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City of Columbia City
Water System Master Plan

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Prepared for

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List of Acronyms

%	percent
ADD	average daily demand
AMR	Automatic meter reading
AWWA	American Water Works Association
CDBG	Community Development Block Grant
CF	Cubic feet
CIP	capital improvement plan
City	City of Columbia City
CT	contact time

DWP	Oregon Dept. of Human Services Drinking Water Program
EDA	U.S. Economic Development Administration
EPA	U.S. Environmental Protection Agency
FEMA	Federal Emergency Management Agency
ft	feet
ft/s	feet per second
GO	general obligation
gpcpd	gallons per capita per day
gpm	gallons per minute
HGL	Hydraulic grade line
HMI	Human machine interface
HP	horsepower
Hwy	Highway
IPS	Iron Pipe Size
ISO	Insurance Services Organization
MCL	maximum contaminant level
MDD	maximum daily demand
MFL	Million fibers per liter
MG	million gallons
mg/l	milligrams per liter
MRDL	Maximum Residual Disinfectant Level
NTU	nephelometric turbidity unit
OAR	Oregon Administrative Rule
BO-IFA	Business Oregon-Infrastructure Finance Authority
OHD	Oregon Health Division
ORS	Oregon revised Statute
OWRD	Oregon Water Resources Department
PHD	peak-hour demand
PLC	programmable logic controller
PRV	pressure-reducing valve
psi	pounds per square inch
PSU	Portland State University
PVC	polyvinyl chloride
RUS	Rural Utility Service
SCADA	supervisory control and data acquisition
SDC	system development change
SDWA	Safe Drinking Water Act
SDWRLF	Safe Drinking Water Revolving Loan Fund
SPWF	Special Public Works Fund
THM	trihalomethane
UGB	urban growth boundary
US EPA	United States Environmental Protection Agency
WMP	Water Master Plan
WRD	Water Resources Department
WTP	water treatment plant
WWF	Water/Wastewater Financing

Executive Summary

ES-1: Introduction

The purpose of this plan is to provide the City of Columbia City (City) with a comprehensive water master plan (WMP) for the future development of their water system. The plan includes a description of the existing water system, the planning criteria, a water system analysis, and a capital improvement plan.

ES-2: Existing System

ES-2.1 Service Area

The service area is defined by the urban growth boundary (UGB). Figure 2-1 shows the service area of the existing water system, city limits, the UGB, contours, property lines, and land use zoning. Figure 2-2 shows the existing water system. Figure 2-3 provides a hydraulic profile and a schematic representation of the system.

ES-2.2 Water Supply

The City has historically purchased treated water wholesale from the City of St. Helens. The connection is located on Highway (Hwy) 30 by L St. In 2007 the City brought PW-2 well into production with the hopes of becoming self sufficient, but flow rates have been less than anticipated and the City still must rely on the City of St. Helens when the well is down for maintenance or to meet peak summer time demands when well capacity is at its lowest and demand is highest. In 2010, the well was capable of producing a sustainable summer time flow of only 115 gallons per minute (gpm). Improvements to the well including: a rehabilitation effort to remove biofouling, lowering the well pump, and connecting the other smaller PW-1 well to the system should yield a sustainable minimum summer time flow of 215 gpm but this has not been adequately tested by seasons of experience.

ES-2.3 Water Rights

The City has water rights totaling 600 gpm for PW-1 and PW-2 wells. The City additionally has water rights for 750 gpm for a well not being utilized due to poor water quality located at the K St. Reservoirs site.

ES-2.4 Water Storage Facilities

The City has three storage reservoirs as summarized in Table ES-1:

Table ES-1: Storage Reservoirs

Reservoir Name	Capacity	Type	Year Built	Overflow Elevation (ft)	Condition or Comments
Upper Reservoir	0.2 MG	Welded Steel	1984	484	In need of repainting
0.2 MG K St.	0.2 MG	Welded Steel	1979	310	Recoated in 2007
1.0 MG K St.	1.0 MG	Concrete	2003	310	

The two welded steel reservoirs are not in compliance with current seismic codes, but no agency has requested any action at this time.

ES-2.5 Pump Stations

The City of Columbia City's water system utilizes two pump stations.

The Upper Booster Pump Station is located at the K Street Reservoirs site and pumps water to the Upper Reservoir. The L St.- St. Helens Booster pumps water from the City of St. Helens 14-inch treated water main up to the K St. Reservoirs.

The pump station information is summarized in Table ES-2

Table ES-2: Pump Station Data

Name	Upper Booster Pump	L St- St. Helens Booster Pump
Location	K St. Reservoir Site	Hwy 30 and L St.
# of Pumps & Capacity	2- 80 gpm each	2 – 210 gpm each
Type of Pumps	Centrifugal	Hydronix Packaged Station with Centrifugal Pumps
Standby Power	None	None
Controls	Controlled by float switches in Upper Reservoir via cable.	None. Controlled by the level in the K St. Reservoir via telemetry.
Structure	Wood building	Fiberglass Enclosure

ES-2.6 Transmission and Distribution Pipelines

Columbia City has approximately sixteen miles of pipelines comprising the water transmission and distribution system. A breakdown of the pipe diameters, lengths and material is presented in Table 2-4. Based upon the pipe type and age, overall, the City should have a fairly good distribution system over the planning period. However, as noted later in this report, there is a fairly high water loss rate and pipe size on some streets limits the available flows for fire fighting.

Of note is the presence of about a mile and a half of duplicate and unneeded older 4-inch pipe lines on 6th St and E St. that are still in service and parallels the newer 10–inch lines that should have been abandoned when the new 10-inch line was installed.

ES-2.7 City of St. Helens Water System Inside of Columbia City

The City of St. Helens has both treated and raw water lines within Columbia City. A 14-inch treated waterline runs down Highway 30 and then easterly to the inactive Ranney Collector #1 located in the center of the industrial zoned area of Columbia City. There is also piping and fire hydrants presumably owned by the Port of St. Helens that are in place to service the industrial area that are connected to and supplied by the City of St. Helens transmission main.

St. Helens also has two wells called Ranney Collectors located in Columbia City that serve as a raw water source. The raw water is pumped through Columbia City to their treatment plant located immediately south of the Columbia City city limits on 4th St.

ES-2.8 System Controls and Telemetry

The City's water system has an existing radio based telemetry system. A Human Machine Interface screen (HMI) is located in the public works office where system parameters such as flow rates, level of water in the reservoirs or the well can be monitored remotely.

The supervisory control and data acquisition (SCADA) system currently does not have the ability to record data. Currently, measurements are taken typically twice a week and entered manually into a spreadsheet.

The current system does not have the capability to monitor the level in the upper reservoir.

ES-2.9 Pressure Zones

The City of Columbia City's existing water system contains four pressure zones as shown in Figure 2-2 and as described below. A hydraulic profile of the system is shown in Figure 2-3.

Upper Reservoir Zone

This zone is fed by the upper reservoir. There are no service connections in this zone; however, there are piping and hydrants. Pressures are close to 20 pounds per square inch (psi). Homes in this zone are outside of the City limits and are serviced by a private water system.

Upper Zone

This zone is fed by the Upper Reservoir. Pressures are reduced at a pressure reducing valve (PRV) on K St. in front of the K St. reservoirs. The pressures on the highest street, 9th St., are very low at approximately 37 psi, while at the bottom of the pressure zone on the south end of 6th St. they are very high at approximately 108 psi.

Middle / K St Reservoir Zone

The Middle Zone is directly fed by the K St reservoirs and serves the majority of the town. Pressures range from 54 to 97 psi.

Lower Zone

The Lower Zone encompasses the entire side of the City east of the highway. It is fed by the middle zone by three PRVs located at E, I, and L Streets. Pressures range from 62 to 102 psi.

ES-2.10 Pressure Reducing Stations

The City has six active pressure reducing stations. All but the I St. Station are in good operable condition. None are equipped with pressure relief back-ups to relieve pressure if the pressure reducing valve should fail.

The I street PRV Station is in a circular vault that is difficult to access and work in and the isolation valves are not operable. It is suspected that the I St PRV is not even functioning.

An inactive PRV station is located at the intersection of K and 9th St. The valving is still present and could be refurbished and piping reconfigured to make functional.

ES-3: Water Requirements

ES-3.1 Historical and Projected Water Demand:

Future Water requirements were calculated based on current per capita usage applied to future estimated population and are presented in Table ES-3.

Table ES-3: Historical Water Usage and Demand Projections

Year	Population	Total Annual Consumption	ADD (gpcpd)	ADD (gpm)	MDD (gpm)	PHD (gpm)
2009	1,934	62,455,404	90	120	435	-
2010	1,979	56,681,353	80	109	236	-
2011	2,025	53,120,821	73	102	200	-
2012	2,053	60,397,207	81	117	291	437
2022	2,346	69,016,974	81	133	333	499
2032	2,580	75,901,020	81	146	366	549

The relationships between the various water system demands are called peaking factors. This study uses peaking factors to develop two commonly used demands: maximum daily demand (MDD) and peak-hour demand (PHD). Since the data available for this study was in the form of monthly purchase records and flow data recorded every three to five days, no historical daily demand peaking factors can be calculated. Therefore, the peaking factors are based on industry-standard values. A MDD/average daily demand (ADD) peaking factor of 2.5 was used and a PHD/MDD peaking factor 1.5 was used for this study.

ES-3.2 Unaccounted-for Water

Unaccounted-for water in the Columbia City Water System is defined as the difference between the total of water pumped from the City's wells added to the water purchased from St. Helens and the total amount of water billed to customers. This difference between water records results from leakage losses, meter discrepancies, unmetered uses such as hydrant and main flushing, operation and maintenance uses, unauthorized connections, fire flow uses, and other unmetered miscellaneous uses. Currently, the City is averaging about 13 percent (%) water loss, which is pretty typical; however, American Water Works Association (AWWA) recommends a goal of less than 10% for municipal systems. Table ES-4 presents the historical water losses for the last five years.

Table ES-4: Historical Unaccounted-for Water

	Units	2007	2008	2009	2010	2011	Average
Total Treated Water Pumped	(MG)[a]	**7.8**	**8.1**	**8.3**	**7.6**	**7.1**	**7.8**
Total Metered Consumption	(MG)	**7.1**	**6.7**	**7.3**	**6.6**	**6.1**	**6.7**
Unaccounted-for water	(MG)	**0.7**	**1.4**	**1.0**	**1.0**	**1.0**	**1.0**
Unaccounted-for water	(%)	**9%**	**18%**	**12%**	**13%**	**14%**	**13%**

Notes:
a) MG = million gallons

ES-3.3 Large-Volume Users

Large-volume users create high point loads on the system. The large-volume users for the City are comprised of industrial, commercial, and institutional customers. The top five water users in the City were compiled from meter records and are presented in Table ES-5 It is important to note that the ADD presented is based on annual usage. The actual daily and hourly peak use will vary depending on the specific use.

Table ES-5: Current Large-Volume Water Users

Rank	User	Type	July 2011 to June 2012 usage (CF)	Annual Usage (MG)	ADD (gpm)	Percentage of System ADD
1	West Oregon Wood Products	Industrial	178,250	1.33	2.54	2.2%
2	Columbia City Sports & Recreation Club	Commercial	30,530	0.23	0.43	0.4%
3	Columbia City School	Institutional	24,252	0.18	0.35	0.3%
4	Caples House Museum	Commercial	17,620	0.13	0.25	0.2%
5	Mini Mart/Gas Station	Commercial	12,000	0.09	0.17	0.1%

Abbreviations:
ADD = average daily demand
CF = cubic feet
gpm = gallons per minute
MG = million gallons

ES-4: System Analysis Criteria

This section presents the criteria used for the master plan system analysis of the existing and future water system.

ES-4.1 Master Plan Analysis Criteria

The following criteria were used to evaluate the adequacy of the water system to provide for the existing (2012) and projected (2032) demands. All Oregon Health Authority (OHA) and Oregon Water Resources Department (OWRD) requirements are met through the proposed criteria, which are acceptable standards of practice in typical master plan studies.

ES-4.2 Source

The source capacities must be adequate to supply water demand to each service zone. Columbia City's storage reservoirs provide peaking equalization and, therefore, the source capacity required is the MDD. Demands greater than the MDD can be served from the reservoir storage.

ES-4.3 Storage

The recommended storage criteria for systems the size of Columbia City's is a minimum of three to a maximum of five times the ADD.

ES-4.4 Pipelines

The DWP has established that the pipeline network should provide the required fire flows in conjunction with the MDD with a minimum residual pressure of 20 pounds psi at any point in the system and a maximum pipeline flow velocity of 10 feet per second (ft/s).

Water mains should be looped wherever feasible in order to prevent dead-ends

Pressure zones should be set to provide 45 to 80 psi.

ES-4.5 Pump Station Flow Rates

Pump stations that feed reservoirs are sized to meet the maximum daily demand (MDD).

ES-4.6 Fire Flow Requirements

The fire flow required for Columbia City is shown in Table ES-6. Fire hydrant spacing requirements required by the St. Helens Fire District is 250 feet from the hydrant to a structure along the hose laying path.

Table ES-6: Fire Flow Design Criteria

	Flow (gpm)	Duration	Minimum System Pressure	Total Volume (gallons)
Residential	1,000	2 hours	20 psi	120,000
Commercial	2,500	2 hours	20 psi	300,000
Industrial	3,500	3 hours	20 psi	630,000

ES-5: Water Quality Requirements

This section contains a discussion of the regulatory requirements enforced on water distributors in the State of Oregon. In short, the City is in compliance with regulations. In general, surface water requires more treatment processes than groundwater.

ES-6: Water System Analysis

ES-6.1 Demand Allocation and Growth

The population of Columbia City is expected to increase by 27% over the 20-year planning period. As depicted in Table ES-3, this will result in a growing water demand. The addition of a large industrial consumer could increase the City's water usage.

ES-6.2 Water Source and Supply

Columbia City obtains water from two sources, the PW-1 and PW-2 well system and from the City of St. Helens. Assuming a reliable sustainable flow during summer months of only 215 gpm (see Section 2.2) from the City's existing wells compared to an estimated 291 current MDD and a forecasted MDD of 366 gpm at the end of the planning period, it is clear that without an additional water source, the City will continue to rely on St. Helens to meet their maximum day demands. Table ES-7 shows the estimated deficiency of the existing wells to meet the maximum daily demands.

Table ES-7: Existing Well Production Deficiency

	ADD (gpm)	MDD (gpm)	Existing Wells (gpm)	MDD Deficit (gpm)
2012	117	291	215	76
2022	133	333	215	118
2032	146	366	215	151

The amount of water that the City would need to purchase from St. Helens in the future without an additional water source cannot be reasonably estimated at this time due to the need being required on peak demand days that are a function of weather and also due to the unproven track record of the recent improvements to the PW-1 and PW-2 Well system.

ES-6.3 Identification of Source Options

The City has previously attempted to find additional water sources and become self sufficient for its water needs and it is still the City's desire to become self sufficient. Previous work has included drilling wells and considering acquiring the City of St. Helens Ranney Collector Well #1. It is recommended that the City find a new water source with a production rate of 400 gpm; however, an acceptable alternative would be to find a water source with a minimum of 150 gpm to meet peak daily demands and rely on the St. Helens system only as a redundant/emergency source.

ES-6.3.1 New Well Source

Past efforts to find water have had limited success; however, additional target areas for finding a producing well are available. It is recommended that a hydrogeologic feasibility report be conducted to identify target areas that also takes into consideration the engineering challenges of getting the water into the existing system. After the feasibility study is completed, then the approach would be to drill test holes at different locations. Pending the results of the test holes, then apply for water rights and develop the new well or wells.

ES-6.3.2 St. Helens Ranney Collector #1

In 2005, the City investigated utilizing the City of St. Helens Ranney Collector #1 that is along the river in the middle of the industrial zoned land owned by the Port of St. Helens inside the City of Columbia City's City limits. The evaluation (included in the Appendix) reported that the collector and chlorination equipment was in reasonable condition, had a reported capacity 500 gallons per minute, water quality was good, the well was not under the influence of surface waters, and could be operated as is with no or minimal work. For reasons not clear in the record, the City did not continue to pursue this option and refocused their attention on developing the PW-2 well. Unfortunately, the flow rates from PW-2 are not what was anticipated at that time. Reconsidering Ranney Collector #1 should be further investigated with special attention given to determining risk of the possibility that the well may now or in the future be influenced by surface water which would require the costly construction of a water treatment plant.

The City of St. Helens draft Water Master Plan reportedly lists Ranney Collector #1 as a possible emergency source of treated water for their water system.

If the Ranney Collector is acquired from the City of St. Helens, then it would be logical for the City of Columbia to also acquire the connected piping in the industrial area as well as the transmission main along Highway 30.

Estimating the cost to acquire St. Helens' Ranney Well #1 and the rest of the treated water piping in Columbia City, is difficult to perform at this time due to the many unknowns and the political aspects involved that are all beyond the scope of this study. At a minimum, additional discussions with the City of St. Helens should be initiated.

ES-6.3.3 Surface Water Source

Due to the high capital cost of building a surface water treatment plant, a surface water source presumably from the Columbia River, should only be considered if the City has exhausted its search for groundwater which does not require expensive treatment methods such as filters. Assuming reasonable rates from the City of St. Helens who already has a water treatment plant to treat water from their other Ranney Collectors, it is very likely that Columbia City would not experience a cost savings by building their own water treatment facility.

ES-6.3.4 Continued Reliance on St Helens Water System

The advantage of continuing to rely on the St. Helens Water system to meet the peak daily flows is that it does not require any capital investment. The disadvantages include the dependence on another municipality.

ES-6.4 Pump Stations

ES-6.4.1 L Street - St. Helens Water Booster Pump Station

This pump station does not have enough capacity to serve current and future maximum daily demands and should be upgraded to increase its capacity from 210 gpm to at least the future maximum daily demand of 366 gpm.

ES-6.4.2 Upper Booster Pump Station

The Upper Booster Pump Station has enough capacity for the planning period.

ES-6.5 Storage

The City has adequate storage over the planning period and no additional storage is needed. The City may consider lowering the levels in the reservoirs to decrease that amount of time the water is held in the reservoirs if water quality issues due to age become a concern.

As noted previously, the Upper Reservoir is in need of being repainted. The other reservoirs are currently in good condition.

ES-6.5 Computer Simulation Model

The hydraulic modeling of the system shows that the system is capable of meeting the maximum daily demand (MDD) and the PHD; however, deficiencies in pressure, fire hydrant spacing, and available fire flow were identified.

ES-6.5.1 Pressure Analysis

Figure 6-1 shows areas of the existing system with excessive high pressures (over 80 psi) and areas with insufficient low pressures (less than 45 psi). The only area of town currently with too low of pressures is 9th St. between K and I Streets.

Areas with high pressure are undesirable for the following reasons:

1. Increase unaccounted-for water through leaks
2. Increased water use and waste due to high pressures
3. Increased maintenance of pipe and service laterals.
4. Customer complaints of too high of pressure
5. Increased risk of safety due to high pressures.

Areas of low pressure are also undesirable for the following reasons:

1. State required minimum at all times is 20 psi.
2. Household appliances, sprinklers, and irrigation systems do not work well.

3. Customer complaints.
4. Potentially dropping below 0 psi in fire flow conditions and causing water quality issues.

To address the pressure issues in the town, three new pressures zones are recommended and pressures in two zones be reduced simply by adjusting the existing valves. Creation of new pressure zones will require the installation of four new pressure reducing stations, refurbishing one existing station currently not in service, and moving another. Figure 6-2 shows the proposed new pressure zones and the pressure contours. Figure 6-3 shows the proposed system hydraulic profile and system schematic. Figure 6-5 shows the proposed water system and pressure zones.

ES-6.5.2 Fire Flow Analysis

The modeling analysis of fire flows shows that the system is capable of providing required fire flows to the residential, commercial, and industrial areas with the following exceptions:

1. Six hydrants connected to the inadequately sized 3-inch and 4-inch lines on The Strand, 1st St. and 4th St.
2. One at A and 6^{th} St.
3. One hydrant at the east end of 9^{th} St.

Hydrants with deficient fire flow are show on Figure 6-4. The modeling showed Items #1 and #2 would require upsizing the mains to 6-inch pipes. Item #3 could be corrected by connecting the south end of the dead end 9^{th} St. line with the line on K St.

ES-6.5.3 Fire Hydrant Spacing

Applying the criteria that fire hydrants be spaced within 250 feet of a structure, it was found that there are numerous gaps in the fire hydrant coverage. Figure 6-6 shows the locations of the areas not meeting the fire hydrant spacing requirements and the proposed hydrants. A total of 33 additional hydrants is estimated; some providing coverage up to 11 homes down to three hydrants that just provide coverage to one home.

ES-6.5.4 Proposed Hydrants - Fire Flow Deficiencies

The hydraulic modeling showed six of the proposed hydrants with insufficient fire flow occur on the same insufficiently sized mains described previously for existing hydrants on The Strand, 1st St., and 4th St.

ES-6.5.5 Future Development Areas

The hydraulic modeling shows that the existing system has the capabilities to be expanded and adequately serve all the areas inside of the current UGB.

As discussed above, the undeveloped Industrial lands are currently served by the City of St. Helen's Water System and no piping is proposed at this time to service that area. Modeling did show that Columbia City system is capable of servicing the area for fire flows.

ES-6.6 Other System Improvements

Included in this category are items to make the system operate more efficiently and safely.

ES-6.6.1 Adding Backup Pressure Relief to PRV Stations

The existing PRV stations do not have backup pressure relief valves to protect downstream customers if the pressure reducing valves fail. While the likelihood of a valve failing is low, the financial liability of causing a water heater or other plumbing fixture to fail and flood a house or many houses is very high. It is recommended to install these on the six existing PRV stations.

ES-6.6.2 Water Service Meter Reading

The City is interested in and has investigated Automatic Meter Reading (AMR) systems. Customer water consumption is currently read manually on a monthly basis by Public Works employees. AMR is a beneficial tool that can save time, money, and mistakes for a water purveyor like Columbia City. AMR systems can also be a powerful tool in water conservation efforts by identifying customer side leaks in a timely manner. Once the specialty meter and hardware are purchased and in place, manual reading of meters will no longer be required except for verification that the automatic process is operating correctly. The City has already included this item in a recent funding application that is still in process.

ES-6.7 System Controls and Telemetry

The existing deficiencies include the inability to remotely monitor the level of the upper reservoir remotely and the inability to store data. These are each discussed below.

ES-6.7.1 Upper Reservoir Level Monitoring

The level of the upper reservoir currently is checked manually by connecting a pressure sensor to a port in the reservoir. The mechanical level indicator on the side of the tank is not functioning and repair is not recommended. Installing a level sensor inside the tank is relatively easy; getting the signal to the City's existing SCADA system is more difficult and will require additional investigation as to the best solution.

ES-6.7.2 Data Storage and Retrieval

The current SCADA system software does not allow the storage and retrieval of data. Data is currently read and entered manually into a spreadsheet, typically twice a week. Data includes items such as pump run times, level of water in the wells and storage reservoirs, flow rates, etc. Daily data is not available and only reflects averages over a 3-5 day period. Daily data is highly desired for analysis for determining items such as maximum daily demand. Other valuable data such as pumping rates and level of water in the wells would be very useful for determining well capacity if it was stored electronically in a data base. The current software installed in 2003 is reportedly capable of having this feature added; however, the software is now considered out of date.

ES-7: Recommendations and Capital Improvement Plan

This section contains the recommended Capital Improvements to the Columbia City water system over the next 20 years. A description of each project is included in section 7.2 and itemized cost estimates for each project are included in the Appendix.

The projects for the additional source will need to be updated as more information is developed such as the feasibility of acquiring the St. Helens Ranney Collector or the location of the new wells, negotiations between owners and agencies, and the outcome of further hydrogeological studies. The CIP plan does not include investigating a new well source as pursuing the Ranney Collector is the City's desired approach.

The CIP summary table is shown in Table ES-8. The costs shown are 2012 dollars; therefore, the City will need to adjust the costs depending upon when the projects are actually undertaken.

ES-8: Funding

We have listed the standard funding agencies and programs for public works infrastructure projects with a general description of the program and contacts for further information. If the City wishes to fund a project, it is highly recommended to attend a "one-stop" meeting in Salem. Representatives of all the funding agencies attend and will let you know what they have available for your project.

Table ES-8: Capital Improvement Plan

	Project	Schedule (Fiscal Years)	Total Project Cost	Existing Needs		Future Need (SDC Eligible)	
				%	Cost	%	Cost
1	Additional Water Source						
1B-1	Ranney Collector #1 Initial Evaluation	2014	$ 12,000	49.7%	$ 5,960	50.3%	$ 6,040
1B-2	Ranney Collector #1 Technical Support	2015 (Pending above)	$ 20,000	49.7%	$ 9,934	50.3%	$ 10,066
2	L St. Booster Pump Station Upgrade	2024	$ 35,000	100%	$ 35,000		
3	Upper Reservoir Restoration	2014-2016	$ 112,000	100%	$ 112,000		
4	Reservoir Seismic Upgrades	2029	$ 150,000	100%	$ 150,000		
5	Pressure Zone Adjustments						
5A	Create 9th St. Pressure Zone	2014	$ 90,000	100%	$ 90,000		
5B	North End Pressure Zone Reduction	2014	$ 290,000	100%	$ 290,000		
5C	Moving 6th St. PRV Station	2014	$ 16,000	100%	$ 16,000		
6	Replacement of I St. PRV	2014	$ 70,000	100%	$ 70,000		
7	Abandon old 4" Piping	2014	$ 100,000	100%	$ 100,000		
8	PRV Pressure Relief Valves	2014	$ 46,000	100%	$ 46,000		
9	Replace Small Diameter Waterlines	2014-2024	$ 590,000	100%	$ 590,000		
10	Additional Fire Hydrants	2014-2024	$ 200,000	100%	$ 200,000		
11	Automatic Meter Reading	2014	$ 153,000	100%	$ 153,000		
12	SCADA System Upgrades						
12A	Upper Reservoir Level Monitoring	2014-2019	$ 9,000	100%	$ 9,000		
12B	Data Storage	2014-2019	$ 35,000	100%	$ 35,000		
13	Leak Detection Survey	2013 and every 3-5 years	$ 6,000	100%	$ 6,000		
	Total		**$ 1,922,000**		**$1,911,934**		**$ 10,066**

Section 1: Introduction

1.1 Authorization

Kennedy/Jenks Consultants (Kennedy/Jenks) was commissioned in December of 2011 by the City of Columbia City (City) to develop a master plan addressing the current status and future needs of the water system, with attention given specifically to serve the industrial lands within the City.

1.2 Acknowledgments

Kennedy/Jenks appreciates the input, many hours of work, and support from City staff, including Leahnette Rivers, Micah Rogers, Andrew Nollette, Randall Christophersen, and Micah Olson. Additional gratitude is extended to the City of St. Helens Staff for providing information on their water system and also to the Port of St. Helens for information on the industrial lands and financial contribution to help fund this study.

1.3 Purpose and Scope

Components of the water system that will be analyzed and discussed are the water supply source, storage facilities, and the distribution and transmission systems. Following a thorough analysis of the existing systems, alterations and improvements to the water system will be recommended, and a capital improvement plan will be provided.

The purpose of this plan is to provide the City with a comprehensive water master plan (WMP) for the future development of their water system. This plan is comprised of eight sections:

- Section 1 includes the purpose and scope of the plan
- Section 2 discusses the service area and a description of the existing water system
- Section 3 provides an analysis of existing water use, population projections, and future water use projections
- Section 4 summarizes the water system planning criteria
- Section 5 contains a brief regulatory evaluation of the water system
- Section 6 provides a hydraulic and capacity analysis of the existing and future water systems
- Section 7 provides a detailed Capital Improvement Plan through 2028 that includes order-of-magnitude cost estimates
- Section 8 provides a summary of funding sources available.

Columbia City has previously prepared a water system plan in 1997, Crane and Merseth Engineering/Surveying. This 2012 comprehensive WMP will account for the changes made to the water system since the previous planning efforts and will serve as a stand-alone document.

Section 2: Existing System

2.1 Service Area

The City of Columbia City owns and operates the potable water system that provides water to its residents, commercial and industrial facilities, and connections outside the city limits to the south of town inside the Urban Growth Boundary (UGB). The service area is all within the UGB. Daily maintenance and operation of the water system are performed by City staff.

Figure 2-1 shows the service area of the existing water system, City limits, the UGB, contours, and property lines, and zoning. Figure 2-2 shows the distribution system within the service area. Figure 2-3 is a hydraulic profile and provides a schematic of the water system.

2.2 Water Supply

The City currently obtains its water from two sources; City of Columbia City owned wells and from the City of St. Helens.

The City of Columbia City water system is currently supplied mainly by two wells located at the public works yard. Water is pumped from the two wells; PW-1 and PW-2, through a dedicated reservoir fill line to the K St. Reservoirs.

PW-2 serves as the primary source of water for the town. This well was drilled in March 2007 with a reported sustainable yield of 400 gallons per minute (gpm). PW-2 was brought on line in August 2008 but did not perform as anticipated. Work was performed in 2010 including removal of biofouling by mechanical and chemical treatment with limited success. The well has a reported minimum summer time sustainable yield of about 115 gpm. In 2011 the pump was lowered 10 feet (ft) to increase summer time flow by a theoretical flow of 85 gpm to bring the total theoretical sustainable flow of PW-2 up to 215 gpm; however, this has not been adequately tested over multiple seasons of experience. Winter time flow rates are substantially higher and able to meet current demands. The pump has an adjustable frequency drive that allows for the operator to adjust the flow rate and is reportedly capable of pumping up to 325-350 gpm.

PW-1 was completed in September 2006, with a reported capacity of 40 gpm. Due to interference with PW-2, it is currently estimated that PW-1 will only add a net flow of 15 gpm during summer months but this has not yet been verified by experience. The theoretical combined summer time flow capacity of the combined PW-1 and PW-2 is 215 gpm. PW-1 was connected to the wellhead treatment facilities of PW-2 in the spring of 2012. A separate flow meter was installed on the PW-1 discharge line so the flow rates from each well can be accounted for.

The estimated total flow from the City's Wells is summarized in Table 2-1.

Table 2-1: Expected Sustainable Minimum Flow Rates from PW-1 and PW-2

Item	Flow Rate
PW-2 Minimum reported sustainable summertime flow rate	115 gpm
Theoretical Increase for lowering the pump 10 ft.	85 gpm
Expected net summertime increase from PW-1	15 gpm
Theoretical Total Flow	215 gpm

Water from both PW-1 and PW-2 is treated with chlorine for disinfection and also with sodium hydroxide for pH adjustment by a flow paced injection system located in the PW-2 well house. The groundwater is treated with enough contact time to provide a 4-log viral inactivation. Adequate contact time is provided by the piping from the well to the K St. Reservoirs and the K-St. Reservoirs.

In January 2011, a Source Water Assessment Report was completed that identified potential (not actual) sources of contamination to PW-2 within the Drinking Water Protection Area. The City is currently developing a Water Source Protection Plan.

The City of Columbia City also purchases treated water wholesale from the City of St Helens, when needed, such as when the existing wells are not operating for maintenance or if peak demands exceed the well capacity. The connection is located on the west side of the highway by L St. as shown on Figure 2-2. The rate is assessed to Columbia City each month for the volume of water measured by a flow meter at the point of entry into Columbia City's water system. A copy of the Water Agreement with the City of St. Helens is included in the Appendix.

2.3 Water Rights

A list of the water rights held by the City is presented in the Sanitary Survey included in the Appendix of this report. Note that the only water rights that are in production pertain to PW-1 and PW-2. The 9th and K St. water rights are not currently being utilized due to water quality issues related to brackish water encountered in the Columbia River Basalts and is not considered a future source. The water rights are summarized in Table 2-2:

Table 2-2: Water Rights Summary

Point of Diversion	Permit #	Water Right	Priority Date
9th and K St. Well (L39270) Well #4 (L42053)	G13937	750 gpm	02/22/00
Public Works Well #1 (L76752 & Public Works Well #2 (L80323)	GR2515/T10507	100 gpm	12/19/07
Public Works Well #1 (L76752 & Public Works Well #2 (L80323)	G16438	500 gpm	12/19/07

2.4 Water Storage Facilities

The City of Columbia City has three water storage reservoirs.

K Street 0.2 million gallons (MG) Reservoir

This is a circular, welded-steel reservoir with an original design capacity of 200,000 gallon (0.20-MG), and was installed in 1979 and repainted in 2007. The tank measures 33 ft in diameter and 32 ft high with a finished floor elevation of 278.35. As part of this study, the elevation of the ring wall was surveyed in the spring of 2012, (NAVD 88/97 datum). The overflow is at an elevation 310.35.

A preliminary assessment in 2010 indicated that seismic upgrades would be required to bring the reservoir up to current codes but this is not required by any authority at this time.

K Street 1.0-MG Reservoir

Constructed in 2003, this circular concrete reservoir has a capacity of 1.0 MG. It is 32.5 ft tall and has a diameter of 75 ft. The overflow elevation is assumed to be the same as the 0.2 MG K St. at 310.35 and a calculated floor elevation of 278.85 (NAVD 88/97 datum).

The two K St reservoirs provide storage for the lower and middle pressure zones.

Upper 0.2 MG Reservoir

This is a circular, welded-steel reservoir with an original design capacity of 200,000 gallon (0.20-MG), and was installed in 1984. The tank measures 33 ft in diameter and 32 ft high with a finished floor elevation of 452.80. As part of this study, the elevation of the ring wall was surveyed in the spring of 2012, (NAVD 88/97 datum). The overflow is at an elevation 484. There is currently no level indicator.

The inside of the tank was inspected by underwater divers in 2000. They recommended the tank be drained, sand blasted, and re-coated as the coating was not in good enough condition to conduct underwater repairs to areas of corrosion. A quarter inch of sediment was removed during the inspection episode. The coating on the exterior of the tank is visibly in poor condition.

A preliminary assessment in 2010 indicated that seismic upgrades would be required to bring the reservoir up to current codes but is not required by any authority at this time.

The upper reservoir provides storage for the upper pressure zone.

2.5 Pump Stations

The City of Columbia City's water system utilizes two pump stations. Both pump stations do not have transfer switches and electrical connections to receive backup electrical power from the City owned portable generators; however, this is common in the industry for pump stations feeding reservoirs as the reservoirs typically provide for several days of emergency storage for situations such as the loss of power.

The Upper Booster Pump is located at the K St. Reservoirs site. This pump station pumps water from the K St. Reservoirs to the Upper Reservoir. The reported flow rate from flow tests done by City staff in 2004, show a flow rate of approximately 80 gpm.

The L St.-St Helens Booster Pump station pumps water from the City of St. Helens 14-inch treated water main at a reported hydraulic grade of 261.5 feet to the K St. reservoirs at the 310 ft elevation level. The capacity of the pump station of 210 gpm was estimated using the average of data provided by the City for July and August of 2010.

The City’s pump station information is summarized in Table 2-3.

Table 2-3: Pump Station Data

Name	Upper Booster Pump	L St- St. Helens Booster Pump
Location	K St. Reservoir Site	Hwy 30 and L St.
# of Pumps & Capacity	2- 80 gpm each	2 – 210 gpm each
Type of Pumps	Centrifugal	Hydronix Packaged Station with Centrifugal Pumps
Standby Power		None
Controls	Controlled by float switches in Upper Reservoir via cable.	None Controlled by the level in the K St. Reservoir via telemetry.
Structure	Wood building	Fiberglass Enclosure

2.6 Transmission and Distribution Pipelines

Columbia City has approximately sixteen miles of pipelines comprising the water transmission and distribution system. A breakdown of the pipe diameters, lengths and material is presented in Table 2-4. The distribution system is shown on Figure 2-2.

Table 2-4: Existing Distribution and Transmission Pipe Inventory

Diameter (in)	Length Ductile Iron (ft)	Length PVC (ft)	Length Cast iron (ft)	Length Galvanized iron (ft)	Length All Materials (ft)	Comments
Distribution						
2	0	1,036	0	286	1,988	
3	0	491	5,014	0	5,505	
4	1,024	6,247	6,779	0	14,050	
6	1,406	18,209	1,399	0	22,304	
8	455	13,219	0	0	16,054	
10	771	12,387	0	0	13,158	
12	2,898	139	0	0	3,037	
16	3,378	0	0	0	3,378	

Diameter (in)	Length Ductile Iron (ft)	Length PVC (ft)	Length Cast iron (ft)	Length Galvanized iron (ft)	Length All Materials (ft)	Comments
18	150	0	0	0	150	
Total	10,082	51,728	13,192	286	79,624	
Transmission						
6	0	1,290	0	0	1,290	PW-2 to L St PS
8	0	1,510	0	0	1,510	L St PS to K St Reservoir
8	0	870	0	0	870	K St PS to Upper Reservoir
Total	**0**	**3,670**	**0**	**0**	**3,670**	
Total System	**10,082**	**55,398**	**13,192**	**286**	**83,294**	

The pipelines which make up the distribution system are, for the most part, located in public rights-of-way and are predominantly looped. All connections are metered. The majority of the distribution system serving Columbia City consists of 6-inch and 8-inch pipe, with 10-inch polyvinyl chloride (PVC) pipelines running through the center of the distribution system acting as the main arterial feeder.

Based upon the pipe type and age, overall, the City should have a fairly good distribution system. However, as noted later in this report, there is a fairly high water loss rate.

The 10-inch pipeline on 6th Street is reportedly Iron Pipe Size (IPS) pressure class 200 pipe. It is the older style that was strips of PVC welded together instead of the continuous extruded pipe that they make now, and the pipe reportedly often splits along the welds during tapping of service lines and is a definite concern. There are no markings on sections of the pipe removed to indicate the type or pressure ratings of the pipe.

Along 6th St. and E St, there is a preexisting 4-inch line of uncertain age running parallel to the newer 10-inch pipe. There is approximately 7,650 ft of this line including approximately 5,850 ft on 6th St. and another 1,800 ft along E St. Unfortunately, when the new line was installed, the 4-inch line was not disconnected and generally only the services and hydrants on the same side of the street were reconnected. The 4-inch pipe is still in service. An unknown number of service lines and some fire hydrants are still connected to the old 4-inch pipe. Connections to the old 4-inch pipe to other mains at intersections is unclear and confusing on available as-built maps and cannot be verified at this time without additional testing and physically exposing some of the connections.

2.7 City of St. Helens System Inside of Columbia City

The City of St. Helens has both treated and raw water lines within Columbia City. A 14-inch reinforced concrete treated waterline runs down Highway 30 and then easterly to the inactive Ranney Collector #1 located in the center of the industrial zoned area of Columbia City. The industrial zoned area is owned by the Port of St. Helens and piping connected to the line is presumably owned by the Port of St. Helens. Connected to the St. Helens transmission line is a fire loop to the south of Ranney Collector #1 of reportedly 10-inch pipes and fire hydrants around the Western Oregon Wood Products facility. Also connected to the St. Helens transmission line and in the north part of the industrial area, there is a 10-inch line to the north with hydrants and also a 4-inch service line to the Pro-Build Wood Products office. Backflow preventers are reportedly in place where the Port owned lines are connected to the St. Helens transmission main.

Original construction plans or “as-builts” of the St. Helens water system and other connected piping inside the industrial area could not be located for this study. The information on the piping was obtained by a hand drawn sketch map provided from the City of St. Helens. Pipe sizes and locations along with hydrant locations have not been verified and locations shown in this report are only approximate. The Western Oregon Wood Products facility and Port of St. Helens office, both located at the south end of the industrial area, are serviced by the City of Columbia City for non-fire flow uses.

The Columbia City connection to the St. Helens system is on the west side of the Highway across from L St. by the L St. Booster Pump Station.

The City of St. Helen’s raw water system through Columbia City includes 14-inch lines on E St. and K St coming from Ranney Collectors #2 and #3 which connect to a 20-inch line on 3rd St. which continues to the City of St. Helens Water Treatment Plant located immediately south of the Columbia City limits on 4th St.

2.8 System Controls and Telemetry

The City’s water system has an existing radio based telemetry system. A human machine Interface screen (HMI) is located in the public works office. The supervisory control and data acquisition (SCADA) software brand is RS View.

The Upper. Booster Pump Station is controlled by float switches in the upper reservoir that send a signal via a cable placed with the pipeline in 1984 that connects the pump station to the upper reservoir. The controls are transmitted to the programmable logic controller (PLC) installed during the 1.0 MG reservoir installation episode in 2003. The PLC is connected to the central SCADA system via radio telemetry.

The L Street / St. Helens booster pump station is controlled by the level of the K St. Reservoirs via radio telemetry. This is also connected to the central SCADA system.

The PW-2 Well System is controlled by a PLC located in the PW-2 Well building and is connected to the central SCADA system.

The SCADA system currently does not have the ability to store data; however, it is reported that the RS View brand software does have the capability but the programming to store data was never competed. Currently, data is entered manually into a spreadsheet, typically twice a week.

2.9 Pressure Zones

The City of Columbia City’s existing water system contains four pressure zones as shown in Figure 2-2 and as described below.

Upper Reservoir Zone

This zone is fed by the upper reservoir. There are no service connections in this zone; however, there are piping and hydrants. Pressures are close to 20 pounds per square inch (psi). Homes in this zone are outside of the City limits and are serviced by a private water system.

Upper Zone

This zone is fed by the Upper Reservoir. Pressures are reduced at a pressure reducing valve (PRV) located in the sidewalk on K St. in front of the K-St. Reservoirs. As shown in Table 2-5, pressures on the highest street, 9^{th} St., are very low especially on the uphill side of the street. while at the bottom the pressure zone on the south end of 6th St. are very high. The hydraulic grade line (HGL) is 395 ft.

Middle Zone

The Middle Zone is directly fed by the K St reservoirs and serves the majority of the town. The HGL is 310 ft.

Lower Zone

The Lower Zone encompassed the entire side of the City east of the highway. It is fed by the middle zone by three PRVs located at E, I, and L Streets. The HGL is currently set at about 250 ft.

