of I/I. However, the report did recommend improvements to the 3rd Avenue Sewer Interceptor, which is owned by Longview and shared by Longview, Kelso and Beacon Hill Sewer District. The improvements included a connector from the interceptor just south of the intersection of Tennant Way and 3rd Avenue to the existing 54" diameter Industrial Way Interceptor which flows to the Kelso - Longview Pump Station. The report also recommended reducing I/I to the interceptor by rehabilitating flow monitoring basin L41 in Longview. Subsequently, the connector was constructed, but the sewer basin for Longview has not been rehabilitated yet. This interceptor is discussed in more detail on page VII-26.

1997 GENERAL SEWER PLAN FOR LONGVIEW-KELSO AREA

A 1997 General Sewer Plan (GSP) prepared by KCM for the Cowlitz Sewer Operating Board (now known as TRRWA) identified deficiencies in the collection system and possible future extensions for Kelso.

As in the 1993 flow study, the GSP identified the 3rd Avenue Interceptor as under capacity for existing and future flows although no hydraulic grade line concerns were identified (i.e. overflowing manholes). It also identified capacity deficiencies along Allen Street near the intersection with Minor Road. Capacity deficiencies were also identified along South Kelso Drive and along the sewer trunk along 13th Avenue between Chestnut and Colorado Streets.

Areas of concern for 20-year future growth included Grade Street east of 5th Avenue and one of the main lines along Manasco Drive. Capacity issues for future growth were also identified along Talley Way. The GSP provided recommendations for improvements to the existing collection system and for future extensions as summarized in Table VII-1 below.

TABLE VII-1: SUMMARY OF RECOMMENDED SEWER LINE IMPROVEMENTS FROM KCM 1997 GENERAL SEWER PLAN					
***KCM Time Frame**	**Status**	**KCM Map I.D.**	**KCM Project Name**	**KCM Project Description**	**Comments**
ST	Minor Rd. Section Done.	CK-1	Minor Rd/ Allen St.	These improvements address existing hydraulic grade line problems along Minor Road and Allen Street, and provide future capacity	The Allen Street portion of the project is identified as a Capital Improvement Project in this Facilities Plan.
ST	25% Complete.	CK-2	Coweeman River 1	The first Coweeman River extension will provide a gravity service main line for an existing service area and accommodate service to future service area.	The remaining portion of this extension located along Valley View Dr. has been identified as a future service area in this Facilities Plan.
ST	Beyond Planning Period.	CK-3	Railroad (South)	The Railroad (south) extension will provide a pump station near Highway 432 on the east bank of the Cowlitz River with a force main to the main trunk of the existing collection system. It will provide short-term service to the industrial area south of the proposed pump station, and future service to the Rose Valley / Carrolls area.	The Rose Valley and Carrolls areas have a low potential for future service in the next 20 years, and therefore, this extension was not revisited in this Plan.
ST	Low Potential For Future Service.	CK-4	Railroad (North)	The Railroad (North) extension will provide a gravity service main line for a future service area in south Kelso.	This area located northwest of the airport along S. Pacific Ave. is considered to have a low potential for future service in the next 20 years, and therefore this extension was not revisited in this Facilities Plan. A parallel extension located west of the Three Rivers Golf Course along South River Rd. is discussed in this Plan.
IT	Done	CK-5	Harris Street	The Harris Street extension will provide a gravity service main line for the northernmost portion of a future service area.	A sewer extension for Highlander Estates was built in 1996.
IT	Potential for Future Service.	CK-6	Allen Street	The Allen Street extension will provide a gravity main line for a future service area north of the Coweeman River.	This extension has been identified as a future service area and is discussed later in this Facilities Plan.

TABLE VII-1: SUMMARY OF RECOMMENDED SEWER LINE IMPROVEMENTS FROM KCM 1997 GENERAL SEWER PLAN					
***KCM Time Frame**	**Status**	**KCM Map I.D.**	**KCM Project Name**	**KCM Project Description**	**Comments**
IT	Beyond Planning Period.	CK-7	Coweeman River 2	The second Coweeman River extension continues the first Coweeman River extension. This project will provide a gravity service main line for a future service area south of the Coweeman River.	This area located further east of the Valley View area is considered to have a low potential for future service in the next 20 years, and therefore, this extension was not revisited in this Plan.
IT	Done	CK-8	Behshel Road	The Behshel Road extension will provide a gravity service main line for a future service area.	A sewer extension for Mt. Brynion Estates was built in 1995.
IT	Potential for Future Service.	CK9	Mt. Brynion Road	The Mt. Brynion Road extension will provide a gravity service main for a future service area.	This extension has been identified as a future service area and is discussed later in this Facilities Plan.
IT	Potential for Future Service.	CK-10	Vista Way	The Vista Way extension will provide a gravity service main line for a future service area.	This extension has been relabeled the Cedar Falls Extension and is discussed later in this Facilities Plan.
IT	High Potential for Part of Future Service Area.	CK-11	Highway 432/ Interstate 5	The Highway 432/Interstate 5 extension project is an extension of the Railroad (south) extension project. This project will provide a gravity service main line for a future service area.	This extension which incorporates a large future service area to the south on both sides of I-5 has been partitioned in this Facilities Plan with a smaller future service area that has a high potential for development during the planning period.
IT	Beyond Planning Period	CK-12	Coweeman River	Coweeman River improvements along the main collection system line between Chestnut Street and Colorado Street are needed to accommodate flows from future sub-basins.	The future service areas identified in the KCM Plan have been reduced to only future service areas with high potential to occur in the 20 year planning period. The future growth outlined in this Facilities Plan is accommodated by the existing sewer interceptor.
LT	Potential for Future Service.	CK-13	Pacific Avenue	The Pacific Ave. extension provides a gravity main line that discharges to the Donation Street pump station, serving a future service area.	This extension has been identified as a future service area and is discussed later in this Facilities Plan.
LT	Beyond Planning Period	CK-14	Minor Road	The Minor Road extension will provide a gravity service main line for a small portion of a future service area.	This area located north of Kelso and east of I-5 is considered to have a low potential for future service in the next 20 years, and therefore, this extension was not revisited in this Plan.

TABLE VII-1: SUMMARY OF RECOMMENDED SEWER LINE IMPROVEMENTS FROM KCM 1997 GENERAL SEWER PLAN					
*KCM Time Frame	Status	KCM Map I.D.	KCM Project Name	KCM Project Description	Comments
LT	Beyond Planning Period	CK-15	Carrolls Road 1	The first Carrolls Road extension will provide a gravity service main line for a future service area.	The Rose Valley and Carrolls areas have a low potential for future service in the next 20 years, and therefore, this extension was not revisited in this Plan
LT	Beyond Planning Period	CK-16	Carrolls Road 2	The second Carrolls Road extension continues the first Carrolls Road extension and provides a gravity main line for a future service area.	The Rose Valley and Carrolls areas have a low potential for future service in the next 20 years, and therefore, this extension was not revisited in this Plan
LT	Beyond Planning Period	CK-17	Rose Valley	The Rose Valley extension project is an extension of the Highway 432/Interstate 5 extension project. This project will provide a gravity service main line for the Rose Valley/Carrolls area.	The Rose Valley and Carrolls areas have a low potential for future service in the next 20 years, and therefore, this extension was not revisited in this Plan
*ST= Short Term (0-5 yrs); IT= Intermediate Term (6-10 yrs); LT= Long Term (11-20 yrs)					

COLLECTION SYSTEM IMPROVEMENTS SINCE 1993

This section presents a summary of the sewer projects that have been constructed in the City of Kelso since the 1993 flow monitoring study. The first table lists new development that has occurred between 1993 and 2010. The second table summarizes sewer rehabilitation projects that have occurred in the same time period.

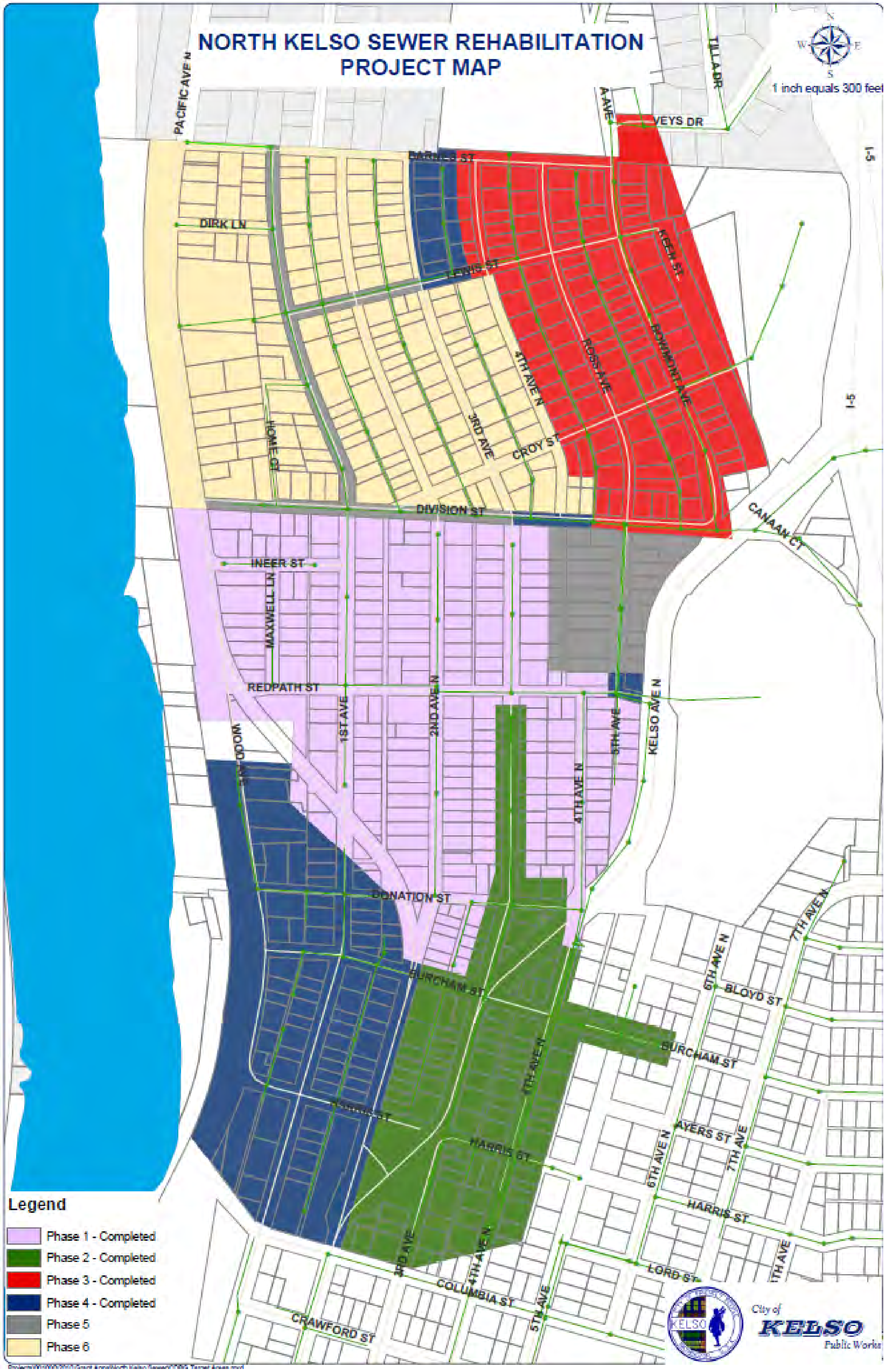
Table VII-2: New Developments/ Sewer Extensions from 1993 to 2010.		
Development	**Year of Construction**	**Description**
Cedar Falls Drive Subdivision	1993	58 single-family lots along Cedar Falls Drive and Roley Court located in southeast Kelso served by 2,800 feet 8-inch PVC gravity sewer branching off the sewer main along South Kelso Drive.
Mt. Brynion Estates	1995	48-lot residential development in northeast Kelso off of Behshel Heights Road is served by a submersible pump station (Mt. Brynion Pump Station) with 1,140 feet of 4-inch ductile iron forcemain, and 3,800 ft 8-inch PVC gravity sewer.
Highlander Estates	1996	A 60-lot residential subdivision in northeast Kelso off of Harris Street Road is served by 4,000 feet of 8-inch PVC gravity sewer.

Table VII-2: New Developments/ Sewer Extensions from 1993 to 2010.		
Development	**Year of Construction**	**Description**
Coweeman Park	1997	Commercial area located in south Kelso served by a submersible sewer pump station (Coweeman Park Drive Pump Station), with 1,200 feet of 4-inch ductile iron forcemain, 325 feet of 10-inch forcemain, and 1,500 feet of 8-inch PVC gravity sewer piping. A 90 foot segment of 10-inch gravity sewer pipe was also installed to extend the existing sewer main south along Talley Way to a point where the forcemain connects. In 2009, approximately 150 feet of 8-inch gravity pipe was abandoned or removed from the west side of the pump station as part of a freeway interchange project.
John Komanecky Site Development	1997	This sewer extension consists of 8” PVC gravity sewer piping extending 590 feet west from S. 13th Avenue along Hazel Street to serve three parcels in a light-industrial zoned area.
Lower Ridge Subdivision	1999	A 25-lot residential subdivision in north Kelso on Bowmont Avenue is served by a 1,400-foot extension of the existing 15-inch PVC gravity sewer.
Clark Street Pump Station	2004	Constructed on the northeast corner of the intersection of 7th Ave. NW and Clark Street. The forcemain discharges to a manhole in Clark Street about 30 feet away. The station serves mostly residential customers including some apartment buildings.
Silver Star Sewer Extension	2007	A 110-foot extension consisting of 8-inch PVC gravity sewer north of Burcham Street (just west of N. Pacific Avenue) was installed to serve three single family residences.

Table VII-3: Sewer Rehabilitation Projects from 1993 to 2010.		
Sewer Rehabilitation Project	**Year of Construction**	**Description**
Lowraine Drive Sewer Re-alignment	1994	Consisted of abandoning an existing section of 8-inch sewer line along Lowraine Drive and installing 275 feet of 8-inch PVC gravity sewer in and providing four (4) service laterals to reconnect existing single-family residences.
Sanitary Sewer Rehabilitation Phase II	1994	Second phase of a 6-phase project to rehabilitate flow monitoring basin K1 in north Kelso as identified in the ’93 Gibbs and Olson flow monitoring study. Replaced existing main line piping with 463 feet of 6-inch PVC, 4,652 feet of 8-inch PVC and 196 feet of 10-inch PVC. Sewer laterals were replaced as well. The project encompassed the area from Columbia Street to Redpath Street (south to north) and from N. Pacific Avenue to Sixth Avenue (west to east). See Figure VII-3.
Sanitary Sewer Replacement	1995	Consisted of two schedules to replace/ re-align existing piping in downtown Kelso by the train station and in west Kelso on Fifth Avenue. The rehabilitation consisted of replacement of existing main line piping with 182 feet 8-inch PVC, 574 feet 10-inch PVC, and 674 feet 15-inch PVC.

Table VII-3: Sewer Rehabilitation Projects from 1993 to 2010.		
Sewer Rehabilitation Project	**Year of Construction**	**Description**
Sanitary Sewer Rehabilitation Phase III	1996	Third phase of a 6-phase project to rehabilitate flow monitoring basin K1 in north Kelso as identified in the '93 Gibbs and Olson flow monitoring study. Replaced existing main line piping with 484 feet of 6-inch PVC, 3,284 feet of 8-inch PVC, 496 feet of 10-inch PVC, 998 feet of 15-inch PVC, and 855 feet of 18-inch PVC gravity sewer piping. Sewer laterals were replaced as well. The project encompassed the area bounded by Fourth Ave. (to the west) and N. Kelso Ave. (to the east), and Division St. (to the south) and Veys St. (to the north). See Figure VII-3.
Sanitary Sewer Replacement	1998	Consisted of replacement/ re-alignment of existing piping in downtown Kelso by the train station. Included installation of 712 feet of 15-inch PVC gravity sewer on South Pacific Avenue from Ash Street to Oak Street and installation of 180 feet of 12-inch PVC gravity sewer on Vine Street between South Pacific Avenue to First Avenue.
800 Block of Walnut Street and Willow Street	1998	Consisted of replacement/ re-alignment of existing piping south Kelso, north of the airport. Included installation of 118 feet of 10-inch PVC, 218 feet of 8-inch PVC, and 63 feet of 6-inch PVC gravity sewer piping.
Donation Street Force Main	1999	To provide additional capacity for the Donation Street Pump Station, 1,218 feet of 10-inch ductile iron forcemain was constructed along N. Fourth Avenue parallel to the existing 8-inch forcemain.
Mill Street Sanitary Sewer Replacement	1999	Involved replacement of 240 feet of 21-inch Class 3 concrete pipe between 11th and 12th Street.
Grim Road-Banyon Drive Sanitary Sewer Force Main	2001	After a mud-slide in a residential subdivision in southeast Kelso, provisions to serve the remaining houses included installation of 3,137 feet of 2-inch Schedule 40 PVC glue joint pipe forcemain from Banyon #1 (Aldercrest #2) pump station along Banyon Drive to West Highland Park Dive. Also, 354 feet of 6-inch PVC gravity sewer along Banyon Drive was installed near the intersection with Mimosa Drive. Two submersible pump stations (Banyon 1 and 2 Pump Stations) were constructed as part of this project as well.
Kelso Drive Sewer Interceptor Replacement	2001	In 2001 a 15-inch concrete interceptor was replaced from MH K13:96 to MH K10:11 with 550 feet of 16-inch ductile iron pipe, 380 feet of 18-inch ductile iron pipe, and 2,020 feet of 21-inch PVC pipe.
North Kelso Sewer Replacement Phase IV	2004	This project is the fourth phase of a six-phase project to rehabilitate flow monitoring basin K1 in north Kelso as identified in the '93 Gibbs and Olson flow monitoring study. The project consisted of two (2) areas in north Kelso: the first was located in the vicinity of Harris Street and N. Pacific Avenue; and the second was located from Redpath Street to the north to Barnes Street. See Figure VII-3. Existing sewer piping was replaced with PVC piping in the following quantities: 5,037 feet 8-inch pipe; 377 feet 10-inch pipe; 225 feet 12-inch pipe, and 118 feet of 18-inch pipe. In addition sewer laterals were replaced.

FIGURE VII-3 – SEWER REHABILITATION FOR
'93 FLOW MONITORING BASIN K1



SANITARY SEWER FLOW MODELING

As part of this GSP/FP, a computer model of Kelso's sewer collection system was developed to evaluate the flow capacity and identify sections of the collection system that are currently undersized. The modeling software used for the analysis was H2OMap Sewer Pro. The sewer model was developed using flow information from the flow monitoring study by Gibbs and Olson, Inc. dated February 1993 (revised March 1993) and using field survey information including manhole rim, locations and sewer pipe inverts, size and pipe type provided by the City of Kelso.

The basis for the model design flow is a two-day, 25-year storm event from the 1993 flow monitoring study. This flow projection was developed for each flow monitoring basin by using regression analysis on selected flow data and the two-day rainfall that occurred on the day of, and day prior to the flow event. Only data where two-day rainfall was greater than 0.25 inches was used. (The model takes into consideration rehabilitation work performed in flow monitoring basin K4.)

These flows for each flow basin were then modified for the purposes of the modeling to obtain a peak hour flow (versus a peak day flow), and they were also modified for a more intense 24-hour duration storm instead of a two-day storm. This flow modification was done by multiplying each of the projected 25-year storm flows in the '93 flow monitoring study by a peaking factor of 1.5. This peaking factor was developed through prior modeling work that Gibbs and Olson conducted for the City of Longview as briefly explained below:

> The model for east Longview was developed using flow and rain data from the '93 flow monitoring study to calibrate a rain/ flow relationship for the collection system. The model projected peak hour flows through unit hydrographs and hyetographs, or rainfall distributions for a 25-year, 24-hour duration storm event. The 25-year storm flows from the model were then compared to the projected 25-year storm flows in the '93 flow study which are peak day flow values for a two-

day storm event versus a peak hour flow value for a 24-hour storm event in the model. The flows differed by an average factor of 1.5.

In addition, flows from properties that have developed since the ’93 flow monitoring study have been accounted for including a significant industrial user, Foster Farms. The waste flows were developed using the following unit flows based on land use and are shown in Table VII-4 or actual flow data where available.

Table VII-4 – Unit Flows for Property Developments Since the 1993 Flow Study

Land Use	Unit Flow
Residential	200 gal/ ERU
Light Industrial/Commercial	1,250 GPAD

ERU = equivalent residency unit. GPAD = gallons per acre per day.

An I/I unit value of 5,000 GPD/ in-mi was used to estimate the I/I flow for the new developments. The flow value per ERU is based on a dry weather flow per capita of 80 GPD and an average number of people per household of 2.5, which is consistent with the KCM GSP. The flow unit value for light industrial and commercial properties is also consistent with the KCM GSP. A summary table of the new developments and breakdown of the flows is presented in Table E.1 in ***Appendix E***. The flow from Foster Farms is based on the effluent limit value of 1.5 MGD on their NPDES permit, and their permit Fact Sheet, which indicates that flows have reached 2 MGD in the past. In the computer model, a peaking factor of 4[2] was used to estimate peak hour flows for the new development waste loads with the exception of Foster Farms, which was assigned a peaking factor of 1.5 due to the more consistent flows as seen from flow data for the facility. A peaking factor was not used for I/I since 5,000 GPD/ in-mi is considered conservative for new pipe that is installed properly. The total I/I from new developments from 1993-2010 is estimated at 0.135 MGD with a total Average Daily Flow of 1.60 MGD. Total peak hour flow with I/I is estimated at 2.77 MGD. The updated design flows for each ’93 flow monitoring basin is presented Table VII-5.

[2] Peaking factor obtained from Department of Ecology’s *Criteria for Sewage Works Design*, October 2006, pg. C1-7, Figure C1-1 *Ratio of Peak Hourly Flow to Design Average Flow.*

Table VII-5 – Model Year 2010 Design Flow Values (Compared to '93 Flow Values Based on Development)				
'93 Flow Mon. Basin	'93 ADF MGD	2010 ADF MGD	'93 PHF MGD	2010 PHF MGD
K1/ K2	0.15	**0.15**	2.54	**2.58**
K3	0.09	**0.09**	0.35	**0.35**
K4 (rehabilitation)	0.09	**0.09**	0.59	**0.59**
K5	0.24	**0.24**	1.08	**1.08**
K6	0.03	**0.03**	0.13	**0.13**
K7	0.26	**0.26**	2.03	**2.03**
K8	0.07	**0.11**	1.04	**1.28**
K9	0.09	**0.09**	2.63	**2.63**
K10	0.04	**0.05**	0.71	**0.77**
K11	0.43	**1.97**	4.80	**7.21**
Total Daily Avg:	1.47	**3.06**	15.88	**18.64**

Note:
ADF= Average Daily Flow
PHF = Peak Hour Flow

The flows in Table VII-5 were distributed in the model by node (i.e. manhole or cleanout) for the waste loads and by in-miles of pipe for I/I for each flow monitoring basin. Point sources of flow such as Foster Farms and backwash from the Kelso Water Treatment Plant (103,000 GPD Max Month in Basin K5) were assigned to the nearest manhole. In addition a flow of 1,600 GPM from the water treatment plant was modeled to simulate an unplanned plant restart with filter waste to the sewer system.

The model correlates well with documented flow data from the Kelso Main Pump Station. This pump station receives flow from all the flow basins except K3. The average of this pump station's flow from April 1st to October 31st from 2007 to 2009 is 2.16 MGD, which compares well with the design base flow of 2.97 MGD based on the values in Table VII-5. On January 7, 2009 during a 5-year storm event, instantaneous flow readings from the pump station flow meter indicated that the meter maxed out at 15 MGD for about 1-1/2 hours on that day, which is consistent with the total design peak hour flow of 18.64 MGD for a 25-year event per the model.

FUTURE FLOWS

Future areas are described in this section and are based on input from the Kelso Public Works Department and City Planning Department. Sewer extensions identified in this section are for future developments are most likely to occur in the next 20 years. It should be noted that the City is in the process of updating their Comprehensive Plan. These future service areas are shown in Figure VII-5.

Flow projections for future service areas were calculated based on the unit flows presented in Table VII-4. Each future service area boundary was outlined based on topography/geography and by input from the City's 2009 Capital Improvements Projects Plan. Total ERU's for residential areas were determined by counting the number of houses on a 2006 aerial photograph of each future service area. A growth rate of 1 percent was applied to the number of ERU's compounded from 2007 to 2030. In areas where there are currently no houses to base a growth rate on, or where accelerated development is expected to occur, the number of ERU's was assumed. An I/I value of 25 GPD/ capita and an average of 2.5 people/ ERU was used to estimate the I/I flow for each future area. For commercial/ light industrial developments, each area's acreage was measured and a unit flow value of 1,250 GPAD was applied. In the computer model, a peaking factor of four[3] was used to estimate peak hour flows for the waste loads. A peaking factor was not used for I/I since it is considered conservative for new pipe that is installed properly. The total I/I from future developments from 2010 to 2030 is estimated at 0.11 MGD with a total Average Daily Flow of 0.43 MGD. Total peak hour flow from future developments with I/I included is estimated to be 1.84 MGD.

In order to size the sewer extension piping, build-out flow projections were calculated based on the same methodology described above but with build-out ERU's based on the following development densities from Kelso City zoning ordinances.

- RSF-15 (residential single-family zone 15) – 3 units/ acre
- RSF-10 (residential single-family zone 10) – 4 units/ acre

[3] Peaking factor obtained from Department of Ecology's *Criteria for Sewage Works Design*, October 2006, pg. C1-7, Figure C1-1 *Ratio of Peak Hourly Flow to Design Average Flow*.

- RSF-5 (residential single-family zone 5) – 9 units/ acre
- RMF (residential multiple-family zone) – 32 units/ acre
- CMR – major retail commercial zone - none
- ILM – light manufacturing industrial zone - none

The total build-out I/I from future service areas is estimated at 0.46 MGD with a total Average Daily Flow of 1.58 MGD. Total peak hour flow from future developments with I/I included is estimated at 6.78 MGD. A summary table of the future developments and breakdown of the flows is presented in Tables E.2 and E.3 in ***Appendix E*** for future and build-out flows, respectively.

FUTURE COLLECTION SYSTEM EXTENSIONS

The future service areas will require extensions of the existing sewer system to serve those areas. How these areas will connect to the existing collection system is discussed below. Line sizing considers build-out for these areas. The routing and location of these lines are estimates only and will be refined as the development in those areas occurs. At this time, we have assumed new lines will follow existing roads or other right-of-ways. Pipe diameter may be increased to meet minimum slopes required.

CEDAR FALLS ROAD EXTENSION

This extension would facilitate further development, within the city limits, of residential properties in an area that has already had some fairly recent development. The increased service area is approximately 144 acres of RSF-10 and RSF-15 zoned properties, or low density residential due to the undulating terrain. The main service route will be along a future extension of Cedar Falls Drive. This will most likely require approximately 4,100 feet of 8-inch line connected to the existing 8-inch line at Manhole K14:39A.

SOUTH RIVER ROAD EXTENSION

This extension would enable further development/redevelopment of residential properties in areas located by the Three Rivers Golf Course and by the Cowlitz River. The increased service area is potentially 110 acres of RSF-10 and RMF zoned properties, or medium to high density residential. It is feasible that the zoning for the RSF-10 properties would change to a higher density RSF-5 once sewer service is established in this flat area. The main service route will be along South River Road; however portions of the line will require easements in order to avoid excessive excavation. A 1,400 foot easement will be required at the Three Rivers Golf Course that essentially follows an old alignment of South River Road between the golfing range and the golf course to the TRRWA Kelso Main Pump Station. An additional 1,600 feet of easement will be required on 11 properties on the east side of South River Road, in order to stay off the dike on South River Road north of Olive Street. Eight of these properties are owned by CDID #3. In total, approximately 5,100 feet of sewer pipe will be required to serve this area: 1,800 feet will be 15 inch sewer pipe; 1,700 feet will be 10 inch; and 1,600 feet of 8 inch pipe. This extension will either connect directly into the Kelso Main Pump Station or just upstream of it.

TALLEY WAY EXTENSION

This extension would facilitate new development, within the city limits, of commercial/retail properties by I-5 Exit No. 36 by extending Talley Way south of State Route 432. The I-5 interchange is currently undergoing an upgrade to enable development in this area. The increased sewer service area is approximately 80 acres. The main service route is not clear since the properties are completely undeveloped; however for the purposes of this Plan, it is assumed that approximately 3,400 feet of 8-inch gravity line and a new sewer pump station rated at 400 GPM would be needed to serve this area. In addition, approximately 2,800 feet of 6-inch forcemain will be required to pump the flows across State Route 432 and the Coweeman River and connect to the existing 10-inch sewer line at Manhole K17:55. Approximately 1,100 feet of the 2,800 foot forcemain has been built across State Route 432 as part of the I-5 interchange project.

ROCKY POINT EXTENSION

This extension is located outside the north city limits with the primary reason for the extension being to provide sewer service to existing residences that have failing septic systems. The increased service area is potentially 169 acres of assumed RSF-5 zoned properties, or medium density residential. The extension consists of a 15-inch sewer pipe that starts at the north end of

Cowlitz Garden Road and proceeds south and east towards the City. A 450-foot bore casing will likely be required to cross both a railroad track and N Pacific Avenue. An 8-inch sewer branch will extend north of the 15-inch pipe along N. Pacific Avenue to Holcomb Avenue to serve the Rocky Point area. Approximately 1,640 feet of easements on four properties, 980 feet of which is owned by Cowlitz County Public Works, will be required. The extension will connect to Manhole K1:141. In total, approximately 5,900 feet of 15 inch sewer pipe and 1,300 feet of 8 inch sewer pipe will be required to serve the area. It is possible that the 15 inch sewer pipe could extend further north and east from Cowlitz Garden Road along N. Pacific Avenue beyond the planning period.

MT. BRYNION ROAD EXTENSION

This extension is located outside the north/northeast city limits. The increased service area is potentially 148 acres of assumed RSF-10 zoned properties, or low density residential. The extension consists of an 8-inch sewer pipe that starts on Mt. Brynion Road near Fouch Road and proceeds south and west towards the City. The sewer line will stay in the right-of-way for its entire length and will connect to Manhole K13:38. In total, approximately 4,000 feet of 8 inch sewer pipe will be required to serve the area. It is possible that the 8 inch sewer pipe could extend further north and east along Mt. Brynion Road beyond the planning period.

EAST ALLEN STREET EXTENSION

This extension is located outside the east city limits. The increased service area is potentially 405 acres of assumed RSF-15 zoned properties, or low density residential. The extension consists of a 15-inch sewer pipe that starts on Allen Street at PG Sweet Road and proceeds west towards the City. The sewer line will stay in the right-of-way for its entire length. A pump station rated at approximately 900 GPM and 700 feet of 10-inch forcemain will be required to pump uphill to Manhole K10:31. Approximately 4,600 feet of 15-inch sewer pipe will be required to serve the area. It is possible that the 15-inch sewer pipe could extend further east along Allen Street beyond the planning period.

VALLEY VIEW EXTENSION

This extension is located outside the east city limits and could potentially serve 137 acres of assumed RSF-15 zoned properties, or low density residential. The extension consists of 4,600 feet of 8-inch sewer pipe. Two pump stations rated at approximately 230 GPM and 90 GPM will also be required with a 4-inch forcemain at 1,800 feet and a 3-inch forcemain at 400 feet, respectively. The sewer extension will stay in the right-of-way for its entire length, but two easements will be required for the pump station sites. The extension will connect to Manhole K16:134.

WALNUT STREET EXTENSION

This extension is located inside the city limits in the central, west part of the City, and it could potentially serve 28 acres of assumed Light Commercial zoned properties. The extension consists of 1,200 feet of 8-inch sewer pipe. The sewer extension will stay in the right-of-way for its entire length and will connect to Manhole K17:44.

HAZEL STREET EXTENSION

This extension is located outside the southwest city limits with the primary reason for the extension being to provide sewer service to existing properties that have septic systems. The increased service area is approximately 25 acres of commercial/ light industrial/ heavy industrial zoned properties. The extension consists of a 10-inch sewer pipe that starts at the west end of the current sewer line on Hazel Street (MH K17:39B) and proceeds west in the right-of-way. In total, approximately 1,900 feet of 10-inch sewer pipe will be required to serve the area.

SOUTH PACIFIC AVENUE EXTENSION

This extension is located outside the southwest city limits with the primary reason for the extension being to provide sewer service to existing properties that have septic systems. The increased service area is approximately 102 acres of mixed use residential/ commercial/ light industrial zoned properties. The extension consists of a 12-inch sewer pipe that starts at the west end of the current sewer trunk on Colorado Street (MH K17:7). The extension alignment proceeds west of Colorado Street along a right-of-way located adjacent to the north border of the Kelso Airport. The extension would then proceed to the northwest along 3rd Avenue South and

South Pacific Avenue to Willow Street. A number of sewer branches would connect to the 12-inch main line to serve each of the streets to the east on the main line. In total, approximately 4,200 feet of 12-inch sewer pipe will be required to serve the area.

FUTURE EXTENSIONS SUMMARY

The future extensions discussed on the previous pages are summarized in Table VII-6.

Table VII-6 - Summary of Future Sewer Extensions

Extension Name	Components
Cedar Falls	4,100 feet of 8" Gravity Pipe
South River Road	1,800 feet of 15" Gravity Pipe 1,700 feet of 10" Gravity Pipe 1,600 feet of 8" Gravity Pipe
Talley Way	3,400 feet of 8" Gravity Pipe 1,700 feet of 6" Forcemain Pump Station
Rocky Point	5,900 feet of 15" Gravity Pipe 450 feet of Bore Casing 1,300 feet of 8" Gravity Pipe
Mt. Brynion Road	4,000 feet of 8" Gravity Pipe
East Allen Street	4,600 feet of 15" Gravity Pipe 700 feet of 10" Forcemain Pump Station
Valley View	4,600 feet of 8" Gravity Pipe 1,800 feet of 4" Forcemain 400 feet of 3" Forcemain Pump Stations (2)
Walnut Street	1,200 feet of 8" Gravity Pipe
Hazel Street	1,900 feet of 10” Gravity Pipe
South Pacific Avenue	4,200 feet of 12” Gravity Pipe

Construction of the proposed extensions will occur over time as future developments evolve. These extensions will most likely be constructed by developers. The information contained in this Plan should be used as a guide to help ensure that sewer extensions occurring in the next few years will be constructed to allow for future development of an entire area at the least cost to the City. When a development is proposed, more specific information will be gathered. That information should then be used to re-evaluate how the near term construction will fit into the long-range planning for a particular area. Specific site locations for the alignments of sewer lines, force mains or pump station locations will depend on many factors that cannot be determined at this time. These factors include how the land owners propose to develop their land, where future roads will be located, where and what other utilities are to be installed, and the density of the development.

AREAS IN CITY LIMITS NOT CURRENTLY SERVED

The City has a number of areas that are within the city limits that are not currently served with sewer collection systems. These areas are discussed below and are identified on Figure VII-5. These areas are described below and are considered to have a low potential for development in the 20 year planning period. Therefore sewer extensions to serve these areas are not addressed in this Plan. Any future extension to serve these areas would be developer driven.

FUTURE K-1

This area consists of 41 acres of vacant land zoned major retail commercial (CMR) located in the northern tip of the City.

FUTURE K-14

Area contains 484 acres of low-to-medium density residential zoned property located in the southeast portion of the City, east of I-5. The area is currently vacant land with undulating terrain.

FUTURE K-16

This area consists of 384 acres of vacant land located in the southeast portion of the City. The area is mostly zoned OPN, open space zone, which is permanently protected from development. A neighborhood development was located in the area, but it has since been removed due to a landslide, leaving only a few houses. The south portion of the area is zoned for low-to-medium density residential development and consists of undulating terrain.

FUTURE K-17

An area located in the very south portion of the City consists of 763 acres of vacant land zoned IGM, general manufacturing industrial zone. The area is located almost entirely in the FEMA

100-year flood plain and consists mostly of Freshwater Forested Shrub and Freshwater Emergent wetlands.

COLLECTION SYSTEM EVALUATION

The collection system evaluation considers the collection system's ability to carry the current year 2010 and projected year 2030 peak hour flows. Modeling results show that there are sewer lines and manholes that are surcharging during large storm events for present and future flows as presented in Figures VII-4 and VII-5, respectively.

CAPACITY RELATED CRITERIA

Flows were distributed in the model by taking the flows in Table VII-5 and assigning them to the pre-1993 manholes in the model according to the '93 flow monitoring basins. Flows from developments that have occurred since 1993 (in Table E.1 in ***Appendix E***) were added to the corresponding manholes in the model for year 2010 flows. The flows generated in the model were compared to the capacity of the piping to identify surcharging piping. A *Manning's n-value* of 0.013 was used for piping roughness. The model calculated hydraulic profiles to determine whether manholes will overflow based on the capacity restrictions of the piping system. For the purposes of this study, we considered areas where manhole overflows occurred to be capacity limited areas that need to be addressed. This approach is conservative in that the model preserves all the flows in the collection system (i.e. where an overflow occurs in the model, no flow is lost). Hydraulic profiles that are within 0.25 feet of the manhole rims were considered overflowing manholes. In addition, hydraulic profiles within 0.5 feet and 1 foot of the manhole rims were analyzed and shown in Figures VII-4 and VII-5.

Another assumption in the capacity analysis for the collection system is that there are no flow restrictions due to undersized pump stations (i.e. inflow equaled outflow for each pump station). This assumption enables any surcharging issues to be carried through the pump stations to downstream piping. Each pump station was reviewed to determine whether inflow exceeded pumping capacity.

CAPACITY ANALYSIS

Present Conditions

The Kelso sewer collection system is overall in good condition hydraulically and does not experience many surcharging manholes according to the model (see Figure VII-4). There are isolated lines that surcharge mainly due to piping that has reverse grade to the flow in some of the further reaches of the collection system; however these sections of piping generally do not cause significant backups. Sections of the main trunk lines have flow constrictions that are discussed below.

<u>4th Avenue and Academy Drive Gravity Sewers</u>

A flow constriction occurs along 4th Avenue in North Kelso. The Donation Street Pump Station, which has 15-inch and 18-inch influent lines, discharges to a 15-inch line that flows south on 4th Avenue. This 15-inch line is able to handle the flows due to the relatively steep slopes. There is one section of line just downstream of MH K3:14A that surcharges, but there, flow is split at the manhole to a 6-inch sewer line to the west that helps alleviate the capacity issue with the 15-inch line. The 15-inch line then constricts to a 12-inch line and flattens in slope where it turns east on Academy Drive between manholes K3:9 and K3:10. The City has observed MH K3:10 surcharging in the past; however the model showed no hydraulic capacity issues in this area. The City recently videotaped the line downstream of this manhole and found roots blocking the line. After the City corrects the root intrusion, this section of line is anticipated to no longer surcharge during storm events and should be monitored during the next event. If any overflow still occurs then the City will revisit this issue and further evaluate it.

<u>13th Avenue Interceptor</u>

The main trunk line along 13th Avenue and portions of the trunk piping to the Kelso Main Pump Station were identified in the model as being surcharged as shown in Figure VII-4. However, the piping is deep enough that the hydraulic grade line remains below the manhole rim elevations. The section of line along 13th Avenue was identified in the KCM GSP as a surcharging pipe section. However, these lines appear to accommodate the hydraulic grade line for the peak hour flows so no action is recommended at this time.

It was shown in the model that if the Kelso Water Treatment Plant wasted 1,600 GPM to the sewer system during an unplanned plant startup, the slug could potentially surcharge the 13th Avenue Interceptor to the point where six additional upstream manholes on the east side of I-5 could surcharge during a 25 year event. The manholes are K10:11A, K10:78, K13:95A, K13:96, K13:97 and K13:103. The water treatment plant will need to avoid or limit discharging to the sewer system during major storm events. For a peak hour 25 year event, the water treatment plant would need to limit its flow to 200 GPM.

Manasco Drive Interceptor

The worst constriction is a section of sewer interceptor that is generally along Manasco Drive from MH K7:77 to K10:11. This segment of piping was also identified as a future growth concern in the KCM GSP. This sewer line consists of 21-inch concrete pipe that was installed in the mid 1970's. The segment of pipe from MH K10:1 to K7:77 is a 24-inch diameter concrete pipe. Manhole K7:77 is an old wetwell that is a remnant from the Kelso Wastewater Treatment Plant that was demolished in the 1970s when the TRRWA was formed. The interceptor has two sewer branches and a forcemain that flow into it. Two branches at 21-inches and 15-inches in diameter flow in from the north and northeast, respectively. In addition, a 10-inch forcemain from the Grade Street Pump Station connects into the interceptor from the southeast. This interceptor also has two areas where the piping slope is reversed against the flow.

The model shows surcharged piping virtually all along the interceptor, and three surcharged manholes were identified upstream of this constriction as shown by the red manholes in Figure VII-4. The City has observed manholes K10:15 and K10:16 in Tam O'Shanter Park surcharging during a high flow event that occurred in January 2009, and reportedly, City crews have observed MH K10:12 surcharging during high flows as well. Both observations correlate with the model. In addition, the model indicated that manholes K13:96 and K10:15C have water surface elevations (WSE) at about 6-inches below their rim elevations (indicated in orange in Figure VII-4), and manholes K13:95A, K10:15E, K10:17, and K10:8 have WSE's at about 1-foot below the rims (indicated in yellow in Figure VII-4). **A capital improvement project to address this issue is presented later in this section.**

Allen Drive Gravity Sewer

Another area of concern that was also identified in the KCM GSP is the 10-inch sewer line located along Allen Street just east of Minor Road. The model indicated that manholes K13:71 and K13:83 would overflow during a large storm event. These manholes were not observed by the City during the January 7-8, 2009 storm event; however the model indicates the piping is undersized and the slope is too shallow for the estimated flows in this area. **A capital improvement project to address this issue is presented later in this section.**

Observed Surcharged Manholes

A number of manholes in addition to the ones discussed on the previous pages were identified by City field observations as surcharged during a storm event on January 7-8, 2009. These manholes are K1:84, K4:7, K1:7, K1:8, K2:13, K9:8, K9:9, K9:10, K15:20, and K15:21. Based on the modeling results, these overflow occurrences, with the possible exception of three, are likely due to partial blockages of the sewer lines. The observed overflow at Harris Street and 12th Avenue (MH K2:13), the overflows on Oak Street (MH K9:8, K9:9 and K9:10), and the overflows at K1:7 and K1:8 could possibly be due to hydraulic issues as explained in the next two paragraphs.

- The sewer line at Harris Street and 12th serves approximately 40 residential parcels. There is a section of pipe downstream of MH K2:13 that has a reverse grade that causes some backwater, but not enough to overflow the manhole. The model has 0.1 MGD flowing through the manhole with 0.024 MGD waste-loading and approximately 0.076 MGD of I/I (37,000 gpd/in-mi). The date of the piping is circa 1950. If the I/I is increased to 0.256 MGD, an overflow does occur in the model. However this would indicate a significant deterioration in the piping since the 1993 Flow Study conducted by Gibbs and Olson.

- The sewer line at Oak Street, serves approximately 18 residential properties. According to the model, there is surcharging that occurs in a major sewer line located south of Oak Street between manholes K9:5 and K9:6. However the surcharging was not enough to overflow the manholes on Oak Street. It would take an increase in the flow from 4.7

MGD to 6.4 MGD applied to MH K9:6 to start overflowing MH K9:9. This is an increase of 37 percent from the flows from the 1993 flow monitoring study. However, the fact that all three manholes along Oak Street were observed surcharging may indicate that there is a blockage in the sewer line downstream of MH K9:8 as the model could not recreate the same pattern of observed surcharging.

- The surcharging at K1:7 and K1:8 located on Donation Street were noted by the City as occurring due to a possibly high wetwell level in the Donation Street Pump Station. It should also be noted that a county stormwater pump station was inoperable during the storm event causing flooding in to the sewer collection system. It was evident in the model that there is a potential capacity issue with this pump station which was also verified with pump hour logs for 2009. The model did not identify any surcharged manholes in this area, and an overflow due to limited pump station capacity would not show up in the model as the outflows for each pump station are set to match the inflows.

It is recommended that the City videotape the areas where they have observed overflows to ensure that there are no sewer line blockages. If it is determined that there are no blockages, then updated flow monitoring information should be obtained from these areas during the wet season downstream of where the overflow occurred. For the overflows on Oak Street, the flow monitor should be placed at manhole K9:5. These areas should then be recalibrated in the model with the new flow data and re-analyzed to determine any hydraulic issues.

<u>Gravity Sewer Maintenance Items</u>

The City identified a number of areas listed below that have frequent backups and I/I as identified in the City's Capital Improvement Project List for 2010.

- Sixth Avenue and Lord Street (City CIP # S-10)
- Elizabeth Street, 8^{th} Avenue to 11^{th} Avenue (City CIP # S-11)
- Coweeman Lane, 8^{th} Avenue to 11^{th} Avenue (City CIP # S-12)
- Fisher's Court, NW 2^{nd} Avenue to Fisher's Lane (City CIP # S-13)

No major hydraulic issues were identified in the model for these areas. The piping in these areas dates back to the 1920's and 1950's, and it is our opinion that due to age, the piping just needs to be replaced. Maintenance summary list to address these issues are presented later in this section.

Future Conditions

The addition of flows from the future (Year 2030) service areas (1.8 MGD) showed a minor impact to the collection system (see Figure VII-5). Three segments of sewer piping were surcharged along the Talley Way branch sewer. A few other areas in the collection system had an isolated surcharged pipe on the main lines. Three additional surcharged manholes were identified at the intersection of Minor Road and Allen Street – K13:95A, K13:96, K13:97. Two additional manholes – K10:11A and K13:103- have water surface elevations at about 1-foot below the rims (indicated in yellow in Figure VII-5). **A capital improvement project (Manasco Drive Interceptor) to address these issues is presented later in this section.**

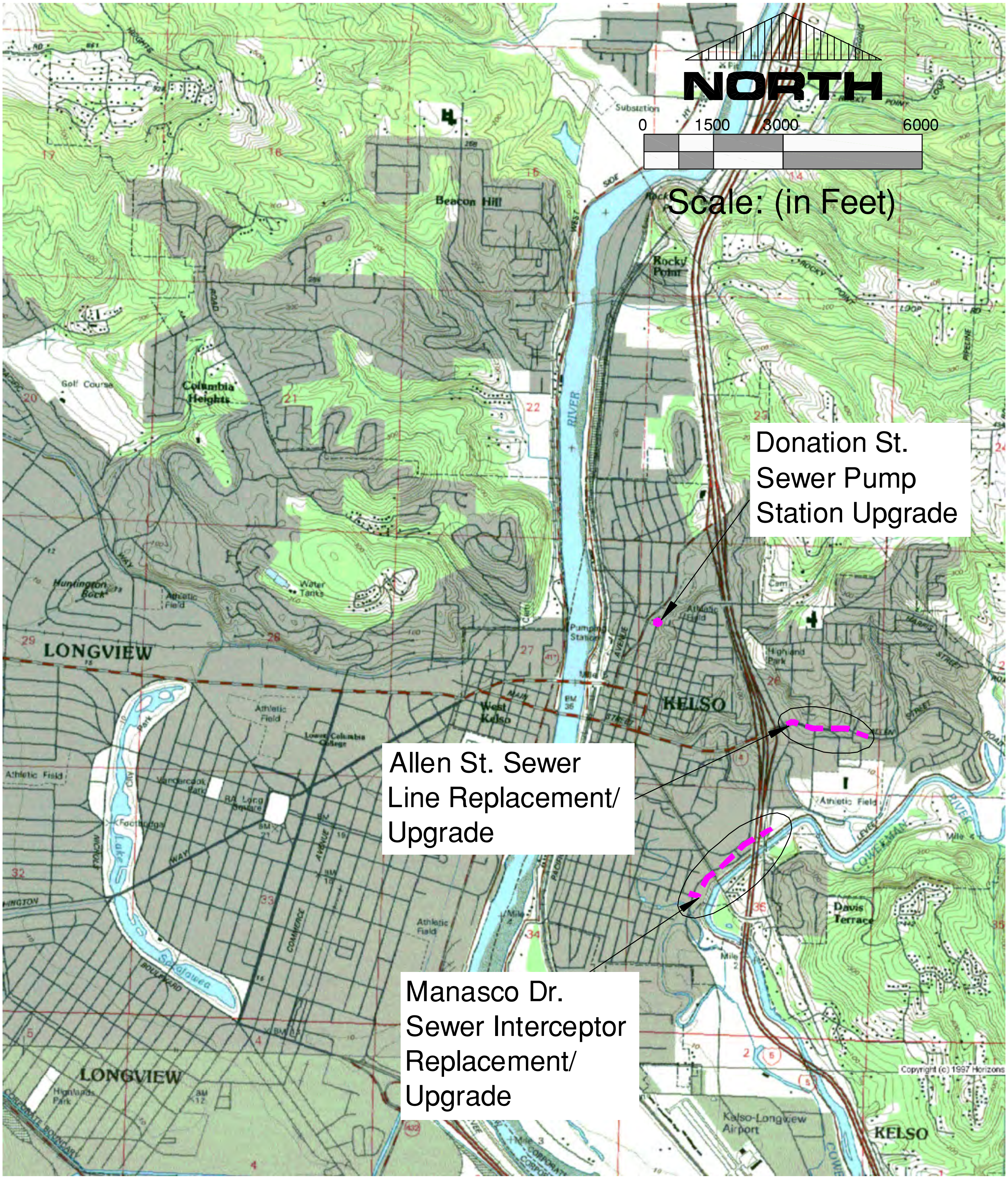
3rd Avenue Interceptor

This regional interceptor can be divided into two major segments, the upper and lower segment. The upper segment accepts flow from Beacon Hill Sewer District's (BHSD) Nevada Drive Pump Station transports the flow through approximately 3,000 feet of 24-inch reinforced concrete sewer pipe (RCSP) generally along 3rd Avenue through West Kelso to the intersection of 3rd Avenue and Washington Street. This upper segment also accepts flows from Kelso's Catlin St. Pump Station at a manhole located at the 3rd Avenue and Catlin Street intersection. The lower segment of the interceptor continues southerly from the intersection of Washington and 3rd along Longview's 1st and 3rd Avenues and consists of approximately 8,800 feet of 24-inch and 27-inch RCSP.

The upper segment of the 3rd Avenue Interceptor is wholly owned and maintained by BHSD. The lower segment is owned by the City of Longview who shares it with Kelso and BHSD. The interlocal agreement in Appendix B – does not address the 3rd Avenue interceptor and the responsibilities of each party for the interceptor. It is recommended BHSD, Longview and Kelso provide a joint planning effort in order to address the interceptor and determine the best way to share the costs between the entities.

RECOMMENDED GRAVITY SEWER IMPROVEMENTS

A review of the collection system shows areas of the system that are undersized to carry peak hour flows for a 25-year event and cause the system to surcharge as discussed in the previous section. As the collection system surcharges, capacity increases and has been shown to carry the peak hour flows without overflows of raw sewage with the exception of the sewer interceptor along Manasco Drive, which is shown in the model to cause several upstream manholes to overflow in three areas, as supported by City observations. Also the sewer line along Allen Street, east of Minor Road, surcharges during a major storm event resulting in two overflowing manholes in the model. Gravity sewer maintenance items that have been identified in the City's Six Year Capital Improvement Program are also summarized below. Cost estimates for the Capital Improvements and maintenance items for the collection system are presented in Tables VII-7 and VII-8, respectively, at the end of this section. The locations of these improvements are shown in Figure VII-6.



Reference: 7.5 Minute USGS Map, Kelso WA, OR Quadrange, dated 1990
7.5 Minute USGS Map, Coal Creek WA, OR Quadrangle, dated 1985
7.5 Minute USGS Map, Rainier WA, OR Quadrangle, dated 1990

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LEGEND

- Existing Pump Station
- Proposed Sewer Line

City of Kelso
General Sewer and Facilities Plan
Capital Improvement Locations
Figure VII-6

Manasco Drive Interceptor Capital Improvement

The Manasco Drive sewer main is undersized and has significant backups to the upstream sewer collection system piping. It is recommended to construct a new sewer interceptor in place of the existing one. The new interceptor will consist of 1,400 feet of 36-inch diameter piping from MH K7:77 to MH K10:7. In addition, 1,000 feet of 30-inch diameter piping would replace the segment from MH K10:7 to MH K10:11. A minimum slope of 0.0006 ft/ft is required for the 36-inch pipe, and 0.0012 ft/ft is required for the 30-inch pipe. ***The upgrade will be able to handle the buildout growth for future service areas as identified in this chapter; however significant restrictions will begin to occur on the sewer trunk along 13th Avenue at 50 percent of the buildout, which is beyond the planning period for this Plan.*** The cost of the replacement is presented in Table VII-7. Right-of-way and wetland mitigation are not anticipated at this time and have not been included in the cost estimate.

Allen Street Sewer Capital Improvement

The Allen Street sewer line does not have adequate capacity causing backups to the upstream sewer collection piping. It is recommended to construct a new sewer line in place of the existing one. The new line will consist of 1,800 feet of 12-inch diameter piping from MH K13:101 to MH K12:1. The slope will also need to be steepened on the piping to a minimum of 0.0040 ft/ ft. The cost of the replacement is presented in Table VII-7. Right-of-way and wetland mitigation are not anticipated at this time and have not been included in the cost estimate.

Gravity Sewer Maintenance Items

The City identified a number of areas listed below that have frequent backups and I/I as identified in the City's Capital Improvement Project List for 2010.

- Sixth Avenue and Lord Street – Further investigation needed.
- Elizabeth Street, 8th Avenue to 11th Avenue– 775 feet 8-inch main
- Coweeman Lane, 8th Avenue to 11th Avenue – 800 feet 8-inch main
- Fisher's Court, NW 2nd Avenue to Fisher's Lane – 885 feet 10-inch main and 540 feet 8-inch main

No major hydraulic issues were identified in the model for these areas. The piping in these areas dates back to the 1920's and 1950's, and it is likely that due to age, the piping just needs to be replaced with same sized pipe.

The sewer at 6th Avenue and Lord Street is a known problem for the City, but the full extent of the problem has not been identified by the City. The sewer model did not identify any major hydraulic issues in this area. There is one small section of 8-inch pipe located between manholes K3:16 and K3:40 that surcharges and may contribute to the problem; however the model did not identify any major backups from it. It is recommended that the City videotape the sewer lines on 6th Avenue and Lord Street to ensure that there are no sewer line blockages. If it is determined that there are no blockages, then updated flow monitoring information should be obtained from this area during the wet season. The model should then be recalibrated with the new flow data and re-analyzed to determine the hydraulic issues, if any. This project has been identified in the City's 6-Year Capital Improvement Plan as S-10 with an estimated cost of $300,000, which will be used in this Plan as a placeholder under maintenance items pending the outcome of the evaluation.

Cost Summaries

Total costs of the Capital Improvement Projects and maintenance items discussed in the previous sections are presented in Table VII-7 and VII-8, respectively, and include construction costs, 7.9 percent sales tax, 30 percent construction contingency, and 25 percent engineering, legal and administration costs. Right-of-way and wetland mitigation are not anticipated at this time and have not been included in this cost estimate. A table listing of collection system projects in order of priority is listed at the end of this chapter.

Table VII-7 - Planning Level Cost Estimate of Capital Improvements for Gravity Piping (Year 2010-2030)	
Manasco Drive Interceptor Replacement/ Upgrade	
1,000 feet of 30" Pipe @ $710/ft	$710,000
1,400 feet of 36" Pipe @ $680/ft	$952,000
Subtotal	$1,662,000
Allen Street Sewer Replacement/ Upgrade	
1,800 feet of 12" Pipe @ $320/ft	$576,000
Subtotal	**$2,238,000**
Sales Tax @ 7.9%	$176,802
Subtotal w/ Tax	**$2,414,802**
Construction Contingency @ 30%	$724,441
Engineering, Admin & Legal @ 25%	$559,500
TOTAL ESTIMATED CAPITAL COST (Rounded)	**$3,699,000**

Table VII-8 - Planning Level Cost Estimate of Maintenance Items for Gravity Piping (Year 2010-2030)	
6th Ave. and Lord St. Sewer Replace (City CIP S-10)	
Pending Further Investigation	$300,000
Elizabeth St., 8th Ave. to 11th Ave. Sewer Replace (City CIP S-11)	
775 ft 8" Pipe @ $270/ft	$209,000
Coweeman Ln., 8th Ave. to 11th Ave. Sewer Replace (City CIP S-12)	
800 ft 8" Pipe @ $270/ft	$216,000
Fisher's Ct., NW 2nd Ave. to Fisher's Ln. Sewer Replace (City CIP S-13)	
885 ft 10" Pipe @ $290/ft & 540 ft 8" Pipe @ $270/ft	$402,000
Subtotal	**$1,127,000**
Sales Tax @ 7.9%	$89,033
Subtotal w/ Tax	**$1,216,033**
Construction Contingency @ 30%	$364,810
Engineering, Admin & Legal @ 25%	$281,750
TOTAL ESTIMATED CAPITAL COST (Rounded)	**$1,863,000**

PUMP STATION DESCRIPTIONS AND EVALUATIONS

The City of Kelso has ten pump stations that it owns and operates. All but one of these stations pump to the Kelso Main Pump Station, which is operated and maintained by the Three Rivers Regional Wastewater Authority (TRRWA). Kelso's contribution of wastewater flow is metered at this station as it is pumped to the Three Rivers Regional Wastewater Plant (TRRWP). The Catlin Street pump station pumps directly to the 3rd Avenue Interceptor in West Kelso. A description of each of the City's various pump stations and discussion on issues with the pump station based on interviews with Public Works field personnel and Department of Ecology Criteria for Sewage Works Design follows.

DONATION ST. PUMP STATION

The pump station is located at 1010 Donation St., was originally built circa 1950 and was rebuilt in 1975. The rebuild consisted of removing and replacing existing equipment. A programmable logic controller (PLC) unit and variable frequency drives (VFD) were installed in 1994. A 100 kW standby generator, which is served by an underground diesel tank (UST), was also installed circa 1994 to provide back-up power. The UST should be evaluated by an environmental consulting firm to determine whether it is in compliance with current regulations. The PLC has a small touch screen human-machine interface (HMI) positioned on the front of the control panel and an auto-dialer reports high/low water level, power/pump/generator start failure, and water in dry well alarm conditions. The PLC, auto-dialer, generator, VFD's, and control panels are housed in a roughly 14- x 18-foot brick building which has a roof-mounted red alarm light and air vent as well as a screened louver on the northerly wall.

There are two entry doors elevated approximately 2.5 feet above the asphalt apron in front of the building to facilitate the loading and unloading of equipment from the station. Water service and a backflow preventer device are in the building, which is situated over the wet well/dry well. An aluminum hatch inside the building provides access to the 10' x 12'-6" x 23'-6" (depth) wet well and a staircase leads down to the two (2) 50 hp Cornell pumps in the dry well. The pumps are the non-clog end suction centrifugal type and are each rated for 1,100 gpm at 85 feet of total dynamic head (TDH). The forcemain consists of approximately 1,200 feet of parallel 8- and 10-inch diameter ductile iron pipes which are routed from Donation Street south to Columbia Street.