The existing pressure zone information is summarized in Table 2-5. A hydraulic profile of the system is shown in Figure 2-3

Table 2-5: Current Pressure Zone Information

Name	Elevations Served (ft)	Pressure (psi)	HGL (ft)	Source/Control
Upper Reservoir Zone	None	N/A	484	Upper Reservoir
Upper Zone				K St PRV
Highest Elevation (9^{th} St. high point)	310	37	395	
High point in Main line, (middle of 9th)	285	47	395	
Lowest Elevation (S. end of 6th)	145	108	395	
Middle Zone, K St Reservoir Zone				K St. Reservoir
Highest Elevation (H and 6th St.)	185	54	310	
Highest House-(Dickson Dev.)	188	52	310	
Lowest Elevation	86	97	310	
Lower Zone				E,I, and L St PRVs
Highest Elevation (4th and M)	106	62	250	
Lowest Elevation (S. end of 2nd St.)	15	102	250	

2.10 Pressure Reducing Valves (PRVS)

The City of Columbia City's existing water system contains six operating pressure reducing stations. Each has smaller diameter low flow by-pass line with a smaller PRV valve. None have pressure relief valves that protect downstream pressures in case the PRVs fail. The PRV stations are all located in underground vaults. All but the I St. PRV are in good working condition and in adequately sized vaults. The I Street PRV is in a circular vault that is difficult to access and work in and the isolation valves are not operable. It is suspected that the I St PRV is not even functioning.

The inactive station is located at the intersection of K and 9th St. The valving is still present and could be refurbished and reconfigured.

Table 2-6 lists the existing PRVs:

Table 2-6: Existing Pressure Reducing Stations

PRV Station Name	Location	Size of Main Valve	Upstream Pressure Zone	Downstream Pressure Zone	Elevation	Pressure Drop (psi)
E St. PRV	Southwest corner of HWY 20 and E Street.	8-inch	Middle/K St	Lower	82.5 (surveyed)	26
I St. PRV	Northeast corner of I St and 5th St.	8-inch	Middle/K St	Lower	106.5 (surveyed)	26
L St. PRV	On north side of L St. on the north side of the railroad bridge.	8-inch	Middle/K St	Lower	112 (surveyed)	26
K St. PRV	In sidewalk by K St. reservoirs just east of 9th St.	6-inch	Upper	Middle/K St	279 (surveyed)	37
H St. PRV	South west corner of 6th and H St.	6-inch	Upper	Middle/K St	175 (estimated)	37
6th St. . PRV	South end of 6th St. (in landscaping)	6-inch	Upper	Middle/K St	149 (estimated)	37
K & 9th St. PRV (Not in service)	In the middle of K St. at the intersection of 9th St.	6-inch	Upper Reservoir	Upper	284 (estimated)	39

Section 3: Water Requirements

This section contains the planning data and analyses used in the development of the population and water demand projections for the City of Columbia City Water Master Plan for the 20-year planning period from 2012 through 2032.

3.1 Definition of Terms

The following definitions are used in this section:

Demand:	The total quantity of water supplied for a given period of time to meet the various required uses, including: residential, commercial, industrial, non-residential, fire fighting, system losses, and other unaccounted-for and miscellaneous uses.
Unaccounted-for Demand:	The difference between the total amount of water withdrawn from the source and the total amount of water billed to customers.
Fire Flow:	Flowrate requirements for buildings and structures fire suppression.

The different levels of water demands are designated as ADD, MDD, and PHD.

Average Daily Demand (ADD):	The total volume of water delivered to the system in one year, divided by 365 days.
Maximum Daily Demand (MDD):	The total flow on the maximum day of the year. Or if expressed as gallon per minute, it is the average flow (over 24 hours) of the peak day of the year.
Peak Hourly Demand (PHD):	The maximum volume of water delivered to the system in any single hour of the year.

The different units to be used in this section include: gallons per minute (gpm), gallons per capita per day (gpcpd), and million gallons (MG).

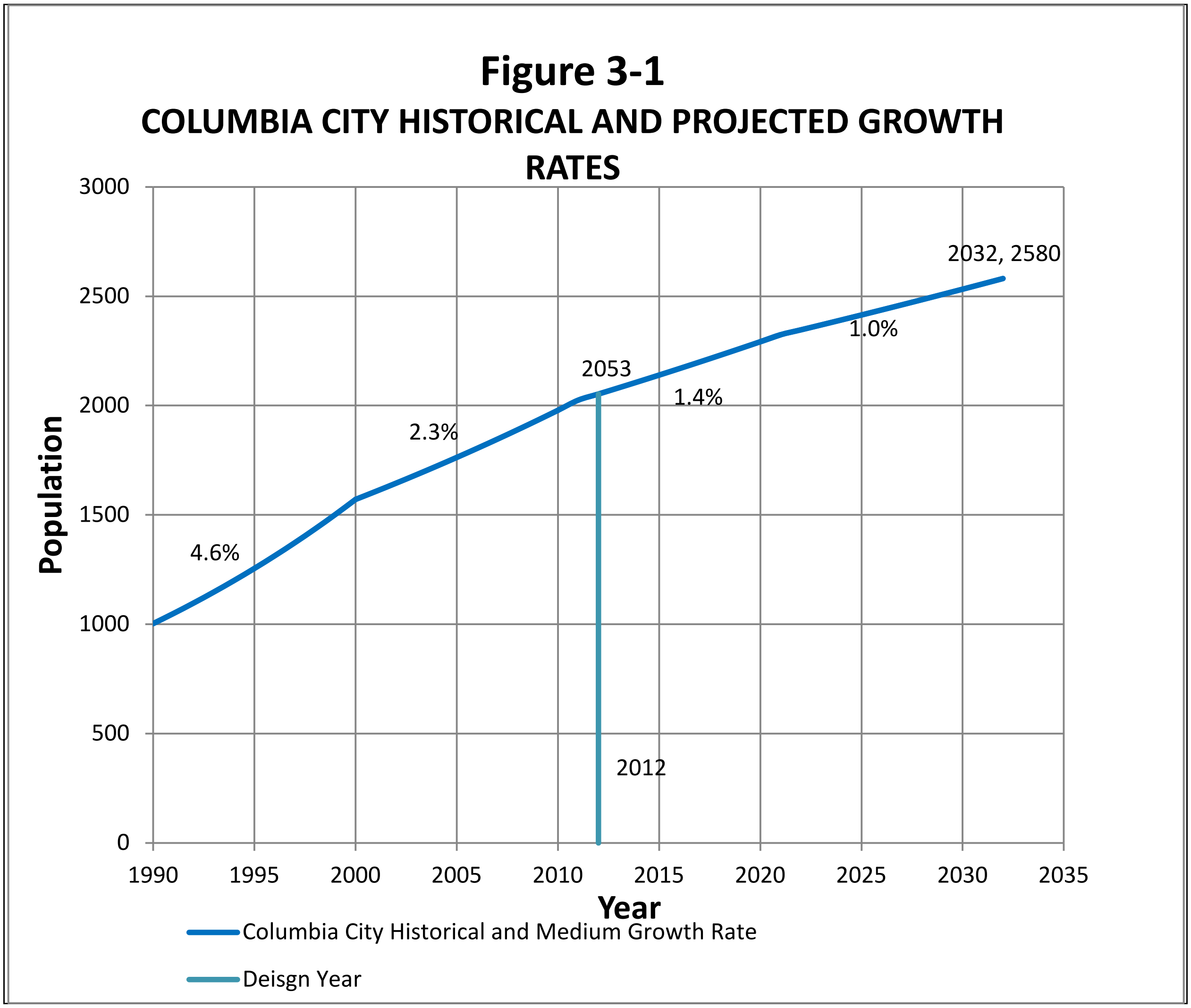
3.2 Historical and Projected Service Area Population

In order to assess the future needs of the water system, an investigation into the historical water usage, historical population, and expected population has been conducted. Historical water use consumption was provided by the City in the form of meter records taken monthly for each customer. Treated water production and water purchased (system demand) was provided by the City in the form of monthly recorded flows through the two meters Also provided was flow and pump run time data collected every three to five days by City personnel.

Historical population figures and future growth rates were obtained from the Population Research Center at Portland State University, publication, Population Forecasts for Columbia County Oregon, its Cities & Unincorporated Area 2010 to 2030, and as adopted by the City amending the Comprehensive Plan in Ordinance No.10-661. An updated buildable lands inventory was supplied by the City and showed that within the urban growth boundary, there was approximately 196 dwelling unit sites available. Applying 2.5 people per dwelling unit, results in a buildout population of 2,543. This correlates within 1.4% of the projected population of 2,580 in 2032. For the purposes of this study, the population estimate from Portland State University (PSU) of 2,580 will be utilized. Table 3-1 and Figure 3-1 present the historical and projected population for Columbia City through the 20 year planning period.

Table 3-1: Historical and Projected Population of Columbia City

Year	Population within City Limits	% Change per Year
1990	1003	-
2000	1571	4.6%
2010	1979	2.3%
2012	2053	1.9%
2022	2346	1.9%
2032	2580	1.5%



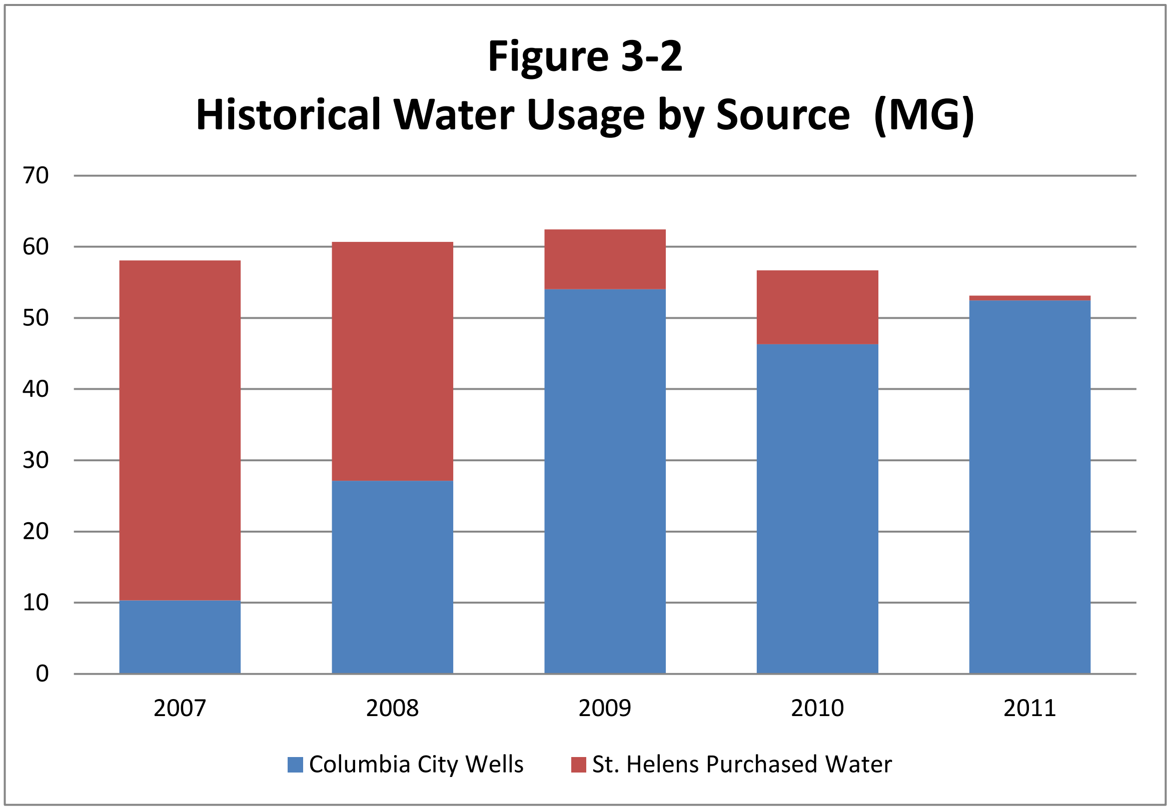
3.3 Historical Water Usage and Demand Projections

Historical water use information and population data are used to estimate per capita usage rates. These values, in conjunction with population projections, are used to estimate future water use.

Historically, all water was purchased from the City of St. Helens. In July of 2007, PW-1 well was brought into production. Water production from the City's PW-1 well peaked in 2009. Production from the well in 2010 was reduced while the well was offline for a couple of months for rehabilitation and St Helens water was utilized. The year of 2011, showed the lowest percentage of purchased water at only 1.2% of the total usage; however, water demand in the summer months was lower than previous years due to cooler weather, and possibly to water conservation efforts. Table 3-2 shows the historical water usage from the two water sources and Figure 3-2 presents the same data in graphical form.

Table 3-2: Historical Water Consumption by Source

Year	2007	2008	2009	2010	2011
Columbia City Wells (MG)	10.3	27.1	54.0	46.3	52.5
St. Helens Purchased Water (MG)	47.7	33.5	8.4	10.4	0.6
Total (MG)	58.1	60.7	62.5	56.7	53.1



Future water demand is projected based on the estimated per capita use presented in Table 3-3. This analysis assumes that the rate of increase in water use for commercial and industrial users will follow the same pattern as for the residential population. The result of this assumption is a conservative projection of future water needs by applying the best available information. It is unknown whether or not the City will experience either the elimination or addition of large water users and, therefore, this planning effort bases the projections for all future water use on the rate of increase of the permanent residential population. However, even with the incorporation of industrial and commercial water users in the per capita projections, the resulting values appear consistent with the national averages of approximately 100 – 150 gpcpd for residential use only.

The per capita water production over the years 2009 through 2011 showed a drop in consumption. This was likely due to a combination of water conservation efforts, meter calibration, and the repair of water leaks.

The City's water system ADD, MDD, and PHD projections are summarized in Table 3-3. The 2012 ADD and MDD are 117 and 291 gpm, respectively, while the 2032 ADD and MDD projections are 146 and 366 gpm, respectively. The PHD at the end of the planning period is 366 gpm.

Demand projections throughout the 20-year planning period, in conjunction with the historical records analyzed from 2009 through 2011, are presented in Table 3-3 below.

Table 3-3: Historical Water Usage and Demand Projections

Year	Population	Total Annual Consumption	ADD (gpcpd)	ADD (gpm)	MDD (gpm)	PHD (gpm)
2009	1,934	62,455,404	90	120	435	-
2010	1,979	56,681,353	80	109	236	-
2011	2,025	53,120,821	73	102	200	-
2012	2,053	60,397,207	81	117	291	437
2022	2,346	69,016,974	81	133	333	499
2032	2,580	75,901,020	81	146	366	549

The relationships between the various water system demands are called peaking factors. This study uses peaking factors to develop two commonly used demands: MDD and PHD. Since the data available for this study was in the form of monthly purchase records and flow data recorded every three to five days, no historical daily demand peaking factors can be calculated. Therefore, the peaking factors are based on industry-standard values.

Typical MDD/ADD peaking factors range from 2.0 – 2.5 (American Water Works Association [AWWA], 1989) with the higher end representing a greater variance from the average demand to the maximum. Higher values of this range are typically applied to smaller systems such as Columbia City. For the purposes of this report, the highest value of 2.5 has been chosen to represent this variance and is used for demand projections in Table 3-3, resulting in a practical yet conservative estimate of the future MDD on the water system.

In order to estimate the PHD/MDD peaking factor, a typical value of 1.5 (AWWA, 1989) was assumed for this study. Estimated PHD values for future years are included in Table 3-3.

3.3.1 Unaccounted-for Water

Unaccounted-for water in the Columbia City Water System is defined as the difference between the total water pumped from the City's wells combined with the water purchased from St. Helens and the total amount of water billed to customers. This difference between water records results from leakage losses, meter discrepancies, unmetered uses such as hydrant and main flushing, operation and maintenance uses, unauthorized connections, fire flow uses, and other unmetered miscellaneous uses.

The average unaccounted-for water in the Columbia City Water System is about 1.0 MG per year. Table 3-4 displays a summary of the total water purchased and consumed with the resulting unaccounted-for water, from the years 2007 to 2011, and the corresponding five-year averages. A goal of less than 10% is currently recommended by AWWA. Ensuring that the City is metering all users and is aggressively detecting and repairing water system leaks will help to reduce the amount of unaccounted-for water and decrease the reliance on purchasing water from the City of St. Helens. This will be discussed in further detail in the Capital Improvements section of this WMP.

Table 3-4: Historical Unaccounted-for Water

	Units	2007	2008	2009	2010	2011	Average
Total Treated Water Pumped	(MG) [(a)]	7.8	8.1	8.3	7.6	7.1	7.8
Total Metered Consumption	(MG)	7.1	6.7	7.3	6.6	6.1	6.7
Unaccounted-for water	(MG)	0.7	1.4	1.0	1.0	1.0	1.0
Unaccounted-for water	(%)	9%	18%	12%	13%	14%	13%

Note:

(a) MG = million gallons

3.3.2 Large-Volume Users

Large-volume users create high point loads on the system. The large-volume users for the City are comprised of industrial, commercial, and institutional customers. The top five water users in the City were compiled from meter records and are represented in Table 3-5. It is important to note that the ADD presented is based on annual usage. The actual daily and hourly peak use will vary depending on the specific use.

The City's top water user is Western Wood Products located in the Industrial zoned portion of town and accounts for 2.2% of the City's ADD. As noted previously, the City of St. Helens System has a fire loop and hydrants around the facility.

The Columbia City Sports and Recreation Club is the second highest user. The Columbia City School of the St. Helens School District is the third-largest user, consuming 0.3% of the City's ADD. The school was closed in June of 2012 with no immediate plans for reopening. The flows from the school were not subtracted from future flow projections due to the small percentage of the City's total usage and the possibility that the school may someday reopen.

Table 3-5: Current Large-Volume Water Users

Rank	User	Type	July 2011 to June 2012 Usage (CF)	Annual Usage (MG)	ADD (gpm)	Percentage of System ADD
1	West Oregon Wood Products	Industrial	178,250	1.33	2.54	2.2%
2	Columbia City Sports & Recreation Club	Commercial	30,530	0.23	0.43	0.4%
3	Columbia City School	Institutional	24,252	0.18	0.35	0.3%
4	Caples House Museum	Commercial	17,620	0.13	0.25	0.2%
5	Mini Mart/Gas Station	Commercial	12,000	0.09	0.17	0.1%

Section 4: System Analysis Criteria

This section presents the criteria used for the master plan system analysis of the existing and future water system presented in Section 4. This section also contains a discussion about the hydraulic model and its development and verification process.

4.1 Master Plan Analysis Criteria

The following criteria were used to evaluate the adequacy of the water system to provide for the existing (2012) and projected (2032) demands. All Oregon Department of Human Services Drinking Water Program (DWP) and Oregon Water Resources Department (OWRD) requirements are met through the proposed criteria, which are acceptable standards of practice in typical master plan studies. The analysis criteria contained in this chapter are intended for water system master planning analysis only and are not intended as specific development standards.

4.1.1 Source

The source capacities must be adequate to supply water demand to each service zone. Columbia City's storage reservoirs provide peaking equalization and, therefore, the source capacity required is the MDD. Demands greater than the MDD over periods of time shorter than one day can be served from the reservoir storage.

4.1.2 Storage

As no storage criteria are set by the DWP, typical standards of practice for master plan studying will be applied. A standard method used to evaluate storage is to divide the total storage requirement into three components: peaking equalization, fire flow, and emergency storage. The total storage requirement for the City's water system under this method would be the sum of these three components as follows:

- Peaking equalization storage is used when demands are greater than the MDD supply capability of the system. Storage for peaking equalization is calculated as 25 percent of the MDD.

- Fire flow storage volume is determined based on fire flows of 3,500 gpm for a three hour duration for industrial and commercial areas and 1,000 gpm for two hours for residential areas and 1,500 gpm for two hours in rural residential areas.

- Emergency storage requirements have the most flexibility in sizing and depend largely on the individual system makeup, lengths of historical emergency outages, and the level of risk the utility is willing to take. A value of two or three times the ADD is often used. For a smaller community like Columbia City, a value of two times the ADD is sufficient.

In addition to the above criteria, consideration of water quality also needs to be considered. As water ages, the quality of the water generally deteriorates. As water ages, the level of chlorine declines and the likelihood of undesirable disinfection byproducts increases. Drinking water is required by DWP to maintain a chlorine residual of 0.2 milligrams per liter (mg/l) for more than four hours. If chlorine levels are not maintained, then additional chlorine can be injected into the system. Excessive storage can also lead to undesirable higher water temperatures if water stays in the reservoirs too long during warmer weather months. The palatability of the water can also decrease over time. Common industry practice is to design storage systems that do not exceed five times the ADD. This guideline is especially applicable for systems the size of Columbia City, where the above method often times leads to excessive storage and the resulting excessive age of the water.

4.1.3 Pipelines

The distribution pipeline network must be able to meet the MDD and maintain pressures greater than 45 psi while maintaining water velocities in the pipeline no greater than 6 feet per second (ft/s). Water mains should be looped wherever feasible in order to prevent dead-ends, increase reliability in the system, reduce flushing, and maintain high water quality. Water mains should be sized for maximum potential demands and fire flow requirements according to the city zoning or planning area.

OAR 33-061-025 (7) requires that all water systems maintain at least 20 psi if pressure throughout the distribution system at all times, in conjunction with the MDD.. The size of network pipes must also be sufficient to handle the refilling of reservoirs during low demand periods of the day. The pressures in the transmission system should not fluctuate by more than 20 to 30 psi from normal ADD pressures as sources refill the reservoirs.

Normally, pressures of between 45 psi and 80 psi are considered appropriate. A lower limit of 45 psi provides adequate pressure to operate household appliances such as dishwashers. Pressure higher than 80 psi may cause damage to household plumbing and would require PRVs per the Oregon Plumbing Code. Excessive water pressures also increase the amount of water generated from leaks. This can be done with a main line PRV, or PRVs at each service. For the purposes of this study, design pressures of between 45 and 80 psi will be used.

4.1.4 Fire Flow Requirements

Fire flow demand is the amount of water required to fight a fire for a specified period of time. Fire protection for the City is provided by the St. Helens Fire Department. To plan for necessary fire-suppression flows, the St. Helens Fire Department subscribes to the National Fire Protection Agency (NFPA), Standard 1142: Standard on Water Supplies for Suburban and Rural Fire Fighting. The NFPA standard specifies guiding criteria that helps the Fire Department plan for fire fighting. Another common method of assigning fire flow rates is based on the Insurance Services Organization (ISO) classification rating that the water required to combat a fire is dependent on the specific characteristics of that building. These factors include site specific issues such as construction, occupancy, exposure, and communication.

Fire flow requirements for Industrial areas can be quite variable depending on the size and type of the structure and the presence of flammable process materials, and the discretion of the local fire marshal. A commonly accepted number for planning purposes with vacant industrial lands is 3,500 gpm for three hours.

Fire flow criteria includes the provision that all points in the water system remain above 20 psi during the fire flow event. This is to prevent the possible backflow of contaminants into water system from household plumbing or groundwater.

Fire flow criteria for the City of Columbia City is summarized in Table 4-1.

Table 4-1: Fire Flow Design Criteria

	Flow (gpm)	Duration	Minimum System Pressure	Total Volume (gallons)
Residential	1,000	2 hours	20 psi	120,000
Commercial	2,500	2 hours	20 psi	300,000
Industrial	3,500	3 hours	20 psi	630,000

4.1.5 Fire Hydrant Spacing Criteria

Fire hydrant spacing requirements required by the St. Helens Fire District is 250 feet from the hydrant to a structure along the hose laying path which typically translates to a hydrant spacing of every 500 ft.

Section 5: Water Quality Requirements

5.1 Introduction

This section contains an overview of recent regulatory evaluations pertaining to the Columbia City Water System as well as a comprehensive discussion outlining the general regulatory requirements for water utilities on both the state and federal levels. Treatment of surface waters is included to provide the City with an understanding of the different requirements for treating surface water than groundwater should surface water sources be considered for future water sources. Not all items listed are applicable to Columbia City; but are included to provide a summary of State requirements. The City is currently in compliance with the applicable requirement.

5.2 Regulatory Requirements

Drinking water quality is regulated by federal law, including the Safe Drinking Water Act (SDWA) and the 1986 amendments to the SDWA, and by State law, including Oregon Administrative Rules (OARs) for public water systems. The U.S. Environmental Protection Agency (EPA) and State agencies enforce drinking water regulations. In Oregon, the Oregon Health Division is the primary agency in the enforcement of federal and state regulations for public water systems.

5.2.1 Federal Regulations

The SDWA, and the amendments thereof, provide the minimum treatment requirements for drinking water quality. The states have the opportunity to use these minimum requirements or develop requirements that are more stringent. OARs, developed for the State of Oregon, are the applicable drinking water quality requirements that meet federal regulations. The federal regulatory requirements on the treatment of drinking water are therefore addressed in the discussion on state regulations.

5.2.2 State Regulations

OAR Chapter 333 lists the applicable drinking water quality requirements for all public water systems in Oregon. These rules were developed by the Oregon Health Division and became effective in December 1992. OAR Chapter 333 sets maximum contaminant levels (MCLs) and action levels for various contaminants, outlines treatment requirements and performance standards, covers treatment requirements for corrosion control, provides sampling and analytical requirements, describes public notice guidelines, and presents other requirements related to the construction and operation of Water Treatment Plants (WTPs).

5.2.2.1 MCLs and Action Levels

OAR 333-61-020 defines MCLs as the maximum allowable level of a contaminant in water delivered to the users of the public water system and defines action levels as the concentration of lead or copper in water which determines, in some cases, the treatment requirements that a water system is required to complete. The required MCLs and action levels are presented in OAR 333-61-030. MCLs are set for inorganic chemicals, organic chemicals, turbidity, microbiological contaminants, and radioactive substances. Action levels are set for the inorganic chemicals, lead, and copper. The regulations further delineate these levels based on water source. In general, there are two types of sources considered: surface water and groundwater under direct influence of surface water (one type, referred to as surface water in this discussion), and groundwater. As indicated in the following discussion, the treatment requirements are generally much stricter for surface water sources.

MCLs and actions levels for various inorganic chemicals are summarized in Table 5-1 and apply to both types of water sources.

Table 5-1: MCLs and Action Level for Inorganic Chemicals

Inorganic Chemical	MCL[a] (mg/l)[b]	Action Level (mg/l)
Antimony	0.006	
Arsenic	0.010	
Asbestos	7 MFL[c]	
Barium	2	
Cadmium	0.005	
Chromium	0.1	
Copper		1.3
Cyanide	0.2	
Fluoride	4	
Lead		0.015
Mercury	0.002	
Nickel	0.1	
Nitrate (as N)	10	
Nitrite (as N)	1	
Total Nitrate + Nitrite (as N)	10	
Selenium	0.05	
Thallium	0.002	

Notes:

(a) MCL = maximum contaminant level
(b) mg/l = milligrams per liter
(c) MFL = million fibers per liter > 10 millimeters (mm)

Exceeding the MCL for fluoride requires public notice as discussed in OAR 333-61-042. The action levels associated with lead and copper are exceeded if the action level is exceeded by the concentration of the contaminant in more than 10% of the tap water samples collected during any monitoring period. If either of these action levels is exceeded as described, the treatment requirements for corrosion control must be addressed. These treatment requirements are covered in OAR 333-61-034 and discussed later in this section.

MCLs for organic chemicals apply to both types of water sources and include organics, trihalomethanes (THMs) volatile organics, and toxic organics. The listing of MCLs for organic chemicals is extensive and can be found in OAR 333-61-030 section (2).

The MCL for turbidity applies only to surface water sources. The required MCL for turbidity, measured as Nephlometric Turbidity Units (NTU), is dependent on whether filtration treatment is provided and on the type of different filtration systems.

MCLs for microbiological contaminants apply to both types of water sources, with specific treatment requirements for each. The MCL is based on the presence or absence of total coliforms in a sample, as outlined in OAR 333-61-030 section (4). Table 5-2 outlines the total coliform requirements based on a number of samples.

Table 5-2: Maximum Microbiological Contaminant Levels

System Samples per Month	Maximum Number Total Coliform - Positive Samples per Month
>= 40	not to exceed 5.0 percent
< 40	not to exceed one sample

Radioactive substances are covered in OAR 333-61-030 section (5), and apply to both types of water sources.

OAR 333-61-020 defines secondary contaminants as those contaminants which, at the levels generally found in drinking water, do not present an unreasonable risk to health, but do have adverse effects on the taste, odor, and color of water, produce undesirable staining of pumping fixtures, and/or interfere with treatment processes applied by water suppliers. Table 5-3 shows the contaminant levels for secondary contaminants.

Table 5-3: Secondary Contaminants

Secondary Contaminant	Contaminant Level
Color	15 color units
Corrosivity	non-corrosive
Foaming agents	0.5 mg/l
pH	6.5 - 8.5
Hardness (as CaCO3)	250 mg/l
Odor	3 threshold odor number
Total Solids	500 mg/l
Aluminum	0.05 - 0.2 mg/l
Chloride	250 mg/l
Copper	1 mg/l
Fluoride	2 mg/l
Iron	0.3 mg/l
Manganese	0.05 mg/l
Silver	0.1 mg/l
Sulfate	250 mg/l
Zinc	5 mg/l

Exceeding the contaminant level for fluoride requires public notice as discussed in OAR 333-61-042.

5.2.2.2 Treatment Requirements and Performance Standards

Treatment requirements and performance standards are presented in OAR 333-61-032. For surface water, the general requirements for this rule require treatment processes that reliably achieve both of the following:

- At least 99.9% (3-log) removal and/or inactivation of *Giarida lamblia* cysts between a point where the raw water is not subject to recontamination by surface water runoff and a point downstream before or at the first customer.

- At least 99.99% (4-log) removal and/or inactivation of viruses between a point where the raw water is not subject to recontamination by surface water runoff and a point downstream before or at the first customer.

The specific treatment requirements to meet the above pathogen removal requirements for surface water are dependent on whether filtration is provided. For surface water systems with filtration, both filtration and disinfection are required to achieve the pathogen removal requirements. The filtration process must meet the turbidity removal requirements discussed earlier in this section. The disinfection process must be sufficient to ensure that the total treatment process will achieve the required pathogen removal. Additionally, the disinfectant concentration in the water entering the distribution system cannot be less than 0.2 mg/l for more than four hours, and the disinfectant concentration in the distribution system cannot be undetectable in more than 5% of the samples taken.

For systems that utilize groundwater as the source, continuous disinfection is required only when there are consistent violations of the total coliform rule.

5.2.2.3 Treatment Requirements for Corrosion Control

The treatment requirements and performance standards for corrosion control are set forth in OAR 333-61-034. All public water systems are required to monitor for lead and copper levels in the system. Monitoring guidelines are outlined in OAR 333-61-034. When the concentration of lead and/or copper exceeds the action levels for these contaminants, as explained earlier in this chapter, the public water system is required to adhere to the subsequent treatment requirements for corrosion control.

5.2.3 Watershed Control

OAR Chapter 333 sets forth requirements for watershed control for surface water sources.

These requirements apply only to public water systems that do not provide filtration treatment. Non-filtering systems must conduct annual sanitary surveys of the watershed for review by the Oregon Health Division. The sanitary surveys include evaluation of the following man-made and natural features:

- Nature and condition of dams, impoundments, intake facilities, diversion works, screens, disinfection equipment, perimeter fence, signs, and gates.

- Nature of surface geology, character of soils, presence of slides, character of vegetation and forests, animal population, and amounts of precipitation.

- Nature of human activities, extent of cultivated and grazing land, zoning restrictions, extent of human habitation, logging activities, method of sewage disposal, proximity of fecal contamination to intake, recreational activities, and measures to control activities in the watershed.

- Nature of raw water, level of coliform organisms, vulnerability assessments of potential contaminants, algae, turbidity, color, mineral constituents, detention time in reservoir, and time required for flow from sources of contamination to intake.

- Type and effectiveness of measures to control contamination and algae, disinfection applications and residuals carried, monitoring practices, and patrol of borders.

5.2.4 Water Resources Department Water Conservation

The Oregon State Water Resources Department (WRD) has developed Oregon Water Management Program policies and principles for water resource issues, including water conservation and efficient water use. A WRD document dated December 1990 describes the policy on water conservation as a high priority for the WRD. Included in this policy is the improvement of water use efficiency through the implementation of voluntary conservation measures. Principles to promote conservation and efficient water use provided in the WRD document are as follows:

- Water users shall construct, operate, and maintain their water systems in a manner which prevents waste and minimizes harm to the waters of the state and injury to other water rights.

- Major water users and suppliers shall prepare Water Management Plans under the guidance of schedules, criteria, and procedures.

- The Commission (a governor-appointed citizens group that adopts water resources rules for the State of Oregon) shall encourage and facilitate the development of sub-basin conservation plans throughout the state by local advisory committees.

- When wasteful practices are identified in Water Management Plans and Sub-basin Conservation Plans, the Commission shall adopt rules prescribing statewide and sub-basin standards and practices.

- A conservation element shall be developed and included in each basin plan when a major plan review and update is preformed.

- The collection, analysis, and distribution of information on water use and availability are necessary to ensure that the waters of the state are managed for maximum beneficial use, and to protect the public welfare, safety, and health.

- The Commission shall support public education programs, research, and demonstration projects to increase citizen and water user awareness of water conservation issues and measures in the state.

- The Commission shall support programs to provide economic assistance to water users to implement desired conservation measures, particularly where the benefits of implementing the measures are high.

OAR Chapter 690 is the applicable water resource management rules developed by WRD. Division 18 of OAR Chapter 691 covers the allocation of conserved water. These rules describe a voluntary program intended to benefit a water right holder from water conservation and efficient water use.

5.3 General Water Quality

5.3.1 Turbidity Removal

As covered in OAR 333-61-030, the MCL for turbidity is applicable only to surface water sources, and is dependent on the type of treatment facilities employed. The requirements are shown in Table 5-4.

Table 5-4: Turbidity Removal Requirements

Filtration Systems	Criterion (MCL)	Monitoring	Compliance
Conventional or Direct Filtration	1.0 NTUs (up to 1 NTU)	Continuous or grab / 4 hours	95% monthly samples < MCL; none > 5 NTU
Slow Sand Filtration	1 NTU (up to 5 NTU)	Continuous or grab / 4 hours (one / day)	95% monthly samples < MCL; none > 5 NTU
Diatomaceous Earth Filtration	1 NTU	Continuous or grab / 4 hours	95% monthly samples < 1 NTU; none > 5 NTU
Other Filtration Technologies	1 NTU (up to 5 NTU)	Continuous or grab / 4 hours (one / day)	95% monthly samples < MCL; none > 5 NTU

5.3.2 Pathogen Removal

As covered in OAR 333-61-032, the pathogen removal (disinfection) requirements are dependent on the type of source water and whether the treatment facilities provide filtration.

For water from groundwater sources, continuous disinfection is not required by the regulations unless repeated violations occur. Typically, the regulations require that when chlorine is used as the disinfectant, the residual disinfectant concentrations cannot be less than 0.2 mg/l after 30 minutes of contact time under all flow conditions.

For surface water sources, pathogen removal requirements are dependent on whether the treatment facilities provide filtration. Maximum removal requirements are for 99.9% (3-log) inactivation of *Giarida lamblia* cysts. Additionally, the residual disinfectant concentration in the water entering the distribution system cannot be less than 0.2 mg/l for more than four hours. Disinfection of surface waters is evaluated by comparing the required and actual contact time (CT) values. Based on the removal requirements and water pH and temperature, a required contact time value can be found either in OAR or in the EPA document *"Guidance Manual for Compliance With the Filtration and Disinfection Requirements for Public Water Systems Using Surface Water Sources"* dated October 1990. The actual contact time value is the known chlorine contact time (in minutes, including consideration for effectiveness) multiplied by the chlorine residual concentration (in mg/l, usually from plant operation records). Actual contact time must be greater than required contact time.

5.3.3 Contact Time

Contact time is required for all surface water systems, as outlined above, and for chlorinated groundwater systems. Actual chlorine contact time is highly dependent on the hydraulic efficiency of the contact chamber. For example, the hydraulic efficiency of a small diameter pipeline is much greater than that of an unbaffled reservoir where mixing for fluids can short circuit the contact time and stagnant areas may exist..

Table 5-5: Chlorine Contact Times

Chlorine Contact Facility	Hydraulic Efficiency
Small Diameter Pipeline (12-inch diameter or less)	90
Large Diameter Pipeline (greater than 12-inch diameter)	80
Baffled Reservoir	20
Unbaffled Reservoir	10

5.4 Lead and Copper Levels

The State places stringent limits on the lead and copper levels in drinking water and requires an intensive monitoring program for these contaminants. Because lead and copper in drinking water often come from the corrosion of residential plumbing, samples for lead and copper measurement are taken primarily from residences.

If not in compliance, the steps required of the water supplier to comply with State regulations are outlined in OAR 333-61-036 and begin with a Lead and Copper Water Treatment Study. The study will evaluate the effectiveness of the following treatment options:

- Alkalinity and pH adjustment
- Calcium hardness adjustment
- Addition of a corrosion inhibitor.

5.5 Other Water Quality Issues

Other water quality issues that are controlled by state regulations include organic and inorganic chemicals, radionuclides, and disinfection by-products. These water quality parameters are discussed below.

- Organic and Inorganic Chemicals – The State requires monitoring of many new chemicals including volatile organic chemicals, synthetic organic chemicals, and inorganic chemicals. Testing of the city water for these chemicals is required.

- Radionuclides – The State requires monitoring and control of specific radionuclides. Testing of the city water for radionuclides is required.

- Disinfection By-Products – Compliance and testing for disinfection by-products includes both Maximum Residual Disinfectant Levels (MRDLs) for chlorine compounds and MCLs for disinfection by-products such as THMs. As of January 2004, all surface and groundwater systems, regardless of size, are required to test for and control disinfection by-products.

Section 6: Water System Analysis

This section contains an analysis of the capacity of the City water system for existing and future water demands. The analysis includes the evaluation of the water source, storage, transmission, and distribution components of the water system.

6.1 Demand Allocation and Growth

The population of Columbia City is expected to increase by 27% over the 20-year planning period. As depicted in Table 3-3 in Section 3, this will result in a growing water demand.

6.2 Water Source and Supply

As discussed in sections 2 and 3, Columbia City obtains water from two sources, the PW-1 and PW-2 well system and from the City of St. Helens. Assuming a reliable sustainable flow during summer months of only 215 gpm (see Section 2.2) from the City's existing wells compared to an estimated 291 current MDD and a forecasted MDD of 366 gpm at the end of the planning period, it is clear that without an additional water source the City will continue to rely on St. Helens to meet their peak day demands. Table 6-1 shows the estimated deficiency of the existing wells to meet the maximum daily demands.

Table 6-1: Existing Well Production Deficiency

Year	ADD (gpm)	MDD (gpm)	Existing Wells (gpm)	MDD Deficit (gpm)
2012	117	291	215	76
2022	133	333	215	118
2032	146	366	215	151

The actual volume of water that would need to be purchased from St. Helens each year is quite difficult to estimate. The amount would depend on the number of peak days incurred during the year which is largely a function of weather along with the amount of water that can be removed from the well which is a function of the depth of water in the aquifer at that time which in turn is a function of previous days pumping rates and seasonal weather as well. Additionally, there is no historical data that could be analyzed since the recent changes the well system (2010 PW-2 Rehabilitation, lower the pump in PW-2 in 2011, and connecting PW-1 in 2012).

It would be most desirable to obtain a new water source (or combination of sources) with a production rate of 400 gpm to provide a redundant water source; however, a new source or sources providing a minimum of 150 gpm would meet the MDD over the planning period and St. Helens could be relied upon as an emergency redundant source.

Water conservation efforts especially during peak usage days would reduce the amount of water needed to be purchased from St. Helens.

6.2.1 Identification of Source Options

Columbia City has previously attempted to find additional water sources and become self sufficient for its water needs and it is still the City's desire to become self sufficient. Previous work has included drilling wells and considering acquiring the City of St. Helens Ranney Collector Well #1.

6.2.1.1 Wells

Previous attempts at drilling wells included drilling at the K-St. reservoir site where brackish water was encountered in the Columbia River Basalts that was unsuitable as a water source. Another well was drilled in the north area of town in Harvard Park that encountered no water in the upper alluvium sediments and while the lower portion of the well encountered productive water zones in the underlying Columbia River Basalts, this water also had water quality issues reportedly of brackish water that would require expansive treatment facilities.

In 2003, the City pursued using an existing well located north of town on the Coastal Chemical property. The City performed pumping and water quality tests and applied for water rights. The City was in the process of addressing the State Water Resources Department's concerns of the effects the well would have on McBride Creek when Dyno-Noble purchased the chemical plant and decided they would not allow the well to be used mainly due to potential liability concerns.

Eric Collins of GSI who has done most of the previous hydrogeologic work for the City was contacted to discuss the next options for finding additional water sources. Initial target areas for new wells include drilling a new well north of town between the chemical plant and McBride Creek and along Hwy 30, both in the south and north part of town. If wells are drilled too close to the Columbia River, they may be determined to be under surface water influence and require treatment. Drilling to the west of town in the Columbia River Basalts is not recommended due to past experience with water quality issues. Drilling new wells in the vicinity of the existing PW-1 and PW-2 is not recommended due to interference with the existing wells.

The first step would be to have a hydrogeologic feasibility report completed. This report would compile previous work and would further define or eliminate potential target areas due to early identification of fatal flaws, and take into consideration location and engineering challenges to connect to the City's water system. Future wells will need to connect to distribution piping in the K St. Reservoir pressure zone or the existing transmission main from the City's wells to the K St. reservoirs. Connection of a future well to existing piping in a lower pressure zone below the K-St. reservoir will not work as the required pressure to fill the reservoir would be higher than the pressure in the lower pressure zone. Also, flow cannot go backwards through pressure reducing valves. With this in mind, future water sources in the south half of town are preferred from an engineering standpoint as less transmission main pipe would need to be installed.