The water level is measured primarily with a bubbler system using compressed air, but one mercury float switch also provides redundancy and will trip an alarm in the event of a failure. The pump station serves Huntington Junior High, Barnes Elementary School, and the surrounding residences in the collection basin, which is the most northerly basin in the system.

The Donation St. Pump Station operates continuously during heavy rains because of an inflow and infiltration (I/I) problem that is suspected by the City crews to originate in the vicinity of Minor Rd. on the east side of Interstate 5. The City observed a surcharged manhole (K1:7) located directly upstream of the pump station during a high flow event that occurred in January 2009, which the City suspects and modeling indicates was caused by inadequate pumping capacity. House fans hung from wire are being used to cool the two pumps which, under high-flow conditions, are both operating at their full service factor. The pumps will need to be up-sized in the near future to keep up with high flows. The existing hatch covers over the pumps are also misaligned, which makes removing the pumps difficult. For these reasons, the work associated with upgrading the Donation St. Pump Station is deemed to be a priority. The Donation Street Pump Station has been identified in the City's Six Year Capital Improvement Program as Item S-07 with a budget of $120,000 for a pump station upgrade including adding two flow meters and correcting electrical safety issues. **A capital improvement project to replace the pump station is presented later in this section.**

GRADE ST. PUMP STATION

The pump station is located at 1501 Coweeman Drive and was originally constructed in the early to mid 1970's. In 1987, the station was rebuilt. The rebuild consisted of: an addition to the existing building to house new pumping equipment and a generator; refurbishing of the existing building and wetwell and installation of new valves, piping, and controls.

The station is primarily controlled by an ultrasonic level sensor, and four (4) mercury float switches provide back-up level monitoring/ controls. Flows are monitored by a magnetic flow meter. The station has no PLC, but wet well levels and flow trends are continuously recorded by a Rustrack RT-8000 data recorder on radial flow monitoring sheets. There is a red emergency light on the top of the brick building to provide a visible alert to City crews in the event of a malfunction. Alarm conditions monitored at the station include high/low water level, power/ pump/ generator start/ pump seal failure, and thermal overload.

Power from the 275 kW air-cooled Cummins generator, which is fueled by a 500-gallon underground diesel tank (UST), is supplied to the pump station by means of an automatic transfer switch in the event of a power outage. The UST was installed by the south wall of the building during the pump station rebuild in 1987 and contains cathodic protection. The cathodic protection system should be inspected to see if the anodes need to be replaced. The UST should be also be inspected by an environmental consulting firm to determine whether it meets current state requirements for UST's. Appropriate exhaust ventilation for the generator is provided by a large louver in the northerly wall of the dry well portion of the building.

Both the wet well and dry well portions of the building are equipped with electric fans for further ventilation. The wet well has an area of 10- x 12-foot and a height of 10 feet. City water is available, and there is a backflow preventer device, although it is inconveniently located near the ceiling which makes maintenance difficult.

The two (2) dry pit 50 hp Fairbanks Morse pumps, which have been in operation since 1987, are still in excellent condition. Each pump has an 8-inch discharge and is rated for 2,500 gpm at 60 feet of TDH. The forcemain itself is a 10-inch steel pipe that is 274 feet in length. The pumps draw seal water from a 100 gallon fiberglass tank which is located in the lower floor of the dry well portion of the building. A steel I-beam rated for 1½ tons maximum capacity spans the ceiling of the upper room. A rolling hook hoist mounted on the beam can be used to pull the pumps or valves in the lower level if necessary.

The station receives flows almost exclusively from residential customers, most of whom are located east of I-5. The basin area extends to the east along Haussler Rd. and Grim Rd. and as far south as Paxton Dr. The pump station is expected to have sufficient capacity to handle flows from the basin throughout the planning period.

The pump station is located adjacent to the Coweeman River and according to FEMA flood insurance maps is located in or adjacent to the 100-year flood zone. A permanent wall has been built around the pump station to help protect it from flooding.

The Grade St. pump station is in excellent condition and continues to adequately handle peak influent flows. Analysis of the sewer model indicates that the station is oversized for the inflows to the station. No major upgrades or modifications are recommended at this time. However, it should be noted that the station does not have telemetry, which should be provided given the size of the station, the lack of an emergency overflow to the downstream collection system, and the potential for an overflow to enter the Coweeman River.

BANYON #2 PUMP STATION (ALDERCREST #1)

The pump station is located at 312 Banyon Dr. at the far eastern boundary of the collection system and is also known as the Aldercrest #1 Pump Station. The station was constructed in 2001 to serve the few residential customers remaining after the circa 1999 landslide that destroyed dozens of homes that were previously in the service area. The submersible station has a 48-inch diameter fiberglass wet well that is 13 feet deep. Two 3.9 hp grinder pumps pump approximately 64 gpm through the 3,140 feet of 2-inch PVC forcemain with a minimum and maximum TDH of 98.4 feet and 162.4 feet, respectively. The pumps' guide rails do not work properly, making it difficult for crews to remove the pumps. Four (4) mercury float switches operate the lead and lag pumps and there is a local warning light on the top of the steel weather-proof electrical box, which is in good condition. The local light indicates a high water level, power failure, pump seal failure, or thermal overload. The station has a basic control panel with no PLC. There is telemetry available to monitor both Banyon #1 and #2 from the Kelso water treatment plant, but the software is currently installed on a computer that is not functioning. The site is located on a hill and has adequate drainage. The perimeter of the site is secured with a 6-foot high chain-link fence with barbed wire, but there is no lighting.

The Banyon #2 pump station is in good condition and is operating well. No major upgrades or modifications are deemed necessary at this time. However, the pumps' guide rails do need to be repaired so that the submersible pumps can be removed and installed easily and fall protection should be added to the wetwell access. In addition, the City plans to add a flow meter to the station as identified under their Capital Improvements (CIP S-05).

BANYON #1 PUMP STATION (ALDERCREST #2)

The pump station is located at 403 Banyon Dr. about 300 feet south of Banyon #2. Banyon #1 is also known as the Aldercrest #2 Pump Station and is similar to Banyon #2. The submersible station has a 36-inch diameter fiberglass wet well with a vented lid and is 9 feet deep. Three (3) floats control the single 3.9 hp grinder pump which discharges through a 2-inch PVC forcemain to Banyon #2. A small post-mounted control panel houses electrical components and a Siemens LOGO! 230RC control display. The enclosure and electrical/control components are in good condition. A local alarm indicates high water levels, pump seal failures, and thermal overloads. The station is located on a 6- x 10-foot parcel at the end of the steep road immediately before an access gate to the Aldercrest landslide area. Only two residences are served by the pump station.

The Banyon #1 pump station is in good condition and is operating well. No major upgrades or modifications are deemed necessary at this time. However, the station does have a junction box in the wet well that routes power to the pump and signal cables from the float switches. Junction boxes that serve non-hazardous intrinsically safe circuits (float switches) do not pose a hazard, but any junction box supplying power to the pumps presents a fire hazard and should either be relocated to a safe location outside the wet well or be replaced with an enclosure rated as (National Electrical Manufacturers Association) NEMA 7 or “XP” (explosion proof). An electrician should verify that the junction box is appropriate for the environment it is in.

The pump station currently serves only two residences. Since the cost for operating and maintaining the pump station is disproportionate to the service fees paid for by the residences, the City may consider removing the pump station and providing just a pressure line to the property lines so that both residences can connect with a private grinder pump system such as an E-one system. The City would need to review its ordinances to ensure it can implement this approach. Also, the City would need to provide guidelines to the residences on procuring and installing a grinder pump system.

MT. BRYNION PUMP STATION (BEHSHEL HEIGHTS)

Constructed in 1995 as part of the Mt. Brynion Estates development, the station serves the residential customers in the northeasterly portion of the collection system. A 1,400 foot private road that branches off to the east of Mt. Brynion Rd. about one-half mile east of I-5 provides access.

The relatively flat site is well secured with a chain-link fence, but has no lighting and the gate is too narrow for the City's vacuum truck which makes some maintenance activities more difficult. Water is available at the station for cleaning and there is a backflow preventer device in a fiberglass box. The 72-inch concrete wet well is about 8 feet deep and has a double-leaf aluminum hatch cover that provides adequate access to the two (2) submersible pumps. Each pump is mounted on a steel guide rail system. Four (4) float switches control the pumps and there is an alarm light mounted on the control panel which indicates high water levels and pump seal failures. The control panel is in good condition, but there is no PLC, telemetry, or auto-dialer. The two (2) steel discharge pipes converge in a valve vault to a single 4-inch ductile iron forcemain that is 1,140 feet in length. A small pressure gage is tapped onto the ductile iron forcemain in the vault, although its orientation makes it difficult to read.

Overall the station functions well; however a few minor issues should be noted. Pump #2 (westerly pump) has been making a light buzz or growling sound for some time and needs to be assessed and repaired. Heavy grease accumulation is also a problem from time to time. The City is considering providing an educational flyer to residents located upstream of the pump station to prevent grease introduction to the station. An electrical junction box is located in the wet well, and should be checked by an electrician to ensure it is rated as (National Electrical Manufacturers Association) NEMA 7 or "XP" (explosion proof). Also, the gate should be widened to accommodate occasional vacuum truck access to the wet well. The City plans to add two flow meters to the station as identified under their Capital Improvements (CIP S-05).

CLARK STREET PUMP STATION

The Clark Street Pump Station is located on the northeast corner of the intersection of 7th Ave. NW and Clark St. and was built in 2004. The site is open and flat and is lacking adequate parking and lighting. There is no perimeter fence, but the control panel is in a locked stainless steel enclosure which provides some security. The station is equipped with two (2) 1.5 hp submersible pumps, each rated for 135 gpm at 12.8 feet of TDH. The pumps have 4-inch diameter suction and discharge lines and two (2) heavy-duty guide rails. The forcemain discharges to a manhole in Clark Street approximately 30 feet away. The wet well is 6 feet in diameter and 13 feet deep and has a double-leaf aluminum hatch cover with a fall prevention system for safety.

The station is controlled primarily by an ultrasonic level sensor, and there are also two (2) back-up float switches. An auto-dialer and local alarm light alert City crews of high/low water levels, power/pump/generator start/pump seal failures, and thermal overloads. Specific alarm conditions are identified with lights inside the control panel. The control panel and its contents are clean and in excellent condition. A small wall-mounted ventilation fan limits dust and high temperatures. A four-pronged electrical receptacle is available for hook-up of a portable generator to run the station. The station serves mostly residential customers including some apartment buildings. Rags and diapers clogging pumps is an on-going problem at this station.

The Clark St. pump station is in excellent condition. The pump clogging issue will need to be further evaluated to determine whether the pumps need to be upgraded or just the impeller. In addition, the City plans to add two flow meters to the station as identified under their Capital Improvements (CIP S-05). A planning level cost estimate assuming the pumps will need to be replaced is presented at the end of this section.

CATLIN ST. PUMP STATION

The Catlin St. pump station is located at 85 Catlin Street and was originally constructed in the mid 1960’s and was most recently remodeled in 1987. The remodel consisted of converting the pump station from a wetwell/ drywell station to a submersible pump station. Its service area includes residential, commercial, and institutional customers including the Cowlitz County Hall of Justice.

An asphalt entrance slopes down to the relatively flat site which is near the west bank of the Cowlitz River, just north of the Hall of Justice. A concrete wall protects the station from flooding on three sides with the front open for vehicular access. The roughly 15-x16-foot concrete building houses all pumps, valves, and monitoring equipment and has a roof-mounted alarm light. The station has two wet wells, the first is a 6-foot diameter manhole, and the second is under the pump station building having an area of 6 feet x 6.5 feet and a depth of 22 feet. The concrete wet wells are in decent condition with no signs of pitting or groundwater intrusion. An electrical junction box is located in the wet well portion of the building and has some signs of corrosion. This location also presents a fire hazard due to the wet well environment. The pump guide rails and associated brackets and hardware are worn and corroded.

The station has a 125 kW water-cooled generator for emergency power which is fueled by a 500-gallon underground diesel tank (UST) installed by the south wall of the building during the pump station rebuild in 1987. The UST contains a cathodic protection system which should be inspected to see if the anodes need to be replaced. The UST should be also be inspected by an environmental consulting firm to determine whether it meets current state requirements for UST's.

A 1,200 cubic feet per minute (cfm) electric fan is installed in the generator room and the wet well portion of the building for ventilation. A City water system equipped with a reduced pressure backflow assembly (RPBA) is available for wash-down and maintenance purposes. Water levels are primarily monitored by a recently installed ultrasonic level sensor, and two float switches provide redundancy monitoring high and low wet well conditions. Flows are measured by an ABB magnetic flow meter, and data is recorded by a radial chart recorder. An auto-dialer notifies the City of high/low water levels, power/ pump/ generator start/ pump seal failures, and thermal overloads. The station does not have a PLC.

The station's two (2) 20 hp Fairbanks Morse submersible pumps - each have a 4-inch discharge and pump 800 gpm at 59 feet TDH. The two (2) discharge pipes are manifolded into a single 6-inch ductile iron pipe in the wet well and transitions to 8-inch pipe just before exiting the building. A steel I-beam rated for 1 ton with a rolling hook hoist is available for easy removal of the pumps. The forcemain is 766 feet in length and an air-vac valve is located at the top of the dike in the driveway approximately 100 feet west of the station. The forcemain has a buried flanged tee located approximately 12 feet west and 3 feet north of the pump station building that is intended to serve as a connection point for emergency by-pass pumping; however the City does not at this time have the equipment to make use of it.

The Catlin Pump Station appears in good condition; however inmates at the Hall of Justice frequently flush rags and other solids down the sewer which clogs the pumps frequently. Also, the check valves are worn out and need to be replaced. Pump replacement for the Catlin Street Pump Station has been identified in the City's Six Year Capital Improvement Program as Item S-08. The model indicates inflows into the pump station at 0.37 MGD, and the pump station has a capacity of 1.15 MGD. A planning level cost estimate for replacing the pumps is presented in the next section.

MAPLE STREET PUMP STATION (FIRST AVENUE)

The Maple Street Pump Station is located at 613 S. 1st Ave. just north of the Kelso Water Treatment Plant and was most recently renovated in 1987. It is a wet well/dry well station that serves the surrounding residential and commercial customers east of the Cowlitz River. The brick building provides adequate security for the station and flat site is large enough for parking and future expansion, although standing water is a problem at the site during the wet season.

The wet well has an area of 3- x 12.5-feet and is 19 feet deep. A ladder and a harness system are used to access the wet well, if necessary. The wet well concrete walls are in good condition and do not show signs of spalling or groundwater intrusion. Water levels are monitored with an ultrasonic level sensor and two (2) float switches (high/low level alarms) provide redundancy. Potable water is available in the wet well and there is an RPBA device to prevent backflow. A 10-inch diameter polyvinyl chloride (PVC) pipe from the wet well is connected to a 500 cfm roof-mounted electric fan to provide ventilation. A larger 2,139 cfm fan provides ventilation for the dry well portion of the building.

The ground floor of the dry well houses an air-cooled Cummins generator for emergency power, which is vented through the southerly wall. The generator is fueled by a 500-gallon underground diesel tank (UST) installed by the south wall of the building during the pump station rebuild in 1987. The UST contains a cathodic protection system which should be inspected to see if the anodes need to be replaced. The UST should be also be inspected by an environmental consulting firm to determine whether it meets current state requirements for UST's.

The electrical panel, radial data recorder, and auto-dialer are located on the ground floor and are in good condition. The alarms include high/low water levels, power/ pump/ generator start/ pump seal failures, and thermal overloads. The alarms are displayed locally and are also telemetered through the auto-dialer. The station has no PLC. A galvanized steel staircase leads down to two 5 hp Fairbanks Morse, non-clog, end suction centrifugal pumps. There is an 8-inch plug valve and an 8-x 6-inch reducer that connect to the 6-inch suction of each pump. Each pump has a 4-inch discharge and a 4-x 6-inch flexible coupler. The 6-inch ductile iron discharge lines manifold into a 6-inch tee, and the forcemain discharge to a manhole adjacent to the pump station. A magnetic flow meter monitors flow on the vertically-oriented discharge before it is routed out of the building to the east into a manhole just outside the building. Two (2) small sump-pumps drain the dry well.

The Maple Street Pump Station is in good condition and the pumps run well. The station may have a capacity issue as interpreted from the computer model, and by analyzing the flow and wet well level chart recordings for the pump station. The model indicates inflows into the pump station at 0.65 MGD, and the pump station has a capacity of 0.72 MGD. Flow chart data indicates that both the prime pump and the backup pump were running during a storm event on January 7-8, 2009. It is recommended that this pump station be monitored during storm events to verify whether additional capacity is needed. The existing flow meter/ data recorder system and the pump run time recordings can be used to monitor the station's performance during high flow events. It should be noted whether the station has enough capacity without the backup pump operating. The City has been rehabilitating a sewer basin (K1) which could reduce the inflows to the pump station.

ELM STREET PUMP STATION

The submersible pump station is located at 305 Elm St. and serves a residential area in south Kelso. The station was constructed in 1990 to replace two other stations as part of the K-4 collection basin rehabilitation project. One (1) 2 hp ABS submersible pump remains from 1990, and the second pump was replaced with a Grundfos submersible in 2007 as part of an upgrade project. Both pumps have a capacity of 85 gpm. Each pump has a 4-inch ductile iron forcemain that extends approximately 200 feet to the north where they discharge to a manhole. Upgrades to many of the control and electrical components of the station were also done as part of the 2007 project.

The station's 6 foot diameter wet well is 13 feet deep and still in very good condition. A roughly 4- x 3-foot, double-leaf hatch cover provides plenty of room for inspection. Both pumps have chains and guide rails for retrieval. Water levels are monitored with an ultrasonic level sensor, and two (2) float switches (high/low level alarms) provide redundancy.

The control panel and power meter are mounted on a galvanized steel panel. The control panel is basic having interior warning lights only for general "fail" and "seal leak" conditions. All components in the control panel were replaced in 2007 and remain in excellent condition. There is no telemetry, PLC, external alarm light, generator receptacle, or auto-dialer at the station. The control panel has no security fencing and the area is poorly lit. The electrical conduits to the control panel have an air-gap which allows corrosive sewer gases from the wet well to be released to the atmosphere rather than being channeled into the control panel. However, the cover to the air-gap does not lock properly and could be susceptible to break-in and vandalism. The wet well hatch cover also does not lock securely and does not have fall protection.

Overall, the Elm St. pump station is in good working order, but the issues regarding the station's security need to be addressed immediately. City plans to add two flow meters to the station as identified under their Capital Improvements (CIP S-05).

COWEEMAN PARK DRIVE PUMP STATION

This submersible pump station was constructed in 1997 and is located at 100 Coweeman Park Drive. The station serves a small commercial area near I-5 Exit 36 at the most southerly portion of the collection system.

The flat site is situated on dredge spoils and is secured with a 6-foot tall chain-link fence. There is room for expansion, but the only parking is in the center turn lane in the street. The wet well is 6 feet in diameter, 12 feet deep and is in good condition. A lockable, double-leaf hatch cover provides adequate access to the wet well and a goose neck pipe provides the wet well ventilation to the atmosphere. The water level is monitored by four (4) mercury-tilt switches and an alarm light is mounted on top of the control panel to indicate high/low water levels and pump seal failures. The control panel also has interior light indicators for these alarm conditions. No PLC, auto-dialer, or other telemetry is provided at the station. Two (2) 3.2 hp submersible pumps each deliver 150 gpm at 33 feet of TDH. The two discharge lines from the wet well enter a separate valve vault and then converge to a single 1,235 foot 4-inch ductile iron forcemain. The forcemain transitions to 10-inch on the west side of Talley Way and then continues north across a bridge for 325 feet before discharging to a manhole. City wash-down water is available at the station, but there is no reverse pressure backflow assembly (RPBA) device for cross connection protection. The station has a four-prong receptacle mounted on the control panel for a portable generator in case of a power failure.

The Coweeman Park Drive pump station is in good condition and handles influent flows adequately. However, a small driveway entrance would give City crews a place to park vehicles and place a portable generator. For cross connection protection, an RPBA should be installed immediately. City plans to add two flow meters to the station as identified under their Capital Improvements (CIP S-05).

RECOMMENDED PUMP STATION IMPROVEMENTS

Pump station deficiencies as discussed in the previous section are addressed below along with cost estimates for capital improvements (Tables VII-9 and VII-10) and maintenance items (Table VII-11). The specific improvements to the Donation Street Pump Station are discussed below.

Donation Street Pump Station

The Donation Street Pump Station will require a capacity upgrade from 1.58 MGD (1,100 gpm) to 2.8 MGD (2,000 gpm) to handle the estimated 25-year storm flows. The pumps will need to be upgraded from two 1,100 gpm pumps to two 2,000 gpm pumps (including one backup). The existing 8- and 10-inch parallel forcemains would be considered large enough to accommodate the increased flows. Reportedly, the existing pressure lines may have a leak. The lines should be pressure tested during the pump station rebuild to identify any leaks and repair them. It is feasible that the capacity upgrade may be prevented by reducing the I/I in the upstream ’93 flow monitoring basin K1, which is contributing the bulk of the flow to the pump station. However, it is more cost effective to upgrade the pump station.

The City also identified a number of other issues with the pump station including lack of flow meters, electrical safety issues including problems with ventilating the wet well, and layout of the pump station including the location of the generator. For this reason, a full replacement of the pump station is recommended. The cost for the replacement pump station is presented in Table VII-9.

Miscellaneous Pump Station Maintenance Items

A summary of maintenance items related to sewer pump stations as identified in the previous section and in the City’s 6-year Capital Improvements Project list is summarized on Tables VII-10 and VII-11 at the end of this section.

The City will evaluate its existing underground fuel storage tanks, which are used for fixed generators at the Donation Street, Grade, Maple, and Catlin pump stations to determine if they need to be upgraded or replaced. Pending the results of the evaluation, the City may consider aboveground storage tanks. It is recommended that the City continue using diesel generators as they are generally less expensive than natural gas or propane generators, and diesel is safer in that it is not as readily ignitable as natural gas or propane. However, the City may need to consider emissions, in which case the propane or natural gas would be the better alternative. It is also recommended that the City continue using a dedicated, permanent generator for each of their main pump stations versus using portable generators so as to minimize pump station downtime during a power outage. This item should be done within the 20-year planning period.

Out of the ten sewer pump stations serving Kelso, four have auto-dialers and two have telemetry available. It is recommended that the City conduct a feasibility study to determine the most cost effective means to provide reliable telemetry for all of their sewer pump stations. The evaluation should include an inventory of the sewer pump stations, a survey of communication technologies and methodologies available for each site (including Fiber Optics, telephone line, radio telemetry, and other wireless technologies), software/ hardware standards, and cost estimates for all feasible options. This item should be done within the 20-year planning period.

Cost Summaries

A cost table for pump station Capital Improvement Projects (CIP's), Maintenance Capital Improvement Projects (MCIP's) and Maintenance Items as discussed in this section is provided in Tables VII-9, VII-10, and VII-11, respectively, on the following pages. For the purposes of this Plan, a CIP is a large scale project that involves a capacity upgrade to an existing pump station. An MCIP is a large scale project to replace components or equipment at a pump station without increasing capacity. A Maintenance Item is a small scale project to improve the functionality of the pump station or update the pump station to meet current State guidelines for sewer pump stations. A table listing of projects in order of priority is listed at the end of this chapter.

Table VII-9 - Planning Level Cost Estimate of Capital Improvement Project (CIP) for Pump Stations (Year 2010-2030)

Pump Station/ Proj. Name	Const. Cost	Admin/ Engineer. 25.0%	Contin-gency 30.0%	Tax 7.9%	Total (Rounded)	Comment
Donation St. (City CIP S-07)	**$1,600,000**	**$400,000**	**$517,920**	**$126,400**	**$2,644,000**	Replace existing pump station. Increase capacity. Evaluate existing UST.

Table VII- 10 - Planning Level Cost Estimate of Maintenance Capital Improvement Project (MCIP's) – Pump Stations (Year 2010-2030)						
Pump Station/ Project Name	**Const. Cost**	**Admin/ Engineer 25.0%**	**Contin-gency 30.0%**	**Tax 7.9%**	**Total (Rounded)**	**Comment**
Clark St.	$50,000	$12,500	$16,185	$3,950	$83,000	Upgrade submersible pumps to grinder pumps. Electrical modifications.
Catlin (City CIP S-08)	$150,000	$37,500	$48,555	$11,850	$248,000	Upgrade submersible pumps to non-clog or grinder pumps. Electrician to inspect and replace electrical junction box in wet well with explosion proof, NEMA 7 box. Replace worn check valves.
Pump Station Flow Meters (City CIP S-05)	$140,000	$35,000	$45,318	$11,060	$231,000	Install flow meters at Coween, Elm, Donation Clark St., Brynion, and Banyon pump stations.
UST Evaluation	$10,000	$2,500	$3,237	$790	$17,000	Evaluate generator underground fuel tanks @ Donation, Grade, Catlin and First Ave. Pump Stations to determine whether they meet current state requirements.
Telemetry Evaluation	$50,000	$12,500	$16,185	$3,950	$83,000	Feasibility study to evaluate telemetry for all sewer pump stations.
Totals:	**$400,000**	**$100,000**	**$129,480**	**$31,600**	**$662,000**	

Table VII- 11 - Planning Level Cost Estimate of Maintenance Items -Pump Stations (Year 2010-2030)						
Pump Station/ Project Name	**Const. Cost**	**Admin/ Engineer 25.0%**	**Contin- gency 30.0%**	**Tax 7.9%**	**Total (Rounded)**	**Comment**
Coweeman	$5,000	$1,250	$1,619	$395	$8,000	Add vehicle parking & wetwell fall protection. Install backflow prevention device for water service.
Elm St.	$5,000	$1,250	$1,619	$395	$8,000	Repair/ add locks for electrical air-gap & wetwell. Add wetwell fall protection.
Banyon #2	$5,000	$1,250	$1,619	$395	$8,000	Pump guiderail repair & wetwell fall protection.
Banyon #1	$1,000	$250	$324	$79	$2,000	Electrician to inspect and replace electrical junction box in wet well with explosion proof, NEMA 7 box.
Mt. Brynion	$2,000	$500	$647	$158	$3,000	Replace existing gate with wider gate. Electrician to inspect and replace electrical junction box in wet well with explosion proof, NEMA 7 box.
Maple St.	$1,000	$250	$324	$79	$2,000	Regrade site for better stormwater drainage. Monitor pump station during high flow storm events.
Totals:	**$19,000**	**$4,750**	**$6,150**	**$1,501**	**$31,000**	

INFILTRATION & INFLOW REDUCTION PROGRAM

INTRODUCTION AND PURPOSE

Portions of the City of Kelso's wastewater collection system suffer from a considerable amount of groundwater infiltration and stormwater inflow (I&I). I&I is a common problem for aging wastewater collection systems in Western Washington. Several factors contribute to the amount of I&I in a collection system. These factors apply to both the mainline collection system in the right-of-way that is owned and maintained by the City as well as side sewers located on private property. The factors include age of pipe, type of pipe, condition of pipe and associated manholes, whether or not storm drainage devices (such as catch basins, area drains, basement sump pumps or down spouts) are connected to the system, the elevation of the ground water table in relation to the sewer lines as well as the type of soil in which the sewer line is located.

Experience in sewer system investigations throughout Western Washington shows that age and type of pipe are very good indicators for prioritization of I&I removal projects. Previous studies have shown peak day wet weather I&I flow rates from collection system basins constructed since the 1970s using PVC pipe with rubber gasketed joints can range from 600 to 2,000 gallons of I&I per day per inch-mile of mainline sewer pipe (gpd/in-mi). For comparison, peak wet weather I&I generated from older non-gasketed concrete or clay pipe (i.e. pipe installed prior to about 1960) is frequently in the range of 25,000 – 50,000 gpd/in-mi, and can exceed flows of 100,000 gpd/in-mi. The unit of measure (gallons of I&I per day per inch of pipe diameter multiplied by the length of pipe in miles) is used to establish a common denominator so that the I&I from sewer basins with different sizes and lengths of pipe can be compared to each other.

Since 1985, Kelso, Longview and Beacon Hill Sewer District have been actively engaged in I&I reduction programs. This has included a flow monitoring program, a $4.8 million (2009 dollars) collection system rehabilitation project and a side sewer testing/ replacement program for the City of Kelso. The project was completed and results summarized in the *Flow Monitoring Study for the Longview/Kelso/Beacon Hill Sewer District Sewer Rehabilitation Program*, dated 1993 and prepared by Gibbs & Olson, Inc. The program resulted in an average of 92% I&I removal from those sewer basins where I&I removal construction work was completed.

The ’93 flow study identified flow monitoring basin K1 as the next worst basin for I/I intrusion. Since the report, the City has been rehabbing this basin in a six-phased approach due to limited funding. The project was started in the 1990s and has replaced approximately 22,200 linear feet of main line so far (see Figure VII-3). The City plans to implement Phase V of the project in the year 2011, which will replace an additional 2,665 feet of main line at a total cost of $1.5 million (2009 dollars) including design. The City is currently seeking funding to implement this phase.

SOURCES OF INFLOW AND INFILTRATION

Infiltration and inflow can be divided into various categories. In general, inflow is considered to be stormwater that enters the sewer system during rainfall events. This inflow comes from such sources as roof drains, area drains, foundation drains, catch basins and storm system defects that are directly connected to the sewer system. The effect of inflow is a rapid rise in sewer system flows in response to rainfall, but then a drop off almost immediately when the rain stops.

Infiltration is generally described as groundwater (from both the groundwater table and saturated soils) that enters the sewer system through defective pipe or manhole joints and old deteriorated sewer lines. These lines consist of both main sewers owned by the sewer utility, as well as, side sewers on private property. Infiltration can be categorized as three types: 1) **“immediate infiltration” –** This is infiltration that causes the sewer system to experience a rapid increase in flows in response to a storm event and is typically observed only after the soil profile above and around the pipe is saturated from previous rainfall events, 2) **“near term infiltration” –** This is infiltration that enters the sewer system over a period of days, or even weeks, after a storm event has ended and again is typically observed after the soil is saturated, and 3) **“long term infiltration” –** This is chronic infiltration mainly from the groundwater table that enters the sewer system slowly and is influenced by rainfall from several previous months. The “long term infiltration” shows an annual cycle with significant increases in the base flow during the November-March period as the groundwater table rises followed by gradual reductions through spring, summer and into the fall as the groundwater table drops.

In general, main sewer and side sewer pipe installed prior to about 1960 are significant sources of all three types of infiltration. Private side sewers installed in the 1960s and early 1970s, using non-gasketed concrete or “fiber” pipe, also contribute large amounts of infiltration. Both main sewers and side sewers installed after the early 1970s using PVC pipe contribute very little infiltration. More will be said later in this section of the report on how pipe age and type of joint material impact infiltration. Although the above observations are generally true, soil type and the actual level of groundwater within a basin also impact infiltration. Those basins with sandy soil and/or a groundwater level below the pipe show lower levels of infiltration even if the basin contains older pipe than those basins with older pipe that have soils that tend to become saturated during the wet season and/or have a high groundwater table. Other factors such as illegal connections of roof, foundation, basement and area drains, topography, and installation quality also impact the level of I&I from any given basin.

As mentioned above, significant sources of infiltration are most frequently experienced from sewer lines installed prior to about 1960. These older main sewer pipes and associated side sewers on private property were most commonly installed using cement grouted joints or tar filled joints, both of which fail dramatically over time. Cement grouted joints fail because of poor installation and movement caused by traffic vibrations and earthquakes. Tar joints also fail because of poor installation but also because the tar has undergone biodegradation over time. This age and type of pipe often show 100% joint failure rates. Continued deterioration of the pipe allows the system to act as an underdrain system for the overlying soil profile. Typical flow patterns from basins with saturated soils and pre- 1960s pipe show a dramatic increase in flow, during a rain event, caused by "immediate infiltration". This peak flow is then followed by several days, and in some cases 2-3 weeks, of gradually decreasing flows caused by "near term infiltration". These basins typically show a significant increase in "base flow" from summer to winter which is the result of the continuous infiltration of groundwater or "long term" infiltration.

In basins where significant development occurred during the 1960's, main sewer pipe generally used rubber gasketed joints which show a low failure rate, usually between 1- 4%, and a corresponding lower infiltration rate. However, during the 1960's, a common pipe used for side sewers is what is referred to as fiber pipe or “Orangeburg” pipe. This pipe is essentially tar coated paper, rolled and pressed into a pipe. Typically, fiber pipe shows an 85-100% joint failure rate and is a significant source of infiltration. Another characteristic of fiber pipe is that it frequently collapses due to the weight of the soil above the pipe and/or softening of the pipe, perhaps caused by hot water from dishwashers, clothes washers, etc. It is also prone to root intrusion.

Most main line sewers installed from the mid-1970s through the present, consist of rubber gasketed joint PVC pipe. Although sewer lines, even new lines, cannot be made completely water tight, PVC pipe, properly installed, has extremely low infiltration rates.

A review of flow and rainfall records reveal that inflow, immediate infiltration and near term infiltration are acute in nature and are directly impacted throughout a rainfall event and shortly thereafter while the surface and soil continue to drain. As such, these sources of I&I have the most significant impact on WWTP flows during a storm event. If subsequent storms are experienced before the flow in the system drops back to base wet weather levels, then the sewer system often sees continued increases in the flow with each storm event. On the other hand long term infiltration is chronic and demonstrates an annual cycle, increasing during the rainy season and decreasing during the summer. It frequently plays a relatively minor role in its contribution to the peak I&I during a storm. However, long term I&I is continuous (even during periods of no rainfall), and it contributes significantly to the total I&I to the system on an annual basis. Long term infiltration is the major component of I&I to the system during non-rainfall conditions.

SIDE SEWER TESTING AND REHABILITATION

During the course of full scale rehabilitation, side sewers from the main to the building are also replaced. The length of side sewer from the mainline sewer to the property line that is within city right-of-way (ROW) is often considered to be city property and thus is replaced at city expense. The length of line between the ROW and the building is considered private (i.e. belonging to the owner of the property). Usually the cost of side sewer replacement on private property is the responsibility of the property owner.

Cities in Western Washington that have undertaken sewer rehabilitation projects recognize the impact a proposed rehabilitation project has on the citizens within the affected area. This includes the direct financial impact to those citizens who are required to replace their side sewer. Several steps can be taken to mitigate this impact and heighten public awareness of the problem. A series of public meetings should be held within the affected neighborhoods to explain the overall I&I removal project, the side sewer replacement program and address citizen concerns. City staff members should also be identified to handle citizen issues and concerns throughout the time period provided for the side sewer replacement work. These issues need to be given high priority and for the most part should be handled within the same day the issue arises.

A major concern with side sewer replacement is to ensure no homeowner is forced to replace their side sewer unless it is in fact defective. One approach to identifying defective side sewers is a side sewer testing program. City crews can perform testing or the contract documents for a rehabilitation project can be written to require the contractor to undertake the test. To minimize testing cost, a three-step approach can be done for testing the side sewers.

In the first step, side sewers are tested using a relatively inexpensive smoke test. This amounts to filling the sewer line with smoke using blower equipment designed for such testing. If the smoke is visible above ground, then the side sewer is a source of infiltration and it has failed the test. If a side sewer fails the smoke test, then it is considered to be defective and identified for replacement.

If it passes the smoke test, then the side sewer is T.V. inspected for structural defects. These defects include but are not limited to cracked, broken or collapsed pipe, and/or root intrusion. If any defect is observed, then the side sewer is considered to be defective and identified for replacement.

If the side sewer passes the smoke test and the T.V. inspection then a more expensive low-pressure air test is performed and side sewers failing the air test are identified for replacement. The air test amounts to pressurizing the side sewer pipe with 3.5 pounds per square inch gauge (psig) of air. If the pressure drops to a predetermined level within a calculated time or the pressure fails to attain 3.5 psig, then air is leaking out of the pipe and the side sewer is a source of infiltration and it has failed the test. Side sewers passing the air test do not have to be replaced. Homeowners with defective side sewers are notified by the City that they are required to replace their line. A major draw back of this approach is that the cost of the testing and inspection program can exceed $600 per side sewer. In a typical basin with 500 side sewers, the side sewer testing program alone could cost $300,000.

To reduce the cost of side sewer testing, a second approach to side sewer testing has been taken. In this approach, prior to holding the public meetings, the City adopts an ordinance declaring all side sewers in the project area are failing and therefore require replacement. However, if a homeowner desires to have their side sewer tested, the City performs a low-pressure air test. If the side sewer passes the air test, the City pays for the test. If the side sewer fails the test then the homeowner pays for the test in addition to the cost of replacement. Under this testing scenario, information is presented to the property owners so they will know the likelihood of their side sewer passing the test. The property owner can then decide their own course of action.

Past rehabilitation efforts have found that the vast majority of side sewers constructed in the City of Kelso prior to the 1960s were constructed of concrete pipe. When tested, 100% of these older concrete side sewers have failed either a smoke test or air pressure test. Fiber pipe side sewer material, typically exhibits a test failure rate in excess of 85%. Side sewers that are constructed of plastic pipe (ABS or PVC material) have an extremely low failure rate provided they were installed correctly. ABS and PVC materials have been in use since the mid 1970s.

Prior to establishing a side sewer testing and/or replacement program, the City's legal counsel should be involved to assist with policy making decisions that affect ordinances, monies spent on private property and defining public responsibilities versus private responsibilities.

In the past property owners were allowed to spot-repair defects found in their side sewers as opposed to replacing them. Time has shown this practice to be ineffective. Frequently the property owner would repair the identified defect, the line would again be smoke tested only to find another defect that required repair and the procedure would start over again. This leads to great frustration on the part of the property owner as well as the City. Experience has shown that if a defect is discovered in a side sewer, then it is highly probable that the entire side sewer is defective and thus must be replaced.

SEWER LINE REPLACEMENT COSTS

Cost estimates for I&I removal are based on replacement of sewer mains, manholes and side sewers from the main to the property line. Defective side sewers on private property are anticipated to be replaced, but the cost of this work is generally the responsibility of the property owner and is not included in the cost estimates. The cost to property owners for replacing private side sewers is highly variable. Factors which influence the cost include the length and depth of the line, the type and extent of landscaping or other improvements over the line, the topography of the site and whether the property owner does the work or hires a contractor. Side sewers on private property are often rather shallow with depths of 3- to 5-feet and, therefore, many property owners elect to replace the line themselves. In this case, the new PVC pipe and all appropriate fittings and cleanouts will be about $300 for a typical side sewer approximately 55-feet long. If a contractor is hired the cost is generally in the range of $1,000-$2,000, but can reach several thousand dollars if the line is long and there is significant surface restoration involved.

Main sewer replacement costs are primarily dependent on size of pipe, depth of pipe and the type of street surface over the pipe that will be disturbed and replaced during construction.

ESTIMATED I&I REMOVAL

To develop a basin-by-basin I&I removal program it is necessary to establish criteria for estimating how much I&I can be removed from any given basin. Pre- and post-rehabilitation basin flow data from five separate I&I removal projects completed by Gibbs & Olson, Inc. in communities in Southwest Washington have shown an average I&I removal rate of about 84% (range 66%-94%). Final I&I flow after rehabilitation have averaged about 6,670 gpd/in- mile (range 4,170-9,130). For estimating purposes in developing and I&I removal program it is assumed that no more than 65% of the I&I can be removed from any basin. It is also assumed that sewer rehabilitation in any basin will not result in post rehabilitation flows of less than 6,700 gpd/in- mi for that basin. When these two criteria are applied to each basin the result is that all basins with less than about 19,100 gpd/in-mi of I&I are eliminated from further consideration for rehabilitation. As previously discussed, it is difficult to predict with accuracy the amount of I&I that can be removed. Using these more conservative estimates for predicting I&I removal helps off-set the inherent risk of the work.

RECOMMENDED I&I REDUCTION WORK FOR KELSO

A sewer rehabilitation program was developed in 1993 for the Kelso sewer system. Since that time the City has developed a detailed inventory of their sewer systems, and they are in the process of developing GIS mapping of the systems. They also have been conducting T.V. inspections of the systems, modeled their collection system and have been undertaking sewer rehabilitation for their worst basin (K1). It is recommended that the City continue with the program outlined under the 1993 flow study, which identifies flow monitoring basins K1 as the worst basin. The City has been rehabilitating this basin in a six-phased approach due to limited funding. The project was started in the 1990s and has replaced approximately 22,200 linear feet of main line so far (see Figure VII-3). The City plans to implement Phase V of the project in the year 2011, which will replace an additional 2,665 feet of main line at a total cost of $1.5 million (2009 dollars) including design. The City is currently seeking funding to implement this phase. Table VII-12 provides an updated planning level cost estimate for the rehabilitation of this basin. Phase's I-IV in basin K1 have already been completed.

The table also shows the annual costs savings to the City for not having to treat the I/I. The annual cost savings are based on a treatment cost of $0.0031 per gallon. The gallons of I/I is based on the I/I rate from the Gibbs and Olson '93 flow study, which is based on a 10 year projected storm event. The cost savings also assume that only 65 percent of the I/I will be removed per the discussion on the previous pages. The total annual cost savings is $138,000 per year once the rehabilitation is completed using 2010 dollars. However, the savings may not be realized until the entire basin is rehabilitated.

Table VII-12 - 2010 to 2030 Sewer Rehabilitation Program							
Year	Project	I/I GPD/in-mi	Dia Pipe In	Total Pipe feet	Unit Cost $/ ft	Const Cost	$$ Savings per Yr
2011	K1 Phase V (Per City Grant Application) (City CIP S-06)	29,391	6	1,175	Per City Grant App.	$1,017,000	$(69,351)
		29,391	8	1,875			
		29,391	10	240			
		29,391	18	550			
2016	K1 Phase VI (City CIP S-14)	29,391	6	300	$250	$1,075,000	$(68,241)
		29,391	8	4,000			
	Subtotal					**$2,092,000**	$(137,592)
	Sales Tax @ 7.9%					$165,268	
	Subtotal w/ Tax					**$2,257,268**	
	Construction Contingency @ 30%					$677,180	
	Engineering, Admin & Legal @ 25%					$523,000	
	TOTAL ESTIMATED CAPITAL COST (Rounded)					**$3,457,000**	

It is not recommended that the City conduct an updated I&I flow monitoring program for the planning period. Flow data from the Kelso Main Pump Station and the Catlin Pump Station for West Kelso, which are the two exit points for the Kelso collection system, suggest that overall, I&I has not increased noticeably since the 1993 Gibbs and Olson flow monitoring study. Flow increases shown in the flow data at the pump stations are accounted for by new developments shown in Table E.1 in Appendix E that have occurred from 1993 to 2010 as explained below.

The base flow from the ’93 flow monitoring study for all basins except West Kelso, is 1.38 MGD. In addition, it is estimated that 1.6 MGD of additional average day flows have occurred since 1993 to 2010 for a total of 2.98 MGD. The average dry weather (April-Oct.) base flow (from 2007 to Sept. 2009) from the Kelso Main Pump Station flow readings is 2.16 MGD.

The average “top 10” flows for the flow monitoring period from the ’93 flow study for all basins except West Kelso, is 8.75 MGD. In addition, it is estimated that 2.2 MGD of additional peak day flows have occurred since 1993 to 2010 for a total of 10.95 MGD. The average of the top 10 flows (from 2007 to Sept. 2009) from the Kelso Main Pump Station flow readings is 9.17 MGD, which actually may suggest a slight decrease in I&I.

The base flow for West Kelso is 0.086 MGD in the ’93 flow study with an average top 10 flow of 0.220 MGD. Flow logs taken from the Catlin Pump Station from August 2008 to August 2009 indicated that the dry weather flow has decreased to the 0.040 to 0.060 MGD range and a peak day flow of 0.231 MGD occurred on January 6, 2009 during a storm event, again suggesting little change in I&I.

The City plans to install flow meters at all of its pump stations as a CIP. The flow meters and diligent flow recordings will help to monitor collection system flows and to recalibrate the City’s sewer model when flow trends change.

COLLECTION SYSTEM IMPROVEMENTS SUMMARY

Table VII-13 presents a summary table of the collection system Capital Improvement Projects (CIP’s) discussed in this chapter in order of priority. Table VII-14 presents a summary table of the collection system Maintenance Items discussed in this chapter in order of priority. The City’s 6-year Capital Improvement Projects list was taken into consideration when developing the table, but the table does not include extensions as they are developer driven. Projects were grouped for each year based on the City’s operating budget for sewer projects. Larger projects noted with an asterisk in the table will require grant funding or loans, and their schedule will be dependent on when funding is received. Also, the priorities are subject to change based on how development occurs in the City (i.e. if rapid development occurs in east Kelso, then the Manasco Drive Interceptor upgrade should move up in priority). All costs are in 2010 dollars and do not include debt service and operation/maintenance.

Table VII-13 - Planning Level Cost Estimate of Collection System Capital Improvement Projects Prioritized (2010 Dollars)							
Year	**No.**	**Project Name**	**Const. Cost**	**Admin/ Engineer 25.0%**	**Contin-gency 30.0%**	**Tax 7.9%**	**Total**
2011	1	Pump Station Flow Meters (City CIP S-05)	$140,000	$35,000	$45,318	$11,060	$231,000
2011	2	Pump Station UST Evaluation	$10,000	$2,500	$3,237	$790	$17,000
2011*	3	K1 Phase V I&I Rehab (City CIP S-06)	$1,017,000	$254,250	$329,203	$80,343	$1,681,000
2012	4	Catlin Pump Station Upgrade (City CIP S-08)	$150,000	$37,500	$48,555	$11,850	$248,000
2012*	5	Donation St. Pump Station Replacement/ Upgrade (City CIP S-07)	$1,600,000	$400,000	$517,920	$126,400	$2,644,000
2014	6	6th Ave and Lord Sewer Replace (City CIP S-10)	$300,000	$75,000	$97,110	$23,700	$496,000
2014	7	Pump Station Telemetry Evaluation	$50,000	$12,500	$16,185	$3,950	$83,000
2016	8	Elizabeth St., 8th Ave. to 11th Ave. Sewer Replace (City CIP S-11)	$209,000	$52,250	$67,653	$16,511	$345,000
2016	9	Clark Street Pump Station Pump Replace	$50,000	$12,500	$16,185	$3,950	$83,000
2017	10	Coweeman Ln., 8th Ave. to 11th Ave. Sewer Replace (City CIP S-12)	$216,000	$54,000	$69,919	$17,064	$357,000
2017*	11	Manasco Drive Interceptor Replacement/ Upgrade	$1,662,000	$415,500	$537,989	$131,298	$2,747,000
2019	12	Fisher's Ct., NW 2nd Ave. to Fisher's Ln. Sewer Replace (City CIP S-13)	$402,000	$100,500	$130,127	$31,758	$664,000
2022	13	Allen Street Sewer Replacement/ Upgrade	$576,000	$144,000	$186,451	$45,504	$952,000
2022*	14	K1 Phase VI I&I Rehab (City CIP S-14)	$1,075,000	$268,750	$347,978	$84,925	$1,777,000
Totals:			**$7,457,000**	**$1,864,250**	**$2,413,831**	**$589,103**	**$12,325,000**

* Can only be implemented with grant funding or loans when available.

Table VII-14 - Planning Level Cost Estimate of Collection System Maintenance Items Prioritized (2010 Dollars)							
Year	**No.**	**Project Name**	**Const. Cost**	**Admin/ Engineer 25.0%**	**Contin-gency 30.0%**	**Tax 7.9%**	**Total**
2011	1	Maple Street Pump Station	$1,000	$250	$324	$79	$2,000
2011	2	Banyon #1 Pump Station	$1,000	$250	$324	$79	$2,000
2011	3	Mt. Brynion Pump Station	$2,000	$500	$647	$158	$3,000
2011	4	Coweeman Park Pump Station	$5,000	$1,250	$1,619	$395	$8,000
2011	5	Banyon #2 Pump Station	$5,000	$1,250	$1,619	$395	$8,000
2011	6	Elm St. Pump Station	$5,000	$1,250	$1,619	$395	$8,000
Totals:			**$19,000**	**$4,750**	**$6,150**	**$1,501**	**$31,000**

SECTION VIII
FINANCIAL CONSIDERATIONS

INTRODUCTION

This section will focus on possible funding considerations for improvements to Kelso's wastewater collection system presented in Table VII-12 herein through 2020 depending on funding availability. This section will also present a preliminary evaluation of potential sewer rates that would be necessary for upgrading the wastewater collection system under various funding scenarios. Projects of this magnitude are extremely difficult to implement without grant and low interest loan assistance from state and/or federal funding agencies. There is currently no regional prioritization process in place for projects but the Cowlitz-Wahkiakum Council of Governments (CWCOG) is working to put together prioritization criteria for the 2012 funding cycle. This priority rating system will be based on the guidelines already established by other funders such as DOE and Rural Development and will be used by State and Federal funders in the future. The most likely sources of funding for this project are:

1. The Washington State Department of Ecology (DOE), Centennial Clean Water Fund Program (Centennial).
2. Community Economic Revitalization Board (CERB)
3. The Department of Commerce Community Development Block Grant General Purpose Grant.
4. Cowlitz County .09 Economic Development Grant
5. Utility Local Improvement District (ULID and LID).
6. Local rates and connection charges.
    - 6a. City Sewer Capital Improvement Fund.
    - 6b. Revenue Bonds.
    - 6c. The State of Washington Public Works Board (PWB), Public Works Trust Fund (PWTF).
    - 6d. DOE, Base Revolving Loan Fund (Revolving Fund).

DEPARTMENT OF ECOLOGY FUNDING PROGRAMS

The DOE Water Quality Program administers two funding programs that provide grants and low-interest loans to projects that improve and protect water quality. The funding programs are the Centennial Fund, which provides grants and the Base Revolving Fund, which provides low-interest loans only. The DOE has streamlined the process for both programs by combining the applications. However, they continue to follow a three step process in which Step I is the planning process, Step II is the design process and Step III is the construction process. DOE will not accept a funding application for Step II until after they have approved the Step I planning documents, and they will not accept a Step III application for construction until they have approved the Step II design documents.

Based upon the *Water Quality Financial Assistance Programs FY 2011 Draft Offer and Applicant List* the application review and approval process can optimistically take approximately 1 year. The process begins with submittal of the application, usually at the end of October, and ends with *Agreement Development* and funds dispersion by September to October of the following year.

Each project is assigned priority-rating points by DOE personnel and prioritized. Those projects receiving the highest priority points and falling within the budget available receive a low interest loan or, infrequently, hardship grant funding. Applicants with an enforcement action (from DOE and/or EPA) against the community and/or a public health emergency or severe public health hazard receive the highest priority. DOE no longer requires a local prioritization process but documenting local support, and more importantly, commitments will help projects score more highly. To be eligible to apply for funding under the Centennial and Revolving Fund programs, the City must have a DOE approved Facilities Plan and all environmental review processes complete prior to the application submittal deadline.

Design costs are not eligible for grant funding but are eligible for Base Revolving loans. Land costs are currently eligible for loans only. The Centennial grant program will fund existing capacity plus an allowance of 10 percent for growth. The Base Revolving loan program will fund capacity for a 20-year period. For both programs, projects must begin within 16 months of the publication of the final offer list, and be completed within five years.

For the City of Kelso, DOE has estimated the Median Household Income (MHI) for 2009 to be \$38,455 per year, which yields a hardship level sewer rate of \$64.09 per month. The average monthly sewer bill in 2009 was \$47.79 per month. Since this figure is below the projected hardship level, the City is not currently eligible for grant funding from the Centennial Funds. The average monthly sewer bill in 2011 is \$50.70 and is scheduled to increase to \$54.48 in 2014. A significant rate increase (around 30-35%) would be required to reach the hardship level. DOE has limited funds available and more and more demand for those funds. Given that Kelso's sewer system is not under administrative order, consent decree, or NPDES permit violations and does not include green elements, it is highly unlikely that grant funds or principle forgiveness would be offered. So, from that standpoint, raising rates to the hardship level will not open up any new grant funding opportunities from DOE and is not recommended. Futhermore the financial considerations identified in this report show the proposed projects can be constructed while keeping Kelso's rates well below hardship levels.

DEPARTMENT OF ECOLOGY CENTENNIAL FUND

In fiscal year 2011, the Centennial Fund is offering approximately \$10 million in statewide competitive funds. The fund is intended to aid communities where sewer improvements would impose a financial hardship upon low and moderate income rate payers. A financial hardship is defined by DOE to exist if the monthly sewer rate is proposed to be at, or above 2 percent of the median household income (MHI). Based upon the degree of financial burden, the DOE may offer grants for 50%, 75% or even 100% of the project cost up to five million dollars. Grant funds are only available for construction and not for facilities planning, sewer development charges or design. The Centennial Fund uses state funds only.

COMMUNITY ECONOMIC REVITALIZATION BOARD (CERB)

The Community Economic Development Revitalization Board (CERB) can fund infrastructure improvements that will demonstrate economic development and growth with jobs that will exceed the countywide median hourly wage. CERB meets six times per year and applications for funding, which include a site visit, are due 45 days before the meeting at which the request is to be considered. Maximum CERB funding for construction projects is \$1M with a 10% cash match required and the grant portion of that may be the lesser of 50% of the project cost or

$300,000. CERB funds could be very limited or nonexistent due to the current state budget shortfall.

COMMUNITY DEVELOPMENT BLOCK GRANT (CDBG):

Community Development Block Grant (CDBG) General Purpose Grants are made available annually through a competitive application process to assist Washington State small cities, towns and counties in carrying out significant community and economic development projects that principally benefit low- and moderate- income persons.

CDBG funds may be used for activities which include, but are not limited to:

- acquisition, final design, construction, reconstruction, or installation of public facilities and community facilities;
- clearance, demolition, removal, and rehabilitation of buildings and housing;
- housing rehabilitation;
- some economic development activities, such as micro-enterprise assistance programs;
- some public service activities when they are a component of a facility or housing project and within 15% of the grant total.

For 2011, CDBG had approximately 13 million dollars to distribute statewide for the General Purpose Grant. The maximum amount for a single grant is 1 million dollars or 1.5 million for projects over 10 million dollars, and cannot exceed $25,000 dollars per household or per job created/retained. The application for the General Purpose Grant is available annually, due in January. Eligibility guidelines for the Block Grant require that projects principally benefit low- and moderate-income persons, or aid in the prevention or elimination of slums or blight. Local governments may submit only one application each funding cycle, unless one application is for local micro-enterprise assistance.

COWLITZ COUNTY ECONOMIC DEVELOPMENT .09 GRANT

Cowlitz County puts out a call for projects to be funded by the .09 Sales Tax Rebate in the spring. Application requests typically range from $50,000 to $500,000 and can include infrastructure improvements but the focus of the grant is economic growth and development.

CITY ULID

Local Improvement Districts (LIDs) are special assessment districts. These districts are formed as a means of assisting benefiting properties in the financing of and payment for needed capital improvements. These special assessment districts are formed to permit the improvements to be financed and paid for over a period of time (not to exceed 30 years) through assessments on the benefiting properties. The difference between ULIDs and LIDs is that, in addition to the assessment on the benefiting properties, utility revenues are also pledged to the repayment of the ULID debt.

State statutes specify that the assessment per parcel must not exceed the special benefit of the improvement to that parcel, which is defined as the difference between the fair market value of the property before and after the local improvement project.

Deferral options are available for low income and senior citizens. Assessments can be deferred indefinitely for qualified senior citizens (RCW 84.38). A deferral of up to four years for economically disadvantaged property owners is also possible (RCW 35.43.250 and 35.54.100). In both cases, the deferred assessment does not go away, but becomes a lien against the property.

In addition to the cost of the improvements, bond sales involve bond counsel, underwriters and other expenses. All of these expenditures must be added to the project costs that ULID participants must assume. If the city elects to form a ULID, then a firm that specialized in the sale of bonds should be contacted as early as possible.

SEWER RATES

The current sewer rate structure as defined in *Water & Sewer Rate Ordinance No. 09-3698* is provided in ***Appendix F*** and is summarized for 2011 as follows:

- All residential: $50.70/month (billed bi-monthly at $101.39)
- Commercial business rates, including apartments are same as other residential with an additional charge of $6.25 per 100 cubic foot for any amount over 1300 cubic feet
- Residential users consuming 200 cubic feet of water or less per month are charged a flat fee of $15.60

- Industrial users (users consuming over 25,000 cubic feet per day of water) are billed based on water consumption at a fixed rate of $8.02 bi-monthly with a volume charge of $3.17 per 100 cubic feet of water.

SEWER CAPITAL IMPROVEMENT FUND

The City currently takes a portion of sewer revenues and places the funds into a Sewer Capital Improvement Fund. Approximately $300,000 per year goes into this account. The fund is set to increase at 3% per year from 2009 – 2013 and then 1.4% for 2014. These funds can be used as a loan match or used to fund some of the critical collection system upgrade projects.

REVENUE BONDS

The City of Kelso may want to fund the project, or a portion of the project, using revenue bonds sold on the open market. Currently, such bonds are selling for about 5 percent interest over 20 years and require a coverage factor of about 40 percent. The sale of revenue bonds provides a method for the City to fund and complete the proposed project in the shortest possible time. However, using revenue bonds for funding would result in the highest debt service cost compared to other available funding options. If funding cannot be obtained from PWTF or DOE, then revenue bonds should be considered as a viable funding option.

PUBLIC WORKS TRUST FUND (PWTF)

The PWTF offers a variety of low-interest loans for infrastructure improvement projects. This information is presented in ***Table VIII-1*** below. No grant funding is available through this program.

Table VIII-1
PWTF Loan Programs

Loan Program	When $ Becomes Available	Loan Limit	Interest Rate	Local Match	Loan Term
PWTF Construction	Upon Legislative Approval, (the Following Spring)	$10 Million per Jurisdiction Per Biennium	0.5%- 2% linked to local match	5%- 15% linked to interest rate (min of 5%)	Life of the project, or 20 yrs. max.
PWTF Pre-Construction	Upon Board Approval	$1 Million per Jurisdiction per Biennium	0.5%- 2% linked to local match	5%-15% linked to interest rate (min of 5%)	5 yrs. max., or 20 yrs. w/proof of construction financing
PWTF Planning	Upon Board Approval	$100,000 per Jurisdiction per Biennium	0%	None	6 yrs.
PWTF Emergency	Upon Board Approval	$500,000 per Jurisdiction per year	3%	None	Life of the project, or 20 yrs. max.

PWTF loans are available to municipalities and utility districts that have an approved Capital Improvement Plan. In addition, municipalities must implement the 0.25 percent real estate excise tax. There are two application processes, a pre-construction application process that is available year-round depending on funding availability and a construction application process in which applications are due usually in May. Pre-construction loans can only be used for administration and engineering needs associated with the project and have a term of 5 years. These loans can be converted to 20 years provided all the construction funding has been secured within two years from the date the pre-construction loan agreement was signed. Pre-construction loans are available within about two months of the application. Construction loans must be approved by the legislature and are usually available June or July in the year after submitting the application. Construction loans have a term of 20 years.