Once the hydrogeologic feasibility study is completed, the next step would be to drill test holes at the selected locations. Assuming an adequate source is located, then water rights would be applied for, and the well developed. Depending on the quality of the water encountered, the level of treatment required is unknown at this time; at a minimum chlorine injection to provide a chlorine residual will be needed.

6.2.1.2 St Helens Ranney Collector #1

Previously, the City investigated utilizing the abandoned City of St. Helens Ranney Collector Well #1. In April of 2005, a Technical Memorandum, *Ranney Collector #1 Evaluation Summary* (Murray, Smith & Associates), was issued showing the results of the evaluation. The memorandum is included in the Appendix. The evaluation included meeting with City of St. Helens personnel, visual inspection, video inspection, drawdown testing, water quality testing, regulatory review, hydraulic analysis, and a review by a nationally recognized firm specializing in evaluating and constructing Ranney Collectors. The evaluation showed that the collector and chlorination equipment was in reasonable condition, had a reported capacity of 500 gallons per minute, water quality was good, the well was not under the influence of surface waters, and could be operated as is with no or minimal work.

Testing reportedly conducted on the well between 1993 and 1997 and again during the evaluation and pump testing episode of 2005 showed that the well was not under the influence of surface waters. St. Helens' other Ranney collectors have been determined to be under the influence of surface water which created the need for St. Helens to build its treatment plant. The recommendation of the report was to continue pursuing acquiring this source.

For reasons not entirely clear in the record, this option was not completely pursued. The recollection of Micah Olsen, previous City of Columbia City Public Works Superintendent, was that after the evaluation was conducted and while the City was working out the details with the City of St. Helens including hiring an indecent appraiser, the well experienced some high turbidity events that could be an indication that the well could be under the influence of surface water and require treatment; however, this information has not been verified by any documentation at this time. The City's focus for obtaining water was then directed to developing the PW-2 well described above. Unfortunately, the flow rates from PW-2 are not what was anticipated at that time and reconsidering Ranney Collector #1 should be further investigated with special attention given to the possibility that the well may now or in the future be influenced by surface water which would require the costly construction of a water treatment plant.

In that plan, it is reportedly mentioned that they Ranney Collector #1 is listed as a possible redundant treated water source in the case of an emergency. The City of St. Helens is currently finalizing a new water master plan. This is an indication that they feel the facility is still a reliable source for treated water.

If the Ranney Collector is acquired from the City of St. Helens, then it would be logical for the City of Columbia City to also acquire the connected fire loop and service piping inside the industrial zone as well as the 14-inch transmission main that follows the highway southward to a connection point at the L St Booster Pump Station. Therefore, St Helens may no longer wish to sell the facilities, and all previous understandings may be invalid. Columbia City and St Helens will need to enter into new discussions concerning this issue. Valving and metering could be provided at the L St. connection point to allow the City of St. Helens to utilize this source in the case of an emergency.

Estimating the cost to acquire St. Helens' Ranney Well #1 and the rest of the treated water, piping in Columbia City is difficult to perform at this time due to the many unknowns and the political aspects involved that are beyond the scope of this study. At a minimum, additional discussions with the City of St. Helens should be initiated.

6.2.1.3 Surface Water Source

Due to the high capital cost of building a surface water treatment plant, a surface water source presumably from the Columbia River, should only be considered if the City has exhausted its search for groundwater which does not require treatment. Assuming reasonable rates from the City of St. Helens, who already has a water treatment plant to treat water from their other Ranney Collectors, it is very unlikely that Columbia City would experience a cost savings by building their own water treatment facility.

6.2.1.4 Continued Reliance on St Helens Water System

The advantage of continuing to rely on the St. Helens Water system to meet the peak daily flows is that it does not require any capital investment. The disadvantages include the dependence on another municipality.

6.2.2 L Street - St. Helens Water Booster Pump Station

If the City of St. Helens' System is to serve as a back-up source of water, then this pump needs to provide the MDD. The L Street - St. Helens Water Booster Pump Station with a capacity of about 210 gpm does not have has enough capacity for the current MDD of 291 MDD and obviously not enough for the end of the planning period MDD of 366 gpm. Upsizing the pump station to deliver approximately 400 gpm is recommended. It should be noted that the pump station is capable of meeting the current ADD of 117 and the year 2032 ADD of 146.

Upgrading this pump station will require increasing the size of the pumps and motors and upgrading some of the electrical equipment.

6.2.3 Upper Booster Pump

This pump station has enough capacity to serve existing and future developed areas through the planning period. The current capacity of the pump station is reported to be approximately 80 gpm which could adequately service approximately 230 homes. Currently, there are 105 connections and at build out, the total number of dwelling units is estimated to be 170 with a corresponding MDD of 60 gpm. Table 6-2 present the required flow rates from the K St. booster pump station over the planning period.

Table 6-2: Upper Zone Flow Rate Estimate

Year	# of Connections	Estimated Population (2.5/dwelling units)	ADD (gpcpd)	ADD (gpm)	MDD (gpm)	PHD (gpm)
Current/2012	105	263	81	15	37	55
2032	170	425	81	24	60	86

6.3 Storage

As discussed in Section 4, there are two methods for calculating the amount of storage for Columbia City. Both methods were applied and are discussed below.

6.3.1 Entire System Storage Requirement

Table 6-3 shows the calculated storage using conventional reservoir sizing methods of the sum of equalization storage of 25% of the MDD, emergency storage of twice the ADD, and industrial fire flow of 3500 gpm for three hours. Even though the industrial area of Columbia City is currently serviced for fire flow from the St Helens water system, the industrial fire flows were utilized in this analysis to show that the Columbia City storage capabilities are adequate to service the industrial area. One potential option for service to the industrial area is to disconnect the St. Helen's treated water 14-Inch pipe on the west side HWY 30 and connect it to the Columbia City Water System at I and E Streets where the pressures are already at the lower pressure zone.

Table 6-3: Storage Requirements Using Sizing for Larger Systems

Year	Service Area ADD[(a)] (MGD)	Service Area MDD (MGD)	Required Storage (MG)[(b)]	Existing Storage (MG)[(c)]	Surplus Capacity (MG)[(d)]	Days of ADD Storage With Existing Tankage
2012	0.17	0.42	1.07	1.40	0.33	8.3
2022	0.19	0.48	1.13	1.40	0.27	7.3
2032	0.21	0.53	1.18	1.40	0.22	6.6

Notes:

(a) ADD & MDD are based on the Total Water Service demands.
(b) The required storage is equal to: (the sum of 25% of the MDD; twice the ADD; and the Industrial Fire Flow of 3,500 GPM for 3 hours :
(c) The existing storage accounts for the full 0.2 MG Upper Reservoir and the 0.2-MG and 1.0-MG K St. Reservoirs
(d) The additional storage volume needed is the difference between the required storage and the existing storage available.

The amount of storage is adequate for the 20 year planning period; however, it exceeds the recommended maximum size of three to five times the ADD, resulting in excessive age of the water as shown in the far right hand column. This is a common scenario for small water systems and is mainly a result of the fire storage requirement constituting a higher percentage of the total storage requirement than it would for larger systems.

Common engineering practice for smaller systems such as Columbia City is to use the recommended three day minimum to five day maximum storage requirement. The storage requirements using these guidelines are presented in Table 6-4.

Table 6-4: Storage Requirements Using Recommended 3-5 ADD Guideline

Year	ADD (gpm)[(a)]	ADD (MGD)	MDD (gpm)[(a)]	MDD (MGD)	Minimum Required Storage (MG)[(b)]	Maximum Required Storage (MG)[(c)]	Existing Storage (MG)[(d)]	Surplus Capacity (MG)[(e)]
2012	117	0.17	0.42	0.56	0.50	0.84	1.40	0.56
2022	133	0.19	0.48	0.62	0.58	0.96	1.40	0.44
2032	146	0.21	0.53	0.67	0.63	1.05	1.40	0.35

Notes:

(a) ADD & MDD are based on the Total Water Service Area demands.
(b) The minimum required storage is equal to: 3 times the ADD.
(c) The maximum required storage is equal to: 5 times the ADD
(d) The existing storage accounts for the full 0.2 MG Upper Reservoir and the 0.2-MG and 1.0-MG K St. Reservoirs
(e) The surplus storage volume needed is the difference between the Maximum Required Storage and the existing storage available.

If water quality issues due to the age of the water become a concern, the turnover rate of the water could be increased by reducing the volume in the existing tanks by operating them at lower water levels, without a significant drop in water pressure to downstream customers.

6.3.2 Upper Pressure Zone Storage Requirements

Since this pressure zone occurs at the top of the system and is supplied solely by the 0.2 MG Upper Reservoir, it needs to be looked at separately for sizing. Table 6-5 shows the calculated storage using conventional reservoir sizing methods of the sum of equalization storage of 25% of the MDD, emergency storage of twice the ADD, and residential fire flow of 1000 gpm for 2 hours.

Table 6-5: Upper Zone Storage Requirements Using Sizing for Larger Systems

Year	Number of Connections	ADD[(a)] (Gallons)	MDD (Gallons)	Required Storage (Gallons) [(b)]	Existing Storage (Gallons) [(c)]	Additional Capacity Required (Gallons) [(d)]	Days of ADD Storage With Existing Tankage
2012	105	21,263	53,156	175,814	200,000	(24,186)	9.4
2032	164	33,210	83,025	207,176	200,000	7,176	6.0

Notes:

(a) ADD & MDD are based on the Total Water Service demands.
(b) The required storage is equal to: (the sum of 25% of the MDD; twice the ADD; and the residential Fire Flow of 1,000 GPM for 2 hours
(c) The existing storage accounts for the full 0.2-MG Upper Reservoir
(d) The additional storage volume needed is the difference between the required storage and the existing storage available.

The amount of storage in the upper zone is approximately 7,000 gallons short of the required storage amount at the planning period. This only represents a 3-4% increase in volume. Given the variables of estimating future number of connections and resulting flows, the amount of storage in the upper reservoir should be considered adequate under this analysis. Additionally, note that the days of storage under ADD conditions exceeds the recommended maximum size of three to five times the ADD, resulting in excessive age of the water as shown in the far right hand column.

Common engineering practice for smaller systems such as Columbia City is to use the recommended three day minimum to five day maximum storage requirement. The storage requirements using these guidelines are presented in Table 6-6.

Table 6-6: Upper Zone Storage Requirements Using Recommended 3-5 ADD Guideline

Year	ADD (gpm)[a]	ADD (MGD)	MDD (gpm)[a]	MDD (MGD)	Minimum Required Storage (Gallons)[b]	Maximum Required Storage (Gallons)[c]	Existing Storage (Gallons)[d]	Surplus Capacity (MG)[e]
2012	117	0.17	0.42	0.56	63,788	106,313	200,000	93,688
2032	146	0.21	0.53	0.67	99,630	166,050	200,000	33,950

Notes:

(a) ADD & MDD are based on the Upper Pressure Zone Area demands.
(b) The minimum required storage is equal to: 3 times the ADD.
(c) The maximum required storage is equal to: 5 times the ADD
(d) The existing storage accounts for the full 0.2-MG Upper Reservoir
(e) The surplus storage volume needed is the difference between the Maximum Required Storage and the existing storage available.

Note that under this analysis, there is more than adequate storage volume in the upper reservoir. As with the entire system, the lowering of the operating level in the upper reservoir could be considered to increase the turnover rate if water quality issues from the age of the water becomes a concern. Since all water passes through a PRV, there will be no pressure lost to customers.

6.4 Computer Simulation Model

The City's water system was modeled using WaterCAD software to simulate the hydraulics of the City's water system. The model consists of a graphical network of pipes, pumps, and storage reservoirs that is very useful for determining the effects of different future and existing scenarios. The lengths, diameter, and friction loss characteristics of the piping are input into the system. Existing maps of the water system and other information provided from the City were utilized. Calibration of the model was performed by comparing the system pressures observed during hydrant flow testing conducted by the City. Elevations were obtained by surveying of the key elements such as the reservoir elevations and some of the pressure reducing stations. Other elevations of the system were taken from Google Earth and probably have an accuracy of +/- 10 feet which translate to a pressure difference of about +/- 4 psi.

Operational scenarios have been introduced into the water system model, which in turn provides an output indicating how the system will respond to different scenarios. The output lists the pressure and hydraulic grade line at each pipe junction or hydrant, velocity and friction losses through each pipe segment, and the operating conditions of all the facilities in the model.

The hydraulic modeling of the system shows that the system is capable of meeting the maximum daily demand (MDD) and the PHD; however, deficiencies in pressure and fire flow were identified and are discussed below.

6.4.1 Pressure Analysis

Figure 6-1 shows areas of the existing system with excessive high pressures (over 80 psi) and areas with insufficient low pressures (less than 45 psi). The only area of town currently with too low of pressures is 9th St. between K and I Streets.

Areas with high pressure are undesirable for the following reasons:

1. Increase unaccounted-for water through leaks
2. Increased water use and waste due to high pressures
3. Increased maintenance of pipe and service laterals
4. Customer complaints of too high of pressure
5. Increased risk of safety due to high pressures.

Areas of low pressure are also undesirable for the following reasons:

1. State required minimum at all times is 20 psi.
2. Household appliances do not work well.
3. Customer complaints.
4. Potentially dropping below 0 psi in fire flow conditions and causing water quality issues.

Table 6-7 below presents the pressures, elevations, and HGL of the proposed pressure zones to correct these issues and also shows the proposed change in pressure in each zone from existing conditions. The Upper Reservoir Pressure Zone is not included as there are no service connections in that zone. Figure 6-2 shows the location of the proposed pressure zones. Figure 6-3 presents the proposed hydraulic profile for the system. The following will discuss the issues and recommendations for each pressure zone. Existing pressures and elevations served were presented in Section 2.

Note that the pressure to some lots will still be above 80 psi and will, therefore, be required to have individual PRV's on the service lines. Since it is proposed to reduce pressures in the areas already over 80 psi, it is assumed that no individual PRVs will be needed by these changes.

6.4.1.1 New 9th St. Pressure Zone

Separating this highest elevation portion of Upper Zone area from the Upper Zone will allow for pressures to be increased to acceptable levels and allow pressures in the lower elevation portion of the upper zone to be reduced. Existing pressures at the high point in the water main are estimated to be about 48 psi and about 37 at the highest houses on the uphill side of the street. The proposed pressure increase in this zone is about 20 psi.

Correcting this problem will require the installation of a pressure reducing station (PRV) at the north end of 9th St. to reduce pressures down to the Revised Upper Zone level and refurbishing of the existing PRV station located at the intersection of K and 9th Streets to reduce pressures from the Upper Reservoir Zone. Connecting directly to the upper reservoir would result in too high of pressures on 9th St.

6.4.1.2 Revised Upper Zone

This zone will remain supplied by the K St. PRV. With the elimination of the high elevation 9th St. area, the pressures in this zone can be reduced by approximately 7 psi. All that is required to achieve this reduction is adjusting the valves in the K St. PRV station.

There are five homes and three vacant lots at the south end of 6th St. that are currently connected to the Upper Zone above the 6th St. PRV. The homes currently have pressures of up to about 108 psi and after the proposed reduction in the Upper Zone, pressures would be up to about 101 psi. The 6th St. PRV is unfavorably located and moving this PRV station to the end of 7th St. would place this area into the more appropriate K St Reservoirs Pressure Zone with pressures up to about 71 psi.

6.4.1.3 Middle / K St. Reservoirs Zone

Pressures in this zone are directly controlled by the water level in the K St. Reservoirs. Pressures in this zone will remain unchanged; however, the size of this zone will be greatly reduced as shown in a comparison of Figures 6-1 and 6-2 and the creation of the new North Zone.

6.4.1.4 New North Pressure Zone

As presented in Section 2, and in Figure 6-1, the majority of the existing Middle / K St. Zone is over the upper limit of desirable pressure of 80 psi. The creation of this new pressure zone will reduce pressures in the north part of town by about 20 psi. This reduction in pressure will require three pressure reducing stations strategically located as follows:

- 5th St. between H and G Streets on a 16-inch line
- 6th and E Streets located on a 10-inch line
- 6th and C Streets located on a 8-inch line.

The main controlling high point with lowest pressures will be the intersection of 6th and E Streets planned for 48 psi. A recently approved three-lot subdivision known as the Dickson Development is located across McBride Creek on the westward extension of Penn St.; has lots with building sites at roughly 188 ft. elevation and the resulting inadequate pressure of 33 psi after the proposed pressure reduction for this zone of 20 psi. A small booster pump station to service these lots would be necessary if the pressures are lowered in this zone or the property owners/builders would need to build individual booster pumps.

6.4.1.5 Revised Lower Zone

Pressures in this zone are recommended to be reduced by approximately 12 psi. Lowering the pressure of this zone can be done by simply adjusting the valves in the E, I, and L Street PRV stations. This will keep the customers in the highest elevation portion of this zone (in the area of 4th St. and M St.) at a comfortable 50 psi and reduce the highest pressures in the zone from approximately 102 psi down to about 89 psi. All of this zone cannot be reasonably lowered below 80 psi without the addition of several PRV stations.

Table 6-7: Proposed Pressure Zones

	Change in Pressure (psi)	Elev. (ft)	Pressure (psi)	HGL (ft)	Source/ Control
Upper Reservoir Zone	None	N/A	N/A	484	Upper Reservoir
New 9th St. Zone:	+20				K St. and 9th PRV Rehab
Highest Elevation (House, mid and N end)		310	56	440	
High point in Mainline, middle of 9th		285	67	440	
Lowest Elevation, (N. end of 9th)		260	78	440	
Revised Upper Zone	-7				K St PRV
Highest Elevation, (N. end of 9th)		260	51	378	
Lowest Elevation (K &7th and 6th & I)		205	75	378	
Future Maximum Elevation (south)		274	45	378	
Future Minimum Elevation (south)		193	80	378	
Middle / K St Reservoir Zone:	None				K St. Reservoirs
Highest Elevation (H and 6th St.)		185	54	310	
Lowest Elevation (Houses on E. side of 5th, I -H)		115	84	310	
Future Maximum Elevation (south)		195	50	310	
Proposed New North Zone	-20				New PRV's
Highest Elevation (6th and E St)		153	48	264	
Highest House-Dickson Development		188	33	264	
Lowest Elevation		86	77	264	
Revised Lower Zone	-12				E,I, and L St PRVs
Highest Elevation (4th and M)		106	50	222	
Lowest Elevation (Houses along river S. end 2nd St).		15	89	222	
Lowest Elev. for less than 80 psi		37	80	222	

Table 6-8: Existing and Proposed PRV Stations

PRV Station Name	Location	Size of Main Valve	Upstream Pressure zone	Downstream Pressure zone	Elevation
Existing PRV Stations:					
E St. PRV	Southwest corner of HWY 30 and E Street.	8-inch	New North	Revised Lower	82.5 (surveyed)
I St. PRV	Northeast corner of I St and 5th St.	8-inch	New North	Revised Lower	106.5 (surveyed)
L St. PRV	On north side of L St. on the north side of the railroad bridge	8-inch	New North	Revised Lower	112 (surveyed)
K St. PRV	In sidewalk by K St. reservoirs just east of 9th St.	6-inch	Upper Reservoir	Middle / K St.	279 (surveyed)
H St. PRV	South west corner of 6th and H St.	6-inch	Revised Upper	Middle / K St.	175 (estimated)
Proposed PRV Stations:					
6th St. PRV (Relocated)	South end of 6th St. (in landscaping)	6-inch	Revised Upper	Middle / K St.	202 (estimated)
K St. & 9th St. PRV (Refurbished)	In the middle of K St. at the intersection of 9th St.	6-inch	Upper Reservoir	9th St.	284 (estimated)
I St. & 9th St. PRV	I & 9th St.	6-inch	9th St.	Revised Upper	260 (estimated)
5th St. PRV	On 5th St. between H & I St.	12-inch	Middle / K St.	New North	127 (estimated)
6th & E St. PRV	6th & E St.	8-inch	Middle / K St.	New North	156 (estimated)
6th & C St. PRV	6th & C St.	6-inch	Middle / K St.	New North	137 (estimated)

6.4.2 Fire Flow Analysis

Fire flow modeling was conducted under both current and future MDD flow conditions with the reservoirs full. The modeling software checks the maximum amount of flow at each hydrant that can be obtained without dropping any other point in the system below 20 psi. The modeling analysis of fire flows shows that the system is capable of delivering the required fire flows to the residential, commercial, and industrial zones with the following exceptions listed in Table 6-9. This scenario is with the existing pressure zones and current settings. Figure 6-4 shows hydrant locations where the required fire flow is unavailable.

The two hydrants on Milores Way in the Upper Reservoir Pressure Zone essentially have no fire flow by definition since the piping next to the reservoir already has a pressure of less than 20 psi.

Table 6-9: Columbia City Water System Modeling – Existing System Fire Flow Deficiencies

No.	Hydrant Location	Required Fire Flowrate (gpm) [(a)]	Modeled Maximum Fire Flowrate (gpm)
1	9th St. and K St.	1,000	757
2	A and 6th St.	1,000	632
3	NE Corner of L St. and 4th St.	1,000	803
4	NE Corner of J St. and 4th St.	1,000	571
5	H St. and The Strand	1,000	550
6	1st St. and G St.	1,000	751

Note:

(a) 1,000 gpm for residential zoning, 2,500 gpm for commercial and 3500 gpm for industrial zoning.

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Each hydrant, where fire flow is unavailable, presents a possible public safety hazard. The location and description of these lines are as follows:

1. 9th and K St. - The waterline on 9th St. is not connected at K St., creating a dead end line at this location. Connecting this line to K St. below the proposed refurbished K and 9th St. PRV would not only solve the dead end line condition, it will bring the fire flows to acceptable levels.

2. A St. and 6th St. – This hydrant is connected to an insufficiently sized water main of only 3-inch in diameter. Connecting the hydrant to the 10-inch line on 6h St. with a 6-inch line will bring the fire flows to acceptable levels.

3. Northeast Corner of L St. and 4th St. – This hydrant is connected to an insufficiently sized 3-inch diameter line. Additionally, this hydrant is an out of date “blow off style”, with a 2.5-inch port, and is redundant with the hydrant located on the southeast corner of the same intersection. This hydrant should be removed and replaced with a hydrant further north.

4. 4th and L St. – This hydrant is connected to an insufficiently sized 3-inch diameter line. The 4th St. line should be upsized from I to L St.

5. H St. and The Strand. – This hydrant is connected to an insufficiently sized 3-inch diameter line. This hydrant is also an out of date “blow off style”, with a 2.5-inch port and should be replaced. The water line on The Strand should be upsized from F St. to I St.

6. 1st St. and G St. – This hydrant is connected to an insufficiently sized 3-inch diameter line. This hydrant is also an out of date "blow off style", with a 2.5-inch port and should be replaced.

In each location that fire flow is unavailable, the proposed alteration to the distribution system (pipe upgrade or system looping) has been added to the model for possible implementation. Figure 6-5 includes all recommended distribution system changes to address deficiencies in the existing distribution system.

6.4.3 Fire Hydrant Spacing

A map of existing fire hydrants was provided by the City. Applying the criteria that fire hydrants be spaced within 250 feet of a structure, it was found that there are numerous gaps in the fire hydrant coverage. Figure 6-6 shows the locations of the areas not meeting the fire hydrant spacing requirements and the proposed hydrants.

Table 6-10 lists the locations of the hydrants and the number of lots lacking coverage it would serve. The number of lots served may be used as a way of prioritizing the placement of new hydrants. It should be noted that areas not yet subdivided were not included in the count as it is assumed that fire hydrants would be installed by the developer, as needed.

Table 6-10: Proposed Hydrant Locations

	Proposed Hydrant Location	# of Additional Tax Lots Covered
1	2nd, between M St & Spinnaker Way	11
2	Spinnaker Way, Western-most Section of Loop	11
3	Park Dr, between Lincoln and Pacific St	10
4	3rd & K St	10
5	6th, between I and K St	9
6	9th, between I and K St	8
7	7th, between I and K St	8
8	4th, between M St and Southern Termination	7
9	5th & D St	6
10	3rd, between E & G	6
11	3rd & H St	5
12	6th & Lincoln	4
13	C St, Eastern Termination Cul-de-Sac	4
14	6th & G St	4
15	7th, Southern Termination Cul-de-Sac	4
16	Tahoma, between Lincoln & Tahoma Ct	3
17	6th & Pacific St	3
18	5th & A St	3
19	H St & 8th Ct	3
20	8th & I St	3

	Proposed Hydrant Location	# of Additional Tax Lots Covered
21	Frontage Road, Northern Termination near Hwy 30	3
22	The Strand & E St	3
23	The Strand & I St	3
24	1st & J St	3
25	1st, Southern Termination	3
26	7th, between C & E St	3
27	Tahoma & Lincoln Street	2
28	Tahoma Ct	2
29	6th & Penn St	2
30	The Strand & G St	2
31	Belle Ct	1
32	E St, just East of 5th St.	1
33	4th, Mid Block, between J & L St.	1
	Total Number of Lots outside of 250 ft coverage	**151**

6.4.4 Proposed Fire Hydrant Fire Flow Deficiencies

With the addition of the new hydrants listed above and using the proposed lower pressures within the system, the hydraulic model identified additional hydrants with insufficient fire flow in addition to the hydrants identified earlier.

Table 6-11: Columbia City Water System Modeling – Proposed Hydrants - Fire Flow Deficiencies

No.	New Hydrant location Hydrant Location	Required Fire Flowrate (gpm) [(a)]	Modeled Maximum Fire Flowrate (gpm)
1	1st St. between G St. & F St	1,000	514
2	The Strand & G St.	1,000	485
3	I St & The Strand	1,000	640
4	1st St. and J St.	1,000	568
5	S. end of 1st St.	1,000	809
6	4th, Mid Block, between J & L St.	1,000	419

Note:

(a) 1,000 gpm for residential zoning, 2,500 gpm for commercial and 3,500 gpm for industrial zoning.

Note these additional hydrants with insufficient fire flow occur on the same insufficiently sized mains described previously for existing hydrants on The Strand, 1st St., and 4th St.

6.4.5 Future Development Areas

The hydraulic modeling shows that the existing system has the capabilities to be expanded and adequately serve all the areas inside of the current UGB. The core pipelines to service undeveloped areas are shown schematically on Figure 6-5. Actual layout will depend on the locations of the streets and lot layouts; however, the fundamental layout, diameters, and loops shown to service these areas should be followed wherever possible. The timing of these lines will be dictated by the rate of development. This work will be done by developers and is therefore not included as a capital improvement project. As development occurs, waterlines should be looped whenever reasonably possible.

The undeveloped area on the south end of town will require the extension of piping from both the revised Upper Pressure zone and the K St. Reservoir zone. Looping should be provided within each zone as much as practical to avoid dead end lines and the two zones should be connected and new PRV stations placed at the connection between the two pressure zones.

Another area is the undeveloped land North of H St. and West of 6th St. A looped system connecting the Revised Upper Zone to the K St. Pressure Zone is recommended.

A loped system extending the 10-inch dead end waterline at Penn St. down through the undeveloped land forming a loop with a new line along the highway is recommended.

As discussed above, the undeveloped Industrial lands are currently served by the City of St. Helens Water System and no piping is proposed at this time to service that area. The hydraulic model was used to run scenarios for servicing the industrial area by the Columbia City System. The modeling results showed the Columbia city water system could provide fire flows to the industrial area.

6.4.6 Duplicate 4-inch Pipe

The modeling showed that the old 4-inch line along 6th St. and E St. (that parallels the newer 10-inch line) contributed a negligible amount to fire flows. From a hydraulic perspective, the contribution that this pipe makes is insignificant. As discussed above, this pipe should be disconnected and permanently abandoned.

6.5 Other System Improvements

Included in this category are items to make the system operate more efficiently and safely.

6.5.1 Adding Backup Pressure Relief to PRV Stations

As noted in section 2, none of the existing pressure reducing stations have pressure relief valves. Pressure relief valves open if the PRV valve fails and discharges large amounts of water to reduce the downstream pressure. It is prudent to install these at locations where, if the pressure reducing valve failed, the downstream customers would experience pressures over 80 psi. While the likelihood of a valve failing is low, the financial liability of causing a water heater or other plumbing fixture to fail and flood a house or many houses is very high. The most common form of failure is debris in the pipeline generated during flushing or water main breaks causing the valves to not close properly. All six of the existing PRV stations fall under this category. The project would typically consist of connecting to the existing pipe downstream of the PRV valve inside the vault, then installing pressure relief valve and piping it through the vault wall and bringing it above the ground surface(to form a required air gap) and installing elbows to direct the water downward onto a splash pad.

6.6 Water Service Meter Reading

The City is interested in and has investigated Automatic meter reading (AMR) systems. Customer water consumption is currently read manually on a monthly basis by Public Works employees. AMR is a beneficial tool that can save time, money, and mistakes for a water purveyor like Columbia City. AMR systems can also be a powerful tool in water conservation efforts by identifying customer side leaks in a timely manner. Once the specialty meter and hardware are purchased and in place, manual reading of meters will no longer be required except for verification that the automatic process is operating correctly. The meter will be equipped with a module that is capable of transmitting signals via cell phone, telephone lines, or Ethernet.

Two options exist for the implementation of an AMR system, with increasing degrees of capital cost and decreasing degrees of operator requirements. The first system is known as “Radio-Read” (Radio), while the second available system is referred to as “Fixed Network” (Fixed).

The Radio system involves installing a new meter and module at each existing and future connection, and purchasing a piece of handheld equipment which reads the radio signal up to a certain distance. The module constantly reads the flow volume recorded by the meter and transmits the information via airwaves, which is picked up by the reader device whenever it is active and within range. To read the meters, an operator drives by each meter once a month with the reader unit onboard. The reader is then brought in and connected to a central computer, which uploads the recorded flow data to proprietary software and interfaces with the billing software.

The fixed system involves installing a new meter and module at each existing and future connection, as well as various “Collector” units that are mounted in strategic locations around the water system. The module at each meter reads the flow volume recorded by the meter twice a day, and transmits the information twice a day to the nearest collector. The local collector then transmits the recorded data to a central “head-end” unit that is located at Public Works headquarters. The central computer contains the software necessary to upload the recorded flow data, and interface with the billing software. Similar to this system are systems that each meter transmitter serves as a relay for any other meter creating a meshed network and centralized collectors/transmitters are not needed.

Two options exist for the execution of an AMR system. The first is to install the specialty meters at existing connections and new water services, and manage the software where the new equipment will be used in conjunction with customer billing and monitoring of the quantity of water flowing in the system. The second is to contract out the monthly labor, where an external agency would be responsible for the meter readings and providing the results to the City based on an agreement. It is not recommended that Columbia City contracts out this work, as it is cost-prohibitive for medium sized water systems, and either level of technology is user friendly so long as good training regimens occur from the onset of the system. Also, if the work is kept in-house, large levels of reporting flexibility are available to further monitor the activity throughout the water system.

6.7 System Controls and Telemetry

The existing deficiencies noted in Section 2 included the inability to remotely monitor the level of the upper reservoir and the inability to store data. These are each discussed below.

6.7.1 Upper Reservoir Level Monitoring

The level of the upper reservoir currently is checked manually by connecting a pressure sensor to a port in the reservoir. The mechanical level indicator on the side of the tank is not functioning and repair is not recommended as these are commonly a high maintenance item, do not work well in freezing conditions, and it is common in the industry for them to not be in operating condition. Additionally, the mechanical level indicator does not provide for remote monitoring or recording of the level of water in the tank.

Connecting the tank to the existing radio based telemetry system would likely not work as these systems usually require a direct line of site between transmitters which is not available given the local topography. A cellular based telemetry system appears to be the best fit for this application, although a less expensive option may be to utilize the existing signal cable that follows the pipeline from K St. to the upper reservoir and connect level readings to the SCADA system at the K-St Reservoirs. The reliability of the 28-year old cable is of concern.

6.7.2 Data Storage and Retrieval

The current SCADA system software does not allow the storage and retrieval of data. Data is currently read and entered manually into a spreadsheet, typically twice a week. Data includes items such a pump run times, level of water in the wells and storage reservoirs, flow rates, etc. Daily data is not available and only reflects averages over a three to five day period. Daily data is highly desired for analysis for determining items such as maximum daily demand. Other valuable data such as pumping rates and level of water in the wells would be very useful for determining well capacity if it was stored electronically in a data base. The current software installed in 2003 is reportedly capable of having this feature added; however, the software is now considered out of date.

Section 7: Recommendations and Capital Improvement Plan

7.1 Introduction

In this section, specific improvements are identified and recommended for implementation over the 20-year planning period. The deficiencies were discussed in detail in previous sections. Recommended solutions and alternatives for addressing system deficiencies, compliance with regulations, system reliability, and additional capacity are presented here.

Budget amounts are provided for improvements and they include the following:

- Opinion of probable construction cost
- 20% markup for contingency
- 25% markup for engineering, legal, and administrative costs on most items. This markup was reduced on some items that would not require significant engineering effort.

Budget level estimates are considered reliable within a margin of plus or minus 20%. These estimates do not include costs associated with obtaining funding such as application preparation, bond council, interim financing, etc. These costs will be highly dependent on the funding source and requirements. Itemized planning level cost estimates are included in the Appendix.

The opinion of probable cost has been rounded up to the nearest $1,000, $10,000, or $100,000, depending on the size of the project. For instance, a dollar value of $18,500 would be rounded up to $19,000; a dollar value of $86,000 would be rounded up to $90,000; and a dollar value of $386,000 would be rounded up to $400,000.

The improvements have been arranged into a capital improvements plan (CIP) which lists the improvements, the opinion of probable cost, and the time when the improvement will be needed. The schedule for some improvements is dependent, in large part, on the actual growth within the existing service area and expansion of the service area. Therefore, the schedule should be used more as a guide.

When determining when to start a project, it is important to remember that larger projects will take a substantial amount of time to complete. It is reasonable to expect that a large project could take three to five years to complete from inception, through funding, land use planning and permitting, design, and construction.

7.2 Project Descriptions

In this section, specific improvements are discussed in an itemized fashion, summarizing the system needs identified in Section 4. Note that there is no particular order to the CIP numbering system. All CIP costs are presented in Table 7-2 following the individual project descriptions.

7.2.1 Project 1 - Additional Water Source

This is a multi-step program that involves short and long term tasks.

7.2.1.1 Additional Wells

The City has chosen not to proceed with this project at this time and proceed with pursuing acquiring the Ranney Collector #1 discussed below. This project would entail conducting an initial investigation to identify targets areas for test wells taking into account engineering aspects as well as hydrogeology (Project 1A-1). Then test target areas with test wells (Project 1A-2), then, if results are favorable, proceed with well development (Project 1A-3). Wellhead development is assumed to include a small building and chemical feed equipment similar to PW-2. For budgeting purposes, it is assumed that transmission piping to connect well is 4,000 ft., but obviously this is dependent on the location of the well. The estimated probable costs for this project are not included in the CIP plan but are presented here for future reference if needed.

Table 7-0: Additional Well Probable Costs

	Project	Schedule	Total Project Cost	Existing Needs		Future Need (SDC Eligible)	
				%	Cost	%	Cost
1	Additional Water Source						
1A-1	Determine Well Target Areas	Current Need	$ 14,000	49.7%	$ 6,954	50.3%	$ 7,046
1A-2	Drill Test Wells	Pending Results of 1A-1	$ 100,000	49.7%	$ 49,669	50.3%	$ 50,331
1A-3	Develop Wellhead	Pending Results of 1A-1	$ 930,000	49.7%	$ 461,921	50.3%	$ 468,079

7.2.1.2 St. Helens Ranney Collector #1

Begin discussions with St. Helens to determine their position with regard to selling the facilities and the cost to acquire the Collector and the existing treated water system inside the industrial lands and the transmission main along Highway 30 to the L St. Booster Pump Station. This investigation should be done concurrently with Project 1A-1 along with a comparison done between the two options. If this proves feasible, then move forward with additional investigation as to the reliability that this source would continue to be considered under the influence of surface water. If the project still proves favorable, then pursue an intergovernmental agreement, the transfer of water rights, and connection to the Columbia City System. Costs included in the CIP only include the costs for technical support from the City Engineer and hydrogeologic for the initial stages of discussion with the City of St. Helens and the additional evaluations as to the overall feasibility and most importantly, the reliability and risks of the Collector being under the influence of surface water.

Costs for acquiring the Collector from St. Helens are not included in the CIP plan due to the political and non-engineering related uncertainties, but could be substantial.

7.2.2 Project 2 - L-Street / St. Helens Booster Pump Station Upgrade

Upgrading this pump to match current and projected MDD will require replacing the existing 7.5 horsepower (HP) pumps with 10 HP pumps. The existing enclosure, piping and valving can be utilized.

7.2.3 Project 3 - Upper Reservoir Restoration

As discussed in section 2, it is recommended to recoat both the interior and exterior of the upper reservoir to prevent additional corrosion. Painting of the upper reservoir will include structural repairs, if needed. To keep customers supplied in the upper zone while the tank is off-line, a smaller temporary storage tank will be located on site or a temporary pressure tank installed at the Upper Booster Pump Station will be necessary. Consideration should be given to doing this project after or concurrently with the seismic upgrades discussed below as it is likely that brackets for the additional anchors would need to be welded to the tank and would require recoating of the areas were the heat from welding damage the coatings. As a matter of good asset management, priority should be given to this project to prevent further corrosion of the tank and likely additional costs in the future.

7.2.4 Project 4 - 0.2 Gallon Reservoirs Seismic Upgrades

As identified in section 2, the older 0.2 MG Upper Reservoir and the 0.2 MG K St. Reservoir do not meet current seismic codes. Preliminary investigations during a grant pursuit from Federal Emergency Management Agency (FEMA), a preliminary investigation conducted by Peterson Engineering, indicated that the reservoirs do not meet current seismic code. The project would likely include increasing the size of the ringwall foundation and applying additional anchoring between the tank and the foundation.

7.2.5 Project 5 - Pressure Zone Adjustments

These projects could be done individually as they are not interdependent.

7.2.5.1 Project 5A - Create 9th St. Pressure Zone

Establishing the new 9th St. pressure zone will require the refurbishing of the existing 9th and K St. PRV station that is not currently in service and the installation of a new PRV station on the north end of 9th St. to connect to the lower Pressure zone. Included in this project is the placement of roughly 40 ft of 6-inch piping to connect the 9th and K St. PRV to the dead end, south end of 9th St.

Funding for creating the 9th St. Pressure Zone was included in a state of Oregon Safe Drinking Water Revolving Loan Fund letter of Interest in the fall of 2011. Funding is still in process.

7.2.5.2 Project 5B - North End Pressure Zone Reduction

This project will have the greatest impact on the City’s efforts to control water pressures. Creation of this new pressure zone will require the installation of three pressure reducing stations and the installation of a small booster pump station located in the right-of-way of Penn St. to service the three lots in the Dickson development.

7.2.5.1 Project 5C - Moving 6th St. Pressure Reducing Station

Options include either moving the existing vault or purchasing a new PRV station. Moving the existing vault will require significant landscape restoration at the current PRV site. It is recommended that a new vault be purchased and the valving and piping from the existing vault be removed, replaced with a single pipe, and transferred to a new vault on the S. End of 7th St. in an existing utility easement. This project provides lower pressures for a relatively small area and thus could be a lower priority item.

7.2.6 Project 6 Replacement of I St. PRV

The I St. PRV is in need of replacement. It is recommended, due to the tight configuration of the vault and the condition of the piping and valves, that this PRV station be replaced entirely.

7.2.7 Project 7 Project 8: Abandon old 4-inch Piping

As discussed previously, the old 4-inch line that runs parallel to the newer 10-inch PVC pipe needs to be abandoned to reduce maintenance costs, reduce water loss from leaks, and simplify the system. Currently, it is uncertain how many services and hydrants are connected to the main and where the line connects as it crosses other water mains.

For budgeting purposes, it is assumed that twenty services and four fire hydrants would need to be reconnected to the newer 10-inch pipe, two fire hydrants would be abandoned, and twelve of the eighteen intersections will need to be physically dug up and disconnected. The original construction plans and “as-builts” appear to be unreliable, contradictory, and generally confusing. Additional field work beyond the scope of this study including testing of sections of the line by shutting valves and checking which homes are still in service would be beneficial. Similar shutting off of valves would help locate where the 4-inch line is connected to the rest of system.

7.2.8 Project 8 - Installing Pressure Relief to Existing PRV Stations

As discussed in Section 6, adding pressure relief valves to prevent over pressurization of downstream customers is recommended. This project will consist of installing pressure relief valves and discharge piping to all six of the operating PRV stations. A cost savings could be realized if this project was performed by City crews. The costs in the CIP plan are for contractor installed rates.

7.2.9 Project 9 - Replace Small Diameter Waterlines

This project addresses insufficient fire flows for existing and proposed fire hydrants. These smaller lines are likely quite old and beyond their useful life. Table 7-1 summarizes the waterlines to be replaced. As part of this project, it is recommended to do the replacement of the old style 2.5 “blowoff style” fire hydrants (one each on The Strand, 1st St., and 4th St.) and install five of the additional hydrants needed for coverage that connect to these lines. It is recommended that the service lines to the meters be replaced during this project.

Table 7-1: Small Diameter Pipe Replacement by Location

Location	Diameter	Footage
The Strand	6-inch	1170
1st St.	6-inch	2230
4th St.	6-inch	1080
A St. (At 6th St.)	6-inch	70

7.2.10 Project 10 - Additional Fire Hydrants

This project would include installing 28 of the additional 33 hydrants that are needed. Five of the additional hydrants would be installed under the "replacing small diameter waterlines" project above, leaving a total of 28 hydrants needed. The City may choose to prioritize these and install them in phases. A project like this could be contracted out or installed by City crews, depending on the timing desired, the availability of City manpower, and the amount of funds available. The project cost in this study assumes installation will be by a contractor and includes the cost of preparation of plans and specifications by an engineer for public bidding.