PWTF has no funding at this time; however, the Public Works Board has submitted a list of needs statewide to the legislature and requested $330 million dollars to help meet these needs. The funds, if approved, will be managed in the same manner as normal funds but with the additional requirement that projects comply with House Bill 5560 for greenhouse gas reductions.

DEPARTMENT OF ECOLOGY BASE REVOLVING FUND (BRF)

The BRF provides low-cost financing or refinancing to local governments for projects that improve and protect the state's water quality. Projects may include publicly-owned wastewater treatment facilities, non-point source pollution control projects, and comprehensive estuary conservation and management programs. This program offered $71.2 million in low-interest and hardship forgivable principal loans for fiscal year 2011. Loans may be provided for up to 100 percent of the total eligible project cost. Sources of money for this program include federal and state funds. Since federal funds are provided through the U.S. Environmental Protection Agency (EPA), projects must comply with all of the federal requirements. This includes completion of an environmental assessment as per the National Environmental Policy Act (NEPA).

Currently the non-hardship interest rate for the Base Revolving Fund program is 1.3 percent for up to a 5-year term and 2.6 percent from beyond five years to 20-year loans. These rates are based on 60% of the average market rate for tax exempt municipal bonds. There are reduced interest rates available for hardship communities ranging from 40% of the market rate down to 0% interest for a 20-year loan and forgivable principal loans ranging from 50 through 100% principal forgiveness up to $5 million. Forgivable principal loans are a relatively new provision of the Revolving Fund, with Congress authorizing the use of forgivable principal loans in the 2010 Clean Water Act appropriation. Forgivable principal means the portion of a loan that is not required to be paid back by the borrower. Applicants receiving a forgivable principal loan must also take a standard Revolving Fund loan. Forgivable principal loans may be offered in the 2012 and 2013 funding cycles if authorized again by Congress in the Clean Water Act 2012 and 2013 appropriation.

WASTEWATER COLLECTION AND TREATMENT SYSTEM O&M COSTS

The 2010 sewer operation and maintenance (O&M) costs allocated by the City are summarized below on ***Table VIII-2***.

Table VIII-2

City of Kelso Sewer Services O&M Cost Summary

Operating Expenses	
Salary, wages, Benefits	458,900
Insurance	17,707
Utilities	18,005
Operating Reserve	303,295
Travel/Training	3,000
Office Equipment/Supplies	43,773
Repairs	44,124
Services-Contracts	126,895
Maintenance Supplies	50,922
Replacement Reserve	400,000
Regional Sewage Treatment	2,644,425
Taxes	436,480
Rent	6,000
Vehicle/Equipment Reserve & Repair	75,422
Total Annual Operating Expenses	***4,628,947***

POTENTIAL FUNDING SCENARIOS

Funding Scenario No. 1 assumes PWTF loans are obtained for all sewer system improvements identified in this report that are proposed to be completed by the year 2020. To estimate the bi-monthly residential sewer bill it is assumed the PWTF loans will bear an interest rate of 0.5% and extend for a 20 year period. It is also assumed the City's growth rate between 2010 and 2020 will be 0.5% per year and that the annual Operation and Maintenance (O&M) expenses will increase at a rate equal to an inflation rate of 2% per year.

Revenue is based on the City continuing to implement the sewer rate increases through 2014 that are already set by the City's *Water & Sewer Rate Ordinance No. 09-3698* . In this funding scenario rates are increased at 1.3% per year during the time period from 2015 through 2020 so that the annual set aside for reserves remains positive through the year 2020.

Table VIII-3 summarizes this funding scenario and shows that by 2015 the bi-monthly residential sewer bill is estimated to be $110.38 ($55.19 per month) and by 2020 the bi-monthly sewer bill is estimated to be $117.73 ($58.87 per month).

Table VIII-3
Funding Scenario No. 1

Estimated Growth Rate = 1/2 % per Year Estimated Inflation = 2% per Year Funding for all Wastewater Improvements = 0.5% Interest for 20 Years						
Year	**Estimated O&M Expenses**	**Annual Debt Service**	**Estimated Annual Revenue**	**Estimated Annual Reserve**	**Proposed Rate Increase**	**Estimated Residential Bi-monthly Sewer Bill**
2010	$3,926,000[1]	$0	$4,254,000	$328,000	per ordinance	$98.44
2015	$4,334,000	$284,000	$4,887,000	$269,000	1.3% per year	$110.38
2020	$4,785,000	$501,000	$5,304,000	$18,000	1.3% per year	$117.73

Funding Scenario No. 2 assumes DOE loans are obtained for all sewer system improvements identified in this report that are proposed to be completed by the year 2020. To estimate the bi-monthly residential sewer bill it is assumed the DOE loans will bear an interest rate of 2.6% and extend for a 20 year period. DOE funding also requires the City to implement a debt coverage factor, for five (5) years, that is equal to 20% of the annual debt payment. This funding scenario also assumes the City's growth rate between 2010 and 2020 will be 0.5% per year and that the annual Operation and Maintenance (O&M) expenses will increase at a rate equal to an inflation rate of 2% per year.

Revenue is based on the City continuing to implement the sewer rate increases through 2014 that are already set by the City's *Water & Sewer Rate Ordinance No. 09-3698*. In this funding scenario rates are increased at 1.9% per year during the time period from 2015 through 2020 so that the annual set aside for reserves remains positive through the year 2020.

[1] Operating expenses not including either Operating or Replacement Reserve accounts as shown in Table VIII-2.

Table VIII-4 summarizes this funding scenario and shows that by 2015 the bi-monthly residential sewer bill is estimated to be $111.03 ($55.52 per month) and by 2020 the bi-monthly sewer bill is estimated to be $121.98 ($60.99 per month).

Table VIII-4
Funding Scenario No. 2

Estimated Growth Rate = 1/2 % per Year
Estimated Inflation = 2% per Year
Funding for all Wastewater Improvements = 2.6% Interest for 20 Years

Year	Estimated O&M Expenses	Annual Debt Service	Estimated Annual Revenue	Estimated Annual Reserve	Proposed Rate Increase	Estimated Residential Bi-monthly Sewer Bill
2010	$3,926,000[2]	$0	$4,254,000	$328,000	per ordinance	$98.44
2015	$4,334,000	$419,610	$4,915,000	$161,390	1.9% per year	$111.03
2020	$4,785,000	$669,123	$5,490,000	$35,877	1.9% per year	$121.98

Funding Scenario No. 3 assumes Revenue Bonds are sold to obtain funding for all sewer system improvements identified in this report that are proposed to be completed by the year 2020. To estimate the bi-monthly residential sewer bill it is assumed the Revenue Bonds will bear an interest rate of 5.0% and extend for a 20 year period. Most Revenue Bonds will require the City to implement a debt coverage factor that is equal to 40% of the annual debt payment. This funding scenario also assumes the City's growth rate between 2010 and 2020 will be 0.5% per year and that the annual Operation and Maintenance (O&M) expenses will increase at a rate equal to an inflation rate of 2% per year.

Revenue is based on the City continuing to implement the sewer rate increases through 2014 that are already set by the City's *Water & Sewer Rate Ordinance No. 09-3698*. In this funding scenario rates are increased at 3.1% per year during the time period from 2015 through 2020 so that the annual set aside for reserves remains positive through the year 2020.

Table VIII-5 summarizes this funding scenario and shows that by 2015 the bi-monthly residential sewer bill is estimated to be $112.34 ($56.17 per month) and by 2020 the bi-monthly sewer bill is estimated to be $130.86 ($65.43 per month).

[2] Operating expenses not including either Operating or Replacement Reserve accounts as shown in Table VIII-2.

Table VIII-5
Funding Scenario No. 3

Estimated Growth Rate = 1/2 % per Year Estimated Inflation = 2% per Year Funding for all Wastewater Improvements = 5% Interest for 20 Years						
Year	**Estimated O&M Expenses**	**Annual Debt Service**	**Estimated Annual Revenue**	**Estimated Annual Reserve**	**Proposed Rate Increase**	**Estimated Residential Bi-monthly Sewer Bill**
2010	$3,926,000[3]	$0	$4,254,000	$328,000	per ordinance	$98.44
2015	$4,551,000	$606,634	$4,976,000	$35,366	3.1% per year	$112.34
2020	$5,276,000	$1,068,462	$5,883,000	$29,538	3.1% per year	$130.86

SUMMARY AND RECOMENDATIONS

Based upon the review of available grant and loan programs, the City of Kelso is eligible for the following programs:

- State Base Revolving Fund
- Community Development Block Grant, General Purpose Grant
- Public Works Trust Fund
- Local Improvement Districts
- Revenue Bonds

An analysis of the sewer system's finances through 2014 was completed as part of this Plan. The analysis used the existing O&M cost and increased those costs by 2.0% per year to allow for inflation. An across the board growth rate of 0.5% per year was used to estimate the number of new customers that would be added each year and the sewer rates used were from the City's current *Water & Sewer Rate Ordinance No. 09-3698*. Finacing of capital projects was based on obtaining DOE loans (20 years at 2.6% interest) each year to cover the cost of that year's projects. The analysis shows that with the current sewer rate structure, the projected capital expenditures, a modest growth rate and inflation rate that the City's sewer utility is in good financial shape through 2014 and no additional rate increases are recommended through 2014. Rates should be raised after 2014 to adjust for inflation and to fund recommended improvements as necessary. Table VIII-6 shows the estimated annual cost of sewer service versus the estimated annual revenue based on the above analysis.

[3] Operating expenses not including either Operating or Replacement Reserve accounts as shown in Table VIII-2.

Table VIII – 6
Estimated Annual Cost of Sewer Service vs. Estimated Annual Revenue

Year	Estimated Annual O&M Expenses	Estimated Annual Debt Service	Estimated Annual Cost of Sewer Service	Annual Estimated Revenue	Annual Reserve Fund
2010	$3,926,000[4]	$0	$3,926,000	$4,254,000	$328,000
2011	$4,004,000	$149,894	$4,153,894	$4,437,000	$283,000
2012	$4,084,000	$374,619	$4,458,619	$4,586,000	$127,000
2013	$4,166,000	$374,619	$4,540,619	$4,737,000	$196,000
2014	$4,249,000	$419,610	$4,668,610	$4,810,000	$141,000

[4] Operating expenses not including either Operating or Replacement Reserve accounts as shown in Table VIII-2.

SECTION IX

IMPLEMENTATION SCHEDULE

SUMMARY

Approval of this General Sewer and Facilities Plan (GSP/FP) by the City of Kelso will result in the adoption of the following three major elements:

1. Presents a long term I/I reduction program.
2. Establishes existing and future sewer service areas with a total projected population in 2030 of 14,447 people.
3. Proposes collection system extension routes and pump station locations to serve the proposed expanded sewer service area.
4. Recommends several projects to improve pump stations and avoid surcharging of collection system lines.

SCHEDULE

It is anticipated that this GSP/FP will be approved by DOE and DOH in late 2010 and that council will adopt it shortly thereafter. The design and construction of I/I removal projects will occur in stages as funding becomes available. The design and construction of collection components to serve presently unsewered areas will occur in stages as each area develops over time. The design and construction of pump station and collection system improvement projects will occur over time as funding allows.

Appendix A

TRRWP NPDES Permit and Fact Sheet

Can be found online at:

http://www.ecy.wa.gov/programs/wq/permits/southwest_permits.html

Appendix B

2005 Revised and Restated Interlocal Agreement

2005
REVISED AND RESTATED
INTERLOCAL AGREEMENT AMONG CITY OF KELSO, CITY OF LONGVIEW, BEACON HILL SEWER DISTRICT, AND COWLITZ COUNTY FOR WASTEWATER TREATMENT & DISPOSAL

WHEREAS, the public health, welfare and safety of the residents of Kelso, Longview, Beacon Hill Sewer District and Cowlitz County require the continued improvement of systems to provide sewerage collection, treatment, disposal, the mitigation of water pollution and the preservation of the area's water resources; and

WHEREAS, the growth of population, unique physical or topographic conditions, and the regional commitment to preservation of water resources require that a central sewage treatment plant, together with interceptors and pumping stations, continue to be improved and operated and that the cities, the County and special district within the specified Longview-Kelso Urban Area dispose of their sewage in general accordance with the Updated Sewerage General Plan dated February, 1997; and

WHEREAS, the ***THREE RIVERS REGIONAL WASTEWATER AUTHORITY, formerly known as the Cowlitz Sewer Operating Board***, hereinafter referred to as the TRRWA, is the most effective agency to continue operating and improving Facilities in order to maintain compliance with applicable federal, state, and local laws and regulations; and

WHEREAS, the Cities of Kelso and Longview (the "Cities"), Beacon Hill Sewer District and the County are served by the Facilities, and each is to equitably share in the financing of Facility improvements and the operation of the central sewage treatment plant; and

WHEREAS, the TRRWA desires to plan and provide for the long-term capital and operational needs of the Facilities, which may include mandated technological and regulatory changes and increased capacity and space demands; and

WHEREAS, the Cities, Beacon Hill Sewer District and the County make up the TRRWA and find that creating this authority under RCW 39.34 provides the TRRWA with necessary powers and responsibilities while ensuring representation in regional authority governance by each of the participating entities; and

WHEREAS, under the terms of a previous agreement among the parties hereto, said parties have acquired the ownership of the land upon which the central sewage treatment plant is situated together with the ownership of related easements for sewer transmission lines; and

WHEREAS, the Parties are currently cooperating with respect to the Facilities pursuant to an "Interlocal Agreement Among City of Kelso, City of Longview, Beacon Hill Sewer District and Cowlitz County for Wastewater Treatment and Disposal" executed between May and July, 1996, as amended by an agreement denominated "First Amendment to Interlocal Agreement among City of Kelso, City of Longview, Beacon Hill Sewer District, and Cowlitz County for Wastewater Treatment and Disposal" effective June 1, 1998, as amended by an agreement entitled "Revised and Restated Interlocal Agreement Among City of Kelso, City of Longview, Beacon Hill Sewer District, and Cowlitz County for Wastewater Treatment and Disposal" which was effective on or about the 1st day of September, 2002, as supplemented by two separate agreements each denominated "Interlocal Agreement for Financing of Wastewater Treatment Plant Expansion" and dated July 26, 1999 (one with respect to $40 million of general obligation bonds issued by the County, and the other with respect to a $7 million Public Works Trust Fund loan) and as further supplemented by an "Interlocal Agreement for Supplemental Financing of Wastewater Treatment Plan Expansion" executed in April and May 2001, with respect to a $3 million Public Works Trust Fund loan; and

WHEREAS, there are currently outstanding three Public Works Trust Fund Construction Loan Agreements (Nos. PW-99-791-009, PW-01-191-020 and PW-05-691-PRE-124) with respect to the facilities, which loan is a revenue obligation that will be subordinate to the refunding bonds issued by the County;

NOW, THEREFORE, in consideration of the mutual benefits contained herein, the parties hereby promise, agree and consent as follows:

SECTION 1. DEFINITIONS.

For the purpose of this Agreement, the following words shall have the following meanings, unless another meaning is clearly intended:

"AADF" means annual average daily flow, and shall mean the total flow of domestic sewage in millions of gallons during a full calendar year, divided by the number of days in such year, expressed in millions of gallons per day (MGD).

"Beacon Hill Sewer District" means Beacon Hill Sewer District, a sewer district organized and existing under the provisions of RCW Title 57.

"Board" means the four member governing board overseeing the TRRWA, as set forth in Section 3.

"BOD" means Biochemical Oxygen Demand, and shall mean a standardized laboratory procedure which measures the amount of oxygen consumed in a wastewater sample during a specified incubation period. This test is described in the most current version of a book entitled "Standard Methods for the Examination of Water and Wastewater."

"Capital Component" means the portion of TRRWA rates that relates to costs of financing the Facilities, as described in Section 7.A.

"County" means Cowlitz County, a political subdivision of the State of Washington .

"TRRWA" means the Three Rivers Regional Wastewater Authority.

"Customer" means a "single family residence" and/or an "equivalent residential unit" (ERU), as defined below.

"Depreciation Component" means the portion of TRRWA rates that relates to depreciation of the Facilities, as described in Section 7.A.

"DOE" means the Washington State Department of Ecology, or its successor.

"Domestic Sewage" means sanitary wastes normally collected from residential establishments, and shall include commercial and industrial wastes of similar strength or quality, and other commercial and/or industrial wastes that are pre-treated in accordance with DOE and EPA guidelines.

"EPA" means the United States Environmental Protection Agency, or its successor.

"Equivalent Residential Unit" or "ERU" is a measure applied to a user of the sewage system other than "single family residence." The number of Equivalent Residential Units assigned to any such user (for example, an apartment house, motel, school, hospital, nursing home, and any other public or commercial establishment) shall be the numerical ratio of the monthly volume of wastewater contributed by such user to the monthly volume of wastewater contributed by a single family residence as defined herein. This will serve as a practical basis for computing the number of ERU's contributing to the joint sewerage system – when and if such a computation is necessary or desirable to either augment or replace a direct flow measurement.

"Facilities" means the TRRWA wastewater treatment Facilities together with applicable lands and easements including conveyances, river crossings, interceptors and pump stations operated and maintained by the TRRWA and as shown on Exhibit "A", attached hereto.

"Flow" means the volume of sewage per unit of time.

"Improvements" means those improvements to the Facilities described in the Updated Sewerage General Plan.

"Influent Point" means the point at which each Party's Internal System connects to the Facilities.

"Internal System" means all sewer lines, pump stations and other sewer facilities, owned and operated by each entity, upstream from the Influent Point, respectively.

"Kelso" means the City of Kelso, Washington, a municipal corporation of the State of Washington.

"Longview" means the City of Longview, Washington, a municipal corporation of the State of Washington.

"MGD" means million gallons per day, referring to a rate of sewage flow.

"Maintenance and Operation Costs" means all direct costs and expenses incurred by the TRRWA in transporting, treating and disposing of Domestic Sewage through the Facilities, maintaining, repairing and replacing those Facilities, and administering a joint Industrial Pre-Treatment program.

"M&O Component" means the portion of TRRWA rates that relates to Maintenance and Operation costs, as described in Section 7.A.

"NPDES Permit" means a "National Pollutant Discharge Elimination System Permit" issued to the TRRWA pursuant to the Federal Clean Water Act, as amended.

"Party" (and, collectively, "Parties") means any of the entities executing this Agreement, as described in Section 2.

"Party's Jurisdiction" means the service area within which a Party is responsible for providing wastewater collection services as shown in the Updated Sewerage General Plan.

"Single Family Residence" means one structure, all connected and under the same roof, located on a lot or tract of real property having a separate and individual property description, with no other structure used for human occupancy located on that tract or lot, and which structure is used as a single family dwelling.

"System Development Charge" or "SDC" means the charge for each new sewer system connection made following execution of this Agreement, as measured in ERU's, for purposes of reimbursing the TRRWA for costs incurred to provide existing capacity or paying for the new connection's use of planned future capacity.

"TSS" means Total Suspended Solids, and shall mean that portion of a filtered sample which is retained on a filter pad that is dried at a specified temperature. This test is described in the most current version of a book entitled "Standard Methods for the Examination of Water and Wastewater."

SECTION 2. PARTIES.

The parties to this Agreement are: the Cities of Longview and Kelso, Washington, organized pursuant to RCW 35A.11, (hereinafter "Longview" and "Kelso" respectively), Cowlitz County, a duly organized county of this state, (hereinafter the "County"), and Beacon Hill Sewer District organized under RCW 57.04 (hereinafter "Beacon Hill").

SECTION 3. THREE RIVERS REGIONAL WASTEWATER AUTHORITY.

Pursuant to RCW 39.34, the parties hereby constitute a separate and distinct third party entity to be known as the Three Rivers Regional Wastewater Authority, which shall be governed by a Board constituted as set forth in this Section. The TRRWA shall be governed by a four (4) member Board composed of the following members:

CITY OF KELSO – 1 member
CITY OF LONGVIEW – 1 member
BEACON HILL SEWER DISTRICT – 1 member
COWLITZ COUNTY – 1 member

The Board shall be made up of an appointed representative from each jurisdiction with responsibility for day to day management, finance, personnel actions, budget development and General Plan implementation. Each Board representative shall be selected by such method and for such term as the appointing entity deems appropriate. The duration, termination, and revocation of any entity-appointed Board member shall be within the sole discretion and control of the appointing entity. Each appointing entity may designate an alternate to serve in the absence or incapacity of its appointed Board member. Each member of the TRRWA's Board will have 1 vote on issues which come before it.

SECTION 4. FINANCES/ENTITY CONTRIBUTIONS.

A. Budget Formulation: The TRRWA shall formulate its preliminary annual budget by the last working day of September each year and in a manner consistent with the budget process employed by the member entities. Each entity's Board member shall submit its proportionate share of the TRRWA's budget to their respective jurisdiction for incorporation of the expenditure into the entity's sewer enterprise fund budget.

The maintenance and operating budget of the TRRWA shall be funded by the parties in proportion to their respective flow to the Facilities.

Repairs and replacements to existing Facilities shall be funded in proportion to each jurisdiction's respective flow to the Facilities.

Upgrades to the existing Facilities for purposes of capacity expansion or regulatory compliance with new standards shall be funded (paid for) by SDC by each party's sewage utility account or in proportion to each jurisdiction's respective flow to the Facilities as determined by the TRRWA.

B. Capital Budget: A separate cumulative capital budget shall be formulated annually. The capital budget shall include two sections:

- Capital Improvements t Maintain and Utilize the Overall Capacity - This portion of the capital budget shall include the reconstruction of any existing TRRWA facilities shown on Exhibit A. In addition it shall include capacity improvements to the TRRWA sewer lines, pumping, and other facilities, as shown on Exhibit A, to the extent of utilizing the primary and secondary treatment capacity of the plant. Capital budget items in this category shall require approval of a majority of the members of the Board. This portion shall also include upgrades for regulatory compliance within the capacity of the plant.

- Capital Improvements to Increase the Overall Capacity - This portion of the capital budget shall include any construction that increases the primary and secondary treatment capacity of the plant or additions to the TRRWA facilities not included on Exhibit A, such as accepting ownership of a member(s) facility or construction of new facilities to serve new areas. Capital budget items in this category shall require approval of a majority of the members of the Board and shall require the approval of the governing bodies of all the parties.

In the event that capital improvements are funded through a borrowing mechanism, the governing bodies of each entity shall be obligated to execute appropriate legal documents committing the entity to its share of debt service until the obligation is satisfied.

C. System Development Charges: TRRWA shall establish a system development charge for new connections that contribute flow to the Facilities of the TRRWA. The amount of these charges shall be calculated as a function of ERU's to recover the cost of new development's use of capacity within the Facilities and will be uniform throughout the service area.

Each Party retains the option of remitting to the TRRWA an amount equal to that which would have been collected through system development charges if and to the extent that jurisdiction chooses not to apply the charge to all new connections.

Moneys collected by the Parties under this system development charge provision shall be remitted to the TRRWA on a monthly basis. The system development charge for new connections that are established in stages or phases may be paid as each stage or phase is developed. These moneys will be placed into a separate fund (the "Separate Accumulative Fund") and used only for those functions established for that fund in Section 7.C.

If the TRRWA is further required by applicable laws or regulations to upgrade the Facilities to provide a higher level of wastewater treatment or to modify the methods and/or locations of wastewater discharge, each Party shall, if it desires to continue discharging Domestic Sewage into the Facilities, pay its proportionate share as established in Section 4.A and 4.B.

The TRRWA shall seek opportunities to reduce or avoid the cost of additional improvements through all mutually agreeable modifications in the quantity and quality of Domestic Sewage discharged by the Parties.

D. Discontinue Discharge: Any Party desiring to discontinue discharging domestic sewage into the Facilities shall give notice of its intent to discontinue discharge not less than three years prior to the date of discontinuance. However, unless another Party or other entity assumes the discontinuing Party's Capital Component obligation under Section 7.A, the discontinuing Party shall remain obligated to pay the Capital Component of TRRWA rates until all bonds payable from those rates as of the date of discontinuance (and any subsequent refunding bonds) are redeemed or defeased.

SECTION 5. SEWAGE TREATMENT.

A. Availability of Capacity. TRRWA shall treat by means of the Facilities the Domestic Sewage discharged by the Parties up to the Facilities capacity as long as the Parties require it, barring events and circumstances which are beyond TRRWA's control. Capacity shall be available on a "first come, first served" basis.

B. Treatment of Domestic Sewage Only. No Party shall discharge into the Facilities any wastewater other than Domestic Sewage. TRRWA is obligated to treat only Domestic Sewage and may reject all other forms of wastewater. TRRWA may refuse to transport and treat Domestic Sewage from those portions of a Party's sewage collection system which do not conform to DOE and/or EPA standards.

(1) Treatment of "High Strength Waste" – Surcharge

In the event that "high strength waste" is accepted for treatment by the Facilities, a surcharge shall be imposed and paid to the TRRWA in addition to any other charges for sewage treatment, as provided by Resolution of the TRRWA.

C. Sewage Quality. The Parties shall cooperate to develop, as needed, rules, ordinances and programs to mitigate mass BOD and TSS or other pollutant levels which are higher than acceptable norms, as determined by either regulatory requirements or by generally accepted environmental practices. The direct costs of such compliance programs, if and when undertaken, shall be recovered from the Party responsible for the discharge of nonconforming wastewater and, unlike general maintenance, replacement and operation costs, shall not be based on overall sewage flow levels.

D. Pre-Treatment Ordinances. Each of the Parties shall adopt a pre-treatment ordinance meeting all Federal and/or State requirements. TRRWA shall be responsible for the administration and operation of a pre-treatment program. Administration and operation shall include, but not be limited to, developing procedures, forms, and instructions; categorizing dischargers; record keeping; compliance tracking; establishment of annual limits; sampling, testing, and monitoring; preparation of control documents; collection of fees and preparation of permits. The Parties shall identify to TRRWA those dischargers within their service areas required to provide pre-treatment and authorize TRRWA to enforce the requirements contained in the Ordinance.

E. Governing Rules and Regulations. The Parties shall assure that their respective sewerage ordinances or other regulations are at least as effective as TRRWA rules and regulations. The TRRWA shall receive, transport, treat and dispose by means of the Facilities the domestic sewage discharged by each Party up to the limits permitted by EPA and DOE.

SECTION 6. OPERATION, TREATMENT, AND QUALITY OF THE FACILITIES AND THE PARTIES' INTERNAL SYSTEMS.

A. Operation and Maintenance of the Facilities. The TRRWA shall be responsible for the operation and maintenance of the Facilities, subject to the terms of this Agreement. The Facilities shall be operated and maintained in accordance with generally accepted engineering standards, and the standards established by the EPA, the DOE, the Washington State Department of Social and Health Services and other federal, state and local agencies. The quantity of Domestic Sewage discharged by each Party into the Facilities shall be metered as determined by the TRRWA. The meter that measures each Party's discharge of Domestic Sewage into the Facilities shall be calibrated by the TRRWA at least once each calendar year and may be inspected by any Party at the expense of such Party at any time upon reasonable notice to the other. The TRRWA may continue to monitor other relevant variables such as water consumption by each Party, rainfall, and other suitable variables, which will be used to provide redundancy for failed meters and an alternative method to check the validity and accuracy of the meter readings. The TRRWA shall be solely responsible for administration of the Facilities. Recognizing the duty of each of the member entities to finance the operation and maintenance of the Facilities, the TRRWA shall defend, indemnify and hold harmless all of the parties hereto from and against all claims, whether sounding in contract or in tort, arising out of or in any way related to the project, PROVIDED that such indemnification shall not extend to cover any obligation of the member entity arising out its proportionate share of flow to the Facilities as established in Section 4.A or otherwise provided under this Agreement. The previous sentence shall survive the completion, expiration, and/or termination of this Agreement.

B. Reporting Requirements. Each Party shall provide the TRRWA with monthly reports of the number of new sewer connections adding flow to the TRRWA Facilities. The TRRWA shall on a monthly basis, record and report the amount of measured Domestic Sewage, measured in MGD, discharged into the Facilities, accounted for by each Party.

The TRRWA shall periodically inspect its Facilities and each of the Parties shall periodically inspect its Internal System to ensure adherence to applicable standards and to reduce infiltration, exfiltration, and deposits of rock or other debris.

C. The Parties’ Internal Systems. Each Party shall operate and maintain its Internal System at its sole expense, including all of its internal facilities as required to maintain the volume and quality of Domestic Sewage within the limits set forth in this Agreement. Each Party shall observe the highest practicable standards and practices in the construction, operation, and maintenance of its Internal System with particular attention to the following: (a) reducing entry into the sewerage system of groundwater and/or surface water (I/I – infiltration and inflow); (b) maintaining a favorable character and quality of Domestic Sewage in accordance with the standards set forth in this Agreement eliminating septicity, entry of petroleum wastes or other chemicals and/or wastes detrimental to sewer lines, pumping stations, the Facilities, and the waters of the Cowlitz River Basin; and (c) maintaining an efficient and economical utility operation, while achieving optimum pollution and environmental control. Each Party shall adopt ordinances, policies, and procedures prohibiting the connection of any storm or drainage facilities to its Internal System.

The TRRWA shall give written notice to a Party of any condition within the Party’s Internal System that violates this Agreement or applicable laws, regulations, or permits. If the Party does not correct such condition within a reasonable time after the TRRWA gives written notice thereof, the Party shall pay to the TRRWA any reasonable and necessary costs and expenses incurred by the TRRWA in connection with such condition. If the Party discharges into the Facilities any solids, liquids, gases, toxic substances, or other substances which the TRRWA reasonably believes is causing or will cause damage to the Facilities, or is creating a public nuisance or a hazard to life or property, the Party shall either discontinue the discharge of such substances, or pay for the costs of modifying the Facilities so that they are capable of satisfactorily handling such substances. Because substandard conditions of Domestic Sewage may cause serious damage to the Facilities, the Parties shall comply with any TRRWA order regarding the composition of Domestic Sewage, and after compliance, may thereafter submit the reasonableness of such order to arbitration as provided in Section 9.

The Parties shall cooperate with each other to determine the source of possible violations of applicable law, regulations and permits (including applicable NPDES Permits). In the event the TRRWA is fined or otherwise penalized by local, state, or federal agencies for failure to operate or maintain the Facilities in accordance with the requirements of such agencies, and it is demonstrated to the satisfaction of the majority of the Board that such failure is due, in whole or in part, to a Party or Parties’ discharge of Domestic Sewage in violation of this Agreement, then the offending Party or Parties shall pay their allocable share (as determined by the TRRWA or by an arbitrator in accordance with Section 9) of the costs of such fines or penalties, including its share of the associated administrative, legal, and engineering costs incurred by the TRRWA in connection with the fines or penalties.

SECTION 7. PAYMENT FOR MAINTENANCE, OPERATION, AND CAPITAL IMPROVEMENT COSTS FOR THE TREATMENT OF DOMESTIC SEWAGE.

A. TRRWA Rates. The TRRWA shall establish rates charged to the Parties for treatment of sewage and septage, external sewage sources and provision of treatment services to the Parties in amounts at least sufficient to provide for (a) the maintenance and operation of the TRRWA Facilities (the “M&O” Component), (b) the principal of, interest on and coverage covenants with respect to any and all revenue obligations that constitute a charge upon the revenues of the TRRWA sewer system (the “Capital Component”), and (c) to the extent not otherwise provided by payments to provide for debt service coverage, depreciation costs for equipment and Facilities necessary to provide wastewater treatment services to the Parties (the “Depreciation Component”). The County has executed two Public Works Trust Fund loan agreements and has issued or will issue revenue bonds payable from the TRRWA rates established under this Section 7. For as long as any of those obligations are outstanding, each Party irrevocably pledges to include amounts in its sewer enterprise fund annual budget, and to establish sewer rates and charges, in amounts sufficient to provide for payment of the TRRWA rates. It is anticipated that either the County or one or more of the other parties to this Agreement will execute Public Works Trust Fund loan agreements or other evidences of indebtedness for the benefit of the TRRWA payable from TRRWA rates established under this Section 7. For as long as those obligations are outstanding, each Party irrevocably pledges to include amounts in its sewer enterprise fund annual budget, and to establish sewer rates and charges, in amounts sufficient to provide for the payment of the TRRWA rates. Each Party recognizes and agrees that those TRRWA rates have been or will be pledged to the repayment of those bonds, and that its obligation to timely pay TRRWA the rates, fees or other payments established under this Agreement may be relied upon by the County or by other financing party pledging, or secured by the Party’s payments to the TRRWA and the TRRWA’s payments to the County or financing party. The TRRWA shall impose, and each Party shall pay, the Capital Component of the payments required under this Section 7 whether or not the Facilities are operating and notwithstanding the suspension, interruption, interference, reduction or curtailment in the operation of the Facilities for any reason whatsoever, in whole or in part. Furthermore, in the event that a Party discontinues discharge under Section 4.D, that party shall be required to pay its allocable share of the Capital Component unless and until another Party or other entity assumes the discontinuing Party’s capacity share and Capital Component obligation. Payments by any Party to the TRRWA, and payments by the TRRWA to the entity financing such indebtedness, shall not be subject to any reduction, whether by offset or otherwise, and shall not be conditioned upon the performance or nonperformance of any Party to this Agreement, except as otherwise approved by all parties or by separate agreement.

B. Monthly Payments. Commencing as soon as practicably possible after the execution of this Agreement, the Parties shall make monthly payments to the TRRWA of the rates and fees established by the TRRWA under Section 7.A, above. The M&O Component of the monthly payments shall include one twelfth of the Party’s proportionate share of the Maintenance and Operation Costs adopted in the annual budget of the TRRWA for the Facilities. Each Party’s share of the total annual Maintenance and Operation Costs, and its share of the repair and replacement and other facilities costs comprising the Capital Component and the Depreciation Component, shall be determined as set forth in Section 4.A and 4.B. Each Party shall provide or allow in its bond authorizing documents that payments to the TRRWA shall be treated as operation and maintenance costs of its own system or as contract resource obligations – in either case constituting a payment obligation prior and superior to the Party’s bonds existing on the date of this agreement.

Each Party's monthly payments shall be due at the earliest date, depending on the Party's accounts payable cycle. In the event that the Party's payment is received more than 45 days after receipt of a TRRWA bill, the TRRWA shall be entitled to a late payment surcharge equal to the interest which the payment would have earned for the period in excess of 45 days, based on an interest rate used by the County Assessor for delinquent taxes. Year end adjustments to the amounts paid by each of the parties for their flow-related costs shall be based on actual flows. The adjustments for the prior year shall be reflected in following year's monthly payments to the TRRWA. These shall be in the form of debits or credits to the specific party's monthly payments.

C. Reserve Fund. The TRRWA shall establish a Separate Accumulative Fund dedicated to funding capital improvements, upgrades and major replacements. This fund shall be distinct from other TRRWA maintenance and operations funds. System Development Charges for the Facilities shall be remitted to the TRRWA which will deposit these moneys into the Separate Accumulative Fund. The TRRWA may at its discretion deposit into the Separate Accumulative Fund amounts from the Depreciation Component and from the coverage portion of the Capital Component.

The TRRWA may use this reserve fund for needed expenditures on an emergency basis and under the terms of this Agreement when the public safety, health and general welfare, legal and regulatory requirements, or unforeseen circumstances require expeditious action.

Money in this Fund shall be used only for system capital improvements, upgrades and replacements to the Facilities, or for emergencies as noted above. The fund may also be used for acquisition of land and existing treatment facilities.

D. Party's Rates and Sources of Payment. The Parties shall pay the charges described in Sections 7.A through 7.C out of revenues derived through each Party's Internal System. As described in Section 7.B, each Party's remittances to the TRRWA, except those revenues derived through System Development Charges, shall be treated as operation and maintenance expenditures or as contract resource obligations. Each Party shall establish rates and collect fees and charges for sewer service in amounts at least sufficient to pay for (a) the maintenance and operation of the Party's Internal System, including the Party's payments to the TRRWA, and (b) the principal and interest on any and all revenue obligations that constitute a charge on the revenue of the Party's Internal System, together with any coverage covenants in the Party's bond authorizing documents. Each Party shall promptly pay all rates charged by the TRRWA. In the event that a Party contests the amount of any TRRWA rate, fee or other required payment, that Party shall nevertheless promptly pay the amount required by the TRRWA and submit the dispute to resolution under Section 9. If the dispute resolution process results in a determination that the Party has overpaid the dispute rate, fee or other payment, the TRRWA shall reimburse that Party for the overpayment in the manner, at the times and with such interest as shall be determined by the dispute resolution process.

E. Books and Accounts. The TRRWA shall keep full and complete books of accounts showing the costs incurred in connection with the Facilities, and the portion thereof applicable to each of the Parties. Minutes of each meeting shall also be kept by the TRRWA.

Any of the Parties, through an interagency service contract with the TRRWA, or outside third parties, may provide administrative support personnel to the TRRWA. The costs of these support services and keeping the financial records and accounts of the TRRWA shall be considered to be a Maintenance and Operation Cost of the TRRWA. Audits of the books shall be performed as determined by the TRRWA or the state and the costs shall be considered a direct cost of TRRWA. More frequent audits, if requested by any Party, shall be charged to the Party or Parties making the request.

F. Future Financing. If the TRRWA determines that there is a need to finance all or a portion of the costs of additional improvements to or extensions of the Facilities, a member entity shall, to the extent of its reasonable ability considering its other obligations and consistent with applicable bond covenants, issue additional revenue or general obligations bonds or other evidences of indebtedness to finance those improvements or extensions. If the TRRWA requests that a member entity issue such obligations, the Parties shall use their best efforts to enter into such agreements or amendments to this Agreement as may be necessary to enable such entity to successfully issue those obligations. If, after reasonable efforts to structure and/or issue such bonds or other obligations, such entity is unable to do so, each of the other parties hereto, to the extent of their reasonable ability considering other obligations of such parties and their respective borrowing abilities, shall issue their own general obligation or revenue bonds or other evidences of indebtedness, and advance the proceeds thereof as needed to the TRRWA. The TRRWA and all of the Parties hereto shall indemnify and hold the borrowing party hereto free and harmless of and from any such indebtedness to the extent of their respective proportionate shares of payment therefore, as such proportionate shares may be determined by reference to Section 4.A or 4.B hereof.

SECTION 8. REPLACEMENT STANDARDS; INSURANCE.

A. Replacement and Rehabilitation Standards. Replacement, reconstruction, rehabilitation, expansion, or upgrading of the Facilities shall be in accordance with applicable federal, state, and local laws and regulations. Additions, betterments and improvements to the Facilities of the TRRWA shall be installed and constructed in accordance with generally recognized engineering standards at least equal to the standards of the TRRWA and in accordance with all applicable federal, state, and local laws and regulations.

B. Insurance. The TRRWA shall purchase on behalf of all Parties and maintain, through its insurance companies or insurance pools, property, boiler and machinery, and liability insurance sufficient to pay for comprehensive loss or damage to the Facilities, resulting from their operation in a normal and prudent manner, including loss or damage caused by the operation of sewerage facilities which are not a direct part of the Treatment Plant.

The Parties shall purchase and maintain, through their own insurance companies or insurance pools, property, boiler and machinery, and liability insurance sufficient to pay for comprehensive loss or damage to the Facilities caused by the operation of their internal system. In the alternative, the TRRWA or a Party, may set aside cash in a reserve fund in an amount sufficient to pay for such loss or damage, subject to review and recommendation by the Board.

SECTION 9. ARBITRATION.

In the event of a dispute between the TRRWA and a Party or Parties concerning any matters arising under the terms and conditions of this Agreement, unless specifically excluded from arbitration, the dispute shall first be considered by an independent review committee. This Committee shall be composed of a representative from each Party who shall be appointed by its elected body. A fifth at large member shall be appointed by the TRRWA. The Review Committee will function as fact finders and attempt to negotiate a voluntary settlement of the dispute. Failing this voluntary resolution, the matter shall be submitted to binding arbitration under the rules of the Superior Court (MAR), RCW ch. 7.04 or RCW ch. 7.06, whichever is appropriate. The decision of the arbitrator shall be final and binding. The arbitrator's fees and costs shall be shared equally by the disputing entities.

SECTION 10. AMENDMENT OR MODIFICATION.

No amendment or modification of this Agreement, including any addition or deletion thereto, shall be effective unless approved and executed by all of the Parties hereto.

SECTION 11. GOVERNING LAWS.

This Agreement shall be governed and construed in accordance with the laws of the State of Washington. Venue in connection with any legal proceeding seeking enforcement of the provisions hereof through injunctive relief or arbitration award pursuant to Section 9 of this Agreement shall be in the Superior Court of the State of Washington for Cowlitz County.

The TRRWA has heretofore prepared and adopted Bylaws for its operations. Such Bylaws shall be subject to amendment in the same manner as their adoption.

SECTION 12. NUMBER AND GENDER.

Whenever applicable, the use of the singular number shall include the plural, the use of the plural number shall include the singular, and the use of any gender shall be applicable to all genders.

SECTION 13. NOTICES.

All notices and payments relating to this Agreement shall be made at the following address, unless the parties are otherwise previously notified in writing:

If to:	Notice to be sent or delivered to:
City of Longview	1525 Broadway, Longview, WA 98632
City of Kelso	203 S. Pacific Avenue, Kelso, WA 98626

Beacon Hill Sewer District	1121 West Side Highway, Kelso, WA 98626
Cowlitz County	207 4th. Avenue North, Kelso, WA 98626

SECTION 14. TERM.

This Agreement shall commence on the 1st day of the calendar month following the date that the last party hereto executes this Agreement, and shall continue for an indefinite term and until terminated by the parties hereto. The Parties agree to negotiate in good faith towards the future continuance of this Agreement. Any amendments or supplements hereto shall be in writing and executed by all of the parties hereto, and a copy thereof shall be attached hereto.

SECTION 15. TERMINATION OF AGREEMENT AND DISPOSITION OF ASSETS ON TERMINATION.

This Agreement may not be terminated so long as there remain outstanding any bonds or other debt or loan obligations payable from the TRRWA rates described in Section 7. Thereafter, this Agreement may be terminated only upon the affirmative vote of a majority of the parties hereto, voting through their respective board members of the TRRWA. Such termination shall not be effective for a period of 180 calendar days following the date of such affirmative vote. On or before the effective day of such termination, the party hereto then having greatest number of customers shall have the exclusive option to purchase all of the assets of the TRRWA constituting the Facilities, including land and improvements. The purchase price shall be such sum as the parties agree upon, and shall be paid by the purchasing party hereto to the then other parties hereto as provided in this Section. If any party hereto has theretofore issued any Bonds or other evidences of indebtedness for the benefit of the TRRWA, any agreement of indemnity or guarantee by the TRRWA and/or by any of the other parties with respect to that indebtedness shall be assumed by the purchasing party.

If the parties shall be unable to agree on the purchase price, such purchase price shall be established as provided in Section 9 (Arbitration) and shall include a sum equal to the then (on the date of purchase) fair market value of all of the Facilities including all personal property, cash in banks and on deposit, and all accounts receivable, less all indebtedness. Indebtedness evidenced by Bonds, Warrants or other evidences of indebtedness assumed by the purchasing party shall be taken into consideration as a reduction in the value of assets of the TRRWA. The interest of each of the then parties to this Agreement shall be deemed to be equal to their proportionate share of payment over the then previous 12 calendar months under the provisions of Sections 4.A and 7.A of this Agreement. Payment shall not be required to be made by the purchasing party to itself for its interest in such assets, and payment to the other parties hereto shall be made within twelve months following the effective date of termination of this Agreement, or such other time as the parties may agree upon. In the event that any of the parties hereto has provided funds to the TRRWA through the issuance of the party’s Bonds or other evidences of indebtedness, the purchasing party shall indemnify and hold such party free and harmless from such Bonds or other indebtedness.

In the event that the party hereto identified in the immediately preceding paragraph as the purchasing party should not elect to exercise its option to purchase, any of the other parties hereto shall be entitled to effect such purchase on the same terms as set forth above. If none of the parties hereto should elect to purchase the interest of the others, then in such event all of the facilities shall be sold as soon as reasonably possible following the effective date of termination, any remaining indebtedness of the TRRWA shall be paid from the proceeds of such sale, and the remaining proceeds shall be divided in the proportions as determined by reference to Sections 4.A and 7.A hereof. The members of the Board of the TRRWA shall supervise the termination and sale of such assets and the distribution of proceeds as herein provided.

SECTION 16. PREVIOUS AGREEMENTS SUPERSEDED.

This Agreement supersedes and replaces the following agreements: (a) "Interlocal Agreement Among City of Kelso, City of Longview, Beacon Hill Sewer District and Cowlitz County for Wastewater Treatment and Disposal", executed between May and July, 1996; (b) "First Amendment to Interlocal Agreement among City of Kelso, City of Longview, Beacon Hill Sewer District, and Cowlitz County for Wastewater Treatment and Disposal" effective June 1, 1998; (c) "Revised and Restated Interlocal Agreement Among City of Kelso, City of Longview, Beacon Hill Sewer District, and Cowlitz County for Wastewater Treatment and Disposal" which was effective on or about the 1st day of September, 2002. Provided, however, that such replacement shall not serve to impair any obligations entered into pursuant to or in reliance on those prior agreements, and the bylaws, rules of procedure of the TRRWA and all Resolutions, Minutes, Contracts, Agreements, proceedings and other matters that were in force and effect on the effective date of this Agreement shall remain in full force and effect except as such matters shall be in conflict herewith and except as such by-laws, rules of procedure, Resolutions, Minutes, Contracts, Agreements, proceedings and other matters are hereafter amended or modified by the board of the TRRWA.

SECTION 17. EXECUTION AND RECORDING.

This Interlocal Agreement may be executed in one or more counterparts, and will be filed with the Cowlitz County Auditor pursuant to RCW 39.34.040 within five days of the date of execution of this Agreement. All fees relating to such recording shall be paid by the TRRWA. All of the Parties agree to execute releases or other appropriate instruments as shall be necessary to certify compliance with the terms of this Agreement upon full and complete satisfaction of the terms of this Agreement.

Dated ______________________________, 2005. City of Longview

Approved as to Form

____ By ____

City Attorney Robert J. Gregory, City Manager

NOTE: Signature pages for the other TRRWA member entities not shown for brevity.

INTERLOCAL AGREEMENT FOR SUPPLEMENTAL FINANCING OF WASTEWATER TREATMENT PLANT EXPANSION BIOSOLIDS HANDLING IMPROVEMENTS

THIS INTERLOCAL AGREEMENT is made and entered into pursuant to Chapter 39.34 of the Revised Code of Washington, by and between the CITY OF LONGVIEW, Washington, a municipal corporation of the State of Washington, (the "City"); the THREE RIVERS REGIONAL WASTEWATER AUTHORITY, a third party entity organized under the law of the State of Washington, (the "TRRWA"); and the City of Kelso, Cowlitz County, and Beacon Hill Sewer District, all municipal corporations organized under the laws of the State of Washington and situated in Cowlitz County, Washington, which entities together with the City are referred to herein as the "member agencies", on the date shown below.

RECITALS

1. The parties to this agreement are also parties to a Revised and Restated Interlocal Agreement among City of Kelso, City of Longview, Beacon Hill Sewer District, and Cowlitz County for Wastewater Treatment and Disposal effective September 1, 2002. Said Agreement, among other provisions, provides for the governance and operations of the TRRWA, formerly known as the Cowlitz Sewer Operating Board (CSOB), under R.C.W. 39.34, and also provides for financing capital improvements. Portions of said agreement that describe financing capital improvements are summarized as follows:

SECTION 4.A.

Upgrades to the existing Facilities for purposes of capacity expansion or regulatory compliance with new standards shall be funded by SDC (system development charge) or in proportion to each jurisdiction's respective flow to the Facilities as determined by the TRRWA.

SECTION 4.B.

In the event that capital improvements are funded through a borrowing mechanism, the governing bodies of each entity shall be obligated to execute appropriate legal documents committing the entity to its share of debt service until the obligation is satisfied.

2. The TRRWA and member agencies have requested that the City, on behalf of the TRRWA, obtain Public Works Trust Fund loans from the Washington State Department of Community, Trade and Economic Development not to exceed $ 11 million.

AGREEMENT

For and in consideration of the mutual covenants contained herein, the parties hereto agree as follows:

1. Duration: This Agreement shall commence as of the date hereof and shall terminate upon repayment of the loan(s) described herein.

2. Purpose: The purpose of this Agreement is to allow the City to secure additional funding for the TRRWA to continue design and construction of an upgrade and expansion of the existing sewer treatment plant in Cowlitz County, Washington. This Agreement supplements that certain Interlocal Agreement for Financing of Wastewater Treatment Plant Expansion entered into between the parties hereto in July, 1999 and the 2001 agreement.

3. Construction: The TRRWA is in the process of designing Lime Pasteurization Treatment for Biosolids and anticipates completing construction by December 2007. The City shall have no responsibility for construction of said project and the TRRWA shall have the authority to determine its design and construction.

4. Financing: Pursuant to the Agreement, City has entered into a Public Works Trust Fund Pre-Construction Loan Agreement Number PW-05-691-PRE-124, evidencing indebtedness. In addition, the City has made application to the Public Works Trust Fund for a construction loan, and if selected for a loan, intends to enter into a Public Works Trust Fund construction loan agreement.

   The funds received pursuant to such loan shall be restricted solely for payment of costs incurred in connection with the project. The City shall transfer all loan proceeds to the TRRWA upon execution of this agreement or subsequent receipt of funds from the Public Works Trust Fund. The TRRWA shall deposit such loan proceeds into a special account and shall properly document expenditures and earnings in accordance with the loan agreement requirements.

5. Repayment: The City shall make principal and interest payments in the manner specified in the Public Works Trust Fund Construction Loan Agreement Number PW-05-691-PRE-124. On or before June 1 of each year, the TRRWA shall pay to the City, an amount equal to principal and interest payment due to the Public Works Trust Fund that year. Each of the member agencies shall make payments to CSOB according to rates established pursuant to Sections 4 and 7 of the Revised and Restated Interlocal Agreement for Wastewater Treatment & Disposal. Should the TRRWA fail to make payment to the City, the City shall have the right to withhold all future operating and/or system development charge payments to the TRRWA until an amount equivalent to the principal and interest payment due that year has been withheld.

6. Repayment Guarantees: For as long as any portion of the loan is outstanding, each of the member agencies irrevocably pledges to include in its sewer enterprise fund budget and establish sewer rate charges annually on all of the property served within its service area in an amount sufficient to pay when due, its proportionate share of the principal and interest on the indebtedness evidenced by the above described loan, and the full faith, credit and resources of the respective member agencies are pledged irrevocably for the collection of those revenues and the prompt payment of such proportionate share of that principal and interest.

7. Termination: Neither the City, nor the TRRWA, nor any member agency may terminate this Agreement until said loan has been repaid.

8. Indemnification: In further consideration of the above described loan, the TRRWA shall defend, indemnify and hold harmless the City from and against all claims, whether sounding in contract or in tort, arising out of or in any way related to the project. This paragraph shall survive the completion, expiration, and/or termination of this Agreement.

9. Recording: This INTERLOCAL Agreement will be filed with the Cowlitz County Auditor pursuant to R.C.W. 39.34.040 within five days of the date of execution of this Agreement. All fees relating to such recording shall be paid by the City. City agrees to execute a release or other appropriate instruments as shall be necessary to certify compliance with the terms of this Agreement upon full and complete satisfaction of the terms of this Agreement.

City of Longview

Dated ________________________________, 2005

Approved as to Form: By:___________________________________

Robert J. Gregory, City Manager

____

City Attorney

{{NOTE: Signature pages of other member entities not included for brevity.}}

Appendix C

Discussion of Projected Flows and Loading for the Three Rivers Plant

Appendix C

Discussion of Projected Flows and Loading for the Three Rivers Plant

Introduction

This memorandum discusses Gibbs & Olson's analysis of wastewater flow projections for the Longview, Kelso, Beacon Hill Sewer District and surrounding urban areas as presented in our General Sewer Plan (GSP) dated February 2007 as compared to the Cowlitz Sewer Operating Board System Improvements Project Facility Plan/ Pre-Design Report (CSOB Facility Plan), prepared by Ace Consultants, Inc., Gibbs and Olson, Inc., and Carollo Engineers, dated November 1999. Flow projections from the CSOB Facility Plan, which include Longview, West Longview, Beacon Hill, and Kelso, indicate that the Three Rivers Regional Wastewater Plant (TRRWP) will hydraulically be at capacity in the year 2013 (i.e. the max day flow will be at 62.4 MGD). The flow projections in the current GSP indicate that the max day design flow will not be reached until sometime after the year 2030. It is the purpose of this memo to explain this discrepancy.

Background

The flow projections in the CSOB Facility Plan are based on flow projections from a GSP prepared by KCM, Inc., dated February 1997. The KCM flow projections were based on: 1)1989-1994 flow data to the TRRWP and the West Longview Wastewater Treatment Plant (WLWTP) and 2)1990 population and projection data obtained by the Cowlitz-Wahkiakum Council of Governments and are presented in the table below.

Table1 - KCM 1990 Population and Annual Growth Projections[1]						
	Projected Average Annual Growth Rates (percent)					
Basin	1990 Pop.	1991 - 1995	1996 - 2000	2001 - 2005	2006 - 2010	2011 - 2015
West Longview	9,900	3.8	2.6	2.3	2.3	2.0
Longview	24,700	0.8	0.5	0.6	0.3	0.1
Beacon Hill	5,000	3.8	2.6	2.2	2.0	2.1
Kelso	12,000	0.4	0.5	0.8	0.6	0.4
Total	**51,600**					

The flow data and projections from the KCM Plan are listed below.

Table 2 - KCM - Historical and Projected Flows by Treatment Plant (MGD)				
	Historical Flow	Projected Flows		
Treatment Plant	1989-1994	1998	2013	Buildout
TRRWP				
Annual Avg.	7.0	9.7	14.4	-
Max Month	15.2	15.1	22.7	-
Max Day	27.5	39.5	53.7	91.0

[1] Cowlitz Sewer Operating Board General Sewer Plan for the Longview-Kelso Urban Area, prepared by KCM, Inc., dated February 1997, pg. 4-1.

Table 2 - KCM - Historical and Projected Flows by Treatment Plant (MGD)				
WLWTP				
Annual Avg.	1.5	1.0	1.2	-
Max Month	2.9	1.8	2.3	-
Max Day	5.7	4.9	5.5	7.7

The KCM flow projections were revised in 1998 by Gibbs and Olson as part of the CSOB Facility Plan. A review and revision of the KCM projections was done to account for changes in the Longview-Kelso area at the time. The G&O review utilized the same methodology for determining residential, commercial and industrial base flows as the KCM study; however, the G&O study modified the projections by utilizing new I/I flow rates[2]:

1) 25 gallons of I/I per capita per day (gpcd) for residential.
2) 300 gallons of I/I gpcd for commercial/ industrial.

In addition, the revision included peaking factors for residential, commercial and industrial flows. A peaking factor of 2.5 was used for residential flow and 1.5 for commercial/industrial[3]. Also, the revision takes into account flows from Foster Farms, Mint Farm Industrial Park, and a flow diversion from West Longview to the TRRWP. The following projections were developed from this Facility Plan:

Table 3 - 1990 CSOB Facility Plan Flow Projections (MGD)[4]			
	Year 1998	Year 2013	Buildout
Average Dry Weather Flow			
Residential Flow	4.43	5.48	12.09
Commercial Flow	1.32	1.74	2.23
Industrial Flow	5.24	9.03	12.59
Total:	**10.99**	**16.25**	**26.91**
Peak Day Design Flow			
Res, Comm, Ind Flow	20.92	29.86	52.47
I/I Flow Within Existing System	31.54	31.54	31.54
New I/I from Future Basins	0	1.02	2.72
Total:	**52.46**	**62.42**	**86.73**

In 2007, as part of the City of Longview GSP, Gibbs and Olson provided a revised estimate of the population and flow projections to account for updated population information and projections provided by the City of Longview. Year 2000 population data was obtained from the US Census Bureau. Aerial photographs of the sewer basins were used to supplement population information where census tracts partially overlapped the sewer basins. Houses were counted and the population was figured using 2.5 persons per home. The data was then corrected with 2004 Washington Office of Financial Management (OFM) data. An annual projection rate of 1% was used beyond 2005 for the greater Longview area based

[2] Memo regarding CSOB Collection System Improvement Project Design Flow Review Summary, prepared by Gibbs and Olson, dated July 16, 1998.
[3] Memo regarding CSOB Collection System Improvement Project Design Flow Review Summary, prepared by Gibbs and Olson, dated July 16, 1998.
[4] CSOB System Improvements Project Facility Plan/Design Report, prepared by Ace Consultants, dated November 1999, pg 1-2.

on information obtained from the City of Longview's Comprehensive Plan, dated 2005. Ninety percent of the Longview service area growth (for both east and west Longview) was distributed to West Longview with 10% to East Longview, which lead to the following annual growths rates for each respective basin.

Table 4 - Current GSP 2000 Population and Annual Growth Projections							
	Projected Average Annual Growth Rates (percent)						
Basin	2000 Pop.	2000-2005	2005-2010	2010-2015	2015-2020	2020-2025	2025-2030
West Longview	12,411	1.5	2.6	2.4	2.3	2.2	2.0
Longview	24,795	0.1	0.2	0.2	0.2	0.2	0.2
Beacon Hill	6,661	0.8	1.0	1.0	1.0	1.0	1.0
Kelso	11,895	-0.1	1.0	1.0	1.0	1.0	1.0
Total	**55,762**						

Historical flow data from the WLWTP and TRRWP dated 2000 to 2005 was used as the basis for the flow projections in the study. An I/I rate of 25 gpcd was utilized for max I/I for any future populations served by the TRRWP. Future flows from future industrial areas (including Mint Farm Phase II and Port of Longview among other areas) were accounted for by using a unit flow of 2,000 gpad. Commercial flows were accounted for using the 1.32 MGD in the CSOB GSP and increasing the flows proportional to the population. The methodology resulted in the following flow projection as compared to the CSOB FP.

Table 5 - Current GSP Flow Projections (MGD)		
	Year 2005	Year 2030
<u>Average Dry Weather Flow</u>		
Residential Flow	4.33	5.55
Commercial Flow	1.34	1.71
Industrial Flow	1.00	2.47
Total:	**6.67**	**9.73**
<u>Peak Day Design Flow</u>		
Res, Comm, Ind Flow	11.85	13.20
I/I Flow Within Existing System	22.42	24.13
New I/I from Future Basins	0.02	0.42
Total:	**34.29**	**37.75**

Discussion

The first discrepancy between the current GSP projections versus the past projection is the use of differing annual growth rates for the service population. The biggest difference in the growth rates occurs at Beacon Hill which was 2-4 times larger in the KCM GSP than the one used in the current GSP. The reason the smaller growth rate was used in the current GSP is that, based on our experience, it was determined that the Beacon Hill area would experience the same trend in population growth as the City of Longview (1% annually through 2030).