7.2.11 Project 11 - Automatic Meter Reading

The City included an AMR system into a Water Revolving Loan Fund Letter of Interest in the fall of 2011. Funding is still in process and looks favorable. Due to the increased efficiencies in manpower of these systems and the positive impacts they can provide for water conservation efforts, it is recommended the City continue pursuing this project. City Staff have already received budget quotes for completing this project which serves as the basis for cost estimating.

7.2.12 Project 12 - SCADA System Upgrades

7.2.12.1 Project 12A - Upper Reservoir Level Monitoring

As discussed in section 6, there are two alternatives to gain the ability to remotely monitor the level of the upper reservoir. One is to utilize the existing signal cable for transmitting the level and the other is to install a cellular based telemetry system. Costs for both are similar (within $1500 of each other) and solutions to this issue should be investigated further utilizing contractors and suppliers as to which alternative is more desirable. The cellular system also requires a monthly fee of $28/month. The cellular system may be slightly more money, but the other alternative would depend on the integrity of a cable that is currently 28 years old. Costs for the cellular system are included in the CIP.

7.2.12.2 Project 12B - Data Storage and Retrieval

Adding data storage and retrieval is recommended. The existing software could be programmed to create a database for less than $10,000; however, the nine year old software is considered out of date and an upgrade of the RS View software system is recommended. The costs shown in the CIP include upgrading the software and adding the data storage and retrieval information.

7.2.13 Project 13 - Leak Detection Survey

The purpose of the survey is to pinpoint the location of leaks within the City's distribution and transmission pipeline network, and target those areas first. Ultimately, by performing the leak detection surveys regularly and fixing the leaks, the City's unaccounted-for water volume will be decreased. We recommend that the City budget to perform a system wide leak detection survey every three to five years.

7.3 CIP

This section contains the recommended Capital Improvements to the Columbia City water system over the next 20 years.

Either 1A or 1B will be constructed based upon the outcome of the hydrogeological evaluation that is now in progress. The total CIP amount assumes 1A will be selected.

The improvements for additional sources will need to be updated as more information is developed such as the exact location of the new wells, negotiations between owners and agencies, and the outcome of further hydrogeological studies.

The CIP summary table is shown in Table 7-2. The costs shown are 2012 dollars; therefore, the City will need to adjust the costs depending upon when the projects are actually undertaken.

Table 7-2: Capital Improvement Plan

	Project	Schedule	Total Project Cost	Existing Needs		Future Need (SDC Eligible)	
				%	Cost	%	Cost
1B-1	Ranney Collector #1 Initial Evaluation	Current Need	$ 12,000	49.7%	$ 5,960	50.3%	$ 6,040
1B-2	Ranney Collector #1 Technical Support	Pending Results of 1B-1	$ 20,000	49.7%	$ 9,934	50.3%	$ 10,066
2	L St. Booster Pump Station Upgrade	Current Need	$ 35,000	100%	$ 35,000		
3	Upper Reservoir Restoration	Current Need	$ 112,000	100%	$ 112,000		
4	Reservoir Seismic Upgrades	Current Need	$ 150,000	100%	$ 150,000		
5	Pressure Zone Adjustments						
5A	Create 9th St. Pressure Zone	Current Need	$ 90,000	100%	$ 90,000		
5B	North End Pressure Zone Reduction	Current Need	$ 290,000	100%	$ 290,000		
5C	Moving 6th St. PRV Station	Current Need	$ 16,000	100%	$ 16,000		
6	Replacement of I St. PRV	Current Need	$ 70,000	100%	$ 70,000		
7	Abandon old 4" Piping	Current Need	$ 100,000	100%	$ 100,000		
8	PRV Pressure Relief Valves	Current Need	$ 46,000	100%	$ 46,000		
9	Replace Small Diameter Waterlines	Current Need	$ 590,000	100%	$ 590,000		
10	Additional Fire Hydrants	Current Need	$ 200,000	100%	$ 200,000		
11	Automatic Meter Reading	Current Need	$ 190,000	100%	$ 190,000		
12	SCADA System Upgrades						
12A	Upper Reservoir Level Monitoring	Current Need	$ 9,000	100%	$ 9,000		
12B	Data Storage	Current Need	$ 35,000	100%	$ 35,000		
13	Leak Detection Survey	2013 and every 3-5 years	$ 6,000	100%	$ 6,000		
	Total		**$ 3,015,000**		**$2,473,437**		**$ 541,563**

Section 8: Funding

We have listed the standard funding agencies and programs for public works infrastructure projects with a general description of the program and contacts for further information. If the City wishes to fund a project, it is highly recommended to attend a “one-stop” meeting in Salem. Representatives of all the funding agencies attend and will let you know what they have available for your project.

8.1 Federal Programs

8.1.1 Rural Utilities Service Water and Wastewater Loans and Grants

The U. S. Department of Agriculture’s Rural Utilities Service (RUS) program provides funding for rural areas and towns with populations of up to 10,000. Assistance includes loans and grants. Funds may be used for installation, repair, improvements, or expansion of rural water distribution and treatment facilities. The costs of land acquisition and legal and engineering fees are eligible for funding if they are necessary to develop the facility.

8.1.1.1 Eligibility Requirements

Water and wastewater loans and grants are available to public entities including municipalities, counties, special purpose districts, Indian tribes and non-profit corporations. Applicants must be unable to obtain the required funds via commercial sources under reasonable terms. Entities must have legal capacity to borrow and repay the loans, must pledge security for the loans, and must be able to efficiently maintain and operate the proposed facilities. The facilities to be funded must be consistent with development plans of the state, multi-jurisdictional area, county, or municipalities where the projects are to be constructed. The facilities must also comply with all relevant local, state, and federal laws including zoning, pollution control, and health and sanitation standards. Because funds are scarce, existing compliance problems are essentially a requirement.

8.1.1.2 Terms

Borrowers of RUS loans must be able to demonstrate the following:

- They have monthly user rates higher than the “statewide average” as defined by RUS. This value changes so it should be verified before proceeding with an application.
- They have legal authority to borrow and repay loans, to pledge security for loans, and to operate and maintain the facilities and services.
- They are financially sound and able to manage the facility effectively.
- They have a financially sound facility based on taxes, assessments, revenues, fees, or other satisfactory sources of income to pay for all facility costs, including operations and maintenance, and to retire indebtedness and maintain a reserve.

The maximum loan term is 40 years but the term may not exceed statutory limitations on the agency borrowing the money or the expected useful life of the improvements. The debt reserve can typically be funded at 10 percent per year over a 10-year period. Loan interest rates and maximum grant amounts are based on median household income as shown in Table 8-1.

Table 8-1: RUS Grant Funds and Loan Interest Rates

Median Household Income	Maximum Grant (portion of total project cost)	Loan Interest Rate as of July 2000
Less than 22,205	75%	4.5%
$22,205 to $27,756	45%	5.25%
Greater than $27,756	0%	5.875%

Please note that median household income, grant amounts and interest rates fluctuate and should be verified prior to proceeding with an application.

8.1.1.3 Contact

Information on the RUS water loan and grant program is available at the following:

Rural Utility Service
Phone: 503 414-3360
http://www.rurdev.usda.gov/

8.1.2 Community Development Block Grants

The U.S. Department of Housing and Urban Development provides grants under the Community Development Block Grant (CDBG) program to facilitate economic development by revitalizing neighborhoods with improved community facilities and services. In Oregon, the Business Oregon-Infrastructure Finance Authority (BO-IFA) administer this program.

8.1.2.1 Eligibility Requirements

The program is available to non-metropolitan cities and counties. Funding may be used for the construction, expansion, or rehabilitation of public water and sewer systems to meet federal and state mandates. They are not intended for capacity building. To be eligible, the applicant must be out of compliance with federal or state rules, regulations, or permits. The service area for the project must contain at least 51 percent low- and moderate-income residents.

8.1.2.2 Contact

Information on the CDBG grant program is available at the following:

Business Oregon-Infrastructure Finance Authority
Phone: 503 986-0123
http://econ.oregon.gov.

8.1.3 Economic Development Act of 1965

The U.S. Economic Development Administration (EDA) authorizes grants and loans under this program to assist communities in areas certified by the Secretary of Commerce as areas of substantial unemployment. Direct grants of up to 50 percent and supplementary grants of up to 80 percent of costs are authorized for water improvements to alleviate economic hardship. The program is geared to projects stimulating permanent industrial and economic development, and communities qualify for funding of water and wastewater improvements that will help create new industry or maintain or substantially increase levels of employment. Eligibility is heavily weighted in favor of projects that will result in economic development. There is a one million dollar maximum allowance per project. Actual funding limits are based on the number of jobs created. We recommend that this program not be pursed unless a large economic development opportunity is identified.

8.2 State Programs

8.2.1 Special Public Works Fund

The Oregon State Legislature created the Special Public Works Fund (SPWF) in 1985. The fund, administered by the BO-IFA, is capitalized through the issuance of state revenue bonds and through state lottery proceeds. The SPWF is intended to promote the creation of jobs for Oregonians. Loans and grants are issued to facilitate the construction of public infrastructure to support industrial / manufacturing development as well as commercial development that is marketed nationally or internationally and attracts business from outside Oregon.

8.2.1.1 Eligibility Requirements

Eligible municipalities are described in the SPWF Applicant's handbook and generally include cities, counties, water supply districts, water and wastewater authorities, sanitary districts, port authorities, water control districts, county service districts, and tribal councils of Indian tribes.

Eligible SPWF projects includes public infrastructure needed to enable the location or expansion of eligible businesses. Specific projects include: wastewater collection and treatment capacity, publicly owned railroad spurs and sidings, purchase of rights of way and easements necessary for infrastructure, airports, port facilities, storm drainage, roadway and bridges, and water source, treatment, storage and distribution. Program funds are not eligible for equipment, wetlands mitigation, general administrative costs, construction of privately owned infrastructure, or the purchase of property not related to infrastructure.

Funding levels are determined by a financial analysis based on demonstrated need. The basis for this analysis includes dept capacity, repayment sources, and applicants' ability to afford loans from additional sources. To be eligible for the program, applicants must document recent interest by eligible businesses looking to locate in the municipality. Moreover, the applicant must demonstrate ongoing marketing efforts relating to economic development of industrial lands.

8.2.1.2 Terms

The following terms apply for SPWF funding:

- Maximum loan term is 25 years. A 20-year term is typical.
- Loans are typically repaid with utility revenues, general funds, voter-approved bonds, or local improvement district revenue.
- The maximum loan is $15 million.

- Grant funding is typically unavailable unless the applicant is classified as “severely affected” or a “timber dependent” community. In such a case, up to $250,000 per project may be awarded to communities without a firm commitment for new business demand.
- Grants are available under the following conditions when there is a firm commitment from one or more eligible businesses:
  - Up to $5,000 in grant funds may be awarded for each full-time-equivalent job created, depending on demonstrated financial need. The total grant funding is limited to $500,000 or 85% of the project cost whichever is less.
  - Of the total jobs created, at least 30% must be “family wage” jobs.
  - Public and / or private investment must equal at least two times the infrastructure cost.

8.2.1.3 Contact Information

Information on the SPWF program is available at the following:

Business Oregon-Infrastructure Finance Authority
Phone: 503 986-0123
http://econ.oregon.gov.

8.2.2 Business Oregon-Infrastructure Finance Authority Water/Wastewater Financing Program

The Oregon State Legislature created the water / wastewater financing program in 1993. It is capitalized by the sale of state revenue bonds and by a portion of state Lottery proceeds. Its primary purpose is to provide financing for construction of public infrastructure required to ensure compliance with the federal SDWA or Clean Water Act. Specifically, it is intended to assist local governments facing state and federal mandates relating to public drinking water systems and wastewater systems.

8.2.2.1 Eligibility Requirements

The program is available to cities, counties, water supply districts, water and wastewater authorities, sanitary districts, port authorities, water control districts, county service districts, and tribal councils of Indian tribes with populations of less than 15,000. Detailed application requirements are available in the Water / Wastewater Financing (WWF) program Applicants Handbook. Funding levels awarded to qualified applicants are determined by a financial analysis based on demonstrated need through the program:

- Water source, treatment, storage, and distribution
- Wastewater collection and capacity
- Storm system
- Purchase of rights of way and easements necessary for infrastructure
- Design and construction engineering.

Programs funds may not be used for privately owned facilities or infrastructure, general administrative costs or the purchase of property not related to infrastructure. Eligibility for program funding is contingent upon having received a Notice of Non-Compliance, from a regulatory agency regarding the SDWA or the Clean Water Act.

To be eligible for grant funding, user rates must be above the statewide average as determined by the agency.

8.2.2.2 Terms

The following terms apply:

- The maximum loan term is 25 years; a 20-year term is typical.
- Maximum grant amount is $750,000, including issuance costs and any debt service reserves (if required).
- Borrowers that are deemed "credit worthy" may be funded through the sale of state revenue bonds. Maximum bonded loan amount for this mechanism is $15,000,000.
- Loans are typically repaid with utility revenue, general funds, or voter approved bon issues.

8.2.2.3 Contact

Information on the WWF program is available at the following:

Business Oregon-Infrastructure Finance Authority
Phone: 503 986-0123
http://econ.oregon.gov.

8.2.3 Safe Drinking Water Revolving Loan Fund

Each federal fiscal year, the US EPA makes funds (as grants) available to states for the Safe Drinking Water Revolving Loan Fund (SDWRLF), a low interest loan program designed to finance drinking water system improvements needed to maintain compliance with the SDWA. In Oregon, the fund is administered by the Oregon Health Division (OHD).

8.2.3.1 Eligibility Requirements

Community and nonprofit non-community water systems are eligible for this fund. Oregon's loan request process begins by identifying and collecting information about current Oregon drinking water system project improvement needs. A Letter of Interest from the water system describing drinking water system needs is required to be considered for this fund.

In order to qualify for this fund, water rates have to be greater than or equal to 1.75% of the mean household income.

Projects that are eligible for this fund are to plan, design, or construct drinking water facilities needed to maintain compliance with the current and future standards and to further public health protection goals of the SDWA and Oregon's Drinking Water Quality Act.

8.2.3.2 Terms

The following terms apply:

- The typical loan term is 20 years.
- Maximum loan amount is $6,000,000.
- Loans are typically repaid with utility revenue, general funds, or voter approved bond issues.

8.2.3.3 Contact

Information on the SDWRLF loan program is available at the following:

Oregon Health Authority
Phone: 971 673-0422
http://oregon.gov/dhs/ph/dwp/srl.shtml

or

Business Oregon-Infrastructure Finance Authority
Phone: 503 986-0123
http://econ.oregon.gov.

8.3 Local Funding Alternatives

8.3.1 General Obligation Bonds

Entities with taxing authority under the laws of the State of Oregon have the option of issuing general obligation (GO) bonds. A GO bond is a bond backed by the full credit of the issuer for the payment of which the issuer can levy *ad valorem taxes*. The issuer can make the required payments on the bonds solely from the tax levy or may use revenues from assessments, user charges or some other source. Since the bonds are secured by the power to tax, they usually justify a lower interest rate than other types of bonds. Generally, GO bonds lend themselves readily to competitive public sale at a reasonable interest rate because of their high degree of security, their tax exempt status, and their general acceptance.

These bonds can be revenue-supported because a portion of the user fee can be pledged toward payment of the debt service. This can eliminate the need to collect additional property taxes to retire the bonds. Revenue-supported GO bonds have most of the advantages of revenue bonds, but also maintain the low interest rate and the marketability of GO bonds.

Oregon law does not limit the total amount or the percentage of GO bonds that a community can issue. This portion of the property tax is outside the state constitutional restriction limiting property taxes to a fixed percentage of assessed value. State law limits the maximum term of GO bonds to 40 years. The typical term for GO bonds is 20 to 30 years. Under the present economic climate, lower interest rates are associated with the shorter terms.

Financing of water system improvements by GO bonds is usually accomplished as follows:

1. The capital costs required for the proposed improvement are determined.
2. A general election is held to authorize the sale of the GO bonds.
3. Following voter approval, the GO bonds are offered for sale to Columbia City and other investors.
4. The revenue from the bond sale is used to pay the capital costs associated with the project.
5. GO bond authorizations must be approved by a majority vote, and this generally limits proposals to projects benefiting all or the majority of a community. Some of the advantages of GO bonds over other types of bonds are as follows:
   - The laws authorizing GO bonds are less restrictive than those governing improvement bonds under the Bancroft Act (described below). Interest rates are not affected by the Bancroft limitations and costly assessment procedures are not required.
   - Taxes paid in the retirement of GO bonds are Internal Revenue Service deductible.
   - GO bonds can be sold prior to construction, providing funds before expenses must be paid.

The use of an *ad valorem tax* is a common method of repaying GO bonds for utility improvements. This method of financing results in the participation of all private property owners within the benefited area, whether the property is developed or undeveloped. The construction costs for the project are shared proportionally among all property owners based on the assessed value of each property.

8.3.2 Revenue Bonds

A revenue bond is a bond that is payable solely from charges made for the services provided. Such bonds cannot be paid from tax levies or special assessments, and their only security is the borrower's promise to operate the system in a way that will provide sufficient net revenues to meet the obligations of the bond issue. Revenue bonds are most commonly retired with revenue from user fees.

Successful issuance of revenue bonds depends on bond market evaluation of the dependability of the revenue pledged. Normally, there are no legal limitations on the amount of revenue bonds to be issued, but excessive amounts are generally unattractive to bond buyers because they represent high investment risk. In rating revenue bonds, buyers consider the economic justification for the project, the reputation of the borrower, methods for billing and collecting, rate structures, and the degree to which forecasts of net revenues are realistic.

8.3.3 Improvement Bonds

Improvement bonds can be issued under an Oregon law called the Bancroft Act. Cities and special districts are limited to improvement bonds not exceeding 3% of the true cash value. For a specific improvement, all property within the assessment area is assessed on an equal basis, regardless of whether it is developed or undeveloped. This assessment becomes a direct lien against the property, and owners have the option of either paying the assessment in cash or applying for improvement bonds to finance the construction, and the assessment is paid over 20 years semi-annual installments with interest.

With improvement bond financing, an improvement district is formed, the boundaries are established, and the benefited properties and property owners are determined. The engineer usually determines an approximate assessment, either on a square-foot basis or a frontage basis. Property owners are then given an opportunity to demonstrate against the project. The assessments against the properties are usually not levied until the actual total cost of the project is determined. Since this determination is normally not possible until the project is completed, funds are not available from assessments for the purpose of making monthly payments to the contractor. Therefore, some method of interim financing must be arranged, or a pre-assessment program, based on the estimated total costs, must be adopted.

The primary disadvantages to this source of revenue are as follows:

- The property to be assessed must have a true cash value at least equal to 50 percent of the total assessments to be levied.
- For projects that benefit the entire City, GO bonds can be issued in lieu of improvement bonds, and they are usually more favorable.

The construction of water and sewerage facilities through the formation of improvement districts is viable when the properties bordering or served by the improvements are specifically benefited. The establishment of an improvement district should be based on a thorough evaluation of the long-range plan for the entire area. Following is a summary of the development of water improvements by this method:

1. Receive written request or petition from affected property owners for the improvement. If there is any question regarding the feasibility or approval of the project, the petitioners should provide sufficient funds to cover engineering, legal, and administrative costs associated with preliminary planning and establishing the district.
2. Establish an assessment district and preliminary cost estimates. The cost estimates presented at this time will be the basis for projecting the assessment; however, some revision may be necessary depending on the scope of the project.
3. If the project meets with the approval of the petitioners, authorize the preparation of plans and specifications. Obtain interim financing.
4. Advertise for bids.
5. Award the construction contract.
6. Construct the project.
7. Sell the bonds and repay the interim financing.

8.3.4 Capital Construction (Sinking) Fund

Sinking funds are often established by budget for a particular construction purpose. Budgeted amounts from each annual budget are carried in a sinking fund until sufficient revenues are available for the needed project. Such funds can also be developed with revenue derived from system development charges or serial levies.

8.3.5 System Development Charges and User Rates

System development charges (SDCs) are fees the City collects from developers when they develop properties that will use the water system or other municipal service. Fees are collected when building permits are issued. SDCs can be used to finance capital improvements required to provide municipal services to the development. They can only be used on projects identified in the CIP that SDC's are being collected for. Operation, maintenance, and replacement costs cannot be financed or repaid by SDC revenues.

As established in ORS 223, an SDC has two principal elements: reimbursement and improvement. The reimbursement portion of the SDC is the fee for buying into existing or under-construction capital facilities. The reimbursement fee represents a charge for using excess capacity in an already paid-for facility. The revenue from this fee is typically used to pay back existing loans for improvements. The improvement portion of the SDC is a fee to cover the cost of capital improvements required to provide increased capacity to serve new development. Initially, the City will be able to charge an improvement fee SDC. After the facilities are constructed, the City must convert the SDC to a reimbursement fee SDC.

Water user rates are monthly fees assessed to all users connected to the water system.

Figures

LEGEND

CITY OF COLUMBIA CITY LIMITS	(green line)	500.87 ACRES
URBAN GROWTH BOUNDARY (UGB)	(orange line)	584.59 ACRES
25 FT ELEVATION CONTOURS	150	

			AREA:
(R-1)	SINGLE-FAMILY RESIDENTIAL	NEWER PLATTED AREAS	67.5 ACRES
(R-2)	GENERAL RESIDENTIAL	DUPLEX/SFD	298.49 ACRES
(R-3)	MULTI-FAMILY RESIDENTIAL	3-10 DU/AC	14.05 ACRES
(MHP)	MANUFACTURED HOME PARK	MANUFACTURED HOMES ONLY	6.77 ACRES
(C)	COMMERCIAL	RETAIL/SERVICES (BUSINESS)	5.19 ACRES
(CR)	COMMERCIAL RECREATION	COLUMBIA RIVER ATHLETIC CLUB	
(I)	INDUSTRIAL	"OLD MILL SITE"	101.80 ACRES
(PARK) (PL)	PUBLIC LANDS, PARK		21.96 ACRES

NOTE:

THIS MAPPING IS BASED ON ELECTRONIC FILE INFORMATION PROVIDED BY COLUMBIA CITY AND HAS BEEN MODIFIED BY KENNEDY/JENKS CONSULTANTS

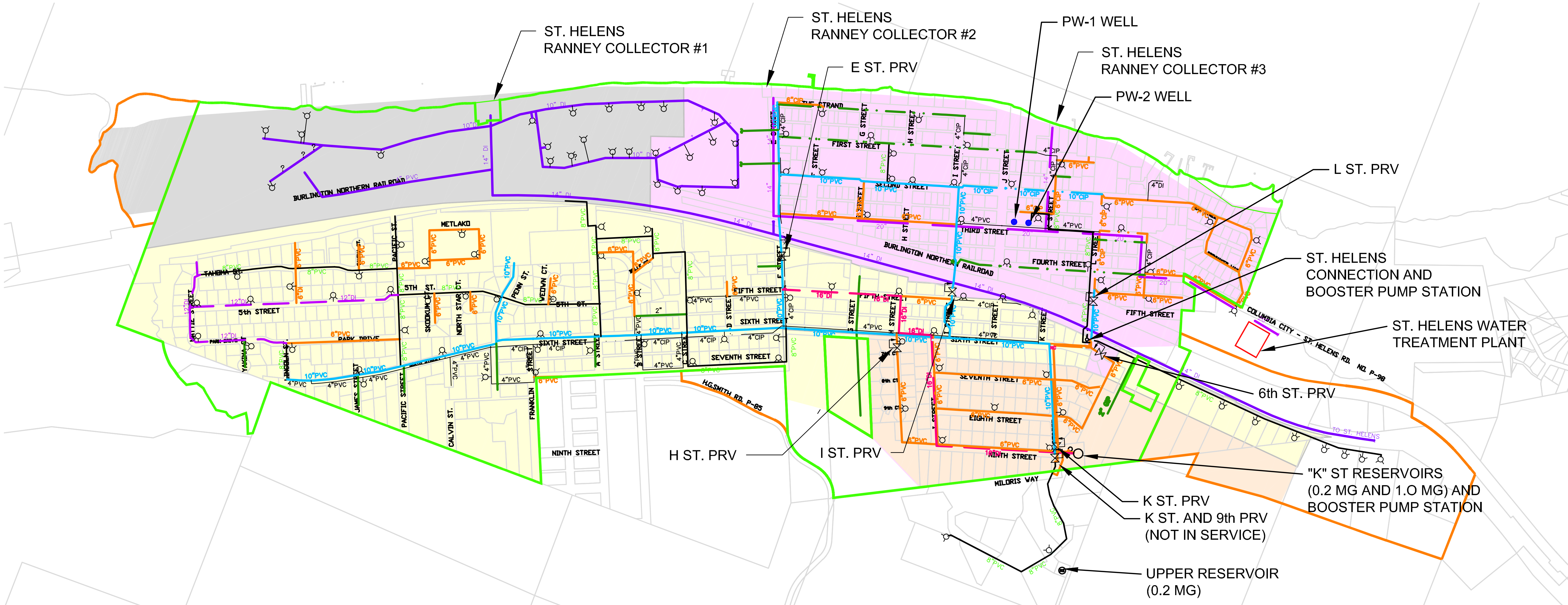
Kennedy/Jenks Consultants

CITY OF COLUMBIA CITY
COLUMBIA CITY, OREGON
WATER MASTER PLAN

SERVICE AREA AND ZONING

1091029.00
AUGUST 2012

FIGURE 2-1



LEGEND

EXISTING PIPES BY SIZE:

1-INCH WATER	1"
2-INCH WATER	2"
3-INCH WATER	3"
4-INCH WATER	4"
6-INCH WATER	6"
8-INCH WATER	8"
10-INCH WATER	10"
12-INCH WATER	12"
16-INCH WATER	16"
TREATED ST. HELENS W/L	14"
ST. HELENS RAW W/L	

NOTE:

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EXISTING FIRE HYDRANT LOCATION

EXISTING PRESSURE REDUCING VALVE

PIPE TYPES:

POLYVINYL CHLORIDE (PVC)	PVC
DUCTILE IRON (DI)	DI
CAST IRON PIPE (CIP)	CIP
GALVANIZED IRON PIPE (GIP)	GIP

PRESSURE ZONES:	AREA:
UPPER RESERVOIR ZONE	75.48 ACRES
MIDDLE / K ST RESERVOIR ZONE	199.58 ACRES
LOWER ZONE	145.08 ACRES
AREA SERVED BY CITY OF ST. HELENS	93.37 ACRES
CITY OF COLUMBIA CITY LIMITS	500.87 ACRES
URBAN GROWTH BOUNDARY (UGB)	584.59 ACRES

0 400 800
APPROXIMATE SCALE IN FEET

N

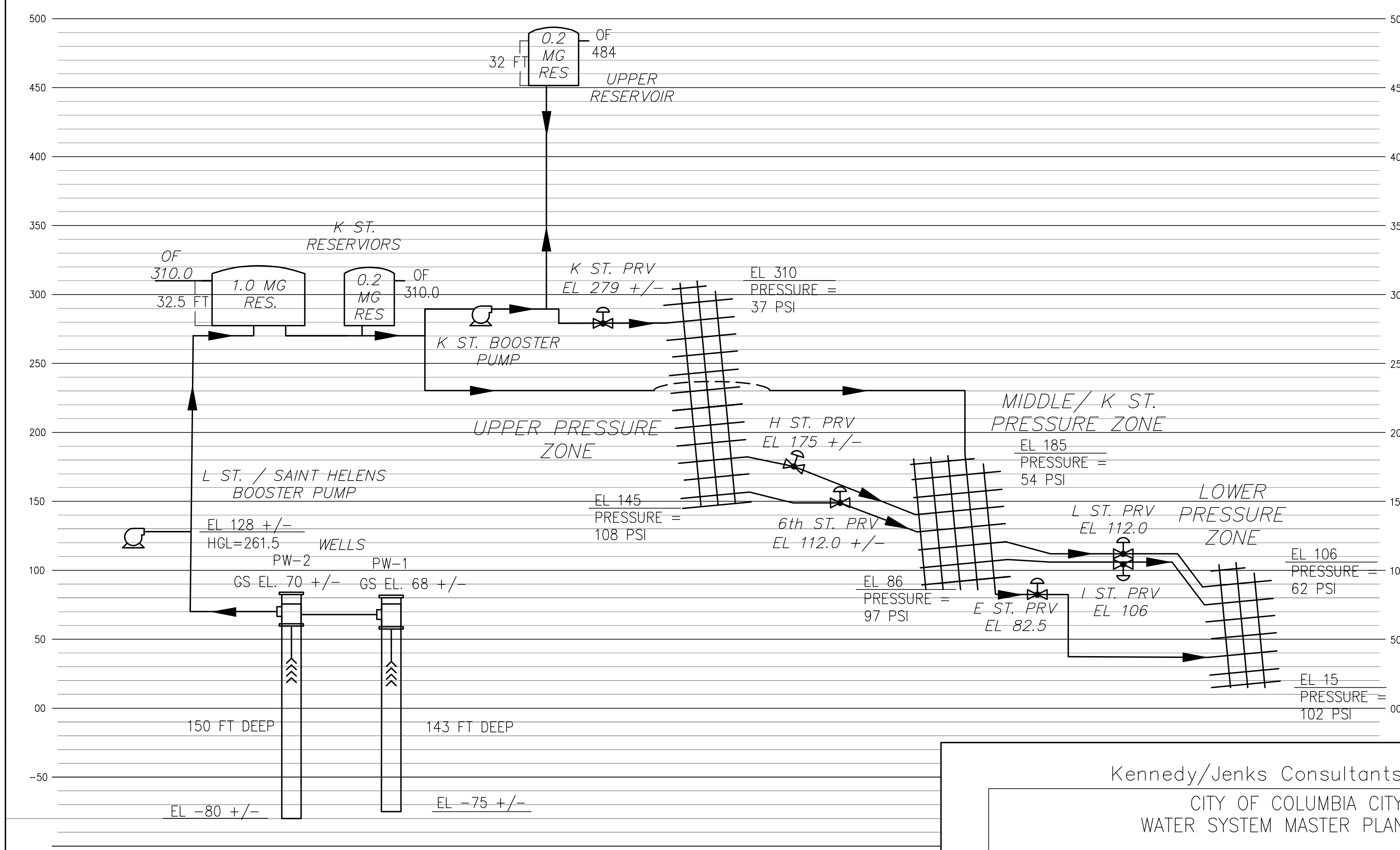
Kennedy/Jenks Consultants

CITY OF COLUMBIA CITY
COLUMBIA CITY, OREGON
WATER MASTER PLAN

EXISTING SYSTEM MAP

1091029.00
AUGUST 2012

FIGURE 2-2



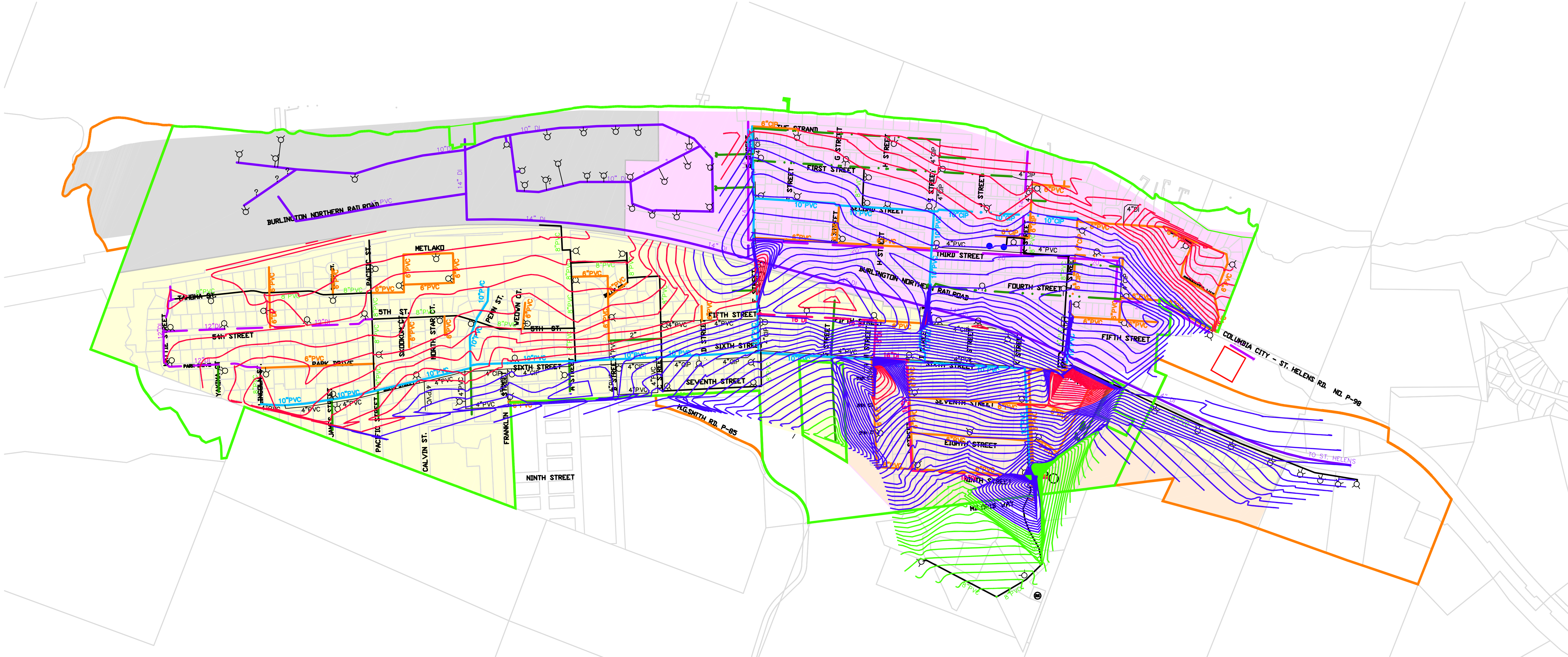
Kennedy/Jenks Consultants

CITY OF COLUMBIA CITY
WATER SYSTEM MASTER PLAN

EXISTING SYSTEM
SCHEMATIC HYDRAULIC PROFILE

K/J 1091029.00

FIGURE 2-3



0 400 800

APPROXIMATE SCALE IN FEET

LEGEND

PRESSURE CONTOUR LEGEND

- 0 - 45 PSI
- 46 - 80 PSI
- OVER 81 PSI

PRESSURE ZONES:	AREA:
UPPER RESERVOIR ZONE	75.48 ACRES
MIDDLE / K ST RESERVOIR ZONE	199.58 ACRES
LOWER ZONE	145.08 ACRES
AREA SERVED BY CITY OF ST. HELENS	93.37 ACRES
CITY OF COLUMBIA CITY LIMITS	500.87 ACRES
URBAN GROWTH BOUNDARY (UGB)	584.59 ACRES

NOTE:

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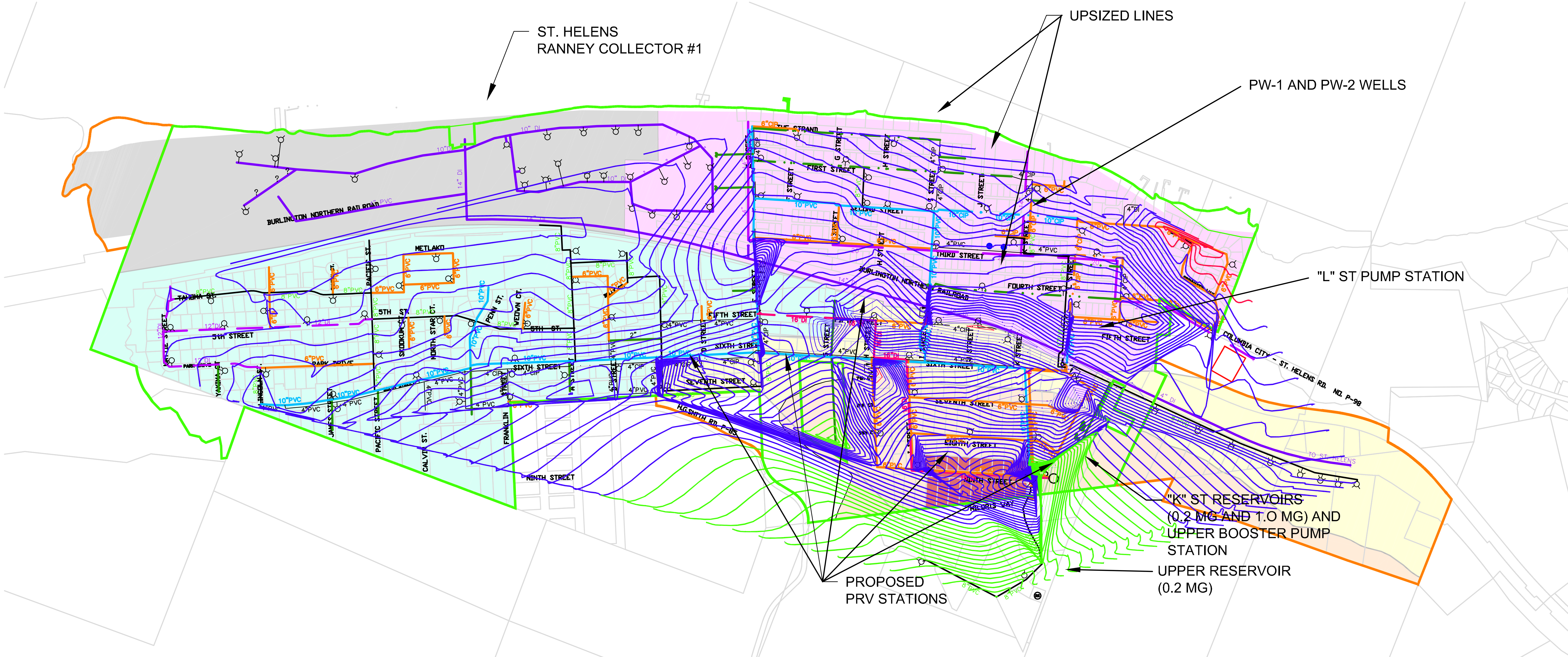
CITY OF COLUMBIA CITY
COLUMBIA CITY, OREGON
WATER MASTER PLAN

EXISTING SYSTEM PRESSURES

1091029.00
AUGUST 2012

FIGURE 6-1



LEGEND

PRESSURE CONTOUR LEGEND

0 - 45 PSI

46 - 80 PSI

OVER 81 PSI

PRESSURE ZONES:

REVISED UPPER RESERVOIR ZONE

REVISED MIDDLE / K ST RESERVOIR ZONE

REVISED LOWER ZONE

AREA SERVED BY CITY OF ST. HELENS

NEW NORTH ZONE

NEW 9th STREET ZONE

CITY OF COLUMBIA CITY LIMITS	500.87 ACRES
URBAN GROWTH BOUNDARY (UGB)	584.59 ACRES

0 400 800

APPROXIMATE SCALE IN FEET

N

NOTE:

THIS MAPPING IS BASED ON ELECTRONIC FILE INFORMATION PROVIDED BY COLUMBIA CITY AND HAS BEEN MODIFIED BY KENNEDY/JENKS CONSULTANTS

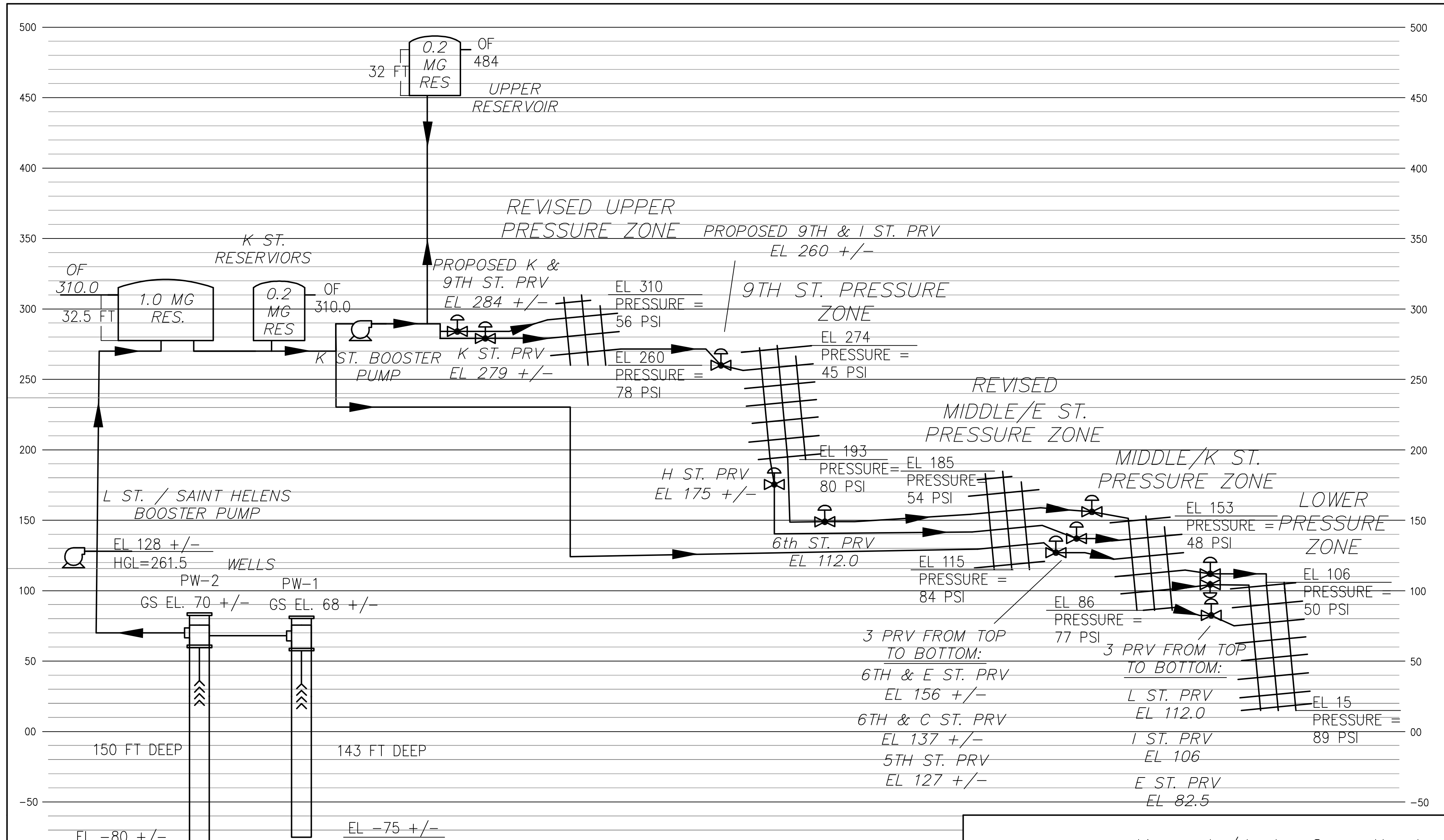
Kennedy/Jenks Consultants

CITY OF COLUMBIA CITY
COLUMBIA CITY, OREGON
WATER MASTER PLAN

PROPOSED SYSTEM PRESSURES

1091029.00
AUGUST 2012

FIGURE 6-2



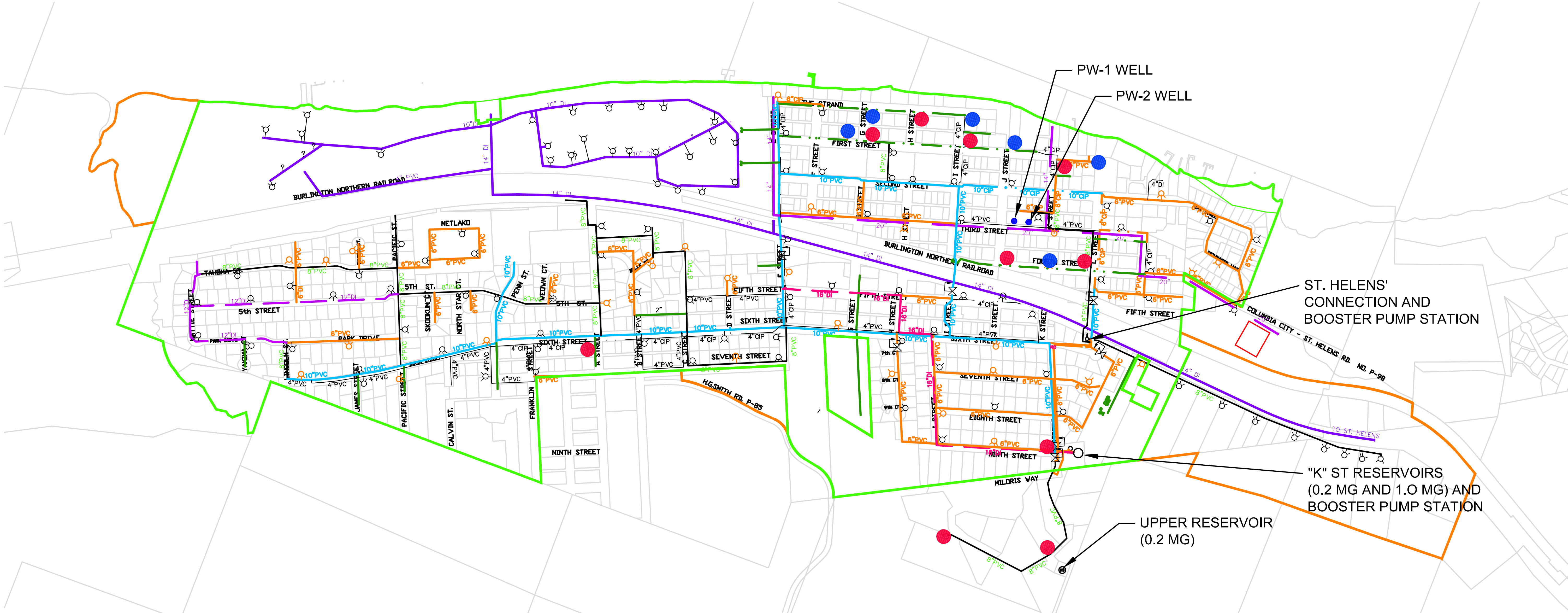
Kennedy/Jenks Consultants

CITY OF COLUMBIA CITY
WATER SYSTEM MASTER PLAN

PROPOSED SYSTEM
SCHEMATIC HYDRAULIC PROFILE

K/J 1091029.00

FIGURE 6-3



LEGEND

EXISTING PIPES BY SIZE:

1-INCH WATER	1"
2-INCH WATER	2"
3-INCH WATER	3"
4-INCH WATER	4"
6-INCH WATER	6"
8-INCH WATER	8"
10-INCH WATER	10"
12-INCH WATER	12"
16-INCH WATER	16"
TREATED ST. HELENS W/L	14"
ST. HELENS RAW W/L	

NOTES:

1. THIS MAPPING IS BASED ON ELECTRONIC FILE INFORMATION PROVIDED BY COLUMBIA CITY AND HAS BEEN MODIFIED BY KENNEDY/JENKS CONSULTANTS.
2. HYDRANTS ON THE ST. HELENS SYSTEM WERE NOT MODELED AS PART OF THIS STUDY

PIPE TYPES:

POLYVINYL CHLORIDE (PVC)	PVC
DUCTILE IRON (DI)	DI
CAST IRON PIPE (CIP)	CIP
GALVANIZED IRON PIPE (GIP)	GIP

PROPOSED FIRE HYDRANT LOCATION

EXISTING FIRE HYDRANT LOCATION

FUTURE HYDRANTS WITH INADEQUATE FIRE FLOW

EXISTING HYDRANTS WITH INADEQUATE FIRE FLOW

CITY OF COLUMBIA CITY LIMITS 500.87 ACRES

URBAN GROWTH BOUNDARY (UGB) 584.59 ACRES

0 400 800

APPROXIMATE SCALE IN FEET

N

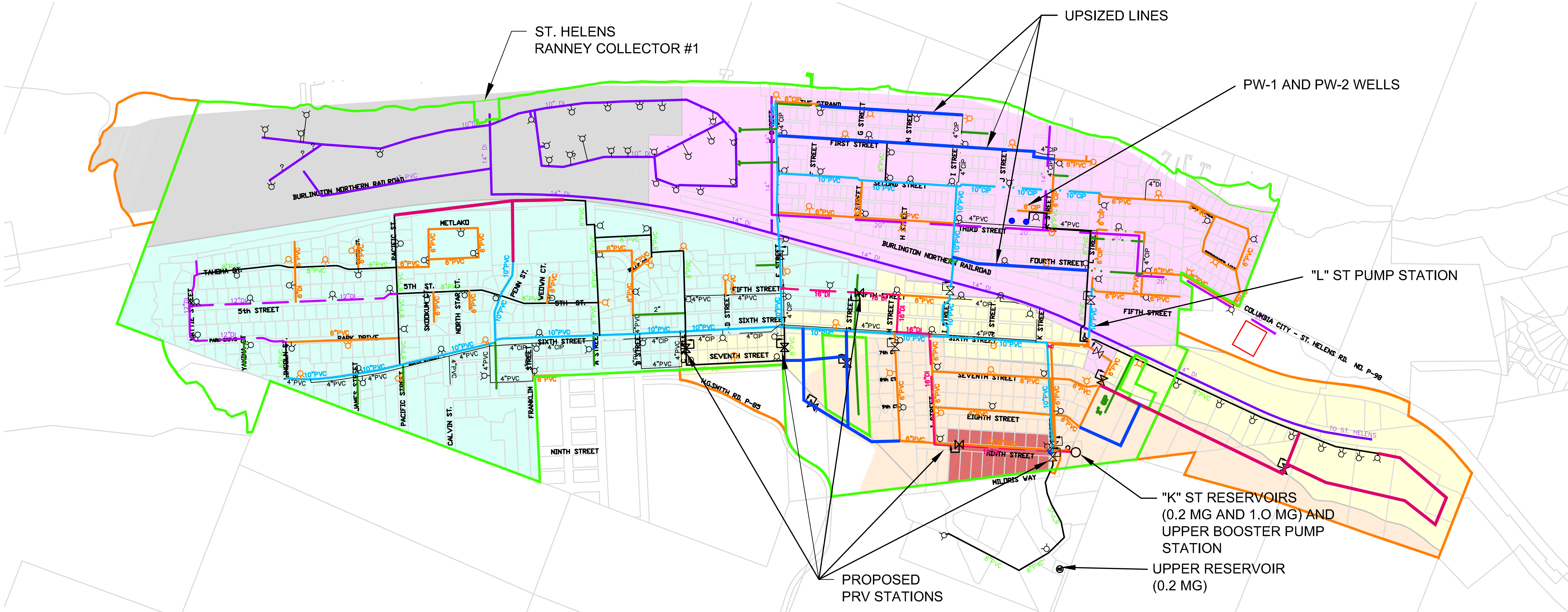
Kennedy/Jenks Consultants

CITY OF COLUMBIA CITY
COLUMBIA CITY, OREGON
WATER MASTER PLAN

HYDRANTS WITH INADEQUATE FIRE FLOW

1091029.00
AUGUST 2012

FIGURE 6-4



LEGEND

EXISTING PIPES BY SIZE:

1-INCH WATER	1"
2-INCH WATER	2"
3-INCH WATER	3"
4-INCH WATER	4"
6-INCH WATER	6"
8-INCH WATER	8"
10-INCH WATER	10"
12-INCH WATER	12"
16-INCH WATER	16"
TREATED ST. HELENS W/L	14"
ST. HELENS RAW W/L	

PROPOSED 8" PIPE

PROPOSED 6" PIPE

PRESSURE REDUCING VALVE

PROPOSED FIRE HYDRANT LOCATION

EXISTING FIRE HYDRANT LOCATION

PIPE TYPES:

POLYVINYL CHLORIDE (PVC)	PVC
DUCTILE IRON (DI)	DI
CAST IRON PIPE (CIP)	CIP
GALVANIZED IRON PIPE (GIP)	GIP

NOTE:

THIS MAPPING IS BASED ON ELECTRONIC FILE INFORMATION PROVIDED BY COLUMBIA CITY AND HAS BEEN MODIFIED BY KENNEDY/JENKS CONSULTANTS

PRESSURE ZONES:

REVISED UPPER RESERVOIR ZONE

REVISED MIDDLE / K ST RESERVOIR ZONE

REVISED LOWER ZONE

AREA SERVED BY CITY OF ST. HELENS

NEW NORTH ZONE

NEW 9th STREET ZONE

CITY OF COLUMBIA CITY LIMITS	500.87 ACRES
URBAN GROWTH BOUNDARY (UGB)	584.59 ACRES

0 400 800
APPROXIMATE SCALE IN FEET

N

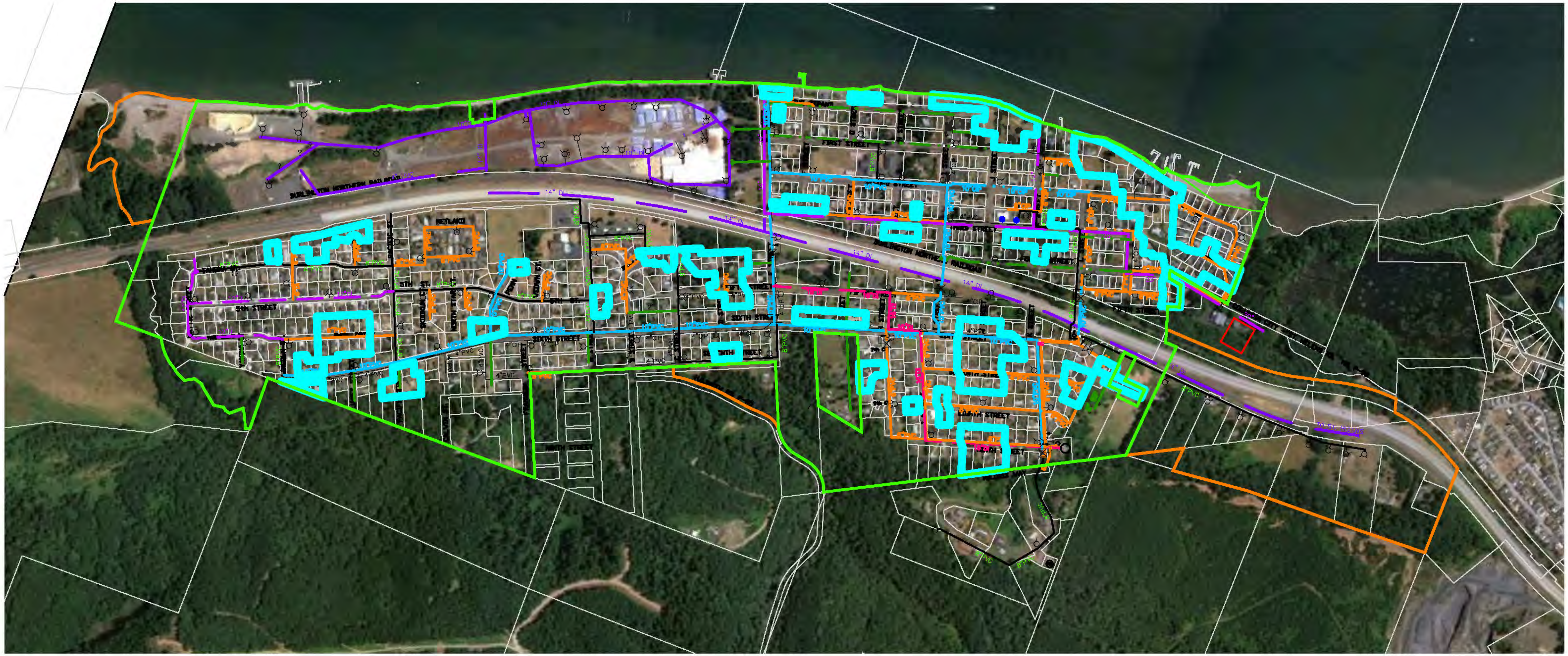
Kennedy/Jenks Consultants

CITY OF COLUMBIA CITY
COLUMBIA CITY, OREGON
WATER MASTER PLAN

PROPOSED WATER SYSTEM

1091029.00
AUGUST 2012

FIGURE 6-5



LEGEND

EXISTING PIPES BY SIZE:

1-INCH WATER 1"
2-INCH WATER 2"
3-INCH WATER 3"
4-INCH WATER 4"
6-INCH WATER 6"
8-INCH WATER 8"
10-INCH WATER 10"
12-INCH WATER 12"
16-INCH WATER 16"
ST. HELENS WATERLINE 14"

NOTE:

THIS MAPPING IS BASED ON ELECTRONIC FILE INFORMATION PROVIDED BY COLUMBIA CITY AND HAS BEEN MODIFIED BY KENNEDY/JENKS CONSULTANTS

EXISTING FIRE HYDRANT LOCATION

AREAS WITHOUT FIRE HYDRANT COVERAGE

PIPE TYPES:

POLYVINYL CHLORIDE (PVC) PVC
DUCTILE IRON (DI) DI
CAST IRON PIPE (CIP) CIP
GALVANIZED IRON PIPE (GIP) GIP

	AREA:
CITY OF COLUMBIA CITY LIMITS	500.87 ACRES
URBAN GROWTH BOUNDARY (UGB)	584.59 ACRES

0 400 800
APPROXIMATE SCALE IN FEET

N

Kennedy/Jenks Consultants

CITY OF COLUMBIA CITY
COLUMBIA CITY, OREGON
WATER MASTER PLAN

EXISTING AREAS WITHOUT FIRE HYDRANT COVERAGE

1091029.00
AUGUST 2012

FIGURE 6-6

Appendix A

Sanitary Survey

Oregon
Theodore R. Kulongoski., Governor

Department of Human Services
Health Services
800 NE Oregon Street
Portland, OR 97232-2162
(971) 673-0405
(971) 673-0457 – FAX
(971) 673-0372 - TTY-Nonvoice

MAR 2 6 2010

March 25, 2010

Micah Rogers
Columbia City (PWS #00203)
PO Box 189
Columbia City, OR 97018

Re: Water System Survey

Dear Mr. Rogers,

Thank you for your time and cooperation in completing the **Water System Survey for Columbia City on December 4, 2009**. A survey is required to be completed approximately every 3-years and is designed to identify any deficiencies or corrections that need to be made to the system or procedures in order to protect public health and ensure compliance with the drinking water standards under Oregon Administrative Rules (OAR) 333-061. I have enclosed a copy of the survey report for your records. This final report follows an earlier draft sent to you in the beginning of February this year, for which the City has been previously billed, so you will not receive another bill. Thanks you for providing input on the previous draft and please feel free to let me know if any corrections need to be made to this final report.

Columbia City serves both purchased treated surface water (from the City of St Helens) and groundwater from two wells to roughly 1,990 customers through 866 connections. Groundwater is treated with chlorine with enough contact time to provide 4-log viral inactivation (31.7 minutes @ 200 gpm through piping prior to first reservoir) and then caustic for corrosion control to match the pH of purchased water (pH of 7.2 min). Purchased surface water is fully treated by the City of St Helens and no other treatment is added by Columbia City. Storage is provided by the 0.2 MG and 1 MG "K" street reservoirs and the 0.2 MG Upper reservoir. The distribution system consists mainly of cast iron, ductile iron, or PVC piping which serve three pressure zones (380-ft Zone 1, 270-ft Zone 2, and 200-ft Zone 3) with two pump stations ("K" St. and "L" St. pump stations). In general, the system is well maintained and operated. Deficiencies identified during the survey are included in the first page of the report and described in greater detail below.

All systems using a surface water or groundwater under the influence of surface water must submit a written plan (Corrective Action Plan) within 45 days describing how and when deficiencies will be corrected. **Please respond with how and when the deficiencies listed below were corrected and the dates of correction by March 31, 2010**. Deficiencies and recommendations are as follows:

Deficiencies

1) **Chlorine residuals must be measured and recorded in the distribution system at least twice a week (OAR 333-061-0036(9)).** At the time of the survey, daily entry point residual monitoring and recording chlorine residuals at the time of coliform sampling was being completed, the additional distribution system residuals monitoring was not being completed. Residuals can be recorded at the same sites as coliform sample sites, but must be done at least twice a week (2 samples per week total) and should be done according to a rotation schedule in order to get representative monitoring results.

2) **Annual Nitrate Sampling for EP-C was not completed in 2009 (OAR 333-061-0025(1)).** Our records indicated that sampling for Nitrates at Entry Point C (Well #2) was completed on February 17, 2010, correcting this deficiency.

Please send the Corrective Action Plan and any supporting documentation by March 1, 2010 to:

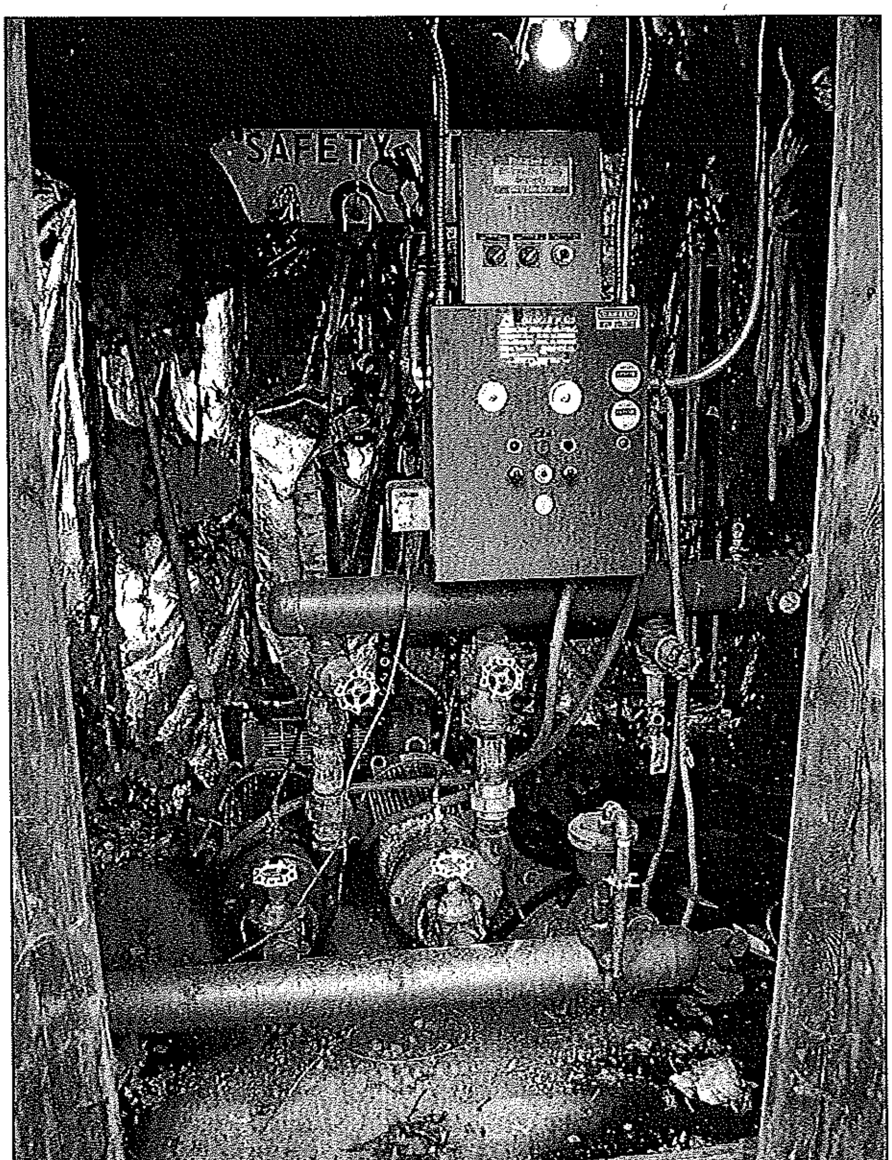
Attn: Evan Hofeld
DHS – Drinking Water Program
PO Box 14450
Portland, OR 97293-0450

Alternatively, you may e-mail me with your response to the first deficiency (since the 2nd deficiency has been resolved) at evan.e.hofeld@state.or.us .

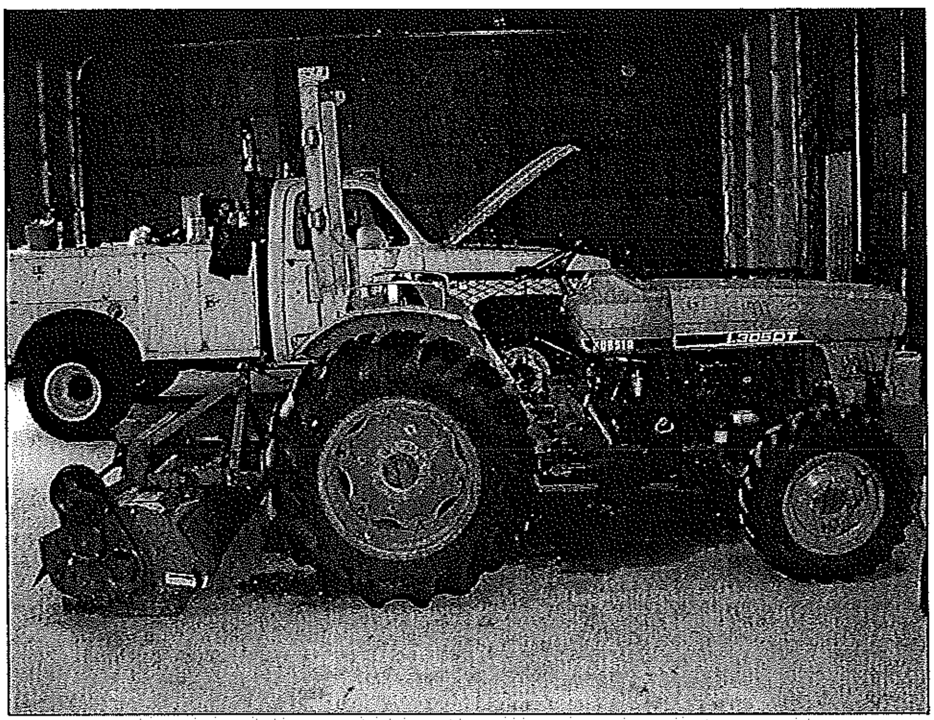
In addition to the above listed deficiencies, I have included a couple of recommendations as follows:

Recommendations

1) **Minimize debris and deterioration in the "K" Street pump house (see photo of "K" Street pump house below).**



2) **Ensure containment of potential contaminant sources within 100-ft of the wells and employ the best management practices outlined in the Oregon Department of Environmental Quality *Automotive Repair and Maintenance Tips for Drinking Water Protection* are followed.** The photograph below shows a tractor and truck stored in the shop bay closest to Well #2.



Again, thank you for your time in completing this survey. If you have questions or would like this information in an alternate format, please feel free to contact me at any time at 971-673-0419 or via e-mail at evan.e.hofeld@state.or.us.

Sincerely,

Evan Hofeld
Regional Engineer
Department of Human Services
Drinking Water Program

Deficiency Summary

Surveyor: Evan Hofeld

Date Corrective Action Plan is due: March 31, 2010 **County:** Columbia

Yes	No	Significant Deficiencies and Rule Violations:	Date to be corrected	Date corrected
☐	☐	**Source:**		
		Well construction:		
		Spring/other source:		
☒	☐	**Treatment:**		
		Surface water treatment:		
		Disinfection: Chlorine must be measured and recorded at least twice a week in the distribution system.		
		Other treatment:		
☐	☐	**Finished Water Storage:**		
☐	☐	**Distribution:**		
☒	☐	**Monitoring:** 2009 Nitrate Sampling is Past Due for EP-C		
☐	☐	**Management & Operations:**		
☐	☐	**Operator Certification:**		
☐	☐	**Other Rule Violations:**		

Comments:

☐ **Source Deficiencies:**

Well Construction Deficiencies (OAR 333-061-0076):
- ☐⊕ Sanitary seal and casing not watertight
- ☐⊕ Does not meet setbacks from hazards
- ☐⊕ Wellhead not protected from flooding
- ☐⊕ No raw water sample tap
- ☐⊕ No treated sample tap (if applicable)
- ☐⊕ No screen on existing well vent

Spring Source Deficiencies (OAR 333-061-0076):
- ☐⊕ Springbox not impervious durable material
- ☐⊕ No watertight access hatch/entry
- ☐⊕ No screened overflow
- ☐⊕ Does not meet setbacks from hazards
- ☐⊕ No raw water sample tap
- ☐⊕ No treated sample tap (if applicable)

☒ **Treatment Deficiencies/Violations:**

Surface Water Treatment Deficiencies:
- ☐+ Turbidity standards not met-0030(3)
- ☐+ Turbidimeters not calibrated per manufacturer or at least quarterly-0036(5)(b)(A)
- ☐⊕ Incorrect location for compliance turbidity monitoring
- ☐⊕ If serving > 3,300 people no alarm or auto plant shut off for low chlorine residual
- ☐⊕ For conventional or direct filtration: No alarm or plant shut off for high turbidity
- ☐⊕ For conventional filtration: Settled water not measured daily
- ☐⊕ For conventional or direct filtration: Turbidity profile not conducted on individual filters at least quarterly
- ☐⊕ For cartridge filtration: No pressure gauges before and after cartridge filter
- ☐⊕ For diatomaceous earth filtration: Body feed not added with influent flow
- ☐+ For membrane filtration: Turbidimeter not present on each unit-0050(4)(c)(G)
- ☐+ For membrane filtration: Direct integrity testing not done at least daily-0036(5)(b)(F)

Disinfection Deficiencies/Violations:
- ☐+ DPD or EPA approved method not used-0036(9).
- ☐+ Free chlorine residual not maintained-0032(3/5)
- ☒+ Chlorine not measured & recorded as required-0036(9)
- ☐+ Minimum CT requirement not met all times-0032(3/5)
- ☐⊕ No means to adequately determine flow rate on contact chamber effluent line
- ☐+ pH, Temperature, and chlorine residual not measured daily at first user-0036(5)(a/b)
- ☐⊕ Failure to calculate CT values correctly
- ☐⊕ No means to adequately determine disinfection contact time under peak flow and minimum storage conditions
- ☐+ Annual raw water sampling past due-0036(6)(w)

UV Disinfection Violations (OAR 333-0050(5)(k)):
- ☐+ Bypass around UV system
- ☐+ Lamp sleeve not cleaned
- ☐+ Lamp not replaced per manufacturer
- ☐+ No intensity sensor with alarm or shut-off
- ☐+ Annual raw water sampling past due-0036(6)(w)

Other Treatment Violations:
- ☐+ Non-NSF approved chemicals-0087(6)
- ☐+ Corrosion control parameters not met-0034

☐ **Distribution System Violations:**
- ☐+ System pressure < 20 psi. -0025(7)

Cross Connection (OAR 333-061-0070):
- ☐+ No ordinance or enabling authority (CWS)
- ☐+ Annual Summary Report not issued (CWS)
- ☐+ Testing records not current (CWS, NTNC, TNC)
- ☐+ No Cross Connection Control Specialist (CWS ≥ 300 connections)

☐ **Finished Water Storage Deficiencies:**
- ☐⊕ Hatch not locked or adequately secured
- ☐⊕ Roof and access hatch not watertight
- ☐⊕ No flap valve, screen, or equivalent on drain.
- ☐⊕ No screened vent

☒ **Monitoring Violations:**
- ☒+ Monitoring not current-0025(1)
- ☐+ MCL violations-0030
- ☐+ No Coliform Sampling Plan-0036(6)(b)(G)

☐ **Management & Operations Violations:**
- ☐+ No operations and maintenance manual. -0065(4)
- ☐+ Emergency response plan not completed. -0064(1)
- ☐+ Major modifications not approved (plan review). -0050
- ☐+ Master plan not current (≥ 300 con.)-0060(5)
- ☐+ Annual CCR not submitted (CWS)-0043(1)(a)
- ☐+ SNC or out of compliance with AO
- ☐+ Public notice not issued as required-0042

☐ **Operator Certification Violations:**
- ☐+ No certified operator at required level-0065(2).
- ☐+ No protocol for under certified operator-0225(5).

☐ **Other Rule Violations:** _____

⊕ Significant deficiency per OAR 333-061-0076
\+ Significant rule violation per OAR 333-061-XXX

Inventory and Narrative

☐ **Outstanding Performer**

County: Columbia

Type	Status	Size	Season
☒ Community (C)	Population:	1,990	☒ All year ☐ Seasonal
☐ Non Transient Non-Community (NTNC)	Connections:	866	Begins: (mm/dd) 1/1
	Service Chars:	MU	Ends: (mm/dd) 12/31
☐ Transient Non-Community (TNC)	Ownership:	4	**Coliform Sampling**
	License		Period: ☒ Monthly ☐ Quarterly
☐ State Reg/Non EPA (NP)	☒ Not Lic ☐ HD ☐ Ag		Samples Required: 2

Operator Certification Required			**Responsible Agency**
WD 2	WT 1	FE ☐ Small WS ☐	☒ State ☐ County ☐ Dept of Agriculture

Primary Administrative Contact (Mailing Address):

Contact Name: Leahnette Rivers — Phone: (503) 397-4010
Title: City Administrator — Cell: ( )
Street Address: PO Box 189 — Emergency #: (-)
City/State/Zip: Columbia City, OR 97018 — Email: lrivers@columbia-city.org

Legal/Owner Address:

Contact Name: City Hall — Phone: ( )
Title: PO Box 189 — Cell: ( )
Street Address: 1840 2nd Street — Emergency #: ( )
City/State/Zip: Columbia City, OR 97018 — Email:

System Physical Address:

Contact Name: Micah Rogers — Phone: (503) 366-0454
Title: Public Works Supervisor (Interim) — Cell: (971) 563-3127
Street Address: 1755 2nd Place — Emergency #: (503) 397-1521
City/State/Zip: Columbia City, OR 97018 — Email: mrogers@columbia-city.org

Emergency Systems Available:

Name: City of St Helens — **PWS ID#:** 41 00724

Narrative:

Columbia City serves both purchased treated water (from the City of St Helens) and groundwater from two wells to roughly 1,990 customers through 866 connections. Groundwater is treated with chlorine with enough contact time to provide 4-log viral inactivation (31.7 minutes @ 200 gpm through piping prior to first reservoir) and then caustic for corrosion control to match the pH of purchased water (pH of 7.2 min). Purchased surface water is fully treated by the City of St Helens and no other treatment is added by Columbia City. Storage is provided by the 0.2 MG and 1 MG "K" street reservoirs and the 0.2 MG Upper reservoir. The distribution system consists mainly of cast iron, ductile iron, or PVC piping which serve three pressure zones (380-ft Zone 1, 270-ft Zone 2, and 200-ft Zone 3) with two pump stations ("K" St. and "L" St. pump stations).

Service area characteristic and owner type codes:

Service Area Characteristics

Primary	Secondary	CODE
Residential	City or Town	MU
Residential	Mobile Home Park	MP
Residential	Subdivision	SU
Residential	Rural	RA
Residential	Other	OR
Transient	Recreation (parks, campground, beaches, ski areas, marinas)	PA
Transient	Service Station	SS
Transient	Summer Camp	SK
Transient	Restaurant/Store	RS
Transient	Highway Rest Area	HR
Transient	Hotel/Motel, B&B	HM
Transient	Other (visitor ctr, church)	OT
Non-Transient Non-Community	School	SC
Non-Transient Non-Community	Institution	IN
Non-Transient Non-Community	Medical Facility	MF
Non-Transient Non-Community	Industrial/Agricultural	IA
Non-Transient Non-Community	Day Care Center	DC
Non-Transient Non-Community	Other	OA
Other	Interstate Carrier	IC
Other	Wholesaler (sells water)	WH
Other	Other Area	OT

Determining System Type

Population/ Daily Use	Number of Connections	>25 Same Daily Users	≥25 Year Round Residents	System Type
<10	<4	No	No	Not a System
10 – 24	4-14	–	–	State Reg/Non-EPA
25+	–	No	No	Transient Non-Community
25+	–	Yes	No	Non-Transient Non-Community
25+	15+	Yes	Yes	Community

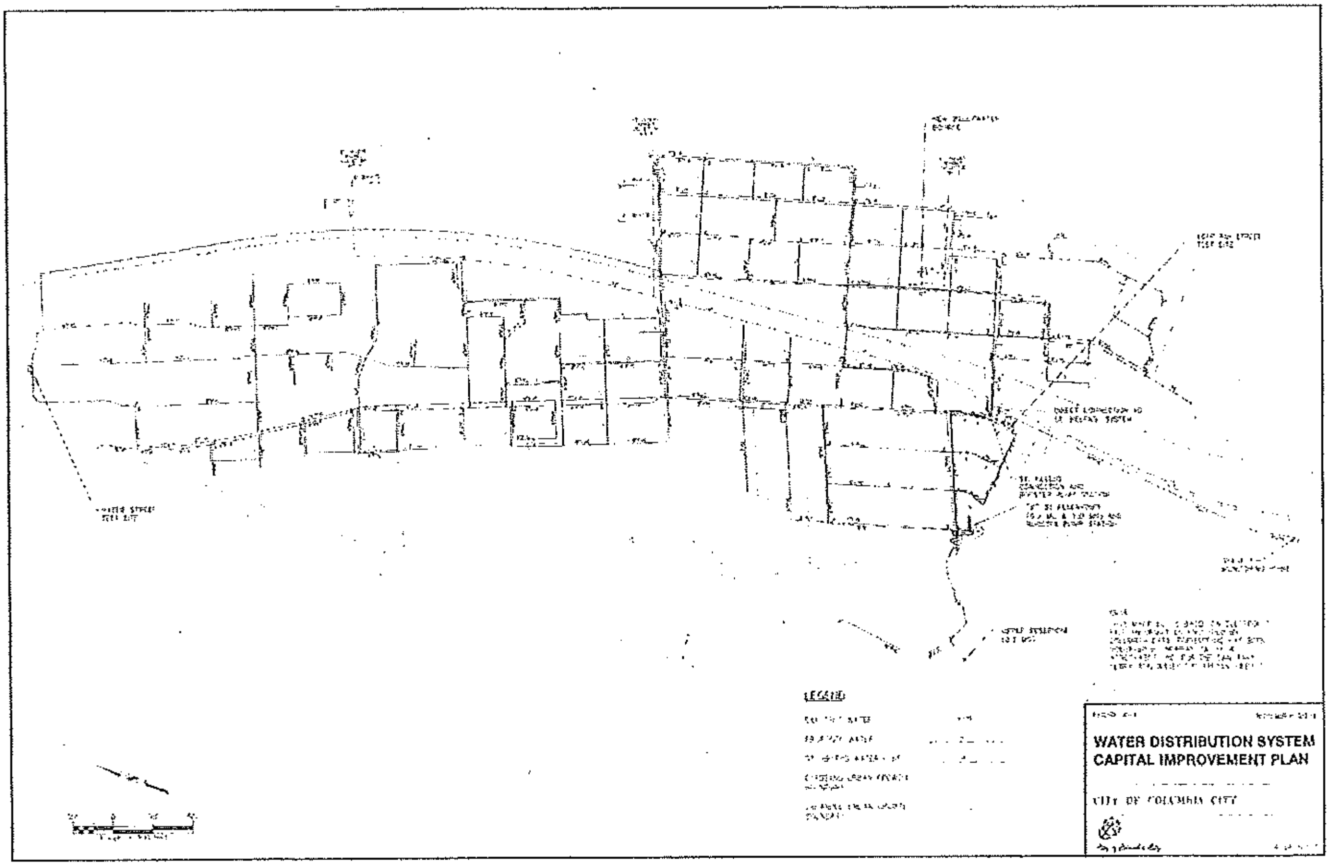
Coliform Bacteria Sampling

Community systems	Monthly samples based on population*		
Non-Transient, Transient, State-Regulated Systems	Groundwater population served		Surface water
	≤1000 1 per quarter	>1000 Monthly based on population*	Monthly sampling based on population*

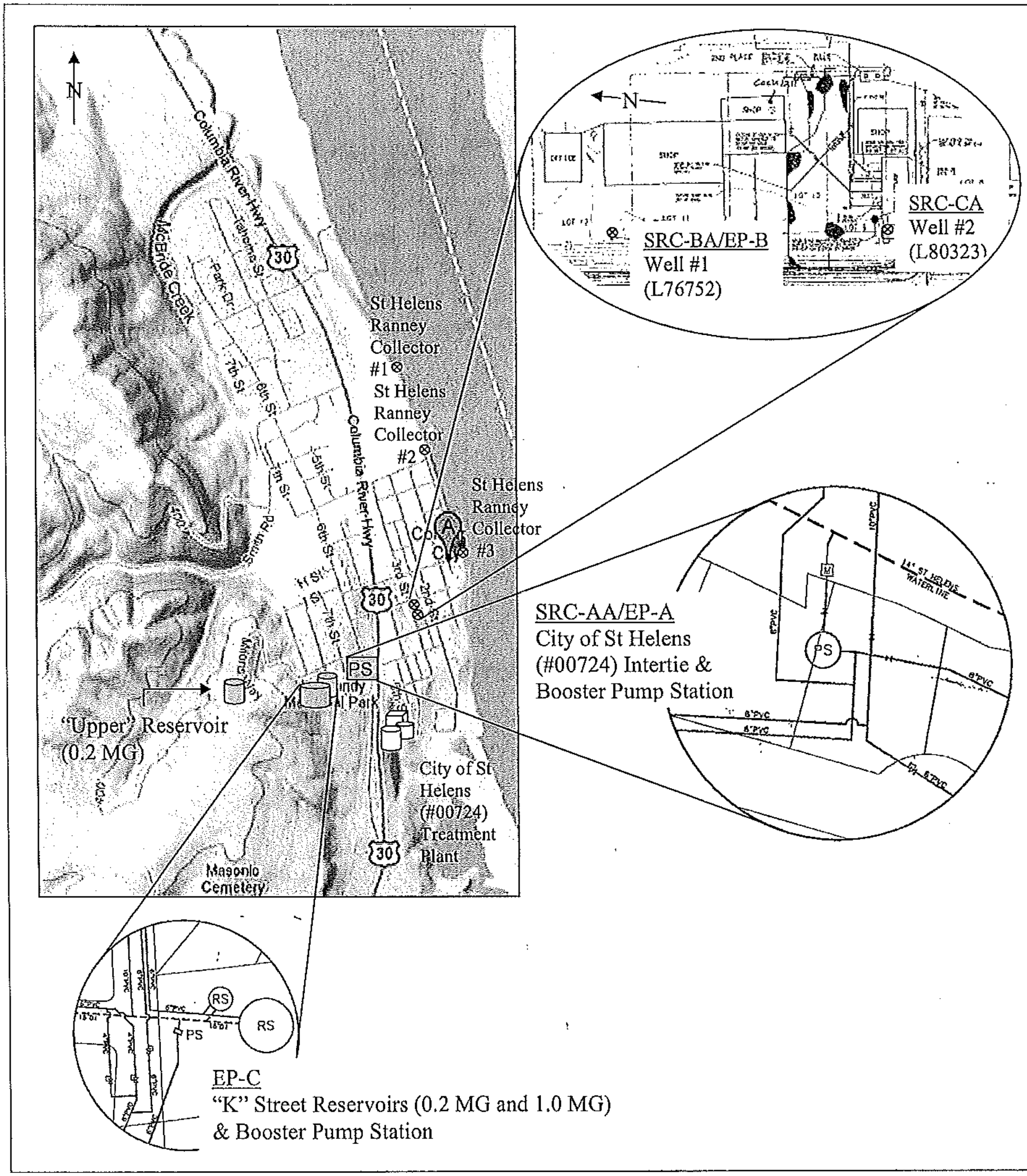
Owner Type	Code
Federal Government	1
Private	2
State Government	3
Local Government	4
Mixed Public/Private	5

* Population	Samples per month
Up to 1,000	1
1,001 to 2,500	2
2,501 to 3,300	3
etc	See rules or call DWP