The resulting population projections based on the growth rates discussed above are presented in the table below for both the KCM and the current GSP. It should be noted that the KCM projection for existing and future service area projections in 1998 is 64,300 as compared to an actual population estimate of the existing service area in 2000 of 55,762 – a difference of approximately 8,500 people.

Table 6 – Population Data and Projection Comparison					
KCM 1990 Population Count and 1998/2013 Projected Populations[5]				G&O 2000 Population Count and 2030 Proj.	
Service Areas	1990 Pop.	1998 Pop.	2013 Pop.	2000 Pop.	2030 Pop.
West Longview	9,900	14,300	21,300	12,411	23,104
Longview	24,700	26,100	27,600	24,795	26,033
Beacon Hill	5,000	9,000	10,100	6,661	8,876
Kelso	12,000	14,900	18,100	11,895	15,158
Total	**51,600**	**64,300**	**77,100**	**55,762**	**73,171**

Based on KCM's 1998 projected max day flow and population, the flow per capita is calculated to be approximately 690 gpcd. The resulting flow difference between the 1998 population projected in the KCM GSP and the year 2000 population count in the current GSP would be at least 5.9 MGD.

The biggest difference in the projected flows is the industrial flow component. The CSOB FP states that industrial flow would contribute 5.24 MGD in 1998 with a peak day flow of 7.86 (5.24 MGD*1.5PF). Based on the FP, an industrial user survey indicated that industrial contributions to the TRRWP amounted to less than 100,000 GPD. Foster Farms was expected to contributed approximately 1.5 MGD and remain constant through 2013 once it was connected to the collection system. No other major contributors were identified for 1998. In 2013 the flow was projected to increase to 9.03 MGD with a peak of 13.5 MGD. It appears that flows from the Mint Farm industrial area may have been accounted for twice between the KCM GSP (future basin L-27) and the CSOB FP.

In the current GSP, the analysis of the 2005-2030 industrial contribution included the following:

Table 7 – Current GSP Year 2030 Industrial Flows			
Contributor	**Acres**	**GPAD**	**Flow MGD**
Misc. Small Industrial Users	-	-	0.10
Foster Farms	-	-	0.75
Mint Farm Phase I	68	2000	0.14
Mint Farm Phase II	369	2000	0.74
Port of Longview	285	2000	0.57
East Longview Future Service	78	2000	0.16
Total			**2.46**

It is believed that all the potentially significant current and future industrial contributors in the Kelso-Longview area were accounted for in this analysis. The flow from Foster Farms is based on average flows as indicated in the DOE fact sheet for the facility. No peaking factors were utilized since the 2,000

[5] Cowlitz Sewer Operating Board General Sewer Plan for the Longview-Kelso Urban Area, prepared by KCM, Inc., dated February 1997, pgs. 5-3 and 5-4.

gallons per acre per day (gpad) was considered conservative. The difference between the industrial contribution in 2030 in the current GSP and that in the CSOB FP for 2013 is approximately 11 MGD.

The final significant difference in the flow projections between the current GSP and the CSOB FP is that in the CSOB FP, a peaking factor of 2.5 was applied to the residential component of the Average Daily Dry Weather Flows to help determine peak flow. The peak I/I flow was then added to this flow. In the current GSP, the residential peaking was accounted for in the statistical analysis of the flow data. It was assumed that the residential component of the flows is consistent with the Average Dry Weather Flows and that peak flows were strictly the result of I/I. In the CSOB FP, peaking is accounted for twice with a peaking factor on the waste flows and then the addition of the peak I/I flows. If a peaking factor were not applied to the residential flows for the year 2013, then the residential component would remain at 5.48 MGD for peak flows rather than 13.7 MGD – a difference of 8.22 MGD.

Conclusion

The flow projections from the KCM GSP and the CSOB FP appear to be conservative. Based on the flow differences discussed above, the projected flows in 2013 would more realistically be around 37.3 MGD than 62.4 MGD peak day based on updated population data and updated conditions in the planning area. There may be other factors that would make the projection lower, but the bulk of the differences are covered in the discussion above.

Appendix D

Sewer Trunk Inventory

Upstream Node	Downstream Node	TYPE	YR_INST	ZONE	MATERIAL	FROM_INV	TO_INV	LENGTH	DIAMETER	COEFF	Slope (ft/FT)	Pipe Capacity (mgd)
Aldercrest No. 1 PS	*K16:53*	*1: Force Main*	*2001*	*K-16*	*PVC*	*370*	*393.86*	*3140*	*2*	*110*	N/A	N/A
Aldercrest No. 2 PS	*Aldercrest No. 1 PS*	*1: Force Main*	*2001*	*K-16*	*PVC*	*324*	*372*	*258*	*2*	*110*	N/A	N/A
Behshel Heights PS	*K10:67A*	*1: Force Main*	*1995*	*K-10*	*D.I.*	*307*	*402.53*	*979*	*4*	*110*	N/A	N/A
Catlin PS	*K5:9A*	*1: Force Main*	*1987*	*K-5*	*DI*	*19.5*	*17.84*	*766*	*8*	*110*	N/A	N/A
Clark PS	*K4:24A*	*1: Force Main*	*0*	*K-4*		*19*	*20.45*	*17*	*6*	*110*	N/A	N/A
CLEANOUT	*Aldercrest No. 2 PS*	*0: Gravity Main*	*0*	*K-16*	*PVC*	*324.5*	*323*	*283*	*6*	*0.013*	0.0053	0.26
Coweeman Park PS	*K17:55*	*1: Force Main*	*1997*	*K-17*	*D.I.*	*27.21*	*26.29*	*1592*	*4*	*110*	N/A	N/A
Donation St. PS	*K3:15*	*1: Force Main*	*1999*	*K-1*	*DI*	*15.6*	*68.85*	*1124*	*10*	*110*	N/A	N/A
Donation St. PS	*K3:15*	*1: Force Main*		*K-1*	*DI*	*16*	*69.08*	*1186*	*8*	*110*	N/A	N/A
Elm St. PS	*K7:42A*	*1: Force Main*	*0*	*K-7*	*DI*	*14.2*	*19.42*	*210*	*4*	*110*	N/A	N/A
First Ave PS	*K6:3A*	*0: Gravity Main*	*0*	*K-6*	*CONC*	*18.1*	*17.71*	*255*	*18*	*0.013*	0.0015	2.66
Grade St. PS	*K10:5*	*1: Force Main*	*1972*	*K-16*	*STEEL*	*17.3*	*10.72*	*305*	*10*	*100*	N/A	N/A
K1:1	*Donation St. PS*	*0: Gravity Main*	*1993*	*K-1*	*PVC*	*6.38*	*6.34*	*34*	*15*	*0.013*	0.0012	1.44
K1:10	K1:9	0: Gravity Main	1994	K-1	PVC	13.67	12.33	335	8	0.013	0.0040	0.49
K1:100	K1:94	0: Gravity Main	1951	K-1	CONC	14.45	13.71	269	10	0.013	0.0028	0.74
K1:101	K1:100	0: Gravity Main	0	K-1	CONC	15.54	14.45	311	8	0.013	0.0035	0.46
K1:102	K1:101	0: Gravity Main	0	K-1	CONC	17.13	15.55	328	8	0.013	0.0048	0.54
K1:102	K1:103	0: Gravity Main	0	K-1	CONC	17.14	16.37	155	8	0.013	0.0050	0.55
K1:103	K1:97	0: Gravity Main	1951	K-1	CONC	16.12	15.28	239	10	0.013	0.0035	0.84
K1:104	K1:103	0: Gravity Main	0	K-1	CONC	17.45	16.34	288	8	0.013	0.0039	0.48
K1:105	K1:104	0: Gravity Main	0	K-1	CONC	18.4	17.5	229	8	0.013	0.0039	0.49
K1:106	K1:103	0: Gravity Main	1951	K-1	CONC	16.77	16.4	134	8	0.013	0.0028	0.41
K1:107	K1:106	0: Gravity Main		K-1	CONC	17.58	16.85	118	8	0.013	0.0062	0.61
K1:108	K1:107	0: Gravity Main		K-1	CONC	20.08	17.69	266	8	0.013	0.0090	0.74
K1:109	K1:106	0: Gravity Main	0	K-1	CONC	18.2	16.85	301	8	0.013	0.0045	0.52
K1:11	K1:8	0: Gravity Main	1994	K-1	PVC	12.7	10.63	341	8	0.013	0.0061	0.61
K1:110	K1:109	0: Gravity Main	1951	K-1	CONC	27.04	18.12	344	8	0.013	0.0259	1.26
K1:111	K1:109	0: Gravity Main	0	K-1	CONC	19.57	18.13	294	8	0.013	0.0049	0.55
K1:112	K1:111	0: Gravity Main	0	K-1	CONC	24.98	19.57	299	6	0.013	0.0181	0.49
K1:113	K1:58	0: Gravity Main	1996	K-1	PVC	10.05	9.36	134	8	0.013	0.0051	0.56
K1:114	K1:113	0: Gravity Main	1996	K-1	PVC	10.95	10.17	123	8	0.013	0.0063	0.62
K1:115	K1:114	0: Gravity Main	1996	K-1	PVC	12.22	11.03	336	8	0.013	0.0035	0.46
K1:116	K1:115	0: Gravity Main	1996	K-1	PVC	14.15	12.31	347	8	0.013	0.0053	0.57
K1:117	K1:116	0: Gravity Main	1996	K-1	PVC	14.68	14.174	154	8	0.013	0.0033	0.45
K1:118	K1:117	0: Gravity Main	1996	K-1	PVC	15.26	14.7	136	8	0.013	0.0041	0.50
K1:118A	K1:118	0: Gravity Main	1996	K-1	PVC	16.1	15.36	108	8	0.013	0.0069	0.65
K1:119	K1:59	0: Gravity Main	1996	K-1	PVC	8.14	8.1	290	18	0.013	0.0001	0.80
K1:12	K1:11	0: Gravity Main	1994	K-1	PVC	15.66	13.18	260	8	0.013	0.0095	0.76
K1:120	K1:119	0: Gravity Main	1996	K-1	PVC	8.55	8.29	239	15	0.013	0.0011	1.38
K1:120A	K1:120	0: Gravity Main	1996	K-1	PVC	18.1	9.28	284	8	0.013	0.0310	1.38
K1:120B	K1:120A	0: Gravity Main	1996	K-1	PVC	48.75	20.04	279	8	0.013	0.1030	2.51
K1:120C	*K1:120B*	*0: Gravity Main*	*1996*	*K-1*	*PVC*	*49.8*	*48.93*	*236*	*6*	*0.013*	0.0037	0.22
K1:121	K1:120	0: Gravity Main	1996	K-1	PVC	9.24	8.64	281	15	0.013	0.0021	1.93
K1:122	K1:121	0: Gravity Main	1996	K-1	PVC	9.39	9.29	177	15	0.013	0.0006	0.99
K1:123	K1:122	0: Gravity Main	1996	K-1	PVC	9.55	9.42	124	15	0.013	0.0010	1.35
K1:124	K1:123	0: Gravity Main	1996	K-1	PVC	9.6	9.57	196	15	0.013	0.0002	0.52

Upstream Node	Downstream Node	TYPE	YR_INST	ZONE	MATERIAL	FROM_INV	TO_INV	LENGTH	DIAMETER	COEFF	Slope (ft/FT)	Pipe Capacity (mgd)
K1:125	K1:124	0: Gravity Main	1996	K-1	PVC	9.77	9.62	215	15	0.013	0.0007	1.10
K1:126	K1:125	0: Gravity Main	1996	K-1	PVC	17.92	10.1	120	10	0.013	0.0652	3.62
K1:127	K1:126	0: Gravity Main	1952	K-1	CONC	20.75	18.29	198	8	0.013	0.0124	0.87
K1:129	K1:126	0: Gravity Main	1952	K-1	CONC	51.01	17.94	300	8	0.013	0.1102	2.59
K1:13	K1:12	0: Gravity Main	1994	K-1	PVC	16.56	15.7	260	8	0.013	0.0033	0.45
K1:130	K1:129	0: Gravity Main	1952	K-1	CONC	60.04	51.98	201	8	0.013	0.0402	1.57
K1:131	K1:130	0: Gravity Main	1952	K-1	CONC	67.14	60.15	103	8	0.013	0.0678	2.03
K1:132	K1:131	0: Gravity Main	1952	K-1	CONC	71.24	67.25	398	8	0.013	0.0100	0.78
K1:133	K1:132	0: Gravity Main	1952	K-1	CONC	73.85	71.35	396	8	0.013	0.0063	0.62
K1:134	K1:129	0: Gravity Main	1952	K-1	CONC	53.21	51.59	317	8	0.013	0.0051	0.56
K1:135	K1:134	0: Gravity Main	1952	K-1	CONC	70.86	53.45	404	8	0.013	0.0431	1.62
K1:136	K1:135	0: Gravity Main	1952	K-1	CONC	72.48	70.9	342	8	0.013	0.0046	0.53
K1:137	K1:125	0: Gravity Main	0	K-1	PVC	10.33	10.09	332	15	0.013	0.0007	1.12
K1:138	K1:137	0: Gravity Main	0	K-1	PVC	11.03	10.41	220	15	0.013	0.0028	2.21
K1:139	K1:138	0: Gravity Main	0	K-1	PVC	11.11	11.09	282	15	0.013	0.0001	0.35
K1:13A	K1:13	0: Gravity Main	1994	K-1	PVC	31.87	16.56	162	8	0.013	0.0947	2.40
K1:13B	K1:13A	0: Gravity Main	1994	K-1	PVC	49.56	32.51	298	8	0.013	0.0571	1.87
K1:14	K1:13	0: Gravity Main	1994	K-1	PVC	18.91	17.31	119	8	0.013	0.0135	0.91
K1:140	K1:139	0: Gravity Main	0	K-1	PVC	11.37	11.16	301	15	0.013	0.0007	1.10
K1:141	K1:140	0: Gravity Main	0	K-1	PVC	11.69	11.48	151	15	0.013	0.0014	1.56
K1:142	*K1:141*	*0: Gravity Main*	*0*	*K-1*	*PVC*	*12.1*	*11.71*	*113*	*15*	*0.013*	0.0034	2.45
K1:19	K1:11	0: Gravity Main	0	K-1	PVC	13.48	12.72	144	8	0.013	0.0053	0.57
K1:19A	K1:19	0: Gravity Main	1994	K-1	PVC	18.36	13.52	457	8	0.013	0.0106	0.80
K1:1A	*Donation St. PS*	*0: Gravity Main*	*1976*	*K-1*	*CONC*	*5.62*	*5.52*	*31*	*18*	*0.013*	0.0032	3.84
K1:2	K1:1	0: Gravity Main	1994	K-1	PVC	15.44	12.93	272	8	0.013	0.0092	0.75
K1:20	K1:19	0: Gravity Main	0	K-1	PVC	14.67	13.51	259	8	0.013	0.0045	0.52
K1:20A	K1:20	0: Gravity Main	2007	K-1	PVC	16.95	14.74	51	8	0.013	0.0429	1.62
K1:21	K1:20	0: Gravity Main	2004	K-1	PVC	18.3	16.45	277	8	0.013	0.0067	0.64
K1:22	K1:21	0: Gravity Main	2004	K-1	PVC	18.92	18.31	246	8	0.013	0.0025	0.39
K1:23	K1:22	0: Gravity Main	2004	K-1	PVC	22.19	18.93	394	8	0.013	0.0083	0.71
K1:24	K1:20	0: Gravity Main	2004	K-1	PVC	15.29	14.83	124	8	0.013	0.0037	0.48
K1:25	K1:23	0: Gravity Main	2004	K-1	PVC	16.7	15.31	144	8	0.013	0.0096	0.77
K1:26	K1:25	0: Gravity Main	2004	K-1	PVC	18.73	16.8	155	8	0.013	0.0124	0.87
K1:26A	K1:26B	0: Gravity Main	2004	K-1	PVC	20.91	21.74	127	8	0.013	Rev. Grd.	N/A
K1:26B	K1:26A	0: Gravity Main	2004	K-1	PVC	23.21	21.01	212	8	0.013	0.0104	0.80
K1:27	K1:24	0: Gravity Main	2004	K-1	PVC	16.23	15.33	222	8	0.013	0.0041	0.50
K1:27B	K1:27	0: Gravity Main	2004	K-1	PVC	17.2	16.41	163	8	0.013	0.0049	0.54
K1:28	K1:26	0: Gravity Main	2004	K-1	PVC	17.05	16.34	135	8	0.013	0.0052	0.57
K1:29	K1:28	0: Gravity Main	2004	K-1	PVC	18.39	17.11	176	8	0.013	0.0073	0.67
K1:29A	K1:29	0: Gravity Main	2004	K-1	PVC	21.56	18.61	306	8	0.013	0.0096	0.77
K1:3	K1:2	0: Gravity Main	1994	K-1	PVC	70.17	17.48	115	6	0.013	0.4588	2.46
K1:30	K1:1A	0: Gravity Main	1976	K-1	CONC	5.52	5.68	192	18	0.013	Rev. Grd.	N/A
K1:31	K1:30	0: Gravity Main	1976	K-1	CONC	5.9	5.65	211	18	0.013	0.0012	2.34
K1:32	K1:31	0: Gravity Main	1976	K-1	CONC	6.32	6.16	229	18	0.013	0.0007	1.80
K1:33	K1:32	0: Gravity Main	1976	K-1	CONC	6.77	6.38	275	18	0.013	0.0014	2.56
K1:34	K1:33	0: Gravity Main	1976	K-1	CONC	6.28	6.85	118	18	0.013	Rev. Grd.	N/A

Upstream Node	Downstream Node	TYPE	YR_INST	ZONE	MATERIAL	FROM_INV	TO_INV	LENGTH	DIAMETER	COEFF	Slope (ft/FT)	Pipe Capacity (mgd)
K1:35	K1:7	0: Gravity Main	1993	K-1	PVC	7.03	6.63	383	15	0.013	0.0010	1.35
K1:37	K1:35	0: Gravity Main	1993	K-1	PVC	7.81	7.04	393	15	0.013	0.0020	1.85
K1:37A	K1:37	0: Gravity Main	2004	K-1	PVC	8.22	8.02	116	12	0.013	0.0017	0.95
K1:37B	K1:34	0: Gravity Main	0	K-1	CONC	7.08	6.33	312	18	0.013	0.0024	3.33
K1:38	K1:37	0: Gravity Main	1993	K-1	PVC	9.17	8.03	259	8	0.013	0.0044	0.52
K1:38A	K1:38	0: Gravity Main	1993	K-1	PVC	10.34	9.27	268	8	0.013	0.0040	0.49
K1:39	K1:38	0: Gravity Main	1993	K-1	PVC	10.9	9.19	280	8	0.013	0.0061	0.61
K1:4	K1:3	0: Gravity Main	1994	K-1	PVC	83.6	70.98	142	8	0.013	0.0887	2.33
K1:40	K1:39	0: Gravity Main	1993	K-1	PVC	12.35	11.06	251	8	0.013	0.0051	0.56
K1:41A	K1:38A	0: Gravity Main	1993	K-1	PVC	13.51	12.02	364	8	0.013	0.0041	0.50
K1:44	K1:41A	0: Gravity Main	1993	K-1	PVC	14.91	13.59	366	8	0.013	0.0036	0.47
K1:45	K1:38A	0: Gravity Main	1993	K-1	PVC	10.55	10.46	20	8	0.013	0.0044	0.52
K1:46	K1:45	0: Gravity Main	1993	K-1	PVC	12.06	10.58	240	8	0.013	0.0062	0.61
K1:47	K1:46	0: Gravity Main	1993	K-1	PVC	13.81	12.28	301	8	0.013	0.0051	0.56
K1:49	K1:51	0: Gravity Main	1993	K-1	PVC	16.17	12.17	359	8	0.013	0.0111	0.82
K1:4A	K1:4	0: Gravity Main	1994	K-1	PVC	85.47	83.63	184	6	0.013	0.0100	0.36
K1:4B	K1:4	0: Gravity Main	1994	K-1	PVC	94.64	83.85	136	8	0.013	0.0791	2.20
K1:5	K1:2	0: Gravity Main	1994	K-1	PVC	16.62	15.53	262	8	0.013	0.0042	0.50
K1:50	K1:51	0: Gravity Main	1993	K-1	PVC	13.35	12.19	262	8	0.013	0.0044	0.52
K1:51	K1:45	0: Gravity Main	1993	K-1	PVC	12.05	10.52	326	8	0.013	0.0047	0.54
K1:52	K1:50	0: Gravity Main	1993	K-1	PVC	15.84	13.36	432	8	0.013	0.0057	0.59
K1:52A	*K1:52*	*0: Gravity Main*	*1993*	*K-1*	*PVC*	*16.7*	*15.91*	*148*	*8*	*0.013*	0.0053	0.57
K1:52B	*K1:52*	*0: Gravity Main*	*1993*	*K-1*	*PVC*	*16.7*	*15.92*	*177*	*8*	*0.013*	0.0044	0.52
K1:53	K1:51	0: Gravity Main	1993	K-1	PVC	13.2	12.19	315	8	0.013	0.0032	0.44
K1:54	K1:53	0: Gravity Main	1993	K-1	PVC	14.72	13.29	314	8	0.013	0.0046	0.53
K1:54A	*TEE*	*0: Gravity Main*	*1951*	*K-1*	*CONC*	*17.29*	*0*	*150*	*6*	*0.013*	0.1153	1.23
K1:54B	K1:54	0: Gravity Main	1951	K-1	CONC	17.4	14.73	302	8	0.013	0.0088	0.73
K1:55	K1:54	0: Gravity Main	1951	K-1	CONC	16.14	14.75	144	8	0.013	0.0096	0.77
K1:56	K1:55	0: Gravity Main	0	K-1	CONC	17.39	16.23	325	8	0.013	0.0036	0.47
K1:57	K1:37A	0: Gravity Main	2004	K-1	PVC	10.24	8.61	302	8	0.013	0.0054	0.57
K1:58	K1:58A	0: Gravity Main	1996	K-1	PVC	7.95	7.92	197	18	0.013	0.0002	0.84
K1:58A	K1:37B	0: Gravity Main	0	K-1	CONC	7.85	7.07	297	18	0.013	0.0026	3.48
K1:59	K1:58	0: Gravity Main	1996	K-1	PVC	8.1	7.98	128	18	0.013	0.0009	2.08
K1:6	K1:5	0: Gravity Main	1994	K-1	PVC	18.62	16.78	257	8	0.013	0.0072	0.66
K1:60	K1:59	0: Gravity Main	1976	K-1	CONC	16.68	8.63	138	8	0.013	0.0584	1.89
K1:60B	K1:60	0: Gravity Main	1996	K-1	PVC	36.75	19.3	160	8	0.013	0.1092	2.58
K1:60C	K1:60B	0: Gravity Main	1976	K-1	CONC	68	36.78	323	6	0.013	0.0967	1.13
K1:61	K1:60	0: Gravity Main	1976	K-1	CONC	36.95	23.23	381	8	0.013	0.0360	1.48
K1:62	K1:61	0: Gravity Main	1976	K-1	CONC	40.64	37.36	118	8	0.013	0.0279	1.30
K1:63	K1:63A	0: Gravity Main	0	K-1	CONC	75.58	73.74	23	8	0.013	0.0812	2.23
K1:63A	K1:62	0: Gravity Main	1976	K-1	CONC	73.47	40.96	384	8	0.013	0.0848	2.27
K1:64	K1:63	0: Gravity Main	1976	K-1	CONC	112.43	75.71	326	8	0.013	0.1127	2.62
K1:65	K1:65B	0: Gravity Main	1976	K-1	CONC	118.6	118.21	15	8	0.013	0.0266	1.27
K1:65B	K1:64	0: Gravity Main		K-1	CONC	117.7	115.33	79	8	0.013	0.0299	1.35
K1:66	K1:65	0: Gravity Main	1965	K-1	CONC	121.57	119.24	126	6	0.013	0.0185	0.49
K1:68	K1:66	0: Gravity Main	1965	K-1	CONC	132.41	121.57	415	6	0.013	0.0261	0.59

Upstream Node	Downstream Node	TYPE	YR_INST	ZONE	MATERIAL	FROM_INV	TO_INV	LENGTH	DIAMETER	COEFF	Slope (ft/FT)	Pipe Capacity (mgd)
K1:69	K1:68	0: Gravity Main	1965	K-1	CONC	134	132.63	175	6	0.013	0.0078	0.32
K1:6A	K1:6	0: Gravity Main	1994	K-1	PVC	26.31	19.42	151	8	0.013	0.0456	1.67
K1:6B	K1:6A	0: Gravity Main	1994	K-1	PVC	62	26.95	104	8	0.013	0.3385	4.54
K1:6D	K1:6	0: Gravity Main	1994	K-1	PVC	29.35	19.04	154	8	0.013	0.0670	2.02
K1:6E	K1:6D	0: Gravity Main	1994	K-1	PVC	60.39	33.59	106	6	0.013	0.2537	1.83
K1:7	K1:1	0: Gravity Main	1993	K-1	PVC	6.35	6.61	123	15	0.013	Rev. Grd.	N/A
K1:73	K1:65B	0: Gravity Main	1976	K-1	CONC	141.46	124.22	129	8	0.013	0.1336	2.86
K1:74	K1:73	0: Gravity Main	1976	K-1	CONC	166.62	141.48	138	8	0.013	0.1827	3.34
K1:75	K1:74	0: Gravity Main	1976	K-1	CONC	170.44	166.85	51	8	0.013	0.0698	2.06
K1:76	K1:75	0: Gravity Main	1976	K-1	CONC	190.26	173.36	144	6	0.013	0.1174	1.24
K1:77	K1:65	0: Gravity Main	1976	K-1	CONC	124.67	118.95	137	8	0.013	0.0416	1.59
K1:78	K1:77	0: Gravity Main	1976	K-1	CONC	135.18	124.88	154	8	0.013	0.0670	2.02
K1:79	K1:78	0: Gravity Main	1976	K-1	CONC	138.31	135.18	231	8	0.013	0.0135	0.91
K1:8	K1:7	0: Gravity Main	1994	K-1	PVC	10.46	8.77	252	10	0.013	0.0067	1.16
K1:80	*K1:80A*	*0: Gravity Main*	*0*	*K-1*	*PVC*	*179.31*	*160*	*212*	*6*	*0.013*	0.0910	1.09
K1:80A	*K1:79*	*0: Gravity Main*	*0*	*K-1*	*PVC*	*160*	*138.67*	*220*	*6*	*0.013*	0.0968	1.13
K1:82	K1:58A	0: Gravity Main	1996	K-1	PVC	7.93	8.15	116	12	0.013	Rev. Grd.	N/A
K1:83	K1:82	0: Gravity Main	1996	K-1	PVC	8.84	8.15	194	10	0.013	0.0036	0.84
K1:84	K1:83	0: Gravity Main	1996	K-1	PVC	9.21	8.86	121	10	0.013	0.0029	0.76
K1:85	K1:84	0: Gravity Main	1996	K-1	PVC	9.94	9.22	245	10	0.013	0.0029	0.77
K1:86	K1:85	0: Gravity Main	1996	K-1	PVC	11.13	10	205	10	0.013	0.0055	1.05
K1:87	K1:86	0: Gravity Main	1996	K-1	PVC	12.57	11.14	234	10	0.013	0.0061	1.11
K1:88	K1:87	0: Gravity Main	1996	K-1	PVC	13.11	12.69	110	8	0.013	0.0038	0.48
K1:88A	K1:88	0: Gravity Main	1996	K-1	PVC	14.3	13.22	152	8	0.013	0.0071	0.66
K1:88B	*K1:88A*	*0: Gravity Main*	*0*	*K-1*	*PVC*	*14.82*	*14.42*	*111*	*8*	*0.013*	0.0036	0.47
K1:89	K1:82	0: Gravity Main	2004	K-1	PVC	12.74	11.4	225	12	0.013	0.0060	1.78
K1:89A	K1:89	0: Gravity Main	0	K-1	CONC	13.44	12.86	142	8	0.013	0.0041	0.50
K1:8B	K1:8	0: Gravity Main	1994	K-1	PVC	14.86	13.74	142	8	0.013	0.0079	0.69
K1:8C	K1:8B	0: Gravity Main	1994	K-1	PVC	17.51	14.92	231	8	0.013	0.0112	0.83
K1:9	K1:8	0: Gravity Main	1994	K-1	PVC	12.19	10.7	338	8	0.013	0.0044	0.52
K1:90	K1:89A	0: Gravity Main	0	K-1	CONC	14.58	13.45	269	8	0.013	0.0042	0.51
K1:91	K1:90	0: Gravity Main	0	K-1	CONC	15.59	14.6	251	8	0.013	0.0039	0.49
K1:92	K1:87	0: Gravity Main	2004	K-1	PVC	13.97	12.6	235	10	0.013	0.0058	1.08
K1:92A	*K1:93A*	*0: Gravity Main*	*2004*	*K-1*	*PVC*	*15.1*	*14.3*	*196*	*8*	*0.013*	0.0041	0.50
K1:93A	K1:92	0: Gravity Main	2004	K-1	PVC	14.28	14.07	183	8	0.013	0.0012	0.26
K1:94	K1:89	0: Gravity Main	1951	K-1	CONC	13.76	12.94	197	10	0.013	0.0042	0.91
K1:95	K1:94	0: Gravity Main		K-1	CONC	14.89	13.81	336	8	0.013	0.0032	0.44
K1:96	K1:97	0: Gravity Main	0	K-1	CONC	16.12	15.43	208	8	0.013	0.0033	0.45
K1:96	K1:95	0: Gravity Main		K-1	CONC	16.17	14.89	328	8	0.013	0.0039	0.49
K1:97	K1:92	0: Gravity Main	1951	K-1	CONC	15.27	14.16	240	10	0.013	0.0046	0.96
K1:98	K1:97	0: Gravity Main	0	K-1	CONC	15.91	15.38	238	8	0.013	0.0022	0.37
K1:99	K1:98	0: Gravity Main	0	K-1	CONC	17.33	15.92	224	8	0.013	0.0063	0.62
K10:08A	K10:8	0: Gravity Main	0	K-10	CONC	4.2	3.93	208	21	0.013	0.0013	3.69
K10:1	*K7:77*	*0: Gravity Main*	*0*	*K-10*	*CONC*	*1.35*	*0.7*	*138*	*24*	*0.013*	0.0047	10.04
K10:100	K10:99	0: Gravity Main	1995	K-10	PVC	391.71	390.67	196	8	0.013	0.0053	0.57
K10:101	K10:91	0: Gravity Main	1995	K-10	PVC	340.06	330.45	70	8	0.013	0.1373	2.89

Upstream Node	Downstream Node	TYPE	YR_INST	ZONE	MATERIAL	FROM_INV	TO_INV	LENGTH	DIAMETER	COEFF	Slope (ft/FT)	Pipe Capacity (mgd)
K10:102	K10:101	0: Gravity Main	1995	K-10	PVC	362.79	351.63	85	8	0.013	0.1319	2.84
K10:103	K10:102	0: Gravity Main	1995	K-10	PVC	393.97	363.43	221	8	0.013	0.1382	2.90
K10:104	K10:103	0: Gravity Main	1995	K-10	PVC	416.9	394.66	206	8	0.013	0.1078	2.57
K10:105	K10:36	0: Gravity Main	1996	K-10	PVC	27.42	26.65	200	10	0.013	0.0038	0.88
K10:106	K10:105	0: Gravity Main	1996	K-10	PVC	48.07	28.04	126	10	0.013	0.1594	5.65
K10:107	K10:106	0: Gravity Main	1996	K-10	PVC	79.36	48.8	222	10	0.013	0.1375	5.25
K10:108	K10:107	0: Gravity Main	1996	K-10	PVC	102.15	80.05	271	10	0.013	0.0816	4.05
K10:109	K10:108	0: Gravity Main	1996	K-10	PVC	106.44	102.55	252	10	0.013	0.0154	1.76
K10:11	K10:9A	0: Gravity Main	0	K-10	CONC	4.48	4.73	222	21	0.013	Rev. Grd.	N/A
K10:110	K10:109	0: Gravity Main	1996	K-10	PVC	111.97	106.72	423	10	0.013	0.0124	1.58
K10:111	K10:108	0: Gravity Main	1996	K-10	PVC	104.01	102.45	177	8	0.013	0.0088	0.73
K10:111A	K10:111	0: Gravity Main	1996	K-10	PVC	112.67	104.57	67	8	0.013	0.1207	2.71
K10:112	K10:111	0: Gravity Main	1996	K-10	PVC	104.8	104.32	46	8	0.013	0.0105	0.80
K10:113	K10:112	0: Gravity Main	1996	K-10	PVC	106.62	104.97	99	8	0.013	0.0167	1.01
K10:114	K10:113	0: Gravity Main	1996	K-10	PVC	110.59	106.74	42	8	0.013	0.0912	2.36
K10:115	K10:114	0: Gravity Main	1996	K-10	PVC	126.91	111.32	117	8	0.013	0.1335	2.85
K10:116	K10:109	0: Gravity Main	1996	K-10	PVC	115.87	106.74	143	8	0.013	0.0637	1.97
K10:117	K10:116	0: Gravity Main	1996	K-10	PVC	136.04	116.54	156	8	0.013	0.1249	2.76
K10:118	K10:117	0: Gravity Main	1996	K-10	PVC	137.1	136.42	119	8	0.013	0.0057	0.59
K10:119	K10:118	0: Gravity Main	1996	K-10	PVC	146.86	137.4	353	8	0.013	0.0268	1.28
K10:11A	K10:11	0: Gravity Main	0	K-10	CONC	5.09	4.93	100	21	0.013	0.0016	4.10
K10:12	K10:11A	0: Gravity Main	0	K-10	CONC	5.5	5.54	243	18	0.013	Rev. Grd.	N/A
K10:121	K10:117	0: Gravity Main	1996	K-10	PVC	148.46	136.83	78	8	0.013	0.1483	3.01
K10:122	K10:121	0: Gravity Main	1996	K-10	PVC	169.31	149.43	160	8	0.013	0.1243	2.75
K10:123	K10:122	0: Gravity Main	1996	K-10	PVC	191.21	170.1	189	8	0.013	0.1119	2.61
K10:124	K10:123	0: Gravity Main	1996	K-10	PVC	194.72	191.69	221	8	0.013	0.0137	0.91
K10:125	K10:124	0: Gravity Main	1996	K-10	PVC	197.8	195.12	184	8	0.013	0.0145	0.94
K10:126	K10:123	0: Gravity Main	1996	K-10	PVC	205.5	192.07	133	8	0.013	0.1008	2.48
K10:127	K10:126	0: Gravity Main	1996	K-10	PVC	214.4	206.28	116	8	0.013	0.0702	2.07
K10:128	K10:127	0: Gravity Main	1996	K-10	PVC	225.8	215.01	138	8	0.013	0.0785	2.19
K10:13	K10:12	0: Gravity Main	0	K-10	CONC	5.94	5.55	379	18	0.013	0.0010	2.18
K10:14	K10:13	0: Gravity Main	0	K-10	CONC	6.33	6.09	132	18	0.013	0.0018	2.89
K10:15	K10:14	0: Gravity Main	1972	K-10	AC	7.06	6.49	333	15	0.013	0.0017	1.73
K10:15B	K10:15	0: Gravity Main	1972	K-10	PVC	7.67	7.22	154	6	0.013	0.0029	0.20
K10:15C	K10:15B	0: Gravity Main	1972	K-10	PVC	8.22	7.67	201	6	0.013	0.0027	0.19
K10:15D	K10:15C	0: Gravity Main	1972	K-10	PVC	8.89	8.22	300	6	0.013	0.0022	0.17
K10:15E	K10:15D	0: Gravity Main	1972	K-10	PVC	9.45	8.94	300	6	0.013	0.0017	0.15
K10:15F	K10:15E	0: Gravity Main	1972	K-10	PVC	10.93	9.49	251	6	0.013	0.0057	0.27
K10:16	K10:15	0: Gravity Main	0	K-10	AC	7.25	7.08	329	15	0.013	0.0005	0.95
K10:17	K10:16	0: Gravity Main	0	K-10	AC	7.48	7.29	340	15	0.013	0.0006	0.99
K10:17A	K10:17	0: Gravity Main	0	K-10	CONC	8.97	7.56	230	6	0.013	0.0061	0.28
K10:17B	K10:17A	0: Gravity Main	0	K-10	CONC	9.52	8.98	122	6	0.013	0.0044	0.24
K10:17C	K10:17B	0: Gravity Main	0	K-10	CONC	10.8	9.52	157	6	0.013	0.0082	0.33
K10:18	K10:17	0: Gravity Main	0	K-10	AC	8.19	7.5	329	15	0.013	0.0021	1.91
K10:19	K10:18	0: Gravity Main	0	K-10	AC	8.74	8.23	334	15	0.013	0.0015	1.63
K10:2	K10:1	0: Gravity Main	1976	K-10	CONC	0.97	1.27	64	21	0.013	Rev. Grd.	N/A

Upstream Node	Downstream Node	TYPE	YR_INST	ZONE	MATERIAL	FROM_INV	TO_INV	LENGTH	DIAMETER	COEFF	Slope (ft/FT)	Pipe Capacity (mgd)
K10:20	K10:19	0: Gravity Main	0	K-10	CONC	9.43	8.8	349	15	0.013	0.0018	1.78
K10:21	K10:20	0: Gravity Main	0	K-10	AC	9.9	9.47	354	15	0.013	0.0012	1.46
K10:22	K10:21	0: Gravity Main	0	K-10	CONC	10.3	10.01	366	15	0.013	0.0008	1.18
K10:23	K10:22	0: Gravity Main	0	K-10	CONC	10.89	10.45	160	15	0.013	0.0028	2.19
K10:23A	K10:23	0: Gravity Main	0	K-10	CONC	10.82	10.93	110	15	0.013	Rev. Grd.	N/A
K10:24	K10:23A	0: Gravity Main	1974	K-10	A.C.	11.52	10.87	331	15	0.013	0.0020	1.85
K10:25	K10:24	0: Gravity Main	1974	K-10	A.C.	10.77	11.52	173	15	0.013	Rev. Grd.	N/A
K10:26	K10:25	0: Gravity Main	1974	K-10	A.C.	11.49	10.85	235	15	0.013	0.0027	2.18
K10:27	*K10:26*	*0: Gravity Main*	*1974*	*K-10*	*A.C.*	*12.44*	*11.67*	*315*	*15*	*0.013*	0.0024	2.06
K10:28	*K10:27*	*0: Gravity Main*	*1974*	*K-10*	*A.C.*	*12.36*	*12.31*	*165*	*15*	*0.013*	0.0003	0.73
K10:29	K10:28	0: Gravity Main	1974	K-10	A.C.	12.38	12.51	324	15	0.013	Rev. Grd.	N/A
K10:3	K10:2	0: Gravity Main	1976	K-10	CONC	0.92	1.05	222	21	0.013	Rev. Grd.	N/A
K10:30	K10:29	0: Gravity Main	1974	K-10	A.C.	14.69	12.46	345	15	0.013	0.0065	3.36
K10:31	K10:30	0: Gravity Main	1974	K-10	A.C.	16.33	15.6	353	15	0.013	0.0021	1.90
K10:31A	K10:31	0: Gravity Main	1974	K-10	A.C.	16.66	16.37	255	15	0.013	0.0011	1.41
K10:32	K10:31A	0: Gravity Main	1974	K-10	A.C.	17.2	16.67	164	15	0.013	0.0032	2.37
K10:33	K10:32	0: Gravity Main	1974	K-10	A.C.	17.55	17.44	201	15	0.013	0.0005	0.98
K10:34	K10:33	0: Gravity Main	1974	K-10	A.C.	18.23	17.59	232	15	0.013	0.0028	2.19
K10:35	K10:34	0: Gravity Main	1974	K-10	A.C.	20.66	19.9	300	12	0.013	0.0025	1.16
K10:36	K10:35	0: Gravity Main	1974	K-10	CONC	21.89	20.68	333	12	0.013	0.0036	1.39
K10:37	K10:36	0: Gravity Main	1974	K-10	CONC	62.81	22.63	227	10	0.013	0.1774	5.97
K10:37A	*K10:37*	*0: Gravity Main*	*1974*	*K-10*	*CONC*	*95*	*62.38*	*203*	*6*	*0.013*	0.1606	1.45
K10:39	K10:37	0: Gravity Main	1974	K-10	AC	80.35	62.44	147	10	0.013	0.1221	4.95
K10:4	K10:3	0: Gravity Main	1976	K-10	CONC	0.47	0.92	209	21	0.013	Rev. Grd.	N/A
K10:40	K10:39	0: Gravity Main	1974	K-10	CONC	86.28	80.57	45	8	0.013	0.1255	2.77
K10:41	K10:40	0: Gravity Main	1974	K-10	CONC	88.4	87.73	130	8	0.013	0.0051	0.56
K10:42	*K10:41*	*0: Gravity Main*	*1974*	*K-10*	*CONC*	*88.87*	*88.47*	*91*	*8*	*0.013*	0.0044	0.52
K10:43	*K10:41*	*0: Gravity Main*	*1974*	*K-10*	*CONC*	*89*	*88.59*	*103*	*8*	*0.013*	0.0040	0.49
K10:44	K10:39	0: Gravity Main	1974	K-10	AC	96.35	80.35	162	10	0.013	0.0986	4.45
K10:45	K10:44	0: Gravity Main	1974	K-10	AC	113.38	96.35	194	10	0.013	0.0878	4.20
K10:46	K10:45	0: Gravity Main	1974	K-10	AC	127.38	113.47	156	10	0.013	0.0889	4.22
K10:47	K10:46	0: Gravity Main	1974	K-10	CONC	128.41	127.63	195	8	0.013	0.0040	0.49
K10:48	K10:47	0: Gravity Main	1974	K-10	CONC	131.53	128.55	93	8	0.013	0.0322	1.40
K10:49	K10:46	0: Gravity Main	1974	K-10	AC	143.95	127.37	146	10	0.013	0.1139	4.78
K10:5	K10:4	0: Gravity Main	1972	K-10	CONC	2.12	0.48	176	21	0.013	0.0093	9.88
K10:50	K10:49	0: Gravity Main	1974	K-10	CONC	168.14	144.17	210	10	0.013	0.1143	4.79
K10:51	K10:50	0: Gravity Main	1974	K-10	CONC	172.67	168.16	289	10	0.013	0.0156	1.77
K10:51A	K10:51	0: Gravity Main	0	K-10	CONC	174.06	172.57	116	10	0.013	0.0128	1.60
K10:52	K10:51A	0: Gravity Main	0	K-10	CONC	208.45	174.1	321	10	0.013	0.1069	4.63
K10:53	K10:52	0: Gravity Main	1974	K-10	CONC	240.71	208.82	159	10	0.013	0.2009	6.35
K10:53A	*K10:53*	*0: Gravity Main*	*1974*	*K-10*	*CONC*	*242.29*	*241.29*	*189*	*6*	*0.013*	0.0053	0.26
K10:55	K10:53	0: Gravity Main	1974	K-10	CONC	246.39	241.07	124	10	0.013	0.0429	2.93
K10:55A	*K10:55*	*0: Gravity Main*	*1974*	*K-10*	*CONC*	*248*	*246.62*	*340*	*8*	*0.013*	0.0041	0.50
K10:56	K10:55	0: Gravity Main	1974	K-10	AC	254	246.59	248	10	0.013	0.0299	2.45
K10:57	K10:56	0: Gravity Main	1974	K-10	AC	260.57	254.12	104	8	0.013	0.0623	1.95
K10:58	K10:57	0: Gravity Main	1974	K-10	AC	274.36	261.01	70	8	0.013	0.1896	3.40

Upstream Node	Downstream Node	TYPE	YR_INST	ZONE	MATERIAL	FROM_INV	TO_INV	LENGTH	DIAMETER	COEFF	Slope (ft/FT)	Pipe Capacity (mgd)
K10:58A	K10:58B	0: Gravity Main	1974	K-10	AC	299.53	291.26	181	8	0.013	0.0456	1.67
K10:58A	K10:58	0: Gravity Main	1974	K-10	AC	299.23	274.36	238	8	0.013	0.1047	2.53
K10:58B	K10:56	0: Gravity Main	1974	K-10	AC	291.24	254.18	250	8	0.013	0.1480	3.00
K10:58C	*K10:58A*	*0: Gravity Main*	*1974*	*K-10*	*AC*	*300*	*299.5*	*121*	*8*	*0.013*	0.0041	0.50
K10:59	K10:58	0: Gravity Main	1974	K-10	CONC	285.06	274.46	72	8	0.013	0.1479	3.00
K10:6	K10:5	0: Gravity Main	0	K-10	CONC	2.25	2.16	155	21	0.013	0.0006	2.47
K10:60	K10:58	0: Gravity Main	1974	K-10	AC	336.06	277.32	158	8	0.013	0.3720	4.76
K10:61	K10:60	0: Gravity Main	1974	K-10	AC	374.49	336.46	130	8	0.013	0.2926	4.23
K10:61A	*K10:61*	*0: Gravity Main*	*1974*	*K-10*	*AC*	*375.53*	*374.53*	*251*	*8*	*0.013*	0.0040	0.49
K10:62	K10:61	0: Gravity Main	1974	K-10	AC	394.69	374.51	139	8	0.013	0.1449	2.97
K10:63	K10:59	0: Gravity Main	1974	K-10	AC	324.17	285.17	200	8	0.013	0.1947	3.45
K10:64	K10:63	0: Gravity Main	1974	K-10	AC	365.64	324.85	258	8	0.013	0.1580	3.11
K10:65	K10:64	0: Gravity Main	1974	K-10	AC	372.4	365.77	94	8	0.013	0.0703	2.07
K10:66	K10:65	0: Gravity Main	1974	K-10	AC	386.52	372.5	94	8	0.013	0.1495	3.02
K10:67	K10:66	0: Gravity Main	0	K-10	PVC	392.45	386.71	103	8	0.013	0.0555	1.84
K10:67A	K10:67	0: Gravity Main	1995	K-10	PVC	402.25	393.04	186	8	0.013	0.0494	1.74
K10:68	K10:51	0: Gravity Main	1974	K-10	AC	205.71	172.88	148	8	0.013	0.2226	3.69
K10:69	K10:68	0: Gravity Main	1974	K-10	AC	232.12	206.66	95	8	0.013	0.2680	4.04
K10:7	K10:6	0: Gravity Main	0	K-10	CONC	2.64	2.51	425	21	0.013	0.0003	1.79
K10:70	K10:69	0: Gravity Main	1974	K-10	AC	264.57	233.65	217	8	0.013	0.1424	2.95
K10:71	K10:70	0: Gravity Main	1974	K-10	AC	277.55	264.76	218	8	0.013	0.0586	1.89
K10:72	K10:71	0: Gravity Main	1974	K-10	AC	279	277.65	341	8	0.013	0.0040	0.49
K10:73	*K10:58B*	*0: Gravity Main*	*1974*	*K-10*	*AC*	*321.79*	*291.26*	*208*	*8*	*0.013*	0.1464	2.99
K10:73	K10:72	0: Gravity Main	1974	K-10	AC	321.41	279.04	246	8	0.013	0.1722	3.24
K10:74	K10:73	0: Gravity Main	1974	K-10	AC	349.7	321.63	150	8	0.013	0.1872	3.38
K10:75	K10:74	0: Gravity Main	1974	K-10	AC	384.5	349.98	329	8	0.013	0.1049	2.53
K10:76	K10:62	0: Gravity Main	1974	K-10	AC	404.38	395.56	288	8	0.013	0.0306	1.37
K10:76	K10:75	0: Gravity Main	1974	K-10	AC	404.3	384.52	135	8	0.013	0.1465	2.99
K10:77	K10:11	0: Gravity Main	2001	K-10	PVC	5.66	5.03	489	21	0.013	0.0013	3.68
K10:77A	K10:77	0: Gravity Main	2001	K-10	PVC	5.59	5.69	104	21	0.013	Rev. Grd.	N/A
K10:78	K10:77A	0: Gravity Main	2001	K-10	PVC	6.07	5.83	352	21	0.013	0.0007	2.67
K10:79	K10:78	0: Gravity Main	2001	K-10	PVC	6.5	6.1	354	21	0.013	0.0011	3.44
K10:8	K10:7	0: Gravity Main	0	K-10	CONC	3.44	2.9	278	21	0.013	0.0019	4.52
K10:80	K10:79	0: Gravity Main	2001	K-10	PVC	6.71	6.56	181	21	0.013	0.0008	2.95
K10:81	K10:80	0: Gravity Main	2001	K-10	PVC	6.92	6.73	270	21	0.013	0.0007	2.72
K10:82	K10:81	0: Gravity Main	2001	K-10	PVC	7.47	6.95	270	21	0.013	0.0019	4.50
K10:83	K10:84	0: Gravity Main	1995	K-10	PVC	396.75	387.05	338	8	0.013	0.0287	1.32
K10:84	K10:85	0: Gravity Main	1995	K-10	PVC	386.82	377.66	333	8	0.013	0.0275	1.30
K10:85	K10:86	0: Gravity Main	1995	K-10	PVC	376.73	348.64	129	8	0.013	0.2174	3.64
K10:86	K10:87	0: Gravity Main	1995	K-10	PVC	344.47	317.73	102	8	0.013	0.2615	3.99
K10:87	K10:88	0: Gravity Main	1995	K-10	PVC	310.48	303.41	62	8	0.013	0.1136	2.63
K10:88	*Behshel Heights PS*	*0: Gravity Main*	*1995*	*K-10*	*PVC*	*303.2*	*302.9*	*69*	*8*	*0.013*	0.0043	0.51
K10:89	K10:88	0: Gravity Main	1995	K-10	PVC	314.94	304.1	159	8	0.013	0.0680	2.04
K10:9	K10:08A	0: Gravity Main	0	K-10	CONC	4.84	4.47	250	21	0.013	0.0015	3.94
K10:90	K10:89	0: Gravity Main	1995	K-10	PVC	324.49	315.35	182	8	0.013	0.0503	1.75
K10:91	K10:90	0: Gravity Main	1995	K-10	PVC	330.14	325.01	157	8	0.013	0.0327	1.41

Upstream Node	Downstream Node	TYPE	YR_INST	ZONE	MATERIAL	FROM_INV	TO_INV	LENGTH	DIAMETER	COEFF	Slope (ft/FT)	Pipe Capacity (mgd)
K10:92	K10:91	0: Gravity Main	1995	K-10	PVC	338.1	330.43	250	8	0.013	0.0307	1.37
K10:93	K10:92	0: Gravity Main	1995	K-10	PVC	344.11	338.13	174	8	0.013	0.0343	1.45
K10:94	K10:93	0: Gravity Main	1995	K-10	PVC	354.25	344.49	279	8	0.013	0.0350	1.46
K10:95	K10:94	0: Gravity Main	1995	K-10	PVC	368.34	354.4	271	8	0.013	0.0514	1.77
K10:96	K10:89	0: Gravity Main	1995	K-10	PVC	332.7	315.43	98	8	0.013	0.1765	3.28
K10:97	K10:96	0: Gravity Main	1995	K-10	PVC	359.85	341.74	120	8	0.013	0.1505	3.03
K10:98	K10:97	0: Gravity Main	1995	K-10	PVC	380.77	360.57	148	8	0.013	0.1365	2.89
K10:99	K10:98	0: Gravity Main	1995	K-10	PVC	390.23	381.37	164	8	0.013	0.0540	1.82
K10:9A	K10:9	0: Gravity Main	0	K-10	CONC	4.71	4.86	103	21	0.013	Rev. Grd.	N/A
K11:1	K10:25	0: Gravity Main	0	K-11	CONC	22.8	11.62	59	8	0.013	0.1907	3.41
K11:10	K11:9	0: Gravity Main	1962	K-11	AC	113.19	104.69	103	6	0.013	0.0826	1.04
K11:10A	*K11:10*	*0: Gravity Main*	*1962*	*K-11*	*AC*	*114*	*113.43*	*142*	*6*	*0.013*	0.0040	0.23
K11:11	K11:11A	0: Gravity Main	0	K-11	CONC	28.73	28.47	28	8	0.013	0.0094	0.76
K11:11A	K11:11B	0: Gravity Main	1962	K-11	AC	28.45	26.96	580	8	0.013	0.0026	0.40
K11:11B	K11:4	0: Gravity Main	1962	K-11	AC	26.91	25.78	525	8	0.013	0.0022	0.36
K11:12	K11:11	0: Gravity Main	0	K-11	CONC	60.88	28.1	99	8	0.013	0.3299	4.49
K11:13	K11:12	0: Gravity Main	1962	K-11	CONC	71.86	60.97	97	8	0.013	0.1122	2.62
K11:14	K11:13	0: Gravity Main	1962	K-11	CONC	72.55	72.04	74	8	0.013	0.0069	0.65
K11:15	K11:14	0: Gravity Main	1962	K-11	CONC	87.24	72.86	223	6	0.013	0.0645	0.92
K11:16	K11:15	0: Gravity Main	1962	K-11	CONC	104.6	87.13	383	6	0.013	0.0456	0.77
K11:1A	K11:1	0: Gravity Main	1962	K-11	CONC	24.6	23.2	9	8	0.013	0.1552	3.08
K11:2	K11:1A	0: Gravity Main	0	K-11	CONC	27.67	25.46	65	6	0.013	0.0342	0.67
K11:2A	*K11:2*	*0: Gravity Main*	*0*	*K-11*	*CONC*	*28*	*27.85*	*212*	*6*	*0.013*	0.0007	0.10
K11:4	K11:1	0: Gravity Main	1962	K-11	CONC	25.78	22.98	151	8	0.013	0.0186	1.06
K11:5	K11:4	0: Gravity Main	1962	K-11	CONC	78.29	29.7	245	8	0.013	0.1983	3.48
K11:6	K11:5	0: Gravity Main	1962	K-11	CONC	89.58	78.84	151	8	0.013	0.0710	2.08
K11:7	K11:6	0: Gravity Main	1962	K-11	CONC	109.88	89.8	189	6	0.013	0.1062	1.18
K11:8	K11:7	0: Gravity Main	1962	K-11	CONC	143.62	111.91	207	6	0.013	0.1532	1.42
K11:8A	*K11:8*	*0: Gravity Main*	*1962*	*K-11*	*CONC*	*144.26*	*143.76*	*108*	*6*	*0.013*	0.0046	0.25
K11:9	K11:6	0: Gravity Main	1962	K-11	AC	102.68	89.74	321	6	0.013	0.0403	0.73
K12:1	K13:86	0: Gravity Main	1957	K-12	AC	26.6	25.78	265	10	0.013	0.0031	0.79
K12:10	K12:8	0: Gravity Main	1957	K-12	CONC	149.32	147.36	179	8	0.013	0.0109	0.82
K12:11	K12:10	0: Gravity Main	1957	K-12	CONC	167.33	149.55	232	8	0.013	0.0767	2.16
K12:12	K12:11	0: Gravity Main	1957	K-12	CONC	171.16	167.47	269	8	0.013	0.0137	0.92
K12:13	K12:12	0: Gravity Main	1957	K-12	CONC	181.98	174.33	194	6	0.013	0.0395	0.72
K12:14	K12:13	0: Gravity Main	1957	K-12	CONC	204.13	184.26	223	6	0.013	0.0890	1.08
K12:15	K12:12	0: Gravity Main	1957	K-12	CONC	174.67	171.29	239	8	0.013	0.0141	0.93
K12:15A	*TEE*	*0: Gravity Main*	*1957*	*K-12*	*CONC*	*177.06*	*176.26*	*198*	*8*	*0.013*	0.0040	0.50
K12:16	K12:15	0: Gravity Main	1957	K-12	CONC	184.06	180.41	124	8	0.013	0.0295	1.34
K12:16A	*K12:16*	*0: Gravity Main*	*1957*	*K-12*	*CONC*	*186.6*	*185.99*	*137*	*6*	*0.013*	0.0045	0.24
K12:17	TEE	0: Gravity Main	1957	K-12	CONC	176.93	176.26	110	8	0.013	0.0061	0.61
K12:17A	*K13:57A*	*0: Gravity Main*	*0*	*K-13*	*CONC*	*221.07*	*219.07*	*390*	*6*	*0.013*	0.0051	0.26
K12:18	K12:17	0: Gravity Main	1957	K-12	CONC	190.89	177.15	198	8	0.013	0.0695	2.06
K12:19	K12:18	0: Gravity Main	1957	K-12	CONC	235.84	191.27	351	8	0.013	0.1269	2.78
K12:2	K12:1	0: Gravity Main	1957	K-12	CONC	60.36	27.31	114	8	0.013	0.2902	4.21
K12:20	K12:19	0: Gravity Main	1957	K-12	CONC	241.29	236.27	98	8	0.013	0.0510	1.76

Upstream Node	Downstream Node	TYPE	YR_INST	ZONE	MATERIAL	FROM_INV	TO_INV	LENGTH	DIAMETER	COEFF	Slope (ft/FT)	Pipe Capacity (mgd)
K12:21	K12:20	0: Gravity Main	1957	K-12	CONC	239.07	241.53	45	6	0.013	Rev. Grd.	N/A
K12:21A	K12:21	0: Gravity Main	1957	K-12	CONC	239.57	239.07	107	6	0.013	0.0047	0.25
K12:22	K12:18	0: Gravity Main	1957	K-12	CONC	195.99	191.22	138	8	0.013	0.0346	1.45
K12:23	K12:22	0: Gravity Main	1957	K-12	CONC	196.96	196.05	229	8	0.013	0.0040	0.49
K12:23A	TEE	0: Gravity Main	0	K-12		216.8	216.28	131	6	0.013	0.0040	0.23
K12:24	K12:23	0: Gravity Main	1957	K-12	CONC	206.56	197.28	100	8	0.013	0.0928	2.38
K12:25	K12:24	0: Gravity Main	1957	K-12	CONC	233.5	207.11	146	8	0.013	0.1810	3.32
K12:25A	K12:25	0: Gravity Main	1957	K-12	CONC	235.25	234.25	259	8	0.013	0.0039	0.49
K12:25B	TEE	0: Gravity Main	0	K-12		243.63	243.13	100	6	0.013	0.0050	0.26
K12:26	TEE	0: Gravity Main	1957	K-12	CONC	248.64	243.13	39	8	0.013	0.1401	2.92
K12:27	K12:26	0: Gravity Main	1957	K-12	CONC	259.07	249.1	141	8	0.013	0.0705	2.07
K12:28	K12:27	0: Gravity Main	1957	K-12	CONC	259.48	259.07	90	8	0.013	0.0046	0.53
K12:29	K12:28	0: Gravity Main	1957	K-12	CONC	284.13	259.74	219	8	0.013	0.1114	2.61
K12:3	K12:2	0: Gravity Main	1957	K-12	CONC	68.79	63.58	161	6	0.013	0.0324	0.65
K12:30	K12:29	0: Gravity Main	1957	K-12	CONC	314.52	284.35	278	8	0.013	0.1086	2.57
K12:31	K12:30	0: Gravity Main	1957	K-12	CONC	355.73	314.55	358	8	0.013	0.1151	2.65
K12:32	K12:31	0: Gravity Main	1957	K-12	CONC	369.86	355.79	326	8	0.013	0.0432	1.62
K12:33	K12:32	0: Gravity Main	1957	K-12	CONC	371.58	369.86	136	8	0.013	0.0127	0.88
K12:34	K12:30	0: Gravity Main	1957	K-12	CONC	350.34	315.4	228	6	0.013	0.1533	1.42
K12:35	TEE	0: Gravity Main	1957	K-12	CONC	374.6	369.96	48	6	0.013	0.0974	1.13
K12:35A	TEE	0: Gravity Main	0	K-12	PVC	384.12	382.85	298	6	0.013	0.0043	0.24
K12:35B	K12:35A	0: Gravity Main	0	K-12	PVC	384.64	384.14	126	6	0.013	0.0040	0.23
K12:36	K12:35	0: Gravity Main	1957	K-12	CONC	378.39	374.67	170	6	0.013	0.0219	0.54
K12:37	K12:36	0: Gravity Main	1957	K-12	CONC	391.59	378.39	98	6	0.013	0.1352	1.33
K12:38	K12:37	0: Gravity Main	0	K-12	CONC	402	391.91	180	6	0.013	0.0560	0.86
K12:39	K12:38	0: Gravity Main	0	K-12	CONC	411.56	402.18	215	6	0.013	0.0437	0.76
K12:3A	K12:3	0: Gravity Main	0	K-12	CONC	70.4	68.91	269	6	0.013	0.0055	0.27
K12:4	K12:2	0: Gravity Main	1957	K-12	CONC	80.51	60.47	318	8	0.013	0.0629	1.96
K12:40	TEE	0: Gravity Main	1957	K-12	CONC	219.4	216.28	31	8	0.013	0.0995	2.46
K12:41	K12:40	0: Gravity Main	1957	K-12	CONC	220.45	219.46	149	8	0.013	0.0067	0.64
K12:41A	TEE	0: Gravity Main	0	K-12		222.1	221.35	147	6	0.013	0.0051	0.26
K12:42	K12:41	0: Gravity Main	1957	K-12	CONC	260.96	225.92	200	8	0.013	0.1754	3.27
K12:43	TEE	0: Gravity Main	1957	K-12	CONC	222.08	221.35	138	6	0.013	0.0053	0.26
K12:43A	TEE	0: Gravity Main	0	K-12		223.5	222.79	147	6	0.013	0.0048	0.25
K12:44	K12:1	0: Gravity Main	1957	K-12	CONC	27.89	26.77	237	10	0.013	0.0047	0.97
K12:45	K12:44	0: Gravity Main	1957	K-12	CONC	64.39	28.04	270	8	0.013	0.1348	2.87
K12:46	K12:45	0: Gravity Main	1957	K-12	CONC	75.64	64.63	348	8	0.013	0.0316	1.39
K12:47	K12:46	0: Gravity Main	1957	K-12	CONC	90.69	75.84	150	8	0.013	0.0988	2.45
K12:48	K12:47	0: Gravity Main	0	K-12	CONC	91.39	90.83	178	8	0.013	0.0032	0.44
K12:49	K12:44	0: Gravity Main	1957	K-12	CONC	28.63	28.07	133	8	0.013	0.0042	0.51
K12:49A	TEE	0: Gravity Main	0	13	CONC	41.27	29.6	23	6	0.013	0.5002	2.57
K12:49B	K12:49A	0: Gravity Main	1966	K-12	CONC	42.86	41.86	176	6	0.013	0.0057	0.27
K12:5	K12:4	0: Gravity Main	1957	K-12	CONC	90.55	80.77	209	8	0.013	0.0467	1.69
K12:50	K12:49	0: Gravity Main	1962	K-12	CONC	28.99	28.69	84	8	0.013	0.0036	0.47
K12:51	TEE	0: Gravity Main	1962	K-12	CONC	30.1	29.6	135	8	0.013	0.0037	0.48
K12:52	K12:51	0: Gravity Main	1962	K-12	CONC	31.08	30.1	273	8	0.013	0.0036	0.47

Upstream Node	Downstream Node	TYPE	YR_INST	ZONE	MATERIAL	FROM_INV	TO_INV	LENGTH	DIAMETER	COEFF	Slope (ft/FT)	Pipe Capacity (mgd)
K12:53	K12:52	0: Gravity Main	1962	K-12	CONC	35.05	31.11	347	8	0.013	0.0113	0.83
K12:53A	K12:53	0: Gravity Main	1962	K-12	CONC	35.76	34.96	31	8	0.013	0.0260	1.26
K12:53B	*K12:53A*	*0: Gravity Main*	*0*	*K-12*	*CONC*	*36.4*	*35.86*	*139*	*6*	*0.013*	0.0039	0.23
K12:53C	*K12:53A*	*0: Gravity Main*	*0*	*K-12*	*CONC*	*37.5*	*35.96*	*270*	*6*	*0.013*	0.0057	0.27
K12:54	K12:53	0: Gravity Main	1962	K-12	CONC	37.09	35.15	63	8	0.013	0.0309	1.37
K12:55	K12:54	0: Gravity Main	1962	K-12	CONC	47.7	38.28	110	8	0.013	0.0855	2.28
K12:56	K12:55	0: Gravity Main	1962	K-12	CONC	72.53	47.68	174	8	0.013	0.1429	2.95
K12:57	K12:56	0: Gravity Main	1962	K-12	CONC	93.91	74	186	8	0.013	0.1070	2.55
K12:58	K12:57	0: Gravity Main	1962	K-12	CONC	113.01	94.07	327	8	0.013	0.0579	1.88
K12:58A	K12:58	0: Gravity Main	1962	K-12	CONC	129.39	113.39	100	8	0.013	0.1604	3.13
K12:5A	K12:5	0: Gravity Main	0	K-12	CONC	115.51	93.35	276	8	0.013	0.0802	2.21
K12:5B	*K12:5A*	*0: Gravity Main*	*0*	*K-12*	*PVC*	*116.4*	*115.77*	*133*	*6*	*0.013*	0.0047	0.25
K12:6	*K12:5A*	*0: Gravity Main*	*0*	*K-12*	*CONC*	*117.73*	*115.62*	*283*	*8*	*0.013*	0.0075	0.67
K12:60	K12:60A	0: Gravity Main	1962	K-12	CONC	149.65	149.16	29	8	0.013	0.0168	1.01
K12:60A	K12:58A	0: Gravity Main	1962	K-12	CONC	146.98	129.76	220	8	0.013	0.0782	2.18
K12:61	K12:60	0: Gravity Main	1962	K-12	CONC	150.75	149.65	28	8	0.013	0.0398	1.56
K12:62	K12:60	0: Gravity Main	1962	K-12	CONC	154.35	151.79	189	8	0.013	0.0135	0.91
K12:63	K12:62	0: Gravity Main	1962	K-12	CONC	155.34	154.57	234	8	0.013	0.0033	0.45
K12:65	K12:61	0: Gravity Main	1962	K-12	CONC	152.44	150.95	375	8	0.013	0.0040	0.49
K12:66	K12:65	0: Gravity Main	1962	K-12	CONC	154.14	152.37	346	8	0.013	0.0051	0.56
K12:66A	K12:66	0: Gravity Main	1962	K-12	CONC	159.83	153.98	83	8	0.013	0.0706	2.07
K12:66B	*K12:66A*	*0: Gravity Main*	*0*	*K-12*	*CONC*	*160.25*	*159.85*	*136*	*8*	*0.013*	0.0029	0.42
K12:67	K12:58A	0: Gravity Main	1962	K-12	CONC	142.29	129.99	114	8	0.013	0.1083	2.57
K12:68	K12:67	0: Gravity Main	1962	K-12	CONC	144.8	142.99	259	6	0.013	0.0070	0.30
K12:69	K12:68	0: Gravity Main	1962	K-12	CONC	172.29	144.92	193	6	0.013	0.1416	1.36
K12:7	*K12:6*	*0: Gravity Main*	*1957*	*K-12*	*CONC*	*122.76*	*117.83*	*119*	*8*	*0.013*	0.0414	1.59
K12:70	K12:67	0: Gravity Main	1962	K-12	CONC	170.43	151.88	285	6	0.013	0.0651	0.93
K12:71	K12:70	0: Gravity Main	1962	K-12	CONC	175.96	171.25	292	6	0.013	0.0161	0.46
K12:72	K12:71	0: Gravity Main	1962	K-12	CONC	177.79	175.96	316	6	0.013	0.0058	0.28
K12:73	K12:16	0: Gravity Main	0	K-12	CONC	189.4	184.1	315	6	0.013	0.0168	0.47
K12:74	*K12:55*	*0: Gravity Main*	*0*	*K-12*	*CONC*	*91.12*	*49.45*	*690*	*8*	*0.013*	0.0604	1.92
K12:8	K12:7	0: Gravity Main	1957	K-12	CONC	147.47	123.01	288	8	0.013	0.0851	2.28
K12:9	K12:8	0: Gravity Main	1957	K-12	CONC	166.91	165.9	101	6	0.013	0.0100	0.36
K12:9A	*K12:9*	*0: Gravity Main*	*1957*	*K-12*	*CONC*	*168.24*	*167.24*	*213*	*6*	*0.013*	0.0047	0.25
K13:1	K13:99	0: Gravity Main	0	K-13	CONC	25.26	24.49	169	10	0.013	0.0046	0.96
K13:10	K13:9	0: Gravity Main	1962	K-13	CONC	119.99	95.17	287	8	0.013	0.0866	2.30
K13:101	K13:102	0: Gravity Main	0	K-13	CONC	9.35	3.5	44	10	0.013	0.1324	5.15
K13:102	K13:103	0: Gravity Main	2001	K-13	DI	7.94	7.85	122	18	0.013	0.0007	1.84
K13:103	K10:82	0: Gravity Main	2001	K-10	DI	7.84	7.48	254	18	0.013	0.0014	2.56
K13:10A	K13:10	0: Gravity Main	0	K-13	CONC	121.39	120.32	172	8	0.013	0.0062	0.62
K13:11	K13:10	0: Gravity Main	1962	K-13	CONC	131.38	120.21	271	8	0.013	0.0412	1.58
K13:11A	TEE	0: Gravity Main	1962	K-13	CONC	148.88	144.57	73	8	0.013	0.0587	1.89
K13:11C	K13:19	0: Gravity Main	1962	K-13	CONC	152.75	150.73	93	8	0.013	0.0218	1.15
K13:11D	*K13:11C*	*0: Gravity Main*	*0*	*K-13*	*CONC*	*153.2*	*152.76*	*129*	*8*	*0.013*	0.0034	0.46
K13:12	K13:11A	0: Gravity Main	1962	K-13	CONC	151.17	149.06	89	8	0.013	0.0238	1.21
K13:12A	*K13:12*	*0: Gravity Main*	*1962*	*K-13*	*CONC*	*154.12*	*153.32*	*183*	*8*	*0.013*	0.0044	0.52

Upstream Node	Downstream Node	TYPE	YR_INST	ZONE	MATERIAL	FROM_INV	TO_INV	LENGTH	DIAMETER	COEFF	Slope (ft/FT)	Pipe Capacity (mgd)
K13:12B	*K13:12*	*0: Gravity Main*	*1962*	*K-13*	*CONC*	*152.07*	*151.27*	*180*	*8*	*0.013*	0.0044	0.52
K13:13	K13:11	0: Gravity Main	1962	K-13	CONC	138.2	131.6	323	8	0.013	0.0204	1.12
K13:14	K13:13	0: Gravity Main	1962	K-13	CONC	141.22	138.2	268	8	0.013	0.0113	0.83
K13:15	K13:14	0: Gravity Main	1962	K-13	CONC	160.17	141.44	314	8	0.013	0.0596	1.91
K13:15A	*TEE*	*0: Gravity Main*	*0*	*K-13*		*162.25*	*161.75*	*103*	*6*	*0.013*	0.0049	0.25
K13:15B	*TEE*	*0: Gravity Main*	*0*	*K-13*		*162.5*	*161.75*	*142*	*6*	*0.013*	0.0053	0.26
K13:16	K13:16A	0: Gravity Main	1962	K-13	CONC	123.09	116.4	82	8	0.013	0.0811	2.22
K13:16A	K13:20	0: Gravity Main	1962	K-13	CONC	116.3	98.1	276	8	0.013	0.0659	2.01
K13:17	K13:16	0: Gravity Main	1962	K-13	CONC	125.66	123.29	341	8	0.013	0.0069	0.65
K13:18	K13:17	0: Gravity Main	1962	K-13	CONC	137.64	125.76	160	8	0.013	0.0744	2.13
K13:18A	*K13:18*	*0: Gravity Main*	*0*	*K-13*	*CONC*	*138.28*	*137.68*	*157*	*8*	*0.013*	0.0038	0.48
K13:19	*TEE*	*0: Gravity Main*	*1962*	*K-13*	*CONC*	*150.62*	*144.57*	*168*	*8*	*0.013*	0.0361	1.48
K13:2	K13:1	0: Gravity Main	1962	K-13	CONC	65.11	26.06	240	8	0.013	0.1630	3.15
K13:20	K13:44	0: Gravity Main	0	K-13	CONC	97.82	73.93	272	8	0.013	0.0877	2.31
K13:21	K13:87	0: Gravity Main	0	K-13	CONC	46.01	44.01	132	10	0.013	0.0152	1.74
K13:22	K13:21	0: Gravity Main	0	K-13	CONC	64.43	46.02	171	10	0.013	0.1076	4.65
K13:23	K13:22	0: Gravity Main	0	K-13	CONC	89.6	64.48	160	10	0.013	0.1568	5.61
K13:24	K13:23	0: Gravity Main	0	K-13	CONC	100.76	89.8	77	10	0.013	0.1422	5.34
K13:25	K13:24	0: Gravity Main	0	K-13	CONC	126.7	101.02	290	10	0.013	0.0885	4.21
K13:26	K13:25	0: Gravity Main	0	K-13	CONC	144.45	126.95	249	10	0.013	0.0703	3.76
K13:27	K13:26	0: Gravity Main	1962	K-13	CONC	157.2	144.46	245	8	0.013	0.0521	1.78
K13:28	K13:27	0: Gravity Main	1962	K-13	CONC	165.15	157.35	228	8	0.013	0.0343	1.45
K13:29	K13:41	0: Gravity Main	0	K-13	CONC	352.48	326.84	138	6	0.013	0.1864	1.57
K13:29A	*K13:29*	*0: Gravity Main*	*0*	*K-13*	*CONC*	*354*	*352.76*	*248*	*4*	*0.013*	0.0050	0.09
K13:3	K13:2	0: Gravity Main	0	K-13	CONC	111.81	65.48	356	8	0.013	0.1302	2.82
K13:30	K13:23	0: Gravity Main	1962	K-13	CONC	90.75	89.7	116	10	0.013	0.0090	1.35
K13:31	K13:30	0: Gravity Main	1962	K-13	CONC	92.23	91.12	71	10	0.013	0.0156	1.77
K13:32	*K13:32*	*0: Gravity Main*	*0*	*K-13*	*CONC*	*117.7*	*116.15*	*327*	*6*	*0.013*	0.0047	0.25
K13:32	K13:31	0: Gravity Main	1962	K-13	CONC	115.72	95.45	291	6	0.013	0.0697	0.96
K13:33	K13:31	0: Gravity Main	1962	K-13	CONC	106.3	92.53	128	8	0.013	0.1078	2.57
K13:33A	*K13:33*	*0: Gravity Main*	*1962*	*K-13*	*CONC*	*110.06*	*109.46*	*136*	*6*	*0.013*	0.0044	0.24
K13:34	K13:33	0: Gravity Main	1962	K-13	CONC	132.16	109.38	133	8	0.013	0.1711	3.23
K13:35	K13:34	0: Gravity Main	1962	K-13	CONC	141.71	134.35	320	6	0.013	0.0230	0.55
K13:35A	*K13:35*	*0: Gravity Main*		*K-13*	*CONC*	*142.3*	*142.04*	*65*	*6*	*0.013*	0.0040	0.23
K13:36	K13:34	0: Gravity Main	1962	K-13	CONC	155	133.49	114	8	0.013	0.1882	3.39
K13:37	K13:36	0: Gravity Main	1962	K-13	CONC	161.41	156.18	251	6	0.013	0.0209	0.52
K13:38	K13:36	0: Gravity Main	1962	K-13	CONC	165.81	155.35	122	8	0.013	0.0858	2.29
K13:39	K13:38	0: Gravity Main	1962	K-13	CONC	176.34	166.15	199	8	0.013	0.0511	1.77
K13:3A	*K13:3*	*0: Gravity Main*	*0*	*K-13*	*CONC*	*112.82*	*112.22*	*170*	*8*	*0.013*	0.0035	0.46
K13:4	K13:2	0: Gravity Main	1962	K-13	CONC	68.48	65.5	140	8	0.013	0.0213	1.14
K13:40	K13:39	0: Gravity Main	1962	K-13	CONC	187.08	179.31	201	8	0.013	0.0387	1.54
K13:41	K13:65	0: Gravity Main	0	K-13	CONC	326.29	317.37	41	6	0.013	0.2163	1.69
K13:42	K13:68A	0: Gravity Main	1957	K-13	CONC	37.83	31.41	33	8	0.013	0.1931	3.43
K13:43	K13:42	0: Gravity Main	1957	K-13	CONC	62.22	37.84	244	8	0.013	0.0999	2.47
K13:43A	*K13:43*	*0: Gravity Main*	*1957*	*K-13*	*CONC*	*63.87*	*62.67*	*280*	*8*	*0.013*	0.0043	0.51
K13:44	K13:21	0: Gravity Main	0	K-13	CONC	73.83	46.02	101	8	0.013	0.2752	4.10

Upstream Node	Downstream Node	TYPE	YR_INST	ZONE	MATERIAL	FROM_INV	TO_INV	LENGTH	DIAMETER	COEFF	Slope (ft/FT)	Pipe Capacity (mgd)
K13:45	K13:68A	0: Gravity Main	1957	K-13	CONC	27.58	26.01	334	10	0.013	0.0047	0.97
K13:45A	K13:68	0: Gravity Main	0	K-13	CONC	23.41	22.82	214	10	0.013	0.0028	0.74
K13:46	K13:45	0: Gravity Main	1957	K-13	CONC	67.16	27.67	256	8	0.013	0.1544	3.07
K13:47	K13:46	0: Gravity Main	1957	K-13	CONC	106.04	67.54	400	8	0.013	0.0963	2.42
K13:48	K13:47	0: Gravity Main	1957	K-13	CONC	129.17	106.29	376	8	0.013	0.0608	1.93
K13:49	K13:48	0: Gravity Main	1957	K-13	CONC	159.92	129.3	420	8	0.013	0.0729	2.11
K13:5	K13:4	0: Gravity Main	1962	K-13	CONC	88.98	68.74	220	8	0.013	0.0921	2.37
K13:50	K13:49	0: Gravity Main	1957	K-13	CONC	176.05	160.09	301	6	0.013	0.0530	0.83
K13:52	K13:50	0: Gravity Main	1957	K-13	CONC	182.8	176.23	300	6	0.013	0.0219	0.54
K13:52A	*K13:52*	*0: Gravity Main*	*0*	*K-13*	*CONC*	*188*	*186.49*	*340*	*6*	*0.013*	0.0044	0.24
K13:53	K13:49	0: Gravity Main	1957	K-13	CONC	184.03	160.11	423	8	0.013	0.0565	1.86
K13:54	K13:53	0: Gravity Main	1957	K-13	CONC	203.37	184.06	268	8	0.013	0.0721	2.10
K13:54A	K13:54	0: Gravity Main	0	K-13	CONC	210.67	203.75	168	6	0.013	0.0412	0.74
K13:55	K13:53	0: Gravity Main	1957	K-13	CONC	186.26	184.09	430	8	0.013	0.0050	0.55
K13:56	K13:55	0: Gravity Main	1957	K-13	CONC	205.42	188.22	271	8	0.013	0.0636	1.97
K13:57	K13:56	0: Gravity Main	1957	K-13	CONC	207.03	205.54	147	6	0.013	0.0102	0.37
K13:57A	K13:57	0: Gravity Main	0	K-13	CONC	219	207.17	154	6	0.013	0.0771	1.01
K13:58	K13:55	0: Gravity Main	1957	K-13	CONC	189.17	186.28	153	8	0.013	0.0189	1.07
K13:59	K13:58	0: Gravity Main	1957	K-13	CONC	222.33	189.42	287	8	0.013	0.1147	2.65
K13:6	K13:5	0: Gravity Main	1962	K-13	CONC	92.37	89.09	150	8	0.013	0.0218	1.15
K13:60	K13:59	0: Gravity Main	1957	K-13	CONC	245.22	226.71	185	8	0.013	0.1002	2.47
K13:61	K13:60	0: Gravity Main	1957	K-13	CONC	253.88	246.17	88	8	0.013	0.0877	2.31
K13:61A	*K13:61*	*0: Gravity Main*	*1957*	*K-13*	*CONC*	*255.66*	*254.46*	*321*	*8*	*0.013*	0.0037	0.48
K13:62	K13:60	0: Gravity Main	1957	K-13	CONC	248.29	245.48	291	8	0.013	0.0096	0.77
K13:63	K13:62	0: Gravity Main	1957	K-13	CONC	251.69	248.29	266	8	0.013	0.0128	0.88
K13:63A	*TEE*	*0: Gravity Main*	*1957*	*K-13*	*CONC*	*265.71*	*264.71*	*176*	*6*	*0.013*	0.0057	0.27
K13:64	TEE	0: Gravity Main	1957	K-13	CONC	296.78	264.71	215	8	0.013	0.1494	3.02
K13:64A	*TEE*	*0: Gravity Main*	*0*	*K-13*	*CONC*	*299.85*	*299.35*	*80*	*6*	*0.013*	0.0062	0.29
K13:64B	*TEE*	*0: Gravity Main*	*1957*	*K-13*	*CONC*	*299.85*	*299.35*	*96*	*6*	*0.013*	0.0052	0.26
K13:65	K13:64	0: Gravity Main	1957	K-13	CONC	316.84	298.47	62	6	0.013	0.2968	1.98
K13:66	K13:65	0: Gravity Main	1957	K-13	CONC	353.34	317.37	294	6	0.013	0.1222	1.27
K13:67	K13:66	0: Gravity Main	1957	K-13	CONC	355.11	353.68	135	6	0.013	0.0106	0.37
K13:67A	*K13:67*	*0: Gravity Main*	*1957*	*K-13*	*CONC*	*355.62*	*355.12*	*84*	*6*	*0.013*	0.0060	0.28
K13:68	K13:999	0: Gravity Main	0	K-13	CONC	22.82	22.03	465	10	0.013	0.0017	0.58
K13:68A	K13:1	0: Gravity Main	1957	K-13	CONC	26.01	26.11	149	10	0.013	Rev. Grd.	N/A
K13:7	K13:6	0: Gravity Main	1962	K-13	CONC	93.49	92.49	97	8	0.013	0.0103	0.79
K13:70	K13:45A	0: Gravity Main	0	K-13	CAST	23.52	23.46	24	10	0.013	0.0025	0.70
K13:71	K13:70	0: Gravity Main	0	K-13	CAST	24.99	23.58	370	10	0.013	0.0038	0.87
K13:72	K13:71	0: Gravity Main	1957	K-13	CONC	25.51	25.07	43	8	0.013	0.0103	0.79
K13:73	K13:72	0: Gravity Main	1957	K-13	CONC	68.23	25.77	345	8	0.013	0.1230	2.74
K13:74	K13:73	0: Gravity Main	1957	K-13	CONC	95.73	68.28	275	8	0.013	0.0999	2.47
K13:75	K13:74	0: Gravity Main	1957	K-13	CONC	97.67	96.06	113	8	0.013	0.0142	0.93
K13:76	K13:75	0: Gravity Main	1957	K-13	CONC	124.87	98.02	207	6	0.013	0.1298	1.31
K13:76A	*K13:76*	*0: Gravity Main*	*1957*	*K-13*	*CONC*	*126.19*	*125.44*	*152*	*6*	*0.013*	0.0049	0.25
K13:78	*K13:90*	*0: Gravity Main*	*1957*	*K-13*	*CONC*	*105.44*	*104*	*208*	*8*	*0.013*	0.0069	0.65
K13:78A	*K13:78*	*0: Gravity Main*	*1957*	*K-13*	*CONC*	*106*	*105.46*	*107*	*6*	*0.013*	0.0050	0.26

Upstream Node	Downstream Node	TYPE	YR_INST	ZONE	MATERIAL	FROM_INV	TO_INV	LENGTH	DIAMETER	COEFF	Slope (ft/FT)	Pipe Capacity (mgd)
K13:79	*K13:90*	*0: Gravity Main*	*0*	*K-13*	*CONC*	*125.28*	*104.15*	*315*	*8*	*0.013*	0.0671	2.02
K13:79A	*K13:79*	*0: Gravity Main*	*0*	*K-13*	*CONC*	*125.68*	*125.28*	*89*	*8*	*0.013*	0.0045	0.52
K13:8	K13:7	0: Gravity Main	1962	K-13	CONC	108.67	94.18	154	8	0.013	0.0942	2.40
K13:80	K13:79	0: Gravity Main	0	K-13	CONC	141.42	124.9	87	8	0.013	0.1897	3.40
K13:81	K13:80	0: Gravity Main	0	K-13	CONC	153.07	141.96	102	8	0.013	0.1087	2.58
K13:81A	*K13:81*	*0: Gravity Main*	*1957*	*K-13*	*CONC*	*157.35*	*156.55*	*166*	*8*	*0.013*	0.0048	0.54
K13:82	K13:80	0: Gravity Main	0	K-13	CONC	158.09	143.79	193	8	0.013	0.0741	2.13
K13:82A	*K13:82*	*0: Gravity Main*	*0*	*K-13*	*CONC*	*158.55*	*158.15*	*117*	*8*	*0.013*	0.0034	0.46
K13:83	K13:71	0: Gravity Main	0	K-13	CAST	24.98	25.14	97	10	0.013	Rev. Grd.	N/A
K13:84	K13:83	0: Gravity Main	1957	K-13	CONC	63.98	25.06	309	8	0.013	0.1260	2.77
K13:84A	*K13:84*	*0: Gravity Main*	*1957*	*K-13*	*CONC*	*64.9*	*64.16*	*154*	*6*	*0.013*	0.0048	0.25
K13:85	K13:84	0: Gravity Main	1957	K-13	CONC	81.02	64.2	241	6	0.013	0.0698	0.96
K13:85A	*K13:85*	*0: Gravity Main*	*1957*	*K-13*	*CONC*	*82*	*81.18*	*212*	*6*	*0.013*	0.0039	0.23
K13:86	K13:83	0: Gravity Main	1957	K-13	CONC	25.75	25.09	241	10	0.013	0.0027	0.74
K13:87	*K13:88*	*0: Gravity Main*	*0*	*K-13*	*CONC*	*44*	*35.95*	*202*	*10*	*0.013*	0.0398	2.83
K13:88	*K13:89*	*0: Gravity Main*	*0*	*K-13*	*CONC*	*35.95*	*27.84*	*204*	*10*	*0.013*	0.0398	2.83
K13:89	*K13:91*	*0: Gravity Main*	*0*	*K-13*	*CONC*	*27.84*	*17.17*	*268*	*10*	*0.013*	0.0398	2.83
K13:9	K13:7	0: Gravity Main	1962	K-13	CONC	95.17	93.49	116	8	0.013	0.0145	0.94
K13:90	*K13:74*	*0: Gravity Main*	*1957*	*K-13*	*CONC*	*103.83*	*96.18*	*81*	*8*	*0.013*	0.0943	2.40
K13:91	K13:93	0: Gravity Main	0	K-13	CONC	16.94	10.31	463	10	0.013	0.0143	1.69
K13:93	K13:94	0: Gravity Main	0	K-13	CONC	10.13	9.92	63	10	0.013	0.0033	0.82
K13:94	K13:95	0: Gravity Main	0	K-13	CONC	9.75	9.11	175	10	0.013	0.0037	0.86
K13:95	K13:95A	0: Gravity Main	2001	K-13	DI	9.1	8.73	190	16	0.013	0.0019	2.19
K13:95A	K13:96	0: Gravity Main	2001	K-13	DI	8.68	8.38	67	16	0.013	0.0045	3.33
K13:96	K13:97	0: Gravity Main	2001	K-13	DI	8.33	8.1	121	16	0.013	0.0019	2.16
K13:97	K13:102	0: Gravity Main	2001	K-13	PVC	8.08	7.9	174	21	0.013	0.0010	3.29
K13:98	K13:98A	0: Gravity Main	0	K-13	CONC	21.63	21.51	7	10	0.013	0.0185	1.92
K13:98A	K13:101	0: Gravity Main	0	K-13	CONC	21.16	9.53	94	10	0.013	0.1237	4.98
K13:99	K13:98	0: Gravity Main	0	K-13	CONC	24.42	21.75	90	10	0.013	0.0296	2.44
K13:999	K13:98A	0: Gravity Main	0	K-13	CONC	21.95	21.25	66	10	0.013	0.0106	1.46
K14:1	K16:126	0: Gravity Main	0	K-16	CONC	31.38	30.83	402	18	0.013	0.0014	2.51
K14:10	K14:9	0: Gravity Main	1972	K-14	CONC	117.61	86.79	384	8	0.013	0.0804	2.21
K14:11	K14:10	0: Gravity Main	1972	K-14	CONC	139.55	117.95	289	8	0.013	0.0748	2.14
K14:12	K14:11	0: Gravity Main	1972	K-14	CONC	148.43	139.6	154	8	0.013	0.0572	1.87
K14:13	K14:12	0: Gravity Main	1972	K-14	CONC	151.87	148.45	308	8	0.013	0.0111	0.82
K14:14	K14:11	0: Gravity Main	1972	K-14	CONC	146.78	139.69	245	8	0.013	0.0290	1.33
K14:15	K14:14	0: Gravity Main	1972	K-14	CONC	157.32	147	205	8	0.013	0.0503	1.75
K14:16	K14:15	0: Gravity Main	1972	K-14	CONC	176.3	157.56	244	8	0.013	0.0768	2.16
K14:16A	*K14:16*	*0: Gravity Main*	*0*	*K-14*	*CONC*	*177.1*	*176.33*	*250*	*8*	*0.013*	0.0031	0.43
K14:17	K14:6	0: Gravity Main	0	K-14	CONC	53.58	52.53	316	10	0.013	0.0033	0.82
K14:18	K14:17	0: Gravity Main	0	K-14	CONC	54.5	53.65	349	10	0.013	0.0024	0.70
K14:19	K14:18	0: Gravity Main	1972	K-14	CONC	55.01	54.55	233	10	0.013	0.0020	0.63
K14:1A	K14:1	0: Gravity Main	1972	K-14	CONC	38.13	31.42	23	8	0.013	0.2862	4.18
K14:2	*K14:1*	*0: Gravity Main*	*0*	*K-14*	*CONC*	*36.88*	*31.5*	*160*	*15*	*0.013*	0.0336	7.65
K14:20	*K14:19*	*0: Gravity Main*	*1972*	*K-14*	*CONC*	*55.71*	*55.01*	*271*	*10*	*0.013*	0.0026	0.72
K14:21	K14:20	0: Gravity Main	1972	K-14	CONC	66.17	55.92	270	10	0.013	0.0380	2.76

Upstream Node	Downstream Node	TYPE	YR_INST	ZONE	MATERIAL	FROM_INV	TO_INV	LENGTH	DIAMETER	COEFF	Slope (ft/FT)	Pipe Capacity (mgd)
K14:22	K14:21	0: Gravity Main	1972	K-14	CONC	67.01	66.28	120	10	0.013	0.0061	1.10
K14:23	K14:22	0: Gravity Main	1972	K-14	STEEL	119.47	67.27	183	8	0.013	0.2845	4.17
K14:24	K14:23	0: Gravity Main	1972	K-14	STEEL	128.85	119.49	83	8	0.013	0.1123	2.62
K14:25	K14:22	0: Gravity Main	1972	K-14	CONC	69.03	67.02	251	10	0.013	0.0080	1.27
K14:26	K14:25	0: Gravity Main	1972	K-14	CONC	82.97	69.33	254	10	0.013	0.0536	3.28
K14:27	K14:26	0: Gravity Main	1972	K-14	CONC	85.38	82.98	153	8	0.013	0.0157	0.98
K14:28	K14:27	0: Gravity Main	1972	K-14	CONC	88.77	85.39	98	8	0.013	0.0343	1.45
K14:29	K14:28	0: Gravity Main	1972	K-14	CONC	116.14	88.92	164	8	0.013	0.1658	3.18
K14:3	*K14:2*	*0: Gravity Main*	*0*	*K-14*	*CONC*	*42.51*	*36.88*	*168*	*15*	*0.013*	0.0336	7.65
K14:30	K14:29	0: Gravity Main	1972	K-14	CONC	136.39	116.14	256	8	0.013	0.0792	2.20
K14:31	K14:30	0: Gravity Main	1972	K-14	CONC	142.43	136.68	47	8	0.013	0.1223	2.73
K14:32	K14:31	0: Gravity Main	1972	K-14	CONC	156.06	142.63	162	8	0.013	0.0829	2.25
K14:33	K14:32	0: Gravity Main	1972	K-14	CONC	159.78	155.99	309	8	0.013	0.0123	0.86
K14:34	K14:32	0: Gravity Main	0	K-14	CONC	159.68	156.06	87	8	0.013	0.0415	1.59
K14:35	K14:5A	0: Gravity Main	0	K-14	PVC	53.04	52.46	176	8	0.013	0.0033	0.45
K14:35A	*K14:35*	*0: Gravity Main*	*0*	*K-14*	*PVC*	*53.77*	*53.17*	*140*	*8*	*0.013*	0.0043	0.51
K14:36	K14:35	0: Gravity Main	0	K-14	PVC	66	53.19	269	8	0.013	0.0476	1.71
K14:36A	*K14:36*	*0: Gravity Main*	*0*	*K-14*	*PVC*	*67.3*	*66.8*	*126*	*8*	*0.013*	0.0040	0.49
K14:37	K14:36	0: Gravity Main	0	K-14	PVC	91.32	70.65	192	8	0.013	0.1079	2.57
K14:38	K14:37	0: Gravity Main	0	K-14	PVC	108.19	91.53	162	8	0.013	0.1027	2.50
K14:39	K14:38	0: Gravity Main	0	K-14	PVC	130.39	108.83	226	8	0.013	0.0952	2.41
K14:39A	*K14:39*	*0: Gravity Main*	*0*	*K-14*	*PVC*	*131.7*	*131.1*	*133*	*8*	*0.013*	0.0045	0.53
K14:4	K14:3	0: Gravity Main	1972	K-14	CONC	51.09	42.81	231	15	0.013	0.0358	7.90
K14:40	K14:39	0: Gravity Main	0	K-14	PVC	151.88	131.07	192	8	0.013	0.1084	2.57
K14:5	K14:4	0: Gravity Main	0	K-14	CONC	51.61	51.16	421	15	0.013	0.0011	1.37
K14:5A	K14:5	0: Gravity Main	0	K-14	PVC	52.37	52.05	113	8	0.013	0.0028	0.42
K14:5B	K14:5A	0: Gravity Main		K-14	PVC	53.4	52.5	249	8	0.013	0.0036	0.47
K14:5C	K14:5B	0: Gravity Main		K-14	PVC	56.65	53.6	207	8	0.013	0.0147	0.95
K14:5D	K14:5C	0: Gravity Main	0	K-14	PVC	78.83	56.73	244	8	0.013	0.0907	2.35
K14:5E	K14:5D	0: Gravity Main	0	K-14	PVC	127.21	79.4	319	8	0.013	0.1498	3.02
K14:6	K14:5	0: Gravity Main	0	K-14	CONC	52.4	51.66	388	15	0.013	0.0019	1.82
K14:7	K14:6	0: Gravity Main	1972	K-14	CONC	73.09	52.08	81	8	0.013	0.2588	3.97
K14:8	K14:7	0: Gravity Main	1972	K-14	CONC	79.52	77.58	33	8	0.013	0.0587	1.89
K14:9	K14:8	0: Gravity Main	1972	K-14	CONC	87.05	79.55	113	8	0.013	0.0662	2.01
K15:1	K14:1A	0: Gravity Main	1972	K-15	CONC	71.63	41.96	247	8	0.013	0.1200	2.71
K15:10	K15:9	0: Gravity Main	0	K-15	CONC	185.64	172.14	174	8	0.013	0.0776	2.18
K15:12	K15:20	0: Gravity Main	0	K-15	CONC	206.59	201.38	240	8	0.013	0.0217	1.15
K15:13	K15:12	0: Gravity Main	0	K-15	CONC	207.73	206.96	78	8	0.013	0.0099	0.78
K15:14	K15:13	0: Gravity Main	1972	K-15	CONC	225.12	208.08	135	8	0.013	0.1266	2.78
K15:15	K15:14	0: Gravity Main	1972	K-15	CONC	243.54	225.56	92	8	0.013	0.1961	3.46
K15:16	K15:14	0: Gravity Main	1972	K-15	CONC	230.05	225.44	91	8	0.013	0.0509	1.76
K15:17	K15:18	0: Gravity Main	0	K-15	CONC	261.78	258.53	204	8	0.013	0.0160	0.99
K15:17	K15:16	0: Gravity Main	0	K-15	CONC	261.9	230.3	201	8	0.013	0.1574	3.10
K15:18	K15:24	0: Gravity Main	0	K-15	CONC	258.15	255.03	199	8	0.013	0.0157	0.98
K15:19	K15:8	0: Gravity Main	0	K-15	CONC	188.06	171.23	217	8	0.013	0.0776	2.18
K15:2	K15:1	0: Gravity Main	0	K-15	CONC	99.28	73.54	273	8	0.013	0.0942	2.40

Upstream Node	Downstream Node	TYPE	YR_INST	ZONE	MATERIAL	FROM_INV	TO_INV	LENGTH	DIAMETER	COEFF	Slope (ft/FT)	Pipe Capacity (mgd)
K15:20	K15:19	0: Gravity Main	0	K-15	PVC	201.15	190.47	213	8	0.013	0.0502	1.75
K15:21	K15:20	0: Gravity Main	0	K-15	CONC	205.27	201.4	60	8	0.013	0.0644	1.98
K15:22	K15:21	0: Gravity Main	0	K-15	CONC	228.92	205.37	124	8	0.013	0.1904	3.41
K15:23	K15:22	0: Gravity Main	0	K-15	CONC	231.92	229.44	111	8	0.013	0.0224	1.17
K15:24	K15:22	0: Gravity Main	0	K-15	CONC	254.88	229.64	144	8	0.013	0.1747	3.27
K15:25	K15:24	0: Gravity Main	0	K-15	CONC	274.06	255.67	88	8	0.013	0.2079	3.56
K15:26	K15:25	0: Gravity Main	1972	K-15	CONC	316.82	275.01	252	8	0.013	0.1662	3.18
K15:27	K15:26	0: Gravity Main	1972	K-15	CONC	343.8	317.08	265	8	0.013	0.1009	2.48
K15:28	K15:27	0: Gravity Main	1972	K-15	CONC	357.97	346.04	58	8	0.013	0.2064	3.55
K15:29	K15:28	0: Gravity Main	1972	K-15	CONC	376.89	360.13	114	8	0.013	0.1476	3.00
K15:3	K15:2	0: Gravity Main	0	K-15	CONC	120.66	100.1	203	8	0.013	0.1012	2.48
K15:30	K15:29	0: Gravity Main	1972	K-15	CONC	396.35	377.91	236	8	0.013	0.0783	2.19
K15:31	K15:26	0: Gravity Main	1972	K-15	CONC	369.26	317.52	301	8	0.013	0.1718	3.24
K15:32	K15:31	0: Gravity Main	1972	K-15	CONC	386.23	369.45	166	8	0.013	0.1009	2.48
K15:33	K15:32	0: Gravity Main	1972	K-15	CONC	396.13	386.51	287	8	0.013	0.0335	1.43
K15:34	K15:33	0: Gravity Main	1972	K-15	CONC	410.98	396.42	321	8	0.013	0.0453	1.66
K15:34A	*K15:34*	*0: Gravity Main*	*0*	*K-15*	*CONC*	*412*	*411.03*	*148*	*4*	*0.013*	0.0065	0.10
K15:35	K15:31	0: Gravity Main	1972	K-15	CONC	372.49	369.32	53	8	0.013	0.0594	1.90
K15:36	K15:35	0: Gravity Main	1972	K-15	CONC	413.11	373.59	323	8	0.013	0.1225	2.73
K15:37	K15:7	0: Gravity Main	1972	K-15	CONC	196.55	164.42	253	8	0.013	0.1269	2.78
K15:38	K15:37	0: Gravity Main	1972	K-15	CONC	208.73	196.75	198	8	0.013	0.0606	1.92
K15:39	K15:38	0: Gravity Main	0	K-15	CONC	220.15	208.73	317	8	0.013	0.0360	1.48
K15:4	K15:3	0: Gravity Main	0	K-15	CONC	134.03	122.27	189	8	0.013	0.0622	1.95
K15:40	K15:39	0: Gravity Main	0	K-15	CONC	221.27	220.28	180	8	0.013	0.0055	0.58
K15:41	K15:37	0: Gravity Main	1972	K-15	CONC	203.58	196.8	130	8	0.013	0.0523	1.79
K15:42	K15:41	0: Gravity Main	1972	K-15	CONC	228.66	204.28	122	8	0.013	0.2000	3.49
K15:43	K15:42	0: Gravity Main	1972	K-15	CONC	254.8	232.33	157	8	0.013	0.1431	2.95
K15:43A	K15:43	0: Gravity Main	1975	K-15	CONC	253.74	255.35	389	8	0.013	Rev. Grd.	N/A
K15:44	K15:43	0: Gravity Main	1972	K-15	CONC	270.62	255.82	111	8	0.013	0.1330	2.85
K15:45	K15:44	0: Gravity Main	1972	K-15	CONC	319.22	272.08	132	8	0.013	0.3582	4.68
K15:46	K15:45	0: Gravity Main	1972	K-15	CONC	342.02	319.86	117	8	0.013	0.1900	3.41
K15:47	K15:46	0: Gravity Main	1972	K-15	CONC	364.29	346.83	160	8	0.013	0.1091	2.58
K15:48	K15:47	0: Gravity Main	1972	K-15	CONC	374.98	364.69	288	8	0.013	0.0357	1.48
K15:49	K15:46	0: Gravity Main	1972	K-15	CONC	387.88	342.19	264	8	0.013	0.1729	3.25
K15:5	K15:4	0: Gravity Main	0	K-15	CONC	135.19	134.03	125	8	0.013	0.0093	0.75
K15:50	K15:49	0: Gravity Main	1972	K-15	CONC	404.64	388	240	8	0.013	0.0692	2.06
K15:51	K15:49	0: Gravity Main	1972	K-15	CONC	392.01	390.71	405	8	0.013	0.0032	0.44
K15:6	K15:5	0: Gravity Main	0	K-15	CONC	161.29	135.42	113	8	0.013	0.2292	3.74
K15:7	K15:6	0: Gravity Main	0	K-15	CONC	164	161.49	61	8	0.013	0.0413	1.59
K15:8	K15:7	0: Gravity Main	0	K-15	CONC	171.11	164.09	419	8	0.013	0.0167	1.01
K15:9	K15:8	0: Gravity Main	0	K-15	CONC	171.87	171.14	190	8	0.013	0.0038	0.48
K16:1	*Grade St. PS*	*0: Gravity Main*	*1972*	*K-16*	*CONC*	*18.94*	*18.74*	*84*	*18*	*0.013*	0.0024	3.32
K16:10	K16:9	0: Gravity Main	0	K-16	CONC	23.68	23.3	365	18	0.013	0.0010	2.19
K16:11	K16:10	0: Gravity Main	0	K-16	CONC	24.04	23.68	335	18	0.013	0.0011	2.23
K16:111	*Aldercrest No. 1 PS*	*0: Gravity Main*	*0*	*K-16*	*PVC*	*386.97*	*366*	*219*	*8*	*0.013*	0.0958	2.42
K16:112	K16:111	0: Gravity Main	0	K-16	PVC	388.3	387.19	240	8	0.013	0.0046	0.53

Upstream Node	Downstream Node	TYPE	YR_INST	ZONE	MATERIAL	FROM_INV	TO_INV	LENGTH	DIAMETER	COEFF	Slope (ft/FT)	Pipe Capacity (mgd)
K16:113	K16:112	0: Gravity Main	0	K-16	PVC	391.94	388.38	175	8	0.013	0.0203	1.11
K16:114	K16:113	0: Gravity Main	0	K-16	PVC	418.92	392.32	255	8	0.013	0.1042	2.52
K16:115	K16:114	0: Gravity Main	0	K-16	PVC	423.81	418.93	195	8	0.013	0.0250	1.23
K16:116	K16:15	0: Gravity Main	0	K-16	CONC	25.13	25.28	349	18	0.013	Rev. Grd.	N/A
K16:117	K16:116	0: Gravity Main	0	K-16	CONC	25.74	25.14	389	18	0.013	0.0015	2.67
K16:118	K16:117	0: Gravity Main	0	K-16	CONC	25.84	25.76	333	18	0.013	0.0002	1.05
K16:119	K16:118	0: Gravity Main	0	K-16	CONC	27.14	25.95	174	18	0.013	0.0068	5.61
K16:12	K16:11	0: Gravity Main	0	K-16	CONC	24.5	24.1	392	18	0.013	0.0010	2.17
K16:120	K16:123	0: Gravity Main	1972	K-16	CONC	94.11	27.32	241	8	0.013	0.2773	4.11
K16:121	K16:120	0: Gravity Main	1972	K-16	CONC	101.25	94.23	191	8	0.013	0.0367	1.50
K16:122	K16:121	0: Gravity Main	1972	K-16	CONC	102.24	101.25	162	8	0.013	0.0061	0.61
K16:123	K16:119	0: Gravity Main	0	K-16	CONC	27.3	27.18	31	18	0.013	0.0039	4.24
K16:124	K16:123	0: Gravity Main	0	K-16	CONC	30.04	28.44	129	18	0.013	0.0124	7.56
K16:125	K16:124	0: Gravity Main	0	K-16	CONC	30.39	30.14	163	18	0.013	0.0015	2.66
K16:126	K16:125	0: Gravity Main	0	K-16	CONC	30.81	30.58	174	18	0.013	0.0013	2.47
K16:127	K16:4	0: Gravity Main	1987	K-16	CONC	22.08	21.27	426	8	0.013	0.0019	0.34
K16:128	K16:127	0: Gravity Main	1987	K-16	CONC	24.08	22.09	209	8	0.013	0.0095	0.76
K16:129	K16:128	0: Gravity Main	1987	K-16	CONC	36.38	24.35	102	8	0.013	0.1177	2.68
K16:13	K16:12	0: Gravity Main	0	K-16	CONC	24.33	24.72	120	18	0.013	Rev. Grd.	N/A
K16:130	K16:129	0: Gravity Main	1987	K-16	CONC	44.74	36.69	156	8	0.013	0.0517	1.78
K16:131	K16:130	0: Gravity Main	1987	K-16	CONC	45.73	44.45	71	8	0.013	0.0180	1.05
K16:132	K16:131	0: Gravity Main	1987	K-16	CONC	62.62	46.18	87	8	0.013	0.1881	3.39
K16:133	K16:132	0: Gravity Main	1987	K-16	CONC	69.44	63.39	82	8	0.013	0.0741	2.13
K16:134	K16:133	0: Gravity Main	1987	K-16	CONC	71.33	70.21	74	8	0.013	0.0150	0.96
K16:134A	*K16:134*	*0: Gravity Main*	*1987*	*K-16*	*CONC*	*72.2*	*71.74*	*133*	*8*	*0.013*	0.0035	0.46
K16:135	K16:134	0: Gravity Main	1987	K-16	CONC	90.76	71.59	143	8	0.013	0.1337	2.86
K16:136	K16:135	0: Gravity Main	1987	K-16	CONC	118.25	91.21	175	8	0.013	0.1549	3.07
K16:137	K16:136	0: Gravity Main	1987	K-16	CONC	125.12	118.64	333	8	0.013	0.0195	1.09
K16:138	K16:137	0: Gravity Main	1987	K-16	CONC	126.14	125.16	204	8	0.013	0.0048	0.54
K16:139	K16:138	0: Gravity Main	1987	K-16	CONC	127.24	126.16	294	8	0.013	0.0037	0.47
K16:139A	*K16:139*	*0: Gravity Main*	*1987*	*K-16*	*CONC*	*127.85*	*127.25*	*139*	*8*	*0.013*	0.0043	0.51
K16:14	K16:13	0: Gravity Main	0	K-16	CONC	24.56	24.47	97	18	0.013	0.0009	2.07
K16:140	K16:139	0: Gravity Main	1987	K-16	CONC	143.82	127.22	326	8	0.013	0.0509	1.76
K16:141	K16:140	0: Gravity Main	1987	K-16	CONC	151.15	143.85	117	8	0.013	0.0622	1.95
K16:142	K16:141	0: Gravity Main	1987	K-16	CONC	162.91	151.35	360	8	0.013	0.0321	1.40
K16:142A	K16:142	0: Gravity Main	1987	K-16	CONC	181.62	163.26	151	8	0.013	0.1219	2.73
K16:142B	*K16:142A*	*0: Gravity Main*	*0*	*K-16*	*PVC*	*182.8*	*181.63*	*334*	*8*	*0.013*	0.0035	0.46
K16:143	K16:133	0: Gravity Main	1987	K-16	CONC	71.35	70.01	351	8	0.013	0.0038	0.48
K16:144	K16:143	0: Gravity Main	1987	K-16	CONC	75.08	71.35	225	8	0.013	0.0166	1.01
K16:145	K16:144	0: Gravity Main	1987	K-16	CONC	75.92	75.17	95	8	0.013	0.0079	0.70
K16:146	K16:145	0: Gravity Main	1987	K-16	CONC	102.74	76.11	241	8	0.013	0.1104	2.60
K16:147	K16:146	0: Gravity Main	1987	K-16	CONC	77.42	76.05	246	8	0.013	0.0056	0.58
K16:148	K16:147	0: Gravity Main	1987	K-16	CONC	103.5	77.51	215	8	0.013	0.1209	2.72
K16:149	K16:147	0: Gravity Main	1987	K-16	CONC	78.44	77.44	286	8	0.013	0.0035	0.46
K16:14A	*K16:14*	*0: Gravity Main*	*0*	*K-16*	*CONC*	*26*	*25.37*	*37*	*8*	*0.013*	0.0172	1.02
K16:15	K16:14	0: Gravity Main	0	K-16	CONC	24.71	24.61	290	18	0.013	0.0003	1.26

Upstream Node	Downstream Node	TYPE	YR_INST	ZONE	MATERIAL	FROM_INV	TO_INV	LENGTH	DIAMETER	COEFF	Slope (ft/FT)	Pipe Capacity (mgd)
K16:150	K16:149	0: Gravity Main	1987	K-16	CONC	96.05	78.47	301	8	0.013	0.0583	1.89
K16:151	K16:150	0: Gravity Main	1987	K-16	CONC	106.14	96.3	173	8	0.013	0.0569	1.86
K16:152	K16:151	0: Gravity Main	1987	K-16	CONC	114.25	106.4	134	8	0.013	0.0587	1.89
K16:153	K16:152	0: Gravity Main	1987	K-16	CONC	121.98	114.34	224	8	0.013	0.0342	1.44
K16:154	K16:153	0: Gravity Main	1987	K-16	CONC	127.53	121.01	341	8	0.013	0.0191	1.08
K16:155	K16:38	0: Gravity Main	0	K-16	PVC	198.07	191.9	170	8	0.013	0.0363	1.49
K16:156	K16:155	0: Gravity Main	0	K-16	PVC	198.88	198.07	138	8	0.013	0.0059	0.60
K16:157	K16:156	0: Gravity Main	0	K-16	PVC	209.89	198.92	162	8	0.013	0.0678	2.03
K16:16	K16:15	0: Gravity Main	1972	K-16	CONC	53.09	25.68	162	8	0.013	0.1695	3.22
K16:17	K16:16	0: Gravity Main	1972	K-16	CONC	58.1	53.67	73	8	0.013	0.0607	1.92
K16:18	K16:17	0: Gravity Main	1972	K-16	CONC	75.73	59.89	396	8	0.013	0.0400	1.56
K16:19	K16:18	0: Gravity Main	0	K-16	PVC	76.49	75.76	320	8	0.013	0.0023	0.37
K16:2	*K16:1*	*0: Gravity Main*	*1975*	*K-16*	*PVC*	*19.46*	*19.26*	*58*	*8*	*0.013*	0.0035	0.46
K16:20	K16:19	0: Gravity Main	0	K-16	PVC	99.7	76.8	111	8	0.013	0.2054	3.54
K16:20A	*K16:20*	*0: Gravity Main*	*0*	*K-16*	*PVC*	*100.7*	*99.91*	*175*	*8*	*0.013*	0.0045	0.53
K16:22	K16:18	0: Gravity Main	1972	K-16	CONC	82.18	75.97	101	8	0.013	0.0615	1.94
K16:23	K16:22	0: Gravity Main	1972	K-16	CONC	87.69	82.64	122	8	0.013	0.0412	1.59
K16:25	K16:23	0: Gravity Main	0	K-16	CONC	116.44	88	366	8	0.013	0.0777	2.18
K16:26	K16:25	0: Gravity Main	1972	K-16	CONC	131.35	116.93	309	8	0.013	0.0466	1.69
K16:27	K16:26	0: Gravity Main	1972	K-16	CONC	148.69	135.19	224	8	0.013	0.0604	1.92
K16:28	K16:27	0: Gravity Main	1972	K-16	CONC	157.28	148.85	131	8	0.013	0.0645	1.98
K16:29	K16:28	0: Gravity Main	1972	K-16	CONC	158.79	157.54	50	8	0.013	0.0251	1.24
K16:3	K16:2	0: Gravity Main	1975	K-16	PVC	20.54	19.39	202	8	0.013	0.0057	0.59
K16:30	K16:29	0: Gravity Main	1972	K-16	CONC	184.66	161.67	153	8	0.013	0.1500	3.03
K16:31	K16:30	0: Gravity Main	1972	K-16	CONC	197.73	185.12	144	8	0.013	0.0874	2.31
K16:32	K16:31	0: Gravity Main	1972	K-16	CONC	216.5	198.65	78	8	0.013	0.2286	3.73
K16:33	K16:32	0: Gravity Main	1972	K-16	CONC	225.75	218.17	136	8	0.013	0.0558	1.85
K16:34	K16:33	0: Gravity Main	1972	K-16	CONC	236.22	226.31	116	8	0.013	0.0857	2.29
K16:35	K16:34	0: Gravity Main	1972	K-16	CONC	242.45	239.61	108	8	0.013	0.0264	1.27
K16:36	K16:28	0: Gravity Main	1972	K-16	CONC	175.56	157.73	193	8	0.013	0.0925	2.38
K16:37	K16:36	0: Gravity Main	1972	K-16	CONC	187.06	175.75	281	8	0.013	0.0403	1.57
K16:38	K16:37	0: Gravity Main	1972	K-16	CONC	191.85	187.22	251	8	0.013	0.0184	1.06
K16:39	K16:38	0: Gravity Main	1972	K-16	CONC	211.34	191.87	195	8	0.013	0.0999	2.47
K16:3A	*K16:3*	*0: Gravity Main*	*1975*	*K-16*	*PVC*	*21*	*20.41*	*140*	*8*	*0.013*	0.0042	0.51
K16:3B	*K16:3*	*0: Gravity Main*	*1975*	*K-16*	*PVC*	*20.91*	*20.31*	*140*	*8*	*0.013*	0.0043	0.51
K16:4	K16:2	0: Gravity Main	1975	K-16	PVC	20.89	19.28	307	8	0.013	0.0052	0.57
K16:40	K16:39	0: Gravity Main	1972	K-16	CONC	228.69	211.35	160	8	0.013	0.1083	2.57
K16:40A	K16:40	0: Gravity Main	1972	K-16	CONC	231.24	228.71	51	8	0.013	0.0491	1.73
K16:41	K16:40A	0: Gravity Main	1972	K-16	CONC	253.96	231.39	208	8	0.013	0.1086	2.57
K16:42	K16:38	0: Gravity Main	1972	K-16	CONC	198.42	191.86	48	8	0.013	0.1354	2.87
K16:43	K16:42	0: Gravity Main	1972	K-16	CONC	221.87	198.58	144	8	0.013	0.1616	3.14
K16:44	K16:43	0: Gravity Main	1972	K-16	CONC	270.54	222.79	279	8	0.013	0.1711	3.23
K16:45	K16:44	0: Gravity Main	1972	K-16	CONC	317.73	271.29	262	8	0.013	0.1774	3.29
K16:46	K16:45	0: Gravity Main	1972	K-16	CONC	318.32	318.44	54	8	0.013	Rev. Grd.	N/A
K16:47	K16:46	0: Gravity Main	1972	K-16	CONC	353.06	318.92	151	8	0.013	0.2264	3.72
K16:48	K16:47	0: Gravity Main	1972	K-16	CONC	355.23	352.31	132	8	0.013	0.0221	1.16