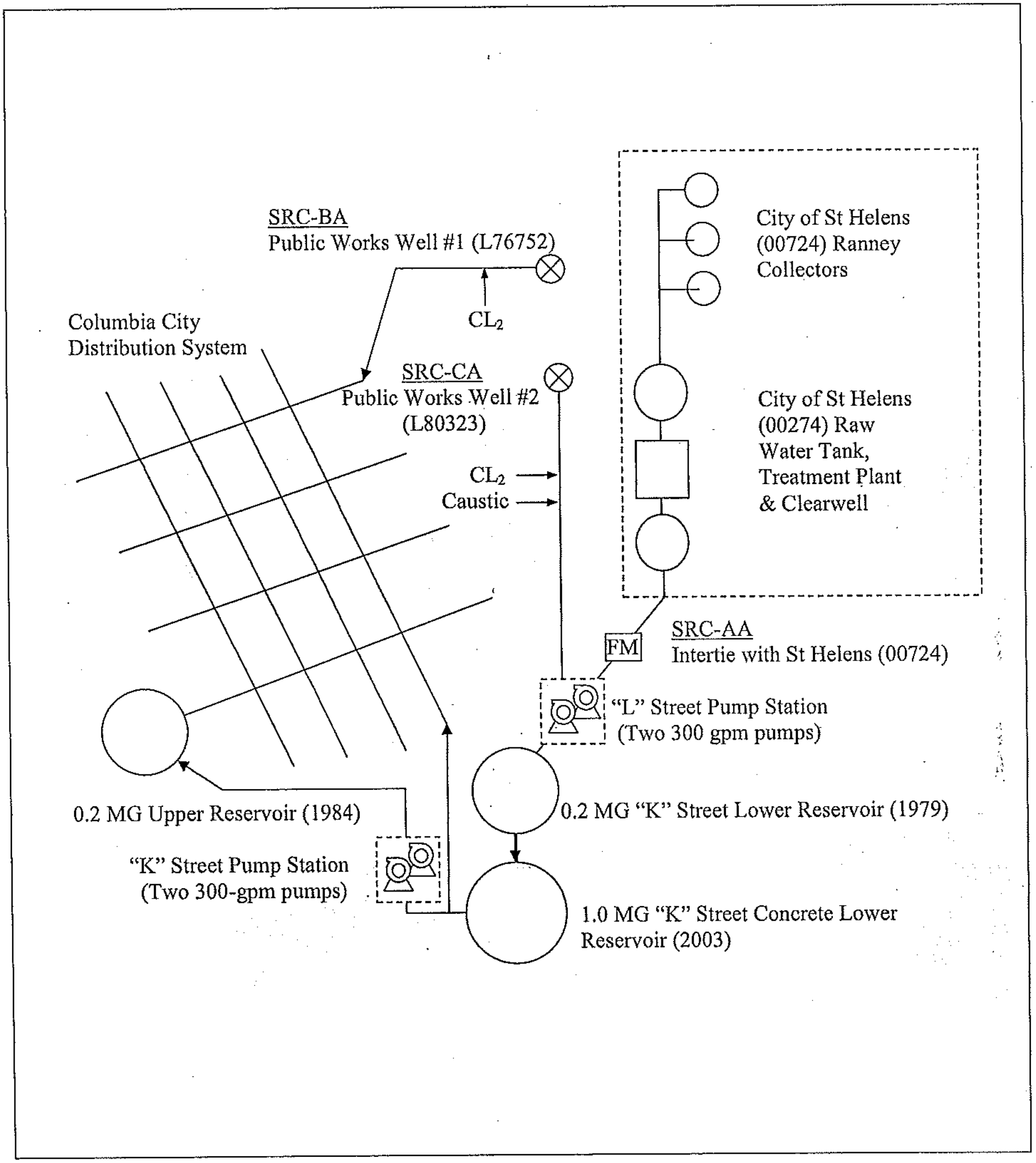
Service Area Map



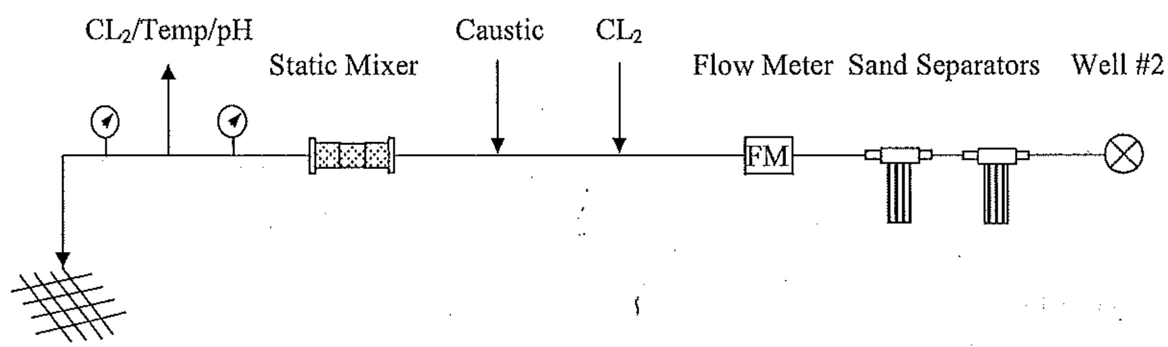
Water System Facility Map

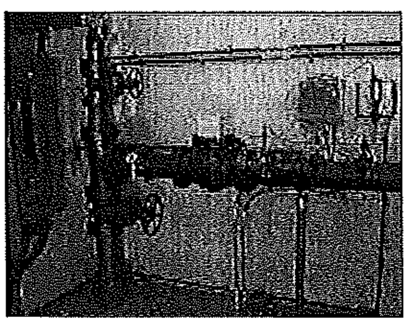


Water System Schematic

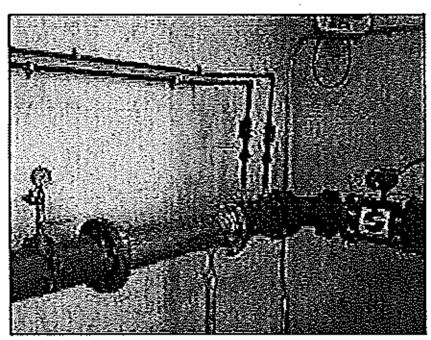


Well #2 Treatment Schematic

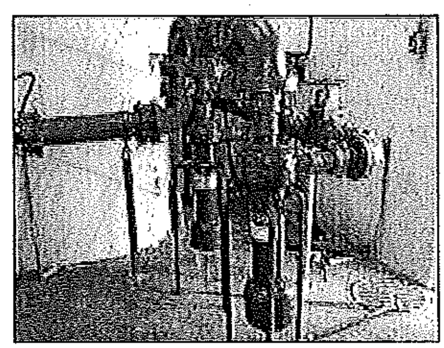




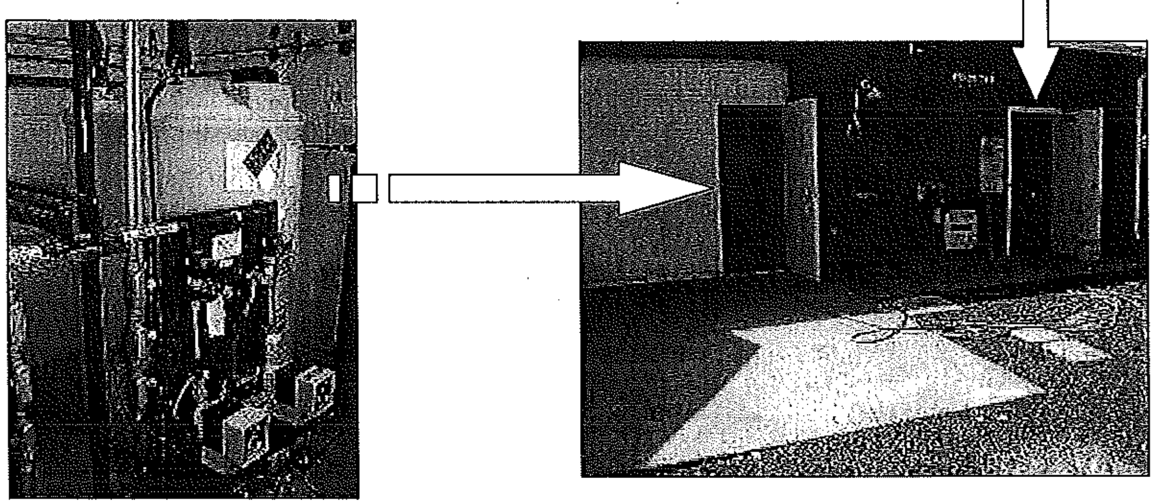
CL_2/Temp/pH Meters



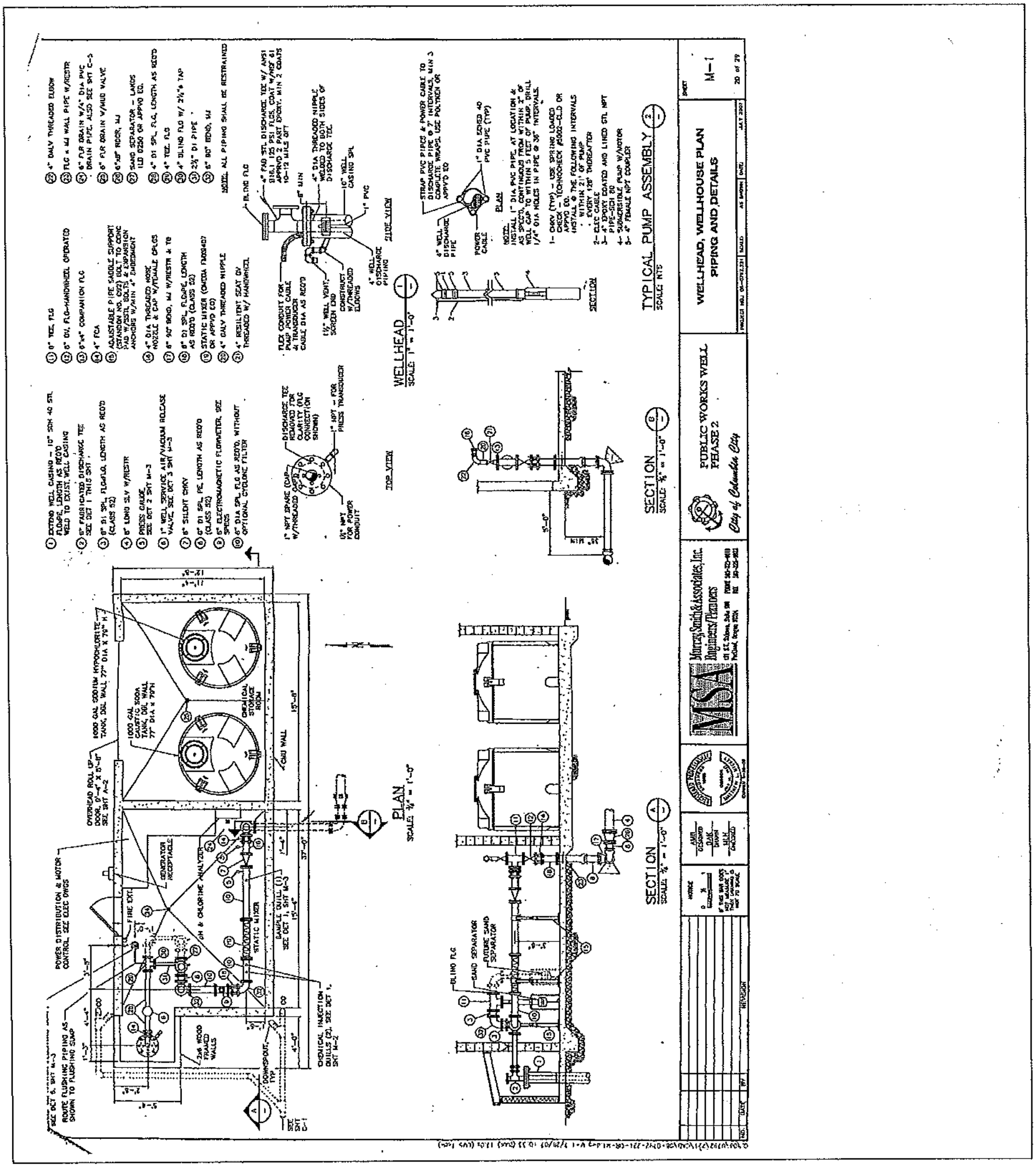
Static Mixer & Flow Meter



Sand Separators & Well #2 (background)



Well #2 Treatment Plant



Source Information

ID	Entry Points	Source Type					Availability					Treatment	
ID	(Location where water enters distribution and is sampled) Name	Ground	Surface	GWUDI	Pur. ground	Pur. surface	Permanent	Seasonal	Begins	Ends	Emergency	None	Treatment Codes**
A	City of St Helens (00724)	☐	☐	☐	☐	☒	☒	☐	1/1	12/31	☐	☐	N996
B	EP for Well #1 (L76752, COLU53313)	☒	☐	☐	☐	☐	☐	☐			☒	☒	Off-line
C	EP for Well #2 (L80323, COLU53400)	☒	☐	☐	☐	☐	☒	☐	1/1	12/31	☐	☐	D421, C503
		☐	☐	☐	☐	☐	☐	☐			☐	☐	

ID	Individual Sources			Source Type					Availability					Treatment	
ID	(Contributing to Entry Point) Name	*Land Use	Capacity (GPM)	Ground	Surface	GWUDI	Pur. ground	Pur. surface	Permanent	Seasonal	Emergency	Abandoned	Disconnected	None	Treatment Codes**
AA	City of St Helens (00724)	G	263	☐	☐	☐	☐	☒	☒	☐	☐	☐	☐	☐	N996
BA	Well #1 (L76752, COLU53313)	G	47	☒	☐	☐	☐	☐	☐	☐	☒	☐	☐	☒	Off-line
CA	Well #2 (L80323, COLU53400)	G	115	☒	☐	☐	☐	☐	☒	☐	☐	☐	☐	☐	D421, C503
				☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
				☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
				☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
				☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	

*Land Use Codes: (A) **Pristine Forest** (B) **Irrigated Crops** (C) **Non-Irrigated Crops** (D) **Pasture** (E) **Light Industry** (F) **Heavy Industry** (G) **Urban-Sewered Area** (H) **Rural On-Site Sewage Disposal** (I) **Urban On-Site Sewage Disposal** (J) **Rangeland** (K) **Managed Forest** (L) **Commercial** (M) **Recreational Use**
**See "Treatment" page for treatment code descriptions.

List current operational patterns for all sources (e.g., Well 1 used continuously @ 100 gpm. Be as specific as possible)
SRC-AA Well #1 is used 1-2x per month, depending on line breaks and summer demands. Well #2 is primary source, which is supplemented through the intertie with the City of St Helens. Production of Well #2 has decreased since last winter from 200 gpm to 190 gpm to 115 gpm over the summer. City is investigating increasing using Well #1.

Yes No

☒ ☐ Does the water system have water rights for all sources? ☐ Not Required

☐ ☒ For GW systems, have there been any modifications to the existing well(s) or spring(s) (e.g. deepened, change in screened interval, springbox reconstruction, etc.)? Describe below:

No changes since original construction.

☐ ☒ Has a Source Water Assessment been completed by ☐ DWP or ☐ DEQ? If yes, attach delineation map and review boundaries with operator.

☒ ☐ Has system implemented source water protection strategies? If yes, describe below:
City has household chemical disposal programs, "dump no waste" labeling on storm drains, and newsletter articles.

☒ ☐ Is the water system interested in source water protection? If yes, contact regional geologist at 541-726-2587.

Comments:

Well Information

		Source ID#: BA		CA		N/A[1]		N/A[1]		N/A[1]			
	Source Name:	Well #1		Well #2		9th St Well		Well #4		Harvard Pk			
	Well Tag ID (e.g. L12345): L	76752		80323		39270		57959		57954			
	(if no well tag ID, enter WRD Well Log ID below)	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
	Well Log on File:	☒	☐	☒	☐	☒	☐	☒	☐	☒	☐	☐	☐
	WRD Well Log ID (e.g. COLU123):	COLU53313		COLU53400		COLU51359		COLU52208		COLU52201			
Wellhead Construction	Well still active	☒	☐	☒	☐	☐	☒	☐	☒	☐	☒	☐	☐
Wellhead Construction	Depth of well (ft.)	143		148		470		395		410			
Wellhead Construction	Depth of grout seal (ft.)	92		39		45				282			
Wellhead Construction	Year of installation (yr.)	09/18/06		03/05/07		07/25/00		01/18/01		01/10/03			
Wellhead Construction	Casing diameter (in.)	12		10		6				8			
Wellhead Construction	• Sanitary seal & casing watertight	☒	☐	☒	☐	☐	☐	☐	☐	☐	☐	☐	☐
Wellhead Construction	• If vented, properly screened	☒	☐	☒	☐	☐	☐	☐	☐	☐	☐	☐	☐
Wellhead Construction	• Wellhead protected from flooding	☒	☐	☒	☐	☒	☐	☐	☐	☐	☐	☐	☐
Wellhead Construction	• Well meets setbacks from hazards	☒	☐	☐	☒	☐	☐	☐	☐	☐	☐	☐	☐
Wellhead Construction	Nearest hazard (ft)			50-100[2]									
Wellhead Construction	Water level device	☐	☒	☒	☐	☐	☐	☐	☐	☐	☐	☐	☐
Wellhead Construction	Concrete slab around casing	☒	☐	☒	☐	☐	☒	☐	☐	☐	☐	☐	☐
Wellhead Construction	Casing height ≥ 12-in. above slab/grade	☒	☐	☒	☐	☒	☐	☐	☐	☐	☐	☐	☐
Wellhead Construction	Pitless adapter	☐	☒	☐	☒	☐	☒	☐	☒	☐	☒	☐	☒
Wellhead Construction	Constructed properly per SWA report	☒	☐	☒	☐	☐	☐	☐	☐	☐	☐	☐	☐
Control Building	Protective housing	☒	☐	☒	☐	☐	☒	☐	☐	☐	☐	☐	☐
Control Building	Flowmeter	☒	☐	☒	☐	☐	☐	☐	☐	☐	☐	☐	☐
Control Building	Pressure gauge	☐	☒	☒	☐	☐	☐	☐	☐	☐	☐	☐	☐
Control Building	Pump to waste piping	☒	☐	☒	☐	☐	☐	☐	☐	☐	☐	☐	☐
Control Building	• Raw sample tap	☒	☐	☒	☐	☐	☐	☐	☐	☐	☐	☐	☐
Control Building	• Treated sample tap ☐N/A	☒	☐	☒	☐	☐	☐	☐	☐	☐	☐	☐	☐
Control Building	Heated	☒	☐	☒	☐	☐	☐	☐	☐	☐	☐	☐	☐
Control Building	Lighted	☐	☒	☒	☐	☐	☐	☐	☐	☐	☐	☐	☐
Control Building	Floor drain	☒	☐	☒	☐	☐	☐	☐	☐	☐	☐	☐	☐
Control Building	Well pump removal provision	☒	☐	☒	☐	☐	☐	☐	☐	☐	☐	☐	☐
Pump	Pump type*	SU		SU									
Pump	Bearing lubrication (FG oil/water)												
Pump	Pumping capacity (gpm)	50		300[3]		50				75			
Pump	Amount of water pumped per year (gallons)												
Pump	Percent of total well supply provided (%)**												
Pump	Static water level (ft below ground surface)	72.6		71.3		138				104			
Pump	Static water level date	09/18/06		03/05/07		07/25/00				01/10/03			

* Pump Types: (VT) Vertical Turbine (SU) Submersible (CE) Centrifugal (SJ) Shallow Jet (DJ) Deep Jet (OT) Other
** The sum of the % for all the wells should equal 100% (e.g. for 2 wells, if well #1 provides 80%, then well #2 must provide 20%).

Comments:
[1] The 9th St Well, Well #4 and the Harvard Park Well exist, but are not in use or connected to the system.
[2] Well #2 was approved through plan review #171-2007 allowing a 50' radius of control around Well #2 and chemical storage w/ spill containment and DEQ BMP for Auto Shops within 100', but no closer than 50'.
[3] The yield of Well #2 was originally 300 gpm based upon a 3-hr pump test in March 2007, but yield has declined over the past year from 200 gpm to 190 gpm to 115 gpm during the summer.

Potential Sanitary Hazards
(From OAR 333-061-0050(2)(a)(F))

The following sanitary hazards are not allowed within 100 feet of a well:

- Any existing or proposed pit privy
- Subsurface sewage disposal drain field
- Cesspool
- Solid Waste disposal site
- Pressure sewer line
- Buried fuel storage tank
- Animal yard, feedlot, or animal waste storage
- Untreated storm water or gray water disposal
- Chemical (including solvent, pesticides, and fertilizers)storage, usage, or application)
- Fuel transfer or storage
- Mineral resource extraction
- Vehicle or machinery maintenance or long term storage
- Junk / auto / scrap yard
- Cemetery
- Unapproved well
- Well that has not been properly abandoned or of unknown or suspect construction
- Source of pathogenic organisms
- Any other similar public health hazards

The following are not allowed within 50 feet of a well:

- Gravity sewer line
- Septic Tank

Exemptions to these setbacks must be listed and documented within the plan approval letter.

If a surface water source is located within 500 feet of a well or spring, please note the water body name and the distance to the well or spring. All groundwater sources within 500 feet to a surface water source should be considered for potential surface water influence. Check the file for correspondence. If a review has been done indicate results in comment section. If not, contact the Springfield office 541-726-2587.

Well & Water Right Summary

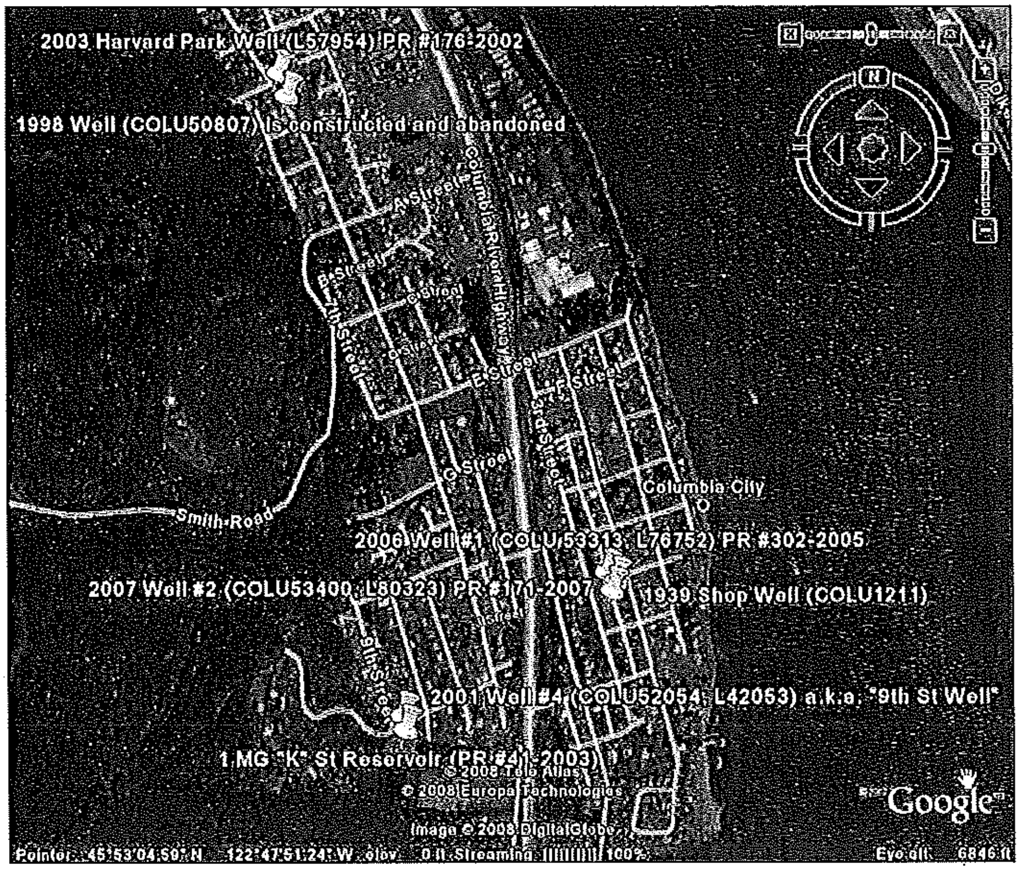
Well Summary

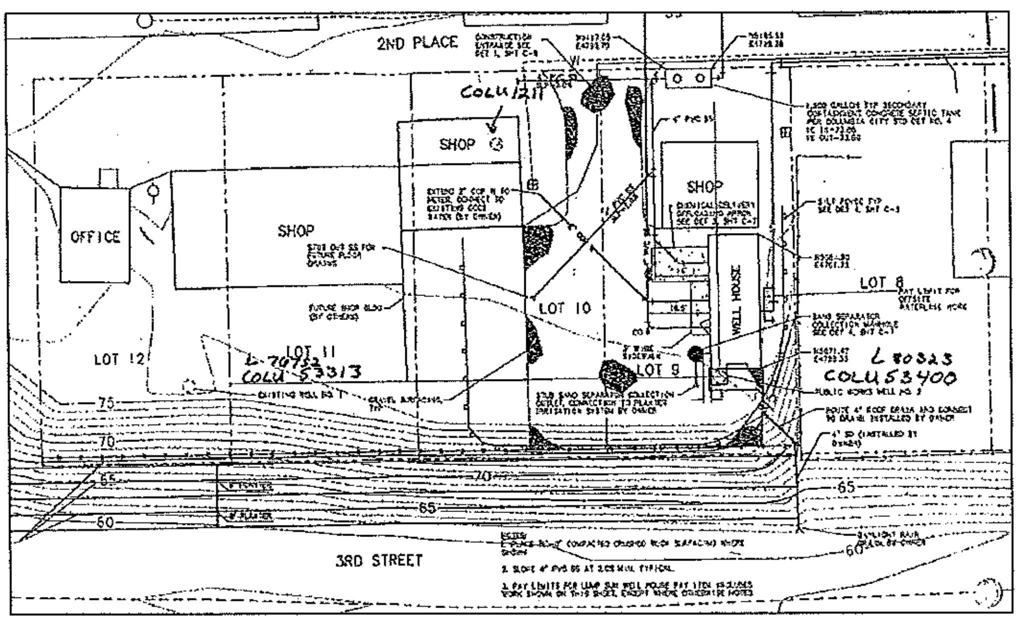
09/04/98	6th & Penn St Well drilled and abandoned (COLU50807) Section 21, T5N, R1W, Tax Lot 00100 (abandoned 09/04/98)
07/25/00	**Ninth and K St Well drilled (COLU51359, L39270) PR#72-2000.** Permit G-13937.
01/18/01	Well #4 (referred to as "9th St Well" in 07/27/01 LTR) drilled (COLU52054, L42053) located south of ninth and K St intersection on the 9th Street Reservoir site – Section 28, T5N, R1W, Tax Lot 3200 (abandoned 03/05/01 COLU52192, altered 6/19/02 COLU52199, partially abandoned 01/24/03 COLU52208 & L57959). PR#72-2000. Permit G-13937. PR #72-2000
09/18/02	Bore Hole B-1 (COLU52203) drilled at 9th and K St on Reservoir Site (Section 28, T5N, R1W, Tax Lot 3200. Bore Hole B-1 abandoned 09/18/02.
09/18/02	**Bore Hole B-2 (COLU52142) drilled at 9th and K St on Reservoir Site (Section 28, T5N, R1W, Tax Lot 3200.**
01/10/03	Harvard Park Well Constructed (COLU52201, L57954) located in Harvard Park, Section 21, T5N, R1W, Tax Lot 100. PR #176-2002. Permit G-13937
09/18/06	**Public Works Well #1 (COLU53313, L76752) was constructed at 1755 Second Place, Section 28, T5N, R1W, Tax Lot 4400 (PR #302-2005). Final Approval granted 07/09/07 PR#302-2005.** Water rights (G2515, 100 gpm, 0.2228 cfs) for the 1939 well (COLU1211) were transferred (T-10507) for this well. An additional water right of 1.114 cfs (500 gpm) was obtained under application G16984/Permit G16438 (priority date 12/19/07).
03/05/07	**Public Works Well #2 (COLU53400, L80323) was constructed PR #171-2007. Well is located at Section 28, T5N, R1W, Tax Lot 4400, St address: 1755 Second Place (PR #171-2007). Final Approval granted 08/19/08 PR#171-2007 with construction waivers obtained for ownership of land under OAR 333-061-0050(2)(a)(B) (30'x66' restrictive easement for the area within 50-ft of the well) and Best Management Practices under DEQ's Automotive Repair and Maintenance Tips for Drinking Water Protection are employed due to the proximity of the City automotive shop within 100-ft of the well.** Water rights (G2515, 100 gpm, 0.2228 cfs) for the 1939 well (COLU1211) were transferred (T-10507) for this well. An additional water right of 1.114 (500 gpm) was obtained under application G16984/Permit G16438 (priority date 12/19/07).
11/15/07	1939 Well (COLU1211) Abandoned 11/15/07 (Start Card 1002630, COLU53510). PR#302-2005.

Water Rights Summary

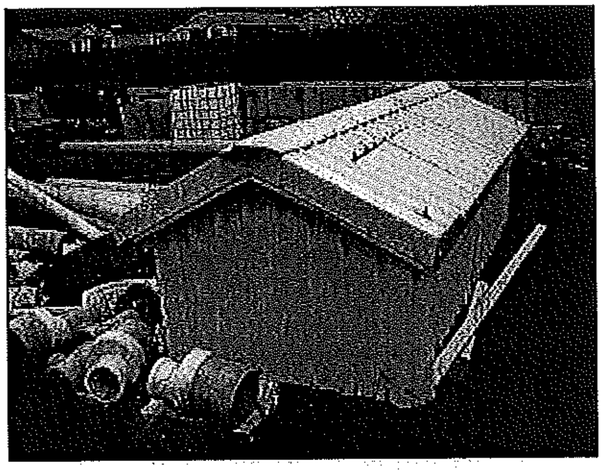
Points of Diversion	Permit #	Water Right	Priority Date
9th & "K" Street Well (L39270) Well #4 (L42053) Harvard Park Well (L57954)	G13937	1.67 cfs (750 gpm)	02/22/00
Public Works Well #1 (L76752) & Public Works Well #2 (L80323)	G2515/T10507	0.2228 cfs (100 gpm)	12/19/07
Public Works Well #1 (L76752) & Public Works Well #2 (L80323)	G16984	1.114 cfs (500 gpm)	12/19/07

Well Summary Maps

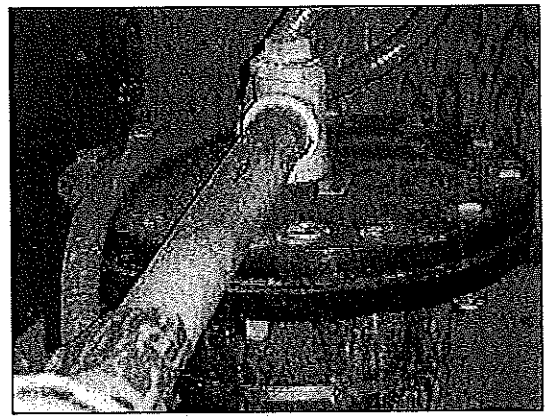




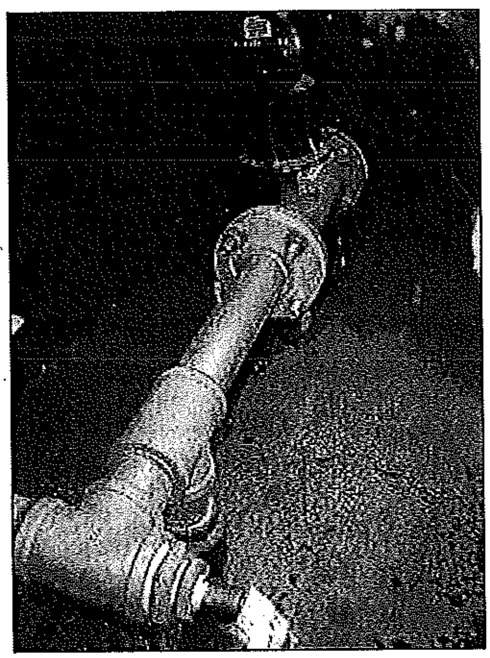
SRC-BA – Public Works Well #1 (L76752)



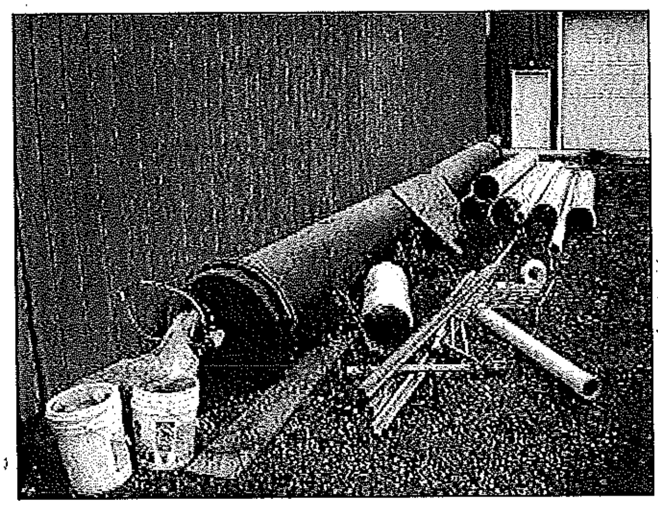
Wellhouse



Well #1 (L76752)
(Drilled 09/18/06)



Well #1 Flow Meter



Pipe for Contact Time

SRC-BB – Public Works Well #2 (L80323)

Oregon
Theodore R. Kulongoski, Governor

Department of Human Services
Public Health Division
800 NE Oregon Street
Portland, OR 97232-2162
(971) 673-1111 - Emergency
(971) 673-0405
(971) 673-0457 - FAX
(971) 673-0372 - TTY-Nonvoice

August 19, 2008

LEAHNETTE RIVERS
CITY OF COLUMBIA CITY (PWS #00203)
PO BOX 189
COLUMBIA CITY, OR 97018

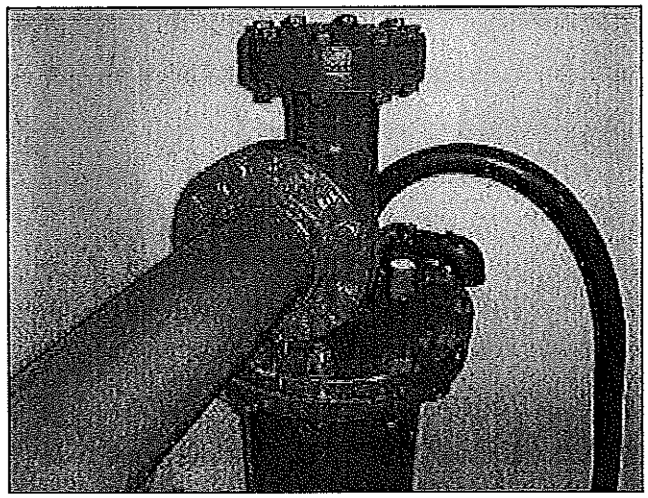
Re: Final Approval for Public Works Well #2 (PR #171-2007)

Dear Ms. Rivers,

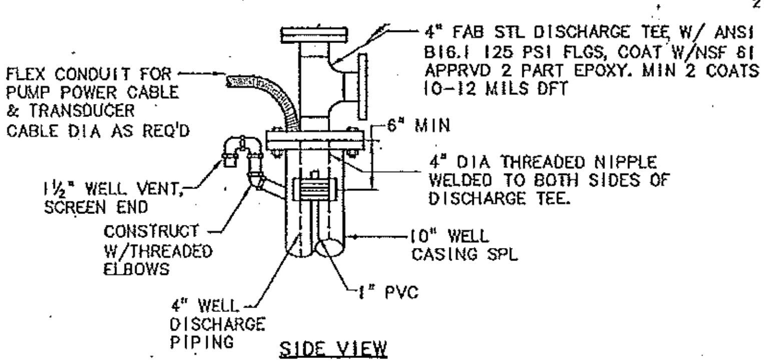
I have received verification that the conditions listed in the July 17th, 2008 Site Visit Summary letter and the August 29th, 2007 Conditional Approval letter have been met. **This completes the plan review process for this project. Approval to use the Public Works Well #2 is granted, effective August 19, 2008.**

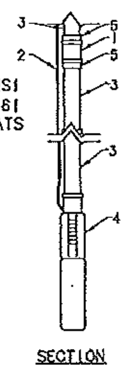
The project, funded in part by SRF Loan #S02009, included abandonment of the 1939 well (COLU1211) and construction of the new Public Works Well #2 (L80323) as part of a wellfield with Public Works Well #1 (L76752). This project also included the construction of related chlorination (sodium hypochlorite) and corrosion control (caustic) treatment facilities and distribution piping. Treated water from the new well is connected to the system through roughly 1,700 feet of new 8" HDPE transmission main extending from the well, westward under the Portland and Western Rail line and HWY 30 at the "L" street bridge in Columbia City to the 6-inch pump main at a point approximately 60-ft north of the "St. Helens Booster Pump Station". Water rights for the well were obtained through a transfer (T-10507) of water rights in the amount of 100 gpm from the 1939 well (GR-2515).

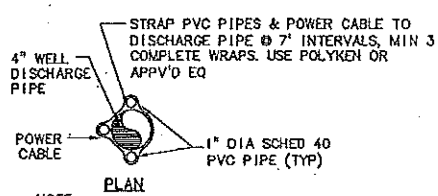
Two applications requesting a waiver from construction standards under OAR 333-061-050(2)(a)(B) and (F) were granted. Chemicals related to the city vehicle maintenance shop may be stored within 100-ft, but no closer than 50-ft of the new well, provided the storage and spill containment practices mentioned in the waiver request application are followed. The 30-ft x 66-ft restrictive easement obtained for Tax Lot 8 to the south, the City's ownership of Tax Lot 9 to the north, and the 3rd Street public right-of-way to the west provide a sufficient 50-ft radius of control around well. I have enclosed copies of the signed waiver requests for your records.



Well #2 (L80323)
(Drilled 03/05/07)







NOTE:
INSTALL 1" DIA PVC PIPE, AT LOCATION & AS SPEC'D, CONTINUOUS FROM WITHIN 2" OF WELL CAP TO WITHIN 5 FEET OF PUMP. DRILL 1/4" DIA HOLES IN PIPE @ 36" INTERVALS.

1– CHKV (TYP) – USE SPRING LOADED CHECK – TECHNOCHECK #5002-CLD OR APPVD EQ.
INSTALL @ THE FOLLOWING INTERVALS
- WITHIN 21' OF PUMP
- EVERY 126' THEREAFTER

2– ELEC CABLE
3– 4" EPOXY COATED AND LINED STL NPT PIPE–SCH 80
4– SUBMERSIBLE PUMP W/MOTOR
5– 4" FEMALE NPT COUPLER

In accordance with the above, the Columbia City water system hereby requests the Department of Human Services to waive the construction standard OAR 333-061-050 (2)(a)(B).
The construction standard requested to be waived is for the following project:
Public Works Well #2 PR #171-2007 (WRD Well ID COLU53400).
This waiver is necessary for the following reasons: The City does not own or have a perpetual restrictive easement for the area within 100-ft of the well.
Proposed alternate measures to protect the health and welfare of the public in lieu of complying with the construction standards OAR 333-061-050 will consist of: Ownership of property plus a 30' x 66' restrictive easement for the area within 50-ft of the well (see attached map).

Leahnette Rivers
Signature
PO Box 189, Columbia City, OR 97018

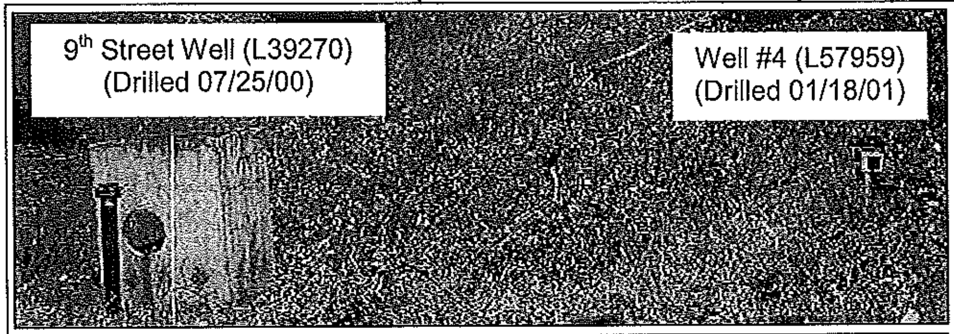
Attach plans of proposed waiver request or Additional supporting information and mail to:

In accordance with the above, the Columbia City water system hereby requests the Department of Human Services to waive the construction standard OAR 333-061-050 (2)(a)(F)
The construction standard requested to be waived is for the following project:
Public Works Well #2 PR#171-2007 (WRD Well ID COLU53400, L80323)
This waiver is necessary for the following reasons: There is a City shop consisting of vehicle maintenance and storage facilities and the storage of related automotive chemicals (oil and miscellaneous) within 100-feet of the well.
Proposed alternate measures to protect the health and welfare of the public in lieu of complying with the construction standards OAR 333-061-050 will consist of: The employment of best management practices outlined in DEQ's Automotive Repair and Maintenance Tips for Drinking Water Protection, and heightened employee awareness through training and education. (see attached letter).