Upstream Node	Downstream Node	TYPE	YR_INST	ZONE	MATERIAL	FROM_INV	TO_INV	LENGTH	DIAMETER	COEFF	Slope (ft/FT)	Pipe Capacity (mgd)
K16:4A	*K16:4*	*0: Gravity Main*	*1975*	*K-16*	*PVC*	*21.5*	*20.92*	*134*	*8*	*0.013*	0.0043	0.51
K16:5	K16:1	0: Gravity Main	0	K-16	CONC	19.4	18.94	366	18	0.013	0.0013	2.41
K16:50	K16:45	0: Gravity Main	1972	K-16	CONC	376.45	318.7	406	8	0.013	0.1423	2.95
K16:51	K16:50	0: Gravity Main	1972	K-16	CONC	377.05	376.6	99	8	0.013	0.0046	0.53
K16:52	K16:51	0: Gravity Main	1972	K-16	CONC	377.37	377.65	68	8	0.013	Rev. Grd.	N/A
K16:52A	*K16:52*	*0: Gravity Main*	*1972*	*K-16*	*CONC*	*379*	*377.53*	*317*	*6*	*0.013*	0.0046	0.25
K16:53	K16:50	0: Gravity Main	1972	K-16	CONC	381.86	376.65	243	8	0.013	0.0214	1.14
K16:54	*K16:53*	*0: Gravity Main*	*1972*	*K-16*	*CONC*	*407*	*389.81*	*129*	*8*	*0.013*	0.1337	2.86
K16:55	*K16:54*	*0: Gravity Main*	*1972*	*K-16*	*PVC*	*407.85*	*407*	*160*	*8*	*0.013*	0.0053	0.57
K16:6	K16:5	0: Gravity Main	0	K-16	CONC	21.36	20.3	314	18	0.013	0.0034	3.95
K16:7	K16:6	0: Gravity Main	0	K-16	CONC	21.92	21.87	450	18	0.013	0.0001	0.72
K16:8	K16:7	0: Gravity Main	0	K-16	CONC	22.43	22.24	212	18	0.013	0.0009	2.03
K16:9	K16:8	0: Gravity Main	0	K-16	CONC	23.1	22.45	347	18	0.013	0.0019	2.94
K16:93	K16:115	0: Gravity Main	0	K-16	PVC	432.22	423.81	349	8	0.013	0.0241	1.21
K17:1	*Kelso Main PS*	*0: Gravity Main*		*K-17*	*CONC*	*-5.44*	*-5.96*	*121*	*48*	*0.013*	*0.0043*	*60.87*
K17:10	K17:9	0: Gravity Main	1972	K-17	CONC	-0.93	-1.82	29	24	0.013	0.0312	25.82
K17:11	K17:10	0: Gravity Main	1975	K-17	CONC	2.28	-0.12	397	10	0.013	0.0060	1.10
K17:12	K17:11	0: Gravity Main	1975	K-17	CONC	3.01	2.2	400	10	0.013	0.0020	0.64
K17:13	K17:12	0: Gravity Main	1975	K-17	CONC	4.34	3.01	425	10	0.013	0.0031	0.79
K17:14	K17:13	0: Gravity Main	1975	K-17	CONC	4.94	4.34	377	10	0.013	0.0016	0.57
K17:15	K17:14	0: Gravity Main	1975	K-17	CONC	6.62	5.26	398	8	0.013	0.0034	0.46
K17:16	K17:15	0: Gravity Main	1975	K-17	CONC	8.28	6.62	328	8	0.013	0.0051	0.56
K17:17	K17:10	0: Gravity Main	0	K-17	CONC	-0.47	-0.88	447	24	0.013	0.0009	4.43
K17:18	K17:17	0: Gravity Main	0	K-17	CONC	0.29	-0.39	437	24	0.013	0.0016	5.77
K17:19	K17:18	0: Gravity Main	0	K-17	CONC	0.75	0.37	331	24	0.013	0.0011	4.96
K17:2	K17:1	0: Gravity Main	1972	K-17	CONC	-5.1	-5.44	755	48	0.013	0.0005	19.71
K17:20	K17:19	0: Gravity Main	0	K-17	CONC	0.91	0.65	288	24	0.013	0.0009	4.39
K17:21	K17:20	0: Gravity Main	1974	K-17	CONC	7.22	1.47	427	15	0.013	0.0135	4.84
K17:22	K17:21	0: Gravity Main	1974	K-17	CONC	7.54	7.24	438	15	0.013	0.0007	1.09
K17:23	K17:20	0: Gravity Main	0	K-17	CONC	1.75	1.25	268	18	0.013	0.0019	2.93
K17:24	K17:23	0: Gravity Main	0	K-17	CONC	2.23	1.65	320	18	0.013	0.0018	2.89
K17:25	K17:24	0: Gravity Main	1974	K-17	CONC	7.59	5.62	393	8	0.013	0.0050	0.55
K17:26	K17:25	0: Gravity Main	1974	K-17	CONC	8.54	7.61	250	8	0.013	0.0037	0.48
K17:27	K17:24	0: Gravity Main	0	K-17	CONC	2.66	2.19	361	15	0.013	0.0013	1.51
K17:28	K17:27	0: Gravity Main	0	K-17	CONC	3.24	2.65	369	15	0.013	0.0016	1.67
K17:29	K17:28	0: Gravity Main	0	K-17	CONC	3.91	3.24	355	15	0.013	0.0019	1.82
K17:3	K17:2	0: Gravity Main	1972	K-17	CONC	-5.04	-5.08	761	48	0.013	0.0001	6.73
K17:30	K17:29	0: Gravity Main	0	K-17	CONC	4.74	3.8	376	15	0.013	0.0025	2.09
K17:31	*K17:30*	*0: Gravity Main*	*1975*	*K-17*	*PVC*	*6.28*	*5.08*	*299*	*8*	*0.013*	0.0040	0.49
K17:32	*K17:31*	*0: Gravity Main*	*1975*	*K-17*	*PVC*	*7.34*	*6.28*	*300*	*8*	*0.013*	0.0035	0.46
K17:33	K17:30	0: Gravity Main	0	K-17	CONC	5.08	4.4	404	12	0.013	0.0017	0.95
K17:34	K17:33	0: Gravity Main	0	K-17	CONC	5.7	5.22	397	12	0.013	0.0012	0.80
K17:35	K17:34	0: Gravity Main	0	K-17	CONC	6.78	5.7	404	12	0.013	0.0027	1.19
K17:36	K17:35	0: Gravity Main	0	K-17	CONC	7.73	6.89	396	10	0.013	0.0021	0.65
K17:36A	K17:36	0: Gravity Main	2000	K-17	PVC	7.51	7.74	108	10	0.013	Rev. Grd.	N/A
K17:36B	K17:36A	0: Gravity Main	2000	K-17	PVC	11.2	7.89	553	8	0.013	0.0060	0.60

Upstream Node	Downstream Node	TYPE	YR_INST	ZONE	MATERIAL	FROM_INV	TO_INV	LENGTH	DIAMETER	COEFF	Slope (ft/FT)	Pipe Capacity (mgd)
K17:36C	K17:36B	0: Gravity Main	2000	K-17	PVC	12.06	11.22	191	8	0.013	0.0044	0.52
K17:36D	*K17:36C*	*0: Gravity Main*	*2000*	*K-17*	*PVC*	*12.2*	*11.22*	*220*	*8*	*0.013*	0.0045	0.52
K17:37	K17:36	0: Gravity Main	0	K-17	CONC	8.91	7.73	445	10	0.013	0.0027	0.73
K17:38	K17:9	0: Gravity Main	1972	K-17	CONC	-2.85	-3.03	447	42	0.013	0.0004	13.05
K17:39	*K17:38*	*0: Gravity Main*	*1972*	*K-17*	*CONC*	*-2.61*	*-2.8*	*483*	*42*	*0.013*	0.0004	12.90
K17:39A	*K17:39*	*0: Gravity Main*	*1997*	*K-17*	*PVC*	*2.33*	*1.43*	*292*	*10*	*0.013*	0.0031	0.79
K17:39B	K17:39A	0: Gravity Main	1997	K-17	PVC	2.94	2.33	298	10	0.013	0.0020	0.64
K17:4	K17:3	0: Gravity Main	1972	K-17	CONC	-4.19	-5.01	575	48	0.013	0.0014	35.07
K17:40	*K17:39*	*0: Gravity Main*	*1972*	*K-17*	*CONC*	*-2.47*	*-2.61*	*374*	*36*	*0.013*	0.0004	8.35
K17:41	K17:40	0: Gravity Main	1972	K-17	CONC	-1.53	-2.44	372	36	0.013	0.0024	21.31
K17:42	K17:41	0: Gravity Main	1972	K-17	CONC	-1.77	-1.47	373	36	0.013	Rev. Grd.	N/A
K17:43	K17:42	0: Gravity Main	1972	K-17	CONC	-1.83	-1.76	381	36	0.013	Rev. Grd.	N/A
K17:44	K17:43	0: Gravity Main	1972	K-17	CONC	-1.13	-1.73	351	36	0.013	0.0017	17.82
K17:46	K17:44	0: Gravity Main	1972	K-17	CONC	-1.28	-0.93	354	36	0.013	Rev. Grd.	N/A
K17:47	K17:46	0: Gravity Main	1972	K-17	CONC	-1.08	-1.06	229	36	0.013	Rev. Grd.	N/A
K17:48	K17:47	0: Gravity Main	1972	K-17	CONC	-0.63	-0.91	316	36	0.013	0.0009	12.83
K17:49	K17:48	0: Gravity Main	1972	K-17	CONC	-0.87	-0.62	237	36	0.013	Rev. Grd.	N/A
K17:5	K17:4	0: Gravity Main	1972	K-17	CONC	-3.97	-4.17	366	48	0.013	0.0005	21.71
K17:50	K17:49	0: Gravity Main	1972	K-17	CONC	-0.59	-0.86	351	36	0.013	0.0008	11.96
K17:51	K17:37	0: Gravity Main	2000	K-17	CONC	9.39	8.9	412	10	0.013	0.0012	0.49
K17:52	K17:51	0: Gravity Main	2000	K-17	CONC	10.62	9.58	388	10	0.013	0.0027	0.73
K17:53	K17:52	0: Gravity Main	2000	K-17	CONC	11.42	10.66	264	10	0.013	0.0029	0.76
K17:54	K17:53	0: Gravity Main	2000	K-17	DI	26	11.54	346	10	0.013	0.0417	2.89
K17:55	K17:54	0: Gravity Main	1997	K-17	CONC	27.21	26.29	91	10	0.013	0.0101	1.42
K17:57	K17:58	0: Gravity Main	1997	K-17	PVC	20.93	19.69	290	8	0.013	0.0043	0.51
K17:57A	K17:57	0: Gravity Main	1997	K-17	PVC	21.18	20.93	95	6	0.013	0.0026	0.19
K17:58	K17:59	0: Gravity Main	1997	K-17	PVC	19.57	17.66	399	8	0.013	0.0048	0.54
K17:59	*Coweeman Park PS*	*0: Gravity Main*	*1997*	*K-17*	*PVC*	*17.47*	*17.07*	*67*	*8*	*0.013*	0.0059	0.60
K17:6	K17:5	0: Gravity Main	1972	K-17	CONC	-3.46	-3.87	636	48	0.013	0.0006	23.57
K17:7	K17:6	0: Gravity Main	1972	K-17	CONC	-3.56	-3.44	325	48	0.013	Rev. Grd.	N/A
K17:8	K17:7	0: Gravity Main	1972	K-17	CONC	-3.59	-3.46	125	48	0.013	Rev. Grd.	N/A
K17:9	K17:8	0: Gravity Main	1972	K-17	CONC	-3.46	-3.59	256	48	0.013	0.0005	20.91
K2:1	K3:42	0: Gravity Main	1950	K-2	CONC	102.05	100.85	248	8	0.013	0.0048	0.54
K2:10	K2:9	0: Gravity Main	1950	K-2	CONC	104.94	104.79	102	6	0.013	0.0015	0.14
K2:11	K2:10	0: Gravity Main	1950	K-2	CONC	104.7	104.95	242	6	0.013	Rev. Grd.	N/A
K2:13	K2:11	0: Gravity Main	1950	K-2	CONC	106.53	104.71	279	6	0.013	0.0065	0.29
K2:14	K2:13	0: Gravity Main	0	K-2	CONC	108.46	106.55	169	6	0.013	0.0113	0.39
K2:15	K2:14	0: Gravity Main	0	K-2	CONC	109.95	108.47	174	6	0.013	0.0085	0.33
K2:16	K2:15	0: Gravity Main	1950	K-2	CONC	119.99	110.15	157	6	0.013	0.0627	0.91
K2:17	K2:16	0: Gravity Main	1950	K-2	CONC	126.32	121.42	240	6	0.013	0.0204	0.52
K2:18	K2:17	0: Gravity Main	1950	K-2	CONC	131.15	127.89	207	6	0.013	0.0158	0.46
K2:18A	K2:18	0: Gravity Main	0	K-2	CLAY	132.45	131.19	80	6	0.013	0.0158	0.46
K2:19	K2:19A	0: Gravity Main	1950	K-2	CONC	111.93	110.71	189	6	0.013	0.0065	0.29
K2:19A	K2:15	0: Gravity Main	1950	K-2	CONC	110.51	110.34	55	6	0.013	0.0031	0.20
K2:20	K2:19	0: Gravity Main	1950	K-2	CONC	122.15	112.03	261	6	0.013	0.0388	0.71
K2:21	K2:7	0: Gravity Main	0	K-2	CONC	106.52	103.66	259	8	0.013	0.0110	0.82

Upstream Node	Downstream Node	TYPE	YR_INST	ZONE	MATERIAL	FROM_INV	TO_INV	LENGTH	DIAMETER	COEFF	Slope (ft/FT)	Pipe Capacity (mgd)
K2:22	K2:21	0: Gravity Main	0	K-2	CONC	108.23	106.49	233	6	0.013	0.0075	0.31
K2:23	K2:22	0: Gravity Main	0	K-2	CONC	110.51	108.26	300	6	0.013	0.0075	0.31
K2:24	K2:23	0: Gravity Main	0	K-2	CONC	113.11	110.44	330	6	0.013	0.0081	0.33
K2:25	K2:21	0: Gravity Main	0	K-2	CONC	111	106.53	260	8	0.013	0.0172	1.02
K2:26	K2:25	0: Gravity Main	0	K-2	CONC	112.07	111.05	197	8	0.013	0.0052	0.56
K2:27A	K2:26	0: Gravity Main	1950	K-2	CONC	113.83	112.11	265	6	0.013	0.0065	0.29
K2:27B	*K2:27A*	*0: Gravity Main*	*1950*	*K-2*	*CONC*	*115.4*	*113.91*	*293*	*6*	*0.013*	0.0051	0.26
K2:28	K2:25	0: Gravity Main	0	K-2	CONC	112.17	111.02	259	8	0.013	0.0044	0.52
K2:29	K2:28	0: Gravity Main	0	K-2	CONC	113.06	112.22	171	6	0.013	0.0049	0.25
K2:3	K2:1	0: Gravity Main	0	K-2	CONC	103	102.08	262	8	0.013	0.0035	0.46
K2:30	K2:29	0: Gravity Main	0	K-2	CONC	114.25	113.08	224	6	0.013	0.0052	0.26
K2:31	K2:30	0: Gravity Main	0	K-2	CONC	115.52	114.26	189	6	0.013	0.0067	0.30
K2:32	K2:28	0: Gravity Main	1950	K-2	CONC	118.47	112.2	256	6	0.013	0.0245	0.57
K2:33	K2:32	0: Gravity Main	0	K-2	CONC	121.49	118.65	127	6	0.013	0.0223	0.54
K2:34	K2:33	0: Gravity Main	0	K-2	CONC	125.19	121.51	189	6	0.013	0.0195	0.51
K2:35	K2:32	0: Gravity Main	0	K-2	CONC	125.66	118.69	310	6	0.013	0.0225	0.54
K2:3A	*K2:3*	*0: Gravity Main*	*0*	*K-2*	*CONC*	*103.7*	*103.14*	*105*	*6*	*0.013*	0.0053	0.26
K2:4	K2:3	0: Gravity Main	0	K-2	CONC	103.98	103.01	260	6	0.013	0.0037	0.22
K2:4A	*K2:4*	*0: Gravity Main*	*0*	*K-2*	*CONC*	*104.7*	*104.19*	*110*	*6*	*0.013*	0.0046	0.25
K2:5	K2:4	0: Gravity Main	0	K-2	CONC	104.98	104.03	260	6	0.013	0.0037	0.22
K2:5A	*K2:5*	*0: Gravity Main*	*0*	*K-2*	*CONC*	*105.9*	*105.35*	*130*	*6*	*0.013*	0.0042	0.24
K2:6	K2:5	0: Gravity Main	0	K-2	CONC	105.54	105.08	94	6	0.013	0.0049	0.25
K2:7	K2:1	0: Gravity Main	1950	K-2	CONC	103.18	102.08	261	8	0.013	0.0042	0.51
K2:8	K2:7	0: Gravity Main	0	K-2	CONC	104.11	103.21	240	8	0.013	0.0037	0.48
K2:9	K2:8	0: Gravity Main	1950	K-2	CONC	104.77	104.14	125	8	0.013	0.0050	0.55
K3:1	K9:44D	0: Gravity Main	0	K-3	CONC	13.64	13.33	44	15	0.013	0.0070	3.49
K3:10	K3:29	0: Gravity Main		K-3	CONC	31.84	30.91	149	15	0.013	0.0062	3.30
K3:11	K3:10	0: Gravity Main	0	K-3	CONC	47.9	32.01	253	12	0.013	0.0629	5.78
K3:12	*K3:11*	*0: Gravity Main*	*1950*	*K-3*	*CONC*	*58.77*	*47.92*	*276*	*12*	*0.013*	0.0394	4.57
K3:13	K3:12	0: Gravity Main	1950	K-3	CONC	66.71	59.08	247	12	0.013	0.0309	4.05
K3:14	K3:14A	0: Gravity Main	0	K-3	CLAY	69.9	69.71	5	6	0.013	0.0390	0.72
K3:14A	K6:39	0: Gravity Main	1951	K-3	CLAY	69.41	52.53	255	6	0.013	0.0663	0.93
K3:14A	K3:13	0: Gravity Main	1950	K-3	CONC	67.95	66.82	277	15	0.013	0.0041	2.67
K3:15	K3:14A	0: Gravity Main	1950	K-3	CONC	68.82	68.01	133	15	0.013	0.0061	3.26
K3:15A	*K1:6B*	*0: Gravity Main*	*1994*	*K-1*	*PVC*	*62.45*	*62.05*	*71*	*6*	*0.013*	0.0056	0.27
K3:16	K3:38	0: Gravity Main	1950	K-3	CONC	94.37	92.3	254	8	0.013	0.0081	0.70
K3:17	K3:39	0: Gravity Main	1950	K-3	CONC	113.18	92.43	259	6	0.013	0.0800	1.03
K3:18	K3:17	0: Gravity Main	1950	K-3	CONC	116.81	113.29	260	6	0.013	0.0135	0.42
K3:19	K3:18	0: Gravity Main	1950	K-3	CONC	120.1	116.98	260	6	0.013	0.0120	0.40
K3:19A	K3:19	0: Gravity Main	1950	K-3	CONC	131.62	120.22	245	6	0.013	0.0465	0.78
K3:19B	K3:19	0: Gravity Main	0	K-3	CONC	126.55	120.59	181	6	0.013	0.0329	0.66
K3:2	K3:1	0: Gravity Main	1950	K-3	CONC	20.21	14.53	253	6	0.013	0.0225	0.54
K3:20	K3:19A	0: Gravity Main	0	K-3	CLAY	135.03	131.63	60	6	0.013	0.0570	0.87
K3:20A	*K3:20*	*0: Gravity Main*	*0*	*K-3*	*CLAY*	*136.5*	*135.04*	*311*	*6*	*0.013*	0.0047	0.25
K3:21	K3:29	0: Gravity Main	0	K-3	CONC	33.55	31.91	121	6	0.013	0.0136	0.42
K3:22	K3:40	0: Gravity Main	1950	K-3	CONC	97.29	94.53	236	8	0.013	0.0117	0.84

Upstream Node	Downstream Node	TYPE	YR_INST	ZONE	MATERIAL	FROM_INV	TO_INV	LENGTH	DIAMETER	COEFF	Slope (ft/FT)	Pipe Capacity (mgd)
K3:23	K3:39A	0: Gravity Main	0	K-3	CONC	107.49	95.85	253	6	0.013	0.0460	0.78
K3:24	K3:23	0: Gravity Main	0	K-3	CONC	113.5	107.5	260	6	0.013	0.0231	0.55
K3:24A	*K3:24*	*0: Gravity Main*	*0*	*K-3*	*CONC*	*114.6*	*113.81*	*248*	*6*	*0.013*	0.0032	0.20
K3:27	K3:9	0: Gravity Main	1950	K-3	CONC	33.41	28.8	9	8	0.013	0.4867	5.45
K3:27A	K3:27	0: Gravity Main	0	K-3	CLAY	61.81	34.17	259	6	0.013	0.1066	1.18
K3:27B	*TEE*	*0: Gravity Main*	*0*	*K-3*	*CLAY*	*64*	*63.43*	*133*	*6*	*0.013*	0.0043	0.24
K3:27C	*TEE*	*0: Gravity Main*	*0*	*K-3*	*CLAY*	*64*	*63.43*	*135*	*6*	*0.013*	0.0042	0.24
K3:28	K3:27	0: Gravity Main	1950	K-3	CONC	36.85	34.45	30	8	0.013	0.0798	2.21
K3:29	K3:9	0: Gravity Main		K-3	CONC	30.86	28.3	117	15	0.013	0.0219	6.18
K3:2A	*K3:2*	*0: Gravity Main*	*0*	*K-3*	*CONC*	*21*	*20.41*	*115*	*6*	*0.013*	0.0051	0.26
K3:3	TEE	0: Gravity Main	1950	K-3	CONC	28.69	26.64	83	6	0.013	0.0248	0.57
K3:30	K3:21	0: Gravity Main	0	K-3	CONC	48.48	41.49	132	6	0.013	0.0531	0.84
K3:30A	K3:30	0: Gravity Main	0	K-3	CONC	61.05	48.72	159	6	0.013	0.0777	1.01
K3:31	K3:30A	0: Gravity Main	0	K-3	CONC	82.34	62.2	39	6	0.013	0.5159	2.61
K3:32	K3:31	0: Gravity Main	0	K-3	CONC	94.2	82.61	189	6	0.013	0.0612	0.90
K3:33	K3:33A	0: Gravity Main	0	K-3	CONC	106.3	105.96	101	6	0.013	0.0034	0.21
K3:33A	K3:32	0: Gravity Main	0	K-3	CONC	105.9	94.41	161	6	0.013	0.0715	0.97
K3:34	K3:33	0: Gravity Main	0	K-3	CONC	114.65	106.37	259	6	0.013	0.0319	0.65
K3:35	*K3:34*	*0: Gravity Main*	*1950*	*K-3*	*CONC*	*116.4*	*114.7*	*187*	*6*	*0.013*	0.0091	0.35
K3:36	K3:28	0: Gravity Main	1950	K-3	CONC	58.73	36.87	258	8	0.013	0.0847	2.27
K3:37	K3:36	0: Gravity Main	1950	K-3	CONC	78.68	59.06	287	8	0.013	0.0684	2.04
K3:38	K3:37	0: Gravity Main	1950	K-3	CONC	91.79	78.78	219	8	0.013	0.0594	1.90
K3:39	K3:14	0: Gravity Main	0	K-3	CLAY	92.06	69.94	261	6	0.013	0.0849	1.06
K3:39A	K3:39	0: Gravity Main	1950	K-3	CONC	95.73	92.53	269	6	0.013	0.0119	0.40
K3:3A	*TEE*	*0: Gravity Main*	*0*	*K-3*	*CONC*	*27.14*	*26.64*	*81*	*6*	*0.013*	0.0061	0.28
K3:4	K3:3	0: Gravity Main	0	K-3	CONC	66.6	28.82	118	6	0.013	0.3201	2.05
K3:40	K3:16	0: Gravity Main	1950	K-3	CONC	94.52	94.39	41	8	0.013	0.0032	0.44
K3:42	K3:22	0: Gravity Main	0	K-3	CONC	100.67	97.34	259	8	0.013	0.0128	0.88
K3:43	K3:12	0: Gravity Main	0	K-3	CLAY	59.81	59.84	6	8	0.013	Rev. Grd.	N/A
K3:43A	*K3:43*	*0: Gravity Main*	*0*	*K-3*	*CLAY*	*60.4*	*59.81*	*155*	*8*	*0.013*	0.0038	0.48
K3:44	K3:13	0: Gravity Main	1950	K-3	CONC	113.31	67.16	528	8	0.013	0.0875	2.31
K3:45	K3:44	0: Gravity Main	1950	K-3	CONC	116.14	113.37	258	8	0.013	0.0107	0.81
K3:46	K3:45	0: Gravity Main	1950	K-3	CONC	117.76	116.26	260	8	0.013	0.0058	0.59
K3:47	K3:46	0: Gravity Main	1950	K-3	CONC	119.04	117.89	244	8	0.013	0.0047	0.54
K3:48	*K3:47*	*0: Gravity Main*	*1950*	*K-3*	*CONC*	*122*	*119.16*	*305*	*6*	*0.013*	0.0093	0.35
K3:49	K3:49B	0: Gravity Main	1950	K-3	CONC	110.39	98.32	236	8	0.013	0.0512	1.77
K3:49A	K3:43	0: Gravity Main	1950	K-3	CONC	75.16	59.82	237	8	0.013	0.0648	1.99
K3:49B	K3:49A	0: Gravity Main	1950	K-3	CONC	98.21	75.32	328	8	0.013	0.0698	2.06
K3:4A	*K3:4*	*0: Gravity Main*	*0*	*K-3*	*PVC*	*72*	*69.91*	*390*	*4*	*0.013*	0.0054	0.09
K3:5	K3:3	0: Gravity Main	0	K-3	CONC	34.58	28.7	490	6	0.013	0.0120	0.40
K3:50	K3:49	0: Gravity Main	1950	K-3	CONC	114.65	110.56	248	8	0.013	0.0165	1.00
K3:51	K3:50	0: Gravity Main	1950	K-3	CONC	117.28	114.7	246	6	0.013	0.0105	0.37
K3:6	K3:5	0: Gravity Main	0	K-3	CONC	34.99	34.56	76	6	0.013	0.0056	0.27
K3:7	K3:6	0: Gravity Main	0	K-3	CONC	60.37	34.99	74	6	0.013	0.3443	2.13
K3:8	K3:8	0: Gravity Main	0	K-3	PVC	92.33	86.64	226	8	0.013	0.0252	1.24
K3:8	K3:7	0: Gravity Main	0	K-3	CONC	86.35	60.37	209	6	0.013	0.1242	1.28

Upstream Node	Downstream Node	TYPE	YR_INST	ZONE	MATERIAL	FROM_INV	TO_INV	LENGTH	DIAMETER	COEFF	Slope (ft/FT)	Pipe Capacity (mgd)
K3:9	K3:1	0: Gravity Main	0	K-3	CONC	28.25	13.86	250	15	0.013	0.0576	10.02
K4:1	K5:12	0: Gravity Main	1921	K-5	CONC	16.37	15	351	10	0.013	0.0039	0.89
K4:10	K4:2	0: Gravity Main	1921	K-4	CONC	18.2	17.03	235	10	0.013	0.0050	1.00
K4:11	K4:10	0: Gravity Main	1921	K-4	CONC	19.65	18.33	284	8	0.013	0.0047	0.53
K4:12	K4:1	0: Gravity Main	1921	K-4	CONC	17.24	16.48	244	8	0.013	0.0031	0.44
K4:13	K4:12	0: Gravity Main	1921	K-4	CONC	17.76	17.26	263	8	0.013	0.0019	0.34
K4:13A	K4:13	0: Gravity Main	1921	K-4	PVC	18.24	17.99	10	8	0.013	0.0244	1.22
K4:14	K4:14A	0: Gravity Main	0	K-4	PVC	18.59	18.525	93	8	0.013	0.0007	0.21
K4:14A	K4:13	0: Gravity Main	0	K-4	PVC	18.26	17.87	168	8	0.013	0.0023	0.38
K4:16	*K4:17*	*0: Gravity Main*	*1921*	*K-4*	*CONC*	*21.04*	*20.23*	*129*	*6*	*0.013*	0.0063	0.29
K4:17	K4:14	0: Gravity Main	1921	K-4	CONC	19.27	18.61	239	6	0.013	0.0028	0.19
K4:18	K4:17	0: Gravity Main	1921	K-4	CONC	19.63	19.39	69	6	0.013	0.0035	0.21
K4:2	K4:1	0: Gravity Main	1921	K-4	CONC	16.68	16.49	247	10	0.013	0.0008	0.39
K4:21	K4:21B	0: Gravity Main	1921	K-4	CONC	20.35	19.69	347	6	0.013	0.0019	0.16
K4:21A	K4:21	0: Gravity Main	0	K-4	PVC	20.52	20.47	82	6	0.013	0.0006	0.09
K4:21B	K4:24B	0: Gravity Main	1921	K-4	CONC	19.51	19.44	129	8	0.013	0.0005	0.18
K4:21C	*K4:21A*	*0: Gravity Main*	*0*	*K-4*	*PVC*	*22.1*	*20.62*	*317*	*6*	*0.013*	0.0047	0.25
K4:22	TEE	0: Gravity Main	1921	K-4	CONC	21.08	20.98	35	6	0.013	0.0029	0.19
K4:23	*TEE*	*0: Gravity Main*	*1921*	*K-4*	*CONC*	*21.75*	*20.98*	*168*	*4*	*0.013*	0.0046	0.08
K4:24	K4:24B	0: Gravity Main	1921	K-4	CONC	19.23	19.4	54	8	0.013	Rev. Grd.	N/A
K4:24A	*K4:24*	*0: Gravity Main*	*0*	*K-4*	*PVC*	*20.45*	*19.45*	*261*	*8*	*0.013*	0.0038	0.48
K4:24B	K4:14	0: Gravity Main	1921	K-4	CONC	19.32	18.63	270	8	0.013	0.0026	0.40
K4:25	K4:24	0: Gravity Main	1996	K-4	PVC	20.02	19.34	310	10	0.013	0.0022	0.66
K4:26	K4:25	0: Gravity Main	1996	K-4	PVC	20.79	20.16	289	10	0.013	0.0022	0.66
K4:28	K4:1	0: Gravity Main	1921	K-4	CONC	16.47	16.45	150	8	0.013	0.0001	0.09
K4:29	K4:29C	0: Gravity Main	0	K-4	PVC	16.61	12.09	487	8	0.013	0.0093	0.75
K4:29A	K4:29B	0: Gravity Main	0	K-4	PVC	12.26	12.02	49	8	0.013	0.0049	0.55
K4:29B	*Clark PS*	*0: Gravity Main*	*0*	*K-4*	*PVC*	*12*	*11.9*	*34*	*8*	*0.013*	0.0030	0.42
K4:29C	*Clark PS*	*0: Gravity Main*	*0*	*K-4*	*PVC*	*12.05*	*11.9*	*44*	*10*	*0.013*	0.0034	0.83
K4:29D	*K4:29*	*0: Gravity Main*	*0*	*K-4*	*PVC*	*17.4*	*16.8*	*129*	*8*	*0.013*	0.0047	0.53
K4:3	K4:2	0: Gravity Main	1921	K-4	CONC	18.11	16.92	219	10	0.013	0.0054	1.04
K4:30	K4:29A	0: Gravity Main	0	K-4	PVC	13.22	12.33	142	8	0.013	0.0063	0.62
K4:30A	K4:30	0: Gravity Main	0	K-4	PVC	14.05	13.38	123	8	0.013	0.0055	0.58
K4:33	K4:28	0: Gravity Main	1921	K-4	CONC	19.97	18.86	241	8	0.013	0.0046	0.53
K4:34	K4:33	0: Gravity Main	1921	K-4	CONC	20.14	20.22	207	8	0.013	Rev. Grd.	N/A
K4:35	K4:34	0: Gravity Main	1921	K-4	CONC	20.26	20.16	107	8	0.013	0.0009	0.24
K4:36	K4:35	0: Gravity Main	1921	K-4	CONC	20.55	20.36	96	8	0.013	0.0020	0.35
K4:4	K4:3	0: Gravity Main	1921	K-4	CONC	19.34	18.2	241	10	0.013	0.0047	0.97
K4:5	K4:4	0: Gravity Main	1921	K-4	CONC	19.94	19.36	209	10	0.013	0.0028	0.75
K4:6	K4:5	0: Gravity Main	1921	K-4	CONC	20.84	20.04	208	10	0.013	0.0038	0.88
K4:7	K4:6	0: Gravity Main	1921	K-4	CONC	21.74	20.86	188	8	0.013	0.0047	0.53
K4:8	K4:7	0: Gravity Main	1921	K-4	CONC	22.45	21.8	183	8	0.013	0.0035	0.46
K4:9	K4:8	0: Gravity Main	1921	K-4	CONC	23.25	22.46	182	6	0.013	0.0043	0.24
K4:9A	*K4:9*	*0: Gravity Main*	*1921*	*K-4*	*CONC*	*23.86*	*23.26*	*120*	*6*	*0.013*	0.0050	0.26
K4:9B	*K4:9*	*0: Gravity Main*	*1921*	*K-4*	*CONC*	*23.9*	*23.29*	*155*	*6*	*0.013*	0.0039	0.23
K5:0	K5:1	0: Gravity Main	0	K-5	CONC	14.87	12.51	24	10	0.013	0.1000	4.48

Upstream Node	Downstream Node	TYPE	YR_INST	ZONE	MATERIAL	FROM_INV	TO_INV	LENGTH	DIAMETER	COEFF	Slope (ft/FT)	Pipe Capacity (mgd)
K5:1	*Catlin PS*	*0: Gravity Main*	*1971*	*K-5*	*CORR*	*10.75*	*10.15*	*272*	*12*	*0.013*	0.0022	1.08
K5:10	K5:9	0: Gravity Main	1921	K-5	CONC	19.51	13.31	543	6	0.013	0.0114	0.39
K5:12	K5:9B	0: Gravity Main	1921	K-5	CONC	14.97	14.16	270	10	0.013	0.0030	0.78
K5:13	K5:9	0: Gravity Main	0	K-5	HDPE	13.5	12.82	256	12	0.013	0.0027	1.19
K5:14	K5:14A	0: Gravity Main	1921	K-5	CONC	18.36	18.08	53	6	0.013	0.0053	0.26
K5:14A	K5:13	0: Gravity Main	1921	K-5	CONC	18.07	13.92	564	6	0.013	0.0074	0.31
K5:16	K5:16A	0: Gravity Main	1921	K-5	CLAY	21.33	19.32	294	6	0.013	0.0068	0.30
K5:16A	K5:13	0: Gravity Main	1921	K-5	CLAY	19.27	16.19	261	6	0.013	0.0118	0.39
K5:18	K5:18A	0: Gravity Main	1921	K-5	CONC	17.94	16.29	275	6	0.013	0.0060	0.28
K5:18A	K5:19	0: Gravity Main	1921	K-5	CLAY	16.24	14.88	266	6	0.013	0.0051	0.26
K5:19	K5:13	0: Gravity Main	0	K-5	HDPE	14.8	13.51	259	10	0.013	0.0050	1.00
K5:19A	K5:19	0: Gravity Main	1921	K-5	CLAY	16.93	15.33	255	6	0.013	0.0063	0.29
K5:1A	K5:0	0: Gravity Main	1971	K-5	CONC	19.38	14.98	278	6	0.013	0.0158	0.46
K5:2	K5:1A	0: Gravity Main	1971	K-5	CONC	21.24	19.45	231	6	0.013	0.0078	0.32
K5:20	K5:19A	0: Gravity Main	1921	K-5	CONC	19.59	17.05	310	6	0.013	0.0082	0.33
K5:20A	K5:22	0: Gravity Main	1921	K-5	CONC	18.98	15.93	271	6	0.013	0.0112	0.38
K5:21	K5:20A	0: Gravity Main	1921	K-5	CONC	22.54	18.96	272	6	0.013	0.0131	0.42
K5:22	K5:19	0: Gravity Main	0	K-5	HDPE	15.58	14.89	254	10	0.013	0.0027	0.74
K5:23A	K5:22	0: Gravity Main	1921	K-5	CONC	17.27	15.82	334	8	0.013	0.0043	0.51
K5:25	K5:27	0: Gravity Main	1921	K-5	CONC	18.23	16.76	301	6	0.013	0.0049	0.25
K5:25A	*K5:25*	*0: Gravity Main*	*1921*	*K-5*	*CLAY*	*19.34*	*18.34*	*182*	*6*	*0.013*	0.0055	0.27
K5:26	K5:25	0: Gravity Main	1921	K-5	CONC	19.61	18.21	300	6	0.013	0.0047	0.25
K5:27	K5:22	0: Gravity Main	0	K-5	HDPE	16.64	15.75	254	10	0.013	0.0035	0.84
K5:27A	*K5:27*	*0: Gravity Main*	*1921*	*K-5*	*CONC*	*19.14*	*16.89*	*462*	*6*	*0.013*	0.0049	0.25
K5:28	K5:28A	0: Gravity Main	0	K-4	PVC	18.93	15.25	266	8	0.013	0.0138	0.92
K5:28A	K4:29A	0: Gravity Main	0	K-4	PVC	15.14	12.46	226	8	0.013	0.0119	0.85
K5:29	K5:27	0: Gravity Main	1921	K-5	CONC	17.47	16.69	252	6	0.013	0.0031	0.20
K5:30	*K5:29*	*0: Gravity Main*	*1921*	*K-5*	*CONC*	*19.85*	*17.55*	*359*	*6*	*0.013*	0.0064	0.29
K5:30A	*K5:30*	*0: Gravity Main*	*1921*	*K-5*	*CONC*	*20.79*	*19.85*	*145*	*6*	*0.013*	0.0065	0.29
K5:31	K5:30A	0: Gravity Main	1921	K-5	CONC	21.56	20.92	140	6	0.013	0.0046	0.24
K5:31	K4:30A	0: Gravity Main	1921	K-4	CONC	21.49	14.27	264	6	0.013	0.0274	0.60
K5:4	*K5:1*	*0: Gravity Main*	*1971*	*K-5*	*CONC*	*20.4*	*17.26*	*462*	*6*	*0.013*	0.0068	0.30
K5:4	*K4:10*	*0: Gravity Main*	*1921*	*K-4*	*CONC*	*20.4*	*18.3*	*168*	*8*	*0.013*	0.0125	0.87
K5:5	K5:1	0: Gravity Main	0	K-5	HDPE	11.84	10.88	235	12	0.013	0.0041	1.47
K5:5A	*K5:5*	*0: Gravity Main*	*1921*	*K-5*	*CONC*	*17.79*	*15.97*	*310*	*6*	*0.013*	0.0059	0.28
K5:6	K5:5A	0: Gravity Main	1921	K-5	CONC	18.89	17.9	239	6	0.013	0.0041	0.23
K5:7	K5:5	0: Gravity Main	1921	K-5	CONC	18.55	16.78	305	6	0.013	0.0058	0.28
K5:8	K5:7	0: Gravity Main	1921	K-5	CONC	20.25	18.72	258	6	0.013	0.0059	0.28
K5:9	K5:5	0: Gravity Main	0	K-5	HDPE	12.75	12.03	248	12	0.013	0.0029	1.24
K5:9B	K5:9	0: Gravity Main	1921	K-5	CONC	14.22	14.15	9	10	0.013	0.0078	1.25
K6:1	K7:58	0: Gravity Main	0	K-7	CONC	16.08	15.04	360	18	0.013	0.0029	3.65
K6:10	K6:9	0: Gravity Main	0	K-6	CONC	19.13	16.58	352	8	0.013	0.0072	0.67
K6:11	K6:8	0: Gravity Main	0	K-6	CLAY	12.4	11.51	261	12	0.013	0.0034	1.35
K6:12	K6:11	0: Gravity Main	1951	K-6	CLAY	14.24	12.56	256	8	0.013	0.0066	0.63
K6:12A	K6:12	0: Gravity Main	0	K-6	CLAY	15.89	14.23	295	8	0.013	0.0056	0.59
K6:13	K6:12A	0: Gravity Main	0	K-6	CLAY	17.72	15.94	308	8	0.013	0.0058	0.59

Upstream Node	Downstream Node	TYPE	YR_INST	ZONE	MATERIAL	FROM_INV	TO_INV	LENGTH	DIAMETER	COEFF	Slope (ft/FT)	Pipe Capacity (mgd)
K6:14	K6:11	0: Gravity Main	1951	K-6	CLAY	15.03	12.56	501	8	0.013	0.0049	0.55
K6:14B	TEE	0: Gravity Main	0	K-6		17.4	16.6	207	8	0.013	0.0039	0.49
K6:15	TEE	0: Gravity Main	1951	K-6	CLAY	18.19	16.55	280	8	0.013	0.0059	0.60
K6:16	K6:15	0: Gravity Main	1951	K-6	CLAY	19.26	18.23	234	8	0.013	0.0044	0.52
K6:17	K6:15	0: Gravity Main		K-6	PVC	18.77	18.28	137	8	0.013	0.0036	0.47
K6:2	K6:2A	0: Gravity Main	0	K-6	CONC	17.47	17.18	119	18	0.013	0.0024	3.36
K6:20	K6:20B	0: Gravity Main	1998	K-6	PVC	14.11	13.29	269	15	0.013	0.0030	2.30
K6:20A	K6:20	0: Gravity Main	0	K-6	CLAY	15.3	14.28	231	12	0.013	0.0044	1.53
K6:20B	K6:5	0: Gravity Main	1998	K-6	PVC	13.29	12.59	251	15	0.013	0.0028	2.21
K6:20C	K6:20A	0: Gravity Main	0	K-6	CLAY	16.4	15.52	234	8	0.013	0.0038	0.48
K6:21	K6:20	0: Gravity Main	1998	K-6	PVC	14.6	14.19	120	15	0.013	0.0034	2.44
K6:22	K6:21	0: Gravity Main	1998	K-6	PVC	15.12	14.61	125	12	0.013	0.0041	1.47
K6:22A	K6:22	0: Gravity Main	0	K-6	PVC	16.37	15.39	217	10	0.013	0.0045	0.95
K6:22B	K6:22A	0: Gravity Main	0	K-6	CONC	17.4	16.39	262	8	0.013	0.0039	0.49
K6:23	K6:20A	0: Gravity Main	1951	K-6	CLAY	18.55	15.64	216	8	0.013	0.0135	0.91
K6:25	K6:22	0: Gravity Main	1951	K-6	CLAY	16.08	15.25	258	12	0.013	0.0032	1.31
K6:25A	K6:25	0: Gravity Main	1951	K-6	CLAY	16.53	16.08	151	10	0.013	0.0030	0.77
K6:25B	K6:25	0: Gravity Main	1951	K-6	CLAY	22.4	21.8	181	10	0.013	0.0033	0.82
K6:26	K6:25	0: Gravity Main	1951	K-6	CLAY	27.35	16.19	264	10	0.013	0.0423	2.91
K6:26A	K6:26	0: Gravity Main	1951	K-6	CLAY	28.25	27.48	252	10	0.013	0.0031	0.78
K6:27	K6:26	0: Gravity Main	0	K-6	CLAY	29.5	27.48	479	6	0.013	0.0042	0.24
K6:27A	K6:27	0: Gravity Main	0	K-6	CLAY	30	29.5	90	6	0.013	0.0055	0.27
K6:28	K6:40	0: Gravity Main	0	K-6	PVC	16.05	15.07	150	10	0.013	0.0065	1.15
K6:29	K6:28	0: Gravity Main	0	K-6	PVC	16.68	16.26	74	10	0.013	0.0056	1.06
K6:2A	K6:1	0: Gravity Main	1965	K-6	CONC	17.11	16.13	301	18	0.013	0.0033	3.88
K6:3	First Ave. PS	0: Gravity Main	0	K-6	PVC	8.17	7.2	33	15	0.013	0.0290	7.12
K6:30	K6:29	0: Gravity Main	1950	K-6	CLAY	19.68	16.72	487	10	0.013	0.0061	1.10
K6:30A	K6:30	0: Gravity Main	0	K-6	CLAY	20.09	19.69	122	10	0.013	0.0033	0.81
K6:31	K6:30	0: Gravity Main	1950	K-6	CLAY	20.49	19.69	20	8	0.013	0.0391	1.55
K6:32	K6:31	0: Gravity Main	1950	K-6	CLAY	26.95	20.59	250	8	0.013	0.0254	1.25
K6:32A	K6:32	0: Gravity Main	0	K-6	CLAY	17.3	16.7	131	8	0.013	0.0046	0.53
K6:33	K6:32	0: Gravity Main	1950	K-6	CONC	30.91	26.99	277	8	0.013	0.0141	0.93
K6:34	K6:36A	0: Gravity Main	1950	K-6	CLAY	47.82	45.63	40	8	0.013	0.0553	1.84
K6:35	K6:33	0: Gravity Main	0	K-6	CONC	44.99	31.02	244	8	0.013	0.0573	1.87
K6:35A	K6:35	0: Gravity Main	0	K-6	CONC	49.1	45	277	8	0.013	0.0148	0.95
K6:36A	K6:33	0: Gravity Main	1950	K-6	CONC	45.44	30.99	220	8	0.013	0.0657	2.00
K6:36B	K6:34	0: Gravity Main	0	K-6	CLAY	48.89	47.89	249	8	0.013	0.0040	0.50
K6:37	K6:34	0: Gravity Main	1950	K-6	CLAY	49.3	48	226	8	0.013	0.0057	0.59
K6:37A	TEE	0: Gravity Main	1950	K-6	CLAY	49.5	26.8	125	8	0.013	0.1821	3.33
K6:37B	K6:37	0: Gravity Main	1950	K-6	CLAY	50.31	49.31	238	8	0.013	0.0042	0.51
K6:38	TEE	0: Gravity Main	1950	K-6	CLAY	51.27	49.63	235	8	0.013	0.0070	0.65
K6:39	K6:38	0: Gravity Main	1950	K-6	CLAY	52.43	51.29	270	8	0.013	0.0042	0.51
K6:3A	K6:2	0: Gravity Main	0	K-6	CONC	17.71	17.47	75	18	0.013	0.0032	3.85
K6:4	K6:3	0: Gravity Main	1995	K-6	PVC	8.94	8.32	402	15	0.013	0.0015	1.64
K6:40	K6:21	0: Gravity Main	0	K-6	PVC	14.91	14.61	179	12	0.013	0.0017	0.94
K6:4A	K6:4	0: Gravity Main	1998	K-6	AC	17.44	16.64	182	8	0.013	0.0044	0.52

Upstream Node	Downstream Node	TYPE	YR_INST	ZONE	MATERIAL	FROM_INV	TO_INV	LENGTH	DIAMETER	COEFF	Slope (ft/FT)	Pipe Capacity (mgd)
K6:5	K6:4	0: Gravity Main	1995	K-6	PVC	10.42	9	192	15	0.013	0.0074	3.59
K6:5A	K6:5	0: Gravity Main	0	K-6	CLAY	16	14.63	233	8	0.013	0.0059	0.60
K6:6	K6:5A	0: Gravity Main	0	K-6	CLAY	17.76	16	299	8	0.013	0.0059	0.60
K6:7	K6:7A	0: Gravity Main	1951	K-6	CLAY	21.04	19.61	295	8	0.013	0.0049	0.54
K6:7A	K6:6	0: Gravity Main	0	K-6	CLAY	19.55	17.76	300	8	0.013	0.0060	0.60
K6:8	K6:5	0: Gravity Main	0	K-6	CLAY	11.41	10.59	249	12	0.013	0.0033	1.32
K6:8A	*K6:8*	*0: Gravity Main*	*0*	*K-6*	*CLAY*	*14.71*	*13.71*	*240*	*8*	*0.013*	0.0042	0.50
K6:9	K6:8	0: Gravity Main	1951	K-6	CLAY	16.6	13.28	505	8	0.013	0.0066	0.63
K7:1	*K7:4*	*0: Gravity Main*		*K-7*	*CONC*	*0.39*	*1.07*	*132*	*30*	*0.013*	Rev. Grd.	N/A
K7:10	K7:9A	0: Gravity Main	0	K-7	PVC	8.27	7.54	167	8	0.013	0.0044	0.52
K7:11	K7:10	0: Gravity Main	0	K-7	PVC	9.12	8.27	271	8	0.013	0.0031	0.44
K7:12	K7:9	0: Gravity Main	0	K-7	PVC	7.03	7.11	264	8	0.013	Rev. Grd.	N/A
K7:13	K7:12	0: Gravity Main	1950	K-7	CONC	8.9	7.17	71	6	0.013	0.0243	0.57
K7:13A	K7:13	0: Gravity Main	0	K-7	CONC	9.63	9.09	46	6	0.013	0.0118	0.39
K7:15	K7:5	0: Gravity Main	1990	K-7	CONC	3.43	2.91	312	21	0.013	0.0017	4.18
K7:16	K7:15	0: Gravity Main	1990	K-7	CONC	3.47	3.33	335	21	0.013	0.0004	2.09
K7:19	K7:16	0: Gravity Main	1990	K-7	CONC	3.8	3.47	336	21	0.013	0.0010	3.21
K7:2	K7:1	0: Gravity Main	0	K-7	CONC	2.28	0.87	508	30	0.013	0.0028	13.96
K7:20	K7:19	0: Gravity Main	0	K-7	PVC	6.83	5.09	244	8	0.013	0.0071	0.66
K7:20A	K7:20	0: Gravity Main	0	K-7	PVC	7.29	6.83	119	8	0.013	0.0039	0.49
K7:20B	K7:20A	0: Gravity Main	0	K-7	PVC	8.56	7.29	250	8	0.013	0.0051	0.56
K7:21	K7:20	0: Gravity Main	0	K-7	PVC	7.92	6.83	270	8	0.013	0.0040	0.50
K7:22	K7:21	0: Gravity Main	0	K-7	PVC	9.36	8	300	8	0.013	0.0045	0.53
K7:22A	*K7:22*	*0: Gravity Main*	*0*	*K-7*	*PVC*	*10.2*	*9.41*	*104*	*8*	*0.013*	0.0076	0.68
K7:23	K7:19	0: Gravity Main	1990	K-7	CONC	4.33	4.68	267	21	0.013	Rev. Grd.	N/A
K7:24	K7:23	0: Gravity Main	0	K-7	PVC	9.8	5.35	136	8	0.013	0.0327	1.41
K7:24A	K7:23	0: Gravity Main	0	K-7	PVC	9.01	6.56	278	8	0.013	0.0088	0.73
K7:25	K7:24	0: Gravity Main	0	K-7	PVC	11.43	9.8	417	8	0.013	0.0039	0.49
K7:25A	K7:24A	0: Gravity Main	0	K-7	PVC	10.29	9.01	299	8	0.013	0.0043	0.51
K7:26	K7:27	0: Gravity Main	0	K-7	PVC	12.16	10.36	436	8	0.013	0.0041	0.50
K7:26A	K7:25A	0: Gravity Main	0	K-7	PVC	11.4	10.29	299	8	0.013	0.0037	0.48
K7:26B	K7:25	0: Gravity Main	0	K-7	PVC	13.2	11.49	413	8	0.013	0.0041	0.50
K7:27	K7:33	0: Gravity Main	0	K-7	PVC	10.41	9.25	261	8	0.013	0.0044	0.52
K7:28	K7:27	0: Gravity Main	0	K-7	PVC	12.07	10.4	406	8	0.013	0.0041	0.50
K7:29	K7:23	0: Gravity Main	1990	K-7	CONC	4.74	4.02	268	21	0.013	0.0027	5.30
K7:3	K7:2	0: Gravity Main	0	K-7	CONC	2.36	2.31	412	30	0.013	0.0001	2.92
K7:30	K7:29	0: Gravity Main	0	K-7	PVC	6.55	5.79	237	10	0.013	0.0032	0.80
K7:31	K7:30	0: Gravity Main	0	K-7	PVC	6.94	6.53	220	10	0.013	0.0019	0.61
K7:32	K7:31	0: Gravity Main	0	K-7	PVC	7.98	6.96	471	10	0.013	0.0022	0.66
K7:33	K7:32	0: Gravity Main	0	K-7	PVC	9.24	7.98	498	10	0.013	0.0025	0.71
K7:34	K7:33	0: Gravity Main	0	K-7	PVC	10.83	9.24	445	8	0.013	0.0036	0.47
K7:34A	K7:34	0: Gravity Main	0	K-7	PVC	11.39	10.92	133	8	0.013	0.0035	0.46
K7:34B	K7:34A	0: Gravity Main	0	K-7	PVC	12.8	11.48	371	8	0.013	0.0036	0.47
K7:35	K7:29	0: Gravity Main	1990	K-7	CONC	8.83	4.66	269	21	0.013	0.0155	12.76
K7:36	K7:35	0: Gravity Main	0	K-7	PVC	12.74	10.39	407	8	0.013	0.0058	0.59
K7:37	K7:36	0: Gravity Main	0	K-7	PVC	14.65	12.77	492	8	0.013	0.0038	0.48

Upstream Node	Downstream Node	TYPE	YR_INST	ZONE	MATERIAL	FROM_INV	TO_INV	LENGTH	DIAMETER	COEFF	Slope (ft/FT)	Pipe Capacity (mgd)
K7:38	K7:33	0: Gravity Main	0	K-7	PVC	11	9.69	260	8	0.013	0.0050	0.55
K7:39	K7:38	0: Gravity Main	0	K-7	PVC	12.72	11.04	446	8	0.013	0.0038	0.48
K7:39A	K7:39	0: Gravity Main	0	K-7	PVC	13.25	12.82	135	8	0.013	0.0032	0.44
K7:39B	K7:39A	0: Gravity Main	0	K-7	PVC	13.65	13.25	105	8	0.013	0.0038	0.48
K7:39C	K7:39B	0: Gravity Main	0	K-7	PVC	15	13.69	280	8	0.013	0.0047	0.53
K7:4	*K7:77*	*0: Gravity Main*		*K-7*	*CONC*	*0.94*	*1.02*	*117*	*30*	*0.013*	Rev. Grd.	N/A
K7:40	K7:38	0: Gravity Main	0	K-7	PVC	13.37	11.99	260	8	0.013	0.0053	0.57
K7:41	K7:40	0: Gravity Main	0	K-7	PVC	15.36	13.49	300	8	0.013	0.0062	0.62
K7:41A	K7:41	0: Gravity Main	0	K-7	PVC	15.96	15.39	168	8	0.013	0.0034	0.46
K7:42	K7:40	0: Gravity Main	0	K-7	PVC	14.6	13.44	377	8	0.013	0.0031	0.43
K7:42	*Elm St. PS*	*0: Gravity Main*	*0*	*K-7*	*PVC*	*9.34*	*8.79*	*150*	*8*	*0.013*	0.0037	0.47
K7:42A	K7:42C	0: Gravity Main	0	K-7	PVC	14.92	14.11	242	8	0.013	0.0034	0.45
K7:42A	*Elm St. PS*	*0: Gravity Main*	*0*	*K-7*	*PVC*	*9.57*	*8.71*	*205*	*8*	*0.013*	0.0042	0.51
K7:42C	K7:45	0: Gravity Main	0	K-7	PVC	14.06	12.55	320	8	0.013	0.0047	0.54
K7:43	K7:52	0: Gravity Main	0	K-7	PVC	17.4	15.49	462	8	0.013	0.0041	0.50
K7:44	K7:53	0: Gravity Main	0	K-7	PVC	15.9	14.7	271	8	0.013	0.0044	0.52
K7:44A	*K7:44*	*0: Gravity Main*	*0*	*K-7*	*PVC*	*16.7*	*15.87*	*219*	*8*	*0.013*	0.0038	0.48
K7:45	K7:35	0: Gravity Main	1990	K-7	CONC	10.05	8.91	270	21	0.013	0.0042	6.65
K7:46	K7:45	0: Gravity Main	0	K-7	PVC	15.13	12.88	386	8	0.013	0.0058	0.60
K7:47	K7:46	0: Gravity Main	0	K-7	PVC	17.12	15.22	371	8	0.013	0.0051	0.56
K7:48	K7:45	0: Gravity Main	1990	K-7	CONC	11.14	10	140	18	0.013	0.0082	6.14
K7:48A	K7:48B	0: Gravity Main	0	K-7	PVC	17.4	14.89	393	8	0.013	0.0064	0.62
K7:48B	K7:48	0: Gravity Main	0	K-7	PVC	14.78	11.83	416	8	0.013	0.0071	0.66
K7:49	K7:48	0: Gravity Main	0	K-7	PVC	13.09	11.76	316	8	0.013	0.0042	0.51
K7:5	K7:3	0: Gravity Main	1999	K-7	CONC	2.91	2.57	240	21	0.013	0.0014	3.85
K7:50	K7:49	0: Gravity Main	0	K-7	PVC	13.45	13.25	125	8	0.013	0.0016	0.31
K7:52	K7:50	0: Gravity Main	0	K-7	PVC	15.38	13.49	432	8	0.013	0.0044	0.52
K7:53	K7:40	0: Gravity Main	0	K-7	PVC	14.7	13.67	259	8	0.013	0.0040	0.49
K7:54	K7:48	0: Gravity Main	1990	K-7	CONC	11.75	11.23	257	18	0.013	0.0020	3.05
K7:55	K7:55A	0: Gravity Main	0	K-7	CLAY	19.67	17.99	348	6	0.013	0.0048	0.25
K7:55A	K7:55B	0: Gravity Main	0	K-7	CLAY	17.93	16.09	458	6	0.013	0.0040	0.23
K7:55B	K7:55C	0: Gravity Main	0	K-7	CLAY	15.96	13.94	465	8	0.013	0.0043	0.52
K7:55C	K7:54	0: Gravity Main	0	K-7	CLAY	13.94	12.25	274	8	0.013	0.0062	0.61
K7:56	K7:54	0: Gravity Main	0	K-7	CONC	18.95	12.1	555	6	0.013	0.0123	0.40
K7:57	K7:54	0: Gravity Main	1965	K-7	CONC	13.03	11.8	221	18	0.013	0.0056	5.07
K7:58	K7:57	0: Gravity Main	0	K-7	CONC	14.97	13.88	290	18	0.013	0.0038	4.16
K7:6	K7:5	0: Gravity Main	0	K-7	PVC	4.72	3.78	244	8	0.013	0.0039	0.49
K7:60	K7:35	0: Gravity Main	0	K-7	PVC	10.93	9.45	355	8	0.013	0.0042	0.50
K7:61	K7:60	0: Gravity Main	0	K-7	PVC	12.57	10.94	356	8	0.013	0.0046	0.53
K7:62	K7:61	0: Gravity Main	0	K-7	PVC	15.35	12.79	302	8	0.013	0.0085	0.72
K7:63	K7:62	0: Gravity Main	1990	K-7	PVC	17.03	15.46	284	8	0.013	0.0055	0.58
K7:64	K7:29	0: Gravity Main	0	K-7	PVC	6.59	4.74	347	10	0.013	0.0053	1.03
K7:65	K7:64	0: Gravity Main	0	K-7	PVC	7.76	6.62	372	10	0.013	0.0031	0.78
K7:66	K7:65	0: Gravity Main	0	K-7	PVC	8.79	7.77	288	10	0.013	0.0035	0.84
K7:67	K7:66	0: Gravity Main	0	K-7	PVC	9.57	8.83	276	10	0.013	0.0027	0.73
K7:68	K7:67	0: Gravity Main	1990	K-7	PVC	10.81	9.82	120	8	0.013	0.0083	0.71

Upstream Node	Downstream Node	TYPE	YR_INST	ZONE	MATERIAL	FROM_INV	TO_INV	LENGTH	DIAMETER	COEFF	Slope (ft/FT)	Pipe Capacity (mgd)
K7:68A	K7:68	0: Gravity Main	0	K-7	PVC	12.58	10.81	164	8	0.013	0.0108	0.81
K7:69	K7:68	0: Gravity Main	0	K-7	PVC	11.28	10.82	183	8	0.013	0.0025	0.39
K7:69A	*K7:69*	*0: Gravity Main*	*0*	*K-7*	*PVC*	*12.6*	*11.39*	*323*	*8*	*0.013*	0.0037	0.48
K7:6A	K7:6	0: Gravity Main	0	K-7	PVC	5.73	4.73	199	8	0.013	0.0050	0.55
K7:70	K7:68	0: Gravity Main	0	K-7	PVC	12.37	11.17	299	8	0.013	0.0040	0.50
K7:70A	K7:70	0: Gravity Main	1963	K-7	CONC	13.21	12.51	43	6	0.013	0.0162	0.46
K7:70B	K7:70A	0: Gravity Main	1963	K-7	CONC	13.34	13.25	111	6	0.013	0.0008	0.10
K7:70C	K7:70B	0: Gravity Main	1963	K-7	CONC	14.17	13.38	201	6	0.013	0.0039	0.23
K7:70D	K7:70	0: Gravity Main	1963	K-7	CONC	14.22	12.49	375	6	0.013	0.0046	0.25
K7:71	K7:67	0: Gravity Main	1990	K-7	PVC	10.24	9.72	128	10	0.013	0.0041	0.90
K7:72	K7:71	0: Gravity Main	0	K-7	PVC	11.03	10.39	261	10	0.013	0.0025	0.70
K7:73	K7:72	0: Gravity Main	1990	K-7	PVC	11.8	11.08	156	10	0.013	0.0046	0.96
K7:74	K7:73	0: Gravity Main	0	K-7	CONC	15.7	13.39	508	8	0.013	0.0045	0.53
K7:75	K7:73	0: Gravity Main	0	K-7	PVC	13.65	12.17	365	8	0.013	0.0040	0.50
K7:75A	K7:75	0: Gravity Main	0	K-7	PVC	14.56	13.72	179	8	0.013	0.0047	0.53
K7:77	K17:50	0: Gravity Main	1972	K-17	CONC	0.7	-0.57	425	36	0.013	0.0030	23.56
K7:9	K7:6A	0: Gravity Main	0	K-7	PVC	7.11	5.78	377	8	0.013	0.0035	0.46
K7:9A	K7:9	0: Gravity Main	0	K-7	PVC	7.54	7.15	95	8	0.013	0.0041	0.50
K8:1	K7:1	0: Gravity Main	0	K-8	CONC	1.19	0.99	128	24	0.013	0.0016	5.78
K8:10	K8:9	0: Gravity Main	0	K-8	CONC	9.75	8.43	300	8	0.013	0.0044	0.52
K8:10A	*K8:10*	*0: Gravity Main*	*0*	*K-8*	*CONC*	*11.5*	*10.68*	*159*	*6*	*0.013*	0.0051	0.26
K8:11	K8:2	0: Gravity Main	1950	K-8	CONC	6.37	6	124	12	0.013	0.0030	1.26
K8:12	K8:11	0: Gravity Main	1950	K-8	CONC	7.4	6.76	300	12	0.013	0.0021	1.06
K8:13	K8:12	0: Gravity Main	1951	K-8	CONC	7.97	7.39	314	12	0.013	0.0018	0.99
K8:14	K8:13	0: Gravity Main	1951	K-8	CONC	8.56	7.97	250	12	0.013	0.0024	1.12
K8:15	K8:14	0: Gravity Main	0	K-8	CONC	9.35	8.57	262	6	0.013	0.0030	0.20
K8:16	K8:14	0: Gravity Main	0	K-8	CONC	8.92	8.77	275	12	0.013	0.0005	0.54
K8:17	K8:16	0: Gravity Main	1951	K-8	CONC	9.68	9.05	300	12	0.013	0.0021	1.06
K8:18	K8:17	0: Gravity Main	1951	K-8	CONC	10.37	9.7	299	12	0.013	0.0022	1.09
K8:19	K8:18	0: Gravity Main	1951	K-8	CONC	10.84	10.39	194	12	0.013	0.0023	1.11
K8:2	K8:3	0: Gravity Main	1950	K-8	CONC	4.55	4.57	5	12	0.013	Rev. Grd.	N/A
K8:20	K8:13	0: Gravity Main	0	K-8	CONC	10.17	7.94	287	8	0.013	0.0078	0.69
K8:21	K8:13	0: Gravity Main	1951	K-8	CONC	8.86	8	250	10	0.013	0.0034	0.83
K8:22	K8:21	0: Gravity Main	0	K-8	CONC	9.33	8.93	146	8	0.013	0.0027	0.41
K8:23	K8:22	0: Gravity Main	0	K-8	CONC	10.6	9.45	302	8	0.013	0.0038	0.48
K8:24	K8:23	0: Gravity Main	1951	K-8	CONC	12.29	10.62	291	6	0.013	0.0057	0.27
K8:25	K8:23	0: Gravity Main	0	K-8	CONC	11.45	10.56	240	8	0.013	0.0037	0.48
K8:26	K8:25	0: Gravity Main	0	K-8	CONC	12.44	11.59	229	8	0.013	0.0037	0.48
K8:27	K8:21	0: Gravity Main	0	K-8	CONC	9.58	8.86	315	8	0.013	0.0023	0.37
K8:28	K8:27	0: Gravity Main	0	K-8	CONC	10.57	9.57	285	8	0.013	0.0035	0.46
K8:29	K8:28	0: Gravity Main	0	K-8	CONC	12.03	10.59	301	8	0.013	0.0048	0.54
K8:3	K8:1	0: Gravity Main	1950	K-8	CONC	1.83	1.2	261	24	0.013	0.0024	7.19
K8:30	K8:29	0: Gravity Main	0	K-8	CONC	13.09	12.04	282	8	0.013	0.0037	0.48
K8:31	K8:27	0: Gravity Main	0	K-8	CONC	12.4	11.15	288	8	0.013	0.0043	0.51
K8:32	K8:31	0: Gravity Main	0	K-8	CONC	13.04	12.39	285	6	0.013	0.0023	0.17
K8:33	K8:31	0: Gravity Main	0	K-8	CONC	13.52	12.43	311	8	0.013	0.0035	0.46

Upstream Node	Downstream Node	TYPE	YR_INST	ZONE	MATERIAL	FROM_INV	TO_INV	LENGTH	DIAMETER	COEFF	Slope (ft/FT)	Pipe Capacity (mgd)
K8:34	K8:33	0: Gravity Main	0	K-8	CONC	14.82	13.52	299	8	0.013	0.0043	0.51
K8:35	K8:34	0: Gravity Main	0	K-8	CONC	16.04	14.72	328	8	0.013	0.0040	0.50
K8:36	K8:31	0: Gravity Main	0	K-8	CONC	13.35	12.49	250	8	0.013	0.0034	0.46
K8:36	K8:26	0: Gravity Main	0	K-8	CONC	13.41	12.45	231	8	0.013	0.0042	0.50
K8:37	K8:36	0: Gravity Main	0	K-8	CONC	14.29	13.43	231	8	0.013	0.0037	0.48
K8:38	K8:37	0: Gravity Main	0	K-8	CONC	15.32	14.31	230	8	0.013	0.0044	0.52
K8:39	K8:38	0: Gravity Main	0	K-8	CONC	16.22	15.35	277	8	0.013	0.0031	0.44
K8:4	K8:2	0: Gravity Main	0	K-8	CONC	5.25	4.51	132	8	0.013	0.0056	0.59
K8:40	K8:39	0: Gravity Main	0	K-8	CONC	17.42	16.22	251	8	0.013	0.0048	0.54
K8:41	K8:3	0: Gravity Main	0	K-8	CONC	2.34	1.65	259	24	0.013	0.0027	7.55
K8:42	K8:41	0: Gravity Main	0	K-8	CONC	2.58	2.3	260	24	0.013	0.0011	4.80
K8:43	K8:42	0: Gravity Main	0	K-8	CONC	3.48	2.75	276	24	0.013	0.0026	7.52
K8:43A	*K8:43*	*0: Gravity Main*	*1990*	*K-8*	*CONC*	*4.8*	*3.96*	*184*	*8*	*0.013*	0.0046	0.53
K8:43B	*K8:43*	*0: Gravity Main*	*0*	*K-8*	*CONC*	*4.67*	*3.87*	*186*	*8*	*0.013*	0.0043	0.51
K8:44	K8:30	0: Gravity Main	1998	K-8	PVC	13.52	13.28	118	8	0.013	0.0020	0.35
K8:44A	*K8:44*	*0: Gravity Main*	*1998*	*K-8*	*PVC*	*14.2*	*13.42*	*215*	*8*	*0.013*	0.0036	0.47
K8:45	K8:19	0: Gravity Main	0	K-8	PVC	11.33	10.94	130	10	0.013	0.0030	0.77
K8:45	K7:19	0: Gravity Main	0	K-7	PVC	12.25	4.68	321	8	0.013	0.0236	1.20
K8:46	K8:45	0: Gravity Main	0	K-8	PVC	12.24	11.49	209	10	0.013	0.0036	0.85
K8:47	K8:46	0: Gravity Main	0	K-8	PVC	12.34	12.12	41	10	0.013	0.0053	1.03
K8:5	K8:4	0: Gravity Main	0	K-8	CONC	6.07	5.25	244	8	0.013	0.0034	0.45
K8:6	K8:5	0: Gravity Main	0	K-8	CONC	7.38	6.09	300	8	0.013	0.0043	0.51
K8:7	K8:6	0: Gravity Main	0	K-8	CONC	8.59	7.44	301	8	0.013	0.0038	0.48
K8:7A	*K8:7*	*0: Gravity Main*	*0*	*K-8*	*CONC*	*11.23*	*10.53*	*121*	*6*	*0.013*	0.0058	0.28
K8:8	K8:5	0: Gravity Main	0	K-8	CONC	7.05	6.09	266	8	0.013	0.0036	0.47
K8:8A	*K8:8*	*0: Gravity Main*	*0*	*K-8*	*CONC*	*8.06*	*7.06*	*195*	*6*	*0.013*	0.0051	0.26
K8:9	K8:8	0: Gravity Main	0	K-8	PVC	8.47	7.11	300	8	0.013	0.0045	0.53
K9:1	K7:3	0: Gravity Main	0	K-9	CONC	1.21	2.65	183	30	0.013	Rev. Grd.	N/A
K9:10	K9:9	0: Gravity Main	1950	K-9	CONC	9.84	9.08	222	8	0.013	0.0034	0.46
K9:11	K9:8	0: Gravity Main	1950	K-9	CORR	7.49	7.37	99	30	0.013	0.0012	9.23
K9:12	K9:11	0: Gravity Main	1950	K-9	CORR	6.87	7.38	124	30	0.013	Rev. Grd.	N/A
K9:12A	*K9:12*	*0: Gravity Main*	*1950*	*K-9*	*CONC*	*10.4*	*9.12*	*256*	*6*	*0.013*	0.0050	0.26
K9:13	K9:16	0: Gravity Main		K-9	CONC	8.04	7.11	89	12	0.013	0.0104	2.35
K9:14	K9:13	0: Gravity Main	1950	K-9	CONC	7.09	8.12	160	12	0.013	Rev. Grd.	N/A
K9:14A	K9:14	0: Gravity Main		K-9	PVC	10.51	9.53	99	8	0.013	0.0099	0.78
K9:14B	K9:14D	0: Gravity Main	0	K-9	PVC	11.67	10.74	203	8	0.013	0.0046	0.53
K9:14C	K9:14B	0: Gravity Main	0	K-9	PVC	12.89	11.73	226	8	0.013	0.0051	0.56
K9:14D	K9:14A	0: Gravity Main		K-9	PVC	10.57	10.57	31	8	0.013	0.0000	0.00
K9:15	K9:14	0: Gravity Main	1950	K-9	CONC	9.98	7.09	325	12	0.013	0.0089	2.17
K9:16	K9:12	0: Gravity Main		K-9	CONC	7	7.02	320	12	0.013	Rev. Grd.	N/A
K9:17	K9:15	0: Gravity Main	1950	K-9	CONC	16.11	10.31	84	6	0.013	0.0687	0.95
K9:18	K9:17	0: Gravity Main	1950	K-9	CONC	57.84	18.1	135	6	0.013	0.2945	1.97
K9:19	K9:18	0: Gravity Main	1950	K-9	CONC	67.9	59.29	88	6	0.013	0.0980	1.14
K9:1A	*K9:1*	*0: Gravity Main*	*0*	*K-9*	*CAST*	*17.57*	*16.17*	*360*	*8*	*0.013*	0.0039	0.49
K9:2	K9:1	0: Gravity Main	0	K-9	CONC	2.22	2.2	304	24	0.013	0.0001	1.19
K9:20	K9:19	0: Gravity Main	1950	K-9	CONC	70.15	68.02	51	6	0.013	0.0416	0.74

Upstream Node	Downstream Node	TYPE	YR_INST	ZONE	MATERIAL	FROM_INV	TO_INV	LENGTH	DIAMETER	COEFF	Slope (ft/FT)	Pipe Capacity (mgd)
K9:21	K9:20	0: Gravity Main	1950	K-9	CONC	89.93	72.13	243	6	0.013	0.0734	0.98
K9:21A	*K9:21*	*0: Gravity Main*	*1950*	*K-9*	*CONC*	*93*	*92.53*	*142*	*6*	*0.013*	0.0033	0.21
K9:22	K9:12	0: Gravity Main	1950	K-9	CONC	11.79	7.97	105	8	0.013	0.0364	1.49
K9:23	K9:22	0: Gravity Main	1950	K-9	CLAY	27.36	11.99	189	8	0.013	0.0815	2.23
K9:24	K9:23	0: Gravity Main	1950	K-9	CLAY	29.92	27.38	287	8	0.013	0.0089	0.74
K9:26	*K9:24*	*0: Gravity Main*	*1950*	*K-9*	*CONC*	*55*	*29.92*	*151*	*6*	*0.013*	0.1658	1.48
K9:27	*K9:26*	*0: Gravity Main*	*0*	*K-9*	*CONC*	*77.9*	*55*	*153*	*6*	*0.013*	0.1501	1.41
K9:27A	K9:27	0: Gravity Main	0	K-9	CONC	85.34	78.33	29	6	0.013	0.2378	1.77
K9:28	K9:27A	0: Gravity Main	0	K-9	PVC	94.84	85.85	79	8	0.013	0.1140	2.64
K9:29	K9:28	0: Gravity Main	1950	K-9	CONC	99.34	95.02	88	6	0.013	0.0493	0.81
K9:3	K9:2	0: Gravity Main	0	K-9	CONC	3.57	2.26	298	24	0.013	0.0044	9.70
K9:30	*K9:26*	*0: Gravity Main*	*0*	*K-9*	*CONC*	*85.46*	*55*	*187*	*6*	*0.013*	0.1629	1.46
K9:31	K9:30	0: Gravity Main	1950	K-9	CONC	90.93	88.65	116	6	0.013	0.0197	0.51
K9:32	K9:31	0: Gravity Main	1950	K-9	CONC	120.36	93.14	331	6	0.013	0.0824	1.04
K9:32A	*K9:32*	*0: Gravity Main*	*0*	*K-9*	*CONC*	*121*	*120.46*	*140*	*6*	*0.013*	0.0038	0.22
K9:34	K9:6	0: Gravity Main	1950	K-9	CONC	6.73	5.36	244	21	0.013	0.0056	7.68
K9:35	K9:34	0: Gravity Main	0	K-9	PVC	9.31	7.19	259	8	0.013	0.0082	0.71
K9:36	K9:34	0: Gravity Main	0	K-9	PVC	9.25	7.69	300	8	0.013	0.0052	0.56
K9:36A	*K9:36*	*0: Gravity Main*	*0*	*K-9*	*PVC*	*10*	*9.28*	*112*	*8*	*0.013*	0.0064	0.63
K9:36B	*K9:36*	*0: Gravity Main*	*0*	*K-9*	*PVC*	*9.5*	*9.17*	*73*	*6*	*0.013*	0.0045	0.24
K9:37	K9:34	0: Gravity Main	1950	K-9	CONC	7.58	6.75	251	21	0.013	0.0033	5.89
K9:38	K9:37	0: Gravity Main	0	K-9	PVC	9.51	8.38	322	8	0.013	0.0035	0.46
K9:38A	*K9:38*	*0: Gravity Main*	*0*	*K-9*	*PVC*	*10.5*	*9.7*	*124*	*6*	*0.013*	0.0064	0.29
K9:39A	K9:37	0: Gravity Main	0	K-9	PVC	9.99	8.53	376	8	0.013	0.0039	0.49
K9:39B	K9:39A	0: Gravity Main	0	K-9	PVC	19.53	11.03	111	8	0.013	0.0768	2.17
K9:39C	*K9:39B*	*0: Gravity Main*	*0*	*K-9*	*PVC*	*20*	*19.59*	*103*	*8*	*0.013*	0.0040	0.49
K9:4	K9:3	0: Gravity Main	0	K-9	CONC	4.49	3.62	377	24	0.013	0.0023	7.02
K9:40	K9:37	0: Gravity Main	1950	K-9	CONC	8.53	7.66	299	21	0.013	0.0029	5.52
K9:40A	K9:40	0: Gravity Main	0	K-9	CONC	9.33	8.43	242	21	0.013	0.0037	6.25
K9:40B	K9:40A	0: Gravity Main	0	K-9	CONC	10.99	10.12	376	18	0.013	0.0023	3.27
K9:40C	*K9:42*	*0: Gravity Main*	*0*	*K-9*	*CONC*	*12.09*	*10.99*	*253*	*15*	*0.013*	0.0043	2.75
K9:41	K9:40A	0: Gravity Main	0	K-9	CONC	9.77	9.49	52	21	0.013	0.0054	7.51
K9:42	K9:41	0: Gravity Main	0	K-9	CONC	10.97	9.92	253	15	0.013	0.0041	2.69
K9:43	K9:40B	0: Gravity Main	0	K-9	CONC	11.53	11.06	285	18	0.013	0.0017	2.76
K9:44	K9:44A	0: Gravity Main	0	K-9	CONC	14.52	14.46	13	6	0.013	0.0047	0.25
K9:44	K9:40C	0: Gravity Main	0	K-9	CONC	12.71	12.09	131	15	0.013	0.0047	2.87
K9:44A	K9:43	0: Gravity Main	0	K-9	CONC	12.67	12.22	129	18	0.013	0.0035	4.01
K9:44B	K9:44A	0: Gravity Main	0	K-9	PVC	16.47	14.59	201	8	0.013	0.0093	0.75
K9:44C	K9:44A	0: Gravity Main	0	K-9	CONC	12.97	12.83	90	18	0.013	0.0016	2.68
K9:44D	K9:44	0: Gravity Main	0	K-9	CONC	13.29	12.73	99	15	0.013	0.0056	3.13
K9:44D	K9:44C	0: Gravity Main	0	K-9	CONC	13.07	13.12	13	15	0.013	Rev. Grd.	N/A
K9:46	K10:7	0: Gravity Main	0	K-9	PVC	11.64	12.22	238	12	0.013	Rev. Grd.	N/A
K9:47	K9:46	0: Gravity Main	0	K-9	PVC	14.2	11.94	346	8	0.013	0.0065	0.63
K9:48	K9:46	0: Gravity Main	0	K-9	PVC	12.89	11.69	245	12	0.013	0.0049	1.61
K9:49	K9:48	0: Gravity Main	0	K-9	PVC	13.81	12.81	425	12	0.013	0.0024	1.12
K9:49A	*K9:49*	*0: Gravity Main*	*0*	*K-9*	*PVC*	*15.07*	*13.87*	*270*	*8*	*0.013*	0.0044	0.52

Upstream Node	Downstream Node	TYPE	YR_INST	ZONE	MATERIAL	FROM_INV	TO_INV	LENGTH	DIAMETER	COEFF	Slope (ft/FT)	Pipe Capacity (mgd)
K9:5	K9:5A	0: Gravity Main	0	K-9	CONC	5.17	4.83	206	24	0.013	0.0016	5.94
K9:50	K9:49	0: Gravity Main	0	K-9	PVC	16.53	13.81	343	8	0.013	0.0079	0.70
K9:50A	K9:50	0: Gravity Main	0	K-9	PVC	17.83	16.63	274	8	0.013	0.0044	0.52
K9:51	K9:50	0: Gravity Main	0	K-9	PVC	17.33	16.67	151	8	0.013	0.0044	0.52
K9:51A	K9:51	0: Gravity Main	0	K-9	PVC	18.15	17.35	202	8	0.013	0.0040	0.49
K9:5A	K9:4	0: Gravity Main	0	K-9	CONC	4.74	4.59	201	24	0.013	0.0007	3.99
K9:5B	TEE	0: Gravity Main	0	K-9	PVC	10.63	10.03	206	6	0.013	0.0029	0.20
K9:5C	TEE	0: Gravity Main	0	K-9	PVC	10.28	10.03	54	6	0.013	0.0046	0.25
K9:5C	K9:5B	0: Gravity Main	0	K-9	PVC	11.05	10.9	28	6	0.013	0.0054	0.27
K9:5D	K9:5C	0: Gravity Main	0	K-9	PVC	10.5	10.28	4	6	0.013	0.0613	0.90
K9:6	K9:5	0: Gravity Main	1950	K-9	CMP	4.96	4.98	173	24	0.013	Rev. Grd.	N/A
K9:7	K9:6	0: Gravity Main	1950	K-9	CONC	7.05	5.59	290	12	0.013	0.0050	1.63
K9:8	K9:7	0: Gravity Main	1950	K-9	CONC	7.37	6.89	166	12	0.013	0.0029	1.24
K9:9	K9:8	0: Gravity Main	1950	K-9	CONC	8.93	7.81	177	8	0.013	0.0063	0.62
Stub	K1:57	0: Gravity Main	2004	K-1	PVC	11.32	10.32	240	8	0.013	0.0042	0.50
Stub	K1:54A	0: Gravity Main	0	K-1	CONC	0	17.33	210	6	0.013	Rev. Grd.	N/A
Stub	K1:37A	0: Gravity Main	0	K-1	PVC	0	8.36	320	8	0.013	Rev. Grd.	N/A
Stub	K9:15	0: Gravity Main	0	K-9	CONC	0	10.22	516	6	0.013	Rev. Grd.	N/A
Stub	K1:37A	0: Gravity Main	0	K-1	PVC	0	9.82	516	8	0.013	Rev. Grd.	N/A
TEE	K4:21A	0: Gravity Main	1921	K-4	CONC	20.98	20.54	163	6	0.013	0.0027	0.19
TEE	K9:5A	0: Gravity Main	0	K-9	PVC	10.03	9.61	143	6	0.013	0.0029	0.20
TEE	K3:27A	0: Gravity Main	0	K-3	CLAY	63.43	62.09	267	6	0.013	0.0050	0.26
TEE	K12:41	0: Gravity Main	1957	K-12	CONC	221.35	220.5	162	6	0.013	0.0053	0.26
TEE	TEE	0: Gravity Main	0	K-13	CONC	161.75	160.94	149	6	0.013	0.0054	0.27
TEE	K13:64	0: Gravity Main	1957	K-13	CONC	299.35	298.35	178	6	0.013	0.0056	0.27
TEE	K12:43	0: Gravity Main	0	K-12	CONC	222.79	222.29	72	6	0.013	0.0069	0.30
TEE	K12:50	0: Gravity Main	1962	K-12	CONC	29.6	28.99	165	8	0.013	0.0037	0.47
TEE	K13:15	0: Gravity Main	0	K-13	CONC	160.94	160.34	152	8	0.013	0.0040	0.49
TEE	K3:2	0: Gravity Main	1950	K-3	CONC	26.64	20.27	258	6	0.013	0.0247	0.57
TEE	K6:14	0: Gravity Main	1951	K-6	CLAY	16.55	14.93	277	8	0.013	0.0058	0.60
TEE	K12:15	0: Gravity Main	1957	K-12	CONC	176.26	175.58	113	8	0.013	0.0060	0.61
TEE	K6:37	0: Gravity Main	1950	K-6	CLAY	49.63	49.35	41	8	0.013	0.0069	0.65
TEE	K12:34	0: Gravity Main	1957	K-12	CONC	369.96	350.41	201	6	0.013	0.0973	1.13
TEE	K13:11	0: Gravity Main	1962	K-13	CONC	144.57	131.75	219	8	0.013	0.0587	1.89
TEE	K12:23	0: Gravity Main	1957	K-12	CONC	216.28	197.4	190	8	0.013	0.0994	2.46
TEE	K12:25	0: Gravity Main	1957	K-12	CONC	243.13	234.11	64	8	0.013	0.1400	2.92
TEE	K13:63	0: Gravity Main	1957	K-13	CONC	264.71	252.37	83	8	0.013	0.1493	3.02

Appendix E

Flow Projections

Table E.1 - Development Since the 1993 G&O Flow Study to 2010

Residential Development	'93 Flow Basin	Nearby MH	Dia Pipe IN	Length FT	In-Mi	GPD/In-Mi	I/I GPD	# ERU'S	GPD per House	ADF GPD	Peak Factor	PHF GPD	PHF + I/I GPD
Mt. Brynion Estates	8	K10:36	8	3,811	5.77	5,000	29,000	41	200	8,000	4	32,000	61,000
Highlander Estates	8	K10:36	8	4,033	6.11	5,000	31,000	60	200	12,000	4	48,000	79,000
Cedar Falls	10	K14:5A/38	8	2,757	4.18	5,000	21,000	60	200	12,000	4	48,000	69,000
Lower Ridge Subdivision	1	K1:125	15	1,408	4.00	5,000	20,000	28	200	6,000	4	24,000	44,000
Summerwind Apartments	8	K10:31	8	930	1.41	5,000	7,000	83	200	17,000	4	68,000	75,000
Corduroy and Allen St. Apartments	8	K10:31	8	500	0.76	5,000	4,000	30	200	6,000	4	24,000	28,000

Note: Flows in residential areas were developed for buildout.

Industrial/Commercial Development	'93 Flow Basin	Nearby MH	Dia Pipe IN	Length FT	In-Mi	GPD/In-Mi	I/I GPD	Acres	GPD per Acre	ADF GPD	Peak Factor	PHF GPD	PHF + I/I GPD
Talley Way Spur (Light Industrial)	11	K17:36	10	700	1.33	5,000	7,000	13	1,250	16,000	4	64,000	71,000
Coweeman Park (Commercial)	11	K17:55	10	851	1.61	5,000	8,000	-	-	5,000	4	20,000	28,000
Foster Farms	11	K17:39	-	-	-	-	-	-	-	1,500,000	1.5	2,250,000	2,250,000
Hazel (Light Industrial)	11	K17:39	15	590	1.68	5,000	8,000	10	1,250	13,000	4	52,000	60,000
Total Flow From New Developments:							**135,000**			**1,595,000**		**2,630,000**	**2,765,000**

Table E.2 - Future Development Year 2010-2030

Residential Development	Zone	Flow Basin	MH Assigned	I/I GPD			# ERU's	GPD per House	ADF GPD	Peak Factor	PHF GPD	PHF+I/I GPD
Cedar Falls Road Ext.	RSF-10	10	K14:39A	1,000			20	200	4,000	4	16,000	17,000
	RSF-15	10	K14:39A	1,000			20	200	4,000	4	16,000	17,000
South River Road Ext.	RMF	11	K17:2	5,000			80	200	16,000	4	64,000	69,000
	RSF-5	11	K17:2	7,000			107	200	21,000	4	84,000	91,000
Rocky Point Ext.	RSF-5	1	K1:141	20,000			319	200	64,000	4	256,000	276,000
Mt. Brynion Rd. Sewer Ext.	RSF-10	9	K13:38	4,000			72	200	14,000	4	56,000	60,000
East Allen St. Sewer Ext.	RSF-15	8	K10:31	7,000			104	200	21,000	4	84,000	91,000
Valley View Ext.	RSF-15	11	K16:134A	2,000			25	200	5,000	4	20,000	22,000
South Pacific Ave Ext.	RSF-5	11	K17:7	12,000			192	200	38,000	4	152,000	164,000
							939					

Industrial/Commercial Development	Zone	Flow Basin	MH Assigned	I/I GPD	Acres			GPD per Acre	ADF Gallons	Peak Factor	PHF GPD	PHF+I/I GPD
Talley Way Ext.	Commercial/ Retail	11	K17:55	20,000	80	-	-	1,250	100,000	4	400,000	420,000
Coweeman Park (Buildout)	Commercial/ Retail	11	K17:57A	6,000	25	-	-	1,250	31,000	4	124,000	130,000
Talley Way Spur (Buildout)	Light Industrial	11	K17:36D	4,000	18	-	-	1250	22,000	4	88,000	92,000
Walnut Ext.	Light Industrial	11	K17:44	7,000	28	-	-	1250	35,000	4	140,000	147,000
South Pacific Ave Ext.	Light Industrial/ Commercial	11	K17:7	5,000	22	-	-	1250	27,000	4	108,000	113,000
Hazel St. Ext.	Light Industrial/ Commercial	11	K17:39B	6,000	25	-	-	1250	31,000	4	124,000	130,000
					197							
Total Flow From Future Developments:				**107,000**					**433,000**		**1,732,000**	**1,839,000**

Note: ERU's based on current number of houses in future service areas with 1% growth compounded annually to 2030.

Table E.3 - Future Development Buildout

Residential Development	Zone	Flow Basin	MH Assigned	I/I GPD	Acres	Density (Units/ Acre)	# ERU's	GPD per House	ADF GPD	Peak Factor	PHF GPD	PHF+I/I GPD
Cedar Falls Road Ext.	RSF-10	10	K14:39A	19,000	72	4	310	200	62,000	4	248,000	267,000
	RSF-15	10	K14:39A	13,000	72	3	209	200	42,000	4	168,000	181,000
South River Road Ext.	RMF	11	K17:2	69,000	34	32	1,099	200	220,000	4	880,000	949,000
	RSF-5	11	K17:2	41,000	76	9	661	200	132,000	4	528,000	569,000
Rocky Point Ext.	RSF-5	1	K1:141	92,000	169	9	1,470	200	294,000	4	1,176,000	1,268,000
Mt. Brynion Rd. Sewer Ext.	RSF-10	9	K13:38	37,000	148	4	592	200	118,000	4	472,000	509,000
East Allen St. Sewer Ext.	RSF-15	8	K10:31	76,000	405	3	1,215	200	243,000	4	972,000	1,048,000
Valley View Ext.	RSF-15	11	K16:134A	26,000	137	3	411	200	82,000	4	328,000	354,000
South Pacific Ave Ext.	RSF-5	11	K17:7	43,000	80	9	693	200	139,000	4	556,000	599,000
					1,193		6,660					

Industrial/Commercial Development	Zone	Flow Basin	MH Assigned	I/I GPD	Acres			GPD per Acre	ADF Gallons	Peak Factor	PHF GPD	PHF+I/I GPD
Talley Way Ext.	Commercial/ Retail	11	K17:55	20,000	80	-	-	1,250	100,000	4	400,000	420,000
Coweeman Park (Buildout)	Commercial/ Retail	11	K17:57A	6,000	25	-	-	1,250	31,000	4	124,000	130,000
Talley Way Spur (Buildout)	Light Industrial	11	K17:36D	4,000	18	-	-	1250	22,000	4	88,000	92,000
Walnut Ext.	Light Industrial	11	K17:44	7,000	28	-	-	1250	35,000	4	140,000	147,000
South Pacific Ave Ext.	Light Industrial/ Commercial	11	K17:7	5,000	22	-	-	1250	27,000	4	108,000	113,000
Hazel St. Ext.	Light Industrial/ Commercial	11	K17:39B	6,000	25	-	-	1250	31,000	4	124,000	130,000
					172							
Total Flow From Future Developments:				**464,000**					**1,578,000**		**6,312,000**	**6,776,000**

Appendix F

Sewer Rate Ordinance

ORDINANCE NO. 09-3698

AN ORDINANCE OF THE CITY OF KELSO AMENDING ORDINANCE NO. 08-3688 DEALING WITH WATER AND SEWER RATES TO CORRECT A TYPOGRAPHICAL ERROR AND MAKING THE RATES ADOPTED RETROACTIVE TO JANUARY 1, 2009.

THE CITY COUNCIL OF THE CITY OF KELSO DO ORDAIN AS FOLLOWS:

SECTION 1. That Ordinance No. 08-3688 is hereby amended to provide as follows:

1. Water Rates for All Residential and Commercial Users within the Corporate Limits:

BI-MONTHLY CHARGES:

Meter Size (In Inches)	2009	2010	2011	2012	2013	2014
3/4 X 5/8	$ 15.46	$ 16.62	$ 17.87	$ 19.21	$ 20.65	$ 22.20
1	$ 31.93	$ 34.33	$ 36.91	$ 39.68	$ 42.66	$ 45.86
1.5	$ 59.80	$ 64.29	$ 69.12	$ 74.31	$ 79.89	$ 85.89
2	$ 92.96	$ 99.94	$ 107.44	$ 115.50	$ 124.17	$ 133.49
3	$ 181.58	$ 195.20	$ 209.84	$ 225.58	$ 242.50	$ 260.69
4	$ 281.51	$ 302.63	$ 325.33	$ 349.73	$ 375.96	$ 404.16
6	$ 891.68	$ 958.56	$1,030.46	$1,107.75	$1,190.84	$1,280.16
8	$1,239.52	$1,332.49	$1,432.43	$1,539.87	$1,655.36	$1,779.52
10	$1,781.60	$1,915.44	$2,059.10	$2,213.54	$2,379.56	$2,558.03

In addition to the fixed charge set forth above, each residential and commercial water customer of the utility shall pay an additional sum for every 100 cubic fee of water consumed.

2009	2010	2011	2012	2013	2014
$2.27	$2.44	$2.62	$2.82	$3.03	$3.26

2. Water Rates for all Industrial Users with the Corporate Limits:

BI-MONTHLY CHARGES

Meter Size (In Inches)	2009	2010	2011	2012	2013	2014
2	~~$ 2,722.66~~ *$ 2,529.15*	~~$ 2,926.86~~ *$ 2,718.84*	~~$ 3,146.38~~ *$ 2,922.75*	~~$ 3,382.36~~ *$ 3,141.96*	~~$ 3,636.04~~ *$ 3,377.61*	~~$ 3,908.75~~ *$ 3,630.93*
3	$ 5,059.52	$ 5,438.99	$ 5,846.92	$ 6,285.44	$ 6,756.85	$ 7,263.62
4	$ 7,907.25	$ 8,500.30	$ 9,137.83	$ 9,823.17	$10,559.91	$11,351.91
6	$15,810.86	$16,996.69	$18,271.44	$19,641.80	$21,134.58	$22,719.68
8	$25,297.61	$27,194.93	$29,234.55	$31,427.15	$33,784.19	$36,318.01
10	$36,362.64	$39,089.84	$42,021.58	$45,173.20	$48,561.19	$52,203.28

In addition to the fixed charge above, each industrial water customer of the utility shall pay an additional sum for every 100 cubic feet of water consumed.

2009	2010	2011	2012	2013	2014
~~$1.70~~	~~$1.83~~	~~$1.96~~	~~$2.11~~	~~$2.27~~	~~$2.44~~
$1.58	*$1.70*	*$1.83*	*$1.96*	*$2.11*	*$2.27*

Customers must consume a minimum of 25,000 cubic feet per day of water to qualify as an industrial user.

3. Private Fire System Connections shall be as follows:

"Connection" shall mean individual line size (not size of water appurtenance).

Bi Monthly Charge:

Connection Size	2009	2010	2011	2012	2013	2014
4"	$ 38.15	$ 41.01	$ 44.09	$ 47.40	$ 50.95	$ 54.77
6"	$ 76.23	$ 81.95	$ 88.09	$ 94.70	$ 101.80	$ 109.44
8"	$ 131.18	$ 141.02	$ 151.60	$ 162.97	$ 175.19	$ 188.33
10"	$ 182.46	$ 196.14	$ 210.86	$ 226.67	$ 243.67	$ 261.94

4. Service Outside City Limits:

The normal rates for water and sewer service to individual accounts located outside the City boundaries shall be 1.5 times the in-City rate.

5. New Connection Charges:

For new water service connections, the meter installation charge shall be as follows:

CONNECTION SIZE	INSIDE CITY	OUTSIDE CITY
3/4 x 5/8 meter set only	$356.00	$ 534.00
1" meter set only	$750.00	$1,125.00

Over 1 inch to be charged on actual construction costs, including labor, materials, equipment, plus 15% overhead (or customer can have contractor install per City specifications). The City does not construct service lines; these must be constructed to City standards by a licensed contractor.

6. Wholesale or Bulk Resale Rates:

Rates charged to other public entities for bulk water for resale purposes shall be at a rate for every 100 cubic feet of water delivered, plus the applicable minimum service charge for the metered connection, as follows:

2009	2010	2011	2012	2013	2014
$0.96	$1.03	$1.11	$1.19	$1.28	$1.37

Bi Monthly Charge:

Connection Size	2009	2010	2011	2012	2013	2014
1"	$ 24.82	$ 26.68	$ 28.68	$ 30.84	$ 33.15	$ 35.63
1.5"	$ 37.01	$ 39.79	$ 42.77	$ 45.98	$ 49.43	$ 53.14
2"	$ 55.23	$ 59.38	$ 63.83	$ 68.62	$ 73.76	$ 79.29
3"	$ 111.37	$ 119.72	$ 128.70	$ 138.35	$ 148.73	$ 159.89
4"	$ 185.35	$ 199.25	$ 214.20	$ 230.26	$ 247.53	$ 266.10
6"	$ 278.37	$ 299.25	$ 321.69	$ 345.82	$ 371.76	$ 399.64

7. Sewer Rates for All Residential and Commercial Users within the Corporate Limits

BI-MONTHLY CHARGE

SERVICE TYPE

A. All residential dwellings

2009	2010	2011	2012	2013	2014
$ 95.57	$ 98.44	$ 101.39	$ 104.43	$ 107.57	$ 108.96

B. Apartments (Plus $5.89 per 100 cubic feet of water consumed in excess of 1300 cubic feet)

2009	2010	2011	2012	2013	2014
$ 95.57	$ 98.44	$ 101.39	$ 104.43	$ 107.57	$ 108.96

C. (1) All Commercial Users

2009	2010	2011	2012	2013	2014
$ 95.57	$ 98.44	$ 101.39	$ 104.43	$ 107.57	$ 108.96

(2) In addition, all commercial users consuming a quantity of water greater than 1300 cubic feet shall be charged for every 100 cubic feet of water consumed in excess of 1300 cubic feet.

2009	2010	2011	2012	2013	2014
~~$6.33~~	~~$6.81~~	~~$7.32~~	~~$7.87~~	~~$8.46~~	~~$9.09~~
$5.89	*$6.07*	*$6.25*	*$6.44*	*$6.63*	*$6.70*

8. Sewer Rates for All industrial Users within the Corporate Limits:

All industrial customers shall pay the following sewer rates based on water consumption:

BI-MONTHLY FIXED CHARGE

2009	2010	2011	2012	2013	2014
$ 7.56	$ 7.79	$ 8.02	$ 8.26	$ 8.51	$ 8.62

VOLUME CHARGE

	2009	2010	2011	2012	2013	2014
Per CCF	$ 2.99	$ 3.08	$ 3.17	$ 3.27	$ 3.37	$ 3.41

Customer must consume a minimum of 25,000 cubic feet per day of water to qualify as an industrial customer.

9. Treatment of "High Strength Waste" – Surcharge:

In the event that "high strength waste" is accepted for treatment by the Facilities, a surcharge shall be imposed and paid to the TRRWA in addition to any other charges for sewage treatment as follows:

BOD:	$ 0.40 per pound
Suspended Solids (SS):	$ 0.55 per pound

Such surcharge shall be assessed to "high strength waste" which is hereby defined to be waste that is in excess of a baseline concentration of 250 mg/l.

Such surcharge shall be calculated as follows:

BOD: (concentration [mg/l] – 250 mg/l) x 8.34 x flow (mgd) x $0.40
SS: (concentration [mg/l] – 250 mg/l) x 8.34 x flow (mgd) x $0.55

10. Miscellaneous

1. The City does not tap the sewer main for side-sewers. This work must be completed by a licensed contractor.

2. Sewer service calls at cost of labor, material, and equipment with a minimum of $50.00 per call.

3. Turn-on fee for new customers or for water that was temporarily turned off $10.00.

4. Water reconnection fee after water is turned off for non-payment but not padlocked is $35.00. Padlock fee is an additional $10.00.

5. Penalty for meter tampering is $100.00 to be paid as a condition to resumption of service.

6. Meter removal charge is $75.00. (Meters are removed where, in the City's judgment, such is necessary to insure that water will not be used without authorization.

7. Water and Sewer Adjustments

a. Water charge adjustments for water leaks will be allowed where sufficient evidence is presented to the City to show that water registering on the meter was not consumed for domestic purposes but was due to leaks or damage on customer's side of the meter, which has been repaired and approved by the Public Works Director or his designee, an adjustment may be made by payment of a pumping charge of $0.58 per 100 cubic feet in lieu of the normal consumption rates. Such rates shall only be applied to that portion of consumption that exceeded annual monthly average amounts of consumption (base amount) for representative period where no leak or damage effected water consumption.

b. Sewer charges exceeding the base amount will be adjusted by estimating the quantity of wastewater entering the sewer system. The maximum adjustment period shall be two months.

All other adjustments shall be determined on a case-by-case basis by the Public Works Director. A utility customer who suffers a monetary loss for water or sewer services without fault or neglect on the part of the utility customer shall notify the City's Public Works Department in writing setting forth the facts and circumstances surrounding the loss.

The Public Works Department shall do an investigation and make a determination on whether the utility customer is due an adjustment on his utility bill and the amount of said adjustment, if any, or whether no adjustment is due the utility customer. The City shall then notify the customer in writing of said determination. If an adjustment is due the utility customer, said adjustment will be reflected on the utility customer's next normal billing cycle.

For water leaks wherein that water does not return to the sewer, the Public Works Director or his designee may estimate the quantity and make the appropriate fee adjustment.

If a determination is made that an adjustment is not due the utility customer, the utility customer may appeal this determination. A notice of appeal shall be made in writing to the City Clerk describing the basis for the appeal not more than ten days after notice to the utility customer of the determination which forms the basis for the appeal. Thereafter, an appeal meeting shall be scheduled by the City Clerk within twenty business days. The appeal board shall consist of the City Manager, City Clerk, and Public Works Director.

8. Water meter test deposit $25.00.

9. Cleaning Usage Fee – an owner of property or a property manager may pay a non-refundable fee of $25.00 to have the water turned on for cleaning purposes for a period of 5 days only. After 5 days, the water will be automatically turned off and padlocked. The $25.00 fee will allow up to 300 cubic feet of water usage. If water is used in excess of 300 cubic feet, the owner or property manager will be charged an additional $3.26 per 100 cubic feet of water consumed, to be billed when the water is turned off. If the owner or property manager wishes the water to remain on after 5 days, then they must make a $60.00 deposit in addition to the $25.00 fee.

11. Capital Recovery Fees – Water Connections:

CONNECTION SIZE	METER EQUIVALENTS (Compound Meter)	CAPITAL RECOVERY FEE
3/4 x 5/8"	1	$ 1,969
1"	2.5	$ 4,923
1.5"	5.0	$ 9,845
2"	8.00	$ 15,752

3"	16	$ 31,504
4"	25	$ 49,225
6"	50	$ 98,450
8"	80	$ 157,520
10"	115	$ 226,435

12. Capital Recovery Fees – Sewer Connections:

CONNECTIONS	**METER EQUIVALENTS** (Compound Meter)	**CAPITAL RECOVERY FEE**
3/4 x 5/8"	1	$ 2,254
1"	2.5	$ 5,635
1.5"	5.0	$ 11,270
2"	8.00	$ 18,032
3"	16	$ 36,064
4"	25	$ 56,350
6"	50	$ 112,700
8"	80	$ 180,320
10"	115	$ 259,210

In addition to all "hook-up" charges, sanitary sewer service charges and other existing charge and fees imposed by a member entity or by the TRRWA, a System Development Charge (SDC) for waste water treatment in the sum of $1,957.00 will be charged for each new Equivalent Residential Unit (ERU) hereafter connected to the facilities of the TRRWA through the sanitary sewer lines of the member entities in accordance with the following conversion tables:

RESIDENTIAL

Dwelling	ERU's per Dwelling Unit
Single family	1.00
Duplex, 3 or 4-plex	0.86
Apartment (5 or more)	0.67

COMMERCIAL

Water Meter Size (Inches)	ERU's Per Meter
5/8	1.00
¾	1.50
1	2.50
1.5	5.00
2	8.00
3	16.00
4	25.00
6	50.00
8	80.00

INDUSTRIAL

1 ERU per each 300 gallons per day flow

13. Senior Citizens Reduction:

Senior Citizens occupying residential dwellings shall be eligible for a reduction of the water/sewer portion of their utility bill of four dollars ($4.00) per billing period, provided they apply and are qualified for such a reduction pursuant to the authority contained in RCW 74.38.070 as a low-income senior citizen. Further, for purposes of implementing this section, the rate reduction will be applied at $2.00 for water service and $2.00 for sewer service per billing period. Those customers receiving either water service of sewer service will only receive a $2.00 reduction per billing period.

For purposes of implementing this section, "low-income senior citizen" means a person who is sixty-one-(61) years of age or older and whose total income, including that of his or her spouse or co-tenant, does not exceed the amount specified in RCW 84.36.381(5) as it now exists or is hereafter amended. Further, for purposes of implementing this section, the definitions of "combined disposable income," "disposable income" and "co-tenant" shall be as defined in RCW 84.36.383(5), (6), and (7), as they now exist or are hereafter amended.

14. Rates for Water Hydrant Meter Rentals – Services:

Rates for water hydrant meter rentals shall, at a minimum, consist of a $950.00 deposit, and a meter charge of $5.00 per day, and a minimum charge of $20.00 for wholesale or bulk resale rates for water consumption. The City Manager or his designee shall have authority to issue water hydrant meter permits in a form to be made available by the City Clerk.

SECTION 2. The rates adopted in this ordinance shall be retroactive to January 1, 2009.

SECTION 3. This Ordinance shall be in full force and effect five days after its passage and publication of summary as required by law.

ADOPTED by the City Council and **SIGNED** by the Mayor this 17th day of March, 2009.

MAYOR

ATTEST/AUTHENTICATION:

CITY CLERK

APPROVED AS TO FORM:

CITY ATTORNEY

PUBLISHED: 3/21/09

Appendix G

Map Pocket

FIGURE VII-1 - SEWER INVENTORY CENTRAL KELSO

Prepared By:

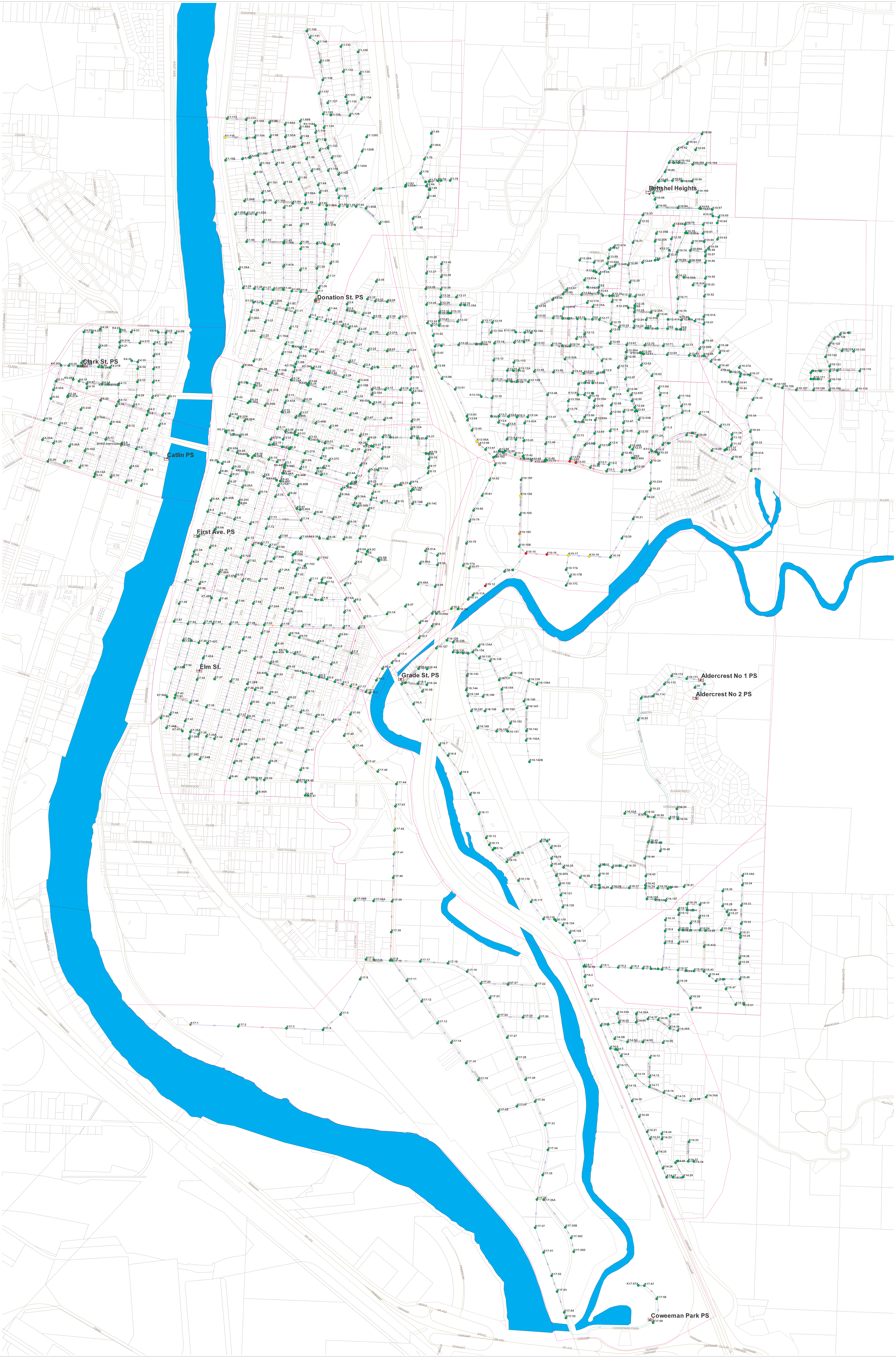
Date: 9/16/2010

FIGURE VII-2 - SEWER INVENTORY SOUTHEAST KELSO

Prepared By:

Date: Monday, September 20, 2010

FIGURE VII-4 - MODEL RESULTS FOR YEAR 2010 W/ 25YR STORM EVENT



Nodes (SUR_PIPE)
- 12"_FREEBOARD
- 6"_FREEBOARD
- FULL_MH

Links (SUR_PIPE)
- REVERSE_INV
- SURCHARGED_PIPE

MH_ID

K_Basins

Rivers

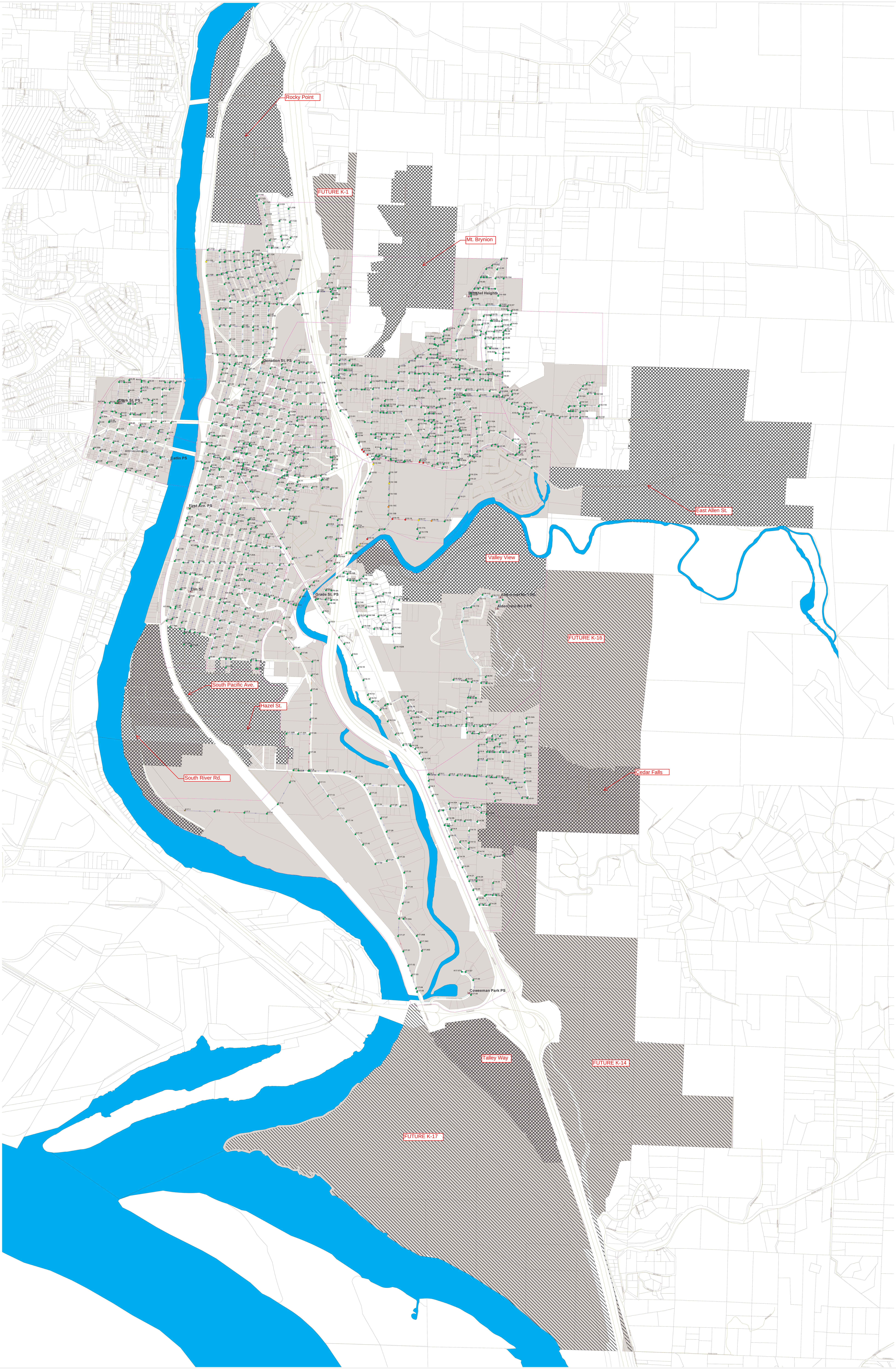
Streets

Parcels_2010

Prepared By:

Date: Thursday, September 16, 2010

FIGURE VII-5 - MODEL RESULTS FOR YEAR 2030 W/ 25 YR STORM EVENT



Nodes (SUR_PIPE)
- 12"_FREEBOARD
- 6"_FREEBOARD
- FULL_MH

Links (SUR_PIPE)
- REVERSE_INV
- SURCHARGED_PIPE

MH_ID

K Basins

Rivers

Areas_Not_Served

Streets

City Parcels 3-07

Sewer_Extensions

County Parcels 3-07

Future_service_areas

Prepared By:

Date: 10/20/2010, 11:46 AM

Appendix H

SEPA Documentation and DNS

KELSO
CITY OF FRIENDLY PEOPLE
WASHINGTON, U.S.A.

CITY OF KELSO
COMMUNITY DEVELOPMENT DEPARTMENT
Michael Kerins, Director
P O Box 819
203 S. Pacific Ave., Suite 208, Kelso WA 98626

DETERMINATION OF NON-SIGNIFICANCE

1. **Description of Proposal:** the City of Kelso Public Works Department is proposing a new ~~General Sewer and Facilities Plan along with the several projects within it. These projects include~~ several extensions to the existing sewer collection system as follows:
   - Cedar Falls Extension
   - Three Rivers Golf Course Extension
   - Talley Way Extension
   - Rocky Point Extension
   - Mt. Brynion Road Extension
   - East Allen St. Extension
   - Valley View Extension
   - Walnut Street Extension

2. **Proponent:** Michael Kardas
   City of Kelso Public Works
   P.O. Box 819
   203 South Pacific Ave.
   Kelso, WA 98626

3. **Location of Proposals:** Various

4. **Lead Agency:** City of Kelso Department of Community Development

5. **File Number:** SEP 10-010

   The lead agency for this proposal has determined that it will not have a probable significant adverse impact on the environment. An environmental impact statement is not required under RCW 43.21C.030(2)(c). This determination is being made after a review of the completed environmental checklist, City ordinances, and other information on file with the lead agency. Information regarding this determination and the City's decision is available to the public on request. This DNS is being issued under WAC 197-11-340(2); the lead agency will not act on this proposal for fourteen (14) days from the date below. Comments must be submitted by 5:00pm on November 11, 2010.

6. **Responsible Official:** MICHAEL P. KERINS

7. **Position/Title:** Director of Community Development

8. **Address:** 203 S. Pacific Ave., #208
   Kelso, WA 98626

9. **Date:** October 28, 2010

10. **Signature:**

DETERMINATION OF NON-SIGNIFICANCE

Description of Proposal: the City of Kelso Public Works Department is proposing a new General Sewer and Facilities Plan along with the several projects within it. These projects include several extensions to the existing sewer collection system as follows:

Cedar Falls, Three Rivers Golf Course, Talley Way, Rocky Point, Mt. Brynion Road, East Allen St., Valley View and Walnut Street

Proponent: Michael Kardas
City of Kelso Public Works
P.O. Box 819
203 South Pacific Ave.
Kelso, WA 98626

Location of Proposals: Various

Lead Agency: Kelso Community Development Dept.

File Number: SEP 10-010

The lead agency for this proposal has determined that it will not have a probable significant adverse impact on the environment. An environmental impact statement is not required under RCW 43.21C.030(2)(c). This determination is being made after a review of the completed environmental checklist, City ordinances, and other information on file with the lead agency. Information regarding this determination and the City's decision is available to the public on request. This DNS is being issued under WAC 197-11-340(2); the lead agency will not act on this proposal for fourteen (14) days from the date below. Comments must be submitted by 5:00pm on November 11, 2010.

Responsible Official: MICHAEL P. KERINS
Position/Title: Director of Community Development
Address: 203 S. Pacific Ave., #208
Kelso, WA 98626

Date: October 28, 2010
Publish: November 3, 2010

AFFIDAVIT OF PUBLICATION

IN THE MATTER NOTICE OF PUBLICATION

Ad Number 453226

CITY OF KELSO COMM. DEV.

DETERMINATION OF NON-SIGNIFICANCE

STATE OF WASHINGTON
COUNTY OF COWLITZ

TRINI M. ARCE being duly sworn says that she is the CHIEF CLERK of THE DAILY NEWS. And that THE DAILY NEWS, published in Cowlitz County, has been approved as a Legal newspaper by order of the Superior court of the State of Washington of Cowlitz County, and that the Annexed printed copy is a true copy of the notice in the above entitled matter as it was printed in the regular entire issue of said paper for a period of one insertions commencing November 03, 2010 and ending on November 03, 2010, and that said newspaper was regularly distributed to its subscribers during all of said period, and that said notice was published in said paper and not in a supplement form. That the full amount of the fee charged for said forgoing publication is the sum of $114.26 at the rate of $1.97 per line for the first insertion and $1.80 per line for each subsequent insertion. There is also an additional charge of $10.00 for every additional affidavit copy over two copies.

TRINI M. ARCE

Trini M. Arce

Subscribed and sworn to before me this
5th Day of November, 2010

JENNIFER L. SMITH

Jennifer L Smith

Notary Public for the State of Washington
Residing in Cowlitz County

JENNIFER L SMITH
NOTARY PUBLIC
STATE OF WASHINGTON
APRIL 13, 2014

KELSO
CITY OF FRIENDLY PEOPLE
WASHINGTON, U.S.A.