Leahnette Rivers
Signature
PO Box 189, Columbia City, OR 97018

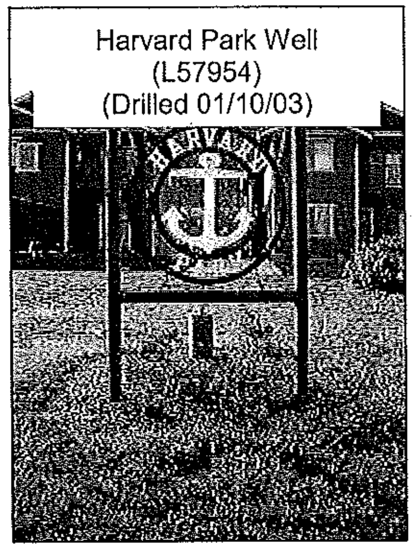
Attach plans of proposed waiver request or Additional supporting information and mail to:

Other Wells
(not connected to the system)



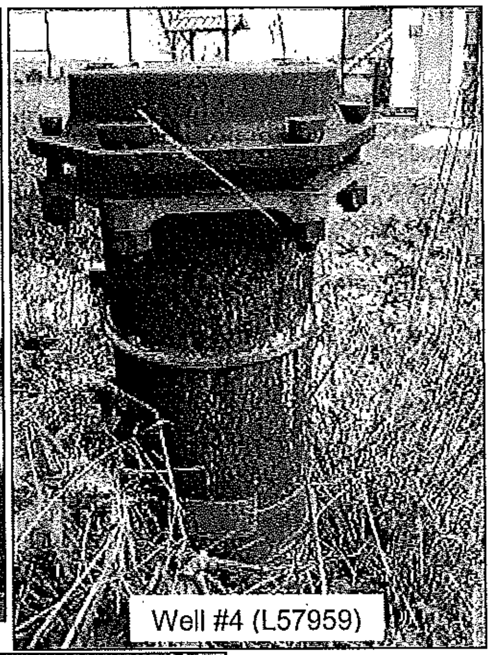
9th Street Well (L39270)
(Drilled 07/25/00)

Well #4 (L57959)
(Drilled 01/18/01)

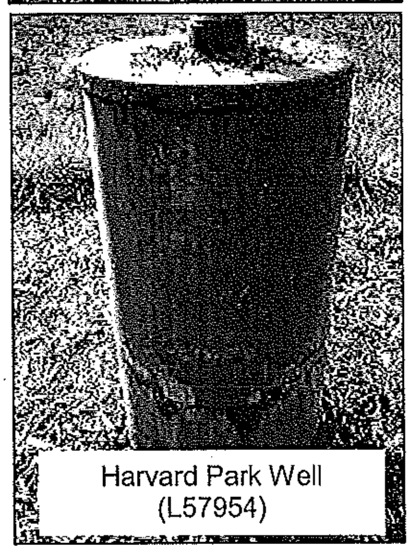


Harvard Park Well
(L57954)
(Drilled 01/10/03)

9th Street Well (L39270)



Well #4 (L57959)



Harvard Park Well
(L57954)

Disinfection

No #	Disinfection Method*	Location	Disinfection Source Water	Residual Maintenance	Other Purpose	Proportional to Flow	Dosage Recorded
1	Sodium Hypochlorite	WTP-A for Wells #1 & #2	☒	☒		☒	☒
			☐	☐		☐	☐
			☐	☐		☐	☐

*Chlorine Gas, Sodium Hypochlorite, On-site Generated Sodium Hypochlorite, Calcium Hypochlorite, Chloramines, Ozone, UV, Mixed-Oxidants, Other

Yes	No		Yes	No	
☒	☐	• Is a DPD or other EPA approved method used?	☒	☐	• NSF 60/61 certified (or equivalent)?
☐	☒	• Are residuals recorded as required?			

Distribution: ☐ ≥ 2x weekly # samples: ______ ☒ w/Coliform Other: ______

EP (SWTR & GWR Comp. Mon.): ☒ ≥ 1x Daily # samples: 1 ☐ Continuous if > 3300 pop ☐ N/A

Range of chlorine residuals at first user: mg/l = 0.6

☒ ☐ • Are raw water samples taken as required (GWR assessment monitoring, etc.)? ☐ N/A

How often? As needed for Triggered Source Water Monitoring

Yes	No	**Chlorine gas** ☒ N/A	Yes	No	
☐	☐	Separate room for gas storage and feeder	☐	☐	Gas cylinders properly secured
☐	☐	Fan with on/off switch outside	☐	☐	Door that opens out
☐	☐	Vent located next to the floor	☐	☐	Self-contained breathing apparatus
☐	☐	Door with a window	☐	☐	Air scrubber system

Yes	No	**UV:** ☐ 4.0-log virus ☐ Total coliform + ☐ Other: N/A	Yes	No	
☐	☐	• Plan Review approval	☐	☐	• Is lamp sleeve cleaned
☐	☐	• Does all water contact UV (no bypass)	☐	☐	• Is lamp replaced per manufacturer
☐	☐	• Annual raw water sampling up to date ☐ N/A	☐	☐	• Intensity sensor with alarm or shut-off

CT evaluation for disinfection ☐ N/A

Disinfection Requirement:
☐ (sw) 0.5 log inactivation Giardia ☐ (sw) 1.0 log inactivation Giardia
☒ (gw) 4.0 log inactivation viruses ☐ (sw) log inactivation Crypto: ______
☐ (gw) Minimum chlorine residual: ______ mg/l

Yes	No	
☒	☐	• Does the contact chamber have effluent flow meter or adequate alternative?

If no, how is peak flow determined for CT calculations? ______

☒ ☐ • Has a tracer study been conducted or adequate alternative? Tracer Study Date: N/A

Demand flow (gpm): 200 Baffling factor (%): 100 (plug flow)

Volume used (gal): 1,700-ft of 8" pipe/1,300-ft of 6" pipe Results (min): 31.7 minutes

☒ ☐ Adequate alternate method for contact time? Describe: Using plug flow only through pipe yields 31.7 minutes of contact time – see contact time information on following page for more info.

Peak hour demand flow over the past 12 months: gpm = Pump yield through pipe is less than 200 gpm

Lowest operating volume over the past 12 months: gallons = N/A – Plug Flow

Yes	No	
☒	☐	Are on-line chlorine analyzers verified weekly with DPD type or EPA approved test kit? Colorimeter
☒	☐	• (SW only) Are pH, temp, and chlorine residual measured daily before or at the first user?
☒	☐	• Are CT values being calculated correctly?
☒	☐	• Are CT values met at all times?

Comments:

Contact Time Requirements (PR# 171-2007)

Oregon
Theodore R. Kulongoski, Governor

Department of Human Services
Public Health Division
800 NE Oregon Street
Portland, OR 97232-2162
(971) 673-1111 - Emergency
(971) 673-0405
(971) 673-0457 - FAX
(971) 673-0372 - TTY-Nonvoice

August 19, 2008

LEAHNETTE RIVERS
CITY OF COLUMBIA CITY (PWS #00203)
PO BOX 189
COLUMBIA CITY, OR 97018

Re: Final Approval for Public Works Well #2 (PR #171-2007)

Due to the presence of coliform bacteria in raw water analyses, 4-log virus inactivation using a disinfectant is required. In order to meet this requirement, 30 minutes of contact time resulting in a CT of 6 must be provided at all times. CT is a product of contact time multiplied by the chlorine residual as measured at the entry point to the distribution, just prior to the first user. More contact time may be needed if entry point pH lies outside the range of 6 to 9, temperature is lower than 10°C or chlorine residual drops below 0.2 mg/l. Theoretical contact time calculations indicate the following contact times and related CT values (at 0.2 mg/l chlorine concentration) are available at the indicated flow rates:

Well production flow rates =>	100-gpm (current maximum water right)	200-gpm	300-gpm (equivalent to peak demand flow out of reservoirs)	500-gpm (potential future water rights)
Contact time through plug flow through 1,700-ft of 8-inch pipe and 1,300-ft of 6-inch pipe from the well to the 0.2 MG reservoir	63.5 min (CT=12.7)	31.7 min (CT=6.3)	21.1 min (CT=4.2)	12.7 min (CT=2.5)
Plus contact time through the 0.2 MG and 1.0 MG reservoirs (10% baffling factor and 300-gpm peak demand flow)	333.3 min (CT=66.7)	333.3 min (CT=66.7)	333.3 min (CT=66.7)	333.3 min (CT=66.7)
Total contact time including both reservoirs =>	396.8 min (CT=79.4)	365 min (CT=73)	354.4 min (CT=70.9)	346 min (CT=69.2)
Using only the 0.2 MG reservoir for contact time yields 67 minutes (10% baffling factor and 300-gpm peak demand flow), which when combined with the pipeline, provides the following total contact times:				
Total contact time using only the 0.2 MG reservoir =>	130.5 min (CT=26.1)	98.7 min (CT=19.7)	88.1 min (CT=17.6)	79.7 min (CT=15.9)

You must ensure that adequate CT is met at all times. I have included a table for your use of required 4-log virus inactivation values (bottom row of table C-7) dependant upon varying water temperatures and valid for a pH range of 6.0 to 9.0.

Treatment

Process Used*	Chemical Added**	Purpose	Location in System	Code***
Chlorination	Sodium Hypochlorite	Disinfection	Well #2 Effluent	D421
pH Adjustment	Caustic (Sodium Hydroxide)	Corrosion Control	After disinfection	C503

*See "Treatment Plant Inspection" page for details on filtration. **See "Disinfection" page for details on disinfection equipment. ***See Treatment Codes on back.

Yes No
☒ ☐ Is equipment maintained properly? ______
☒ ☐ Is redundant equipment available? ______

What lab equipment is available and used? (jar testing, turbidimeter, pH meter, etc.):

DPD-type HACH digital Pocket Colorimeter II, pen-type pH tester, HACH DR850 portable colorimeter. Wallace & Tiernan DEPOLOX 3 Plus on-line chlorine and pH analyzer. Sparling totalizing and rate flow meter.

☒ ☐ • Are chemicals NSF Standard 60 certified or equivalent? (☐N/A - no chemicals are used)

Comments:
12.5% sodium hypochlorite (diluted to 1.1%) and 25% sodium hydroxide are supplied through Cascade Columbia.

Yes / No
☒ ☐ Does system practice corrosion control?
☒ ☐ • Is corrosion control operated within parameters set by DWP? ☐N/A

Comments:

Records Kept:

Yes / No		Yes / No	
☐ ☒	Dosages	☒ ☐	Flowrate
☐ ☒	Raw pH	☒ ☐	Treated pH
☐ ☒	Raw temperature	☒ ☐	Treated temperature
☐ ☒	Raw turbidity and/or particle counts	☐ ☒	Treated turbidity

Comments:
On-line CL17 is checked 2x per week with DBP-type collorimeter. pH is checked every week. Dosages are proportional to flow and maintained by a PLC and kept within specified ranges with high and low alarms. Dosages are not recorded. Raw water pH is roughly 6.9-6.8. Alarms for pH include a high level alarm at a pH of 8.5 and a low level at a pH of 6.5. High chlorine residual alarm is set at 1.99 mg/l and a low alarm is set at 0.19 mg/l. Dosages are adjusted to match City of St Helens (pH of 7.6 and CL2 of 0.66 mg/l).

Treatment Codes:

Disinfection By-products Control
B121 Activated Carbon, Granular
B125 Activated Carbon, Powdered
B200 Chloramines
B220 Chlorine Dioxide
B240 Coagulation
B344 Filtration, Pressure Sand
B500 Lime-Soda Ash Addition
B600 Rapid Mix
B742 pH Adjustment, Pre
EP240 Enhanced Coagulation
ES240 Enhanced Softening

Disinfection
D200 Chloramines
D220 Chlorine Dioxide
D401 Gaseous Chlorination, Post
D403 Gaseous Chlorination, Pre
D421 Hypochlorination, Post
D423 Hypochlorination, Pre
D541 Ozonation, Post
D543 Ozonation, Pre
D455 Iodine
D720 Ultraviolet Radiation
D800 Mixed Oxidants

Residual Maintenance
X200 Residual Maintenance, Chloramines
X401 Residual Maintenance, Gas Chlorination
X421 Residual Maintenance, Hypochlorination
X800 Residual Maintenance, Mixed Oxidants

Dechlorination
E121 Activated Carbon, Granular
E627 Reducing Agent, Sulfur Dioxide

Corrosion Control
C441 Inhibitor, Bimetallic Phosphate
C443 Inhibitor, Hexametaphosphate
C445 Inhibitor, Orthophosphate
C447 Inhibitor, OrthoPolyphosphate Blend
C449 Inhibitor, Silicate
C501 pH/Alkalinity Adjustment-Lime
C502 pH/Alkalinity Adjustment-Soda Ash
C503 pH/Alkalinity Adjustment-Caustic Soda
C504 pH/Alkalinity Adjustment-Sodium Bicarbonate
C505 pH/Alkalinity Adjustment-Calcite Contractor
C506 Calcium Carbonate Precipitation
C550 LCCA for L/C
C999 Blending

Inorganics Removal
I344 Filtration, Pressure Sand
I460 Ion Exchange
I640 Reverse Osmosis
I999 Blending

Arsenic Removal
A100 Activated Alumina
A240 Coagulation
A320 Electrodialysis
A347 Microfiltration
A348 Filtered
A460 Ion Exchange
A500 Lime Softening
A640 Reverse Osmosis
A900 Granular Ferric Hydroxide
A999 Blending

Iron Removal
F343 Filtration, Greensand
F344 Filtration, Pressure Sand
F345 Filtration, Rapid Sand
F403 Gaseous Chlorination, Pre
F423 Hypochlorination, Pre
F460 Ion Exchange
F543 Ozonation, Pre
F560 Permanganate
F640 Reverse Osmosis
F680 Sequestration
F740 pH Adjustment

Manganese Removal
M343 Filtration, Greensand
M423 Hypochlorination, Pre
M560 Permanganate
M680 Sequestration

Other
Z380 Fluoridation
Z551 Public Education for L/C
Z580 Peroxide
Z720 Ultraviolet Radiation

"Non-Treatment"
N000 No Treatment / Not Applicable
N349 Unfiltered, Avoiding Filtration
N350 Unfiltered, Must Install Filter
N996 Treatment Applied by Seller

Organics Removal
O121 Activated Carbon, Granular
O145 Aeration, Packed Tower
O160 Algae Control
O423 Hypochlorination, Pre
O560 Permanganate
O742 pH Adjustment, Pre
O999 Blending

Particulate Removal (SWTR)
P240 Coagulation
P341 Filtration,Cartridge
P342 Filtration, Diatomaceous Earth
P344 Filtration, Pressure Sand
P345 Filtration, Rapid Sand
P346 Filtration, Slow Sand
P347 Filtration, Membrane
P349 Natural Filtration
P360 Flocculation
P520 Microscreening
P600 Rapid Mix
P660 Sedimentation
P700 Sludge Treatment
P742 pH Adjustment, Pre

Softening (Hardness Removal)
S240 Coagulation
S344 Filtration, Pressure Sand
S360 Flocculation
S460 Ion Exchange
S500 Lime – Soda Ash Addition
S640 Reverse Osmosis
S680 Sequestration

Taste/Odor Control
T121 Activated Carbon, Granular
T125 Activated Carbon, Powdered
T141 Aeration, Cascade
T143 Aeration, Diffused
T149 Aeration, Spray
T160 Algae Control
T403 Gaseous Chlorination, Pre
T423 Hypochlorination, Pre
D541 Ozonation, Post
D543 Ozonation, Pre
T560 Permanganate
T720 Ultraviolet Radiation

Storage and Pressure Tanks

Number	Name	Tank Type*	Tank Material	Year Built	Volume (gal.)
1	Upper Reservoir	G	Steel	1984	200,000
2	"K" St Lower Reservoir (new)	G	Concrete	2003	1,000,000
3	"K" St Lower Reservoir (old)	G	Steel	1979	200,000

* (G) Ground (E) Elevated (P) Pressure

Total Volume: 1,400,000 gal

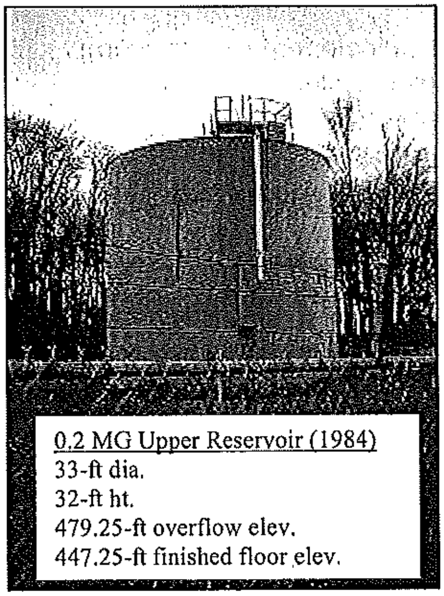
	Reservoir Features / Reservoir Number:	1 Yes	1 No	2 Yes	2 No	3 Yes	3 No	Yes	No	Yes	No
Hatch	● Secured (e.g. locked, bolted, etc)	☒	☐	☒	☐	☒	☐	☐	☐	☐	☐
	● Watertight	☒	☐	☒	☐	☒	☐	☐	☐	☐	☐
	Curbed lid (shoe box style)	☒	☐	☒	☐	☒	☐	☐	☐	☐	☐
Features	Drain to daylight	☒	☐	☒	☐	☒	☐	☐	☐	☐	☐
	Overflow	☒	☐	☒	☐	☒	☐	☐	☐	☐	☐
	● Overflow/drain protected (screen/flap/valve)	☐	☐	☒	☐	☐	☐	☐	☐	☐	☐
	● Screened vent	☒	☐	☒	☐	☒	☐	☐	☐	☐	☐
	Water level gauge	☒	☐	☒	☐	☒	☐	☐	☐	☐	☐
	Bypass piping	☐	☒	☒	☐	☒	☐	☐	☐	☐	☐
	Fence/gate	☒	☐	☒	☐	☒	☐	☐	☐	☐	☐
	Cathodic plates watertight ☐ N/A	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
	Alarm for high or low levels	☒	☐	☒	☐	☒	☐	☐	☐	☐	☐
Maintenance	Exterior in good condition	☐	☒	☒	☐	☐	☒	☐	☐	☐	☐
	Interior in good condition	☐	☒	☒	☐	☒	☐	☐	☐	☐	☐
	Approved interior coating	☒	☐	☒	☐	☒	☐	☐	☐	☐	☐
	Inspection schedule	☒	☐	☒	☐	☒	☐	☐	☐	☐	☐
	Cleaning schedule	☒	☐	☒	☐	☒	☐	☐	☐	☐	☐
	Continuously disinfected (● post '81 redwood)	☒	☐	☒	☐	☒	☐	☐	☐	☐	☐
Plumbing Config.	Separate inlet/outlet	☐	☒	☒	☐	☒	☐	☐	☐	☐	☐
	Baffling	☐	☒	☐	☒	☐	☒	☐	☐	☐	☐
	Used for contact time	☐	☒	☐	☒	☐	☒	☐	☐	☐	☐

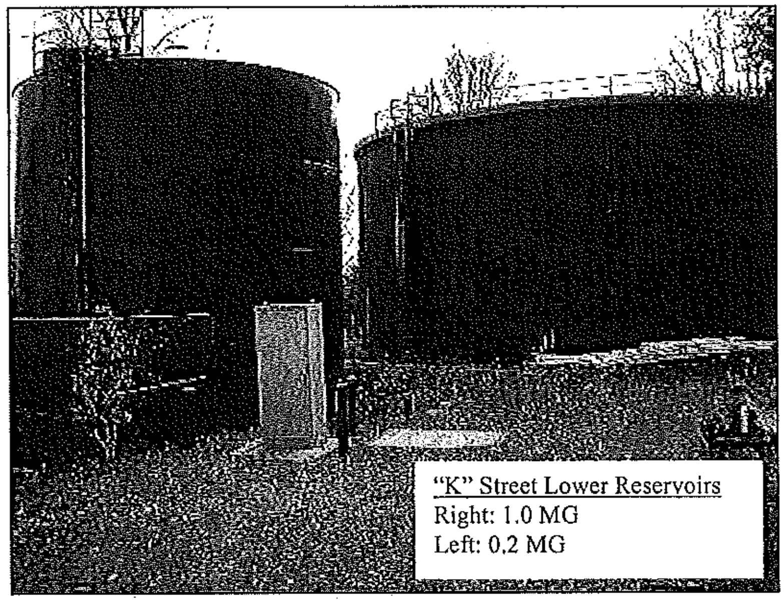
	Pressure Tanks / Number:				
Pressure Tanks	Used for contact time	☐	☐	☐	☐
	Accessible for maintenance	☐	☐	☐	☐
	Separate inlet/outlet	☐	☐	☐	☐
	Bypass piping	☐	☐	☐	☐
	Access port ☐ N/A	☐	☐	☐	☐
	Drain	☐	☐	☐	☐
	Pressure relief device	☐	☐	☐	☐
	Air bladder/diaphragm	☐	☐	☐	☐
	Valve for adding air	☐	☐	☐	☐
	Water level sight glass ☐ N/A	☐	☐	☐	☐

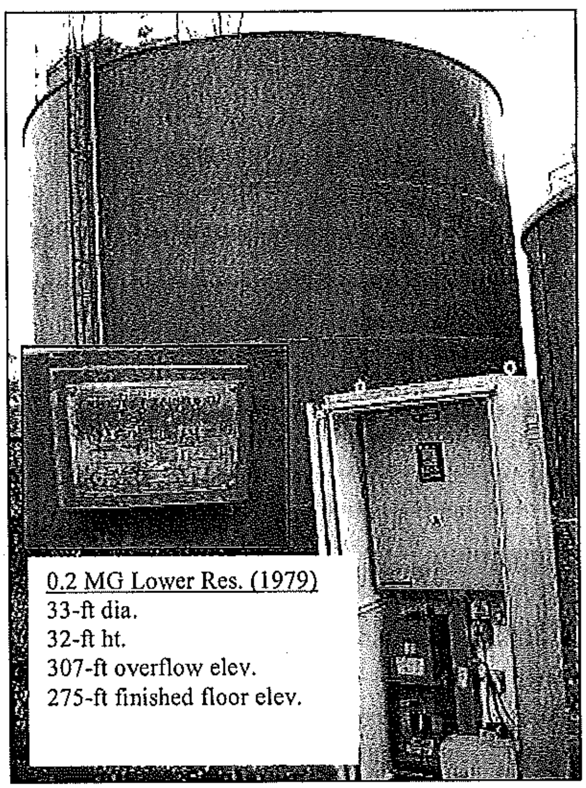
Comments

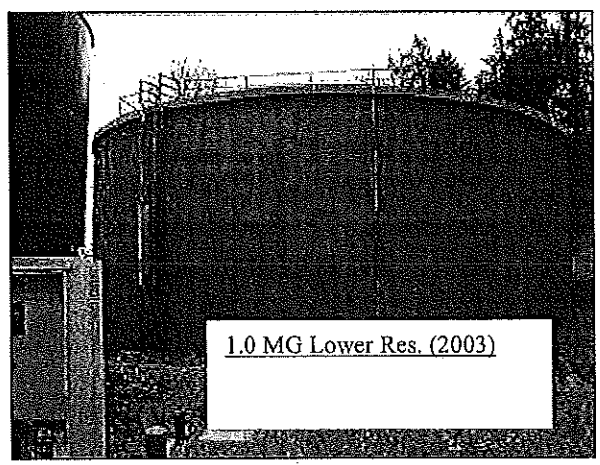
Lower reservoirs were re-coated in 2007. 2000 Liquivision report rec. Upper tank be re-coated. Lower reservoirs have intrusion alarms. The 1979 Lower Reservoir overflows to the 1.0 MG Lower Reservoir (no flap valve needed on overflow). Water level is tracked with transducers and SCADA.

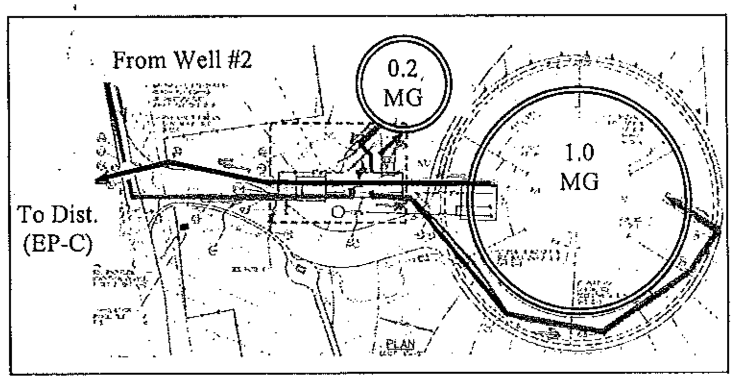
Water System Schematic











Distribution System Information

Service Area and Facility Map

Yes	No	
☒	☐	Does the system have a service area and facility map (indicate features on map):

- ☒ Booster pumps
- ☒ Pressure regulating valves
- ☒ Pressure zones
- ☒ Sampling points
- ☒ Sources-wells & withdrawal points
- ☒ Storage facilities (reservoirs)
- ☒ Treatment facilities
- ☒ Water lines (including size and material)

Distribution Data

Yes	No		Comments
☒	☐	● System pressure >20 psi	Lowest pressure is 50-60 psi, 90 psi is highest
☒	☐	Are service connections metered? (what %)	100%
☒	☐	Water system leakage <10%	8.4% - monthly comparisons of billed vs production
☒	☐	Waterline depth >30"	30" min on mains & services
☒	☐	Piping looped	Mostly looped - Chimes Crest is longest dead end
☒	☐	Hydrants or blowoffs on all dead ends	
☒	☐	Routine flushing (How often)	Annual
☒	☐	Adequate valving	Number of valves seem fine - some need servicing
☐	☒	Routine valve turning (How often)	Plans to start annual or more freqent in 2010
☐	☒	Asbestos cement (AC) pipe absent from system	

Comments:
System has 4 PRVs. Existing piping consists of older CI, DIP, & PVC. New piping is C900 PVC or DIP.

Cross Connection Control (CWS, NTNC, and TNC)

Yes	No	N/A		Comments
☒	☐	☐	● Ordinance or enabling authority (CWS)	Ordinance 01-575-0 (eff. 12/02/01)
☒	☐	☐	List of installed devices (CWS, NTNC, TNC)	Just updated - 300 (double checks at all new serv.)
☒	☐	☐	● Devices tested annually (CWS, NTNC, TNC)	Testing is split between City (mostly) and owners
☒	☐	☐	● Annual Summary Report submitted (CWS)	For 2008
☒	☐	☐	● Certified Cross Connection Control Specialist (CWS ≥ 300 connections)	Micah Olson.

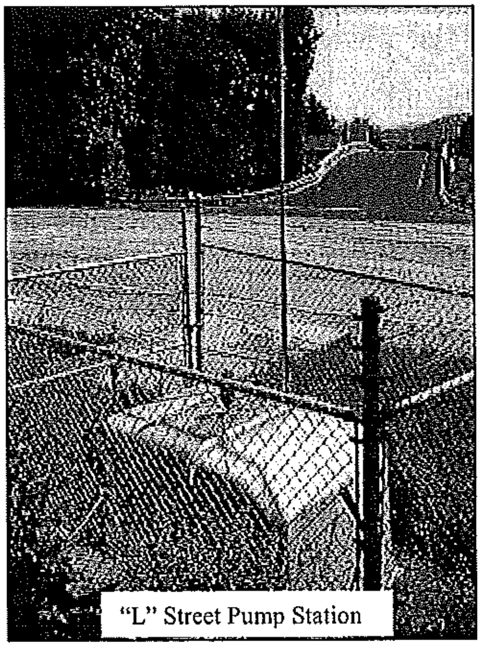
Comments:
Micah Rogers is planning on being certified as a WD2 and Cross Connection Control Specialist.

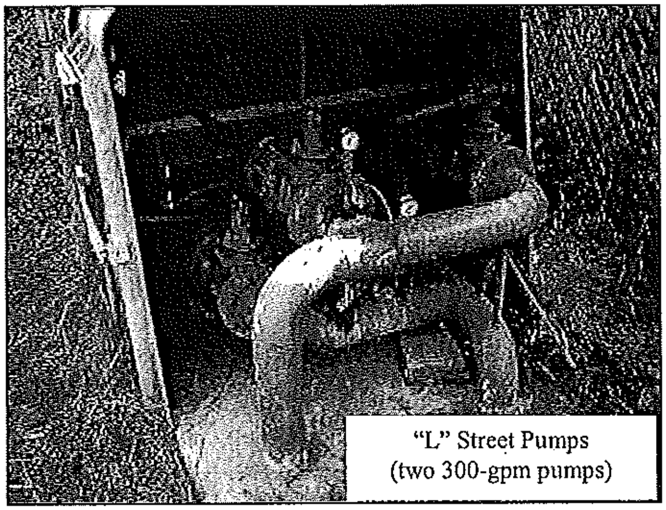
Booster Pumps

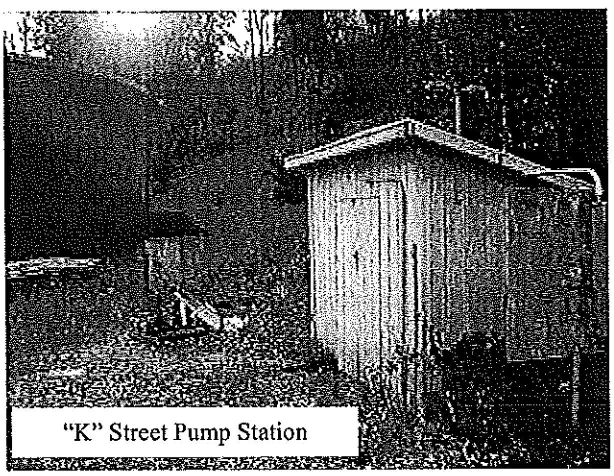
Number	Name (location)	Deficiencies or Comments	HP	GPM	Aux. Power Yes	Aux. Power No
2	"L" Street Pump Station	Both are 300-gpm pumps, but performance is more like 190-250 gpm	7.5	300	☐	☒
2	"K" Street Pump Station	Both are 300-gpm pumps, but performance is more like 50 gpm	7.5	300	☐	☒
					☐	☐
					☐	☐
					☐	☐
					☐	☐

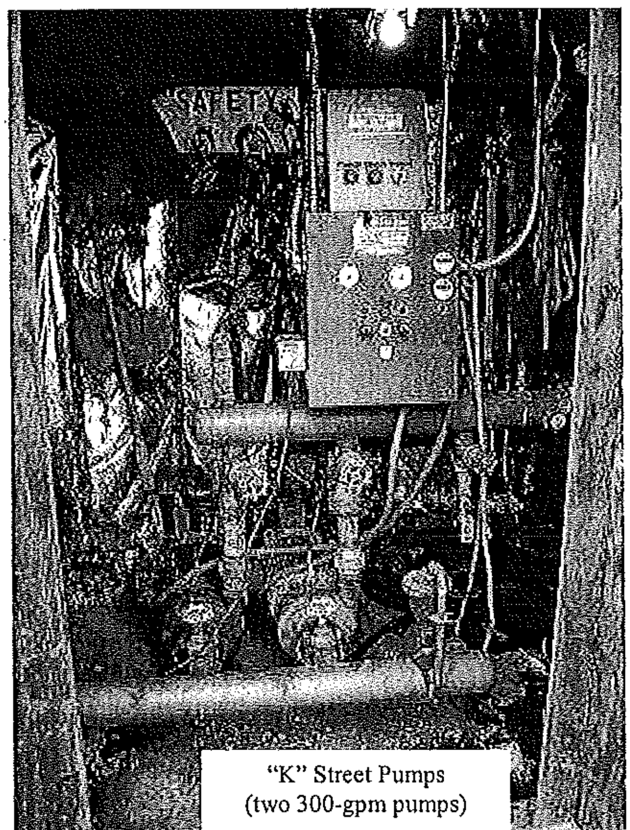
Comments:
System has 1 portable back up generator and is seeking to get a Counter-Terrorism grant to get a 2nd generator. Distribution Map was updated by MSA in March 2008. System has 3 pressure zones - Zone 1 - 380', Zone 2 - 270', & Zone 3 - 200'.

Pump Stations


"L" Street Pump Station


"L" Street Pumps
(two 300-gpm pumps)


"K" Street Pump Station


"K" Street Pumps
(two 300-gpm pumps)

Water Quality Monitoring

Contaminant	N/A	Frequency	Next Tests Due
Entry Point Sampling:			
Nitrate	☐	1 Sample Per Year - EP-C	2010
Arsenic	☐	1 Sample Every 3 Yrs - EP-C	2010
Inorganic Chemicals (Including Nitrite) (sw)	☒		
Inorganic Chemicals (Including Nitrite) (gw)	☐	1 Sample Every 3 Yrs - EP-C	2010
SOCs	☐	1 Sample Every 3 Yrs - EP-C	2010
VOCs (sw)	☒		
VOCs (gw)	☐	1 Sample Every 3 Yrs - EP-C	2011
Radionuclides (Community Water Systems Only):			
Gross Alpha	☐	1 Sample Every 6 Yrs – EP-C	2014
Radium 226/228	☐	1 Sample Every 9 Yrs – EP-C	2017
Uranium	☐	1 Sample Every 9 Yrs – EP-C	2017
Distribution System Sampling:			
Coliform Bacteria	☐	2 samples per month	Monthly
Asbestos (for AC pipe/asbestos geologic areas)	☒		
TTHMs and HAA5s	☐	2 Samples per Quarter	Quarterly
Lead and Copper, # sites: 10	☐	1 Round Every 3 Years	June 1 – Sept 30, 2012
Other Sampling:			
TOC	☒		
Turbidity	☒		
Source Water Coliform	☐	Triggered Source Monitoring	When detected in Dist.
Other (specify)	☒	DBP Stage II per IDSE	To be determined

Yes ☐ No ☒ • Is all required monitoring current?

Comments:
Past due for Nitrate.

Yes ☒ No ☐ Has the system experienced chemical (last 5 years) or bacteriological (last 2 years) detections?
If yes, list what contaminant and when?

At EP-C: Gross Beta of 1.7 PC/L in 2008, Nitrate of 2.7 mg/l in 2007. At EP-B: Toluene of 0.0036 mg/l in 2007, Nitrate of 3.5 mg/l in 2007.

Yes ☒ No ☐ • Have all MCL violations been addressed? ☒ N/A No MCL Violations.

Yes ☒ No ☐ Does the system have any monitoring reductions granted? Explain:

Every 9 years for Radium 226/228 & Uranium. Every 3 years for Lead & Copper & SOC.

Yes ☒ No ☐ • Does the system have a written coliform sampling plan?

Does the plan include:

Yes	No		Yes	No	
☒	☐	Brief narrative	☒	☐	Rotation schedule
☒	☐	Distribution map	☒	☐	Repeat locations
☒	☐	Sample site locations	☐	☒	Source(s) ☐ N/A

Yes ☒ No ☐ Are TTHM and HAA5 samples taken at location of maximum residence time? (☐ Not required)
Where in the system are the monitoring sites for TTHM and HAA5?

DBPMAX01 - 61061 COL RVR HWY, DBPMAX02 - 3565 Tahoma St, DBPMAX03 - 330 Mattie St, & DBPMAX04 - 1510 6th St are identified as DBP Stage 1 sites.

Comments:
System is sampling at DBPMAX03 - 330 Mattie St & DBPMAX04 - 1510 6th St under reduced DBP sampling.

Management & Operations

O&M Manual and Emergency Response Plan

Yes	No	
☒	☐	• Does system have an operation and maintenance manual?
☒	☐	• Does system have an emergency response plan?

Operator Certification

Requirements for system: WD: 2 WT: 1 ☐ FE required Small System: ☐

Name	Certification Number	WT Level	WD Level	FE	Small System
DRC: *Micah B. Olson	3794	1	3	☐	☐
Micah A. Rogers	7227		1	☐	☐
Andrew C. Nollette	08368		1	☐	☐
				☐	☐
				☐	☐

*DRC= direct responsible charge. Attach additional sheets if necessary to list all certified personnel.

Yes	No	
☒	☐	Is DRC identified?
☒	☐	• Is DRC certified at appropriate level?
☒	☐	• Does system have written operating protocols for other operators? ☐ N/A

If DRC is a Contract Operator:

Yes	No	
☒	☐	Does DWP have contract on file? ☐ N/A

How does contract operator work with system? ☐ N/A

Provides operational direction and retains control over treatment decisions.

Plan Review/Master Plan

Yes	No	
☒	☐	• Have all major modifications (since 8/21/81) been approved by DWP?
☒	☐	Does system have a current plan review exemption for water main extensions?
☒	☐	• Does the system have a current (<20 yr. old) master plan? (☐ Not required if < 300 connections) What year was the plan completed? 1997
☐	☒	Does the master plan include a water conservation plan?

Compliance Status

Yes	No	
☒	☐	• Is water system in compliance (all orders resolved and not a significant non-complier)? How many violations has the system had in the past two years?
☒	☐	• Does the system issue Public Notice for Violations as required? ☐ No violations requiring public notice

Other

Yes	No	
☒	☐	Has a capacity assessment been completed by DWP? If yes, list deficiencies noted: Capacity assessment was completed for SRF. All deficiencies corrected as part of SRF Loan.
☒	☐	• Are consumer confidence reports sent to users each year and certified?

Comments:
9th Street Well (PR# 72-2000) and Harvard Park Well (PR#176-2002) do not have final approval. VA was completed in 2005 and the ERP was done in May 2008 and will be updated in 2010.

Appendix B

St. Helens Water Agreement

[illegible] 5/4/82
Adopted 5/20/82
Res. No. 333

WATER AGREEMENT

The CITY OF COLUMBIA CITY, hereinafter called "Columbia City," and the CITY OF ST. HELENS, hereinafter called "St. Helens," agree as follows:

1. This agreement completely supercedes all provisions relating to the sale and puchase of water between the parties in an agreement titled "City of Columbia City Pipeline Permit" dated June 16, 1976.

2. St. Helens presently owns and operates two Raney Collector water wells within the Columbia City area, as well as pump stations, chlorinators, and pipelines; and presently supplies Columbia City with potable water. Columbia City presently owns and operates its own transmission system from the point of connection with St. Helens' pipelines at a master meter.

3. The anticipated future needs of the St. Helens water system, including Columbia City, require St. Helens to obtain additional water within the forseeable future. The most appropriate potential source of water for the system is one or more water intake and treatment facilities such as additional wells in the Columbia City area on lands not owned by Columbia City.

4. DURATION: St. Helens agrees to furnish Columbia City water until Columbia City secures sufficient water from another source, at which time either party may terminate the agreement on the giving of the other party 180 days written notice. The parties may agree in such event that St. Helens will sell Columbia City surplus water.

In the event St. Helens obtains its water from a source outside of Columbia City and discontinues the use of the Raney Collectors in Columbia City, St. Helens may lease or offer for sale the wells and its distribution system to Columbia City for a price set by an appraisal of the system, made by an independent appraiser agreed upon by both parties.

5. AMOUNT OF WATER: Columbia City may purchase and use up to 1,000,000 cubic feet of water per month. In the event one or more additional water intake and treatment facilities yielding sufficient quantities are put in operation within the Columbia City limits, the monthly amount will increase by 500,000 cubic feet per month per well, provided Columbia City complies with the following paragraph.

Columbia City shall pay a percentage representing its share of all water sold by St. Helens, of the cost of the additional water intake and treatment facilities and transmission lines to the point the water is delivered to Columbia City if Columbia City desires the additional 500,000 cubic feet from an additional well. No direct charge for capital costs of the additional water intake and treatment facilities will be made to Columbia City if they do not desire the additional water and remain at the 1,000,000 cubic feet level.

a. If any additional water intake and treatment facilities are financed by general obligation bonds, percentage above mentioned, shall be amortized over the life of the bonds at the same rate of interest paid on the bonds and added to Columbia City's monthly water charge.

b. If any additional water intake and treatment facilities are financed by revenue bonds, the general increase in water rates of the entire St. Helens water system, including Columbia City, will pay the proportionate share of water used by Columbia City mentioned above.

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No users outside the Columbia City current urban growth boundry shall be furnished water unless presently connected to the system, or unless Columbia City is required by governmental regulation, present obligation or litigation to furnish outside users.

In the event an industry locates in Columbia City, a contract with the industry will be negotiated between the industry and the parties hereto based on surplus water. If that is not satisfactory to the industry, it will have to obtain its water elsewhere.

If unavoidable and unforseeable events make it impossible to furnish the amount of water provided for in this agreement, the parties to this agreement shall share the available water on a pro rata basis, using the average monthly quantities used by each city during the preceding twelve months in calculating each party's respective pro rata share.

If unforeseen events require St. Helens to supply part or all of its customers by an alternative water intake and treatment facility to the wells in Columbia City, such as a surface water system, Columbia City shall receive its pro rate share at the same rate per cubic foot as customers within St. Helens to include charges for capital costs of the system and any costs of maintaining water transmission lines, beyond the St. Helens city limits especially for Columbia City.

Columbia City agrees to enforce St. Helens water usage curtailment orders for temporary supply shortages.

6. CHARGES: Columbia City shall pay the estimated cost for St. Helens to provide water to its tie in. St. Helens shall determine the cost annually based on construction, operating maintenance, administration, depreciation and interest on general obligation bonds, of that portion of the St. Helens system including, but not limited to, water wells or inlet structures, transmission lines, reservoirs and treatment facilities that directly benefits Columbia City. The total costs above mentioned shall be divided by the total water sold. Columbia City will pay that price per cubic foot. Columbia City has the right to review the costs and calculatations annually for accuracy. Both cities shall cooperate in establishing the annual rate.

The water will be delivered to Columbia City through a master meter.

Water charges shall be paid within 10 days from the billing date.

Columbia City shall be responsible for its own water quality and distribution system, including installation, repair, maintenance, the billing and collecting of water bills from its own customers, but St. Helens shall maintain the system up to the Columbia City's tie-in in good condition and repair.

7a. MUTUAL COOPERATION: The parties shall cooperate with each other with respect to the existing system and the exploration and development of additional water intake and treatment facilities within the city limits of Columbia City, provided however, the cooperation shall be at no expense to Columbia City.

7b. In the event conditional use permits, street vacations, or other land use actions are needed for the installation of additional collectors or distribution systems, Columbia City shall not unreasonably withhold approval. This agreement shall in no manner be construed as limiting any rights of the citizens of Columbia City to follow their usual and legal recourses in objecting to conditional uses, street vacations or any other land use actions.

7c. St. Helens shall have the right to explore and develop water sources, including wells and underground surface water infiltration systems, within Columbia City during the term of this agreement.

7d. St. Helens shall be granted all necessary easements and/or permits, and free access to Columbia City streets for the installation, replacement, repair and maintenance of waterlines reasonably necessary to deliver water from any water intake and treatment facilities to St. Helens' distribution system. Such easements and permits shall be in writing and in the form attached hereto as Exhibit A.

7e. At the execution of this agreement, the parties shall execute a separate water pipeline permit with the same date as this agreement.

7f. The cost of engineering, legal fees and testing, as well as the cost of the water intake and treatment facilities, including water lines to the present system, shall be included in well construction costs in the event Columbia City desires to obtain a share of the water in excess of 1,000,000 cubic feet from the facility.

8. ARBITRATION: In the event injury, damage, costs or financial liability shall hereafter arise to or be suffered or incurred by Columbia City as the result of the exercise of the privileges herein granted to St. Helens, St. Helens does hereby promise and agree to pay the same in full to Columbia City expeditiously and without unreasonable delay.

In the event of a dispute between the parties to this agreement over any matter arising as a result of this agreement, either party shall have a right to have the dispute determined and settled by arbitration. One arbitrator shall be appointed by each party within ten days of notice by either body that an agreement cannot be mutually reached. Preferably, the arbitrators so selected should have some specific knowledge in the field that is in dispute, and the arbitrator, or any member of his family, shall not be an employee or public official of the City which selects him. Within ten days of their employment, the two arbitrators so selected by each City shall meet for the purpose of selecting a third independent and unbiased arbitrator to sit with them as a board of arbitration. The board of arbitration shall then hear a full representation from each municipality upon the matter in controversy, and the decision of two members of the said board, to be arrived at within 30 days of the hearing, shall be binding upon each municipality. The cost of the arbitrator's service and any other necessary costs of the arbitration shall be split equally between the parties to this agreement.

9. ATTORNEY FEES: In the event legal action is filed to enforce the terms of this agreement, the prevailing party shall be awarded a reasonable attorney fee in both trial and appellate courts.

DATED this 20 day of May, 1982.

CITY OF COLUMBIA CITY	CITY OF ST. HELENS
By William L. Lewis	By Frank A. Corsiglia
Mayor	Mayor

Exhibit "A"

PIPELINE PERMIT

PARTIES: The parties to this agreement are CITY OF COLUMBIA CITY, called Columbia City, and CITY OF ST. HELENS, called St. Helens.

AGREEMENT: Columbia City hereby permits St. Helens to install, maintain, repair and replace waterlines on the following terms and conditions:

DESCRIPTION: Waterlines in place per prior permit:

> Franklin Street, Garfield Street, A Street, B Street, C Street, D Street, E Street, F Street, G Street, H Street, I Street, K Street, L Street, Fifth Street on West Side of U.S. Highway 30.

> Waterlines to be installed per this permit:

> First Street, Fourth Street, Third Street, K Street, M Street between Third Street and Fourth Street, any other Street that is most convenient to any water intake and treatment facility installed and operated by St. Helens, at or near the end of "K" Street, provided the same is reasonably necessary. If St. Helens should determine that the routes indicated in this agreement are not reasonable, or if additional routes are necessary to connect other future water intake and treatment facilities to transmission lines, any proposed change or modification of routes shall first be negotiated with Columbia City for approval. Waterline route modifications or changes will not affect other sections of this agreement.

TERM OF PERMIT: This permit shall commence when executed and continue so long as St. Helens utilizes the waterlines.

LIABILITY: St. Helens shall be solely liable for all damages arising out of injury or damage to persons or property arising out of installation, maintenance, operation, repair or replacement of its waterlines and specifically any damage as a result of a leak, fracture or rupture of the line for whatever cause. Columbia City shall be solely liable for all damages arising out of installation, maintenance, repair, replacement, leakage or rupture of its transmission and service lines including its point of connection with St. Helens' waterlines. St. Helens and Columbia City reserve the right to take legal action against anyone damaging their respective waterlines.

HOLD HARMLESS: St. Helens shall hold Columbia City, its council, employees or agents harmless from any liability or damages arising out of any activities of St. Helens under the terms of this agreement specifically including damage from leakage, fracture or rupture of the waterline. St. Helens shall pay any and all defense costs incurred by Columbia City, its agents or employees in defending any claim for damage or injury arising out of this agreement. This provision does not apply to damage caused by Columbia City or its employees.

CONDUCT OF WORK:

A. St. Helens will complete all future repairs, maintenance, replacement and reconstruction in a workmanlike manner and will clear up all debris occasioned by such repair, maintenance, replacement and reconstruction. St. Helens shall designate all pipeline material specifications including pipe, valve and fitting, size, grade, construction and manufacture.

B. During the repair, maintenance, replacement and reconstruction of any water pipelines, St. Helens, at all times, will maintain such watchman or watchmen and/or barricade and/or other safety devices as may be necessary to properly protect traffic upon Columbia City streets, and to warn and safeguard the public against injury or damage resulting from the operations of St. Helens in the repair, maintenance, replacement or reconstruction of said water pipelines.

C. St. Helens shall so conduct its repair, maintenance, replacement and reconstruction operations that there shall be no unreasonable interference or interruptions of traffic upon and along any Columbia City streets. Columbia City may specify reasonable details in connection with the handling of traffic and such specifications shall be complied with by St. Helens.

D. The repair, keeping, maintenance, replacement and reconstruction of any water pipelines are subject to the paramount control of Columbia City over its said streets, to preserve the health, peace and safety, and no right or privilege herein granted shall be deemed or construed to be beyond the reach or authority of Columbia City to exercise reasonable control over St. Helens, which control shall be reasonable, not arbitrary, and only for the purpose of protecting the health, peace and safety of the citizens of Columbia City.

E. The entire cost of repairing, maintaining, replacing and reconstructing said water pipelines, including the cost of materials, trenching, laying, backfilling, paving, supervision and inspection, and any other expense whatsoever incident thereto, is to be paid for by St. Helens. St. Helens shall reimburse Columbia City for any authorized repair, maintenance, replacement or reconstruction, done by Columbia City within ten (10) days after being billed therefor by Columbia City. Columbia City shall make no repairs on the St. Helens system without authorization from St. Helens, except in an emergency.

F. The backfilling of all trenches and tunnels must be accomplished immediately after the waterlines have been placed therein and must be well tamped and compacted so as to allow the least possible amount of subsequent settlement. All debris, refuse and waste of all kinds which may have accumulated upon any Columbia City streets by reason of the operations of St. Helens must be removed immediately upon completion of said operations and Columbia City streets must be restored to at least as good a condition as they were prior to such operations. All work in connection with the said pipeline repair, keeping, maintenance, replacement and reconstruction across Columbia City streets must be done in a neat and workmanlike manner and under the general supervision of the Columbia City Council whose decision shall be final with respect to any of the conditions, terms, stipulations and provisions of this permit and must meet with its approval.

G. Where said pipelines cross Columbia City streets they shall be installed to a depth of not less than thirty (30) inches at top of pipe, or an accepted industry standard at the time of construction for the installation conditions.

ARBITRATION: In the event injury, damage, costs or financial liability shall hereafter arise to or be suffered or incurred by Columbia City as the result of the exercise of the privileges herein granted to St. Helens, St. Helens does hereby promise and agree to pay the same in full to Columbia City expeditiously and without unreasonable delay.

In the event of a dispute between the parties to this agreement over any matter arising as a result of this agreement, either party shall have a right to have the dispute determined and settled by arbitration. One arbitrator shall be appointed by each party within ten days of notice by either body that an agreement cannot be mutually reached. Preferably, the arbitrators so selected should have some specific knowledge in the field that is in dispute, and the arbitrator, or any member of his family, shall not be an employee or public official of the City which selects him. Within ten days of their employment, the two arbitrators so selected by each City shall meet for the purpose of selecting a third independent and unbiased arbitrator to sit with them as a board of arbitration. The board of arbitration shall then hear a full representation from each municipality upon the matter in controversy, and the decision of two members of the said board, to be arrived at within 30 days of the hearing, shall be binding upon each municipality. The cost of the arbitrator's service and any other necessary costs of the arbitration shall be split equally between the parties to this agreement.

CONSIDERATION: The consideration for this permit shall be the furnishing of potable water to Columbia City per a separate "Water Agreement" dated May 20, 1982.

SCOPE OF PERMIT: This permit and the separate water agreement referred to above replace and supersede a certain "City of Columbia City Pipeline Permit" dated June 16, 1976, between the parties.

DATED this 20th day of May, 1982.

CITY OF COLUMBIA

By William L. Lewis
William L. Lewis, Mayor

CITY OF ST. HELENS

By Frank A. Corsiglia
Frank A. Corsiglia, Mayor

Appendix C

Cost Estimates

Columbia City Water Master Plan
Engineer's Opinion of Probable Cost
Project 1A
Additional Water Source

Well Research	Quantity	Units	Unit Cost	Cost
1A-1: Study to Identify Targets	1	LS	$ 14,000	$ 14,000
1A-2: Drill and Test Four Test Holes	1	LS	$ 100,000	$ 100,000

Project 1A-3 Develop New Well - Additional Water Source

Item	Quantity	Units	Unit Cost	Cost
Drill Well	1	LS	$ 100,000.00	$ 100,000
Mechanical Systems and Equipment,	1	LS	$ 101,000.00	$ 101,000
Electrical Systems and Equipment	1	LS	$ 32,500.00	$ 32,500
Instrumentation	1	LS	$ 32,000.00	$ 32,000
CMU Building (Well House)	600	sf	$ 265.00	$ 159,000
6-inch pipe, not paved along highway	3,000	lf	$ 28.00	$ 84,000
6-inch pipe-pavment	500	lf	$ 49.00	$ 24,500
Pipe Fittings	1	LS	$ 5,000.00	$ 5,000
Mobilization	10%			$ 41,000
Subtotal				$ 579,000
Land	1	ac	$ 20,000.00	$ 20,000
Contingency	20%			$ 119,800
Subtotal				$ 718,800
Engineering, Surveying, Admin	25%			$ 179,700
Geohydrology & Surveying				$ 30,000
Total				$ 928,500
				$ 930,000

Columbia City Water Master Plan

Engineer's Opinion of Probable Cost
Project 1B
Ranney Collector Evaluation

	Hydrologist	Engineer	Total
1B-1: Intital Evaluation, Contact with the City of St. Helens, Review of existing data, regulatory review, and Technical Memornandum.	7,000	5,000	$ 12,000.00
1B-2: Technical Support for continued negotiations and evaluations, transfer of water rights, etc.	5,000	15,000	$ 20,000.00

Columbia City Water Master Plan

Engineer's Opinion of Probable Cost
Project 2
L St. Booster Pump Upgrade

Item	Quantity	Units	Unit Cost	Cost
New pumps	2	LS	$ 8,000.00	$ 16,000
misc.	1	LS	$ 1,000.00	$ 1,000
Misc.Eelectrical	1	LS	$ 4,000.00	$ 4,000
Mobilization	10%			$ 2,000
Subtotal				$ 23,000
Contingency	20%			$ 4,600
Subtotal				$ 27,600
Engineering, Surveying, Admin	25%			$ 6,900
Total				$ 34,500
			Use	**$ 35,000**

Columbia City Water Master Plan

Engineer's Opinion of Probable Cost
Project 3
Upper Reservoir Restoration

Item	Quantity	Units	Unit Cost	Cost
Mobilization	1	LS		$ 7,000
Painting and Resurfacing Interior	5,028	SF	$ 8.00	$ 40,225
Painting and Resurfacing Exterior	4,173	SF	$ 3.00	$ 12,518
Temporary Tank or Pressure Tank	1	LS	$ 12,000.00	$ 12,000
Misc repairs	1	LS	$ 10,000.00	$ 10,000
Subtotal				$ 74,743
Contingency	20%			$ 14,949
				$ 89,692
Engineering, Admin	25%			$ 22,423
Total				$ 112,115
			Use	**$ 112,000**

Columbia City Water Master Plan

Engineer's Opinion of Probable Cost
Project 4
Reservoir Siesmic Upgrades

Item	Quantity	Units	Unit Cost	Cost
Additonal Ring wall and straps	2	LS	$ 42,000.00	$ 84,000
Mobilization	10%			$ 8,400
Subtotal				$ 92,400
Contingency	20%			$ 18,480
Subtotal				$ 110,880
Engineering, Surveying, Admin	35%			$ 38,808
Total				$ 149,688
			Use	**$ 150,000**

Columbia City Water Master Plan

Engineer's Opinion of Probable Cost
Project 5A
Create 9th St Pressure Zone

Item	Quantity	Units	Unit Cost	Cost
New 6" X 2" Packaged PRV	1	LS	$ 31,000.00	$ 31,000
Site Work, Excavation	1	LS	$ 7,750.00	$ 7,750
Refurbish K&9th PRV (by City)	1	LS	$ 12,000.00	$ 12,000
Connect PRV to 9th St. Main, (6" pipe)	50	lf	$ 50.00	$ 2,500
Mobilization	10%			$ 5,300
Subtotal				$ 58,550
Contingency	20%			$ 11,710
Subtotal				$ 70,260
Engineering, Surveying, Admin	25%			$ 17,565
Total				$ 87,825
			Use	**$ 90,000**

Columbia City Water Master Plan

Engineer's Opinion of Probable Cost

Project 5B

North Pressure Zone Reduction

Item	Quantity	Units	Unit Cost	Cost
PRV Stations:				
New 6" X 2" Packaged PRV	1	LS	$ 31,000.00	$ 31,000
Site Work, Excavation	1	LS	$ 7,750.00	$ 7,750
New 8" X 2" Packaged PRV	1	LS	$ 36,000.00	$ 36,000
Site Work, Excavation	1	LS	$ 9,000.00	$ 9,000
Connection fittings and misc	1	LS	$ 2,500.00	$ 2,500
10" piping with Surface Restoration	30	LF	$ 60.00	$ 1,800
New 14" X 2" Packaged PRV	1	LS	$ 42,000.00	$ 42,000
	1	LS	$ 10,500.00	$ 10,500
PRV Subtotal				**$ 140,550**
Booster Pump for Dickson Development				
Duplex packaged pump station, pressure tank, with enclosure	1	LS	$ 15,000	$ 15,000
Installation, Concrete Slab, Misc	1	LS	$ 5,000	$ 5,000
Electrical (100 ft, 230V single phase service)	1	LS	$ 12,000	$ 12,000
Site Piping and valves	1	LS	$ 1,000	$ 1,000
Bollards	4	ea	$ 150	$ 600
Booster Pump Subtotal				**$ 33,600**
Sub Total				$ 174,150
Mobilization	10%			$ 17,000
Subtotal				$ 191,150
Contingency	20%			$ 38,230
Subtotal				$ 229,380
Engineering, Surveying, Admin	25%			$ 57,345
Total				$ 286,725
			Use	**$ 290,000**

Columbia City Water Master Plan

Engineer's Opinion of Probable Cost

Project 5C

Move 6th St. PRV Station

Item	Quantity	Units	Unit Cost	Cost
New Vault, lid, and hatch	1	LS	$ 5,000.00	$ 5,000
Site Work, Excavation	1	LS	$ 1,500.00	$ 1,500
Connection fittings and misc	1	LS	$ 1,000.00	$ 1,000
Landscaping and Restoration	1	LS	$ 2,000.00	$ 2,000
(Assumes leaing existing vault in place and moving the vaavles to a new vault.)				
Sub Total				$ 9,500
Mobilization	10%			$ 1,000
Subtotal				$ 10,500
Contingency	20%			$ 2,100
Subtotal				$ 12,600
Engineering, Surveying, Admin	25%			$ 3,150
Total				$ 15,750
			Use	**$ 16,000**

Columbia City Water Master Plan

Engineer's Opinion of Probable Cost
Project 6
Replace I St PRV

Item	Quantity	Units	Unit Cost	Cost
New 8" X 2" Packaged PRV	1	LS	$ 36,000.00	$ 36,000
Site Work, Excavation	1	LS	$ 9,000.00	$ 9,000
Mobilization	10%			$ 4,500
Subtotal				$ 49,500
Contingency	20%			$ 9,900
Subtotal				$ 59,400
Engineering, Surveying, Admin	25%			$ 14,850
Total				$ 74,250
			Use	**$ 70,000**

Columbia City Water Master Plan

Engineer's Opinion of Probable Cost

Project 7

Abandon Exist 4" Pipe on 6th and E Streets

Item	Quantity	Units	Unit Cost	Cost
Replace Water Service lines	20	EA	$ 1,050.00	$ 21,000
Make Service Connections	20	EA	$ 500.00	$ 10,000
Disconnect at Instersections	12	EA	$ 2,000.00	$ 24,000
Connect Fire Hydrants	4	EA	$ 1,225.00	$ 4,900
Abandon Hydrants	2	EA	$ 250.00	$ 500
Mobilization	10%			$ 6,000
Subtotal				$ 66,400
Contingency	20%			$ 13,280
Subtotal				$ 79,680
Engineering, Surveying, Admin	25%			$ 19,920
Total				$ 99,600
			Use	**$ 100,000**

Columbia City Water Master Plan

Engineer's Opinion of Probable Cost
Project 8
PRV Pressure Relief Vavles

Item	Quantity	Units	Unit Cost	Cost
3" Pressure Relief Valve	1	EA	$ 3,000.00	$ 3,000
Piping and Fittings	1	EA	$ 1,000.00	$ 1,000
Core vault	1	EA	$ 150.00	$ 150
Conctrete Splash pad	1	EA	$ 500.00	$ 500
Mobilization	10%			$ 500
Subtotal				$ 5,150
Contingency	20%			$ 1,030
Subtotal				$ 6,180
Engineering, Surveying, Admin	25%			$ 1,545
Total per Vault				$ 7,725
For Six Vaults:				**$ 46,350**
			USE	**$ 46,000**

Columbia City Water Master Plan

Engineer's Opinion of Probable Cost
Project 9
Distribution System Looping and Upgrades

Item	Quantity	Units		Unit Cost		Cost
Assumed surface AC restoratoin, all 6" Diameter						
The Strand	1,170	LF	$	49.00	$	57,366
First St.	2,230	LF	$	49.00	$	109,270
Fourth St.	1,080	LF	$	49.00	$	52,920
A St.	70	LF	$	49.00	$	3,430
Service connections	64	EA	$	1,200.00	$	76,800
Traffic Control	1	LS	$	10,000.00	$	10,000
Main Connections and valves at intersectioins	10	EA	$	2,200.00	$	22,000
Fire Hydrant Assembly	8	EA	$	3,900.00	$	31,200
Mobilization	10%				$	33,000
Subtotal					$	395,986
Contingency	20%				$	79,197
Subtotal					$	475,183
Engineering, Surveying, Admin	25%				$	118,796
Total					$	593,979
			USE		**$**	**590,000**

Columbia City Water Master Plan

Engineer's Opinion of Probable Cost
Project 10
Additional Hydrants

Item	Quantity	Units	Unit Cost		Cost	
New Hydrant Assembly	28	EA	$	3,400.00	$	95,200
6" waterline with resurfacing	28	EA	$	980.00	$	27,440
Mobilization	10%				$	12,300
Subtotal					$	134,940
Contingency	20%				$	26,988
Subtotal					$	161,928
Engineering, Surveying, Admin	25%				$	40,482
Total					$	202,410
			Use		**$**	**200,000**

Columbia City Water Master Plan

Engineer's Opinion of Probable Cost
Project 11
Automatic Meter Reading -

Item	Quantity	Units	Unit Cost		Cost	
Water Meters	1	LS	$	97,500	$	97,500
MD Collector	1	LS	$	7,600	$	7,600
Handheld Reader	1	LS	$	7,100	$	7,100
Meter Installation	1	LS	$	40,000	$	40,000
Subtotal					$	152,200
Contingency	20%				$	30,440
Subtotal					$	182,640
Engineering, Surveying, Admin	5%				$	9,132
Total					$	191,772
			USE		**$**	**190,000**

Columbia City Water Master Plan

Engineer's Opinion of Probable Cost
Project 12A
SCADA System Upgrades - Upper Reservoir

Item	Quantity	Units	Unit Cost	Cost
Misc Electrical	1	LS	$ 2,500.00	$ 2,500
Programming to add to the Existing System	1	LS	$ 2,500.00	$ 2,500
Level Sensor at Upper Resrvoir	1	LS	$ 1,200.00	$ 1,200
Mobilization	0%			$ -
Subtotal				$ 6,200
Contingency	20%			$ 1,240
Subtotal				$ 7,440
Engineering, Surveying, Admin	5%			$ 372
Total				$ 7,812
				$ 8,000
Cellular system unit for 1 measurement/hr	1	LS	$ 1,200.00	$ 1,200
RTU	1	LS	$ 2,000.00	$ 2,000
Pressure tranducer, installed	1	LS	$ 1,200.00	$ 1,200
Solar power Unit or elect from site if available	1	LS	$ 1,000.00	$ 1,000
One time initial fee to add to City's existing system.	1	LS	$ 2,000.00	$ 2,000
Mobilization	0%			$ -
Subtotal				$ 7,400
Contingency	20%			$ 1,480
Subtotal				$ 8,880
Engineering, Surveying, Admin	5%			$ 444
Total				$ 9,324
				$ 9,000

Columbia City Water Master Plan

Engineer's Opinion of Probable Cost
Project 12B:
SCADA System Upgrades - Data Storage

Item	Quantity	Units	Unit Cost	Cost
Add Data Storage Capabilities - Programing Existing Software	1	LS	$ 3,000.00	$ 3,000
Mobilization	0%			$ -
Subtotal				$ 3,000
Contingency	20%			$ 600
Subtotal				$ 3,600
Engineering, Surveying, Admin	5%			$ 180
Total				$ 3,780
				$ 4,000
To upgrade the RSView System	1	LS	$ 28,000.00	$ 28,000
Mobilization	0%			$ -
Subtotal				$ 28,000
Contingency	20%			$ 5,600
Subtotal				$ 33,600
Engineering, Surveying, Admin	5%			$ 1,680
Total				$ 35,280
				$ 35,000

Columbia City Water Master Plan

Engineer's Opinion of Probable Cost
Project 13
Leak Detection Survey

Item	Quantity	Units	Unit Cost	Cost
Comprehensive Leak Detection Survey	1	LS	$ 5,000.00	$ 5,000
Mobilization	0%			$ -
Subtotal				$ 5,000
Contingency	20%			$ 1,000
Subtotal				$ 6,000
Engineering, Surveying, Admin	5%			$ 300
Total				$ 6,300
				$ 6,000

Appendix D

Ranney Collector Well #1 Evaluation

MSA
Murray, Smith & Associates, Inc.
Engineers/Planners
121 S.W. Salmon, Suite 900 ▪ Portland, Oregon 97204-2919 ▪ PHONE 503.225.9010 ▪ FAX 503.225.9022

APR 1 2 2005

TECHNICAL MEMORANDUM

DATE: April 11, 2005

PROJECT: 99-0433.206

TO: Ms. Leahnette Rivers
City Administrator/Recorder
City of Columbia City

FROM: Matt L. Hickey, P.E. MLH
Murray, Smith & Associates, Inc.

RE: Ranney Collector # 1 Evaluation Summary

Purpose

The purpose of this memorandum is to document the evaluation process and summarize the results of the assessment performed by MSA and the City for the St. Helens Ranney Collector #1. This memorandum also presents recommendations regarding the City's purchase of the collector.

Background

The City of St. Helens currently owns and operates three Ranney Collectors (Ranney #1, Ranney #2 and Ranney #3) located in the City of Columbia City. Ranney Collectors #2 and #3 are currently determined to be under the influence of surface water, and Ranney #1 is not. Ranney Collectors #2 and #3 have a much greater capacity than Ranney #1. As such, the City of St. Helens is constructing a water treatment plant that will allow them to use Ranneys #2 and #3 exclusively to meet their water demands and no longer require Ranney #1 as a backup. In accordance with the agreement between the two cities, if the City of St. Helens no longer needs one of its collectors, they may lease or sell the well and its distribution systems to the City of Columbia City for a price set by an appraisal of the system, made by an independent appraiser agreed upon by both parties. To determine if the facility is operational and worth purchasing, the City of Columbia City requested that MSA perform an assessment of Ranney Collector #1.

To assess the well, MSA and the City of Columbia City have conducted evaluation efforts that included visual inspection, review of records, interviews with City of St. Helens staff, capacity testing, video inspection and consultations with regulatory agencies. Also, a company specializing in collector wells was consulted and they provided a memorandum, which is attached, summarizing their opinions. Each element of the evaluation process is summarized below.

Reviews with St. Helens Staff

On October 13, 2004, the City of Columbia City and the City of St. Helens met to discuss the evaluation process for the well, transfer of water rights and possible arrangements for purchasing the well. St. Helens granted permission to the City of Columbia City to visually inspect and conduct drawdown testing of the well.

In that meeting, it was noted that the collector was constructed in 1954 and the pumps have been changed and rebuilt recently. Also, it was noted that the existing 14-inch concrete cylinder pipe that extends from the well to the City of St. Helens will be included with the purchase of the well. The City of St. Helens agreed to provide a video of the well developed in 1992 and copies of reports they had from other inspections. The City of St. Helens has used Ranney #1 recently for water supply to the City and it is reported to have a capacity of approximately 500 gpm. It is also reported that sediment and mineral deposits and bacterial growth have been found in the caisson during past video inspections.

Other reviews with St. Helens included Columbia City staff collecting data from the operations and engineering staff at St. Helens. Information gathered included as-builts, water quality test records and pump make and model information.

Visual Inspections

On October 1, 2004, MSA and City staff visited the collector facilities and performed a visual inspection. From the visual inspection it was determined that the collector well includes a concrete caisson that is 16 feet in diameter and 70 feet deep, two vertical turbine pumps (75 and 50 hp), eight 8-inch diameter collector laterals that extend radially from the caisson at lengths ranging from 19 to 41 feet, a steel catwalk from the river bank to the top of the caisson, 14-inch diameter piping from the caisson to the river bank, steel frame work over the caisson for extracting the pumps, a building housing electrical and control equipment and a standby generator, and a building housing chlorination equipment.

The visual inspections showed that the facility is in generally good condition. The structures appear to be structurally sound; although there is some rust and loose paint on the steel frame work on the exterior of the facility. The pumps and electrical equipment appear to be in satisfactory condition and the exposed piping also appeared sound. It was noted that the generator had not been operated or serviced for several years. The buildings look to be in good repair and the chlorination system is reported to be relatively new and is serviced often.

Generally, the facility looks to be in an operable condition, and it appears that major repairs will not be required to operate the facility.

Video Inspections

In 1980, an inspection performed by the City of St. Helens showed that there was a significant amount of sand in the bottom of the caisson. At that time, the City of St. Helens cleaned the caisson and removed the sand. A video inspection was performed in 1992 by the City of St. Helens of the collector well caisson. The video showed that there appeared to be some corrosion or build-up on the ladders and pipe brackets.

On December 6, 2004, the City of Columbia City conducted a video inspection of the collector well caisson. The inspection was completed by Advanced American Technologies, Inc., and it was performed using a diver and underwater video equipment. During this inspection, the caisson and the laterals were inspected.

The caisson was relatively clean with about 1 ½ inches of sediment in the bottom. During the inspection, all of the equipment in the caisson was videoed including the valves on the laterals, valve risers, the caisson floor, the level sensing tubes, pump columns, ladders and pipe brackets. All of this hardware and equipment appears to be in fair condition. It was noted that the valves on two of the laterals were closed and there was no screen on the end of the 75 horse power pump casing.

To inspect the laterals the diver inserted a crawler camera into the laterals. Of the 8 total laterals, 7 were inspected as one was too full of sand to allow the camera to pass. The laterals appeared to be sound and in good condition. All of them contained at least some sand, mineral growth and bacterial growth, and some had significant amounts of each of these. However, between all of the laterals, a significant portion of the 1-inch by ¼-inch openings in the laterals that allow water to enter, were open and free of corrosion and/or growths.

Drawdown Testing

Beginning on December 17, 2004, the City of Columbia City conducted a draw down test of the well to determine the capacity of the well and evaluate the overall operations of the facility. The draw down test included pumping the well at a constant rate of 430 gpm using the existing 50 gpm pump. The test was conducted for 10 consecutive days. During this test, other wells were monitored to determine the impacts of the draw down on the aquifer. These wells included a monitoring well adjacent to the Ranney #1, the Coastal Chemical Well (about 1 mile northwest) and the Morse Brother's well (about 0.7 miles northwest). During this test, water quality samples were taken to determine if there was influence from the

Columbia River. Water samples were taken from the well and the river every day during the drawdown test. The parameters measured were pH, temperature, turbidity and conductivity. The results of the test showed that the water in the collector dropped about 12 feet in 7 days. The well adjacent to the collector dropped similarly. The levels in the two other wells showed insignificant changes. The water quality test results showed that the water being discharged from the well had no similar characteristics as the river water. The well water average parameters were as follows: 6.6 pH, 12 deg. C, .1 NTU turbidity and a 230-232 conductivity. During the same time the river water average parameters were 7.3 pH, 7.55 deg, C and turbidity and conductivity similar to the well water. These results suggest that the well is not influenced by the surface water from the river.

Regulatory Review

Oregon Department of Human Services Drinking Water Program (DHS)

A key element in determining whether the well should be obtained by the City is whether the water in the well is determined to be surface water influenced. If the water from the well is determined to be surface water influenced, it is likely that the DHS will require further treatment, such as filtering. In discussions with DHS, it was found that records show from past testing that the collector is not under surface water influence and the recent testing supports these findings. Also, the representative from DHS explained that there do not appear to be any pending regulations that would change the status of the Ranney #1 related to surface water influence, and as they consider the collector to be groundwater they have no reason to re-evaluate the well unless conditions change.

The tests to determine surface water influence include a test called microscopic particulate analysis (MPA). In order to estimate whether a water source is surface water influenced, a risk score is developed based on the contaminates found in the water sample. If the water sample has a score below 10, it is determined to be groundwater. The MPA tests were performed several times for Ranney #1 between 1993 and 1997, and the results produced a risk score well below 10 (in the 2-6 range) thus showing that the well was not surface water influenced. These tests were also performed on Ranney #2 during the same time. In the late 90's, Ranney #2 was found to be surface water influenced. Also, St. Helens' other collector, Ranney #3, was constructed in 2001 and found to be under surface water influence in 2002 or 2003.

Oregon Water Resources Department (OWRD)

Another important interest associated with acquiring the well is transfer of ownership of the water rights for the well from the City of St. Helens to the City of Columbia City. OWRD is responsible for regulating this change in ownership. In discussions with the department, it was found that Ranney #1 does not have a water right but a water claim. However, OWRD treats this as a water right; therefore, the ownership transfer process is the same as that for a water right. This transfer process involves filling out OWRD application forms, obtaining signatures from both parties and a fee of $25.

Hydraulic Analysis

MSA reviewed the hydraulic capacity of the 50 horsepower (hp) collector well pump to determine if it has the capability to deliver water to the 307 foot reservoirs at 9th Street and K Street. By analyzing the pump curve for the existing pump, it was found that the pump should be able to pump at approximately 350 to 380 gpm at 332 feet of total dynamic head. This nearly meets the 395 gpm maximum day demand projected for the year 2025. If the City desires to produce more water from the collector, up to approximately 500 gpm, the existing 70 hp can be run for short periods of time to the meet maximum day demands.

Collector Wells International Review

Ground Water Solutions, Inc. (GSI) and Collector Wells International (CWI), a company specializing in analyzing and constructing Ranney Collectors, reviewed the recent video of the collector and results of the drawdown tests. CWI provided a memorandum summarizing their findings. Please see attached memorandum. They concluded in their memo that based on the drawdown testing, the well could provide approximately 500 gpm and be within an acceptable drawdown range. Also, based on their past experience with Ranney #1, they estimated that pumping at lower rates (below 500 gpm) would result in less sand being drawn into the laterals.

CWI presented some options for the City to assess before beginning use of the well. The suggested options are as follows:

- Do Nothing -- Use collector as is
- Conduct Well Screen Maintenance -- Clean and redevelop well screens
- Well Screen Replacement Installation -- If higher yields are desired, stainless steel screens can be placed into the existing laterals. These would reduce the amount of sand pulled into the well

CWI also provided budget level cost estimates for various options. These are as follows:

- Replacement of Well -- $1.1 million
- Clean Laterals and Caisson -- $25,000 to $50,000
- Clean Laterals and Caisson and Redevelop Laterals and Aquifer -- $75,000 to $90,000
- Replace Well Screens -- $400,000 to $450,000

Preliminary Appraised Costs

To acquire the Ranney Collector from the City of St. Helens, the City can purchase the facility at fair market value in accordance with the agreement between the cities. To determine the fair market value for the 50-year-old collector, there are a couple of options that are commonly used to provide a fair assessment of the value. One method involves estimating the depreciated value of the facility. This includes estimating the cost to replace the facility with a new one in today's dollars and depreciating this cost over about 50 years (1954 - 2005). This assumes the collector has additional expected life. The other method involves estimating the revenue lost by the seller over some period of time and using this dollar amount to estimate the value of the facility.

Conclusions and Recommendations

Based on results of the above described investigations and testing, it is recommended that the City pursue purchase of Ranney Collector #1 from the City of St. Helens. It appears that the City will be able to use the collector in its current condition. This is in accordance with the "Do Nothing" option described in the CWI's memorandum. Some minor work that should be performed would be to install a screen on the bottom of the casing for the 75 hp pump.

If the well is purchased by the City, potential piping modifications may be needed on the existing 14-inch transmission main. This may include a valve being cut into the 14-inch line just south of the City's water pump station on Highway 30. Also, prior to purchasing the collector, the City should review the current access and pipeline easements associated with the well.

Leahnette, if you have any questions or need any additional information in this regard, please contact us. Thank you.

MLH:mc

Memo

To: Jeff Barry, Groundwater Solutions, Inc.
Matt Hickey, Murray Smith and Associates, Inc.

From: Henry Hunt, Collector Wells International, Inc.
Sam Stowe, Collector Wells International, Inc.

Date: January 5, 2005

Re: City of Columbia City, Ranney Well #1 Evaluation

Gentlemen:

Thank you for the chance to review the results of the underwater video inspection of the collector well #1 in Columbia City, Oregon.

We understand that Columbia City is interested in acquiring this collector well to provide their own water supply of about 400-500 gpm or more, if possible. This well is located just to the north of Columbia City, adjacent to the Columbia River. When I last visited this collector well, the caisson was approximately 20-25 feet from the edge of the river.

I understand that certain measures were taken some years ago in an attempt to improve the seal around the well caisson and possibly within selected lateral screens to try and restrict surface water influences from the well. I understood this work to include grouting of some type, presumably to include grouting around the exterior of the caisson (surface seal) and/or within portions of one or more of the lateral well screens.

Reportedly, the collector well was designed to produce 3 mgd when constructed in 1955, which coincides with the reported capacity of 2,083 gpm noted in the OWRD permit. This represents a fairly liberal screen design that resulted in higher entrance and approach velocities, which may have caused the continuing intrusion of sand to some degree, and may have exacerbated the plugging by mineralogical scales, as observed in the video. Under present-day design criteria, the accessible length of lateral well screen (177-194 lineal feet) would be appropriate to produce about 500-550 gpm using this screen material. This suggests that the well was historically operated about 4 times above what would be the design used today. Assuming an open area of the slotted pipe of 18 %, the current amount of screened pipe can deliver 500 gpm at an entrance velocity of 1 foot per minute. This low entrance velocity is very acceptable, especially given the very good water quality. Also in-line flow and approach velocities will be very low at 500 gpm.

During the recent underwater inspection by closed-circuit television, about 177 lineal feet of the well screen was viewable for a variety of reasons. In one lateral (#6), the camera was able to reach the full installed length as evidenced by reaching the back of the digging head, which is traditionally attached to the end of the lateral well screen. In another lateral (#2), the camera was stopped by a piece of sand-line (used during the original construction) that remained in the lateral. In two laterals (#1 and 9), the camera was stopped by an excessive build-up of sediment lying in the bottom of the lateral screen. In the remaining four laterals, the camera reached a point in the line that was blocked by what appeared to be a grout pipe, that may have been attached to a plug or bulkhead that may have been used to seal off the outer lengths of these laterals for one reason or another. It should be noted that an additional 8 feet of lateral in #1 and another 9 feet of lateral in #9 is probably available if the sediment blockage within the screen were cleared. This would provide an additional 17 feet of lateral well screen above the 177 feet observed. Lateral #5 was reportedly closed following construction, and has never been in use. These restrictions are shown in the attached table.

Lateral number	Installed length (ft)	Viewable length (ft)	Restriction
1	29	21	Sediment blockage
2	33	12	Hit sandline
3	29	22	Hit grout pipe
4	29.5	25	Hit grout pipe
5	0	0	Capped closed
6	33	28	Reached full length
7	24	20	Hit grout pipe
8	41	39	Hit grout pipe
9	19	10	Sediment blockage
Totals	210.5	177	

In all of the lateral screens viewed, mineral scale was observed on the well screen, in some cases up to an inch or so thick, and there was some degree of sediment lying on the bottom of the well screens. This scale blocked at least part of the well screen slots in some areas, and the slots appeared to be fairly open at others. Where it could be observed, the screen material appeared to be full thickness and not corroded. In general, the screen material looked to be at or near full thickness, and in some cases, the bare steel screen material could be seen.

It is common for sand and debris to accumulate over time in the bottom of the well screen. It has been reported that sand and debris were cleaned from the well several times since 1980. It is uncertain at this time what pumping rates were used during that time that may have caused sand to enter the well. If this well is operated at a pumping rate of 4-500 gpm in the future, it is possible that less sand will enter with the lower entrance velocities, however, continued inspection of the well is necessary to monitor this occurrence so that corrective measures, if warranted, can be taken.

Based upon a cursory review of the results of the recent 10-day pumping test conducted on Collector Well No. 1: the well was pumped at an average rate of about 430 gallons per minute (gpm), and the water level in the well appeared to have stabilized within five days (or less) of pumping. The stabilized drawdown corrected for river level variations appears to be on the order of 11.5 feet, resulting in a specific capacity of about 37 feet per foot of drawdown. An observation well 10 feet from the caisson had about the same drawdown as the collector well. No other wells monitored had any readily apparent drawdown as the result of pumping Collector Well No.1, although you could argue that Collector Well No. 2 (2200 feet away) may have experienced a minor amount of drawdown (+/- 0.5 feet). This "drawdown" may have also been due to other outside pumping influences such Collector Well No. 3.

It is understood that the maximum proposed pumping rate for the well is about 500 gpm. Under the conditions that existed at the time of the test, it is estimated that the well should be able to yield 500 gpm with about 14 feet of drawdown. This is less than one half of the available drawdown. Available drawdown is about 30 feet, if you consider a normal static water level of + 5 feet msl and recommended maximum pumping level of – 25 ft msl. This level (- 25 feet msl) is about 10 feet above the centerline of laterals, providing a nominal safety factor.

In summary, we see no hydraulic problem with Collector Well No. 1 being able to deliver 500 gpm with a reasonable safety factor. Redevelopment of the laterals to remove sand and bacterial growth, followed by disinfection may be advantageous for the long-term operation of the well.

Based upon this very cursory review, several options appear to be viable:

1. **Do nothing.** If the City can live with 400-500 gpm, it may be possible to develop this capacity without doing anything to the well. However, we would recommend that, at a minimum, the well be disinfected and sediment and any loose debris be removed from the base of the collector well caisson and from inside the lateral well screens. Based upon the reported recurring intrusion of sand into the well, it is also recommended that periodic (every 5 years) underwater inspection be made of the well to evaluate the presence of sand in the well, which could cause future problems with pumping equipment, or within the distribution system. This sand accumulation may also affect capacity as sand accumulates in the screens, covering some of the slots.
2. **Well screen maintenance.** Cleaning and redevelopment of the well screens should restore the open area of the well screen and provide more favorable flow conditions in and around the screen to reduce plugging and reduce the intrusion of sand to some degree. However, if capacities above 500 gpm are desired, this length of screen may be insufficient.
3. **Well screen replacement installation.** If yields above 500 gpm are desired, it is advisable to install additional lateral well screen to improve flow conditions and reduce the potential for migration of sand into the screens. The new screen will be constructed using stainless steel wedge-wire for a more hydraulically-efficient design. Additional well screen may be warranted if:
   a. **Higher capacities are desired.** Longer lateral lengths may be necessary to develop additional capacities for the well as this will increase the

effective well diameter and reduce entrance velocities which may reduce the rate of plugging and reduce the migration of sand into the well.

b. **The source of recharge needs to be managed.** If the State (OWRD) classifies the well as under the influence or will require additional testing before providing a determination, it may be possible to increase the time–of-travel and degree of filtration for the water to try and obtain a more favorable (groundwater) classification by projecting new lateral well screens away from the river.

If there are inconsistencies or concerns regarding the source classification of the well with regard to river influences, water quality sampling data should be collected from individual laterals while pumping to identify water quality differences that should identify potential alternatives for well rehabilitation to achieve the desired classification.

Budget Costs

The existing collector well, as is, would have a replacement value of about $ 900,000 for the base unit, plus another $ 200 – 400,000 for the pump house building, walkway, electrical controls, pumps and mechanical, etc. to complete the well.

The cost to clean out the sediment from the bottom of the caisson and from within the lateral screens, would probably cost about $ 25 – 50,000 assuming that a local diving firm could be used.

The cost to clean out the sediment from within the bottom of the caisson and lateral well screens, to clean the lateral well screens and redevelop the lateral well screens (and surrounding aquifer) and disinfect the well would be about $ 75 – 90,000.

The cost to replace the well screens will vary depending upon the number and length of screen needed to accomplish the desired objective (see 3a and 3b above). For a capacity of between 1000 and 2000 gpm, the cost to add new lateral well screens would probably be about $ 400-450,000.

This well offers some viable options for Columbia City, particularly if the OWRD determines that the water produced is groundwater quality. As you review these comments and options, we would be pleased to discuss various alternatives with you to meet the desired end goals.

Thank you for the opportunity to review this information and provide these comments.