CITY OF KELSO
COMMUNITY DEVELOPMENT DEPARTMENT
Michael P. Kerins, Director
203 S. Pacific Ave., Kelso WA 98626
360-423-9922, fax 360-423-6591

October 13, 2010

TO: All Interested Parties and SEPA Consulted Agencies

FROM: Michael P. Kerins, Director of Community Development

SUBJ: **Notice of Application for SEPA Environmental Review, File No.: SEP 10-010.**

NOTICE OF PROPOSAL

On September 22, 2010 an application for Environmental (SEPA) Review was received from the City of Kelso Public Works Department for a new General Sewer and Facilities Plan along with the several projects being proposed within it. These projects include several extensions to the existing sewer collection system as follows:

• Cedar Falls Extension	4,100 feet of 8" gravity pipe
• Three Rivers Golf Course Extension	1,800 feet of 15" gravity pipe 1,700 feet of 10" gravity pipe 1,600 feet of 8" gravity pipe
• Talley Way Extension	3,400 feet of 8" gravity pipe 1,700 feet of 6" forcemain Pump Station
• Rocky Point Extension	5,900 feet of 15" gravity pipe 450 feet of bore casing 1,300 feet of 8" gravity pipe
• Mt. Brynion Road Extension	4,000 feet of 8" gravity pipe
• East Allen St. Extension	4,600 feet of 15" gravity pipe 700 feet of 10" forcemain Pump Station
• Valley View Extension	4,600 feet of 8" gravity pipe 1,800 feet of 10" forcemain (2) Pump Stations
• Walnut Street Extension	1,200 feet of 8"gravity pipe

Construction of the extensions is intended to occur over time as future developments evolve. The extensions are most likely to be constructed by developers. The City of Kelso intends to require the extensions and any improvements to the existing sewer system to be constructed in accordance with the specifications and Best Management Practices outlined in the Kelso Engineering Design Manual (KEDM)

ENVIRONMENTAL REVIEW

The City of Kelso Community Development Department is the lead agency for this proposal under the State Environmental Policy Act (SEPA). The environmental checklist and other information on file with the Community Development Department are available to the public upon request. Written comments concerning the environmental impacts of the proposal will be accepted during the 15-day public comment period, which ends on ***October 27, 2010***. A threshold environmental determination will then be issued and distributed for additional comments. Comments will be considered and the determination will then be re-issued with or without additional mitigation.

REQUEST FOR WRITTEN COMMENT

You views on the proposal are welcome. All written comments received by *October 27, 2010* will be considered prior to issuing the determination. Mail your comments on this project to City of Kelso Community Development Department, Room 208, Kelso City Hall, 203 S. Pacific Ave., Kelso, Washington 98626. Be sure to reference ***File No. SEP 10-010*** in your correspondence.

NOTICE OF DECISION

A copy of the determination will be mailed to you. You may appeal the threshold determination and/or decision to the Hearing Examiner for review at an open record public hearing. Notice of such appeal and applicable fees must be filed with the City of Kelso Community Development Department within fourteen (14) days following the issuance of the final decision. If you have any questions on this proposal, please call Mike Kerins at (360) 577-3320.

Encl.: Area Map, Narrative

CITY OF KELSO

Community Development Department

ENVIRONMENTAL CHECKLIST

Purpose of Checklist

The State Environmental Policy Act (SEPA), Chapter 43.21C RCW, requires all governmental agencies to consider the environmental impacts of a proposal before making decisions. An environmental impact statement (EIS) must be prepared for all proposals with probable significant adverse impacts on the quality of the environment. The purpose of this checklist is to provide information to help you and the agency identify impacts from your proposal (and to reduce or avoid impacts from the proposal, if it can be done) and to help the agency decide whether an EIS is required.

Instructions for Applicants

This environmental checklist asks you to describe some basic information about your proposal. Governmental agencies use this checklist to determine whether the environmental impacts of your proposal are significant, requiring preparation of an EIS. Answer the questions briefly, with the most precise information known, or give the best description you can.

You must answer each question accurately and carefully, to the best of your knowledge. In most cases, you should be able to answer the questions from your own observations or project plans without the need to hire experts. If you really do not know the answer, or if a question does not apply to your proposal, write "do not know" or "does not apply". Complete answers to the questions now may avoid unnecessary delays later.

Some questions ask about governmental regulations, such as zoning, shoreline, and landmark designations. Answer these questions if you can. If you have problems, the governmental agencies can assist you.

The checklist questions apply to all parts of your proposal, even if you plan to do them over a period of time or on different parcels of land. Attach any additional information that will help describe your proposal or its environmental effects. The agency to which you submit this checklist may ask you to explain your answers or provide additional information reasonably related to determining if there may be significant adverse impact.

Use of Checklist for Nonproject Proposals

Complete this checklist for non-project proposals, even though questions may be answered "does not apply". IN ADDITION, complete the SUPPLEMENTAL SHEET FOR NONPROJECT ACTIONS (Part D). For non-project actions, the references in the checklist to the words "project", "applicant", and "property or site" should be read as "proposal", "proposer" and "affected geographic area" respectively.

TO BE COMPLETED BY APPLICANT

EVALUATION FOR AGENCY USE ONLY

A. BACKGROUND

APPLICATION NO.______________

1. Name of proposed project, if applicable: City of Kelso General Sewer and Facilities Plan (GSP/FP).

2. Name of applicant: City of Kelso, Washington. Public Works Department

3. Address and phone number of applicant and contact person:

   Mr. David Sypher, P.E., Public Works Director
   City Hall
   203 S. Pacific Ave. Ste. #205
   Kelso, Washington 98626
   Phone: 360-423-6590

4. Date checklist prepared: August 18, 2010

5. Agency requesting checklist: City of Kelso, WA

6. Proposed timing or schedule (including phasing, if applicable):

   It is anticipated that this GSP/FP will be approved by DOE and DOH in late 2010 and that council will adopt it shortly thereafter. The design and construction of I/I removal projects recommended in the GSP/FP will occur in stages as funding becomes available. The design and construction of collection components to serve presently unsewered areas will occur in stages as each area develops over time. The design and construction of pump station and collection system improvement projects will occur over time as funding allows.

7. Do you have any plans for future additions, expansion, or further activity related to or connected with this proposal? If yes, explain.

   Design and construction related to the recommendations in the GSP/FP for wastewater collection and treatment improvements will occur at a future date.

8. List any environmental information you know about that has been prepared, or will be prepared, directly related to this proposal.

   City of Kelso has prepared a Comprehensive Plan which was adopted by the City Council in September 1980, with chapter updates in 1987 and 1992. An update to the comprehensive plan maps occurred in 1994. The Comprehensive Plan can be found at *http://omtools.com/~kelsogo/community/key_planning_documents.php.* Also, existing conditions were described in the GSP/FP. An environmental report has also been prepared for the GSP/FP.

9. Do you know whether applications are pending for governmental approvals of other proposals directly affecting the property covered by your proposal? If yes, explain.

   None Known. ?

10. List any governmental approvals or permits that will be needed for your proposal, if known.

    The Washington State Departments of Ecology and Health and the Kelso City Council must approve the GSP/FP. A Shorelines Review will be required.

11. Give brief, complete description of your proposal, including the proposed uses and the size of the project and site. There are several questions later in this checklist that ask you to describe certain aspects of your proposal. You do not need to repeat those answers on this page

    The purpose of the GSP/FP is to guide the City of Kelso in providing sewer service through the year 2030. Three (3) Capital Improvement Projects (CIPs) were identified in the GSP to improve the capacity of the existing collection system. A large sewer pump station (Donation Street Pump Station) with a capacity of 1.58 MGD will be rebuilt and upgraded to 2.8 MGD. Approximately 2,400 feet of existing large diameter gravity sewer will be replaced with large diameter piping and re-aligned in right-of-ways and easements (Manasco Drive Interceptor). In addition, approximately 1,800 feet of 10-inch diameter gravity sewer will be replaced with 12-inch diameter piping and along Allen Street.

    Other CIP's in the GSP/FP involve replacing old sewer piping with new pipe to reduce groundwater infiltration and stormwater inflow into the collection system. In addition, pump station maintenance items were outlined. These items do not upgrade or increase the capacity of the existing infrastructure and therefore are considered *categorically exempt* and are not discussed in this report.

    The GSP/FP provides planning guidance on sewer collection system extensions; however, the extensions will be designed and constructed by developers as development occurs at which point the developer will need to conduct the environmental review.

    The GSP/FP also ensures that the Three Rivers Regional Wastewater Treatment Plant which serves Kelso, Longview and Beacon Hill Sewer District, has adequate capacity to meet the Kelso flow requirements for the planning period.

12. Location of the proposal. Give sufficient information for a person to understand the precise location of your proposed project, including a street address, if any, and section, township, and range, if known. If a proposal would occur over a range of area, provide the range or boundaries of the site(s). Provide a legal description, site plan, vicinity map, and topographic map, if reasonably available. While you should submit any plans required by

the agency, you are not required to duplicate maps or detailed plans submitted with any permit applications related to this checklist.

Attachment No. 1 contains a USGS map of the City showing the location of the affected areas.

B. ENVIRONMENTAL ELEMENTS

1. Earth

(a) General description of the site (circle one): Flat, rolling, hilly, steep slopes, mountainous, other

The proposed work areas are located on a flat low alluvial delta.

(b) What is the steepest slope on the site (approximate percent slope)?

Between 0 - 3 percent slope.

(c) What general types of soils are found on the site (for example: clay, sand, gravel, peat, muck). If you know the classification of agricultural soils, specify them and note any prime farmland.

The Natural Resource Conservation Service (NRCS) data identifies the following soil types for each project area: Donation St. Pump Station – Caples silty clay loam, 0%-3% slopes; Manasco Interceptor – Arents, 0% - 5% slopes, Caples silty clay loam, 0%-3% slopes, and Panamaker gravelly sand, 0% - 3% slopes; Allen Street Sewer – Godfrey silt loam, 0% - 3% slopes and Sara silt loam, 8% - 15% slopes and. There is no prime farmland in the area of the proposed projects.

(d) Are there surface indications or history of unstable soils in the immediate vicinity? If so, describe.

Based a City of Longview Critical Areas Map, dated August 17, 2004, which also covers Kelso, there are *very unstable soils* located adjacent to the Donation St. Pump Station to the east and *unstable soils* located further east and approximately 800 feet to the south. A major landslide occurred on January 8, 2009 at the intersection of Burcham St. and N. 4th St., which is approximately 100 feet to 150 feet south of the Donation St. pump station. The slide was approximately 100 feet in width and material fell about 35 feet to 40 feet in

TO BE COMPLETED BY APPLICANT | **EVALUATION FOR AGENCY USE ONLY**

elevation. The soil in the vicinity of the slide is classified as Kalama gravelly loam with 30% - 60% slopes. For the proposed Manasco Dr. Interceptor, areas of unstable soils and active landslides are located across the Coweeman River to the south. Unstable soils also exist where the Allen Street sewer line upgrade will occur.

(e) Describe the purpose, type, and approximate quantities of any filling or grading proposed. Indicate source of fill.

The pump station project may involve deep excavation and backfilling for the wetwell. There will be trench excavation for Manasco Dr. Interceptor and Allen Street sewer line. Import backfill material will be used underneath any pavement; otherwise, native fill will be used. Quantities will be determined during design.

(f) Could erosion occur as a result of clearing, construction, or use? If so, generally describe.

Erosion is possible during construction, but best management practices will be addressed and followed during design and construction to prevent erosion. Stormwater erosion control will be consistent with the City's erosion control ordinances.

(g) About what percent of the site will be covered with impervious surfaces after project construction (for example, asphalt or buildings)?

N/A

(h) Proposed measures to reduce/control erosion, or other impacts to the earth, if any:

Best management practices will be addressed and followed during design and construction to prevent erosion. Stormwater erosion control will be consistent with the City's erosion control ordinances.

2. Air

(a) What types of emissions to the air would result from the proposal (i.e., dust, automobile, odors, industrial wood smoke) during construction and when the project is completed? If any, generally describe and give approximate quantities if known.

Diesel engine emissions will result from construction activities.

(b) Are there any off-site sources of emissions or odor that may affect your proposal? If so, generally describe.

No.

(c) Proposed measures to reduce or control emissions or other impacts to air, if any:

N/A.

3. Water

(a) Surface:

(1) Is there any surface water body on or in the immediate vicinity of the site (including year-round and seasonal streams, saltwater, lakes, ponds, wetlands)? If yes, describe type and provide names. If appropriate, state what stream or river it flows into.

The proposed Manasco Interceptor project is parallel to the Coweeman River at an average offset distance of approximately 120 feet. The Donation St. Pump Station and Allen Street sewer line are not located in the immediate vicinity of a water body or wetland.

(2) Will the project require any work over, in, or adjacent to (within 200 feet) the described waters? If yes, please describe and attach available plans.

Yes, see above. Work at the Manasco Dr. Interceptor will occur inside a dike (dry side) along the Coweeman River.

(3) Estimate the amount of fill and dredge material that would be placed in or removed from surface water or wetlands and indicate the area of the site that would be affected. Indicate the source of fill material.

None.

(4) Will the proposal require surface water withdrawals or diversions? Give general description, purpose and approximate quantities if known.

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No.

(5) Does the proposal lie within a 100-year floodplain? If so, note location on the site plan.

No, all project areas are diked.

(6) Does the proposal involve any discharges of waste materials to surface waters? If so, describe the type of waste and anticipated volume of discharge.

The proposals will increase flows to the Three Rives Regional Waste Water Treatment Plant, which discharges to the Columbia River; however it will also reduce raw sewer overflow from the collection system.

(b) Ground:

(1) Will ground water be withdrawn, or will water be discharged to ground water? Give general description, purpose and approximate quantities if known.

Other than dewatering for trenching as needed, no groundwater will be withdrawn, nor will water be discharged to groundwater.

(2) Describe waste material that will be discharged into the ground from septic tanks or other sources, if any (for example: Domestic sewage; industrial, containing the following chemicals; agricultural; etc.). Describe the general size of the system, the number of such systems, the number of houses to he served (if applicable), or the number of animals or humans the system(s) are expected to serve.

No waste material will be discharged into the ground.

(c) Water Runoff - (including storm water):

(1) Describe the source of runoff (including storm water) and method of collection and disposal, if any (include quantities if known). Where will this water flow? Will this water flow into other waters? If so, describe.

Any stormwater runoff during construction would be handled according to the City's stormwater ordinances and the project-specific Stormwater Pollution and Prevention Plan (SWPPP).

(2) Could waste materials enter ground or surface waters? If so, generally describe.

Although it is considered unlikely, there is a potential that raw wastewater could enter ground or surface waters during connections to existing sewer lines and during sewage bypass operations. The management of any sewer bypasses or connections to live sewer lines will ultimately be done during the design/ construction phase of the project.

(d) Proposed measures to reduce or control surface, ground, and runoff water impacts, if any:

Please refer to answer (c)(1)&(2) above.

4. Plants

(a) Check or circle types of vegetation found on the site:

- __ deciduous tree: alder, maple, aspen, other
- __ evergreen tree: fir, cedar, pine, other
- X shrubs
- X grass
- __ pasture
- __ crop or grain
- __ wet soil plants: cattail, buttercup, bullrush, skunk cabbage, other
- __ water plants: water lily, eelgrass, milfoil, other
- __ other types of vegetation

(b) What kind and amount of vegetation will be removed or altered?

Vegetation will mainly be altered by the Manasco Dr. Interceptor replacement/ realignment. The vegetation that will be encountered will consist mainly of grass (including ball field grass), blackberry briars and Scotch Broom.

(c) List threatened or endangered species known to be on or near the site.

No threatened or endangered species of plants appear to be within the proposed work areas.

(d) Proposed landscaping, use of native plants, or other measures to preserve or enhance vegetation on the site, if any:

No landscaping other than hydroseeding would be proposed.

TO BE COMPLETED BY APPLICANT

EVALUATION FOR AGENCY USE ONLY

5. Animals

(a) Circle any birds and animals which have been observed on or near the site or are known to be on or near the site:

birds: hawk, heron, eagle, songbirds, other: waterfowl

mammals: ~~deer,~~ bear, elk, beaver, other: nutria, rabbits, possums, raccoons, coyotes

fish: bass, salmon, trout, herring, shellfish, other:

(b) List any threatened or endangered species known to be on or near the site.

Any recommended improvements in the GSP do not occur in any wildlife areas and are not expected to impact any threatened or endangered species.

(c) Is the site part of a migration route? If so, explain.

The City is located in the Pacific Flyway north-south migratory route for birds.

(d) Proposed measures to preserve or enhance wildlife, if any:

None.

6. Energy and Natural Resources

(a) What kinds of energy (electric, natural gas, oil, wood stove, solar) will be used to meet the completed project's energy needs? Describe whether it will be used for heating, manufacturing, etc.

Electricity and diesel fuel (emergency power) will be used to power upgraded pump stations.

(b) Would your project affect the potential use of solar energy by adjacent properties? If so, generally describe.

No.

(c) What kinds of energy conservation features are included in the plans of this proposal? List other proposed measures to reduce or control energy impacts, if any:

TO BE COMPLETED BY APPLICANT | **EVALUATION FOR AGENCY USE ONLY**

Pump station upgrades will be designed to operate efficiently to minimize energy usage.

7. Environmental Health

(a) Are there any environmental health hazards, including exposure to toxic chemicals, risk of fire and explosion, spill, or hazardous waste, that could occur as a result of this proposal? If so, describe.

Other than de minimus quantities associated with periodically maintaining the pump stations, no toxic chemicals will be onsite.

(1) Describe special emergency services that might be required.

None will be required.

(2) Proposed measures to reduce or control environmental health hazards, if any:

None.

(b) Noise

(1) What types of noise exist in the area which may affect your project (for example: traffic, equipment, operation, other)?

Traffic from motor vehicles and other human activities.

(2) What types and levels of noise would be created by or associated with the project on a short-term or a long-term basis (for example: traffic, construction, operation, other)? Indicate what hours noise would come from the site.

Short term: construction equipment (earthmoving, generators, air compressors, light and heavy trucks). Long term: Noise from the operation of existing diesel generator during power outages and routine testing will be generated from the pump station sites. Construction would be limited to the hours of 7:00 am to 7:00 pm on weekdays.

(3) Proposed measures to reduce or control noise impacts, if any?

Hours of construction will be limited.

TO BE COMPLETED BY APPLICANT | **EVALUATION FOR AGENCY USE ONLY**

8. Land and Shoreline Use

(a) What is the current use of the site and adjacent properties?

The Manasco Dr. Interceptor traverses commercial properties including restaurants, a bank and a hotel. The interceptor also traverses two right-of-ways: Manasco Drive and I-5. Adjacent properties to the Donation Street Pump Station are single-family residences and vacant wooded properties to the east and south. Adjacent properties to the Allen Street sewer line are commercial and residential.

(b) Has the site been used for agriculture? If so, describe.

No.

(c) Describe any structures on the site.

The pump station to be rebuilt has a structure that houses the pumps, electrical gear and emergency generators. The Manasco Interceptor is located near an existing bank building, a few restaurants and a hotel. The interceptor also crosses behind a concrete retaining wall associated with an overpass for I-5. The Allen Street Sewer line is located in street right-of-way.

(d) Will any structures be demolished? If so, what?

A sewer pump station will be completely or partially demolished. Inside dimensions of the pump station is approximately 10-foot by 10-foot by 15 feet deep. Approximately 4,200 ft of sewer line will be removed and replaced. Approximately 25,000 sq. ft. of pavement will be demolished and replaced along with approximately 500 feet of sidewalk.

(e) What is the current zoning classification of the site?

Based upon the City of Kelso zoning map: the Manasco Dr. Interceptor traverses commercial properties including CMR (commercial - major retail) and CSR (commercial – specialty retail/services) designated properties The Donation Street Pump is zoned SF5 (single-family residence). Allen Street sewer is located in right-of-way.

TO BE COMPLETED BY APPLICANT

EVALUATION FOR AGENCY USE ONLY

(f) What is the current comprehensive plan designation of the site?

See above.

(g) If applicable, what is the current shoreline master program designation of the site?

Based on a state shoreline map provided by Cowlitz County, the designation for the Manasco Dr. Interceptor sites is "Urban". The Donation Street Pump Station site and Allen Street sewer line are not applicable.

(h) Has any part of the site been classified as an "environmentally sensitive" area? If so, specify.

According to National Wetlands Inventory, there appears to be a *Freshwater Emergent Wetland* located adjacent to the proposed Manasco Dr. Interceptor. A wetlands delineation will be performed for the design. According to the Cowlitz County Ordinance Regarding Critical Aquifer Recharge Areas and the soil designations on pages 3-4 of this checklist, the sensitivity rating is "slight"; however there is a section of the Manasco Dr. Interceptor where the sensitivity rating is "severe" in the Panamaker soil type.

(i) Approximately how many people would reside or work in the completed project?

None.

(j) Approximately how many people would the completed project displace?

None

(k) Proposed measures to avoid or reduce displacement impacts, if any:

N/A

(l) Proposed measures to ensure the proposal is compatible with existing and protected land uses and plans, if any:

The proposed sewer improvements have been located so as to minimize any impacts to surrounding properties. Most of the structures proposed will be underground. There will be some ancillary buildings and fencing associated with the pump station upgrades. The aesthetics of these aboveground structures will be addressed during design. Pump stations will contain odor control and a muffler on the emergency diesel generator so as to minimize impacts to surrounding properties.

9. **Housing**

(a) Approximately how many units would be provided, if any? Indicate whether high, middle, or low-income housing.

None.

(b) Approximately how many units, if any, would be eliminated? Indicate whether high, middle or low-income housing.

None.

(c) Proposed measures to reduce or control housing impacts, if any.

N/A.

10. **Aesthetics**

(a) What is the tallest height of any proposed structure(s), not including antennas; what is the principal exterior building material(s) proposed?

Most of the proposed structures will be buried underground. Ancillary buildings for proposed pump station upgrades will likely be around 10' high or less.

(b) What views in the immediate vicinity would be altered or obstructed?

None known.

(c) Proposed measures to reduce or control aesthetic impacts, if any:

The aesthetics of the sewer improvements will be addressed during design.

11. **Light and Glare**

(a) What type of light or glare will the proposal produce? What time of day would it mainly occur?

None.

(b) Could light or glare from the finished project hazard or interfere with views?

No.

(c) What existing off-site sources of light or glare may affect your proposal?

None.

(d) Proposed measures to reduce or control light and glare impacts, if any:

N/A.

12. Recreation

(a) What designated and informal recreational opportunities are in the immediate vicinity?

The northeast end of the proposed Manasco Dr. Interceptor is located near a city park, Tam O'Shanter Park, and near ball fields.

b) Would the proposed project displace any existing recreational uses? If so, describe.

No.

(c) Proposed measures to reduce or control impacts on recreation, including recreation opportunities to be provided by the project or applicant, if any:

The projects will not have significant impact on the recreational facilities.

13. Historic and Cultural Preservation

(a) Are there any places or objects listed on, or proposed for, national, state, or local preservation registers known to be on or next to the site? If so, generally describe.

No.

(b) Generally describe any landmarks or evidence of historic, archaeological, scientific, or cultural importance known to be on or next to the site.

N/A.

(c) Proposed measures to reduce or control impacts, if any:

N/A.

14. Transportation

(a) Identify public streets and highways serving the site, and describe proposed access to the existing street system. Show on site plans, if any.

The pump station site has existing access. Manasco Interceptor is accessible by Manasco Drive. The Allen Street sewer line is accessible via Allen Street.

(b) Is site currently served by public transit? If not, what is the approximate distance to the nearest transit stop?

N/A.

(c) How many parking spaces would the completed project have? How many would the project eliminate?

The proposed pump station rebuild will have access and parking for City Public Works crews for regular operation and maintenance. Parking will be sized for cranes to lift and remove/install large pumps..

(d) Will the proposal require any new roads or streets, or improvements to existing roads or streets, not including driveways? If so, generally describe (indicate whether public or private).

No.

(e) Will the project use (or occur in the immediate vicinity of) water, rail, or air transportation? If so, generally describe.

No.

(f) How many vehicular trips per day would be generated by the completed project? If known, indicate when peak volumes would occur.

TO BE COMPLETED BY APPLICANT

EVALUATION FOR AGENCY USE ONLY

No additional vehicular trips are anticipated.

(g) Proposed measures to reduce or control transportation impacts.

None required.

15. Public Services

(a) Would the project result in an increased need for public services (for example: fire protection, police protection, health care, schools, other)? If so, generally describe.

No.

(b) Proposed measures to reduce or control direct impacts on public services, if any:

None required.

16. Utilities

(a) Circle utilities currently available at the site: electricity, natural gas, water, refuse service, telephone, sanitary sewer, septic system, other.

(b) Describe the utilities that are proposed for the project, the utility providing the service, and the general construction activities on the site or in the immediate vicinity which might be needed.

Utilities needed for construction of the proposed facilities include electricity and water. Utilities needed for the operation and maintenance of the proposed upgraded sewer pump stations are electricity, water and possibly telephone. Service providers are Cowlitz County PUD for electrical, City of Kelso for water, and Qwest for the telephone.

C. SIGNATURE

The above answers are true and complete to the best of my knowledge. I understand that the lead agency is relying on them to make its decision.

Signature: David M Sy

Date Submitted: 9/22/10

D. SUPPLEMENTAL SHEET FOR NONPROJECT ACTIONS
(Do not use this sheet for project actions)

Because these questions are very general, it may be helpful to read them in conjunction with the list of the elements of the environment.

When answering these questions, be aware of the extent the proposal, or the types of activities likely to result from the proposal, would affect the item at a greater intensity or at a faster rate than if the proposal were not implemented. Respond briefly and in general terms.

1. How would the proposal be likely to increase discharge to water; emissions to air; production, storage, or release of toxic or hazardous substances; or production of noise?

This document is a tool to identify needed improvements to the City's sewer collection system. Some of the projects are based on operation and maintenance needs and others are driven by lack of adequate capacity. Current land use designations were used to estimate future needs. Increased discharge to water via the treatment plant operated by the Three Rivers Regional Wastewater Authority (TRRWA) will be due to the modest population increases predicted during the planning period. Activities covered in this proposal will not otherwise increase discharges to water or emissions to air. No toxic or hazardous materials will be by products of the planned projects.

Proposed measures to avoid or reduce such increases are:

No specific measures are proposed as part of this plan. The City will continue to enforce its portions of the TRRWA National Pollutant Discharge Elimination System (NPDES) permit

2. How would the proposal be likely to affect plants, animals, fish, or marine life?

This proposal will have no impacts on plants, animals, fish or marine life.

Proposed measures to protect or conserve plants, animals, fish, or marine life are:

No measures are proposed.

3. How would the proposal be likely to deplete energy or natural resources?

The proposal includes a few projects that use moderate amounts electricity. New more energy efficient equipment will be planned as part of the pumping station improvement projects. The result should be energy savings over current consumption levels.

No natural resources will be depleted as part of this proposal.

Proposed measures to protect or conserve energy and natural resources are:

Projects with electrical equipment will install more energy efficient equipment. No other specific measures are proposes to conserve natural resources.

4. How would the proposal be likely to use or affect environmentally sensitive areas or areas designated (or eligible or under study) for governmental protection; such as parks, wilderness, wild and scenic rivers, threatened or endangered species habitat, historic or cultural sites, wetlands, floodplains, or prime farmlands?

Projects proposed in this document will be constructed within existing, previously disturbed, City rights of way or property.

Proposed measures to protect such resources or to avoid or reduce impacts are:

No specific measures are planned or proposed under this effort.

5. How would the proposal be likely to affect land and shoreline use, including whether it would allow or encourage land or shoreline uses incompatible with existing plans?

No activity is proposed that is inconsistent or incompatible with existing land use plans.

Proposed measures to avoid or reduce shoreline and land use impacts are:

No specific measures are proposed to reduce shoreline or land use impacts.

6. How would the proposal be likely to increase demands on transportation or public services and utilities?

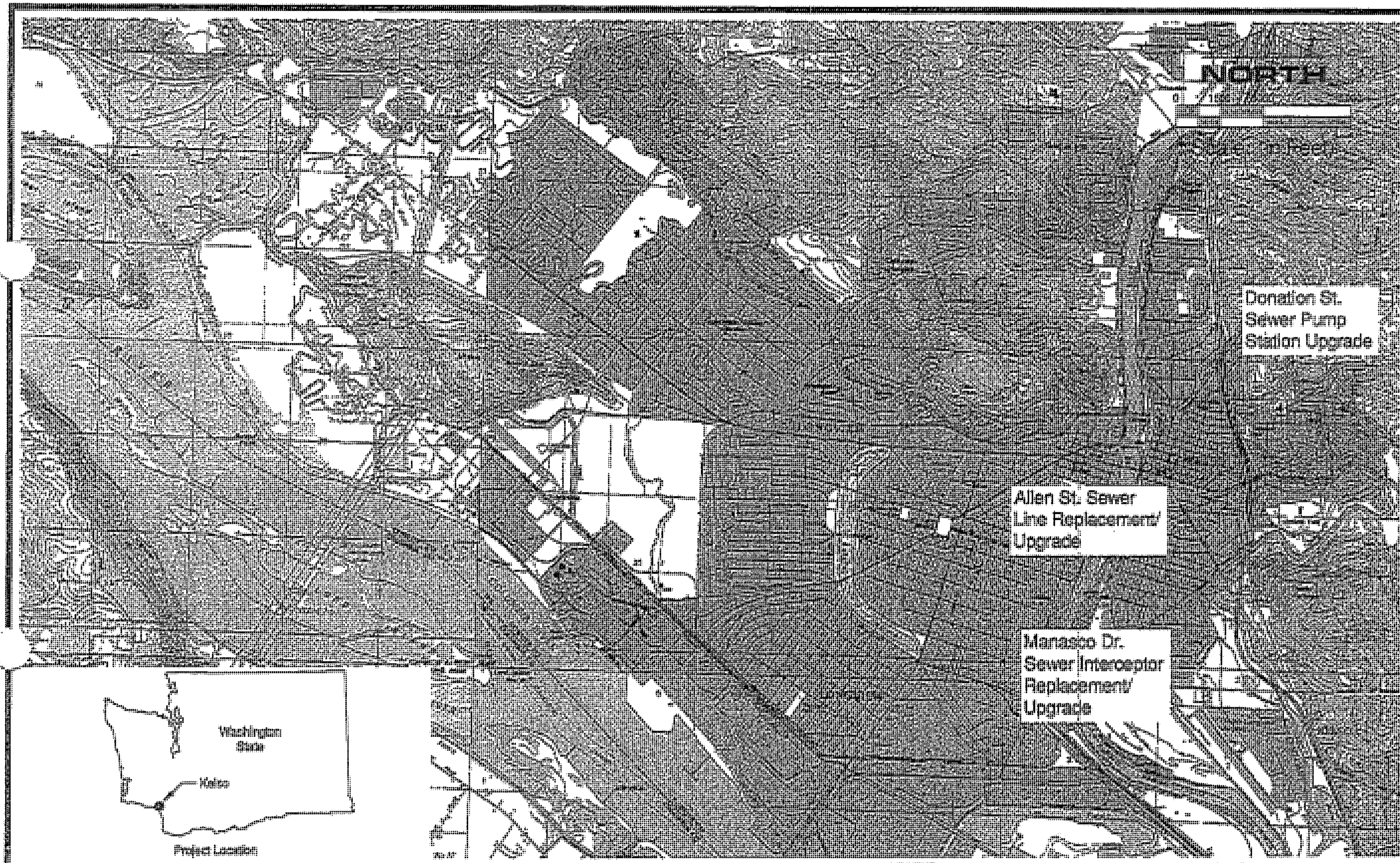
The document has no effect on the transportation system. It is a planning tool for the City's sanitary sewer system.

Proposed measures to reduce or respond to such demand(s) are:

No specific measures are planned or proposed under this effort.

7. Identify, if possible, whether the proposal may conflict with local, state, or federal laws or requirements for the protection of the environment.

No projects or other activities will conflict with local, state or federal laws of any kind.



Reference: 7.5 Minute USGS Map, Kelso WA, OR Quadrangle, dated 1990
7.5 Minute USGS Map, Coal Creek WA, OR Quadrangle, dated 1985
7.5 Minute USGS Map, Rainier WA, OR Quadrangle, dated 1990

LEGEND:
• Existing Pump Station
— — — Proposed Sewer Line

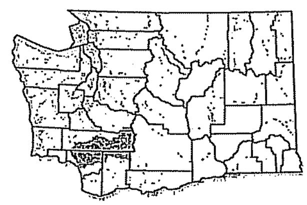
Attachment 1
City of Kelso
SEPA Checklist
Project Locations

RECEIVED
CITY OF KELSO
OCT 26 2010
COMMUNITY
DEVELOPMENT

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
PO Box 47775 • Olympia, Washington 98504-7775 • (360) 407-6300
711 for Washington Relay Service • Persons with a speech disability can call 877-833-6341

October 27, 2010

Michael P. Kerins, Director
City of Kelso
Community Development Department
PO Box 819
Kelso, WA 98626



Your address is in the **Cowlitz** watershed

Dear Mr. Kerins:

Thank you for the opportunity to comment on the prethreshold consultation for the General Sewer & Facilities Plan project (File No. SEP 10-010) as proposed by David Sypher, City of Kelso. The Department of Ecology (Ecology) reviewed the environmental checklist and has the following comment(s):

WASTE 2 RESOURCES: Mike Drumright (360) 407-6397

If greater than 250 cubic yards of inert, demolition, and/or wood waste is used as fill material, a solid waste handling permit is required from the local jurisdictional health department. Standards apply as defined by Washington Administrative Code (WAC) 173-350-990-Criteria for Inert Waste.

Ecology's comments are based upon information provided by the lead agency. As such, they may not constitute an exhaustive list of the various authorizations that must be obtained or legal requirements that must be fulfilled in order to carry out the proposed action.

If you have any questions or would like to respond to these comments, please contact the appropriate reviewing staff listed above.

Department of Ecology
Southwest Regional Office

(CR: 10-5375)

cc: Mike Drumright, W2R
David Sypher, City of Kelso (Applicant/Contact)

Appendix I

Environmental Report (Bound Separately)

Appendix J

ESA Compliance

ECOLOGICAL LAND SERVICES, INC.

September 16, 2010

David Dunn
Water Quality Program
Washington Department of Ecology
P.O. Box 47600
Olympia, Washington 98504

Subject: The Kelso General Sewer and Facilities Plan

Mr. Dunn,

The proposal is a project action toward implementing the recommended collection system Capital Improvement Projects (CIPs) outlined in the *City of Kelso General Sewer Plan and Draft Facilities Plan* (GSP/FP) (dated August 2010, prepared by Gibbs and Olson, Inc.). The *City of Kelso General Sewer Plan and Facilities Plan* (GSP/FP) is a combined two-phased planning document to guide the City of Kelso in providing municipal sewer service through the year 2030. The GSP/FP evaluates sewer collection-system improvements and then discusses the logistics for implementing the improvements. The GSP/FP is a necessary detailed planning step toward the design and construction of the recommended sewer improvements for Kelso's 20-year planning period.

To meet its collection system needs through the year 2030, the City plans to upgrade a large pump station, a gravity sewer interceptor, and a section of sewer pipe in order to meet increased flow requirements. These three projects will increase the sewer capacity, but they are also necessary to handle the current demand. The two sewer-line upgrades are causing backups and the Donation Street pump station cannot currently keep up with a 25-year storm event. The project will also alleviate surcharging from groundwater infiltrating into the sewer system during larger storm events, which is currently causing localized flooding in a city park and roadways from overflowing manholes.

Other CIPs in the GSP/FP involve replacing old sewer piping with new pipe to reduce groundwater infiltration and stormwater inflow into the collection system. In addition, pump-station maintenance will be performed. These items do not upgrade or increase the capacity of the existing infrastructure and are considered routine maintenance activities. The GSP/FP provides planning guidance on sewer collection-system extensions; however, the extensions will be designed and constructed by developers as development occurs, at which point the developer will conduct environmental reviews. Although the three primary projects increase sewer capacity, they are also necessary to alleviate localized flooding during heavy rainfall. The completion of this project will not be the sole cause for new development. The area within Kelso's corporate boundary is largely built out. If there are extensions to the sewer system in the next 20 years, it will mainly add existing residences that currently use septic systems. Few new homes or developments are expected.

In summary, the CIPs that involve increasing sewer capacity will consist of the following elements:

- Manasco Drive Interceptor: This major sewer interceptor is undersized and requires replacement of 1,400 feet of 24-inch and 21-inch concrete pipe with 36-inch pipe and 1,000 feet of 21-inch pipe with 30-inch pipe.
- Allen Street Sewer Upgrade: This sewer line is undersized and requires an upgrade of 1,800 feet of 10-inch pipe to 12-inch diameter piping.
- Donation Street Pump Station: This pump station (originally built in the 1950s) needs to be replaced to increase flow capacity to be able to handle storm flows and to address electrical safety and layout issues.

Ecological Land Services, Inc. (ELS) has prepared this assessment on behalf of the Environmental Protection Administration (EPA) to fulfill its responsibilities under the Endangered Species Act and the Magnuson-Stevens Fishery Conservation and Management Act. A federal nexus was created when a Washington Department of Ecology grant was used that was funded by the EPA. This letter addresses potential impacts to federally listed species under the jurisdiction of the U.S. Fish and Wildlife Service (USFWS) and the National Marine Fisheries Service (NMFS).

Project Location and Activities
The CIPs are entirely within the City of Kelso within Sections 26, 27, and 35 in Township 8 North, Range 2 West of the Willamette Meridian (see attachment). Land use in the three main project areas is high-density residential or commercial. Kelso is protected from 100-year floods by a diking system and is not within 200 feet of shorelines of statewide significance.

All the CIPs are entirely within existing rights-of-way, so no property acquisition is necessary. Equipment used for the projects will include backhoes, dump trucks, graders, loaders, pavers, and hand tools. Some roadside vegetation may be cut, but it consists of herbaceous vegetation or landscaping. No new impervious surfaces are associated with this project. Construction will take place during the dry season (May through September). Any necessary traffic detours will be short.

Potential Impacts and Minimization Measures
Potential direct impacts to the environment include stormwater runoff from exposed soils and stockpiled soils. During construction, best management practices (BMPs) will be employed to minimize the amount of erosion and sediment leaving the site during rainfall events. The BMPs will be consistent with the *Stormwater Management Manual for Western Washington* (Ecology, 2005) and the Kelso stormwater manual, and may include the use of silt fences, straw bales, and geonetting. Exposed soil areas and soil stockpiles

will be covered with plastic sheeting. Clearing will occur only in areas of active construction. Following construction, the site will be promptly revegetated. Chemical handling and vehicle fueling related to construction will be conducted in contained areas on the site. Any spills will be cleaned promptly to minimize the potential for runoff.

Species Presence

The location of the three primary improvement projects were visited on September 15, 2010 to determine the status and availability of suitable habitat for listed species in the project areas and to evaluate any potential impacts of the proposed project. The project does not involve working in or near aquatic habitats and creates no new impervious surfaces.

NMFS provides listings of threatened and endangered species under its jurisdiction. The current listing includes the presence of the Lower Columbia River Evolutionarily Significant Unit (ESU) of Chinook salmon, the Columbia River ESU of chum salmon, the Lower Columbia River ESU of coho salmon, the Lower Columbia River Distinct Population Segment (DPS) of steelhead trout, and the Southern DPS of Columbia River smelt. These species and the designated critical habitat for Chinook, chum, and steelhead occur in the Cowlitz and Coweeman rivers. However, the project areas are not located near tributaries of these rivers. Manasco Drive is close to the Coweeman River, but the dike protecting the area from floods does not allow water to flow toward the river.

Terrestrial species are under the jurisdiction of the USFWS (see attachment). There is no suitable habitat present for any of these listed species, and no critical habitat has been designated near the project areas.

Because there is no suitable habitat near the project areas and the projects are not near streams that are tributaries to the Cowlitz or Coweeman rivers, the project will have *no effect* on the Lower Columbia River ESU of Chinook salmon, the Columbia River ESU of chum salmon, the Lower Columbia River ESU of coho salmon, the Lower Columbia River DPS of steelhead, and the Southern DPS of Columbia River smelt.

Designated critical habitat exists for lower Columbia ESUs/DPSs of chinook, chum, and steelhead in the Cowlitz or Coweeman rivers. Critical habitat for coho and smelt have not been proposed or designated. For the reasons stated above for salmonid populations, the project will have *no effect* on designated salmon or steelhead critical habitat.

Essential Fish Habitat

In compliance with the Magnuson-Stevens Fishery Conservation and Management Act, essential fish habitat (EFH) was assessed for the project. EFH for Pacific salmon exists in the Cowlitz and Coweeman rivers, but the project does not occur near EFH for Pacific groundfish or coastal pelagic species. Because there is no EFH near the project areas, and the projects are not near streams that are tributaries to the Cowlitz or Coweeman rivers, the project will *not adversely affect* EFH for Pacific salmon.

Please feel free to contact me at 360-578-1371 extension 110 or by email using lynn@eco-land.com if you have questions about this project.

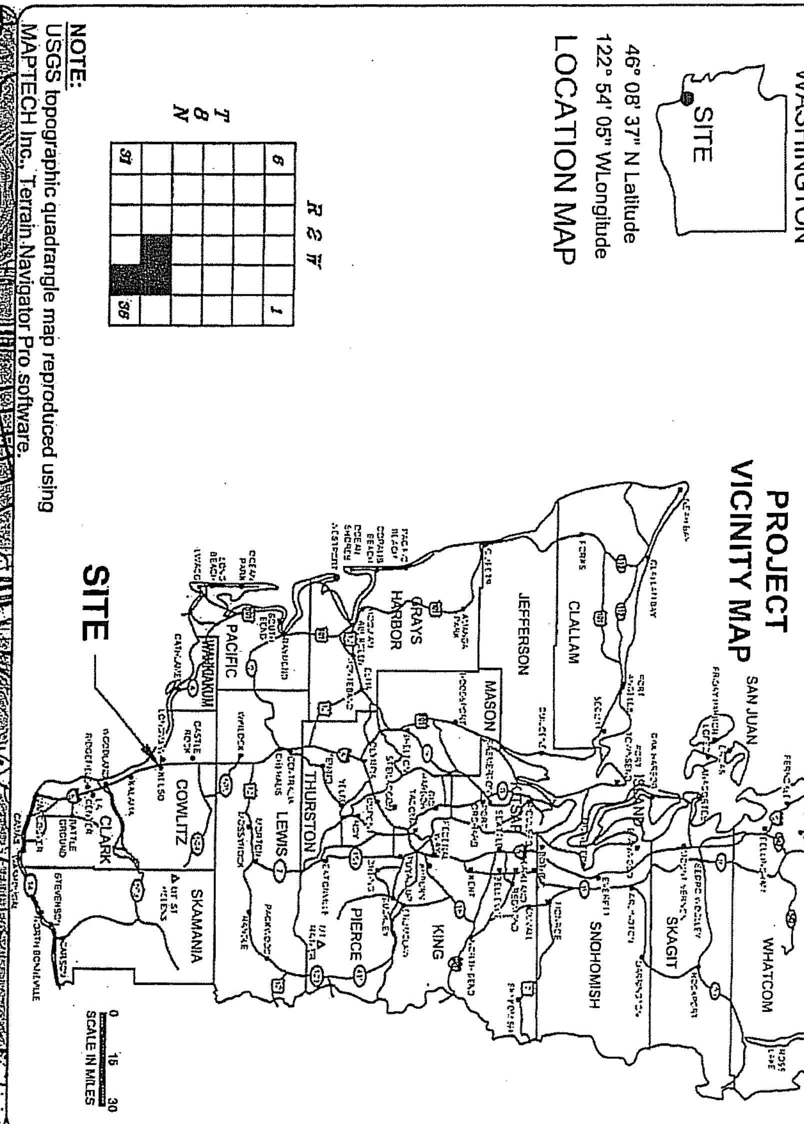
Sincerely,

Lynn Simpson

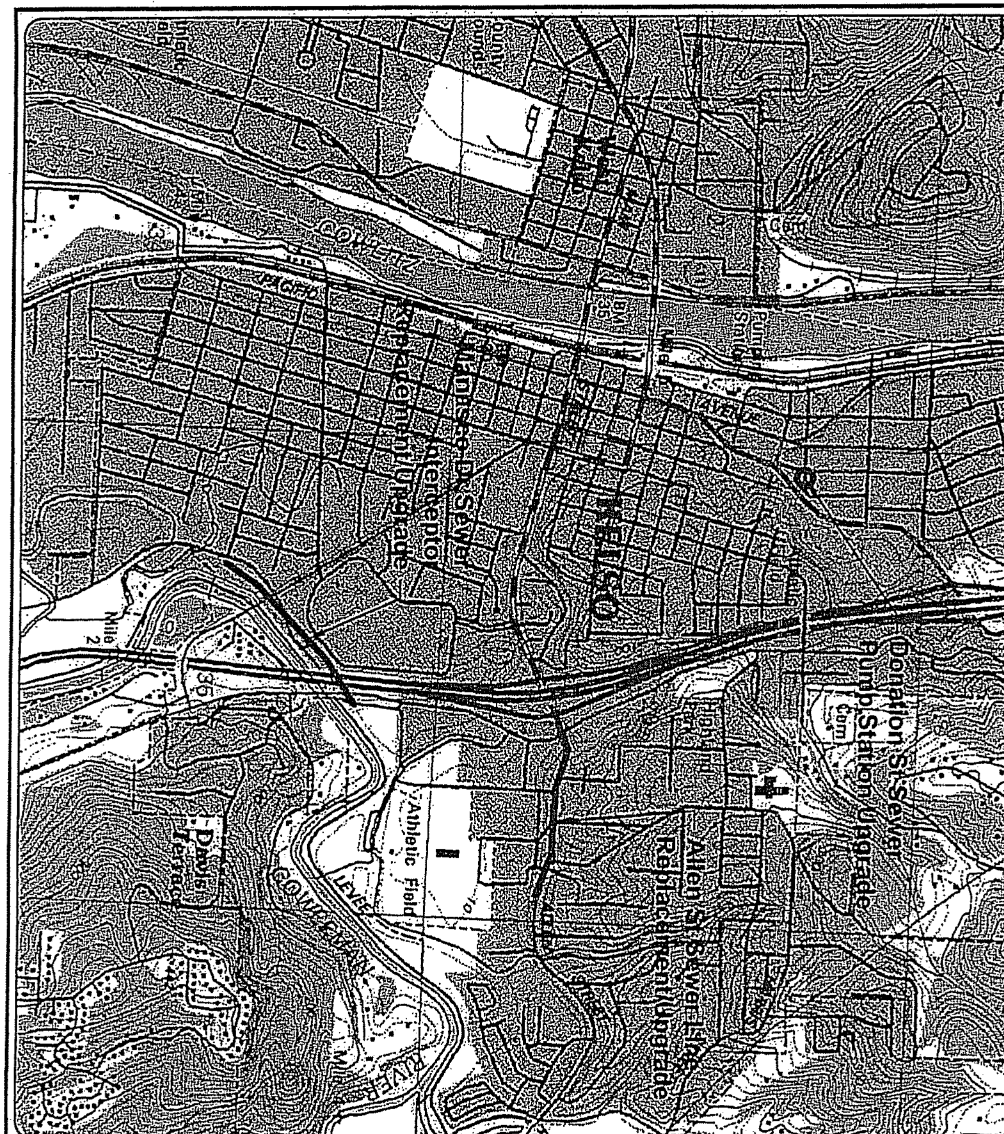
Lynn Simpson
Environmental Scientist

Enclosures: Figure
NMFS and USFWS species listings

cc: Dave Dunn, Washington Department of Ecology
Mike Marshall, Gibbs and Olson, Inc.



NOTE:
USGS topographic quadrangle map reproduced using MAPTECH Inc., Terrain Navigator Pro software.



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0 2000 4000
SCALE IN FEET
1" = 2000'

ECOLOGICAL LAND SERVICES, INC.
1157 3rd Ave., Suite 220
Longview, WA 98632
Phone: (360) 578-1371 Fax: (360) 414-9305

DATE: 9/16/10
DWN: BCB
REQ. BY: LS
PRJ. MGR: LS
CHK:
PROJECT NO: 120:50

Figure 1
VICINITY MAP
General Sewer and Facilities Plan
Gibbs & Olson
City of Kelso, Cowlitz County, Washington
Sections 26, 27 & 31, Township 8N, Range 2W, W.M.

Endangered Species Act Status of West Coast Salmon & Steelhead

(Updated July 1, 2005)

Species[1]			Current Endangered Species Act Listing Status	ESA Listing Actions Under Review
Sockeye Salmon (*Oncorhynchus nerka*)	1	Snake River	[illegible]	
	2	Ozette Lake	[illegible]	
	3	Baker River	*Not Warranted*	
	4	Okanogan River	*Not Warranted*	
	5	Lake Wenatchee	*Not Warranted*	
	6	Quinalt Lake	*Not Warranted*	
	7	Lake Pleasant	*Not Warranted*	
Chinook Salmon (*O. tshawytscha*)	8	Sacramento River Winter-run	[illegible]	
	9	Upper Columbia River Spring-run	[illegible]	
	10	Snake River Spring/Summer-run	[illegible]	
	11	Snake River Fall-run	[illegible]	
	12	Puget Sound	[illegible]	
	13	Lower Columbia River	[illegible]	
	14	Upper Willamette River	[illegible]	
	15	Central Valley Spring-run	[illegible]	
	16	California Coastal	[illegible]	
	17	Central Valley Fall and Late Fall-run	*Species of Concern*	
	18	Upper Klamath-Trinity Rivers	*Not Warranted*	
	19	Oregon Coast	*Not Warranted*	
	20	Washington Coast	*Not Warranted*	
	21	Middle Columbia River spring-run	*Not Warranted*	
	22	Upper Columbia River summer/fall-run	*Not Warranted*	
	23	Southern Oregon and Northern California Coast	*Not Warranted*	
	24	Deschutes River summer/fall-run	*Not Warranted*	
Coho Salmon (*O. kisutch*)	25	Central California Coast	[illegible]	
	26	Southern Oregon/Northern California	[illegible]	
	27	Lower Columbia River	[illegible]	• Critical habitat
	28	Oregon Coast	[illegible]	
	29	Southwest Washington	*Undetermined*	
	30	Puget Sound/Strait of Georgia	*Species of Concern*	
	31	Olympic Peninsula	*Not Warranted*	
Chum Salmon (*O. keta*)	32	Hood Canal Summer-run	[illegible]	
	33	Columbia River	[illegible]	
	34	Puget Sound/Strait of Georgia	*Not Warranted*	
	35	Pacific Coast	*Not Warranted*	
Steelhead (*O. mykiss*)	36	Southern California	[illegible]	
	37	Upper Columbia River	[illegible]	
	38	Central California Coast	[illegible]	
	39	South Central California Coast	[illegible]	
	40	Snake River Basin	[illegible]	
	41	Lower Columbia River	[illegible]	
	42	California Central Valley	[illegible]	
	43	Upper Willamette River	[illegible]	
	44	Middle Columbia River	[illegible]	
	45	Northern California	[illegible]	
	46	Oregon Coast	*Species of Concern*	
	47	Southwest Washington	*Not Warranted*	
	48	Olympic Peninsula	*Not Warranted*	
	49	Puget Sound	[illegible]	• Critical habitat
	50	Klamath Mountains Province	*Not Warranted*	
Pink Salmon (*O. gorbuscha*)	51	Even-year	*Not Warranted*	
	52	Odd-year	*Not Warranted*	

1 The ESA defines a "species" to include any distinct population segment of any species of vertebrate fish or wildlife. For Pacific salmon, NOAA Fisheries Service considers an evolutionarily significant unit, or "ESU," a "species" under the ESA. For Pacific steelhead, NOAA Fisheries Service has delineated distinct population segments (DPSs) for consideration as "species" under the ESA.

LISTED AND PROPOSED ENDANGERED AND THREATENED SPECIES AND CRITICAL HABITAT; CANDIDATE SPECIES; AND SPECIES OF CONCERN IN COWLITZ COUNTY AS PREPARED BY THE U.S. FISH AND WILDLIFE SERVICE WESTERN WASHINGTON FISH AND WILDLIFE OFFICE

(Revised November 1, 2007)

LISTED

Bull trout (*Salvelinus confluentus*)

Columbian white-tailed deer (*Odocoileus virginianus leucurus*)

Marbled murrelet (*Brachyramphus marmoratus*)

Northern spotted owl (*Strix occidentalis caurina*)

Major concerns that should be addressed in your Biological Assessment of project impacts to listed animal species include:

1. Level of use of the project area by listed species.
2. Effect of the project on listed species' primary food stocks, prey species, and foraging areas in all areas influenced by the project.
3. Impacts from project activities and implementation (e.g., increased noise levels, increased human activity and/or access, loss or degradation of habitat) that may result in disturbance to listed species and/or their avoidance of the project area.

Sidalcea nelsoniana (Nelson's checker-mallow)

Major concerns that should be addressed in your Biological Assessment of project impacts to listed plant species include:

1. Distribution of taxon in project vicinity.
2. Disturbance (trampling, uprooting, collecting, etc.) of individual plants and loss of habitat.
3. Changes in hydrology where taxon is found.

DESIGNATED

Critical habitat for bull trout

Critical habitat for the marbled murrelet

Critical habitat for the northern spotted owl

PROPOSED

None

CANDIDATE

None

SPECIES OF CONCERN

Bald eagle (*Haliaeetus leucocephalus*)
Cascades frog (*Rana cascadae*)
California wolverine (*Gulo gulo luteus*)
Coastal cutthroat trout (*Oncorhynchus clarki clarki*)
Columbia torrent salamander (*Rhyacotriton kezeri*)
Larch Mountain salamander (*Plethodon larselli*)
Long-eared myotis (*Myotis evotis*)
Long-legged myotis (*Myotis volans*)
Northern goshawk (*Accipiter gentilis*)

Northwestern pond turtle (*Emys* (= *Clemmys*) *marmorata marmorata*)
Olive-sided flycatcher (*Contopus cooperi*)
Pacific lamprey (*Lampetra tridentata*)
Pacific Townsend=s big-eared bat (*Corynorhinus townsendii townsendii*)
Peregrine falcon (*Falco peregrinus*)
River lamprey (*Lampetra ayresi*)
Tailed frog (*Ascaphus truei*)
Valley silverspot (butterfly) (*Speyeria zerene bremeri*)
Van Dyke=s salamander (*Plethodon vandykei*)
Western toad (*Bufo boreas*)
Cimicifuga elata (tall bugbane)

Appendix K

Agency Review Comments and Response

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
PO Box 47775 • Olympia, Washington 98504-7775 • (360) 407-6300

RECEIVED
OCT 2 4 2011
GIBBS & OLSON, INC.

October 18, 2011

Mr. David Sypher, Public Works Director
City of Kelso Public Works Department
P.O. Box 819
Kelso, WA 98626

Re: Approval of Kelso General Sewer and Facilities Plan

Dear Mr. Sypher:

Pursuant to RCW 90.48.110 and WAC 173-240-030, the above-referenced General Sewer Plan/Facilities Plan (Plan) has been reviewed and is hereby approved. Enclosed is one copy of the approved Plan for your records.

Sewage facilities within the planning area boundary shall be constructed according to the approved general sewer plan or amendments thereto. Engineering reports and plans/specifications for construction of planned collection, treatment, and disposal facilities shall be submitted to this department for review and approval in accordance with Chapter 173-240 WAC.

Engineering reports and plans and specifications for sewer line extensions, including pump stations, need not be submitted for approval. Prior to construction, you are required to submit a written description of the project and written assurance that the extension is in conformance with the general sewer plan. In the following situations Ecology approval is necessary for sewer line extensions prior to construction:

a) The proposed sewers or pump stations involve installation of overflows or bypasses; or

b) The proposed sewers or pump stations discharge to an overloaded treatment, collection, or disposal facility.

Plans and specifications for projects described in this approved Plan must be submitted and approved prior to start of construction in accordance with WAC 173-240-030. Plans and specifications which deviate from the approved Plan will not be approved unless the report is so amended and approved.

If you have any questions concerning this approval, please contact Al Bolinger at 360-407-6319 or al.bolinger@ecy.wa.gov .

Sincerely,

Robert W. Bergquist, LEED© AP
Southwest Region Manager
Water Quality Program

Enclosure

cc: Mike Marshall, Gibbs & Olson, Inc.
Dave Dougherty, Ecology/SWRO

STATE OF WASHINGTON
DEPARTMENT OF HEALTH
OFFICE OF SHELLFISH AND WATER PROTECTION
16201 East Indiana Avenue, Suite 1500, Spokane Valley, Washington 99216
TDD Relay 1-800-833-6388

RECEIVED
FEB 11 2011
GIBBS & OLSON, INC.

February 4, 2011

Mr. David Sypher, Public Works Director
City of Kelso
PO Box 819
Kelso, Washington 98626

RE: City of Kelso, Cowlitz County, DOH Project #: R10-012 - Project Approval

Dear Mr. Sypher:

The City of Kelso's General Sewer and Facilities Plan received in our office on September 21, 2010 has been reviewed in accordance with the provisions of WAC 246-271 and for conformance with the Water Reclamation and Reuse Standards, and is hereby **APPROVED**.

Please note that this approval addresses issues of concern of this department and is not intended to either supersede or replace requirements of or approvals required from the Washington Department of Ecology.

Regulations establishing a schedule of fees for review and approval of planning, engineering and construction documents were adopted July 1, 1987 and revised in August 3, 2007. An itemized bill for $ 816.00 is enclosed.

If you have any questions, please feel free to contact me at (509) 329-2146 or by email at craig.riley@doh.wa.gov.

Sincerely,

Craig L. Riley

Craig L. Riley, P.E.
Water Reclamation & Reuse Program, Division of Environmental Health

cc: Clark County Public Health
Mike Marshall, Gibbs and Olson, Olympia
Greg Zentner, Dept. of Ecology, SWRO, Olympia
Regina Grimm, WDOH, SWRO, Tumwater

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
PO Box 47775 • Olympia, Washington 98504-7775 • (360) 407-6300

December 23, 2010

Mr. David Sypher, Public Works Director
City of Kelso Public Works Department
203 S. Pacific Ave., Suite 205
PO Box 819
Kelso, WA 98626

Re: Comments on Kelso General Sewer and Facilities Plan

Dear Mr. Sypher:

I have reviewed the above referenced document and have provided my comments below.

1. Ref. p. I-3, Figure VII-5 doesn't seem to exist. Please proof the document to insure all information is included in the document.
2. Ref. p. V, List of Figures, A Map Pocket referred to in the List of Figures doesn't seem to be included. Please include in the final document.
3. Ref. Appendix H, Please insure that SEPA compliance is documented in the final document.

If you have questions or comments on these comments, please contact me at 360-407-6319 or al.bolinger@ecy.wa.gov.

Regards,

Al Bolinger

Al Bolinger, P.E.
Facility Engineer
Water Quality Program
Southwest Regional Office

cc. Mike Marshall, P.E., Gibbs & Olson, Inc.
Southwest Region Central Files, Cowlitz County, Engineering